Appendix A WATER SUPPLY SERVICING

A.1 DOMESTIC WATER DEMAND ESTIMATE

316 Somerset Street East - Domestic Water Demand Estimates

Densities as per City Guidelines:

Comercial	28000.0	
4 BR Apt	4.0	ppu

Building ID	Area (m2)	Population	Daily Rate of Demand	Avg Day Demand		Max Day Demand [1]		Peak Hour Demand [2]	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Residential	-	16	350	3.9	0.06	9.7	0.16	21.4	0.36
Commercial	98.94	-	28000	0.2	0.003	0.3	0.005	0.5	0.01
Total Site :		**16**		**4.08**	**0.07**	**10.01**	**0.17**	**21.91**	**0.37**

Average day water demand for residential areas equal to 350 L/cap/d.

The City of Ottawa water demand criteria used to estimate peak demand rates for residential areas are as follows:

1 maximum day demand rate = 2.5 x average day demand rate for residential

2 maximum hour demand rate = 2.2 x maximum day demand rate for residential

Water demand criteria used to estimate peak demand rates for retail areas are as follows:

1 maximum day demand rate = 1.5 x average day demand rate

2 maximum hour demand rate = 1.8 x maximum day demand rate

A.2 FIRE FLOW REQUIREMENTS PER FUS

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401405
Project Name: 316 Somerset St E
Date: 3/27/2018
Fire Flow Calculation #: 1
Description: Apartment Building

Notes:

Step	Task	Notes						Value Used	Req'd Fire Flow (L/min)
1	Determine Type of Construction	Wood Frame						1.5	-
2	Determine Ground Floor Area of One Unit	-						150	-
	Determine Number of Adjoining Units	Includes adjacent wood frame structures separated by 3m or less						1	-
3	Determine Height in Storeys	Does not include floors >50% below grade or open attic space						3	-
4	Determine Required Fire Flow	(F = 220 x C x $A^{1/2}$). Round to nearest 1000 L/min						-	7000
5	Determine Occupancy Charge	Limited Combustible						-15%	5950
6	Determine Sprinkler Reduction	None						0%	0
		Non-Standard Water Supply or N/A						0%	
		Not Fully Supervised or N/A						0%	
		% Coverage of Sprinkler System						0%	
7	Determine Increase for Exposures (Max. 75%)	Direction	Exposure Distance (m)	Exposed Length (m)	Exposed Height (Stories)	Length-Height Factor (m x stories)	Construction of Adjacent Wall	-	-
		North	20.1 to 30	6.7	2	0-30	Ordinary or Fire-Resistive with Unprotected Openings	6%	2559
		East	3.1 to 10	13.4	2	0-30	Wood Frame or Non-Combustible	17%	
		South	30.1 to 45	8.8	2	0-30	Wood Frame or Non-Combustible	5%	
		West	3.1 to 10	9.5	2	0-30	Ordinary or Fire-Resistive with Unprotected Openings	15%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							9000
		Total Required Fire Flow in L/s							150.0
		Required Duration of Fire Flow (hrs)							2.00
		Required Volume of Fire Flow (m^3)							1080

A.3 BOUNDARY CONDITIONS

Kilborn, Kris

From: Buchanan, Richard <Richard.Buchanan@ottawa.ca>
Sent: Wednesday, February 21, 2018 5:07 PM
To: Kilborn, Kris
Subject: RE: Boundary Conditions Request - 316 Somerset St E
Attachments: 316 Somerset E Feb 2018.pdf

Hi Kris

The following are boundary conditions, HGL, for hydraulic analysis at 316 Somerset East (zone 1W) assumed to be connected to the 406mm on Somerset (see attached PDF for location).

Minimum HGL = 106.5m

Maximum HGL = 115.8m; the maximum pressure is estimated to be above 80 psi. A pressure check at completion of construction is recommended to determine if pressure control is required

Max Day + FireFlow (150 L/s) = 106.9m

These are for current conditions and are based on computer model simulation.

Disclaimer: The boundary condition information is based on current operation of the city water distribution system. The computer model simulation is based on the best information available at the time. The operation of the water distribution system can change on a regular basis, resulting in a variation in boundary conditions. The physical properties of watermains deteriorate over time, as such must be assumed in the absence of actual field test data. The variation in physical watermain properties can therefore alter the results of the computer model simulation.

Richard Buchanan, CET

Project Manager, Development Approvals
Planning, Infrastructure and Economic Development Department
Planning & Growth Management Branch
City of Ottawa | Ville d'Ottawa
613.580.2424 ext./poste 27801
ottawa.ca/planning / ottawa.ca/urbanisme

From: Kilborn, Kris [mailto:kris.kilborn@stantec.com]
Sent: Thursday, February 15, 2018 2:17 PM
To: Buchanan, Richard <Richard.Buchanan@ottawa.ca>
Cc: O'Connor, Ann <Ann.O'Connor@ottawa.ca>; Odam, Cameron <Cameron.Odam@stantec.com>
Subject: FW: Boundary Conditions Request - 316 Somerset St E

Good afternoon Richard hope all is well

Stantec has been retained by TC United Group for the Civil Design for the 316 Somerset Street Project.

From my understanding there was a pre-consultation in late November of last year and you were involved on Infrastructure side.

I am wondering if you could send a request for watermain hydraulic boundary conditions for the 316 Somerset St E – site plan, We anticipate the watermain connection to the proposed site plan as shown in the attached figure. This includes the connection to the 406mm WM along Somerset St E adjacent to the site.

The intended land use is a 3 storey apartment building consisting of a ground floor commercial space and the second and third floor both consisting of two - 4 bedroom apartment units.

Estimated domestic demands and fire flow requirements for the site are as follows:

Average Day Demand	- 0.1 L/s
Max Day Demand	- 0.17 L/s
Peak Hour Demand	- 0.4 L/s
Fire Flow Demand	- 150 L/s

The Fire Flow Requirement is based on see the information and calculations in the FUS sheet attached to the email.

Thanks in advance,

Kris Kilborn
Senior Associate, Community Development,
Business Center Sector Leader (BCSL)

Direct: (613) 724-4337
Mobile: (613) 297-0571
Fax: (613) 722-2799

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue
Ottawa ON K2C 3G4 CA

Stantec

'

'

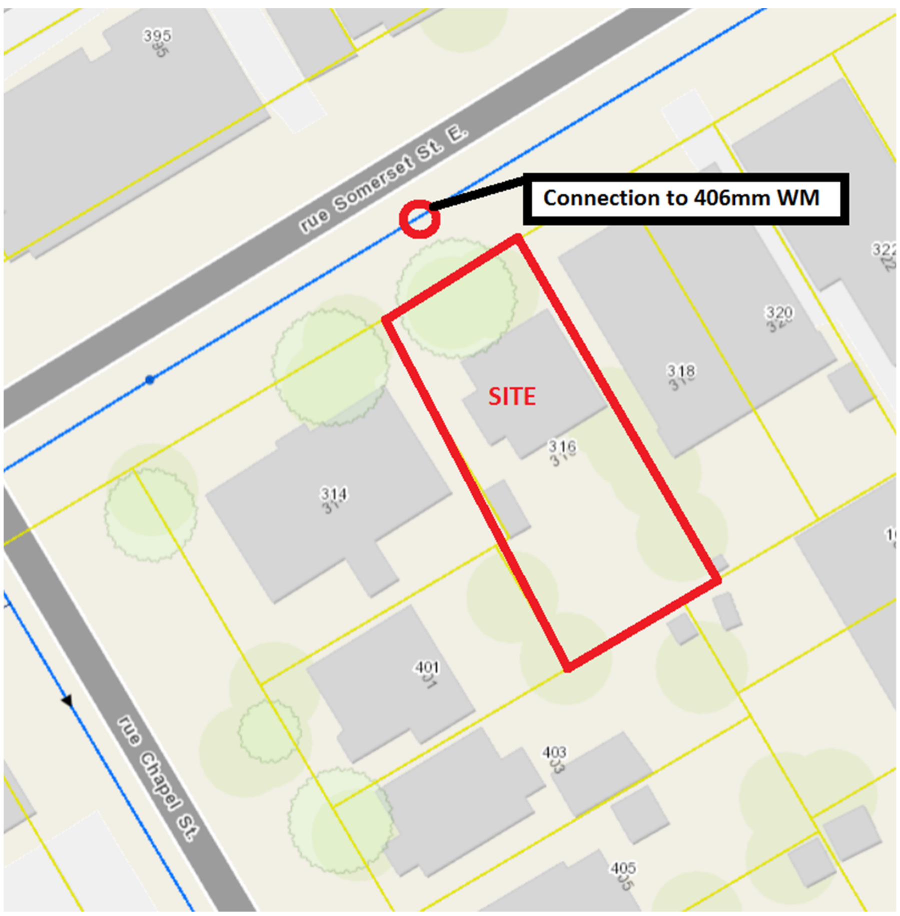
Boundary Conditions for 316 Somerset Street E

Information Provided:

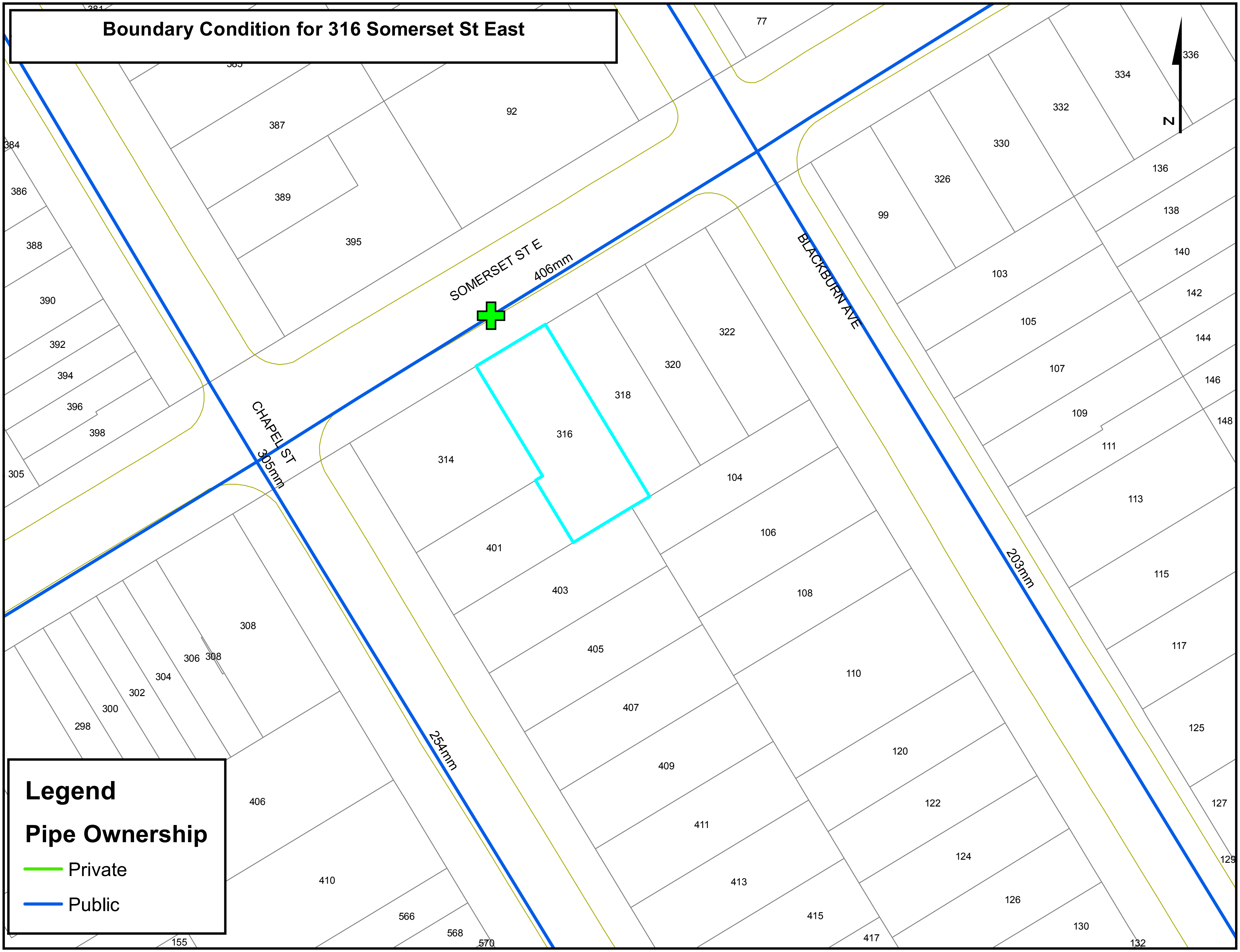
Date Provided: February 2018

Flow Demands		
Scenario	Demand	
	L/min	L/s
Average Daily Demand	4.1	0.1
Maximum Daily Demand	10	0.17
Peak Hour	21.9	0.4
Fire Flow Demand	9000	150

Location: 316 Somerset Street E



Boundary Condition for 316 Somerset St East



Appendix B WASTEWATER SERVICING

B.1 SANITARY SEWER DESIGN SHEET

SUBDIVISION:

316 Somerset Street East

DATE: 4/9/2018
REVISION: 1
DESIGNED BY: TR
CHECKED BY:

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

FILE NUMBER: 160401405

DESIGN PARAMETERS

MAX PEAK FACTOR (RES.)=	4.0	AVG. DAILY FLOW / PERSON	280 l/p/day	MINIMUM VELOCITY	0.60 m/s
MIN PEAK FACTOR (RES.)=	2.0	COMMERCIAL	28,000 l/ha/day	MAXIMUM VELOCITY	3.00 m/s
PEAKING FACTOR (INDUSTRIAL):	2.4	INDUSTRIAL (HEAVY)	55,000 l/ha/day	MANNINGS n	0.013
PEAKING FACTOR (COMM., INST.):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
		INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
		INFILTRATION	0.33 l/s/Ha		
PERSONS / 3 BED APT	3.1				
PERSONS / 4 BED APT	4.0				

LOCATION			RESIDENTIAL AREA AND POPULATION								COMMERCIAL		INDUSTRIAL (L)		INDUSTRIAL (H)		INSTITUTIONAL		GREEN / UNUSED		C+I+I	INFILTRATION			TOTAL	PIPE								
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (ha)	UNITS 3 BED	UNITS 4 BED	POP.	CUMULATIVE AREA (ha)	CUMULATIVE POP.	PEAK FACT.	PEAK FLOW (l/s)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	AREA (ha)	ACCU. AREA (ha)	PEAK FLOW (l/s)	TOTAL AREA (ha)	ACCU. AREA (ha)	INFILT. FLOW (l/s)	FLOW (l/s)	LENGTH (m)	DIA (mm)	MATERIAL	CLASS	SLOPE (%)	CAP. (FULL) (l/s)	CAP. V PEAK FLOW (%)	VEL. (FULL) (m/s)	VEL. (ACT.) (m/s)
BLDG	BLDG	TEE	0.027	0	4	16	0.03	16	4.00	0.21	0.010	0.010	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.036	0.04	0.01	0.22	12.5	135 1820	PVC	SDR 35	1.00	11.5	**1.95%**	0.80	0.26

Appendix C STORMWATER MANAGEMENT

C.1 STORM SEWER DESIGN SHEET

316 Somerset Street East		STORM SEWER DESIGN SHEET (City of Ottawa)
DATE:	10-Sep-2018	
REVISION:	1	
DESIGNED BY:	TR	FILE NUMBER: 1604-01405
CHECKED BY:		

DESIGN PARAMETERS

$I = a / (t+b)^c$ (As per City of Ottawa Guidelines, 2012)

	1:2 yr	1:10 yr			
a =	732.951	1174.184	MANNING'S n =	0.013	BEDDING CLASS = B
b =	6.199	6.014	MINIMUM COVER:	2.00	m
c =	0.810	0.816	TIME OF ENTRY	10	min

LOCATION			DRAINAGE AREA															
AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (ROOF) (ha)	C (-)	ACCUM. AREA (5YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	ACCUM. AREA (100YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)	$I_{5\text{-YEAR}}$ (mm/h)	$I_{10\text{-YEAR}}$ (mm/h)	$Q_{CONTROL}$ (NOTE 1) (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)
SITE	CBMH 600	MAIN	0.04	0.00	0.00	0.59	0.04	0.021	0.021	0.00	0.000	0.000	10.00	76.81	122.14	0.0	0.0	4.5
													10.28					

AREA ID NUMBER	PIPE SELECTION												
	LENGTH (m)	PIPE WIDTH OR DIAMETEI (mm)	PIPE HEIGHT (mm)	PIPE SHAPE (-)	MATERIAL (-)	CLASS (-)	SLOPE %	Q_{CAP} (FULL) (L/s)	% FULL (-)	VEL. (FULL) (m/s)	VEL. (ACT) (m/s)	TIME OF FLOW (min)
SITE	10.2	200	200	CIRCULAR	PVC	-	1.00	33.3	**13.57%**	1.05	0.61	0.28
		1820	1820									

C.2 RATIONAL METHOD CALCULATIONS

Stormwater Management Calculations

File No: **160401405**
Project: **316 Somerset Street East**
Date: **10-Sep-18**

SWM Approach:
Post-development to Pre-development flows

Post-Development Site Conditions:

Overall Runoff Coefficient for Site and Sub-Catchment Areas

Runoff Coefficient Table								
Sub-catchment Area **Catchment Type**	**ID / Description**		**Area (ha) "A"**		**Runoff Coefficient "C"**		**"A x C"**	**Overall Runoff Coefficient**
Uncontrolled - Tributary	UNC-1	Hard	0.001		0.9	0.001		
		Soft	0.002		0.2	0.000		
		Subtotal		0.002			0.00084	0.400
Roof	BLDG 1	Hard	0.016		0.9	0.014		
		Soft	0.000		0.2	0.000		
		Subtotal		0.016			0.01404	0.900
Controlled - Tributary	CB 600, CBT 501	Hard	0.004		0.9	0.00387		
		Soft	0.015		0.2	0.00290		
		Subtotal		0.019			0.006768	0.360
Total				**0.037**			**0.022**	
Overall Runoff Coefficient= C:								**0.59**

Total Roof Areas	**0.016 ha**
Total Tributary Surface Areas (Controlled and Uncontrolled)	**0.021 ha**
Total Tributary Area to Outlet	**0.037 ha**
Total Uncontrolled Areas (Non-Tributary)	**0.000 ha**
Total Site	**0.037 ha**

Stormwater Management Calculations

Project #160401405, 316 Somerset Street East
Modified Rational Method Calculatons for Storage

2 yr Intensity $I = a/(t + b)^c$
City of Ottawa

a =	732.951
b =	6.199
c =	0.81

t (min)	I (mm/hr)
5	103.57
10	76.81
15	61.77
20	52.03
25	45.17
30	40.04
35	36.06
40	32.86
45	30.24
50	28.04
55	26.17
60	24.56

2 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.0365
C: 0.40

Typical Time of Concentration

tc (min)	I (2 yr) (mm/hr)	Qtarget (L/s)
10	76.81	**3.12**

2 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC-1 — Uncontrolled - Tributary
Area (ha): 0.00
C: 0.40

tc (min)	I (5 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
5	103.57	0.24	0.24		
10	76.81	0.18	0.18		
15	61.77	0.14	0.14		
20	52.03	0.12	0.12		
25	45.17	0.11	0.11		
30	40.04	0.09	0.09		
35	36.06	0.08	0.08		
40	32.86	0.08	0.08		
45	30.24	0.07	0.07		
50	28.04	0.07	0.07		
55	26.17	0.06	0.06		
60	24.56	0.06	0.06		

Subdrainage Area: BLDG 1 — Roof
Area (ha): 0.016 — Maximum Storage Depth: 150 mm
C: 0.90

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	76.81	3.00	1.44	1.56	**0.93**	78.5	0.00
20	52.03	2.03	1.41	0.62	0.75	73.3	0.00
30	40.04	1.56	1.32	0.24	0.44	59.3	0.00
40	32.86	1.28	1.19	0.09	0.21	47.3	0.00
50	28.04	1.09	1.04	0.05	0.16	41.2	0.00
60	24.56	0.96	0.92	0.03	0.12	36.6	0.00
70	21.91	0.86	0.83	0.02	0.09	33.0	0.00
80	19.83	0.77	0.76	0.01	0.07	30.1	0.00
90	18.14	0.71	0.70	0.01	0.05	27.7	0.00
100	16.75	0.65	0.65	0.01	0.03	25.7	0.00
110	15.57	0.61	0.60	0.00	0.03	23.9	0.00
120	14.56	0.57	0.56	0.00	0.03	22.4	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
2-year Water Level	78.5	0.08	1.44	0.93	6.28	OK

Subdrainage Area: CB 600, CBT 501 — Controlled - Tributary
Area (ha): 0.019
C: 0.36

tc (min)	I (2 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	76.81	2.89	1.30	1.59	0.95
20	52.03	2.39	1.44	0.94	1.13
30	40.04	2.07	1.44	0.63	**1.13**
40	32.86	1.81	1.38	0.44	1.05
50	28.04	1.57	1.27	0.30	0.91
60	24.56	1.39	1.17	0.22	0.78
70	21.91	1.25	1.09	0.16	0.67
80	19.83	1.13	1.01	0.12	0.58
90	18.14	1.04	0.95	0.09	0.50
100	16.75	0.96	0.89	0.07	0.44
110	15.57	0.90	0.84	0.06	0.38
120	14.56	0.84	0.79	0.05	0.33

Storage: : Above CB

Orifice Size:	LMF 55	
Invert Elevation	56.59	m
Obvert Elevation:	56.79	m
Max Storage Depth	0.28	m
Downstream W/L	54.56	m

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
2-year Water Level	56.87	0.28	1.44	1.13	3.37	OK

SUMMARY TO OUTLET

			Vrequired	Vavailable*	
Tributary Area	0.037	ha			
Total 2yr Flow to Sewer	1.4	L/s	1.13	3.37 m^3	Ok
Non-Tributary Area	0.002	ha			
Total 5yr Flow Uncontrolled	0.2	L/s			
Total Area	0.039	ha			
Total 2yr Flow	1.7	L/s			
Target	2.9	L/s			

Project #160401405, 316 Somerset Street East
Modified Rational Method Calculatons for Storage

100 yr Intensity $I = a/(t + b)^c$
City of Ottawa

a =	1735.688
b =	6.014
c =	0.820

t (min)	I (mm/hr)
5	242.70
10	178.56
15	142.89
20	119.95
25	103.85
30	91.87
35	82.58
40	75.15
45	69.05
50	63.95
55	59.62
60	55.89

100 YEAR Predevelopment Target Release from Portion of Site

Subdrainage Area: Predevelopment Tributary Area to Outlet
Area (ha): 0.0410
C: 0.40

	Qtarget	
2-Year Pre Development Discharge	3.12	L/s
Less Peak Sanitary Discharge of	0.22	L/s
Target Release Rate	**2.90**	**L/s**

100 YEAR Modified Rational Method for Entire Site

Subdrainage Area: UNC-1 — Uncontrolled - Tributary
Area (ha): 0.00
C: 0.50

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	0.52	0.52		
20	119.95	0.35	0.35		
30	91.87	0.27	0.27		
40	75.15	0.22	0.22		
50	63.95	0.19	0.19		
60	55.89	0.16	0.16		
70	49.79	0.15	0.15		
80	44.99	0.13	0.13		
90	41.11	0.12	0.12		
100	37.90	0.11	0.11		
110	35.20	0.10	0.10		
120	32.89	0.10	0.10		

Subdrainage Area: BLDG 1 — Roof
Area (ha): 0.016 — Maximum Storage Depth: 150 mm
C: 1.00

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)	Depth (mm)	
10	178.56	7.74	1.73	6.01	3.61	124.6	0.00
20	119.95	5.20	1.76	3.44	**4.13**	129.6	0.00
30	91.87	3.98	1.76	2.23	4.01	128.5	0.00
40	75.15	3.26	1.74	1.52	3.65	125.2	0.00
50	63.95	2.77	1.70	1.07	3.22	119.2	0.00
60	55.89	2.42	1.66	0.77	2.76	112.7	0.00
70	49.79	2.16	1.62	0.54	2.29	106.0	0.00
80	44.99	1.95	1.57	0.38	1.82	99.1	0.00
90	41.11	1.78	1.52	0.27	1.44	90.3	0.00
100	37.90	1.64	1.46	0.18	1.08	81.9	0.00
110	35.20	1.53	1.41	0.12	0.76	73.8	0.00
120	32.89	1.43	1.35	0.08	0.54	64.1	0.00

Storage: Roof Storage

	Depth (mm)	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Discharge Check
100-year Water Level	129.6	0.13	1.76	4.13	6.28	OK

Subdrainage Area: CB 600, CBT 501 — Controlled - Tributary
Area (ha): 0.019
C: 0.45

tc (min)	I (100 yr) (mm/hr)	Qactual (L/s)	Qrelease (L/s)	Qstored (L/s)	Vstored (m^3)
10	178.56	5.93	2.01	3.92	2.35
20	119.95	4.59	2.25	2.34	2.81
30	91.87	3.92	2.31	1.60	**2.89**
40	75.15	3.50	2.30	1.20	2.88
50	63.95	3.20	2.26	0.94	2.82
60	55.89	2.97	2.21	0.76	2.74
70	49.79	2.79	2.16	0.63	2.65
80	44.99	2.63	2.10	0.53	2.54
90	41.11	2.48	2.04	0.44	2.40
100	37.90	2.35	1.98	0.38	2.27
110	35.20	2.24	1.92	0.32	2.13
120	32.89	2.12	1.85	0.28	1.98

Storage: Surface Storage Above CB

Orifice Size:	LMF 55		Volume in CB 600 when head = 0.7	0.25
Invert Elevation	56.59	m	Max available volume in CB	0.72
Obvert Elevation:	56.79	m		
Max Storage Depth	0.73	m		
Downstream W/L	54.56	m		

	Stage	Head (m)	Discharge (L/s)	Vreq (cu. m)	Vavail (cu. m)	Volume Check
100-year Water Level	57.32	0.73	2.31	2.89	3.37	OK
					0.48	

SUMMARY TO OUTLET

			Vrequired	Vavailable*
Tributary Area	0.037	ha		
Total 100yr Flow to Sewer	2.3	L/s	2.89	3.37 m^3
Non-Tributary Area	0.002	ha		
Total 100yr Flow Uncontrolled	0.5	L/s		
Total Area	0.039	ha		
Total 100yr Flow	2.8	L/s		
Target	2.9	L/s		

Project #160401405, 316 Somerset Street East
Roof Drain Design Sheet, Area BLDG
Standard Watts Model R1100 Accutrol Roof Drain

Rating Curve				Volume Estimation				Water Depth
Elevation (m)	Discharge Rate (cu.m/s)	Outlet Discharge (cu.m/s)	Storage (cu. m)	Elevation (m)	Area (sq. m)	Volume (cu. m) Increment	Volume (cu. m) Accumulated	Water Depth (m)
0.000	0.0000	0.0000	0	0.000	0	0	0	0.000
0.025	0.0003	0.0006	0	0.025	3	0	0	0.025
0.050	0.0006	0.0013	0	0.050	14	0	0	0.050
0.075	0.0007	0.0014	1	0.075	31	1	1	0.075
0.100	0.0008	0.0016	2	0.100	56	1	2	0.100
0.125	0.0009	0.0017	4	0.125	87	2	4	0.125
0.150	0.0009	0.0019	6	0.150	126	3	6	0.150

Drawdown Estimate			
Total Volume (cu.m)	Total Time (sec)	Vol (cu.m)	Detention Time (hr)
0.0	0.0	0.0	0
0.2	161.3	0.2	0.0448
0.8	389.1	0.6	0.1529
1.8	682.0	1.1	0.34235
3.6	1022.2	1.8	0.6263
6.3	1397.9	2.6	1.0146

Rooftop Storage Summary

Total Building Area (sq.m)		157
Assume Available Roof Area (sq.	80%	125.6
Roof Imperviousness		0.99
Roof Drain Requirement (sq.m/Notch)		232
Number of Roof Notches*		2
Max. Allowable Depth of Roof Ponding (m)		0.15
Max. Allowable Storage (cu.m)		6
Estimated 100 Year Drawdown Time (h)		0.7

* As per Ontario Building Code section OBC 7.4.10.4.(2)(c).

* Note: Number of drains can be reduced if multiple-notch drain used.

From Watts Drain Catalogue

Head (m) L/s

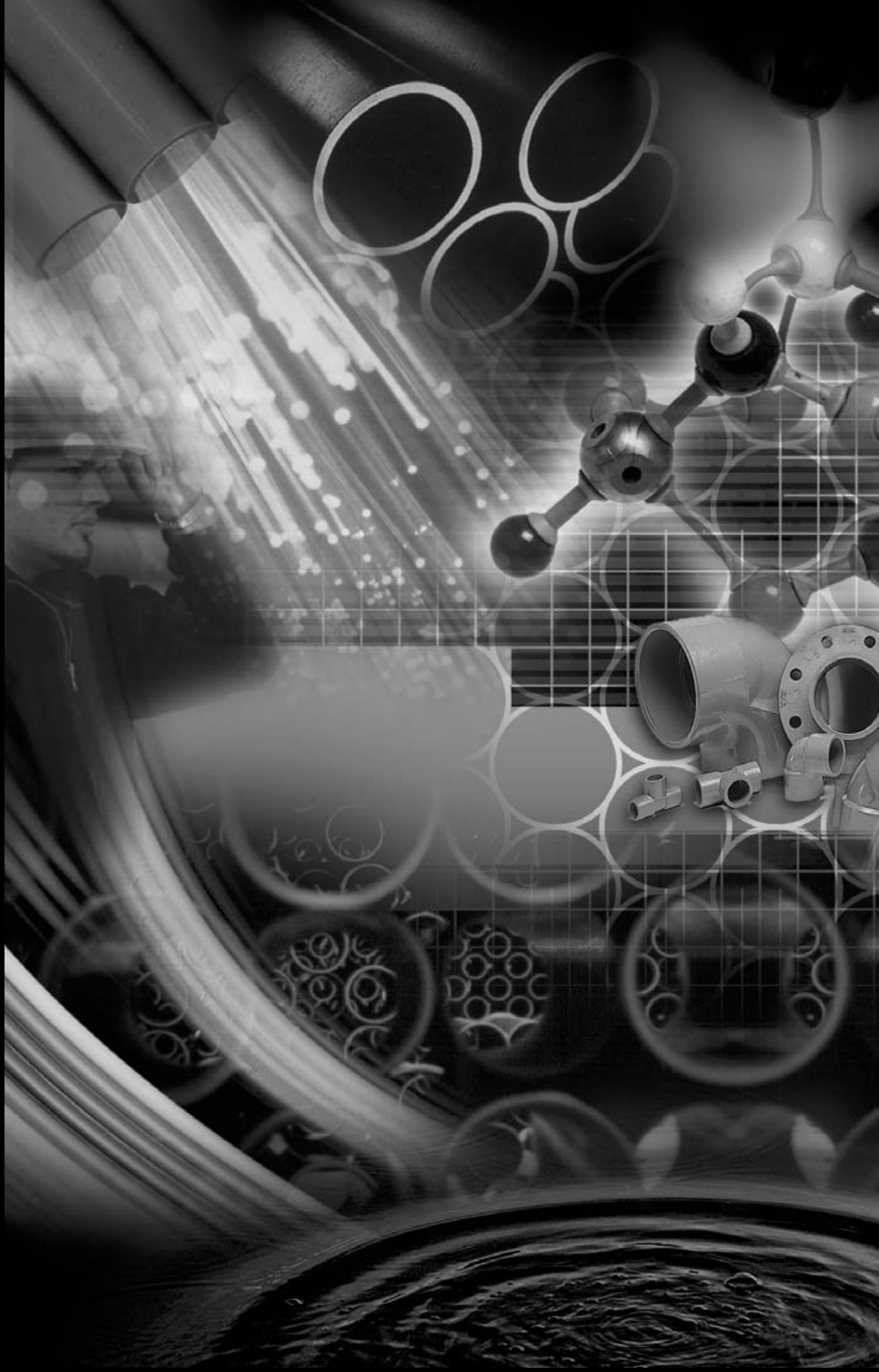
Head (m)	Open	75%	50%	**25%**	Closed
0.025	0.3155	0.3155	0.3155	**0.3155**	0.3155
0.050	0.6309	0.6309	0.6309	**0.6309**	0.3155
0.075	0.9464	0.8675	0.7886	**0.7098**	0.3155
0.100	1.2618	1.1041	0.9464	**0.7886**	0.3155
0.125	1.5773	1.3407	1.1041	**0.8675**	0.3155
0.150	1.8927	1.5773	1.2618	**0.9464**	0.3155

Calculation Results

	2yr	**100yr**	**Available**
Qresult (cu.m/s)	0.001	0.002	-
Depth (m)	0.078	0.130	0.150
Volume (cu.m)	0.9	4.1	6.3
Draintime (hrs)	0.2	0.7	

Volume III: TEMPEST™ INLET CONTROL DEVICES

Municipal Technical Manual Series



SECOND EDITION

LMF (Low to Medium Flow) ICD

HF (High Flow) ICD

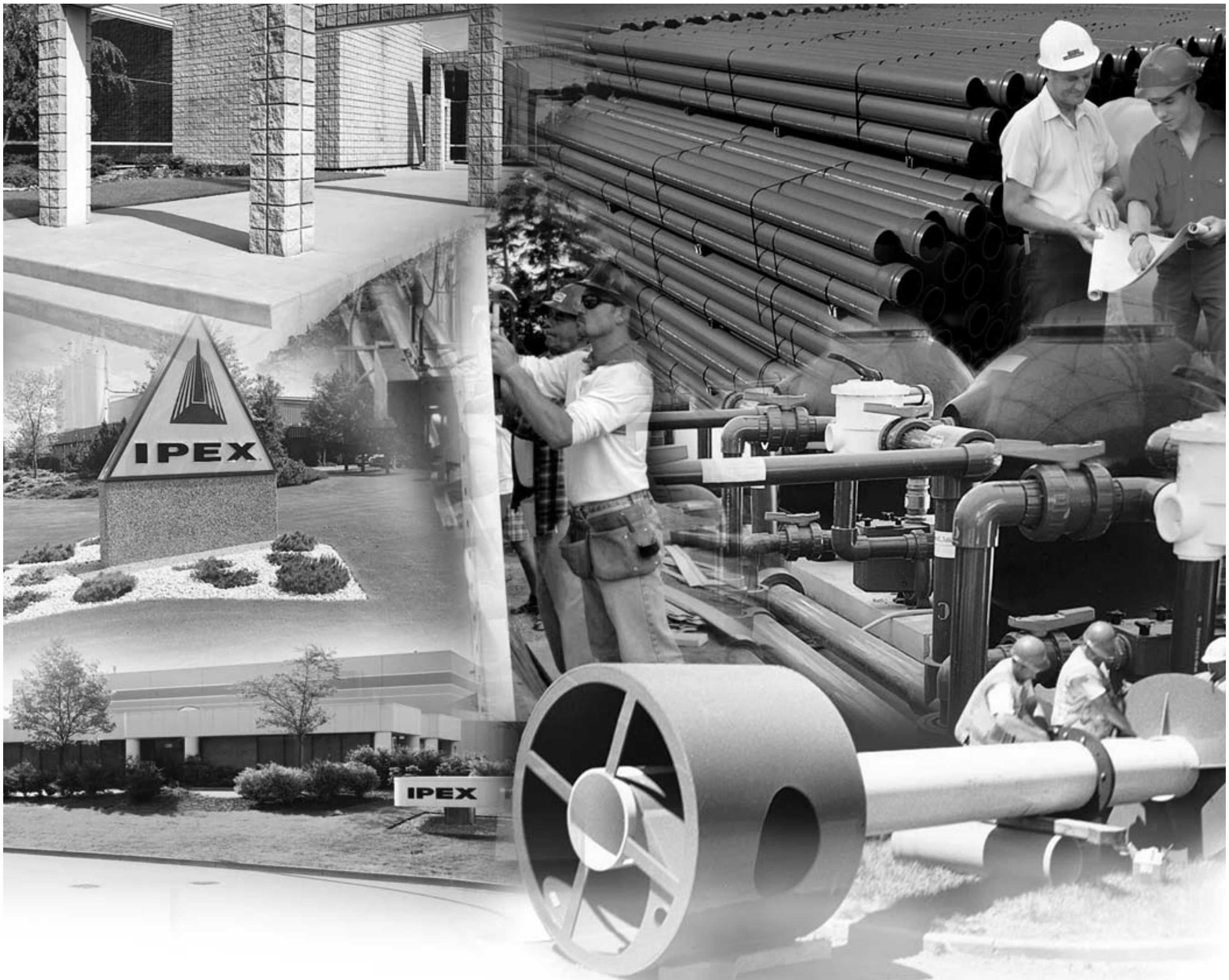
MHF (Medium to High Flow) ICD

IPEX

IPEX Tempest™ Inlet Control Devices

Municipal Technical Manual Series

Vol. I, 2nd Edition



About IPEX

At IPEX, we have been manufacturing non-metallic pipe and fittings since 1951. We formulate our own compounds and maintain strict quality control during production. Our products are made available for customers thanks to a network of regional stocking locations throughout North America. We offer a wide variety of systems including complete lines of piping, fittings, valves and custom-fabricated items.

More importantly, we are committed to meeting our customers' needs. As a leader in the plastic piping industry, IPEX continually develops new products, modernizes manufacturing facilities and acquires innovative process technology. In addition, our staff take pride in their work, making available to customers their extensive thermoplastic knowledge and field experience. IPEX personnel are committed to improving the safety, reliability and performance of thermoplastic materials. We are involved in several standards committees and are members of and/or comply with the organizations listed on this page.

For specific details about any IPEX product, contact our customer service department.

CONTENTS

PRODUCT INFORMATION: TEMPEST LOW, MEDIUM FLOW (LMF) ICD

Purpose

To control the amount of storm water runoff entering a sewer system by allowing a specified flow volume out of a catch basin or manhole at a specified head. This approach conserves pipe capacity so that catch basins downstream do not become uncontrollably surcharged, which can lead to basement floods, flash floods and combined sewer overflows.

Product Description

Our LMF ICD is designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter and larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 14 preset flow curves, the LMF ICD has the ability to provide flow rates: 2lps – 17lps (31gpm – 270gpm)

Product Function

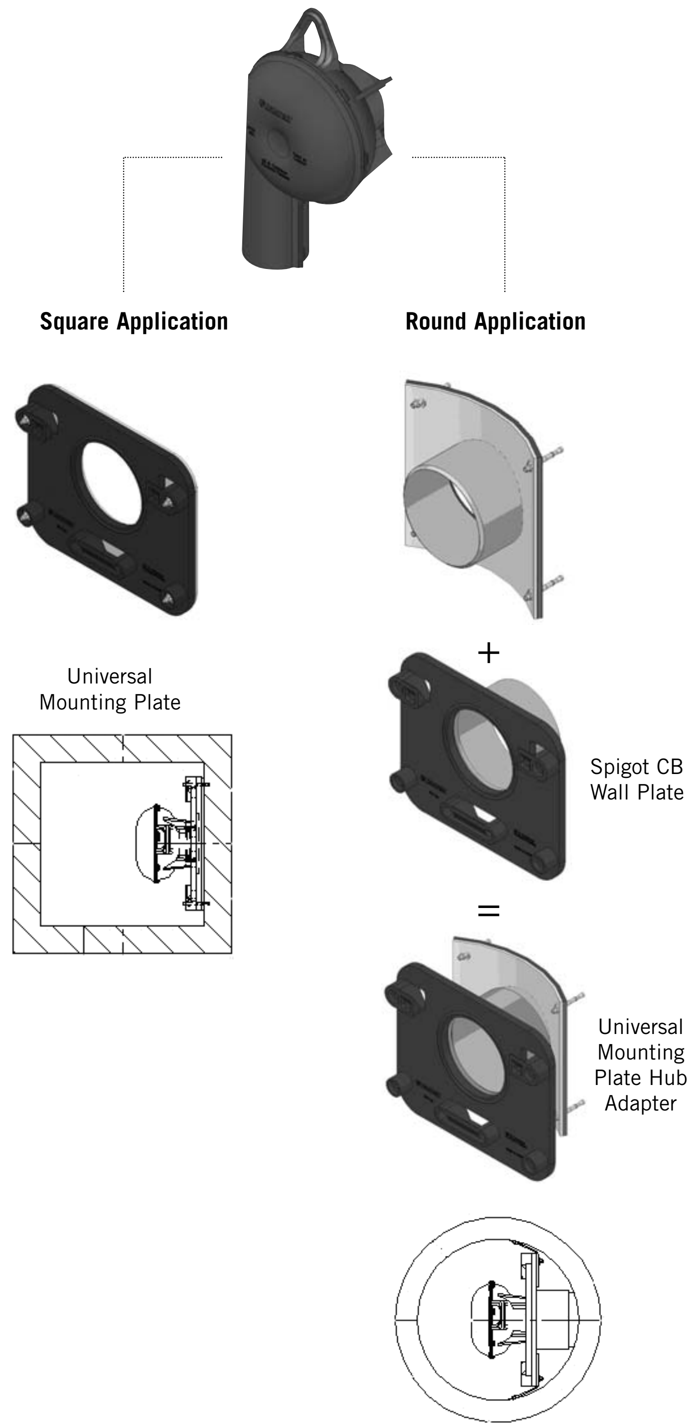
The LMF ICD vortex flow action allows the LMF ICD to provide a narrower flow curve using a larger orifice than a conventional orifice plate ICD, making it less likely to clog. When comparing flows at the same head level, the LMF ICD has the ability to restrict more flow than a conventional ICD during a rain event, preserving greater sewer capacity.

Product Construction

Constructed from durable PVC, the LMF ICD is light weight 8.9 Kg (19.7 lbs).

Product Applications

Will accommodate both square and round applications:



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

Chart 1: LMF 14 Preset Flow Curves

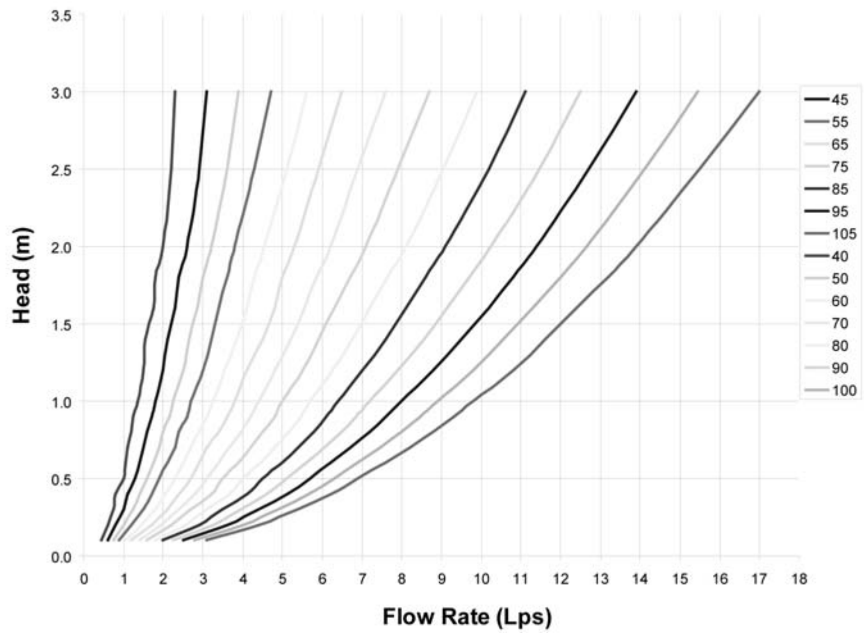
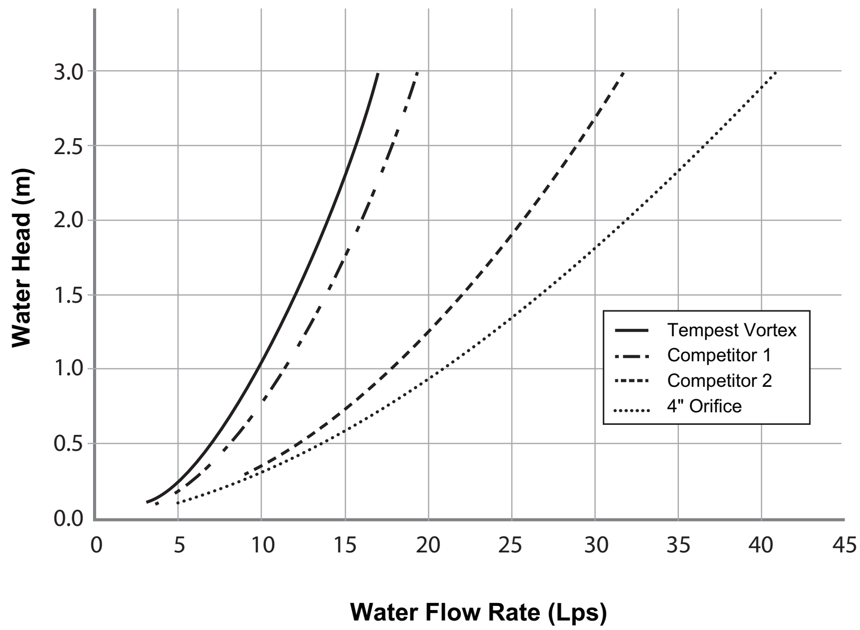


Chart 2: LMF Flow vs. ICD Alternatives



NOTE: Do not use or test the products in this manual with compressed air or other gases including air-over-water-boosters

PRODUCT INSTALLATION

Instructions to assemble a TEMPEST LMF ICD into a Square Catch Basin:

STEPS:

1. Materials and tooling verification:
    - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
    - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device.
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST LMF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
    - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
    - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the spigot catch basin wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the CB spigot wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot wall plate and the catch basin wall.
6. Apply solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the universal mounting plate hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the ICD device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut back the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

PRODUCT TECHNICAL SPECIFICATION

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook will be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above must not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices will consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

PRODUCT INFORMATION: TEMPEST HF & MHF ICD

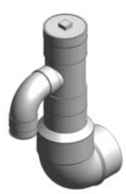
Product Description

Our HF, HF Sump and MHF ICD's are designed to accommodate catch basins or manholes with sewer outlet pipes 6" in diameter or larger. Any storm sewer larger than 12" may require custom modification. However, IPEX can custom build a TEMPEST device to accommodate virtually any storm sewer size.

Available in 5 preset flow curves, these ICDs have the ability to provide constant flow rates: 9lps (143 gpm) and greater

Product Function

TEMPEST HF (High Flow): designed to manage moderate to higher flows 15 L/s (240 gpm) or greater and prevent the propagation of odour and floatables. With this device, the cross-sectional area of the device is larger than the orifice diameter and has been designed to limit head losses. The HF ICD can also be ordered without flow control when only odour and floatable control is required.



TEMPEST HF (High Flow) Sump: The height of a sewer outlet pipe in a catch basin is not always conveniently located. At times it may be located very close to the catch basin floor, not providing enough sump for one of the other TEMPEST ICDs with universal back plate to be installed. In these applications, the HF Sump is offered. The HF Sump offers the same features and benefits as the HF ICD; however, is designed to raise the outlet in a square or round catch basin structure. When installed, the HF sump is fixed in place and not easily removed. Any required service to the device is performed through a clean-out located in the top of the device which can be often accessed from ground level.

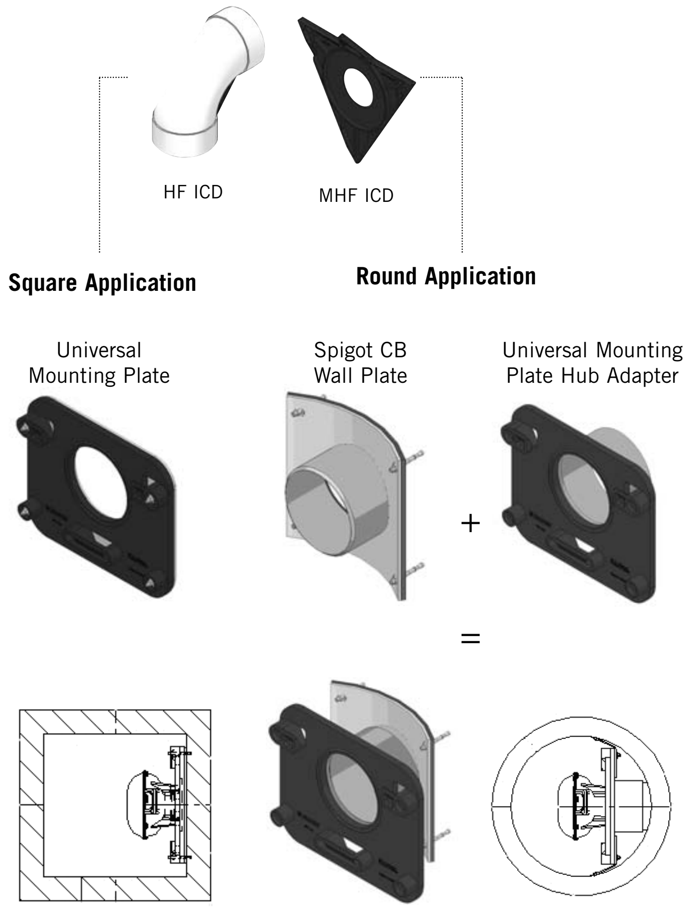
TEMPEST MHF (Medium to High Flow):
The MHF plate or plug is designed to control flow rates 9 L/s (143 gpm) or greater. It is not designed to prevent the propagation of odour and floatables.

Product Construction

The HF, HF Sump and MHF ICDs are built to be light weight at a maximum weight of 6.8 Kg (14.6 lbs).

Product Applications

The HF and MHF ICD's are available to accommodate both square and round applications:



The HF Sump is available to accommodate low to no sump applications in both square and round catch basins:

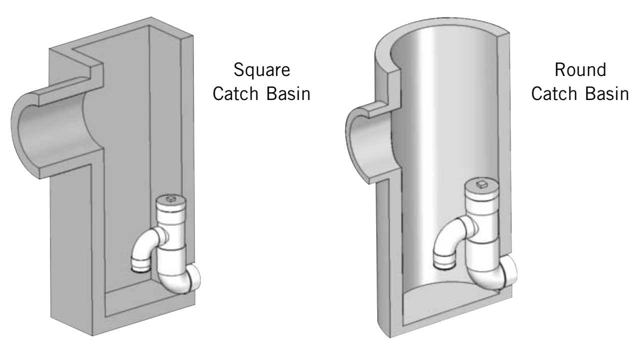
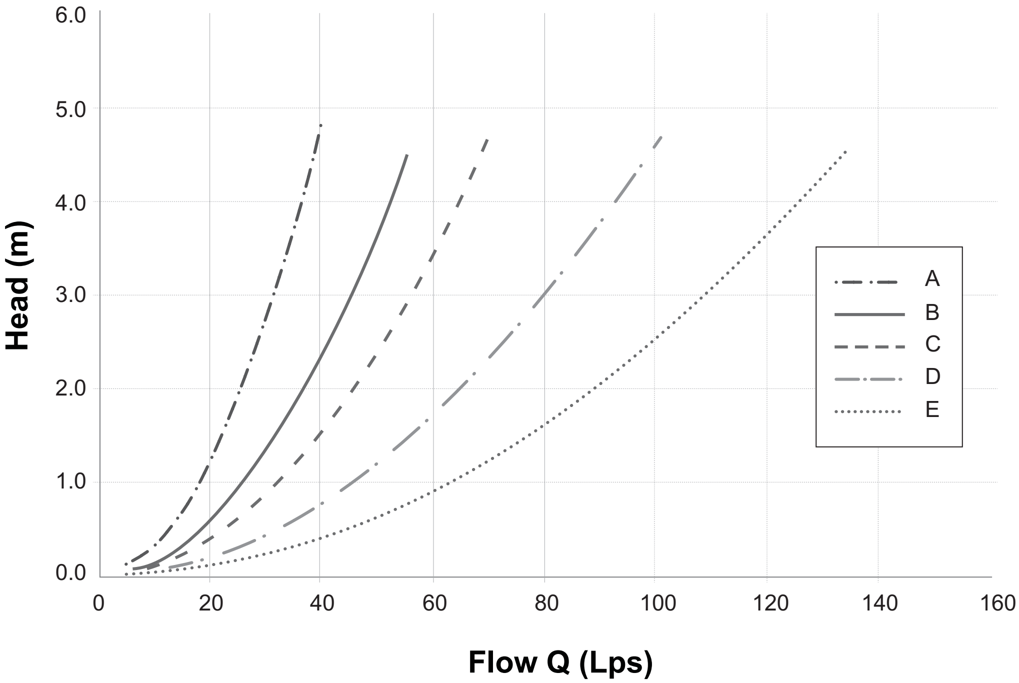


Chart 3: HF & MHF Preset Flow Curves



PRODUCT INSTALLATION

Instructions to assemble a TEMPEST HF or MHF ICD into a Square Catch Basin:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers, (4) nuts, universal mounting plate, ICD device
2. Use the mounting wall plate to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a minimum of 1-1/2" depth up to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the universal wall mounting plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the wall mounting plate and the catch basin wall.
6. From the ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the universal wall mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- Call your IPEX representative for more information or if you have any questions about our products.

Instructions to assemble a TEMPEST HF or MHF ICD into a Round Catch Basin:

STEPS:

1. Materials and tooling verification.
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level and marker.
   - Material: (4) concrete anchor 3/8 x 3-1/2, (4) washers and (4) nuts, spigot CB wall plate, universal mounting plate hub adapter, ICD device.
2. Use the round catch basin spigot adaptor to locate and mark the hole (4) pattern on the catch basin wall. You should use a level to ensure that the plate is at the horizontal.
3. Use an impact drill with a 3/8" concrete bit to make the four holes at a depth between 1-1/2" to 2-1/2". Clean the concrete dust from the holes.
4. Install the anchors (4) in the holes by using a hammer. Thread the nuts on the top of the anchors to protect the threads when you hit the anchors with the hammer. Remove the nuts from the ends of the anchors.
5. Install the spigot CB wall plate on the anchors and screw the 4 nuts in place with a maximum torque of 40 N.m (30 lbf-ft). There should be no gap between the spigot CB wall plate and the catch basin wall.
6. Put solvent cement on the hub of the universal mounting plate, hub adapter and the spigot of the CB wall plate, then slide the hub over the spigot. Make sure the universal mounting plate is at the horizontal and its hub is completely inserted onto the spigot. Normally, the corners of the hub adapter should touch the catch basin wall.
7. From ground above using a reach bar, lower the device by hooking the end of the reach bar to the handle of the ICD device. Align the triangular plate portion into the mounting wall plate. Push down the device to be sure it has centered in to the wall mounting plate and has created a seal.

WARNING

- Verify that the outlet pipe doesn’t protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

PRODUCT TECHNICAL SPECIFICATION

Instructions to assemble a TEMPEST HF Sump into a Square or Round Catch Basin:

STEPS:

1. Materials and tooling verification:
   - Tooling: impact drill, 3/8" concrete bit, torque wrench for 9/16" nut, hand hammer, level, mastic tape and metal strapping
   - Material: (2) concrete anchor 3/8 x 3-1/2, (2) washers, (2) nuts, HF Sump pieces (2).
2. Apply solvent cement to the spigot end of the top half of the sump. Apply solvent cement to the hub of the bottom half of the sump. Insert the spigot of the top half of the sump into the hub of the bottom half of the sump.
3. Install the 8" spigot of the device into the outlet pipe. Use the mastic tape to seal the device spigot into the outlet pipe. You should use a level to be sure that the fitting is standing at the vertical.
4. Use an impact drill with a 3/8" concrete bit to make a series of 2 holes along each side of the body throat. The depth of the hole should be between 1-1/2" to 2-1/2". Clean the concrete dust from the 2 holes.
5. Install the anchors (2) in the holes by using a hammer. Put the nuts on the top of the anchors to protect the threads when you hit the anchors. Remove the nuts from the ends of the anchors.
6. Cut the metal strapping to length and connect each end of the strapping to the anchors. Screw the nuts in place with a maximum torque of 40 N.m (30 lbf-ft). The device should be completely flush with the catch basin wall.

WARNING

- Verify that the outlet pipe doesn't protrude into the catch basin. If it does, cut down the pipe flush to the catch basin wall.
- The solvent cement which is used in this installation is to be approved for PVC.
- The solvent cement should not be used below 0°C (32°F) or in a high humidity environment. Refer to the IPEX solvent cement guide to confirm the required curing time or visit the IPEX Online Solvent Cement Training Course available at www.ipexinc.com.
- Call your IPEX representative for more information or if you have any questions about our products.

General

Inlet control devices (ICD's) are designed to provide flow control at a specified rate for a given water head level and also provide odour and floatable control where specified. All ICD's will be IPEX Tempest or approved equal.

All devices shall be removable from a universal mounting plate. An operator from street level using only a T-bar with a hook shall be able to retrieve the device while leaving the universal mounting plate secured to the catch basin wall face. The removal of the TEMPEST devices listed above shall not require any unbolting or special manipulation or any special tools.

High Flow (HF) Sump devices shall consist of a removable threaded cap which can be accessible from street level with out entry into the catchbasin (CB). The removal of the threaded cap shall not require any special tools other than the operator's hand.

ICD's shall have no moving parts.

Materials

ICD's are to be manufactured from Polyvinyl Chloride (PVC) or Polyurethane material, designed to be durable enough to withstand multiple freeze-thaw cycles and exposure to harsh elements.

The inner ring seal will be manufactured using a Buna or Nitrile material with hardness between Duro 50 and Duro 70.

The wall seal is to be comprised of a 3/8" thick Neoprene Closed Cell Sponge gasket which is attached to the back of the wall plate.

All hardware will be made from 304 stainless steel.

Dimensioning

The Low Medium Flow (LMF), High Flow (HF) and the High Flow (HF) Sump shall allow for a minimum outlet pipe diameter of 200mm with a 600mm deep Catch Basin sump.

Installation

Contractor shall be responsible for securing, supporting and connecting the ICD's to the existing influent pipe and catchbasin/manhole structure as specified and designed by the Engineer.

SALES AND CUSTOMER SERVICE

Canadian Customers call IPEX Inc.

Toll free: (866) 473-9462

www.ipexinc.com

U.S. Customers call IPEX USA LLC

Toll free: (800) 463-9572

www.ipexamerica.com

About the IPEX Group of Companies

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 established a reputation for product innovation, quality, end-user focus and performance.

Markets served by IPEX group products are:

- Electrical systems
- Telecommunications and utility piping systems
- PVC, CPVC, PP, ABS, PEX, FR-PVDF and PE pipe and fittings (1/4" to 48")
- Industrial process piping systems
- Municipal pressure and gravity piping systems
- Plumbing and mechanical piping systems
- PE Electrofusion systems for gas and water
- Industrial, plumbing and electrical cements
- Irrigation systems

Products manufactured by IPEX Inc. and distributed in the United States by IPEX USA LLC.

Tempest™ is a trademark of IPEX Branding Inc.

MNMNTPIP110817

IPEX

WATTS® DRAINAGE

Adjustable Accutrol Weir

Tag: ______________

Adjustable Flow Control for Roof Drains

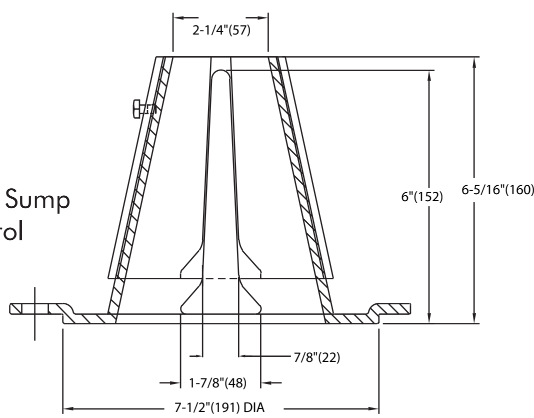
ADJUSTABLE ACCUTROL(for Large Sump Roof Drains only)

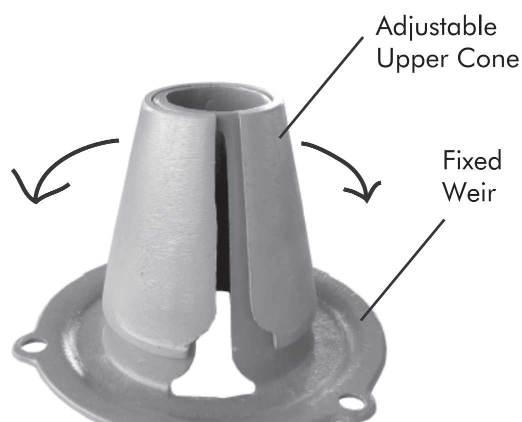
For more flexibility in controlling flow with heads deeper than 2", Watts Drainage offers the Adjustable Accutrol. The Adjustable Accutrol Weir is designed with a single parabolic opening that can be covered to restrict flow above 2" of head to less than 5 gpm per inch, up to 6" of head. To adjust the flow rate for depths over 2" of head, set the slot in the adjustable upper cone according to the flow rate required. Refer to Table 1 below.
Note: Flow rates are directly proportional to the amount of weir opening that is exposed.

EXAMPLE:

For example, if the adjustable upper cone is set to cover 1/2 of the weir opening, flow rates above 2" of head will be restricted to 2-1/2 gpm per inch of head.

Therefore, at 3" of head, the flow rate through the Accutrol Weir that has 1/2 the slot exposed will be:
[5 gpm(per inch of head) x 2 inches of head] + 2-1/2 gpm(for the third inch of head) = 12-1/2 gpm.





1/2 Weir Opening Exposed Shown Above

TABLE 1. Adjustable Accutrol Flow Rate Settings

Weir Opening Exposed	Head of Water 1"	2"	3"	4"	5"	6"
	Flow Rate (gallons per minute)					
Fully Exposed	5	10	15	20	25	30
3/4	5	10	13.75	17.5	21.25	25
1/2	5	10	12.5	15	17.5	20
1/4	5	10	11.25	12.5	13.75	15
Closed	5	10	10	10	10	10

Job Name ______________ Contractor ______________

Job Location ______________ Contractor's P.O. No. ______________

Engineer ______________ Representative ______________

CANADA

WATTS DRAINAGE

CANADA: 5435 North Service Road, Burlington, ON, L7L 5H7 TEL: 905-332-6718 TOLL-FREE: 1-888-208-8927 Website: www.wattsdrainage.ca

(Dimension) Denotes Millimeters

Appendix D GEOTECHNICAL INVESTIGATION

316 SOMERSET STREET – GEOTECHNICAL REPORT

Project No.: CP-17-0637

Prepared for:

TC United Group
800 Industrial Ave. Unit 9
Ottawa, ON, K1G 4B8

Prepared by:

McIntosh Perry
115 Walgreen Rd, R.R. 3
Carp, ON K0A 1L0

DRAFT

March 2018

McINTOSH PERRY

TABLE OF CONTENTS

APPENDICES

GEOTECHNICAL INVESTIGATION and
FOUNDATION DESIGN RECOMMENDATION REPORT
316 Somerset Street, Ottawa, Ontario

1.0 INTRODUCTION

This report presents the factual findings obtained from a geotechnical investigation performed at the above-mentioned site, for the proposed construction of a three floor multi-use building in Ottawa, Ontario. The field work was carried out on January 18, 2018 and comprised of two boreholes advanced to a maximum depth of 5.1 m below existing ground surface.

The purpose of the investigation was to explore the subsurface conditions at this site and to provide anticipated geotechnical conditions influencing the design and construction of the proposed building.

McIntosh Perry Consulting Engineers Ltd (McIntosh Perry) carried out the investigation at the request of TC United.

2.0 SITE DESCRIPTION

The property under considerations for proposed development is located 316 Somerset Street, east of the intersection with Chapel Street. The property is located west of the Rideau River in a neighbourhood called Sandy Hill of Ottawa. The property is located in the middle of a residential development. The existing property contains a single family dwelling and a detached single car garage. An asphalt driveway runs along the west of the property to the garage. The property is relatively flat, the backyard is enclosed by a chain link fence and the front yard is surrounded by shrubbery.

It is understood the proposed structure will be a 3-story mixed use building, with a basement.

Location of the property is shown on Figure 1, included in Appendix B.

3.0 FIELD PROCEDURES

Staff of McIntosh Perry Consulting Engineers (McIntosh Perry) visited the site before the drilling investigation to mark out the proposed borehole locations and assess access for drill rig access. Utility clearance was carried out by USL-1 on behalf of McIntosh Perry. Public and private utility authorities were informed and all utility clearance documents were obtained before the commencement of drilling work.

The equipment used for drilling was owned and operated by CCC Geotechnical & Environmental Drilling Ltd. of Ottawa, Ontario. Boreholes were advanced using hollow stem augers aided by a truck-mounted CME-55 drilling rig. Boreholes were advanced to a maximum depth of 5.1 m below the ground level. Soil samples were obtained at 0.6 m intervals of depth in boreholes using a 50 mm outside diameter split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. Boreholes were backfilled with auger cuttings. All boreholes were restored to match the original surface. Borehole locations are shown on Figure 2, included in Appendix B. Geotechnical boreholes were only drilled in the driveway and front of the existing building due to restricted access to be backyard caused by detached garage.

4.0 LABORATORY TEST PROCEDURES

Selected samples were tested for moisture content by McIntosh Perry.

The soil samples recovered will be stored in McIntosh Perry storage facility for a period of one month after submission of the final report. Samples will be disposed after this period of time unless otherwise requested in writing by the Client.

5.0 SITE GEOLOGY AND SUBSURFACE CONDITIONS

5.1 Site Geology

Based on published physiography maps of the area (Ontario Geological Survey) the site is located within the Ottawa Valley Clay Plains. Surficial geology maps of southern Ontario identify the property as on fine-textured glaciomarine deposits.

The Ottawa Valley between Pembroke and Hawkesbury, Ontario consists of clay plains interrupted by ridges of rock or sand. It is naturally divided into two parts, above and below Ottawa, Ontario. Within the valley, the bedrock is further faulted so that some of the uplifted blocks appear above the clay beds. The sediments themselves in the valley are deep silty clay. Although the clay deposits are grey in color like the limestones that underlies them in part, they are only mildly calcareous and likely derived from the more acidic rock of the Canadian Shield.

5.2 Subsurface Conditions

In general, the site stratigraphy consists of fill material underlain by shale. The soils encountered at this site can be divided into two different zones.

a) Fill
b) Shale

The soils encountered during the course of the investigation, together with the field and laboratory test results are shown on the Record of Borehole sheets included in Appendix C. Description of the strata encountered are given below.

5.2.1 Fill

Asphalt thickness in BH18-1 was observed to be 40 mm and 25 mm in BH18-2. Below the asphalt was a layer of fill which began as brown, moist and compact sand and gravel, with traces of clay and silt. This fill layer then transitioned to a silty gravelly sand described as dark brown, moist and loose. The fill finally transitioned into a dark brown, moist, loose silty sand with some gravel. SPT 'N' values within this layer were 6 to 7 blows/300 mm. Moisture content with this layer was observed to be an average of 24%. The thickness of the fill, was observed to range from 1.5 m to 1.6 m. It is understood two additional boreholes were advanced in the backyard for environmental sampling using portable drilling equipment. The fill encountered in the backyard was observed to be of a similar consistency as the front yard and refusal on shale was encountered at 1.2 m in both boreholes.

5.2.2 Shale

Below the fill in both boreholes was highly weathered to weathered black shale. Due the weathered and fractured nature of the shale, boreholes were advanced into the layer through auguring. The shale was cored in BH18-1 and showed the rock core recovery (CR) ranging from 46% to 100%. Rock quality designation (RQD) for the cored rock samples ranged from 10% to 46%. The recovery and quality increased with depth. Mud seams were observed within the core.

5.3 Groundwater

Groundwater was not observed in the open borehole BH18-1, an accurate water level could not be obtained in borehole BH 18-2 due to the presence of core water. Groundwater level may be expected to fluctuate due to seasonal changes.

6.0 DISCUSSIONS AND RECOMMENDATIONS

6.1 General

This section of the report provides recommendations for the design of a mixed use three storey building, with commercial space located on the ground level, and residential units in the basement and in the second and third floors. The recommendations are based on interpretation of the factual information obtained from the boreholes advanced during the subsurface investigation. The discussions and recommendations presented are intended to provide sufficient information to the designer of the proposed building to select the suitable types of foundation to support the structure.

The comments made on the construction are intended to highlight aspects which could have impact or affect the detailed design of the building, for which special provisions may be required in the Contract Documents. Those who requiring information on construction aspects should make their own interpretation of the factual data presented in the report. Interpretation of the data presented may affect equipment selection, proposed construction methods, and scheduling of construction activities.

6.2 Project Design

6.2.1 Existing Site Condition

Detailed site condition is provided in Section 2. The property is predominately leveled, and contains a two-storey single family home. The surrounding area consisted of residential homes. The location of the site is shown on Figure 1 included in Appendix B.

6.2.2 Proposed Development

It is understood that the proposed development will be a three-story mixed-use building with a basement, and will likely be a conventional slab on grade with shallow footing foundation.

6.3 Frost Protection

Based on applicable building codes, a minimum earth cover of 1.8 m, or the thermal equivalent of insulation, should be provided for all exterior footings to reduce the effects of frost action.

6.4 Site Classification for Seismic Site Response

Selected spectral responses in the general vicinity of the site for 10% chance of exceedance in 50 years (475 years return period) are as indicated in Table 6-1, shown below and in Appendix D;

Table 6-1: Selected Seismic Spectral Responses (10% in 50 Yrs)

Sa(0.2)	Sa(0.5)	Sa(2.0)	PGA	PGV
0.161	0.088	0.021	0.102	0.068

The site can be classified as a Site Class "C" for soft rock for the purposes of site-specific seismic response to earthquakes based on Table 4.1.8.4.A OBC 2012.

6.5 Slabs-on-Grade

Free-floating Slabs-on-grade should be supported on minimum 200 mm of Granular A compacted to 100% SPMDD. In case the subgrade needs to be raised Granular B type II or Granular A needs to be compacted to minimum 96% SPMDD. If the slab-on-grade is designed to support internal columns, the fill used for the grade raise shall be compacted to minimum 100% SPMDD. The fill should be placed in horizontal lifts of uniform thickness of no more than 300 mm before compaction and it should be placed at appropriate moisture content. The requirements for fill material and compaction may be addressed with a note on the structural drawing for foundation or grading drawing and/or with a Non-Standard Special Provision (NSSP).

All slab-on-grade units shall float independently from all load-bearing structural elements.

6.6 Shallow Foundations

Considering the order of structural loads expected at the foundation level, provision of conventional strip footings will be adequate. Footings are expected to be buried to resist overturning and sliding and also to provide protection against frost action.

The excavation should extend at a minimum to the top of shale, any existing fill and any material from the existing building must be removed from the footprint of the proposed building. Extremely weathered shale and all loose pieces of rock shall be removed from the footprint of the proposed footings. A geotechnical staff shall attend the site upon completion of excavation and approve the subgrade. Shale is expected to degrade relatively quickly upon exposure. Foundation footprint shall be protected by placement of grout or lean concrete upon excavation. The grout reduce the risk of degradation and also improves the integrity of the rock surface. The other option is to rapidly place the forms on the approved subgrade, apply the grout/lean concrete and then proceed with rebar placement. If the shale has to be over-excavated due to surficial poor quality, the grade can be raised by lean concrete within the influence zone of the footing. The influence zone of the footing is defined by a line going outward and downward from the edge of the footing to the subgrade. The lean concrete shall provide compression strength equal or higher than the shale.

If adequate frost cover is not provided, the deficit of earth cover should be compensated by application of synthetic insulation material adequately projecting beyond foundation walls.

6.6.1 Bearing Capacity

Assuming the strip footings are constructed through excavating the fill and exposing the weathered but relatively intact native shale, the following bearing capacity values can be used for structural design;

A factored beading pressure at Ultimate Limit State (ULS) of 350 kPa can be used for the design on approved shale subgrade. If footings are placed on rock, the serviceability settlements are expected to be minimal and there is no relevance to serviceability limit state (SLS).

Due to the expected size of rock fractures, strip footings shall not be less than 0.75 m in width and isolated pad footings shall not be less than 1.5 m in shorter dimension.

6.7 Lateral Earth Pressure

Free draining material should be used as backfill material for foundation walls. If the proper drainage is provided “at rest” condition may be assumed for calculation of earth pressure on foundation walls. The following parameters are recommended for the granular backfill.

Table 6-1: Backfill Material Properties

Borehole	Granular "A"	Granular "B"
Effective Internal Friction Angle, ϕ'	35°	30°
Unit Weight, $\gamma\ (kN/m^3)$	22.8	22.8

7.0 CONSTRUCTION CONSIDERATIONS

Any organic material and existing fill material of any kind, shall be removed from the footprint of the footings and all structurally load bearing elements. If grade raise above the native subgrade is required suitable fill material to conform to specifications of OPSS Granular criteria shall be used. The Structural Fill should be free from any recycled or deleterious material, it should not be placed in lifts thicker than 300 mm and should be compacted as specified.

It is not clear is the founding level will be below groundwater at the time of construction. If water infiltrates into the excavation, a conventional sump and pump method can be applied. The excavated subgrade must be kept dry at all times to minimize the disturbance of the subgrade. Groundwater elevation is expected to fluctuate seasonally.

A geotechnical engineer or technician should attend the site to confirm the type of the material and level of compaction.

Foundation walls should be backfilled with free-draining material such as OPSS Granular types A or B. The native till is not a suitable material for backfilling. Sub-drains with positive drainage to the City sewer should be provided at foundation level.

8.0 SITE SERVICES

At the subject site, the burial depth of water-bearing utility lines is typically 2.4 m below ground surface. If this depth is not achievable due to design restrictions, equivalent thermal insulation should be provided. The contractor should retain a professional engineer to provide detailed drawings for excavation and temporary support of the excavation walls during construction.

Utilities should be supported on minimum of 150 mm bedding of Granular A compacted to minimum 96% of SPMDD. Utility cover can be Granular A or Granular B type II compacted to 96% SPMDD. All covers are to be compacted to 100% SPMDD if intersecting structural elements. The engineer designing utilities shall ensure the proposed utility pipes can tolerate compaction loads.

Cut-off walls should be provided for utility trenches running below the groundwater level to mitigate the settlement risk due to groundwater lowering.

9.0 CEMENT TYPE AND CORROSION POTENTIAL

Among samples retrieved during the investigation, there was not adequate sample recovery encountered for chemical testing. It is expected the building will be founded on shale bedrock, and backfilled with granular material. No sulphate attack is expected from shale bedrock; therefore General Use (Type GU) Portland cement will be adequate. Based on the composition of the proposed backfill (OPSS Granular) it is typically expected to be non-aggressive or mildly-aggressive, for buried steel elements in contact with existing fill. The contractor shall confirm with the material source.

10.0 CLOSURE

We trust this geotechnical investigation and foundation design report meets requirements of your project. The "Limitations of Report" presented in Appendix A are an integral part of this report. Please do not hesitate to contact the undersigned should you have any questions or concerns.

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Appendix E DRAWINGS