HADDAD MORGAN & ASSOCIATES LTD
CONSULTING ENGINEERS

Stormwater Management and Storm Release Study Report ***(REVISED)***

Development on Grove Ave. at Old St. John Elementary School Site

Windsor, Ontario

23-209

January 17, 2024

William Tape, Ph.D., P.E., P.Eng.

SUBMITTED TO:

The City of Windsor

The principal objective of this report is to provide the stormwater management for multi-unit residential development on Grove Avenue within the lands formally containing St. John's Catholic Elementary School (1920 Grove). This shall include the stormwater storage requirement, in accordance with the storm water management guidelines set out in Windsor/Essex Region Stormwater Management Standards Manual.

Available Infrastructure

In coordination with the City of Windsor the storm flow will convey to the existing storm sewer on Partington as directed by the Development Department at the City of Windsor. Specific to the Sanitary flow it will be conveyed to the combined sewer in Bridge accessible at the northly limit of the development.

Pre-Develops Conditions

The current site is 1.21 Ha in size and contained a single-story school structure and supporting paved play and parking services. These surfaces and buildings we demolished in recent years as the development of this site proceeded in coordination with the City of Windsor Engineering Department. The release rate is per the previous section of this report in coordination with Development.

STORM

Proposed Development

The proposed project includes the residential buildings and a new parking lot with access from Grove Avenue. In the developed condition, the surface condition breakdown will be as follows:

Building Area	3370.8 square metres
Paved/Hardscape Area	3617.2 square metres
Landscaped Area	5091.0 square metres

The introduction of the new on-site storm network would change the overland flow distance, in addition to accounting for the flow on paved infrastructure and thus this was accounted for in the calculations associated with the design of the onsite network as defined in the attached drawings. The release rate applied for the site is based on the following study and discussions with the City of Windsor.

The net rate stated above was used as the basis for determining the storage requirement.

The proposed system includes the following components:

- New storm sewer system under the proposed pavement;
- Underground storage units;
- Outlet control;

- Surface storage within parking areas where permitted by the standard.

Existing Partington Storm Sewer Study

As directed by the Development department at the City of Windsor we have undertaken a static analysis of the Partington Storm sewer specific to receiving the proposed development flow. Following from this the City has noted that a flow rate of 45-50L/s would be the limitation of outletting from the proposed development.

Our analysis which is attached has found that prior to the presence of the development the tailwater condition, defined by the City of Windsor (at College and Partington), results in an upward shift of the hydraulic grade line (HGL) of 0.074m at each manhole within the Partington line. This is based on a constant tail condition at College of 177.374m which is the maximum value provided; however, it is known that the maximum has a finite time span and as such any upticks would be limited in duration.

Following from the attached summary sheet which shows the differential specific to the development being present comparative to the existing condition in its absence, as would be expected one will see an upward movement of the HGL of 0.132m south of the development input area at 50L/s and an upward shift of 0.119m along the same reach under a development flow of 45 L/s.

Given available inverts pumping of the system will be needed and as such a constant rate of 45L/s was held for both the 5 year and 100 year events reducing impact on the system under the more significant storm event. However, as found in the drawings the system is set such that once the storm water from the site reaches a depth equal to the invert of the outlet (under gravity) to the pump will shut down and a gravity flow will proceed with flow control governed by a flow control device as noted in the drawings. Once the event ends and the system drains to a level of the invert of the gravity outlet the pump would re-engage to drain the system.

Given the above the impact of the development as proposed will be nominal and less when consideration is given to the dynamic changes which are seen in the actual tail conditions.

Bridge Sewer Study

The analysis of the Bridge Avenue combined sewer, attached, indicates that in the presence of sanitary flow from this development and that of the existing area (assuming no peaking of sanitary flow in the presence of a 5-year event) finds that the additional sanitary load per the static analysis yields an uptick of 0.045 m at a maximum over the pre-site development condition. These conditions are based on the tailwater conditions at College Avenue of 178.12 dictated by the City of Windsor.

The full assessment provided in this report for the Bridge sewer assessed the following conditions:

- Sanitary loading from the new development at 312 persons plus 50 persons/ha for the existing residence at a ultimate flow factor (UFF) of 6 per the city standard.
- Assessment of the predevelopment condition of the sewer under the 5-year event (current) with the addition of sanitary loading to a UFF of 1. Done in the absence of a tailwater condition.
- Assessment of the post development condition of the sewer under the 5-year event (current) with the addition of sanitary loading to a UFF of 1. Done in the absence of a tailwater condition.
- Assessment of the predevelopment condition of the sewer under the 5-year event (current) with the addition of sanitary loading to a UFF of 1. Done in the presence of a tailwater condition.
- Assessment of the post development condition of the sewer under the 5-year event (current) with the addition of sanitary loading to a UFF of 1. Done in the presence of a tailwater condition.

The application of the UFF variation for this assessment is based on the consideration that the existing sewer is not designed to the current storm design standards and by applying such storm standards the pipe by itself is insufficient to convey the needed flows with or without development in the absence of pressurization of the network through naturally occurring head conditions. The current City standard does provide a UFF of 6 for a sanitary sewer load associated with the defined population (with and without development) however, the standard fails to provide direction on assessment of a combined sewer. The simple application of a factor of 6 to the sanitary loading in the presence of a storm intensity in excess of that which the pipe would be designed for fails to provide a reasonable assessment of capacity. Through our correspondence with the City it is our position that if the current storm intensity is to be applied to this older combined sewer line than during such event it is reasonable to assume that sanitary loading from residence would be limited during such events allowing for a consideration of a UFF of 1 during the event.

Minor System

The minor system consists of the proposed storm sewer network to be constructed on the site. A detailed depiction of the proposed storm sewer infrastructure can be found in the design drawings. Due to the proposed flow restrictions, stormwater quantity control is necessary in the minor system design. Therefore, the necessary storm water storage associated with the 5-year storm shall be accommodated by means of underground structures (pipes, manholes, catch basins, and storage units). The minor system hydraulic grade line (HGL) shall be below ground elevations (i.e., **no surface storage**), as per the standards manual.

Major System

The major system conveys flows during the major storm event. The design was developed using the minimum standard for major system design, the 100-year return period. The necessary storm water storage associated with the 100-year storm event shall be accommodated by means of underground structures (pipes, manholes, catch basins, storage units) and surface storage.

Runoff Control
Based on the establishing of the 5-year and 100-year event flood storage levels and an anticipated elevation of the outlet, it was found that a tempest HF flow control device is required. This opening will be secured to the gravity outlet and set to provide a maximum release rate of 45 l/s during the 100-year event and 45 l/s during the 5-year event. Prior to the release being accomplished via a gravity discharge pumping (see next section) shall be used with a set rate of 45 L/s and defined pump staging, pumping is provided given the depth of the on site storm network relative to the receiving sewer inverts (Partington).

Pumping
Refer to the drawings attached for specific float and control settings. The final pump shall be selected through a design build submission for various vendors. Pump on and off stages is also defined in the document. Once water levels reach the gravity outlet the pump will shut down until such time that the levels return to the invert level of the outlet so pumping can resume.

Storage Requirements
Based on the requirements already noted in this report, it was found that the site would require a minimum storage capacity of 143.7 cubic metres for the 1:5-year storm and 455.2 cubic metres for the 1:100-year storm.

The minor storm is contained below surface in its entirety with the 100 year event reaching a flood elevation of not more than 184.41.

Please refer to page 5 of the calculation package attached for definition of the storage measures and associated volumes.

Free Board
Given the above 100-year flood levels all openings to the building shall be set to an elevation of not less than 0.3m above this point which is an elevation of 184.71

Water Quality
Referring to the attached a water quality unit by ADS is proposed. Please find attached the analysis provided by ADS.

Closing
Should you have any questions or comments regarding this report, please feel free to contact our office.

SWM ANALYSIS OF SITE

HADDAD MORGAN & ASSOCIATES LTD
CONSULTING ENGINEERS

This project has been analyzed in accordance with the requirements set out in the latest edition of the Windsor-Essex Region Stormwater Management Report for catchments 2Ha or smaller

Project Description:	Grove Avenue Development		
Project No.:	23-209/18-141		
Date of Analysis	Dec-23	Revision	2
Design for Minor Event	5	Design for Major Event	100

Property Information (SM units)

Description	Existing	New	Table 3.2.2.7 C
Total Catchment Size	12079	12079	
Building Area	0	3370.8	0.95
Paved Area	0	3617.2	0.95
Gravel Area	0		0.70
Landscape - Clay	12079	5091.0	0.20
Landscape - Sand			0.15
Residential Single Family			0.60
Resid. Single - Lots <500SM			0.70
Residential - semi det.			0.70
Residential - Town/Row			0.80
Industrial Commerical			0.90

	AC	
Description	Existing	New
Building Area	-	3,202.26
Paved Area	-	3,436.34
Gravel Area	-	-
Landscape - Clay	2,415.80	1,018.20
Landscape - Sand	-	-
esidential Single Family	-	-
id. Single - Lots <500SM	-	-
Residential - semi det.	-	-
esidential - Town/Row	-	-
ndustrial Commerical	-	-
Sumation	2,415.80	7,656.80

Soil Designation (A-D)	D	
% Impervious Override	0	%

Storm Event - Section 3.2 **(Pre-Developed)**

Storm Event	a	b	c
2	854	7	0.818
5	1259	8.8	0.838
10	3-209/18-14	9.5	0.845
25	14-Dec-23	10.2	0.852
50	2114	10.6	0.858
100	2375	11	0.861

$I = \frac{a}{(T+b)^c}$

Minor Storm	
a	1259
b	8.8
c	0.838
Major Storm	
a	2375
b	11
c	0.861

Time of Concentration - 3.7.3

Time of Concentration = t (sheet) +t (shallow) + t (concentrated)

t sheet (t1) $= \frac{6.92L^{0.6}n^{0.6}}{I^{0.4}S^{0.3}}$

Length of Shallow flow	190	m
Mannings	Grass - shore praire	
Average Slope	1	%
Shallow Concentrated Flow (User Input) t2	0	min
Concentrated time (pipe flow) (User Input) t3	0	min

***USER NOTE - macro will not run to solve t1 if t1 below reads 0.0 - input higher value*

Mannings n - Values Per Table 3.7.4.1

Value	Description
0.013	Smooth asphalt/concrete
0.06	Cultived soil - resid. Cover <20%
0.17	Cultived soil - resid. Cover >20%
0.13	Range (natural)
0.15	Grass - shore praire
0.24	grass - dense
0.4	woods - light underbrush
0.8	woods - dense underbrush
0	User Input

Minor Storm Event		
Calculated n value	0.15	
t2+t3	0	min
t1 (sheet)	44.99	min
t total	44.99	min
Intensity	44.64	mm/hr

Major Storm Event		
Calculated n value	0.15	
t2+t3	0	min
t1 (sheet)	34.07	min
t total	34.07	min
Intensity	89.47	mm/hr

Page 3 ***Pre-Development Runoff and Flow Control Analysis***

Soil Classification D

	AC		
Description	Existing	New	
Property Total Area CM	12,079.00	12,079.00	
Building Area	3-209/18-14	3,202.26	
Paved Area	45,274.00	3,436.34	
Gravel Area	-	-	
Landscape - Clay	2,415.80	1,018.20	
Landscape - Sand	-	-	*
Residential Single Family	-	-	*
Resid. Single - Lots <500SM	-	-	*
Residential - semi det.	-	-	*
Residential - Town/Row	-	-	*
Industrial Commerical	-	-	*
Sumation AC	47,689.80	7,656.80	

** User Note: % Impervious taken as 100% for noted items - if different use overide on Pg.1*

% Impervious	57.9	%	C equiv by AC	0.634
Storage depth 3.3.2	91.1	mm	C 100 year	0.843

Runoff Pre-Development

Intensity (minor)	44.64	mm/hr	reduce by 150 person at 0.0042l/s
Intensity (major)	89.47	mm/hr	0.63

Rational Method - PreDevelopment

Q_{minor}	0.594	CMS	Q Reduction	-0.00315 CMS **
Q_{major}	1.188	CMS	** per approval authority	

Surface Elevation :	Minor Event	180.11	m
	Major Event	180.41	m

Outlet Info:	Invert at outlet	179.50	m		
	Orifice Diameter	180.00	mm	Max. Dia.	911.6 mm
	Orifice coefficient	0.62			
	Tailwater elev.	180	m		

Head Condition Differential	Minor	0.110	m	
	Major	0.410	m	

Discharge Rate Through Orifice	Minor	0.045	CMS	***OK***
	Major	0.045	CMS	***OK***

Page 4 ***Storage Requirements***

Zero Release condition

Storage Depth 91.09 mm

Zero Release Storage	1100.3 CM

$C_{100year}$ 0.843 C_{minor} 0.634

Release Rates CMS Minor 0.045 Major 0.045

23-209/18-141 CMS CMS

	Minor Event				Major			
Time	Intensity (mm/hr)	Total Input CM	Total Release CM	Storage CM	Intensity (mm/hr)	Total Input CM	Total Release CM	Storage CM
5	139.6	89.06	13.50	75.6	218.2	185.28	13.42	171.85
10	107.7	137.46	27.00	110.5	172.7	293.20	26.85	266.35
15	88.4	169.22	40.50	128.7	143.7	365.93	40.27	325.66
20	75.3	192.30	54.00	138.3	123.5	419.34	53.70	365.64
25	65.9	210.20	67.50	142.7	108.6	460.85	67.12	393.73
30	58.7	224.70	81.00	143.7	97.1	494.44	80.55	413.89
35	53.0	236.83	94.50	142.3	87.9	522.43	93.97	428.46
40	48.4	247.22	108.00	139.2	80.4	546.31	107.39	438.92
45	44.6	256.29	121.50	134.8	74.2	567.05	120.82	446.23
50	41.4	264.33	135.00	129.3	68.9	585.33	134.24	451.08
55	38.7	271.55	148.50	123.0	64.4	601.63	147.67	453.97
60	36.3	278.08	162.00	116.1	60.5	616.33	161.09	455.24
65	34.2	284.06	175.50	108.6	57.1	629.69	174.51	455.18
70	32.4	289.55	189.00	100.6	54.0	641.93	187.94	453.99
75	30.8	294.65	202.50	92.1	51.3	653.21	201.36	451.85
80	29.3	299.39	216.00	83.4	48.9	663.67	214.79	448.88
85	28.0	303.83	229.50	74.3	46.7	673.41	228.21	445.20
90	26.8	308.01	243.00	65.0	44.7	682.52	241.64	440.89
95	25.7	311.94	256.50	55.4	42.8	691.09	255.06	436.03
100	24.7	315.67	270.00	45.7	41.2	699.16	268.48	430.67
105	23.8	319.20	283.50	35.7	39.6	706.79	281.91	424.88
110	23.0	322.57	297.00	25.6	38.2	714.02	295.33	418.69
115	22.2	325.78	310.50	15.3	36.9	720.90	308.76	412.14
120	21.5	328.85	324.00	4.8	35.7	727.46	322.18	405.28
125	20.8	331.79	337.50	- 5.7	34.6	733.72	335.61	398.11
130	20.2	334.61	351.00	- 16.4	33.5	739.71	349.03	390.68
135	19.6	337.33	364.50	- 27.2	32.5	745.46	362.45	383.00
140	19.0	339.94	378.00	- 38.1	31.6	750.97	375.88	375.10
145	18.5	342.47	391.50	- 49.0	30.7	756.28	389.30	366.98
150	18.0	344.91	405.00	- 60.1	29.9	761.40	402.73	358.67
155	17.6	347.26	418.50	- 71.2	29.1	766.33	416.15	350.18
160	17.1	349.55	432.00	- 82.5	28.4	771.09	429.58	341.52
165	16.7	351.76	445.50	- 93.7	27.7	775.70	443.00	332.70
				143.7				455.2

Page 5 - Storage Distribution

Alternate Zero Release Solution **1100.3** **CM**

Minor Event	**143.7**	**CM - REQUIRED**			
CB	5				1.80
MH	7				9.50
PIPING 150 DIA	23-209/18-141	L=	220		3.89
200 DIA	14-Dec-23	L=	0		0.00
250 DIA		L=	113.4		5.57
300 DIA		L=	60		4.24
Underground Storage		qty	2	at 86.02 CM each	172.04
				total	197.04

Major Event	**455.2**	**CM - REQUIRED**			
surface storage	2074.9SM				207.5
CB	5				1.8
MH	7				9.5
PIPING 150 DIA		L=	220		3.9
200 DIA		L=			0.0
250 DIA		L=	113.4		5.6
300 DIA		L=	60		4.2
Underground Storage					256
					488.5

PARTINGTON STORM SEWER ANALYSIS

5YEAR PER DEVELOPMENT REQUIREMENTS

PARTINGTON SUMMARY

50L/s	Condition						
	5 year No tail Condition		5 year With Tail condition		Differentials No tail	W/ Tail condition	
Manhole	W/O D	W.D.	W/O D	W.D.			
5R3522	181.990	182.064	182.122	182.196	0.132	0.132	
5R3521	181.217	181.291	181.349	181.423	0.132	0.132	
5R3520	180.823	180.897	180.956	181.030	0.132	0.132	
5R3519	180.030	180.104	180.163	180.237	0.132	0.132	
5R3518	179.430	179.504	179.563	179.637	0.132	0.132	
5R3517	178.719	178.793	178.851	178.925	0.132	0.132	Load added
5R3516	178.668	178.742	178.801	178.875	0.132	0.132	
5R3515	178.066	178.140	178.071	178.145	0.005	0.005	
5R3514	177.688	177.762	177.691	177.765	0.003	0.003	
5R3756	177.413	177.487	177.415	177.489	0.002	0.002	

45L/s	Condition						
	5 year No tail Condition		5 year With Tail condition		Differentials No tail	W/ Tail condition	
Manhole	W/O D	W.D.	W/O D	W.D.			
5R3522	181.990	182.064	182.109	182.183	0.119	0.119	
5R3521	181.217	181.291	181.336	181.410	0.119	0.119	
5R3520	180.823	180.897	180.942	181.016	0.119	0.119	
5R3519	180.030	180.104	180.149	180.223	0.119	0.119	
5R3518	179.430	179.504	179.549	179.623	0.119	0.119	
5R3517	178.719	178.793	178.837	178.911	0.119	0.119	Load added
5R3516	178.668	178.742	178.787	178.861	0.119	0.119	
5R3515	178.066	178.140	178.070	178.144	0.004	0.004	
5R3514	177.688	177.762	177.691	177.765	0.003	0.003	
5R3756	177.413	177.487	177.415	177.489	0.001	0.001	

Event Information	A	1259	B	8.8	C	0.838	**5 year no tail condition on Partington**	
Tail Condition	HGL	0	m				**No development**	
Develop	flow	0	CMS					
Develop	HGL		m					

W.R.T. downstream pt

Street	From	To	Local C	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m	HGL elev	time to next pt
Partington	5R3523	5R3522	0.7	5784	4048.8	20	75.35	0.085	300	119	181.100	180.541	183.860	183.250	0.071	0.470	0.013	0.066	PRESSURIZED	110	1.20	1.481	0.073	180.541	0.773	181.990	1.65
Partington	5R3522	5R3521	0.7	6438	8555.4	21.65	71.90	0.171	450	119	180.421	180.159	183.250	183.500	0.159	0.220	0.013	0.134	PRESSURIZED	110	1.07	1.267	0.059	180.159	0.393	181.217	1.85
Partington	5R3521	5R3520	0.7	6535	13129.9	23.50	68.44	0.250	450	119	180.159	179.588	183.500	182.080	0.159	0.480	0.013	0.198	PRESSURIZED	110	1.57	1.136	0.126	179.588	0.793	180.823	1.26
Partington	5R3520	5R3519	0.7	6226	17488.1	24.76	66.27	0.322	525	119	179.528	179.112	182.080	181.300	0.216	0.350	0.013	0.254	PRESSURIZED	110	1.49	0.914	0.113	179.112	0.600	180.030	1.33
Partington	5R3519	5R3518	0.7	5463	21312.2	26.10	64.14	0.380	525	104	179.112	178.602	181.300	180.850	0.216	0.490	0.013	0.301	PRESSURIZED	110	1.75	0.730	0.157	178.602	0.712	179.430	0.99
Partington	5R3518	5R3517	0.7	1595	22428.7	27.09	62.66	0.390	525	7	178.572	178.534	180.850	180.500	0.216	0.540	0.013	0.316	PRESSURIZED	110	1.80	0.528	0.166	178.534	0.050	178.719	0.06
Partington	5R3517	5R3516	0.7	5556	26317.9	27.15	62.57	0.457	600	119.5	178.474	178.056	180.500	180.150	0.283	0.350	0.013	0.363	PRESSURIZED	110	1.62	0.516	0.133	178.056	0.602	178.668	1.23
Partington	5R3516	5R3515	0.7	6123	30604	28.38	60.83	0.517	675	106	177.996	177.742	180.150	180.500	0.358	0.240	0.013	0.412	PRESSURIZED	110	1.44	0.331	0.106	177.742	0.378	178.066	1.22
Partington	5R3515	5R3514	0.7	6156	34913.2	29.60	59.20	0.574	750	106	177.682	177.501	180.500	180.400	0.442	0.170	0.013	0.459	PRESSURIZED	110	1.30	0.208	0.086	177.501	0.275	177.688	1.36
Partington	5R3514	5R3756	0.7	5374	38675	30.96	57.50	0.618	750	106	177.501	177.300	180.400	180.400	0.442	0.190	0.013	0.485	PRESSURIZED	110	1.40	0.113	0.100	177.300	0.315	177.413	1.26

Event Information	A	1259	B	8.8	C	0.838	**5 year max tail water constant**	
Tail Condition	HGL	177.374	m				**No development**	
Develop	flow	0	CMS					
Develop	HGL		m					

W.R.T. downstream pt

Street	From	To	Local C	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m	Acc. Head Loss	HGL elev	time to next pt
Partington	5R3523	5R3522	0.7	5784	4048.8	20	75.35	0.085	300	119	181.100	180.541	183.860	183.250	0.071	0.470	0.013	0.066	PRESSURIZED	110	1.20	1.555	0.073	180.541	0.773	0.772942075	182.064	1.65
Partington	5R3522	5R3521	0.7	6438	8555.4	21.65	71.90	0.171	450	119	180.421	180.159	183.250	183.500	0.159	0.220	0.013	0.134	PRESSURIZED	110	1.07	1.341	0.059	180.159	0.393	0.393421933	181.291	1.85
Partington	5R3521	5R3520	0.7	6535	13129.9	23.50	68.44	0.250	450	119	180.159	179.588	183.500	182.080	0.159	0.480	0.013	0.198	PRESSURIZED	110	1.57	1.210	0.126	179.588	0.793	0.793184125	180.897	1.26
Partington	5R3520	5R3519	0.7	6226	17488.1	24.76	66.27	0.322	525	119	179.528	179.112	182.080	181.300	0.216	0.350	0.013	0.254	PRESSURIZED	110	1.49	0.988	0.113	179.112	0.600	0.599923323	180.104	1.33
Partington	5R3519	5R3518	0.7	5463	21312.2	26.10	64.14	0.380	525	104	179.112	178.602	181.300	180.850	0.216	0.490	0.013	0.301	PRESSURIZED	110	1.75	0.804	0.157	178.602	0.712	0.711601684	179.504	0.99
Partington	5R3518	5R3517	0.7	1595	22428.7	27.09	62.66	0.390	525	7	178.572	178.534	180.850	180.500	0.216	0.540	0.013	0.316	PRESSURIZED	110	1.80	0.602	0.166	178.534	0.050	0.050411334	178.793	0.06
Partington	5R3517	5R3516	0.7	5556	26317.9	27.15	62.57	0.457	600	119.5	178.474	178.056	180.500	180.150	0.283	0.350	0.013	0.363	PRESSURIZED	110	1.62	0.590	0.133	178.056	0.602	0.602424693	178.742	1.23
Partington	5R3516	5R3515	0.7	6123	30604	28.38	60.83	0.517	675	106	177.996	177.742	180.150	180.500	0.358	0.240	0.013	0.412	PRESSURIZED	110	1.44	0.405	0.106	177.742	0.378	0.37801726	178.140	1.22
Partington	5R3515	5R3514	0.7	6156	34913.2	29.60	59.20	0.574	750	106	177.682	177.501	180.500	180.400	0.442	0.170	0.013	0.459	PRESSURIZED	110	1.30	0.282	0.086	177.501	0.275	0.274749557	177.762	1.36
Partington	5R3514	5R3756	0.7	5374	38675	30.96	57.50	0.618	750	106	177.501	177.300	180.400	180.400	0.442	0.190	0.013	0.485	PRESSURIZED	110	1.40	0.187	0.100	177.300	0.315	0.314579953	177.487	1.26

Event Information	A	1259	B	8.8	C	0.838	**5 year no tail condition on Partington**	
Tail Condition	HGL	0	m				**Development 45L/s**	
Develop	flow	0	CMS					
Develop	HGL		m					

W.R.T. downstream pt

Street	From	To	Local C	Develop. Load	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m		HGL elev	time to next pt
Partington	5R3523	5R3522	0.7		5784	4048.8	20	75.35	0.085	300	119	181.100	180.541	183.860	183.250	0.071	0.470	0.013	0.066	PRESSURIZED	110	1.20	1.599	0.073	180.541	0.773		182.109	1.65
Partington	5R3522	5R3521	0.7		6438	8555.4	21.65	71.90	0.171	450	119	180.421	180.159	183.250	183.500	0.159	0.220	0.013	0.134	PRESSURIZED	110	1.07	1.386	0.059	180.159	0.393		181.336	1.85
Partington	5R3521	5R3520	0.7		6535	13129.9	23.50	68.44	0.250	450	119	180.159	179.588	183.500	182.080	0.159	0.480	0.013	0.198	PRESSURIZED	110	1.57	1.254	0.126	179.588	0.793		180.942	1.26
Partington	5R3520	5R3519	0.7		6226	17488.1	24.76	66.27	0.322	525	119	179.528	179.112	182.080	181.300	0.216	0.350	0.013	0.254	PRESSURIZED	110	1.49	1.032	0.113	179.112	0.600		180.149	1.33
Partington	5R3519	5R3518	0.7		5463	21312.2	26.10	64.14	0.380	525	104	179.112	178.602	181.300	180.850	0.216	0.490	0.013	0.301	PRESSURIZED	110	1.75	0.849	0.157	178.602	0.712		179.549	0.99
Partington	5R3518	5R3517	0.7		1595	22428.7	27.09	62.66	0.390	525	7	178.572	178.534	180.850	180.500	0.216	0.540	0.013	0.316	PRESSURIZED	110	1.80	0.647	0.166	178.534	0.050		178.837	0.06
Partington	5R3517	5R3516	0.7	45	5556	26317.9	27.15	62.57	0.502	600	119.5	178.474	178.056	180.500	180.150	0.283	0.350	0.013	0.363	PRESSURIZED	110	1.78	0.634	0.161	178.056	0.717		178.787	1.12
Partington	5R3516	5R3515	0.7		6123	30604	28.27	60.98	0.518	675	106	177.996	177.742	180.150	180.500	0.358	0.240	0.013	0.412	PRESSURIZED	110	1.45	0.336	0.107	177.742	0.380		178.070	1.22
Partington	5R3515	5R3514	0.7		6156	34913.2	29.49	59.35	0.576	750	106	177.682	177.501	180.500	180.400	0.442	0.170	0.013	0.459	PRESSURIZED	110	1.30	0.210	0.087	177.501	0.276		177.691	1.36
Partington	5R3514	5R3756	0.7		5374	38675	30.85	57.64	0.619	750	106	177.501	177.300	180.400	180.400	0.442	0.190	0.013	0.485	PRESSURIZED	110	1.40	0.115	0.100	177.300	0.316		177.415	1.26

Event Information	A	1259	B	8.8	C	0.838	**5 year max tail water constant**	
Tail Condition	HGL	177.374	m				**Development 45L/s**	
Develop	flow	0	CMS					
Develop	HGL		m					

W.R.T. downstream pt

Street	From	To	Local C	Develop Addition	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m	Acc. Head Loss	HGL elev	time to next pt
Partington	5R3523	5R3522	0.7		5784	4048.8	20	75.35	0.085	300	119	181.100	180.541	183.860	183.250	0.071	0.470	0.013	0.066	PRESSURIZED	110	1.20	1.673	0.073	180.541	0.773	0.772942075	182.183	1.65
Partington	5R3522	5R3521	0.7		6438	8555.4	21.65	71.90	0.171	450	119	180.421	180.159	183.250	183.500	0.159	0.220	0.013	0.134	PRESSURIZED	110	1.07	1.460	0.059	180.159	0.393	0.393421933	181.410	1.85
Partington	5R3521	5R3520	0.7		6535	13129.9	23.50	68.44	0.250	450	119	180.159	179.588	183.500	182.080	0.159	0.480	0.013	0.198	PRESSURIZED	110	1.57	1.328	0.126	179.588	0.793	0.793184125	181.016	1.26
Partington	5R3520	5R3519	0.7		6226	17488.1	24.76	66.27	0.322	525	119	179.528	179.112	182.080	181.300	0.216	0.350	0.013	0.254	PRESSURIZED	110	1.49	1.106	0.113	179.112	0.600	0.599923323	180.223	1.33
Partington	5R3519	5R3518	0.7		5463	21312.2	26.10	64.14	0.380	525	104	179.112	178.602	181.300	180.850	0.216	0.490	0.013	0.301	PRESSURIZED	110	1.75	0.923	0.157	178.602	0.712	0.711601684	179.623	0.99
Partington	5R3518	5R3517	0.7		1595	22428.7	27.09	62.66	0.390	525	7	178.572	178.534	180.850	180.500	0.216	0.540	0.013	0.316	PRESSURIZED	110	1.80	0.721	0.166	178.534	0.050	0.050411334	178.911	0.06
Partington	5R3517	5R3516	0.7	45	5556	26317.9	27.15	62.57	0.502	600	119.5	178.474	178.056	180.500	180.150	0.283	0.350	0.013	0.363	PRESSURIZED	110	1.78	0.708	0.161	178.056	0.717	0.716633705	178.861	1.12
Partington	5R3516	5R3515	0.7		6123	30604	28.27	60.98	0.518	675	106	177.996	177.742	180.150	180.500	0.358	0.240	0.013	0.412	PRESSURIZED	110	1.45	0.410	0.107	177.742	0.380	0.379761976	178.144	1.22
Partington	5R3515	5R3514	0.7		6156	34913.2	29.49	59.35	0.576	750	106	177.682	177.501	180.500	180.400	0.442	0.170	0.013	0.459	PRESSURIZED	110	1.30	0.284	0.087	177.501	0.276	0.27601109	177.765	1.36
Partington	5R3514	5R3756	0.7		5374	38675	30.85	57.64	0.619	750	106	177.501	177.300	180.400	180.400	0.442	0.190	0.013	0.485	PRESSURIZED	110	1.40	0.189	0.100	177.300	0.316	0.316016351	177.489	1.26

Event Information	A	1259	B	8.8	C	0.838	**5 year no tail condition on Partington**	
Tail Condition	HGL	0	m				**Development - 50L/s**	
Develop	flow	0	CMS					
Develop	HGL		m					

W.R.T. downstream pt

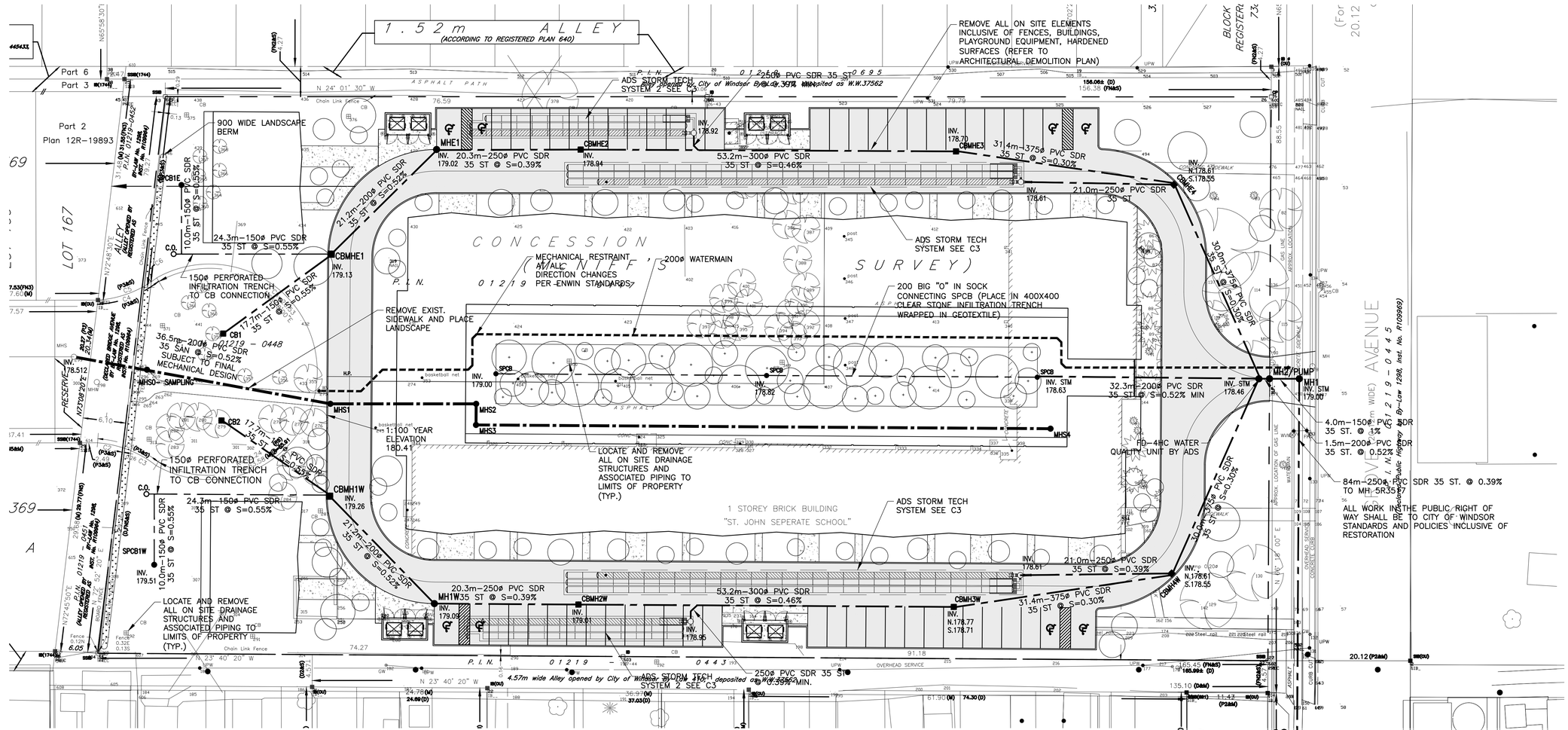
Street	From	To	Local C	Develop. Load	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m		HGL elev	time to next pt
Partington	5R3523	5R3522	0.7		5784	4048.8	20	75.35	0.085	300	119	181.100	180.541	183.860	183.250	0.071	0.470	0.013	0.066	PRESSURIZED	110	1.20	1.613	0.073	180.541	0.773		182.122	1.65
Partington	5R3522	5R3521	0.7		6438	8555.4	21.65	71.90	0.171	450	119	180.421	180.159	183.250	183.500	0.159	0.220	0.013	0.134	PRESSURIZED	110	1.07	1.400	0.059	180.159	0.393		181.349	1.85
Partington	5R3521	5R3520	0.7		6535	13129.9	23.50	68.44	0.250	450	119	180.159	179.588	183.500	182.080	0.159	0.480	0.013	0.198	PRESSURIZED	110	1.57	1.268	0.126	179.588	0.793		180.956	1.26
Partington	5R3520	5R3519	0.7		6226	17488.1	24.76	66.27	0.322	525	119	179.528	179.112	182.080	181.300	0.216	0.350	0.013	0.254	PRESSURIZED	110	1.49	1.046	0.113	179.112	0.600		180.163	1.33
Partington	5R3519	5R3518	0.7		5463	21312.2	26.10	64.14	0.380	525	104	179.112	178.602	181.300	180.850	0.216	0.490	0.013	0.301	PRESSURIZED	110	1.75	0.862	0.157	178.602	0.712		179.563	0.99
Partington	5R3518	5R3517	0.7		1595	22428.7	27.09	62.66	0.390	525	7	178.572	178.534	180.850	180.500	0.216	0.540	0.013	0.316	PRESSURIZED	110	1.80	0.660	0.166	178.534	0.050		178.851	0.06
Partington	5R3517	5R3516	0.7	50	5556	26317.9	27.15	62.57	0.507	600	119.5	178.474	178.056	180.500	180.150	0.283	0.350	0.013	0.363	PRESSURIZED	110	1.79	0.648	0.164	178.056	0.730		178.801	1.11
Partington	5R3516	5R3515	0.7		6123	30604	28.26	60.99	0.519	675	106	177.996	177.742	180.150	180.500	0.358	0.240	0.013	0.412	PRESSURIZED	110	1.45	0.336	0.107	177.742	0.380		178.071	1.22
Partington	5R3515	5R3514	0.7		6156	34913.2	29.48	59.36	0.576	750	106	177.682	177.501	180.500	180.400	0.442	0.170	0.013	0.459	PRESSURIZED	110	1.30	0.211	0.087	177.501	0.276		177.691	1.36
Partington	5R3514	5R3756	0.7		5374	38675	30.84	57.65	0.619	750	106	177.501	177.300	180.400	180.400	0.442	0.190	0.013	0.485	PRESSURIZED	110	1.40	0.115	0.100	177.300	0.316		177.415	1.26

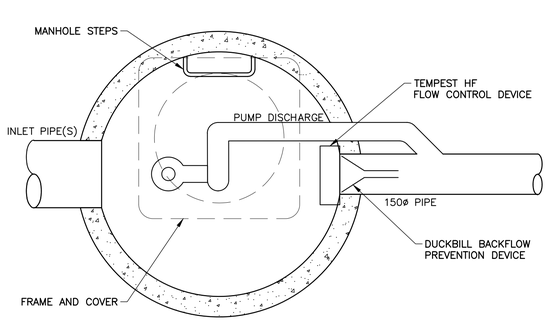
Event Information	A	1259	B	8.8	C	0.838	**5 year max tail water constant**	
Tail Condition	HGL	177.374	m				**Development - 50L/s**	
Develop	flow	0	CMS					
Develop	HGL		m					

W.R.T. downstream pt

Street	From	To	Local C	Develop Addition	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m	Acc. Head Loss	HGL elev	time to next pt
Partington	5R3523	5R3522	0.7		5784	4048.8	20	75.35	0.085	300	119	181.100	180.541	183.860	183.250	0.071	0.470	0.013	0.066	PRESSURIZED	110	1.20	1.687	0.073	180.541	0.773	0.772942075	182.196	1.65
Partington	5R3522	5R3521	0.7		6438	8555.4	21.65	71.90	0.171	450	119	180.421	180.159	183.250	183.500	0.159	0.220	0.013	0.134	PRESSURIZED	110	1.07	1.474	0.059	180.159	0.393	0.393421933	181.423	1.85
Partington	5R3521	5R3520	0.7		6535	13129.9	23.50	68.44	0.250	450	119	180.159	179.588	183.500	182.080	0.159	0.480	0.013	0.198	PRESSURIZED	110	1.57	1.342	0.126	179.588	0.793	0.793184125	181.030	1.26
Partington	5R3520	5R3519	0.7		6226	17488.1	24.76	66.27	0.322	525	119	179.528	179.112	182.080	181.300	0.216	0.350	0.013	0.254	PRESSURIZED	110	1.49	1.120	0.113	179.112	0.600	0.599923323	180.237	1.33
Partington	5R3519	5R3518	0.7		5463	21312.2	26.10	64.14	0.380	525	104	179.112	178.602	181.300	180.850	0.216	0.490	0.013	0.301	PRESSURIZED	110	1.75	0.936	0.157	178.602	0.712	0.711601684	179.637	0.99
Partington	5R3518	5R3517	0.7		1595	22428.7	27.09	62.66	0.390	525	7	178.572	178.534	180.850	180.500	0.216	0.540	0.013	0.316	PRESSURIZED	110	1.80	0.734	0.166	178.534	0.050	0.050411334	178.925	0.06
Partington	5R3517	5R3516	0.7	50	5556	26317.9	27.15	62.57	0.507	600	119.5	178.474	178.056	180.500	180.150	0.283	0.350	0.013	0.363	PRESSURIZED	110	1.79	0.722	0.164	178.056	0.730	0.729883967	178.875	1.11
Partington	5R3516	5R3515	0.7		6123	30604	28.26	60.99	0.519	675	106	177.996	177.742	180.150	180.500	0.358	0.240	0.013	0.412	PRESSURIZED	110	1.45	0.410	0.107	177.742	0.380	0.37993746	178.145	1.22
Partington	5R3515	5R3514	0.7		6156	34913.2	29.48	59.36	0.576	750	106	177.682	177.501	180.500	180.400	0.442	0.170	0.013	0.459	PRESSURIZED	110	1.30	0.285	0.087	177.501	0.276	0.276137974	177.765	1.36
Partington	5R3514	5R3756	0.7		5374	38675	30.84	57.65	0.619	750	106	177.501	177.300	180.400	180.400	0.442	0.190	0.013	0.485	PRESSURIZED	110	1.40	0.189	0.100	177.300	0.316	0.31616082	177.489	1.26

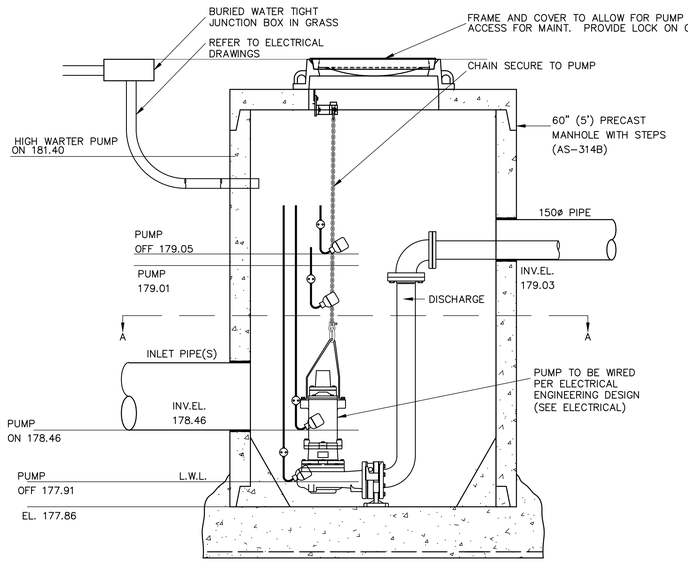
DEVELOPMENT DRAWINGS





SECTION A–A – PUMPING MANHOLE

NOT TO SCALE



SECTIONAL DETAIL OF PUMPING MANHOLE

NOT TO SCALE

ALL MEASUREMENTS SHOWN ON THIS DRAWING ARE IMPERIAL UNLESS MENTIONED OTHERWISE.

SITE BENCHMARK:

SEE SURVEY

THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS:

1. TOPOGRAPHIC SURVEY
2. ARCHITECTURAL SITE PLAN AND ARCHITECTURAL SITE DEMO
3. MECHANICAL SITE PLAN

HADDAD MORGAN & ASSOCIATES LTD
CONSULTING ENGINEERS
24 Shepherd St. E. Windsor, ON N8X 2J8
(519) 973-1177 hma@haddadmorgan.com

LICENSED PROFESSIONAL ENGINEER
W.D. TAPE
100026210
JANUARY 17, 2024
PROVINCE OF ONTARIO

DATE	ISSUED FOR
JAN 17, 24	REVISION
JAN 15, 24	REVISION
DEC 14, 23	SWM REPORT REVISION
MAR 27, 23	SWM REPORT

PROJECT :

GROVE AVENUE DEVELOPMENT

OLIVIA CONSTRUCTION HOMES

Windsor, Ontario

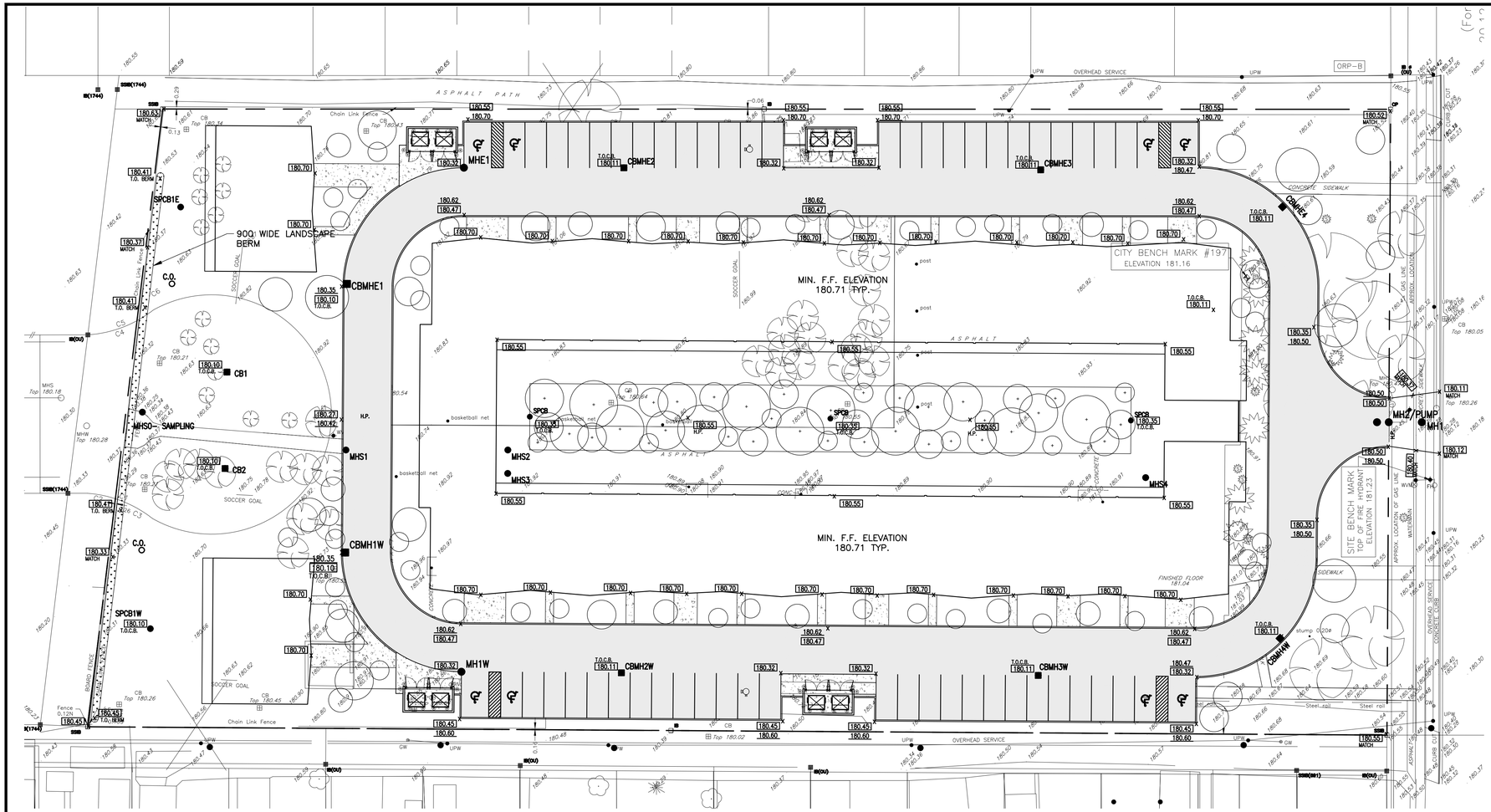
DWG. TITLE :

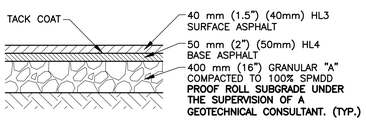
SITE SERVICING

DATE	: FEB 2023
SCALE	: AS SHOWN
DESIGNED BY	: W.T.
DRAWN BY	: A.K./V.K.
CHECKEDBY	: W.T.
APPROVED BY	: W.T.
PROJECTNO.	: 23–209

DWG. NO.

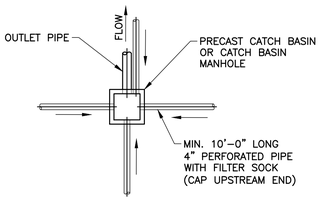
C1





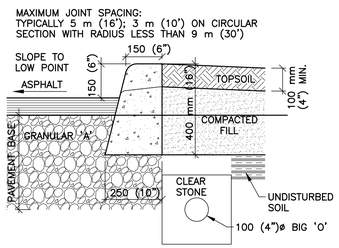
PARKING LOT PAVEMENT

NOT TO SCALE



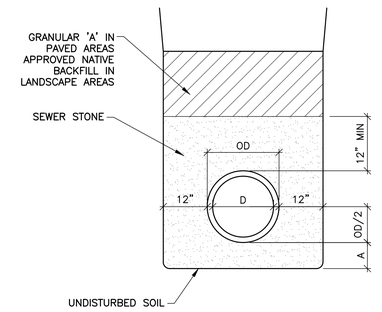
SUBDRAINS AT CATCHBASIN DETAIL

NOT TO SCALE



150 mm (6") HIGH CONCRETE CURB

NOT TO SCALE

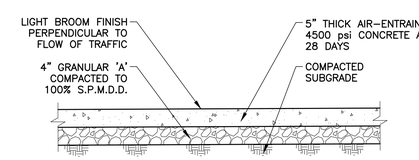


NOTES: O.D. IS NOT TO INCLUDE BELL.
A = D/4 BUT NOT LESS THAN 6"

ALTERNATIVE BEDDING MATERIAL MAY BE USED, SUBJECT TO THE APPROVAL OF THE ENGINEER PRIOR TO THE START OF CONSTRUCTION.

CLASS 'B' BEDDING DETAIL

NOT TO SCALE



NOTES:

1. CONTRACTION JOINTS SHALL BE SPACED AT 5'-0" MAXIMUM INTERVALS.
2. EXPANSION JOINTS SHALL BE PREMOULDED FILLER, SPACED AT A MAXIMUM OF 50'-0" O.C. AND SHALL BE PROVIDED WHERE THE WALK ABUTS STRUCTURES, BEGINNING AND END OF RADII AND WHERE WALK ABUTS EXISTING CONCRETE.

CONCRETE SIDEWALK

NOT TO SCALE

ALL MEASUREMENTS SHOWN ON THIS DRAWING ARE METRIC UNLESS MENTIONED OTHERWISE.

SITE BENCHMARK:

SEE SURVEY FOR BENCHMARK LOCATION

THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS:

1. SURVEY
2. ARCHITECTURAL SITE PLAN AND ARCHITECTURAL SITE DEMO PLAN
3. MECHANICAL SITE PLAN

GENERAL NOTES:

1. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION, THE CONTRACTOR SHALL FIELD VERIFY ALL DIMENSIONS AND FIELD CONDITIONS. IN THE EVENT DIMENSIONS OR FIELD CONDITIONS VARY FROM DESIGN DRAWINGS, THE ENGINEER SHALL BE NOTIFIED.
2. THE LOCATION OF UTILITIES AS SHOWN ON THIS DRAWING ARE NOT CERTIFIED AS TO LOCATION. THE ONUS LIES UPON THE TENDERER (AND AFTER ACCEPTANCE OF TENDER, UPON THE CONTRACTOR) TO ASCERTAIN AT HIS OWN EXPENSE THE EXACT LOCATION OF EACH UTILITY. NO EXTRA OR CLAIM FOR COMPENSATION WILL BE ALLOWED IF IT IS DISCOVERED THAT ANY UTILITY IS ACTUALLY LOCATED ON THE SITE AND IS IN CONFLICT WITH THE PROPOSED WORKS.
3. THE CONTRACTOR ASSUMES FULL RESPONSIBILITY TO CONTACT THE VARIOUS UTILITY COMPANIES FOR LOCATES AND TO REPAIR ANY DAMAGE THAT MAY HAVE OCCURRED TO THESE UTILITIES OR TO OTHER THIRD PARTIES ARISING OUT OF ANY ACT OR NEGLECT BY THE CONTRACTOR, OR ANYONE ACTING UNDER HIS AUTHORITY, DURING THE COURSE OF WORK. THE CONTRACTOR AGREES TO INDEMNIFY THE GREATER ESSEX COUNTY DISTRICT SCHOOL BOARD AND HADDAD, MORGAN AND ASSOCIATES LTD. AGAINST THE CONTRACTOR'S ACTIONS.
4. ALL SIGNS, BARRICADES, FENCES AND LIGHTS SHALL BE MAINTAINED BY THE CONTRACTOR AS DIRECTED BY THE ENGINEER.
5. THE CONTRACTOR AND HIS WORKERS SHALL UNDERTAKE ALL WORK ON THIS PROJECT IN COMPLIANCE WITH THE "OCCUPATIONAL HEALTH AND SAFETY ACT AND REGULATIONS FOR CONSTRUCTION PROJECTS", ONT. REG. 213/91 AS AMENDED.
6. ALL WORK SHALL CONFORM TO THE CITY OF WINDSOR SPECIFICATIONS AND/OR REQUIREMENTS.
7. ALL DIMENSIONS SHOWN ON THE PLAN ARE IN METRIC UNITS.
8. ALL DIMENSIONS SHOWN ON THE PLAN ARE TO FACE OF CURB OR EDGE OF PAVEMENT, UNLESS NOTED OTHERWISE. ALL ELEVATIONS INDICATED ARE AT EDGE OF PAVEMENT.
9. THE LIMIT FOR EXCAVATION AND GRANULAR BASE INSTALLATION SHALL BE 6" BEYOND EDGE OF PAVEMENTS OR BACK OF CURB.
10. SUBGRADE SHALL BE SHAPED TO THE SPECIFIED GRADE AND CROSS SECTION AND HEAVILY PROOF-ROLLED TO DETERMINE THE PRESENCE OF ANY SOFT SPOTS IN THE PRESENCE OF A GEOTECHNICAL ENGINEER.
11. ALL EXCAVATED MATERIAL SHALL BE REMOVED FROM SITE.
12. GRANULAR BASE SHALL BE GRANULAR 'A' MATERIAL CONFORMING TO OPSS 1010, MECHANICALLY COMPACTED TO 100% S.P.M.D.D. BASE THICKNESS SHALL BE MINIMUM 12".
13. STORM DRAINS SHALL BE PVC PIPE DR35 CERTIFIED TO CSA B182.2. TRENCHES UNDER PAVEMENTS, SIDEWALKS AND 5' BEHIND CURBS TO BE BACKFILLED WITH GRANULAR 'A' CONFORMING TO OPSS 1010 MECHANICALLY COMPACTED TO 100% S.P.M.D.D. UNDER GRASSED AREA BACKFILL WITH NATIVE MATERIAL COMPACTED TO 90% S.P.M.D.D. STORM DRAINS SHALL BE INSTALLED IN ACCORDANCE WITH OPSS 410.
14. BENCHING IS NOT REQUIRED IN STORM MANHOLES. PROVIDE A MINIMUM OF 12" AND A MAXIMUM OF 18" DEEP SUMP.
15. CATCH BASINS SHALL BE INSTALLED IN ACCORDANCE WITH OPSS 407 AT THE LOCATIONS AS INDICATED. CATCH BASIN FRAME AND COVER SHALL CONFORM TO OPSD 400.020. CATCH BASINS TO HAVE 24" SUMPS. INSTALL 6" ø 'T' TRAP CLEAN-OUTS. INSTALL FILTER CLOTH UNDER GRATES DURING CONSTRUCTION.
16. SUBDRAINS AND TILE DRAINS SHALL BE 4" ø BIG 'O' WRAPPED WITH FILTER FABRIC SOCK BACKFILLED WITH 3/4" CLEAR STONE. SLOPE 4" ø BIG 'O' @ 0.2%. BIG 'O' SUBDRAINS SHALL BE INSTALLED UNDER CURBS AND CONNECTED TO THE NEAREST CATCHBASIN.
17. CONCRETE FOR BARRIER CURBS, SIDEWALKS AND DRIVEWAYS SHALL HAVE A COMPRESSIVE STRENGTH OF 32 MPa AT 28 DAYS WITH 6% TO 8% AIR ENTRAINMENT.
18. THE CONTRACTOR SHALL SUPPLY, PLACE AND COMPACT HOT-MIX, HOT-LAID ASPHALTIC CONCRETE IN ACCORDANCE WITH OPSS 310 "HOT MIX ASPHALT".
19. SURFACE COURSE ASPHALT SHALL BE HL3 AND BASE COURSE ASPHALT SHALL BE HL4. ASPHALTIC MIXTURES SHALL BE MANUFACTURED IN ACCORDANCE WITH THE REQUIREMENTS OF OPSS 1150.
20. PAVEMENT MARKINGS SHALL BE PLACED ON A CLEAN SURFACE. TRAFFIC PAINT SHALL BE WATER BASED LATEX TRAFFIC PAINT YELLOW IN COLOUR.
21. ALL EXISTING GRASS AREAS DISTURBED DURING CONSTRUCTION SHALL BE RESTORED WITH A MINIMUM OF 4" TOPSOIL, GRASS SEED AND HYDRO MULCH.
22. PROVIDE ALL CONCRETE PAVED SURFACES, SIDEWALKS, AND DRIVES WITH CRYSTAL-LOK BY IMCO.
23. PROVIDE SURVEY SEALED BY A ONTARIO LAND SURVEYOR VERIFYING ALL GRADES AND INVERTS UPON COMPLETION OF WORK.
24. MANAGE ALL EXCESS SOILS IN ACCORDANCE WITH ALL APPLICABLE REGULATIONS.
25. ALL WORK IN THE RIGHT OF WAY SHALL BE IN ACCORDANCE WITH CITY OF WINDSOR BEST PRACTICES AND STANDARDS AND SUBJECT TO FULL TIME INSPECTION AS REQUIRED/DIRECTED BY THE CITY OF WINDSOR.

SEDIMENT CONTROL MEASURES:

1. THE CONTRACTOR SHALL PROTECT ALL EXPOSED SURFACES AND CONTROL ALL RUNOFF DURING CONSTRUCTION.
2. ALL EROSION CONTROL MEASURES SHALL BE IN PLACE PRIOR TO STARTING CONSTRUCTION AND MUST REMAIN IN PLACE UNTIL RESTORATION IS COMPLETE.
3. THE CONTRACTOR SHALL MAINTAIN EROSION CONTROL MEASURES DURING CONSTRUCTION.
4. ALL COLLECTED SEDIMENT SHALL BE DISPOSED OF AT AN APPROVED LOCATION.
5. AREA DISTURBED DURING CONSTRUCTION SHALL BE KEPT TO A MINIMUM.
6. ALL DE-WATERING SHALL BE DISPOSED OF IN AN APPROVED SEDIMENTATION BASIN.
7. THE CONTRACTOR SHALL PROTECT ALL CATCHBASINS, MANHOLES AND PIPE ENDS FROM SEDIMENT INTRUSION WITH FILTER CLOTH OR OTHER APPROVED METHOD.
8. ALL SUMPS SHALL BE KEPT CLEAN DURING CONSTRUCTION.
9. THE CONTRACTOR SHALL PREVENT WIND-BLOWN DUST.
10. STRAW BALES ARE TO BE USED DURING CONSTRUCTION, AS REQUIRED.

THE FOLLOWING CITY OF WINDSOR STANDARD DRAWINGS SHALL APPLY TO THIS CONTRACT:

COMMERCIAL DRIVE – CONCRETE	AS-204
CURB AND GUTTER FOR ASPHALT PAVEMENT	AS-208
FLAT CATCH BASIN FRAME AND GRATE	AS-301
MANHOLE FRAME AND COVER TYPE II	AS-304A
DETAIL OF TYPICAL MANHOLE STEP	AS-305
STANDARD GOSS GULLY TRAP	AS-307
600mmX600mm PRECAST CONCRETE CATCH BASIN (WITH GOSS GULLY TRAP)	AS-309
PRIVATE DRAIN DETAIL (SINGLE)	AS-313
PRE-CAST MAINTENANCE HOLE 1200mm DIAMETER	AS-314A
PRE-CAST MAINTENANCE HOLE 1500mm DIAMETER	AS-314B
CLEANOUT AT PROPERTY LINE	AS-325
RESIDENTIAL CONCRETE SIDEWALK	AS-401
SIDEWALK WHEEL CHAIR RAMP	AS-402
SUB DRAIN AT CATCH BASIN	AS-515
TRUNCATED DOME TACTILE SURFACE INDICATORS	AS-549
2' x 2' PRE-CAST CONCRETE CATCHBASIN WITH T-Y TRAP AND CLEANOUT	BD-02

HADDAD MORGAN & ASSOCIATES LTD
CONSULTING ENGINEERS
24 Shepherd St. E. Windsor, ON N8X 2J8
(519) 973-1177 hma@haddadmorgan.com

LICENSED PROFESSIONAL ENGINEER
W.D. TAPE
100026210
JANUARY 17, 2024
PROVINCE OF ONTARIO

JAN 17, 24	REVISION
JAN 15, 24	REVISION
DEC 14, 23	SWM REPORT REVISION
MAR 27, 23	SWM REPORT
DATE	ISSUED FOR

PROJECT :

GROVE AVENUE DEVELOPMENT

OLIVIA CONSTRUCTION HOMES

Windsor, Ontario

DWG. TITLE :

SITE GRADING

DATE	: FEB 2023
SCALE	: AS SHOWN
DESIGNED BY	: W.T.
DRAWN BY	: A.K./V.K.
CHECKEDBY	: W.T.
APPROVED BY	: W.T.
PROJECTNO.	: 23-209

DWG. NO.

C2

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	CODY NEATH 519-465-9958 CODY.NEATH@ADSPIPE.COM
ADS SALES REP:	JOHN NADALIN 226-219-9268 JOHN.NADALIN@ADSPIPE.COM
PROJECT NO:	S3926985
ONTARIO SITE COORDINATOR:	RYAN RUBENSTEIN 519-710-3687 RYAN.RUBENSTEIN@ADSPIPE.COM

Advanced Drainage Systems, Inc.

SiteAssist™ FOR STORMTECH INSTALLATION INSTRUCTIONS VISIT OUR WEBSITE

GROVE AVE DEVELOPMENT

WINDSOR, ON.

SC-310 STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH SC-310.
2. CHAMBERS SHALL BE ARCH-SHAPED AND SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE OR POLYETHYLENE COPOLYMERS.
3. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2922 (POLETHYLENE) OR ASTM F2418 (POLYPROPYLENE), "STANDARD SPECIFICATION FOR CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
4. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORTS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
5. THE STRUCTURAL DESIGN OF THE CHAMBERS, THE STRUCTURAL BACKFILL, AND THE INSTALLATION REQUIREMENTS SHALL ENSURE THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET FOR: 1) LONG-DURATION DEAD LOADS AND 2) SHORT-DURATION LIVE LOADS, BASED ON THE CSA S6 CL-625 TRUCK AND THE AASHTO DESIGN TRUCK WITH CONSIDERATION FOR IMPACT AND MULTIPLE VEHICLE PRESENCES.
6. CHAMBERS SHALL BE DESIGNED, TESTED AND ALLOWABLE LOAD CONFIGURATIONS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS". LOAD CONFIGURATIONS SHALL INCLUDE: 1) INSTANTANEOUS (<1 MIN) AASHTO DESIGN TRUCK LIVE LOAD ON MINIMUM COVER 2) MAXIMUM PERMANENT (75-YR) COVER LOAD AND 3) ALLOWABLE COVER WITH PARKED (1-WEEK) AASHTO DESIGN TRUCK.
7. REQUIREMENTS FOR HANDLING AND INSTALLATION:
   - TO MAINTAIN THE WIDTH OF CHAMBERS DURING SHIPPING AND HANDLING, CHAMBERS SHALL HAVE INTEGRAL, INTERLOCKING STACKING LUGS.
   - TO ENSURE A SECURE JOINT DURING INSTALLATION AND BACKFILL, THE HEIGHT OF THE CHAMBER JOINT SHALL NOT BE LESS THAN 50 mm (2").
   - TO ENSURE THE INTEGRITY OF THE ARCH SHAPE DURING INSTALLATION, a) THE ARCH STIFFNESS CONSTANT SHALL BE GREATER THAN OR EQUAL TO 400 LBS/FT/%. THE ASC IS DEFINED IN SECTION 6.2.8 OF ASTM F2418. AND b) TO RESIST CHAMBER DEFORMATION DURING INSTALLATION AT ELEVATED TEMPERATURES (ABOVE 23° C / 73° F), CHAMBERS SHALL BE PRODUCED FROM REFLECTIVE GOLD OR YELLOW COLORS.
8. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. UPON REQUEST BY THE SITE DESIGN ENGINEER OR OWNER, THE CHAMBER MANUFACTURER SHALL SUBMIT A STRUCTURAL EVALUATION FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE AS FOLLOWS:
   - THE STRUCTURAL EVALUATION SHALL BE SEALED BY A REGISTERED PROFESSIONAL ENGINEER.
   - THE STRUCTURAL EVALUATION SHALL DEMONSTRATE THAT THE SAFETY FACTORS ARE GREATER THAN OR EQUAL TO 1.95 FOR DEAD LOAD AND 1.75 FOR LIVE LOAD, THE MINIMUM REQUIRED BY ASTM F2787 AND BY SECTIONS 3 AND 12.12 OF THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS FOR THERMOPLASTIC PIPE.
   - THE TEST DERIVED CREEP MODULUS AS SPECIFIED IN ASTM F2922 SHALL BE USED FOR PERMANENT DEAD LOAD DESIGN EXCEPT THAT IT SHALL BE THE 75-YEAR MODULUS USED FOR DESIGN.
9. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

IMPORTANT - NOTES FOR THE BIDDING AND INSTALLATION OF THE SC-310 SYSTEM

1. STORMTECH SC-310 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH SC-310 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-800/DC-780 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR AN EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM - 150 mm (6") SPACING BETWEEN THE CHAMBER ROWS.
7. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE 20-50 mm (3/4-2").
8. THE CONTRACTOR MUST REPORT ANY DISCREPANCIES WITH CHAMBER FOUNDATION MATERIALS BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
9. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

1. STORMTECH SC-310 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-800/DC-780 CONSTRUCTION GUIDE".
2. THE USE OF CONSTRUCTION EQUIPMENT OVER SC-310 & SC-740 CHAMBERS IS LIMITED:
   - NO EQUIPMENT IS ALLOWED ON BARE CHAMBERS.
   - NO RUBBER TIRED LOADERS, DUMP TRUCKS, OR EXCAVATORS ARE ALLOWED UNTIL PROPER FILL DEPTHS ARE REACHED IN ACCORDANCE WITH THE "STORMTECH SC-310/SC-740/SC-800/DC-780 CONSTRUCTION GUIDE".
   - WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT CAN BE FOUND IN THE "STORMTECH SC-310/SC-740/SC-800/DC-780 CONSTRUCTION GUIDE".
3. FULL 900 mm (36") OF STABILIZED COVER MATERIALS OVER THE CHAMBERS IS REQUIRED FOR DUMP TRUCK TRAVEL OR DUMPING.

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

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

PROPOSED LAYOUT - SYSTEM 1

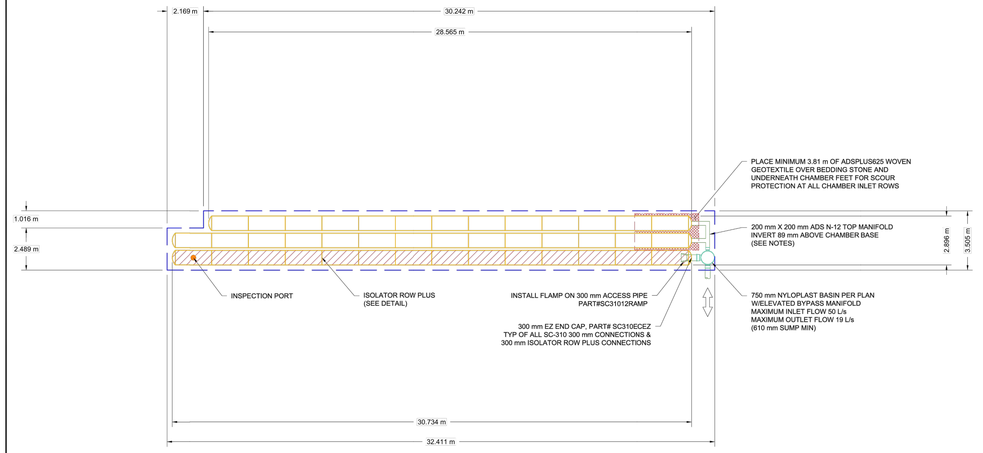
41	STORMTECH SC-310 CHAMBERS
6	STORMTECH SC-310 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
41.9	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
111.4	SYSTEM AREA (m²)
71.8	SYSTEM PERIMETER (m)

PROPOSED ELEVATIONS - SYSTEM 1

181.741	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):
179.913	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):
179.760	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):
179.760	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):
179.760	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT):
179.455	TOP OF STONE:
179.303	TOP OF SC-310 CHAMBER:
178.986	200 mm TOP MANIFOLD INVERT:
178.920	300 mm ISOLATOR ROW PLUS INVERT:
178.897	BOTTOM OF SC-310 CHAMBER:
178.745	BOTTOM OF STONE:

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- THE STORMTECH SYSTEM DEPICTED DOES NOT CONTAIN PROPER WATER QUALITY MEASURES. ABSENCE OF WATER QUALITY MEASURES CAN RESULT IN UNTREATED STORMWATER. ADS RECOMMENDS THE USE OF ISOLATOR ROW PLUS AND AN UPSTREAM HIGH FLOW BYPASS ON ALL STORMTECH SYSTEMS TO PROPERLY DIRECT THE FIRST FLUSH.
- **ATTENTION:** THIS DRAWING IS NOT INTENDED FOR USE IN BIDDING OR CONSTRUCTION WITHOUT THE PRIOR APPROVAL OF THE PROJECT'S ENGINEER OF RECORD (EOR). AS WITH ALL PROPOSED ADS LAYOUTS, THE EOR SHOULD REVIEW AND APPROVE THIS DRAWING PRIOR TO USE IN BIDDING AND/OR CONSTRUCTION. IT IS THE ULTIMATE RESPONSIBILITY OF THE EOR TO ENSURE THAT THE PRODUCT(S) DEPICTED AND THE ASSOCIATED DETAILS MEET ALL APPLICABLE LAWS, REGULATIONS, AND PROJECT REQUIREMENTS.



GROVE AVE DEVELOPMENT
WINDSOR, ON.
DATE: 01/19/24 DRAWN: JR CHECKED: JR
PROJECT #: S3926985

DATE	DRWN	CHKD	DESCRIPTION
JAN 17, 24	JR	JR	REVISION
JAN 15, 24	JR	JR	REVISION
DEC 14, 23	JR	JR	SWM REPORT REVISION
MAR 27, 23	JR	JR	SWM REPORT
DATE			ISSUED FOR

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StormTech® Chamber System
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HILLIARD, OH 43026

SCALE = 1 : 150

2 SHEET OF 8

PROPOSED LAYOUT - SYSTEM 2

87	STORMTECH SC-310 CHAMBERS
7	STORMTECH SC-310 END CAPS
152	STONE ABOVE (mm)
152	STONE BELOW (mm)
40	% STONE VOID
86.6	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
227.7	SYSTEM AREA (m²)
136.9	SYSTEM PERIMETER (m)

PROPOSED ELEVATIONS - SYSTEM 2

181.431	MAXIMUM ALLOWABLE GRADE (TOP OF PAVEMENT/UNPAVED):
179.603	MINIMUM ALLOWABLE GRADE (UNPAVED WITH TRAFFIC):
179.450	MINIMUM ALLOWABLE GRADE (UNPAVED NO TRAFFIC):
179.450	MINIMUM ALLOWABLE GRADE (BASE OF FLEXIBLE PAVEMENT):
179.450	MINIMUM ALLOWABLE GRADE (TOP OF RIGID PAVEMENT):
179.145	TOP OF STONE:
178.993	TOP OF SC-310 CHAMBER:
178.676	200 mm TOP MANIFOLD INVERT:
178.610	300 mm ISOLATOR ROW PLUS INVERT:
178.587	BOTTOM OF SC-310 CHAMBER:
178.435	BOTTOM OF STONE:

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECHNICAL NOTE 6.32 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THIS CHAMBER SYSTEM WAS DESIGNED WITHOUT SITE-SPECIFIC INFORMATION ON SOIL CONDITIONS OR BEARING CAPACITY. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR DETERMINING THE SUITABILITY OF THE SOIL AND PROVIDING THE BEARING CAPACITY OF THE INSITU SOILS. THE BASE STONE DEPTH MAY BE INCREASED OR DECREASED ONCE THIS INFORMATION IS PROVIDED.
- THE STORMTECH SYSTEM DEPICTED DOES NOT CONTAIN PROPER WATER QUALITY MEASURES. ABSENCE OF WATER QUALITY MEASURES CAN RESULT IN UNTREATED STORMWATER. ADS RECOMMENDS THE USE OF ISOLATOR ROW PLUS AND AN UPSTREAM HIGH FLOW BYPASS ON ALL STORMTECH SYSTEMS TO PROPERLY DIRECT THE FIRST FLUSH.
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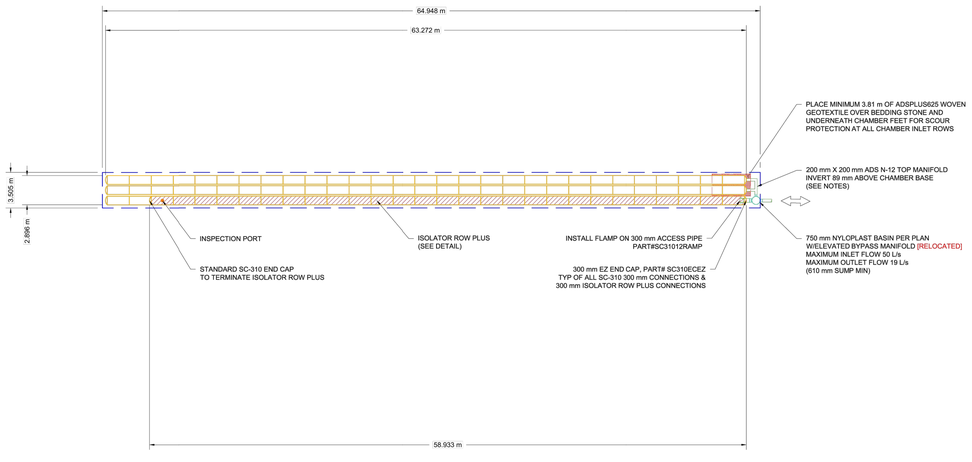

GROVE AVE DEVELOPMENT
WINDSOR, ON.
DATE: 01/19/24 DRAWN: JR CHECKED: JR
PROJECT #: S3926985

DATE	DRWN	CHKD	DESCRIPTION
JAN 17, 24	JR	JR	REVISION
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SCALE = 1 : 250

3 SHEET OF 8

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CONSULTING ENGINEERS
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(519) 973-1177 hma@haddadmorgan.com

LICENSED PROFESSIONAL ENGINEER
M.D. TAPE
100026210
PROVINCE OF ONTARIO
JANUARY 17, 2024

JAN 17, 24	REVISION
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DATE	ISSUED FOR

PROJECT :

GROVE AVENUE DEVELOPMENT

OLIVIA CONSTRUCTION HOMES

Windsor, Ontario

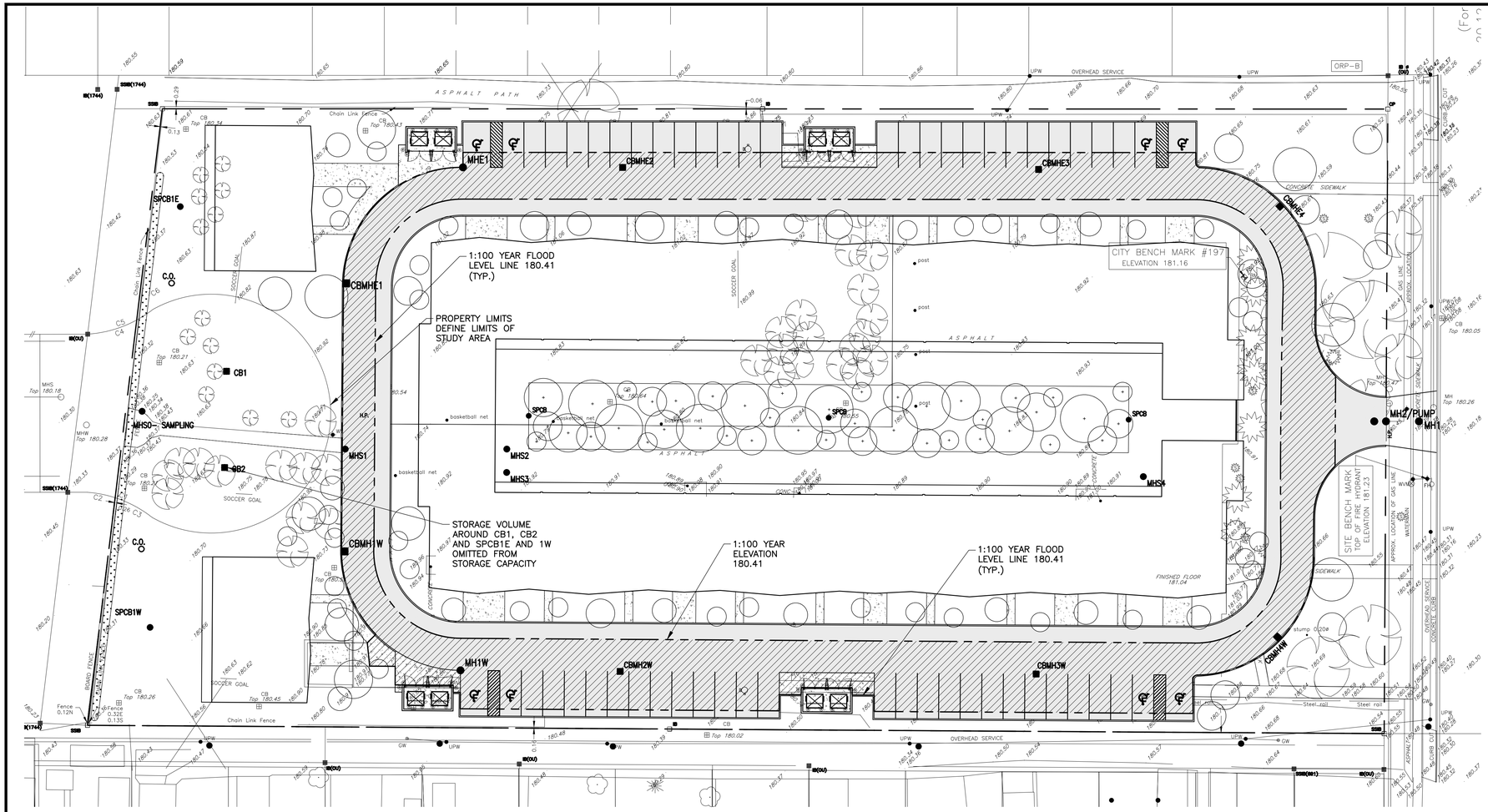
DWG. TITLE :

STORM CHAMBER DETAILS

DATE	: FEB 2023
SCALE	: AS SHOWN
DESIGNED BY	: W.T.
DRAWN BY	: A.K./V.K.
CHECKEDBY	: W.T.
APPROVED BY	: W.T.
PROJECTNO.	: 23-209

DWG. NO.

C3



ALL MEASUREMENTS SHOWN ON THIS DRAWING ARE METRIC UNLESS MENTIONED OTHERWISE.

SITE BENCHMARK:

SEE SURVEY FOR BENCHMARK LOCATION

THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE FOLLOWING DRAWINGS:

1. SURVEY
2. ARCHITECTURAL SITE PLAN
3. MECHANICAL SITE PLAN

HADDAD MORGAN & ASSOCIATES LTD
CONSULTING ENGINEERS
24 Shepherd St. E. Windsor, ON N8X 2J8
(519) 973-1177 hma@haddadmorgan.com

LICENSED PROFESSIONAL ENGINEER
W.D. TAPE
100026210
JANUARY 17, 2024
PROVINCE OF ONTARIO

DATE	ISSUED FOR
JAN 17, 24	REVISION
JAN 15, 24	REVISION
DEC 14, 23	SWM REPORT REVISION
MAR 27, 23	SWM REPORT

PROJECT :

GROVE AVENUE DEVELOPMENT

OLIVIA CONSTRUCTION HOMES

Windsor, Ontario

DWG. TITLE :

100 YEAR FLOOD LINE

DATE	: FEB 2023
SCALE	: AS SHOWN
DESIGNED BY	: W.T.
DRAWN BY	: A.K./V.K.
CHECKEDBY	: W.T.
APPROVED BY	: W.T.
PROJECTNO.	: 23-209

DWG. NO.

C4

BRIDGE AVENUE ASSESSMENT

Manhole	No tail condition with sanitary and storm present pre-development	No tail condition with sanitary and storm present post-development	tail condition with sanitary and storm present pre-development	tail condition with sanitary and storm present post-development	Differential - no tail conditon	Differential - with tail conditon
5C162	180.671	180.707	181.469	181.514	0.035	0.045
5C161	180.671	180.707	181.289	181.329	0.035	0.040
5C160	180.671	180.707	181.108	181.144	0.035	0.035
5C159	180.073	180.099	180.510	180.536	0.026	0.026
5C158	178.940	178.953	179.377	179.390	0.014	0.014

for 5C162 open channel flow condition found specific to ability to convey flow in pipe in the absense of tailwater head HGL within pipe network

Event Information	A	1259	B	8.8	C	0.838
Tail Condition	HGL	0	m			
Develop						

Bridge Sanitary Analysis

With development - no storm just sanitary loading

Street	From	To	Local C	Local Area SM				Q CMS storm	Persons Added	Sanitary Flow CMS	Ultimate flow fact.	Total Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Condition
Bridge	5C162	5C161	0.7	6066				0.000	342	0.00144	6.000	0.009	375	75	178.512	178.235	180.960	181.390	0.110	0.369	0.013	0.107	OPEN CHANNEL	Pipe able to convey proposed flow
Bridge	5C161	5C160	0.7	6200				0.000	31	0.00157	6.000	0.009	375	73.476	178.232	178.028	181.390	181.140	0.110	0.278	0.013	0.092	OPEN CHANNEL	Pipe able to convey proposed flow
Bridge	5C160	5C159	0.7	6140				0.000	31	0.00170	6.000	0.010	375	68.32	178.018	177.853	181.140	179.860	0.110	0.242	0.013	0.086	OPEN CHANNEL	Pipe able to convey proposed flow
Bridge	5C159	5C158	0.7	3664				0.000	18	0.00177	6.000	0.011	375	62.85	177.850	177.683	179.860	179.650	0.110	0.266	0.013	0.090	OPEN CHANNEL	Pipe able to convey proposed flow

Event Information	A	1259	B	8.8	C	0.838	**5 year no tail condition on Bridge**
Tail Condition	HGL	0	m				**No development - sanitary and storm loading**
Develop	flow	0	CMS				
Develop	HGL		m				

W.R.T. downstream pt

Street	From	To	Local C	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS storm	Persons Added	Sanitary Flow CMS	Ultimate flow fact.	Total Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m	Acc. Head Loss	HGL elev	time to next pt
Bridge	5C162	5C161	0.7	6066	4246.2	20	75.35	0.089	30	0.00013	1.000	0.089	375	75	178.512	178.235	180.960	181.390	0.110	0.470	0.013	0.120	OPEN CHANNEL	110	0.81					0		1.55
Bridge	5C161	5C160	0.7	6200	8586.2	21.55	72.10	0.172	31	0.00026	1.000	0.172	375	73.476	178.232	178.028	181.390	181.140	0.110	0.220	0.013	0.082	PRESSURIZED	110	1.56	2.619	0.124	178.028	0.599	0.5985327	180.671	0.79
Bridge	5C160	5C159	0.7	6140	12884.2	22.34	70.58	0.253	31	0.00039	1.000	0.253	375	68.32	178.018	177.853	181.140	179.860	0.110	0.480	0.013	0.121	PRESSURIZED	110	2.29	2.225	0.267	177.853	1.133	1.1334223	180.073	0.50
Bridge	5C159	5C158	0.7	3664	15449	22.83	69.65	0.299	18	0.00046	1.000	0.299	375	62.85	177.850	177.683	179.860	179.650	0.110	0.350	0.013	0.104	PRESSURIZED	110	2.71	1.257	0.374	177.683	1.424	1.423509	178.940	0.39

Event Information	A	1259	B	8.8	C	0.838	**5 year no tail condition on Bridge**
Tail Condition	HGL	0	m				**With development - sanitary and storm**
Develop	flow	0	CMS				
Develop	HGL		m				

W.R.T. downstream pt

Street	From	To	Local C	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS storm	Persons Added	Sanitary Flow	Ultimate flow fact.	Total Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m	Acc. Head Loss	HGL elev	time to next pt
Bridge	5C162	5C161	0.7	6066	4246.2	20	75.35	0.089	342	0.00144	1.000	0.090	375	75	178.512	178.235	180.960	181.390	0.110	0.369	0.013	0.107	OPEN CHANNEL	110	0.82					0	180.707	1.53
Bridge	5C161	5C160	0.7	6200	8586.2	21.53	72.15	0.172	31	0.00157	1.000	0.174	375	73.476	178.232	178.028	181.390	181.140	0.110	0.278	0.013	0.092	PRESSURIZED	110	1.57	2.655	0.126	178.028	0.608	0.6076671	180.707	0.78
Bridge	5C160	5C159	0.7	6140	12884.2	22.31	70.63	0.253	31	0.00170	1.000	0.254	375	68.32	178.018	177.853	181.140	179.860	0.110	0.242	0.013	0.086	PRESSURIZED	110	2.30	2.251	0.271	177.853	1.146	1.1459329	180.099	0.49
Bridge	5C159	5C158	0.7	3664	15449	22.80	69.71	0.299	18	0.00177	1.000	0.301	375	62.85	177.850	177.683	179.860	179.650	0.110	0.266	0.013	0.090	PRESSURIZED	110	2.72	1.270	0.378	177.683	1.437	1.4372747	178.953	0.38

Event Information		A	1259	B	8.8	C	0.838																								
Tail Condition		Tailwater	178.12	m																											
Develop		flow	0	CMS																											
Street	From	To	Local C	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS storm	Persons Added	Sanitary Flow CMS	Ultimate flow fact.	Total Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m	Acc. Head Loss	HGL elev	time to next pt
Bridge	5C162	5C161	0.7	6066	4246.2	20	75.35	0.089	30	0.00013	1.000	0.089	375	75	178.512	178.235	180.960	181.390	0.110	0.470	0.013	0.120	OPEN CHANNEL	110	0.81	2.960	0.033	178.235	0.180	0.1801124	181.289	1.55
Bridge	5C161	5C160	0.7	6200	8586.2	21.55	72.10	0.172	31	0.00026	1.000	0.172	375	73.476	178.232	178.028	181.390	181.140	0.110	0.220	0.013	0.082	PRESSURIZED	110	1.56	3.056	0.124	178.028	0.599	0.5985327	181.108	0.79
Bridge	5C160	5C159	0.7	6140	12884.2	22.34	70.58	0.253	31	0.00039	1.000	0.253	375	68.32	178.018	177.853	181.140	179.860	0.110	0.480	0.013	0.121	PRESSURIZED	110	2.29	2.662	0.267	177.853	1.133	1.1334223	180.510	0.50
Bridge	5C159	5C158	0.7	3664	15449	22.83	69.65	0.299	18	0.00046	1.000	0.299	375	62.85	177.850	177.683	179.860	179.650	0.110	0.350	0.013	0.104	PRESSURIZED	110	2.71	1.694	0.374	177.683	1.424	1.423509	179.377	0.39

5 year with tail condition on Bridge

No development - sanitary and storm loading

Event Information		A	1259	B		8.8	C		0.838																						
Tail Condition		tailwater	178.12	m																											
Develop		flow	0	CMS																											
Street	From	To	Local C	Local Area SM	Acc AC	time minutes	I mm/hr	Q CMS storm	Persons Added	Sanitary Flow	Ultimate flow fact.	Total Q CMS	Diameter mm	Length m	Inverts Upstream	Downstm	Rim Upstream	Dwnstrm	Area SM	Slope %	n	Q full open flow	Condition	Hazen-William C	Velocity m/s	Presssure Head m	Kinetic Head m	Potential Head m	Head Loss m	Acc. Head Loss	HGL elev	time to next pt
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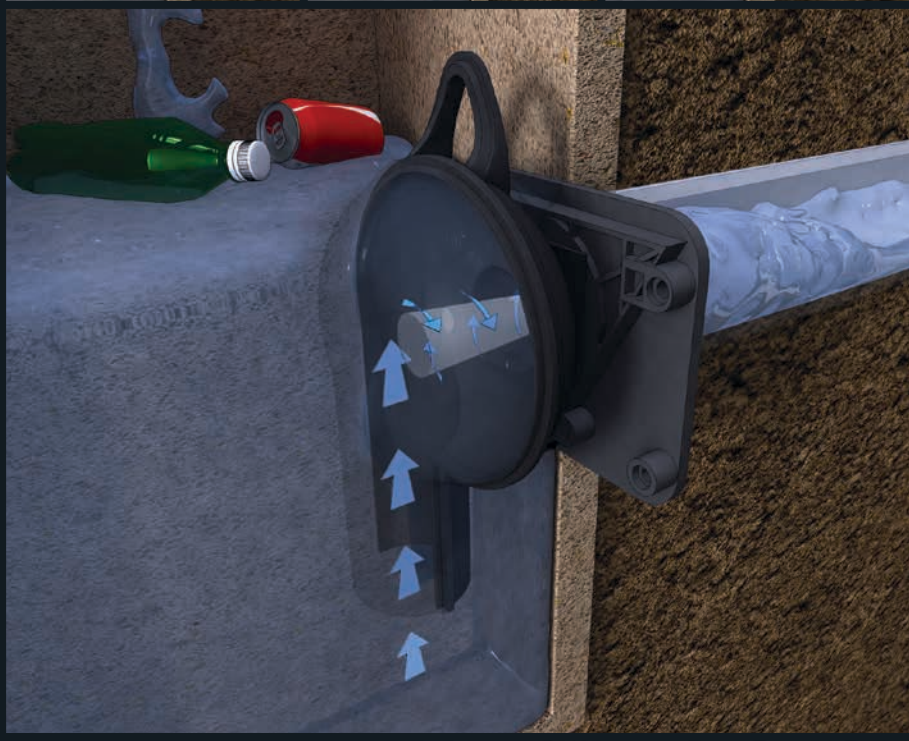
Bridge	5C161	5C160	0.7	6200	8586.2	21.53	72.15	0.172	31	0.00157	1.000	0.174	375	73.476	178.232	178.028	181.390	181.140	0.110	0.278	0.013	0.092	PRESSURIZED	110	1.57	3.092	0.126	178.028	0.608	0.6076671	181.144	0.78
Bridge	5C160	5C159	0.7	6140	12884.2	22.31	70.63	0.253	31	0.00170	1.000	0.254	375	68.32	178.018	177.853	181.140	179.860	0.110	0.242	0.013	0.086	PRESSURIZED	110	2.30	2.688	0.271	177.853	1.146	1.1459329	180.536	0.49
Bridge	5C159	5C158	0.7	3664	15449	22.80	69.71	0.299	18	0.00177	1.000	0.301	375	62.85	177.850	177.683	179.860	179.650	0.110	0.266	0.013	0.090	PRESSURIZED	110	2.72	1.707	0.378	177.683	1.437	1.4372747	179.390	0.38

5 year with tail condition on Bridge

With development - sanitary and storm

TEMPEST FLOW CONTROL DEVICE

THE NEXT GENERATION IN STORM SEWER INLET CONTROLS



TEMPEST™
INLET CONTROL DEVICES

STORM WATER FLOW CONTROL

THE COST-EFFECTIVE SOLUTION TO YOUR STORM WATER SURCHARGE PROBLEMS

- Conserves sewer system capacity
- System accommodates low to high flows
- Integrated odour and floatable control
- Fast and easy to install and maintain

IPEX
by aliaxis

We build tough products for tough environments®

TEMPEST™
INLET CONTROL DEVICES

THE NEXT GENERATION IN STORM SEWER INLET CONTROLS

✓ Reduces Sewer Overflows & Basement Backups

Tempest is a family of cost-effective inlet control devices that work together across a series of catch basins to limit the amount of storm water runoff that can enter a combined sewer system during a storm event. Basement backups and sewer overflows are avoided because storm water surcharges are controlled at the sewer inlet and are allowed to remain in catch basins or temporarily above ground.

✓ Integrated Odour & Floatable Control

In addition to flow control, Tempest systems can also alleviate sewer system odour emissions as well as prevent floating debris from entering the sewer system.

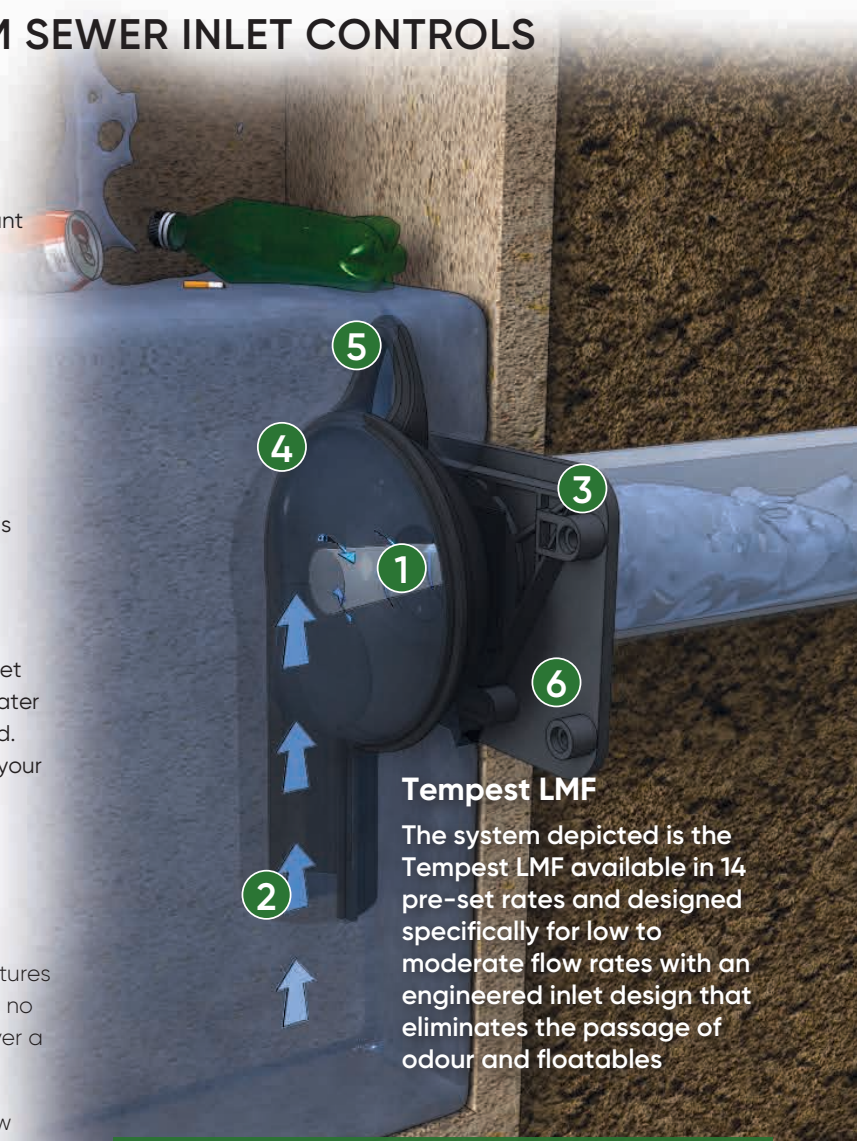
✓ Wide Range of Models & Pre-set Flow Rates

Available in a wide range of patent pending models and pre-set flow rates, Tempest systems can accommodate most storm water flow control requirements from 32 GPM to 270 GPM and beyond. Application specific solutions can also be engineered to meet your unique needs in both wet and dry catch basin environments.

✓ Easy to Install & Maintain

Constructed from durable PVC, Tempest units are corrosion free and built to last. The Tempest's light weight design accommodates both square and round catch basins and features a universal back plate and interchangeable components with no moving parts that makes the units quick and easy to install over a catch basin outlet pipe.

These devices also include a quick release mechanism to allow easy access for service without the need to drain the installation.

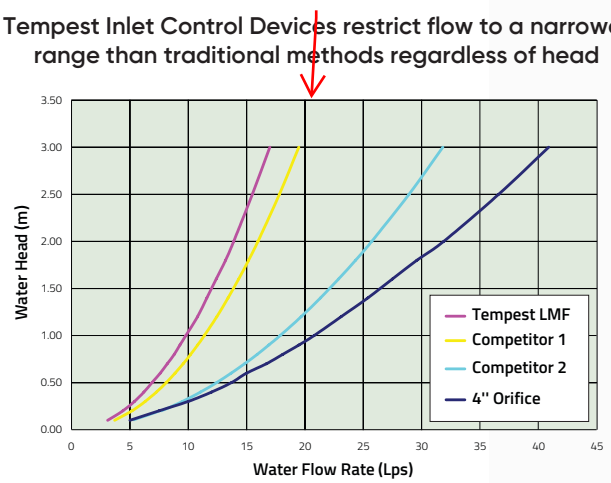


Tempest LMF

The system depicted is the Tempest LMF available in 14 pre-set rates and designed specifically for low to moderate flow rates with an engineered inlet design that eliminates the passage of odour and floatables

Not applicable for development proposed flow and head

Tempest Inlet Control Devices restrict flow to a narrower range than traditional methods regardless of head



FEATURES & BENEFITS

1. Restricts flow to a narrow range regardless of head
2. Unit design prevents the passage of floatables and odours
3. Neoprene gasket for air-tight seal*
4. Virtually maintenance free and corrosion free durable PVC construction
5. Features a quick release mechanism that's accessed with reach bar. Unit can then be simply lifted out for easy maintenance*
6. Universal back plates available for both square and round catch basins*

* Excluding Tempest HF Sump

THE TEMPEST FAMILY OF SYSTEMS

TEMPEST LMF

Restricts:
- ✓ Flow
- ✓ Odours
- ✓ Floatables

LOW to MODERATE FLOW RATES
32 GPM (2 L/s) – 270 GPM (17 L/s)
14 pre-set flow rates

The Tempest LMF system features a vortex inlet design that allows a low flow rate to be set and eliminates the passage of odours and floatables and allows for debris and sediment to collect in the structure.

TEMPEST MHF

Restricts:
- ✓ Flow

MEDIUM TO HIGH FLOW RATES
143 GPM (9L/s) or greater
Specified pre-set flow rates

The Tempest MHF is a standard orifice plate or plug device designed to allow a specified flow volume through the outlet pipe at a specified head.

TEMPEST HF & HF SUMP

Restricts:
- ✓ Flow
- ✓ Odours
- ✓ Floatables

HIGH FLOW RATES
240 GPM (15 L/s) or greater
5 pre-set flow rates

The standard Tempest HF system allows a near constant discharge rate to be set and eliminates the passage of odours and floatables and allows for debris and sediment to collect in the structure.

The Tempest HF SUMP system is designed for catch basins & manholes in which there is no sump or the outlet pipe is too low to install standard Tempest device.

UNIVERSAL BACK PLATES

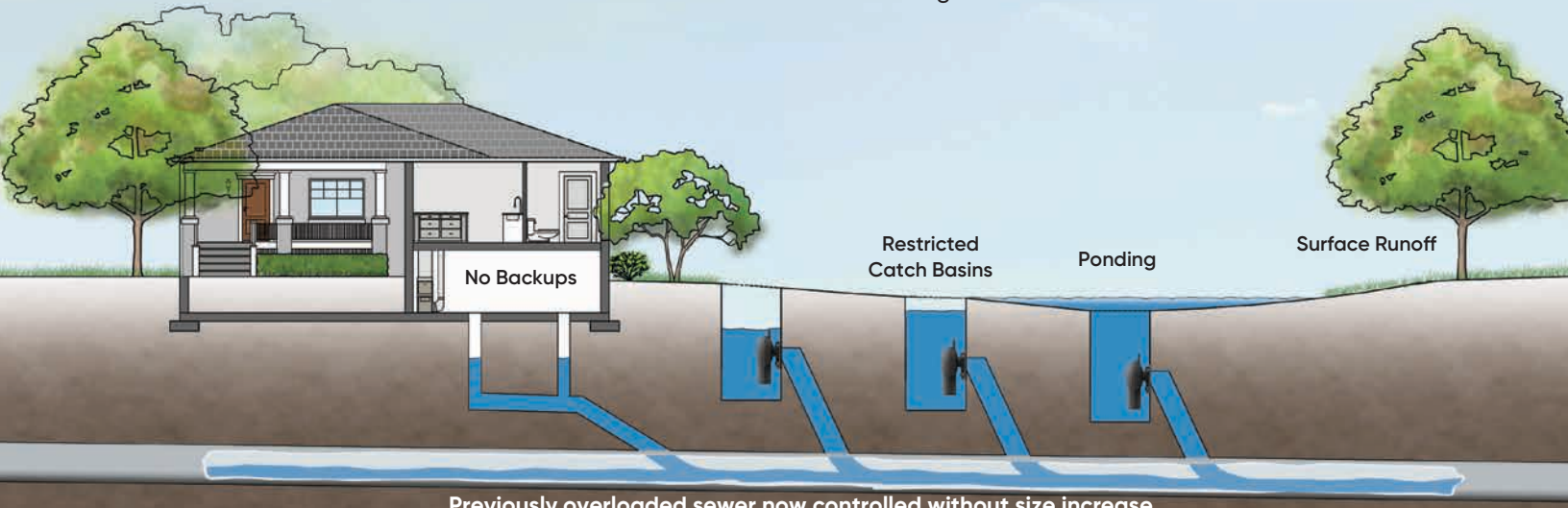
Available for BOTH square and round catch basins.*

For square catch basins

For round catch basins

SOLUTION: TEMPEST INLET CONTROL SYSTEMS

- Provides control by restricting flow into the sewer system
- Provides temporary ponding in catch basins, parking lots & roadways
- Helps preserve sewer capacity, slows down the inlet flow
- Reduces residential flooding and flash flooding
- Water surcharge is controlled and directed as per engineer design
- Can accommodate outlet pipes 6" and larger



Previously overloaded sewer now controlled without size increase

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As leading suppliers of thermoplastic piping systems, the IPEX Group of Companies provides our customers with some of the largest and most comprehensive product lines. All IPEX products are backed by more than 50 years of experience. With state-of-the-art manufacturing facilities and distribution centers across North America, we have earned a reputation for product innovation, quality, end-user focus and performance.

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- Telecommunications and utility piping systems
- PVC, CPVC, PP, PVDF, PE, ABS, and PEX pipe and fittings
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- Plumbing and mechanical piping systems
- Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems

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IPEX by aliaxis

BRMNTPIP170103RC

WATER QUALITY PROVIDE BY ADS

ADS OGS Sizing Summary

Project Name: Grove Ave

Consulting Engineer: Haddad Morgan

Location: Windsor, ON

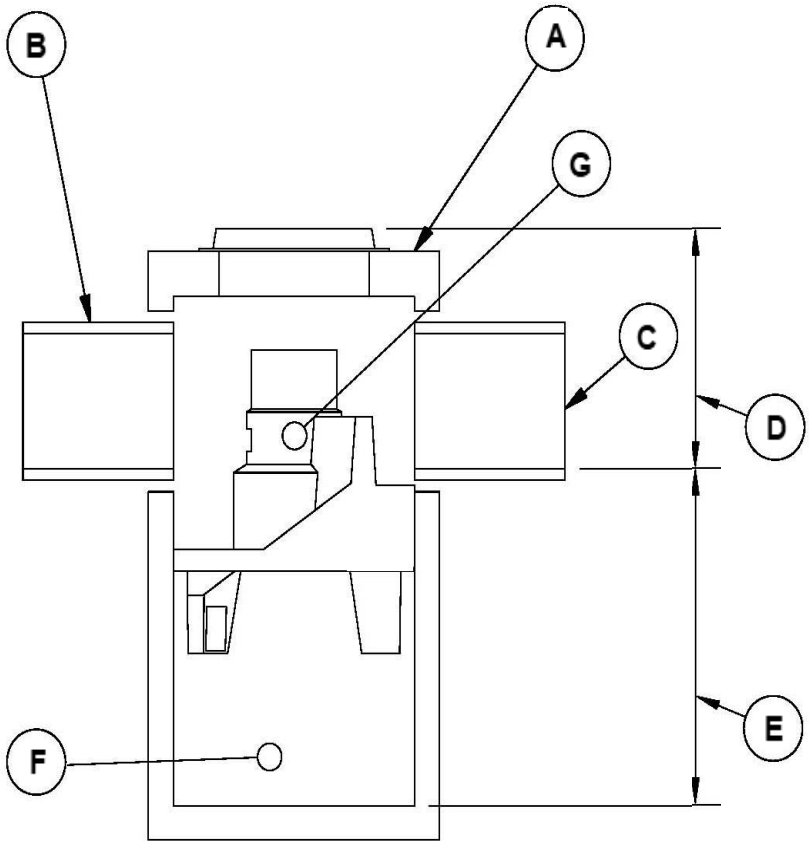
Sizing Completed By: C. Neath **Email:** cody.neath@adspipe.com

Treatment Requirements		
Treatment Goal:	Normal (MOE)	
Selected Parameters:	70% TSS	90% Volume
Selected Unit:	**FD-4HC**	

Site Details	
Site Area:	1.21 ha
% Impervious:	60%
Rational C:	0.66
Rainfall Station:	Windsor, ONT
Particle Size Distribution:	Fine
Peak Flowrate:	485 L/s

Summary of Results		
Model	**TSS Removal**	**Volume Treated**
FD-4HC	72.0%	>90%
FD-5HC	81.0%	>90%
FD-6HC	84.0%	>90%
FD-8HC	88.0%	>90%
FD-10HC	91.0%	>90%

FD-4HC Specification	
Unit Diameter (A):	1,200 mm
Inlet Pipe Diameter (B):	300 mm
Outlet Pipe Diameter (C):	300 mm
Height, T/G to Outlet Invert (D):	2000 mm
Height, Outlet Invert to Sump (E):	1515 mm
Sediment Storage Capacity (F):	0.78 m³
Oil Storage Capacity (G):	723 L
Recommended Sediment Depth for Maintenance:	440 mm
Max. Pipe Diameter:	600 mm
Peak Flow Capacity:	510 L/s



Site Elevations:	
Rim Elevation:	180.50
Inlet Pipe Elevation:	178.50
Outlet Pipe Elevation:	178.50

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.

Project Name:	Grove Ave
Consulting Engineer:	Haddad Morgan
Location:	Windsor, ON

Net Annual Removal Efficiency Summary: FD-4HC

Rainfall Intensity(1)	Rational Equation Flowrate	Surface Loading Rate	Fraction of Rainfall(1)	FD-4HC Removal Efficiency	Weighted Net-Annual Removal Efficiency
mm/hr	L/s	L/min/m^2	%	%	%
3.00	6.7	353	13.2%	87%	11.5%
4.00	8.9	471	9.6%	85%	8.1%
5.00	11.1	588	7.5%	83%	6.2%
6.00	13.3	706	6.0%	82%	4.9%
7.00	15.5	824	4.8%	81%	3.9%
8.00	17.7	941	4.1%	80%	3.3%
9.00	20.0	1059	3.6%	79%	2.8%
10.00	22.2	1177	3.2%	78%	2.5%
11.00	24.4	1295	2.8%	77%	2.2%
12.00	26.6	1412	2.5%	77%	1.9%
15.00	33.3	1765	6.6%	75%	5.0%
20.00	44.4	2354	8.3%	73%	6.1%
25.00	55.5	2942	5.8%	72%	4.2%
30.00	66.6	3531	4.6%	70%	3.2%
35.00	77.6	4119	3.8%	69%	2.6%
40.00	88.7	4707	2.9%	69%	2.0%
45.00	99.8	5296	2.4%	68%	1.6%
50.00	110.9	5884	1.8%	0%	0.0%
65.00	144.2	7650	6.6%	0%	0.0%
				Total Net Annual Removal Efficiency:	72.0%
				Total Runoff Volume Treated:	>90%

Notes:

(1) Based on Windsor/Essex Region Stormwater Manual 2018, Table 3.4.1.5

(2) Based on third party verified data and appoximating the removal of a PSD similar to the STC Fine distribution