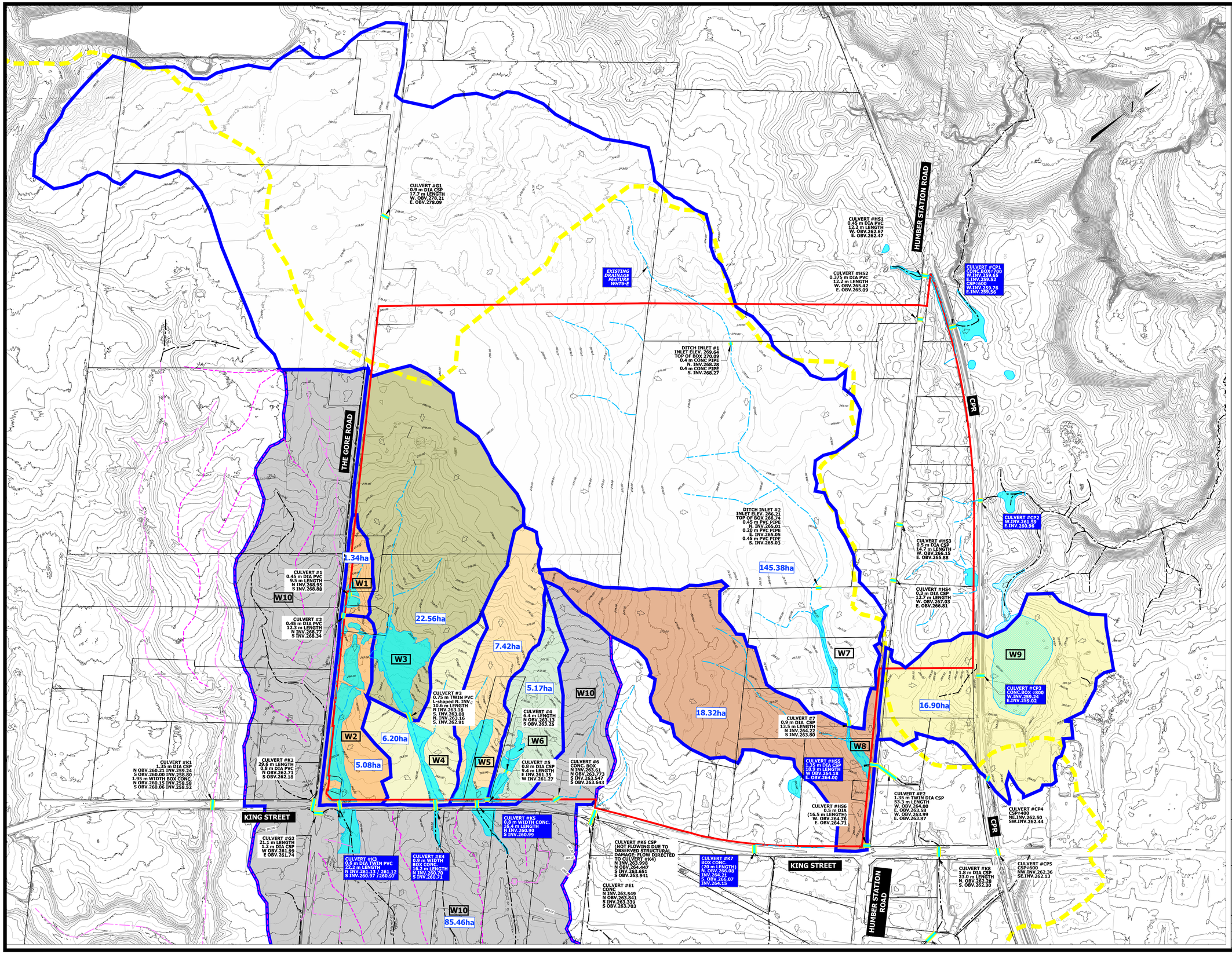

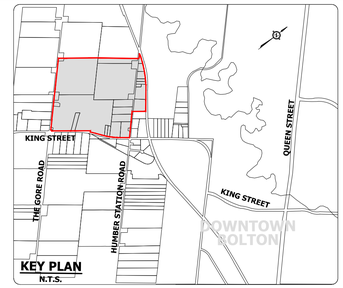

LEGEND:

- STUDY AREA LIMIT
- EXISTING CONTOUR
- EXISTING CULVERT LOCATION
- CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
- UNEVALUATED CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
- TRCA WATERSHED BOUNDARY BETWEEN THE MAIN HUMBER AND THE WEST HUMBER RIVER
- PRE-DEVELOPMENT OVERLAND FLOW DIRECTION
- UNEVALUATED WETLAND (STAKED JUNE 2016, BEACON)
- PROVINCIALLY SIGNIFICANT WETLAND
- W2 — EXISTING WETLAND ID
- CONTRIBUTING DRAINAGE AREA BOUNDARY TO EXISTING WETLAND BASED ON UPDATED TOPOGRAPHY (URBANTECH)
- 18.32ha — CONTRIBUTING WETLAND DRAINAGE AREA IN HECTARS
- CULVERT #K3 0.9 m WIDTH BOX CONC. 16.2 m LENGTH N INV.260.70 S INV.260.71 — EXISTING CULVERT DESCRIPTION
- EXISTING SURFACE HIGH POINT / DRAINAGE DIVIDE (URBANTECH)
- EXISTING SURFACE LOW POINTS / DRAINAGE PATH (URBANTECH)

Wetland ID	Existing Drainage Area to Wetland (ha)
W1	1.34
W2	6.42 (1.34+5.08)
W3	22.56
W4	28.76 (22.56+6.20)
W5	7.42
W6	5.17
W7	145.38
W8	163.62 (145.30+18.32)
W9	16.90
W10	85.46

OUTLET W10 TOTAL = 133.23ha

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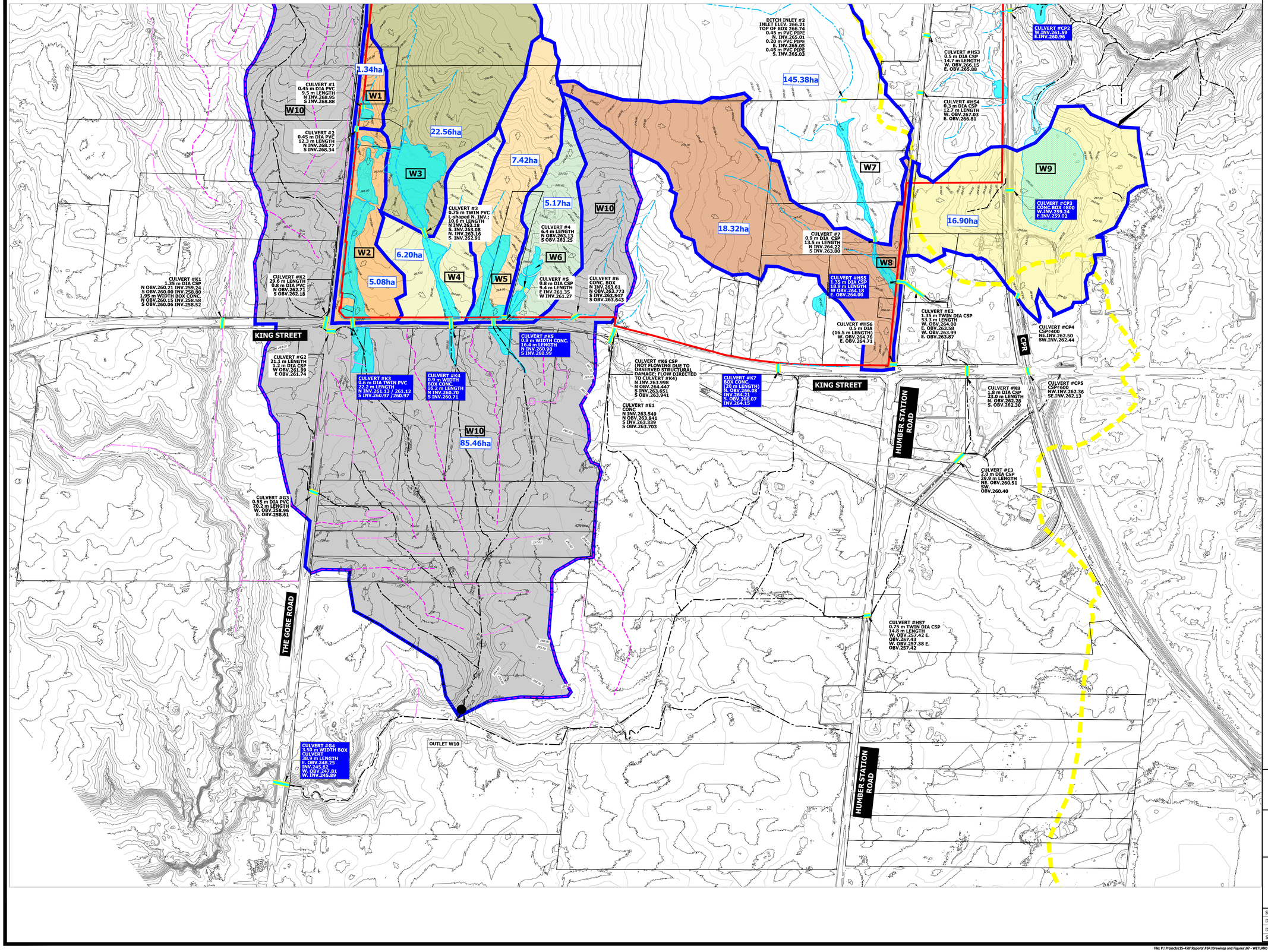
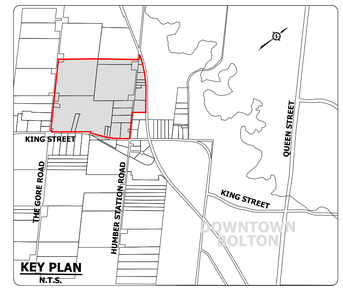
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
CALEDON STATION SECONDARY PLAN

PRE-DEVELOPMENT DRAINAGE AREAS TO EXISTING WETLANDS

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
DRAWN BY:	A.G./K.S.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	S.K./E.L.	CHECKED BY:	A.F.	701A	
SCALE:	1:4000	DATE:	MAY 2023		





LEGEND:

- STUDY AREA LIMIT
- EXISTING CONTOUR
- EXISTING CULVERT LOCATION
- CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
- UNEVALUATED CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
- TRCA WATERSHED BOUNDARY BETWEEN THE MAIN HUMBER AND THE WEST HUMBER RIVER
- PRE-DEVELOPMENT OVERLAND FLOW DIRECTION
- UNEVALUATED WETLAND (STAKED JUNE 2016, BEACON)
- PROVINCIALLY SIGNIFICANT WETLAND
- W2 — EXISTING WETLAND ID
- CONTRIBUTING DRAINAGE AREA BOUNDARY TO EXISTING WETLAND BASED ON UPDATED TOPOGRAPHY (URBANTECH)
- 18.32ha — CONTRIBUTING WETLAND DRAINAGE AREA IN HECTARES
- CULVERT #K3 0.9 m WIDTH BOX CONC. 16.2 m LENGTH N INV.260.70 S INV.260.71 — EXISTING CULVERT DESCRIPTION
- EXISTING SURFACE HIGH POINT / DRAINAGE DIVIDE (URBANTECH)
- EXISTING SURFACE LOW POINTS / DRAINAGE PATH (URBANTECH)

Wetland ID	Existing Drainage Area to Wetland (ha)
W1	1.34
W2	6.42 (1.34+5.08)
W3	22.56
W4	28.76 (22.56+6.20)
W5	7.42
W6	5.17
W7	145.38
W8	163.62 (145.30+18.32)
W9	16.90
W10	85.46

OUTLET W10 TOTAL = 133.23ha

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TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
CALEDON STATION SECONDARY PLAN

PRE-DEVELOPMENT DRAINAGE AREAS TO EXISTING WETLANDS

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
DRAWN BY:	A.G./K.S.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	S.K./E.L.	CHECKED BY:	A.F.	701B	
SCALE:	1:4000	DATE:	MAY 2023		

File: P:\Projects\15-458\Reports\FSR\Drawings and Figures\07 - WETLAND WATER BALANCE\701_PRE-DEVELOPMENT DRAINAGE AREAS TO WETLANDS (W1-W9).dwg - Revised by <D2EC> : Mon, Jan 11 2021 - 7:15am

DRAINAGE TO W3 BY PIPE
5.78ha

CULVERT #1
0.45 m DIA PVC
9.5 m LENGTH
N INV.268.95
S INV.268.88

W1
0.48ha

CULVERT #2
0.45 m DIA PVC
12.3 m LENGTH
N INV.268.77
S INV.268.34

0.25ha

ELEMENTARY SCHOOL

105-R6

106-R2

105-R6, 106-R2
ROOF/LID DRAINAGE TO W5 BY PIPE
0.80ha

106-R6

106-R7

W3
2.97ha

3.43ha
W2

THE GORE ROAD

CULVERT #3
0.75 m TWIN PVC
L-shaped N. INV.;
10.6 m LENGTH
N INV.263.18
S. INV.263.08
N. INV.263.16
S. INV.262.91

SWM POND 2A

4.65ha
W4

W5
4.70ha

106-R3

106-R4

106-R5

106-R3 TO 106-R7
ROOF/LID DRAINAGE TO W6 BY PIPE
1.32ha

W6
1.91ha

CULVERT #4
6.4 m LENGTH
N OBV.263.13
S OBV.263.25

CULVERT #5
0.8 m DIA CSP
9.4 m LENGTH
E INV.261.35
W INV.261.27

CULVERT #6
CONC. BOX
N INV.263.61
N OBV.263.773
S INV.263.547
S OBV.263.643

SWM POND 1

CULVERT #K2
29.6 m LENGTH
0.8 m DIA PVC
N OBV.262.71
S OBV.262.18

KING STREET

KING STREET

CULVERT #G2
21.1 m LENGTH
1.2 m DIA CSP
W OBV.261.99
E OBV.261.74

CULVERT #K3
0.6 m DIA TWIN PVC
22.2 m LENGTH
N INV.261.13 / 261.12
S INV.260.97 /260.97

CULVERT #K4
0.9 m WIDTH
BOX CONC.
16.2 m LENGTH
N INV.260.70
S INV.260.71

CULVERT #K5
0.8 m WIDTH CONC.
16.4 m LENGTH
N INV.260.90
S INV.260.99

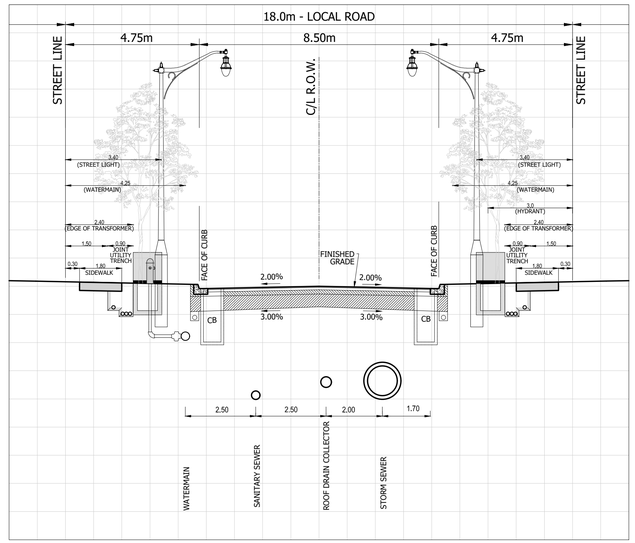
CULVERT #K6 CSP
(NOT FLOWING DUE TO OBSERVED STRUCTURAL DAMAGE; FLOW DIRECTED TO CULVERT #K4)
N INV.263.998
N OBV.264.447
S INV.263.651
S OBV.263.941

CULVERT #E1
CONC
N INV.263.549
N OBV.263.841
S INV.263.339
S OBV.263.703

CULVERT #K7
BOX CONC.
(20 m LENGTH)
N. OBV.266.08
INV.264.21
S. OBV.266.07
INV.264.15

W10
78.99ha

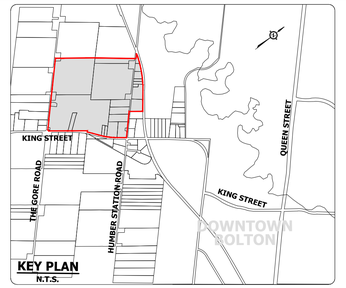
SWM POND 2B



18.0m ROW CROSS SECTION WITH RDC
(TYPICAL DETAIL)

WETLAND ID	EXISTING DRAINAGE AREA (HA)	(*) PROPOSED DRAINAGE AREA (HA)	CHANGE IN DRAINAGE AREA (%)
W1	1.34	0.48	64
W2	5.08	3.43	32
W3	22.56	2.88	87
W4	6.20	2.16	65
W5	7.42	1.93	74
W6	5.17	0.96	81
TOTAL	47.77	11.84	75
TOTAL (W10 OUTET)	133.23	90.83	31

(*) POST-DEVELOPMENT CONDITION ASSUMES LOSS OF WETLAND 1 AND 2 FOOTPRINT DUE TO THE GORE ROAD WIDENING.



LEGEND:

- LIMIT OF PROPERTY
- EXISTING CONTOUR
- EXISTING CULVERT LOCATION
- CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
- UNEVALUATED CEISMP HEADWATER DRAINAGE FEATURES (BEACON)
- TRCA WATERSHED BOUNDARY BETWEEN THE MAIN HUMBER AND THE WEST HUMBER RIVER
- PRE-DEVELOPMENT OVERLAND FLOW DIRECTION
- POST-DEVELOPMENT OVERLAND FLOW DIRECTION
- UNEVALUATED WETLAND (STAKED JUNE 2016, BEACON)
- W2 — EXISTING WETLAND ID
- CONTRIBUTING DRAINAGE AREA BOUNDARY TO EXISTING WETLAND BASED ON UPDATED TOPOGRAPHY (URBANTECH)
- PROPOSED CONTRIBUTING DRAINAGE AREA BOUNDARY TO EXISTING WETLAND
- ROOF/LID DRAINAGE BY PIPE TO WETLANDS
- 18.32ha — CONTRIBUTING WETLAND DRAINAGE AREA IN HECTARS
- CULVERT #K3 0.9 m WIDTH BOX CONC. 16.2 m LENGTH N INV.260.70 S INV.260.71 — EXISTING CULVERT DESCRIPTION
- EXISTING SURFACE HIGH POINT / DRAINAGE DIVIDE (URBANTECH)
- EXISTING SURFACE LOW POINTS / DRAINAGE PATH (URBANTECH)
- PROPOSED EPA (ENVIRONMENTAL POLICY AREA) / CHANNEL
- PROPOSED PARK BLOCK

NOTES:
* REFER TO DRAWINGS 701A & 701BFOR EXISTING DRAINAGE AREA PLAN TO WETLANDS.
* A ROOF DRAIN COLLECTOR (RDC) SYSTEM WILL BE PROPOSED AS THE APPROACH TO MITIGATION OF THE INFILTRATION DEFICIT TO THE INDIVIDUAL WETLANDS. THE RDC SYSTEM IS A "THIRD PIPE" WITHIN THE PROPOSED ROW COLLECTING CLEAN ROOF DRAINAGE AS WELL AS THE DRAINAGE FROM REAR LOT PERVIOUS AREAS. REFER TO A TYPICAL ROW DETAIL WITH RDC ON THIS DRAWING.
* FEATURE BASED WATER BALANCE WILL BE FURTHER ADVANCED IN FUTURE SUPPORTING STUDIES, AND THE PROPOSED RDC SYSTEM WILL BE CONSIDERED IN CONJUNCTION WITH THE APPROPRIATE ADDITIONAL LID MEASURES.

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TOWN OF CALEDON
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CALEDON STATION SECONDARY PLAN

POST-DEVELOPMENT DRAINAGE AREAS TO EXISTING WETLANDS

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
DRAWN BY:	A.G./K.S.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	702	
SCALE:	1:2000	DATE:	MAY 2023		

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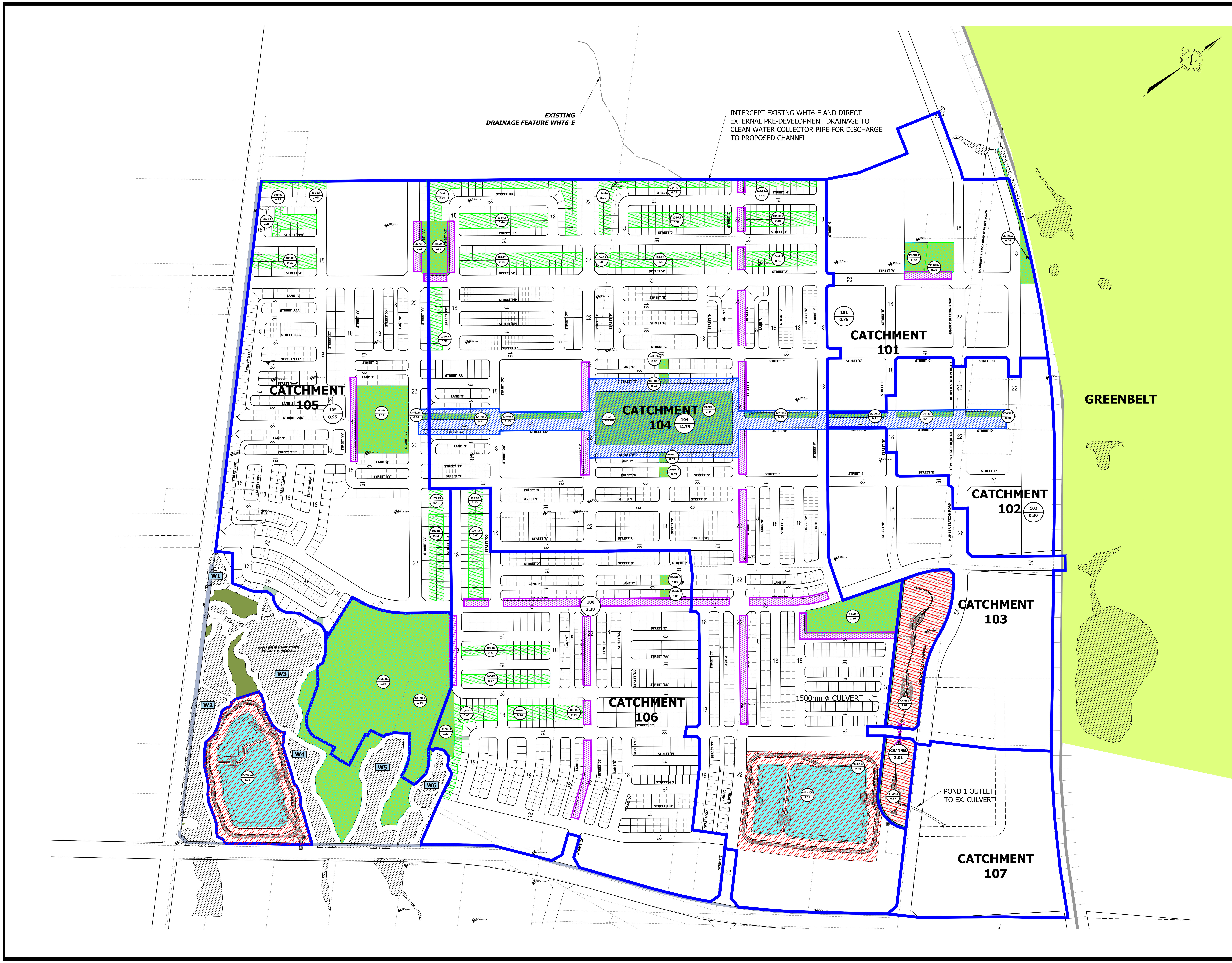

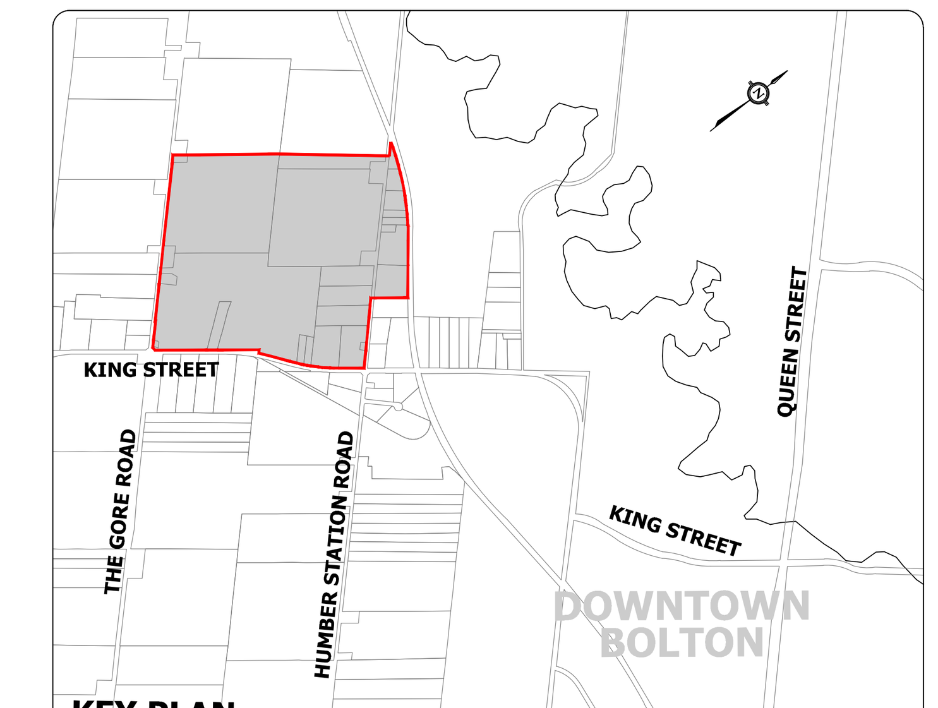

KEY PLAN
N.T.S.

LEGEND

- STORM DRAINAGE AREA BOUNDARY
- DRAFT PLAN AREAS
- NON-PARTICIPATING PROPERTY
- GREENBELT
- EXISTING UNEVALUATED WETLAND
- PROPOSED EPA (ENVIRONMENTAL POLICY AREA) / CHANNEL
- PARK AREAS
- CLEAN AREAS (ROOFTOP AND YARDS)
- CHAN 1 / 2.05 — AREA ID / AREA (ha)
- SWM PONDS
- LINEAR PARK
- SILVA CELL
- 18 — RIGHT OF WAY WIDTH (m)

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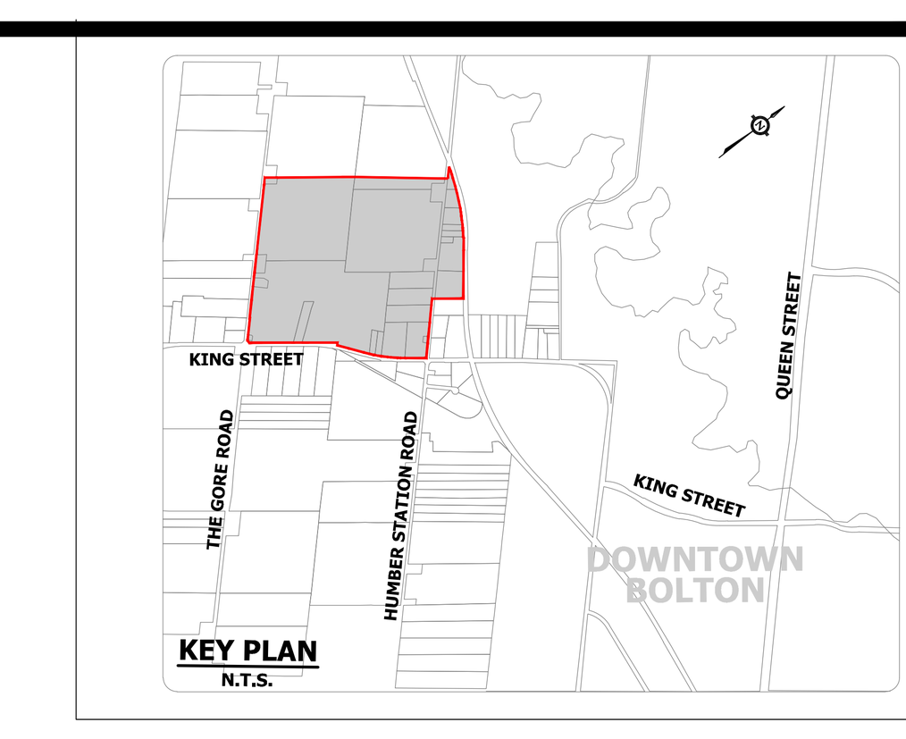
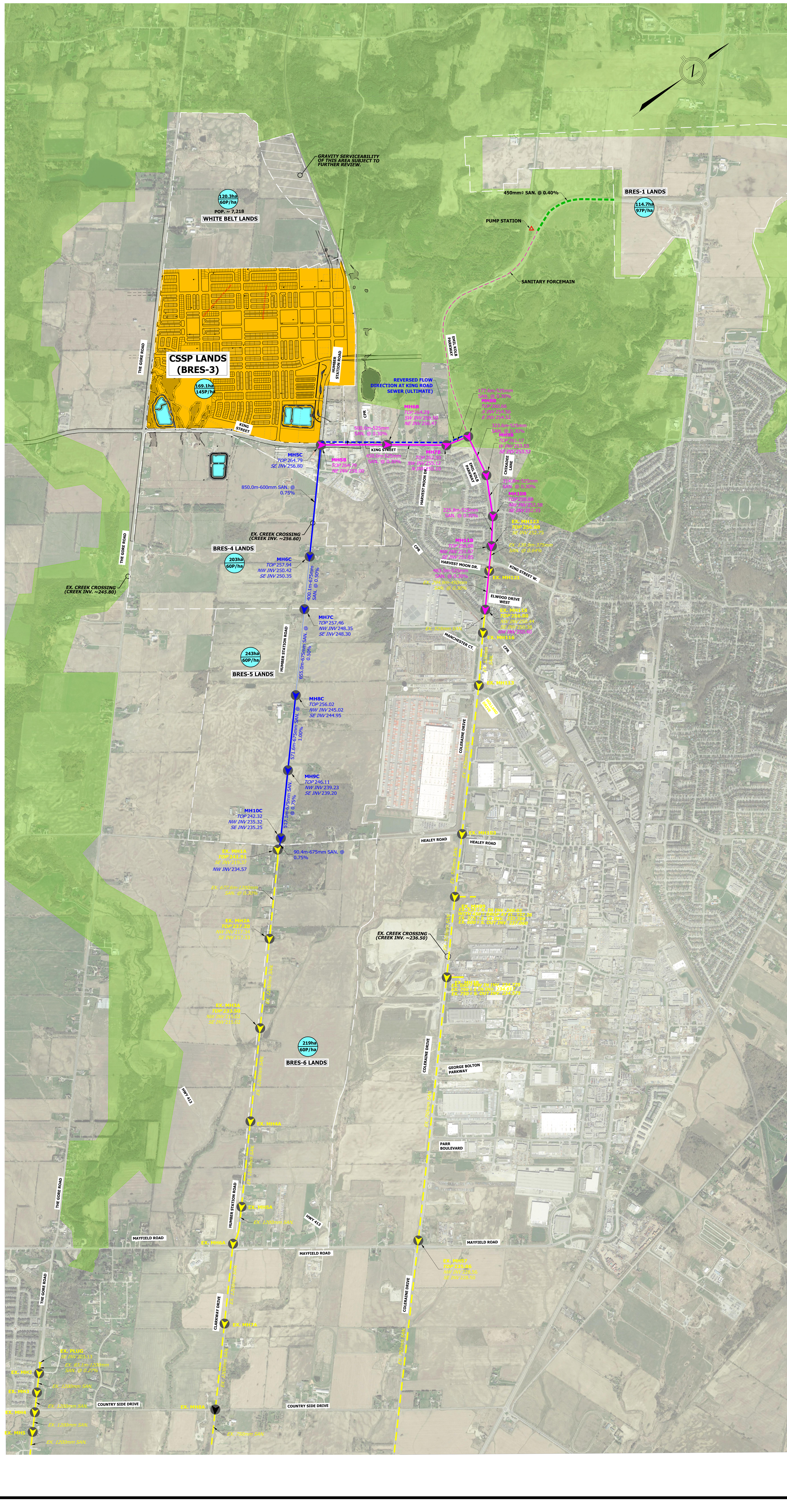
WATER BALANCE PLAN

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
DRAWN BY:	A.G./X.S.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	703	
SCALE:	1:3000	DATE:	MAY 2023		





LEGEND:

- CALEDON STATION SECONDARY PLAN (CSSP)
- GREENBELT
- PROPOSED BRES SANITARY DRAINAGE AREA BOUNDARY
- 23ha — SANITARY DRAINAGE AREA; 60P/ha — POPULATION DENSITY
- HUMBER STATION WASTEWATER SEWER (REGION DC#23-2271) COUNTRYSIDE DR. TO HEALY ROAD/ CONSTRUCTION COMPLETE BY 2025
- EXISTING SANITARY TRUNK
- ULTIMATE SANITARY SEWER (SEE DRAWINGS 803 & 804)
- INTERIM SANITARY SEWER

ALL PIPE SIZES ARE SUBJECT TO REGION OF PEEL MASTER PLAN UPDATES

NOTES:
* ESTIMATED POPULATION DENSITY 60 PEOPLE / HECTARE FOR EXTERNAL DRAINAGE AREAS OUTSIDE OF CSSP TO BE CONFIRMED BY REGION.
*SUBJECT TO REGION CONFIRMATION ON THE EXISTING COLERAINE TRUNK SEWER CAPACITY, EXTERNAL DRAINAGE NORTH OF CSSP COULD BE ACCOMMODATED IN THE CSSP SANITARY SEWER SYSTEM.
* REFER TO DRAWING 802 FOR CSSP INTERNAL SANITARY DRAINAGE PLAN AND SERVICING.
* REFER TO DRAWINGS 803 AND 804 FOR EXTERNAL TRUNK SANITARY SEWER PROFILE.

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**TOWN OF CALEDON
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CALEDON STATION SECONDARY PLAN**

TRUNK (DC) SANITARY SERVICING PLAN

SURVEYED BY:	J.D.B	DATE:	2020	JOB NO.	15-458
DRAWN BY:	A.G./X.S.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	801	
SCALE:	1:10000	DATE:	MAY 2023		

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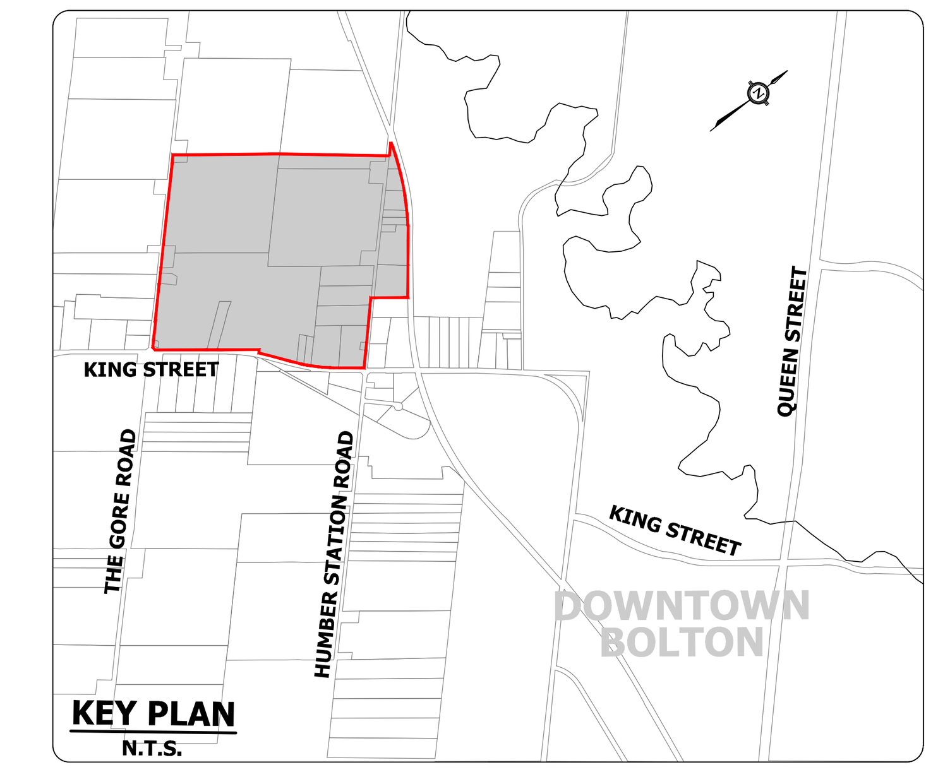

KEY PLAN
N.T.S.

LEGEND

- DRAFT PLAN AREAS
- NON-PARTICIPATING PROPERTY
- GREENBELT
- EXISTING UNEVALUATED WETLAND
- PROPOSED EPA (ENVIRONMENTAL POLICY AREA) / CHANNEL
- INTERNALSANITARY DRAINAGE AREA BOUNDARY
- EXTERNAL SANITARY DRAINAGE AREA BOUNDARY
- INTERNAL SANITARY SEWER
- EXTERNAL SANITARY SEWER
- 2.0ha / 70 / 140 — AREA Ha. / POPULATION / POPULATION EQUIVALENT PP/Ha.
- 97ha / 60 / 5820 — EXTERNAL AREA Ha. / EXTERNAL POPULATION / POPULATION EQUIVALENT PP/Ha.
- 2.0ha / 70 / 140 — FUTURE AREA Ha. / FUTURE POPULATION / FUTURE POPULATION EQUIVALENT PP/Ha.
- SAN.MH5A / TOP 90.75m / S 85.00m / N 85.00m / E 85.00m — SANITARY MANHOLE ID / PROPOSED GROUND ELEVATION / PROPOSED SEWER INVERTS

NOTE:
* REFER TO DRAWING 801 FOR EXTERNAL DRAINAGE AREAS AND TRUNK SEWER.

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INTERNAL SANITARY DRAINAGE PLAN

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458	
DRAWN BY:	A.G./X.S.	CHECKED BY:	S.H.	DRAWING NO.		SHEET NO.
DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	802		
SCALE:	1:3000	DATE:	MAY 2023			

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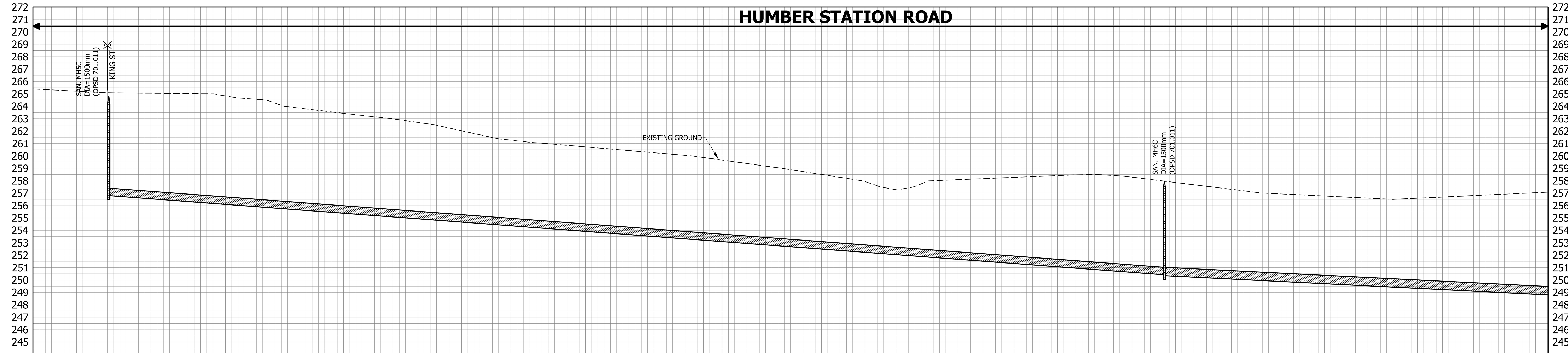
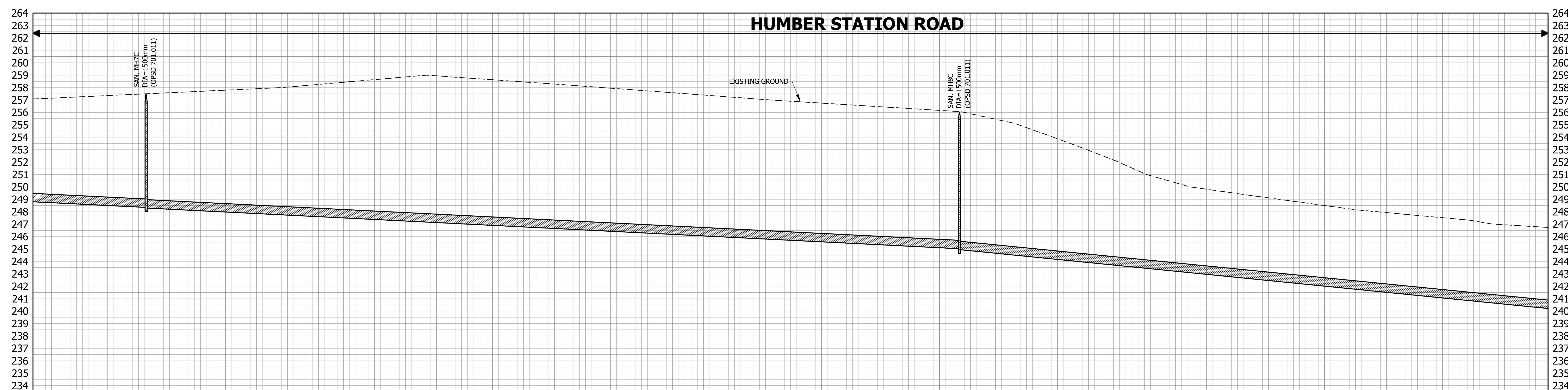


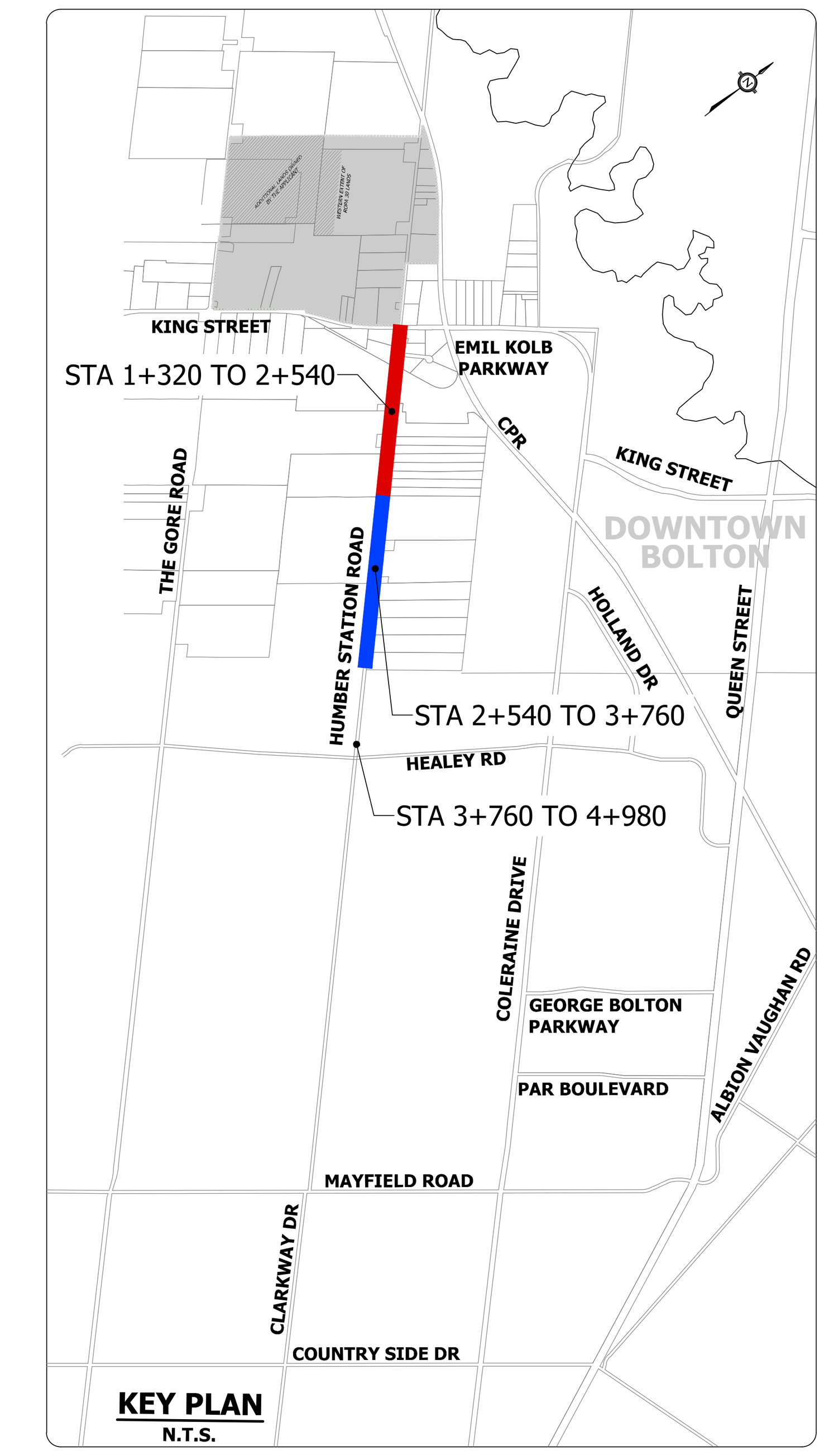
SANITARY SEWER INVERT: SE256.80 — 850.0m-600mm CONC. SAN. @ 0.75% — NW250.42 / SE250.35 — 400.1m-675mm CONC. SAN. @ 0.50%

CENTERLINE CHAINAGE	EXISTING CENTERLINE ELEVATION
1+350	265.24
1+400	265.07
1+450	265.02
1+500	264.56
1+550	263.67
1+600	263.10
1+650	262.37
1+700	261.32
1+750	260.86
1+800	260.43
1+850	260.01
1+900	259.32
1+950	258.58
2+000	257.59
2+050	258.02
2+100	258.23
2+150	258.43
2+200	258.35
2+250	257.74
2+300	257.13
2+350	256.82
2+400	256.57
2+450	256.66
2+500	256.90



SANITARY SEWER INVERT: 400.1m-675mm CONC. SAN. @ 0.50% — NW248.35 / SE248.30 — 655.0m-675mm CONC. SAN. @ 0.50% — NW245.02 / SE244.95 — 571.6m-675mm CONC. SAN. @ 1.00%

CENTERLINE CHAINAGE	EXISTING CENTERLINE ELEVATION
2+550	257.13
2+600	257.36
2+650	257.59
2+700	257.81
2+750	258.08
2+800	258.51
2+850	258.94
2+900	258.70
2+950	258.35
3+000	257.99
3+050	257.62
3+100	257.25
3+150	256.90
3+200	256.59
3+250	256.29
3+300	255.78
3+350	254.42
3+400	252.56
3+450	250.62
3+500	249.60
3+550	248.91
3+600	248.23
3+650	247.75
3+700	247.27
3+750	246.80



KEY PLAN
N.T.S.

NOTES:
1. REFER TO DRAWING 801 FOR PLANVIEW DESIGN.

TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
CALEDON STATION SECONDARY PLAN

EXTERNAL SANITARY TRUNK PROFILE (ULTIMATE)

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
DRAWN BY:	E.L.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	E.L.	CHECKED BY:	S.H.	803	1 OF 2
SCALE:	V 1:200 H 1:2000	DATE:	MAY 2021		

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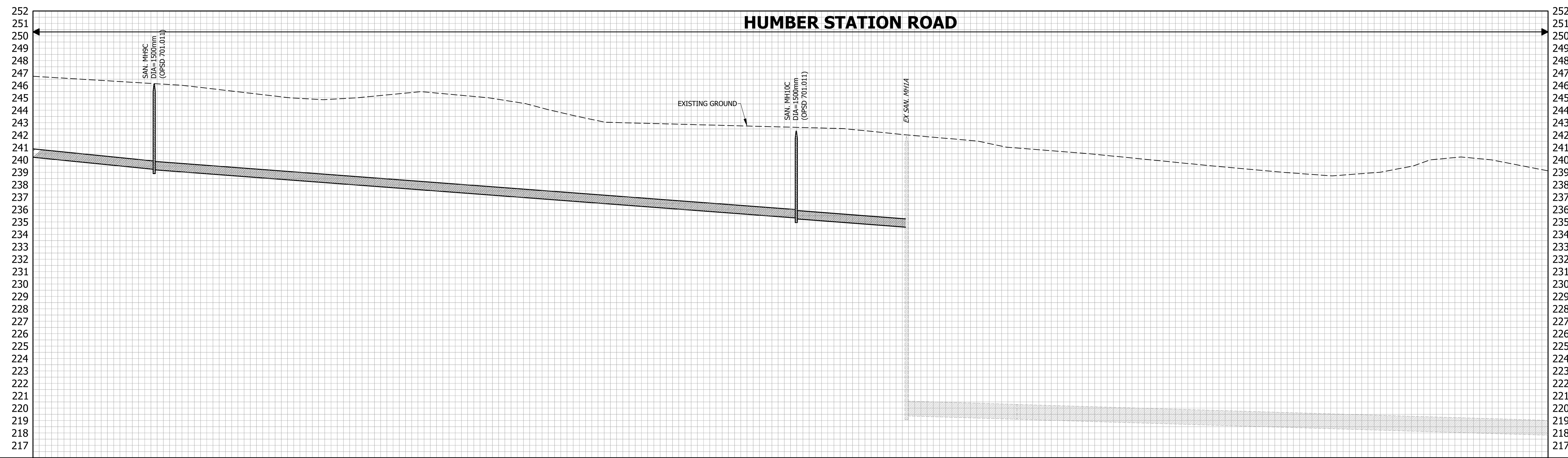
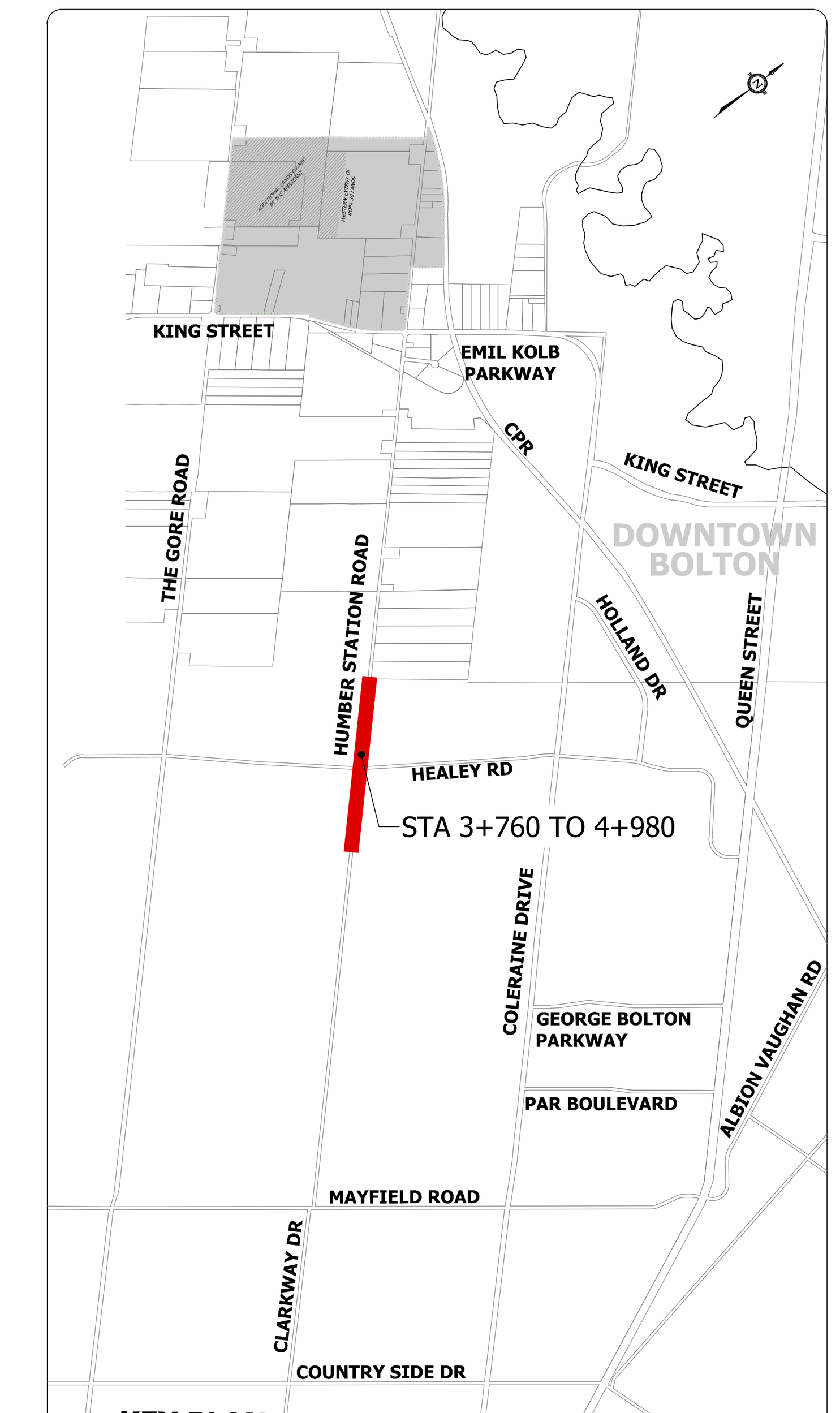


SANITARY SEWER INVERT	571.6m-675mm CONC. SAN. @ 1.00%	NW239.23 SE239.20					517.1m-675mm CONC. SAN. @ 0.75%					NW235.32 SE235.25	90.4m-675mm CONC. SAN. @ 0.75%	NW234.57 SE219.37						EX. 1200mm CONC. SAN.					SANITARY SEWER INVERT
EXISTING CENTERLINE ELEVATION	246.49	246.19	245.78	245.20	244.88	245.28	245.25	244.64	243.47	242.96	242.82	242.69	242.56	242.15	241.70	240.98	240.58	240.10	239.61	239.15	238.75	239.10	240.14	239.70	EXISTING CENTERLINE ELEVATION
CENTERLINE CHAINAGE	3+800	3+850	3+900	3+950	4+000	4+050	4+100	4+150	4+200	4+250	4+300	4+350	4+400	4+450	4+500	4+550	4+600	4+650	4+700	4+750	4+800	4+850	4+900	4+950	CENTERLINE CHAINAGE



KEY PLAN
N.T.S.

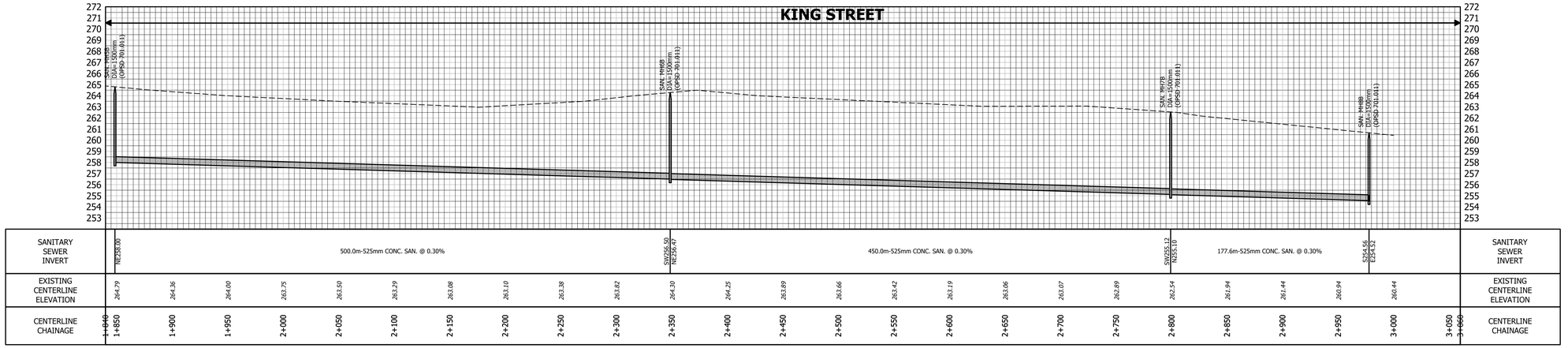
NOTES:
1. REFER TO DRAWING 801 FOR PLANVIEW DESIGN.

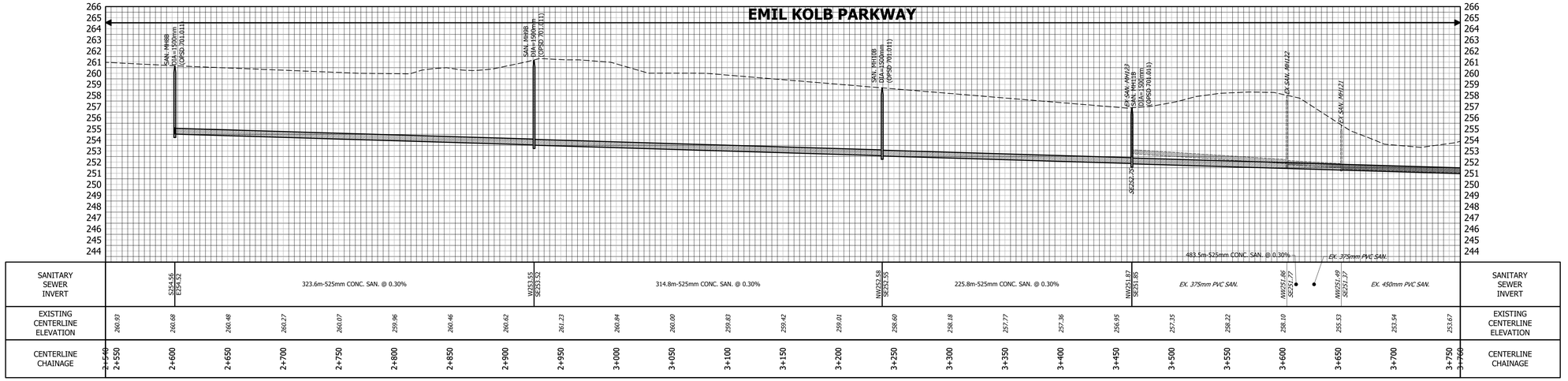
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
CALEDON STATION SECONDARY PLAN

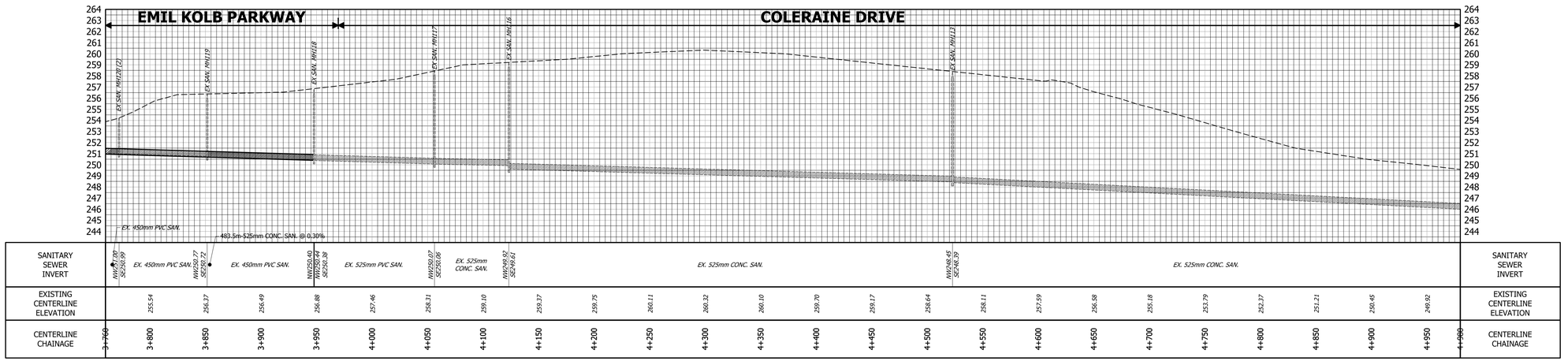
EXTERNAL SANITARY TRUNK PROFILE (ULTIMATE)

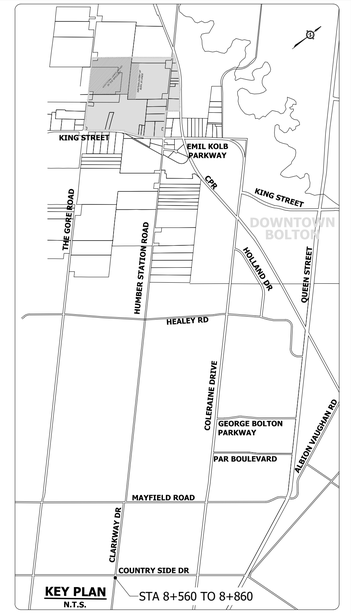
SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
DRAWN BY:	E.L.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	E.L.	CHECKED BY:	S.H.	804	2 OF 2
SCALE:	V 1:200 H 1:2000	DATE:	MAY 2021		

P:\PROJECTS\15-458\REPORTS\21-03-01 FSR ARGO\DRAWINGS AND FIGURES\08 - SANITARY SERVICING\804_SANITARY TRUNK PROFILE.DWG









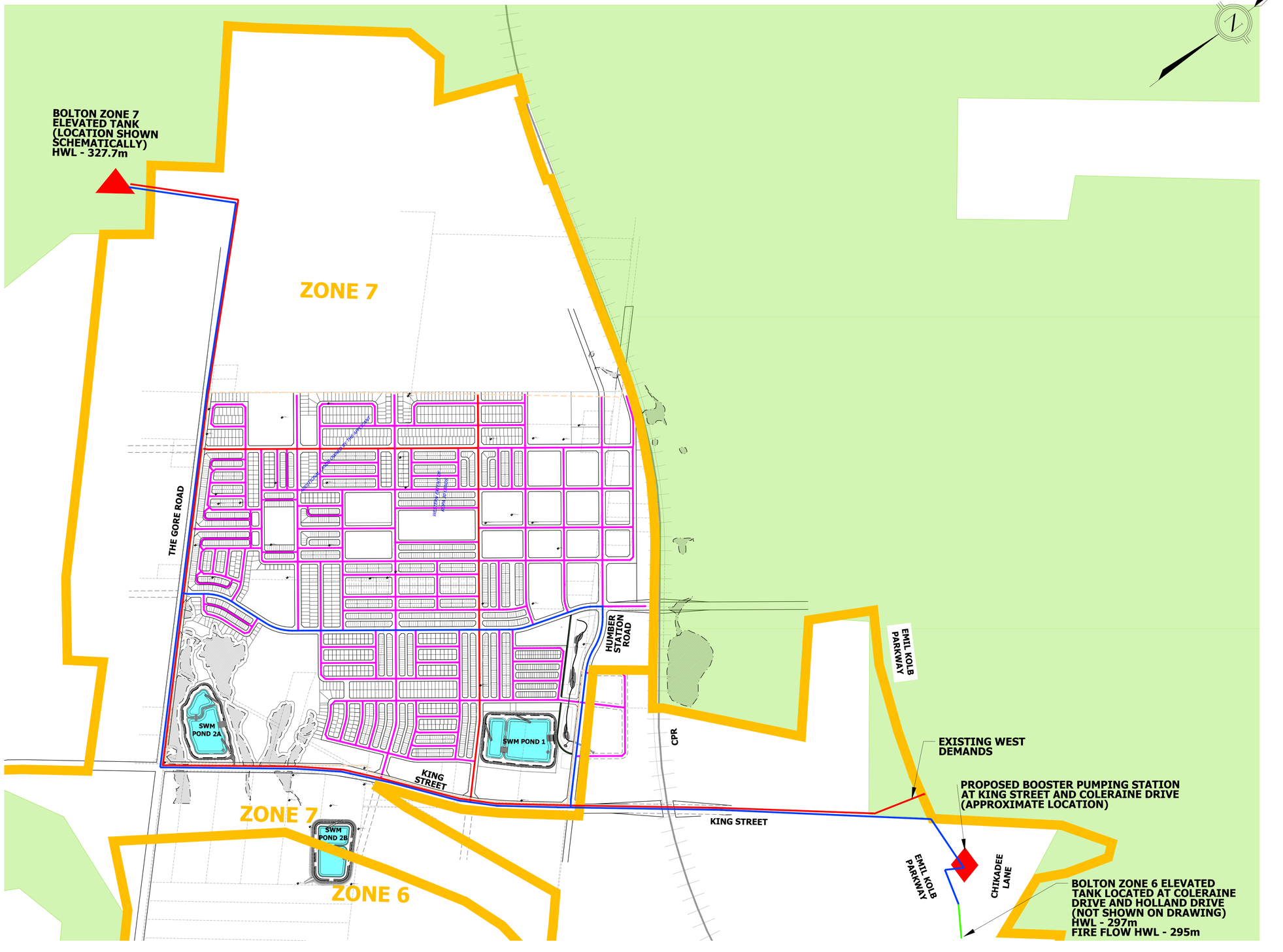
NOTES:
1. REFER TO DRAWING 801 FOR PLANVIEW DESIGN.

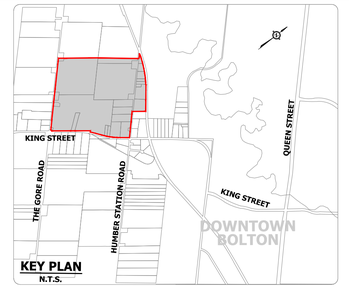
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
CALEDON STATION SECONDARY PLAN

EXTERNAL SANITARY TRUNK PROFILE (INTERIM)

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
DRAWN BY:	E.L.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	E.L.	CHECKED BY:	S.H.	805	1 OF 1
SCALE:	V 1:200 H 1:2000	DATE:	MAY 2021		

P:\PROJECTS\15-458\REPORTS\21-03-01 FSR ARGO\DRAWINGS AND FIGURES\08 - SANITARY SERVICING\805_SANITARY TRUNK PROFILE.DWG





LEGEND:

- GREENBELT
- WATER PRESSURE ZONE BOUNDARY
- PROPOSED 200mm WATERMAIN
- PROPOSED 400mm WATERMAIN
- PROPOSED 600mm WATERMAIN
- PROPOSED 1050mm WATERMAIN
- EXISTING TRUNK WATERMAIN
- PROPOSED ELEVATED WATER TANK (LOCATION SUBJECT TO EA)
- PROPOSED BOOSTER PUMPING STATION (LOCATION SUBJECT TO EA)

NOTES:

* ULTIMATE CSSP BUILD OUT WILL REQUIRE DEVELOPMENT OF A NEW ZONE 7.
* IT IS EXPECTED THAT A PORTION OF THE INITIAL CSSP DEVELOPMENT WILL BE ABLE TO PROCEED PRIOR TO CONSTRUCTION OF THE ULTIMATE ZONE 7 SERVICING SOLUTION. FURTHER MODELING SHOULD DETERMINE WHICH SERVICING AREAS WILL BE SUPPORTED WITH THE EXISTING ZONE 6 WATERMAIN.
* THE BOOSTER STATION AND ZONE 7 ELEVATED TANK LOCATIONS ARE SUBJECT TO FUTURE EAs.
*THIS PLAN IS A RECREATION OF THE MODEL FORM BOLTON OPTION 3 LANDS PRELIMINARY WATER MODELING BY R.J. BURNSIDE DATED 2023-05-15.

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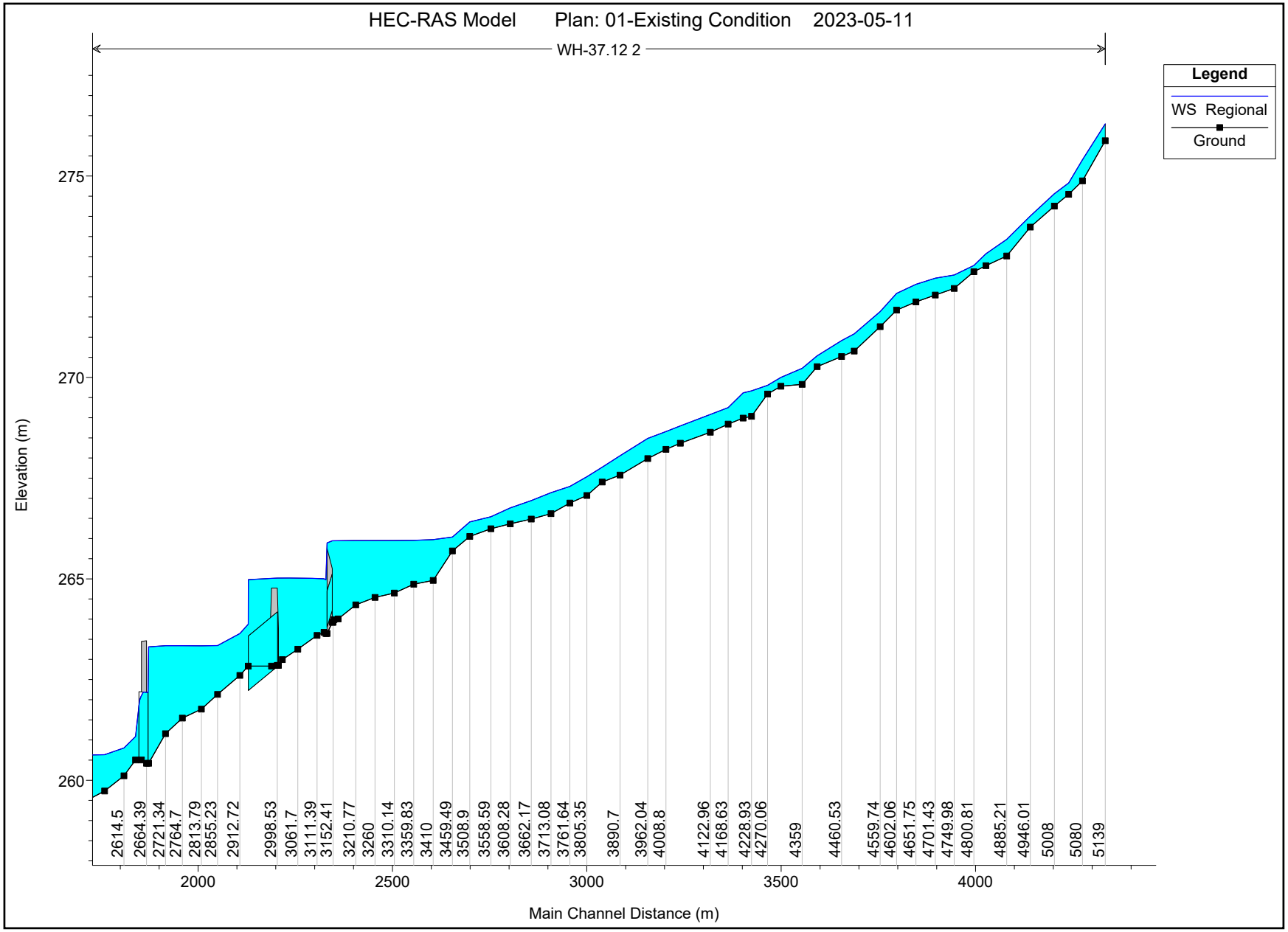
A Division of Leighton-Zec West Ltd.
3780 14th Avenue, Suite 301,
Markham, ON, L3R 3T7
TEL 905.946.9461 • urbantech.com

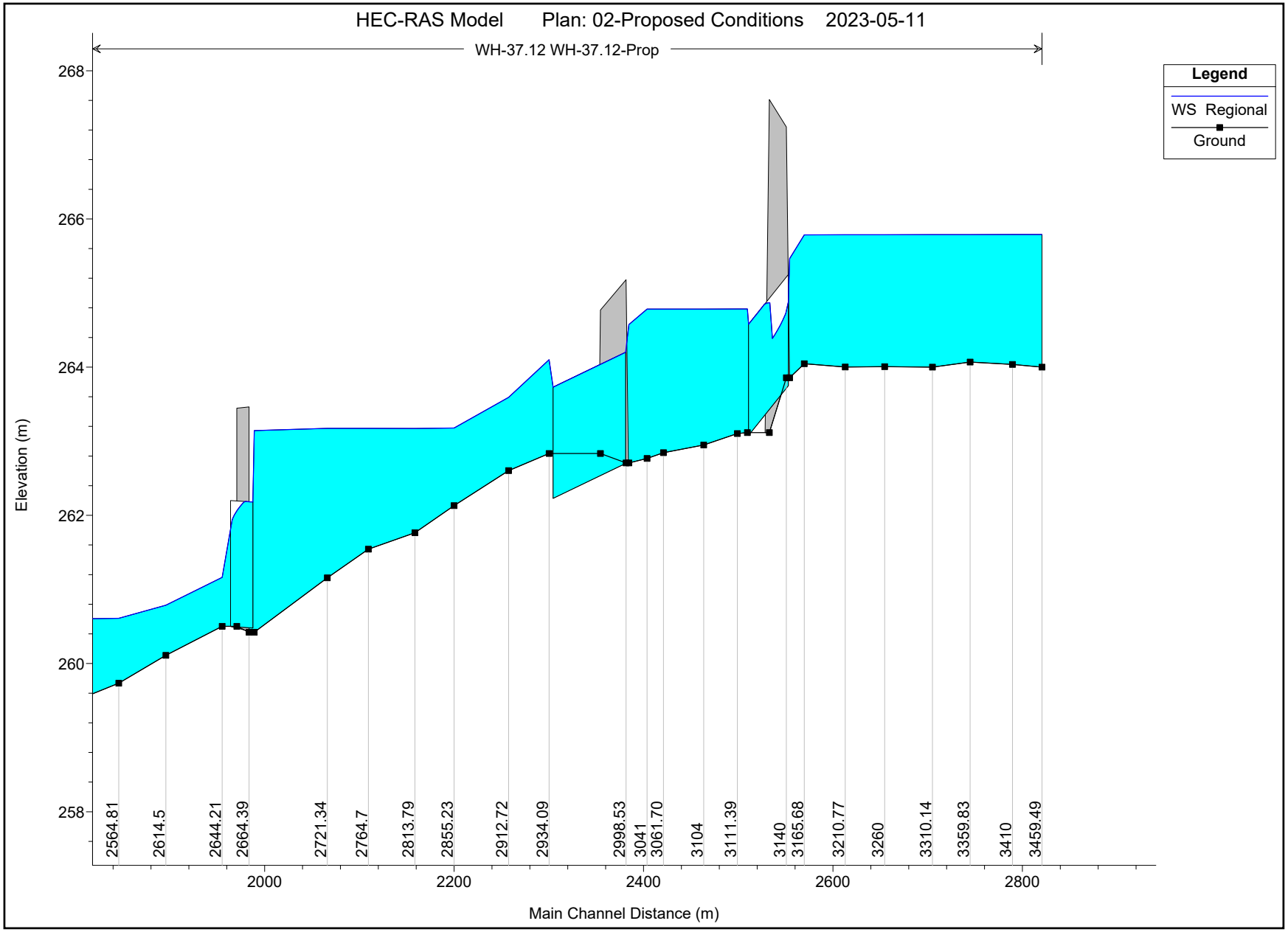
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
CALEDON STATION SECONDARY PLAN

WATER DISTRIBUTION PLAN

SURVEYED BY:	J.D.B.	DATE:	2020	JOB NO.	15-458
DRAWN BY:	A.G./K.S.	CHECKED BY:	S.H.	DRAWING NO.	SHEET NO.
DESIGNED BY:	S.K./E.L.	CHECKED BY:	S.K./A.F.	901	
SCALE:	1:6000	DATE:	MAY 2023		

APPENDIX 2
Hydraulic Model Results
Disk Available Upon Request for Detailed Output


HEC-RAS Model Plan: 01-Existing Condition 2023-05-11
WH-37.12 2
Legend
WS Regional
Ground
Elevation (m)
275
270
265
260
2614.5
2664.39
2721.34
2764.7
2813.79
2855.23
2912.72
2998.53
3061.7
3111.39
3152.41
3210.77
3260
3310.14
3359.83
3410
3459.49
3508.9
3558.59
3608.28
3662.17
3713.08
3761.64
3805.35
3890.7
3962.04
4008.8
4122.96
4168.63
4228.93
4270.06
4359
4460.53
4559.74
4602.06
4651.75
4701.43
4749.98
4800.81
4885.21
4946.01
5008
5080
5139
2000
2500
3000
3500
4000
Main Channel Distance (m)


HEC-RAS Model Plan: 02-Proposed Conditions 2023-05-11
WH-37.12 WH-37.12-Prop
Legend
WS Regional
Ground
Elevation (m)
268
266
264
262
260
258
2564.81
2614.5
2644.21
2664.39
2721.34
2764.7
2813.79
2855.23
2912.72
2934.09
2998.53
3041
3061.70
3104
3111.39
3140
3165.68
3210.77
3260
3310.14
3359.83
3410
3459.49
2000
2200
2400
2600
2800
Main Channel Distance (m)

APPENDIX 3
Storm Sewer Design Calculations

URBANTECH®

STORM SEWER DESIGN SHEET

10 Year Storm

Macville Argo

Town of Caledon

PROJECT DETAILS

Project No: 15-458
Date: 11-May-23
Designed by: E.L.
Checked by: S.H.

DESIGN CRITERIA

Min. Diameter = 300 mm
Mannings 'n'= 0.013
Starting Tc = 20 min
Factor of Safety = 10 %

Rainfall Intensity = $\frac{A}{(Tc+B)^{c}}$

A = 2221
B = 12
c = 0.908

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m^3/s)	CONSTANT FLOW (m^3/s)	ACCUM. CONSTANT FLOW (m^3/s)	TOTAL FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
SWM POND 1																				
STREET 'I'	MH1	MH2	6.05	0.72	4.36	4.36	95.5	1.155			1.155	181.4	0.50	900	1.28	2.01	20.00	1.50	21.50	90%
STREET 'I'	MH2	MH3	18.11	0.72	13.04	17.40	91.6	4.425			4.425	133.5	0.50	1200x1800 (BOX)	5.95	2.75	21.50	0.81	22.31	74%
STREET 'I'	MH3	MH5	17.10	0.72	12.31	29.71	89.6	7.395			7.395	234.0	0.50	1200x2400 (BOX)	8.50	2.95	22.31	1.32	23.63	87%
STREET 'I'	MH5	MH6	7.11	0.72	5.12	34.83	86.6	8.377			8.377	160.0	0.50	1500x2400 (BOX)	11.69	3.25	23.63	0.82	24.45	72%
STREET 'I'	MH6	MH8	12.30	0.72	8.86	43.68	84.8	10.292			10.292	334.6	0.50	1500x2400 (BOX)	11.69	3.25	24.45	1.72	26.17	88%
STREET 'I'	MH8	MH9				43.68	81.3	9.871			9.871	25.3	0.40	1500x2400 (BOX)	10.46	2.91	26.17	0.15	26.31	94%
OUTLET 1	MH9	HW1	3.18	0.72	2.29	45.97	81.1	10.353			10.353	20.9	0.30	1500x3000 (BOX)	11.94	2.65	26.31	0.13	26.45	87%
POND 2A																				
STREET 'EEE'	MH50	MH51	1.08	0.63	0.68	0.68	95.5	0.180			0.180	136.8	0.50	450	0.20	1.27	20.00	1.80	21.80	90%
STREET 'HH'	MH51	MH52				0.68	90.8	0.172			0.172	128.8	0.50	450	0.20	1.27	21.80	1.69	23.49	85%
	MH52	MH53	2.70	0.63	1.70	2.38	86.9	0.575			0.575	57.0	0.50	750	0.79	1.78	23.49	0.53	24.03	73%
	MH53	MH36	2.50	0.63	1.58	3.96	85.7	0.942			0.942	97.8	0.50	900	1.28	2.01	24.03	0.81	24.84	74%
SWM POND 2B																				
STREET 'Y'	MH40	MH41	3.90	0.75	2.93	2.93	95.5	0.776			0.776	244.0	0.50	825	1.02	1.90	20.00	2.14	22.14	76%
STREET 'JJ'	MH41	MH43	11.68	0.75	8.76	11.69	90.0	2.922			2.922	230.0	0.50	1350	3.77	2.64	22.14	1.45	23.60	77%
STREET 'JJ'	MH43	MH44				11.69	86.7	2.813			2.813	75.5	0.50	1350	3.77	2.64	23.60	0.48	24.07	75%
STREET 'JJ'	MH44	MH45	12.04	0.75	9.03	20.72	85.6	4.927			4.927	169.2	1.00	1350	5.34	3.73	24.07	0.76	24.83	92%
KING STREET	MH45	MH46				20.72	84.0	4.835			4.835	52.9	1.00	1350	5.34	3.73	24.83	0.24	25.07	91%
	MH46	MH47				20.72	83.5	4.807			4.807	89.0	1.00	1350	5.34	3.73	25.07	0.40	25.46	90%
	MH47	HW2B				20.72	82.7	4.761			4.761	105.2	0.50	1650	6.44	3.01	25.46	0.58	26.05	74%
SWM POND 2A																				
STREET 'VV'	MH30	MH31	3.23	0.63	2.03	2.03	95.5	0.540			0.540	183.6	1.00	600	0.61	2.17	20.00	1.41	21.41	88%
STREET 'VV'	MH31	MH32	8.90	0.63	5.61	7.64	91.8	1.949			1.949	186.0	1.30	975	2.56	3.42	21.41	0.91	22.31	76%
STREET 'VV'	MH32	MH33	4.33	0.63	2.73	10.37	89.6	2.581			2.581	181.5	1.30	1050	3.11	3.60	22.31	0.84	23.16	83%
STREET 'VV'	MH33	MH34	5.26	0.63	3.31	13.68	87.7	3.332			3.332	225.0	1.30	1200	4.45	3.93	23.16	0.95	24.11	75%
STREET 'Y'	MH34	MH35				13.68	85.5	3.252			3.252	50.1	0.40	1500	4.47	2.53	24.11	0.33	24.44	73%
STREET 'Y'	MH35	MH36				13.68	84.8	3.225			3.225	60.2	0.40	1500	4.47	2.53	24.44	0.40	24.84	72%
PARK	MH36	MH37				17.64	84.0	4.117			4.117	90.0	0.40	1650	5.76	2.70	24.84	0.56	25.39	71%
PARK	MH37	MH38				17.64	82.9	4.061			4.061	41.8	0.40	1650	5.76	2.70	25.39	0.26	25.65	70%
PARK	MH38	MH39				17.64	82.4	4.036			4.036	148.9	0.40	1650	5.76	2.70	25.65	0.92	26.57	70%
OUTLET 2A	MH39	HW2A	5.87	0.27	1.58	19.22	80.6	4.303			4.303	69.0	0.40	1650	5.76	2.70	26.57	0.43	27.00	75%

Urbantech Consulting, A Division of Leighton-Zec Ltd.
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www.urbantech.com

URBANTECH®

STORM SEWER DESIGN SHEET

10 Year Storm

Macville Argo

Town of Caledon

PROJECT DETAILS

Project No: 15-458
Date: 11-May-23
Designed by: E.L.
Checked by: S.H.

DESIGN CRITERIA

Min. Diameter =	**300**	**mm**	**Rainfall Intensity =**	**A / (Tc+B)^c**
Mannings 'n'=	**0.013**			
Starting Tc =	**20**	**min**	**A =**	**2221**
			B =	**12**
Factor of Safety =	**10**	**%**	**c =**	**0.908**

NOMINAL PIPE SIZE USED

STREET	FROM MH	TO MH	AREA (ha)	RUNOFF COEFFICIENT "R"	'AR'	ACCUM. 'AR'	RAINFALL INTENSITY (mm/hr)	FLOW (m^3/s)	CONSTANT FLOW (m^3/s)	ACCUM. CONSTANT FLOW (m^3/s)	TOTAL FLOW (m^3/s)	LENGTH (m)	SLOPE (%)	PIPE DIAMETER (mm)	FULL FLOW CAPACITY (m^3/s)	FULL FLOW VELOCITY (m/s)	INITIAL Tc (min)	TIME OF CONCENTRATION (min)	ACC. TIME OF CONCENTRATION (min)	PERCENT FULL (%)
CATCHMENT 101																				
STREET 'A'	CONT.	MH301	2.28				232.6		0.148	0.148	0.148									
STREET 'A'	MH301	MH302	3.69	0.78	2.88	2.88	95.5	0.763		0.148	0.911	115.0	1.00	750	1.11	2.52	20.00	0.76	20.76	82%
STREET 'A'	CONT.	MH302	3.15				232.6		0.205	0.205	0.205									
STREET 'A'	MH302	MH303	2.69	0.78	2.10	4.98	93.5	1.292		0.353	1.645	100.6	1.00	900	1.81	2.85	20.76	0.59	21.35	91%
	CONT.	MH303	1.35				232.6		0.088	0.088	0.088									
	MH303	MH304	1.47	0.78	1.15	6.12	92.0	1.564		0.441	2.005	98.3	0.50	1200	2.76	2.44	21.35	0.67	22.02	73%
	MH304	EX				6.12	90.3	1.536		0.441	1.977	22.7	0.50	1200	2.76	2.44	22.02	0.16	22.18	72%
CATCHMENT 102																				
STREET 'D'	CONT.	MH400	2.00				232.6		0.220	0.220	0.220									
	MH400	MH401	0.95	0.70	0.67	0.67	95.5	0.176		0.220	0.396	100.5	1.00	600	0.614	2.17	20.00	0.77	20.77	65%
	CONT.	MH401	1.09				232.6		0.120	0.120	0.120									
	MH401	MH402	1.00	0.70	0.70	1.37	93.4	0.354		0.340	0.694	55.0	0.50	750	0.787	1.78	20.77	0.51	21.29	88%
	CONT.	MH404	1.25				232.6		0.138	0.138	0.138									
	MH404	MH402	1.11	0.70	0.78	0.78	95.5	0.206		0.138	0.344	52.0	0.50	600	0.434	1.54	20.00	0.56	20.56	79%
	CONT.	MH402	0.70				232.6		0.077	0.077	0.077									
	MH402	HW400	0.90	0.70	0.63	2.77	92.1	0.709		0.554	1.264	80.5	0.50	975	1.585	2.12	21.29	0.63	21.92	80%
CATCHMENT 103																				
	CONT.	MH500	2.15				232.6		0.168	0.168	0.168									
	MH500	MH503	1.05	0.82	0.86	0.86	95.5	0.228		0.168	0.396	101.1	0.50	675	0.594	1.66	20.00	1.01	21.01	67%
	CONT.	MH502	7.66				232.6		0.597	0.597	0.597									
	MH502	MH503	2.45	0.82	2.01	2.01	95.5	0.533		0.597	1.130	21.1	0.50	900	1.280	2.01	20.00	0.17	20.17	88%
	MH503	HW500				2.87	92.8	0.740		0.765	1.505	98.1	0.50	1050	1.931	2.23	21.01	0.73	21.75	78%
WETLAND 3																				
	MH20B	MH21B					95.5		0.081	0.081	0.081	46.1	0.50	375	0.124	1.12	20.00	0.68	20.68	65%
	MH21B	MH22B					93.7			0.081	0.081	10.0	0.50	375	0.124	1.12	20.68	0.15	20.83	65%
	MH22B	MH23B					93.3			0.081	0.081	96.1	0.50	375	0.124	1.12	20.83	1.43	22.26	65%
	MH23B	MH3					89.7			0.081	0.081	23.7	0.50	375	0.124	1.12	22.26	0.35	22.61	65%
WETLAND 5																				
	MH1B	MH2B	1.10	0.75	0.83	0.83	95.5	0.219			0.219	157.5	0.40	525	0.272	1.26	20.00	2.09	22.09	80%
	MH2B	HW5				0.83	90.1	0.207			0.207	124.8	0.40	525	0.272	1.26	22.09	1.66	23.74	76%
WETLAND 6																				
STREET 'EE'	MH10B	MH11B	0.50	0.75	0.38	0.38	95.5	0.099			0.099	201.5	0.40	375	0.111	1.00	20.00	3.34	23.34	90%
STREET 'EE'	MH11B	MH12B	0.40	0.75	0.30	0.68	87.2	0.164			0.164	196.7	0.40	450	0.180	1.13	23.34	2.89	26.24	91%
STREET 'EE'	MH12B	MH13B		0.75		0.68	81.2	0.152			0.152	21.7	0.40	450	0.180	1.13	26.24	0.32	26.56	84%
	MH13B	MH14B				0.68	80.6	0.151			0.151	30.3	0.40	450	0.180	1.13	26.56	0.45	27.00	84%
	MH14B	HW6				0.68	79.8	0.150			0.150	33.6	0.40	450	0.180	1.13	27.00	0.49	27.49	83%

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APPENDIX 4
Stormwater Management
Disk Available Upon Request for Detailed Output

URBANTECH®

SWM DESIGN CALCULATIONS - POND
HYRDO-0: Contributing Drainage Area and Land Use

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 2023-05-11

Prepared by: J.P.O
Checked by: S.H.

POND 1	From	To	Area [ha]	Runoff Coefficient	Imperviousness %IMP=100 X (C-0.2)/0.7	Imperviousness %IMP= (C-0.05)/0.009	Design Requirement		
							Conveyance	Quantity	Quality
Total Drainage Area to HW1			65.14	0.74	76.7	76.3	•	•	•
Pond Block			4.34	0.55	50.0	55.6	•	•	•
Total Drainage Area (Quality Control Only)			**69.48**	**0.73**	**75.0**	75.0			
Total Drainage Area (Quantity Control Only)			**69.48**	**0.73**	**75.0**	75.0			
Total Drainage Area to Pond			**69.48**	**0.73**	**75.0**	75.0	**69.48**	**69.48**	**69.48**

URBANTECH

SWM POND DESIGN CALCULATION - POND
SWMF-1 TARGET SUMMARY

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 11-May-23

Prepared by: J.P.O
Checked by: S.H.

POND 1

Design Target

Wet Pond *(Per MOE Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level	Water Quality Storage Vol	Extended Detention	Permanent Pool
(%)	m^3/ha	m^3/ha	m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210
Interpolated Storage Requirement			
75.0%	233	40	**193**

	Area [ha]	IMP%
Total Contributing Area	69.48	75%
Quantity Control Only	69.48	75%
Quality Control Only	69.48	75%

URBANTECH®

SWM POND DESIGN CALCULATIONS
SWMF-3: Sediment Forebay Sizing

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 11-May-23

Prepared by: JPO
Checked by: SH

POND 1

*Equalization pipe will be approximately sized at detailed design

	Drainage Area (ha)	Runoff Coefficient
HW1	65.14	0.74

Settling Calcs (MOECC 2003, Wet Pond)

$Dist_R = (rQ_p/V_s)^{0.5}$ *(MOECC Eq'n 4.5)*

Parameter	HW1	Description
r =	3.0	*Proposed length-to-width ratio of forebay*
Q_p =	0.050	*Proposed Extended Detention Release Rate (m3/s)*
V_s =	0.0003	*Settling velocity (0.0003 m/s most cases)*
$Dist_R$ =	22	*Forebay Length Required (m)*
$Dist_P$ =	141	*Forebay Length Provided (m)*

HW1	**SUFFICIENT FOREBAY LENGTH PROVIDED.**

Note: Forebay should not exceed one-third of pond surface area

Minor and Major system flow approximation (VO6)			
	Area (ha)	Q5 (m^3/s)	Q100 (m^3/s)
HW1	65.14	8.33	12.78

Dispersion Length (MOECC 2003, Wet Pond)

$Dist_R = 8*Q/d/V_r$ *(MOECC Eq'n 4.6)*

Parameter	HW1	Description
Q	8.33	*Minor inlet flowrate (m^3/s)*
d	2.00	*Depth of permanent pool in forebay (m)*
V_r	0.5	*Desired velocity of forebay (m/s)*
$Dist_R$	67	*Dispersion Length Required (m)*
$Dist_P$	141	*Dispersion Length Provided (m)*

HW1	**SUFFICIENT FOREBAY LENGTH PROVIDED**

URBANTECH®

VO6 Model Results - Pond 1

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 2023-05-11

Prepared by: J.P.O
Checked by: S.H

Pond Level	Elevation	Target Flows	Post Development Flows	Volume
			Pond	
		m^3/s	m^3/s	(m^3)
ED	263.45	-	0.050	12,626
2	263.59	0.449	0.449	16,475
5	263.76	0.683	0.683	21,510
10	263.99	0.843	0.843	28,332
25	264.16	1.060	1.060	33,588
50	264.28	1.232	1.232	37,431
100	264.41	1.396	1.396	41,200
Regional	265.52	-	5.512	78,017
Maintenance Road	266.30	-	-	106,079

URBANTECH®

SWM DESIGN CALCULATIONS - POND
HYRDO-0: Contributing Drainage Area and Land Use

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 2023-05-11

Prepared by: JPO
Checked by: SH

Pond 2A	From	To	Area [ha]	Runoff Coefficient	Imperviousness %IMP=100 X (C-0.2)/0.7	Imperviousness %IMP= (C-0.05)/0.009	Design Requirement		
							Conveyance	Quantity	Quality
Catchment 105 to Pond			21.61	0.76	80.0	78.9	•	•	•
Catchment 105 greater than 5mm			5.79	0.80	85.0	82.8	•	•	•
Pond Block			3.73	0.55	50.0	55.6	•	•	•
Total Drainage Area (Quality Control Only)			**31.13**	**0.74**	**77.3**	76.8			
Total Drainage Area (Quantity Control Only)			**31.13**	**0.74**	**77.3**	76.8			
Total Drainage Area to Pond			**31.13**	**0.74**	**77.3**	76.8	**31.13**	**31.13**	**31.13**

URBANTECH

SWM POND DESIGN CALCULATION - POND
SWMF-1 TARGET SUMMARY

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 11-May-23

Prepared by: J.P.O
Checked by: S.H

POND 2A

Design Target

Wet Pond *(Per MOE Stormwater Management Planning and Design Manual 2003, Table 3.2)*

Impervious Level	Water Quality Storage Vol	Extended Detention	Permanent Pool
(%)	m^3/ha	m^3/ha	m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210
Interpolated Storage Requirement			
76.8%	236	40	**196**

	Area [ha]	IMP%
Total Contributing Area	31.13	77%
Quantity Control Only	31.13	77%
Quality Control Only	31.13	77%

*Emergency flow target is the larger of the 100-Year uncontrolled and Regional Storm event

URBANTECH®

SWM POND DESIGN CALCULATIONS
SWMF-3: Sediment Forebay Sizing

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 11-May-23

Prepared by: J.P.O
Checked by: S.H.

POND 2A

*Equalization pipe will be approximately sized at detailed design

	Drainage Area (ha)	Runoff Coefficient
HW1	27.40	0.76

Settling Calcs (MOECC 2003, Wet Pond)

$Dist_R = (rQ_p/V_s)^{0.5}$ *(MOECC Eq'n 4.5)*

Parameter	HW1	Description
r =	3.0	*Proposed length-to-width ratio of forebay*
Q_p =	0.020	*Proposed Extended Detention Release Rate (m3/s)*
V_s =	0.0003	*Settling velocity (0.0003 m/s most cases)*
$Dist_R$ =	14	*Forebay Length Required (m)*
$Dist_P$ =	115	*Forebay Length Provided (m)*

HW1	**SUFFICIENT FOREBAY LENGTH PROVIDED.**

Note: Forebay should not exceed one-third of pond surface area

Minor and Major system flow approximation (from VO6)		
	Area (ha)	Q10 (m^3/s)
HW1	27.40	3.98

Dispersion Length (MOECC 2003, Wet Pond)

$Dist_R = 8*Q/d/V_r$ *(MOECC Eq'n 4.6)*

Parameter	HW1	Description
Q	3.98	*Minor inlet flowrate (m^3/s)*
d	2.00	*Depth of permanent pool in forebay (m)*
V_r	0.5	*Desired velocity of forebay (m/s)*
$Dist_R$	32	*Dispersion Length Required (m)*
$Dist_P$	115	*Dispersion Length Provided (m)*

HW1	**SUFFICIENT FOREBAY LENGTH PROVIDED**

URBANTECH®

VO6 Model Results - Pond 2A

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 2023-05-11

Prepared by: J.P.O
Checked by: S.H

Pond Level	Achieved Elevation	Target Flows	Post Development Flows			Volume
			Pond	Uncontrolled	Total	
		m^3/s	m^3/s	m^3/s	m^3/s	(m^3)
ED	261.27	-	0.02	0.158	0.18	5,119
2	261.38	0.22	0.09	0.13	0.22	7,300
5	261.50	0.34	0.19	0.15	0.34	9,742
10	261.65	0.42	0.25	0.17	0.42	12,739
25	261.76	0.53	0.34	0.19	0.53	15,146
50	261.84	0.62	0.41	0.20	0.61	16,889
100	261.92	0.70	0.48	0.21	0.69	18,607
Regional	262.94	-	1.57	0.18	1.75	41,261
Maintenance Road	264.00	-	-	-	-	67,986

URBANTECH®

SWM DESIGN CALCULATIONS - POND
HYRDO-0: Contributing Drainage Area and Land Use

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 2023-05-11

Prepared by: JPO
Checked by: SH

Pond 2B	From	To	Area [ha]	Runoff Coefficient	Imperviousness %IMP=100 X (C-0.2)/0.7	Imperviousness %IMP= (C-0.05)/0.009	Design Requirement		
							Conveyance	Quantity	Quality
Catchment 106			25.91	0.75	79.0	78.1	•	•	•
King Street			2.30	0.76	80.0	78.9	•	•	•
Development South of King Street			3.65	0.76	80.0	78.9	•	•	•
Pond Block			2.05	0.55	50.0	55.6	•	•	•
Total Drainage Area (Quality Control Only)			**33.91**	**0.74**	**77.4**	76.9			
Total Drainage Area (Quantity Control Only)			**33.91**	**0.74**	**77.4**	76.9			
Total Drainage Area to Pond			**33.91**	**0.74**	**77.4**	76.9	**33.91**	**33.91**	**33.91**

URBANTECH®

SWM POND DESIGN CALCULATION - POND
SWMF-2 TARGET SUMMARY

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 11-May-23

Prepared by: JPO
Checked by:

POND 2B

Design Target

Wet Pond *(Per MOE Stormwater Management Planning and Design Manual 2003, Table 3.2*

Impervious Level	Water Quality Storage Vol	Extended Detention	Permanent Pool
(%)	m^3/ha	m^3/ha	m^3/ha
35%	140	40	100
55%	190	40	150
70%	225	40	185
85%	250	40	210
Interpolated Storage Requiremen			
76.9%	236	40	**196**

	Area [ha]	IMP%
Total Contributing Area	33.91	77%
Quantity Control Only	33.91	77%
Quality Control Only	33.91	77%

URBANTECH®

SWM POND DESIGN CALCULATIONS
SWMF-3: Sediment Forebay Sizing

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 11-May-23

Prepared by: JPO
Checked by: SH

POND 2B

*Equalization pipe will be approximately sized at detailed design

	Drainage Area (ha)	Runoff Coefficient
HW1	31.86	0.75

Settling Calcs (MOECC 2003, Wet Pond)

$Dist_R = (rQ_p/V_s)^{0.5}$ *(MOECC Eq'n 4.5)*

Parameter	HW1	Description
r =	3.0	*Proposed length-to-width ratio of forebay*
Q_p =	0.026	*Proposed Extended Detention Release Rate (m3/s)*
V_s =	0.0003	*Settling velocity (0.0003 m/s most cases)*
$Dist_R$ =	16	*Forebay Length Required (m)*
$Dist_P$ =	83	*Forebay Length Provided (m)*

HW1	**SUFFICIENT FOREBAY LENGTH PROVIDED.**

Note: Forebay should not exceed one-third of pond surface area

Minor and Major system flow approximation (from VO6)			
	Area (ha)	Q10 (m^3/s)	Q100 (m^3/s)
HW1	31.86	4.38	6.67

Dispersion Length (MOECC 2003, Wet Pond)

$Dist_R = 8*Q/d/V_r$ *(MOECC Eq'n 4.6)*

Parameter	HW1	Description
Q	4.38	*Minor inlet flowrate (m^3/s)*
d	1.50	*Depth of permanent pool in forebay (m)*
V_r	0.5	*Desired velocity of forebay (m/s)*
$Dist_R$	47	*Dispersion Length Required (m)*
$Dist_P$	83	*Dispersion Length Provided (m)*

HW1	**SUFFICIENT FOREBAY LENGTH PROVIDED**

URBANTECH®

VO6 Model Results - Pond 2B

Project Name: Macville Community
Municipality: Town of Caledon
Project No.: 15-458
Date: 2023-05-11

Prepared by: J.P.O
Checked by: S.H

Pond Level	Elevation	Target Flows	Post Development Flows			Volume
			Pond	Uncontrolled	Total	
		m^3/s	m^3/s	m^3/s	m^3/s	(m^3)
ED	257.91	-	0.03	0.166	0.19	6,323
2	258.06	0.25	0.13	0.12	0.25	8,674
5	258.22	0.38	0.21	0.16	0.38	11,459
10	258.43	0.47	0.24	0.23	0.47	15,001
25	258.59	0.58	0.31	0.27	0.58	17,783
50	258.71	0.68	0.38	0.31	0.68	19,823
100	258.82	0.77	0.43	0.34	0.77	21,806
Regional	259.92	-	2.56	0.25	2.81	42,618
Maintenance Road	261.20	-	-	-	-	69,743

Culvert Report

Node 6 - Catchment 103 Post-Dev Flow = 1.67

Invert Elev Dn (m)	=	259.0200
Pipe Length (m)	=	18.7500
Slope (%)	=	1.2001
Invert Elev Up (m)	=	259.2450
Rise (mm)	=	800.0
Shape	=	Box
Span (mm)	=	800.0
No. Barrels	=	1
n-Value	=	0.013
Culvert Type	=	Rectagular Concrete
Culvert Entrance	=	Tapered inlet throat
Coeff. K,M,c,Y,k	=	0.475, 0.667, 0.0179, 0.97, 0.2

Embankment

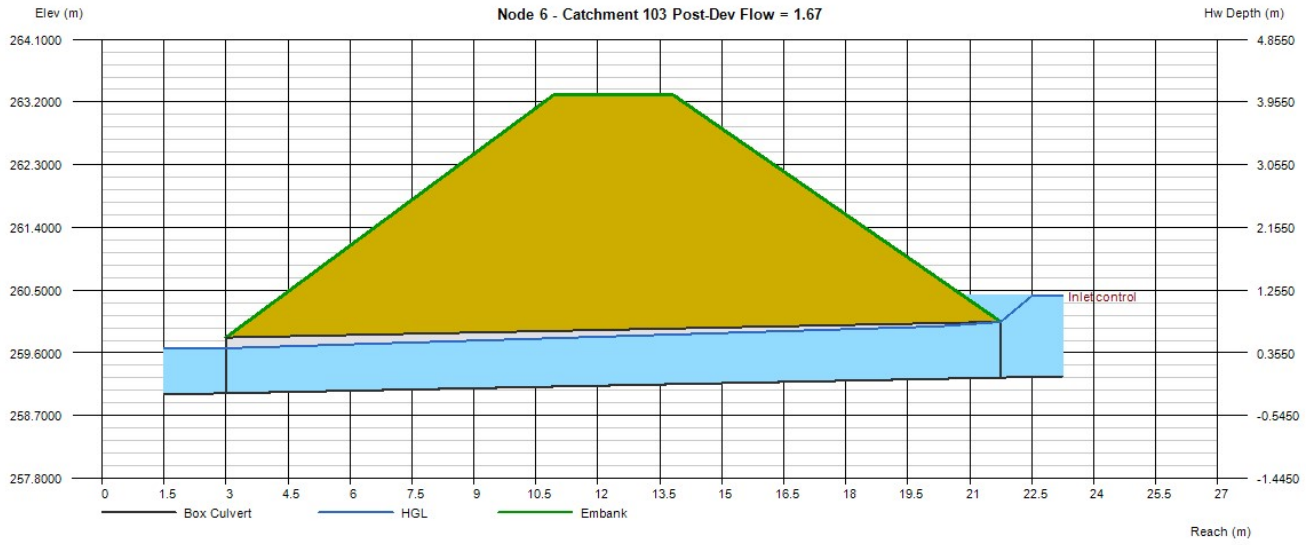
Top Elevation (m)	=	263.3000
Top Width (m)	=	2.9000
Crest Width (m)	=	50.0000

Calculations

Qmin (cms)	=	1.6700
Qmax (cms)	=	1.6700
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	1.6700
Qpipe (cms)	=	1.6700
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	3.2305
Veloc Up (m/s)	=	2.7377
HGL Dn (m)	=	259.6662
HGL Up (m)	=	260.0075
Hw Elev (m)	=	260.4160
Hw/D (m)	=	1.4638
Flow Regime	=	Inlet Control



Culvert Report

Node 7 - Catchment 102 Post-Dev Flow = 1.12

Invert Elev Dn (m)	=	260.9600
Pipe Length (m)	=	10.6000
Slope (%)	=	0.8000
Invert Elev Up (m)	=	261.0448
Rise (mm)	=	900.0
Shape	=	Circular
Span (mm)	=	900.0
No. Barrels	=	1
n-Value	=	0.022
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

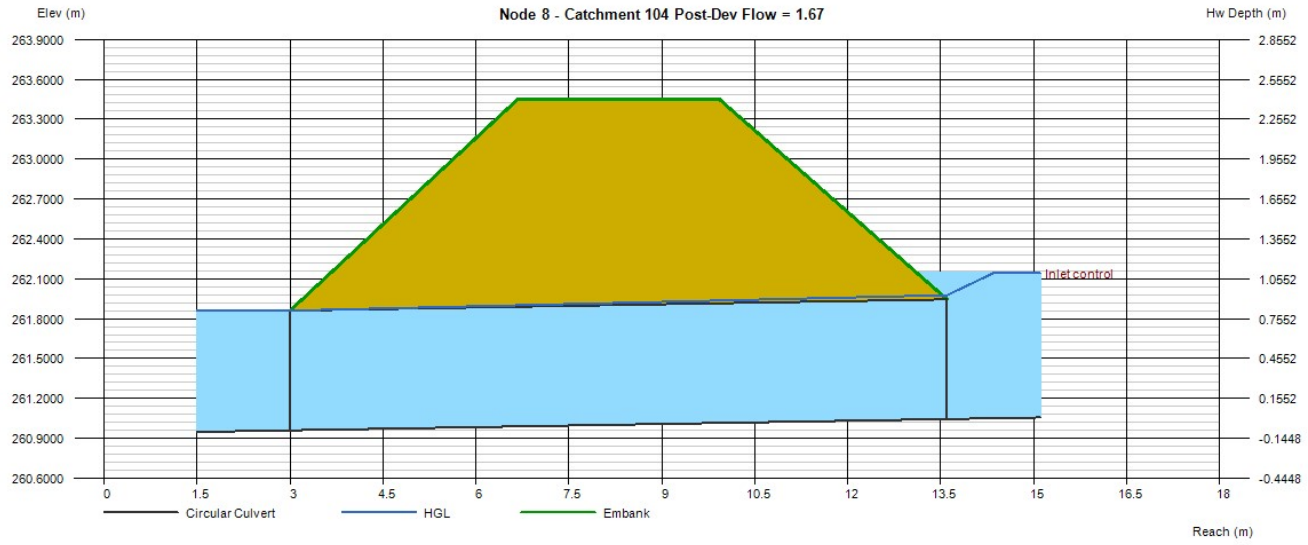
Top Elevation (m)	=	263.4500
Top Width (m)	=	3.2500
Crest Width (m)	=	50.0000

Calculations

Qmin (cms)	=	1.1200
Qmax (cms)	=	1.1200
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	1.1200
Qpipe (cms)	=	1.1200
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	1.7609
Veloc Up (m/s)	=	1.7605
HGL Dn (m)	=	261.8600
HGL Up (m)	=	261.9763
Hw Elev (m)	=	262.1425
Hw/D (m)	=	1.2197
Flow Regime	=	Inlet Control



Culvert Report

Node 8 - Catchment 101 Post-Dev Flow = 1.83

Invert Elev Dn (m)	=	259.5200
Pipe Length (m)	=	16.5000
Slope (%)	=	0.8001
Invert Elev Up (m)	=	259.6520
Rise (mm)	=	700.0
Shape	=	Circular
Span (mm)	=	700.0
No. Barrels	=	2
n-Value	=	0.022
Culvert Type	=	Circular Corrugate Metal Pipe
Culvert Entrance	=	Projecting
Coeff. K,M,c,Y,k	=	0.034, 1.5, 0.0553, 0.54, 0.9

Embankment

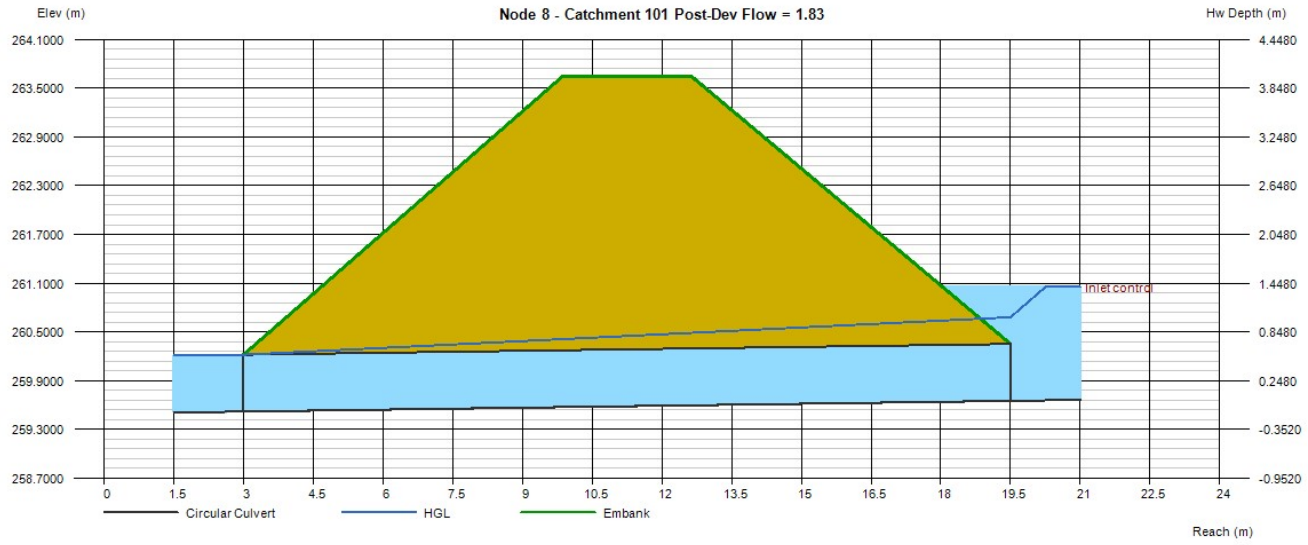
Top Elevation (m)	=	263.6500
Top Width (m)	=	2.7500
Crest Width (m)	=	50.0000

Calculations

Qmin (cms)	=	1.8300
Qmax (cms)	=	1.8300
Tailwater Elev (m)	=	Normal

Highlighted

Qtotal (cms)	=	1.8300
Qpipe (cms)	=	1.8300
Qovertop (cms)	=	0.0000
Veloc Dn (m/s)	=	2.3776
Veloc Up (m/s)	=	2.3776
HGL Dn (m)	=	260.2200
HGL Up (m)	=	260.6808
Hw Elev (m)	=	261.0528
Hw/D (m)	=	2.0011
Flow Regime	=	Inlet Control



Silva Cell Sizing Spreadsheet

Catchment Number	Drainage Area	ROW Length
LN PARK	6.82 ha	1125.3 m
ROW1	0.18 ha	152.5 m
ROW2	0.15 ha	128.0 m
ROW3	0.06 ha	44.0 m
ROW4	0.2 ha	139.5 m
ROW5	0.18 ha	125.5 m
ROW6	0.06 ha	44.0 m
ROW7	0.2 ha	143.2 m
ROW8	0.33 ha	235.0 m
ROW9	0.28 ha	197.5 m
ROW10	0.2 ha	141.0 m
ROW11	0.25 ha	200.9 m
ROW12	0.18 ha	132.0 m
ROW13	0.11 ha	81.0 m
ROW 24	0.13 ha	90.5 m
ROW14	0.11 ha	81.0 m
ROW15	0.13 ha	90.5 m
ROW16	0.13 ha	91.4 m
ROW17	0.06 ha	41.5 m
ROW18	0.11 ha	93.1 m
ROW19	0.14 ha	101.5 m

Treatment Volume	Silva Cell Height	Ponding Depth	Soil Media Depth	Drainage Layer Depth (below system)	Silva Cell Footprint	Required Cell Length
1705 m^3	3x 1.092 m	0.3 m	0.792 m	0.3 m	**3000.7** m^2	983.8 m
45 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**90.2** m^2	123.2 m
37.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**75.2** m^2	102.7 m
15 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**30.1** m^2	41.1 m
50 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**100.2** m^2	136.9 m
45 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**90.2** m^2	123.2 m
15 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**30.1** m^2	41.1 m
50 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**100.2** m^2	136.9 m
82.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**165.4** m^2	225.9 m
70 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**140.3** m^2	191.7 m
50 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**100.2** m^2	136.9 m
62.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**125.3** m^2	171.1 m
45 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**90.2** m^2	123.2 m
27.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**55.1** m^2	75.3 m
32.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**65.1** m^2	89.0 m
27.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**55.1** m^2	75.3 m
32.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**65.1** m^2	89.0 m
32.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**65.1** m^2	89.0 m
15 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**30.1** m^2	41.1 m
27.5 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**55.1** m^2	75.3 m
35 m^3	2x 0.784 m	0.3 m	0.484 m	0.3 m	**70.2** m^2	95.8 m

Ponding	Soil Media	Drainage Layer (in system)	Drainage Layer (below system)	Net Soil Volume
810.2 m^3	534.7 m^3	0.0 m^3	360.1 m^3	2138.9 m^3
24.4 m^3	9.8 m^3	0.0 m^3	10.8 m^3	39.3 m^3
20.3 m^3	8.2 m^3	0.0 m^3	9.0 m^3	32.7 m^3
8.1 m^3	3.3 m^3	0.0 m^3	3.6 m^3	13.1 m^3
27.1 m^3	10.9 m^3	0.0 m^3	12.0 m^3	43.7 m^3
24.4 m^3	9.8 m^3	0.0 m^3	10.8 m^3	39.3 m^3
8.1 m^3	3.3 m^3	0.0 m^3	3.6 m^3	13.1 m^3
27.1 m^3	10.9 m^3	0.0 m^3	12.0 m^3	43.7 m^3
44.6 m^3	18.0 m^3	0.0 m^3	19.8 m^3	72.0 m^3
37.9 m^3	15.3 m^3	0.0 m^3	16.8 m^3	61.1 m^3
27.1 m^3	10.9 m^3	0.0 m^3	12.0 m^3	43.7 m^3
33.8 m^3	13.6 m^3	0.0 m^3	15.0 m^3	54.6 m^3
24.4 m^3	9.8 m^3	0.0 m^3	10.8 m^3	39.3 m^3
14.9 m^3	6.0 m^3	0.0 m^3	6.6 m^3	24.0 m^3
17.6 m^3	7.1 m^3	0.0 m^3	7.8 m^3	28.4 m^3
14.9 m^3	6.0 m^3	0.0 m^3	6.6 m^3	24.0 m^3
17.6 m^3	7.1 m^3	0.0 m^3	7.8 m^3	28.4 m^3
17.6 m^3	7.1 m^3	0.0 m^3	7.8 m^3	28.4 m^3
8.1 m^3	3.3 m^3	0.0 m^3	3.6 m^3	13.1 m^3
14.9 m^3	6.0 m^3	0.0 m^3	6.6 m^3	24.0 m^3
18.9 m^3	7.6 m^3	0.0 m^3	8.4 m^3	30.6 m^3

ROW20	0.06 ha	41.5	m	15 m^3	2x	0.784 m	0.3 m	0.484 m	0.3 m	**30.1** m^2	41.1 m	8.1 m^3	3.3 m^3	0.0 m^3	3.6 m^3	13.1 m^3
ROW21	0.06 ha	44.0	m	15 m^3	2x	0.784 m	0.3 m	0.484 m	0.3 m	**30.1** m^2	41.1 m	8.1 m^3	3.3 m^3	0.0 m^3	3.6 m^3	13.1 m^3
ROW22	0.03 ha	23.3	m	7.5 m^3	2x	0.784 m	0.3 m	0.484 m	0.3 m	**15.0** m^2	20.5 m	4.1 m^3	1.6 m^3	0.0 m^3	1.8 m^3	6.5 m^3
ROW23	0.12 ha	85.0	m	30 m^3	2x	0.784 m	0.3 m	0.484 m	0.3 m	**60.1** m^2	82.1 m	16.2 m^3	6.5 m^3	0.0 m^3	7.2 m^3	26.2 m^3
TOTAL	10.28 ha	3672.6	m	2570 m^3						**4734.5** m^2	3352.4 m					

Notes
* required length assumes 60% effective length of silva cells in ROW and 100% length in parks
* volumes have been reduced by 10% to account for the Silva Cell structures
* void space for soil media is calculated at 25%
* void space for drainage layer (crushed rock) is calculated at 40%
* volume for drainage layer below system is not reduced by 10% because its under the system vs in the system

APPENDIX 5
DS Consultants Geotechnical and Hydrogeological Reports

REPORT ON

PRELIMINARY GEOTECHNICAL INVESTIGATION
PROPOSED DEVELOPMENT
MACVILLE COMMUNITY
SECONDARY PLAN AREA
THE GORE ROAD AND KING STREET
BOLTON, ONTARIO

PREPARED FOR:

Caledon Community Partners

Project No: 20-169-104
Date: October 24, 2022

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APPENDICES

1. INTRODUCTION

DS Consultants Ltd. (DS) was retained by Caledon Community Partners to prepare a preliminary geotechnical investigation report for the proposed development, Macville Community, in connection with a Preliminary Framework Plan to establish the Macville Community Secondary plan area, located at The Gore Road and King Street in Bolton, Ontario.

It is understood that the proposed development will consist of a residential subdivision (single-family dwellings and low to mid-rise residential buildings), stormwater ponds, and a possible transit hub.

The proposed site grades and lowest finished floor elevations for the proposed structures were not known to us at the time of writing this report.

The purpose of this geotechnical investigation was to obtain information about the subsurface conditions at boreholes locations and from the findings in the boreholes to make engineering recommendations pertaining to the geotechnical design of underground utilities, roads and to comment on the foundation conditions for the building construction.

This report deals with geotechnical issues only. Findings in the hydrogeological investigation by DS are documented under separate cover.

This report is provided on the basis of the terms of reference presented above and, on the assumption, that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for Caledon Community Partners and its architect and designers. Third party use of this report without DS consent is prohibited.

2. BACKGROUND INFORMATION

In 2020, DS was retained by Bolton Option 3 Landowners Group to complete a preliminary geotechnical, environmental, and hydrogeological studies for the proposed development at the Site (Macville Community, in connection with a LOPA application to establish the Macville Community Secondary plan area, located at The Gore Road and King Street in Bolton, Ontario).

DS carried out the geotechnical investigation field work at the subject site during the period of July 27 to 31, 2020, consisting of sixteen (16) boreholes (BH20-1 to BH20-16) which were drilled to depths ranging from 6.7 to 11.3 m below the existing grade at the locations shown on the Borehole Location Plan, **Drawing 1**. The Borehole logs are attached in **Appendix A** of this report

Monitoring wells were installed in all boreholes, except Boreholes BH20-8, BH20-10, and BH20-13 to monitor long-term stabilized groundwater levels.

In addition, laboratory tests such as moisture content for all soil samples, grain size distribution (sieve and hydrometer analyses) and Atterberg Limit tests were carried out, by DS Consultants on selected samples.

3. FIELD AND LABORATORY WORK

DS has now been retained by Caledon Community Partners to carry out a subsequent preliminary geotechnical investigation for the Macville Community Preliminary Framework Plan to establish the Macville Community Secondary plan area.

A total of fourty-two (42) sampled boreholes (BH22-1 through BH22-42), see **Drawing 1** for borehole locations) were drilled by DS in 2022, to depths ranging from 8.1 to 13.6 m below the existing grade. **Additionally, three boreholes, (BH22-36A, BH22-39A and BH22-40A) were augered to depths of 4.0 to 7.6 m without soil sampling beside BH22-36, BH22-39, and BH22-40, respectively, for installation of shallow monitoring wells.**

Boreholes were drilled with solid and hollow stem continuous flight augers equipment by a drilling sub-contractor under the direction and supervision of DS personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to the DS laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples from geotechnical boreholes were tested for moisture contents. Grain size analyses of sixteen (16) selected soil samples were conducted and the results are presented on **Drawings 47 to 49**. Atterberg Limits testing was conducted on selected seven (7) soil sample and results are presented on the respective borehole logs and on **Drawings 50 and 51**.

Water level observations were made during and upon completion of drilling. Twenty-four (24) monitoring wells of 50mm diameter were installed in Boreholes BH22-1, BH22-3, BH22-5, BH22-10, BH22-11, BH22-13, BH22-14, BH22-15, BH22-17, BH22-20, BH22-22, BH22-25, BH22-27, BH22-28, BH22-29, BH22-32, BH22-33, BH22-35, BH22-36A, BH22-39, BH22-39A, BH22-40, BH22-40A and

BH22-42, for the long-term groundwater levels monitoring. The elevation surveying of the boreholes was undertaken by DS Consultants Ltd. personnel, using the differential GPS unit.

4. SUBSURFACE CONDITIONS

4.1 Soil Conditions

The borehole location plan is shown on **Drawing 1**. General notes on sample description are provided on **Drawing 1A**. The subsurface conditions in the boreholes (BH22-1 to BH22-42) by DS were generally consistent with the findings from the 2020 investigation and are presented in the individual borehole logs presented on **Drawings 2 to 46**. Logs of the previous boreholes (BH20-1 to BH20-16) are attached in **Appendix A**.

Topsoil and Fill/(Possible Fill) Material and Weathered/Disturbed Native Material:

A surficial layer of topsoil, ranging from 200 to 550 mm in thickness, was observed at the surface of all the boreholes, except BH20-4.

Fill or weathered/disturbed native material (possible fill in BH22-9) consisting of clayey silt to silty clay and sandy silt to silty sand soils were detected in all the boreholes below the topsoil layer and extended to approximate depths ranging from 0.4 to 2.3 m below the existing ground surface. In the area of Borehole BH20-4, the fill layer was overlain by a concrete slab, approximately 300 mm in thickness. In the area of Borehole BH22-9, the weathered/disturbed clayey silt to silty clay with inclusions of gravel, organic staining, and no readily apparent structure. Hence, this layer may be possible fill. The fill and weathered/disturbed native materials were generally brown to dark brown in color and contained and trace of organics, gravel, and rootlets.

SPT 'N' values measured in fill and weathered/disturbed native materials ranged from 3 to 15 blows per 300mm penetration, indicating a soft to stiff consistency or loose to compact state. The moisture content of this moist to wet fill and weathered/disturbed native soil layer ranged from 5 to 24%.

The type/quantity and extent of the existing weathered/disturbed soil or fill, and topsoil layers must be explored by further test pit investigation prior to/during excavation.

Clayey Silt/Silty Clay Till:

Clayey silt to silty clay till deposit was encountered below the weathered/disturbed soil layer in Boreholes BH22-1 to BH22-5, BH22-8, BH22-10, BH22-11, BH22-14 to BH22-35, BH22-37 to BH22-40 and BH22-42, below a thin sandy silt to silty sand deposit in BH22-36 and BH22-41, below the fill layer in BH20-1 to BH20-3 and BH20-5 to BH20-16, and extended to approximate depths ranging from 1.5 to 12.8 m below existing ground surface, i.e., the maximum explored depth of Boreholes

BH22-14, BH22-16, BH22-17, BH22-19, BH22-20, BH22-21, BH22-24, BH22-34, BH22-36, BH22-37 to BH22-41, BH20-6, BH20-7, BH20-10, BH20-14 and BH20-15. The clayey silt till was interrupted by a cohesionless silt deposit between 4.6 and 6.1 m depth in BH22-24 and by a gravelly sand deposit between 1.8 and 10.7 m depths in BH22-34. This, in general, moist to very moist clayey to silty clay till deposit was brown to grey in color and contained some sand too sandy and trace to some gravel. SPT 'N' values measured in the clayey silt to silty clay till ranged from 8 to more than 50 blows per 300 mm of penetration, indicating a stiff to hard consistency (generally very stiff to hard). The moisture content of this clayey silt to silty clay till deposit ranged from 7 to 26%.

Grain size analyses of seven (7) soil samples (BH22-1/SS3, BH22-14/SS7, BH22-21/SS5, BH22-25/SS3, BH22-36/SS3 and SS8, and BH22-41/SS6) obtained from the current drilling program, were conducted and the results are presented on **Drawings 47 and 48.** Grain size analyses of one (1) silty clay till soil sample (BH20-7/SS4) was conducted during 2020 drilling program and the results are presented on the logs in **Appendix A**. The fractions of soil particles of clayey silt to silty clay tills are presented as follows:

Clay: 20 to 37%
Silt: 38 to 51%
Sand: 11 to 31%
Gravel: 1 to 15%

Atterberg limits tests of above noted seven (7) soil samples (BH22-1/SS3, BH22-14/SS7, BH22-21/SS5, BH22-25/SS3, BH22-36/SS3 and SS8, and BH22-41/SS6) were conducted. The results are shown on the borehole logs and on **Drawings 50 and 51.** The results of BH20-7/SS4) are shown on the log in **Appendix A.** They are summarized as follows:

Liquid limit (W_L): 19 to 33%
Plastic limit (W_P): 12 to 26%
Plasticity index (PI): 7 to 16

Clayey Silt:

A thin layer of clayey silt with trace sand was encountered below the clayey silt/silty clay till deposit in BH22-18 and extended to a depth of 7.6 m below existing ground surface. SPT 'N' value measured in the clayey silty was in the order of 29 blows per 300 mm of penetration, indicating a very stiff consistency. The moisture content of this clayey silt layer was 10 %.

Sandy Silt Till:

A cohesionless sandy silt till deposit was encountered below the clayey silt to silty clay till deposit in Boreholes BH22-1, BH22-3, BH22-10, BH22-11, BH22-15, BH22-22, BH22-23, BH22-28, and BH22-

33, below a sand deposit in BH22-2 and 22-42, and below the clayey silt layer in BH22-18. The sandy silt till deposit extended to depths ranging from 3.1 to 12.8 m below existing ground surface, i.e., the maximum depth explored in BH22-2, BH22-15, BH22-18, BH22-23, and BH22-42.

SPT 'N' values measured within this sandy silt till deposit ranged from 21 to more than 50 blows per 300 mm of penetration, indicating compact to very dense relative density. The moisture content of this moist to wet sandy silt till deposit ranged from 8 to 23%.

Grain size analyses of two (2) sandy silt till samples soil samples (BH22-10/SS5 and BH22-18/SS8) w obtained from the current drilling program, were conducted and the results are presented on **Drawings 47 and 49,** with the following fractions:

Clay: 11%
Silt: 40 to 64%
Sand: 24 to 38%
Gravel: 1 to 11%

Cohesionless Deposits of silt, sandy Silt to Silty Sand, Sand, Sand and Gravel, and Sandy Gravel/Gravelly Sand:

Cohesionless deposits of silt, sandy silt to silty sand, sand, sand and gravel and sandy gravel/gravelly sand soils with inclusions of clay and varying amounts of gravel was encountered underlying or embedded in the clayey silt to silty clay till and/or sandy silt till deposits in Boreholes BH22-1, BH22-2, BH22-3, BH22-4, BH22-5, BH22-8, BH22-10, BH22-11, BH22-24, BH22-25, BH22-26, BH22-27, BH22-28, BH22-29 to BH22-35, BH22-42, BH20-1 to BH20- 3, BH20-5, BH20-8, BH20-9, BH20-11 to BH20-13 and BH20-16, below the weathered/disturbed soils in BH22-6, BH22-7, BH22-9, BH22-12, BH22-13, BH22-36 and BH22-41, and below the fill in BH20-4. These cohesionless deposits extended to depths ranging from 0.8 to 13.6 m below existing ground surface, i.e., the maximum depths explored in BH22-1, BH22-3, BH22-4, BH22-5, BH22-6, BH22-7, BH22-8, BH22-9, BH22-10, BH22-11, BH22-12, BH22-13, BH22-25 to BH22-33, BH22-35, BH20-1 to BH20- 3, BH20-5, BH20-8, BH20-9, BH20-11 to BH20-13 and BH20-16.

SPT 'N' values measured within this sandy, silty deposits ranged from 7 to more than 50 blows per 300 mm of penetration, indicating loose to very dense relative density. Disturbance of the split spoon samples noted at depth in BH22-27 and BH22-30 is likely attributable to heaving of the water bearing silty sand/sand. The moisture content of this moist to wet sands and silts ranged from 6 to 27%.

This moist to wet deposit was brown to grey in color and layers of sand and gravel and/or sandy gravel/gravelly sand materials were encountered in the area of Borehole BH22-33 between depths of 6.1 and 9.1 m, BH22-34 between depths of 1.8 and 10.7 m, and BH20-16, between depths of 1.5

and 3.3 m and between depths of 4.5 and 6.2 m. SPT 'N' values measured within this sand and gravel and sandy gravel/gravelly sand layers ranged from 24 to 66 blows per 300mm of penetration, indicating compact to very dense relative density.

Grain size analyses of seven (7) cohesionless, silt, sandy silt to silty sand, sand and sandy gravel/gravelly sand soil samples (BH22-13/SS6 and SS9, BH22-25/SS9, BH22-28/SS7, BH22-32/SS10, BH22-33/SS8 and BH22-34/SS6) obtained from the current drilling program were conducted and the results are presented on **Drawings 47 to 49.** Grain size analyses of eight (8) cohesionless, silt, sandy silt to silty sand, and sand and gravel soil samples sample (BH20-5/SS8, BH20-8/SS4 and SS7, BH20-11/SS8, BH20-12/SS7, BH20-16/SS4, SS6 and SS7) was conducted during 2020 drilling program and the results are presented on the logs in **Appendix A**. The fractions of soil particles of cohesionless sands, silts and gravel are presented as follows:

Clay:	2 to 18%
Silt:	10 to 94%
Sand:	1 to 82%
Gravel:	0 to 52%

4.2 Groundwater Conditions

During drilling and upon completion of drilling, groundwater was observed at variable depths, or the bottom of boreholes was wet in some boreholes while some boreholes remained dry.

Groundwater levels in the monitoring wells installed at twenty-four (24) borehole locations from current drilling program (BH22-1, BH22-3, BH22-5, BH22-10, BH22-11, BH22-13, BH22-14, BH22-15, BH22-17, BH22-20, BH22-22, BH22-25, BH22-27, BH22-28, BH22-29, BH22-32, BH22-33, BH22-35, BH22-36A, BH22-39, BH22-39A, BH22-40, BH22-40A) measured on September 8, 2022 and in thirteen (13) borehole locations from 2020 drilling program (BH1 to BH7, BH9, BH 11, BH 12 and BH14 to BH 16) on August 6, 2020, September 8, 2020 and October 22, 2020. The groundwater level measurements are provided below on **Table 1**. **It should be noted that the groundwater level in BH22-32 was at a depth of 0.32 m below existing ground surface, which would indicate that the sand deposit encountered below 10.7 m depth in the borehole is under a hydrostatic condition in that area of the site.**

Table 1: Summary of Groundwater Level Measurements in Monitoring Wells

BH No.	Ground Surface Elevation (m)	Date of Drilling	Date of Observation	Depth of Groundwater (m)	Elevation of Groundwater (m)
BH 22- 1	279.0	Aug 31, 2022	Sept 8, 2022	3.40	275.60
BH 22-3	274.8	Aug 30, 2022	Sept 8, 2022	1.42	273.40
BH 22-5	279.7	Aug 31, 2022	Sept 8, 2022	6.53	273.20
BH 22-10	269.9	Sept 6, 2022	Sept 8, 2022	1.27	268.60
BH 22-11	272.9	Sept 6, 2022	Sept 8, 2022	2.78	269.30
BH 22-13	276.1	Sept 1, 2022	Sept 8, 2022	6.03	270.10
BH 22-14	271.4	Sept 1, 2022	Sept 8, 2022	11.9	259.50
BH 22-15	270.2	Aug 29, 2022	Sept 8, 2022	1.93	268.30
BH 22-17	269.0	Aug 29, 2022	Sept 8, 2022	2.26	266.70
BH 22-20	269.4	Aug 29, 2022	Sept 8, 2022	2.51	266.90
BH 22-22	267.8	Aug 26, 2022	Sept 8, 2022	1.43	266.30
BH 22-25	270.9	Aug 25, 2022	Sept 8, 2022	3.10	267.80
BH 22-27	271.2	Aug 19, 2022	Sept 8, 2022	4.25	266.90
BH 22-28	270.9	Aug 19, 2022	Sept 8, 2022	4.81	266.10
BH 22-29	268.9	Aug 23, 2022	Sept 8, 2022	3.80	265.10
BH 22-32	265.3	Aug 23, 2022	Sept 8, 2022	0.32	265.00
BH 22-33	268.0	Aug 25, 2022	Sept 8, 2022	4.29	263.70
BH 22-35	266.1	Aug 24, 2022	Sept 8, 2022	2.23	263.80
BH 22-36A	261.8	Sept 7, 2022	Sept 19, 2022	2.70	259.10
BH 22-39A	266.6	Sept 7, 2022	Sept 19, 2022	1.92	264.70
BH 22-40	264.0	Sept 7, 2022	Oct 18, 2022	3.03	260.90
BH 22-40A	263.9	Sept 7, 2022	Sept 19, 2022	1.92	262.00

BH22-42	266.7	Sept. 6, 2022	Oct 18, 2022	2.05	264.60
BH 20- 1	279.8	July 27, 2020	Aug 6, 2020	4.10	275.70
			Sept 8, 2020	4.24	275.56
			Oct 22, 2020	4.51	275.29
BH 20-2	278.8	July 27, 2020	Aug 6, 2020	6.12	272.68
			Sept 8, 2020	6.36	272.44
			Oct 22, 2020	6.48	272.32
BH 20-3	278.6	July 27, 2020	Aug 6, 2020	6.0	272.60
			Sept 8, 2020	Dry	Dry
			Oct 22, 2020	Dry	Dry
BH 20-4	277.1	July 27, 2020	Aug 6, 2020	3.77	273.33
			Sept 8, 2020	3.90	273.20
			Oct 22, 2020	Not accessible	Not accessible
BH 20-5	273.0	July 29, 2020	Aug 6, 2020	2.78	270.22
			Sept 8, 2020	3.09	269.91
			Oct 22, 2020	3.38	269.62
BH 20-6	271.0	July 28, 2020	Aug 6, 2020	6.71	264.23
			Sept 8, 2020	1.15	269.85
BH 20-7	261.7	July 31, 2020	Aug 6, 2020	Dry	Dry
			Sept 8, 2020	6.52	255.18
			Oct 22, 2020	3.40	258.30
BH 20-9	274.1	July 28, 2020	Aug 6, 2020	4.43	269.67
			Sept 8, 2020	4.72	269.38
			Oct 22, 2020	4.97	269.13
BH 20-11	270.1	July 29, 2020	Aug 6, 2020	5.42	264.68
			Sept 8, 2020	5.37	264.73

			Oct 22, 2020	5.33	264.77
BH 20-12	264.9	July 31, 2020	Aug 6, 2020	0.20	264.70
			Sept 8, 2020	0.10	264.80
			Oct 22, 2020	0.14	264.76
BH 20-14	267.7	July 30, 2020	Aug 6, 2020	3.32	264.38
			Sept 8, 2020	3.43	264.27
			Oct 22, 2020	3.59	264.11
BH 20-15	264.1	July 30, 2020	Aug 6, 2020	2.41	261.69
			Sept 8, 2020	2.33	261.77
			Oct 22, 2020	2.41	261.69
BH 20-16	265.5	July 31, 2020	Aug 6, 2020	2.12	263.38
			Sept 8, 2020	2.27	263.23
			Oct 22, 2020	2.49	263.01

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations in response to major weather events. Further groundwater level readings in the monitoring wells are recommended.

5. DISCUSSION AND RECOMMENDATIONS

5.1 SITE GRADING & ENGINEERED FILL

It is understood that the Macville Community Secondary Plan, once approved through a Local Official Plan Amendment (LOPA), will serve as a framework for future development of the Subject Lands for the purposes of accommodating residential and mixed-use development with related complimentary uses, such as open spaces, parks, trails, commercial uses, the Bolton GO Station, the Natural Heritage System (NHS), and stormwater management facilities. This report must be updated when the site plan is approved. Recommendations for different components will be provided in the updated geotechnical report.

For the residential subdivision with residential lots/buildings, underground services, roads, and driveways, it is recommended that all fill to be placed for grading purposes be constructed as engineered fill to provide competent subgrade below house foundations, roads, boulevards, etc.

Prior to placement of engineered fill, all existing surficial organic material/topsoil, fill materials, weathered/disturbed native soils and soils containing topsoil/organics should be stripped to expose the undisturbed inorganic native subgrade. The exposed subgrade should then be proof rolled with a heavy sheepsfoot roller to identify weak areas. Any weak or excessively wet zones identified during proof-rolling should be sub-excavated and replaced with compacted competent material to establish stable and uniform conditions. Prior to placement of engineered fill, the subgrade should be inspected and approved by a geotechnical engineer.

General guidelines for the placement and preparation of engineered fill are presented in **Appendix B**. Bearing capacity values of 150 kPa at SLS and 225 kPa at ULS can be used on engineered fill, provided that all requirements in **Appendix B** are adhered to. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential.

The following is a recommended procedure for an engineered fill:

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS. Without this confirmation no responsibility for the performance of the structure can be accepted by DS. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DS engineer prior to placement of fill.

5. The approved engineered fill must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Granular Fill preferred. Engineered fill should not be placed (where it will support footings) during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be

aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur.

6. Full-time geotechnical inspection by DS during placement of engineered fill is required. Work cannot commence or continue without the presence of the DS representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. Bearing capacity values of 150 kPa at SLS and 225 kPa at ULS may be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested, and footings should be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

10. After completion of the pad a second contractor may be selected to install footings. All excavations must be backfilled under full time supervision by DS to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DS.

11. After completion of compaction, the surface of the pad must be protected from disturbance from traffic, rain, and frost.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

The native soils and any existing fill materials free from organics/topsoil and organics to be excavated from cut-areas are considered suitable for re-use as engineered fill, provided that their moisture contents at the time of construction are at or near optimum. Clayey tills are likely to be excavated in cohesive chunks or blocks and will be difficult to compact. They should be pulverized and placed in thin layers not exceeding 200 mm and compacted using heavy equipment suitable for these types of soils (e.g., heavy sheepsfoot compactors).

5.2 ROADS/PAVEMENTS

The investigation has shown that the predominant subgrade soil, after stripping the topsoil and any other organic and otherwise unsuitable subsoil, will generally consist of clayey silt/silty clay till and silt to sandy silt soils.

Based on the above and assuming that traffic usage will be residential, the following minimum pavement thickness is recommended for the roads to be constructed within the development.

For Minor Local or Local Roads

40 mm HL3 Asphaltic Concrete
65 mm HL8 Asphaltic Concrete
150 mm Granular 'A'
300 mm Granular 'B'

For Collector Roads

40 mm HL3 Asphaltic Concrete
90 mm HL8 Asphaltic Concrete
150 mm Granular 'A'
450 mm Granular 'B'

Roads and driveway pavements/aprons should be constructed as per the Town of Bolton standards.

The site subgrade and weather conditions (i.e., if wet) at the time of construction may necessitate the placement of thicker granular sub-base layer and/or geogrid in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

5.2.1 STRIPPING, SUB-EXCAVATION AND GRADING

The site should be stripped of all organic soil/topsoil, fill materials, weathered/disturbed soils, soils containing topsoil/organics or otherwise unsuitable soils to the full depth of the roads, both in cut and fill areas. Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Owing to the clayey (i.e., impervious) nature of some subsoils at the site, proper cambering and allowing the water to escape towards the sides (where it can be removed by means of subdrains)

is considered to be beneficial for this project. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material may need to be used.

Any fill required for re-grading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in thin layers and compacted to at least 98% of its SPMDD. The compaction of the new fill should be checked by frequent field density tests.

5.2.2 CONSTRUCTION

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200 mm (uncompacted thickness) and should be compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading, and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field density tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

5.2.3 DRAINAGE

The installation of full-length subdrains on all roads is recommended. The subdrains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards catch-basins. As discussed in Section 5.2.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards subdrains or other interceptors.

5.3 WATERMAIN/SEWERS

As a part of the site development, a network of new watermains, storm and sanitary sewers will be constructed. It is assumed that the trenches will generally be within 4 to 5 m below the existing grade.

The type of material for the pipes to be used for watermains or sewers will be the choice of civil engineer.

5.3.1 TRENCHING

The boreholes show that below the existing topsoil and fill, the trenches will be predominantly dug through the silty clay till, sand and gravel and sandy silt to silt soils. Groundwater seepage within the clayey silt/silty clay till is expected to be slow to moderate and manageable by gravity drainage and pumping from filtered sumps. Positive dewatering will be required for any excavations in cohesionless soils (sand, gravel, silt, sandy silt to silty sand and sandy silt till) below groundwater table. The groundwater table must be lowered to at least 1.0 m below the excavation base.

Excavations in fill and native soils can be carried out with heavy hydraulic backhoe.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, fill material and weathered/disturbed native soils can be classified as Type 3 Soil above groundwater and Type 4 Soil below groundwater table or in perched water condition. The very stiff to hard clayey silt/silty clay (till) can be classified as Type 2 Soil above groundwater and Type 3 Soil below groundwater. Cohesionless soils (sand, gravel, silt, sandy silt to silty sand, sandy silt till) can be classified as Type 3 soil above groundwater and as Type 4 below groundwater.

The sides of excavations in the natural strata can be expected to be temporarily stable at relatively steep side slopes above the groundwater table for short periods of time but they should be cut back at slopes no steeper than 1V:1.5H in fill material and 1V:1H in clayey silt/silty clay till in order to comply with the safety regulations. The OHSA stipulates that any excavation deeper than 1.2m must be shored or cut back at a slope of 1V:1H or flatter, depending on the soil type.

It should be noted that the till is a non-sorted sediment and therefore contain cobble and boulders. Possible large obstructions such as buried concrete pieces are also anticipated in the fill material. Provisions must be made in the excavation contract for the removal of possible boulders in the till and obstructions in the fill material.

5.3.2 BEDDING

Subject to design grades, the sewer pipes will predominantly be laid within the native soils and/or engineered fill which will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The bedding should conform to the current Ontario Provincial Standard specifications (OPSS 401/OPSD 802) and/or standards set by the local municipality.

The recommended minimum thickness of granular bedding below the invert of the pipes is 150 mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or in accordance with local standards or if wet or weak subgrade conditions or fill materials are

encountered at the trench base level. The bedding material should consist of well graded granular material such as Granular 'A' or equivalent.

After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300 mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly graded bedding material.

5.3.3 BACKFILLING OF TRENCHES

Based on visual and tactile examination, the on-site excavated inorganic native soils are considered to be suitable for re-use as backfill in the service trenches provided their moisture contents at the time of construction are within 2 percent of their optimum moisture content. Significant aeration of the wet excavated soils will be required prior to their use as backfill material.

The clayey deposits especially when its consistency is hard is likely to be excavated in cohesive chunks or blocks and will be difficult to compact in confined areas. For use as backfill, the clayey material will have to pulverized and placed in thin layers. The clayey soils will have to be compacted using heavy equipment suitable for these soils which may be difficult to operate in the narrow confines of the trenches. Unless the clayey materials are properly pulverized and compacted in sufficiently thin lifts post-construction settlements could occur. Their use in narrow trenches such as laterals (where heavy compaction equipment cannot be operated) may not be feasible.

Selected inorganic fill and the native soils free from topsoil and organics can be used as general construction backfill where it can be compacted with sheep's foot type compactors. Loose lifts of soil, which are to be compacted, should not exceed 200 mm. Depending on the time of construction and weather, some excavated material may be too wet to compact and will require aeration prior to its use.

Imported granular fill, which can be compacted with handheld equipment, should be used in confined areas.

The excavated soils are not considered to be free draining. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used.

The backfill should be placed in maximum 200 mm thick layers at or near (±2%) their optimum moisture content and each layer should be compacted to at least 95% SPMDD. In the upper 1.5 m of the subgrade, underneath the road base, the compaction should be increased to 98% SPMDD.

Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

The on-site excavated soils and especially the clayey soils should not be used in confined areas (e.g., around catch-basins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of imported granular fill together with an appropriate frost taper would be preferable in confined areas and around structures, such as catch-basins.

It should be noted that the excavated soils are subject to moisture content increase during wet weather which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

The topsoil encountered at the site can be used for landscaping fill area to raise the grades. Topsoil cannot be reused as foundation or trench backfill material.

5.3.4 ANTI SEEPAGE COLLARS/TRENCH PLUGS

For pipes installed under the groundwater table, seepage between the trench backfill material and the trench wall may cause erosion of the backfill materials. it is recommended that nominal anti-seepage collars (maximum spacing 50 m) be provided to prevent erosion of the backfill materials. Anti seepage collar should not be located at pipe joint.

The anti-seepage collar may consist of a clay plug surrounding the sewer pipe. A typical clay plug will be about 1 m thick and extends laterally to a minimum distance of 0.5 m from the pipe circumference with a minimum of 0.3 m embedment into the shale or native sub-grade. Typical (not to scale) anti-seepage collar conceptual detail is provided on **Drawing 52.**

The on-site native clayey soils may be suitable for such purpose subject to additional sampling and testing.

5.3.5 THRUST BLOCKS AND JOINT RESTRAINTS

An allowable (or SLS) bearing resistance of 150 kPa and factored ULS bearing resistance of 225 kPa can be used in the design of thrust blocks constructed on undisturbed native soils or engineered fill.

5.4 FOUNDATION CONDITIONS

It is understood that the Macville Community Secondary Plan, once approved through a Local Official Plan Amendment (LOPA), will serve as a framework for future development of the Subject Lands for the purposes of accommodating residential and mixed-use development with related complimentary uses, such as open spaces, parks, trails, commercial uses, the Bolton GO Station, the Natural Heritage System (NHS), and stormwater management facilities. This report must be updated when the site plan is approved. Recommendations for different components will be provided in the updated geotechnical report.

5.4.1 Proposed Houses

It is understood that the proposed subdivision will consist of single-family homes (detached, townhomes, back-to-backs, and stacked) with one level of basement.

The native soils encountered in the boreholes are competent to support the proposed houses on conventional footings.

The spread and strip footings founded on the undisturbed native soils (below any fill or weathered/disturbed native soils) can be designed for a bearing capacity of 150 kPa at SLS (Serviceability Limit State), and for a factored geotechnical resistance of 225 kPa at ULS (Ultimate Limit State).

Subject to design grades, footing founding elevations, in the area of Borehole BH20-12 (2020 investigation), must be confirmed on site due to variable soil conditions. The footings might be lowered, or less bearing capacity be used.

In addition, the locally encountered silt, sandy silt to silty sand at the base of footings can be easily disturbed by construction activities. A concrete skim coat, about 50 mm in thickness, on the founding subgrade immediately after its approval might be required, on a case by case basis, to prevent its disturbance by construction activities.

Due to the difference in ground elevations and subject to design grades, should the proposed footings be founded above the competent native soils, then the proposed houses can also be supported by spread and strip footings founded on engineered fill for a bearing capacity of 150 kPa at the serviceability limit states (SLS) and for a factored geotechnical resistance of 225 kPa at the ultimate limit states (ULS), provided all requirements in Section 5.1 and in **Appendix B** are adhered to.

5.4.2 PROPOSED LOW TO MID-RISE RESIDENTIAL BUILDINGS

It is understood that low to mid-rise residential buildings (varying from 4 to 6 storey and up to probably 15 storey) are proposed to be erected in the vicinity of the GO station, the areas of boreholes BH22-36 to BH22-42 and BH20-10, BH20-11, BH20-14, and BH20-15 (2020 investigation). The proposed buildings will also include underground parking.

The design grades and number of floors/underground parking levels are not known at this stage. Therefore, our recommendations should be considered preliminary and will be revised when the proposed Site/Foundation plan becomes available.

Based on the provided recent information, it is understood that the number of floors could range as high as 15 storey structures in some locations, however, due to the variable soil conditions and the presence of less competent soils, the available soil bearing capacity information is not yet available to define the necessary geotechnical recommendations for such structures. Therefore, further location specific deep borehole investigation is required to investigate the subsurface soil conditions at greater depths and the need to utilize deep foundation alternative (if required) and or raft foundation and confirm the soil bearing capacities, subject to design loads.

In addition, settlement analyses will be required when the foundation plan/design loads areas available to evaluate/quantify the total and differential settlements.

Subject to design grades/loads, number of floors/levels of underground parking and based on the information from the above-mentioned boreholes, the following soil bearing capacities, as presented in Table 2, are available (which must be confirmed by further borehole investigation).

Table 2: Bearing Values and Founding Levels of conventional Footings in Native Soils

BH No.	Surface Elevation At Borehole (m)	Bearing Capacity at SLS (kPa)	Factored Geotechnical Resistance at ULS (kPa)	Minimum Depth below Existing Ground (m)	Founding Level At or Below Elevation (m)
BH22-36	261.7	150 200	225 300	1.0 2.3	260.7 259.4
BH22-37	265.1	200	300	1.2	263.9
BH22-38	262.7	150 250	225 375	1.1 1.8	261.6 260.9
BH22-39	266.5	250	375	1.7	264.8
BH22-40	265.1	200	300	1.1	264.0

BH22-41	264.0	150 200	225 300	1.1 2.5	262.9 261.5
BH22-42	266.7	200	300	1.1	265.6
BH20-10	268.3	200	300	2.0	266.3
BH20-11	270.1	250	375	1.2	268.9
BH20-14	267.7	150 250	225 375	1.2 2.5	266.5 265.2
BH20-15	264.1	200 150	300 225	2.0 5.0	262.1 259.1

5.4.3 GENERAL FOUNDATION NOTES

Foundations designed to the specified bearing capacities at the serviceability limit states (SLS) are expected to settle less than 25 mm total and 19 mm differential.

All footings exposed to seasonal freezing conditions must have at least 1.4 metres of soil cover for frost protection.

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

It should be noted that the recommended bearing capacities have been calculated by DS from the borehole information for the design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by DS to validate the information for use during the construction stage.

5.5 FLOOR SLAB

The floor slab can be supported on grade provided all organic materials/topsoil, fill, and surficial softened/disturbed native soils are removed and the base thoroughly proof rolled. The fill required to raise the grade can consist of inorganic soil, approved by this office, placed in shallow lifts, and compacted to 98 percent of Standard Proctor Maximum Dry Density (SPMDD). Where engineered fill is used to support the foundations, the floor slab can also be supported by engineered fill.

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab.

A perimeter and underfloor drainage system will be required around the exterior basement walls, as shown on **Drawing 53**.

5.6 EARTH PRESSURES

The lateral earth pressures acting on retaining walls or underground structures may be calculated from the following expression:

$$p = k(\gamma h + q)$$

where, p = Lateral earth pressure in kPa acting at depth h

K = Earth pressure coefficient, assumed to be 0.40 for vertical walls and horizontal backfill for permanent construction

γ = Unit weight of backfill, a value of 21 kN/m^3 may be assumed

h = Depth to point of interest in metres

q = Equivalent value of surcharge on the ground surface in kPa

The above expression assumes that the perimeter drainage system prevents the build up of any hydrostatic pressure behind the wall.

5.7 STORMWATER MANAGEMENT PONDS

The proposed stormwater management ponds which will be located at the west-central portion of the subject site.

The pond design grades are not available at this stage. Due to the variable soil conditions and the presence of different types of soils at different depths, recommendations will be provided at later stage including the clay liner recommendations, if required, when design information are available.

Based on the subsurface conditions encountered in boreholes BH22-13 and BH22-14 and subject to design grades, the soils at the pond sides and base after removing the existing weathered/disturbed native materials will consist of silty clay/clayey silt till, and silt to sandy silt. The groundwater levels measured in the monitoring wells within the pond areas ranged from 6.03 (BH22-13) to 11.9 m below the existing grade, corresponding to Elevations 259.5 and 270.1 m, in Boreholes BH22-13 and BH22-14, respectively.

Where the pond bottom and sides consist of cohesionless (sandy) soils, a clay liner will be required to retain water in the pond. The required thickness and uplift stability of the liner must be estimated and analyzed when the design information for the pond is available.

Dewatering system will be required for excavations below groundwater levels, subject to depth of excavations and type of soils encountered, to be confirmed during design stage.

Anti-seepage collars should be considered for outlet works that direct flow out of the SWM pond as these outlet works are subject to hydraulic heads directly from the pond. The provision of anti-seepage collars would increase the seepage path along the outlet works and therefore reduce the quantity of potential seepage.

6. GENERAL COMMENTS AND LIMITATIONS OF REPORT

DS Consultants Ltd. (DS) should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, DS will assume no responsibility for interpretation of the recommendations in the report.

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to DS at the time of preparation. Unless otherwise agreed in writing by DS, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial organic soil/topsoil or fill layers may vary markedly and unpredictably.

The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as

to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. DS accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report. We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DS CONSULTANTS LTD

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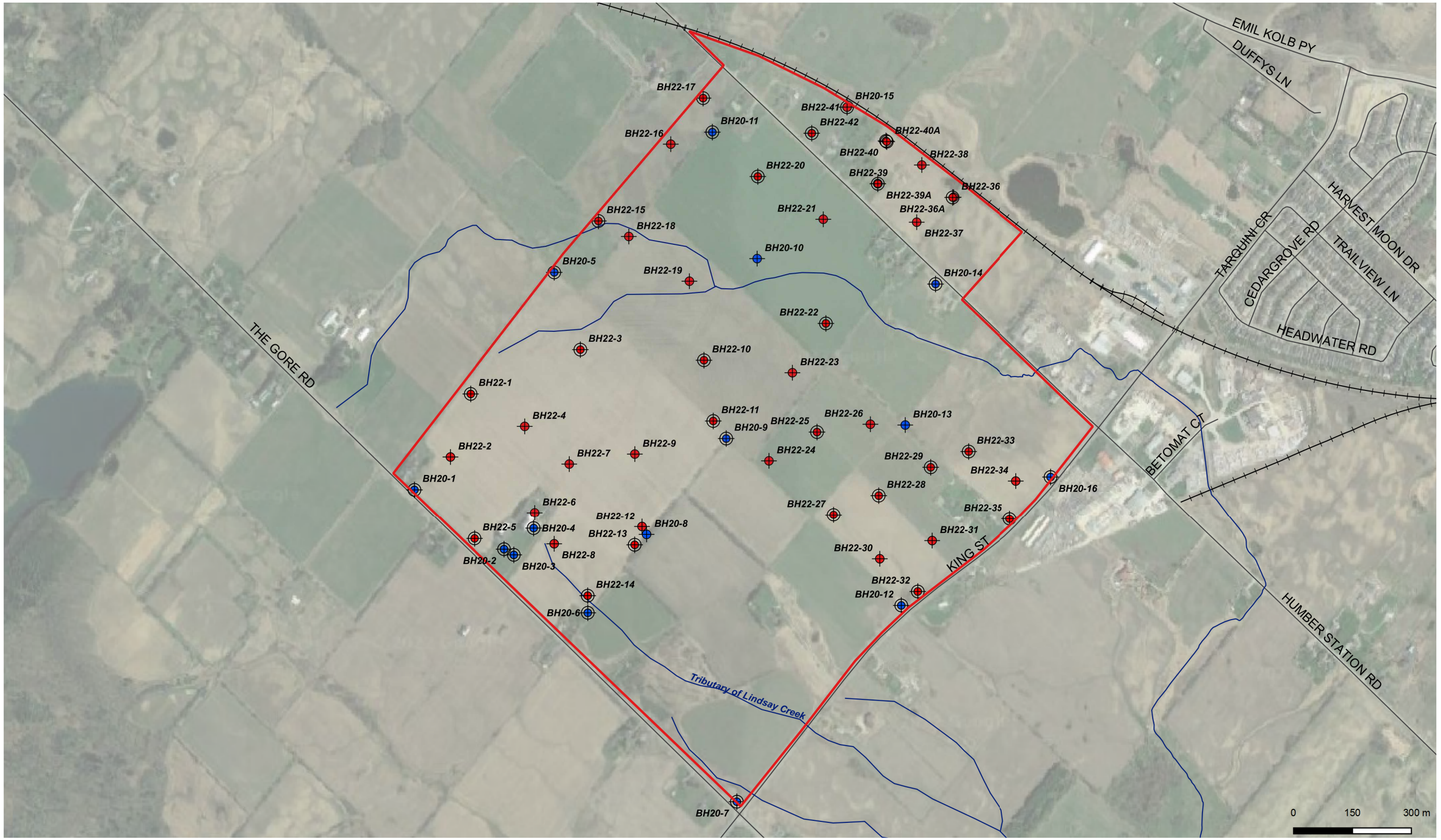
Senior Geotechnical Engineer

Fanyu Zhu, Ph.D., P.Eng.
Principal Engineer

Shabbir Bandukwala, M.Eng., P.Eng.
Principal Engineer

Drawings



Legend

- Approx Property Boundary
- Borehole
- Monitoring Well
- Borehole-2020
- Monitoring Well-2020

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Project: GEOTECHNICAL INVESTIGATION
The Gore Road and King Street, Caledon, ON

Title: **BOREHOLE AND MONITORING WELL LOCATIONS**

N

Client: CALEDON COMMUNITY PARTNERS

Size:	Approved By:	Drawn By:	Date:
11x17	O.B	S.Y	October 2022
Rev. 0	Scale: As Shown	Project No.: 20-169-104	Drawing No.: 1

Image/Map Source: *Google Satellite Image*

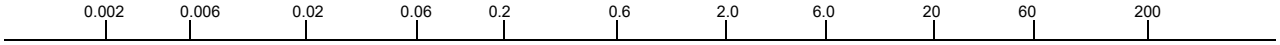
C:\0Sharon\20-169-100 Bolton Option 3 Lands\1-QGIS\GEO\Drawing 1 – Borehole and Monitoring Well Locations.qgs Oct-24 07:31

Drawing 1A: Notes On Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by DSCL also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

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LOG OF BOREHOLE BH22-1

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858060.2 E 597225.82

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-31-2022

REF. NO.: 20-169-104
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
279.0												
278.9 0.0	**TOPSOIL:** 300mm											
278.7 0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace sand, trace gravel, trace rootlets, brown, moist, stiff		1	SS	9		278					
278.2 0.8	**SILTY CLAY TO CLAYEY SILT TILL:** trace to some sand, trace gravel, brown, moist, very stiff to hard sandy silt till layer @2.3m		2	SS	24							
			3	SS	28		277					2 18 47 33
			4	SS	32		276					
			5	SS	31	▽						
	grey below 4.6m		6	SS	34		275	W. L. 275.6 m Sep 08, 2022				
272.7 6.3	**SANDY SILT TILL:** trace clay, trace gravel, grey, very moist, very dense		7	SS	65		274					
271.4 7.6	**SANDY SILT TO SILTY SAND:** trace clay, trace gravel, grey, wet, very dense		8	SS	78		273					
270.8 8.2	**END OF BOREHOLE:**						272					
	Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 8, 2022 3.4						271					

DS SOIL LOG-2021-FINAL 20-169-104 GEO COPY.GPJ DS.GDT 22-10-21

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES + 3, × 3: Numbers refer to Sensitivity ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-2

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857899.68 E 597174.15

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-31-2022

REF. NO.: 20-169-104
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
280.2							
279.9 0.0	**TOPSOIL:** 300mm		1	SS	8		280
0.3	**WEATHERED/DISTURBED**						
279.4	**NATIVE:** sandy silt, clayey, trace						
1 0.8	rootlets, trace gravel, brown, moist, loose		2	SS	13		279
278.7	**SILTY CLAY TO CLAYEY SILT**						
1.5	**TILL:** some sand to sandy, trace		3	SS	15		278
2	rootlets, trace gravel, brown, moist, stiff						
	SILTY SAND TO SANDY SILT:		4	SS	36		
3	trace clay, brown, moist, compact to dense						277
			5	SS	34		
4							276
	wet, trace gravel below 4.6m		6	SS	45		
5							275
6			7	SS	44		274
7							273
	grey below 7.8m		8	SS	35		
8							272
9	compact below 9.1m		9	SS	19		271
10							270
269.5							
10.7 11	**SAND:** some silt to silty, trace clay, grey, wet, compact		10	SS	16		269
12							
268.0							268
12.2	**SANDY SILT TILL:** some clay, trace gravel, grey, wet, very dense		11	SS	53		
267.4							
12.8	**END OF BOREHOLE:**						

Notes:
1) Water at depth of 4.5m during drilling.

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-3

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858172.91 E 597505.29

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-30-2022

REF. NO.: 20-169-104
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
274.8												
274.6	**TOPSOIL:** 250mm											
274.2 0.6	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace sand, trace gravel, trace rootlets, brown, moist, stiff		1	SS	9		274					
			2	SS	20							
	SILTY CLAY TO CLAYEY SILT TILL: trace sand, trace gravel, brown, moist, very stiff		3	SS	23	▽						
			4	SS	28		272					
271.6 3.2	**SANDY SILT TILL:** some clay to clayey, trace gravel, grey, moist, compact to dense		5	SS	30		271					
			6	SS	21		270					
			7	SS	28		269					
267.2							268					
7.6	**SANDY SILT:** trace clay, trace gravel, grey, wet, dense to very dense		8	SS	42		267					
			9	SS	59		266					
265.1												
9.7	**END OF BOREHOLE:**											

W. L. 273.4 m
Sep 08, 2022

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	1.42

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-4

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857977.59 E 597363.66

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-30-2022

REF. NO.: 20-169-104
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
279.8												
279.6	**TOPSOIL:** 200mm											
0.2	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace sand, trace gravel, trace rootlets, brown, moist, stiff		1	SS	9		279					
278.8												
1.0	**SILTY CLAY TO CLAYEY SILT TILL:** trace sand, trace gravel, brown, moist, very stiff to hard		2	SS	26							
2			3	SS	50/ 130mm		278					
277.5	sand pocket@1.5m											
2.3	**SAND:** trace to some silt, trace gravel, brown, moist, dense		4	SS	36		277					
3			5	SS	41							
4							276					
275.2												
4.6	**SANDY SILT TO SILT:** trace clay, brown, wet, compact to dense		6	SS	25		275					
5												
6			7	SS	39		274					
7							273					
8			8	SS	19		272					
9							271					
10			9	SS	41		270					
11							269					
268.5	grey below 10.7m		10	SS	45							
11.3	**END OF BOREHOLE:**											

Notes:
1) Water at depth of 4.6m during drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS CONSULTANTS LTD.
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LOG OF BOREHOLE BH22-5

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857690.79 E 597235.89

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-31-2022

REF. NO.: 20-169-104
ENCL NO.: 6

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
279.7 / 0.0	**TOPSOIL:** 320mm				
279.4 / 0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt, some sand to sandy, trace rootlets, trace gravel, brown, moist, stiff	1	SS	10	279
278.9 / 0.8	**SILTY CLAY TO CLAYEY SILT TILL:** trace sand, trace gravel, brown, moist, hard	2	SS	45	
		3	SS	30	278
		4	SS	37	277
276.6 / 3.1	**SANDY SILT:** trace clay, brown, moist, dense to very dense	5	SS	82	276
	wet below 4.6m	6	SS	46	275
273.6 / 6.1	**SILT:** some clay, trace sand, silty clay pockets, trace gravel, brown, wet, dense	7	SS	40	274
	W. L. 273.2 m Sep 08, 2022				
	some sand to sandy@7.6m	8	SS	48	272
271.5 / 8.2	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	6.53

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-6

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857757.24 E 597389.06

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-31-2022

REF. NO.: 20-169-104
ENCL NO.: 7

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
278.0												
0.0 / 277.6	**TOPSOIL:** 380mm		1	SS	9							
0.4 / 277.2	**WEATHERED/DISTURBED NATIVE:** sandy silt, trace clay, trace gravel, trace rootlets, brown, moist, loose											
0.8	**SILTY SAND TO SANDY SILT:** trace clay, brown, moist, compact to dense		2	SS	10		277					
			3	SS	25		276					
			4	SS	38							
			5	SS	45		275					
	wet below 4.6m		6	SS	33		274					
			7	SS	23		273					
			8	SS	19		272					0 51 46 3
			9	SS	18		271					
			10	SS	26		270					
	greyish brown below 12.2m		11	SS	31		269					
265.2							268					
12.8	**END OF BOREHOLE:** Notes: 1) Water at depth of 4.6m during drilling.						267					
							266					

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-7

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857881.68 E 597477

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-30-2022

REF. NO.: 20-169-104
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
279.8												
279.8	**TOPSOIL:** 300mm											
0.3 / 279.5	**WEATHERED/DISTURBED NATIVE:** silty clay, trace sand, trace rootlets, trace gravel, brown, moist, firm		1	SS	7		279					
0.8 / 279.0			2	SS	10							
1.5 / 278.3	**SANDY SILT:** some clay, brown, moist, compact		3	SS	24		278					
	SILT: some sand to sandy, trace clay, trace gravel, brown, very moist, compact to dense occasional silty clay pockets, wet below 2.3m		4	SS	31		277					
	silty clay layer@3.1m		5	SS	31							0 0 75 25
	grey below 4.6m		6	SS	39		276					
			7	SS	26		275					
			8	SS	43		274					
			9	SS	31		273					
			10	SS	32		272					
			11	SS	30		271					
267.0							270					
12.8	**END OF BOREHOLE:**						269					
	Notes: 1) Water at depth of 2.3m during drilling.						268					

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-8

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857677.07 E 597438.67

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep-01-2022

REF. NO.: 20-169-104
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
277.0												
277.0 / 0.0	**TOPSOIL:** 200mm											
0.2 / 276.2	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace sand, trace gravel, trace rootlets, brown, moist, stiff		1	SS	11		276					
1 0.8	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, very stiff		2	SS	17							
2 / 274.7			3	SS	26		275					
2.3	**SILT:** some sand to sandy, trace clay, trace gravel, brown, moist, dense to very dense		4	SS	65							
3			5	SS	60		274					
4							273					
	grey, wet below 4.6m		6	SS	51							
5							272					
6			7	SS	38		271					
7							270					
8			8	SS	34		269					
9 / 267.9							268					
9.1	**SILTY SAND TO SANDY SILT:** trace clay, grey to brown, wet, compact to dense		9	SS	24							
10							267					
11	brown, clayey silt pocket@10.7m		10	SS	48		266					
12							265					
264.2			11	SS	44							
12.8	**END OF BOREHOLE:** Notes: 1) Water at depth of 4.6m during drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-9

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857907.13 E 597643.95

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep-02-2022

REF. NO.: 20-169-104
ENCL NO.: 10

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
278.2								20 40 60 80 100	10 20 30			
278.0	**TOPSOIL:** 250mm											
0.3	**FILL:** clayey silt to silty clay, some sand to sandy, trace gravel, trace rootlets, organic staining, dark brown to brown, moist, firm to stiff (possible weathered/disturbed native)		1	SS	7		278					
1			2	SS	11		277					
2			3	SS	9		276					
275.9												
2.3	**SILT:** some sand to sandy, trace clay, brown, moist, dense to very dense		4	SS	31							
3			5	SS	53		275					
4							274					
	wet below 4.6m		6	SS	53		273					
5												
272.1												
6.1	**SANDY SILT TO SILTY SAND:** trace clay, brown, wet, dense		7	SS	42		272					
7							271					
8			8	SS	38		270					
9			9	SS	38		269					
268.1			10	SS	43							
10.1	**END OF BOREHOLE:** Notes: 1) Water at depth of 4.6m during drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-10

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858145.98 E 597819.82

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep-06-2022

REF. NO.: 20-169-104
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
269.9					
269.8 0.0	**TOPSOIL:** 280mm				
0.3	**WEATHERED/DISTURBED**	1	SS	8	
269.1	**NATIVE:** clayey silt to silty clay, trace to some sand, trace gravel, trace rootlets, brown, moist, stiff				269
1 0.8		2	SS	15	
268.4	**SILTY CLAY TILL:** trace to some sand, trace gravel, brown, moist, very stiff				
1.5		3	SS	29	W. L. 268.6 m Sep 08, 2022
2	**SANDY SILT TILL:** trace to some clay, trace gravel, brown, moist, compact to very dense				268
		4	SS	71	
3					267
		5	SS	61	
4					266
	grey, wet below 4.6m	6	SS	56	
5					265
263.8					
6.1	**SANDY SILT TO SILTY SAND:** trace clay, trace gravel, grey, wet, compact to dense	7	SS	38	264
7					263
		8	SS	37	
8					262
9					261
		9	SS	23	
10					260
259.6		10	SS	31	
10.3	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	1.27

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
1	24	64	11

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-11

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857991.3 E 597843.47

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep-06-2022

REF. NO.: 20-169-104
ENCL NO.: 12

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"
272.9 / 0.0	**TOPSOIL:** 250mm	1	SS	8
272.6 / 0.3	**WEATHERED/DISTURBED NATIVE:** silty clay, trace sand, trace gravel, trace rootlets, brown, moist, stiff			
272.1 / 0.8	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, very stiff to hard	2	SS	21
		3	SS	32
270.2 / 2.7	**SANDY SILT TILL:** clayey, trace gravel, brown, moist, dense to very dense	4	SS	40
		5	SS	50/ 50mm
268.3 / 4.6	**SANDY SILT TO SILTY SAND:** trace clay, trace gravel, brown, wet, compact to very dense	6	SS	54
		7	SS	44
		8	SS	14
		9	SS	37
262.6 / 10.3	**END OF BOREHOLE:**	10	SS	53

Notes:
1) Monitoring well installed 1 m away from borehole.
2) 50mm dia. monitoring well installed upon completion.
3) Water Level Readings:

Date: Water Level(mbgl):
Sept. 08, 2022 3.6

W. L. 269.3 m
Sep 08, 2022

DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-12

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857721.12 E 597662.19

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep-02-2022

REF. NO.: 20-169-104
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
277.7 / 0.0	**TOPSOIL:** 300mm						
277.4 / 0.3	**WEATHERED/DISTURBED NATIVE:** sandy silt to silt, trace clay, trace gravel, trace rootlets, dark brown to brown, moist, compact		1	SS	10		277
276.7 / 1.0	**SILT:** some sand to sandy, trace clay, trace gravel, brown, moist, compact to very dense clayey@2.3m		2	SS	18		
			3	SS	33		276
			4	SS	59		275
	wet below 3.1m		5	SS	75		274
			6	SS	66		273
			7	SS	40		272
270.1 / 7.6	**SANDY SILT TO SILTY SAND:** trace clay, brown, wet, compact to dense		8	SS	38		271
			9	SS	33		270
	grey below 10.7m		10	SS	45		269
			11	SS	14		268
264.9 / 12.8	**END OF BOREHOLE:** Notes: 1) Water at depth of 3.1m during drilling.						267
							266
							265

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-13

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857674.46 E 597643.49

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep-01-2022

REF. NO.: 20-169-104
ENCL NO.: 14

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
276.1 / 0.0	**TOPSOIL:** 250mm	1	SS	9	276
275.8 / 0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace rootlets, trace sand, trace gravel, brown, moist, stiff				
275.2 / 0.9	**SILT:** trace sand, trace clay, trace gravel, brown, moist, compact to very dense	2	SS	15	275
		3	SS	19	
		4	SS	70	274
		5	SS	72	273
					272
	wet below 4.6m	6	SS	52	271
		7	SS	34	W. L. 270.1 m Sep 08, 2022
268.5 / 7.6	**SANDY SILT:** trace clay, brown, wet, compact to dense	8	SS	35	269
					268
	grey below 9.1m	9	SS	21	267
					266
		10	SS	46	265
					264
263.3 / 12.8	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 08, 2022 6.03	11	SS	37	

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	0	3	93	4
	0	31	64	5

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-14

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857544.96 E 597523.95

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Sep-01-2022

REF. NO.: 20-169-104
ENCL NO.: 15

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
271.4 / 0.0	**TOPSOIL:** 300mm				
271.1 / 0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt, trace rootlets, trace sand, trace gravel, brown, moist, firm	1	SS	7	271
270.4 / 1.0	**SILTY CLAY TO CLAYEY SILT TILL:** some sand to sandy, trace gravel, brown, moist, stiff to hard	2	SS	9	
		3	SS	34	270
	sandy below 2.3m	4	SS	42	269
	grey below 3.4m	5	SS	48	268
		6	SS	22	267
		7	SS	26	266
		8	SS	28	265
		9	SS	19	264
		10	SS	16	263
	moist to very moist @12.2m	11	SS	12	262
258.6 / 12.8	**END OF BOREHOLE:**				261

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	11.9

W. L. 259.5 m
Sep 08, 2022

DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	4	31	45	20

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-15

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858500.39 E 597551.22

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-29-2022

REF. NO.: 20-169-104
ENCL NO.: 16

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
270.2 / 0.0	**TOPSOIL:** 300mm				
0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace rootlets, trace gravel, trace sand, brown, moist, stiff to firm	1	SS	10	270
1 / 268.7		2	SS	6	269
1.5	**SILTY CLAY TO CLAYEY SILT TILL:** trace sand, trace gravel, brown, moist, very stiff to hard	3	SS	25	
2		4	SS	38	268
3		5	SS	24	267
4					266
5	grey below 4.6m	6	SS	22	
6		7	SS	21	265
7 / 262.6					264
7.6	**SANDY SILT TILL:** trace to some clay, trace gravel, grey, moist, very dense	8	SS	57	263
8 / 262.0					
8.2	**END OF BOREHOLE:**				

Notes:
1) 50mm dia. monitoring well upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	1.93

W. L. 268.3 m
Sep 08, 2022

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-16

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858695.96 E 597735.36

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-29-2022

REF. NO.: 20-169-104
ENCL NO.: 17

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
268.8												
268.8	**TOPSOIL:** 250mm											
0.3	**WEATHERD/DISTURBED NATIVE:** clayey silt, some sand, trace gravel, brown, moist, stiff		1	SS	9		268					
268.0 0.8	**SILTY CLAY TO CLAYEY SILT TILL:** trace sand, trace gravel, brown, moist, very stiff to hard		2	SS	17							
			3	SS	20		267					
			4	SS	36		266					
	grey below 3.5m		5	SS	27		265					
			6	SS	27		264					
			7	SS	21		263					
	silty sand pockets @ 7.6m		8	SS	25		262					
260.6							261					
8.2	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-17

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858813.11 E 597817.61

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-29-2022

REF. NO.: 20-169-104
ENCL NO.: 18

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	TYPE	BLOWS/0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
269.0												
268.9	**TOPSOIL:** 300mm											
268.7 0.3	**WEATHERED/DISTURBED**		1	SS	8							
268.2	**NATIVE:** sandy silt, trace to some											
1 0.8	clay, trace rootlets, trace gravel, brown, moist, loose		2	SS	23		268					
	SILTY CLAY TO CLAYEY SILT TILL: trace sand, trace gravel, brown, moist, very stiff to hard		3	SS	27		267					
			4	SS	33	▽ W. L. 266.7 m Sep 08, 2022	266					
3			5	SS	31							
4							265					
5	grey below 4.9m		6	SS	26		264					
6	possible boulder@6.1m		7	SS	50/75mm		263					
7							262					
8 260.8			8	SS	24		261					
8.2	**END OF BOREHOLE:**											

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	2.26

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-18

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858460.95 E 597628.58

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-29-2022

REF. NO.: 20-169-104
ENCL NO.: 19

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
270.0								20 40 60 80 100	10 20 30			
269.7 0.0	**TOPSOIL:** 250mm											
0.3	**WEATHERED/DISTURBED**		1	SS	3							
269.2	**NATIVE:** clayey silt, some sand,											
1 0.8	trace rootlets, trace gravel, brown, moist, soft		2	SS	21		269					
	SILTY CLAY TO CLAYEY SILT TILL: trace sand, trace gravel, brown, moist, very stiff to hard		3	SS	21		268					
2			4	SS	34		267					
3			5	SS	31		266					
4												
	grey below 4.6m		6	SS	18		265					
5												
263.9							264					
6.1	**CLAYEY SILT:** trace sand, grey, moist, very stiff		7	SS	29							
7							263					
262.4												
7.6	**SAND AND SILT TILL:** some clay, some gravel, grey, moist, dense		8	SS	31		262					11 38 40 11
8 261.8												
8.2	**END OF BOREHOLE:**											
	Notes: 1) Borehole wet at the bottom upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-19

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858347.09 E 597782.77

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-30-2022

REF. NO.: 20-169-104
ENCL NO.: 20

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
269.0 / 0.0	**TOPSOIL:** 280mm						
268.7 / 0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt, trace sand, trace rootlets, trace gravel, brown, moist, firm		1	SS	6		
268.2 / 0.8	**SILTY CLAY TO CLAYEY SILT TILL:** trace sand, trace gravel, brown, moist, stiff to hard trace fine rootlets above 0.9m		2	SS	9		268
			3	SS	23		267
			4	SS	31		266
			5	SS	32		265
	sandy, grey below 4.6m		6	SS	24		264
			7	SS	24		263
			8	SS	20		262
260.8 / 8.2	**END OF BOREHOLE:** Notes: 1) Water at depth of 7.3 during drilling.						261

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-20

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858613.57 E 597956.89

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Aug-29-2022

REF. NO.: 20-169-104
ENCL NO.: 21

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
269.4							
269.0 0.0	**TOPSOIL:** 250mm						
0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt, some sand to sandy, trace rootlets, trace gravel, brown, moist, firm		1	SS	7		269
268.6 1 0.8			2	SS	24		
	SILTY CLAY TO CLAYEY SILT TILL: trace sand, gravelly sand pocket@1.0m, brown, moist, very stiff to hard		3	SS	30		268
2							
			4	SS	45	▽	267
3						W. L. 266.9 m Sep 08, 2022	
			5	SS	39		266
4							
	grey below 4.6m		6	SS	19		265
5							
							264
6			7	SS	21		
							263
7							
							262
8 261.2			8	SS	18		
8.2	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 08, 2022 2.51						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

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GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-21

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858504.78 E 598123.48

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-26-2022

REF. NO.: 20-169-104
ENCL NO.: 22

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
267.4						
267.1 0.0	**TOPSOIL:** 250mm	1	SS	6	267	
0.3	**WEATHERED/DISTURBED NATIVE:** sandy silt, trace rootlets, trace clay, trace gravel, brown, moist, loose					
266.6 1 0.8	**SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard	2	SS	20	266	
2		3	SS	18		
265		4	SS	30	265	
3		5	SS	33	264	4 17 47 32
4					263	
5	grey below 4.6m	6	SS	16		
6					262	
		7	SS	16	261	
7					260	
8 259.2		8	SS	19		
8.2	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.					

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-22

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858239.64 E 598130.15

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-26-2022

REF. NO.: 20-169-104
ENCL NO.: 23

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"
267.8				
267.8 / 0.0	**TOPSOIL:** 250mm			
267.5 / 0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace rootlets, some sand, trace gravel, dark brown, moist, firm	1	SS	7
267.0 / 0.8	**CLAYEY SILT TO SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, very stiff to hard	2	SS	16
		3	SS	26
		4	SS	33
		5	SS	39
	grey below 4.6m	6	SS	15
		7	SS	22
260.2 / 7.6	**SANDY SILT TILL:** some clay to clayey, trace gravel, silty sand pockets, grey, moist, very dense	8	SS	68
259.6 / 8.2	**END OF BOREHOLE:**			

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	1.43

W. L. 266.3 m
Sep 08, 2022

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-23

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858114.18 E 598044.93

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-26-2022

REF. NO.: 20-169-104
ENCL NO.: 24

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
270.6							
270.0 / 0.0	**TOPSOIL:** 250mm						
269.8 / 0.3	**WEATHERED/DISTURBED NATIVE:** silty clay, trace rootlets, trace sand, trace gravel, brown, moist, firm		1	SS	5		270
0.8	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, very stiff to hard		2	SS	23		
			3	SS	24		269
			4	SS	29		268
			5	SS	30		267
	grey below 4.6m		6	SS	21		266
264.5 / 6.1	**SANDY SILT TILL:** clayey, trace gravel, grey, moist, compact to very dense		7	SS	27		265
							264
262.5 / 8.1	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.		8	SS	50/ 100mm		263

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-24

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857889.88 E 597985.22

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-25-2022

REF. NO.: 20-169-104
ENCL NO.: 25

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
273.1												
273.0	**TOPSOIL:** 200mm											
272.8												
272.7	**WEATHERED/DISTURBED NATIVE:** silty clay, trace sand, trace rootlets, brown, moist, stiff		1	SS	12		273					
0.4												
1	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, stiff to hard		2	SS	32		272					
2			3	SS	36		271					
3			4	SS	35		270					
4			5	SS	38		269					
268.5												
4.6	**SILT:** some clay, some sand, trace gravel, grey, moist, dense		6	SS	30		268					
5												
267.0												
6.1	**CLAYEY SILT TO SILTY CLAY TILL:** trace sand, trace gravel, grey, moist, very stiff		7	SS	20		267					
7												
8			8	SS	17		266					
9	sandy @9.1m		9	SS	17		265					
10							264					
262.7			10	SS	16		263					
10.4	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 20-169-104 GEO COPY.GPJ DS.GDT 22-10-21

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Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH22-25

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857963.09 E 598107.54

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-25-2022

REF. NO.: 20-169-104
ENCL NO.: 26

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
270.9 / 0.0	**TOPSOIL:** 300mm	1	SS	10		270
270.6 / 0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace rootlets, trace sand, trace gravel, brown, moist, stiff	2	SS	28		
270.1 / 0.8	**SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard	3	SS	29		269
		4	SS	31		268
		5	SS	30	W. L. 267.8 m Sep 08, 2022	267
	grey below 4.6m	6	SS	18		266
		7	SS	34		265
263.3 / 7.6	**SILTY SAND:** trace clay, silt seams, grey, wet, compact to very dense	8	SS	57		264
		9	SS	22		263
		10	SS	37		262
259.6 / 11.3	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 08, 2022 3.1					261 / 260

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	1	14	49	36
	0	70	27	3

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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DS CONSULTANTS LTD.
Geotechnical ◆ Environmental ◆ Materials ◆ Hydrogeology

LOG OF BOREHOLE BH22-26

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857983.06 E 598243.39

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-24-2022

REF. NO.: 20-169-104
ENCL NO.: 27

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
269.0 / 0.0	**TOPSOIL:** 200mm						
268.8 / 0.2	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace rootlets, trace sand, brown, moist, stiff		1	SS	9		
268.2 / 0.8	**SILTY CLAY TO CLAYEY SILT TILL:** trace sand, trace gravel, brown, moist, stiff to hard		2	SS	28		268
			3	SS	22		267
			4	SS	39		266
			5	SS	34		265
	grey below 4.6m		6	SS	14		264
	silty sand pockets below 6.1m		7	SS	31		263
			8	SS	53		262
259.9 / 9.1							261
259.6 / 9.4	**SILT:** trace to some sand, trace clay, grey, moist to wet, very dense		9	SS	50/ 30mm		260
	END OF BOREHOLE: Notes: 1) Borehole wet at the bottom upon completion.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-27

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857751.7 E 598149.64

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-19-2022

REF. NO.: 20-169-104
ENCL NO.: 28

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
271.2							
270.9 0.0	**TOPSOIL:** 230mm		1	SS	12		271
0.2	**WEATHERED/DISTURBED**						
270.4	**NATIVE:** clayey silt to silty clay, some sand to sandy, trace rootlets, trace gravel, brown, moist, stiff		2	SS	23		270
269.5 1.7	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, very stiff		3	SS	35		269
	SANDY SILT: trace clay, trace gravel, brown, moist, dense		4	SS	46		268
	clayey seams @3.1m		5	SS	44		267
266.6 4.6	grey @4.5m					W. L. 266.9 m Sep 08, 2022	
	SILT: some clay to clayey, some sand, grey, very moist, compact		6	SS	29		266
	wet below 6.1m		7	SS	26		265
263.6 7.6	**SANDY SILT:** trace clay, grey, wet, compact		8	SS	20		263
			9	SS	19		262
			10	SS	17		261
259.0 12.2	**SILTY SAND:** trace clay, grey, wet, (disturbed)		11	SS	disturbed		259
258.4 12.8	**END OF BOREHOLE:**						

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	4.25

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

disturbed sample

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-28

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857801.25 E 598264.59

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-19-2022

REF. NO.: 20-169-104
ENCL NO.: 29

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
270.9							
270.7 0.2	**TOPSOIL:** 200mm		1	SS	13		
270.1 0.8	**WEATHERED/ DISTURBED NATIVE:** clayey silt, some sand to sandy, trace gravel, trace rootlets, brown, moist, stiff		2	SS	30		270
268.6 2.3	**SILTY CLAY TO CLAYEY SILT TILL:** trace sand, trace gravel, brown, moist, hard sandy@1.5m		3	SS	55		269
267.8 3.1	**SANDY SILT TILL:** trace clay, trace to some gravel, brown, moist, dense		4	SS	44		268
	SANDY SILT: trace clay, brown, very moist to wet, very dense		5	SS	72		267
265.9 5.0	**SILT:** some clay to clayey, trace sand, trace to some gravel, grey, very moist to wet, dense to very dense		6	SS	56	▽ W. L. 266.1 m Sep 08, 2022	
			7	SS	32		265
263.3 7.6	**SANDY SILT:** trace clay, grey, wet, compact to dense		8	SS	37		264
			9	SS	29		263
			10	SS	14		262
259.6 11.3	**END OF BOREHOLE:**						261
	Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 08, 2022 4.81						260

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	1	10	71	18

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-29

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857873.47 E 598396.84

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-23-2022

REF. NO.: 20-169-104
ENCL NO.: 30

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
268.9							
268.8	**TOPSOIL:** 250mm						
0.3	**WEATHERED/DISRURBED**		1	SS	10		
268.1	**NATIVE:** silty clay, trace sand,						
1 0.8	trace gravel, trace rootlets, brown, moist, stiff		2	SS	26		268
	SILTY CLAY TO CLAYEY SILT						
	TILL: trace sand, trace gravel,		3	SS	26		267
2	brown, moist, very stiff to hard						
	sandy silt till lenses below 2.3m		4	SS	34		266
3 265.7							
3.2	**SAND:** trace silt, trace gravel, orange brown, moist to wet, compact to dense		5	SS	36		
4						▽	
							W. L. 265.1 m Sep 08, 2022
	clayey silt pockets, grey, wet@4.6m		6	SS	39		264
5							
6			7	SS	29		263
							262
7							
			8	SS	32		261
8							
9 259.8							260
9.1	**SILTY SAND:** silt pockets, trace clay, grey, wet, dense		9	SS	43		
259.2							
9.7	**END OF BOREHOLE:**						

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	3.8

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-30

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857638.89 E 598267.27

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-23-2022

REF. NO.: 20-169-104
ENCL NO.: 31

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
268.3												
268.0	**TOPSOIL:** 250mm											
0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace sand, trace rootlets, brown, moist, stiff		1	SS	10		268					
267.5												
1 0.8			2	SS	35		267					
	SILTY CLAY TILL: trace sand, trace gravel, occasional cobble, brown, moist, very stiff to hard		3	SS	28							
2 266.0												
2.3	**SANDY SILT:** trace clay, brown to grey, wet, dense grey below 2.6m		4	SS	35		266					
3			5	SS	32		265					
4 263.7												
4.6	**SILT TO SANDY SILT:** some sand, trace to some clay, grey, wet, compact		6	SS	23		264					
5							263					
6			7	SS	25		262					
7							261					
8			8	SS	21		260					
9 259.2												
9.1	**SAND:** some silt to silty, grey, wet, compact		9	SS	11		259					
10							258					
11			10	SS	29		257					
12 255.5			11	SS	disturbed		256					(disturbed sample)
12.8	**END OF BOREHOLE:** Notes: 1) Water at depth of 2.3m during drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-31

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857685.22 E 598400.58

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-23-2022

REF. NO.: 20-169-104
ENCL NO.: 32

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
268.8												
268.8	**TOPSOIL:** 200mm											
0.2	**WEATHERED/DISTURBED**		1	SS	9		268		○			
268.0	**NATIVE:** clayey silt to silty clay, trace sand, trace gravel, trace organics/rootlets, brown, moist, stiff											
1 0.8	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, very stiff		2	SS	24				○			
2			3	SS	24		267		○			
266.5												
2.3	**SILT:** some sand to sandy, trace to some clay, brown, wet, compact to dense		4	SS	37		266		○			
3			5	SS	38				○			
4							265					
	grey below 4.6m		6	SS	28		264		○			
5												
6			7	SS	33		263		○			
7							262					
8			8	SS	37		261		○			
9							260					
			9	SS	35				○			
10							259					
258.1												
10.7	**SAND:** some silt to silty, trace clay, brown to greyish brown, wet, dense		10	SS	30		258		○			
257.5												
11.3	**END OF BOREHOLE:**											

Notes:
1) Water at depth of 2.3m during drilling.

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-32

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857555.59 E 598363.99

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-23-2022

REF. NO.: 20-169-104
ENCL NO.: 33

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
265.3						
265.1 0.0	**TOPSOIL:** 200mm	1	SS	9	▽	265
0.2	**WEATHERED/DISTURBED**				W. L. 265.0 m	
264.5	**NATIVE:** clayey silt to silty clay,				Sep 08, 2022	
1 0.8	trace sand, trace gravel, trace rootlets, brown mottled, moist, stiff	2	SS	19		264
	SILTY CLAY TILL: trace sand, trace gravel, brown mottled, moist,	3	SS	14		
263.3	stiff to very stiff					263
2 2.0	**SANDY SILT:** trace clay, trace to some gravel, grey, very moist, compact to dense	4	SS	21		
3	wet below 2.3m	5	SS	27		262
4						
		6	SS	38		261
5						
						260
6		7	SS	27		
						259
7						
						258
8	with silty sand lenses below 7.6m	8	SS	33		
						257
9		9	SS	23		
						256
10						
254.6						255
11 10.7	**SAND:** some silt, trace clay, grey, wet, compact	10	SS	24		
						254
12 253.1						
12.2 252.5	**SANDY SILT:** with clayey silt pockets, grey, wet, compact	11	SS	15		253
12.8	**END OF BOREHOLE:**					

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date:	Water Level(mbgl):
Sept. 08, 2022	0.32

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	82	15	3

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-33

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857913.51 E 598493.46

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-25-2022

REF. NO.: 20-169-104
ENCL NO.: 34

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
268.0 / 0.0	**TOPSOIL:** 250mm				
267.7 / 0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace rootlets, trace sand, trace gravel, brown, moist, stiff	1	SS	10	
267.2 / 0.8	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, stiff to very stiff	2	SS	12	267
265.7 / 2.3	**SANDY SILT TILL:** trace clay, trace gravel, occasional cobble, brown, moist, compact to very dense occasional wet sand seams@3.1m	3	SS	29	266
		4	SS	41	265
		5	SS	25	264
	W. L. 263.7 m Sep 08, 2022	6	SS	50/ 100mm	263
261.9 / 6.1	**SANDY GRAVEL:** some silt, brown, wet, compact to dense	7	SS	25	262
		8	SS	43	261
258.9 / 9.1	**SILTY SAND TO SANDY SILT:** trace clay, grey, wet, compact to dense	9	SS	27	260
		10	SS	35	259
256.7 / 11.3	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 08, 2022 4.29				258 257

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

REMARKS AND GRAIN SIZE DISTRIBUTION (%)	GR	SA	SI	CL
	52	34	11	3

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-34

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857838.45 E 598615.09

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-24-2022

REF. NO.: 20-169-104
ENCL NO.: 35

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
267.0												
266.8 / 0.0	**TOPSOIL:** 250mm											
0.3	**WEATHERED/DISTURBED**		1	SS	8							
266.2	**NATIVE:** silty clay to clayey silt, trace sand, trace gravel, trace rootlets, brown, moist, stiff											
1 0.8			2	SS	13		266					
	CLAYEY SILT TO SILTY CLAY											
265.2	**TILL:** trace to some sand, trace		3	SS	28							
2 1.8	gravel, brown, moist, stiff to very stiff						265					
	GRAVELLY SAND: some silt, trace clay, brown, wet, compact to very dense		4	SS	44							
3	moist, some cobbles at 3.1m		5	SS	51		264					
4							263					
5			6	SS	25		262					32 54 11 3
6							261					
			7	SS	24							
7							260					
8			8	SS	56		259					
9							258					
			9	SS	43							
10							257					
256.3												
10.7	**CLAYEY SILT TILL:** sandy, trace gravel, sand pockets, grey, moist,		10	SS	49		256					
11 255.7	hard											
11.3	**END OF BOREHOLE:**											
	Notes: 1) Water at depth of 1.8m during drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-35

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4857741.56 E 598599.11

DRILLING DATA
Method: Hollow Stem Auger
Diameter: 200mm
Date: Aug-24-2022

REF. NO.: 20-169-104
ENCL NO.: 36

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
266.1							
266.0	**TOPSOIL:** 250mm						
0.3	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace sand, trace gravel, trace rootlets, brown, moist, firm		1	SS	5		
265.3							
0.8			2	SS	21		265
264.6	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, very stiff						
1.5			3	SS	18		
	SANDY SILT TO SILTY SAND: trace clay, brown, wet, compact to dense						264
			4	SS	30		
							263
			5	SS	32		
							262
			6	SS	23		261
260.0							
6.1	**SAND:** some silt, trace silt seams, brown, wet, compact		7	SS	17		260
258.5							
7.6	**SANDY SILT TO SILTY SAND:** trace clay, grey, wet, compact to very dense		8	SS	37		259
							258
			9	SS	52		257
							256
			10	SS	37		255
							254
			11	SS	47		
							253
			12	SS	23		
252.5							
13.6	**END OF BOREHOLE:**						

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water Level Readings:

Date: Water Level(mbgl):
Sept. 08, 2022 2.23

W. L. 263.8 m
Sep 08, 2022

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-36

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858560.88 E 598455.25

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-07-2022

REF. NO.: 20-169-104
ENCL NO.: 37

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
261.7												
260.9 / 0.0	**TOPSOIL:** 250mm		1	SS	7		261					
0.3	**WEATHERED/DISTURBED NATIVE:** silty sand, trace rootlets, trace gravel, brown, moist, loose		2	SS	12							
260.2 / 1.5	**SANDY SILT:** some clay, trace gravel, brown, very moist, compact		3	SS	10		260					4 25 48 23
	SILTY CLAY TILL: some sand to sandy, trace gravel, brown, moist, stiff to very stiff grey below 2.3m		4	SS	16		259					
			5	SS	16		258					
			6	SS	18		257					
			7	SS	19		256					
			8	SS	19		255					6 19 45 30
			9	SS	27		254					
251.2			10	SS	26		253					
10.5	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.						252					

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-36A

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858560.27 E 598452.63

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-07-2022

REF. NO.: 20-169-104
ENCL NO.: 38

SOIL PROFILE			SAMPLES										
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
261.8												
0.0	Straight drilled to 4m to installed well						261					
1												
2							260					
3						▽						
257.8							W. L. 259.1 m Sep 19, 2022					
4.0	**END OF BOREHOLE:** Notes: 1) Straight drilled to 4m to install 50mm dia. monitoring well. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 19, 2022 2.7						258					

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-37

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858497.3 E 598361.23

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-07-2022

REF. NO.: 20-169-104
ENCL NO.: 39

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
265.1							
265.0 0.0	**TOPSOIL:** 230mm		1	SS	5		
0.2	**WEATHERED/DISTURBED**						
264.3	**NATIVE:** clayey silt to silty clay, trace rootlets, trace sand, trace gravel, brown, moist, firm		2	SS	22		264
0.8	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, stiff to very stiff		3	SS	27		263
			4	SS	29		
	grey below 3.1m		5	SS	22		262
							261
			6	SS	14		260
			7	SS	14		259
							258
256.9			8	SS	16		257
8.2	**END OF BOREHOLE:**						

Notes:
1) Borehole wet at the bottom upon completion.

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-38

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858642.88 E 598374.23

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-07-2022

REF. NO.: 20-169-104
ENCL NO.: 40

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
262.7							
262.6 0.0	**TOPSOIL:** 250mm		1	SS	6		262
0.3	**WEATHERED/DISTURBED**						
261.9	**NATIVE:** clayey silt to silty clay, trace rootlets, trace sand, trace gravel, brown to reddish brown, moist, firm		2	SS	13		
1 0.8	**SILTY CLAY TILL:** trace sand, trace gravel, brown, moist, stiff to very stiff		3	SS	22		261
2			4	SS	42		260
3	grey below 3.1m		5	SS	24		259
4							
5			6	SS	21		258
6							257
			7	SS	25		256
7							
8 254.5			8	SS	23		255
8.2	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-39

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858595.53 E 598262.19

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-07-2022

REF. NO.: 20-169-104
ENCL NO.: 41

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
266.5												
266.3 0.2	**TOPSOIL:** 200mm											
	WEATHERED/DISTURBED NATIVE: clayey silt to silty clay, trace rootlets, brown, moist, firm		1	SS	5		266					
265.7 1 0.8	silty sand lens below 0.5m		2	SS	9							
265.0 1.5	**SILTY CLAY TILL:** trace sand, trace gravel, trace rootlets, brown, moist, stiff (disturbed)		3	SS	23		265					
2	**SILTY CLAY TILL:** trace sand, trace gravel, trace rootlets, brown, moist, very stiff to hard		4	SS	35		264					
3			5	SS	41		263					
4							262					
5	grey below 4.6m		6	SS	34							
6							261					
			7	SS	19		260					
7												
8 258.3			8	SS	26		259					
8.2	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-39A

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858595.12 E 598262.27

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-07-2022

REF. NO.: 20-169-104
ENCL NO.: 42

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
266.6											
0.0	Straight drilled to 7.6m to install well.						266				
							265				
						W. L. 264.7 m Sep 19, 2022	264				
							263				
							262				
							261				
							260				
259.0							259				
7.6	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 19, 2022 1.92										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-40

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858703.05 E 598283.24

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-07-2022

REF. NO.: 20-169-104
ENCL NO.: 43

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
264.0 / 0.0	**TOPSOIL:** 230mm	1	SS	8	
263.7 / 0.2	**WEATHERED/DISTURBED**				
263.2 / 0.8	**NATIVE:** silty clay, trace sand, trace rootlets, trace gravel, brown, moist, stiff	2	SS	27	263
	SILTY CLAY TILL: trace sand, trace gravel, brown, moist, very stiff to hard trace rootlets above 1.0m	3	SS	27	262
		4	SS	37	261
	grey below 3.1m	5	SS	29	
		6	SS	15	260
		7	SS	20	259
		8	SS	17	258
255.8 / 8.2	**END OF BOREHOLE:**				257
	Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Oct 18, 2022 3.03				256

W. L. 260.9 m
Oct 18, 2022

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-40A

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858702.2 E 598285.12

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-07-2022

REF. NO.: 20-169-104
ENCL NO.: 44

SOIL PROFILE			SAMPLES										
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT 20 40 60 80 100 / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE 20 40 60 80 100	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT w_P w w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
263.9												
0.0	Straight drilled to 4.0m to install well.						263					
							262					
							W. L. 262.0 m Sep 19, 2022					
							261					
259.9							260					
4.0	**END OF BOREHOLE:** Notes: 1) 50mm dia. monitoring well installed upon completion. 2) Water Level Readings: Date: Water Level(mbgl): Sept. 19, 2022 1.92											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-41

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858790.18 E 598184.07

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-06-2022

REF. NO.: 20-169-104
ENCL NO.: 45

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
264.0												
0.0 / 263.7	**TOPSOIL:** 350mm		1	SS	9		263					
0.4 / 263.2	**WEATHERED/DISTURBED NATIVE:** clayey silt to silty clay, trace gravel, trace sand, organic staining, trace rootlets, brown, moist, stiff		2	SS	12							
0.8			3	SS	12		262					
261.7	**SANDY SILT TO SILTY SAND:** trace to some clay, trace gravel, brown, very moist, compact											
2.3	**SILTY CLAY TILL:** trace to some sand, trace gravel, brown, moist, stiff to very stiff grey below 3.1m		4	SS	24		261					
			5	SS	21		260					
			6	SS	16		259					1 11 51 37
			7	SS	13		258					
			8	SS	20		257					
255.8							256					
8.2	**END OF BOREHOLE:** Notes: 1) Borehole wet at the bottom upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

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LOG OF BOREHOLE BH22-42

PROJECT: Geotechnical Investigation
CLIENT: Caledon Community Partners
PROJECT LOCATION: The Gore Rd. & King St., Bolton, ON
DATUM: Geodetic
BH LOCATION: See Drawing 1 N 4858723.71 E 598094.14

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Sep-06-2022

REF. NO.: 20-169-104
ENCL NO.: 46

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
266.7							
266.4 0.0	**TOPSOIL:** 250mm		1	SS	13		266
0.3	**WEATHERED/DISTURBED**						
265.9	**NATIVE:** clayey silt to silty clay,						
1 0.8	trace sand, trace gravel, trace rootlets, brown, moist, stiff		2	SS	21		
	SILTY CLAY TILL: trace sand, trace gravel, brown, moist, very stiff		3	SS	21		265
2						W. L. 264.6 m Oct 18, 2022	
			4	SS	26		264
3							
			5	SS	27		
4							263
	grey below 4.6m		6	SS	17		262
5							
260.6							261
6.1	**SAND:** silt pockets, grey, wet, compact		7	SS	18		
7							260
259.1							
7.6	**SANDY SILT TILL:** trace clay, trace gravel, grey, very moist, dense		8	SS	32		259
258.5 8							
8.2	**END OF BOREHOLE:**						

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Readings:

Date: Water Level(mbgl):
Oct. 18, 2022 2.05

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

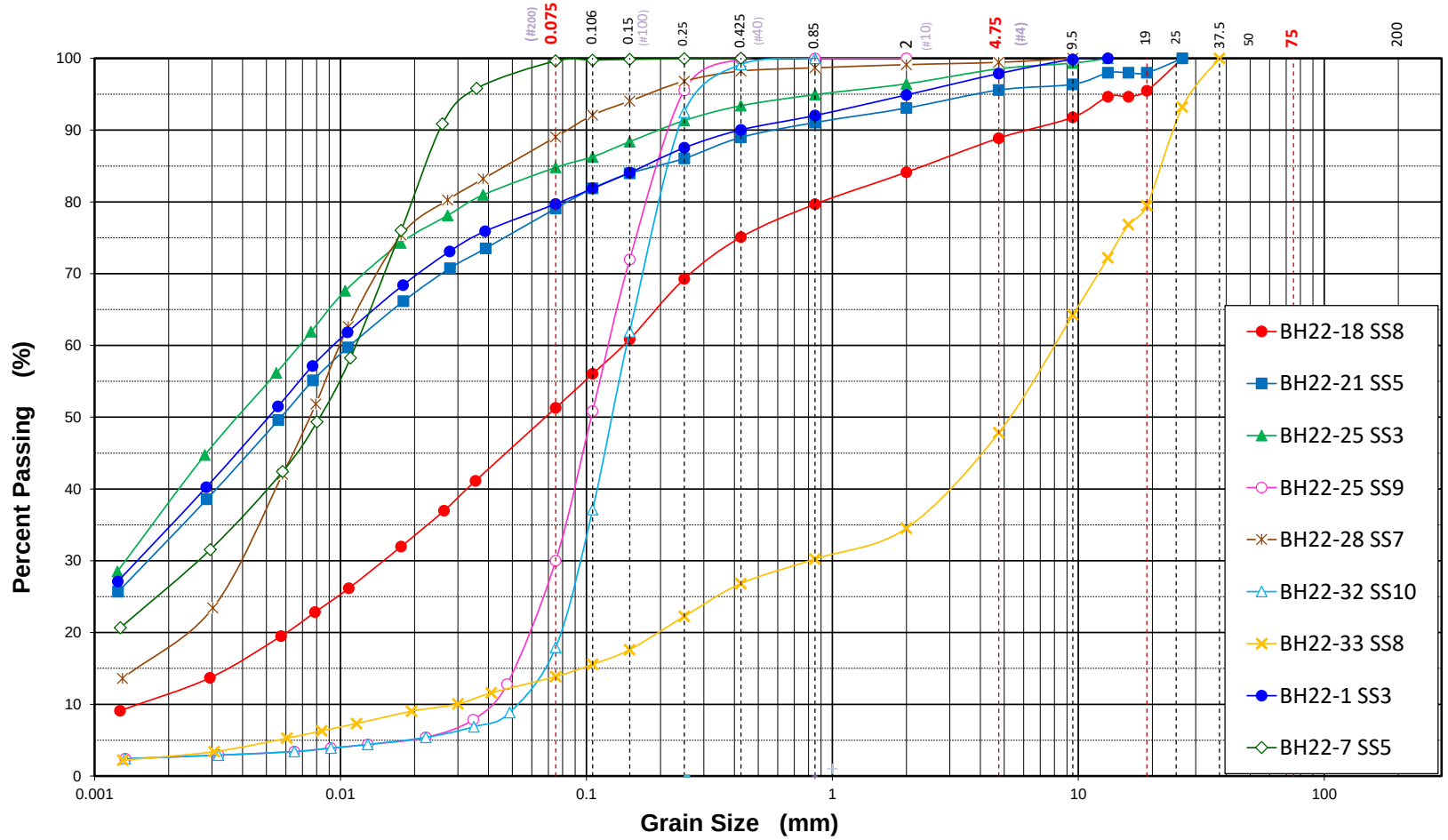
REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG-2021-FINAL 20-169-104 GEO COPY.GPJ DS.GDT 22-10-21

Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	

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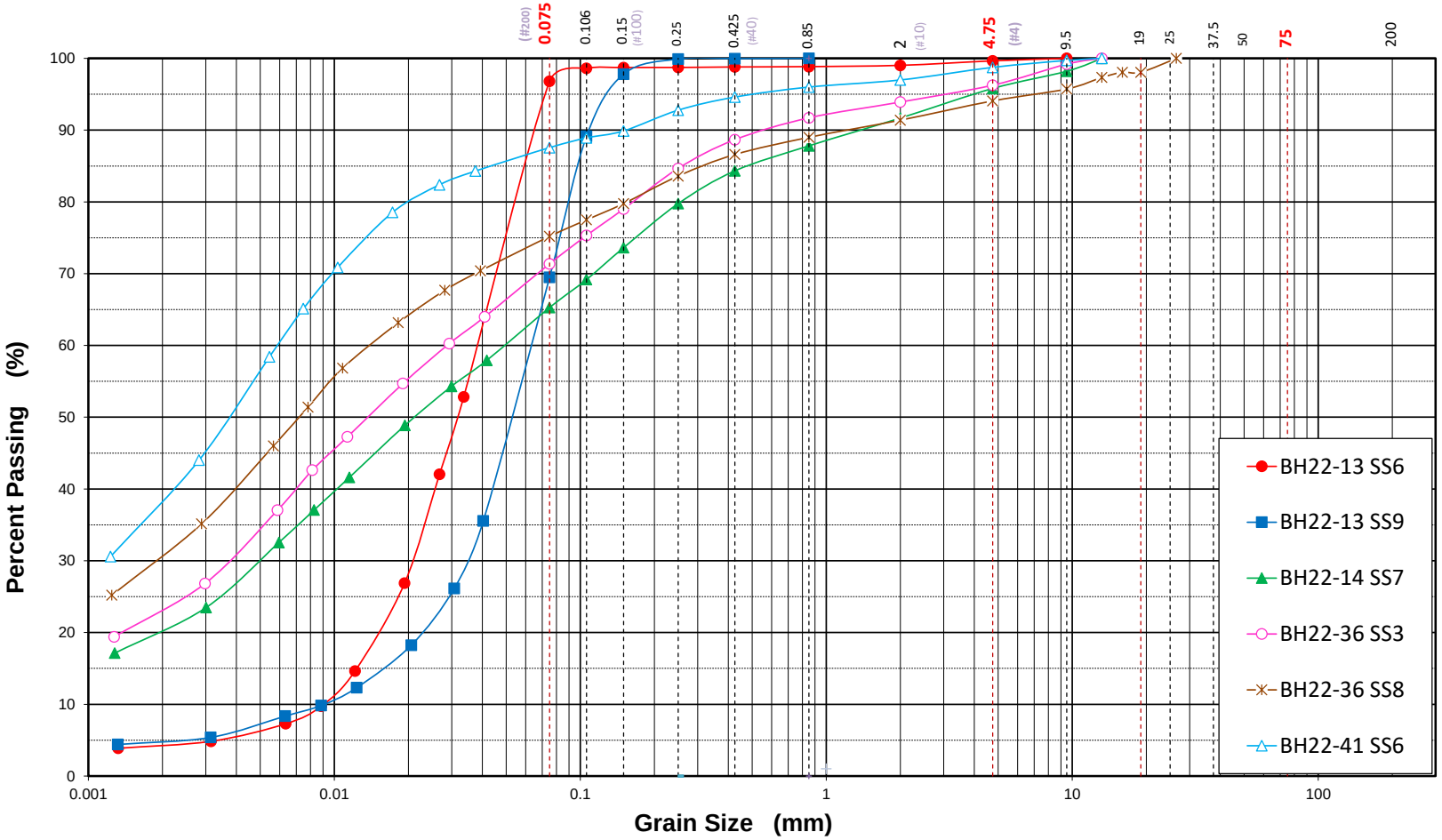
Project	**Geotechnical Investigation**	Project No	**20-169-104**
Location	**Macville Secondary Plan, Caledon, ON**	Date	**Aug-31-2022**
Client	**Caledon Community Partners**	Figure No	47

Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	

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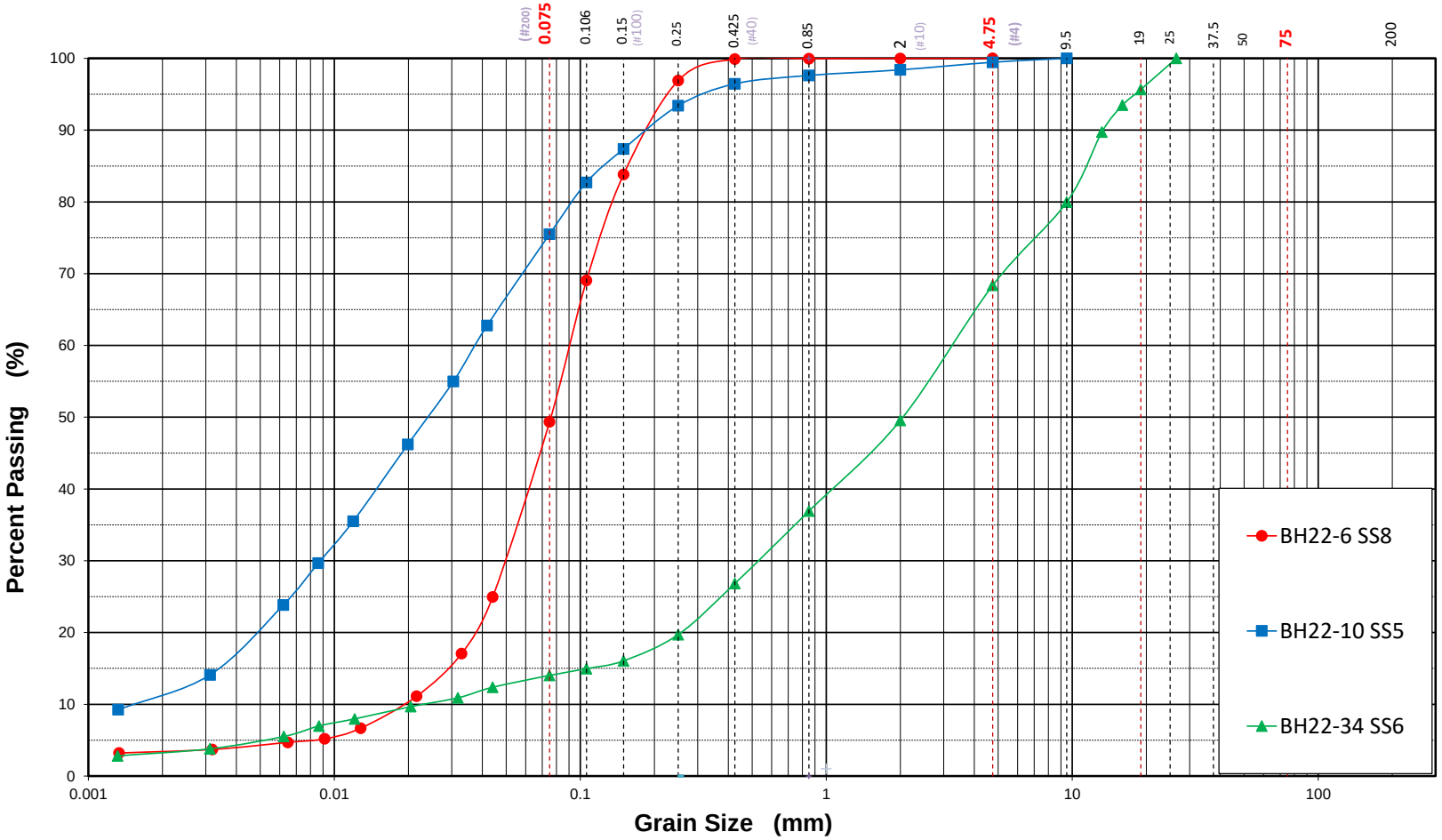
Project	**Geotechnical Investigation**	Project No	**20-169-104**
Location	**Macville Secondary Plan, Caledon, ON**	Date	**Sep-09-2022**
Client	**Caledon Community Partners**	Figure No	48

Particle Size Distribution (ASTM-D421/D422)



Silt and Clay		Sand			Gravel		Cobble +
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	

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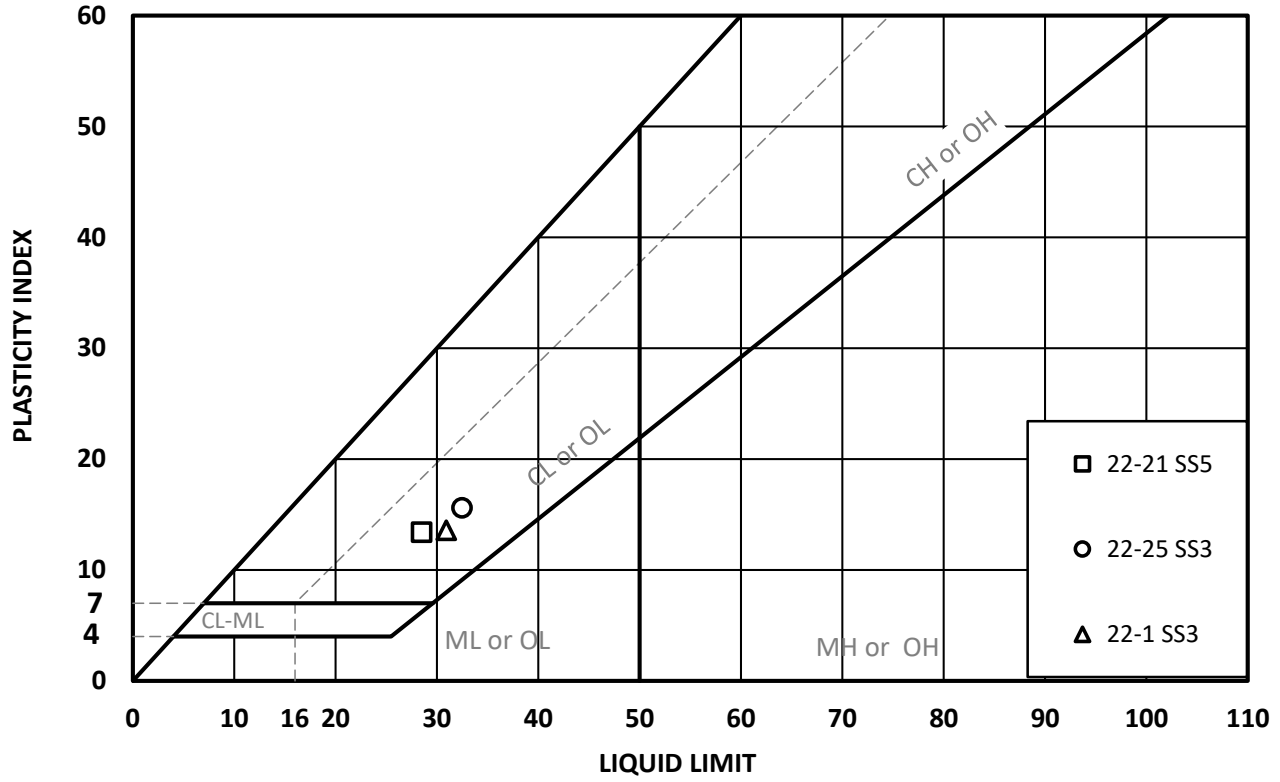
Project	**Geotechnical Investigation**	Project No	**20-169-104**
Location	**Macville Secondary Plan, Caledon, ON**	Date	**Sep-20-2022**
Client	**Caledon Community Partners**	Figure No	49

Atterberg Test (ASTM D-4318)



Code	Sample ID	Sample No.		Moisture Contant (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	USCS Symbol
1	□	22-21	SS5	13	28.5	15.1	13.4	CL
2	○	22-25	SS3	15	32.5	16.9	15.6	CL
3	△	22-1	SS3	14	30.9	17.3	13.6	CL

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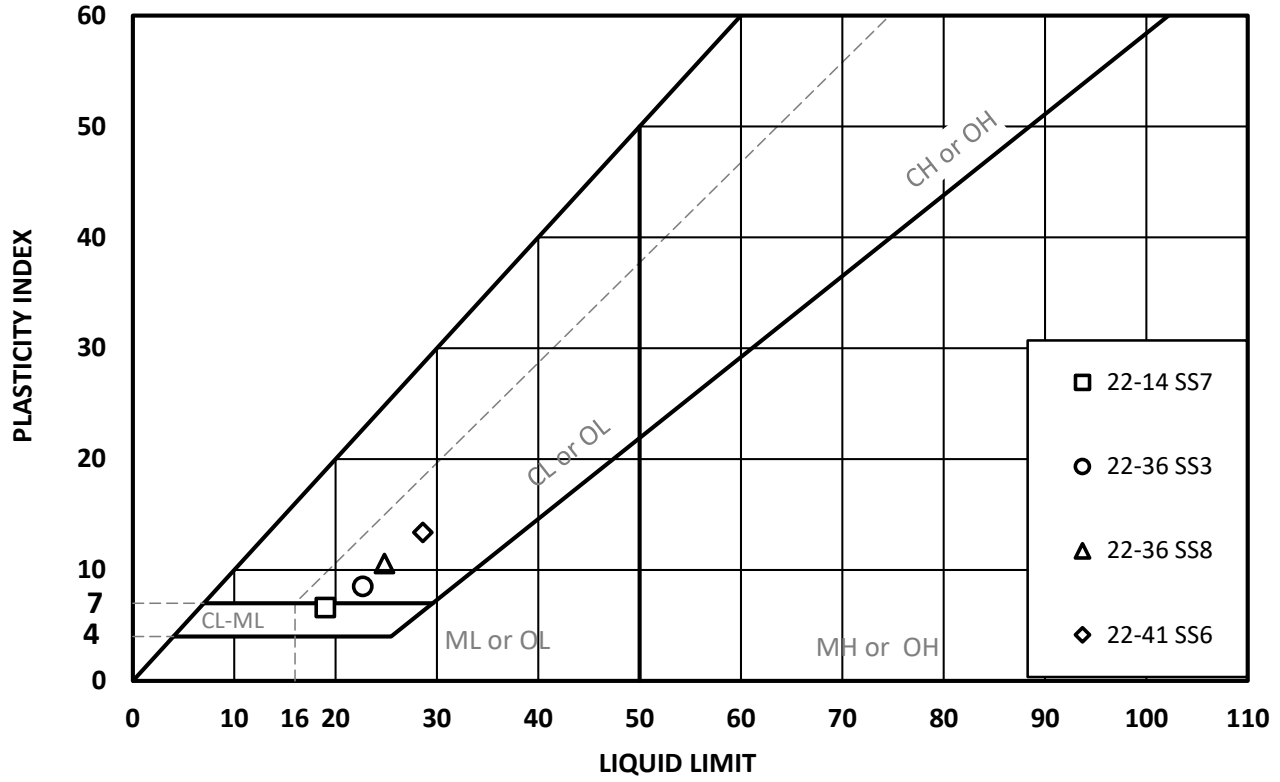
Project	**Geotechnical Investigation**	Project No	**20-169-104**
Location	**Macville Secondary Plan, Caledon, ON**	Date	**Aug-31-2022**
Client	**Caledon Community Partners**	Figure No	50

Atterberg Test (ASTM D-4318)



Code	Sample ID	Sample No.		Moisture Contant (%)	Liquid Limit (%)	Plastic Limit (%)	Plasticity Index (%)	**USCS Symbol**
1	□	22-14	SS7	9	19	12.4	6.6	CL-ML
2	○	22-36	SS3	17	22.7	14.2	8.5	CL
3	△	22-36	SS8	13	24.8	14.2	10.6	CL
4	◇	22-41	SS6	15	28.6	15.2	13.4	CL

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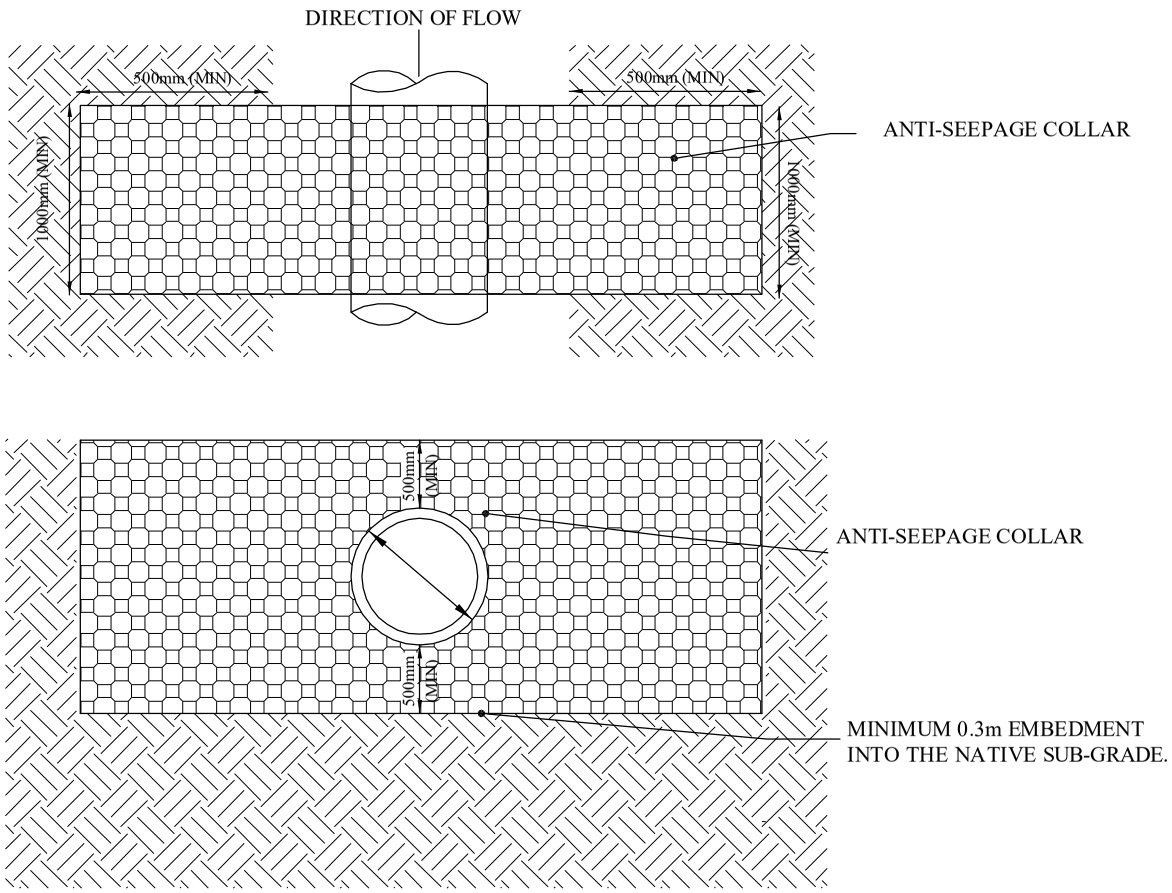
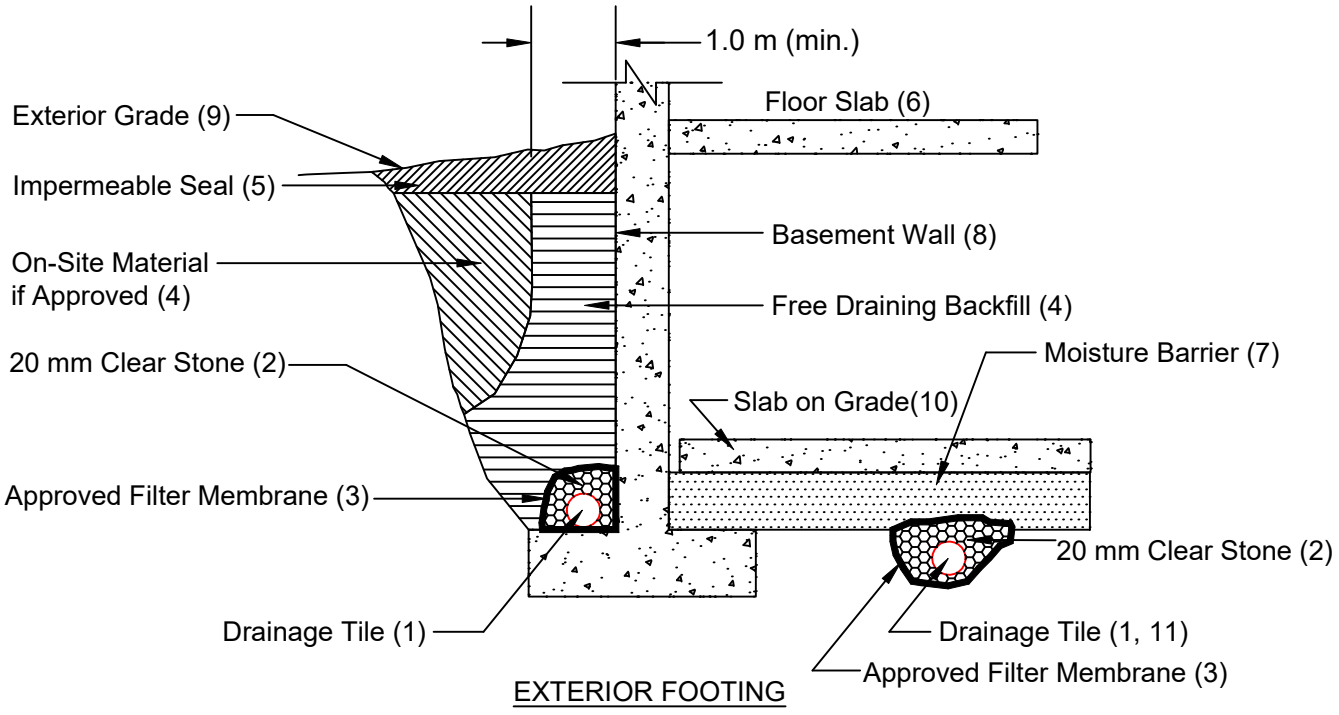
Project	**Geotechnical Investigation**	Project No	**20-169-104**
Location	**Macville Secondary Plan, Caledon, ON**	Date	**Sep-09-2022**
Client	**Caledon Community Partners**	Figure No	51

Drawing No. 52: TYPICAL TRENCH PLUG INSTALLATION



ANTI-SEEPAGE COLLAR DETAIL

SCALE: N.T.S.



EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm (18") of the wall. Use hand controlled light compaction equipment within 1.8 m (6') of wall. The minimum width of the Granular 'B' backfill must be 1.0 m.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted. Maximum thickness of seal to be 0.5 m.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
8. Basement wall to be damp proofed /water proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab.
12. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
13. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
14. Do not connect the underfloor drains to perimeter drains.
15. Review the geotechnical report for specific details.

DRAINAGE AND BACKFILL RECOMMENDATIONS
Basement with Underfloor Drainage

(not to scale)

Appendix A

Borehole Logs from DS 2020 Investigation

LOG OF BOREHOLE BH20-1

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857815.92 E 597082.44

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
279.8							
0.0 / 279.8	**TOPSOIL:** 300mm		1	SS	6		
0.3 / 279.0	**FILL:** sandy silt, trace gravel, dark brown, moist, loose						
0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff to hard		2	SS	19		279
			3	SS	36		278
	trace cobble below 2.3m		4	SS	55		
			5	SS	32		276
275.3						W. L. 275.7 m Aug 06, 2020[1] W. L. 275.3 m Oct 22, 2020	
4.5	**SILTY CLAY:** trace sand, grey, very moist, very stiff		6	SS	17		
273.8							274
6.0	**SILT:** trace clay, grey, wet, compact		7	SS	12	Filter Pack / Slotted Pipe	
			8	SS	20		272
271.6							
8.2	**END OF BOREHOLE:**						

Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	4.11
Sept 8, 2020	4.24
Oct 22, 2020	4.51

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

DS CONSULTANTS LTD.

LOG OF BOREHOLE BH20-2

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857663.29 E 597311.06

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 3

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
278.8					
278.6	**TOPSOIL:** 200mm				
0.2	**FILL:** sandy silt, trace gravel, brown, moist, loose	1	SS	8	
278.0					278
1 0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff	2	SS	16	
		3	SS	19	277
2 276.5					
2.3	**SANDY SILT:** trace clay, brown, moist to very moist, very dense	4	SS	58	
3					276
		5	SS	58	
4					275
5		6	SS	66	274
6	wet below 6m	7	SS	51	
7					
8 270.6		8	SS	52	271
8.2	**END OF BOREHOLE:**				

Notes:
1) Water level at 6.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.12
Sept 8, 2020	6.36
Oct 22, 2020	6.48

Bentonite
Filter Pack
Slotted Pipe
W. L. 272.7 m Aug 06, 2020
W. L. 272.3 m Oct 22, 2020

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-3

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857648.82 E 597335.94

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"
278.6				
0.0 / 278.3	**TOPSOIL:** 300mm			
0.3 / 277.8	**FILL:** sandy silt, trace gravel, brown, moist, compact	1	SS	10
0.8	**SILTY CLAY TILL:** sandy, trace gravel, sand seams, brown, moist, stiff	2	SS	13
		3	SS	10
276.3				
2.3	**SILTY SAND:** trace clay, grey, moist, compact to very dense	4	SS	15
		5	SS	35
	wet below 4.5m	6	SS	65
		7	SS	49
271.9				
6.7	**END OF BOREHOLE:**			

Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.0
Sept 8, 2020	dry
Oct 22, 2020	dry

GROUND WATER CONDITIONS: Bentonite; Filter Pack; Slotted Pipe; W. L. 272.6 m Aug 06, 2020

ELEVATION: 278, 277, 276, 275, 273, 272

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR SA SI CL

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-4

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857717.02 E 597386.34

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/27/2020

REF. NO.: 20-169-100
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
277.1							
0.0 / 276.8	**CONCRETE:** 300mm						
0.3 / 276.3	**FILL:** clayey silt, trace gravel, grey to brown, moist, stiff		1	SS	8		
0.8	**SANDY SILT:** trace clay, brown, moist, compact to very dense		2	SS	21		276
			3	SS	42		275
			4	SS	62		274
			5	SS	56		
	wet below 4.5m		6	SS	46		272
271.1 / 6.0	**SANDY SILT:** trace silt, brown, wet, compact		7	SS	28		271
270.4 / 6.7	**END OF BOREHOLE:**						

Bentonite
W. L. 273.3 m
Aug 06, 2020
Sep 08, 2020
Slotted Pipe

Notes:
1) Water level at 4.5m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	3.77
Sept 8, 2020	3.90
Oct 22, 2020	inaccessible

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-5

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858369.55 E 597438.77

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

REF. NO.: 20-169-100
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
273.0					
272.9 0.0	**TOPSOIL:** 250mm				
272.7 0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact	1	SS	15	
272.2 0.8	**SILTY CLAY TILL:** sandy, trace gravel, frequent sand seams, brown, moist, hard	2	SS	35	272
		3	SS	31	271
		4	SS	39	
270.0 3.0	**CLAYEY SILT TILL:** sandy, trace gravel, interbed of sandy silt layers, greyish brown, moist to very moist, hard	5	SS	35	
	grey below 4.5m	6	SS	37	269 / 268
	sand seams below 6m	7	SS	46	267 / 266
265.5 7.5	**SILTY SAND:** trace clay, grey, moist, very dense	8	SS	74/ 280mm	
	very moist at 9m	9	SS	59	264
263.3 9.7	**END OF BOREHOLE:**				

Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.78
Sept 8, 2020	3.09
Oct 22, 2020	3.38

GROUND WATER CONDITIONS: W. L. 270.2 m Aug 06, 2020; W. L. 269.6 m Oct 22, 2020; Filter Pack; Slotted Pipe

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
8	0	51	47	2

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-6

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857501.44 E 597524.2

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
271.0 / 0.0	**TOPSOIL:** 250mm				
270.7 / 0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, loose	1	SS	8	
270.2 / 0.8	**CLAYEY SILT TILL:** sandy, trace gravel, sand seams, brown, moist, stiff to hard	2	SS	12	270
		3	SS	21	269
	hard below 2.3m	4	SS	59	
		5	SS	58	268
					267
	grey below 4.5m	6	SS	31	266
					265
		7	SS	39	
262.8 / 8.2	**END OF BOREHOLE:**	8	SS	25	263

Notes:
1) Borehole dry during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	6.77
Sept 8, 2020	1.15

Bentonite
Filter Pack
W. L. 269.8 m Sep 08, 2020
W. L. 264.2 m Aug 06, 2020

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-7

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857020.81 E 597903.58

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 8

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
261.7												
0.0 / 261.2	**TOPSOIL:** 500mm		1	SS	8							
0.5 / 260.9	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, stiff											
0.8	**CLAYEY SILT TILL:** some sand, trace gravel, brownish grey, very moist, stiff		2	SS	10		261					
	with silt and sand seams at 1.5m		3	SS	13		260					
259.4												
2.3	**SILTY CLAY TILL:** some sand, some gravel, greyish brown, moist, very stiff to hard		4	SS	39							15 18 38 29
	grey, very moist to wet below 3m						Bentonite					
			5	SS	28	▼	W. L. 258.3 m Oct 22, 2020					
			6	SS	21		257					
							256					
			7	SS	19	▼	Filter Pack W. L. 255.2 m Sep 08, 2020					
			8	SS	25		254					
							253					
			9	SS	16		Bentonite: Bottom of hole					
							252					
			10	SS	24		251					
250.4												
11.3	**END OF BOREHOLE:**											

Notes:
1) Borehole dry during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	dry
Sept 8, 2020	6.52
Oct 22, 2020	3.40

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-8

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857701.02 E 597673.81

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS / 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
277.2								
0.0 / 276.8	**TOPSOIL:** 340mm		1	SS	8		277	
0.4 / 276.4	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, brown, moist, loose							
1 0.8 / 275.7	**CLAYEY SILT TILL:** sandy, trace gravel, brown, moist, compact		2	SS	10		276	
1.5	**SILT:** some clay, trace sand, trace gravel, brown, very moist, compact to very dense		3	SS	19			
2			4	SS	58		275	2 2 85 11
3			5	SS	92/ 255mm		274	
4								
5			6	SS	74		273	
271.2							272	
6.0	**SANDY SILT:** trace clay, brown, wet, very dense		7	SS	62		271	0 27 67 6
7								
8 / 269.0			8	SS	54		270	
8.2	**END OF BOREHOLE:** Notes: 1) Water at depth of 6.1m during drilling.						269	

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-9

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857946.64 E 597876.44

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/28/2020

REF. NO.: 20-169-100
ENCL NO.: 10

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
274.1 / 0.0	**TOPSOIL:** 550mm	1	SS	5	274
273.6 / 0.6	**FILL:** sandy silt, trace topsoil/ organics, trace clay, trace gravel, trace organics, trace rootlets, dark brown, moist, loose	2	SS	16	273
273.3 / 0.8	**SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard	3	SS	25	272
	sand seams below 2.3m	4	SS	38	
		5	SS	72	271
	grey below 4.5m	6	SS	45	270
	trace cobble, very moist below 6m	7	SS	24	268
266.6 / 7.5	**SANDY SILT:** trace clay, grey, wet, compact	8	SS	29	267
265.9 / 8.2	**END OF BOREHOLE:**				266

Notes:
1) Water level at 7.6m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	4.43
Sept 8, 2020	4.72
Oct 22, 2020	4.97

Bentonite
W. L. 269.7 m Aug 06, 2020
W. L. 269.1 m Oct 22, 2020
Filter Pack
Slotted Pipe

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-10

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858404.6 E 597955.26

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

REF. NO.: 20-169-100
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
268.3							
0.0 / 268.0	**TOPSOIL:** 300mm						
0.3 / 267.5	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact		1	SS	15		268
0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist to very moist, very stiff		2	SS	21		267
			3	SS	25		
			4	SS	25		266
	grey below 3m		5	SS	16		265
			6	SS	20		264
			7	SS	17		263
			8	SS	15		262
260.1							261
8.2	**END OF BOREHOLE:** Notes: 1) Borehole dry and open upon completion.						

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-11

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858726.5 E 597841.19

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/29/2020

REF. NO.: 20-169-100
ENCL NO.: 12

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
270.1 / 0.0	**TOPSOIL:** 300mm				
269.8 / 0.3	**FILL:** sandy silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, compact	1	SS	12	270
269.3 / 0.8	**SILTY CLAY TILL:** sandy, trace gravel, sand seams, brown, moist, very stiff to hard	2	SS	19	269
		3	SS	22	
		4	SS	28	268
		5	SS	44	267
	grey below 4.5m	6	SS	24	266
		7	SS	21	265
262.4 / 7.7	**SILT:** some sand, trace clay, trace gravel, grey, wet, compact	8	SS	28	264
		9	SS	27	263
260.4 / 9.7	**END OF BOREHOLE:**				261

Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	5.42
Sept 8, 2020	5.37
Oct 22, 2020	5.33

Bentonite
W. L. 264.7 m Aug 06, 2020
Filter Pack
Slotted Pipe

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
1	11	80	8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-12

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857520.15 E 598321.99

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
264.9							
0.0 / 264.5	**TOPSOIL:** 400mm		1	SS	8		
0.4 / 264.1	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, sand seams, trace rootlets, dark brown, moist, stiff						
0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist to very moist, stiff		2	SS	8		
			3	SS	9		
	grey below 2.3m		4	SS	10		
261.9							
3.0	**SANDY SILT TO SILT:** trace clay, grey, very moist, dense		5	SS	32		
	wet below 4.5m		6	SS	36		
258.9							
6.0	**SILT:** trace clay, trace sand, grey, very moist, compact to loose		7	SS	25		
			8	SS	7		
256.7							
8.2	**END OF BOREHOLE:**						

W. L. 264.7 m
Aug 06, 2020

Bentonite
Filter Pack
Slotted Pipe

Notes:
1) Water level at 3.1m below grade during drilling
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	0.2
Sept 8, 2020	0.1
Oct 22, 2020	0.14

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	1	94	5

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH20-13

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857981.07 E 598332.09

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

REF. NO.: 20-169-100
ENCL NO.: 14

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"
268.1 / 0.0	**TOPSOIL:** 200mm			
0.2 / 267.3	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, dark brown, moist, stiff	1	SS	12
0.8	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brownish grey, moist, stiff to very stiff	2	SS	19
		3	SS	20
		4	SS	26
		5	SS	14
	grey below 4.5m	6	SS	9
		7	SS	19
260.6				
7.5 / 259.9	**SANDY SILT TO SILT:** trace clay, trace gravel, grey, wet, very dense	8	SS	94/ 255mm
8.2	**END OF BOREHOLE:** Notes: 1) Water at 7.6m below grade during drilling			

GROUND WATER CONDITIONS

ELEVATION: 268, 267, 266, 265, 264, 263, 262, 261, 260

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-14

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858339.89 E 598409.18

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

REF. NO.: 20-169-100
ENCL NO.: 15

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
267.7					
0.0 / 267.3	**TOPSOIL:** 400mm	1	SS	7	267
0.4 / 266.9	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace sand, trace rootlets, brown, moist, firm				
0.8	**SILTY CLAY TILL:** some sand, trace gravel, frequent sand seams, brown, moist, stiff to hard	2	SS	14	
		3	SS	13	266
		4	SS	27	265
		5	SS	28	
		6	SS	24	263
	grey below 6m	7	SS	18	262
		8	SS	29	261
		9	SS	22	260
	interbed of clayey silt and sany silt layers, wet below 10.5m	10	SS	35	259
256.4					257
11.3	**END OF BOREHOLE:**				

W. L. 264.3 m Aug 06, 2020
Oct 22, 2020
Bentonite
Filter Pack
Slotted Pipe

Notes:
1) 50mm dia. monitoring well installed upon completion.
2) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	3.32
Sept 8, 2020	3.43
Oct 22, 2020	3.59

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)
SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%) (10 20 30)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-15

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4858789.95 E 598183.97

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/30/2020

REF. NO.: 20-169-100
ENCL NO.: 16

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
264.1					
0.0 / 263.8	**TOPSOIL:** 350mm	1	SS	12	264
0.4 / 263.3	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace sand, trace rootlets, brown, moist, stiff				
0.8	**CLAYEY SILT TILL:** some sand, trace gravel, sand seams, brown, moist, stiff to very stiff	2	SS	18	263
		3	SS	22	
		4	SS	27	262
		5	SS	27	261
	grey below 4.5m	6	SS	17	260
		7	SS	14	259
		8	SS	16	258
	wet below 9m	9	SS	12	257
254.4					255
9.7	**END OF BOREHOLE:**				

Notes:
1) Water level at 9.1m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.41
Sept 8, 2020	2.33
Oct 22, 2020	2.41

W. L. 261.7 m
Aug 06, 2020
Bentonite
Filter Pack
Slotted Pipe

DYNAMIC CONE PENETRATION RESISTANCE PLOT
SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)
METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

LOG OF BOREHOLE BH20-16

PROJECT: Geotechnical Investigation
CLIENT: Bolton Option 3 Landowners Group
PROJECT LOCATION: Bolton Option 3 Lands, Caledon, Ontario
DATUM: Geodetic
BOREHOLE LOCATION: See Drawing 1 N 4857848.7 E 598703.75

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150mm
Date: Jul/31/2020

REF. NO.: 20-169-100
ENCL NO.: 17

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	METHANE AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
265.5							
0.0 / 265.1	**TOPSOIL:** 400mm	1	SS	9		265	
0.4 / 264.7	**FILL:** clayey silt, trace topsoil/ organics, trace gravel, trace rootlets, brown, moist, stiff						
0.8 / 264.0	**SILTY CLAY TILL:** some sand, trace gravel, sand seams, brown, moist, stiff to hard	2	SS	33			
1.5	**GRAVELLY SAND:** some silt, trace clay, brown, very moist to wet, compact to dense	3	SS	30		264	
262.2		4	SS	24	W. L. 263.4 m Aug 06, 2020[1] W. L. 263.1 m Oct 22, 2020		22 64 10 4
3.3 / 261.0	**SANDY SILT:** trace clay, brown, wet, compact	5	SS	20		262	
4.5	**SAND AND GRAVEI:** some silt, trace clay, brownish grey, wet, very dense	6	SS	66		261	42 37 15 6
259.3						260	
6.2 / 258.0	**SILTY SAND:** some clay, trace gravel, greyish brown, wet, dense	7	SS	38	Filter Pack Slotted Pipe		3 61 26 10
7.5 / 257.3	**SANDY SILT:** trace clay, grey, wet, dense	8	SS	41		258	
8.2	**END OF BOREHOLE:**						

Notes:
1) Water level at 2.3m below grade during drilling.
2) 50mm dia. monitoring well installed upon completion.
3) Water level Reading:

Date:	Water Level (mbgl):
Aug 6, 2020	2.12
Sept 8, 2020	2.27
Oct 22, 2020	2.49

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100
SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100
PLASTIC LIMIT w_P — NATURAL MOISTURE CONTENT w — LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30
POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

DS SOIL LOG 20-169-100 BOLTON OPTION 3 LANDS.GPJ DS.GDT 21/1/8

Appendix B
Engineered Fill Guidelines

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows; however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and DS Consultants Ltd (DSCL). Without this confirmation no responsibility for the performance of the structure can be accepted by DSCL. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a DSCL engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by DSCL during placement of engineered fill is required. Work cannot commence or continue without the presence of the DSCL representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 kPa at SLS (225 kPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

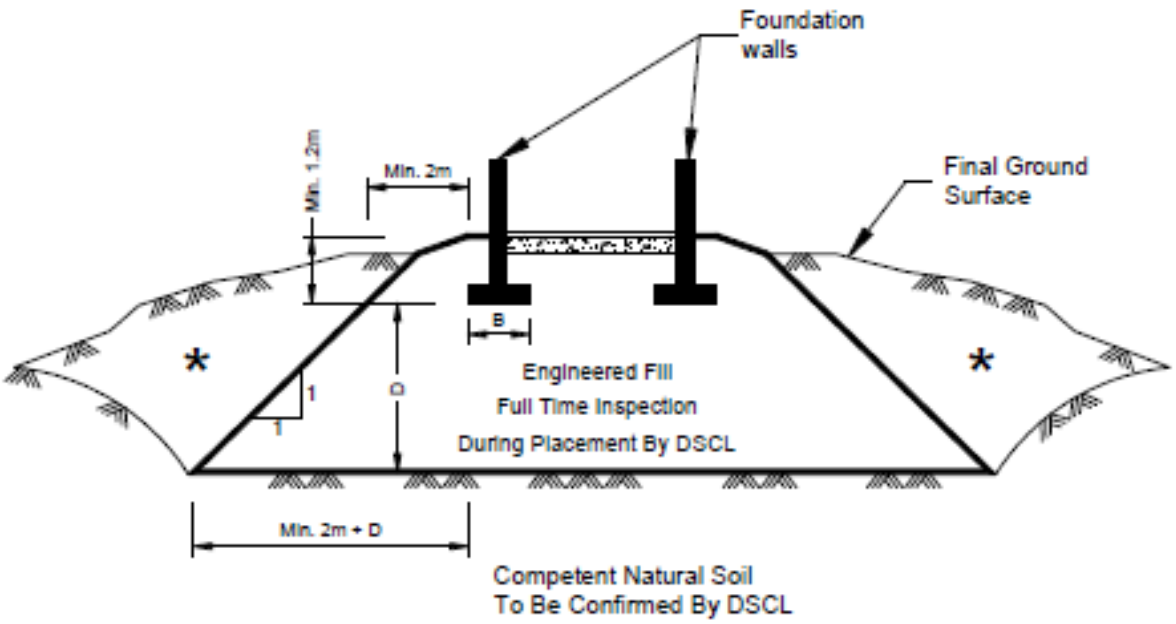
10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from DSCL prior to footing concrete placements. All excavations must be backfilled under full time supervision by DSCL to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of DSCL.

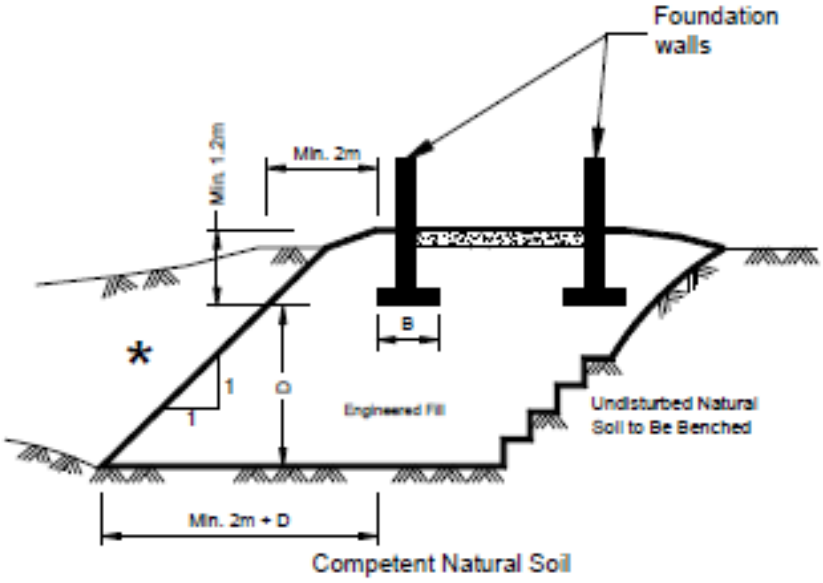
11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with DS Consultants Ltd report attached.





* Backfill in this area to be as per the DSCL report.

REPORT ON

PRELIMINARY HYDROGEOLOGICAL INVESTIGATION
PROPOSED DEVELOPMENT
Caledon Station
&
Argo King I & II
BOLTON, ONTARIO

FOR:

Draft Plan of Subdivision (21T-22001) and for Amendment for the Zoning By-Law (RZ 2022-0002)

PREPARED FOR:

Caledon Community Partners
c/o Glen Schnarr & Associates

Project No: 20-169-100
Date: May 17, 2023

DS CONSULTANTS LTD.
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Vaughan, Ontario, L4H 0K8
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20-169-104 **May 17th, 2023**

Liz Hurst
Caledon Community Partners
c/o Glen Schnarr & Associates
700-10 Kingsbridge Garden Circle
Mississauga, ON, L5R 3K6

Via email: lizh@gsai.ca

RE: Hydrogeological Investigation – Caledon Station (Caledon Station (Argo Macville I, Argo Macville II, Robert Speirs, Argo Macville V, Argo Humberking & Argo HumberKing Station lands) & Argo King I & II, Caledon (Bolton), ON

DS Consultants Limited (DS) was retained by Caledon Community Partners to complete a Hydrogeological Investigation on the Argo Macville I, Argo Macville II, Robert Speirs, Argo Macville V, Argo Humberking and Argo HumberKing Station lands, herein referred to as Caledon Station, and 7675 King Steet, Bolton, here in referred to as Argo King I & II. These sites are portions of a greater study area completed for the Bolton Option 3 Landowner's group. The Caledon Station and ARGO Humber Station lands include the development of approximately 107.19 hectares (ha) and 5.61 ha of land situated on The Gore Road and Humber Station Road in Bolton, ON, respectively. Argo King I & II lands include the development of approximately 8.7 ha of land situated south of King Street, approximately 400 m east from the Gore Road. The area is primarily agricultural with some residential lots. The proposed development of these lands includes residential and mixed-use land uses, open spaces, parks, trails, commercial uses, the Bolton GO Station, natural heritage features and areas designated for stormwater management (SWM Ponds). The development will also include the construction of roadways including storm and sanitary sewer and water distribution infrastructure.

This Hydrogeological Investigation provides an overview of the existing geological and hydrogeological conditions at the Site and surrounding area and provides an assessment of hydrogeological constraints and potential impacts of the proposed development on local groundwater resources. A significant aim of the study is to provide mitigation measures to reduce or eliminate the impacts of development on local water resources, groundwater users, and the natural environment. It also includes an estimation of construction dewatering requirements and groundwater permanent drainage conditions.

If needed, the results of this investigation can be used in support of an application for a Category 3 Permit to Take Water (PTTW) or an Environmental Activity Sector Registry (EASR) for construction dewatering from the Ministry of the Environment, Conservation and Parks (MECP) and discharge permitting from the Town of Caledon.

Based on the results of our investigation, the following conclusions and recommendations are presented:

1. The Site is located within the Main Humber sub watershed part of the larger Humber River watershed. The surface water and drainage setting at the Site comprises a total of eight (8) wetlands within the

Caledon Station and three (3) wetlands within the Argo King I & II development, which are incorporated into the tributaries of the Humber River and ultimately flow into Lake Ontario. Relief across the Site ranges from approximately 281 masl in the northwest corner of the Site to 262.0 masl in the southwest corner of the Site. The study area is characterized as having moderate drainage, which is directed overland into various streams on the Site.

2. The Site is situated within the South Slope Physiographic Region of Southern Ontario (Chapman and Putnam, 1984), and lies within a Drumlinized Till Plain Physiographic Landform. Surficial geology mapping made available by the Ontario Geological Survey (2010) indicates that the study area is covered entirely by Halton till. There are some glacial deposits of sand and gravel to the west of the site and modern alluvial deposits of silt, sand, and gravel to the east along tributaries to the Humber River. The overburden in the vicinity of the site is clayey silt to sandy silt till deposits (Halton till).

3. Based on the MECP water well records search, there are ninety-eight (98) water wells within 500 meters of the Site. Forty-nine (49) water wells are noted as domestic and/or livestock supply wells, five (5) water wells were noted for commercial use, two (2) wells were noted for industrial use, and two (2) wells were noted for municipal use. All other remaining wells are either abandoned, not in use or monitoring/test hole wells. Private domestic and commercial water supply wells are drilled into sandy aquifers confined under clay till. The depths of these wells range from 7.5 to 63.4 mbgs. It is recommended that a private door-to-door water well survey be completed within a 500 m radius of the Site to confirm private use of groundwater in the study area.

4. To assess soil and groundwater conditions at the Site, DS used sixteen (16) exploratory boreholes advanced during the geotechnical investigations at the Caledon Station Site carried out in July 2020 which included thirteen (13) monitoring wells (MWs). Three (3) boreholes were advanced April 22nd, 2021, in which two (2) MWs were installed. Between August 19th and September 7th, 2022, forty-two (42) exploratory boreholes were advanced in which twenty-three (23) MWs were installed. Between June 19th and June 21st, 2019, seven (7) boreholes were advanced at the Argo I & Argo II Site in which four (4) MWs were installed. Between October 13th and October 17th nine (9) boreholes were advanced in which five (5) MWs installed. Monitoring Wells were constructed with two (2) inch PVC casing and a 1.5 m or 3.0 m length of screen installed at varying depths ranging from 4.0 to 11.0 meters below ground surface (mbgs).

5. Based on the subsurface investigation, the stratigraphic setting of the Site comprises of topsoil/fill /disturbed native materials underlain by native soil deposits. The native soil deposits at the Site includes clayey silt till to silty clay till (Halton till) to depths ranging from 1.5 m to 11.3 mbgs, which in turn is underlain by silt/sandy silt/silty sand (Newmarket till) extending to the maximum depth of investigation. Modern alluvium deposits consisting of sand and gravel were encountered in the southeast corner of the Site. Bedrock was not encountered during the subsurface investigation.

6. **DS** implemented a groundwater monitoring program at the Caledon Station Site in August 2020 on bi-monthly basis and at Argo King I & II in October 2022 on a monthly basis to assess long-term

groundwater fluctuations. Groundwater was found in monitoring wells at depths ranging from 255.2 to 271.1 mbgs at the Caledon Station Site and from 255.8 to 261.0 masl at the Argo King I & II Site throughout their respective monitoring periods. Artesian conditions were encountered within the northeaster quadrant of the Argo King I & II Site. The groundwater flow direction within the Site area is inferred to be in a north-easterly and southeasterly direction towards the tributaries intersecting the Sites. Continuous groundwater monitoring at the Site indicated that the groundwater levels at the Site had a gradual decline during the August to October ongoing monitoring period.

7. Single Well Response Tests (SWRTs) were completed by DS in nine (9) monitoring wells on August 6th and 7th, 2020 and in eighteen (18) monitoring wells between November 1st and November 3rd, 2022 at the Caledon Station Site and SWRTs were completed in nine (9) monitoring wells between June 2019 and October 2022 at Argo King I & II to estimate hydraulic conductivity (K) for the representative geological units in which the wells were screened. The hydraulic conductivity values between the sites ranged from 2.9×10^{-10} m/sec within the low permeably clay silt till to 4.0×10^{-5} m/sec within the highly permeable sand.

8. Three (3) unfiltered groundwater samples were collected from select monitoring well locations (BH22-13 BH22-17 and BH22-32), on November 3rd, 2023, from the Caledon Station Site and two (2) unfiltered groundwater samples were collected from BH22-1 and BH22-5 on October 26th, 2022, from Argo King I & II. Groundwater quality results were compared to parameters limits outlined in the Peel Region Sanitary and Storm Sewer Discharge By-Law 53-2010 and the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to the Region's sewer system and nearby surface water features. Based on the results of the analytical testing, Total Suspended Solids (TSS) and manganese exceeded at all locations in addition to phosphorus and zinc exceedance detected at the Argo King I & II Site at BH22-1. Multiple exceedances were reported against PWQO standards. Pre-treatment of the pumped water will be required prior to discharging into a natural surface water feature.

9. DS collected two (2) non-filtered surface water samples on October 24, 2020, from the Caledon Station Site; one (1) from the surface water stream in the southwest corner of the Site (Surface Station: SG W2-1); and one (1) sample from the surface water stream in the southeast corner of the Site (Surface Station: SG W8-1). The baseline water quality samples were compared against the PWQO standards. Based on the results of the analytical testing, the water quality exceeded the PWQO criteria for various metal parameters and phosphorus.

10. **DS** commenced continuous pre-construction monitoring at the Site including the onsite wetlands on the Caledon Station and Argo King I & II Sites to determine the interaction between surface and groundwater. The continuous pre-construction surface water and groundwater monitoring program of the Caledon Station and Argo King I & II Sites are currently underway. The findings from the data collected to-date are from during the August 2020 to March of 2023 and October 2022 to April 2023 monitoring periods.

11. Based on the preliminary results of the monitoring during the August to October period in 2020, all wetlands at the Site appear to be ephemeral features. The monitoring program to-date generally indicated an upward shallow groundwater gradient at Wetlands 1 through 3, and Wetland 8, and a downward shallow groundwater gradient at Wetlands 4 through 7 within the Caledon Station Site. The monitoring program to date at the Argo King I & II Site generally indicated an upward gradient at wetland 1 and a downward gradient for wetlands 2 and 3. Continued monitoring at the Site is required to confirm groundwater and surface water dynamics at the Site.

12. In-situ infiltration testing was conducted by **DS** field personnel on September 2nd, 2020. The testing was completed at a depth of 0.5m and 1.5 m mbgs at ten monitoring well locations (BH20-1, BH20-2 and BH20-5 through BH20-16). Based on the test results, the site primarily consists of a low permeable silty clay till with a measured infiltration rate ranging from about 16 to 38 mm/hr with an average of 26 mm/hr. One test location at (BH20-16 - southeast corner of the Site) with sand and gravel deposits, produced an infiltration rate of 108 mm/hr. Soils with infiltration rates over 15 mm/hr are considered suitable for Soakaways, infiltration trenches and chambers (TRCA, 2010).

13. Results of the Site water balance show a decrease in annual infiltration (94,215 m^3/year), from pre-development to post-development conditions. The effects are the result of increased impervious areas replacing pervious areas of the Site. Considering the high groundwater elevations across the Site, lot level mitigation was considered the best approach for improving infiltration in the post-development condition. The current LID plan includes connecting about 9.8 ha of impervious surfaces with 20.5 ha of pervious area to maximize infiltration potential. Additionally, Silva Cells is utilized road ROWs and parks. The post-development with mitigation infiltration deficit is reduced to 21,851 m^3/yr from pre-development conditions.

14. Changes to wetland catchment size directly affect the volume and timing of stormwater contributions to downgradient features. A Wetland Water Balance Risk Evaluation following TRCA guidelines (TRCA, Nov 2017) showed there is high risk to wetlands W1 to W6 as a result of reduced catchment size. In order to understand the effects of the reduced catchment area and evaluate the magnitude of actual hydrological changes, a wetland water balance is currently being completed by Urbantech using a continuous model. The results of the ongoing pre-construction wetland monitoring program undertaken by **DS** will be used in conjunction with the continuous model to assess the actual risks to the wetlands. Based on the findings of the water balance results, a wetland mitigation plan will be developed.

15. It is understood that the provided site grading plan and the design of the four (4) storm water management ponds are currently preliminary and the proposed site servicing plan and the architectural drawings with the final basement floor slab elevations of all structures to be constructed below grade have not been finalized at this stage. **DS** made numerous assumptions, as outlined in Section 6.0 of this report, in support of the groundwater seepage assessment during the construction period. The requirements for dewatering/control during the construction period is as follows:

15.0 Medium Density Residential Blocks – 346,830 L/day (incl. 50% safety factor on anticipated seepage rates and contribution from a 2-year storm) **per block**;

15.1 Townhouse and Single Detached Units – 186,705 L/day (incl. 50% safety factor on anticipated seepage rates and contribution from a 2-year storm) **per unit;**

15.2 Site Servicing (Developmental Site area / Newmarket Till) – 15,500 L/day (incl. 50% safety factor on anticipated seepage rate and contribution from a 2-year storm) **per unit trench segment**;

15.3 Storm Water Management Pond 1 – 899,000 L/day (incl. 50% safety factor on anticipated rate; and contribution from a 10 mm storm event);

15.4 Storm Water Management Pond 2A – 280,000 L/day (incl. 50% safety factor on anticipated rate; and contribution from a 10 mm storm event); and

15.5 Storm Water Management Pond 2B – 223,750 L/day (incl. 50% safety factor on anticipated rate; and contribution from a 10 mm storm event); and

15.6 Interim Storm Water Management Pond – 240,500 L/day (incl. 50% safety factor on anticipated rate; and contribution from a 10 mm storm event)

16. All low-rise residential blocks, institutional and commercial zones are not anticipated to require any permanent groundwater drainage control as they are expected to be constructed with a water-proofing membrane. The proposed SWM pond designs will require permanent groundwater control. Based on preliminary designs provided to DS. The requirements for dewatering/control during the construction period is as follows:

    16.0 Storm Water Management Pond 1 – 255,750 L/day (incl. 50% safety factor on anticipated rate); and

    16.1 Storm Water Management Pond 2A – 11,250 L/day (incl. 50% safety factor on anticipated rate); and

    16.2 Storm Water Management Pond 2B – 13,500 L/day (incl. 50% safety factor on anticipated rate); and

    16.3 Interim Storm Water Management Pond – 45,000 L/day (incl. 50% safety factor on anticipated rate)

17. During the construction period, the requirements to obtain any water taking permits (EASR/PTTW) will depend on the ownership structure of the Site and the staging for development. During the post-construction period, PTTW registration with the MECP will be required for the permanent drainage anticipated for the proposed SWM Ponds.

18. A discharge permit may be required from the Toronto and Region Conservation Authority (TRCA), Region of Peel and/or Town of Caledon if the water is to be discharged to a nearby/on-site surface water body as a result of construction dewatering. A discharge and monitoring plan will need to be prepared prior to obtaining a discharge approval from the TRCA, Peel Region and/or Town of Caledon. Based on the results of the groundwater analytical testing pre-treatment of the pumped water will be required to ensure compliance with the Peel Region sewer use by-law/PWQO criteria prior to discharging into the sewer system or natural surface water features.

19. During the post-construction period, a sewer discharge agreement with the local upper and/or lower tier municipality may be required prior to any discharging operations into the municipal sewer system.

20. Dewatering activities adjacent to the on-site wetland features has the potential to lower the groundwater and/or surface water levels in the wetlands. Once a groundwater dewatering system is set up at the Site, daily and weekly monitoring should be implemented to assess the groundwater conditions such as water levels, measurement of discharge flow, discharge water quality and any adverse impacts as a result of dewatering, if any.

21. In conformance with Regulation 903 of the Ontario Water Resources Act, the decommissioning of any dewatering system and monitoring wells should be carried out by a licensed contractor under the supervision of a licensed water well technician.

Should you have any questions regarding these findings, please do not hesitate to contact the undersigned.

DS Consultants Ltd.

Prepared By:

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Project Manager

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Senior Hydrogeologist

Scott Watson, B.A.T.
GeoBase Solution (GBS) Ltd.

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

DS Consultants Limited (DS) was retained by Caledon Community Partners to complete a Hydrogeological Investigation on the Argo Macville I, Argo Macville II, Robert Speirs, Argo Macville V, Argo Humberking and Argo HumberKing Station lands, herein referred to as Caledon Station, and 7675 King Steet, Bolton, here in referred to as Argo King I & II. These sites are portions of a greater study area completed for the Bolton Option 3 Landowner's group.

The Caledon Station and ARGO Humber Station lands include the development of approximately 107.19 ha and 5.61 ha of land, respectively, situated on The Gore Road and Humber Station Road in Bolton, ON. Argo King I & II lands include the development of approximately 8.7 ha of land situated south of King Street, approximately 400 m east from the Gore Road. The Site locations are shown in **Figure 1**. The area is primarily agricultural with some residential lots. The proposed development of these lands includes residential and mixed-use land uses, open spaces, parks, trails, commercial uses, the Bolton GO Station, natural heritage features and areas designated for stormwater management (SWM Ponds). The development will also include the construction of roadways including storm and sanitary sewer and water distribution infrastructure.

This hydrogeological investigation includes characterization of existing geological, hydrogeological and hydrologic conditions of the Site and local features including eight (8) wetland units within the Caledon Station property boundary, and three (3) wetland units within the Argo King I & II property boundary. The investigation provides an assessment of opportunities and constraints including potential impacts on local groundwater resources. A significant aim of the study is to provide mitigation measures to reduce or eliminate the impacts of development on local water resources, groundwater users, and the natural environment. The study also provides an estimation of construction dewatering requirements and groundwater permanent drainage conditions.

1.1 Purpose

The purpose of this investigation is to characterize groundwater conditions over the study area and provide construction dewatering estimates and recommendations for design and mitigation measures to reduce or eliminate impacts of development on local water resources. The investigation will inform a water balance study to help define potential risks to the wetlands features within the Site. This investigation also includes an asassessment of dewatering requirements and provides recommendations for the obtaining the necessary permits prior to construction such as a Permit to Take Water (PTTW) or registry on the Environmental Activity Sector Registry (EASR) from the Ministry of Environment and Conservation and Parks (MECP).

1.2 Scope of Work

The scope of work for this investigation includes:

(i) Drilling and installation of monitoring wells, piezometers, and stream flow monitoring instrumentation;

(ii) Collecting and interpreting available reports and data including the MECP Water Well Records (WWR), geotechnical, hydrogeological and environmental studies completed at the Site;
(iii) In-situ hydraulic conductivity testing
(iv) Stream water level and flow monitoring including seasonal fluctuation;
(v) Water quality assessment for surface water and groundwater;
(vi) Site water balance assessment;
(vii) Feature based water balance assessment;
(viii) Wetland water balance assessment;
(ix) Data analyses and report preparation, and;
(x) Review and response to agency comments.

2.0 PREVIOUS STUDIES

DS reviewed the following previous studies during our background review:

- *"Headwater Drainage Feature Assessment: In Support of the Bolton Residential Expansion Study"*, by Aquafor Beech Ltd., dated June 16. 2013, File No.: 65473
- *"Preliminary Geotechnical Investigation, Proposed Residential Subdivision, Bolton Option 3 Lands, Bolton, Ontario"*, by DS Consultants Ltd., dated September 4, 2020, File No.: 20-169-100
- *"A Report to Humberking (I) Developments Limited and HumberKing (IV) Developments Limited, A Geotechnical Investigation for Proposed Mixed-Use Development, King Street and Humber Station Road, Town of Caledon", prepared by Soil Engineers Ltd., dated December 2021, File No. 2108-S069*
- *"Draft- A Report to HumberKing (I) Developments Limited and HumberKing (IV) Developments Limited, Hydrogeolocial Assessment, Proposed Mixed Use Development King Street and Humber Station Road, Town of Caledon", prepared by Soil Engineers Ltd., dated December 2022, File No. 2108-W069*

A brief summary of the findings from each investigation/report is provided in the following sections.

2.1 Headwater Drainage Feature Assessment: In Support of the Bolton Residential Expansion Study (Aquafor Beech Ltd., 2014)

Aquafor Beech Limited (Aquafor) completed a *Headwater Drainage Feature Assessment* (2014) in support of the BRES Study being carried out by the Town of Caledon. The objectives of the investigation included delineation of Headwater Drainage Features (HDF) within the Caledon Station Site. The study identified and classified a total of four (4) HDFs as summarized below:

- Headwater Drainage Feature-1 (HDF-1) is located in the eastern portion of the Site and consists of fifteen (14) stream reaches (1a, 1b, 1c, 1d, 1e, 1f, 1g, 1h, 1i, 1j, 1k, 1l, 1m and 1n);

- Headwater Drainage Feature-2 (HDF-2) is located along the eastern boundary of the Site and consists of two (2) stream reaches (2a and 2b);

- Headwater Drainage Feature-3 (HDF-3) is located within the western portion of the Site and consists of seven (7) stream reaches (3a, 3b, 3c, 3d, 3e, 3f and 3g); and,

- Headwater Drainage Feature-4 (HDF-4) is located along the western property boundary of the Site and consists of three (3) stream reaches (4a, 4b and 4c). Stream reach 4b is noted to be an existing pond.

The Headwater Drainage Map by Aquafor (2014) is provided in **Appendix A**.

2.2 Preliminary Geotechnical Investigation, Proposed Residential Subdivision, Bolton Option 3 Lands, Bolton, Ontario (DS Consultants Limited, 2020)

A Preliminary Geotechnical Investigation was completed by DS Consultants Ltd., for the greater site, Bolton Option 3 Lands. The investigation involved advancing a total of sixteen (16) boreholes to depths ranging from 6.7 m to 11.3 mbgs. Groundwater monitoring wells were installed in thirteen (13) borehole locations (BH20-1, BH20-2, BH20-3, BH20-4, BH20-5, BH20-6, BH20-7, BH20-9, BH20-11, BH20-12, BH20-14, BH20-15 and BH20-16) to permit monitoring of groundwater levels at the Site.

Based on the subsurface investigation completed at the Site, the Site was underlain by a surficial layer of topsoil, fill and/or disturbed native materials to depths of 0.8 mbgs, which in turn was underlain by native soils extending to the full depth of investigation. The native soils at the Site comprised of clayey silt/silty clay till material underlain by a lower cohesionless silt to sandy silt and silty sand deposits. Bedrock was not encountered to the full depth of investigation.

The clayey silt till was encountered under the fill layer in all borehole locations except BH20-4 and extended to depths ranging from 1.5 m to 7.7 mbgs and to the termination depth in Boreholes BH20-6, BH20-7, BH20-10, BH20-14 and BH20-15. The clayey silt to silty clay layer contained sand seams and trace to some amounts of sand, gravel and cobbles. The unit was noted to be moist to very moist and wet at the bottom of some borehole locations. The soil was generally found to be brown to grey in colour.

The lower cohesionless silt to sandy silt and silty sand deposits was found underlying the clayey silt to silty clay deposits in Boreholes BH20-1 to BH20-3, BH20-5, BH20-8, BH20-9, BH20-11 to BH20-13 and BH20-16 and extended to the full depth of investigation. This unit contained layers of sand and gravel/gravelly sand materials in the location of Borehole BH20-16 at various depths ranging from 1.5 m to 6.2 mbgs. The unit was noted to be moist to wet and brown to grey in colour.

The investigation involved equipping thirteen (13) borehole locations with 50 mm diameter monitoring wells to permit the monitoring of groundwater levels at the Site. On-completion groundwater levels were collected and noted to range from 2.3 m to 9.1 mbgs. Groundwater levels in the monitoring wells were measured in August 2020 and ranged from 0.2 m to 6.8 mbgs (Elev. 260.4 masl to 275.7 masl). Monitoring Well BH20-7 was found to be dry.

2.3 A Report to HumberKing (I) Developments Limited and HumberKing (IV) Developments Limited, A Geotechnical Investigation for Proposed Mixed-Use Development, King Street and Humber Station Road, Town of Caledon (Soil Engineers Ltd., 2021).

A Geotechnical Investigation was completed by Soil Engineers Ltd., for the northeast and northwest quadrant of King Street and Humber Station Road in the Town of Caledon. The investigation involved advancing a total of eighteen (18) boreholes to a depth of 6.6 mbgs. Groundwater monitoring wells were installed in eight (8) borehole locations (BH1, BH4, BH5, BH6, BH8, BH14, BH16 and BH18) to permit monitoring of groundwater levels at the Site.

Based on the subsurface investigation completed at the Site, the Site was underlain by a surficial layer of topsoil, fill and/or disturbed native materials, which in turn was underlain by native soils extending to the full depth of investigation. The native soils at the Site comprised of silty clay/sandy till material underlain by a lower cohesionless sand and sandy silt deposits. Bedrock was not encountered to the full depth of investigation.

The clayey silt till was encountered under the fill layer in all borehole locations and extended to the maximum explored depths except for BH18. In BH18 a dense cohesionless sandy silt layer was encountered in 2.9 mbgs and extending to 5.6 mbgs underlain by sand extending to the maximum explored depth of the borehole.

The investigation involved equipping eight (8) borehole locations with 50 mm diameter monitoring wells to permit the monitoring of groundwater levels at the Site. On-completion groundwater levels were collected, and all boreholes were noted as dry, except for BH17 where groundwater was found at 6.1 mbgs (260.1 masl).

2.4 Draft- A Report to HumberKing (I) Developments Limited and HumberKing (IV) Developments Limited, Hydrogeological Assessment, Proposed Mixed Use Development King Street and Humber Station Road, Town of Caledon (Soil Engineers Ltd. 2022).

A Hydrogeological Investigation was completed by Soil Engineers Ltd., at the development site located at King Street and Humber Station Road in the Town of Caledon. The investigation involved the use of the eight (8) monitoring wells advanced as part of the Geotechnical Investigation by Soil Engineers Ltd. In 2021 to permit monitoring of groundwater levels at the Site. The following findings are summarized below:

- The site is within the till plains within the south slope physiographic region of Southern Ontario and is underlain by the Halton Till. The Site lies within Humber River Watershed and Main Humber Sub-watershed.

- Groundwater levels were measured on October 21, November 4 and on November 16, 2021, with a maximum groundwater fluctuation of 1.67 m. Groundwater levels ranged from 1.308 to 4.93

mbgs (241.60to 243.67 masl). Monitoring wells in BH1 and BH4 were dry throughout the monitoring period. The groundwater flow direction was inferred to flow in an easterly and southeasterly direction.

- Six (6) Single Well Response Tests were completed to determine the yield capacity and flow of groundwater for the ground water-bearing subsurface. Estimated hydraulic conductivity (k) values ranged from 4.2×10^{-8} to 2.5×10^{-6} m/s.

- Construction dewatering for the underground basement structures and for the installation of the associated underground services and storm water management infrastructure were estimated.

    - The maximum estimated dewatering rate for a housing structure (west of Humber Station Road) ranged from 26,663.4 to 84,317.2 L/day with a 3x safety factor for 25 x 13 m for proposed housing structures with a permitter of 88m;

    - The maximum estimated dewatering rate for an excavation of 175 x 150m (west of Humber Station Road) ranged from 196,945.8 to 622,797.2 L/day with a 3x safety factor for the proposed housing structures with a permitter of 88m;

    - For a 50m site servicing trench the estimated maximum dewatering rate ranged from 8,298.0 to 26,240.7 L/day.

3.0 FIELD INVESTIGATION

To assess soil and groundwater conditions at the Site, DS used sixteen (16) exploratory boreholes advanced during the geotechnical investigations at the Caledon Station Site carried out in July 2020 which included thirteen (13) monitoring wells (MWs) installed at borehole locations BH20-1 through BH20-7, BH20-9, BH20-11 through BH20-12, and BH20-14 through BH20-16. Three (3) boreholes were advanced April 22nd, 2021. Two (2) MWs installed in boreholes BH21-1 and BH21-2. Between August 19th and September 7th, 2022, forty-two (42) exploratory boreholes were advanced. Twenty-three (23) MWs were installed at borehole locations BH22-1, BH22-3, BH22-5, BH22-10, BH22-11, BH22-13 through BH22-15, BH22-17, BH22-20, BH22-22, BH22-25, BH22-27 through BH22-29, BH22-32, BH22-33, BH22-35, BH22-36A, BH22-39A, BH22-40, BH22-40A, and BH22-42.

Between June 19th and June 21st, 2019, seven (7) boreholes were advanced at the Argo I & Argo II Site in which four (4) MWs were installed at borehole locations BH19-1, and BH19-3 through BH19-7. Between October 13th and October 17th nine (9) boreholes were advanced in which five (5) MWs installed in boreholes BH22-1, BH22-5, and BH22-7 through BH22-9. The borehole and monitoring well locations are as shown in **Figure 4A**. The detailed subsurface conditions are provided in the boreholes logs in **Appendix B**. MWs were constructed in accordance with O.Reg. 903, with 2-inch PVC casing and a 1.5 m or 3.0 m length of screen. Screens were installed at varying depths ranging from 4.0 to 11.0 meters below ground surface (mbgs).

Monitoring wells were developed before use to allow for groundwater level monitoring, hydraulic conductivity testing, and to assess groundwater quality. Monitoring wells were developed before use to allow for groundwater level monitoring, hydraulic conductivity testing, and to assess groundwater quality. Thirty-six (36) single well response tests (SWRTs) were completed by performing a rising head test to estimate hydraulic conductivity values of the overburden at the Site.

Three (3) unfiltered groundwater samples were collected from the Caledon Station Site and two (2) unfiltered groundwater samples were collected from the Argo King I & II Site. Groundwater quality results were compared to parameters limits outlined in the Peel Region Sanitary and Storm Sewer Discharge By-Law 53-2010 and the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to the Region's sewer system and nearby surface water features as part of the hydrogeological investigation.

Two (2) unfiltered surface water samples were collected from the Caledon Station Site for comparison of water quality against the PWQO to assess baseline water quality conditions at the Site prior to commencing construction activities.

4.0 PHYSICAL SETTING

Available topographic maps, environmental, geotechnical, and hydrogeological reports, and the Ontario Geological Survey were used to develop an understanding of the physical setting of the study area. The borehole logs from all investigations at the site as well as the Ministry of the Environment, Conservation and Parks Water Wells Records (MECP WWRs) used to interpret the geological and hydrogeological conditions at the Site.

4.1 Physiography and Drainage

The Site is located within a physiographic region of Southern Ontario known as the South Slope and within a physiographic landform feature known as the Drumlinized Till Plain (Chapman and Putnam, 1984). The South Slope physiographic region lies between the Oak Ridges Moraine in the north and the Peel Plain in the south. Much of the land surface topography and geology in southern Ontario was formed during the most recent glaciation period, known as the Wisconsin Glaciation, which was accompanied by various meltwater lakes and channels. The Pleistocene deposits present in the Caledon and Brampton area are associated with the advancing and retreating of this ice sheet. The South Slope consists of low-lying till plains, with undulating to gently rolling terrain and incised valleys around larger creeks and rivers. The South Slope has a gently, but steady slope to the southeast towards Lake Ontario, which results in overall good drainage.

The study area generally comprises of two main aquifers. The deeper aquifer is the Scarborough Aquifer Complex usually at depths greater than 40 or shallower sections of sand and silty sand associated with the Thorncliffe Aquifer complex. A second localized shallower aquifer consists of discontinuous sand lenses within the Halton till or the upper sandy silt of the ORM Aquifer Complex at depths up to 20 mbgs. The Scarborough Aquifer complex is overlain by the Newmarket and Halton till aquitards that also sandwich the ORM Aquifer Complex, therefore displaying he piezometric surface of a confined aquifer system, varying between 5 and 20 mbgs (Bolton Residential Expansion Study Background Environmental Study, 2014).

The Site is located within the Main Humber subwatershed, part of the larger Humber River Watershed. There are numerous headwater drainage features located within the Site (Section 4.3.5). The closest surface watercourse to the Site is the Humber River, located approximately 1 km east of the Site. The topography within the Site is gently rolling with a general slope towards the south/southeast. The study area is characterized as having a moderate drainage and is directed overland into various streams on the Site.

4.2 Geology

The following presents a brief description of regional and site geology based on the review of available information and site-specific soil investigations.

4.2.1 Quaternary Geology

The surficial geology at the Site and in the surrounding area is predominantly comprised of clay to silt-textured silt (Ontario Geological Survey, 2010). A pocket of surficial ice-contact stratified deposits consisting of sand and gravel with minor amounts of clay, silt and till are present west of the Site. There are modern alluvial deposits consisting of clay, silt, sand and gravel deposits present along the Humber River and its tributaries in the east. An illustration of surficial geology for the Site and surrounding area is provided in **Figure 2B.**

4.2.2 Bedrock Geology

Available published mapping indicates that bedrock in the area predominantly comprises of shale and minor limestone part of the Queenston Formation (MNDM Map 2544 Bedrock Geology of Ontario). Bedrock was not encountered as part of the borehole drilling program within the Caledon Station Site area. Based on the MECP water well records, there are ten (10) water well records which were reportedly completed into bedrock. The thickness of the overburden generally ranged from 24.7 mbgs to 75.0 mbgs, based on nine (9) well records (MECP WWR No. 4903854, 7275497, 4906470, 4908193, 4908194, 4904437, 4905615, 7267796, and 4907399). There is one (1) well record (MECP WWR No. 4905839) located approximately 490 northeast of the Site with a reported depth to bedrock of 11.0 mbgs. This well record is located within the valley lands of the Humber River, and for this reason the ground surface elevation of the well is likely significantly lower than surface elevations across the Site.

4.2.3 Site Geology

The stratigraphic setting of the Sites was interpreted from the soil encountered during the current subsurface investigation. In summary, the Sites are underlain by a surficial layer of topsoil / fill / disturbed native material, which in turn was underlain by native soil deposits extending to the full depth of investigation. The native soil deposits at the Site comprised of clayey silt till to silty clay till (Halton Till), which in turn was underlain by silt to sandy silt/sandy silt deposits. Bedrock was not encountered during the subsurface investigation.

The stratigraphic conditions encountered at the Sites during the current subsurface investigations were generally consistent with the findings from the previously completed Preliminary Geotechnical Investigation (Sections 2.4 and 2.5).

The stratigraphic conditions encountered in the boreholes are in detail summarized below.

Table 2: Summary of Stratigraphic Conditions

Caledon Station	Argo King I & II
Topsoil/Fill/Disturbed Native	
Topsoil: 200-550 mm encountered in all BHs	Topsoil: 200-350 mm encountered in BHs expcept fopr BH19-5
Earth fill/disturbed native material was encountered at all BH locations and extended to a maximum depth of 2.3 mbgs.	Earth fill/disturbed native material was encountered at all BH locations and extended to a maximum depth of 1.5 mbgs.
Fill/disturbed native material consist of sandy silt to clayey silt with trace grave and trace amounts of topsoil/organics	Fill/disturbed native material consist of clayey silt to silty clay with trace topsoil and organics
Halton Till Deposits (Clayey Silt Till to Silty Clay Till)	
Glacial Till- clayey silt to silty clay with trace amounts of sand and gravel was encountered in all BHs except for BH20-4, BH22-6, BH22-7, BH22-9, BH22-1 and BH22-13.	Glacial Till- clayey silt to silty clay was encountered in all BHs
Occasional wet silt/sand seams	Range from 2.1 to 11.3 mbgs and to borehole termination depth in CH19-1, BH19-2, BH19-5, BH19-8, BH22-4 to BH22-6 and BH22-8
Range from 1.5 to 9.7 mbgs and to borehole termination depth in BH20-6, BH20-10, BH20-15, BH22-14, BH22-16, BH22-17, BH22-19, BH22-20, BH22-21, BH22-24, BH22-34, BH22-37, BH22-38 through BH22-41	
Newmarket Till (Silt/Sandy Silt/ Silty Sand)	
Silt/sandy silt/silty sand was encountered in all BHs except for BH20-6, BH20-10, BH20-15, BH21-1, BH21-3, BH22-34 underlying the Halton Till or Fill	Silt/sandy silt/silty sand was encountered in all BHs except for BH19-2, BH19-8, BH22-4 to BH22-6 and BH22-8

Range from 1.0 to 10.7 mbgs between BHs BH21-2, BH22-24, BH22-30, BH22-31 and BH22-36 and to the maximum explored depth in all other encountered BHs.	Ranged from 4.8 to 11.3 mbgs. The deposits were water bearing and present in a loose to dense state.
Sand, Sand & Gravel	
A sand/sand and gravel seam unit were encountered in BHs BH22-2, BH22-4, BH22-29, BH22-30 extending to depths of 4.6 to 12.2 and to the maximum explored depth in BH22-30	Not encountered

The location of the boreholes and monitoring wells is provided in **Figure 4**. The borehole logs are provided in **Appendix B**. Geological Cross-Sections A-A' to F-F', which depict the stratigraphic setting at the Site are provided in **Figure 5A to 5F**.

4.3 Hydrogeology

The hydrogeology at the Site was evaluated using the on-site monitoring wells, piezometers, and staff gauges installed by DS, local domestic wells and existing hydrogeological and environmental reports for the area.

4.3.1 Local Groundwater Use

As part of the hydrogeological study, DS completed a search of the Ministry of the Environment, Conservation and Parks (MECP) Water Well Record (WWR) database for both sites. Based on the MECP water well records search, there are ninety-eight (98) water wells within 500 meters of the two Sites. Forty-nine (49) water wells are noted as domestic and/or livestock supply wells, five (5) water wells were noted for commercial use, two (2) wells were noted for industrial use, and two (2) wells were noted for municipal use. All other remaining wells are either abandoned, not in use or monitoring/test hole wells. Private domestic and commercial water supply wells are drilled into sandy aquifers confined under clay till. The depths of these wells range from 7.5 to 63.4 mbgs. Domestic water supply records exist for wells drilled between the dates of January 1957 to June 2016. The water well record summary is included **in Appendix C. Figure 3** shows the MECP water well location plan.

It is recommended that a door-to-door private water well survey be completed within a 500 m radius of the Site to confirm the use of groundwater for private servicing in the study area.

There are zero (0) records of permit to take water (PTTW) within 1 km of the site.

4.3.2 Groundwater Conditions

DS implemented a groundwater monitoring program at the Caledon Station Site in August 2020 on bi-monthly basis and at Argo King I & II in October 2022 on a monthly basis. Monitoring programs began with a Site visit to collect groundwater levels to assess long-term groundwater fluctuations. Currently, the monitoring has been conducted from August 2020 to February 2023 at the Caledon Station Site and from October 2022 to April 2023 at Argo King I & II, and will be ongoing until January 2024 and October 2024, respectively. **Figure 4** shows the monitoring well locations. **Table 1** presents a summary of the measured groundwater level elevations in all monitoring wells and piezometers.

Caledon Station

Throughout the study area, groundwater levels were found to range between 255.2 masl (BH20-7) and 276.16 masl (BH20-1) in the proposed developmental area, which represent the groundwater levels within the overburden at the Site. Based on the groundwater elevation contours, the direction of groundwater flow is generally expected to be in a southeasterly direction. Flow diverges across the site to the south and east into their respective tributaries of the Humber River. The average hydraulic gradient flowing west to east is estimated to be 0.007 m/m. The average hydraulic gradient from the north to the south is estimated to be approximately 0.010 m/m. Groundwater outlets to surface streams at the southwest and southeast limits of the site. The Inferred groundwater map is provided in **Figure 6**.

Continuous water level monitoring was conducted on four (4) monitoring well at BH20-5, BH20-7, BH20-12 and BH20-16 since August 2020 and from an additional seven (7) MWs since November 2022. Continuous monitoring was completed using a fixed interval pressure and temperature data recording device (Levelogger^{TM}) which was corrected for atmospheric pressure from a central location on the site.

Based on continuous and manual monitoring, the water levels in the monitoring wells have not varied significantly during the current monitoring period. The groundwater levels in the monitoring wells have generally gradually declined during the late summer to the fall monitoring period, and then increasing throughout the winter peaking in mid spring. Groundwater levels in MWs increased following precipitation events. Season variation ranged from 0.43 m (BH20-3) to 3.7 M (BH20-11) during the monitoring period.

The hydrographs for the continuous groundwater monitoring are provided in **Appendix F**.

Argo King I & II

Throughout the study area, groundwater levels were found to range between 256.0 masl (BH22-7) and 260.3 masl (BH19-7) in the proposed developmental area, which represent the groundwater levels within the overburden at the Site. Groundwater levels in MWs BH19-1, BH19-3, BH19-4, BH19-5, BH22-1, BH22-5 and BH22-9 were generally above the ground surface. Water levels in BH22-7, occasionally rose above the ground surface. The water levels in monitoring wells BH19-1, BH19-3, and BH22-5 gradually increased above the ground surface in the winter (January 2023) and remained elevated for the remainder of the monitoring period. Based on the groundwater elevation contours, the direction of groundwater flow is generally expected to be in a southeasterly direction. Flow diverges across the site to the south and east into their

respective tributaries of the Humber River. The average estimated hydraulic gradient flowing west to east is estimated to be 0.002 m/m. The average estimated hydraulic gradient from the north to the south is estimated to be approximately 0.002 m/m. Groundwater outlets to surface streams at the southwest and southeast limits of the site. A groundwater elevation contour and flow map are provided in **Figure 6**.

Continuous water level monitoring was conducted at three (3) MWs at BH19-7, BH22-5 and BH22-7. Continuous monitoring was completed using a fixed interval pressure and temperature data recording device (Levelogger^{TM}) which was corrected for atmospheric pressure from a central location on the site.

Based on continuous and manual monitoring, the water levels in the monitoring wells have not varied significantly during the current monitoring period, with the exception of an increase of water levels above the ground surface for the above noted monitoring wells. The groundwater levels generally increased following major precipitation events. Continued groundwater level monitoring at the Site is required to establish seasonal groundwater variations.

The hydrographs for the continuous groundwater monitoring are provided in **Appendix F**.

4.3.3 Hydraulic Conductivity

Single Well Response Tests (SWRTs) were completed by DS in nine (9) monitoring wells on August 6th and 7th, 2020 and in eighteen (18) monitoring wells between November 1st and November 3rd, 2022 at the Caledon Station Site and SWRTs were completed in nine (9) monitoring wells between June 2019 and October 2022 at Argo King I & II to estimate hydraulic conductivity (K) for the representative geological units in which the wells were screened. SWRTs were completed by performing a rising head test (slug test) using a bailer to remove water from the well. A data logger was placed at the bottom of the wells to monitor recovery. Hydraulic conductivity (k) values were calculated using the Bouwer and Rice method. **Table 3** presents a summary of the hydraulic conductivity (K) results for the representative geological units. The hydraulic conductivity values between the sites ranged from 2.9 x 10^{-10} m/sec within the low permeably clay silt till to 4.0 x 10^{-5} m/sec within the highly permeable sand. The hydraulic testing results are provided in **Appendix D.**

Table 3: Summary of Hydraulic Conductivity (K) Test Results

Well ID	Screen Interval (masl)	Screened Formation	K- Value(m/s)
Caledon Station			
BH20-1	272.2 m to 273.7 m	Silt	7.3 x 10^{-7}
BH20-5	264.0 m to 275.5 m	Silty sand	5.3 x 10^{-7}
BH20-6	262.5 m to 264.0 m	Clayey silt till, sand seams	1.4 x 10^{-7}
BH20-9	266.5 m to 268.0 m	Silty clay till, some sand	3.2 x 10^{-6}
BH20-11	261.0 m to 262.5 m	Silt, some sand	5.2 x 10^{-8}
BH20-12	258.9 m to 260.4 m	Silt	6.0 x 10^{-7}
BH20-14	257.4 m to 258.9 m	Silty Clay Till	7.3 x 10^{-7}
BH20-15	255.1 m to 256.6 m	Clayey Silt Till	7.4 x 10^{-9}
BH20-16	258.1 m to 259.6 m	Silty Sand	1.5 x 10^{-8}

BH22-1	271.4 m to 274.5	Silty Clay to Clayey Silt Till & Sandy Silt	3.0×10^{-6}
BH22-3	268.6 m to 271.6	Sandy Silt Till	2.8×10^{-7}
BH22-5	272.2 m to 275.2	Sandy Silt & Silt	4.3×10^{-8}
BH22-10	260.8 m to 263.8	Sandy Silt to Silty Sand	3.0×10^{-7}
BH22-13	264.1 m to 267.1 m	Sandy Silt	1.6×10^{-6}
BH22-14	259.4 m to 262.4 m	Silty Clay to Clayey Silt Till	2.9×10^{-10}
BH22-17	261.5 m to 264.5 m	Silty Clay to Clayey Silt Till	1.2×10^{-8}
BH22-20	258.8 m to 261.8 m	Silty Clay to Clayey Silt Till	1.0×10^{-8}
BH22-22	260.2 m to 263.2 m	Silty Clay to Clayey Silt Till	1.8×10^{-8}
BH22-25	260.3 m to 263.3 m	Silty Sand	3.6×10^{-7}
BH22-27	259.0 m to 262.0 m	Sandy Silt	1.9×10^{-6}
BH22-28	260.3 m to 263.3 m	Sandy Silt	3.4×10^{-6}
BH22-29	259.8 m to 262.8 m	Sand	6.7×10^{-6}
BH22-32	253.1 m to 256.1 m	Sandy Silt	5.4×10^{-6}
BH22-33	257.5 m to 260.5 m	Sandy Gravel & Silty Sand to Sandy Silt	4.6×10^{-6}
BH22-36	257.8 m to 260.8 m	Native, Sandy Silt and Silty Clay Till	5.3×10^{-9}
BH22-40	256.4 m to 259.4 m	Silty Clay Till	1.1×10^{-9}
BH22-42	259.1 m to 262.1 m	Silty Clay Till & Sand	2.5×10^{-9}
Argo King I & II			
BH19-1	255.7 m to 257.2	Sand & Clayey Silt Till	9.9×10^{-7}
BH19-3	253.7 m to 255.2	Clayey Silt Till and Sandy Silt Till	1.1×10^{-7}
BH19-4	256.6 m to 258.1 m	Silty Sand	4.1×10^{-5}
BH19-5	254.6 m to 256.1 m	Sandy Silt Till	1.9×10^{-8}
BH19-6	253.3 m to 254.8 m	Sandy Silt Till	1.0×10^{-7}
BH19-7	254.2 m to 255.7 m	Sandy Silt Till	2.4×10^{-7}
BH22-5	251.5 m to 254.5 m	Silty Clay Till	5.5×10^{-8}
BH22-7	246.7 m to 249.7 m	Clayey Silt Till	3.8×10^{-9}
BH22-8	250.3 m to 253.3 m	Silty Clay to Clayey Silt Till	8.0×10^{-9}

4.3.4 In-Situ Infiltration Testing

In-situ infiltration testing was conducted by DS field personnel on September 2nd, 2020. The testing was completed in the location of monitoring wells (BH20-1, BH20-2, BH20-5, BH20-6, BH20-9, BH20-11 and BH20-15) as shown below in **Table 4**, to provide a preliminary field assessment of infiltration rates of surficial soils across the Site. Testing was completed following the guidelines outlined in the Low Impact Development (LID) Stormwater Management Planning and Design Guide for Stormwater Infiltration, 2010 (Appendix C Site Evaluation and Soil Testing Protocol).

To estimate the infiltration rate of soils in the test locations, **DS** completed in-situ infiltration testing at a depth of 0.5m and 1.5 m bgs. The testing included the use of a constant head infiltrometer which operates using the Marriott Bottle principal, whereby a shallow ponded head of water is maintained at a constant depth within an augured borehole. The steady-state flow of water into the subsurface soil following

saturated conditions is regarded as the field saturated hydraulic conductivity (K_{fs}) rate respective of the depth of the head utilized. The results of the infiltration testing are summarized below in **Table 3**.

Table 4: Summary of Test Pits and Estimated Soil Infiltration Rates

Test Location	Test Depth (mbgs)	Soil Type	Water Head	Steady State Rate of Water Level Change (cm/min)	K_{fs} (cm/sec)	Infiltration Rate (mm/hr)
BH20-1	0.5	Sandy Silt	0.05 m	0.34	3.20E-05	34.1
	1.5	Silty Clay	0.05 m	0.03	2.82E-06	17.8
BH20-2	0.5	Sandy Silt	0.05 m	0.28	2.63E-05	32.4
	1.5	Silty Clay	0.05 m	0.02	1.88E-06	16.0
BH20-5	0.5	Sandy Silt	0.05 m	0.20	1.88E-05	29.6
	1.5	Silty Clay	0.05 m	0.04	3.76E-06	19.2
BH20-6	0.5	Silty Clay	0.05 m	0.11	1.03E-05	25.2
	1.5	Silty Clay	0.05 m	0.02	1.88E-06	16.0
BH20-9	0.5	Silty Clay	0.05 m	0.08	7.52E-06	23.1
	1.5	Silty Clay	0.05 m	0.03	2.82E-06	17.8
BH20-11	0.5	Silty Clay	0.05 m	0.48	4.51E-05	37.4
	1.5	Silty Clay	0.05 m	0.04	3.76E-06	19.2
BH20-15	0.5	Silty Clay	0.05 m	0.40	3.76E-05	35.6
	1.5	Silty Clay	0.05 m	0.06	5.64E-06	21.4

Notes:
-mbgs– meters below ground surface
-Infiltration Rate approximated from Kfs using calculations provided in Figure C1 of Appendix C - Site Evaluation and Soil Testing Protocol (Low Impact Development (LID) Stormwater Management Planning and Design Guide for Stormwater Infiltration, 2010)

Based on the results of the infiltration testing, the site primarily consists of a low permeable silty clay till with a measured infiltration rate ranging from about 16 to 38 mm/hr with an average of 25 mm/hr. Soils with infiltration rates over 15 mm/hr are considered suitable for Soakaways, infiltration trenches and chambers (TRCA, 2010).

For the purpose of calculating design infiltration rates for on-site LID measures, Table C2 in the "Low Impact Development Stormwater Management Planning and Design Guide" (Appendix C), was used to determined safety correction factors for each of the test pit locations. The safety factors are applied to the measured infiltration rates of soils for each location to address heterogeneity of the soils. The calculated safety correction factors and the design infiltration rates for each location was determined to be 2.5. As a result of applying the safety correction factors, an infiltration rate ranging from about 6 to 15 mm/hr (average 10 mm/hr), can be considered for design purposes at the tested locations within the silty clay soils. A design infiltration rate of 43 mm/hr was calculated for the tested location within the sand and gravel deposits. Continued water level monitoring at all locations is recommended to ensure a minimum of 1 m clearance between the top of the seasonally high-water table and the bottom of any infiltration measure.

4.3.5 Groundwater Quality

Three (3) unfiltered groundwater samples were collected from select monitoring well locations (BH22-13 BH22-17 and BH22-32), on November 3rd, 2023, from the Caledon Station Site and two (2) unfiltered

groundwater samples were collected from BH22-1 and BH22-5 on October 26th, 2022, from Argo King I & II. Samples were collected to assess groundwater quality. The samples were placed in pre-cleaned laboratory supplied vials and/or bottles provided with analytical test group-specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The groundwater samples were submitted to SGS Laboratories in Lakefield, Ontario. SGS is certified by the Canadian Association of Laboratory Accreditation Inc. (CALA) and the Canadian Standard Association (CSA). Groundwater quality results were compared to parameters limits outlined in the Peel Region Sanitary and Storm Sewer Discharge By-Law 53-2010 and the Provincial Water Quality Objectives (PWQO) for surface water to assess the suitability of discharge to the Region's sewer system and nearby surface water features as part of the hydrogeological investigation. **Table 5** and **Table 6** presents a summary of exceeded parameters.

Table 5: Parameters in Groundwater Exceeding the Peel Region Bylaw Discharge Criteria

				Caledon Station			Argo King I & II	
Parameter	**Unit**	**Storm Guideline limit**	**Sanitary Guideline limit**	**BH22-13**	**BH22-17**	**BH22-32**	**BH22-1**	**BH22-5**
Total Suspended Solids (TSS)	mg/L	15	350	**492**	**169**	**32**	**38,300**	**94**
Manganese	mg/L	0.05	5	**0.132**	**0.101**	0.0462	**2.17**	**0.148**
Phosphorus	mg/L	0.4	10	0.011	0.098	0.073	**3.12**	0.171
Zinc	mg/L	0.04	3	<0.002	0.0006	0.004	**0.057**	0.019
Note: 0.00- Exceeded Storm Bylaw 0.00- Exceeded Sanitary Bylaw								

Table 6: Parameters in Groundwater Exceeding MECP PWQO Guidelines

			Caledon Station			Argo King I & II	
Parameter	**Unit**	**Guideline limit**	**BH22-13**	**BH22-17**	**BH22-32**	**BH22-1**	**BH22-5**
Arsenic	mg/L	0.005	0.001	0.0009	<0.0002	**0.072**	**0.0061**
Cadmium	mg/L	0.0001	<0.000003	0.000013	0.000005	**0.000178**	0.000024
Cobalt	mg/L	0.0009	0.000676	**0.00106**	0.000342	**0.0125**	**0.00314**
Copper	mg/L	0.001	0.0005	**0.0025**	**0.0011**	**0.0266**	**0.0056**
Lead	mg/L	0.005	<0.00009	0.00108	0.00043	**0.018**	0.00155
Phosphrous	mg/L	0.01	**0.011**	**0.098**	**0.073**	**3.12**	**0.171**
Zinc	mg/L	0.02	<0.002	0.006	0.004	**0.057**	0.0019
4AAP-Phenolics	mg/L	0.001	**0.003**	**0.002**	**<0.002**	**<0.002**	**<0.002**
0.00 – Exceeds PWQO parameter							

4.3.6 Surface Water Conditions

Caledon Station

The surface water and drainage setting at the Site comprises a total of eight (8) wetlands (Wetland 1, 2, 3, 4, 5, 6, 7 and 8), which are incorporated into the tributaries of the Humber River and ultimately flow into Lake Ontario. All accessible wetlands at the Site were instrumented with surface stations consisting of staff gauges and associated nested piezometer set.

A continuous pre-construction surface water and groundwater monitoring program of the Site is currently underway, and this report includes the findings from the data collected to-date during the August 2020 to March of 2023 monitoring period. All staff gauges installed within the wetlands at the Site have been instrumented with a Levelogger™ to allow for continuous monitoring at every 15-minute interval. The monitoring program includes a Site visit on an every bi-monthly basis to retrieve the water level data from the Levelogger™ and to collect manual readings within all surface stations and monitoring wells at the Site.

As discussed in Section 2.1, Aquafor (2014) completed a *Headwater Drainage Feature Assessment* of the Site and delineated the four (4) Headwater Drainage Features (HDFs) and their associated reaches at the Site. The surface stations are installed within the delineated drainage reaches at the Site.

The location of the wetlands is provided in **Figure 4**.

A discussion on the surface water conditions at all surface stations is provided below.

Wetland 1 and 2

Wetlands 1 and 2 are located within the southwestern corner of the Site along The Gore Road and within the Headwater Drainage Feature HDF-4. Due to accessibility constraints, Wetland 1 could not be instrumented with a surface station to permit monitoring within the wetland. Wetland 2 was equipped with a staff gauge, SG W2-1, and a nested piezometer set, W2-PZS and W2-PZD within Reach 4a. The shallow and deep nested piezometers were installed to depths of 1.1 m (Elev. 260.5 masl) and 2.0 m (259.5 masl) below existing ground surface, respectively. Staff gauge SG W2-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W2-1 is approximately 261.3 masl. Piezometer W2-PZD was instrumented with a datalogger in September 2022 to allow for continuous monitoring of shallow groundwater levels. The ground surface elevation at the location of W2-PZD is approximately 261.4 masl.

During the continuous monitoring of staff gauge SG W2-1 in Wetland 2, the Reach 4a channel has generally remained dry during late spring & summer monitoring periods (May to September from 2020 to 2022 monitoring period, with some flow observed following precipitation events. This flow was noted to diminish into dry conditions within 1-2 days after the cessation of the storm event. Ponding of surface water is also observed at the staff gauge intermittently during the year due to its location surrounded by thick vegetation

which impeded flow resulting in higher water levels. Increased flows were recorded between 2020 to 2023 in the winter and early spring generally between the months of November and March indicative of flows primarily sourced from strong precipitation events and snow melt, with maximum flow rate of 660,096 L/day measured in May 2022.

The groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels are generally slightly above the base of the Reach 4a channel during the current monitoring period. The water level in the shallow piezometer was found to be approximately 0.1 m to 0.2 m above the base of the Reach 4a channel, with the exception of April 2021 and September 2022 where the shallow piezometer water level was below the base of the Reach 4a. The water level in the deep piezometer was found to be approximately at the base of Reach 4a to maximum of 0.37 m above the base of the Reach 4a channel observed in April 2021. The shallow groundwater gradient at the location of Reach 4a was found to be upward during the current monitoring period with the exception of monitoring events in September 2020 to February 2021, and July 2022 showcasing a downward gradient; with an upward gradient generally ranging from 0.42 in the spring (April 2021) to 0.04 m/m in the Fall (November 2022), and a downward gradient ranging from -0.04 m/m in the Fall (September 2020) to -0.01 in the Summer (July 2022).

The flow observed in the monitoring data for the Reach 4a channel after precipitation events and in the Winter may potentially be as a result of the low permeability surficial silty clay till soils precluding the free infiltration of storm water into the ground. This allows for the saturation of the near surficial soils creating perched groundwater conditions, which in turn further reduces the soil infiltration rates and allows for increased surface runoff along the Reach 4a channel. Nearby Monitoring Well BH20-7 indicates the deep groundwater level to be measured at 1.1 m below existing grade (Elev. 261.7 masl) during highest point in the current monitoring period. For this reason, groundwater is not considered to be recharging the Reach 4a channel. There is also a potential for recharging of the surface water in the Reach 4a channel from the up-gradient Reach 4b (pond) and 4c of HDF-4. Given that the primary source of flow in the Reach 4a channel during the current monitoring period is determined to be from precipitation events, this channel is considered an ephemeral feature.

The hydrographs for Wetlands 1 and 2 are provided in **Appendix F**.

Wetland 3

Wetland 3 is located within the southwestern portion of the Site and within the Headwater Drainage Feature HDF-3. The wetland was equipped with a staff gauge, SG W3-1 and a nested piezometer set, W3-PZS and W3-PZD within Reach 3c of HDF-3. The shallow and deep nested piezometers were installed to depths of 1.0 m (Elev. 269.9 masl) and 1.9 m (269.1 masl) below existing ground surface, respectively. Staff gauge SG W3-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland at approximate ground surface elevation of 270.7 masl. Wetland 4 is located downstream of this wetland location with respect to surface water flow.

During the continuous monitoring of staff gauge SG W3-1 in Wetland 3, Reach 3c has generally remained dry during the 2020 through 2023 monitoring period, with very minimal response to precipitation events. Based on the reach's headwater characteristics in the early stage of forming its source from the catchment

area, intermittent flow was recorded in Reach 3c, and diminished into dry conditions within the same day. Peak flow was recorded on May 2022 as 21,168 L/day. The manual groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels are below the base of Reach 3c from August through December 2020 and rise above the base of the Reach 3c from April 2021, peaking in June 2021 and gradually decreasing to below the base of Reach 3c in January 2022. Piezometer water levels remain near the base of Reach 3c, except for monitoring event which occurred in March 2022 fallowing a major precipitation event, where the deep piezometer water level rose above the base of Reach 3c. The water level in the shallow piezometer was found to range between approximately 0.05 m to 0.82 m below the base of Reach 3c throughout the monitoring period rising above the base of Reach 3c in the spring ranging approximately between 0.07 to 1.0 m above the base of Reach 3c. The water level in the deep piezometer was found to be approximately 0.02 m to 1.2 m below the base of Reach 3c throughout the monitoring period rising in the winter to above the bed of Reach 3c to approximately 0.04 m to 0.19 m above the base of Reach 3c. The shallow groundwater gradient at the location of Reach 3c was found to be generally upward during the current monitoring period with the exception for the monitoring period of June to October 2021, and November 2022 where the gradient shifts downward; with a maximum gradient of 1.51 m/m (downward) occurring in the fall (September 2021) and minimum gradient of 0.007 (downward) occurring late fall November 2022.

Reach 3c is located within tiled agricultural cropland without a discernable channel (Aquafor, 2014). The short-lived flow observed in the monitoring data for Reach 3c following precipitation is not considered to be a prevalent flow due to the absence of a defined channelized morphology at this location. Further, shallow groundwater levels recorded in the nested piezometers for the monitoring period April through September 2021 are above the base of Reach 3c, suggesting contributions to the feature from groundwater during the spring through the fall period. Flow observed in May 2022 and January 2022 are likely the result of precipitation/melt events as the shallow groundwater levels are considerably below the base of Reach 3c. Given that Reach 3c had some minor response to precipitation events, the feature is considered ephemeral.

The hydrograph for Wetland 3 is provided in **Appendix F**.

Wetland 4

Wetland 4 is located within the southwestern corner of the Site, east of Wetland 2 within the Headwater Drainage Feature HDF-3. Wetland 4 was equipped with a staff gauge, SG W4-1, and a nested piezometer set, W4-PZS and W4-PZD within the Reach 3a channel. The shallow and deep nested piezometers were installed to depths of 0.6 m (Elev. 260.7 masl) and 1.6 m (259.5 masl) below existing ground surface, respectively. Staff gauge SG W4-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W4-1 is approximately 261.0 masl. The stations were removed in May 2021 due to road construction and reinstalled in August 2022. The ground surface elevation at the re-installed location of the staff gauge SG W4-1 is approximately 260.8 masl. The shallow and deep re-installed nested piezometers were installed to depths of 0.7 m (Elev. 260.5 masl) and 1.7 m (259.5 masl) below existing ground surface, respectively.

During the continuous monitoring of staff gauge SG W4-1 in Wetland 4, the Reach 3a channel has generally remained dry during the August to October 2022 monitoring period, with very minimal response to precipitation events. Intermittent flow was recorded in Reach 3a, diminishing into dry conditions within the same day. A peak of 0.2 m (261.03 masl) above the base of the reach and flow of 1,487,808 L/day was measured in March 2023. The manual groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels were below the base of Reach 3a at the onset of monitoring (September 2020) increasing above the base of Reach 3a until April 2021 when the station was removed. The station was reinstalled in August of 2022. Water levels in the nested piezometers were below the base of Reach 3c throughout the fall of 2022, increasing in the winter to above the be in January 2023 where water levels were sustained for the remainder of the monitoring period until March 2023. There is generally a downward gradient at the location, with a magnitude of 0.17 m/m. An upward gradient is recorded between January to March 2023. There is no data available for the summer periods, however, a general relationship based on the available early spring and late summer data would indicate a downward gradient, indicative of recharge conditions.

All up-gradient reaches (3b, 3c, 3d, 3e, 3f and 3g) in HDF-3 are located within tile agricultural cropland without discernible channels (Aquafor, 2014). For this reason, based on the current data, recharge of surface flows for Reach 3a from up-gradient reaches in HDF-3 is not considered to be likely. Given that the shallow groundwater levels recorded in the nested piezometers during the current monitoring period are generally below the base of Reach 3a, there is no contribution to the feature from groundwater during the late summer and fall period. Given that Reach 3a had some minor response to precipitation events, it is considered an ephemeral feature. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrograph for Wetland 4 is provided in **Appendix F**.

Wetland 5 and 6

Wetlands 5 and 6 are located near the southern boundary of the Site along King Street, east of Wetland 4 within the Headwater Drainage Feature HDF-3. Both wetlands are equipped with a single staff gauge, SG W5-1, and a nested piezometer set, W5-PZS and W5-PZD within Reach 3g. The shallow and deep nested piezometers were installed to depths of 0.8 m (Elev. 260.5 masl) and 1.8 m (259.4 masl) below existing ground surface, respectively. Staff gauge SG W5-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W5-1 is approximately 261.1 masl. The stations were removed in May 2021 due to road construction and reinstalled in August 2022. The ground surface elevation at the re-installed location of the staff gauge SG W5-1 is approximately 260.9 masl. The shallow and deep re-installed nested piezometers were installed to depths of 0.8 m (Elev. 260.5 masl) and 1.6 m (259.6 masl) below existing ground surface, respectively.

During the continuous monitoring of staff gauge SG W5-1, the Reach 3g channel has generally remained dry during the monitoring period, with minimal flow observed following precipitation events. This flow was noted to diminish into dry conditions within 1-2 days after the cessation of the storm event. The surface

water levels and flow in SG W5-1 was intermittent throughout the monitoring period and observed to be strong during the late winter period and early spring period, with flows dissipating with time until dry conditions persist starting in late spring 2021 and 2023. A steep increase in water levels is observed during late winter months (February), likely the result of snow melt, where a peak of 0.4 m (261.5 masl) above the reach base was observed in February 2021. Peak flow as a result of snow melt was observed to be 385,776 L/day in March 2023. The groundwater monitoring in the nested piezometers indicate the following:

- The water level in the shallow piezometer was consistently above the base of the Reach 3g throughout the entire monitoring period apart from October 2020. A gradual increase in water level is observed in late fall during October (2020 and 2022) and remained at elevated levels till late spring (2021 and 2023) based on the current available data. A peak water level of 0.35 m (261.4 masl) above the reach base was observed during April 2021, and was 0.013 m (261.08 masl) below the reach base at one occurrence during October 2020. Responses to precipitation in W5-PZS were low to moderate.

- The water level in the deep piezometer followed the same general trend as the shallow piezometer and was consistently above the base of the Reach 3g throughout most of the monitoring period. The water level is observed to be close the reach base during late fall (2020 and 2022) and gradually increases and remains elevated till late spring (2021 and 2023). A peak in the water level was noted to be 0.33 m (261.2 masl) in March 2023, and was 0.003 m (261.09 masl) below the reach base in October 2020. Responses to precipitation in W5-PZD were low to moderate.

The shallow groundwater gradient at the location of Reach 3g was found to be downward during most of the monitoring period; with a rise in the gradient from 0.019 m/m to 1.1 m/m between September and October 2020. The downward gradient remains persistent during 2020 to 2021 monitoring period, however, the gradient reverses to and upward gradient during 2022 to 2023 monitoring period, indicating a change towards greater ground water inputs into the reach.

The flow observed in the monitoring data for the Reach 3g channel after precipitation events may potentially be as a result of the low permeability surficial silty clay till soils precluding the free infiltration of storm water into the ground. This allows for the saturation of the near surficial soils creating perched groundwater conditions, which in turn further reduces the soil infiltration rates and allows for increased surface runoff along the Reach 3g channel. Based on the monitoring of Wetland 5 and 6 during the late summer and fall monitoring period, groundwater was not considered a source for contributions to surface water flow in Reach 3g. Groundwater levels observed in the shallow piezometer at the elevation of the Reach 3g streambed is considered to be perched groundwater conditions. All up-gradient reaches (3f and 3g) in HDF-3 are located within tile agricultural cropland without discernible channels (Aquafor, 2014). For this reason, based on the current data, recharge of surface water flows for Reach 3g from up-gradient reaches in HDF-3 is not considered to be likely. Given that the primary source of flow in the Reach 3g channel during the current monitoring period is determined to be from precipitation events, this channel is considered an ephemeral feature. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrographs for Wetlands 5 and 6 are provided in **Appendix F**.

Wetland 7

Wetland 7 is located within the southeastern portion of the Site, north of Wetland 8 and within the Headwater Drainage Feature HDF-1. The wetland was equipped with a staff gauge, SG W7-1 and a nested piezometer set, W7-PZS and W7-PZD within Reach 1d of HDF-1. The shallow and deep nested piezometers were installed to depths of 1.1 m (Elev. 269.9 masl) and 1.8 m (269.1 masl) below existing ground surface, respectively. An additional staff gauge SG W7-2 was installed on the upstream end of the wetland within Reach 1e. Staff gauge SG W7-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the local low point of the wetland at its upstream location. Piezometer W7-PZD was instrumented with a datalogger in September 2022 to allow for continuous monitoring of shallow groundwater levels. The ground surface elevation at the location of staff gauge SG W7-1 is approximately 265.3 masl.

During the continuous monitoring of staff gauge SG W7-1 in Wetland 7, both Reach 1d and Reach 1e have consistently remained dry in the summer periods during the 2020 to 2023 period. Generally, the surface water levels in the staff gauge remained dry during summer periods and gradually increases during late fall and early winter in which the water levels remain elevated throughout the winter until late spring, where a gradual recession is noted until dry conditions are once again reached in the summer. The surface water levels observed in the staff gauge during late spring and early summer is accompanied by ponding, where elevated surface water levels were sustained long after seasonal spring melt and precipitation events, which in turn subsequently feeds into southern limits of Reach 1e. Peak surface water levels were observed 0.52 m (265.827 masl) above the base of the reach with peak flow of 250,128 L/day recorded in March 2023. Staff gauge SG W7-1 did not display any response to precipitation events apart from a major precipitation event in September 2021.

The water levels in the shallow and deep piezometers had similar seasonal trends and were observed to be consistently above the base of the reach throughout the monitoring period, apart from the summer to late fall in June to November 2022 and intermittent monitoring events during 2020 and 2021. Both piezometers remained dry during early fall season (2020 to 2022) and remain dry till the end of fall, following a steep increase in water levels remaining elevated until late spring. The water levels peak in March with peak water levels were recorded in March 2023 of 0.5 m (265.8 masl) above reach base for W7-PZD, and 0.47 m (265.77 masl) above reach base for W7-PZS. Responses to precipitation in the piezometers were low to moderate.

All up-gradient reaches (1e, 1f, 1k, 1l, 1m and 1n) are located in tiled agricultural croplands without discernable channels. For this reason, there is likely no surface water recharge from any upstream reaches in HDF-1. Further, the dry conditions indicate that there is no surface water and groundwater interaction during the August to October period. There is a slight upward gradient observed during the winter and spring period of 2023 indicating slight contributions of ground water inputs into the reach. At this stage, Reach 1d is considered a non-perennial surface water feature.

The hydrograph for Wetland 7 is provided in **Appendix F**.

Wetland 8

Wetland 8 is located in the southeastern portion of the Site along Humber Station Road and within the Headwater Drainage Feature HDF-1. Wetland 8 was equipped with a staff gauge, SG W8-1, and a nested piezometer set, W8-PZS and W8-PZD within the Reach 1a channel. The shallow and deep nested piezometers were installed to depths of 0.8 m (Elev. 262.8 masl) and 1.7 m (261.9 masl) below existing ground surface, respectively. Staff gauge SG W8-1 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG W8-1 is approximately 263.4 masl. Piezometer W8-PZD was instrumented with a datalogger in September 2022 to allow for continuous monitoring of shallow groundwater levels.

During the continuous monitoring of staff gauge SG W8-1 in Wetland 8, the Reach 1a channel has sustained flow for the majority of the monitoring period with increased response to precipitation events. The flow in the Reach 1a channel was noted to become dry at the end of September and transitioning into the October 2020 period and throughout the summer periods of 2021 and 2022 periods when there were no large precipitation events. Reach 1a channel did not display much response to any storm events for most of the monitoring period, however, there was a noticeable relationship to larger precipitation events during the dry periods in the summer and fall season of 2021 and 2022, corresponding to steep rises and gradual recessions in the water levels following precipitation events. Surface water levels tended to rise during late fall (2020 and 2021) and in the early winter during 2022, where they stay elevated until late spring where dry conditions persist there after. Peak surface water levels were recorded during March of 2022 and 2023 at 0.31 m (263.6 masl) above the reach base and peak flow of 6,885,648 L/day during March 2023. The groundwater monitoring in the nested piezometers indicate the following:

- The water level in the shallow piezometer was consistently above the reach base throughout the monitoring period apart from a few occurrences in the summer and fall when it fell below the base with dry conditions observed in October 2020 and June 2021. The water level tends to rise in the early fall period (2020 to 2022) and peaked at 0.3 m (263.6 masl) above the reach base in March 2023. Responses to precipitation in W8-PZS was low to moderate.

- The groundwater in the deep piezometer is generally consistent with the trend of the shallow piezometer and remains above the reach base throughout the monitoring period apart from June and November 2021 and July 2022, with dry conditions observed in June 2021. The water levels rise during early fall and gradually increase and peak during late winter and spring, where they gradually decrease during late spring (2020 to 2023). The water levels reach a peak water level of 0.26 m (263.8 masl) above reach base in March 2023. Responses to precipitation in W8-PZD was low to moderate.

The shallow groundwater gradient at the location of Reach 1a was found to be upward throughout the monitoring period, however, with the exception of monitoring events in January 2023 to March 2023, where a downward gradient is observed, indicating a mixed relationship of ground water recharge conditions and contributions into the reach.

Up-gradient Reaches 1d, 1e, 1f, 1g, 1i, 1j, 1k, 1l, 1m and 1n are located within tile agricultural cropland without discernable channels (Aquafor, 2014). Further, upstream Reaches 1b and 1c comprise of a well-defined channel, which may allow for flow of surface water downgradient into Reach 1a. Reach 1h also has a reported well-defined channel, however connectivity with Reach 1a is lost as a result of the absence of a channel along the intermediary Reach 1g (Aquafor, 2014). It is likely that surface water flows carried from Reach 1b and 1c allows for recharge to Reach 1a following precipitation events and/or at times of high groundwater tables. Based on the groundwater elevation contours (**Figure 6**), the deeper groundwater level in the area of Reach 1a during the current monitoring period is expected to be approximately 262.0 masl to 263.0 masl. Given that monitoring from the nested piezometer indicated an upward shallow groundwater gradient for majority of the monitoring period, it is likely that surface water flows in Reach 1a may receive contribution from groundwater. For this reason, Reach 1a is likely an intermittent surface water feature.

The hydrograph for Wetland 8 is provided in **Appendix F**.

Argo King I & II

The surface water and drainage setting at the Site comprises a total of three (3) wetlands (Wetland 1, 2 and 3), which are incorporated into the tributaries of the Humber River and ultimately flow into Lake Ontario. All accessible wetlands at the Site were instrumented with surface stations consisting of staff gauges and associated nested piezometer set.

A continuous pre-construction surface water and groundwater monitoring program of the Site is currently underway, and this report includes the findings from the data collected to-date from the October 2022 to April 2023 monitoring period. All staff gauges installed within the wetlands at the Site have been instrumented with a Levelogger™ to allow for continuous monitoring at every 15-minute interval. The monitoring program includes a Site visit on monthly basis to retrieve the water level data from the Levelogger™ and to collect manual readings within all surface stations and monitoring wells at the Site.

The location of the wetlands is provided in **Figure 4**.

A discussion on the surface water conditions at all surface stations is provided below.

Wetland 1

Wetland 1 is located within the eastern portion of the Site along a tributary of Lindsay Creek. Wetland 1 was equipped with a staff gauges, SG1-1, SG1-2, and SG1-3 with a nested piezometer set, PZ1-1S and PZ1-1D; PZ1-2S and PZ1-2D; and PZ1-3S and PZ1-3D. The shallow piezometers for PZ1-1S, PZ1-2S, and PZ1-3S were installed to depths of 0.9 m (Elev. 258.0 masl), 1.1 m (Elev. 255.7 masl) and 1.2 m (256.9 masl) below existing ground surface, respectively. The deep piezometers for PZ1D, PZ2D, and PZ3D were installed to depths of 1.9 m (Elev. 257.0 masl), 2.0 m (Elev. 254.9 masl) and 1.9 m (256.2 masl) below existing ground surface, respectively. All staff gauge and deep piezometer locations were instrumented with a datalogger to allow for continuous monitoring of surface water levels and shallow groundwater levels. The ground surface elevation at the location of staff gauges (SG1 to SG3) ranges from 259.4 to 260.5 masl.

During the continuous monitoring of staff gauge SG1 through SG3 in Wetland 1, the channel was dry during the beginning of the monitoring period in the fall (October to November 2022). Water levels gradually increased above the base the channel in December and remained above the base of the channel for the remainder of the monitoring with peak water level and flow recorded in March 2023 at SG1-2 of 0.1 m above the base of the channel (Elev. 257.0 masl) and 2,790,720 L/day, respectively. No flow was observed from the October 2022 through February 2023 monitoring period. The channel had minimal to moderate response to precipitation events, diminishing to baseline conditions within 1-2 days after the cessation of the storm event. The manual groundwater monitoring in the nested piezometer indicates that the shallow and deep piezometer water levels were generally above the base of the channel during the current monitoring period, apart form SG1-2, where the piezometer groundwater levels were below the base of the channel form October 2022 to December 2022 from it gradually increased above the base. The water level in the shallow piezometers were found to range from above ground surface to 0.39 mbgs. The water level in the deep piezometer was found to range from above ground surface to 0.34 mbgs. The shallow groundwater gradient at the location of Wetland 1 was generally found to be upward for the current monitoring period. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrographs for Wetland 1 are provided in **Appendix F**.

Wetland 2

Wetland 2 is located within the central portion of the Site. The wetland was equipped with a staff gauge, SG2 and a nested piezometer set, PZ2S and PZ2D. The shallow and deep nested piezometers were installed to depths of 1.2 m (Elev. 258.7 masl) and 2.0 m (258.0 masl) below existing ground surface, respectively. Staff gauge SG2 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and at approximate ground surface elevation of 259.9 masl.

During the continuous monitoring of staff gauge SG2 in Wetland 2, the channel was dry during the beginning of the monitoring period in the fall (October to November 2022). Water levels gradually increased above the base the channel in December and remained above the base of the channel for the remainder of the monitoring with peak water level recorded in March 2023 at SG2 of 0.1 m above the base of the channel (Elev. 260.0 masl). No flow was recorded for the current monitoring period. The channel had minimal to moderate response to precipitation events, diminishing into baseline conditions within 1-2 days after the cessation of the storm event. The manual groundwater monitoring in the nested piezometer indicates that the shallow and deep piezometer water levels were generally below the base of the channel with water levels gradually increasing above the base of the wetland in the winter (February) and remain elevated throughout the spring (apart from frozen conditions from February to March) and gradually decline in May. The water level in the shallow piezometers were found to range from above ground surface to 0.73 mbgs. The water level in the deep piezometer was found to range between 0.25 and 0.73 mbgs. The shallow groundwater gradient at the location of Wetland 2 was generally found to be downward for the current monitoring period. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrograph for Wetland 3 is provided in **Appendix F**.

Wetland 3

Wetland 3 is located along the eastern boundary of the property. Wetland 3 was equipped with a staff gauge, SG3, and a nested piezometer set, PZ3S and PZ3D. The shallow and deep nested piezometers were installed to depths of 1.4 m (Elev. 257.9 masl) and 2.1 m (2572 masl) below existing ground surface, respectively. Staff gauge SG3 was instrumented with a datalogger to allow for continuous monitoring of surface water levels and was installed within the low point of the wetland where it exits/outlets from the Site. The ground surface elevation at the location of staff gauge SG3 is approximately 259.2 masl.

During the continuous monitoring of staff gauge SG3 in Wetland 3, the channel has generally remained dry during the current monitoring period, apart from monitoring events in December 2022, and from February to March 2023. Peak water levels were recorded in February 2023 at 0.1 m above the base of the channel. Peak flow was recorded in March 2023 of 761,400 L/day. No flow was observed for the October 2022 to February 2023 monitoring period. The manual groundwater monitoring in the nested piezometer indicate that the shallow and deep piezometer water levels were generally below the base of the channel occasionally increasing above the base of the channel in the spring (March). The water level in the shallow piezometer was found to range from above the ground surface to 1.1 mbgs. The water level in the deep piezometer was found to range from above the ground surface to 1.3 mbgs. The shallow groundwater gradient at the wetland location was found to be downward during the current monitoring period. Further monitoring will be required to confirm the seasonal fluctuations and to confirm the surface/groundwater interaction dynamics.

The hydrograph for Wetland 4 is provided in **Appendix F**.

4.3.7 Surface Water Quality

DS collected two (2) non-filtered surface water samples on October 24, 2020, from the Caledon Station Site; one (1) from the surface water stream in the southwest corner of the Site (Surface Station: SG W2-1); and one (1) sample from the surface water stream in the southeast corner of the Site (Surface Station: SG W8-1). The samples were placed in pre-cleaned laboratory supplied vials and/or bottles provided with analytical test group-specific preservatives, as required. Dedicated nitrile gloves were used during sample handling. The surface water samples were submitted to SGS Laboratories in Lakefield, Ontario. SGS is certified by the Canadian Association of Laboratory Accreditation Inc. (CALA) and the Canadian Standard Association (CSA). The samples were analyzed for general chemistry parameters, total suspended solids and dissolved oxygen against PWQO standards to establish baseline conditions as part of the Hydrogeological Investigation. **Table 7** presents a summary of exceeded parameters**.**

Table 7: Parameters in Surface Water Exceeding the PWQO

				Caledon Station	
Parameter Exceeded	**Unit**	**Sample Location**	**Guideline limit**	**Concentration (SG W2-1)**	**Concentration (SG W8-1)**
Aluminum	ug/L	Surface stream	75	**2,610**	**2,400**
Aluminum (dissolved)	ug/L	Surface stream	0.015	**0.034**	**0.096**
Arsenic	ug/L	Surface stream	5	**12.0**	1.0
Cobalt	ug/L	Surface stream	0.9	**1.86**	**1.87**
Copper	ug/L	Surface stream	5	**6.9**	3.2
Iron	ug/L	Surface stream	300	**36,800**	**4,300**
Phosphorus	ug/L	Surface stream	0.01	**1.93**	**0.358**
Zinc	ug/L	Surface stream	20	**24**	**19**

Bold – parameter exceeds the PWQO standards.

Based on the analytical testing results, both surface water samples exceeded the PWQO for various parameters.

The certificate of analysis report is provided in **Appendix E.**

5.0 SITE WATER BALANCE

To understand and compare existing hydrologic conditions, a Thornthwaite site water balance was completed. The Thornthwaite water balance (Thornthwaite, 1948; Mather, 1978; 1979) is an accounting type method used to analyze the allocation of water among various components of the hydrologic cycle. Inputs to the model are monthly temperature, Site latitude, precipitation, and stormwater run-on. Outputs include monthly potential and actual evapotranspiration, evaporation, water surplus, total infiltration, and total runoff. For ease of calculation, a spreadsheet model was used for the computation.

When precipitation (P) occurs, it can either runoff (R) through the surface water system, infiltrate (I) to the water table, or evaporate/evapotranspiration (ET) from the earth's surface and vegetation. The sum of R and I is termed as the water surplus (S). When long-term averages of P, R, I and ET are used, there is no net change in groundwater storage (ST). Annually, however, there is a potential for small changes in ST. The annual water budget can be stated as **P = ET + R + I + ST** and the components are discussed below.

Precipitation (P)

Based on the 30-year average for the Toronto Pearson Airport Climate Station in Ontario, the average precipitation for the area is about 786 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in **Table G-1, Appendix G.**

Storage (St)

Groundwater storage (ST) of native soils for the existing Site was estimated using values of Water Holding Capacity (mm) of respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning & Design Manual (MOE, March 2003). The land uses, soil types and respective water

holding capacities chosen to represent existing conditions at the Site include the following with their respective water holding capacity applied to March for monthly calculations:

- Pasture/Shrubs, Silty Clay Soils – 200 mm
- Moderately Rooted Crop, Silty Clay Soils – 150 mm
- Urban Lawns, Pervious Development – 75 mm

Using the procedures outlined in the SWM Planning & Design Manual for the above land use and soil type, the annual change in storage is zero (0).

Evapotranspiration (Et)

Monthly Potential Evapotranspiration (PET) is estimated using monthly temperature data and is defined as a water loss from a homogeneous vegetation-covered area that never lacks water (Thornthwaite,1948; Mather, 1978). In the Thornthwaite water balance model, PET is calculated using the Hamon equation (Hamon, 1061);

PET Hamon = 13.97 * d * D2 * Wt

Where:
d = the number of days in the month
D = the mean monthly hours of daylight in units of 12 hours
Wt = a saturated water vapour density term = 4.95 * e0.627/100
T = the monthly mean temperature in degrees Celsius

The calculated Actual Evapotranspiration (AET) is based on PET and changes in ST (Δ ST). Where there is not enough P to satisfy PET, a reduction in ST occurs. As a result, volumes of AET are less than PET. Also, it is assumed that evaporation will occur and will amount to approximately 15% of the total precipitation for an impervious cover.

Precipitation Surplus (S)

Precipitation surplus is calculated as P–ET. For pervious areas, ET is considered AET and for impervious areas, ET is evaporation.

Infiltration (I) and Runoff (R)

For pervious areas, precipitation surplus has two components in the Thornthwaite model: a runoff component (overland flow that occurs when soil moisture capacity is exceeded) and an infiltration component. The accumulation of infiltration factors for topography, soil types and cover as prescribed in Table 3.1 of the SWM Planning & Design Manual give infiltration factors for existing conditions on the Site as shown below in **Table 8**. The runoff component calculated in the pre-development model is the remaining volume of precipitation surplus following AET, ET, and infiltration. For existing agricultural areas with tile drainage, there is expected to be a significant reduction in infiltration.

Table 8 - Existing Conditions – Infiltration Factor

Land uses / soil types	Topography	Soil	Cover	Total Infiltration Factor
Pasture & Shrubs / Clay Loam	0.1	0.15	0.15	0.4
Moderately Rooted Crop / Clay Loam	0.1	0.15	0.1	0.35
Tile Drained Moderately Rooted Crop / Clay Loam	0.05	0.05	0.05	0.15
Urban Lawns / Clay Loam	0.1	0.15	0.05	0.3

5.1 Pre-development Water Balance

The Site boundary used for the water balance has a total area of 181.7 ha and is predominantly comprised of landscaped/vegetated areas with only 1.7% of the total Site area comprising of existing buildings and asphalt/paved hard surfaces. **Figure 7** shows the pre-development conceptual model considered for establishing current hydrologic conditions. To predict outputs of the pre-development water balance, various inputs were entered into the Thornthwaite model including monthly precipitation and temperature, site latitude, water holding capacity values for native soils and factors of infiltration. Various inputs and outputs of the model are summarised below.

The average annual precipitation rate for the area is approximately 786 mm/year. In the pervious area of the Site, the PET is estimated to be 605 mm/year, which is approximately 77% of the total annual precipitation rate. Based on the monthly distribution of soil storage for all pervious areas of the Site characteristic of silty clay soils, the resulting annual AET rate for each pervious area will be as follows:

- Pasture/Shrubs – 551.6 mm/year
- Moderately Rooted Crop – 533.9 mm/year
- Urban Lawn – 501.8 mm/year

There will not be any evapotranspiration from the existing impervious area of the Site however a loss of 15% from all incoming precipitation and surface runoff due to evaporation is accounted for in the water balance model. All water surplus in the existing impervious area of the Site will convert into surface runoff.

Based on the above, the resulting annual evapotranspiration, infiltration and runoff volumes for each area of the Site during the pre-development period is summarized in **Table 9** below.

Table 9 – Summary of Pre-Development Water Balance

Land Uses / Soil Types	ET Volume (m^3/year)	AET Volume (m^3/year)	Infiltration Volume (m^3/year)	Runoff Volume (m^3/year)
Pasture & Shrubs / Clay Loam	NIL	109,347	18,586	27,879
Moderately Rooted Crop / Clay Loam	NIL	586,891	97,015	180,170
Tile Drained Moderately Rooted Crop / Clay Loam	NIL	207,421	14,695	83,269
Urban Lawns / Clay Loam	NIL	49,562	8,422	19,650
Impervious Areas	3,734	NIL	NIL	21,162
Total	***3,734***	***953,221***	***138,717***	***332,131***

The detailed calculations are provided in **Table G-2, Appendix G**.

5.2 Post-development Water Balance

A post-development water balance was completed to predict hydrologic changes to the Site as a result of proposed conditions. The conceptual model considered for establishing proposed hydrologic conditions is provided in **Figure 8.** Nine separate drainage areas are shown with boundaries and imperviousness provided by Urbantech as reported in the Functional Servicing Report (FSR) for the Caledon Station Secondary Plan (Urbantech, May 2023).

To predict outputs of the post-development water balance, the same elements of the 30-year average weather data and site latitude inputs were used. Various inputs and outputs of the post-development model are described in detail below. The detailed calculations are presented in **Table G-3, Appendix G**.

PRECIPITATION (P)

Based on the 30-year average for the Toronto Pearson Airport Climate Station, the average precipitation for the area is about 786 mm/year for the period between 1981 and 2010. Also, the average monthly temperature from this station has been used. The monthly distribution of precipitation is presented in **Table 1, Appendix G.**

STORAGE (ST)

Groundwater storage (ST) of native soils for the post-development scenario was estimated using the values of soil moisture holding capacity or respective land use and soil types identified in Table 3.1 of the Storm Water Management (SWM) Planning and Design Manual (MOE, March 2003). The land uses, soil types and respective water holding capacities chosen to represent existing conditions at the Site including the following with their respective water holding capacity applied to March for monthly calculations:

- Pasture/Shrubs, Silty Clay Soils – 200 mm
- Urban Lawns/Landscaped, Previous Development – 75 mm

Similar to the pre-development conditions, using the procedures outlined in the SWM Planning & Design Manual for each land use, the annual change in storage is 0. The monthly distribution of ST for each of the land use/soil types is presented in **Table G-1, Appendix G**.

EVAPORATION / EVAPOTRANSPIRATION (ET)

The proposed plans for development during the post-construction period will result in an increase in the total impervious hard surfaces across the Site. The total impervious area following the proposed plans for development is approximately 1,304,277 m^2 , or about 72% of the total area. In the impervious areas, it is assumed that only evaporation will occur and will amount to approximately 15% of the total precipitation. Considering a total annual precipitation of 786 mm/year, evaporation is estimated at 118 mm. On this basis, the total annual volume of evaporation is estimated at 153,774 m^3/year. The detailed calculations for evaporation are included in **Table G-3, Appendix G**.

For post-development pervious areas, monthly PET is estimated using the same inputs and calculations described in the pre-development model respective of land use and soil moisture holding capacity. In the post-development scenario, annual AET is 53,535 m^3/year for the pasture/shrubs area and 208,349 m^3/year for the pervious landscape/development area of the Site. The monthly distribution of Post-development AET and detailed calculations are presented in **Table G-3, Appendix G**.

PRECIPITATION SURPLUS (S)

For post-development pervious surfaces at the site, precipitation surplus is calculated as the difference between precipitation and actual evapotranspiration (P–AET), which is summarized below for each of the post-development pervious catchment areas:

- Pasture/Shrubs – 234.4 mm/year
- Pervious Landscaped – 284.2 mm/year

For Impervious surfaces at the site, surplus is P-ET where ET is estimated at 15% of P. The resulting precipitation surplus is about 668 mm/year. The more detailed calculations are included in **Table 3, Appendix G**.

INFILTRATION (I)

The same accumulation of infiltration factors for topography, soil types and cover as prescribed in Table 3.1 of the SWM Planning & Design Manual were used give infiltration factors for post-development conditions.

Considering the infiltration factors used, the total volume of Infiltration (I) estimated for post-development conditions of each pervious areas of the Site is summarized below:

- Pasture/Shrubs – 9,100 m^3/year
- Previous Landscaped – 35,403 m^3/year

On this basis, the resulting infiltration during the post-construction period is estimated to be 44,502 m^3/year. The more detailed calculations are presented in **Table G-3, Appendix G**.

RUNOFF (R)

The runoff component calculated in the post-development model is a combination of the remaining volume of precipitation surplus for both pervious and impervious areas. The total volume of runoff (R) estimated for the post-development conditions of the pervious areas is summarized below:

- Pasture/Shrubs – 13,649 m^3/year
- Pervious Landscaped – 953,994 m^3/year

All precipitation water over impervious hard surfaces will convert into surface runoff after accounting for evaporative losses. On this basis, the resulting surface runoff during the post-construction period is estimated to be 967,643 m^3/year.

The more detailed calculations are presented in **Table G-3, Appendix G**.

5.3 Site Water Balance Results

Based on the results of the pre-development and post-development water balance completed, the proposed development is expected to produce a decrease in annual infiltration of 94,215 m^3/year and an increase in annual runoff of 635,512 m^3/year. The effects are the result of increased impervious areas replacing pervious areas of the Site. The analysis is summarised in Table G-5, Appendix G.

A summary of the results from the pre- and post-development water balance without mitigation is provided in **Table 10** below:

Table 10 – Summary of Pre- and Post-Development Site Water Balance (without Mitigation)

	Pre-Development	Post-Development	Change
ET (m^3/year)	3,734	153,774	-150,040
AET (m^3/year)	953,221	261,884	691,337
Infiltration (m^3/year)	138,717	44,502	94,215
Runoff (m^3/year)	332,131	967,643	-635,512

5.4 Post-development Water Balance (With Mitigation)

Groundwater elevations across the Site are high and present a challenge for mitigating infiltration deficits. With this in mind, best efforts have been made to reduce the infiltration deficit using lot level, passive Low Impact Development (LID) measures. The location and design of the LIDs are provided in the FSR (Urbantech, May 2023). The mitigation was entered into the post-development water balance to assess the effectiveness at addressing infiltration deficits. The following mitigation considered.

Connected Impervious and Pervious Surfaces

Considering the high groundwater elevations across the Site, lot level mitigation was considered the best approach for improving infiltration in the post-development condition. The current LID plan includes connecting about 9.8 ha of impervious surfaces with 20.5 ha of pervious area to maximize infiltration potential. The areas considered include impervious roofs and paved areas to rear yards and pervious areas of parks, channels and SWM ponds from Catchments 101, 104, 105 and 106. Stormwater generated from

the impervious areas contribute to the pervious area during precipitation events and is made available for evapotranspiration, infiltration and runoff. The result is increased evapotranspiration and surplus available for infiltration and runoff. The effectiveness of connecting the impervious and pervious areas is estimated to provide and infiltration benefit of 18,041 m^3/yr. Detailed calculations are presented in **Table G-4, Appendix G**.

Silva Cells

The Silva Cell is a patented modular suspended pavement system that holds unlimited amounts of lightly compacted soil while supporting traffic loads. That soil serves to provide stormwater treatment and storage for on-site infiltration. Areas considered as contributing catchments for the Silva Cells includes approximately 6.3 ha impervious area and about 4.0 ha pervious area, from road ROWs and parks in Catchment 104, 105 and 106. The Silva Cells was designed to capture a 25mm storm event for each respective catchment. As a result, it is expected that the Cells are capable of storing and infiltrating a maximum of 90% annual rainfall depth however, surplus available form the impervious and pervious surfaces accounts for less. The effectiveness of the Silva Cells is estimated to provide and infiltration benefit of 54,323 m^3/yr. Detailed calculations are presented in **Table G-4, Appendix G**.

The mitigated water balance is summarized in **Table G-4, Appendix G**. With mitigation, the post-development infiltration deficit is reduced to 21,851 m^3/yr from pre-development conditions.

It should be noted that the detailed design of the LID facilities at the Site during the post-construction period have not been finalized. Changes or additions to the LID plan should include a revised water balance. Please refer to the above-referenced Functional Service Report (FSR) by Urbantech (2023) for further information regarding the LIDs under consideration.

6.0 FEATURE BASED WATER BALANCE

6.1 Pre-development Sub catchments

Pre-development catchment mapping showing topographical drainage divides and wetland catchments were provided by Urbantech (2021) to document existing drainage patterns across the site and determine which areas are within the catchments of wetlands W1 through W9. The mapping was completed to inform the proposed functional servicing for the development. Wetland and constraints mapping was provided by Beacon. The Pre-Development catchment map is presented in **Figure 9**.

The pre-development mapping shows catchments for 9 wetland units including W1 through W9. Catchments for wetlands W1 to W6 includes west areas of the Site which drain south across King Rd. Each of these catchments are limited to within the Site boundaries with exception to some ditch and road runoff from the east side of The Gore Rd. The largest subcatchment is mapped draining directly into W7 and includes approximately 75.9 ha of upgradient area which runs onto the Site via HDF WHT6-E. The drainage feature appears to be captured within a collector pipe which is observed to transect the Site from the north boundary to somewhere between wetland W7 and W8. The entire catchment area within the Site is currently tile drained. Flow exists the Site at wetland W8 via a culvert across Humber Station Road approximately 30m north of the southeast corner of the Site. Wetland catchment W9 is located east of the

Site and the CP Rail. The wetland is not within the Sites boundaries however there is a small portion of the catchment within the proposed development area.

6.2 Post-Development Subcatchments

Post-development wetland catchments were provided by Urbantech to document proposed changes to existing drainage patterns for wetland catchments W1 to W6. The Post-Development Catchment Map is provided in Drawings 501 to 503 in Functional Servicing Report (Urbantech 2023). Based on the post-development wetland catchments provided, changes to catchment boundaries for Wetland 1 to 6 include area reductions of about 48 to 87%. The post development boundaries are limited to the wetland / constraint's boundaries with exception to about 90 residential lots which are proposed to drain uncontrolled into the wetland features. The uncontrolled drainage includes runoff from pervious back yards and half of the roof area which includes roof leaders discharging to backyards. A summary of changes to catchment size and imperviousness is provided in **Appendix G, Table G-6**.

Wetlands W7 and W8 are proposed to be relocated and so were not included in the post-development water balance assessment. It should be noted that the external run-on from HDF WHT6-E which is currently conveyed to wetlands W7/W8 via a drainage pipe is proposed it be redirected toward the relocated features to provide runoff contributions as required. Wetland W9 was also not included in the water balance assessment as it is located off Site and was not accounted for in the post-development catchment mapping.

6.3 Wetland Water Balance Risk Evaluation

To aid in determining the level of risk and evaluation requirements for the study, an assessment was completed using the Wetland Water Balance Risk Evaluation guidelines provided by the Toronto and Region Conservation Authority (TRCA, Nov 2017). The guideline provides criteria used to evaluate the magnitude of potential hydrological impact on a wetland. The criteria include:

i) The proportion of impervious cover in the catchment of the wetland that would result from the proposal;
ii) The degree of change in the size of the wetland catchment;
iii) Water taking from, or discharge to, surface water bodies or aquifers directly connected to the wetland, and;
iv) The impact on locally significant recharge areas.

Considering the above criteria, increases to impervious cover and changes to wetland catchment size were evaluated.

6.3.1 Impervious Cover Score

An increase in the percent of impervious cover within a wetland catchment has the effect of reducing infiltration and potentially decreasing baseflow and/or interflow contributions to the wetland. It further increases runoff contributions and risks of flooding and potentially increases stormwater sediment and contaminant loading. To assess the risk of the proposed impervious surfaces on sensitive features including Wetlands 1, 2, 3 and 5/6, the Impervious Cover Score (S) was calculated for each of the catchments. The

equation defining S is as follows:

$$S = \frac{IC \cdot Cdev}{C}$$

where,

IC is the proportion of impervious cover proposed within the specific catchment (as a percentage between 0 and 100)
C dev is the total proposed development area within the catchment (in ha)
C is the size of the wetland's catchment (in ha).

Results of the calculation are provided in **Table 9** and show that wetland catchment W1 to W6 are presented with low risk based on the calculated S.

Table 11 –Impervious Cover Score - Probability and Magnitude of Hydrological Change

Subcatchment Area Name	Pre-development Catchment Size (m^2)	Proposed Impervious Cover (m^2)	Impervious Cover Score (S) (%)	Sensitive Feature	magnitude of hydrological change
Wetland 1 (W1)	13,402	72.2	0. 5	Wetland	Low
Wetland 2 (W2)	50,784	0	0	Wetland	Low
Wetland 3 (W3)	225,600	352	0.2	Wetland	Low
Wetland 4 (W4)	62,040	918	1.5	Wetland	Low
Wetland 5 (W5)	74,225	502	0.7	Wetland	Low
Wetland 6 (W6)	47,447	62	0.1	Wetland	Low

Note: * Impervious Cover Score (S) calculated using equation 1 (TRCA - Wetland Water Balance Risk Evaluation, Nov 2017)

6.3.2 Change in Catchment Size

Changes to catchment size directly effects the volume and timing of stormwater contributions to downgradient features. To evaluate the magnitude of hydrological change these effects can have, pre-development and post-development catchments were compared. **Table 10** provides the area breakdown for pre- and post-development conditions. The same magnitude thresholds used for impervious cover (10% and 25 %) are used as thresholds to define catchment size alteration. As a result, changes to catchment size for W1 to W6 is considered high risk.

Table 12 –Changes to Catchment Size - Probability and Magnitude of Hydrological Change

Subcatchment Area Name	Pre-development catchment area (m^2)	Post-Development Catchment Area (m^2)	% Change in Catchment Area	Sensitive Feature	Magnitude of Hydrological Change *
W1	13,402	3,843	71% decrease	Wetland	High
W2	50,784	30,519	40% decrease	Wetland	High
W3	225,600	29,108	87% decrease	Wetland	High

W4	62,040	19,451	68% decrease	Wetland	High
W5	74,225	18,423	75% decrease	Wetland	High
W6	47,447	8,854	81% decrease	Wetland	High

Note: * Based on Table 2: Criteria used to evaluate the probability and magnitude of hydrological change (TRCA - Wetland Water Balance Risk Evaluation, Nov 2017)

6.4 Wetland Water Balance

To estimate potential hydrologic changes to the wetland catchments as a result of the proposed development, a Thornthwaite Water Balance was completed for all retained onsite wetlands with catchments identified as intersecting the site. The model was developed using the same input as the site water balance with the exception of including only those areas which fall within the Wetland catchments.

6.4.1 Existing Conditions

The existing conditions across the wetland catchments W1 to W6 include a silty clay loam soil type on a rolling terrain with pervious cover consisting of cultivated agricultural areas, pasture and shrub (NHS areas) and urban lawn and impervious surfaces associated with existing developed areas of the Site. **Table 11** shows the pre-development catchment breakdown of land uses for each subcatchment.

Table 13 – Pre-Development Conditions

Subcatchment Area Name	Pre-development catchment area (m^2)	Mature Forest (m^2)	Pasture and Shrub (m^2)	Moderately Rooted Crop (m^2)	Landscaped (m^2)	Impervious Surface (m^2)
W1	13,402	0	5,161	4,003	1,881	2,357
W2	50,784	0	26,743	18,870	1,486	3,685
W3	225,600	0	35,599	163,350	21,470	5,181
W4	62,040	0	8,313	52,371	0	1,356
W5	74,225	0	19,471	50,398	3,331	1,025
W6	47,447	0	16,702	27,448	1,989	1,307

6.4.2 Proposed Development

It is expected that the proposed plans for development will result in a decrease in the total catchment area size for Wetlands 1 to 6 during the post-development conditions. In order to understand the effects of the reduced catchment area and evaluate the magnitude of actual hydrological changes, a wetland water balance is currently being completed by Urbantech, which includes the use of a continuous model. A pre-construction wetland monitoring program by **DS** is currently underway and will be ongoing for a minimum of a 1-year period to establish baseline conditions throughout the hydroperiods for Wetlands 1 to 6. The results of the baseline wetland monitoring will be used in combination with the continuous modeling to assess the actual risk to the wetlands. Based on the findings of the water balance results, a wetland mitigation plan will be developed.

7.0 CONSTRUCTION DEWATERING

Based on the preliminary designs, the proposed plans for development will consist of low-rise residential blocks, commercial and institutional zones, Stormwater Management (SWM) Ponds and greenspace. The development will also include the construction of roadways and associated storm, sanitary sewer and water distribution infrastructure. Detailed design of the proposed plans for the developments are not currently finalized, it is assumed that the proposed residential blocks will comprise of one (1) level of underground basement and/or parking. Further, the institutional and mixed commercial use blocks and the GO station block will be constructed slab-on-grade.

Based on the findings of the subsurface drilling investigation, there are significant variations noted in the subsurface stratigraphic and groundwater conditions across the Sites. The construction of the low-rise residential blocks and the site servicing will be dispersed across the Site areas and therefore will encounter varying subsurface conditions at different locations of the Sites. Grading plans and site plans for the Site located at Argo King I & II were not provided to **DS**, and therefore flow rates will be provided once grading plans and site plan designs are received. The following preliminary grading plans for the Caledon Station Site were provided to **DS** for review in estimating the requirements for groundwater control and dewatering during the construction period:

- *"Drawing No. 301 - Preliminary Grading Plan (1 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *"Drawing No. 302 - Preliminary Grading Plan (2 of 4), Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan (BRES Option 3 Lands)"*, by Urbantech Consulting, dated Jan 2021, File No.: 15-458
- *"Drawing No. 601 – SWM Pond 1, Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan,"* by Urbantech Consulting, dated Sep 2021, File No.: 15-458
- *"Drawing No. 602 – Interim SWM Pond, Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan,"* by Urbantech Consulting, dated Sep 2021, File No.: 15-458
- *"Drawing No. 603 – SWM Pond 2A, Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan,"* by Urbantech Consulting, dated Sep 2021, File No.: 15-458
- *"Drawing No. 604 – SWM Pond 2B, Town of Caledon, Regional Municipality of Peel, Macville Secondary Plan,"* by Urbantech Consulting, dated Sep 2021, File No.: 15-458

Based on the review of the proposed preliminary grading plans, it is understood that the site grades will generally range from approximately 280.0 masl in the northwestern corner to an approximate elevation of 275.0 masl in the southwest and 267.6 masl in the southeastern corner of the Site. For the purpose of assessing the requirements for groundwater control and dewatering during the construction period, a conceptual model of the Site has been prepared based on the proposed site grading and the worst-case subsurface conditions, which can be encountered during the trenching/excavation for the low-rise residential blocks and site servicing. Conceptual models for the mid-rise residential developments are prepared based on inference from nearby boreholes and monitoring wells in the locality of these proposed structures.

It is expected that the trenching and excavation earthwork during the construction period will extend below the groundwater table in certain areas of the Site and groundwater control and dewatering will be required to ensure the excavation area remains dry and safe. Generally, the excavations will be completed into the cohesive clayey silt till, however will extend into the underlying silty sand till / silt unit in certain locations.

The dewatering estimates also include provisions for controlling storm water in the excavation area from an incidental 2-year storm event. As per the Ministry of Transportation (MTO) Intensity-Distribution-Frequency (IDF) curves for the Town of Caledon, a 2-Year storm that is 2-hours in duration would result in a 13.5 mm/hr of rainfall intensity.

This section calculates the estimated dewatering required during the construction of the proposed residential buildings and private services.

7.1 Estimation of Flow Rate – Medium Density Residential Blocks, Low-Rise Development

It is understood that the architectural designs for the proposed structures at the Site are not finalized at this time. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- An excavation for one (1) residential block within the larger Site development will comprise of fifteen (15) medium density residential blocks. The development is to include a series of townhouses and single detached homes. This will result in an excavation that will be approximately 80 m x 130 m in area for one block.

- The low-rise residential development will comprise of one (1) level of underground basement extending to approximately 2 m below ground surface. The excavation will extend an additional 0.5 m below the finished floor basement slab for the foundation. On this basis, the base of excavation for each low-rise residential block will be advanced to 2.5 m below ground surface.

As previously indicated, the excavations for the proposed residential blocks will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. Generally, it is expected that the excavations for the low-rise residential blocks will be completed above the groundwater table and construction dewatering/control will be minimal for the majority of the Site, and particularly during the summer period. To assess the requirements for groundwater control and dewatering during the construction period, a conceptual site model was prepared assuming the worst-case scenario with respect to the depth of excavation below the ground water table at the Site. Based on the proposed preliminary grading plan, it is anticipated that these conditions will likely be present in the south-central portion of the Site. For the purpose of estimating the requirements for groundwater control and dewatering during the construction period, the groundwater table in the conceptual site model was set to Elev. 267.5 masl (BH20-14, March 2023). The elevation at the base of excavation will be Elev. 265.2 masl. On this basis, the excavation will be advanced to a depth of 2.5 m below the ground surface. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of excavation.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rates are estimated to be on the order of 44,020 L/day. An incidental 2-year storm event will result in a total of 280,800 L of water to be removed from the excavation. The total **unit** dewatering rate during the construction period for **one (1) residential low-rise block** development at the Site is estimated to be **346,830 L per day**, which includes a 50% safety factor on the anticipated rates and the contribution from an incidental precipitation event.

The maximum predicted theoretical radius of influence is estimated to be 3.6 m from the edge of the excavation.

It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed site grading and/or deviation from any assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.2 Estimation of Flow Rate – Townhouse & Single Detached Units

Based on Block Plan Concept dated May 1st, 2023, provided to DS, blocks consist of townhouses and detached homes are proposed within the Caledon Station Community. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- A maximum excavation for one (1) single residential detached unit within the larger Site development will be approximately 12.8 m x 27 m in area; and,
- The single detached units and townhouse developments will comprise of one (1) level of underground basements extending to approximately 2 m below ground surface. The excavation will extend an additional 0.5 m below the lowest finished floor basement slab for the foundation. On this basis, the base of excavation for each mid-rise residential block will be advanced to 2.5 m below ground surface.

The excavations for the proposed residential blocks will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. The highest groundwater level measured in the east portion of the Site is 0.3 mbgs at Elev. 265.8 masl (BH22-32). On this basis, the excavation for the mid-rise residential development will extend approximately 2.5 m below the groundwater table. For this reason, groundwater control and dewatering during the construction period will be required to maintain a dry and safe excavation. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of excavation.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of an equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rate is estimated to be a maximum rate of 118,300 L/day. An incidental 2-year storm event will result in a total of 9,330 L of water to be removed from the excavation. The total **unit** dewatering rate during the construction period for **one (1) unit** (assuming

largest unit dimensions) is estimated to be on the order of **186,705 L per day**, which includes a 50% safety factor on the anticipated rates and contribution from an incidental 2-year precipitation event.

The predicted theoretical radius of influence is estimated to be 10.5 m from the edge of the excavation.

It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed site grading and/or deviation from any assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.3 Estimation of Flow Rate – Site Servicing

It is understood that the site servicing plans for the proposed development at the Site are not finalized at this stage. For the purpose of assessing groundwater seepage rates during the construction period, the following assumptions were made:

- The trenching for the site servicing will be completed in segments of 30 m x 2 m per day; and
- The lowest invert level of the proposed trunk sewer and local servicing infrastructure will be limited to a depth of 4 mbgs.

As previously indicated, the trenching for the proposed site servicing will be dispersed across the Site area and therefore will encounter varying subsurface conditions at different locations of the Site. Generally, it is expected that the excavations for the site servicing will be completed above the groundwater table and construction dewatering/control will typically be minimal for the majority of the Site, and particularly during the summer period. To assess the requirements for groundwater control and dewatering during the construction period, a conceptual site model was prepared assuming the worst-case scenario with respect to the depth of excavation below the ground water table at the Site. Based on the proposed preliminary grading plan, it is anticipated that these conditions will likely be present in the south-central portion of the Site. For the purpose of estimating the requirements for groundwater control and dewatering during the construction period, the groundwater table in the conceptual site model was set to Elev. 269.7 masl (BH20-9, August 6, 2020). The elevation at the base of excavation will be Elev. 266.3 masl. On this basis, the excavation will be advanced to a depth of 3.4 m below the ground surface. There will be a requirement to lower the groundwater table to an elevation of 0.5 m below the base of the trench.

The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of an equivalent radius under unconfined groundwater conditions. The anticipated groundwater seepage rates are estimated to be on the order of 9,006 L/day. An incidental 2-year storm event will result in a total of 1,620 L of water to be removed from the trench. The total **unit** dewatering rate during the construction period for **one (1) trench segment** at the Site is estimated to be **15,500 L per day**, which includes a 50% safety factor on the anticipated rates and contributions from an incidental precipitation event.

The maximum predicted theoretical radius of influence is estimated to be 2 m from the edge of the excavation.

It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Furthermore, the detailed design of the proposed site servicing has not been finalized at this stage. During the detailed design stage, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.4 Estimation of Flow Rate – Storm Water Management Ponds

The proposed plans for development will include three (3) storm water management (SWM) ponds, inclusive of an interim SWM Pond. SWM Pond locations are presented in **Figure 4.** Preliminary SWM Pond designs were provided to DS by Urbantech Consulting dated September 2021. The proposed depths of SWM Ponds 1, 2A, 2B and interim SWM ponds are 261 masl, 259 masl, 255.5 masl, and 268.5 masl, respectively. Target dewatering rates should be lowered 1 m below the proposed depths to maintain dry conditions within the excavations.

Table 14 below indicates the boreholes considered for the estimated flow rated. Based on the highest groundwater level at each proposed SWM Pond, the excavations for the SWM Ponds will extend below the groundwater table. For this reason, groundwater control and dewatering during the construction period will be required to maintain a dry and safe excavation. The groundwater seepage volume in the excavation is estimated using the Dupuit-Forcheimer analytical model for flow into a linear trench from a system of wells of an equivalent radius under unconfined groundwater conditions.

Table 14 – Estimated Construction Dewatering SWM Pond Flow Rates

Parameter	SWM Pond 1	SWM Pond 2A	SWM Pond 2B	Interim SWM Pond
Monitoring Well	BH22-33	BH20-7	BH22-5	BH22-13
Seasonal High Groundwater Level (masl)	264.8	261.8	259.6	280
H- Initial Elevation of Water Table (m)	5.88	16.4	15.4	4.4
h- Final Elevation of Water Table (m)	1.1	2.8	7.3	1.0
In-Situ K- Hydraulic Conductivity (m/s)	4.6 X 10-6	1.4 X 10-7	5.5 X 10-8	1.6 X 10-6
Ro- Radius of Influence (m)	168	94	84	86
Re- Equivalent Radius (m)	137.0	89.7	80.8	72.9
A- Unit Area (m2)	59,000	25,300	20,500	16,700

C- Dimensionless constant	3	3	3	
Q- Flow rate (L/d)	206,000	18,000	12,500	49,000
Q- Total Flow Rate - 50% safety factor (L/d)	309,000	27,000	18,750	73,500
Q- Flow 100 mm storm water (L/day)	590,000	253,000	205,000	167,000
Q- Total Flow Rate (L/d)	**899,000**	**280,000**	**223,750**	**240,500**

It is understood that the provided site grading plans are currently preliminary and are subject to changes in the future. Should there be any changes to the proposed site grading and/or deviation from any assumptions made above, **DS** should be consulted to confirm if revisions to the construction dewatering/control assessment is deemed to be required.

7.5 Permanent Drainage (Long-term Discharge) - Medium Density Residential Blocks, Townhouse & Single Detached Units

It is understood that the residential blocks will include one (1) level of underground basement, which will likely be constructed above the water table and with a water-proofing membrane. A perimeter drainage system will be installed, however all collected percolating stormwater will be discharged to landscaped/vegetated areas of individual residential lots. Further, the institutional and commercial zones will be constructed slab-on-grade. For this reason, all low-rise residential blocks, institutional and commercial zones are not anticipated to require any permanent groundwater drainage control.

Given that the detailed design for the proposed plans for development were not finalized at this stage, various assumptions were made to assess the requirements for groundwater control and dewatering during the post-construction period. During the detailed design stage, if the assumptions made therein Section 6.0 of this report deviate from the finalized developmental designs, then **DS** should be consulted to revise the estimated groundwater seepage rates and permitting requirements.

7.6 Permanent Drainage (Long-term Discharge) – Storm Water Management Ponds

The proposed SWM pond designs will require permanent groundwater control. This is required to prevent hydrostatic pressure from up lifting the base of the pond during both normal operation and maintenance events. Due to the high-water level/hydrostatic pressure at the pond location the use of a conventional weeping tile drainage system will not be adequate in controlling the amount groundwater required to protect the base of the ponds. The groundwater can be controlled using relief wells that penetrate the aquifer. Permanent drainage volumes at each SWM pond location are summarised in **Table 15** below inclusive of a 50% safety factor.

Table 15 – Estimated Permanent Drainage SWM Pond Flow Rates

Parameter	SWM Pond 1	SWM Pond 2A	SWM Pond 2B	Interim SWM Pond
Monitoring Well	BH22-33	BH20-7	BH22-5	BH22-13
Screened Unit	Sand & Gravel & Silty Sand to Sandy Silt	Silty Clay Till	Sandy Silt & Silt	Sandy Silt
Seasonal High Groundwater Level (masl)	264.8	261.8	259.6	280
In-Situ K- Hydraulic Conductivity (m/s)	4.6 X 10-6	1.4 X 10-7	5.5 X 10-8	1.6 X 10-6
Q- Flow Rate (L/day)	170,500	7,500	9,000	30,000
Q- Flow Rate 50% safety factor (L/day)	255,750	11,250	13,500	45,000

In order to ensure a stable design for SWM Pond 1, the base of the pond should be raised above the top of the sand unit (aquifer), or an alternative location should be considered. **Pump tests are recommended to be performed at each of the SWM Pond locations to accurately estimate aquifer parameters (storativity and transmissivity) and to estimate accurate construction dewatering and permanent drainage volumes.**

7.7 Permit Requirements

7.7.1 Environmental Activity and Sector Registry (EASR) /Permit to Take Water (PTTW) Application

An Environmental Activity Sector Registration (EASR) Posting is required to be submitted to the Ministry of the Environment, Conservation and Parks (MECP) if the taking of groundwater and stormwater for a temporary construction project is between 50,000 L/day and 400,000 L/ day. The EASR application is an online registry and should be submitted to the MECP before commencing any construction dewatering operations. A PTTW is required to be submitted to the MECP if the taking of groundwater and stormwater for a temporary construction project is greater than 400,000 L/ day.

During the construction period, the requirements to obtain any water taking permitting (EASR/PTTW) will depend on the ownership structure of the Site and the staging for development. The estimates for groundwater control and dewatering provided in Section 7.1 through 7.4 of this report should be made use of each individual land parcel that comprise of the larger subject Site. It is anticipated that an EASR Posting will likely be required, however if the construction dewatering rates exceed 400 m^3 on any given day, a PTTW Registration with the MECP will be required.

During the post-construction period, the anticipated permanent drainage flows for each of the SWM ponds are expected to be greater than 50,000 L/day. Given that the estimated permanent drainage flows are expected to be greater than the MECP threshold of 50,000 L/day, a long-term PTTW will be required in

support of permanent groundwater control for the SWM Ponds should design details corroborate the assumptions made in this assessment.

7.7.2 Discharge Permits (Construction Dewatering and Permanent Drainage)

The Site is located within the Humber River watershed, which is located within the regulatory jurisdiction of the Toronto and Region Conservation Authority (TRCA). A discharge permit may be required from the TRCA, Peel Region and/or Town of Caledon if the water is to be discharged to a nearby/on-site surface water feature during the construction period. A discharge and monitoring plan will need to be prepared prior to obtaining a discharge approval from the TRCA, Peel Region and/or Town of Caledon.

If the private water during the post-construction period is anticipated to be discharged into the proposed municipal sewer system, a sewer discharge agreement with the Town of Caledon and/or Regional Municipality of Peel will be required prior to any discharging operations.

8.0 POTENTIAL IMPACTS

The following are the predicted potential impacts as a result of construction dewatering:

8.1 Local Groundwater Use

Based on the MECP WWRs, there are numerous well records listed within the boundary of the Site and the immediately adjacent area. The wells located within the Site boundary are expected to be decommissioned prior to commencing construction works for the proposed development. The majority of water supply wells in the area are noted to be installed at deeper depths. Given that the proposed construction is anticipated to extend less then 10m below existing ground surface, and the resulting radius of influence from the dewatering activities will be kept minimal, short and long-term impacts to private wells in the area during the construction period is not considered to be likely.

It is understood that the detailed design of the proposed plans for development have not been finalized at this stage. These specific details include, among other items, the maximum depth of excavation/trenching required in support of the proposed development, servicing and storm water management ponds. At this stage, the above-defined assumptions were considered in this assessment with regards to the deepest anticipated depth of excavation. It should be noted that if at the detailed design stage, the above assumptions do not hold true, then this assessment will need to be revisited based on the finalized design details.

8.2 Surface Water Features

Based on the proposed plans for development at the Site, the following may have the potential for impacts to natural surface water features:

(i) Groundwater control and dewatering operations during the construction period;
(ii) Reduction of groundwater recharge and possibly groundwater contributions to surface water features as a result of impervious surfaces following construction; and,

(iii) Reduction of runoff available to natural features as a result of changes to Site drainage.

A discussion on the potential for impacts (i to iii above) are provided below.

Groundwater Control and Dewatering:

All dewatering activities for the proposed development adjacent to the existing wetlands have the potential to interfere and lower the groundwater table within the wetland features. During the construction period, monitoring of the wetlands must be continued to ensure the groundwater levels and surface water flows in the headwater drainage features are not being lowered. On the onset of completing the pre-construction monitoring, **DS** will prepare a contingency plan, which will outline pre-defined *"review*" and "*response*" levels for all surface water stations in the wetlands, where impacts to the surface water features will have become apparent and mitigative measures as well as more frequent monitoring will need to be initiated promptly. Further preliminary details on the contingency plan are discussed in Section 8.0.

Pumped water from temporary construction dewatering activities should be managed to avoid direct discharge of potentially impacted water into sensitive features such as the wetland. To manage the potential risks to surface water quality, a discharge plan should be developed for proper discharge of private water during the construction period.

Reduction in Groundwater Recharge:

As discussed in Section 4.3.6, there are eight (8) wetlands within the Caledon Station and three (3) wetlands within the Argo King 1 & II development. A water balance assessment has not been proposed for the Argo Kin I & II lands and the baseline monitoring program is currently underway. Therefore, the below discussion refers to the conclusions made from the monitoring program and water balance assessment within the Caledon Station Community.

Wetlands W7 and W8 are being relocated with existing upgradient (offsite) contributions proposed to be redirected toward the new features. An adaptive management program for the newly constructed features will be required to ensure there is adequate contribution. For wetlands W1 to W6, a long-term pre-construction surface water and groundwater monitoring program is currently underway. Monitoring during the current period indicates that most wetlands are ephemeral surface water features, with minimal to some response to precipitation events. Upward shallow groundwater gradient at wetland W3 is noted, however further monitoring will be required to establish seasonal baseline conditions and to confirm surface water and groundwater interaction dynamics for each of the wetlands.

There is a potential that groundwater levels may rise during the spring period and provide contribution to seasonal baseflow of the wetlands. A reduction in recharge over the Site as a result of the development may result in a lowering of the water table and thus a reduction in groundwater contribution. The water balance completed for the Site shows there is a total Site infiltration deficit of 21,851 m^3/yr following mitigation. The mitigation plan provides a significant improvement to the unmitigated Post-Development

condition however, to prevent risk to the wetlands which may rely on contribution from groundwater, the post-development infiltration deficit should be further reduced / eliminated through the designing and implementation of additional Low Impact Development (LID) servicing for storm water management at the Site. LID's which target areas surrounding upgradient portions of wetlands W1 through W6 would help maintain groundwater gradients toward the features without necessarily requiring a complete elimination of the infiltration deficit over the entire Site.

Reduction in Runoff Contribution:

Results of the wetland water balance shows there is reduced runoff within upgradient wetland catchments which is considered contribution for each of the wetlands W1 to W6. It is anticipated that the runoff deficits can be managed by introducing LIDs which collect and convey clean sources of runoff from residential lots. The system can outlet to infiltration trenches constructed around the wetland buffer to maintain groundwater gradients toward each of the wetland units. Runoff contribution can be maintained by sizing the trenches to allow larger precipitation/melt events to overflow to constructed outlets along the natural wetland inlets. It is anticipated that there is enough storm water surplus available and sufficient infiltration potential available in native soils based on in-situ infiltration testing results.

Discharged water from storm sewer outfalls should be designed to avoid direct discharge into the wetland where possible. Results of the wetland risk assessment (TRCA, Nov 2017) indicates that since the impervious cover was calculated to be under 15% of the total wetland catchment, that stormwater generated over the proposed development currently contributing to wetlands presently includes a low risk. should an outfall be considered with a direct discharge to the wetland, the risk to the wetland should be revaluated.

8.3 Point of Discharge and Groundwater Quality

A discharge plan will be required for the discharge of pumped groundwater from construction dewatering activities. The plan must identify the discharge location and ensure the discharge will not result in any adverse impacts by identifying the discharge measures to be installed and control measures to limit the turbidity of the discharge water.

Discharged water from temporary construction dewatering activities should be managed to avoid direct discharge of potentially impacted water into sensitive features such as the wetland. To manage the potential risks to surface water quality, a discharge plan should be developed for the discharge of pumped groundwater from the construction dewatering.

The results of the groundwater analytical testing indicate the quality of groundwater exceeded the Provincial Water Quality Objective (PWQO) for total cobalt. Therefore, pre-treatment of the pumped construction water will be required prior to discharging into any surface water bodies. Exceedances of metals can generally be treated through the use of a primarily filtration. The design and effectiveness of the pre-treatment system will be the responsibility of the pre-treatment system contractor. The quality of the discharge water must meet the guideline limits of the PWQO prior to discharging into any surface water features. If the pumped water is to be discharged into a surface water body, a monitoring plan will need to

be prepared and submitted to the Toronto and Region Conservation Authority (TRCA), Peel Region and/or the Town of Caledon to obtain approval for a discharge permit.

8.4 Source Protection Area

The Sites are located within the Toronto Region Source Protection Area (SPA). The Sites were identified to be within an area of significant groundwater recharge; however, a vulnerability score was not specified for the Sites. Significant groundwater recharge areas are characterized by porous soils such as sand and gravel, which allows water to seep easily to the ground. A recharge area is considered significant when it helps maintain water levels in an aquifer that supplies a community with drinking water. Groundwater impacts as a result of construction should be assessed and minimize potential impacts to drinking water.

8.5 Highly Vulnerable Aquifer

The Sites are not located within a Highly Vulnerable Aquifer (HVA). No HVA impacts are anticipated due to the proposed development.

8.6 Wellhead Protection Area

The sites and the study area were not located within a municipal Wellhead Protection Area-Quantity (WHPA-Q). No WHPA-Q impacts are anticipated due to the proposed development.

8.7 Intake Protection Zone

The Sites and the study area are not located within a water intake protection zone (IPZ). No IPZ impacts are anticipated due to the proposed temporary dewatering.

8.8 Well Decommissioning

Following the completion of construction activities, all dewatering wells, well points, eductors, and monitoring wells installed at various stages of this project must be decommissioned. The installation and eventual decommissioning of the wells and the dewatering system must be carried out by a licenced water well contractor in accordance with Regulation 903 of the Ontario Water Resources Act.

9.0 MONITORING AND MITIGATION

Based on the hydrogeological investigation, **Table 16** below provides a recommended monitoring program, triggers for mitigation and recommended mitigation measures for groundwater levels and the discharge of water during construction.

Table 16: Monitoring and Mitigation Plan

PERIOD	MONITORING LOCATION	MONITORING FREQUENCY	METHOD	TRIGGERS FOR MITIGATION	COMMENTS / RECOMENDATIONS
WATER LEVELS					

PERIOD	MONITORING LOCATION	MONITORING FREQUENCY	METHOD	TRIGGERS FOR MITIGATION	COMMENTS / RECOMENDATIONS
Pre-Construction	Groundwater level monitoring (available on-site monitoring wells)	Continuously for one week	Dataloggers within the existing wells	None	Complete hydrographs to document baseline water levels
	Existing surface water stations (including staff gauages and nested piezometers)	Continuously for one week	Dataloggers within the existing staff gauges and manual measurements in nested piezometer	None	Complete hydrograph to document baseline water levels
During construction	Existing monitoring wells or replacements adjacent to dewatering area	Daily until target water level is reached	Dataloggers with weekly downloads	Target drawdown not reached or exceeded	Increased / reduced pumping; if pumping is approaching 400 m^3/day, a PTTW will be required
	Discharge volume	Daily at discharge location	Manual with totalizing flow meter in-line	Flow exceeds predicted volumes	Reduce to maximum allowed or obtain a PTTW
	Existing surface water stations (including staff gauages and nested piezometers)	Continuously until pre-defined *review* and/or *response* trigger levels are reached	Dataloggers and manual monitoring with weekly downloads	Drawdown of groundwater levels in wetlands to pre-defined *review* and/or *response* levels	The *review* and *response* levels will be finalized upon completion of the 1-year pre-construction monitoring
	Groundwater Contribution to Wetland (if any)	Continuously until pre-defined *review* and/or *response* trigger levels are reached	Dataloggers and manual monitoring with weekly downloads	Drawdown of surface water flows in wetlands below pre-defined *review* and/or *response* levels	The *review* and *response* levels will be finalized upon completion of the 1-year pre-construction monitoring
Post-Construction	Existing monitoring wells or replacements adjacent to dewatering area	Weekly for one month or until water levels reach 90% of original static level	Datalogger water level monitoring with weekly downloads	NA	NA
	Existing surface water stations (including staff gauages and nested piezometers)	Weekly for one month or until water levels reach 90% of original static level	Datalogger water level monitoring with weekly downloads	N/A	N/A

PERIOD	MONITORING LOCATION	MONITORING FREQUENCY	METHOD	TRIGGERS FOR MITIGATION	COMMENTS / RECOMENDATIONS
WATER QUALITY					
During construction (discharge to surface water feature)	Groundwater Discharge from dewatering	Sample for parameters against the PWQO criteria Field monitoring for turbidity and correlation with lab results	Once the start of dewatering at the point of discharge Weekly from the dewatering system for the first month of active dewatering Assuming water quality is compliant, monthly for the remainder of the dewatering period.	Discharge quality exceeds the PWQO criteria Field TSS/Turbidity exceed the PWQO criteria	More frequent monitoring will be considered Enhanced treatment of the discharge water will be considered, if needed
During Construction (surface water quality in wetlands)	Surface water flows at each surface water station	Sample for parameters against the PWQO criteria Field monitoring for turbidity and correlation with lab results	Sampling to be completed during construction monitoring on a monthly basis, until trigger level is reached	Exceedance in background turbidity concentration in water quality by more than 20 NTU or total suspended solids concentration above 25 mg/L	Conduct a site visit with the contractor; revisit the effectiveness of the pre-treatment system with the contractor and property owner to potentially alter construction phasing/methodology plan; revisit surface runoff at the Site and sediment and erosion control measures; and assess the need for clean up of the HDFs to minimize sediment transport

10.0 LIMITATIONS

This report was prepared for the sole use of the addressee to provide an assessment of the hydrogeological conditions on the property. The information presented in this report is based on information collected during the completion of the hydrogeological investigation. DS Consultants Limited was required to use and rely upon various information sources produced by other parties. The information provided in this report reflects DS' judgment in light of the information available at the time of report preparation. This report may not be relied upon by any other person or entity without the written authorization of DS Consultants Ltd. The scope of services performed in the execution of this investigation may not be

appropriate to satisfy the needs of other users, and any use or reuse of this document or findings, conclusions, and recommendations represented herein, is at the sole risk of said users. The conclusions drawn from the Hydrogeological report were based on information at selected observation and sampling locations. Different conditions between and beyond these locations may become apparent during future investigations or on-site work, which could not be detected or anticipated at the time of this investigation. DS Consultants Ltd. cannot be held responsible for hydrogeological conditions at the site that was not apparent from the available information.

Should you have any questions regarding these findings, please do not hesitate to contact the undersigned.

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Tables

Caledon Station Secondary Plan, Bolton, ON
Hydrogeological Investigation
20-169-104

Staff Gaugre (SG)				08-Sep-20		22-Oct-20		9-Dec-20		18-Feb-21		07-Apr-21		09-Jun-21		03-Sep-21		27-Oct-21		06-Jan-22		09-Mar-22		05-May-22		07-Jul-22		08-Sep-22		08-Nov-22		04-Jan-23		21-Mar-23	
SG ID	TOP Elevation (masl)	Depth (top of pipe)	Surface Elev. (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)
SG-W2-1	262.6	1.4	261.3	1.3	261.4	1.4	261.3	1.2	261.5	1.1	261.6	1.3	261.3	dry		1.3	261.3	1.2	261.4	1.2	261.5	0.9	261.7	1.2	261.4	1.3	261.3	1.3	261.4	1.2	261.4	1.2	261.4
SG-W3-1	271.9	1.3	270.6	dry		dry		dry		no data		dry		dry		dry		dry		1.3	270.7	1.3	270.7	dry		dry		dry		dry		dry	
SG-W4-1	262.4	1.4	261.0	dry		dry		1.4	261.0	1.3	261.1	1.4	261.0	0.0	262.4	under construction, inaccessible												dry		dry		dry		dry	
SG-W5-1	262.4	1.3	261.1	dry		1.3	261.1	1.3	261.1	1.2	261.2	1.3	261.1	0.0	262.4	under construction, inaccessible												dry		dry		dry		dry	
SG-WHT6-E	270.9	1.4	269.4	dry		dry		dry		frozen		dry		dry		dry		1.3	269.5	1.2	269.7	1.2	269.6	1.3	269.5	dry		dry		dry		1.2	269.6	1.2	269.7
SG-W7-1	266.4	1.1	265.3	dry		dry		1.0	265.4	0.9	265.5	0.9	265.5	dry	265.3	0.0	266.4	0.8	265.6	0.8	265.7	0.7	265.7	0.8	265.6	dry		dry		dry	265.3	0.8	265.6	0.6	265.8
SG-W8-1	264.8	1.5	263.3	1.4	263.4	dry		1.4	263.4	1.3	263.5	1.4	263.4	1.5	263.3	1.5	263.3	1.3	263.5	1.3	263.5	1.2	263.6	1.3	263.5	1.6	263.2	dry		1.5	263.3	1.3	263.5	1.2	263.6
Culvert	263.6		263.0	1.7	261.9	1.7	261.9	1.8	261.8	No data		No data		No data		No data		No data		No data		No data		No data		No data		No data		No data		No data	
New W4-1	262.0	1.1	260.8																									dry	260.8	dry	260.8	0.9	261.0	0.9	261.0
New W5 -1	261.9	1.0	260.9																									dry	260.9	1.0	260.9	0.9	261.0	0.9	261.0

ezometer (PZ)				08-Sep-20		22-Oct-20		9-Dec-20		18-Feb-21		07-Apr-21		09-Jun-21		03-Sep-21		27-Oct-21		06-Jan-22		09-Mar-22		05-May-22		07-Jul-22		08-Sep-22		08-Nov-22		04-Jan-23		21-Mar-23	
PZ ID	TOP Elevation (masl)	Depth (top of pipe)	Surface Elev. (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)
W3-PZS	271.7	1.8	270.9	1.6	270.1	1.3	270.4	1.1	270.6	no data		1.0	270.7	0.0	271.7	0.0	271.7	1.1	270.6	1.2	270.5	1.1	270.6	1.1	270.6	1.9	269.8	1.8	269.8	1.6	270.1	1.1	270.6	1.1	270.6
W3-PZD	271.8	2.7	271.0	1.5	270.3	1.3	270.5	1.1	270.6	no data		0.9	270.8	0.0	271.8	2.3	269.5	1.1	270.7			0.7	271.8	0.7	271.1	1.2	270.6	1.9	269.9	1.9	269.9	1.7	270.1	1.1	270.6
PZ-WHT6-E(S	270.2	1.8	269.6	dry		dry		1.8	268.4	1.2	269.0	1.8	268.4	1.9	268.3	0.0	270.2	0.7	269.5			270.2	0.6	269.7	1.2	269.0		268.4	dry	268.4	dry	268.4	0.8	269.4	0.7	269.5
PZ-WHT6-E(D	270.3	3.3	269.5	2.2	268.1	2.1	268.1	1.7	268.5	1.2	269.1	1.8	268.4	2.0	268.3	3.0	267.3	1.6	268.7	1.2	269.1	1.6	268.6	1.5	268.8	2.0	268.3	dry	267.0	dry	267.0	1.9	268.4	0.9	269.4
W7-PZS	266.2	1.6	266.2	dry		dry		0.6	265.6	0.5	265.7	0.6	265.6	1.1	265.1	0.0	266.2	0.8	265.4	0.8	265.4	0.5	265.7	0.5	265.7	1.3	264.9	dry	264.6	0.5	265.8	0.4	265.8		
W7-PZD	266.2	2.4	266.2	dry		2.2	264.0	0.6	265.6	0.5	265.7	0.6	265.6	1.1	265.1	0.0	266.2	0.8	265.4	0.8	265.4	0.5	265.7	0.5	265.7	1.3	264.9	dry	263.8	dry	263.8	0.4	265.8	0.4	265.8
W8-PZD	264.4	2.5	263.6	1.0	263.4	2.2		1.0	263.4	1.0	263.4	1.0	263.4	dry		1.1	263.3	0.8	263.6	0.8	263.6	0.1	264.3	0.9	263.5	1.2	263.2	1.1	263.3	1.1	263.3	1.0	263.4	0.8	263.6
W8-PZS	264.3	1.6	263.6	1.0	263.4	dry		1.0	263.4	0.9	263.4	1.0	263.3	dry		1.1	263.2	0.8	263.5	0.9	263.4	0.1	264.3	0.9	263.5	1.2	263.2	1.1	263.2	1.0	263.3	0.8	263.5	0.7	263.6
W5-PZD	261.9	2.5	261.2	0.8	261.1	2.0	259.9	0.7	261.2	0.7	261.2	1.1	260.8	dry		Station Removed During Construction							Station Removed During Construction					1.5	260.9	dry		dry			
W5-PZS	262.2	1.7	261.3	1.1	261.1	1.1	261.1	0.9	261.2	0.8	261.3	0.7	261.4	dry		Station Removed During Construction							Station Removed During Construction					1.4	260.9	dry		dry			
W4-PZD	261.9	2.4	261.1	1.2	260.7	2.2	259.7	0.9	261.0	0.8	261.1	0.9	261.0	dry		Station Removed During Construction							Station Removed During Construction					1.2	260.5	dry		dry			
W4-PZS	262.2	1.5	261.3	1.3	260.9	dry		1.0	261.2	0.9	261.3	1.0	261.2	dry		Station Removed During Construction							Station Removed During Construction				dry		dry		dry			
W2-PZD	262.4	2.9	261.5	1.0	261.4	1.0	261.3	1.0	261.4	0.9	261.4	0.7	261.6	1.0	261.4	1.0	261.4	0.9	261.4	0.9	261.5	0.9	261.5	1.0	261.4	1.0	261.4	1.0	261.3	1.0	261.4	0.9	261.4		
W2-PZS	262.2	1.7	261.5	0.8	261.5	0.8	261.4	0.8	261.4	0.8	261.5	1.0	261.2	0.9	261.3	0.0	262.2	0.8	261.4		262.2	0.8	261.4	0.9	261.3	0.9	261.4	1.0	261.2	0.9	261.3	0.9	261.4	0.9	261.3
new W5-PZD	261.3	2.7	261.3																									1.5	262.2	1.3	260.0	1.2	260.1	1.2	260.1
new W5-PZS	261.3	1.8	261.3																									1.4	259.9	1.3	260.0	1.2	260.1	1.2	260.1
new W4-PZD	261.1	2.2	261.1																									1.2	259.9	1.3	259.8	0.6	260.5	0.5	260.6
new W4-PZS	261.2	1.5	261.2																									dry		dry		1.0	260.2	1.0	260.2

Monitoring Well (MW)				06-Aug-20		08-Sep-20		22-Oct-20		9-Dec-20		18-Feb-21		07-Apr-21		09-Jun-21		03-Sep-21		27-Oct-21		06-Jan-22		09-Mar-22		05-May-22		07-Jul-22		08-Sep-22		08-Nov-22		04-Jan-23		21-Mar-23	
MW ID	Surface Elevation (masl)	Depth (mbgs)	Stick-Up (m)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)
BH20-1	279.8	6.9	1.0	5.1	275.7	5.2	275.6	5.5	275.3	5.5	275.3	5.3	275.5	4.8	276.0	5.1	275.7	5.6	275.2	5.5	275.3	4.7	276.1	5.1	275.7	4.6	276.2	4.9	275.9	5.5	275.3	5.8	275.0	5.9	274.9	4.9	275.9
BH20-2	278.8	7.2	0.9	7.1	272.7	7.3	272.4	7.4	272.3	7.4	272.3	7.4	272.4	7.0	272.7	7.3	272.4	7.8	272.0	7.4	272.3	6.8	272.9	7.0	272.8	6.8	272.9	7.1	272.7	7.6	272.2	7.9	271.8	7.8	271.9	7.0	272.7
BH20-3	278.5	6.2	1.0	6.9	272.6	dry		dry		7.1	272.4	Dry		7.0	272.5	7.1	272.4					6.7	272.8	7.0	272.5	6.7	272.8	7.0	272.5	7.0	272.5	7.1	272.4	6.9	272.6	
BH20-4	277.1	5.5	0.0	4.6	272.5	4.8	272.3	inaccessible		inaccessible		Frozen		4.6	272.5	5.0	273.0	6.4	270.6	5.1	271.9					4.5	272.6	4.7	272.4	5.2	271.9	5.6	271.5	5.5	271.6	4.8	272.3
BH20-5	273.1	9.3	1.0	3.8	270.3	4.1	270.0	4.4	269.7	4.3	269.8	4.0	270.0	3.8	270.3	4.0	270.0	4.6	269.5	4.2	269.9	3.5	270.6	3.7	270.3	3.3	270.7	3.8	270.2	4.3	269.8	4.8	269.2	4.7	269.3	3.7	270.4
BH20-6	270.9	7.6	0.9	7.6	264.2	2.0	269.8	1.6	270.2	1.1	270.7	1.2	270.6	1.2	270.7	1.4	270.4	1.8	270.1	1.1	270.8			1.2	270.6	1.1	270.7	1.3	270.5	1.5	270.3	1.4	270.4	1.3	270.5	1.1	270.7
BH20-7	261.7	7.7	1.1	dry		7.6	255.2	4.4	258.4	2.2	260.6	1.2	261.6	1.1	261.7	1.3	261.5	1.2	261.6	1.0	261.8					1.3	261.5	1.3	261.5	1.3	261.5	1.1	261.7	1.1	261.7	1.2	261.6
BH20-9	274.1	7.4	0.9	5.3	269.7	5.6	269.4	5.9	269.1	5.9	269.1	5.7	269.3	5.1	269.9	5.6	269.4	6.2	268.8	5.9	269.1	5.2	269.8	5.4	269.6	5.0	270.0	5.3	269.7	5.9	269.1	6.2	268.8	6.1	268.9	5.4	269.6
BH20-11	270.1	9.1	1.0	6.4	264.7	6.4	264.7	6.3	264.8	6.2	264.9	6.0	265.1	3.6	267.5	3.9	267.2	4.6	266.5	2.7	268.4	3.2	267.9	3.8	267.3	3.3	267.8	3.8	267.3	4.6	266.5	5.7	265.4	3.7	267.4	2.6	268.5
BH20-12	264.9	4.6	0.8	1.0	264.7	0.9	264.8	0.9	264.8	0.8	264.9	0.6	265.1	0.5	265.2	0.5	265.2	1.0	264.8	0.9	264.9					0.3	265.5	0.4	265.3	0.8	265.0	0.9	264.9	0.9	264.8	0.6	265.1
BH20-14	267.7	11.0	0.9	4.2	264.3	4.3	264.2	4.5	264.1	4.1	264.4	4.1	264.5	3.8	264.8	4.1	264.4	4.7	263.9	1.1	267.5	1.3	267.2	3.8	264.7	1.8	266.7	4.0	264.5			4.4	264.1	1.2	267.4	1.1	267.5
BH20-15	264.1	9.4	1.0	3.4	261.7	3.3	261.8	3.4	261.7	2.9	262.2	2.8	262.3	2.7	262.4	3.0	262.1	3.4	261.7	3.0	262.1	2.5	262.6	2.8	262.3	2.7	262.4	3.1	262.0	3.4	261.7	3.0	262.1	2.6	262.5		
BH20-16	265.5	7.8	0.9	3.0	263.4	3.2	263.3	3.4	263.0	3.2	263.3	3.2	263.2	2.9	263.5	3.1	263.3	3.5	262.9	3.0	263.5	2.6	263.8	2.6	263.9	2.6	263.8	3.0	263.5	3.3	263.1	3.4	263.0	3.2	263.3	2.2	264.2
BH22-1	279.0	7.4	1.0																											4.4	275.6	5.3	274.7	5.2	274.8	3.6	276.4
BH22-3	274.8	5.7	1.0																											2.4	273.4	3.1	272.8	1.9	273.9	1.3	274.5
BH22-5	279.7	7.6	1.1																											7.6	273.2	8.0	272.8	8.0	272.7	6.7	274.1
BH22-10	269.9	8.2	1.0																											1.9	269.0	2.1	268.8	1.8	269.2	1.3	269.7
BH22-11	272.9	6.7	0.8																											4.4	269.3	4.8	269.0	4.6	269.1	3.9	269.8
BH22-13	276.1	9.4	1.0																											7.0	270.1	7.4	269.7	7.2	269.9	6.1	271.0
BH22-14	271.4	12.3	0.8																											12.4	259.8	8.7	263.5	2.2	270.0	1.1	271.1
BH22-15	270.2	7.3	0.8																											2.8	268.3	3.9	267.1			3.0	268.0
BH22-17	269.0	7.6	0.9																											3.2	266.7	3.8	266.1	1.5	268.3	0.2	269.7
BH22-20	269.4	7.6	0.8																											3.2	266.9	4.2	266.0	4.7	265.5	2.1	268.1
BH22-22	267.8	7.7	0.8																											2.3	266.3	3.0	265.5	3.2	265.4	1.6	267.0
BH22-25	270.9	10.8	0.9																											3.9	267.9	4.2	267.6	4.0	267.8	3.2	268.6
BH22-27	271.2	12.0	0.9																											5.2	266.9	5.3	266.8	5.0	267.1	4.0	268.1
BH22-28	270.9	10.7	0.9																											5.7	266.1	5.8	266.0	5.6	266.2	4.6	267.2
BH22-29	268.9	8.8	0.9																											4.7	265.1	4.9	264.9	4.8	265.0	3.6	266.2
BH22-32	265.3	11.6	0.8																											1.2	264.9	1.3	264.8	0.9	265.2	0.3	265.8
BH22-33	267.9	9.2	1.0																											5.3	263.7	5.4	263.5	5.3	263.7	4.2	264.8
BH22-35	266.1	10.8	0.9																											3.2	263.8	3.3	263.7	2.9	264.0	2.2	264.8
BH22-36	261.7	4.1	1.0																											2.7	260.0	2.8	259.9	1.2	261.6	1.2	261.6
BH22-39	266.5	4.1	0.9																											2.3	265.1	2.3	265.1	1.1	266.3	0.9	266.6
BH22-40A	265.1	7.7	1.0																											dry	257.3	5.7	260.3	3.5	262.5	2.1	263.9
BH22-40B	265.1	4.0	1.0																											dry	261.0	4.8	261.2	4.6	261.5	2.5	263.5
BH22-42	266.7	7.4	1.0																											6.2	261.5	3.7	264.0	3.3	264.3	1.5	266.1

Argo King I & II, Bolton, ON

Hydrogeolgogical Investigation

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Staff Gauge (SG)				24-Oct-22		21-Nov-22		19-Dec-22		26-Jan-23		24-Feb-23		23-Mar-23		26-Apr-23	
SG ID	TOP Elevation (masl)	Depth (top of pipe)	Surface Elev. (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)
SG1	261.5	1.4	260.0	dry		dry		1.3	260.2	1.3	260.2	1.3	260.2	1.2	260.2	1.3	260.2
SG2	261.9	1.4	260.5	dry		dry		1.2	260.7	1.2	260.7	1.2	260.6	1.2	260.7	1.2	260.7
SG3	260.8	1.4	259.4	dry		dry		1.3	259.5	1.2	259.5	1.3	259.5	1.2	259.5	1.3	259.4
SG4	262.6	1.4	261.2	dry		dry		dry	261.2	1.4	261.3	1.3	261.4	1.2	261.4	1.3	261.3
SG5	261.8	1.3	260.5	dry		dry		1.1	260.7	dry		1.2	260.7	1.2	260.6	dry	

Piezometer (PZ)					24-Oct-22		21-Nov-22		19-Dec-22		26-Jan-23		24-Feb-23		23-Mar-23		26-Apr-23	
PZ ID	TOP Elevation (masl)	Depth (top of pipe)	Stick-up (m)	Surface Elev. (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)
PZ1S	260.0	2.1	1.1	258.9	1.2	258.8	1.2	258.8	1.3	258.7	dry	258.0	1.2	258.8	1.2	258.8	1.2	258.8
PZ1D	260.2	3.2	1.4	258.9	1.1	259.2	1.6	258.7	1.6	258.7	1.4	258.8	1.4	258.8	1.4	258.8	1.5	258.8
PZ2S	257.6	1.9	0.7	256.8	1.1	256.4	0.9	256.7	0.8	256.8	0.7	256.9	0.7	256.8	0.7	256.9	0.8	256.8
PZ2D	257.6	2.7	0.8	256.9	1.0	256.6	0.9	256.7	0.8	256.8	0.7	257.0	Frozen		0.7	256.9	0.9	256.8
PZ3S	259.1	2.1	1.0	258.1	1.3	257.8	1.1	257.9	1.1	258.0	1.1	258.0	1.0	258.1	1.0	258.1	1.1	258.0
PZ3D	259.2	3.0	1.1	258.1	0.9	258.3	1.3	257.9	1.2	258.0	1.2	258.0	1.1	258.1	1.1	258.1	1.2	258.0
PZ4S	260.8	2.1	0.9	259.9	1.7	259.2	1.5	259.3	1.2	259.6	1.0	259.9	0.9	260.0	0.8	260.0	0.9	259.9
PZ4D	261.2	3.3	1.2	260.0	2.5	258.7	1.9	259.3	1.6	259.6	1.4	259.8	1.2	260.0	1.2	260.0	1.3	259.9
PZ5S	260.1	2.2	0.8	259.3	dry		2.0	258.1	1.4	258.7	1.0	259.1	0.9	259.2	0.8	259.3	1.0	259.1
PZ5D	259.9	2.7	0.6	259.3	2.3	257.6	1.8	258.1	1.5	258.4	0.9	259.0	0.7	259.2	0.6	259.3	0.7	259.1

Monitoring Well (MW)				26-Oct-22		21-Nov-22		19-Dec-22		26-Jan-23		24-Feb-23		23-Mar-23		26-Apr-23	
MW ID	Surface Elevation (masl)	Depth (mbgs)	Stick-Up (m)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)	Depth to Water (TOP)	Depth to Water (masl)
BH19-1	257.2	6.0	0.7	1.4	256.5	1.5	256.4	1.6	256.4	0.7	257.3	0.5	257.5	0.4	257.5	0.7	257.3
BH19-3	259.8	6.1	0.7	1.5	259.1	1.5	259.0	1.5	259.1	0.8	259.8	0.6	259.9	0.6	259.9	0.7	259.9
BH19-4	262.7	6.0	0.6	artesian		artesian		artesian		artesian		artesian		artesian		artesian	
BH19-5	260.7	6.1		artesian		artesian		artesian		artesian		artesian		artesian		artesian	
BH19-6	259.3	6.1	0.8	1.5	258.6	1.6	258.5	1.4	258.7	1.2	258.9	1.2	258.9	1.0	259.1	1.2	258.9
BH19-7	260.4	7.1	0.9	no data				2.0	259.4	1.0	260.3	1.1	260.2	0.9	260.4	1.0	260.3
BH22-1	262.1	8.2	1.0	artesian		damaged		artesian		artesian		artesian		artesian		artesian	
BH22-5	259.1	7.7	1.0	1.7	258.4	1.7	258.4	1.8	258.3			0.5	259.6	0.5	259.6	0.8	259.3
BH22-7	257.6	10.3	1.1	2.5	256.2	2.7	256.0	2.6	256.1	1.4	257.3	0.9	257.8	1.0	257.7	1.3	257.5
BH22-8	259.4	9.4	1.0	2.4	258.1	2.2	258.2	2.2	258.2	1.3	259.2	1.2	259.3	1.0	259.4	1.1	259.3
BH22-9	261.6	7.5	0.7	artesian		artesian		artesian		artesian		artesian		artesian		artesian	

Total Channel Stream Flow Rates

Caledon Station Secondary Plan, Bolton, ON

Date	SG W2		SG W3		SG W4		SG W5		SG WHT6-E		SG W7		SG W8	
	m^3/day	L/day	m^3/day	L/day	m^3/day	L/day	m^3/day	L/day	m^3/day	L/day	m^3/day	L/day	m^3/day	L/day
08-Sep-20	no flow		no flow		no flow		no flow		no flow		no flow		no flow	
23-Oct-20	no flow		no flow		no flow		no flow		no flow		no flow		no flow	
09-Dec-20	no flow		no flow		24	23,760	259	258,768	no flow		no flow		no flow	
18-Feb-21	no flow		no flow		24	23,760	259	258,768	no flow		no flow		no flow	
27-Apr-21	475	475,200	no flow		no flow		113	113,400	no flow		60	59,616	58	58,320
09-Jun-21	no flow		no flow		no flow		no flow		no flow		no flow		no flow	
03-Sep-21	no flow		no flow		no flow		no flow		no flow		no flow		no flow	
29-Oct-21	no flow		no flow		452	451,656	38	38,016	2,472	2,471,904	no flow		990	989,712
06-Jan-22	no flow		no flow		no flow		no flow		no flow		no flow		no flow	
09-Mar-22	no flow		no flow		650	649,728	154	154,440	788	787,968	no flow		223	222,912
05-May-22	660	660,096	21	21,168	69	69,120	235	235,440	158	158,112	no flow		10	10,368
07-Jul-22	no flow		no flow		no flow		no flow		no flow		no flow		no flow	
08-Sep-22	no flow		no flow		no flow		no flow		no flow		no flow		no flow	
08-Nov-22	no flow		no flow		no flow		6	6,048	no flow		no flow		no flow	
04-Jan-23	no flow		10	10,238	565	565,056	361	360,720	956	955,584	no flow		289	289,440
21-Mar-23	78	77,544	no flow		1,488	1,487,808	386	385,776	1,198	1,198,368	250	250,128	6,886	6,885,648

Argo King I & II, Bolton, ON

Date	SG1-1		SG1-2		SG1-3		SG2		SG3	
	m^3/day	L/day	m^3/day	L/day	m^3/day	L/day	m^3/day	L/day	m^3/day	L/day
26-Oct-22	no flow		no flow		no flow		no flow		no flow	
21-Nov-22	no flow		no flow		no flow		no flow		no flow	
19-Dec-22	no flow		no flow		no flow		no flow		no flow	
26-Jan-23	no flow		no flow		no flow		no flow		no flow	
24-Feb-23	no flow		no flow		no flow		no flow		no flow	
23-Mar-23	1,054	1,054,080	2,791	2,790,720	634	634,176	no flow		761	761,400
26-Apr-23	57	57,024	100	100,224	no flow		no flow		43	43,200

Figures

Legend

- Caledon Station Property Boundary
- Argo King I & Argo King II
- Parcels
- Wetland

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Client:
CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

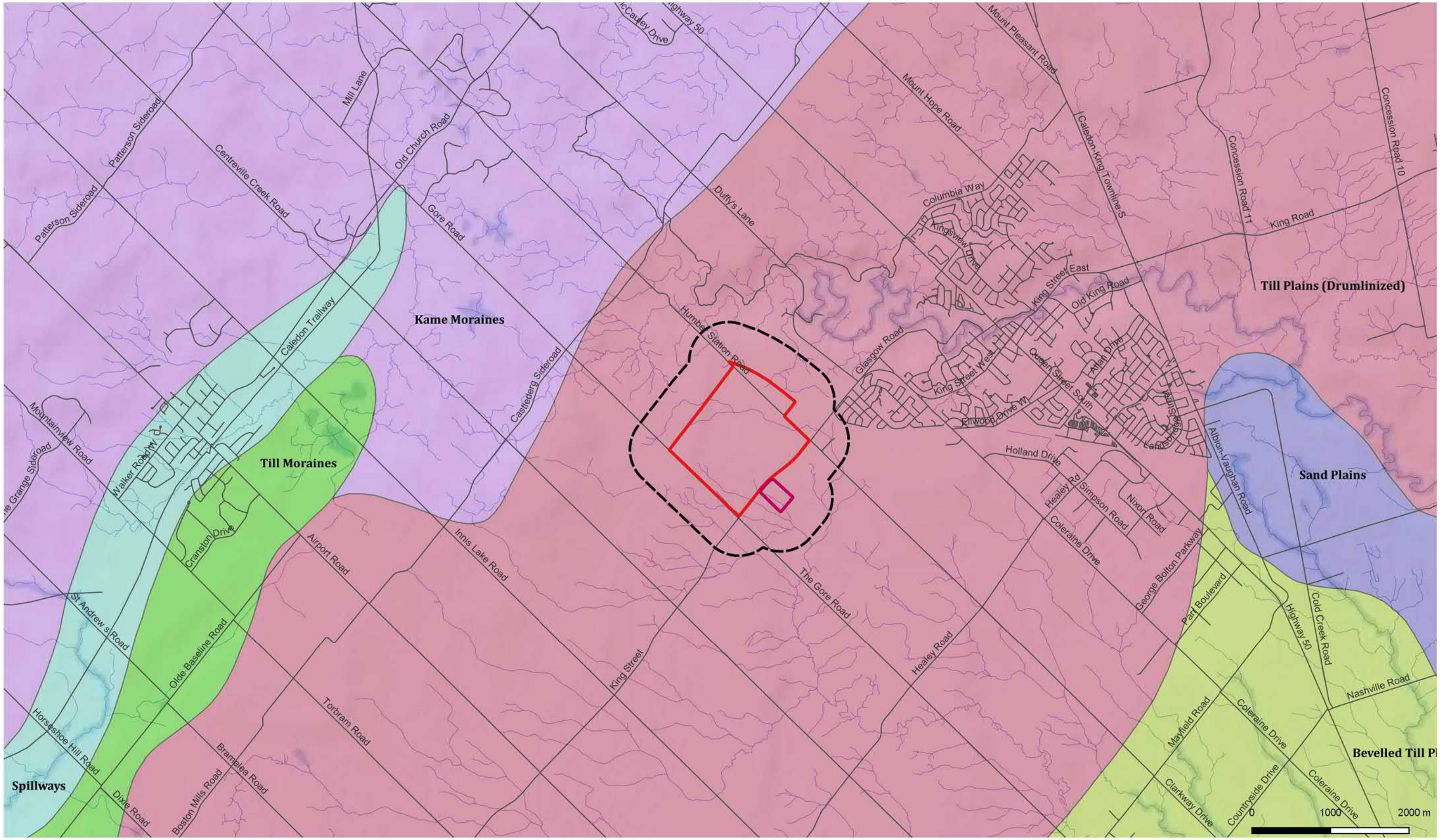
Title: **SITE LOCATION PLAN**

N

Size:	Approved By:	Drawn By:	Date:
11x17	D.S	S.Y	February 2023
Rev. 0	Scale: As Shown	Project No.: 20-169-104	Figure No.: 1

Image/Map Source: *Google Satellite Image*

J:\-GIS\2020 PROJECTS\20-169-100 Bolton Option 3 Lands\1-QGIS\HydroG\104\Figure 1 – Site Location Plan.qgs May-16 11:55



Legend

- Caledon Station Property Boundary
- Argo King I & Argo King II
- 500m Buffer
- Bevelled Till Plains
- Kame Moraines
- Sand Plains
- Spillways
- Till Moraines
- Till Plains (Drumlinized)

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Client: CALEDON COMMUNITY PARTNERS c/o GLEN SCHNARR & ASSOCIATES

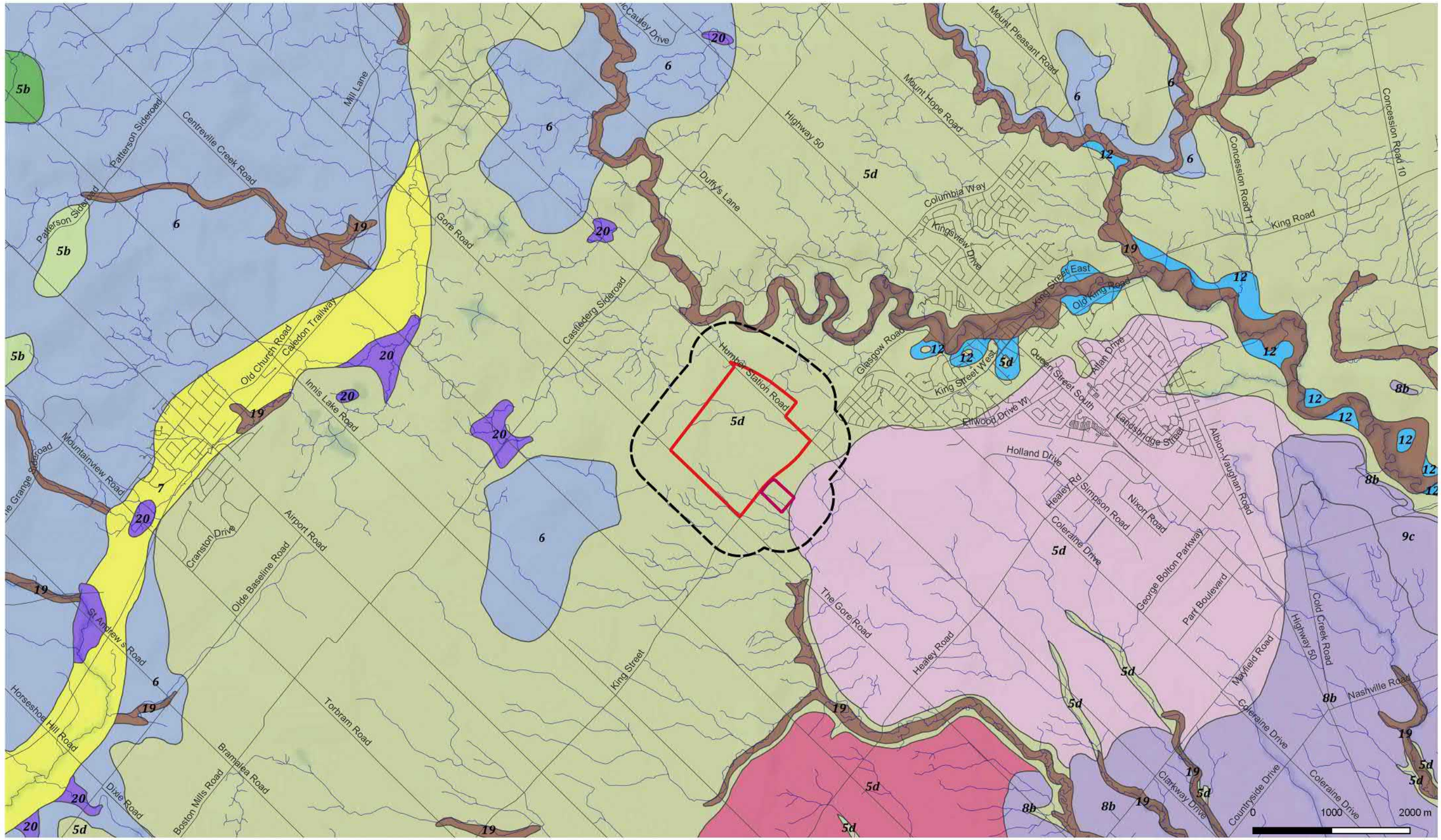
Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **REGIONAL PHYSIOGRAPHY MAP**

N

Size:	Approved By: D.S	Drawn By: S.Y	Date: February 2023
11x17	Scale: As Shown	Project No.: 20-169-104	Figure No.: **2A**
Rev. 0	Image/Map Source: *Google Satellite Image*		

J:\-GIS\2020 PROJECTS\20-169-100 Bolton Option 3 Lands\1-QGIS\HydroG\104\Figure 2A – Regional Physiography Map.qgs May-16 09:07



Legend

- Caledon Station Property Boundary
- Argo King I & Argo King II
- 500m Buffer
- 12 - Older Alluvium
- 19 - Modern Alluvium
- 20 - Bog Deposits
- 5b - Halton Till
- 5b - Northern Lower Till
- 5b - Wentworth Till
- 5d - Wildfield Till
- 6 - Ice-contact stratified drift
- 7 - Sand
- Wildfield Till

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Client: CALEDON COMMUNITY PARTNERS c/o GLEN SCHNARR & ASSOCIATES

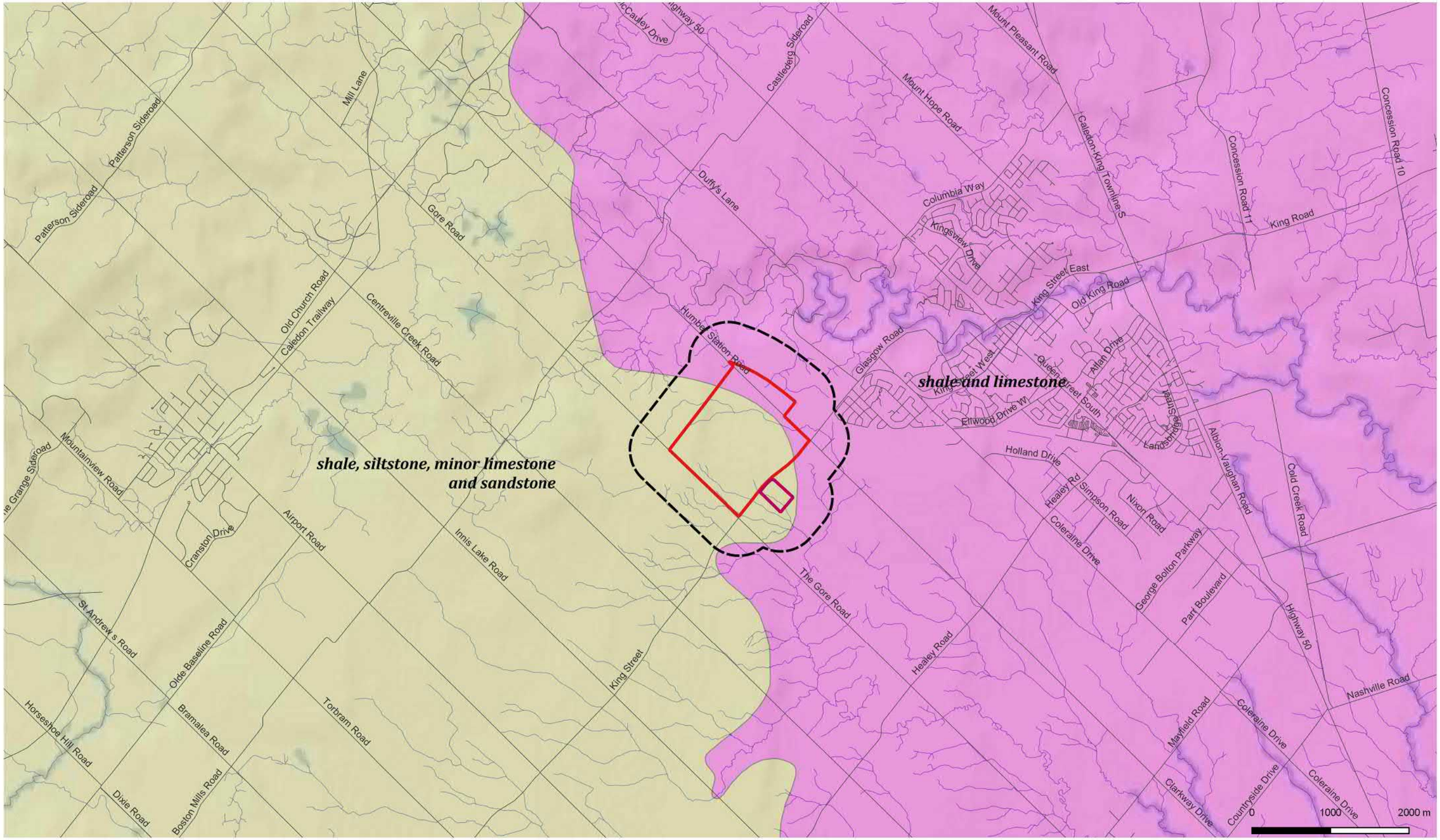
Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **SURFICIAL GEOLOGY MAP**

Size:	Approved By:	Drawn By:	Date:
11x17	D.S	S.Y	February 2023
Rev. 0	Scale: As Shown	Project No.: 20-169-104	Figure No.: **2B**

Image/Map Source: *Google Satellite Image*

J:\-GIS\2020 PROJECTS\20-169-100 Bolton Option 3 Lands\1-QGIS\HydroG\104\Figure 2B – Surficial Geology Map.qgs May-16 09:09



Legend

- Caledon Station Property Boundary
- Argo King I & Argo King II
- 500m Buffer
- Georgian Bay Formation
- Queenston Formation

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Client: CALEDON COMMUNITY PARTNERS c/o GLEN SCHNARR & ASSOCIATES

Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

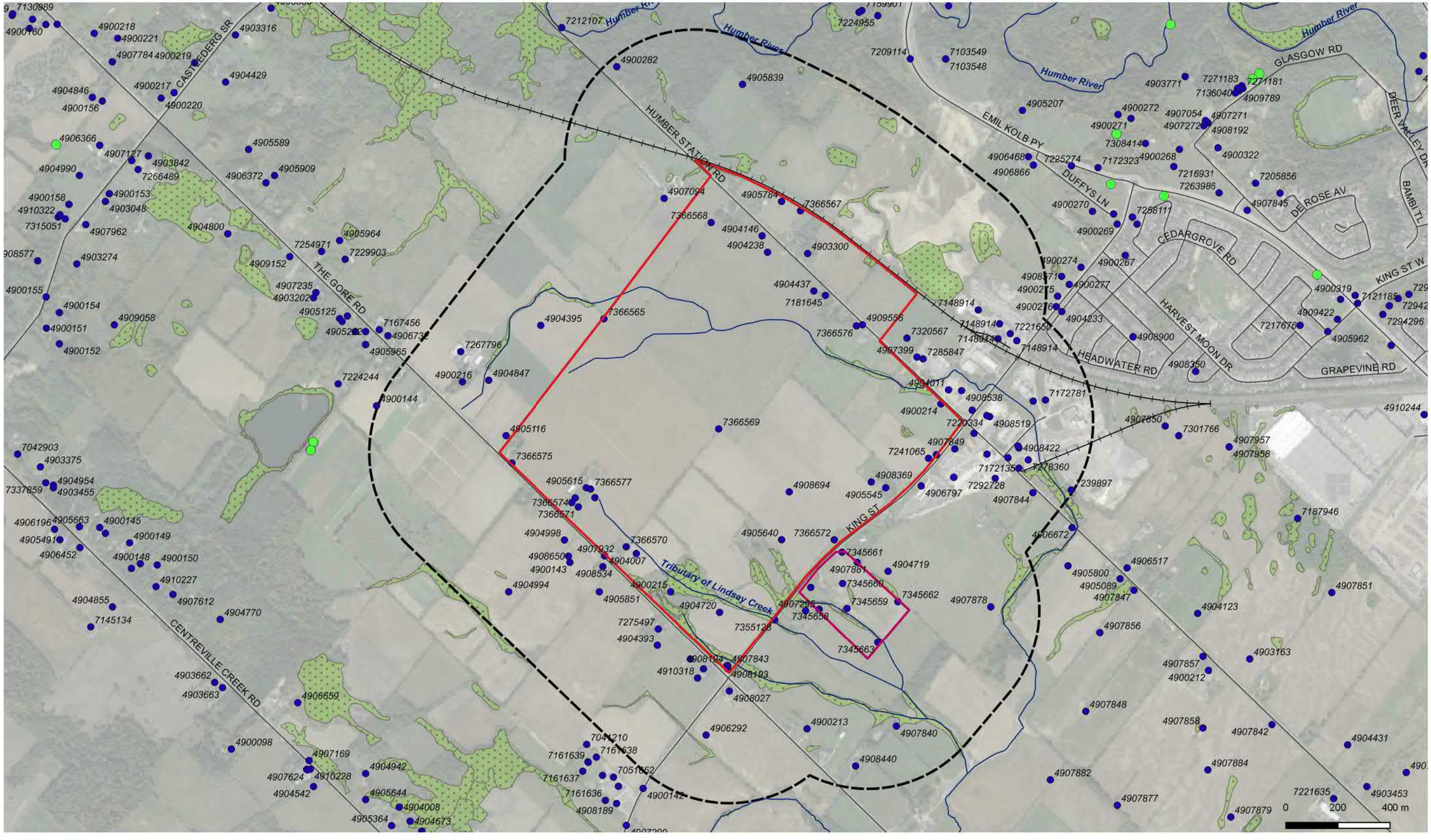
Title: **BEDROCK GEOLOGY MAP**

Size:	Approved By:	Drawn By:	Date:
11x17	D.S	S.Y	February 2023
Rev. 0	Scale: As Shown	Project No.: 20-169-104	Figure No.: **2C**

Image/Map Source: *Google Satellite Image*

J:\-GIS\2020 PROJECTS\20-169-100 Bolton Option 3 Lands\1-QGIS\HydroG\104\Figure 2C – Bedrock Geology Map.qgs May-16 09:10

J:\-GIS\2020 PROJECTS\20-169-100 Bolton Option 3 Lands\1-QGIS\HydroG\104\Figure 3 – Site Location and MECP Well Records.qgs May-16 09:12



Legend

- Caledon Station Property Boundary
- Argo King I & Argo King II
- 500m Buffer
- Wetland
- Permit to take water
- Registered Water Well (MECP WWR)

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Client: CALEDON COMMUNITY PARTNERS c/o GLEN SCHNARR & ASSOCIATES

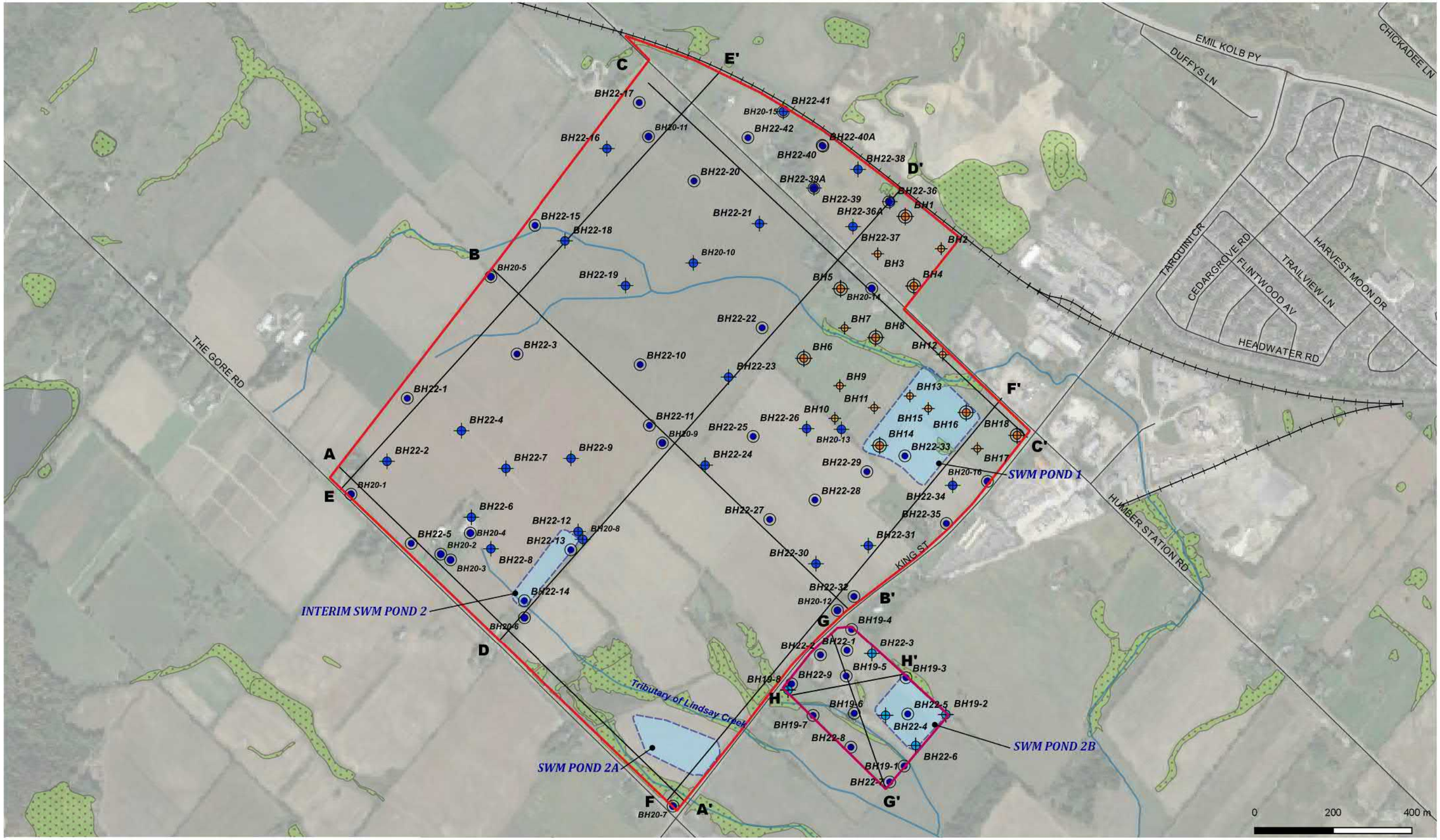
Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **MECP WATER WELL RECORDS & PTTW MAP**

N

Size:	Approved By:	Drawn By:	Date:
11x17	D.S	S.Y	February 2023
Rev. 0	Scale: As Shown	Project No.: 20-169-104	Figure No.: 3

Image/Map Source: *Google Satellite Image*



Legend

- Caledon Station Property Boundary
- Argo King I & Argo King II
- Borehole
- Monitoring Well
- Borehole (Soil Eng)
- Monitoring Well (Soil Eng)
- Wetland
- SWM Pond
- Cross Section

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Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **BOREHOLE AND MONITORING WELL LOCATIONS**

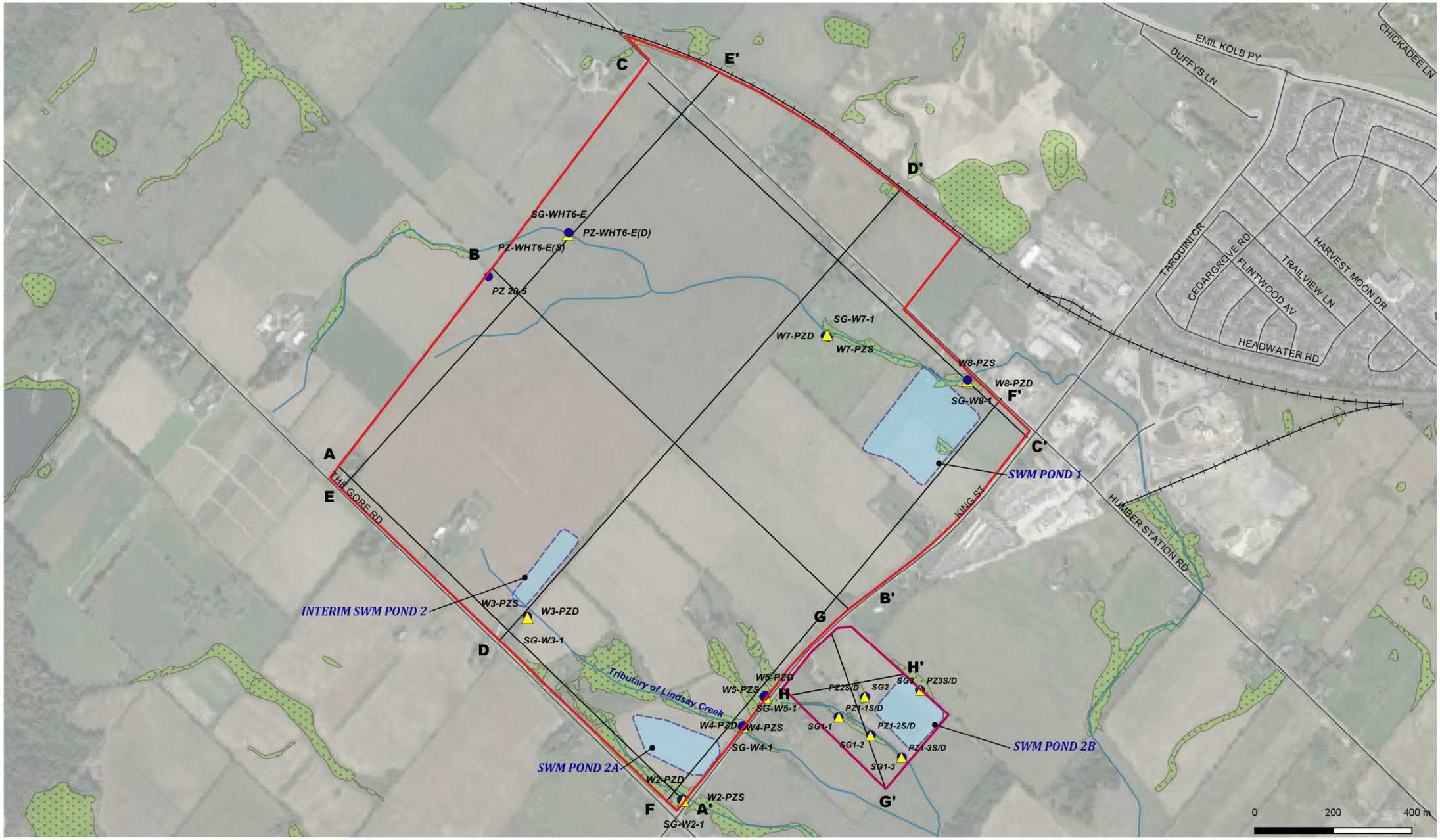
Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
11x17	D.S	S.Y	February 2023
Rev. 0	Scale: As Shown	Project No.: 20-169-104	Figure No.: **4A**

Image/Map Source: *Google Satellite Image*

J:\-GIS\2020 PROJECTS\20-169-100 Bolton Option 3 Lands\1-QGIS\HydroG\104\Figure 4 - Borehole and Instrumentation Location Map.qgs May-16 09:15

J:\-GIS\2020 PROJECTS\20-169-100 Bolton Option 3 Lands\1-QGIS\HydroG\104\Figure 4 - Borehole and Instrumentation Location Map.qgs May-16 09:14



Legend

- Argo King I & Argo King II
- Caledon Station Property Boundary
- Piezometer
- Staff Gauge
- Cross Section
- Wetland
- SWM Pond

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Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **INSTRUMENTAL LOCATION MAP**

N

Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
11x17	D.S	S.Y	February 2023
Rev. 0	Scale: As Shown	Project No.: 20-169-104	Figure No.: **4B**

Image/Map Source: *Google Satellite Image*

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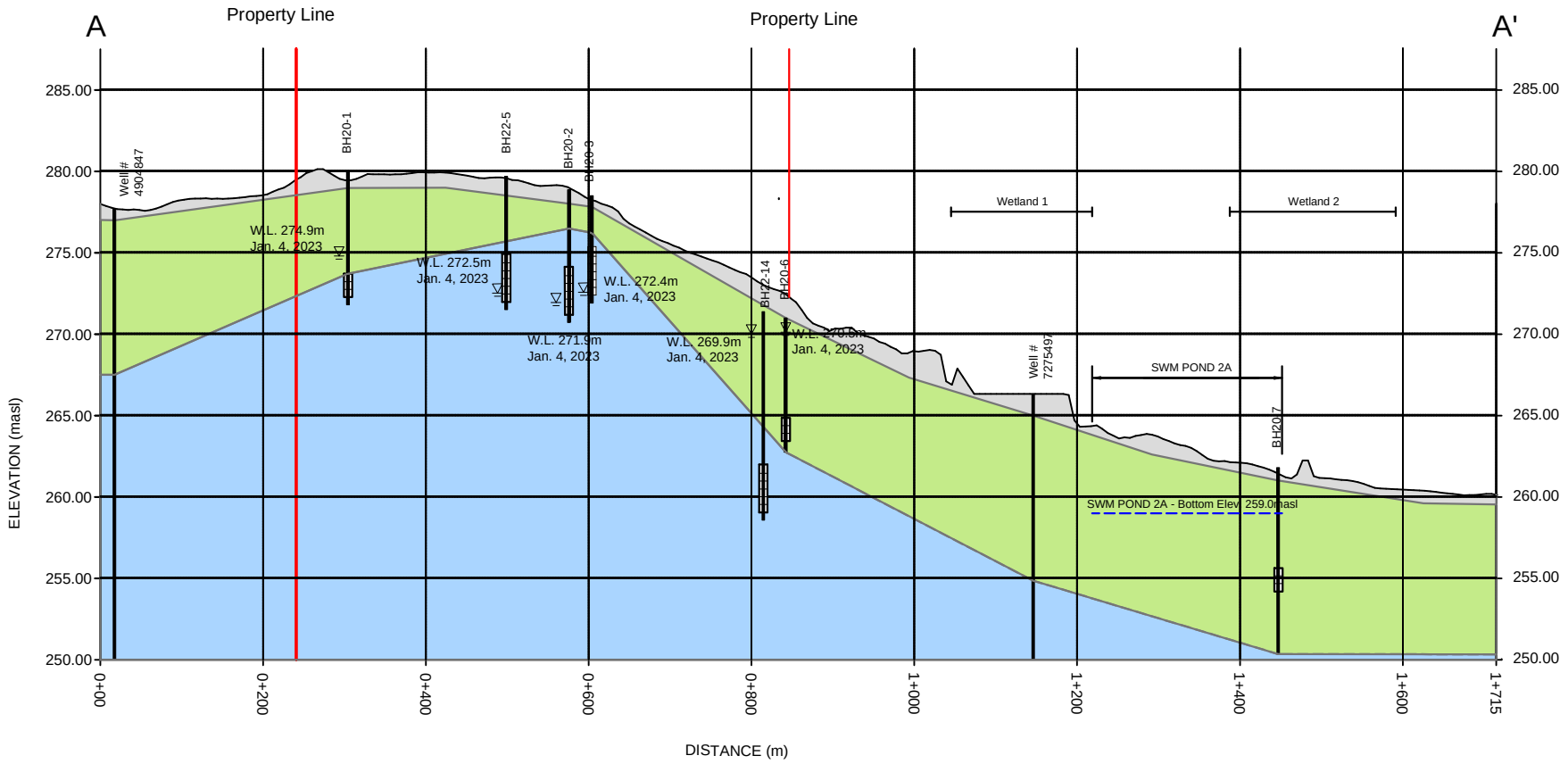

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Vertical Scale: 1:400

Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **GEOLOGICAL CROSS SECTION A-A'**

Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	D.S	M.Z/S.Y	February 2023
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5A**

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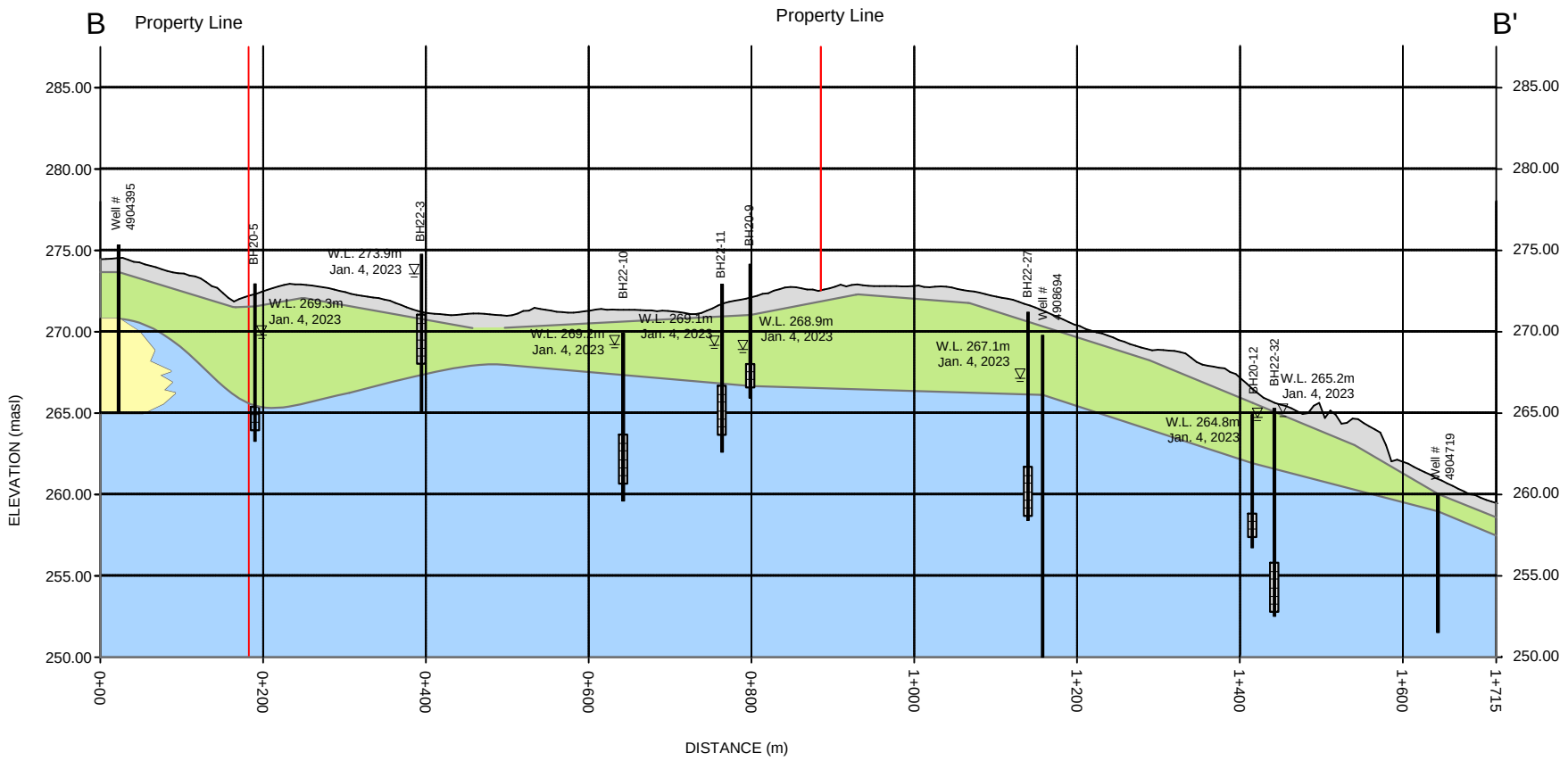

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Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **GEOLOGICAL CROSS SECTION B-B'**

Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	D.S	M.Z/S.Y	February 2023
Rev.	**Scale:**	**Project No:**	**Figure No.**
	As Shown	20-169-100	**5B**

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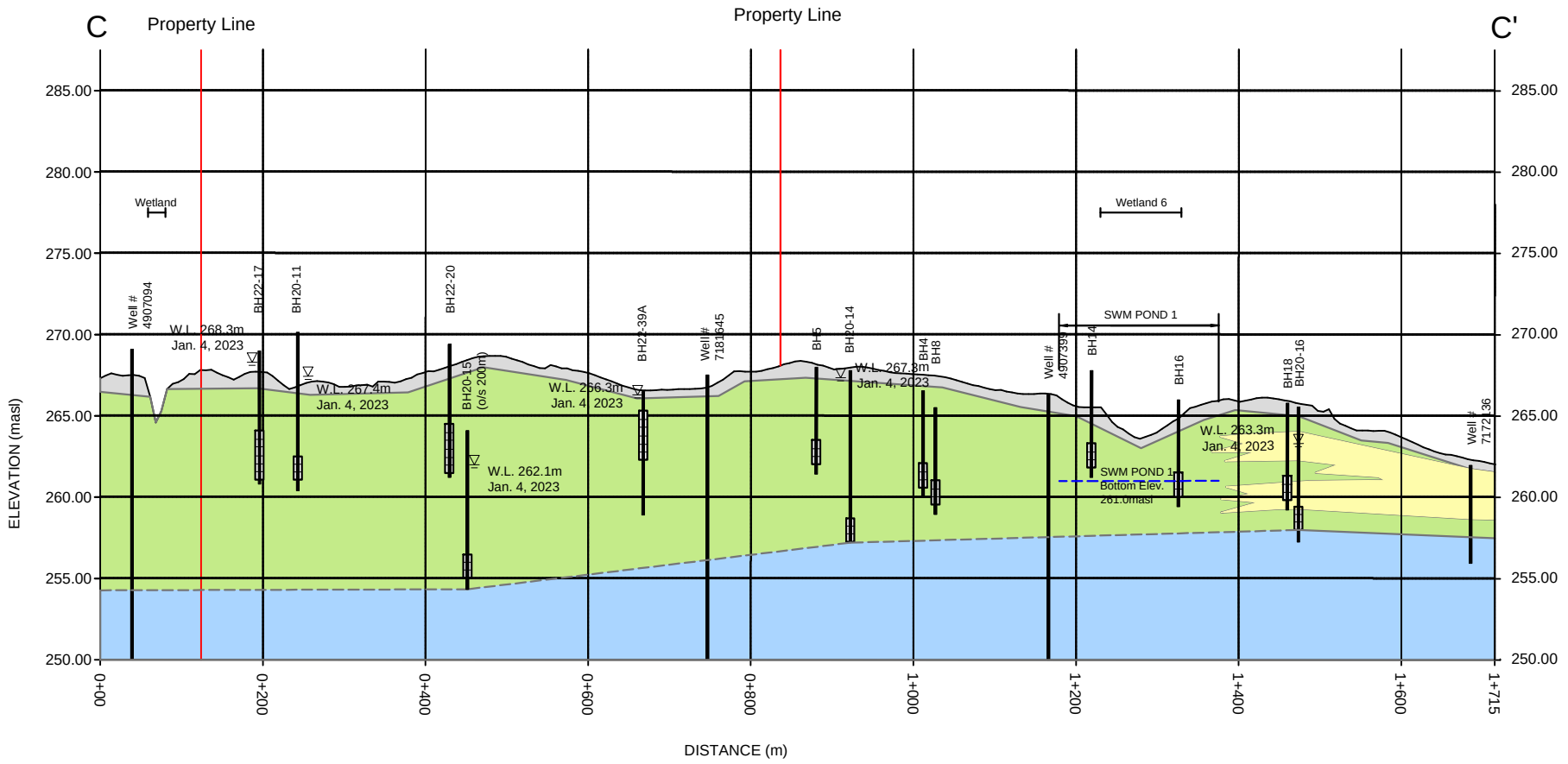

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Vertical Scale: 1:400

Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **GEOLOGICAL CROSS SECTION C-C'**

Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	D.S	M.Z/S.Y	February 2023
Rev.	Scale: As Shown	Project No: 20-169-100	Figure No. 5C

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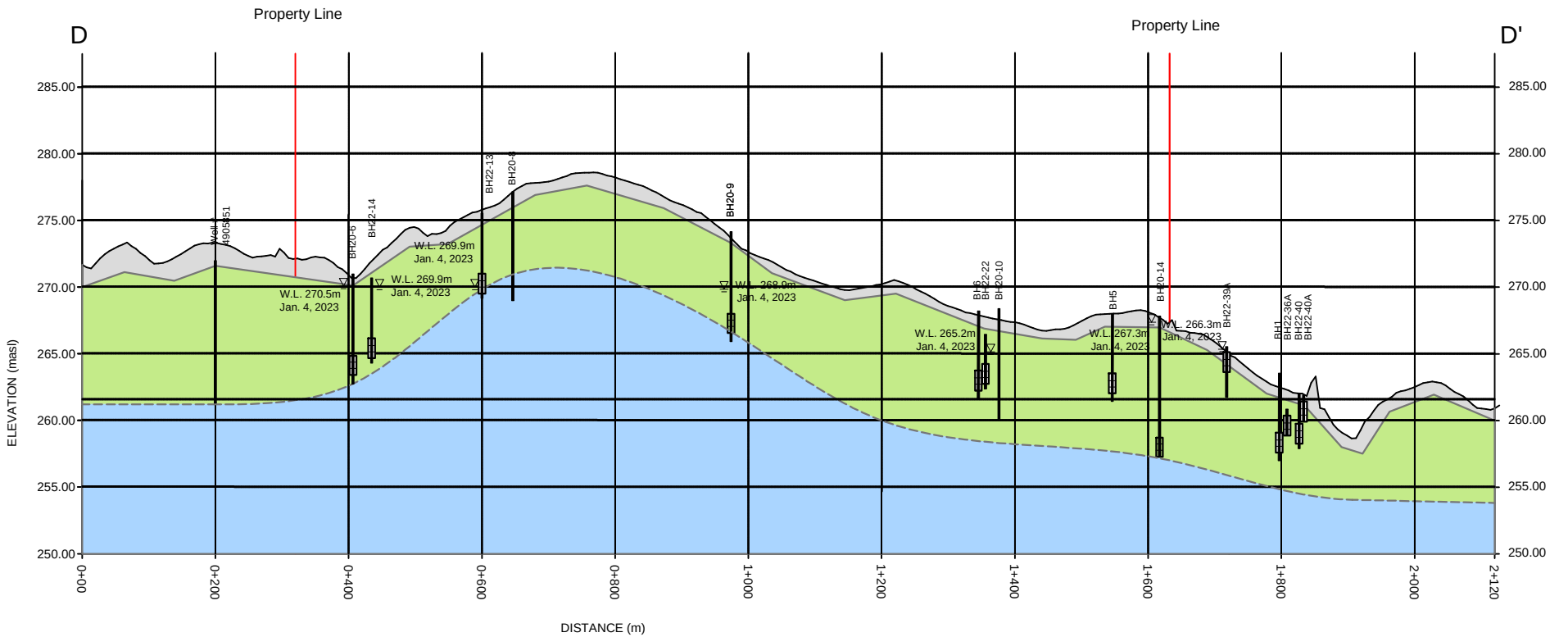

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Vertical Scale: 1:200

Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **GEOLOGICAL CROSS SECTION D-D'**

Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	D.S	M.Z/S.Y	February 2023
Rev.	Scale:	Project No:	Figure No.
	As Shown	20-169-100	**5D**

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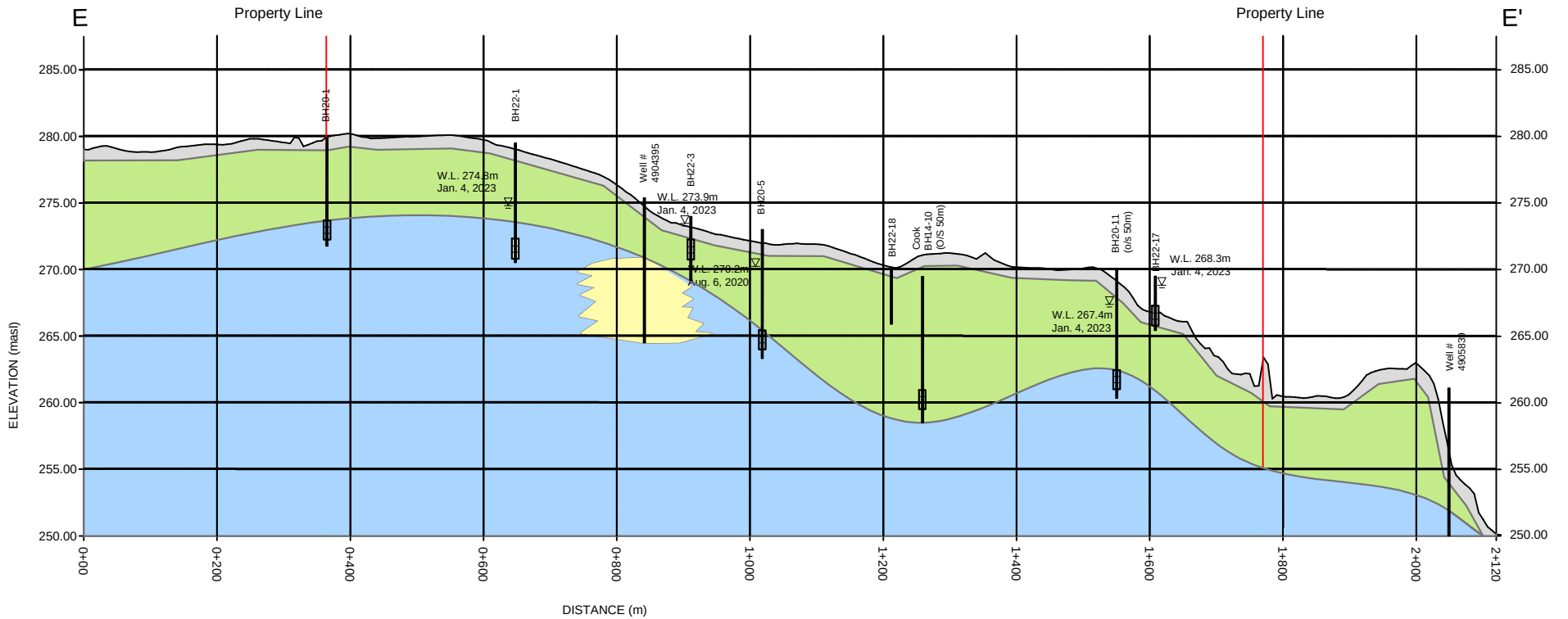

Horizontal Scale: 1:2000
Vertical Scale: 1:200

Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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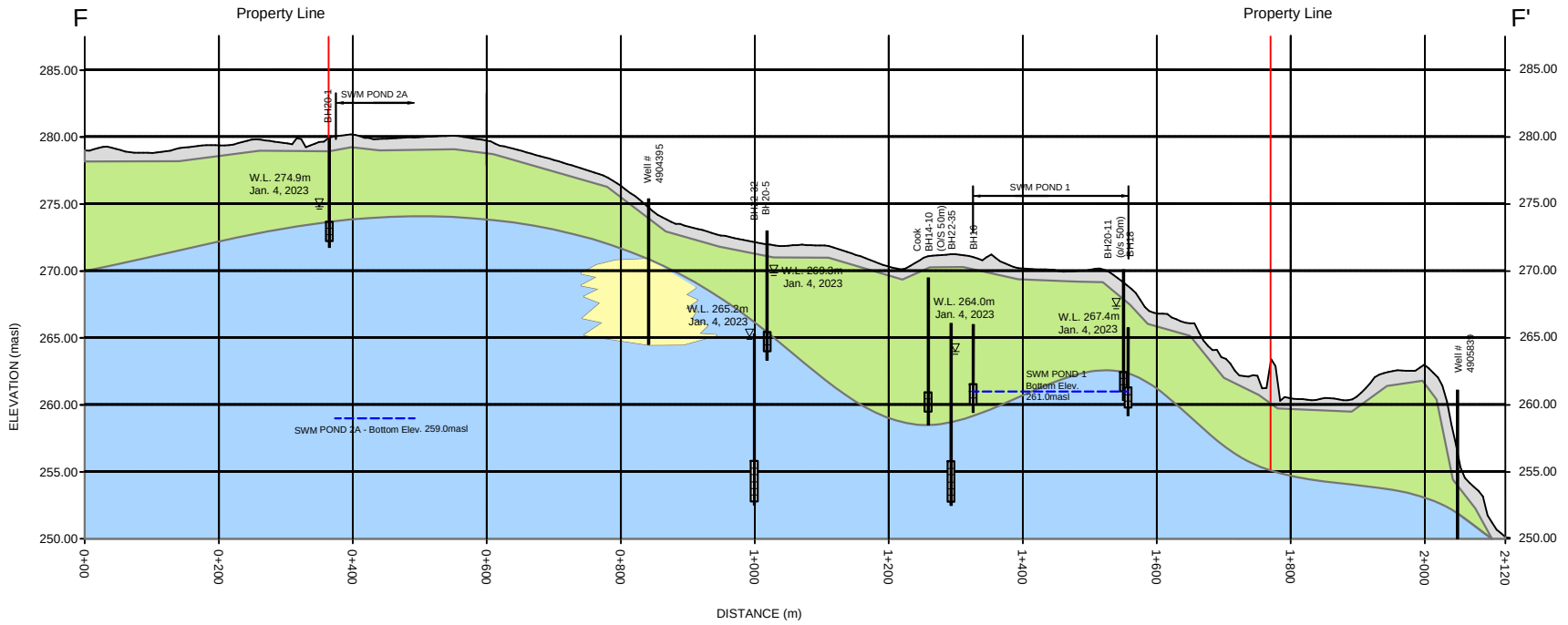
Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **GEOLOGICAL CROSS SECTION E-E'**

Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	D.S	M.Z/S.Y	February 2023
Rev.	Scale: As Shown	Project No: 20-169-100	Figure No. 5E

Path:----



Horizontal Scale: 1:2000
Vertical Scale: 1:200

Sand
Disturbed/Fill
Clayey Silt Till
Silty Sand Till/Silt
Well
Screen

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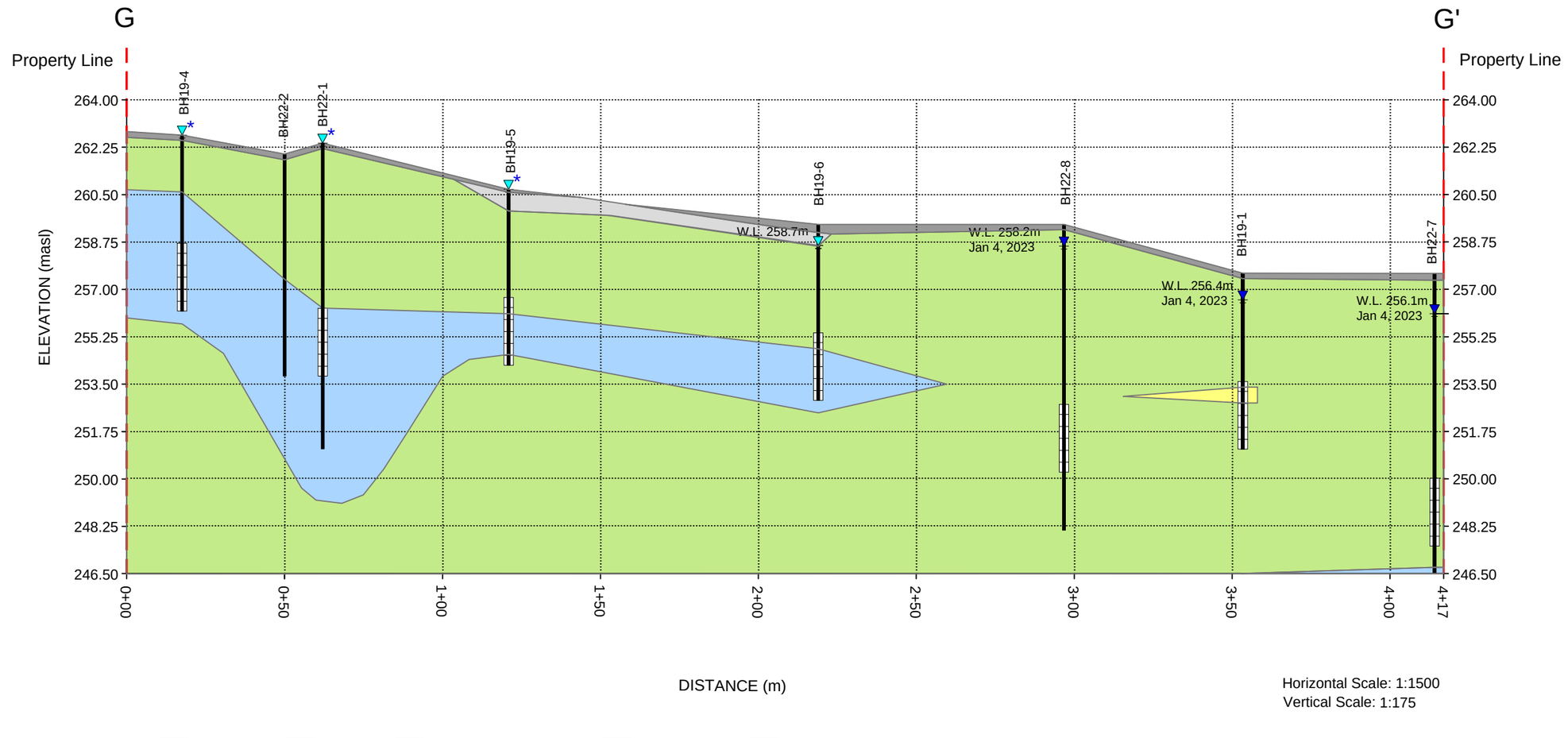
Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **GEOLOGICAL CROSS SECTION F-F'**

Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	D.S	M.Z/S.Y	February 2023
Rev.	Scale: As Shown	Project No: 20-169-100	Figure No. 5F



Overburden Groundwater Elevation (04 Jan 2023)

Artesian Monitoring Well

Groundwater Level of Lower Confined Water Unit

Well

Screen

Path:----

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Client:
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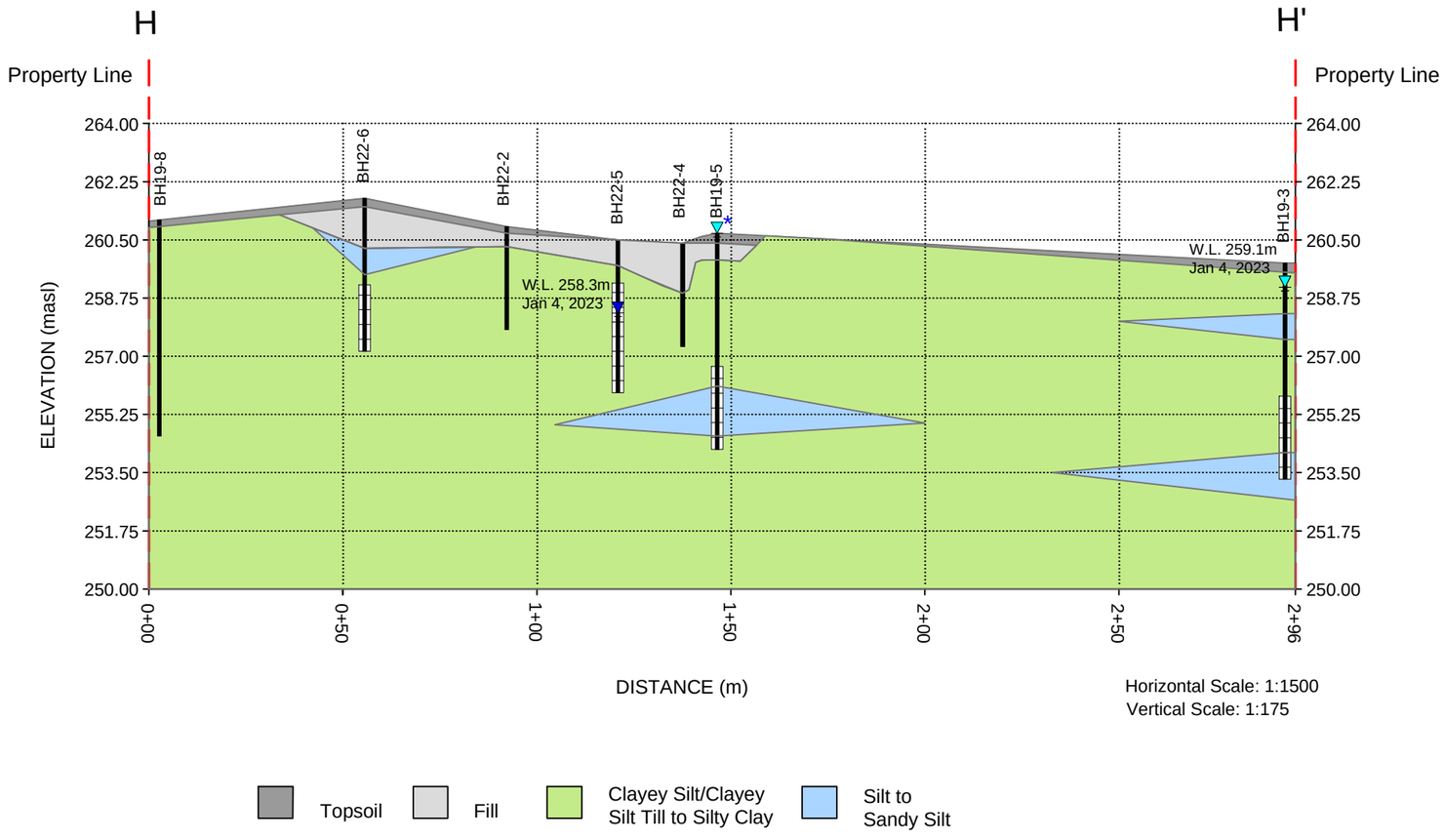
Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **GEOLOGICAL CROSS SECTION G-G'**

Size:	Approved By:	Drawn By:	Date:
11 X 17	D.S	S.Y	February 2023
Rev.	**Scale:**	**Project No:**	**Figure No.**
	A Shown	19-093-100	**5G**



Overburden Groundwater Elevation (04 Jan 2023)

Artesian Monitoring Well

Groundwater Level of Lower Confined Water Unit

Well

Screen

Path:---

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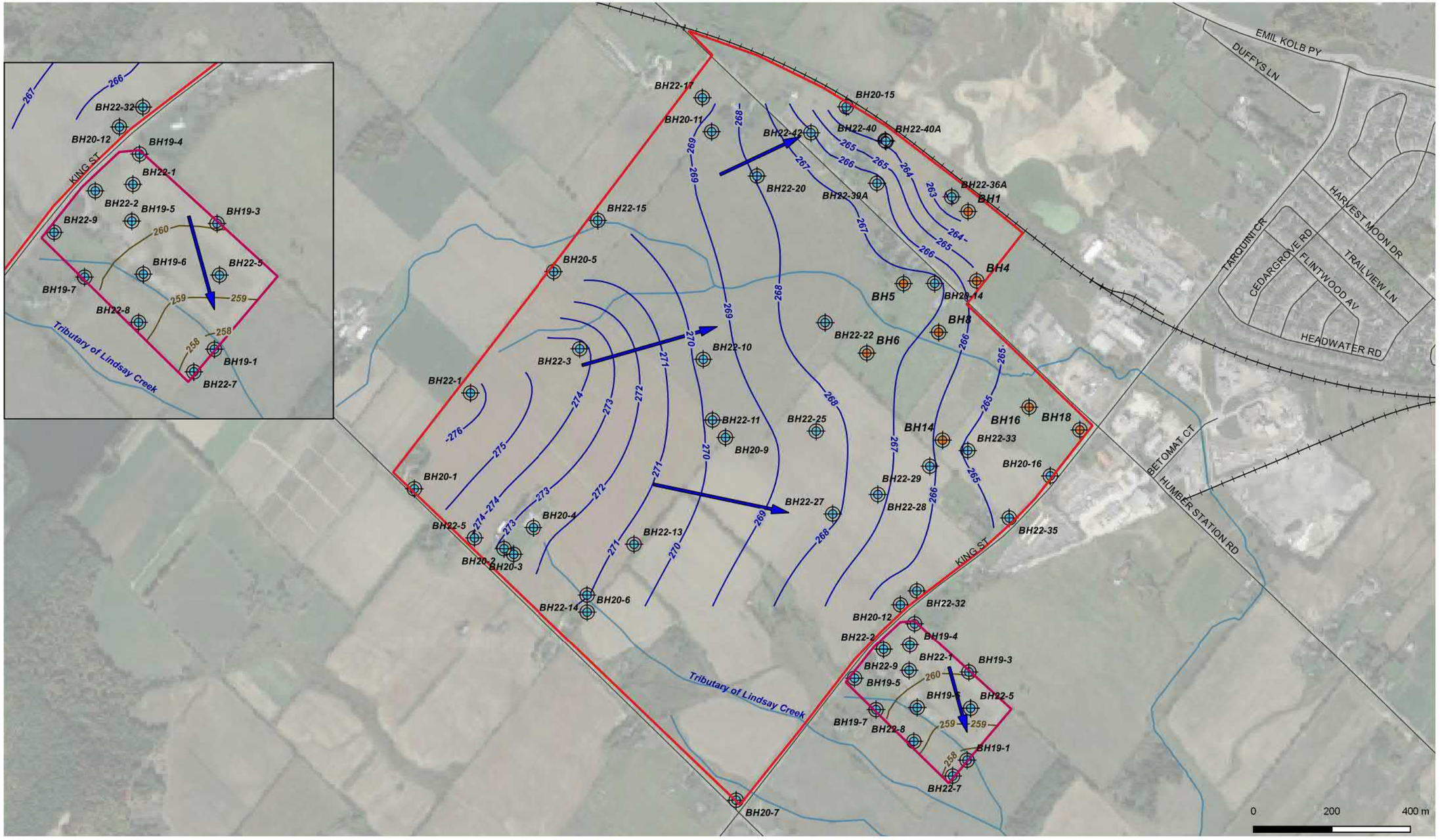
Client:
CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Project:
HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title:
GEOLOGICAL CROSS SECTION H-H'

Size:	Approved By:	Drawn By:	Date:
11 X 17	D.S	S.Y	February 2023
Rev.	Scale: A Shown	Project No: 19-093-100	Figure No. **5H**



Legend

- Caledon Station Property Boundary
- Argo King I & Argo King II
- Monitoring Well
- Monitoring Well (Soil Eng)
- Inferred Groundwater Flow Direction
- Groundwater Elevation Contours - March 21, 2023
- Groundwater Elevation Contours - March 23, 2023

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Project: HYDROGEOLOGICAL INVESTIGATION
Caledon Station and Argo King I & Argo King II, Caledon (Bolton), ON

Title: **GROUNDWATER FLOW MAP**

Client: CALEDON COMMUNITY PARTNERS
c/o GLEN SCHNARR & ASSOCIATES

Size:	Approved By:	Drawn By:	Date:
11x17	D.S	S.Y / P.P.	February 2023
Rev. 0	Scale: As Shown	Project No.: 20-169-104	Figure No.: 6

Image/Map Source: *Google Satellite Image*

J:\-GIS\2020 PROJECTS\20-169-100 Bolton Option 3 Lands\1-QGIS\HydroG\104\Figure 6 - Groundwater Flow Map.qgs May-16 09:27

Legend

- Secondary Plan Boundary 2023

Hydrologic Cover Types

- Cultivated
- Impervious
- Landscaped
- Shrub
- Tile drain Cultivated

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Project: HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - CALEDON STATION

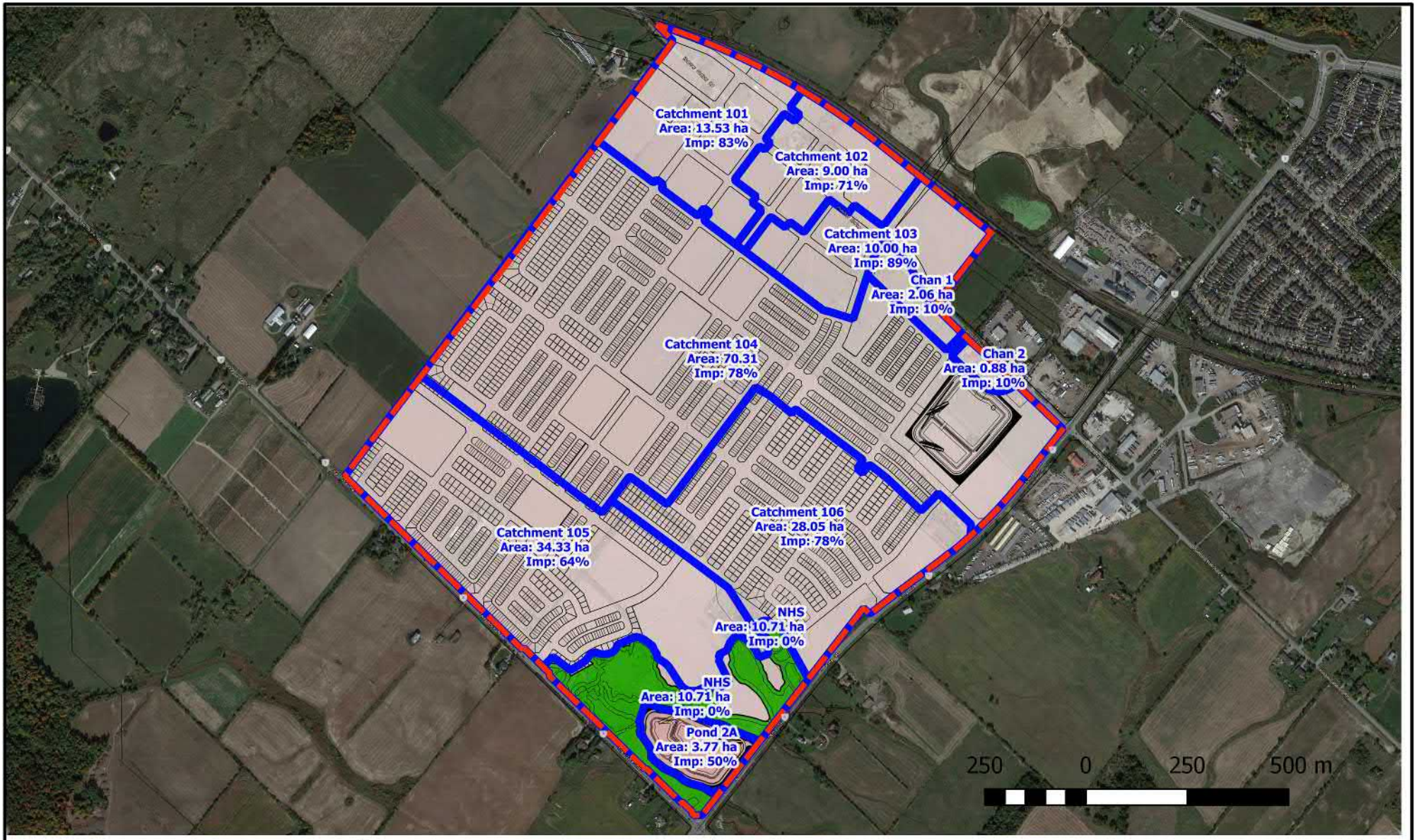
Title: **PRE-DEVELOPMENT CONCEPTUAL MODEL -SITE WATER BALANCE**

N

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	M.G	S.W	May 2023
Rev: 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 7

Image/Map Source: *Google Satellite Image*



Legend

- Site Boundary
- Proposed Drainage Boundaries

Hydrologic Cover Types

- Development Area
- Shrub

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Project: HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - CALEDON STATION

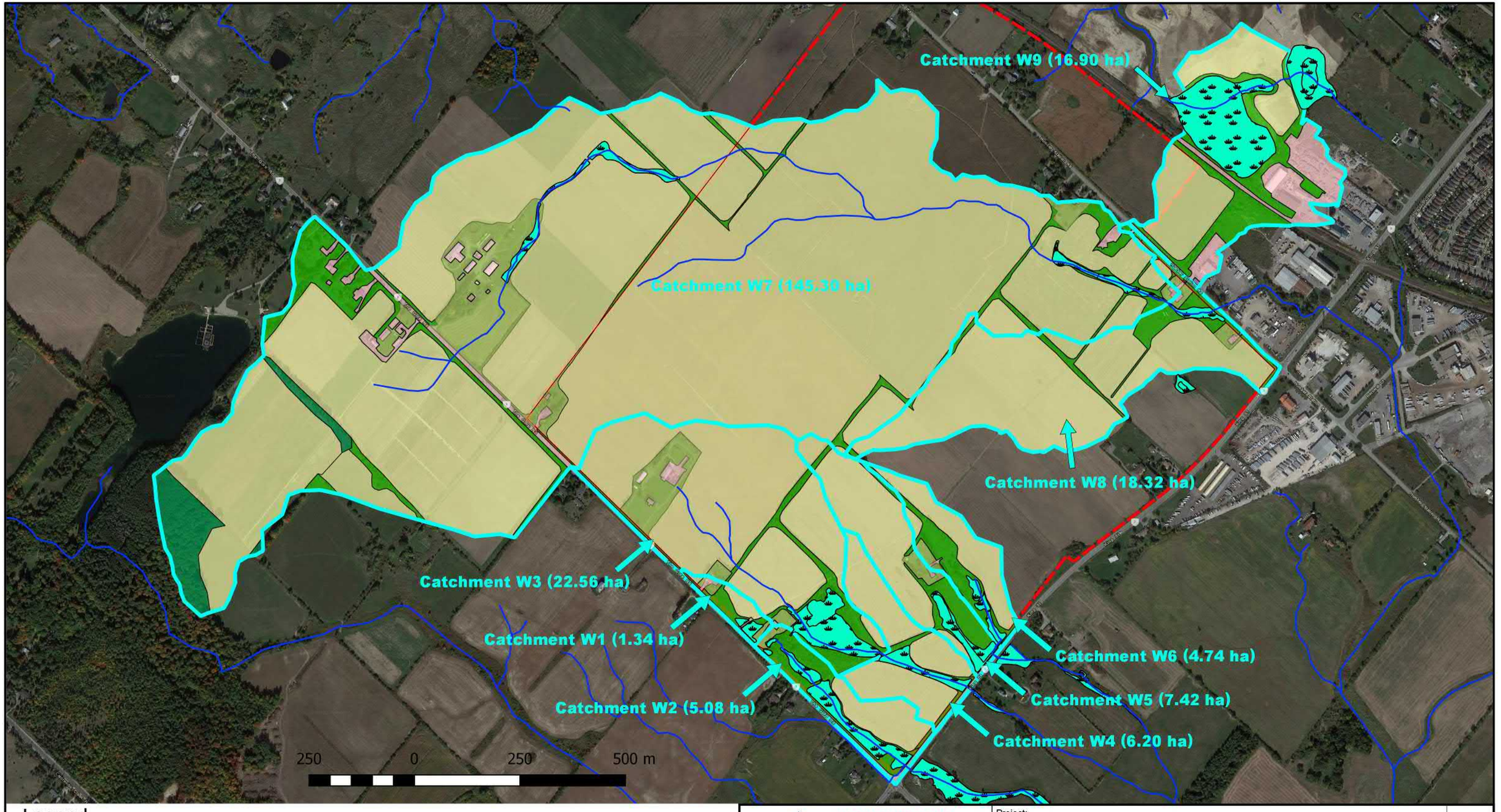
Title: **POST-DEVELOPMENT CONCEPTUAL MODEL -SITE WATER BALANCE**

N

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
8.5 x 11	M.G	S.W	May 2023
Rev: 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 8

Image/Map Source: *Google Satellite Image*



Legend

- Site Boundary
- Wetlands
- Watercourse
- Pre-development Wetland Catchments

Hydrologic Cover Types

- Cultivated
- Forest
- Impervious
- Landscaped
- Shrub

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Project: HYDROGEOLOGICAL INVESTIGATION & WATER BALANCE STUDY - CALEDON STATION

Title: **PRE-DEVELOPMENT LAND USE & WETLAND CATCHMENT MAP**

N

Client: Option 3 Landowners Group

Size:	Approved By:	Drawn By:	Date:
11x17	MG	SW	May 2023
Rev. 0	Scale: As Shown	Project No.: 20-169-100	Figure No.: 9

Image/Map Source: *Google Satellite Image*