Appendix A POTABLE WATER SERVICING ANALYSIS

BOUNDARY CONDITIONS

Boundary Conditions For: 801 Ralph Hennessy Ave.

Date of Boundary Conditions: 2018-Aug-17

Provided Information:

Scenario	Demand	
	L/min	L/s
Average Daily Demand	69.6	1.2
Maximum Daily Demand	174	2.9
Peak Hour	383.4	6.4
Fire Flow #1 Demand	14,000	233.3
Fire Flow #2 Demand	15,000	250.0

Number Of Connections: 1

Location:

BOUNDARY CONDITIONS

Results:

Connection #: 1 Pre-Configuration

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	133.1	59.0
Peak Hour	125.4	48.0
Max Day Plus Fire (14,000) L/min	122.3	43.7
Max Day Plus Fire (15,000) L/min	121.9	43.1

[1]Elevation: **91.600 m**

Connection #: 2 Pre-Configuration

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	132.1	58.5
Peak Hour	125.4	47.4
Max Day Plus Fire (14,000) L/min	112.1	28.6
Max Day Plus Fire (15,000) L/min	110.3	26.0

[1]Elevation: **91.52 m**

Connection #: 1 Post-Configuration

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	147.8	80.0
Peak Hour	145.6	76.9
Max Day Plus Fire (14,000) L/min	143.7	74.1
Max Day Plus Fire (15,000) L/min	143.3	73.6

[1]Elevation: **91.600 m**

BOUNDARY CONDITIONS

Connection #: 2 Post-Configuration

Demand Scenario	Head (m)	Pressure[1] (psi)
Maximum HGL	147.8	80.0
Peak Hour	145.6	75.1
Max Day Plus Fire (14,000) L/min	138.1	66.3
Max Day Plus Fire (15,000) L/min	137.5	65.4

[1]Elevation: **91.52 m**

Notes:

1) As per the Ontario Building Code in areas that may be occupied, the static pressure at any fixture shall not exceed 552 kPa (80 psi.) Pressure control measures to be considered are as follows, in order of preference:

a) If possible, systems to be designed to residual pressures of 345 to 552 kPa (50 to 80 psi) in all occupied areas outside of the public right-of-way without special pressure control equipment.
b) Pressure reducing valves to be installed immediately downstream of the isolation valve in the home/ building, located downstream of the meter so it is owner maintained.

2) Two connections must be looped within proposed subdivion

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. Fire Flow analysis is a reflection of available flow in the watermain; there may be additional restrictions that occur between the watermain and the hydrant that the model cannot take into account.

Riverside Phase 8 Block 221 - Domestic Water Demand Estimates
- Based on Proposed Richcraft Site Plan (160401422)

Building ID	Units	Population	Daily Rate of Demand	Avg Day Demand		Max Day Demand		Peak Hour Demand	
				(L/min)	(L/s)	(L/min)	(L/s)	(L/min)	(L/s)
Block 1	12	27.6	350	6.7	0.11	16.8	0.28	36.9	0.61
Block 2	12	27.6	350	6.7	0.11	16.8	0.28	36.9	0.61
Block 3	12	27.6	350	6.7	0.11	16.8	0.28	36.9	0.61
Block 4	8	18.4	350	4.5	0.07	11.2	0.19	24.6	0.41
Block 5	12	27.6	350	6.7	0.11	16.8	0.28	36.9	0.61
Block 6	12	27.6	350	6.7	0.11	16.8	0.28	36.9	0.61
Block 7	12	27.6	350	6.7	0.11	16.8	0.28	36.9	0.61
Townhome 1	10	27	350	6.6	0.11	16.4	0.27	36.1	0.60
Townhome 2	10	27	350	6.6	0.11	16.4	0.27	36.1	0.60
Townhome 3	8	21.6	350	5.3	0.09	13.1	0.22	28.9	0.48
Townhome 4	10	27	350	6.6	0.11	16.4	0.27	36.1	0.60
Total Site :	**118**	**286.6**		**69.7**	**1.16**	**174.1**	**2.90**	**383.1**	**6.39**

Assume 2.3p/stacked unit and 2.7p/townhome

Maximum day demand rate = 2.5 x average day demand rate

Peak hour demand rate = 2.2 x maximum day demand rate

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401422
Project Name: Richcraft Block 221 Riverside
Date: 8/14/2018
Fire Flow Calculation #: 1
Description: Back-to-back Townhomes Block 2

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	-						470	-
	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						-	12000
5	Determine Occupancy Charge	Limited Combustible						-15%	10200
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	30.1 to 45	30.8	3	91-120	Wood Frame or Non-Combustible	5%	4692
		East	3.1 to 10	15.1	3	31-60	Wood Frame or Non-Combustible	18%	
		South	30.1 to 45	30.8	3	91-120	Wood Frame or Non-Combustible	5%	
		West	3.1 to 10	15.1	3	31-60	Wood Frame or Non-Combustible	18%	
8	Determine Final Required Fire Flow	Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min							15000
		Total Required Fire Flow in L/s							250.0
		Required Duration of Fire Flow (hrs)							3.00
		Required Volume of Fire Flow (m^3)							2700

Stantec

FUS Fire Flow Calculation Sheet

Stantec Project #: 160401422
Project Name: Richcraft Block 221 Riverside
Date: 8/14/2018
Fire Flow Calculation #: 1
Description: Back-to-back Stacked Condo Flat 5

Notes:

<table>
<tr><th>Step</th><th>Task</th><th colspan="6">Notes</th><th>Value Used</th><th>Req'd Fire Flow (L/min)</th></tr>
<tr><td>1</td><td>Determine Type of Construction</td><td colspan="6">Wood Frame</td><td>1.5</td><td>-</td></tr>
<tr><td rowspan="2">2</td><td>Determine Ground Floor Area of One Unit</td><td colspan="6">-</td><td>339</td><td>-</td></tr>
<tr><td>Determine Number of Adjoining Units</td><td colspan="6">Includes adjacent wood frame structures separated by 3m or less</td><td>1</td><td>-</td></tr>
<tr><td>3</td><td>Determine Height in Storeys</td><td colspan="6">Does not include floors >50% below grade or open attic space</td><td>3</td><td>-</td></tr>
<tr><td>4</td><td>Determine Required Fire Flow</td><td colspan="6">($F = 220 \times C \times A^{1/2}$). Round to nearest 1000 L/min</td><td>-</td><td>11000</td></tr>
<tr><td>5</td><td>Determine Occupancy Charge</td><td colspan="6">Limited Combustible</td><td>-15%</td><td>9350</td></tr>
<tr><td rowspan="4">6</td><td rowspan="4">Determine Sprinkler Reduction</td><td colspan="6">None</td><td>0%</td><td rowspan="4">0</td></tr>
<tr><td colspan="6">Non-Standard Water Supply or N/A</td><td>0%</td></tr>
<tr><td colspan="6">Not Fully Supervised or N/A</td><td>0%</td></tr>
<tr><td colspan="6">% Coverage of Sprinkler System</td><td>0%</td></tr>
<tr><td rowspan="5">7</td><td rowspan="5">Determine Increase for Exposures (Max. 75%)</td><td>Direction</td><td>Exposure Distance (m)</td><td>Exposed Length (m)</td><td>Exposed Height (Stories)</td><td>Length-Height Factor (m x stories)</td><td>Construction of Adjacent Wall</td><td>-</td><td>-</td></tr>
<tr><td>North</td><td>3.1 to 10</td><td>14.5</td><td>3</td><td>31-60</td><td>Wood Frame or Non-Combustible</td><td>18%</td><td rowspan="4">5049</td></tr>
<tr><td>East</td><td>10.1 to 20</td><td>22.7</td><td>3</td><td>61-90</td><td>Wood Frame or Non-Combustible</td><td>14%</td></tr>
<tr><td>South</td><td>20.1 to 30</td><td>14.5</td><td>3</td><td>31-60</td><td>Wood Frame or Non-Combustible</td><td>8%</td></tr>
<tr><td>West</td><td>10.1 to 20</td><td>22.7</td><td>3</td><td>61-90</td><td>Wood Frame or Non-Combustible</td><td>14%</td></tr>
<tr><td rowspan="4">8</td><td rowspan="4">Determine Final Required Fire Flow</td><td colspan="7">Total Required Fire Flow in L/min, Rounded to Nearest 1000L/min</td><td>14000</td></tr>
<tr><td colspan="7">Total Required Fire Flow in L/s</td><td>233.3</td></tr>
<tr><td colspan="7">Required Duration of Fire Flow (hrs)</td><td>3.00</td></tr>
<tr><td colspan="7">Required Volume of Fire Flow (m^3)</td><td>2520</td></tr>
</table>

Hydraulic Model Results - Average Day Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
101	0.11	92.78	147.8	78.22	539.31
103	0.05	92.60	147.8	78.47	541.03
104	0.00	92.50	147.8	78.61	542.00
105	0.22	92.40	147.8	78.76	543.03
108	0.22	92.45	147.8	78.68	542.48
113	0.13	92.45	147.8	78.68	542.48
115	0.11	91.75	147.8	79.68	549.38
119	0.10	92.30	147.8	78.90	544.00

Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
201	501	101	29.29	204	110	0.44	0.01
203	101	103	26.86	204	110	0.33	0.01
204	103	104	12.91	204	110	0.21	0.01
208	105	108	43.48	204	110	-0.01	0
212	108	113	40.22	204	110	-0.23	0.01
215	115	113	28.44	204	110	0.39	0.01
225	119	103	54.06	204	110	-0.08	0
226	113	119	51.12	204	110	0.02	0
227	104	105	43.38	204	110	0.21	0.01
229	503	115	20.34	204	110	0.5	0.02

Hydraulic Model Results -Peak Hour Analysis

Junction Results

ID	Demand	Elevation	Head	Pressure	
	(L/s)	(m)	(m)	(psi)	(Kpa)
101	0.61	92.78	145.6	75.09	517.73
103	0.30	92.60	145.6	75.34	519.45
104	0.00	92.50	145.6	75.48	520.42
105	1.23	92.40	145.6	75.62	521.38
108	1.23	92.45	145.6	75.55	520.90
113	0.71	92.45	145.6	75.55	520.90
115	0.61	91.75	145.6	76.55	527.80
119	0.54	92.30	145.6	75.77	522.42

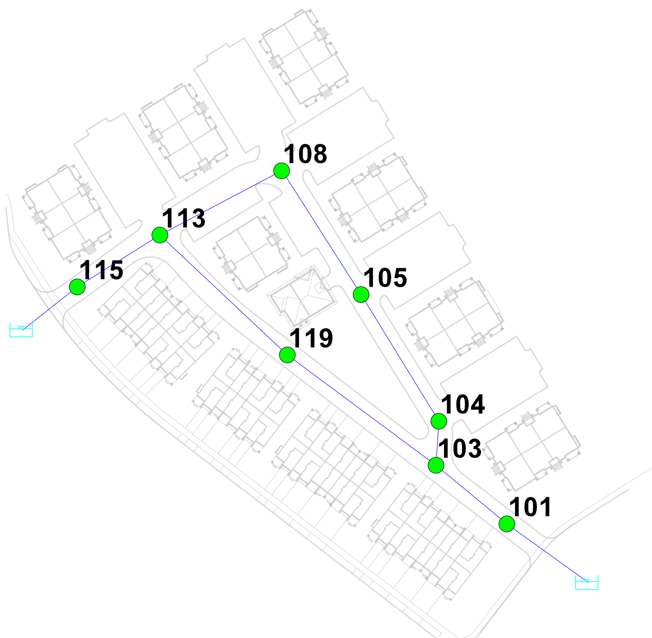
Pipe Results

ID	From Node	To Node	Length	Diameter	Roughness	Flow	Velocity
			(m)	(mm)		(L/s)	(m/s)
201	501	101	29.29	204	110	2.47	0.08
203	101	103	26.86	204	110	1.86	0.06
204	103	104	12.91	204	110	1.16	0.04
208	105	108	43.48	204	110	-0.07	0.00
212	108	113	40.22	204	110	-1.30	0.04
215	115	113	28.44	204	110	2.15	0.07
225	119	103	54.06	204	110	-0.40	0.01
226	113	119	51.12	204	110	0.14	0.00
227	104	105	43.38	204	110	1.16	0.04
229	503	115	20.34	204	110	2.76	0.08

Hydraulic Model Results -Fire Flow Analysis

ID	Static Demand	Static Pressure		Static Head	Fire-Flow Demand	Residual Pressure		Available Flow at Hydrant	Available Flow Pressure	
	(L/s)	(psi)	(Kpa)	(m)	(L/s)	(psi)	(Kpa)	(L/s)	(psi)	(Kpa)
101	0.28	66.07	455.54	139.26	250	60.35	416.10	744.55	20	137.90
103	0.14	67.84	467.74	140.32	250	59.46	409.96	645.33	20	137.90
104	0	68.16	469.95	140.45	250	57.31	395.14	562.35	20	137.90
105	0.56	68.88	474.91	140.85	250	53.65	369.91	475.54	20	137.90
108	0.56	69.41	478.57	141.28	250	54.54	376.04	493.12	20	137.90
113	0.32	69.98	482.50	141.68	250	61	420.58	669.73	20	137.90
115	0.28	72.65	500.91	142.85	250	65.63	452.51	886.5	20	137.90
119	0.25	69.25	477.46	141.02	250	55.79	384.66	513.44	20	137.90

160401422-2018-12-13-BLOCK 221 - JUNCTION ID



JUNCTION (MOTYPE)
- Active
- Domain

TANK (MOTYPE)
- Active Tank
- Domain Tank
- Active Reservoir
- Domain Reservoir

PIPE (MOTYPE)
- Active Pipe
- Domain Pipe
- Active Check Valve
- Domain Check Valve

PUMP (MOTYPE)
- Active
- Domain

ANNO2

VALVE (MOTYPE)
- Active
- Domain

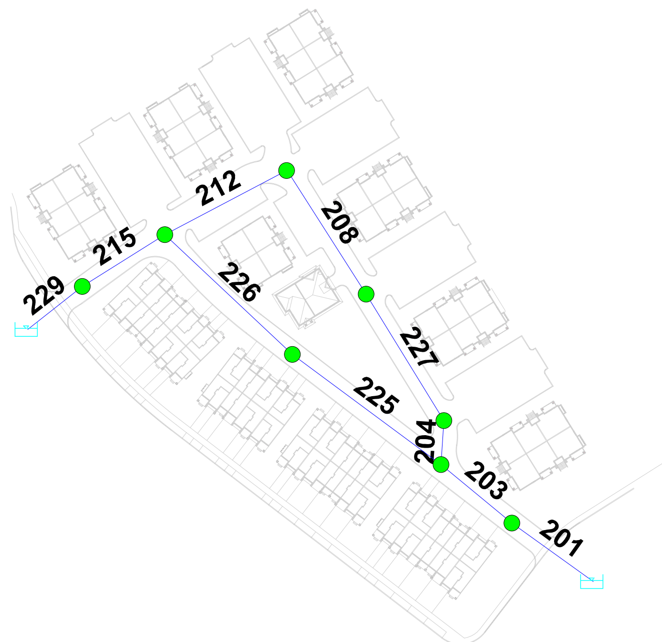
ACAD-160401422-SP.dxf

ACAD-160401422-SP.dxf

Prepared By:

Date: 12/13/2018 12:06:55 PM

160401422-2018-12-13-BLOCK 221 - PIPE ID



JUNCTION (MOTYPE)
- Active
- Domain

TANK (MOTYPE)
- Active Tank
- Domain Tank
- Active Reservoir
- Domain Reservoir

PIPE (MOTYPE)
- Active Pipe
- Domain Pipe
- Active Check Valve
- Domain Check Valve

PUMP (MOTYPE)
- Active
- Domain

ANNO2

VALVE (MOTYPE)
- Active
- Domain

ACAD-160401422-SP.dxf

ACAD-160401422-SP.dxf

Prepared By:

Date: 12/13/2018 12:10:02 PM

Appendix B STORMWATER MANAGEMENT CALCULATIONS

B.1 Storm Sewer Design Sheet

B.2 PCSWMM Model Input

B.1 STORM SEWER DESIGN SHEET

Stantec

RIVERSIDE SOUTH PHASE 8 BLOCK 221	
DATE:	2018-12-19
REVISION:	1
DESIGNED BY:	-
CHECKED BY:	-

STORM SEWER DESIGN SHEET (City of Ottawa)

FILE NUMBER: 160401422

DESIGN PARAMETERS

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

	1:2 yr	1:5 yr	1:10 yr	1:100 yr
a =	732.951	998.071	1174.184	1735.688
b =	6.199	6.053	6.014	6.014
c =	0.810	0.814	0.816	0.820

MANNING'S n = 0.013 BEDDING CLASS = B

MINIMUM COVER: 2.00 m

TIME OF ENTRY 10 min

LOCATION / DRAINAGE AREA

AREA ID NUMBER	FROM M.H.	TO M.H.	AREA (2-YEAR) (ha)	AREA (5-YEAR) (ha)	AREA (10-YEAR) (ha)	AREA (100-YEAR) (ha)	AREA (ROOF) (ha)	C (2-YEAR) (-)	C (5-YEAR) (-)	C (10-YEAR) (-)	C (100-YEAR) (-)	A x C (2-YEAR) (ha)	ACCUM AxC (2YR) (ha)	A x C (5-YEAR) (ha)	ACCUM. AxC (5YR) (ha)	A x C (10-YEAR) (ha)	ACCUM. AxC (10YR) (ha)	A x C (100-YEAR) (ha)	ACCUM. AxC (100YR) (ha)	T of C (min)
L116A	116	104	0.15	0.00	0.00	0.00	0.00	0.76	0.00	0.00	0.00	0.116	0.116	0.000	0.000	0.000	0.000	0.000	0.000	10.00
L104A	104	103	0.07	0.00	0.00	0.00	0.00	0.77	0.00	0.00	0.00	0.055	0.172	0.000	0.000	0.000	0.000	0.000	0.000	10.51
																				11.44
L115A	115	103	0.13	0.00	0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.093	0.093	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.56
L103A	103	102	0.09	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.073	0.338	0.000	0.000	0.000	0.000	0.000	0.000	11.44
																				12.13
L112A	112	102	0.11	0.00	0.00	0.00	0.00	0.83	0.00	0.00	0.00	0.095	0.095	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.58
L113A	113	102	0.14	0.00	0.00	0.00	0.00	0.75	0.00	0.00	0.00	0.104	0.104	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.56
L102A	102	101	0.06	0.00	0.00	0.00	0.00	0.84	0.00	0.00	0.00	0.052	0.589	0.000	0.000	0.000	0.000	0.000	0.000	12.13
																				12.92
	107	106	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.00
L111A	111	106	0.05	0.00	0.00	0.00	0.00	0.20	0.00	0.00	0.00	0.011	0.011	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.32
L106A	106	105	0.46	0.00	0.00	0.00	0.00	0.78	0.00	0.00	0.00	0.356	0.367	0.000	0.000	0.000	0.000	0.000	0.000	10.32
	105	101	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.000	0.367	0.000	0.000	0.000	0.000	0.000	0.000	11.01
																				11.50
L108A	108	101	0.13	0.00	0.00	0.00	0.00	0.85	0.00	0.00	0.00	0.114	0.114	0.000	0.000	0.000	0.000	0.000	0.000	10.00
																				10.50
L101A	101	100	0.05	0.00	0.00	0.00	0.00	0.57	0.00	0.00	0.00	0.030	1.099	0.000	0.000	0.000	0.000	0.000	0.000	12.92
																				13.71

DRAINAGE AREA (continued) / PIPE SELECTION

AREA ID NUMBER	FROM M.H.	TO M.H.	I_{2-YEAR} (mm/h)	I_{5-YEAR} (mm/h)	$I_{10-YEAR}$ (mm/h)	$I_{100-YEAR}$ (mm/h)	$Q_{CONTROL}$ (L/s)	ACCUM. $Q_{CONTROL}$ (L/s)	Q_{ACT} (CIA/360) (L/s)	LENGTH (m)	PIPE WIDTH OR DIAMETE (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)
L116A	116	104	76.81	104.19	122.14	178.56	0.0	0.0	24.8	29.2	300	300	CIRCULAR	PVC	-	1.00	96.2	**25.79%**	1.37	0.96	0.51
L104A	104	103	74.91	101.58	119.07	174.04	0.0	0.0	35.7	47.2	300	300	CIRCULAR	CONCRETE	-	0.50	68.0	**52.49%**	0.97	0.84	0.93
L115A	115	103	76.81	104.19	122.14	178.56	0.0	0.0	19.9	30.2	300	300	CIRCULAR	PVC	-	1.00	96.2	**20.72%**	1.37	0.90	0.56
L103A	103	102	71.68	97.15	113.84	166.37	0.0	0.0	67.3	41.9	300	300	CIRCULAR	CONCRETE	-	0.50	68.0	**98.94%**	0.97	1.01	0.69
L112A	112	102	76.81	104.19	122.14	178.56	0.0	0.0	20.2	31.4	300	300	CIRCULAR	PVC	-	1.00	96.2	**21.00%**	1.37	0.90	0.58
L113A	113	102	76.81	104.19	122.14	178.56	0.0	0.0	22.3	31.2	300	300	CIRCULAR	PVC	-	1.00	96.2	**23.15%**	1.37	0.93	0.56
L102A	102	101	69.48	94.13	110.29	161.15	0.0	0.0	113.6	41.4	450	450	CIRCULAR	CONCRETE	-	0.25	148.7	**76.41%**	0.91	0.88	0.78
	107	106	76.81	104.19	122.14	178.56	0.0	0.0	0.0	75.1	300	300	CIRCULAR	PVC	-	1.00	96.2	**0.00%**	1.37	0.00	0.00
L111A	111	106	76.81	104.19	122.14	178.56	0.0	0.0	2.3	9.2	300	300	CIRCULAR	PVC	-	1.00	96.2	**2.40%**	1.37	0.47	0.32
L106A	106	105	75.58	102.51	120.16	175.65	0.0	0.0	77.1	33.0	375	375	CIRCULAR	CONCRETE	-	0.25	82.4	**93.50%**	0.78	0.80	0.68
	105	101	73.14	99.15	116.21	169.84	0.0	0.0	74.6	23.5	375	375	CIRCULAR	CONCRETE	-	0.25	82.4	**90.48%**	0.78	0.80	0.49
L108A	108	101	76.81	104.19	122.14	178.56	0.0	0.0	24.2	28.2	300	300	CIRCULAR	PVC	-	1.00	96.2	**25.19%**	1.37	0.94	0.50
L101A	101	100	67.17	90.95	106.55	155.67	0.0	0.0	205.0	40.5	600	600	CIRCULAR	CONCRETE	-	0.15	248.1	**82.64%**	0.85	0.85	0.80

Project: **BLOCK 211**

Chamber Model -	MC-4500			
Units -	**Metric**	Click Here for Imperial		
Number of Chambers -	66			
Number of chambers -	10			
Voids in the stone (porosity) -	40	%		
Base of Stone Elevation -	0.00	m	☑ Include Perimeter Stone in Calculations	
Amount of Stone Above Chambers -	305	mm		
Amount of Stone Below Chambers -	229	mm		
Area of system -	288	sq.meters	Min. Area -	254.31 sq.meters

StormTech MC-4500 Cumulative Storage Volumes

Height of System *(mm)*	Incremental Single Chamber *(cubic meters)*	Incremental Single End Cap *(cubic meters)*	Incremental Chambers *(cubic meters)*	Incremental End Cap *(cubic meters)*	Incremental Stone *(cubic meters)*	Incremental Chamber, End *(cubic meters)*	Cumulative System *(cubic meters)*	Elevation *(meters)*
2057	0.00	0.00	0.00	0.00	2.925	2.92	362.39	2.06
2032	0.00	0.00	0.00	0.00	2.925	2.92	359.47	2.03
2007	0.00	0.00	0.00	0.00	2.925	2.92	356.54	2.01
1981	0.00	0.00	0.00	0.00	2.925	2.92	353.62	1.98
1956	0.00	0.00	0.00	0.00	2.925	2.92	350.69	1.96
1930	0.00	0.00	0.00	0.00	2.925	2.92	347.77	1.93
1905	0.00	0.00	0.00	0.00	2.925	2.92	344.84	1.91
1880	0.00	0.00	0.00	0.00	2.925	2.92	341.92	1.88
1854	0.00	0.00	0.00	0.00	2.925	2.92	339.00	1.85
1829	0.00	0.00	0.00	0.00	2.925	2.92	336.07	1.83
1803	0.00	0.00	0.00	0.00	2.925	2.92	333.15	1.80
1778	0.00	0.00	0.00	0.00	2.925	2.92	330.22	1.78
1753	0.00	0.00	0.08	0.00	2.894	2.97	327.30	1.75
1727	0.00	0.00	0.22	0.00	2.837	3.06	324.33	1.73
1702	0.00	0.00	0.31	0.01	2.798	3.11	321.27	1.70
1676	0.01	0.00	0.39	0.01	2.763	3.17	318.16	1.68
1651	0.01	0.00	0.50	0.02	2.716	3.24	314.99	1.65
1626	0.01	0.00	0.85	0.02	2.576	3.45	311.75	1.63
1600	0.02	0.00	1.24	0.03	2.414	3.69	308.31	1.60
1575	0.02	0.00	1.49	0.04	2.311	3.84	304.62	1.57
1549	0.03	0.00	1.70	0.05	2.227	3.97	300.77	1.55
1524	0.03	0.01	1.87	0.05	2.153	4.08	296.80	1.52
1499	0.03	0.01	2.03	0.06	2.087	4.18	292.72	1.50
1473	0.03	0.01	2.17	0.07	2.027	4.27	288.54	1.47
1448	0.03	0.01	2.31	0.08	1.971	4.35	284.27	1.45
1422	0.04	0.01	2.43	0.08	1.919	4.43	279.91	1.42
1397	0.04	0.01	2.54	0.09	1.871	4.51	275.48	1.40
1372	0.04	0.01	2.65	0.10	1.825	4.57	270.97	1.37
1346	0.04	0.01	2.75	0.11	1.781	4.64	266.40	1.35
1321	0.04	0.01	2.85	0.11	1.740	4.70	261.76	1.32
1295	0.04	0.01	2.94	0.12	1.700	4.76	257.06	1.30
1270	0.05	0.01	3.03	0.12	1.663	4.82	252.30	1.27
1245	0.05	0.01	3.11	0.13	1.627	4.87	247.48	1.24
1219	0.05	0.01	3.19	0.14	1.592	4.92	242.61	1.22
1194	0.05	0.01	3.27	0.14	1.559	4.97	237.68	1.19
1168	0.05	0.01	3.34	0.15	1.527	5.02	232.71	1.17
1143	0.05	0.02	3.41	0.15	1.497	5.07	227.69	1.14
1118	0.05	0.02	3.48	0.16	1.468	5.11	222.62	1.12
1092	0.05	0.02	3.55	0.17	1.439	5.15	217.51	1.09
1067	0.05	0.02	3.61	0.17	1.412	5.19	212.36	1.07
1041	0.06	0.02	3.67	0.18	1.386	5.23	207.17	1.04
1016	0.06	0.02	3.73	0.18	1.361	5.27	201.94	1.02
991	0.06	0.02	3.78	0.19	1.336	5.31	196.67	0.99
965	0.06	0.02	3.84	0.19	1.313	5.34	191.36	0.97
940	0.06	0.02	3.89	0.20	1.290	5.38	186.02	0.94
914	0.06	0.02	3.94	0.20	1.269	5.41	180.64	0.91
889	0.06	0.02	3.99	0.20	1.247	5.44	175.23	0.89
864	0.06	0.02	4.03	0.21	1.227	5.47	169.79	0.86
838	0.06	0.02	4.08	0.21	1.207	5.50	164.32	0.84
813	0.06	0.02	4.12	0.22	1.188	5.53	158.82	0.81
787	0.06	0.02	4.16	0.22	1.170	5.56	153.29	0.79
762	0.06	0.02	4.20	0.23	1.153	5.58	147.74	0.76
737	0.06	0.02	4.24	0.23	1.135	5.61	142.15	0.74
711	0.06	0.02	4.28	0.24	1.118	5.63	136.54	0.71
686	0.07	0.02	4.31	0.24	1.104	5.66	130.91	0.69
660	0.07	0.02	4.35	0.24	1.089	5.68	125.25	0.66
635	0.07	0.02	4.38	0.25	1.074	5.70	119.58	0.64
610	0.07	0.03	4.41	0.25	1.060	5.72	113.88	0.61
584	0.07	0.03	4.44	0.25	1.047	5.74	108.15	0.58
559	0.07	0.03	4.47	0.26	1.034	5.76	102.41	0.56
533	0.07	0.03	4.50	0.26	1.022	5.78	96.65	0.53
508	0.07	0.03	4.52	0.26	1.010	5.80	90.87	0.51
483	0.07	0.03	4.55	0.27	0.999	5.81	85.08	0.48
457	0.07	0.03	4.57	0.27	0.989	5.83	79.26	0.46
432	0.07	0.03	4.59	0.27	0.979	5.84	73.44	0.43
406	0.07	0.03	4.61	0.28	0.969	5.86	67.59	0.41
381	0.07	0.03	4.63	0.28	0.960	5.87	61.73	0.38
356	0.07	0.03	4.65	0.28	0.951	5.88	55.86	0.36
330	0.07	0.03	4.67	0.29	0.943	5.90	49.98	0.33
305	0.07	0.03	4.68	0.29	0.936	5.91	44.08	0.30
279	0.07	0.03	4.70	0.29	0.929	5.92	38.17	0.28
254	0.07	0.03	4.72	0.29	0.919	5.93	32.26	0.25
229	0.00	0.00	0.00	0.00	2.925	2.92	26.32	0.23
203	0.00	0.00	0.00	0.00	2.925	2.92	23.40	0.20
178	0.00	0.00	0.00	0.00	2.925	2.92	20.47	0.18
152	0.00	0.00	0.00	0.00	2.925	2.92	17.55	0.15
127	0.00	0.00	0.00	0.00	2.925	2.92	14.62	0.13
102	0.00	0.00	0.00	0.00	2.925	2.92	11.70	0.10
76	0.00	0.00	0.00	0.00	2.925	2.92	8.77	0.08

PROJECT INFORMATION	
ENGINEERED PRODUCT MANAGER:	VIVEK SHARMA 647-463-9803 VIVEK.SHARMA@ADS-PIPE.COM
ADS SALES REP:	HASSAN ELMI 416-985-9757 HASSAN.ELMI@ADS-PIPE.COM
PROJECT NO:	S087842

ADVANCED DRAINAGE SYSTEMS, INC.

BLOCK 211 RIVERSIDE SOUTH

OTTAWA, ONTARIO - CANADA

STORMTECH CHAMBER SPECIFICATIONS

1. CHAMBERS SHALL BE STORMTECH MC-4500.
2. CHAMBERS SHALL BE MANUFACTURED FROM VIRGIN, IMPACT-MODIFIED POLYPROPYLENE COPOLYMERS.
3. CHAMBER ROWS SHALL PROVIDE CONTINUOUS, UNOBSTRUCTED INTERNAL SPACE WITH NO INTERNAL SUPPORT PANELS THAT WOULD IMPEDE FLOW OR LIMIT ACCESS FOR INSPECTION.
4. 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.
5. CHAMBERS SHALL BE CERTIFIED TO CSA B184, "POLYMERIC SUB-SURFACE STORMWATER MANAGEMENT STRUCTURES", AND MEET THE REQUIREMENTS OF ASTM F2418-16, "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
6. CHAMBERS SHALL BE DESIGNED AND ALLOWABLE LOADS DETERMINED IN ACCORDANCE WITH ASTM F2787, "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
7. ONLY CHAMBERS THAT ARE APPROVED BY THE SITE DESIGN ENGINEER WILL BE ALLOWED. THE CHAMBER MANUFACTURER SHALL SUBMIT THE FOLLOWING UPON REQUEST TO THE SITE DESIGN ENGINEER FOR APPROVAL BEFORE DELIVERING CHAMBERS TO THE PROJECT SITE:
   a. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES 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 AASHTO FOR THERMOPLASTIC PIPE.
   b. A STRUCTURAL EVALUATION SEALED BY A REGISTERED PROFESSIONAL ENGINEER THAT DEMONSTRATES THAT THE LOAD FACTORS SPECIFIED IN THE AASHTO LRFD BRIDGE DESIGN SPECIFICATIONS, SECTION 12.12, ARE MET. THE 50 YEAR CREEP MODULUS DATA SPECIFIED IN ASTM F2418 MUST BE USED AS PART OF THE AASHTO STRUCTURAL EVALUATION TO VERIFY LONG-TERM PERFORMANCE.
   c. STRUCTURAL CROSS SECTION DETAIL ON WHICH THE STRUCTURAL EVALUATION IS BASED.
8. CHAMBERS AND END CAPS SHALL BE PRODUCED AT AN ISO 9001 CERTIFIED MANUFACTURING FACILITY.

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

1. STORMTECH MC-4500 CHAMBERS SHALL NOT BE INSTALLED UNTIL THE MANUFACTURER'S REPRESENTATIVE HAS COMPLETED A PRE-CONSTRUCTION MEETING WITH THE INSTALLERS.
2. STORMTECH MC-4500 CHAMBERS SHALL BE INSTALLED IN ACCORDANCE WITH THE "STORMTECH MC-3500/MC-4500 CONSTRUCTION GUIDE".
3. CHAMBERS ARE NOT TO BE BACKFILLED WITH A DOZER OR EXCAVATOR SITUATED OVER THE CHAMBERS. STORMTECH RECOMMENDS 3 BACKFILL METHODS:
   - STONESHOOTER LOCATED OFF THE CHAMBER BED.
   - BACKFILL AS ROWS ARE BUILT USING AN EXCAVATOR ON THE FOUNDATION STONE OR SUBGRADE.
   - BACKFILL FROM OUTSIDE THE EXCAVATION USING A LONG BOOM HOE OR EXCAVATOR.
4. THE FOUNDATION STONE SHALL BE LEVELED AND COMPACTED PRIOR TO PLACING CHAMBERS.
5. JOINTS BETWEEN CHAMBERS SHALL BE PROPERLY SEATED PRIOR TO PLACING STONE.
6. MAINTAIN MINIMUM 9" (230 mm) SPACING BETWEEN THE CHAMBER ROWS.
7. INLET AND OUTLET MANIFOLDS MUST BE INSERTED A MINIMUM OF 300 mm (12") INTO CHAMBER END CAPS.
8. EMBEDMENT STONE SURROUNDING CHAMBERS MUST BE A CLEAN, CRUSHED, ANGULAR STONE MEETING THE AASHTO M43 DESIGNATION OF #3 OR #4.
9. STONE SHALL BE BROUGHT UP EVENLY AROUND CHAMBERS SO AS NOT TO DISTORT THE CHAMBER SHAPE. STONE DEPTHS SHOULD NEVER DIFFER BY MORE THAN 300 mm (12") BETWEEN ADJACENT CHAMBER ROWS.
10. STONE MUST BE PLACED ON THE TOP CENTER OF THE CHAMBER TO ANCHOR THE CHAMBERS IN PLACE AND PRESERVE ROW SPACING.
11. THE CONTRACTOR MUST REPORT ANY KNOWN DISCREPANCIES WITH CHAMBER FOUNDATION MATERIAL BEARING CAPACITIES TO THE SITE DESIGN ENGINEER.
12. ADS RECOMMENDS THE USE OF "FLEXSTORM CATCH IT" INSERTS DURING CONSTRUCTION FOR ALL INLETS TO PROTECT THE SUBSURFACE STORMWATER MANAGEMENT SYSTEM FROM CONSTRUCTION SITE RUNOFF.

NOTES FOR CONSTRUCTION EQUIPMENT

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

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

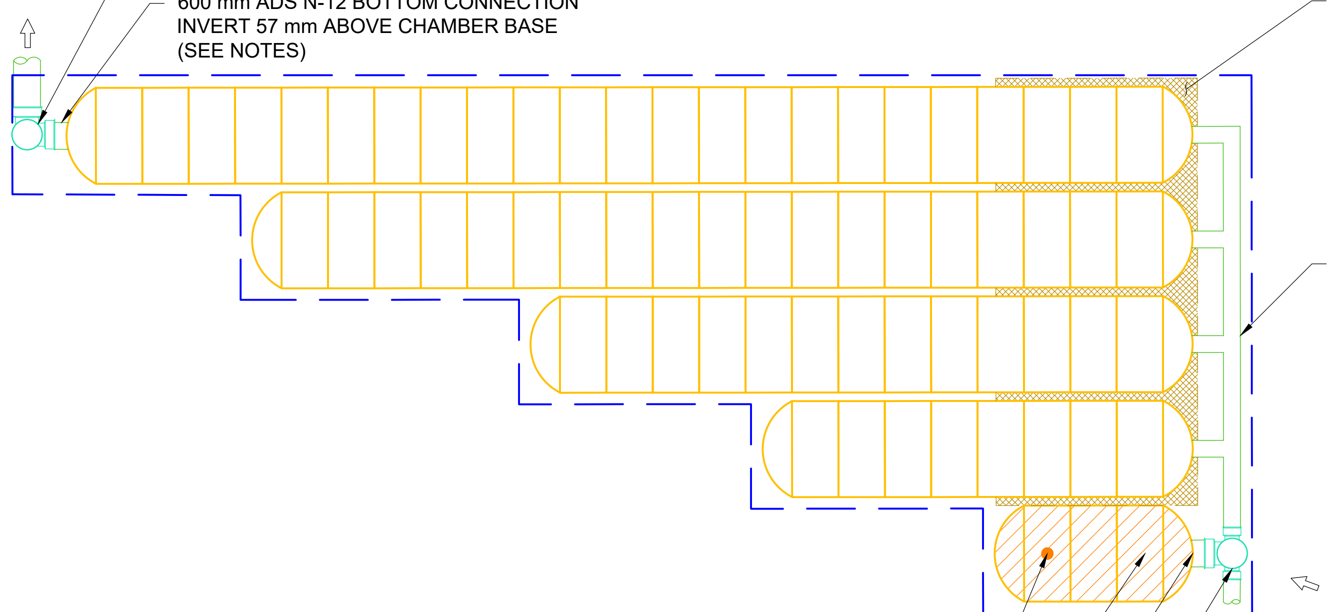
CONTACT STORMTECH AT 1-888-892-2694 WITH ANY QUESTIONS ON INSTALLATION REQUIREMENTS OR WEIGHT LIMITS FOR CONSTRUCTION EQUIPMENT.

CONCEPTUAL LAYOUT

66	STORMTECH MC-4500 CHAMBERS
10	STORMTECH MC-4500 END CAPS
305	STONE ABOVE (mm)
229	STONE BELOW (mm)
40	% STONE VOID
362.5	**INSTALLED SYSTEM VOLUME (m³) (PERIMETER STONE INCLUDED)**
288	SYSTEM AREA (m²)
94	SYSTEM PERIMETER (m)

NOTES

- MANIFOLD SIZE TO BE DETERMINED BY SITE DESIGN ENGINEER. SEE TECH SHEET #7 FOR MANIFOLD SIZING GUIDANCE.
- DUE TO THE ADAPTATION OF THIS CHAMBER SYSTEM TO SPECIFIC SITE AND DESIGN CONSTRAINTS, IT MAY BE NECESSARY TO CUT AND COUPLE ADDITIONAL PIPE TO STANDARD MANIFOLD COMPONENTS IN THE FIELD.
- THE SITE DESIGN ENGINEER MUST REVIEW ELEVATIONS AND IF NECESSARY ADJUST GRADING TO ENSURE THE CHAMBER COVER REQUIREMENTS ARE MET.
- THE SITE DESIGN ENGINEER MUST REVIEW THE PROXIMITY OF THE CHAMBERS TO THE BUILDING/STRUCTURE. NO FOUNDATION LOADS SHALL BE TRANSMITTED TO THE CHAMBERS. THE SITE DESIGN ENGINEER MUST CONSIDER EFFECTS OF POSSIBLE SATURATED SOILS ON BEARING CAPACITY OF SOILS AND SEEPAGE INTO BASEMENTS.
- **NOT FOR CONSTRUCTION:** THIS LAYOUT IS FOR DIMENSIONAL PURPOSES ONLY TO PROVE CONCEPT & THE REQUIRED STORAGE VOLUME CAN BE ACHIEVED ON SITE.



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4640 TRUEMAN BLVD
HILLIARD, OH 43026

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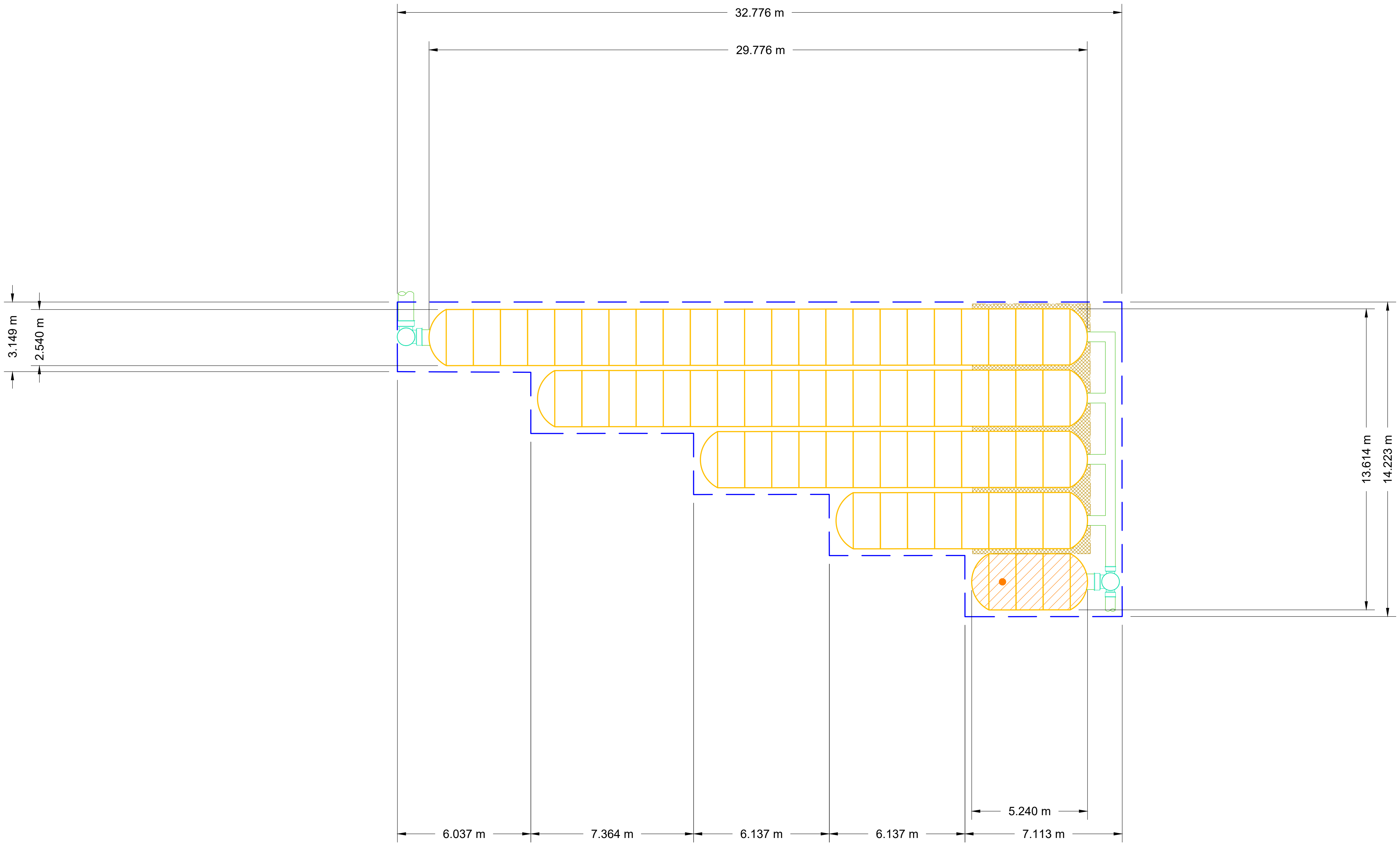
SCALE = 1 : 200

REV	DWN	CKD	DESCRIPTION

BLOCK 211 RIVERSIDE SOUTH
OTTAWA, ONTARIO - CANADA

DATE: 6/4/2018 DRAWN: PM
PROJECT #: S087842 CHECKED: RWD



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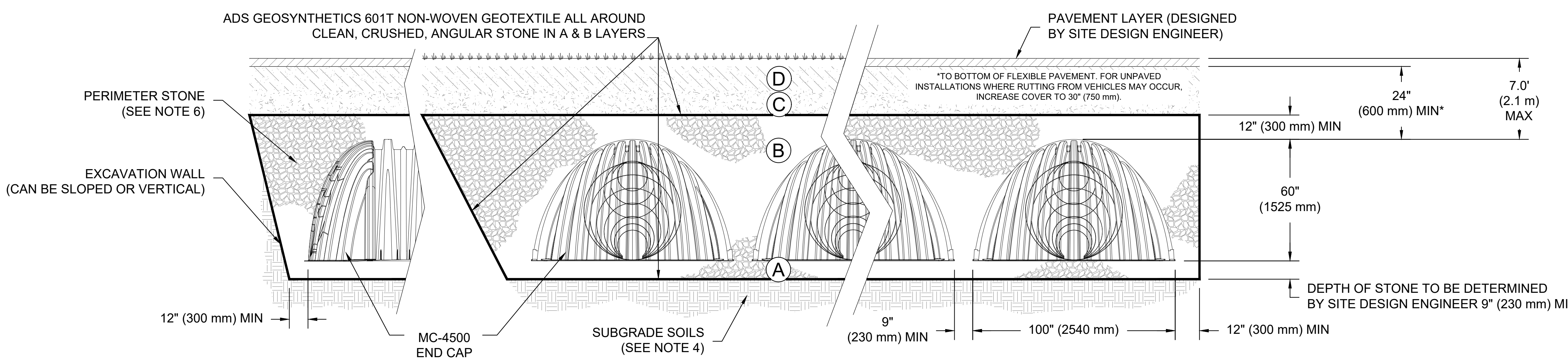
SCALE = 1 : 200

ACCEPTABLE FILL MATERIALS: STORMTECH MC-4500 CHAMBER SYSTEMS

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

PLEASE NOTE:
1. THE LISTED AASHTO DESIGNATIONS ARE FOR GRADATIONS ONLY. THE STONE MUST ALSO BE CLEAN, CRUSHED, ANGULAR. FOR EXAMPLE, A SPECIFICATION FOR #4 STONE WOULD STATE: "CLEAN, CRUSHED, ANGULAR NO. 4 (AASHTO M43) STONE".
2. STORMTECH COMPACTION REQUIREMENTS ARE MET FOR 'A' LOCATION MATERIALS WHEN PLACED AND COMPACTED IN 9" (230 mm) (MAX) LIFTS USING TWO FULL COVERAGES WITH A VIBRATORY COMPACTOR.
3. WHERE INFILTRATION SURFACES MAY BE COMPROMISED BY COMPACTION, FOR STANDARD DESIGN LOAD CONDITIONS, A FLAT SURFACE MAY BE ACHIEVED BY RAKING OR DRAGGING WITHOUT COMPACTION EQUIPMENT. FOR SPECIAL LOAD DESIGNS, CONTACT STORMTECH FOR COMPACTION REQUIREMENTS.



NOTES:

1. MC-4500 CHAMBERS SHALL CONFORM TO THE REQUIREMENTS OF ASTM F2418 "STANDARD SPECIFICATION FOR POLYPROPYLENE (PP) CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
2. MC-4500 CHAMBERS SHALL BE DESIGNED IN ACCORDANCE WITH ASTM F2787 "STANDARD PRACTICE FOR STRUCTURAL DESIGN OF THERMOPLASTIC CORRUGATED WALL STORMWATER COLLECTION CHAMBERS".
3. "ACCEPTABLE FILL MATERIALS" TABLE ABOVE PROVIDES MATERIAL LOCATIONS, DESCRIPTIONS, GRADATIONS, AND COMPACTION REQUIREMENTS FOR FOUNDATION, EMBEDMENT, AND FILL MATERIALS.
4. THE SITE DESIGN ENGINEER IS RESPONSIBLE FOR ASSESSING THE BEARING RESISTANCE (ALLOWABLE BEARING CAPACITY) OF THE SUBGRADE SOILS AND THE DEPTH OF FOUNDATION STONE WITH CONSIDERATION FOR THE RANGE OF EXPECTED SOIL MOISTURE CONDITIONS.
5. ONCE LAYER 'C' IS PLACED, ANY SOIL/MATERIAL CAN BE PLACED IN LAYER 'D' UP TO THE FINISHED GRADE. MOST PAVEMENT SUBBASE SOILS CAN BE USED TO REPLACE THE MATERIAL REQUIREMENTS OF LAYER 'C' OR 'D' AT THE SITE DESIGN ENGINEER'S DISCRETION.
6. PERIMETER STONE MUST BE EXTENDED HORIZONTALLY TO THE EXCAVATION WALL FOR BOTH VERTICAL AND SLOPED EXCAVATION WALLS.

BLOCK 211 RIVERSIDE SOUTH
OTTAWA, ONTARIO - CANADA

DATE: 6/4/2018 | DRAWN: PM
PROJECT #: S087842 | CHECKED: RWD

REV	DWN	CKD	DESCRIPTION

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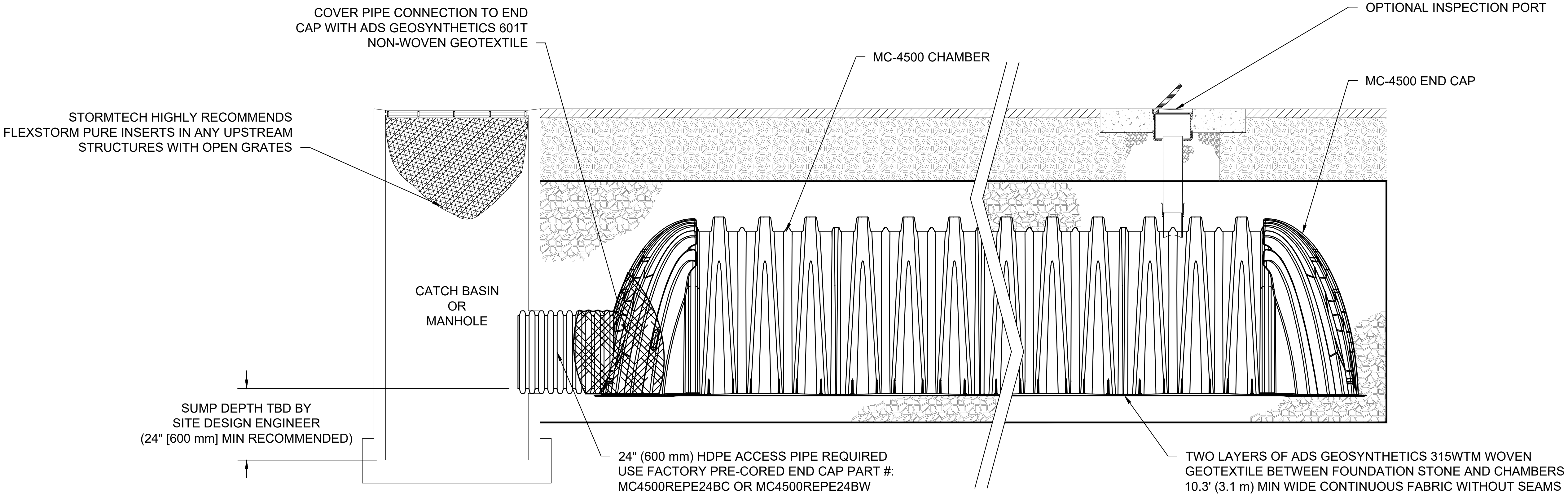


MC-4500 ISOLATOR ROW DETAIL

NTS

INSPECTION & MAINTENANCE

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

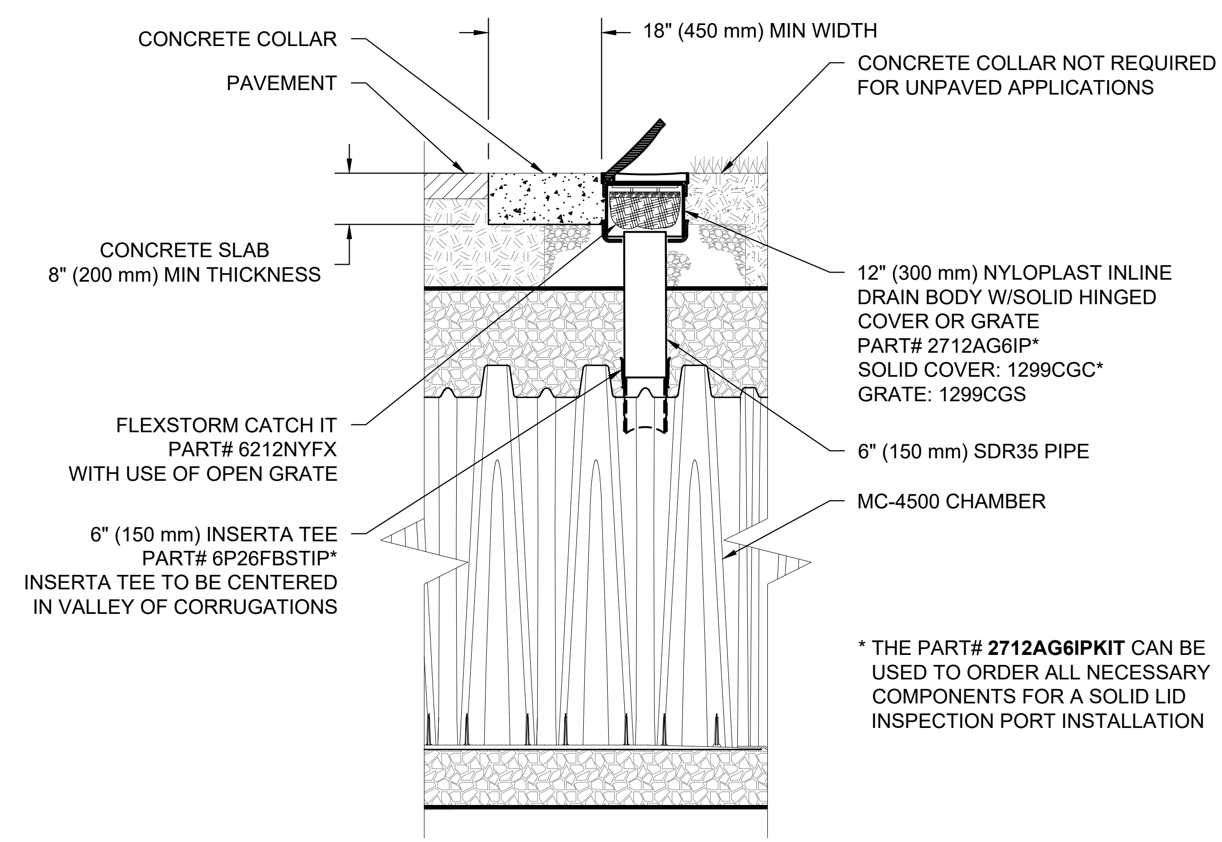
STEP 2) CLEAN OUT ISOLATOR ROW USING THE JETVAC PROCESS
- A. A FIXED CULVERT CLEANING NOZZLE WITH REAR FACING SPREAD OF 45" (1.1 m) OR MORE IS PREFERRED
- B. APPLY MULTIPLE PASSES OF JETVAC UNTIL BACKFLUSH WATER IS CLEAN
- C. VACUUM STRUCTURE SUMP AS REQUIRED

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

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

NOTES

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



* THE PART# **2712AG6IPKIT** CAN BE USED TO ORDER ALL NECESSARY COMPONENTS FOR A SOLID LID INSPECTION PORT INSTALLATION

MC-4500 6" INSPECTION PORT DETAIL

NTS

BLOCK 211 RIVERSIDE SOUTH
OTTAWA, ONTARIO - CANADA

DATE: 6/4/2018 | DRAWN: PM
PROJECT #: S087842 | CHECKED: RWD

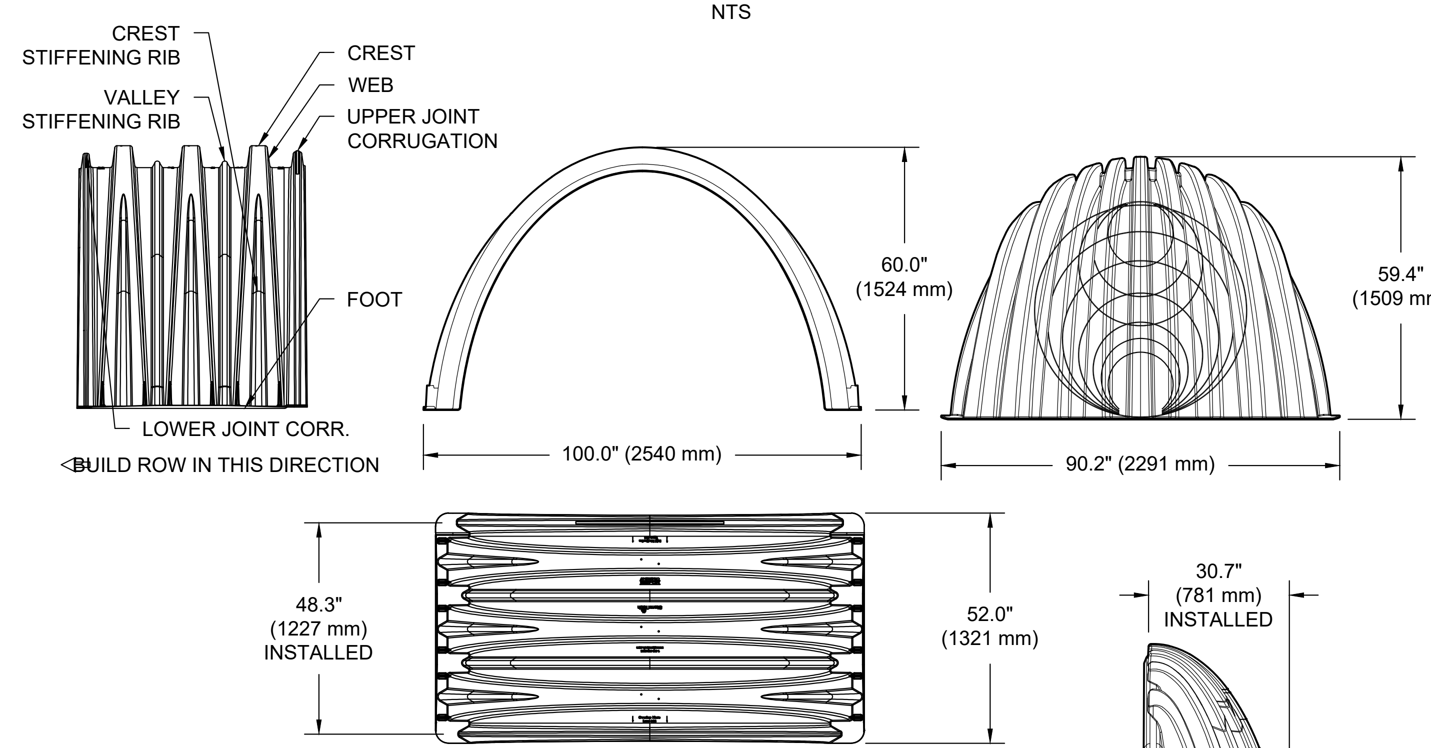
REV	DWN	CKD	DESCRIPTION

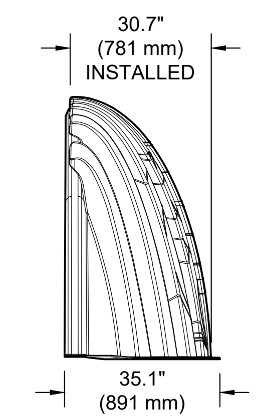
StormTech® Detention•Retention•Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS® ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026

MC-4500 TECHNICAL SPECIFICATION

NTS





NOMINAL CHAMBER SPECIFICATIONS

SIZE (W X H X INSTALLED LENGTH)	100.0" X 60.0" X 48.3"	(2540 mm X 1524 mm X 1227 mm)
CHAMBER STORAGE	106.5 CUBIC FEET	(3.01 m³)
MINIMUM INSTALLED STORAGE*	162.6 CUBIC FEET	(4.60 m³)
WEIGHT	130.0 lbs.	(59.0 kg)

NOMINAL END CAP SPECIFICATIONS

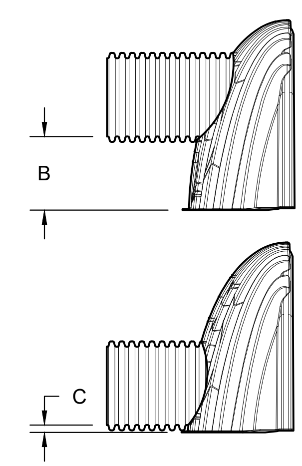
SIZE (W X H X INSTALLED LENGTH)	90.2" X 59.4" X 30.7"	(2291 mm X 1509 mm X 781 mm)
END CAP STORAGE	35.7 CUBIC FEET	(1.01 m³)
MINIMUM INSTALLED STORAGE*	108.7 CUBIC FEET	(3.08 m³)
WEIGHT	135.0 lbs.	(61.2 kg)

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

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

PART #	STUB	B	C
MC4500REPE06T	6" (150 mm)	42.54" (1.081 m)	---
MC4500REPE06B		---	0.86" (22 mm)
MC4500REPE08T	8" (200 mm)	40.50" (1.029 m)	---
MC4500REPE08B		---	1.01" (26 mm)
MC4500REPE10T	10" (250 mm)	38.37" (975 mm)	---
MC4500REPE10B		---	1.33" (34 mm)
MC4500REPE12T	12" (300 mm)	35.69" (907 mm)	---
MC4500REPE12B		---	1.55" (39 mm)
MC4500REPE15T	15" (375 mm)	32.72" (831 mm)	---
MC4500REPE15B		---	1.70" (43 mm)
MC4500REPE18TC	18" (450 mm)	29.36" (746 mm)	---
MC4500REPE18TW			
MC4500REPE18BC		---	1.97" (50 mm)
MC4500REPE18BW			
MC4500REPE24TC	24" (600 mm)	23.05" (585 mm)	---
MC4500REPE24TW			
MC4500REPE24BC		---	2.26" (57 mm)
MC4500REPE24BW			
MC4500REPE30BC	30" (750 mm)	---	2.95" (75 mm)
MC4500REPE36BC	36" (900 mm)	---	3.25" (83 mm)
MC4500REPE42BC	42" (1050 mm)	---	3.55" (90 mm)

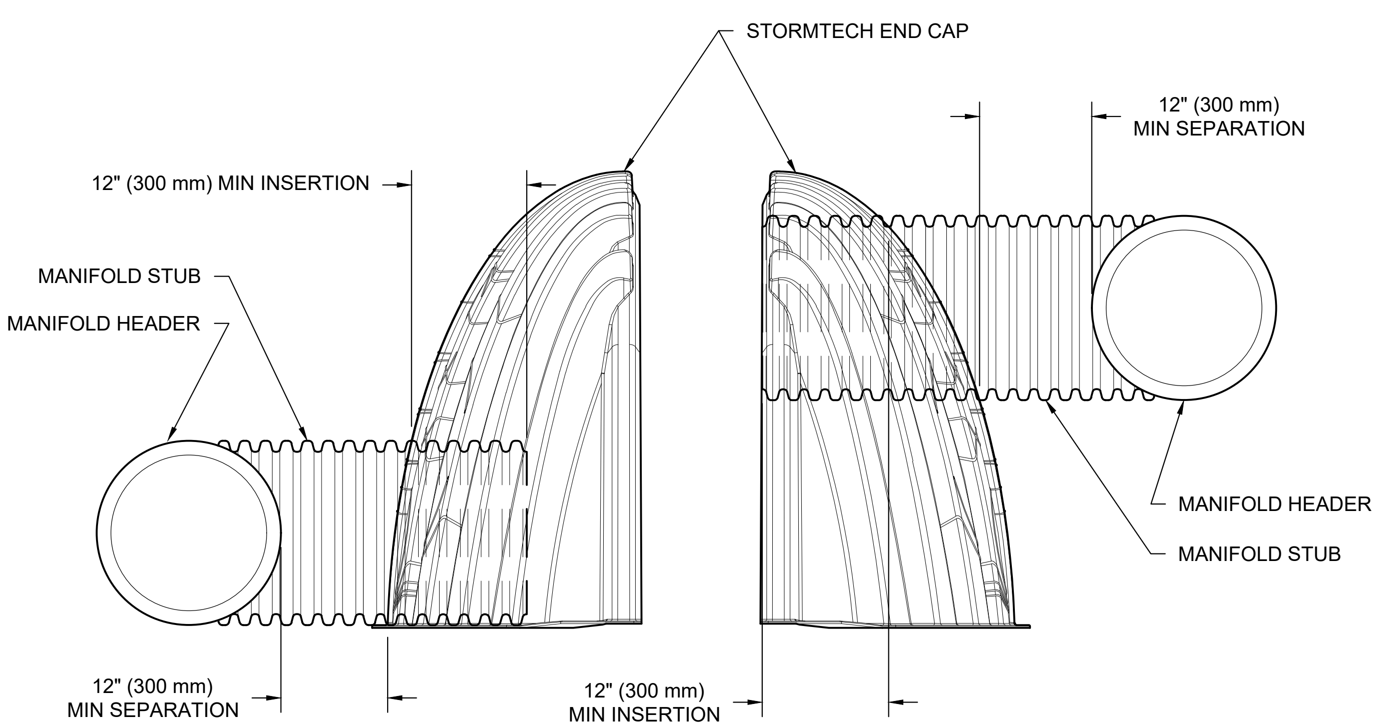
NOTE: ALL DIMENSIONS ARE NOMINAL



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

MC-SERIES END CAP INSERTION DETAIL

NTS



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

BLOCK 211 RIVERSIDE SOUTH
OTTAWA, ONTARIO - CANADA

DATE: 6/4/2018 | DRAWN: PM
PROJECT #: S087842 | CHECKED: RWD

REV	DWN	CKD	DESCRIPTION

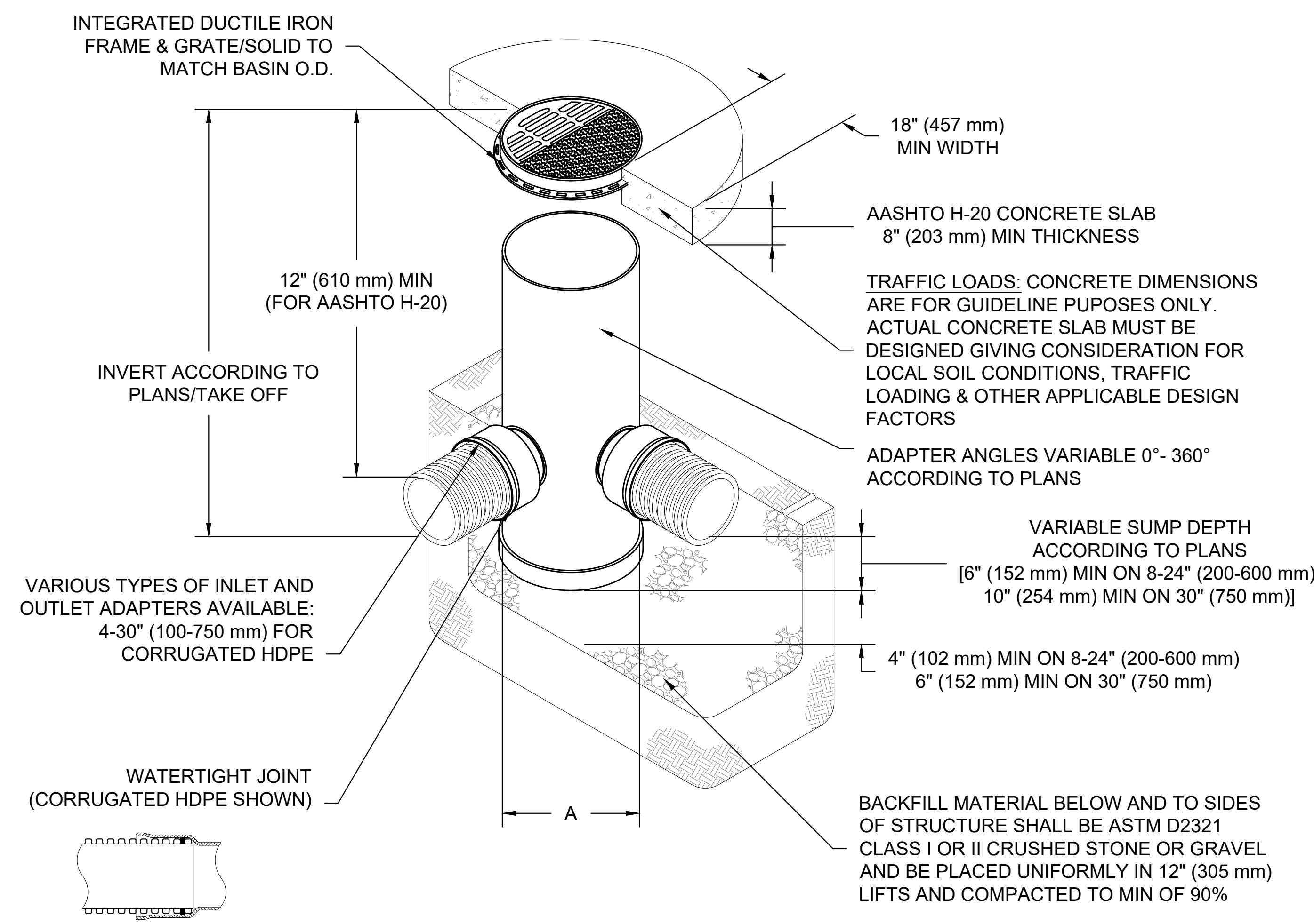
StormTech
Detention • Retention • Water Quality
70 INWOOD ROAD, SUITE 3 | ROCKY HILL | CT | 06067
860-529-8188 | 888-892-2694 | WWW.STORMTECH.COM

ADS
ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026

SHEET 6 OF 7

NYLOPLAST DRAIN BASIN

NTS



NOTES

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

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

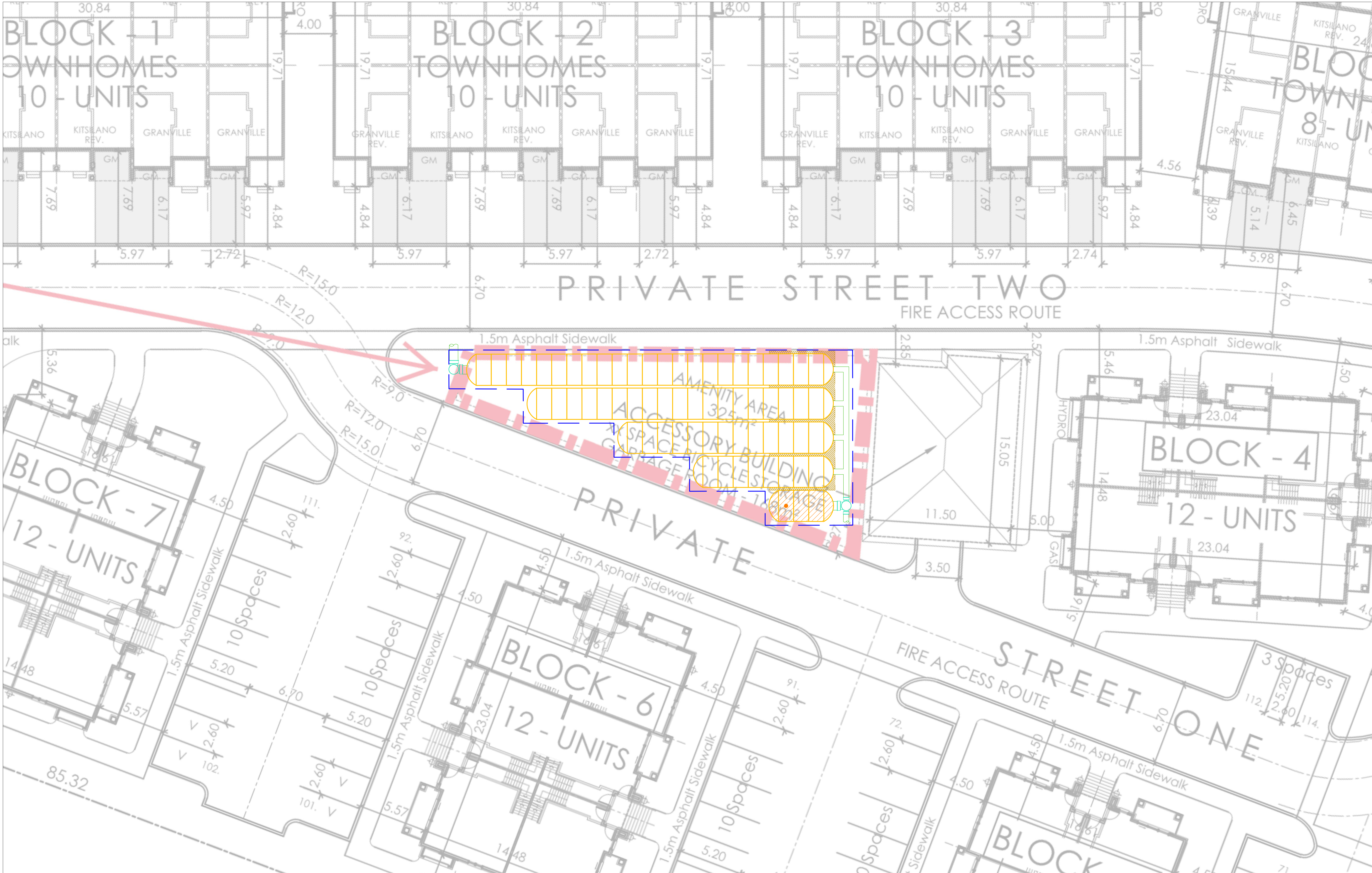
BLOCK 211 RIVERSIDE SOUTH
OTTAWA, ONTARIO - CANADA

DATE: 6/4/2018 DRAWN: PM
PROJECT #: S087842 CHECKED: RWD

REV	DWN	CKD	DESCRIPTION

Nyloplast
3130 VERONA AVE
BUFORD, GA 30518
PHN (770) 932-2443
FAX (770) 932-2490
www.nyloplast-us.com

ADS ADVANCED DRAINAGE SYSTEMS, INC.
4640 TRUEMAN BLVD
HILLIARD, OH 43026


BLOCK - 1
TOWNHOMES
10 - UNITS
BLOCK - 2
TOWNHOMES
10 - UNITS
BLOCK - 3
TOWNHOMES
10 - UNITS
BLOCK - 8
KITSILANO
KITSILANO REV.
GRANVILLE
GRANVILLE REV.
GM
30.84
4.00
19.71
7.69
6.17
5.97
4.84
2.72
2.74
5.98
4.56
PRIVATE STREET TWO
FIRE ACCESS ROUTE
R=15.0
R=12.0
R=9.0
6.70
1.5m Asphalt Sidewalk
AMENITY AREA
325m²
ACCESSORY BUILDING
BICYCLE STORAGE
GARAGE ROOM
2.85
2.52
15.05
11.50
3.50
5.00
HYDRO
GAS
BLOCK - 4
12 - UNITS
23.04
14.48
BLOCK - 7
12 - UNITS
BLOCK - 6
12 - UNITS
BLOCK
PRIVATE STREET ONE
FIRE ACCESS ROUTE
10 Spaces
3 Spaces
4.50
2.60
5.20
5.57
85.32
1.5m Asphalt Sidewalk

B.2 PCSWMM MODEL INPUT

```
[TITLE]


[OPTIONS]
;;Options            Value
;;------------------ ------------
FLOW_UNITS           LPS
INFILTRATION         HORTON
FLOW_ROUTING         DYNWAVE
START_DATE           09/14/2011
START_TIME           00:00:00
REPORT_START_DATE    09/14/2011
REPORT_START_TIME    00:00:00
END_DATE             09/15/2011
END_TIME             00:00:00
SWEEP_START          01/01
SWEEP_END            12/31
DRY_DAYS             0
REPORT_STEP          00:01:00
WET_STEP             00:05:00
DRY_STEP             00:05:00
ROUTING_STEP         5
ALLOW_PONDING        YES
INERTIAL_DAMPING     PARTIAL
VARIABLE_STEP        0
LENGTHENING_STEP     0
MIN_SURFAREA         0
NORMAL_FLOW_LIMITED  BOTH
SKIP_STEADY_STATE    NO
FORCE_MAIN_EQUATION  D-W
LINK_OFFSETS         ELEVATION
MIN_SLOPE            0
MAX_TRIALS           8
HEAD_TOLERANCE       0.0015
SYS_FLOW_TOL         5
LAT_FLOW_TOL         5
MINIMUM_STEP         0.5
THREADS              4

[EVAPORATION]
;;Type          Parameters
;;-------------- ----------
CONSTANT      0.0
DRY_ONLY      NO

[RAINGAGES]
;;               Rain      Time   Snow   Data
;;Name           Type      Intrvl Catch  Source
;;-------------- --------- ------ ------ ----------
RG1              INTENSITY 0:10   1.0    TIMESERIES 100yr+20_3hr_chicago

[SUBCATCHMENTS]
;;                                                 Total    Pcnt.             Pcnt.
  Curb     Snow
;;Name           Raingage         Outlet           Area     Imperv   Width    Slope
  Length   Pack
;;-------------- ---------------- ---------------- -------- -------- --------
-------- -------- --------
L101A            RG1              501              0.051781 52.857   36       3
  0
L102A            RG1              515              0.061829 91.429   52       3
  0
L103A            RG1              509              0.086869 91.429   36       3
```

```
  0
L104A           RG1              516              0.071786 81.429   70       3
  0
L106A           RG1              519              0.456678 82.857   120      3
  0
L108A           RG1              503              0.133578 92.857   62       3
  0
L111A           RG1              111S             0.054174 0        45       3
  0
L112A           RG1              505              0.114021 90       66       3
  0
L113A           RG1              507              0.139092 78.571   58       3
  0
L115A           RG1              511              0.12791  75.714   58       3
  0
L116A           RG1              513              0.152952 80       58       3
  0
UNC-1           RG1              OF3              0.073129 32.857   16       3
  0
UNC-2           RG1              OF2              0.130716 32.857   29.5     3
  0

[SUBAREAS]
;;Subcatchment   N-Imperv   N-Perv     S-Imperv   S-Perv     PctZero    RouteTo
PctRouted
;;-------------- ---------- ---------- ---------- ---------- ---------- ----------
----------
L101A           0.013      0.25       1.57       4.67       0          OUTLET
L102A           0.013      0.25       1.57       4.67       0          OUTLET
L103A           0.013      0.25       1.57       4.67       0          OUTLET
L104A           0.013      0.25       1.57       4.67       0          OUTLET
L106A           0.013      0.25       1.57       4.67       0          OUTLET
L108A           0.013      0.25       1.57       4.67       0          OUTLET
L111A           0.013      0.25       1.57       4.67       0          OUTLET
L112A           0.013      0.25       1.57       4.67       0          OUTLET
L113A           0.013      0.25       1.57       4.67       0          OUTLET
L115A           0.013      0.25       1.57       4.67       0          OUTLET
L116A           0.013      0.25       1.57       4.67       0          OUTLET
UNC-1           0.013      0.25       1.57       4.67       0          PERVIOUS
100
UNC-2           0.013      0.25       1.57       4.67       0          PERVIOUS
100

[INFILTRATION]
;;Subcatchment   MaxRate    MinRate    Decay      DryTime    MaxInfil
;;-------------- ---------- ---------- ---------- ---------- ----------
L101A           76.2       13.2       4.14       7          0
L102A           76.2       13.2       4.14       7          0
L103A           76.2       13.2       4.14       7          0
L104A           76.2       13.2       4.14       7          0
L106A           76.2       13.2       4.14       7          0
L108A           76.2       13.2       4.14       7          0
L111A           76.2       13.2       4.14       7          0
L112A           76.2       13.2       4.14       7          0
L113A           76.2       13.2       4.14       7          0
L115A           76.2       13.2       4.14       7          0
L116A           76.2       13.2       4.14       7          0
UNC-1           76.2       13.2       4.14       7          0
UNC-2           76.2       13.2       4.14       7          0

[OUTFALLS]
;;              Invert     Outfall      Stage/Table      Tide
;;Name          Elev.      Type         Time Series      Gate Route To
```

```
;;-------------- ---------- ------------ ---------------- ---- ----------------
OF1              87.44      FIXED        88.39            NO
OF2              0          FREE                          NO
OF3              0          FREE                          NO
OF4              92.62      FREE                          NO
OF5              91.6       FREE                          NO

[STORAGE]
;;               Invert   Max.     Init.    Storage    Curve
Ponded   Evap.
;;Name           Elev.    Depth    Depth    Curve      Params
Area     Frac.    Infiltration parameters
;;-------------- -------- -------- -------- ---------- -------- -------- --------
-------- -------- -----------------------
101              87.501   4.938    0.889    FUNCTIONAL 0        0        0        0
      0
101A-S           92.48    0.35     0        FUNCTIONAL 0        0        0        0
      0
102              87.724   4.736    0.666    FUNCTIONAL 0        0        0        0
      0
103              89.102   3.221    0        FUNCTIONAL 0        0        0        0
      0
103A-S           92.46    0.35     0        FUNCTIONAL 0        0        0        0
      0
103B-S           92.35    0.35     0        FUNCTIONAL 0        0        0        0
      0
104              89.368   3.11     0        FUNCTIONAL 0        0        0        0
      0
105              88.43    4.035    0        FUNCTIONAL 0        0        0        0
      0
106              88.543   3.797    0        FUNCTIONAL 0        0        0        0
      0
106A-S           92.76    0.35     0        FUNCTIONAL 0        0        0        0
      0
106B-S           92.45    0.35     0        FUNCTIONAL 0        0        0        0
      0
107              89.37    3.42     0        FUNCTIONAL 0        0        0        0
      0
108              89.738   2.562    0        FUNCTIONAL 0        0        0        0
      0
111              89.342   3.478    0        FUNCTIONAL 0        0        0        0
      0
111S             89.64    2.86     0        TABULAR    111S                       0
      0
112              89.66    2.65     0        FUNCTIONAL 0        0        0        0
      0
113              89.9     2.4      0        FUNCTIONAL 0        0        0        0
      0
115              89.72    2.59     0        FUNCTIONAL 0        0        0        0
      0
116              89.72    2.59     0        FUNCTIONAL 0        0        0        0
      0
501              90.3     1.73     0        FUNCTIONAL 0        0        0        0
      0
503              90.75    1.78     0        TABULAR    503-S                      0
      0
505              90.75    1.73     0        TABULAR    505-S                      0
      0
507              90.75    1.78     0        TABULAR    507-S                      0
      0
509              90.92    1.73     0        TABULAR    509-S                      0
      0
511              90.73    1.78     0        TABULAR    511-S                      0
```

```
      0
513              90.75    1.78     0        TABULAR    513-S                        0
      0
515              90.73    1.73     0        TABULAR    515-S                        0
      0
516              90.87    1.73     0        FUNCTIONAL 0        0        0         0
      0
519              90.82    1.73     0        TABULAR    509-S                        0
      0

[CONDUITS]
;;               Inlet            Outlet                      Manning    Inlet
Outlet     Init.      Max.
;;Name           Node             Node             Length     N          Offset
Offset     Flow       Flow
;;-------------- ---------------- ---------------- ---------- ---------- ----------
---------- ---------- ----------
C1               106A-S           OF4              16.965     0.01       92.76
92.62      0          0
C10              519              101A-S           49.057     0.013      92.2
92.54      0          0
C11              106B-S           519              47.401     0.013      92.45
92.2       0          0
C13              101A-S           501              37.397     0.013      92.52
91.68      0          0
C16              106A-S           106B-S           28.952     0.013      92.76
92.45      0          0
C2               106B-S           516              35.789     0.013      92.45
92.25      0          0
C4               101A-S           515              13.882     0.013      92.48
92.11      0          0
C5               515              103A-S           12.265     0.013      92.11
92.46      0          0
C6               103A-S           509              27.695     0.013      92.46
92.3       0          0
C7               509              103B-S           4.865      0.013      92.3
92.35      0          0
C8               103B-S           516              31.403     0.013      92.35
92.25      0          0
C9               501              OF5              10.858     0.013      91.68
91.6       0          0
Pipe_12          111              106              9.2        0.013      89.642
89.55      0          0
Pipe_13          112              102              31.4       0.013      89.96
89.646     0          0
Pipe_14          113              102              31.2       0.013      90.2
89.89      0          0
Pipe_16          115              103              30.2       0.013      90.02
89.718     0          0
Pipe_17          116              104              29.2       0.013      90.02
89.728     0          0
Pipe_2           101              OF1              40.5       0.013      87.501
87.44      0          0
Pipe_3           102              101              41.4       0.013      88.024
87.92      0          0
Pipe_4           103              102              41.9       0.013      89.402
89.192     0          0
Pipe_5           104              103              47.2       0.013      89.668
89.432     0          0
Pipe_6           105              101              23.5       0.013      88.73
88.671     0          0
Pipe_7           106              105              33         0.013      88.843
88.76      0          0
```

```
Pipe_8           107              106              75.1        0.013       89.669
88.918     0          0
Pipe_9           108              101              28.2        0.013       90.04
89.756     0          0

[ORIFICES]
;;               Inlet            Outlet           Orifice      Crest       Disch.
 Flap Open/Close
;;Name           Node             Node             Type         Height      Coeff.
 Gate Time
;;-------------- ---------------- ---------------- ------------ ----------
---------- ---- ----------
L7-IC            111S             111              SIDE         89.64       0.572
 NO   0

[WEIRS]
;;               Inlet            Outlet           Weir         Crest       Disch.
 Flap End       End
;;Name           Node             Node             Type         Height      Coeff.
 Gate Con.      Coeff.     Surcharge  RoadWidth  RoadSurf
;;-------------- ---------------- ---------------- ------------ ----------
---------- ---- -------- ---------- ---------- ---------- ----------
503-W            503              101A-S           ROADWAY      92.48       1.67
 NO   0         0          YES         6         PAVED
505-W            505              103A-S           ROADWAY      92.48       1.67
 NO   0         0          YES         6         PAVED
507-W            507              103A-S           ROADWAY      92.48       1.67
 NO   0         0          YES         6         PAVED
511-W            511              516              ROADWAY      92.46       1.67
 NO   0         0          YES         6         PAVED
513-W            513              516              ROADWAY      92.48       1.67
 NO   0         0          YES         6         PAVED
C12              519              111S             TRANSVERSE   92.22       1.67
 NO   0         0          YES
C3               516              111S             TRANSVERSE   92.27       1.67
 NO   0         0          YES

[OUTLETS]
;;               Inlet            Outlet           Outflow    Outlet
Qcoeff/                     Flap
;;Name           Node             Node             Height     Type
QTable           Qexpon     Gate
;;-------------- ---------------- ---------------- ---------- ----------------
---------------- ---------- ----
501-IC           501              101              91.68      TABULAR/HEAD
501-IC                      NO
503-IC           503              108              90.75      TABULAR/DEPTH
503-IC                      NO
505-IC           505              112              90.75      TABULAR/HEAD
505-IC                      NO
507-IC           507              113              90.75      TABULAR/HEAD
507-IC                      NO
509-IC           509              103              90.92      TABULAR/HEAD
505-IC                      NO
511-IC           511              115              90.73      TABULAR/HEAD
511-IC                      NO
513-IC           513              116              90.75      TABULAR/HEAD
513-IC                      NO
515-IC           515              102              90.73      TABULAR/HEAD
515-IC                      NO
516-IC           516              104              90.87      TABULAR/HEAD
516-IC                      NO
519-IC           519              106              90.82      TABULAR/HEAD
```

519-IC NO

[XSECTIONS]

;;Link	Shape	Geom1	Geom2	Geom3	Geom4	Barrels
;;--------------	------------	----------------	----------	----------	----------	----------
C1	IRREGULAR	PrivateRoad-1	0	0	0	1
C10	IRREGULAR	PrivateRoad-2	0	0	0	1
C11	IRREGULAR	PrivateRoad-2	0	0	0	1
C13	IRREGULAR	PrivateRoad-1	0	0	0	1
C16	IRREGULAR	PrivateRoad-1	0	0	0	1
C2	IRREGULAR	PrivateRoad-1	0	0	0	1
C4	IRREGULAR	PrivateRoad-1	0	0	0	1
C5	IRREGULAR	PrivateRoad-1	0	0	0	1
C6	IRREGULAR	PrivateRoad-1	0	0	0	1
C7	IRREGULAR	PrivateRoad-1	0	0	0	1
C8	IRREGULAR	PrivateRoad-1	0	0	0	1
C9	IRREGULAR	PrivateRoad-1	0	0	0	1
Pipe_12	CIRCULAR	0.3	0	0	0	1
Pipe_13	CIRCULAR	0.3	0	0	0	1
Pipe_14	CIRCULAR	0.3	0	0	0	1
Pipe_16	CIRCULAR	0.3	0	0	0	1
Pipe_17	CIRCULAR	0.3	0	0	0	1
Pipe_2	CIRCULAR	0.6	0	0	0	1
Pipe_3	CIRCULAR	0.45	0	0	0	1
Pipe_4	CIRCULAR	0.3	0	0	0	1
Pipe_5	CIRCULAR	0.3	0	0	0	1
Pipe_6	CIRCULAR	0.375	0	0	0	1
Pipe_7	CIRCULAR	0.375	0	0	0	1
Pipe_8	CIRCULAR	0.3	0	0	0	1
Pipe_9	CIRCULAR	0.3	0	0	0	1
L7-IC	CIRCULAR	0.083	0	0	0	
503-W	RECT_OPEN	0.35	6	0	0	
505-W	RECT_OPEN	0.35	6	0	0	
507-W	RECT_OPEN	0.35	6	0	0	
511-W	RECT_OPEN	0.35	6	0	0	
513-W	RECT_OPEN	0.35	6	0	0	

```
C12               RECT_OPEN    1                4          0          0
C3                RECT_OPEN    1                4          0          0

[TRANSECTS]

;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.02m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.013
X1 16.5mROW          7        4        12.5     0.0       0.0       0.0      0.0
0.0
GR 0.23     0        0.15     4        0        4         0.13      8.25     0
12.5
GR 0.15     12.5     0.23     16.5

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.013
X1 16.5mROW_half    4        0.0      4.25     0.0       0.0       0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25      0.23      8.25

;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.245m.
NC 0.02     0.02     0.013
X1 18mROW           7        4.75     13.25    0.0       0.0       0.0      0.0
0.0
GR 0.25     0        0.15     4.75     0        4.75      0.13      9        0
13.25
GR 0.15     13.25    0.25     18

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.245m.
NC 0.02     0.02     0.013
X1 18mROW_half      4        0.0      4.25     0.0       0.0       0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25      0.25      9

;Full street, width = 8.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.27m.
NC 0.02     0.02     0.013
X1 20mROW           7        5.75     14.25    0.0       0.0       0.0      0.0
0.0
GR 0.27     0        0.15     5.75     0        5.75      0.13      10       0
14.25
GR 0.15     14.25    0.27     20.5

;Half street, width = 4.25m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.27m.
NC 0.02     0.02     0.013
X1 20mROW_half      4        0.0      4.25     0.0       0.0       0.0      0.0
0.0
GR 0.13     0        0        4.25     0.15     4.25      0.27      10

;Full street, width = 24m, curb = 0.15m , cross-slope = 0.016m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.014
X1 24mROW           7        4        28       0.0       0.0       0.0      0.0
0.0
GR 0.23     0        0.15     4        0        4         0.19      16       0
28
GR 0.15     28       0.23     32

;Half street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
```

```
0.02m/m, bank-height = 0.28m.
NC 0.02     0.02     0.013
X1 24mROW_half      4        0.0      5.5      0.0       0.0       0.0      0.0
0.0
GR 0.17     0        0         5.5      0.15     5.5      0.28     12

;Full street, width = 5.5m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.23m.
NC 0.02     0.02     0.013
X1 8.5mROW          7        1.5      7        0.0       0.0       0.0      0.0
0.0
GR 0.18     0        0.15      1.5      0        1.5      0.08     4.25     0
7
GR 0.15     7        0.18      8.5

;Half street, width = 2.75m, curb = 0.15m , cross-slope = 0.03m/m, bank-slope =
0.02m/m, bank-height = 0.18m.
NC 0.02     0.02     0.013
X1 8.5mROW_half     4        0.0      2.75     0.0       0.0       0.0      0.0
0.0
GR 0.08     0        0         2.75     0.15     2.75     0.18     4.25

;Full CS13m, road width = 7.0m,Road slope = 1.3%
NC 0.02     0.02     0.013
X1 PrivateRoad-1    6        3        10       0.0       0.0       0.0      0.0
0.0
GR 0.3      0        0.24      3        0.09     3        0        10       0.15
10
GR 0.21     13

;Full CS13m, road width = 7.0m, Road slope = 1.3%
NC 0.02     0.02     0.013
X1 PrivateRoad-2    6        3        10       0.0       0.0       0.0      0.0
0.0
GR 0.2      0        0.14      3        0.09     3        0        10       0.15
10
GR 0.21     13

[LOSSES]
;;Link           Inlet      Outlet     Average    Flap Gate  SeepageRate
;;-------------- ---------- ---------- ---------- ---------- ----------
Pipe_12          0          1.32       0          NO         0
Pipe_13          0          1.32       0          NO         0
Pipe_14          0          0.06       0          NO         0
Pipe_16          0          1.32       0          NO         0
Pipe_17          0          1.32       0          NO         0
Pipe_2           0          1.32       0          NO         0
Pipe_3           0          0.14       0          NO         0
Pipe_4           0          1.32       0          NO         0
Pipe_5           0          0.06       0          NO         0
Pipe_6           0          1.32       0          NO         0
Pipe_7           0          0.06       0          NO         0
Pipe_8           0          0.06       0          NO         0
Pipe_9           0          1.32       0          NO         0

[CURVES]
;;Name           Type       X-Value    Y-Value
;;-------------- ---------- ---------- ----------
501-IC           Rating     0          0
501-IC                      1.38       7
501-IC                      1.73       7

503-IC           Rating     0          0
```

503-IC		1.38	6
503-IC		1.73	6
505-IC	Rating	0	0
505-IC		1.38	6
505-IC		1.73	6
507-IC	Rating	0	0
507-IC		1.38	8
507-IC		1.73	8
511-IC	Rating	0	0
511-IC		1.38	6
511-IC		1.73	6
513-IC	Rating	0	0
513-IC		1.38	12
513-IC		1.73	12
515-IC	Rating	0	0
515-IC		1.38	4
515-IC		1.73	4
516-IC	Rating	0	0
516-IC		1.38	7
516-IC		1.73	7
519-IC	Rating	0	0
519-IC		1.38	2
519-IC		1.73	2
ROW	Rating	0	0
ROW		1.8	14
ROW		2.15	14
111S	Storage	0	326
111S		1.525	326
111S		1.53	0
111S		2.51	0
111S		2.86	0
503-S	Storage	0	0
503-S		1.38	0
503-S		1.73	342.29
505-S	Storage	0	0
505-S		1.38	0
505-S		1.73	354.29
507-S	Storage	0	0
507-S		1.38	0
507-S		1.73	303.43
509-S	Storage	0	0
509-S		1.38	0
509-S		1.73	5.14
511-S	Storage	0	0
511-S		1.38	0
511-S		1.73	296
513-S	Storage	0	0
513-S		1.38	0

```
513-S                          1.73        268

515-S            Storage       0           0
515-S                          1.38        0
515-S                          1.73        191.43

[TIMESERIES]
;;Name           Date       Time       Value
;;-------------- ---------- ---------- ----------
100yr+20_3hr_chicago               0:10       7.254876
100yr+20_3hr_chicago               0:20       9.050628
100yr+20_3hr_chicago               0:30       12.19056
100yr+20_3hr_chicago               0:40       19.162668
100yr+20_3hr_chicago               0:50       48.785964
100yr+20_3hr_chicago               1:00       214.2708
100yr+20_3hr_chicago               1:10       64.858236
100yr+20_3hr_chicago               1:20       32.78244
100yr+20_3hr_chicago               1:30       21.888468
100yr+20_3hr_chicago               1:40       16.484304
100yr+20_3hr_chicago               1:50       13.270512
100yr+20_3hr_chicago               2:00       11.142252
100yr+20_3hr_chicago               2:10       9.628668
100yr+20_3hr_chicago               2:20       8.496264
100yr+20_3hr_chicago               2:30       7.616376
100yr+20_3hr_chicago               2:40       6.912348
100yr+20_3hr_chicago               2:50       6.335736
100yr+20_3hr_chicago               3:00       5.854452

100yr3hrChicago                0:10       6.04573
100yr3hrChicago                0:20       7.54219
100yr3hrChicago                0:30       10.1588
100yr3hrChicago                0:40       15.96889
100yr3hrChicago                0:50       40.65497
100yr3hrChicago                1:00       178.559
100yr3hrChicago                1:10       54.04853
100yr3hrChicago                1:20       27.3187
100yr3hrChicago                1:30       18.24039
100yr3hrChicago                1:40       13.73692
100yr3hrChicago                1:50       11.05876
100yr3hrChicago                2:00       9.28521
100yr3hrChicago                2:10       8.02389
100yr3hrChicago                2:20       7.08022
100yr3hrChicago                2:30       6.34698
100yr3hrChicago                2:40       5.76029
100yr3hrChicago                2:50       5.27978
100yr3hrChicago                3:00       4.87871

2yr3hrChicago                  0:10       2.81459
2yr3hrChicago                  0:20       3.49824
2yr3hrChicago                  0:30       4.68718
2yr3hrChicago                  0:40       7.30485
2yr3hrChicago                  0:50       18.20881
2yr3hrChicago                  1:00       76.805
2yr3hrChicago                  1:10       24.07906
2yr3hrChicago                  1:20       12.36376
2yr3hrChicago                  1:30       8.32403
2yr3hrChicago                  1:40       6.30341
2yr3hrChicago                  1:50       5.09498
2yr3hrChicago                  2:00       4.29133
2yr3hrChicago                  2:10       3.71786
2yr3hrChicago                  2:20       3.28762
2yr3hrChicago                  2:30       2.95254
2yr3hrChicago                  2:40       2.68388
```

```
2yr3hrChicago            2:50       2.46348
2yr3hrChicago            3:00       2.27921

5yr3hrChicago            0:10       3.68223
5yr3hrChicago            0:20       4.58232
5yr3hrChicago            0:30       6.15055
5yr3hrChicago            0:40       9.6141
5yr3hrChicago            0:50       24.17035
5yr3hrChicago            1:00       104.193
5yr3hrChicago            1:10       32.03692
5yr3hrChicago            1:20       16.3375
5yr3hrChicago            1:30       10.96479
5yr3hrChicago            1:40       8.28693
5yr3hrChicago            1:50       6.68897
5yr3hrChicago            2:00       5.6279
5yr3hrChicago            2:10       4.87167
5yr3hrChicago            2:20       4.30483
5yr3hrChicago            2:30       3.8637
5yr3hrChicago            2:40       3.51028
5yr3hrChicago            2:50       3.22046
5yr3hrChicago            3:00       2.97831

[REPORT]
INPUT      NO
CONTROLS   NO
SUBCATCHMENTS ALL
NODES ALL
LINKS ALL

[TAGS]
Node       OF1              MN
Node       101              MN
Node       102              MN
Node       103              MN
Node       104              MN
Node       105              MN
Node       106              MN
Node       107              MN
Node       108              MN
Node       111              MN
Node       112              MN
Node       113              MN
Node       115              MN
Node       116              MN
Link       C1               MJ
Link       C10              MJ
Link       C11              MJ
Link       C13              MJ
Link       C16              MJ
Link       C2               MJ
Link       C4               MJ
Link       C5               MJ
Link       C6               MJ
Link       C7               MJ
Link       C8               MJ
Link       C9               MJ
Link       503-W            MJ
Link       505-W            MJ
Link       507-W            MJ
Link       511-W            MJ
Link       513-W            MJ
Link       C12              MJ
Link       C3               MJ
```

```
[MAP]
DIMENSIONS       368864.07345     5015135.8109     369059.57755     5015341.2051
UNITS            Meters

[COORDINATES]
;;Node           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
OF1              368885.5         5015226.019
OF2              369020.082       5015147.65
OF3              368905.171       5015310.628
OF4              369030.71        5015163.952
OF5              368882.683       5015230.916
101              368914.3         5015255
101A-S           368923.373       5015256.851
102              368949.6         5015276
103              368971.7         5015241
103A-S           368945.413       5015270.906
103B-S           368965.965       5015247.436
104              368996.4         5015201
105              368930.5         5015237
106              368956.6         5015217
106A-S           369016.265       5015172.846
106B-S           368993.841       5015191.157
107              369020.3         5015168
108              368895.8         5015285
111              368962.2         5015224
111S             368979.146       5015218.059
112              368935.8         5015299
113              368972.7         5015291
115              368994.8         5015255
116              369019.6         5015215
501              368891.854       5015236.728
503              368899.571       5015275.466
505              368941.29        5015299.492
507              368970.842       5015280.728
509              368963.27        5015251.486
511              368990.471       5015250.74
513              369012.626       5015213.362
515              368935.227       5015264.075
516              368983.336       5015221.276
519              368957.812       5015221.919

[VERTICES]
;;Link           X-Coord          Y-Coord
;;-------------- ---------------- ----------------
C11              368972.858       5015208.124
C2               368996.829       5015198.433
C2               368997.83        5015202.579
C6               368949.2         5015270.633
C6               368952.183       5015268.216
C12              368968.814       5015220.056
503-IC           368896.949       5015279.311
505-IC           368937.104       5015300.268
507-IC           368971.484       5015285.413
511-IC           368992.279       5015253.231
513-IC           369015.95        5015214.004

[POLYGONS]
;;Subcatchment   X-Coord          Y-Coord
;;-------------- ---------------- ----------------
L101A            368893.291       5015234.646
L101A            368888.195       5015241.6
```

Appendix C SANITARY SEWER CALCULATIONS

SANITARY SEWER DESIGN SHEET
(City of Ottawa)

Stantec

SUBDIVISION:
RIVERSIDE SOUTH PHASE 8
BLOCK 221

DATE:	12/19/2018
REVISION:	1
DESIGNED BY:	TR
CHECKED BY:	KS

FILE NUMBER: 160401422

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 (ICI >20%):	1.5	INDUSTRIAL (LIGHT)	35,000 l/ha/day	BEDDING CLASS	B
PERSONS / SINGLE	3.4	INSTITUTIONAL	28,000 l/ha/day	MINIMUM COVER	2.50 m
PERSONS / TOWNHOME	2.7	INFILTRATION	0.33 l/s/Ha	HARMON CORRECTION FACTOR	0.8
PERSONS / CONDO	2.3				

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 SINGLE	UNITS TOWN	UNITS CONDO	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)
R2A	2	1	0.14	0	14	0	38	0.14	38	3.67	0.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.14	0.14	0.0	0.5	96.7	200	PVC	SDR 35	0.40	21.1	**2.35%**	0.67	0.23
R17A	17	16	0.11	0	0	8	18	0.11	18	3.71	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.11	0.11	0.0	0.3	28.7	200	PVC	SDR 35	0.65	27.0	**0.96%**	0.85	0.23
R16A	16	14	0.11	0	0	4	9	0.22	28	3.69	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.11	0.22	0.1	0.4	42.7	200	PVC	SDR 35	0.50	23.6	**1.71%**	0.74	0.24
R15A	15	14	0.11	0	0	8	18	0.11	18	3.71	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.11	0.11	0.0	0.3	28.2	200	PVC	SDR 35	0.65	27.0	**0.96%**	0.85	0.23
R14A	14	10	0.12	0	0	8	18	0.46	64	3.63	0.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.12	0.46	0.2	0.9	45.4	200	PVC	SDR 35	0.50	23.6	**3.85%**	0.74	0.29
R11A	11	10	0.14	0	0	8	18	0.14	18	3.71	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.14	0.14	0.0	0.3	30.5	200	PVC	SDR 35	0.50	23.6	**1.13%**	0.74	0.21
R13A	13	12	0.05	0	0	4	9	0.05	9	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.05	0.05	0.0	0.1	28.8	200	PVC	SDR 35	0.65	27.0	**0.47%**	0.85	0.18
R12A	12	10	0.09	0	0	8	18	0.14	28	3.69	0.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.09	0.14	0.0	0.4	35.5	200	PVC	SDR 35	0.65	27.0	**1.39%**	0.85	0.26
R10A	10	5	0.06	0	0	4	9	0.79	120	3.58	1.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	0.79	0.3	1.6	41.6	200	PVC	SDR 35	0.50	23.6	**6.97%**	0.74	0.36
R9A	9	8	0.06	0	0	4	9	0.06	9	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	0.06	0.0	0.1	25.7	200	PVC	SDR 35	1.00	33.4	**0.39%**	1.05	0.20
R8A	8	7	0.33	0	15	4	50	0.39	59	3.64	0.7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.33	0.39	0.1	0.8	108.9	200	PVC	SDR 35	1.00	33.4	**2.46%**	1.05	0.36
R7A	7	5	0.06	0	4	4	20	0.45	79	3.62	0.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.06	0.45	0.1	1.1	26.2	200	PVC	SDR 35	1.00	33.4	**3.20%**	1.05	0.40
R6A	6	5	0.15	0	0	8	18	0.15	18	3.71	0.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.15	0.15	0.0	0.3	28.6	200	PVC	SDR 35	1.00	33.4	**0.81%**	1.05	0.26
R5A	5	4	0.03	0	0	4	9	1.42	226	3.50	2.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.03	1.42	0.5	3.0	28.6	200	PVC	SDR 35	0.50	23.6	**12.83%**	0.74	0.42
R18A	18	4	0.04	0	0	4	9	0.04	9	3.73	0.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.04	0.04	0.0	0.1	33.2	200	PVC	SDR 35	0.65	27.0	**0.46%**	0.85	0.18
R4A	4	3	0.05	0	5	0	14	1.50	249	3.49	2.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.05	1.50	0.5	3.3	35.1	200	PVC	SDR 35	0.50	23.6	**13.99%**	0.74	0.43
R3A	3	1	0.01	0	0	0	0	1.51	249	3.49	2.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.01	1.51	0.5	3.3	8.1	200	PVC	SDR 35	0.50	23.6	**14.01%**	0.74	0.43
	1	STUB	0.00	0	0	0	0	1.65	287	3.47	3.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.65	0.5	3.8	2.5	200	PVC	SDR 35	0.32	18.9	**19.92%**	0.60	0.39
	STUB	35	0.00	0	0	0	0	1.65	287	3.47	3.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.00	1.65	0.5	3.8	12.9	200	PVC	SDR 35	0.32	18.9	**19.92%**	0.60	0.39
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Appendix D GEOTECHNICAL INVESTIGATION

July 2015

REPORT ON

Geotechnical Investigation Proposed Residential Development Riverside South Development (Phase 8) Ottawa, Ontario

Submitted to:
Riverside South Development Corporation
2193 Arch Street
Ottawa, Ontario
K1G 2H5

REPORT

Report Number: 1418804

Distribution:

11 copies - Riverside South Development Corporation
1 copy - Golder Associates Ltd.

Golder Associates

Table of Contents

1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for a proposed residential development to be located within the Riverside South Community (Phase 8) in Ottawa, Ontario.

The purpose of this geotechnical investigation was to supplement the existing subsurface information and determine the general soil and groundwater conditions across the site by means of 16 boreholes. Based on an interpretation of the factual information obtained, along with existing data available for the site, engineering guidelines are provided on the geotechnical design aspects of the project, including construction considerations which could affect design decisions.

The reader is referred to the "Important Information and Limitations of This Report" which follows the text but forms an integral part of this document.

2.0 DESCRIPTION OF PROJECT AND SITE

Plans are being prepared to develop a proposed residential subdivision within the Riverside South Community (Phase 8) in Ottawa, Ontario (see Site Plan, Figure 1).

The site is located south of Earl Armstrong Road, between Spratt Road and Canyon Walk Drive. The subject site is irregular in shape and measures approximately 1,250 by 420 metres in size.

It is understood that the development will consist of a conventional subdivision with a mix of single family homes and townhouses, as well as access roads and services within the subdivision.

The site topography is relatively flat with a gentle downward slope from east to west (i.e., towards the river). The majority of the site is currently undeveloped, consisting of former agricultural land or forested areas.

Golder Associates previously completed two geotechnical investigations within or in close proximity to the site. The results of those investigations are provided in the following reports:

1) Report to Totten Sims Hubicki Associates by Golder Associates Ltd. titled "Geotechnical Considerations for Earl Armstrong Road Widening, Former River Road to Limebank Road, Ottawa, Ontario", dated January 2008 (Project No. 06-1120-290).

2) Report to the Riverside South Development Corporation by Golder Associates Ltd. titled "Preliminary Geotechnical Investigation, Proposed Residential Development, Riverside South Community Development, Phases 6 to 9" dated September 2009 (Project No. 09-1121-0120).

Based on a review of these previous geotechnical investigations and the published geological mapping, the subsurface conditions at the site likely consist of surficial deposits of layered silty clay, clayey silt, sandy silt and silty sand overlying silty clay and glacial till, which in turn are underlain by bedrock. Based on published geological maps, the bedrock surface is expected to be at depths ranging from about 5 to 25 metres (sloping downward from south to north across the site) and to consist of March formation sandstone.

3.0 PROCEDURE

The field work for this investigation was carried out between January 5 and 15, 2015. At that time, 16 boreholes (numbered 14-1 to 14-16, inclusive) were put down at the approximate locations shown on the Site Plan, Figure 1.

The boreholes were advanced using a track-mounted continuous flight hollow-stem auger drill rig, supplied and operated by Marathon Drilling Ltd. of Ottawa, Ontario. The boreholes were generally advanced to depths of about 5.9 to 9.8 metres below the existing ground surface. Below about 7.6 and 6.1 metres depth, boreholes 14-5 and 14-14 were advanced without sampling, using a dynamic cone penetration test (DCPT), to depths of about 9.8 and 10.4 metres, respectively, below the existing ground surface.

Standard Penetration Tests (SPT) were carried out in the boreholes at regular intervals of depth and samples of the soils encountered were recovered using split spoon sampling equipment. In situ vane testing was carried out where possible in the cohesive deposits to determine the undrained shear strength of these soils. In addition, seven relatively undisturbed 73 millimetre diameter thin walled Shelby tube samples of the silty clay were obtained from selected boreholes using a fixed piston sampler.

Standpipe piezometers were sealed into boreholes 14-1, 14-4, 14-8, 14-11, 14-14, and 14-16 to allow subsequent measurement of the groundwater level across the site. The groundwater levels in these standpipe piezometers were measured on January 27, 2015.

The field work was supervised by an experienced technician from our staff who located the boreholes, directed the drilling operations and in situ testing, logged the boreholes, and took custody of the soil samples retrieved.

Upon completion of the drilling operations, samples of the soils encountered in the boreholes were transported to our laboratory for further examination by the project engineer and for laboratory testing. The laboratory testing included natural water content determinations, Atterberg limit tests and oedometer consolidation testing.

Soil samples from boreholes 14-3 and 14-14 were submitted to EXOVA Environmental Ontario Ltd. for basic chemical analysis related to potential sulphate attack on buried concrete elements and corrosion of buried ferrous elements.

The borehole locations were selected, picketed, and surveyed in the field by Golder Associates Ltd. The borehole locations and elevations were surveyed using a Trimble R8 Global Positioning System (GPS) unit. The elevations are referenced to Geodetic datum.

4.0 SUBSURFACE CONDITIONS

4.1 General

Information on the subsurface conditions is provided as follows:

- Record of Borehole Sheets for the current investigation are provided in Appendix A, which also show the results of the laboratory testing.
- Record of Borehole Sheets from relevant boreholes from the previous investigations by Golder Associates are provided in Appendix B.
- The results of the basic chemical analysis carried out on soil samples from boreholes 14-3 and 14-14 are provided in Appendix C.

The subsurface conditions on the site generally consist of topsoil, underlain by layered silty clay, clayey silt and silty sand, overlying compressible silty clay, followed by glacial till.

The following sections present a more detailed overview of the subsurface conditions on this site, with a focus on the boreholes advanced for the current investigation.

4.2 Topsoil and Fill

Topsoil exists at ground surface at all of the borehole locations, with the exception of borehole 14-2 where the topsoil had been stripped. The topsoil varies in thickness from about 220 to 300 millimetres.

A layer of topsoil fill and soil was encountered at borehole 14-9 with a total thickness of about 0.6 metres. The soil fill consists of silty clay with organic matter and cobbles.

4.3 Weathered Silty Clay to Clay

The topsoil and fill are typically underlain by a deposit of silty clay to clay which has been weathered to a grey brown colour. The weathered deposit extends to depths of about 0.6 to 3.1 metres below the existing ground surface.

Standard penetration tests carried out within this material gave SPT N values of about 2 to 10 blows per 0.3 metres of penetration. The results of two in situ vane tests carried out in the weathered silty clay to clay measured undrained shear strength values of about 92 and greater than 96 kilopascals. The results of the in situ testing indicate a stiff to very stiff consistency.

The results of one Atterberg limit test carried out on a sample of the weathered deposit gave a plasticity index value of about 43 percent and a liquid limit value of about 74 percent, indicating a soil of high plasticity.

The measured natural water contents of two samples of the weathered silty clay were about 32 and 43 percent.

About 0.4 metres of intermixed clayey silt, silty clay, and silty sand were encountered above the weathered deposit at borehole 14-3. Similarly, about 0.7 metres of clayey silt and silty clay overlie the weathered deposit at borehole 14-15.

A discontinuous layer of sand was encountered below the weathered deposit at borehole 14-15. The sand has a thickness of about 0.3 metres and extends down to a depth of about 2.2 metres below the existing ground surface.

4.4 Layered Silty Sand and Clayey Silt

A deposit of layered silty sand and clayey silt was encountered below the topsoil and/or weathered deposit in all of the boreholes with the exception of 14-8 and 14-15. The layered silty sand and clayey silt has a thickness that ranges from about 0.5 to 2.1 metres and extends down to depths of about 1.4 to 4.0 metres below the ground surface. This deposit generally contains silty clay layers. In boreholes 14-7, 14-9, 14-12, and 14-13 this deposit grades to a clayey silt and silty clay with silty sand layers.

Standard penetration tests carried out within this deposit gave SPT N values of about 1 to 7 blows per 0.3 metres of penetration, indicating a very loose to loose state of packing.

The results of one Atterberg limit test carried out on a sample of the clayey silt and silty clay from borehole 14-12 gave a plasticity index value of about 23 percent and a liquid limit value of 39 percent, indicating a soil of intermediate plasticity.

The measured natural water contents of four samples of this deposit ranged from about 28 to 41 percent.

4.5 Unweathered Silty Clay to Clay

The layered silty sand and clayey silt are underlain by a deposit of silty clay to clay (hereafter referred to as silty clay). The silty clay deposit is unweathered and typically grey in colour. The unweathered deposit extends to, or was proven/inferred to, depths ranging from 4.4 to 9.1 metres below the ground surface. The silty clay was fully penetrated in boreholes 14-1, 14-5, 14-8, 14-12, and 14-13, which are located generally within the central-south part of the site. The deposit is apparently thicker beneath the east, west, and north parts of the site.

The results of in situ vane testing in the deposit measured undrained shear strength values generally ranging from about 29 to greater than 96 kilopascals, indicating a firm to very stiff consistency, with the shear strength generally increasing with depth. Within the shallower/weaker portions of the deposit the undrained shear strength is more typically in the range of 30 to 50 kilopascals (i.e., firm).

The results of two Atterberg limit tests carried out on samples of the unweathered silty gave plasticity index values of about 20 and 36 percent and liquid limit values of about 34 and 57 percent, indicating a soil of intermediate to high plasticity.

Natural water contents ranging from about 33 to 69 percent were measured in the unweathered silty clay.

Oedometer consolidation testing was carried out on two Shelby tube samples of the unweathered clay. The results of the testing are provided on Figures 2 and 3 and are summarized in the table below.

Borehole/ Sample No.	Sample Depth/ Elevation (m)	σ_{v0}' (kPa)	σ_p' (kPa)	C_c	C_r	e_0	OCR
14-3 / 6	5.1 / 86.2	50	125	0.70	0.014	1.31	2.5
14-9 / 6	5.0 / 86.2	50	130	0.45	0.010	1.06	2.6

Notes:
- σ_p' - Apparent preconsolidation pressure
- σ_{v0}' - Computed existing vertical effective stress
- C_c - Compression index
- e_o - Initial void ratio
- OCR - Overconsolidation ratio
- C_r - Recompression index

4.6 Clayey Silt to Silty Clay

A thin layer of clayey silt and/or silty clay was encountered below the silty clay in boreholes 14-10, 14-12, and 14-14. The clayey silt and silty clay was encountered at depths between about 4.4 to 6.1 metres below the existing ground surface and was proven/inferred to depths ranging from about 4.9 to 7.0 metres.

The measured natural water content of one sample of the clayey silt was about 39 percent.

4.7 Glacial Till

A deposit of glacial till was encountered beneath the silty clay at boreholes 14-1, 14-5, 14-8, 14-10, 14-12, 14-13, and 14-14. The glacial till consists of a heterogeneous mixture of gravel, cobbles, and boulders in a matrix of silty sand or sandy silt. The glacial till was encountered at depths ranging from about 4.9 to 9.1 metres below the existing ground surface and proven to extend to depths ranging from about 6.1 to 10.4 metres below the existing ground surface. The till surface was found to be shallowest beneath the central-south portions of the site.

Standard penetration tests carried out within the glacial till gave SPT N values typically ranging from about 14 to 52 blows per 0.3 metres of penetration, indicating a generally compact to very dense state of packing.

The measured natural water content of one sample of the glacial till was about 10 percent.

4.8 Groundwater

The groundwater levels sealed in boreholes 14-1, 14-4, 14-8, 14-11, 14-14, and 14-16 were measured on January 27, 2015. The observed groundwater levels are summarized in the table below:

Borehole Number	Ground Surface Elevation (m)	Water Level Depth (m)	Water Level Elevation (m)
14-1	91.18	1.17	90.01
14-4	91.91	0.94	90.39
14-8	92.21	1.91	90.30
14-11	91.55	1.32	90.23
14-14	92.03	0.82	91.21
14-16	91.99	1.22	90.77

Groundwater levels are expected to fluctuate seasonally. Higher groundwater levels are expected during wet periods of the year, such as spring.

5.0 DISCUSSION

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of this project based on our interpretation of the borehole information as well as the project requirements, and is subject to the limitations in the "Important Information and Limitations of This Report" which follows the text of this report.

5.2 Site Grading

Based on the subsurface conditions encountered and the soil strengths determined within the boreholes, the site has been divided into two assessment areas, Area A and Area B, as shown on the Site Plan, Figure 1. The subsurface conditions in Areas A and B generally consist of topsoil underlain by weathered silty clay, layered clayey silt and silty sand, overlying a deposit of unweathered and compressible sensitive silty clay, followed by glacial till.

The "softer" unweathered silty clay deposits in Areas A and B have limited capacity to accept additional load from the weight of grade raise fill and from the foundations of houses without undergoing consolidation settlements. Therefore, for these areas, to leave sufficient remaining capacity for the silty clay to support house foundations, with reasonable footing sizes, the thicknesses of grade raise fill will need to be limited.

The following table provides the maximum grade raises which are permitted for each of the assessment areas indicated on Figure 1. These grade raise limitations have been assessed based on leaving sufficient remaining capacity in the silty clay deposit such that strip footings up to 0.6 metres in size can be designed using an allowable bearing pressure of at least 75 kilopascals, consistent with design in accordance with Part 9 of the Ontario Building Code.

Assessment Zone	Maximum Permissible Grade Raise (metres)
A	2.1
B	1.9

It should also be noted that these maximum permissible grade raises were calculated assuming that any fill required for site grading (above original grade) and the backfill within the garages would have a unit weight of no more than 19.5 kilonewtons per cubic metre. Silty clay, clayey silt and silty sand (such as present on this site), as well as crushed clear stone and uniform fine sand (for the garage backfill) may be suitable for this purpose. Sand and gravel, glacial till, and crushed stone typically have a higher unit weight and, if these materials are to be used, the maximum permissible grade raises would be reduced and would need to be re-evaluated.

If the grading restrictions given above cannot be accommodated, then further recommendations from Golder Associates could be provided, if and when they are required.

As a general guideline regarding the site grading, the preparation for filling of the site should include stripping the topsoil for predictable performance of structures and services. The topsoil is not suitable as engineered fill and should be stockpiled separately for re-use in landscaping applications only. In areas with no proposed structures, services, or roadways, the topsoil may be left in place provided some settlement of the ground surface following filling can be tolerated.

5.3 Foundations

It is considered that the proposed residences may be supported on spread footings founded on or within the weathered silty clay or layered clayey silt and silty sand.

As discussed in the preceding section, the silty clay has a limited capacity to accept the combined load from site grading fill and foundation loads. The allowable bearing pressures for spread footing foundations are therefore based on limiting the stress increases on the unweathered firm, compressible, grey silty clay at depth to an acceptable level so that foundation settlements do not become excessive.

Four important parameters in calculating the stress increase on the unweathered silty clay are:

- The thickness of soil below the underside of the footings and above the firm silty clay;
- The size (dimensions) of the footings;
- The amount of surcharge in the vicinity of the foundations due to landscape fill, underslab fill, floor loads, etc., as described in Section 5.2; and,
- The effects of groundwater lowering caused by this or other construction.

Provided that the grade raises are restricted to those indicated in Section 5.2, strip footing foundations up to 0.6 metres in width and pad footings up to 2.0 metres square can be designed using a maximum allowable bearing pressure of 75 kilopascals. As such, the house footings may be sized in accordance with Part 9 of the Ontario Building Code (OBC).

The post construction total and differential settlements of footings sized using the above maximum allowable bearing pressure should be less than about 25 and 15 millimetres, respectively, provided that the subgrade at or below founding level is not disturbed during construction.

The tolerance of the house foundations to accept those settlements could be increased by providing nominal levels of reinforcing steel in the top and bottom of the foundation walls.

Further, the provided maximum allowable bearing pressure for footing foundations supported by the silty clay corresponds to settlement resulting from consolidation of this deposit. Consolidation of the silty clay is a process which takes months or longer and, as such, results from sustained loading. Therefore, the foundation loads to be used in conjunction with the above allowable bearing pressure should be the full dead load plus sustained live load.

Any existing ditches that may underlie future houses (such as the ditch located on the east side of Area B), will need to be filled. The following guidelines are provided in regards to filling of the ditches beneath future houses:

- The ditch should be made dry and cleaned of all organic or disturbed soil prior to filling.
- Filling to the underside of footing elevation should be carried out using crushed clear stone having a unit weight not exceeding about 17.5 kilonewtons per cubic metre (i.e., similar to the native soil). The use of clear stone is recommended so as to avoid possible settlements associated with the use of heavier material.
- The engineered fill should be placed to occupy the full house footprint and the full zone of influence/support for the foundations. That zone is considered to extend down and out from the outside edge of the perimeter foundations at a slope of 1H:1V (horizontal:vertical).

- The engineered fill should be placed in maximum 300 millimetre thick lifts and be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable vibratory compaction equipment.
- To avoid settlements resulting from loss of soil into the voids in the clear stone, it should be fully encapsulated in a geotextile. The geotextile should be placed on the bottom and sides of the ditch, as well as over the top of the clear stone.
- A Class II non-woven geotextile should be used, with a Filtration Opening Size (FOS) not exceeding 150 microns, in accordance with Ontario Provincial Standard Specifications (OPSS) 1860.
- Footings founded on or within properly placed engineered fill (as described above) can also be designed using a maximum allowable bearing pressure of 75 kilopascals.

5.4 Frost Protection

All exterior perimeter foundation elements or foundation elements in unheated areas should be provided with a minimum of 1.5 metres of earth cover for frost protection purposes. Isolated and/or unheated exterior footings adjacent to surfaces which are cleared of snow cover during winter months should be provided with a minimum of 1.8 metres of earth cover.

5.5 Seismic Design

The seismic design provisions of the 2012 Ontario Building Code (OBC) depend, in part, on the shear wave velocity of the upper 30 metres of soil and/or bedrock below founding level. The OBC also permits the Site Class to be specified based solely on the stratigraphy and in situ testing data, rather than from direct measurement of the shear wave velocity. Based on this methodology, and based on the available information it is considered that a Site Class of E would be applicable to the design of structures in both Areas A and B. It should be noted that the seismic Site Class is not directly applicable to structures designed in accordance with Part 9 of the OBC (i.e., conventional housing); however this assessment is provided to address City of Ottawa requirements that relate to housing on Site Class E sites. It should also be noted that a more favourable Site Class value could potentially be assigned for houses in Areas A and B. Based on previous shear wave velocity testing in the Phase 9 site to the west of Phase 8, it is considered reasonably likely that a Site Class of at least D might feasibly be assigned to much of the site on the basis of such testing (particularly where the glacial till is shallower).

5.6 Basement Excavations

Excavations for basements will be through the topsoil, weathered silty clay and layered clayey silt and silty sand. No unusual problems are anticipated with excavating the overburden soils using conventional hydraulic excavating equipment.

Side slopes in the overburden materials should be stable in the short term at 1 horizontal to 1 vertical in accordance with the *Occupational Health and Safety Act* (OHSA) of Ontario for Type 3 soils.

Some groundwater inflow into the excavations could be expected. However, for the planned basement excavation depths, it should be possible to handle the groundwater inflow by pumping from well filtered sumps in the excavations.

Based on the *present* groundwater levels, excavations deeper than about 0.8 metres may, in some areas, extend below the groundwater level. Where the subgrade is found to be wet and sensitive to disturbance, consideration should be given to placing a mud slab of lean concrete over the subgrade (following inspection and approval by geotechnical personnel) or a 150 millimetre thick layer of OPSS Granular A underlain by a non-woven geotextile, to protect the subgrade from construction traffic.

5.7 Basement and Garage Floor Slabs

In preparation for the construction of the basement floor slabs, all loose, wet and disturbed materials should be removed from beneath the floor slabs. Provision should be made for at least 200 millimetres of 19 millimetres crushed clear stone to form the base of the basement floor slabs.

To prevent hydrostatic pressure build up beneath the basement floor slabs, it is suggested that the granular base material be positively drained. This could be achieved by providing a hydraulic link between the underslab fill material and the exterior drainage system.

The backfill material inside the garage should have a unit weight no greater than 19.5 kilonewtons per cubic metre (i.e., uniform fine sand or clear crushed stone). The garage backfill should be placed in maximum 300 millimetre thick lifts and be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment. The granular base for the garage floor slab should consist of at least 150 millimetres of OPSS Granular A compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

5.8 Basement Wall and Foundation Wall Backfill

The soils at this site are frost susceptible and should not be used as backfill directly against exterior, unheated, or well insulated foundation elements. To avoid problems with frost adhesion and heaving, a bond break such as Platon system sheeting should be placed against the foundation walls.

Drainage of the wall backfill should be provided by means of a perforated pipe subdrain in a surround of 19 millimetre clear stone, fully wrapped in geotextile, which leads by gravity drainage to an adjacent storm sewer or sump pit. Conventional damp proofing of the basement walls is appropriate with the above design approach.

Should the foundations be designed in accordance with Part 4 of the Ontario Building Code, further guidelines on the foundation wall design will be required.

5.9 Site Servicing

Excavations for the installation of site services will be made through the topsoil, layered clays, silts, and sand, as well as potentially the glacial till. No unusual problems are anticipated with excavating the overburden using conventional hydraulic excavating equipment. However, it should be expected that boulders will be encountered within the glacial till (for deeper trenches). Boulders larger than 0.3 metres in size should be removed from the excavation side slopes.

In accordance with the OHSA of Ontario, the overburden soils would generally be classified as Type 3 soils and side slopes in the overburden in the short term may be sloped at 1 horizontal to 1 vertical. Alternatively, excavations within the overburden could also be carried out within a fully braced steel trench box, which would minimize the width of the excavation.

Some groundwater inflow into the excavations could be expected. However, it should generally be possible to handle the groundwater inflow by pumping from well filtered sumps in the excavations provided suitably sized pumps are used.

The actual rate of groundwater inflow to the trench will depend on many factors including the contractor's schedule and rate of excavation, the size of the excavation, and the time of year at which the excavation is made. There also may be instances where significant volumes of precipitation and/or groundwater collects in an open excavation, and must be pumped out. A Permit to Take Water (PTTW) should be obtained from the provincial Ministry of the Environment and Climate Change (MOECC) for this work.

At least 150 millimetres of OPSS Granular A should be used as pipe bedding for sewer and water pipes. Where unavoidable disturbance to the subgrade surface does occur, it may be necessary to place a sub-bedding layer consisting of compacted OPSS Granular B Type II beneath the Granular A or to thicken the Granular A bedding. The bedding material should, in all cases, extend to the spring line of the pipe and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density. The use of crushed clear stone as a bedding layer should not be permitted anywhere on this project since fine particles from the sandy backfill materials or sandy soils on the trench walls could potentially migrate into the voids in the clear crushed stone and cause loss of lateral pipe support.

Cover material, from spring line of the pipe to at least 300 millimetres above the top of pipe, should consist of OPSS Granular A or Granular B Type I with a maximum particle size of 25 millimetres. The cover material should be compacted to at least 95 percent of the material's standard Proctor maximum dry density.

It should generally be possible to re-use the drier weathered silty clay, clayey silt, silty sand, and glacial till as trench backfill.

However, the high moisture content of the deeper clayey deposits (i.e., silty clay and clayey silt) makes these soils difficult to handle and compact. If these materials are excavated during installation of the site services, they should be wasted or should only be used as backfill in the lower portion of the trenches to limit the amount of long term settlement of the roadway surface. If the unweathered silty clay or clayey silt are used in trenches under roadways, long term settlement of the pavement surface should be expected. Some significant padding of the roadways may be required prior to final paving. In that case, it would also be prudent to delay final paving for as long as practical.

Where the trench will be covered with hard surfaced areas, the type of native material placed in the frost zone (between subgrade level and 1.8 metres depth) should match the soil exposed on the trench walls for frost heave compatibility.

Trench backfill should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

Impervious dykes or cut-offs should be constructed at 100 metre intervals in the service trenches to reduce groundwater lowering at the site due to the "french drain" effect of the granular bedding and surround for the service pipes. It is important that these barriers extend from trench wall to trench wall and that they fully penetrate the granular materials to the trench bottom. The dykes should be at least 1.5 metres wide and could be constructed using relatively dry (i.e., compactable) grey brown silty clay from the weathered zone.

5.10 Pavement Design

In preparation for pavement construction, all topsoil, fill (if containing organic matter); disturbed or otherwise deleterious materials should be removed from the roadway areas.

Pavement areas requiring grade raising to proposed subgrade level should be filled using acceptable OPSS Select Subgrade Material (SSM) or Earth Borrow. The SSM or Earth Borrow should be placed in maximum 300 millimetre thick lifts and should be compacted to at least 95 percent of the material's standard Proctor maximum dry density using suitable compaction equipment.

The surface of the pavement subgrade should be crowned to promote drainage of the roadway granular structure. Perforated pipe sub-drains should be provided at subgrade level extending from the catch basins for a distance of at least 3 metres longitudinally, parallel to the curb in two directions.

The pavement structure for local roads without bus or truck traffic should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	375

The pavement structure for collector roadways which will include bus and truck traffic should consist of:

Pavement Component	Thickness (millimetres)
Asphaltic Concrete	90
OPSS Granular A Base	150
OPSS Granular B Type II Subbase	450

The granular base and subbase materials should be uniformly compacted as per OPSS 501, Method A. The asphaltic concrete should be compacted in accordance with the procedures outlined in OPSS 310

The composition of the asphaltic concrete pavement should be as follows:

- Superpave 12.5 mm Surface Course 40 mm
- Superpave 19 mm Base Course 50 mm

The asphaltic cement should consist of PG 58-34 and the design of the mixes should be based on a Traffic Category B for local roads and Category D for collector roads.

In regards to the above pavement structure for local roads, it should be noted that the 50 millimetres of asphaltic concrete base course would provide sufficient structural support and would therefore be adequate for the initial periods of roadway service. However, the 90 millimetres of asphaltic concrete is specified for the local roadways based on the typical construction sequence which would require a surface course placement following substantial completion of the house construction.

In addition, if a similar paving sequence is proposed for collector roads, with an additional course being required upon substantial completion of site development, then a thicker overall asphaltic concrete layer would be required (to allow for three lifts), since two initial lifts will likely be required to support the construction traffic. Alternatively, a thicker base course could be provided during construction phase and a 40 millimetre surface course provided at the substantial completion. Further guidelines for both options can be provided, if required.

The above pavement designs are based on the assumption that the pavement subgrade has been acceptably prepared (i.e., where the trench backfill and grade raise fill have been adequately compacted to the required density and the subgrade surface not disturbed by construction operations or precipitation). Depending on the actual conditions of the pavement subgrade at the time of construction, it could be necessary to increase the thickness of the subbase and/or to place a woven geotextile beneath the granular materials.

Based on previous experience with the construction of roadways on other phases of the Riverside South Community, there is considered to be a high likelihood for portions of the roadways to require both a geotextile and additional granular subbase, unless the pavement construction is carried out during optimal weather conditions. A significant contingency in the construction budget should be carried for such measures.

5.11 Pools, Decks and Additions

The following guidelines are provided to address some typical requirements of the City of Ottawa.

5.11.1 Above Ground and In Ground Pools

No special geotechnical considerations are necessary for the installation of in-ground pools, provided that the pool (including piping) does not extend deeper than the house footing level. A geotechnical assessment will be required if the pool extends deeper than the house foundations.

Due to the additional loads that would be imposed by the construction of *above-ground pools*, these should be located no closer than 2 metres from the outside wall of the house. In addition, the installation of an above-ground pool should not be permitted to alter the existing grades within 2 metres of the house. Provided these restrictions are adhered to, no further geotechnical assessment should be required for above-ground pools.

5.11.2 Decks

It is considered that, in general, no particular geotechnical evaluation/assessment will be necessary for future decks, added by the homeowners, except where:

- The deck will be attached to the house; and/or,
- The deck will be heavily loaded and require spread footing or drilled pier foundations (i.e., where the deck will be designed in accordance with Part 9 of the OBC and require a building permit).

5.11.3 Additions

Any proposed addition to a house (regardless of size) will require a geotechnical assessment. The geotechnical assessment must consider the proposed grading, foundation types and sizes, depths of foundations, and design bearing pressures. Written approval from a geotechnical engineer should be required by the City of Ottawa prior to the building permit being issued.

5.12 Corrosion and Cement Type

Samples of soil from boreholes 14-3 and 14-14 were submitted to EXOVA Environmental Ontario for basic chemical analysis related to potential corrosion of buried steel elements and potential sulphate attack on buried concrete elements. The results of this testing are provided in Appendix C. The results indicate that concrete made with Type GU Portland cement should be acceptable for substructures. The results also indicate a moderate to elevated potential for corrosion of exposed ferrous metal, which should be considered in the design of substructures.

5.13 Trees

The clay soils on this site are potentially sensitive to water depletion by trees of high water demand during periods of dry weather. When trees draw water from clay soil, the clay undergoes shrinkage which can result in settlement of adjacent structures. Some restrictions could therefore need to be imposed on the planting of trees of higher water demand in close proximity to the foundations of houses or other structures founded at shallow depth. The required set-backs can be evaluated once further details are available on the site grading design.

6.0 ADDITIONAL CONSIDERATIONS

The soils at this site are sensitive to disturbance from ponded water, construction traffic and frost.

All footing and subgrade areas should be inspected by experienced geotechnical personnel prior to filling or concreting to ensure that soil having adequate bearing capacity has been reached and that the bearing surfaces have been properly prepared. The placing and compaction of any engineered fill as well as sewer bedding and backfill should be inspected to ensure that the materials used conform to the specifications from both a grading and compaction point of view.

At the time of the writing of this report, only limited details for the proposed subdivision were available. Golder Associates should be retained to review the guidelines provided in this report once additional details are known.

It should also be noted that no oedometer consolidation tests were carried out on the Shelby tube samples retrieved for this investigation; if the permissible grade raises specified in Section 5.2 cannot be accommodated, consolidation testing could be considered to further refine the grading recommendations.

For any higher/heavier structures (e.g., schools, commercial buildings etc.) proposed for the site that will be designed in accordance with Part 4 of the OBC, further investigation will be required to support the site plan and building permit applications and additional geotechnical guidelines will need to be provided for detailed design.

The groundwater level monitoring devices (i.e., standpipe piezometers or wells) installed at the site will require decommissioning at the time of construction in accordance with Ontario Regulation 128/03. However, it is expected that most of the wells will either be destroyed during construction or can be more economically abandoned as part of the construction contract. If that is not the case or is not considered feasible, abandonment of the monitoring wells can be carried out separately.

7.0 CLOSURE

We trust this report satisfies your current requirements. If you have any questions regarding this report, please contact the undersigned.

GOLDER ASSOCIATES LTD.

LICENSED PROFESSIONAL ENGINEER
S. A. TRICKEY
100104579
PROVINCE OF ONTARIO

Susan Trickey, P.Eng.
Geotechnical Engineer

Mike Cunningham, P.Eng.
Principal, Geotechnical Engineer

WAM/SAT/MIC/sg/ob
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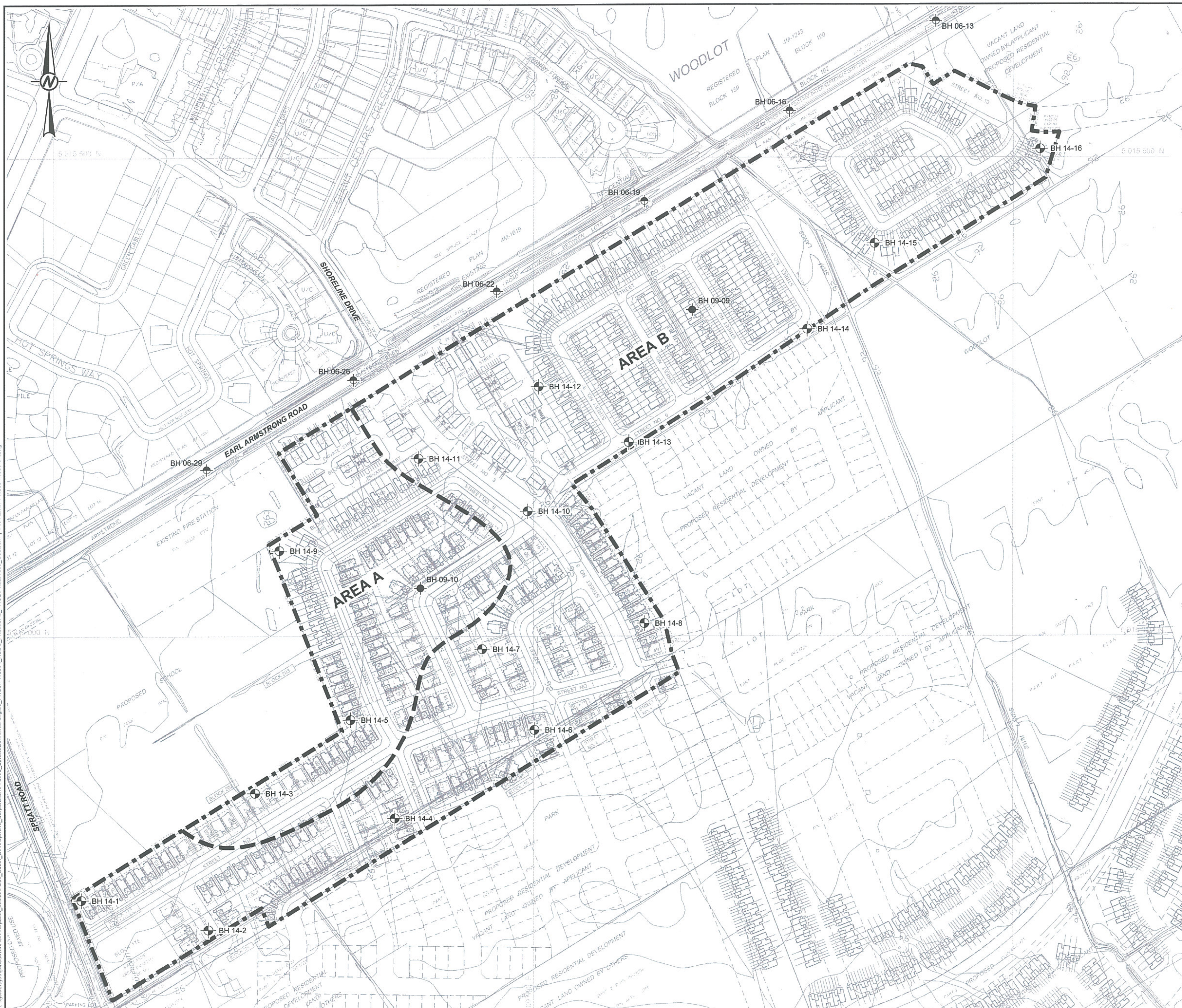
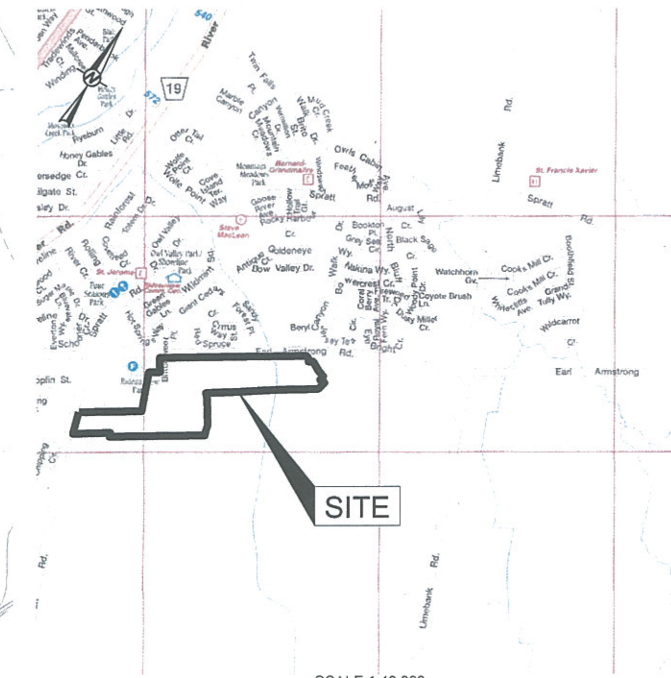


KEY MAP



SCALE 1:40,000

LEGEND

- APPROXIMATE BOREHOLE LOCATION IN PLAN, PRESENT INVESTIGATION
- APPROXIMATE BOREHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD. REPORT N o. 09-1121-0120
- APPROXIMATE BOREHOLE LOCATION IN PLAN, PREVIOUS INVESTIGATION BY GOLDER ASSOCIATES LTD. REPORT N o. 06-1120-290
- APPROXIMATE LIMIT OF PHASE 8 DEVELOPMENT
- ASSESSMENT AREA

NOTES

1. THIS FIGURE IS TO BE READ IN CONJUNCTION WITH THE ACCOMPANYING GOLDER ASSOCIATES LTD. LETTER REPORT No. 1418804

REFERENCE

1. BASE PLAN SUPPLIED IN ELECTRONIC FORMAT BY ANNIS, O'SULLIVAN VOLLEBEKK LTD. PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83, COORDINATE SYSTEM: MTM ZONE 9, VERTICAL DATUM: CGVD28

0 100 200
1:4,000 METRES

CLIENT
RIVERSIDE SOUTH DEVELOPMENT CORPORATION

PROJECT
GEOTECHNICAL INVESTIGATION
RIVERSIDE SOUTH DEVELOPMENT (PHASE 8)
PROPOSED RESIDENTIAL DEVELOPMENT - OTTAWA, ONTARIO

TITLE
SITE PLAN

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-02-26
PREPARED	JM
DESIGN	----
REVIEW	SAT
APPROVED	MIC

PROJECT No.	PHASE	Rev.	FIGURE
1418804	1000	A	1

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25 mm

PROJECT: 1418804

RECORD OF BOREHOLE: 14-12

SHEET 1 OF 1

LOCATION: See Site Plan

BORING DATE: January 13, 2015

DATUM: Geodetic

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

Boring method: Power Auger, 200 mm Diam. (Hollow Stem)

DESCRIPTION (SOIL PROFILE)	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	BLOWS/0.30m
GROUND SURFACE	91.90			
TOPSOIL	0.00			
(CI/CH) SILTY CLAY to CLAY; grey brown (WEATHERED CRUST); cohesive, w>PL	91.65 / 0.25	1	GRAB	-
(SM-ML) SILTY SAND and CLAYEY SILT; grey brown; non-cohesive, moist, loose	91.29 / 0.61	2	SS	5
(ML-CI) CLAYEY SILT and SILTY CLAY; grey brown, contains silty sand layers; cohesive, w>PL, firm	90.47 / 1.43	3	SS	1
(CI/CH) SILTY CLAY to CLAY; grey brown; cohesive, w>PL, stiff	89.46 / 2.44	4	SS	2
(CI/CH) SILTY CLAY to CLAY; grey; cohesive, w>PL, firm to stiff	88.85 / 3.05	5	SS	1
(ML) CLAYEY SILT; grey; cohesive, w>PL, very stiff	87.48 / 4.42			
(ML) sandy SILT, some gravel; grey, contains cobbles/boulders (GLACIAL TILL); non-cohesive, wet, compact	87.02 / 4.88	6	SS	6
		7	SS	14
End of Borehole	85.80 / 6.10			

DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m: 20 40 60 80

SHEAR STRENGTH Cu, kPa: nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)

HYDRAULIC CONDUCTIVITY, k, cm/s: 10^{-6} 10^{-5} 10^{-4} 10^{-3}

WATER CONTENT PERCENT: Wp ⊢—○W—⊣ Wl (20 40 60 80)

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

WL in open borehole at 1.22 m depth below ground surface upon completion of drilling

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: PAH

CHECKED: WAM

Appendix E DRAWINGS