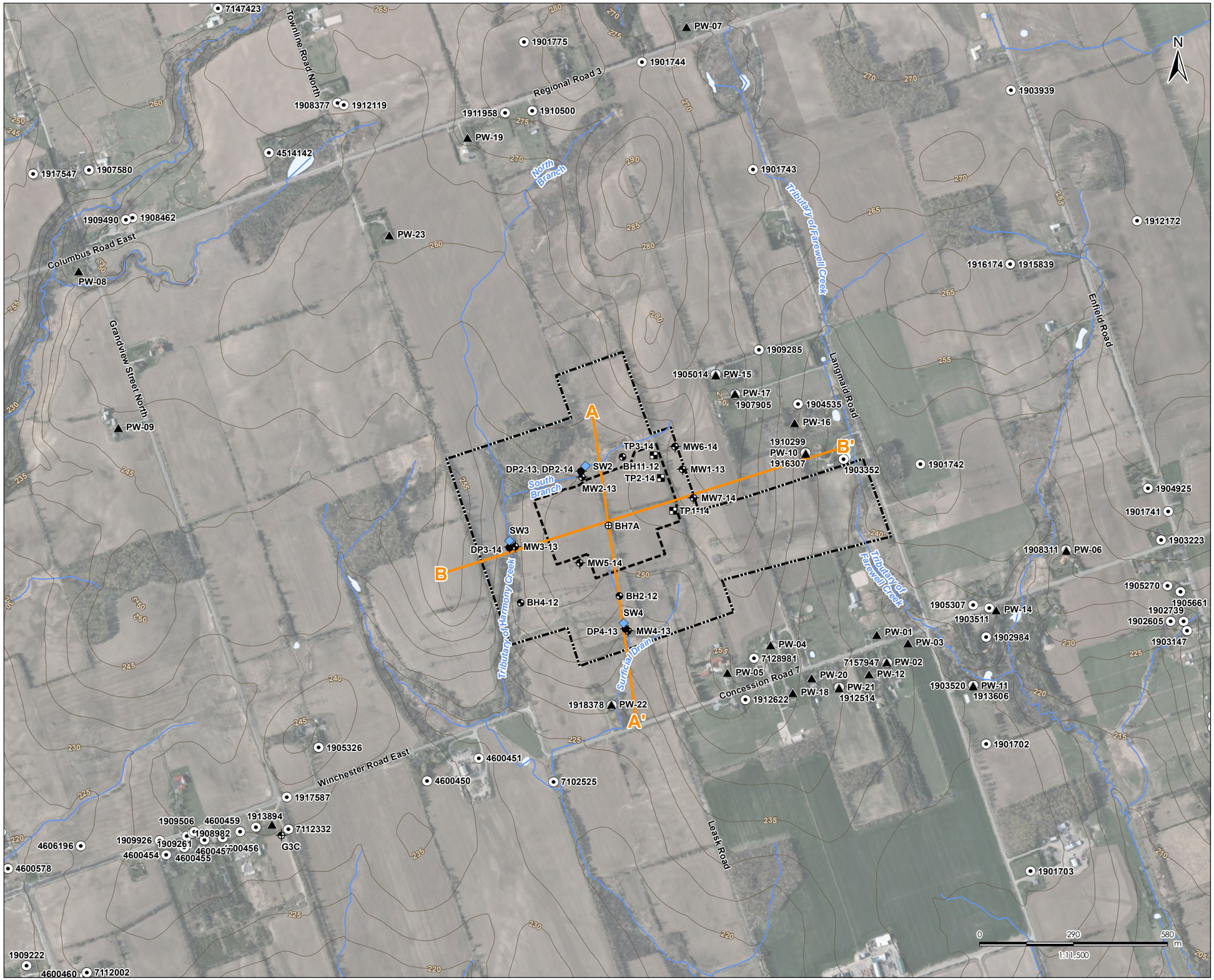
APPENDIX A

Figures



Stantec

Legend

- Project Area
- Station Site
- MOECC Water Well Record
- Monitoring Well (Stantec, 2013)
- Piezometer (Stantec, 2013)
- Test Pit (Stantec, 2013)
- Surface Water Monitoring (Stantec, 2013)
- Monitoring Well (EXP, 2012)
- Monitoring Well (Inspec-Sol, 2012) - Abandoned
- Monitoring Well (MTO, 2009)
- Private Well
- Topographic Contour (mAMSL)
- Cross-Section Location
- Watercourse
- Waterbody

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © First Base Solutions, 2012.
4. MOECC Water well locations are approximate and have been positioned based on published UTM coordinates © Queen's Printer for Ontario, 2012.

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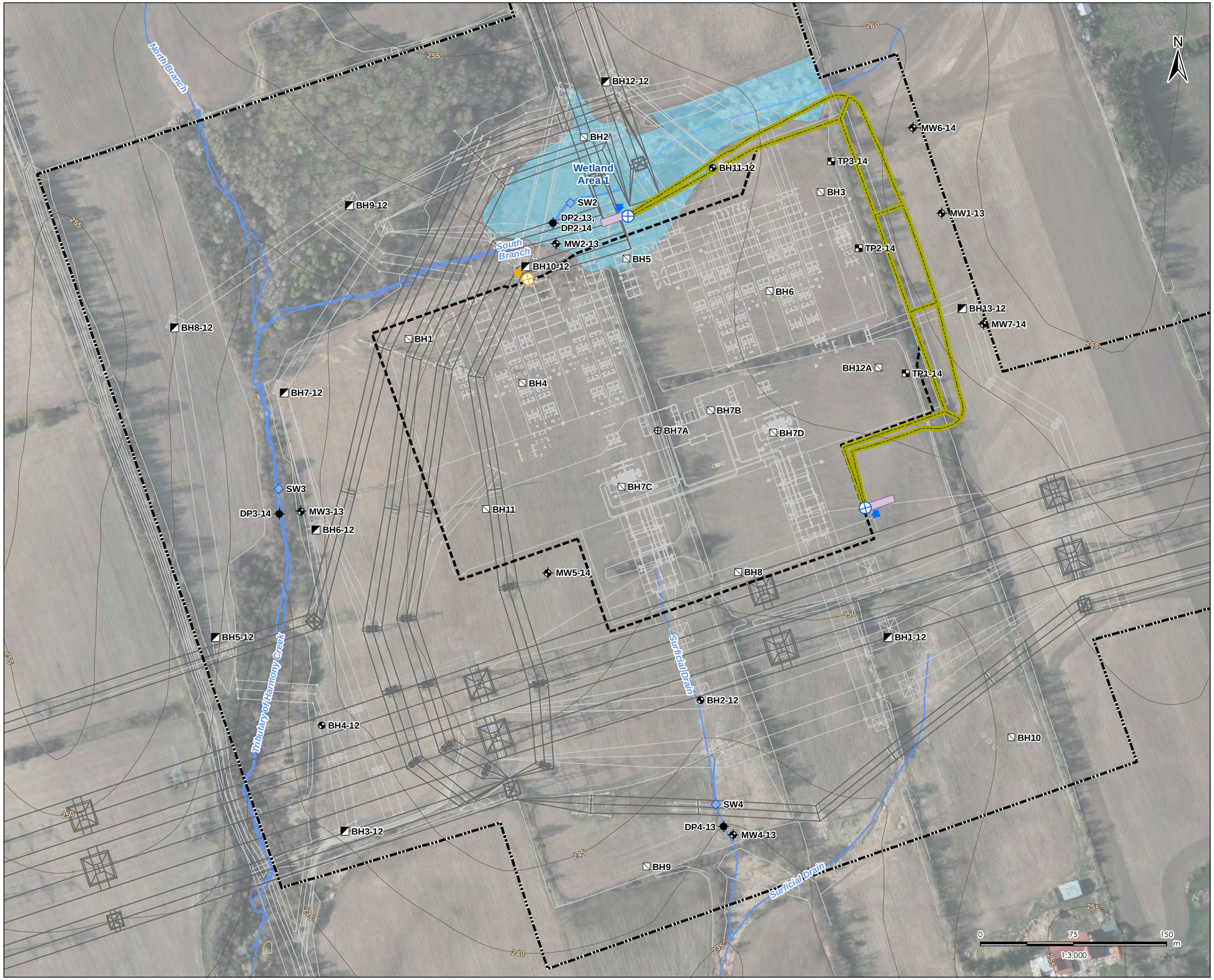
Figure No.
1

Title
Project Location

\\Cdl 220-f02\Work_group\01609\active\609760745\drawing\MXD\Hydrogeology\PTTW_Report\160900764_PTTWR_Fig01_ProjectLocation.mxd
Revised: 2014-11-10 By: ccoughlan



Stantec

Legend

- Monitoring Well (Stantec, 2013)
- Piezometer (Stantec, 2013)
- Test Pit (Stantec, 2013)
- Surface Water Monitoring (Stantec, 2013)
- Monitoring Well (EXP, 2012)
- Monitoring Well (Inspec-Sol, 2012) - Abandoned
- Borehole (Inspec-Sol, 2012)
- Borehole (EXP, 2012)
- Topographic Contour (mAMSL)
- Permanent Discharge from Drainage System
- Permanent Discharge from Toe Drain
- Project Area
- Station Site
- Cut Slope
- Approximate locatin of Temporary Frac Tanks
- Watercourse
- New Infrastructure
- Wetland

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.
3. Orthoimagery © First Base Solutions, 2012.
4. Topography derived from the MNR Digital Elevation Model - Version 2.0.0 - Provincial Tiled Dataset (DEM) © Queen's Printer for Ontario, 2006.
5. Wetland boundary as delineated by Stantec (Natural Heritage Existing Conditions Report, 2012).

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Figure No.
2

Title
Project Site Plan

\\cd1220-f02\work_group\01609\active\160900745\drawing\MXD\Hydrogeology\PTTW_Report\160900764_PTTWR_Fig02_SitePlan.mxd
Revised: 2014-11-11 By: searles

\\cd1220-f02\Work_group\01609\active\609607\45\drawing\MXD\Hydrogeology\PTTW_Report\160900764_PTTWR_Fig03_SufficialGeology.mxd
Revised: 2014-11-10 By: ccoghlan

Stantec

Legend

- Monitoring Well (Inspec-Sol, 2012) - Abandoned
- Monitoring Well (EXP, 2012)
- Borehole (Inspec-Sol, 2012)
- Borehole (EXP, 2012)
- MOE Water Well Record
- Oak Ridges Moraine
- Project Area
- Transformer Station Site
- Road
- Waterbody
- Watercourse

Surficial Geology

- 20: Organic deposits
- 19: Modern alluvial deposits
- 9c: Coarse-textured glaciolacustrine deposits (Foreshore-basinal deposits)
- 6: Ice-contact stratified deposits
- 5b: Stone-poor, carbonate-derived silty to sandy till (Newmarket Till)
- 5d: Glaciolacustrine-derived silty to clayey till (Halton Till)

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2012.
3. Surficial geology produced by the Ontario Geological Survey 2003. Surficial geology of Southern Ontario; Ontario Geological Survey, MRD 128.

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Figure No.
3

Title
Surficial Geology

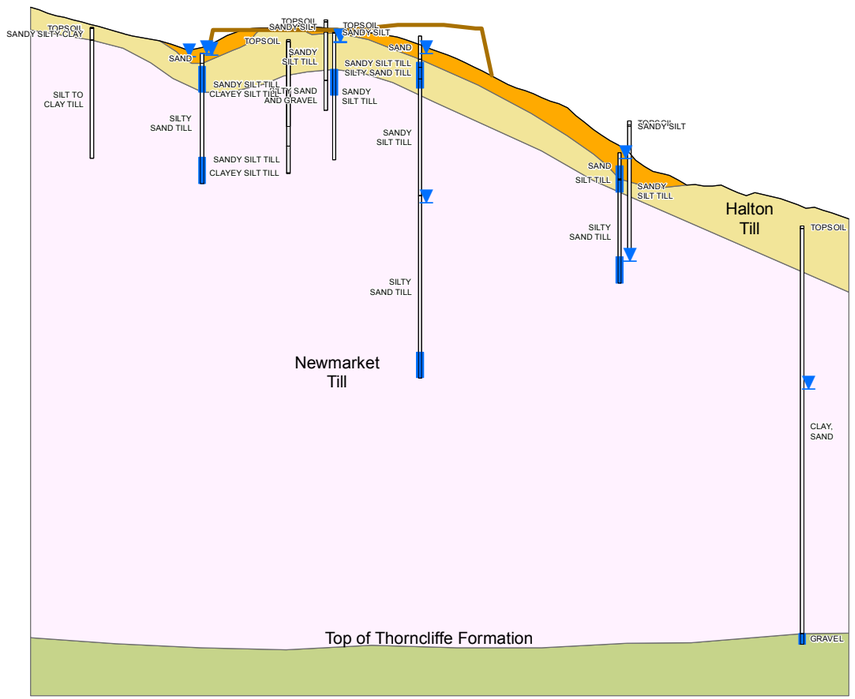
A
NORTH

A'
SOUTH

Project Area

Station Site

BH12-12(OS 2m)
DP2-14(OS 60m)
MW2-13(OS 62m)
BH4(OS 103m)
BH7A(OS 0m)
MW5-14(OS 104m)
MW4-13(OS 13m)
BH9(OS 60m)
PW-22 (1918378)(OS 70m)



Elevation (mAMSL)

0 100 200 m

1:7,000

10x Vertical Exaggeration

\\cd1220-f02\Work_group\01609\active\609760745\drawing\MXD\Hydrogeology\PTTW_Report\160900764_PTTWR_Fig04_xsecAA.mxd
Revised: 2014-11-10 By: ccoghlan

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160960764

Stantec

Legend

280787 4 (OS m)
Well ID (Offset)

Sand
Stratigraphy

Water Level

Well Screen

Proposed Final Grade

Ground Surface

Surficial Silt and Sand

Halton Till[1]

Newmarket Till[1]

Thorncliffe Formation[1]

Notes

1. [1] - Adapted from Expanded Core Model, York, Peel, Durham, Toronto and The Conservation Authorities Moraine Coalition (YPDT-CAMC) (2006).

2. Water level elevations are presented for October 1, 2014, with the exception of MW5-14S from October 8, 2004, MW5-14I from October 28, 2014 and BH7A from the 2012 well log.

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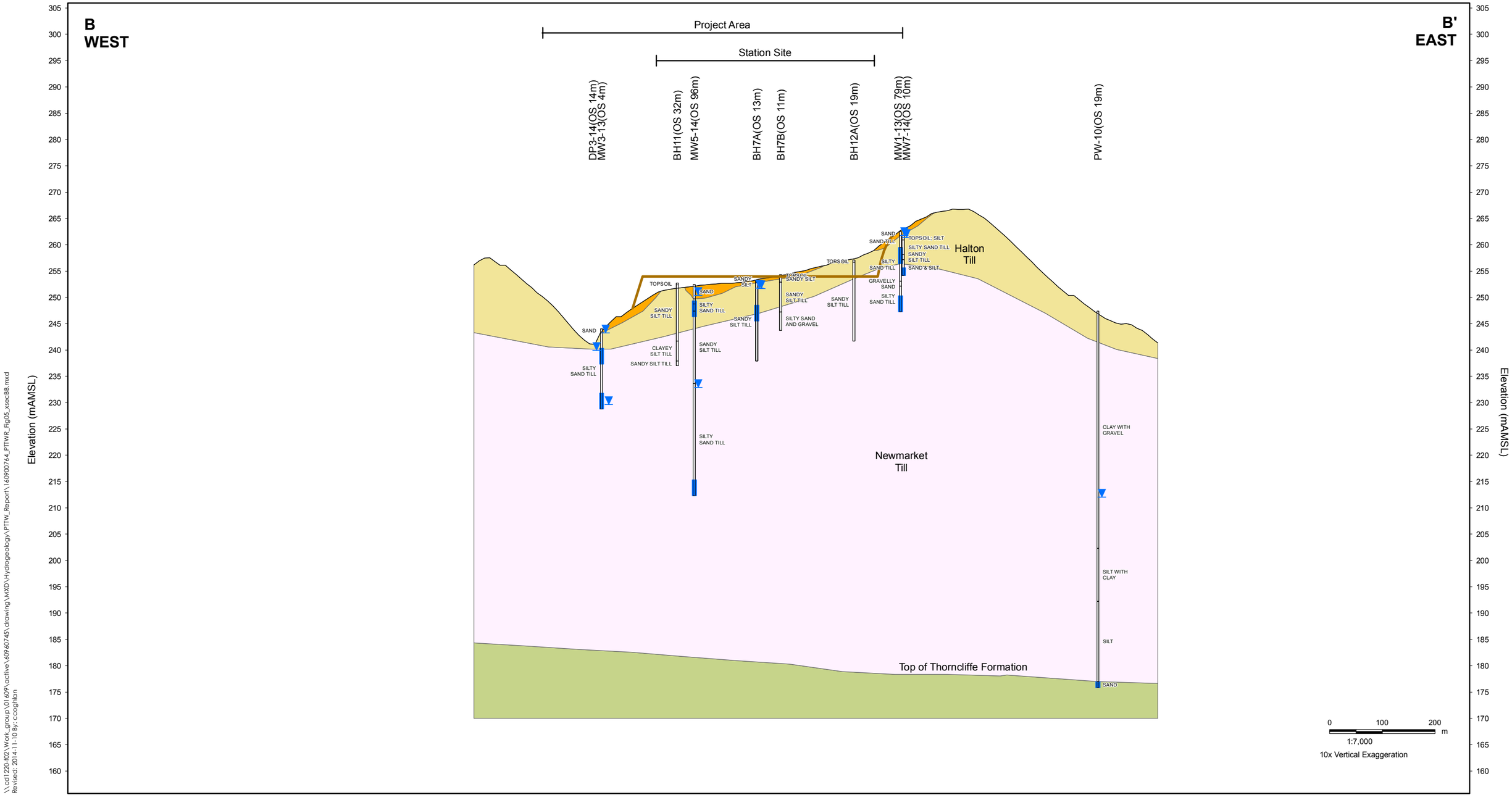
Figure No.
4

Title
Cross-Section A-A'



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Revised: 2014-11-10 By: ccoghlan

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160960764

Stantec

Legend

2807874 (OS m) — Well ID (Offset)

Sand — Stratigraphy

Water Level

Well Screen

Proposed Final Grade

Ground Surface

Surficial Silt and Sand

Halton Till[1]

Newmarket Till[1]

Thorncliffe Formation[1]

Notes

1. [1] - Adapted from Expanded Core Model, York, Peel, Durham, Toronto and The Conservation Authorities Moraine Coalition (YPDT-CAMC) (2006).
2. Water level elevations are presented for October 1, 2014, with the exception of MW5-14 where data is presented from October 8, 2014, MW5-14I from October 28, 2014 and BH7A from the 2012 well log.

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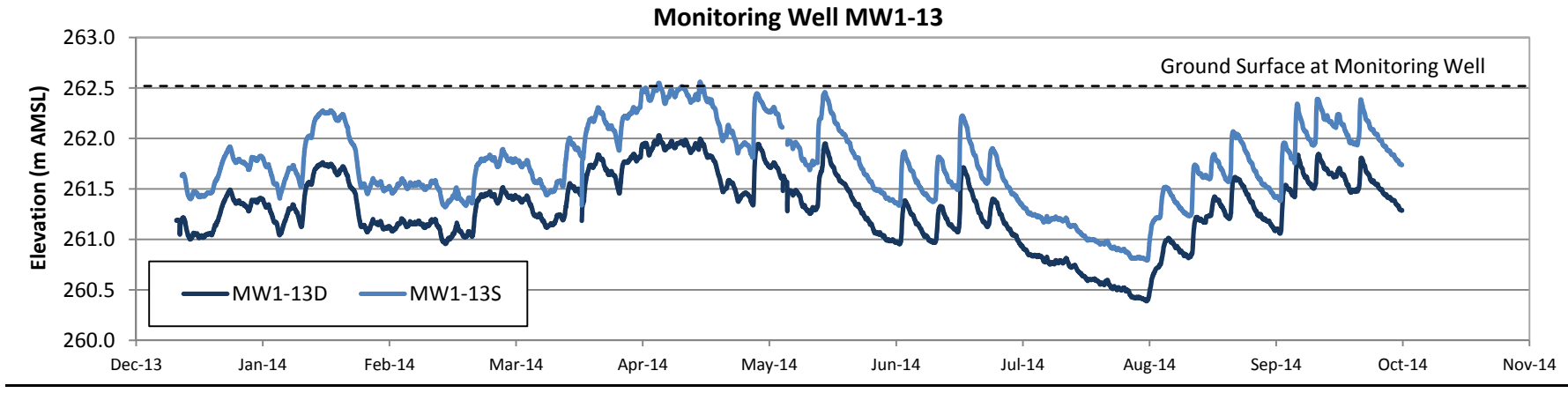
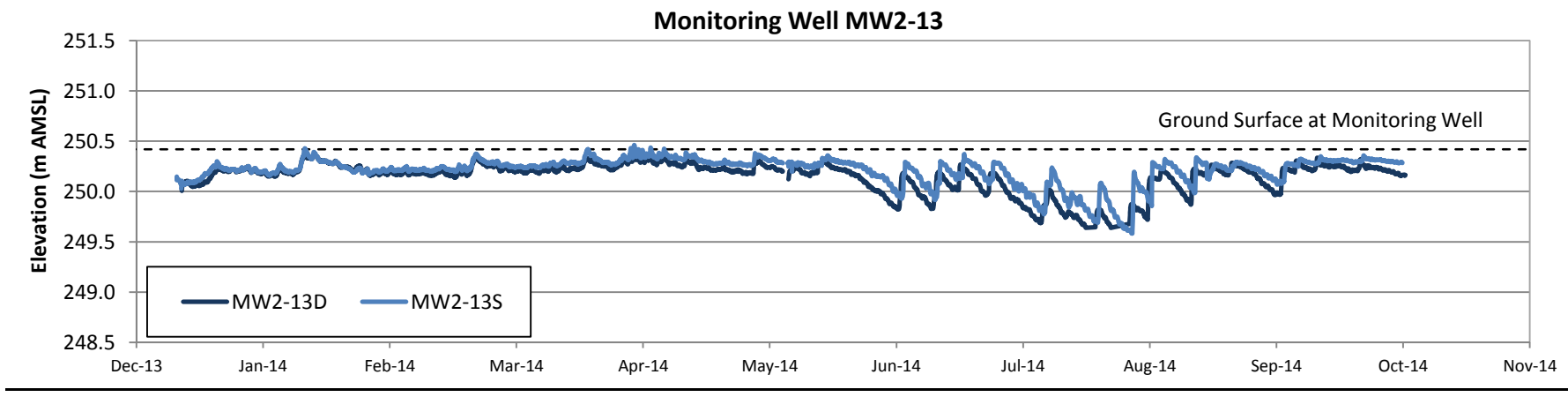
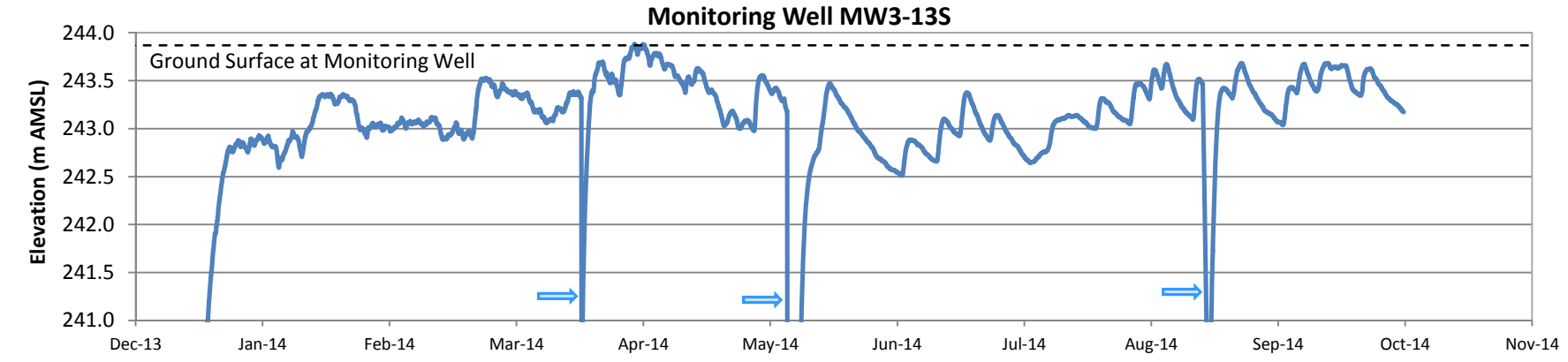
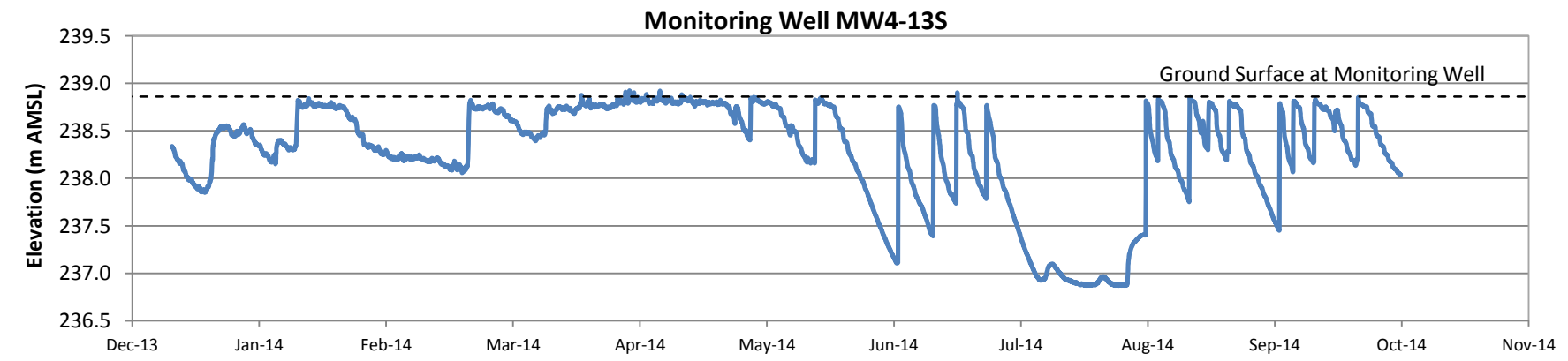
Figure No.
5

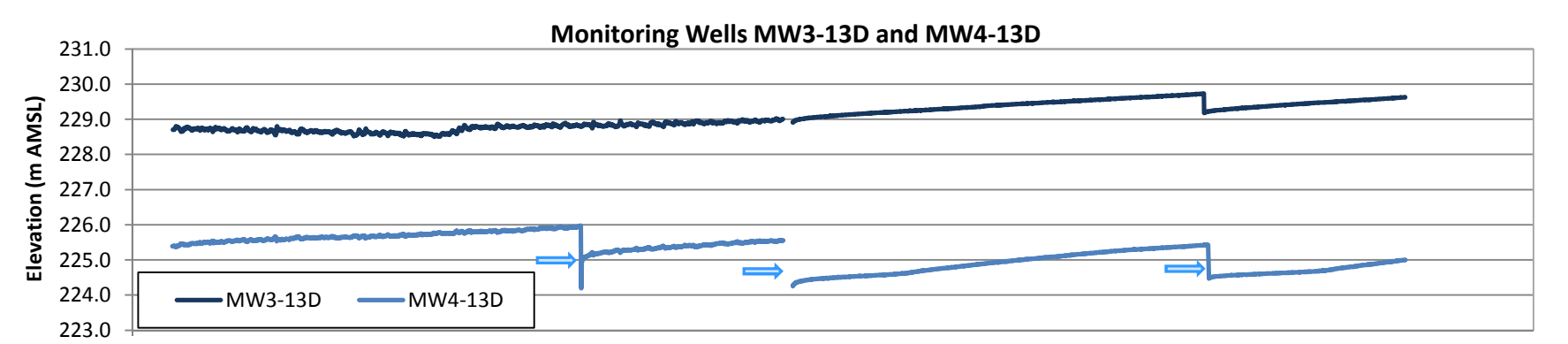
Title
Cross-Section B-B'

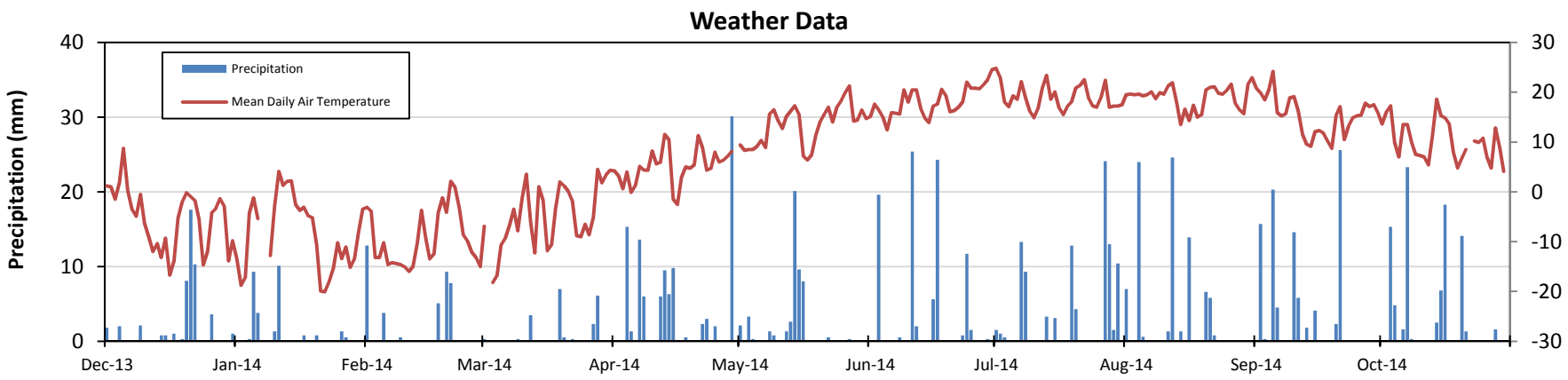












Notes: ⇒ Change in water level due to sampling event.

Weather Data was obtained from Environment Canada for the Oshawa Climate Station

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Hydrogeologic Assessment Report
Clarington, Ontario

Figure No.

6

Title **Hydrographs - Monitoring Wells**

Stantec

L:\01609\Active\160900764\Planning\Reports\Cat 3 PTTW-Clarington TS\Appendix\A_Fig\Fig_hydrographs.xlsx

Stantec

N

Townline Road North
Regional Road 3
Columbus Road East
Grandview Street North
Enfield Road
Langmaid Road
Concession Road 7
Winchester Road East
Harmony Road North
Leask Road

PW-07 266.8
PW-19 270.6
PW-23 259.8
PW-08
PW-09 236.8
PW-15
PW-17
PW-16 250.2
PW-10
PW-06
PW-14 224.7
PW-01 237.2
PW-03 233.6
PW-04
PW-20 241.9
PW-12 235.1
PW-02
PW-05
PW-18
PW-21
PW-11 219.9
PW-22
PW-13
G3C

MW6-14 260.4
TP3-14
DP2-13, DP2-14 249.9 250.1
SW2
BH11-12
TP2-14
MW1-13 261.8
MW2-13 250.3
TP1-14
MW7-14 262.0
BH7A
SW3
DP3-14 239.9 240.0
MW3-13 243.2
MW5-14 250.3
BH2-12
BH4-12
SW4
DP4-13
MW4-13 238.1

0 290 580 m
1:11,500

Legend

- Project Area
- Station Site
- Private Well Monitoring Area
- Monitoring Well (Stantec, 2013)
- Piezometer (Stantec, 2013)
- Test Pit (Stantec, 2013)
- Surface Water Monitoring (Stantec, 2013)
- Monitoring Well (EXP, 2012)
- Monitoring Well (Inspec-Sol, 2012) - Abandoned
- Monitoring Well (MTO, 2009)
- Private Well
- Topographic Contour (mAMSL)
- Watercourse
- Well Screened up to 16 mBGS
- 250.1 Surface Water Elevation (mAMSL)
- 250.2 Groundwater Elevation (mAMSL)
- Interpreted Groundwater Contour - Shallow Overburden (mAMSL)
- Groundwater Flow Direction
- Wetland

Notes

1. Coordinate System: NAD 1983 UTM Zone 17N
2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © First Base Solutions, 2012.
4. Water level elevation data for October 1, 2014 with the exception of MW5-14S, MW6-14 and MW7-14 from October 8, 2014.

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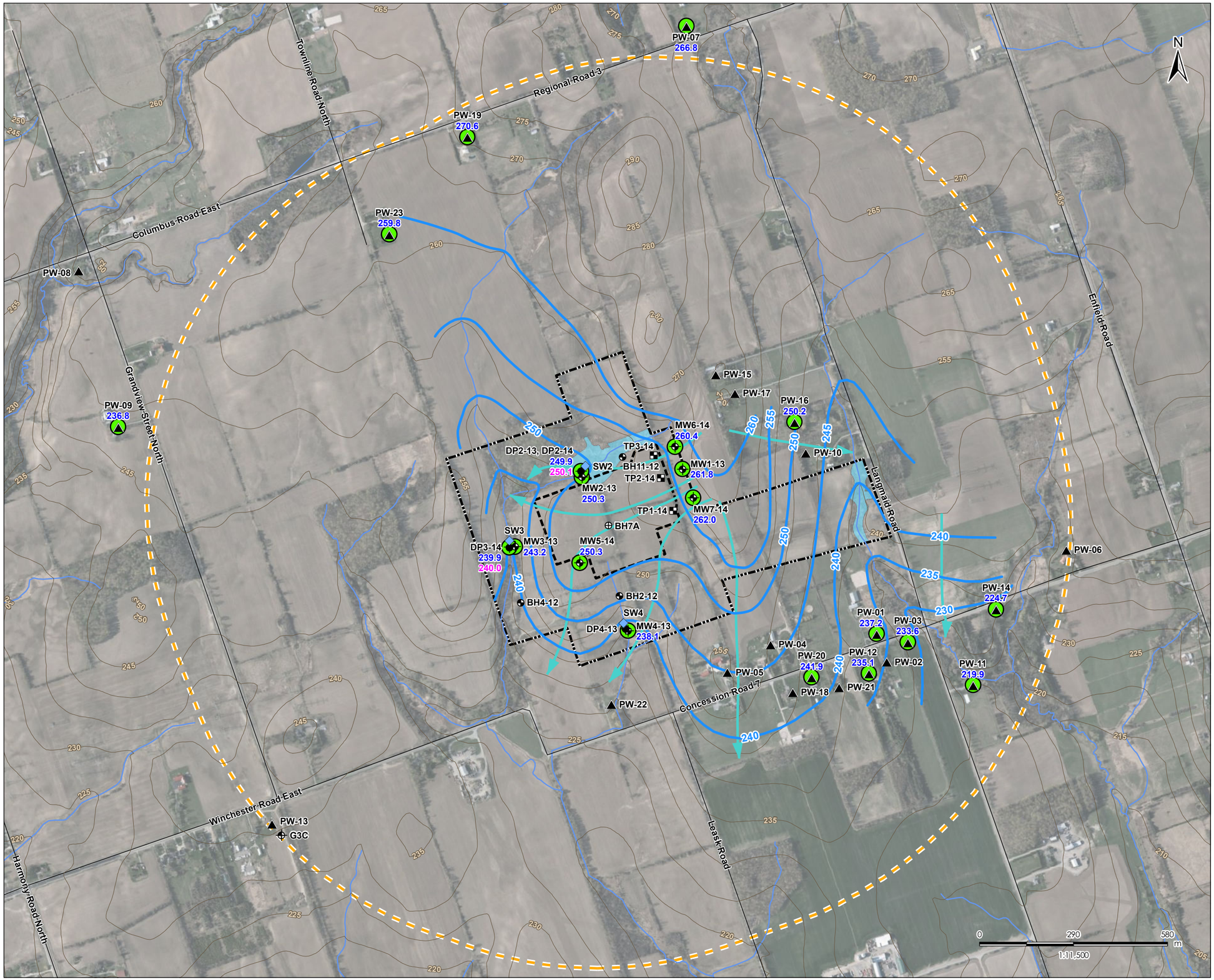
Figure No.
7

Title
Interpreted Pre-Construction Groundwater Levels Shallow Overburden

\\cdl220-f02\Work_group\01609\active\609607451\drawing\MXD\Hydrogeology\PTTW_Report\160900764_PTTWR_Fig07_PreConstGrdwShOverburden.mxd
Revised: 2014-11-14 By: ccoghlan



\\cdl220-f02\Work_group\01609\active\609607451\drawing\MXD\Hydrogeology\PTTW_Report\160900764_PTTWR_Fig08_PostConsGrdwSh0verburden.mxd
Revised: 2014-11-14 By: ccoghlan

Stantec

Legend

- Project Area
- Station Site
- Private Well Monitoring Area
- Monitoring Well (Stantec, 2013)
- Piezometer (Stantec, 2013)
- Test Pit (Stantec, 2013)
- Surface Water Monitoring (Stantec, 2013)
- Monitoring Well (EXP, 2012)
- Monitoring Well (Inspec-Sol, 2012) - Abandoned
- Monitoring Well (MTO, 2009)
- Private Well
- Topographic Contour (mAMSL)
- Watercourse
- Well Screened up to 16 mBGS
- 250.1 Surface Water Elevation (mAMSL)
- 250.2 Groundwater Elevation (mAMSL)
- Interpreted Groundwater Contour - Shallow Overburden (mAMSL)
- Groundwater Flow Direction
- Wetland

Notes

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2. Base features produced under license with the Ontario Ministry of Natural Resources © Queen's Printer for Ontario, 2013.
3. Orthoimagery © First Base Solutions, 2012.
4. Water level elevation data for October 1, 2014 with the exception of MW5-14S, MW6-14 and MW7-14 from October 8, 2014.

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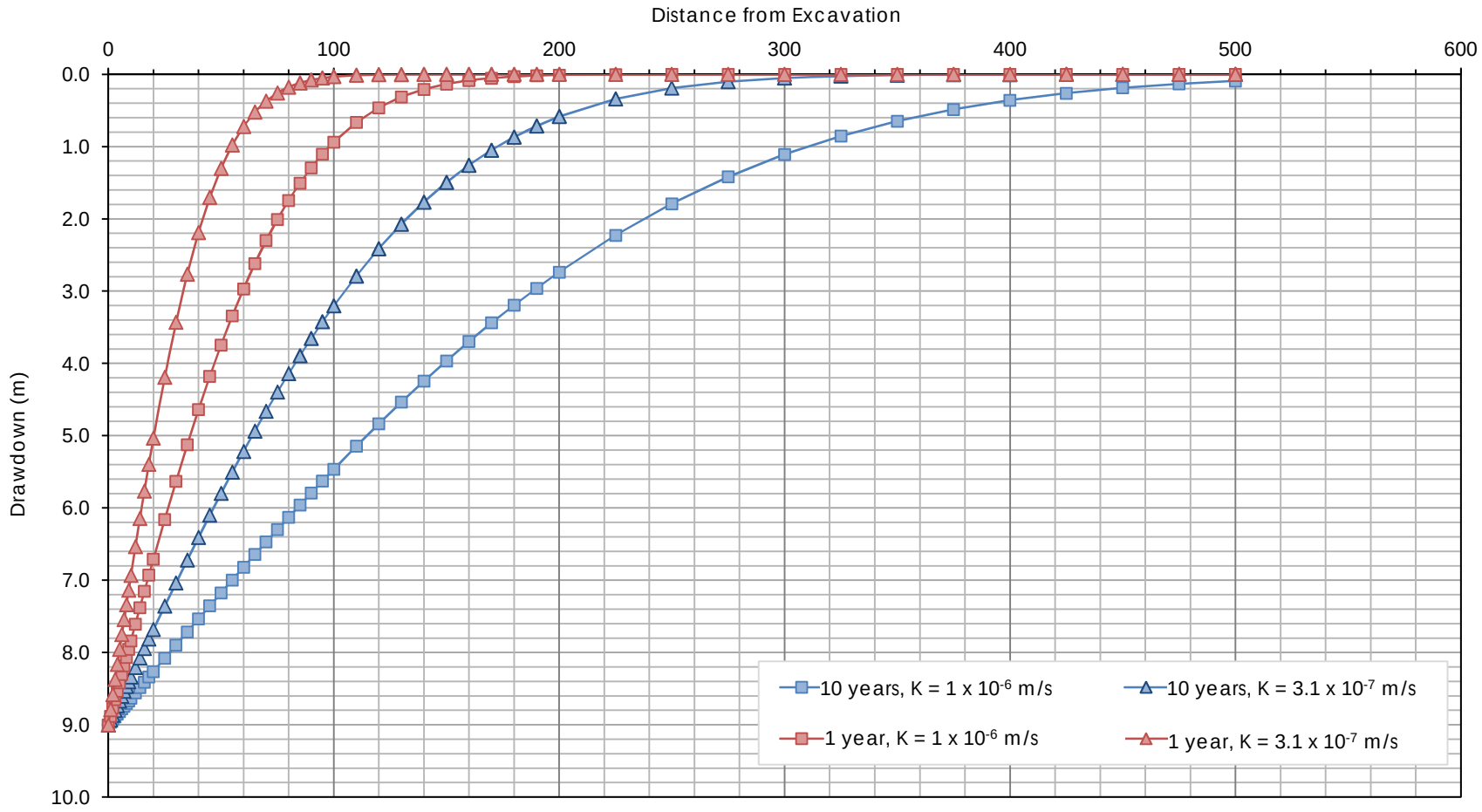
Figure No.
8

Title
Interpreted Post-Construction Groundwater Levels Shallow Overburden



Notes:

Analytical solution based on Edelman (1947).

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Figure No.

9

Title

Predicted Extent of Drawdown

Stantec

APPENDIX B

Tables

TABLE 1
WELL CONSTRUCTION DETAILS

Location				Coordinates			Elevation			Stick-up	Borehole Depth	Well Diameter	Screened Interval				Screened Material	
													Top of Well Screen		Bottom of Well Screen			
MOE WWR No.	Well ID	Installation Date	Status	Easting	Northing	Source	Ground Surface	Top of Casing	Source								Screened Unit	Hydrualic Conductivity
							m AMSL	m AMSL		(m AGS)	(m BGS)	(mm)	(m BGS)	(m AMSL)	(m BGS)	(m AMSL)		(m/s)
Monitoring Wells																		
-	MW1-13S	Dec-13	Monitoring Well	673222	4872738	Hydro One (Sept 2014)	262.52	263.39	Hydro One (Sept 2014)	0.87	6.1	51	3.05	259.47	6.10	256.42	Silty Sand Till	9.E-08
-	MW1-13D	Dec-13	Monitoring Well	673222	4872738	Hydro One (Sept 2014)	262.52	263.42	Hydro One (Sept 2014)	0.90	15.2	51	12.19	250.33	15.24	247.28	Silty Sand Till	9.E-06
-	MW2-13S	Dec-13	Monitoring Well	672910	4872716	Hydro One (Sept 2014)	250.42	251.27	Hydro One (Sept 2014)	0.85	4.6	51	1.52	248.90	4.57	245.85	Silty Sand Till	2.E-07
-	MW2-13D	Dec-13	Monitoring Well	672906	4872714	Hydro One (Sept 2014)	250.40	251.26	Hydro One (Sept 2014)	0.86	15.2	51	12.19	238.21	15.24	235.16	Silty Sand Till	1.E-07
-	MW3-13S	Dec-13	Monitoring Well	672702	4872499	Hydro One (Sept 2014)	243.87	244.80	Hydro One (Sept 2014)	0.93	6.7	51	3.66	240.21	6.71	237.16	Silty Sand Till	7.E-09
-	MW3-13D	Dec-13	Monitoring Well	672703	4872495	Hydro One (Sept 2014)	244.03	244.97	Hydro One (Sept 2014)	0.94	15.2	51	12.19	231.84	15.24	228.79	Silty Sand Till	na
-	MW4-13S	Dec-13	Monitoring Well	673051	4872242	Hydro One (Sept 2014)	238.86	239.78	Hydro One (Sept 2014)	0.92	4.6	51	1.52	237.34	4.57	234.29	Sand Silty Sand Till	1.E-05
-	MW4-13D	Dec-13	Monitoring Well	673050	4872238	Hydro One (Sept 2014)	238.72	239.55	Hydro One (Sept 2014)	0.83	15.2	51	12.19	226.53	15.24	223.48	Silty Sand Till	na
-	MW5-14S	Oct-14	Monitoring Well	672901	4872453	Field GPS (2014)	252.60	253.51	Hydro One Topography (0.25 m contours)	0.91	6.1	51	3.10	249.50	6.10	246.50	Sandy Silt Till Silty Sand Till	2.E-05
-	MW5-14I	Oct-14	Monitoring Well	672901	4872453	Field GPS (2014)	252.60	253.43	Hydro One Topography (0.25 m contours)	0.83	40.1	51	37.10	215.50	40.10	212.50	Silty Sand Till	1.E-09
-	MW6-14	Oct-14	Monitoring Well	673195	4872811	Field GPS (2014)	260.80	261.71	Hydro One Topography (0.25 m contours)	0.91	7.6	51	6.10	254.70	7.60	253.20	Silt Till	4.E-07
-	MW7-14	Oct-14	Monitoring Well	673254	4872654	Field GPS (2014)	261.75	262.65	Hydro One Topography (0.25 m contours)	0.90	7.6	51	6.10	255.65	7.60	254.15	Silt Till Sandy Silt Till	8.E-07
Boreholes																		
7191922	BH2-12	Nov-12	Abandoned	673024	4872350	Inspect-Sol (2012)	246.40	247.30	Hydro One Topography (0.25 m contours)	0.90	15.9	na	12.15	234.25	15.20	231.20	Sandy Silt Till	-
-	BH4-12	Nov-12	Abandoned	672719	4872330	Inspect-Sol (2012)	243.20	244.10	Hydro One Topography (0.25 m contours)	0.90	15.5	na	12.45	230.75	15.50	227.70	Sandy Silt Till	-
-	BH11-12	Nov-12	Abandoned	673034	4872779	Inspect-Sol (2012)	253.50	254.41	Hydro One Topography (0.25 m contours)	0.91	15.5	51	11.75	241.75	14.80	238.70	Sandy Silt Till Silt and Sand	-
-	BH7A	May-12	Abandoned	672989	4872568	exp (2012)	253.20	na	Exp borehole log (2012)	na	15.7	na	4.70	248.50	7.75	245.45	Sandy Sitl Till	-

TABLE 1
WELL CONSTRUCTION DETAILS

Location				Coordinates			Elevation			Stick-up	Borehole Depth	Well Diameter	Screened Interval				Screened Material	
													Top of Well Screen		Bottom of Well Screen			
MOE WWR No.	Well ID	Installation Date	Status	Easting	Northing	Source	Ground Surface	Top of Casing	Source								Screened Unit	Hydraulic Conductivity
							m AMSL	m AMSL		(m AGS)	(m BGS)	(mm)	(m BGS)	(m AMSL)	(m BGS)	(m AMSL)		(m/s)
Drivepoint Piezometers																		
na	DP4-13 (MP4)	Dec-13	Piezometer	673055	4872236	Hydro One (Sept 2014)	238.41	239.09	Hydro One (Sept 2014)	0.68	1.57	25	1.15	237.26	1.57	236.84	na	-
na	DP2-13 (MP2, SW2)	Dec-13	Abandoned	672900	4872725	Adjacent to DP2-14	250.10	251.14	Adjacent to DP2-14	1.04	1.21	25	0.79	249.31	1.21	248.89	na	-
na	DP2-14 (MP2, SW2)	May-14	Piezometer	672900	4872725	Hydro One (Sept 2014)	250.10	251.62	Hydro One (Sept 2014)	1.52	1.34	25	0.92	249.18	1.34	248.76	na	-
na	DP3-14 (MP3, SW3)	May-14	Piezometer	672684	4872500	Field GPS (2014)	240.00	241.69	Hydro One Topography (0.25 m contours)	1.69	0.87	25	0.45	239.55	0.87	239.13	na	-
Test Pits																		
na	TP1-14	Oct-14	Abandoned	673189	4872613	Field GPS (2014)	256.40	na	Hydro One Topography (0.25 m contours)	na	4.88	na	na	na	na	na	Silty Sand Till	-
na	TP2-14	Oct-14	Abandoned	673151	4872714	Field GPS (2014)	258.20	na	Hydro One Topography (0.25 m contours)	na	4.57	na	na	na	na	na	Silty Sand Till	-
na	TP3-14	Oct-14	Abandoned	673129	4872784	Field GPS (2014)	257.10	na	Hydro One Topography (0.25 m contours)	na	3.96	na	na	na	na	na	Silty Sand Till	-

Notes:

Northing and Easting Coordinates presented as UTM NAD 83 Zone 17

na: not applicable

m AGS: metres above ground surface

m BGS: metres below ground surface

m AMSL: metres above mean sea level

Table 2
Summary of Groundwater Analytical Results - Monitoring Wells
Clarington Tranformer Station
Hydro One Networks Inc.

Sample Location			MW1-13-S					MW6-14	MW7-14
Sample Date			13-Dec-13	19-Mar-14	7-May-14	15-Aug-14	1-Oct-14	9-Oct-14	9-Oct-14
Sample ID			CLARS1213TWG-160960745-20131213-JK1	MW1-13-S	MW1-13-S	MW1-13-S	WG-160900764-20141001-JK9	WG-160900764-20141009-AD02	WG-160900764-20141009-AD03
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			MAXX	MAXX	MAXX	MAXX	MAXX	MAXX	MAXX
Laboratory Work Order			B3L6734	B443695	B475182	B4E7727	B4I4645	B4I9252	B4I9252
Laboratory Sample ID	Units	PWQO	UH4001	VG2315	VV0844	XD5197	XV9683	XY3183	XY3184
General Chemistry									
Acidity	mg/L	n/v	-	26	14	15	84	12	13
Alkalinity, Bicarbonate (as CaCO3)	mg/L	n/v	180	180	190	190	200	200	210
Alkalinity, Carbonate (as CaCO3)	mg/L	n/v	1.2	1.3	1.8	1.6	1.7	1.8	1.7
Alkalinity, Total (as CaCO3)	mg/L	$_{s16}$[A]	180	180	190	190	200	200	210
Ammonia (as N)	mg/L	n/v	0.37	0.13	0.91	0.72	0.44	0.12	0.10
Anion Sum	meq/L	n/v	7.36	7.11	7.48	7.28	7.82	4.83	5.88
Cation Sum	meq/L	n/v	7.46	6.85	10.6	7.29	7.73	4.93	5.98
Chloride	mg/L	n/v	37	25	25	25	25	10	27
Cyanide (Free)	µg/L	5[A]	-	< 2	< 2	< 2	< 2	< 2	< 2
Dissolved Organic Carbon (DOC)	mg/L	n/v	2.8	1.2	1.4	1.2	1.1	2.9	2.1
Electrical Conductivity, Lab	µmhos/cm	n/v	740	700	720	710	740	420	530
Fluoride	mg/L	n/v	-	0.16	0.14	0.17	0.15	0.26	0.17
Hardness (as CaCO3)	mg/L	n/v	330	320	490	340	370	210	270
Ion Balance	%	n/v	0.670	1.90	17.3	0.0300	0.580	0.990	0.830
Langelier Index (at 20 C)	none	n/v	0.588	0.597	0.980	0.693	0.714	0.469	0.600
Langelier Index (at 4 C)	none	n/v	0.339	0.348	0.732	0.445	0.467	0.220	0.351
Nitrate (as N)	mg/L	n/v	5.59	12.8	16.1	11.0	18.2	< 0.10	0.11
Nitrate + Nitrite (as N)	mg/L	n/v	5.62	12.8	-	11.5	-	< 0.10	0.11
Nitrite (as N)	mg/L	n/v	0.027	0.033	< 0.010	0.511	0.108	< 0.010	< 0.010
Orthophosphate(as P)	mg/L	n/v	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010	< 0.010
pH	S.U.	6.5-8.5[A]	7.84	7.89	8.00	7.97	7.95	7.98	7.94
Saturation pH (at 20 C)	none	n/v	7.25	7.29	7.02	7.28	7.23	7.51	7.34
Saturation pH (at 4 C)	none	n/v	7.50	7.54	7.27	7.52	7.48	7.76	7.59
Sulfate	mg/L	n/v	110	90	87	95	84	24	40
Total Dissolved Solids	mg/L	n/v	-	416	454	534	616	262	326
Total Organic Carbon	mg/L	n/v	-	1.5	2.7	2.5	2.7	3.1	2.2
Total Suspended Solids	mg/L	n/v	-	1800	400	230	2600	310	560
Turbidity, Lab	ntu	n/v	-	100	120	76	580	96	360
BTEX and Petroleum Hydrocarbons									
Benzene	µg/L	100$_{b}$[C]	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.24	< 0.20
Toluene	µg/L	0.8[C]	**1.0[C]**	< 0.20	< 0.20	< 0.20	< 0.20	**2.5[C]**	**1.0[C]**
Ethylbenzene	µg/L	8[C]	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	0.50	0.21
Xylene, m & p-	µg/L	32$_{s17}$[B]	1.2	< 0.20	< 0.20	< 0.20	< 0.40	2.1	1.4
Xylene, o-	µg/L	40$_{b}$[C]	0.49	< 0.20	< 0.20	< 0.20	< 0.20	0.67	0.44
Xylenes, Total	µg/L	72$_{s10}$[B]	1.7	< 0.20	< 0.20	< 0.20	< 0.40	2.8	1.8
PHC F1 (C6-C10 range)	µg/L	n/v	< 25	< 25	< 25	< 25	< 25	< 25	< 25
PHC F1 (C6-C10 range) minus BTEX	µg/L	n/v	< 25	< 25	< 25	< 25	< 25	< 25	< 25
PHC F2 (>C10-C16 range)	µg/L	n/v	< 100	< 100	< 100	< 100	< 100	< 100	< 100
PHC F3 (>C16-C34 range)	µg/L	n/v	< 200	< 200	< 200	< 200	< 200	< 200	< 200
PHC F4 (>C34-C50 range)	µg/L	n/v	< 200	< 200	< 200	< 200	< 200	< 200	< 200
Chromatogram to baseline at nC50	none	n/v	YES	YES	YES	YES	YES	YES	YES
Metals									
Aluminum	µg/L	75[C]	< 5.0	7.0	-	< 5.0	5.4	27	16
Antimony	µg/L	20[C]	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Arsenic	µg/L	100[A] 5[C]	< 1.0	< 1.0	-	< 1.0	< 1.0	< 1.0	< 1.0
Barium	µg/L	n/v	110	59	-	63	66	97	100
Beryllium	µg/L	1100$_{s3}$[A]	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Bismuth	µg/L	n/v	< 1.0	-	-	-	< 1.0	< 1.0	< 1.0
Boron	µg/L	200$_{a}$[C]	76	38	-	59	38	47	21
Cadmium	µg/L	0.2[A] 0.1/0.5$_{s12}$[C]	< 0.10	< 0.10	-	< 0.10	< 0.10	< 0.10	< 0.10
Calcium	µg/L	n/v	87000	80000	-	85000	89000	39000	57000
Cesium	µg/L	n/v	< 0.20	-	-	-	-	-	-
Chromium (Hexavalent)	µg/L	1[A]	-	< 0.50	< 0.50	***< 5.0***	***< 5.0***	< 0.50	< 0.50
Chromium (Total)	µg/L	1$_{s11}$[A]	***< 5.0***	***< 5.0***	-	***< 5.0***	***< 5.0***	***< 5.0***	***< 5.0***
Cobalt	µg/L	0.9[A]	0.85	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Copper	µg/L	5[A] 1/5$_{s13}$[C]	< 1.0	< 1.0	-	< 1.0	< 1.0	1.8	1.6
Iron	µg/L	300[A]	< 100	< 100	-	< 100	< 100	< 100	< 100
Lead	µg/L	5/10/20/25$_{s14}$[A] 1/3/5$_{s15}$[C]	< 0.50	< 0.50	-	< 0.50	< 0.50	< 0.50	< 0.50
Lithium	µg/L	n/v	16	-	-	-	8.6	5.2	5.1
Magnesium	µg/L	n/v	27000	29000	-	31000	35000	26000	31000
Manganese	µg/L	n/v	35	16	-	14	5.8	38	31
Mercury	µg/L	0.2[A]	-	-	-	< 0.10	-	-	-
Mercury	mg/L	0.0002[A]	-	< 0.00010	< 0.00010	-	< 0.00010	< 0.00010	< 0.00010
Molybdenum	µg/L	40[C]	13	9.1	-	15	11	5.9	4.1
Nickel	µg/L	25[A]	< 1.0	< 1.0	-	< 1.0	< 1.0	1.6	< 1.0
Phosphorus	µg/L	30$_{s4}$[C]	***< 100***	***< 100***	-	***< 100***	***< 100***	***< 100***	***< 100***
Potassium	µg/L	n/v	12000	5500	-	6200	5100	6200	3700
Rubidium	µg/L	n/v	6.9	-	-	-	-	-	-
Selenium	µg/L	100[A]	< 2.0	< 2.0	-	< 2.0	< 2.0	< 2.0	< 2.0
Silicon	µg/L	n/v	6900	6000	-	6800	7900	7900	10000
Silver	µg/L	0.1[A]	< 0.10	< 0.10	-	< 0.10	< 0.10	< 0.10	< 0.10
Sodium	µg/L	n/v	13000	6800	-	7100	6300	15000	11000
Strontium	µg/L	n/v	420	370	-	400	400	450	420
Tellurium	µg/L	n/v	< 1.0	-	-	-	< 1.0	< 1.0	< 1.0
Thallium	µg/L	0.3$_{b}$[C]	< 0.050	< 0.050	-	< 0.050	< 0.050	< 0.050	< 0.050
Tin	µg/L	n/v	< 1.0	-	-	-	< 1.0	< 1.0	< 1.0
Titanium	µg/L	n/v	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0
Tungsten	µg/L	30$_{a}$[C]	< 1.0	-	-	-	< 1.0	< 1.0	< 1.0
Uranium	µg/L	5$_{a}$[C]	3.6	3.1	-	3.0	3.0	2.8	3.5
Vanadium	µg/L	6[C]	0.75	< 0.50	-	< 0.50	0.63	0.57	0.53
Zinc	µg/L	30[A] 20[C]	< 5.0	< 5.0	-	< 5.0	< 5.0	< 5.0	< 5.0
Zirconium	µg/L	4$_{a}$[C]	< 1.0	-	-	-	< 1.0	< 1.0	< 1.0
Polychlorinated Biphenyls									
Aroclor 1242	µg/L	0.001[A]	-	***< 0.05***	***< 0.05***	***< 0.05***	***< 0.5***	***< 0.05***	***< 0.05***
Aroclor 1248	µg/L	0.001[A]	-	***< 0.05***	***< 0.05***	***< 0.05***	***< 0.5***	***< 0.05***	***< 0.05***
Aroclor 1254	µg/L	0.001[A]	-	***< 0.05***	***< 0.05***	***< 0.05***	***< 0.5***	***< 0.05***	***< 0.05***
Aroclor 1260	µg/L	0.001[A]	-	***< 0.05***	***< 0.05***	***< 0.05***	***< 0.5***	***< 0.05***	***< 0.05***
Polychlorinated Biphenyls (PCBs)	µg/L	0.001$_{s7}$[A]	-	***< 0.05***	***< 0.05***	***< 0.05***	***< 0.5***	***< 0.05***	***< 0.05***
Semi - Volatile Organic Compounds									
Acenaphthene	µg/L	n/v	-	< 1	< 0.2	< 0.2	< 4	< 0.2	< 0.2
Acenaphthylene	µg/L	n/v	-	< 1	< 0.2	< 0.2	< 4	< 0.2	< 0.2
Anthracene	µg/L	0.0008$_{a}$[C]	-	***< 0.3***	***< 0.05***	***< 0.05***	***< 1***	***< 0.05***	***< 0.05***
Benzo(a)anthracene	µg/L	0.0004$_{a}$[C]	-	**0.3[C]**	**0.05[C]**	***< 0.05***	***< 1***	***< 0.05***	***< 0.05***
Benzo(a)pyrene	µg/L	n/v	-	0.26	0.04	0.03	< 0.2	< 0.01	< 0.01
Benzo(b/j)fluoranthene	µg/L	n/v	-	0.4	0.06	< 0.05	< 1	< 0.05	< 0.05
Benzo(g,h,i)perylene	µg/L	0.00002$_{a}$[C]	-	***< 0.5***	***< 0.2 MI***	***< 0.05***	***< 1***	***< 0.05***	***< 0.05***
Benzo(k)fluoranthene	µg/L	0.0002$_{a}$[C]	-	***< 0.3***	***< 0.05***	***< 0.05***	***< 1***	***< 0.05***	***< 0.05***
Biphenyl, 1,1'- (Biphenyl)	µg/L	0.2$_{a}$[C]	-	***< 0.5***	< 0.1	< 0.1	***< 2***	0.2	< 0.1
Bis(2-Chloroethyl)ether	µg/L	200$_{a}$[C]	-	< 3	< 0.5	< 0.5	< 10	< 0.5	< 0.5
Bis(2-Chloroisopropyl)ether	µg/L	n/v	-	< 3	< 0.5	< 0.5	< 10	< 0.5	< 0.5
Bis(2-Ethylhexyl)phthalate (DEHP)	µg/L	0.6[A]	-	**17[A]**	**4[A]**	**2[A]**	**28[A]**	***< 1***	**1[A]**
Chloroaniline, 4-	µg/L	n/v	-	< 5	< 1	< 1	< 20	< 1	< 1
Chlorophenol, 2- (ortho-Chlorophenol)	µg/L	n/v	-	< 0.5	< 0.1	< 0.1	< 2	< 0.1	< 0.1
Chrysene	µg/L	0.0001$_{a}$[C]	-	**0.4[C]**	**0.06[C]**	***< 0.05***	***< 1***	***< 0.05***	***< 0.05***
Dibenzo(a,h)anthracene	µg/L	0.002$_{a}$[C]	-	***< 0.5***	***< 0.1***	***< 0.1***	***< 2***	***< 0.1***	***< 0.1***
Dichlorobenzidine, 3,3'-	µg/L	0.6$_{a}$[C]	-	***< 3***	< 0.5	< 0.5	***< 10***	< 0.5	< 0.5
Dichlorophenol, 2,4-	µg/L	n/v	-	< 0.5	< 0.1	< 0.1	< 2	< 0.1	< 0.1
Diethyl Phthalate	µg/L	n/v	-	< 0.5	0.1	0.1	< 2	< 0.1	< 0.1

See notes on last page

Table 2
Summary of Groundwater Analytical Results - Monitoring Wells
Clarington Tranformer Station
Hydro One Networks Inc.

Sample Location				MW1-13-S				MW6-14	MW7-14
Sample Date			13-Dec-13	19-Mar-14	7-May-14	15-Aug-14	1-Oct-14	9-Oct-14	9-Oct-14
Sample ID			CLARS1213TWG-160960745-20131213-JK1	MW1-13-S	MW1-13-S	MW1-13-S	WG-160900764-20141001-JK9	WG-160900764-20141009-AD02	WG-160900764-20141009-AD03
Sampling Company			STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC	STANTEC
Laboratory			MAXX	MAXX	MAXX	MAXX	MAXX	MAXX	MAXX
Laboratory Work Order			B3L6734	B443695	B475182	B4E7727	B4I4645	B4I9252	B4I9252
Laboratory Sample ID	Units	PWQO	UH4001	VG2315	VV0844	XD5197	XV9683	XY3183	XY3184
Semi - Volatile Organic Compounds									
Dimethyl Phthalate	µg/L	n/v	-	< 0.5	< 0.1	< 0.1	< 2	< 0.1	< 0.1
Dimethylphenol, 2,4-	µg/L	10_b[C]	-	< 3	< 0.5	< 0.5	< 10	< 0.5	< 0.5
Dinitrophenol, 2,4-	µg/L	n/v	-	< 10	< 2	< 2	< 40	< 2	< 2
Dinitrotoluene, 2,4-	µg/L	4[C]	-	< 1	< 0.3	< 0.3	***< 5***	< 0.3	< 0.3
Dinitrotoluene, 2,6-	µg/L	6[C]	-	< 1	< 0.3	< 0.3	< 5	< 0.3	< 0.3
Fluoranthene	µg/L	0.0008_a[C]	-	***< 1***	***< 0.2***	***< 0.2***	***< 4***	***< 0.2***	***< 0.2***
Fluorene	µg/L	0.2_a[C]	-	***< 1***	< 0.2	< 0.2	***< 4***	< 0.2	< 0.2
Indeno(1,2,3-cd)pyrene	µg/L	n/v	-	< 0.5	< 0.1	< 0.1	< 2	< 0.1	< 0.1
Methylnaphthalene (Total)	µg/L	n/v	-	< 1.4	< 0.28	< 0.28	< 5.7	1.2	< 0.28
Methylnaphthalene, 1-	µg/L	2_b[C]	-	< 1	< 0.2	< 0.2	***< 4***	0.3	< 0.2
Methylnaphthalene, 2-	µg/L	2_b[C]	-	< 1	< 0.2	< 0.2	***< 4***	0.8	< 0.2
Naphthalene	µg/L	7_a[C]	-	< 1	< 0.2	< 0.2	< 4	0.5	< 0.2
Pentachlorophenol	µg/L	0.5[A]	-	< 0.5	< 0.1	< 0.1	***< 2***	< 0.1	< 0.1
Phenanthrene	µg/L	0.03_a[C]	-	**0.6[C]**	**0.1[C]**	***< 0.1***	***< 2***	**0.2[C]**	***< 0.1***
Phenol	µg/L	5_b[C]	-	< 3	< 0.5	< 0.5	***< 10***	< 0.5	< 0.5
Pyrene	µg/L	n/v	-	0.9	0.14	0.11	< 1	< 0.05	< 0.05
Trichlorobenzene, 1,2,4-	µg/L	0.5[A]	-	< 0.5	< 0.1	< 0.1	***< 2***	< 0.1	< 0.1
Trichlorophenol, 2,4,5-	µg/L	n/v	-	< 1	< 0.2	< 0.2	< 4	< 0.2	< 0.2
Trichlorophenol, 2,4,6-	µg/L	n/v	-	< 1	< 0.2	< 0.2	< 4	< 0.2	< 0.2
Volatile Organic Compounds									
Acetone	µg/L	n/v	-	< 10	< 10	< 10	< 10	16	10
Benzene	µg/L	100_b[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	0.24	< 0.20
Bromodichloromethane	µg/L	200_a[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Bromoform (Tribromomethane)	µg/L	60_a[C]	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Bromomethane (Methyl bromide)	µg/L	0.9_a[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Carbon Tetrachloride (Tetrachloromethane)	µg/L	n/v	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chlorobenzene (Monochlorobenzene)	µg/L	15[A]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Chloroform (Trichloromethane)	µg/L	n/v	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Dibromochloromethane	µg/L	40_a[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,2-	µg/L	2.5[A]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,3-	µg/L	2.5[A]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorobenzene, 1,4-	µg/L	4[A]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichlorodifluoromethane (Freon 12)	µg/L	n/v	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Dichloroethane, 1,1-	µg/L	200[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Dichloroethane, 1,2-	µg/L	100[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethene, 1,1-	µg/L	40[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Dichloroethene, cis-1,2-	µg/L	200[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloroethene, trans-1,2-	µg/L	n/v	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropane, 1,2-	µg/L	0.7_a[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Dichloropropene, 1,3- (sum of isomers cis + trans)	µg/L	n/v	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Dichloropropene, cis-1,3-	µg/L	n/v	-	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30	< 0.30
Dichloropropene, trans-1,3-	µg/L	7_a[C]	-	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40	< 0.40
Ethylbenzene	µg/L	8[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	0.50	0.21
Ethylene Dibromide (Dibromoethane, 1,2-)	µg/L	5_a[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Hexane (n-Hexane)	µg/L	n/v	-	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0	< 1.0
Methyl Ethyl Ketone (MEK)	µg/L	400_a[C]	-	< 10	< 10	< 10	< 10	< 10	< 10
Methyl Isobutyl Ketone (MIBK)	µg/L	n/v	-	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0	< 5.0
Methyl tert-butyl ether (MTBE)	µg/L	200_a[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Methylene Chloride (Dichloromethane)	µg/L	100_a[C]	-	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0	< 2.0
Styrene	µg/L	4_b[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethane, 1,1,1,2-	µg/L	20_a[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethane, 1,1,2,2-	µg/L	70[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Tetrachloroethene (PCE)	µg/L	50[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Toluene	µg/L	0.8[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	**2.5[C]**	**1.0[C]**
Trichloroethane, 1,1,1-	µg/L	10_a[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Trichloroethane, 1,1,2-	µg/L	800[C]	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Trichloroethene (TCE)	µg/L	20[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Trichlorofluoromethane (Freon 11)	µg/L	n/v	-	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50	< 0.50
Vinyl chloride	µg/L	600_a[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20	< 0.20
Xylene, m & p-	µg/L	32_{s17}[B]	-	< 0.20	< 0.20	< 0.20	< 0.20	2.1	1.4
Xylene, o-	µg/L	40_b[C]	-	< 0.20	< 0.20	< 0.20	< 0.20	0.67	0.44
Xylenes, Total	µg/L	72_{s10}[B]	-	< 0.20	< 0.20	< 0.20	< 0.20	2.8	1.8

Notes:

PWQO	Provincial Water Quality Objectives of the Ministry of Environment and Energy (MOEE, 1999)
A	PWQO Table 2
B	PWQO Table 2 - Calc
C	PWQO Table 2 - Interim
6.5[A]	Concentration exceeds the indicated standard.
15.2	Concentration was detected but did not exceed applicable standards.
< 0.50	Laboratory reportable detection limit exceeded standard.
< 0.03	The analyte was not detected above the laboratory reportable detection limit.
n/v	No standard/guideline value.
-	Parameter not analyzed / not available.
a	This Interim PWQO was set for emergency purposes based on the best information readily available. Employ due caution when applying this value.
b	This Interim PWQO is currently under development. The value is subject to change upon publication by MOE.
s3	The PWQO for beryllium is hardness dependent. If hardness <75 mg/L than PWQO is 0.011 mg/L. For hardness > 75 mg/L, PWQO is 1.1 mg/L.
s4	Applies to Phosphorus, total. PWQO is 0.03 mg/L for rivers and streams, 0.02 mg/L for lakes, and 0.01 mg/L for lakes naturally below this value.
s7	Standard is applicable to total PCBs, and the individual Aroclors should be added for comparison.
s10	The PWQO value for Total Xylenes is 72 ug/L, which represents the most conservative individual value for the m-, p- and o-xylene isomers.
s11	The value for hexavalent chromium has been applied for analysis of total chromium.
s12	The interim PWQO for cadmium is hardness dependent. If hardness <100 mg/L than PWQO is 0.0001 mg/L. For hardness >100 mg/L, PWQO is 0.0005 mg/L.
s13	The interim PWQO for copper is hardness dependent. If hardness <20 mg/L than PWQO is 0.001 mg/L. For hardness >20 mg/L, PWQO is 0.005 mg/L.
s14	PWQO for lead is alkalinity dependent. For alkalinity <20 mg/L, PWQO is 0.005 mg/L. For alkalinity between 20-40 mg/L, PWQO is 0.01 mg/L. For alkalinity between 40-80 mg/L, PWQO is 0.02 mg/L. For alkalinity >80 mg/L, PWQO is 0.025 mg/L.
s15	Interim PWQO for lead is hardness dependent. For hardness <30 mg/L, interim PWQO is 0.001 mg/L. For hardness between 30-80 mg/L, interim PWQO is 0.003 mg/L. For hardness >80 mg/L, interim PWQO is 0.005 mg/L.
s16	Alkalinity should not be decreased by more than 25% of the natural concentration.
s17	The laboratory is unable to distinguish the m- and p-Xylene isomers, therefore the PWQO standards for m-Xylene (2 ug/L) and p-Xylene (30 ug/L) have been summed to apply to m&p-Xylenes.
MI	Detection limit was raised due to matrix interferences.

APPENDIX C

Engineering Drawing

NK296-DDS-15400-5004

NOTES:

1. ALL DIMENSIONS AND ELEVATIONS ARE IN METERS UNLESS NOTED.
2. ALL PIPE ELEVATIONS ARE GIVEN TO INVERT, UNLESS OTHERWISE SPECIFIED.
3. ALL LOCATING DIMENSIONS ARE GIVEN TO THE CENTER LINE OF PIPE AND MANHOLE.
4. ALL DRAINS SHALL BE INSTALLED IN ACCORDANCE WITH O.H. SPECIFICATION L-1166-85 FOR LAYING BURIED DRAINAGE PIPING.
5. FOR BACK FILL AND BEDDING AND FURTHER NOTES SEE DWG. SCD-D4S-12400-0006.
6. "SELECTED BACK FILL" IS EXCAVATED SOIL, FREE OF FROZEN LUMPS, VEGETABLE AND STONES OR ROCK FRAGMENTS EXCEEDING 65mm IN ANY DIMENSION.
7. LIFT HOLES SHALL BE GROUTED WITH CEMENT MORTAR PRIOR TO PLACING ANY BACKFILL.
8. ALL CONNECTING DRAIN PIPES SHALL BE GROUTED IN THEIR RESPECTIVE HOLES WITH CEMENT MORTAR AFTER SETTING TO LINE AND GRADE.
9. THE MANHOLE COVER AND FRAME ARE TO BE SET LEVEL ON A NOMINAL 19mm THK CEMENT MORTAR BED.
10. PERFORATED PIPE SHALL BE LAID WITH PERFORATIONS DOWN.
11. DIMENSIONAL TOLERANCES FOR BURIED PIPE LOCATION AND ELEVATION IS ±10mm.
12. CAP OPEN ENDS OF UNDERDRAINAGE.
13. THE SUB-DRAIN TO BE PERFORATED HDPE STORM SEWER PIPE OF 320kPa WITH SPLIT COUPLE JOINING SYSTEM CONFORMING TO CSA 182.8-02, OPSS 1840 BY ARMTEC OR EQUIVALENT APPROVED BY ENGINEER.
14. GEOTEXTILE TO BE N/W TERRAFIX 270R OR EQUIVALENT APPROVED BY ENGINEER.
15. STORM SEWER TO BE SOLID HDPE PIPE AASHTO M294-CAN/CSAB182 WITH INTEGRAL BELL AND SPIGOT UTILIZING FLEXIBLE ELASTOMERIC SEALS OR ADEQUATE APPROVED BY THE DESIGN ENGINEER.
16. SEWER MANHOLES TO BE PRECAST AS PER OPSD701.010 701.030 AND 704.010.
17. FRAME AND COVER TO BE CAST IRON ROUND AS PER OPSD-401.020 (TYPE 'A').
18. STEPS TO BE HOLLOW CIRCULAR ALUMINUM WITH POLYETHYLENE ENCASEMENT AS PER OPSD-405.010.

LEGEND:

- TOP OF SLOPE
- TOE OF SLOPE
- SLOPE OF GRADE
- DIRECTION OF FLOW
- PROPOSED CHAIN LINK FENCE
- F/G FINISH GRADE ELEVATION
- R/G ROUGH GRADE ELEVATION
- C/R CROWN OF ROAD ELEVATION
- E/R EDGE OF ROAD ELEVATION
- B/D BOTTOM OF DITCH ELEVATION
- SOLID STORM SEWER HDPE
- PERFORATED HDPE UNDERDRAIN PIPE
- MANHOLE

Manhole List

MH No.	INNER DIA. (mm)	NET DEPTH (mm)	COVER & FRAME	50mm INSULATION REQ. AROUND PERIMETER
1	1200	2500	STANDARD CAST IRON	YES
2	1200	2500	STANDARD CAST IRON	YES
3	1200	2500	STANDARD CAST IRON	YES
4	1200	2500	STANDARD CAST IRON	YES
5	1200	2500	STANDARD CAST IRON	YES
6	1200	2500	GMI-3200 COMPOSITE	YES
7	1500	3000	GMI-3200 COMPOSITE	YES

S1 (TYP.)
1:30

S2 (TYP.)
NTS

S3
1:50

S4
1:50
(RE: OPSD 810.010)

PLAN
1:600

Hydro One Networks Inc.
ENGINEERING & CONSTRUCTION SERVICES

Project: CLARINGTON TS NK296
Contract No.: SITE PLAN SUBMISSION
Title: CLARINGTON T.S. STATION DRAINAGE PLAN AND DETAILS

dsn D. LIU	designed by D. WANG		
chkd C. XU	design approved T. MEISNER	ref. Standard	
date yyyy/mm/dd 2014/10/31	subconsultant		
network number 50104493	remarks ISSUED FOR M.O.E. CERTIFICATE OF APPROVAL		
scale AS SHOWN	Drawing No. NK296-DDS-15400-5004	Sheet No. 02	Rev. No.

CLASS NO 51

A0 (841 x 1189)

microfilm no.

APPENDIX D

Borehole Logs

Monitoring Well: MW1-13D/S

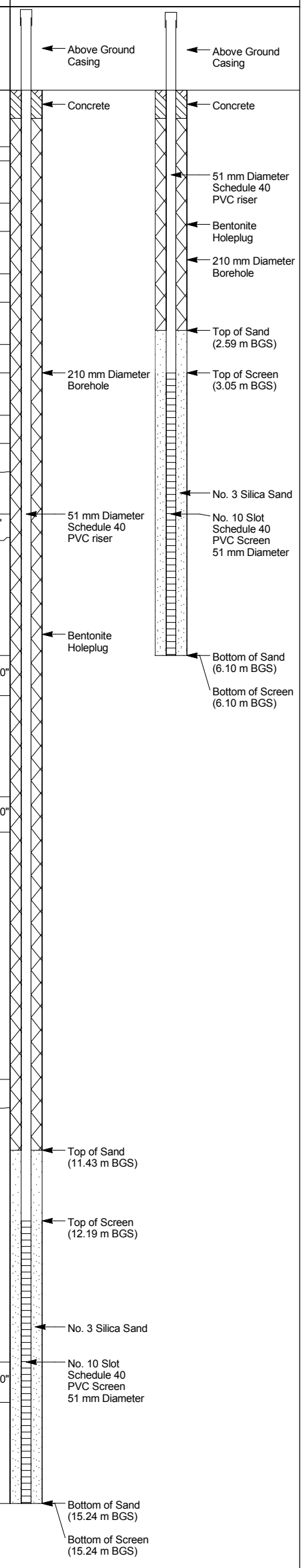
Project: Clarington TS Natural Heritage
Client: Hydro One Networks Inc.
Location: Clarington, Ontario
Number: 160960745

Field investigator: Jamie Koch
Contractor: Aardvark Drilling Inc
Drilling method: Track Mount CME 75 108 mm ID Hollow Stem Auger
Date started/completed: 11-Dec-2013 / 12-Dec-2013

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	N Value
				263.42				
			Ground Surface	262.52				
			TOPSOIL; SAND loose, dark brown, fine grained sand, some silt, moist	0.00 262.32				
			SAND loose, brown with reddish brown staining, fine grained sand, some silt, trace fine grained gravel, moist, little organics	0.20 261.76	1	SS	19	2-2-2-6 (4)
			SAND with SILT TILL compact, brown, fine grained sand with silt, little fine grained gravel, trace clay, moist to wet	0.76	2	SS	16	3-5-7 (12)
					3	SS	16	4-7-11 (18)
					4	SS	16	7-12-17 (29)
				259.47				
			SILTY SAND TILL dense, brown, silty fine grained sand, little to some fine grained gravel, little clay, moist	3.05	5	SS	18	9-24-39 (63)
			moist to dry beginning at 3.81 m BGS		6	SS	12	39-70 (70)
				257.95				
			SILTY SAND TILL (Newmarket Till) very dense, grey, silty fine grained sand, little to some fine grained gravel, little clay, moist	4.57	7	SS	10	54-50/4.0" (50/4.0")
					8	SS	17	32-36-50/5.0" (50/5.0")
					9	SS	15	25-47-50/3.0" (50/3.0")
			gravelly sand, grey, fine grained gravel and sand, little silt, wet (9.45 m to 10.36 m BGS) note: no split spoon sample. interpretation based on augur grinding and field observation of flushed out material					
			some clay, little fine grained gravel beginning at 10.67 m BGS		10	SS	12	58-70 (70)
			little fine to medium grained gravel at 13.72 m BGS		11	SS	17	38-48-50/5.0" (50/5.0")
			End of Borehole	247.28 15.24				

WELL DETAILS

	MW1-13D	MW1-13S
Name:	MW1-13D	MW1-13S
GS Elev:	262.52 m AMSL	262.52 m AMSL
TOC Elev:	263.42 m AMSL	263.39 m AMSL
Easting:	673222	673222
Northing:	4872738	4872738
Stick-up:	0.90 m	0.87 m



Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

Drawn By/Checked By: HB / BG

Monitoring Well: MW6-14

Project: Clarington TS Natural Heritage
Client: Hydro One Networks Inc.
Location: Clarington, Ontario
Number: 160960745

Field investigator: Jamie Koch
Contractor: Aardvark Drilling Inc (Teracore)
Drilling method: Track Mount CME 75 108 mm ID HSA
Date started/completed: 03-Oct-2014

Ground surface elevation: 260.80 m AMSL
Top of casing elevation: 261.71 m AMSL
Easting: 673195
Northing: 4872811

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	N Value	Lab Analyses	WELL DETAILS
				261.71						Above Ground Casing Stick-Up: 0.91 m
0	0		Ground Surface	260.80						
			TOPSOIL ; SILTY SAND loose, dark brown, fine grained sand, little fine grained gravel, moist	0.00 260.60						
			SILTY SAND TILL compact, brown, fine grained sand, moist	0.20 260.19	1	SS	24" 100%	2-2-3-8 (5)		Cement Seal 0.0 m to 0.5 m
			SILT TILL dense, brown, Silt, some fine grained sand, some fine grained gravel, trace clay, moist	0.61						
					2	SS	19" 79%	43-15-34-22 (49)		
5			little fine grained gravel beginning at 2.29 m BGS							210 mm Diameter Borehole
	2				3	SS	24" 100%	8-17-20-22 (37)		
					4	SS	24" 100%	4-17-26-32 (43)		
10					5	SS	11" 100%	10-50/5" (n/a)		Bentonite Grout 0.5 m to 5.5 m
	4				6	SS	7" 58%	10-50/5" (n/a)		
15			colour transition to grey at 4.57 m BGS		7	SS	9" 100%	20-50/3" (n/a)		
					8	SS	10" 100%	20-50/3" (n/a)		Top of Sand (5.5 m BGS)
	6									No. 3 Silica Sand
20			SILTY SAND TILL (Newmarket Till) very dense, grey, silty fine grained sand, some gravel, some clay, moist grain size analysis: 38% sand, 30% silt, 18% gravel , 14% clay at 6.2 m BGS	254.70 6.10	9	SS	10" 100%	35-50/4" (n/a)	Grain Size (6.2 m BGS)	Top of Screen (6.1 m BGS)
			little gravel at 6.86 m BGS grain size analysis: 41% sand, 34% silt , 16% clay, 8% gravel at 7.0 m BGS		10	SS	10" 91%	44-50/4" (n/a)	Grain Size (7.0 m BGS)	No. 10 Slot Schedule 40 PVC Screen 51 mm Diameter
25			End of Borehole	253.18 7.62						Bottom of Sand (7.6 m BGS) Bottom of Screen (7.6 m BGS)
	8									

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

Screen Interval: 6.10 - 7.62 m BGS
Sand Pack Interval: 5.49 - 7.62 m BGS
Well Seal Interval: 0.46 - 5.49 m BGS

Stantec

Drawn By/Checked By: NS / BG

Monitoring Well: MW7-14

Project: Clarington TS Natural Heritage
Client: Hydro One Networks Inc.
Location: Clarington, Ontario
Number: 160960745

Field investigator: Jamie Koch
Contractor: Aardvark Drilling Inc (Teracore)
Drilling method: Track Mount CME 75 108 mm ID HSA
Date started/completed: 03-Oct-2014

Ground surface elevation: 261.75 m AMSL
Top of casing elevation: 262.65 m AMSL
Easting: 673254
Northing: 4872654

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Elevation (m AMSL) Depth (m BGS)	Sample Number	Sample Type	Recovery	N Value	Lab Analyses	WELL DETAILS
				262.66						Above Ground Casing Stick-Up: 0.9 m
0	0		Ground Surface	261.75						
			TOPSOIL; SILT compact, dark brown, some fine grained sand, moist	0.00	1	SS	10" 42%	1-5-8-7 (13)		Cement Seal 0.0 m to 0.6 m
				260.94						
			SILTY SAND TILL compact, grey-brown to brown, silty fine grained sand, little fine grained gravel, trace clay, moist	0.81	2	SS	24" 100%	5-7-13-20 (20)		
5			becoming very hard at 1.52 m BGS		3	SS	12" 50%	10-20-23-40 (43)		210 mm Diameter Borehole
	2		colour transition to brown, some fine grained gravel, dry to moist at 2.29 m BGS		4	SS	24" 100%	18-17-18-28 (35)		
10			compact, brown, silty fine sand seam, moist to wet at 3.51 m BGS (0.20 m thick)	258.14	5	SS	24" 100%	16-32-38-44 (70)		Bentonite Grout 0.6 m to 5.5 m
			SANDY SILT TILL very dense, brown, fine grained sandy silt, some fine grained gravel, trace clay, moist	3.61	6	SS	18" 75%	8-38-50 (88)		
	4			257.18						
15			SILTY SAND TILL (Newmarket Till) very dense, grey, silty fine grained sand, some clay, some fine grained gravel, moist	4.57	7	SS	8" 100%	38-50/2" (n/a)		
					8	SS	11" 69%	12-50/5" (n/a)		Top of Sand (5.5 m BGS)
										No. 3 Silica Sand
20	6		little fine grained gravel beginning at 6.10 m BGS							Top of Screen (6.1 m BGS)
			grain size analysis: 42% sand, 40% silt , 10% clay, 8% gravel at 6.3 m BGS		9	SS	15" 100%	10-40-50/3" (>50)	Grain Size (6.3 m BGS)	
			little gravel at 6.86 m BGS		10	SS	17" 94%	13-35-50/5" (>50)	Grain Size (7.1 m BGS)	No. 10 Slot Schedule 40 PVC Screen 51 mm Diameter
			grain size analysis: 43% sand, 34% silt , 14% clay, 9% gravel at 7.1 m BGS							
25				254.13						Bottom of Sand (7.6 m BGS)
	8		End of Borehole	7.62						Bottom of Screen (7.6 m BGS)

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
SS - split-spoon sample
n/a - not available

Screen Interval: 6.10 - 7.62 m BGS
Sand Pack Interval: 5.49 - 7.62 m BGS
Well Seal Interval: 0.61 - 5.49 m BGS

Drawn By/Checked By: NS / BG

Test Pit: TP1/2/3-14

Project: Clarington TS Natural Heritage
Client: Hydro One Networks Inc.
Location: Clarington, Ontario
Number: 160960745

Field investigator: Jamie Koch
Contractor:
Drilling method: Excavator
Date started/completed: 09-Oct-2014

Depth (ft)	Depth (m)	Graphic Log	Lithologic Description	Depth (m BGS)	WELL DETAILS
			Ground Surface		GS Elev: n/a TOC Elev: n/a Easting: n/a Northing: n/a Stick-up: n/a
			TOPSOIL dark brown topsoil	0.00	
			SAND brown, some silt	0.30	
2			SILTY SAND brown	0.61	
	1				
4			SILTY SAND TILL very dense, brown, becoming grey with depth, silty fine grained Sand, some clay, some coarse grained gravel water seeping at 1.22	1.22	
6	2				
8					Test Pit native soil backfill
10	3				
12					
14	4				
16			grain size analysis: sand 39%, silt 32%, gravel 16% and clay 13% at 4.88 m BGS End of Borehole	4.88	
18	5				
	6				

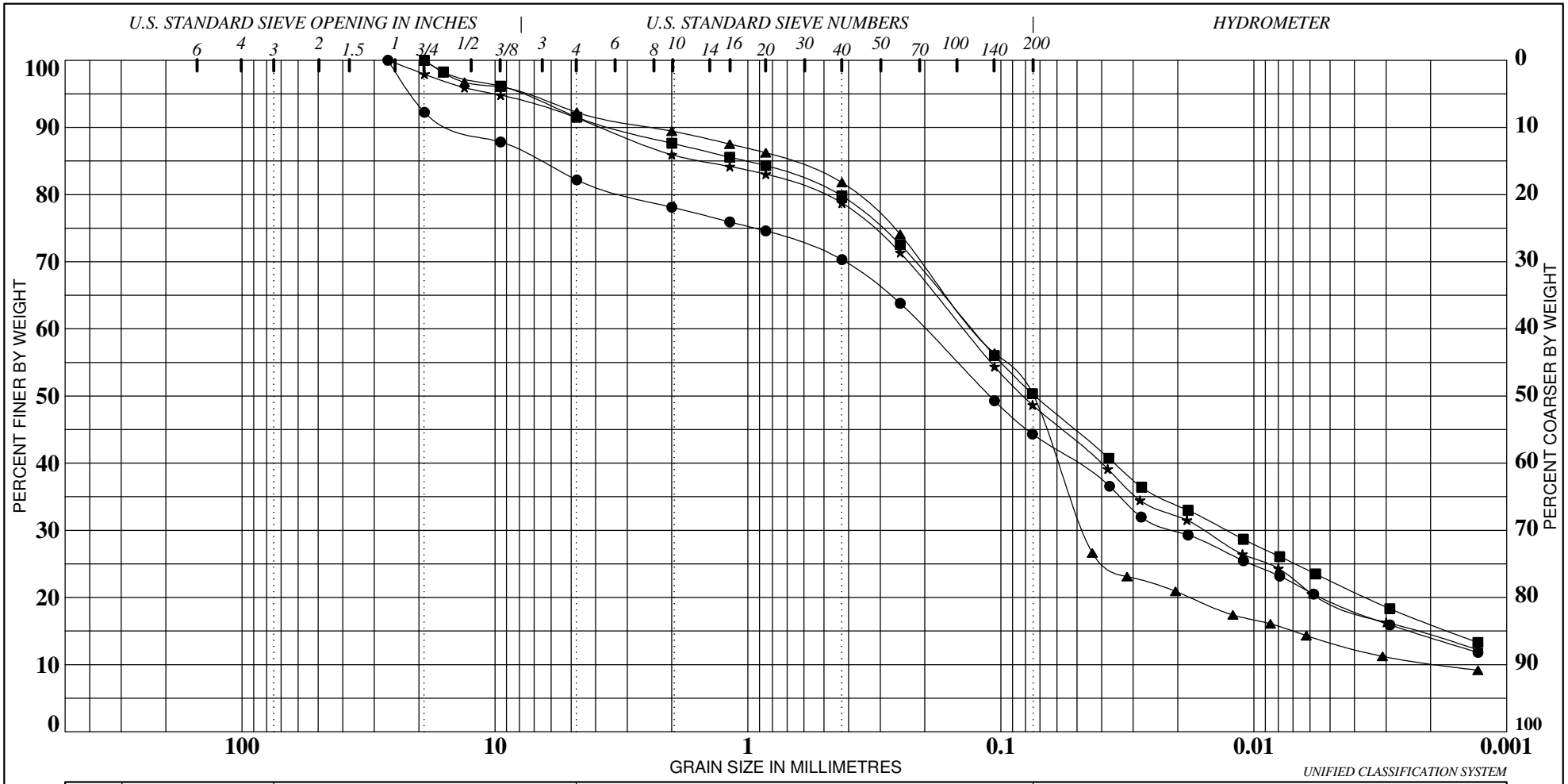
SUBSURFACE PROFILE | SAMPLE DETAILS | WELL DETAILS

Notes:
m AMSL - metres above mean sea level
m BGS - metres below ground surface
m BTOC - metres below top of casing
n/a - not available

- Test Pit 2 and 3 show similar stratigraphy,
- Refer to Figure 2 for test pit locations
- Depth of TP2-14 was 4.6 m BGS
- TP2-14 grain size analysis was completed at 4.6 m BGS
- Depth of TP3-14 was 4.0 m BGS
- TP3-14 grain size analysis was completed at 4.0 m BGS

Stantec

Drawn By/Checked By: HB/BG



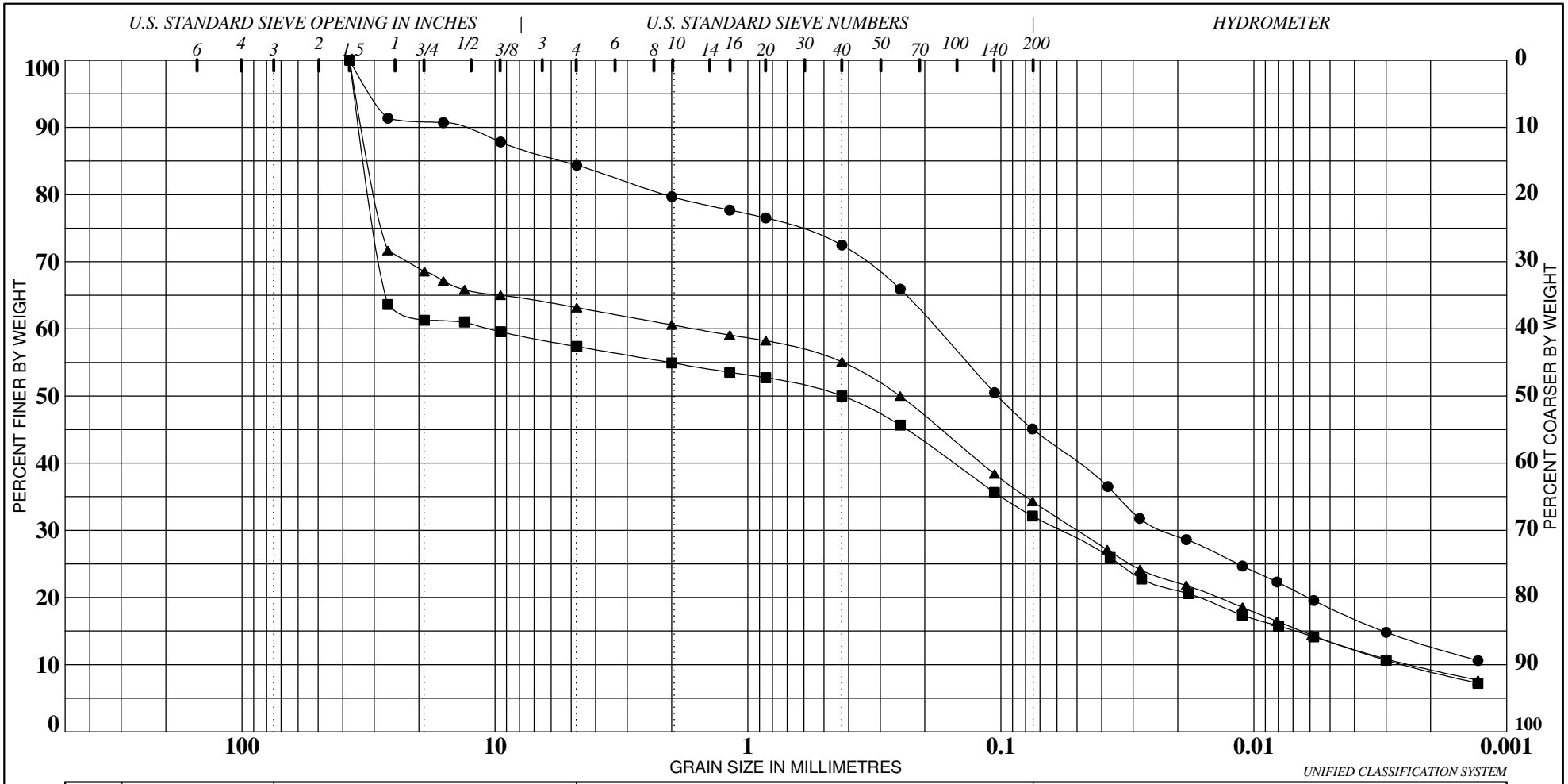
BLDs	COBBLES	GRAVEL		SAND			SILT & CLAY	
		coarse	fine	coarse	medium	fine	SILT	CLAY

Specimen	Depth (m)	Description	W%	%Gravel	%Sand	%Silt	%Clay	>75µ
● MW6-14 - 9	6.2	SILTY CLAYEY SAND with GRAVEL(SC-SM)	5	18	38	30	14	56
■ MW6-14 - 10	7.0	SILTY CLAYEY SAND(SC)	5	8	41	34	16	49
▲ MW7-14 - 9	6.3	SILTY CLAYEY SAND(SC)	5	8	42	40	10	50
★ MW7-14 - 10	7.1	SILTY CLAYEY SAND(SC)	5	9	43	34	14	52

Stantec

Project: Clarington Transformer Station
Location: Clarington, ON
Project No.: 160900764

GRADATION CURVE (ASTM D422)
Figure: 1
Remarks:



BLDs	COBBLES	GRAVEL		SAND			SILT & CLAY	
		coarse	fine	coarse	medium	fine	SILT	CLAY

Specimen	Depth (m)	Description	W%	%Gravel	%Sand	%Silt	%Clay	>75µ
● TP1 - 2	4.9	SILTY CLAYEY SAND with GRAVEL (SC-SM)	5	16	39	32	13	55
■ TP2 - 2	4.6	SILTY CLAYEY GRAVEL with SAND	3	43	25	23	9	68
▲ TP3 - 2	3.7	SILTY CLAYEY GRAVEL with SAND(GS-CM)	5	37	29	25	9	66

Stantec

Project: Clarington Transformer Station
Location: Clarington, ON
Project No.: 160900764

GRADATION CURVE (ASTM D422)
Figure: 2
Remarks:

Photo 1: TP1-14 – October 9, 2014

Photo 2: TP2-14 – October 9, 2014

Photo 3: TP2-14 – October 9, 2014
Minor seepage noted at 1.2 m BGS

Photo 4: TP3-14 – October 9, 2014

APPENDIX E

Dewatering Calculations

Seepage within Ditch within Unconfined Aquifer

$$\frac{\partial h}{\partial t} = \frac{KD}{\eta}\frac{\partial^2 h}{\partial x^2}$$

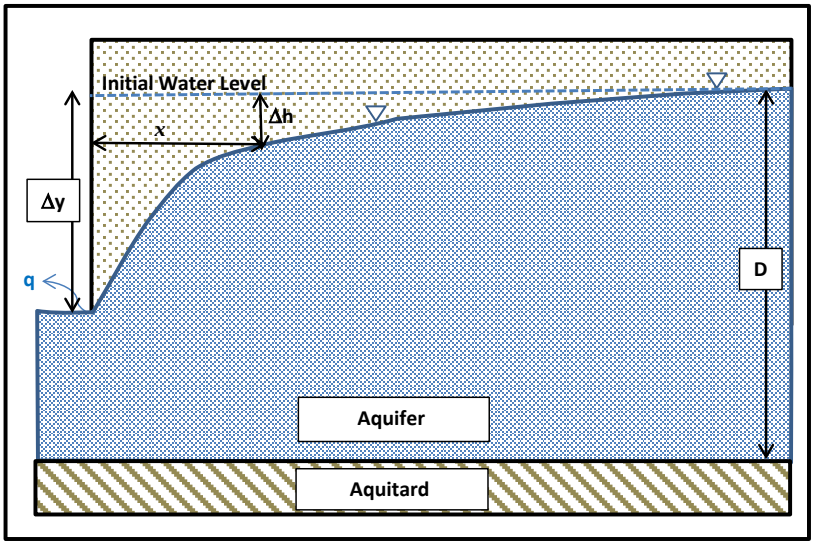
Based on solution by Edelman (1947)

$$u = \frac{x}{2\sqrt{\frac{KDt}{\eta}}}$$

$$\Delta h = -\Delta y\, f_o(u), when\, \Delta y > 0$$

$$q_o = \frac{KD(\Delta y)}{\sqrt{\pi}} * \left(\frac{KDt}{\eta}\right)^{-0.5}$$

Conceptual Model



Where:

K = Hydraulic Conductivity (m/s)
D = Thickness of Initial Aquifer (m)
η = porosity
x = distance from edge of excavation (m)
t = time (s)
Δh = change in water level (m)
Δy = change in water level within ditch (m)
q_o = seepage rate per unit length of ditch (m^2/s)
Q = Seepage volume (L/day)

Calculations are for flow along one side of ditch and assume instantaneous change in head within the ditch, Dh << D, horizontal flow and infinite aquifer.

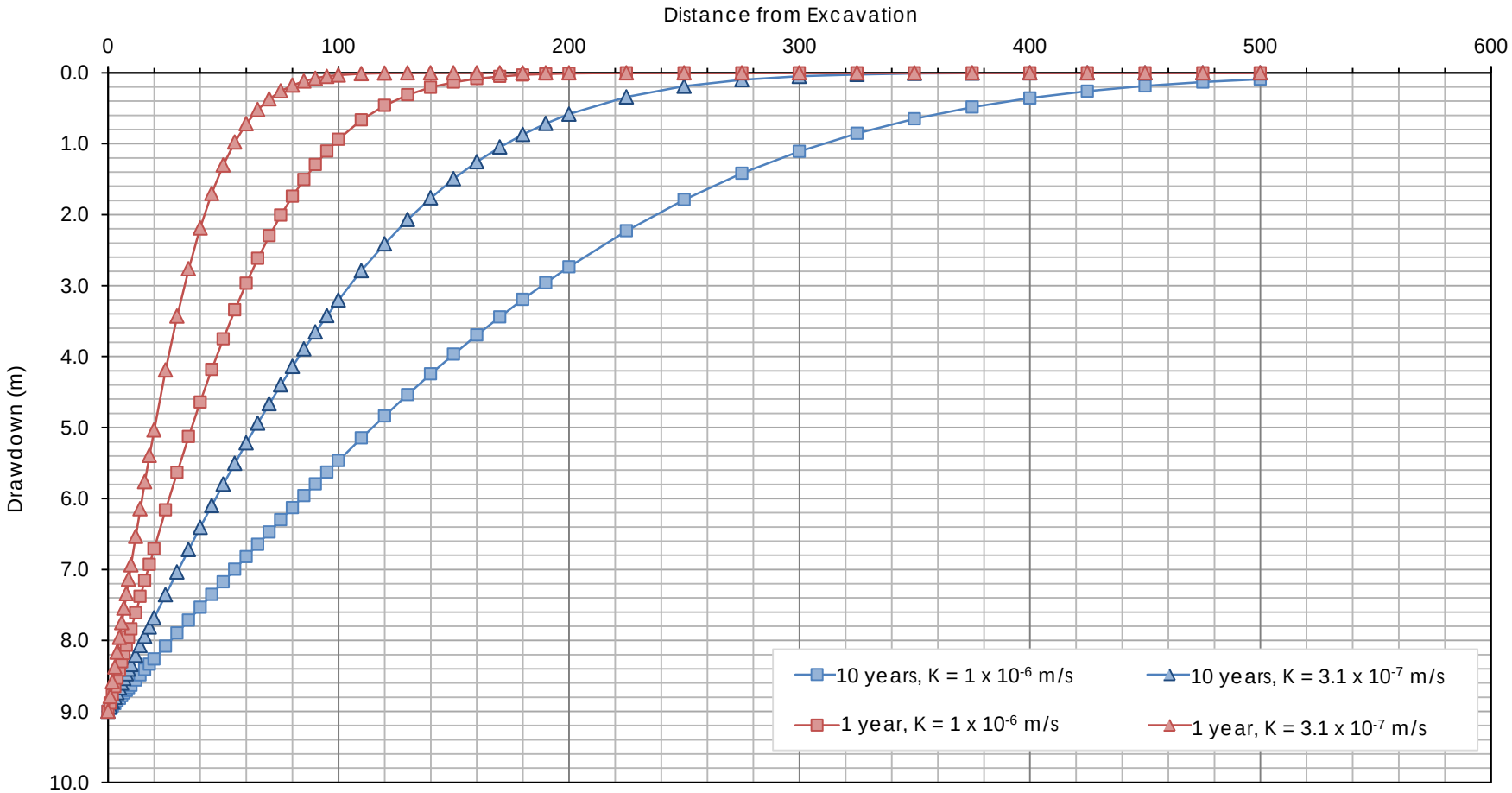
Calculations

K =	1.00E-06	m/s	Initial water level =	261	m AMSL
D =	18	m	Maximum Drawdown =	252	m AMSL
η =	0.3		Δy =	9	m
			Length of Ditch =	400	m

Groundwater Seepage

Time (t) (days)	Seepage Rate (q_o) (m^2/sec)	Seepage Volume (Q) L/day
14	1.1E-05	370,781
100	4.0E-06	138,733
365	2.1E-06	72,616
3650	6.6E-07	22,963

Equations obtained from International Institute for Land Reclamation and Improvement (ILRI), 1994. Drainage Principles and Applications. Publication 16, 2nd Edition.



Notes:

Analytical solution based on Edelman (1947).

Client/Project

Hydro One

Category 3 PTTW Hydrogeologic Assessment Report

Clarington, Ontario

Figure No.

9

Title

Predicted Extent of Drawdown

Stantec