Inglis Subdivision

Preliminary

Stormwater Management Report

Project Location:

10125 Oxbow Drive, Komoka, ON

Prepared for:

Heather Johnston-Inglis
P.O. Box 63, Formosa, ON

Prepared by:

MTE Consultants
123 St. George Street
London, ON N6A 3A1

June 12, 2020

MTE File No.: 43705-104

Engineers, Scientists, Surveyors.

Contents

Figures

Appendices

1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Ms. Inglis (Client) to complete the servicing report for the Inglis Subdivision to be constructed at 10125 Oxbow Drive in the Community of Komoka, Municipality of Middlesex Centre.

The site is approximately located at the intersection of Oxbow Drrive and Union Avenue. The property is bounded to the north by Oxbow Drive, to the south and west by municipally owned properties (Park, water tower) and golf course, and to the east by residential properties. For the exact location of the site, refer to Figure 1.

The Inglis property is being considered along with two other residential properties (10147 & 10171 Oxbow Drive) currently under separate ownership. Together these parcels are approximately 10.4ha in area inclusive of a portion of Oxbow drive across the frontage of the properties and the existing borrow pit. This report addresses the municipal servicing of the proposed subdivision. The site grading, servicing and stormwater management details for the site are illustrated on the figures provided.

2.0 Sanitary Servicing

Effluent from the proposed subdivision is intended to be directed through the Municipally Owned parklands to the south to an existing 200mm sanitary sewer on Queen Street. Lots fronting onto Oxbow Drive will require a new sanitary sewer to be constructed in the Oxbow R.O.W. to pick up effluent from these lots. The new sewer can direct flows from these lots to the internal sewers which will direct the flows to Queen Street.

The proposed draft plan for the Inglis property indicates 4.81 ha of residential development area with 49 single family lots, 8 townhouse units, and 0.23ha of future residential lands. The external properties are approximately 2.52 ha. Allowing for the Municipality's estimate for low density development, the external and future residential areas will allow for the construction of approximately (2.52ha + 0.23ha) x 30 u/ha = 83 additional units.

Allowing for a population of 3 persons/unit, a total population of 420 persons is expected for the subdivision. Allowing for an average daily consumption of 350 L/day (0.004 L/s), factoring in the Municipality's specified peaking factor (0.8 x Harmon = 3.21), and adding the Municipality's infiltration allowance (0.1 L/s/ha x 7.3ha = 0.73 L/s) the peak expected flow rate from the site is approximately 420 x 0.004 x 3.21 + 0.73 = 6.26 L/s.

Based on the sanitary drainage plan for the neighbouring Fieldstone Subdivision (Prepared by Development Engineering, Dated March-2017) the sanitary sewer on Queen street currently collects effluent from approximately 25 units and directs flows south. Based on the layout of the existing sanitary MH's it is assumed the sanitary sewers from the proposed subdivision will connect into MH117 as labelled on the sanitary drainage plan. MTE has completed a sanitary capacity analysis from the proposed connection location down to the 250mm sanitary sewer on Huron Avenue. The analysis shows that all sewer runs have adequate capacity to convey effluent from the proposed site. The capacity analysis prepared by MTE is included in Appendix 'A'. Proposed Sanitary routing is illustrated on Figure 2.

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Division			
Project Number: 43705-104	Scale: 1:2000	Part of Dwg:	
	Date: 05/22/2020	Revision #:	

Project Name: OXBOW DRIVE SUBDIVISION

Drawing Title: SITE LOCATION

Issued For:

Drawing Number: FIG.1

DWG PATH:P:\P\43705\104\TEMP DWGS\JJM\43705-104-FIGURES.dwg
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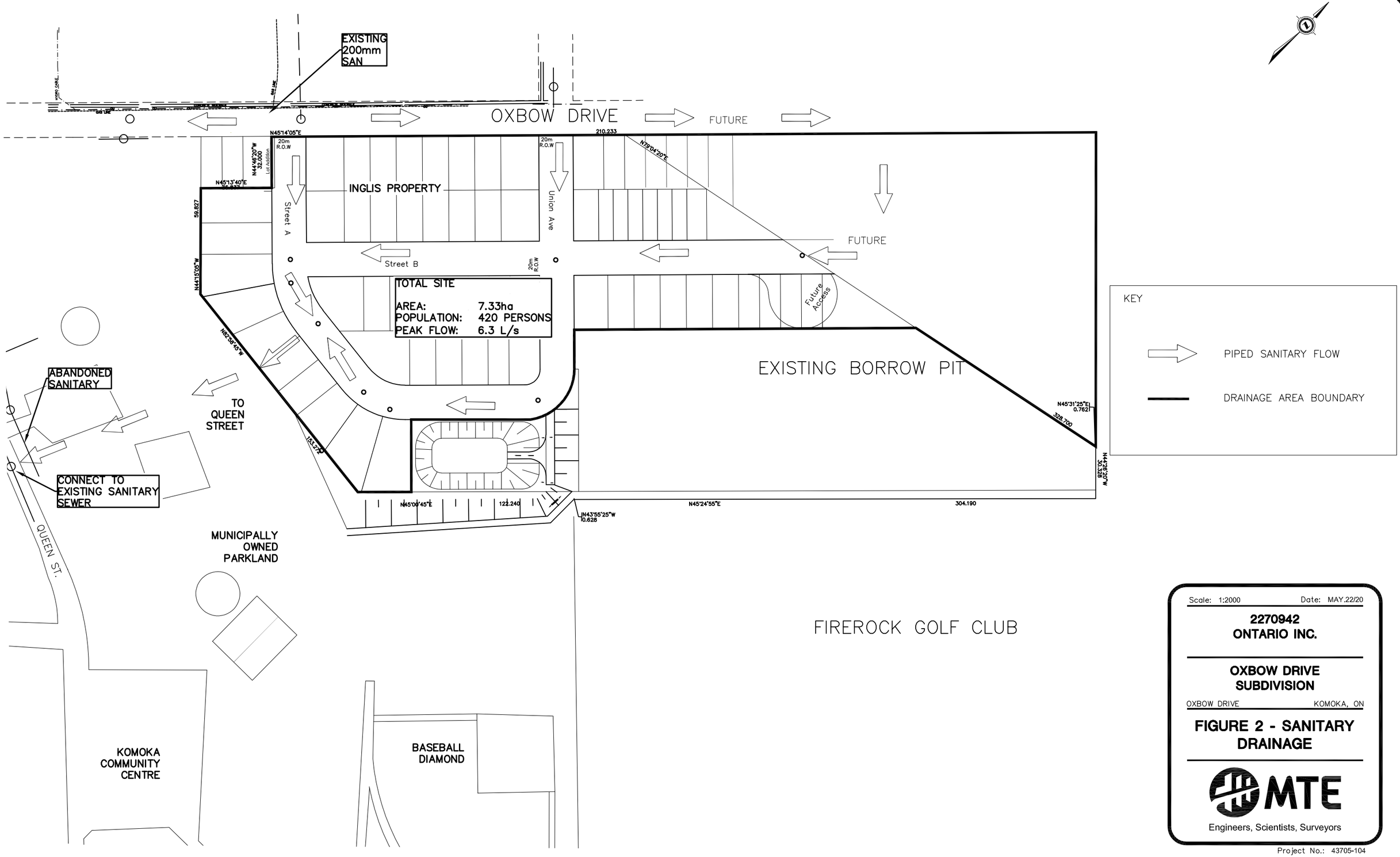

Scale: 1:2000 Date: MAY.22/20

2270942 ONTARIO INC.

OXBOW DRIVE SUBDIVISION

OXBOW DRIVE KOMOKA, ON

FIGURE 2 - SANITARY DRAINAGE

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Project No.: 43705-104

P:\P\43705\104\TEMP DWGS\JJM\43705-104-FIGURES.dwg

3.0 Water Distribution

Water supply for the proposed subdivision will be provided by:

- Two (2) connections to the existing 150mm watermain on Oxbow Drive; and
- One (1) future connection to future extension of 150mm watermain along Oxbow drive to service future development to the east.

It is anticipated that two connections to the 150mm main on Oxbow will be completed as part of the development of the Inglis property and another completed upon development of the external properties. Proposed water distribution network is illustrated in Figure 3.

3.1 Water distribution Modelling

The proposed and future development conditions were modelled using WaterCAD to determine the expected pressures and available flow rates within the proposed subdivision. The site was modelled as a network of nodes connected by pipes. Demands were applied at the nodes based on the proposed and assumed future lotting, estimated population and consumtion rates, and the max day and peak hour demand factors as specified in the Municipality's design guidelines. Physical properties were assigned to the pipes as per Municipal criteria.

Supply for the subdivision was modelled as a reservoir with a fixed elevation connected to the existing 150mm watermain on Oxbow drive at the approximate location of the Municipal water tower and the intersection of Oxbow Drive and Union Avenue. The elevation of the reservoir was calculated to be 284.60 masl based on the results of a hydrant flow test located in the subdivision north of Oxbow Drive. The flow test was completed in 2015 at Municipal Hydrant KO-94 and showed a static pressure of 50.3 psi which equates to roughly 35.4m of pressure head. Based on the Plan Profile drawing of Oakcrest rive (on which hydrant KO-94 is located) the approximate surface elevation in the location of the hydrant is 249.20. Thus, the reservoir elevation was set at 284.60 masl. A sketch of the model network along with a summary of the demands and physical properties applied within the model are included in Appendix 'B'.

3.2 Results

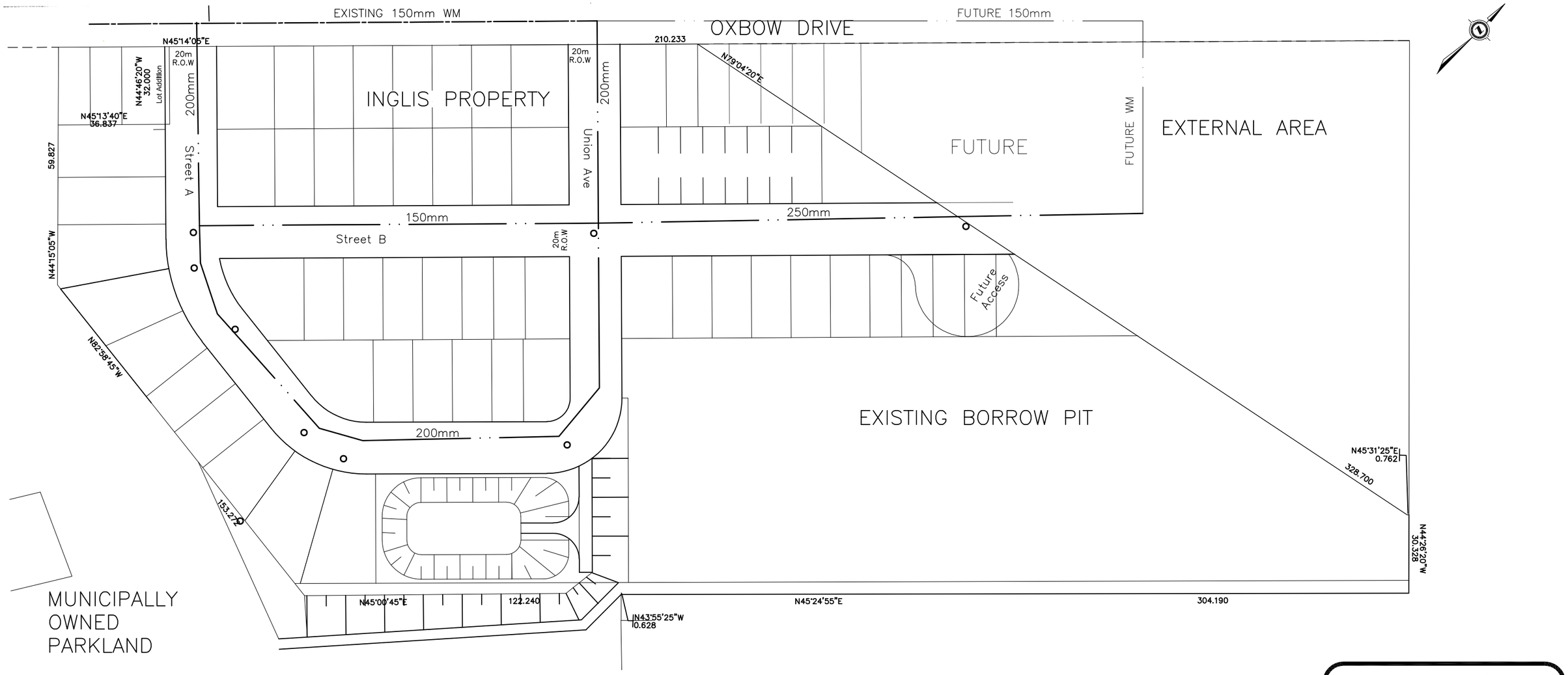
3.2.1 Pressure

Pressures within the system are expected to remain between 307 and 354 kPa during all domestic demand scenarios under proposed and future conditions. This is within the Municipality's preferred operating range of 275-550 kPa.

3.2.2 Velocity

Maximum velocity within the proposed system during domestic demand scenarios is approximately 0.07 and 0.12 m/s for the proposed and future conditions respectively.

Maximum velocity during fire flow scenarios was checked by applying a fire demand of 100 L/s at nodes J-3, J-5, J-8, J-9, and J-20. The maximum velocity in the system was found to be 2.2 and 2.0 m/s during the proposed and future conditions respectively.



LEGEND

——-——-—— EXISTING WATER MAIN

———————— PROP. WATER MAIN

Scale: 1:1500 Date: MAY.22/20

2270942 ONTARIO INC.

OXBOW DRIVE SUBDIVISION

OXBOW DRIVE KOMOKA, ON

FIGURE 3 - WATER DISTIBUTION

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Project No.: 43705-104

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3.2.3 Fire Flow

The fire flow analysis feature within the WaterCAD program was used to determine the available fire flow at all locations within the system. The model was run with constraints specifying a maximum allowable velocity of 2.4 m/s and minimum allowable system pressure of 140 kPa. Minimum available fire flow rate was determined to be 109 and 114 L/s during the proposed and future development scenarios.

3.2.4 Age

An age analysis was run assuming average day demands to determine the maximum age within the system under the proposed development conditions. Both scenarios were run assuming full buildout conditions. The maximum age in the system was modelled to be roughly 35.1 hrs. and 19.7 hrs. under the proposed and future development conditions respectively.

Modelling parameters and results are summarized in Appendix ‘B’ below.

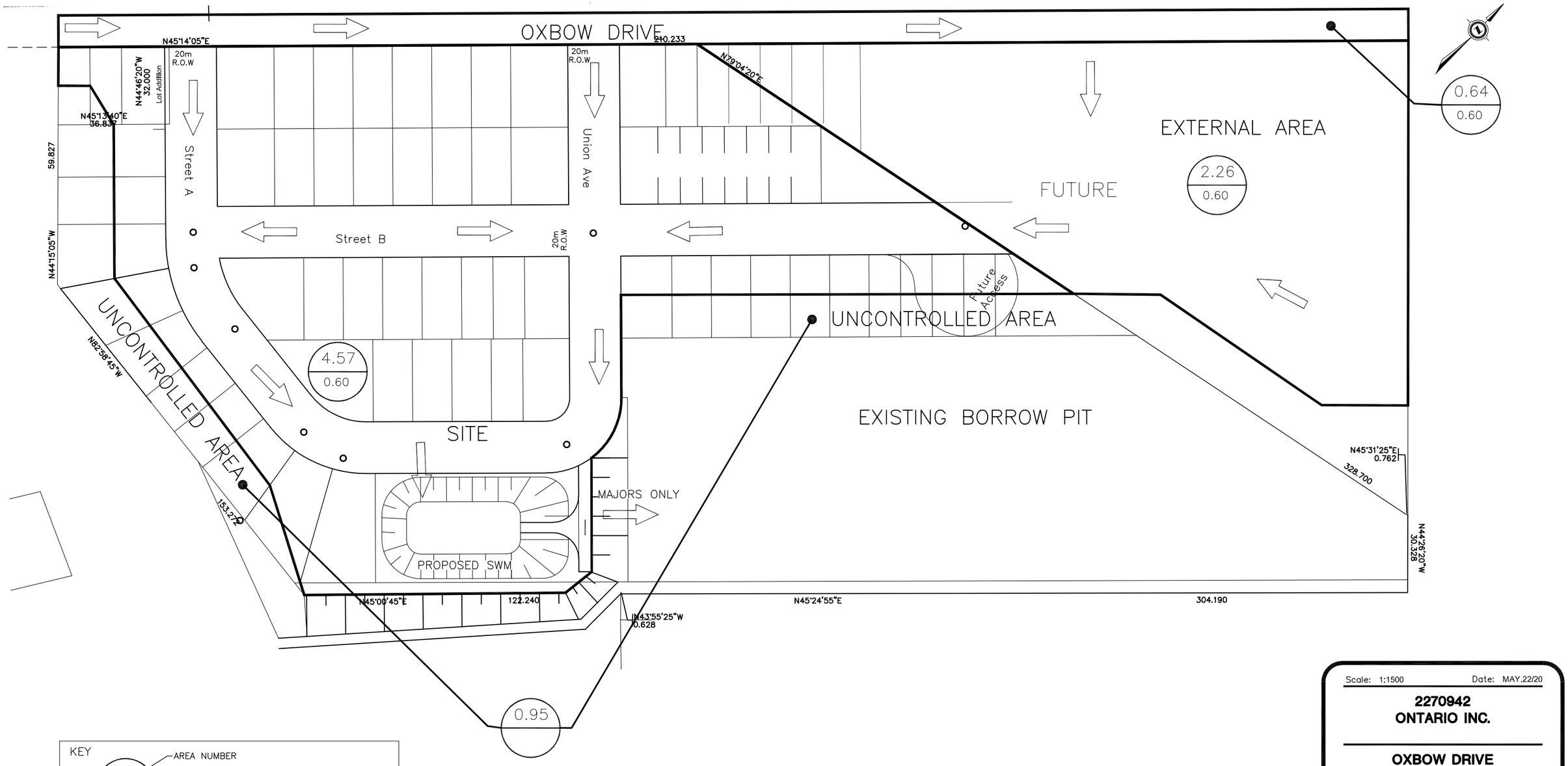
4.0 Stormwater Management

Under existing conditions the majority of the proposed subdivision lands drain to an existing borrow pit located on the Inglis property. The borrow pit has no outlet and drains via infiltration to the local shallow groundwater.

A geotechnical investigation for the Inglis property showed that the site has a thick layer of fill material over the northern portion of the site but the underlying native soils are sandy in nature with high conductivity.

It is proposed that lot-level Infiltration measures be employed wherever possible across the site and that all minor system runoff (≤ 5 yr) be infiltrated in an end-of-pipe SWM facility. Major system runoff will be released to the borrow pit in a controlled manner to prevent erosion or scour within the pit.

For further SWM details, refer to the preliminary SWM report for the site prepared by MTE. Proposed drainage patterns are illustrated in Figure 4.



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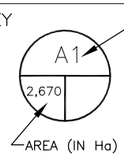

DRAINAGE AREA CATCHMENT

OVERLAND FLOW DIRECTION

DRAINAGE AREA BOUNDARY

Scale: 1:1500 Date: MAY.22/20

2270942 ONTARIO INC.

OXBOW DRIVE SUBDIVISION

OXBOW DRIVE KOMOKA, ON

FIGURE 4 - STORM DRAINAGE

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Project No.: 43705-104

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5.0 Conclusions

Based on the foregoing analysis, it is concluded that:

i. The proposed subdivision may be adequately serviced through the installation of gravity sanitary sewers, connection to the existing municipal water distribution network, and the establishment of lot-level and end-of-pipe SWM infrastructure;

ii. A sanitary outlet can be provided for the subdivision through the existing municipally owned lands to the south and connecting into the existing sanitary sewer on Queen Street.

iii. Water servicing can be supplied by connections to the existing mains on Oxbow Drive and Queen Street. Connection to the Queen Street main may be provided through the municipally owned land to the south.

iv. Stormwater management for the site may be accommodated through the implementation of lot-level and end-of-pipe infiltration measures with major flows being directed to the borrow pit.

v. Availability of utilities will need to be confirmed with the appropriate providers.

All of which is respectfully submitted,

MTE Consultants Inc.

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JJM:jjm

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Appendix A

Sanitary Capacity Analysis

RESIDENTIAL POPULATION DENSITIES

THE FOLLOWING POPULATION ALLOWANCES WILL APPLY WHEN DESIGNING SANITARY SEWERS:

(A) HECTARE BASIS

LOW DENSITY (SINGLE FAMILY/SEMI-DETACHED)	= 30 UNITS/HA @ 3 PEOPLE/UNIT
MEDIUM DENSITY (TOWNHOUSES)	= 75 UNITS/HA @ 2.4 PEOPLE/UNIT
HIGH DENSITY (APARTMENTS)	= 150-300 UNITS/HA @ 1.6 PEOPLE/UNIT
COMMERCIAL / INSTITUTIONAL / CHURCH	= 100 PEOPLE/HA
ELEMENTARY SCHOOL	= 400 PEOPLE
SECONDARY SCHOOL	= 1500 PEOPLE

(B) LOT BASIS

SINGLE FAMILY	= 3 PEOPLE
DUPLEX / SEMI	= 6 PEOPLE

SANITARY SEWER DESIGN SHEET
MUNICIPALITY OF MIDLESEX CENTRE
CITY ENGINEER'S DEPARTMENT

PROJECT NAME : Inglis Subdivision - Sanitary Capacity Analysis

DATE : October 2019
DESIGNED BY : JJM
CHECKED BY :
FILE No : 43705-104
SHEET : 1of1

DESIGN CRITERIA

SEWAGE = 350 L/DAY/CAP = 0.00405 x 1.1 l/s/person
INFILTRATION = 8640 L/HA/DAY = infilt. of 0.100 l/s/ha
PEAKING FACTOR = HARMON FORMULA $M = 0.8 * [1 + \frac{14}{4 + P^{0.5}}]$

LOCATION				AREA (HECTARES)			POPULATION					SEWAGE FLOW				SEWER DESIGN					Source of Information					
AREA No.	STREET	FROM M.H.	TO M.H.	NET OR GROSS	DELTA AREA ha	TOTAL AREA ha	PER ha	PER LOT	No. OF LOTS	DELTA POP.	TOTAL POP.	M Min.2.0	SEWAGE l/s	INFILT. l/s	TOTAL l/s	DIA. mm	SLOPE %	n	VELOCITY m / s	CAP. l / s	Dwg #	Prepared By	Dated
	Proposed Site		118		7.30	7.30		2.4	8	20.00	20	3.50	0.31	0.73	**1.04**								
					0.00	7.30		3	132	396.00	416	3.21	5.95	0.73	**6.68**								
	Existing	119	118		0.68	0.68		4	6	24.00	24	3.50	0.37	0.07	**0.44**						Project: Fieldstone Estates Phases 4 & 5		
	Queen Street	118	117		0.71	8.69		4	6	24.00	464	3.19	6.60	0.87	**7.47**	200	0.49	0.013	0.73	22.96	Sanitary Area Plan	ENG PLUS	Nov. 23, 2009
		117	Ex. 44		1.58	10.27		4	11	44.00	508	3.18	7.19	1.03	**8.22**	200	0.61	0.013	0.82	25.62	Design Sheets	ENG PLUS	Nov. 23, 2009
	Simcoe Avenue	Ex. 44	Ex. 43		0.69	10.96		3	6	18.00	526	3.17	7.43	1.10	**8.53**	200	3.35	0.013	1.91	60.03	Sanitary sewer slopes taken from Fieldstone Estates Project		
		Ex. 43	Ex. 42		1.05	12.01		3	10	30.00	556	3.16	7.83	1.20	**9.03**	200	0.42	0.013	0.68	21.26	Dwg 11	MTE	02/08/2017
		Ex. 42	Ex. 41		0.89	12.90		3	8	24.00	580	3.15	8.15	1.29	**9.44**	200	0.42	0.013	0.68	21.26			
	External 1		Ex. 41			5.85		3	47		141	3.36	2.11	0.59	**2.70**						External Area from Fieldstone Estates - Komoka Phase 2		
																					P&P dgws	Eng Plus	June 27/11
																					Population from unit count based on aerial photography (Google)		
	Simcoe Cres.	Ex. 41	46		1.14	19.89		3	4	12.00	733	3.10	10.14	1.99	**12.13**	200	0.36	0.013	0.63	19.68	Unit Counts and Sewer Sizes & Slopes From		
		46	47		1.24	21.13		3	4	12.00	745	3.10	10.30	2.11	**12.41**	200	0.30	0.013	0.57	17.97	Sewage Works Project No 52-0030-01		
		47	48		0.00	21.13		3	2	6.00	751	3.10	10.39	2.11	**12.50**	200	0.30	0.013	0.57	17.97	S 19 & S20	Totten Sims Hubicki Associates	January 1995
																					Contributing Area Estimates from		
																					Village of Komoka Sanitary Sewer System Project		
																					Design sheets	Totten Sims Hubicki Associates	24-Nov-94
	External 2		48			3.97		3	21		63	3.43	0.96	0.40	**1.36**						Population from unit count based on aerial photograph (Google)		
																					Area estimate from Village of Komoka Sanitary Sewer System Project		
																					Design sheets	Totten Sims Hubicki Associates	24-Nov-94
																					Drainage pattern discerned from		
																					Sewage Works Project No 52-0030-01		
																					S20	Totten Sims Hubicki Associates	January 1995
	Springer Street	48	48A		0.00	25.10		3		0.00	814	3.09	11.20	2.51	**13.71**	250	0.38	0.013	0.75	36.66	Sewage Works Project No 52-0030-01		
		48A	69		0.00	25.10		3		0.00	814	3.09	11.20	2.51	**13.71**	250	0.34	0.013	0.71	34.68	S23	Totten Sims Hubicki Associates	January 1995
	External 3		69			4.73					142	3.36	2.13	0.47	**2.60**						External Area and Population from		
																					Village of Komoka Sanitary Sewer System Project		
																					Design sheets	Totten Sims Hubicki Associates	24-Nov-94
		69	69A		0.58	30.41		3	2	6.00	962	3.05	13.07	3.04	**16.11**	250	0.30	0.013	0.66	32.57	Unit Count and Sewer Info from		
		69A	79		0.58	30.99		19	3	57.00	1019	3.03	13.77	3.10	**16.87**	250	0.30	0.013	0.66	32.57	Sewage Works Project No 52-0030-01		
																					S23	Totten Sims Hubicki Associates	January 1995
																					Area Estimate from		
																					Village of Komoka Sanitary Sewer System Project		
																					Design sheets	Totten Sims Hubicki Associates	24-Nov-94

Appendix B

Water Distribution Modelling Information

Project: Inglis Subdivision
Project No: 43705-104
Location: Komoka, ON
Date: 8-Jun-20
Designer: JJM

Criteria and Background

Average Day Consumption:	350	L/day/cap
	0.004	L/s/cap
Max Day Peaking Factor:	2.75	
Peak Hour Peaking Factor:	4.13	

Lots

Proposed:	59
Future (assumed):	83
Population:	422

Boundary Condition

Local Hydrant:	KO-94 (Test Completed May, 2015)	
Elevation:	249.20	masl
Static Pressure:	50.3	psi
	35.4	m H_2O
HGL Elevation:	284.6	masl

Pressure Requirements (kPa)

Avg. Day:	275	(minimum)
Max Day:	275	(minimum)
Peak Hour:	N/A	
Max Day + Fire:	140	(minimum)
Max Allowable:	550	(maximum)

Demands

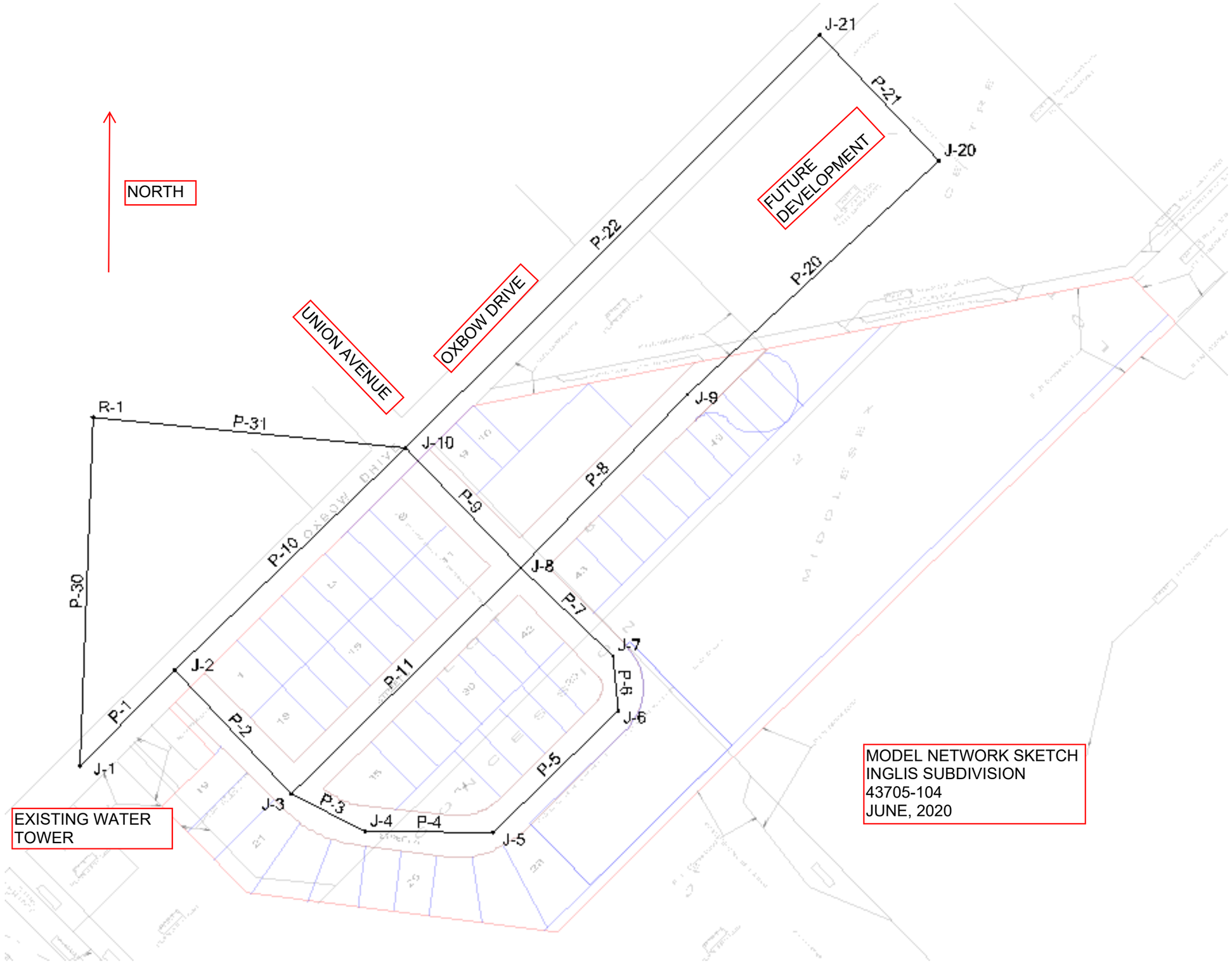
Node	Units	# Units	ppu	Total Population	Demands (L/s)		
					Avg Day	Max Day	Peak Hour
J-2	1-4	4	3	12	0.049	0.134	0.201
J-3	15-18, 19-22, 35-38	12	3	36	0.146	0.401	0.602
J-4	22-25	4	3	12	0.049	0.134	0.201
J-5	26-28, 32-34	7	3	21	0.085	0.234	0.351
J-6	29-31	3	3	9	0.036	0.100	0.151
J-7	-						
J-8	11-14, 39-45,	11	3				
	BLK 50	8	2.4	52	0.211	0.582	0.873
J-9	46-49	4	3	12	0.049	0.134	0.201
J-10	5-10	6	3	18	0.073	0.201	0.301
J-11	Future	83	3	249	1.009	2.774	4.166

Node Info and Results Summary

Node	Elevation	Proposed Conditions					Future Conditions				
		Pressure (kPa)			Available Fire Flow	Max Age (hrs)	Pressure (kPa)			Available Fire Flow	Max Age (hrs)
		Avg Day	Max Day	Peak Hour			Avg Day	Max Day	Peak Hour		
J-1	253.20	307.3	307.3	307.3	-	1.4	307.3	307.3	307.3	-	0.7
J-2	252.55	313.7	313.7	313.7	-	5.4	313.7	313.6	313.6	-	2.6
J-3	249.60	342.5	342.5	342.5	139	11.7	342.5	342.5	342.4	143	4.2
J-4	248.60	352.3	352.3	352.3	122	16.1	352.3	352.3	352.2	124	5.7
J-5	248.50	353.3	353.3	353.3	128	28.2	353.3	353.3	353.2	142	8.7
J-6	249.70	341.6	341.6	341.5	119	11.0	341.6	341.5	341.5	124	16.1
J-7	249.20	346.5	346.4	346.4	114	8.4	346.4	346.4	346.3	114	19.7
J-8	249.30	345.5	345.5	345.5	109	2.3	345.5	345.4	345.4	120	3.7
J-9	249.90	339.6	339.6	339.6	109	35.1	339.6	339.5	339.4	127	5.6
J-10	251.20	326.9	326.9	326.9	-	0.4	326.9	326.9	326.9	-	0.2
J-20	250.75	*(N/A)*	*(N/A)*	*(N/A)*	*(N/A)*	*(N/A)*	331.3	331.2	331.1	134	8.4
J-21	249.00	*(N/A)*	*(N/A)*	*(N/A)*	-	*(N/A)*	348.4	348.3	348.2	-	6.0

Pipe Info and Result Summary

Pipe	Hazen-Williams 'C' Value	Size	Length	Proposed Conditions					Future Conditions					
				Velocity (m/s)					Velocity (m/s)					
				Peak Hour	J-3	J-5	J-8	J-9	Peak Hour	J-3	J-5	J-8	J-9	J-20
P-1	100	150	66	0.04	1.73	1.48	1.13	1.13	0.07	1.69	1.42	1.04	0.99	0.94
P-2	110	200	83	0.06	1.58	1.35	1.03	1.03	0.06	1.54	1.29	0.94	0.9	0.85
P-3	110	200	41	0.02	1.02	1.68	0.65	0.65	0.03	1.04	1.66	0.59	0.57	0.54
P-4	110	200	63	0.01	1.02	1.68	0.65	0.65	0.02	1.05	1.65	0.59	0.56	0.53
P-5	110	200	86	0.01	1.03	1.51	0.64	0.64	0.01	1.05	1.54	0.58	0.55	0.52
P-6	110	200	27	0.02	1.03	1.52	0.64	0.64	0.01	1.06	1.54	0.58	0.55	0.52
P-7	110	200	63	0.02	1.03	1.52	0.64	0.64	0.01	1.06	1.54	0.58	0.55	0.52
P-8	110	250	118	0.01	0.00	0.00	0.00	2.04	0.07	0.12	0.14	0.18	1.77	1.68
P-9	110	200	82	0.07	1.65	1.89	2.2	2.2	0.12	1.5	1.71	2.01	1.91	1.81
P-10	100	150	157	0.03	1.09	0.93	0.71	0.71	0.05	1.06	0.89	0.65	0.62	0.59
P-11	100	150	158	0.00	1.06	0.62	0.66	0.66	0.02	1.08	0.67	0.6	0.57	0.54
P-20	110	250	168	*(N/A)*	*(N/A)*	*(N/A)*	*(N/A)*	*(N/A)*	0.06	0.12	0.15	0.18	0.27	1.68
P-21	100	150	85	*(N/A)*	*(N/A)*	*(N/A)*	*(N/A)*	*(N/A)*	0.06	0.49	0.56	0.66	0.91	1.16
P-22	100	150	287	*(N/A)*	*(N/A)*	*(N/A)*	*(N/A)*	*(N/A)*	0.06	0.49	0.56	0.66	0.91	1.16


NORTH
UNION AVENUE
OXBOW DRIVE
FUTURE DEVELOPMENT
R-1
P-31
J-10
P-22
J-21
P-21
J-20
P-20
J-9
P-8
P-9
J-8
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J-3
P-2
J-2
P-1
J-1
P-30
P-10
P-11
EXISTING WATER TOWER
MODEL NETWORK SKETCH
INGLIS SUBDIVISION
43705-104
JUNE, 2020

Appendix C

Geotechnical Report

10125 Oxbow Drive Development

Geotechnical Investigation

Project Location:
10125 Oxbow Drive
Komoka, ON

Prepared for:
2270942 Ontario Ltd.
P.O. Box 63
Formosa, ON N0G 1W0

Prepared by:
MTE Consultants
123 St. George Street
London, ON N6A 3A1

April 2, 2020

MTE File No.: 43705-301

Engineers, Scientists, Surveyors.

Contents

Tables

Appendices

1.0 Introduction

MTE Consultants Inc. (MTE) was retained by Ms. Heather Johnson-Inglis to conduct a geotechnical investigation for a proposed development at 10125 Oxbow Drive, Komoka Ontario, as shown on **Figure 1 in Appendix A**. The 7.7 hectare site is currently vacant and was a previous aggregate extraction pit.

The site is bordered to the north by Oxbow Drive and a retirement facility; to the east by residential buildings; to the west by a park and Municipality lands and to the south by a golf course. The ground surface generally slopes from north to south from approximate Elevation 251.5 to 245.5 metres (m).

A previous report was completed by LVM entitled "Planned Residential Subdivision, 10125 Oxbow Drive, Komoka, Ontario" dated May 20, 2015. The previous boreholes from LVM have been incorporated into this report. Geodetic elevations have been added to the LVM borehole logs based on the site benchmark used in the previous investigation. The borehole logs from the previous report are provided in Appendix B.

The purpose of this geotechnical investigation is to determine the soil and groundwater conditions in the area of the proposed development and provide geotechnical engineering recommendations for site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration.

2.0 Field and Laboratory Program

The fieldwork for this investigation was carried out between December 10 and 19, 2019 and involved the drilling of eight boreholes (Boreholes MW101-19 to BH108-19) to depths ranging from 5.0 to 11.3 m. The locations of the boreholes are shown on the Site Plan, **Figure 2 in Appendix A**.

Private and public utility companies were contacted prior to the start of drilling activities in order to isolate underground utilities near the boring locations.

The boreholes were advanced with a D50 track mounted drill rig equipped with continuous flight hollow stem augers, supplied and operated by London Soil Test Ltd.

Representative soil samples were recovered throughout the depths explored. Standard Penetration Tests (SPT) were carried out during sampling operations in the boreholes using conventional split spoon equipment. The SPT N-values recorded are plotted on the borehole logs in **Appendix B**.

Upon completion of drilling, monitoring wells were installed in MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19. The remaining boreholes were backfilled with soil cuttings and bentonite in accordance with Ontario Regulation 468/10 (formerly O. Reg. 903) under the provinces Water Resources Act.

Five 50 mm diameter monitoring wells were installed in Boreholes MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19 to allow measurement of stabilized groundwater levels and groundwater sampling and testing, if required. The installations comprised 1.5 m filtered screen and bentonite seals above the screen. Stabilized water level measurements were taken by MTE on January 7 and February 4, 2020. Details of the installation and groundwater observations and measurements are provided on the appended borehole logs.

The monitoring wells were installed in accordance to Ontario Regulation 468/10. A licensed well technician must properly decommission all wells before construction. The construction,

maintenance and abandonment of the wells are regulated under the province's Water Resources Act.

The fieldwork was monitored throughout by a member of our geotechnical engineering staff, who directed the drilling procedures; conducted SPT tests; documented the soil stratigraphies; monitored the groundwater conditions; and transported the recovered soil samples back to our office for further classification.

The ground surface elevations at the borehole locations were surveyed by MTE OLS Ltd. and referenced to geodetic datum.

All of the soil samples collected were submitted for moisture content testing and six soil samples were submitted for particle size distribution analyses. The results of the laboratory tests are provided in **Appendix C**. The remaining soil samples will be stored for a period of 1 month and will be discarded of at that time without prior request from the client to extend storage time.

3.0 Soil Conditions

Reference is provided to the appended borehole logs for soil stratigraphy details, SPT N-values, moisture content profiles, and groundwater observations and measurements. Soil conditions encountered at the site typically include topsoil/fill materials overlying granular deposits and silt.

3.1 Topsoil

Topsoil/Surficial organic fill was encountered surficially in all of the boreholes and was 80 to 915 mm thick (average thickness = 430 mm). The topsoil typically comprises dark brown silty to sandy topsoil. A layer of buried topsoil was encountered MW108-19 at a depth of 1.1 m and was 30 mm thick. Topsoil was determined through visual observation and no nutrient testing for applicable plant growth was performed as part of the scope of work for this project.

3.2 Fill Material

Variable fill material was encountered beneath topsoil in Boreholes MW101-19, BH102-19, MW104-19, BH105-19, BH106-19 and MW108-19. The fill materials ranged in thickness from 40 mm to 9.3 m and extended to depths of 0.1 to 9.4 m. The fill was deepest at the northern part of the site near Oxbow Drive. The fill typically ranges in composition from sand to silty sand to sand and gravel with rootlets. SPT N-values measured in the fill ranged from 5 to 19 blows per 300 mm penetration of the split spoon sampler indicating loose to compact conditions. Insitu moisture contents in the fill were 5 to 19% indicating moist to wet conditions.

Fill materials encountered in the LVM Boreholes BH01-15 to BH06-15 ranged in thickness from 0.7 to 8.5 m and extended to the termination depth of Borehole 04-15.

3.3 Granular Deposits

Granular soils were encountered beneath topsoil, fill materials or silts in all of the boreholes. The granular deposits were about 1.0 to 7.9 m. All boreholes were terminated in the granular soils except for MW104-19, BH106-19 and MW108-19. The granular soils typically range in composition from sand to silty sand to gravelly sand to sand and gravel. The results of six particle size distribution analyses conducted on the granular deposits are provided in **Appendix C** and summarized in the following table;

Table 1 - Results of Granular Deposits Particle Size Distribution Analyses

Borehole Number	Sample Depth (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
MW101-19	10.7 - 11.3	0	85	14	1
MW103-19	7.6 - 8.2	53	40	6	1
MW104-19	7.6 - 8.1	24	66	9	1
BH106-19	3.8 – 4.3	0	73	26	1
MW107-19	3.8 - 4.4	0	73	26	1
MW108-19	1.5 - 2.0	3	87	9	1

SPT N-values measured in the granular soils range from 4 to greater than 50 blows per 300 mm penetration of the split spoon sampler indicating very loose to very dense conditions. Insitu moisture contents in the granular range from 2 to 20% indicating damp to wet conditions. Cobbles were encountered in MW103-19 and MW104-19 at depths of 5.3m and 4.4m, respectively, during drilling.

3.4 Silt and Clayey Silt Deposits

Silt to clayey silt was encountered beneath or interlayered in the granular soils in all of the boreholes except BH102-19, MW103-19 and MW107-19 and extends to the termination depth of MW104-19, BH106-19 and MW108-19. SPT N-values range from 26 to greater than 50 blows per 300 mm penetration of the split spoon sampler indicating compact to very dense conditions. Insitu moisture contents in the silt soils range from 8 to 21% indicating moist to wet conditions.

4.0 Groundwater Conditions

Groundwater observations were carried out in the open boreholes at the time of drilling and are summarized on the borehole logs. Groundwater was noted within the granular deposits or fill materials in all boreholes at depths of 0.9 to 9.1 m below the ground surface.

Groundwater levels were measured in MW101-19, MW103-19, MW104-19, MW107-19 and MW108-19 on January 7 and February 4, 2020 at depth of 0.5 to 8.8 m beneath the ground surface or Elevations 243.1 to 244.8 m. The results of the measured groundwater levels are summarized in the table below:

Table 2 – Groundwater Measurements

Borehole	Ground Surface Elevation (mASL	Measured Groundwater Level January 7, 2020		Measured Groundwater Level February 4, 2020	
		Depth (m)	Elevation (m)	Depth (m)	Elevation (m)
MW101-19	251.9	8.79	243.11	8.33	243.57
MW103-19	250.9	7.45	243.45	7.17	243.73
MW104-19	250.2	6.29	243.91	6.01	244.19
MW107-19	245.8	1.72	244.08	1.10	244.70
MW108-19	245.3	0.85	244.45	0.54	244.76

It should be noted that the groundwater levels can vary and are subject to seasonal fluctuations and local variations.

5.0 Discussion and Recommendations

5.1 General

The project involves the design for a proposed development located at 10125 Oxbow Drive in Komoka, Ontario. Based on the detailed design information known at the time of preparing this report, a total of about 97 residential lots were proposed with a stormwater management dry pond to the west part of the property and a medium density block to the southeast corner.

The subsurface stratigraphy at the site generally comprises topsoil and/or fill materials overlying granular soils and silt deposits. Groundwater was measured within the granular deposits about 0.5 to 8.8 m below the ground surface or Elevations 243.1 to 244.8 m in MW101-19, MW103-19, MW104-19, MW107-9 and MW108-19 on January 7 and February 4, 2020.

Based on the results of this geotechnical investigation, the proposed development will be problematic due to the thickness of fill soils on site and the elevation difference across the site. The following subsections of this report contain geotechnical recommendations pertaining to development of the property; including, site grading, site servicing, foundations, basements, floor slabs, pavement design, subdrainage requirements, and stormwater infiltration. It is recommended that geotechnical consultant provide additional recommendations once the final grading, servicing and cut/fill plans are completed.

5.2 Site Preparation

The first construction activity that will be required for the proposed development will be grading. Prior to carrying out any cutting and engineering fill operations, the surficial topsoil and fill materials must be removed and stockpiled. The average topsoil and fill thickness for the north part of the site (BH102-19 and LVM Boreholes BH01-15 to BH05-15) was approximately 7.7 m. The topsoil and fill materials thickness in the remaining areas of the property averaged about 0.7 m. The topsoil and fill soils could be used in landscaping areas.

The southern part of the site will require a grade raise to construct the proposed design of the development. The majority of the existing fill materials are not suitable for use as structural fill but could be used in parkland or landscape areas where no bearing capacity is required.

The majority of the inorganic native soils above the groundwater table are suitable for reuse as engineered fill if sufficient drying time is allotted. All fill should be placed in maximum 300 mm thick lifts and compacted to the following percentages;

Table 3 - Engineered Fill Requirements

Fill Use	Minimum Compaction Required
Structural fill to support buildings	100% SPMDD
Subgrade fill beneath pavements or services	95%SPMDD
Bulk fill in landscape area	90%SPMDD

The subgrade soils are susceptible to disturbance due to the silt content, and it is recommended that construction traffic on the subgrade be minimized.

Structural fill used for raising grades beneath the buildings should comprise granular material such as OPSS Granular 'B'. Any imported fill should be tested and verified by a geotechnical engineer prior to placement.

Structural fill pads should extend a minimum 0.3 m beyond the edge of the footing envelope of any building and down to subgrade at an angle of 45 degrees to the horizontal. Full time testing by geotechnical personnel is recommended during fill placement and compaction to monitor material quality, lift thickness, and verify the compaction by insitu density testing.

In order to minimize the effects of weather and groundwater, fill operations onsite should be carried out in the dry summer months.

5.3 Site Servicing

5.3.1 Excavations and Dewatering

The development will be serviced with full municipal services. It is anticipated that the invert levels for the watermain and sewers will be at conventional depths in engineered fill soils.

Temporary excavations to conventional depths for installation of underground pipes at this site must comply with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil, fill materials and granular soils encountered in the boreholes would be classified as Type 3 soils (O. Reg. 213/91, s. 226 (4)), exclusive of groundwater effects. Temporary side slopes must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation for open cut pipe installation.

Trench side slopes must be continuously inspected especially after periods of heavy rainfall or snow melt to identify areas of instability. Surface water should be directed away from entering the trench.

Groundwater inflow should be expected where the excavations extend into the groundwater encountered within the granular deposits at about Elevations 243.1 to 244.8 m. It is our geotechnical opinion that proactive dewatering in the form of vacuum well points or the like would be required to handle the groundwater infiltration in this area if excavations extend below the groundwater level. It will be necessary to flatten the excavation side slopes where groundwater seepage is occurring to ensure stability. Every excavation that a worker may be required to enter shall be kept reasonably free of water (O. Reg. 213/91, s. 230).

It should be noted that an Environmental Activity and Sector Registry (EASR) or Permit to Take Water (PTTW) will be required for the dewatering system for sewer installations at the site installed below the groundwater level. The design of the dewatering system should be

completed by a specialized dewatering contractor to control groundwater at least 0.5 m below the invert level in order to provide stable excavation base.

5.3.2 Pipe Bedding

It is anticipated invert elevation of the pipes will be at conventional 2 to 3 m depths below ground surface. No bearing problems are anticipated for pipes set on properly dewatered native inorganic subsoil or imported structural fill. The existing fill and topsoil are not suitable to support pipes without significant settlement. The bedding material may need to be thickened if sub-excavation encounters soft or spongy soil from the base of the service trench.

Pipe bedding for water and sewer services should be conventional Class 'B' pipe bedding comprising a minimum 150 mm thick layer of OPSS Granular 'A' aggregate below the pipe invert. Granular 'A' type aggregate should be provided around the pipe to at least 300 mm above the pipe and the bedding aggregate should be compacted to a minimum 95% Standard Proctor Maximum Dry Density (SPMDD).

A well-graded clear stone such as Coarse Aggregate for HL4 Asphaltic Concrete (OPSS 1003) could be used in the sewer trenches as bedding below the spring line of the pipe to facilitate sump pump dewatering, if necessary. The clear stone should be compacted with a plate tamper and fully wrapped with a non-woven filter cloth.

5.3.3 Trench Backfilling

The trenches above the specified pipe bedding should be backfilled with inorganic onsite soils placed in 300 mm thick lifts and compacted to at least 95% SPMDD. Wet or saturated native soils are not considered suitable for reuse as trench backfill. Any additional material required at the site should comprise imported granular soils such as OPSS Select Subgrade Material.

To minimize potential problems, backfilling operations should follow closely after excavation so that only a minimal length of trench is exposed. Care should be taken to protect side slopes of excavations by diverting surface run-off away from the excavations. If construction extends into the winter, then additional steps should be taken to minimize frost and ensure that frozen material is not used as backfill.

5.4 Pavements

It is understood pavements will be constructed for the proposed roadways at the site. The pavement subgrade soils will comprise native inorganic soils or imported structural fill.

The pavement component thicknesses in the following table are recommended based on the proposed pavement usage, the frost-susceptibility and strength of the subgrade soils, Municipality standards and the Benkelman beam spring rebound coefficient for granular soils;

Table 4 - Pavement Design

Pavement Component	Light Duty	Heavy Duty
Asphalt Hot Mix	90 mm	110 mm
OPSS 1010 Granular ‘A’ Base	150 mm	150 mm
OPSS 1010 Granular ‘B’ Subbase	350 mm	450 mm

Heavy duty pavements should be used for main access ways to the development and where large vehicles will frequent, such as garbage and fire trucks.

Samples of aggregates should be checked for conformance to OPSS 1010 prior to utilization on site and during construction. The Granular 'B' subbase and Granular 'A' base courses must be compacted to 100% SPMDD, as verified by insitu density testing.

The asphaltic concrete paving materials should conform to the requirements of OPSS 1150. The asphalt should be placed and compacted in accordance with OPSS 310. The Performance Graded Asphalt Cement designation for the asphaltic concrete is 58-28.

The asphaltic concrete should comprise 40 mm of HL3 surface over 50 mm of HL8 binder for the light duty pavement option and 50 mm of HL3 surface over 60 mm of HL8 binder for the heavy duty pavement option.

The pavement design is based on the assumption that construction will be carried out during the drier time of the year and that the subgrade soil is stable as determined by proof-rolling inspected by a geotechnical engineer. If the subgrade is wet and unstable, additional granular subbase will be required.

All materials and construction services required for the work should be in accordance with the relevant sections of the Ontario Provincial Standard Specifications.

It is strongly recommended to install subdrains beneath the low areas of pavement and connected to catchbasins. The purpose of the subdrains is to remove excess subsurface water in order to improve overall pavement serviceability and increase the pavement life. Consideration should be given to providing continuous subdrains along the perimeter edges of the new roadways to promote drainage of the granular materials.

The work of subdrain installation shall be in accordance with OPSS 405 and OPSD 216.021. The subdrain shall be 100 or 150 mm diameter perforated pipe conforming to OPSS 1801 or 1840, and wrapped with geotextile conforming to OPSS 1860.

5.5 Curbs, Gutter and Sidewalks

The concrete for curbs, gutters and sidewalks should be proportioned, mixed, placed and cured in accordance with the requirements of OPSS 353, and OPSS 1350 and shall meet the Municipality of Middlesex Centre standards or specific requirements (OPSS 353.05.01):

- Minimum compressive strength = 30 MPa at 28 days
- Coarse aggregate = 19.0 mm nominal max. size
- Maximum slump = 60 mm for curb and gutter, 70 mm for sidewalks
- Air entrainment = 7.0 ± 1.5%

During cold weather any freshly placed concrete must be covered with insulating blankets to protect against freezing as per OPSS 904. Three cylinders from each day's pour should be taken for compressive strength testing. Air entrainment, temperature and slump tests should be conducted on the same batch of concrete from the test cylinders made.

5.6 Foundation Design

It is understood that the proposed building design may be constructed with slab-on-grade floors or with full basements.

In general, the undisturbed compact native soils or approved structural fill is considered suitable to support building foundations.

Building footings constructed on the undisturbed compact native granular soils or approved structural fill may be designed for a factored geotechnical bearing resistance at Ultimate Limit States (ULS) of 225 kPa, and soil bearing resistance for 25 mm of settlement at Serviceability

Limit States (SLS) of 150 kPa. The existing fill and topsoil are not suitable to support building foundations.

The founding materials are susceptible to disturbance by construction activity, especially during wet weather and care should be taken to preserve the integrity of the material as bearing strata.

The soil in trenches beneath footings for sewer and watermain services shall be compacted by tamping up to the level of the footing base, or shall be filled with concrete having a strength not less than 10 MPa, to support the footing.

The footing areas must be inspected by a geotechnical engineer to ensure that the soil conditions encountered at the time of construction are suitable to support the design resistances prior to pouring concrete. Any loose, disturbed, organic and deleterious material identified during the inspection should be removed from the footing areas and replaced with structural fill or concrete.

All exterior floor slabs and footings in unheated areas must be provided with a minimum 1.2 m of earth cover after final grading in order to minimize the potential of damage due to frost action, as per Ontario Provincial Standard Drawing, OPSD 3090.101, dated November 2010. If construction is undertaken during the winter, the subgrade soil and concrete should be protected from freezing.

A modulus of subgrade reaction of 25 MPa/m should be used in the design of the floor slab.

A minimum 150 mm thick layer of Granular 'A' material uniformly compacted to 100% SPMDD should be provided directly beneath the floor slab for leveling and support purposes.

Where spread footings are constructed at different elevations, the difference in elevation in the individual footing should not be greater than one half of the clear distance between the footings. The lower footing should be constructed first so that if it is necessary to construct the lower footings at a greater depth than anticipated, the elevation of the upper footings can be adjusted accordingly. Stepped strip footings should be constructed in accordance with OBC Section 9.15.3.8.

A Site Classification ‘D’ should be used for earthquake load and effects in accordance with Table 4.1.8.4.A. of the 2012 Ontario Building Code.

All excavations at the site should be carried out in conformance with the Ontario Occupational Health and Safety Act and Regulations for Construction Projects. The topsoil, fill materials and granular soils encountered in the boreholes would be classified as Type 3 soils, and temporary side slopes through this material must be cut at an inclination of 1.0 horizontal to 1.0 vertical or less from the base of the excavation, exclusive of groundwater effects.

5.6.1 Basements

It is understood that basements may be installed for the proposed buildings at the site. Basement construction at the site may be problematic if a grade raise is not employed. The basement excavations will encounter groundwater conditions in the granular soils at Elevations 243.1 to 244.8 m. We recommend the basement floor levels be designed a minimum 0.5 m above the seasonal high groundwater elevations.

Basements at this site must be provided with perimeter weeping tile systems as per the Ontario Building Code (Section 9.14). The drain tile or pipe should be laid on undisturbed or well compacted soil so that the top of the tile or pipe (minimum 100 mm diameter) is below the bottom of the basement floor slab. The top and sides of the drain tile or pipe shall be surrounded with not less than 150 mm of crushed stone or other clean coarse granular material containing no more than 10% of material that will pass the 4 mm sieve. The crushed stone

should be wrapped with filter cloth. The weeping tile must drain to a suitable frost-free outlet or sump equipped with an automatic pump that will discharge water into a storm sewer service or other frost free outlet.

The portion of the exterior basement wall and floor slab below finished ground level must be waterproofed as per the Ontario Building Code (Subsection 9.13.3). Free-draining sand materials should be used for basement wall backfill. The basement wall backfill should be graded to allow drainage away from the foundation.

The basement walls should be designed to resist the lateral earth pressure. For calculating the lateral earth pressure, the coefficient of earth pressure (K) may be assumed as 0.50 for cohesionless sandy soils and 1.0 for silt and clay (Section 24.12.3.3 Canadian Foundation Engineering Manual). The bulk unit weight of the retained backfill may be taken as 21 kN/m^3 for well-compacted soil. An appropriate factor of safety should be employed.

The subgrade for the basement floor slabs should comprise undisturbed compact native soil or well compacted fill. A minimum 100 mm thick layer of coarse clean granular material containing not more than 10% material that will pass a 4 mm sieve shall be placed beneath slabs in houses as per Subsection 9.16.2 of the Ontario Building Code. If the subgrade soil is wet, we strongly recommend that subfloor weeping tiles be placed and connected to the sump pit.

If a moisture-sensitive floor finish is to be applied to the slab, then we recommend that a 15 mil polyethylene moisture vapour barrier be installed directly beneath the slab as per Article 9.13.2.7 of the Ontario Building Code. The purpose of the vapour barrier is to reduce moisture transfer by diffusion as per Article 5.5.1.2 of the Ontario Building Code. Joints in the vapour barrier should be lapped not less than 100 mm.

Concrete testing should be performed onsite to determine the slump, temperature, and air entrainment; and concrete cylinders should be cast for compressive strength testing.

5.7 Storm water Infiltration

It is understood that at-source infiltration of stormwater runoff from the development may also be considered for this site. Soak-away pits generally require soils with a minimum percolation rate of 15 mm/hr and a minimum separation between the bottom of the pit and the seasonally high water table of 1 m (MOE, 2003). Six particle size distribution analyses were carried out on the granular deposits encountered at the site. They are plotted on **Table 101 in Appendix C**.

The estimated vertical hydraulic conductivity (k) is derived from an empirical formula by Hazen and Beyer. The estimated design infiltration rate is based on recommendations found in the Low Impact Development Stormwater Management Planning and Design Guide, Appendix C, Version 1.0, 2011, published by the Toronto and Region (TRCA) and the Credit Valley (CVC) Conservation Authority, and the approximate relationship between hydraulic conductivity and infiltration rate. A Factor of Safety of 2.5 has been applied to the calculated infiltration rates.

Table 5 - Infiltration Rates for Native Soils

Borehole Number	Sample Depth (m)	Borehole Elevation (mASL)	Soil Type	Estimated K-Value (m/sec)	Infiltration Rate (mm/hr)
MW101-19	10.7 – 11.3	251.9	Sand	3.9E-5	49
MW103-19	7.6 – 8.2	250.9	Sand and Gravel	7.4E-3	201
MW104-19	7.6 – 8.1	250.2	Gravelly Sand	6.5E-5	56
BH106-19	3.8 – 4.3	245.3	Silty Sand	1.7E-5	39
MW107-19	3.8 – 4.3	245.8	Silty Sand	2.9E-5	46
MW108-19	1.5 – 2.0	245.3	Sand	6.5E-5	57

It is our opinion that at-source infiltration of stormwater runoff is feasible for this development but will be dependent on the type of imported structural fill soils used to raise grades at the site.

5.8 Construction inspection and Testing

MTE recommends that geotechnical inspection and testing procedures be conducted throughout the various phases of the project.

Engineer site visits should be conducted to confirm geotechnical bearing resistances for footings. Soil compaction testing should be carried out on structural fill beneath the residential buildings, foundation wall backfill, subslab granular fill, and trench backfill. Laboratory and field testing of the pavement structure components (granulars and asphaltic concrete) should be conducted, as well as concrete testing for foundations, curbs and sidewalks.

MTE offers soil compaction, concrete, and asphalt testing as well as soil inspection services through our Stratford and London offices.

6.0 Limitations of Report

Services performed by MTE Consultants Inc. (MTE) were conducted in a manner consistent with the level of care and skill ordinarily exercised by members of the Geotechnical Engineering & Consulting profession practicing under similar conditions in the same geographic area were the services are provided. No other warranty or representation expressed or implied as to the accuracy of the information, conclusions or recommendations is included or intended in this report.

This report was completed for the sole use of the Client. This report is not intended to be exhaustive in scope or to imply a risk-free site. As such, this report may not deal with all issues potentially applicable to the site and may omit aspects which are or may be of interest to the reader.

In addition, it should be recognized that a soil sample result represents one distinct portion of a site at the time it is collected, and that the findings of this report are based on conditions as they existed during the time period of the investigation. The material in the report reflects our best judgment using the information available at the time the report was written. The soil and groundwater conditions between and beyond the test holes may differ from those encountered in the test holes. Should subsurface conditions arise that are different from those in the test holes MTE should be notified to determine whether or not changes should be made as a result of these conditions.

It should be recognized that the passage of time may affect the views, conclusions and recommendations (if any) provided in this report because groundwater conditions of a property can change, along with regulatory requirements. All design details were not known at the time of submission of this report and it is recommended MTE should be retained to review the final design documents prior to construction to confirm they are consistent with our report recommendations. Should additional or new information become available, MTE recommends that it be brought to our attention in order that we may determine whether it affects the contents of this report.

Any use which another party makes of this report, or any reliance on, or decisions to be made based upon it, are the responsibility of such parties. MTE accepts no responsibility for liabilities incurred by or damages, if any, suffered by another party as a result of decisions made or actions taken, based upon this report. Others with interest in the site should undertake their own investigations and studies to determine how or if the condition affects them or their plans. The contractors bidding on this project or undertaking the construction should make their own interpretation of the factual information and draw their own conclusions as to how subsurface conditions may affect their work.

The benchmark and elevations provided in this report are primarily established to identify differences between the test hole locations and should not be used for other purposes such as, planning, development, grading, and excavation.

All of which is respectfully submitted,

MTE Consultants Inc.

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BXT:MXW

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Appendix A

Figures

REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO

MTE
Engineers, Scientists, Surveyors
519-271-7952

SCALE: N.T.S

CLIENT: 2270942 ONTARIO LTD.

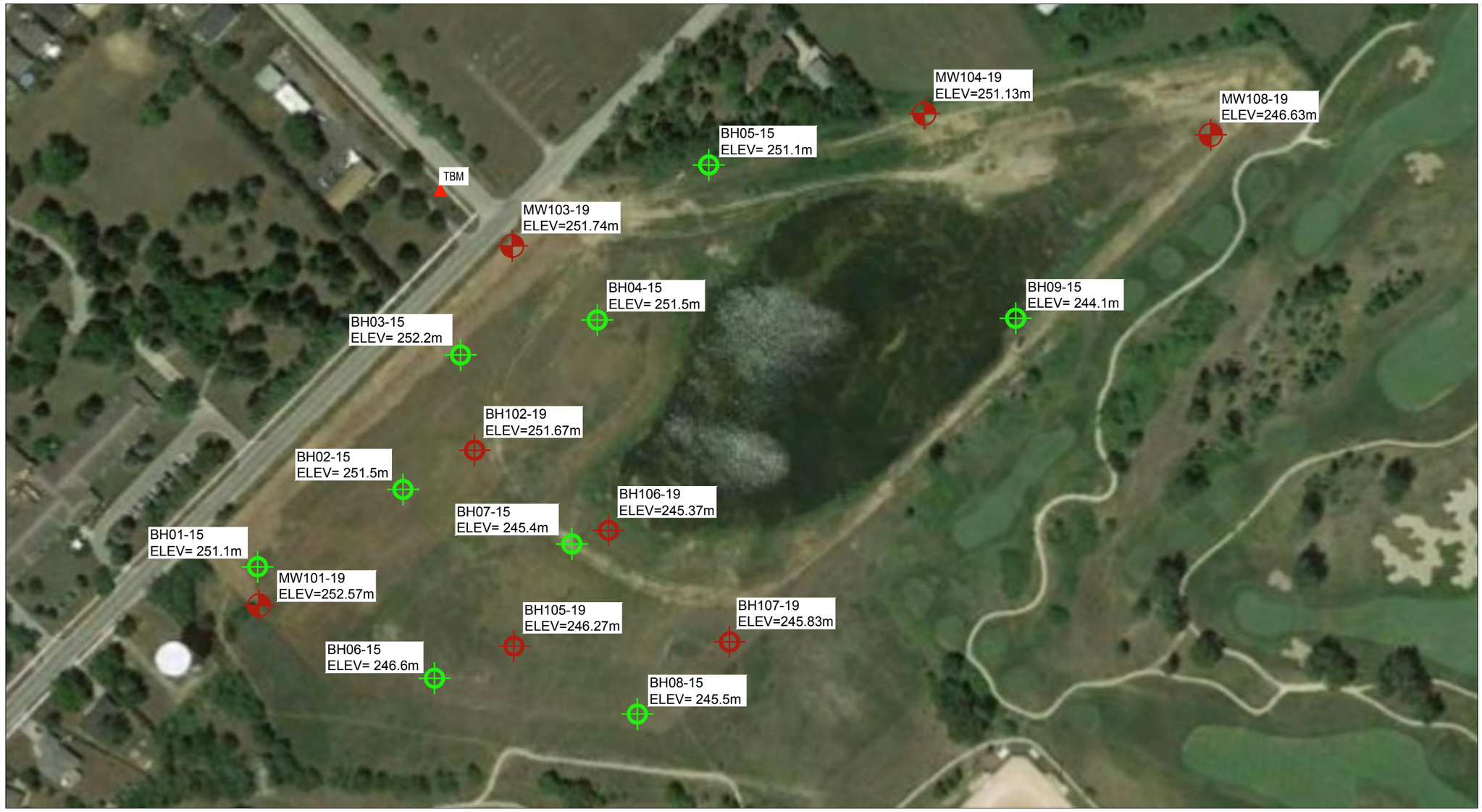
PROJECT: OXBOW DRIVE GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATION

SITE: 10125 OXBOW DRIVE, MIDDLESEX CENTRE, ONTARIO

TITLE: LOCATION PLAN

Reviewed By	DMG
Prepared By	AKW
Drawn By	AKW
Date	JANUARY 2020
Project No.	43705–301
Figure No.	1

N
NORTH



LEGEND

BH101-20 — MTE BOREHOLE

MW103-20 — MTE MONITORING WELL

BH01-15 — LVM BOREHOLE (2015)

TBM — TEMPORARY BENCHMARK

REFERENCES:

- AERIAL IMAGE FROM GOOGLE EARTH PRO.
- EXISTING LVM BH FROM LVM DWG #P-0008182-01-100 SHEET 002 REV 00
- TBM: EXISTING TOP OF FIRE HYDRANT NORTH OF SITE (TOP OF SPINDLE, ELEVATION=251.12m)

N

NORTH

0 20 40 60 80 100m

Scale(11x17): 1:2000

MTE
Engineers, Scientists, Surveyors
519-271-7952

CLIENT: 2270942 ONTARIO LTD.

PROJECT: OXBOW DRIVE GEOTECHNICAL AND HYDROGEOLOGICAL INVESTIGATION

SITE: 10125 OXBOW DRIVE, MIDDLESEX CENTRE, ONTARIO

TITLE: SITE PLAN

Reviewed By	BXT		
Prepared By	AKW	Project No.	43705-301
Drawn By	AKW	Figure No.	2
Date	JANUARY 2020		

Project: 43705-301 CAD: \\MTE85.LOCAL\MTE\DWG\P\43705\301\BH FIGURES\43705-2 SITE PLAN
January 16, 2020 - 11:07 a.m. - Plotted By: dgross

Appendix B

Borehole Logs

Abbreviations and Symbols

Boreholes BH101-19 to BH108-19

LVM Boreholes BH-01-15 to BH-09-15

ID Number: MW101-19

Project: 10125 Oxbow Drive Development

Project No: 43705-301

Client: 2270942 Ontario Ltd.

Site Location: 10125 Oxbow Drive, Komoka, ON

Drill Date: 12/11/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (Dynamic Cone)	Shear Strength (PP) kPa / Shear Strength (FV) kPa	Water Content %
0 / 0	Ground Surface	251.9					
	FILL (TOPSOIL) dark brown silty topsoil, some sand, moist (915mm)	0.0 / 251.0					
2 /	**FILL** brown clayey silt, some gravel, trace sand, moist	0.9	1	SS	6		14
4 /			2	SS	8		4
6 / 2	**SAND** loose to compact brown sand, trace to some silt, moist		3	SS	10		2
8 /			4	SS	17		3
10 /		248.2					3
12 / 4	some gravel	3.7 / 247.4	5	SS	26		3
14 /	compact	4.5 / 246.6	6	SS	30		2
16 /			7	SS	32		2
18 /	dense	5.3					
20 / 6			8	SS	32		2
22 /		245.1					
24 /	**SILT** very dense brown silt, some sand, moist	6.8 / 244.5	9	SS	50/127mm		11
26 / 8	trace clay with some sand seams	7.4	10	SS	94		15
28 /		243.2					
30 /	**SAND** very dense, sand, some silt, trace clay, wet	8.7	11	SS	50/279mm		16
32 / 10							
34 /							
36 /		240.6	12	SS	50/279mm		5
38 /	Drilling Terminated	11.3					
40 / 12							
42 /							

Groundwater Observations and Standpipe Details: Concrete; Bentonite; 8.3 mbgs (Feb. 4, 2020); 51 mm PVC Riser; Encountered; Sand Pack; 51mm Slotted Screen

Field Technician: M. Costello

Drafted by: M. Costello

Reviewed by: B. Thorner

Sheet: 1 of 1

Top of pipe elevation: 252.57m asl
Water encountered at 9.1mbgs during drilling
Water level measured at 243.11m asl on January 7, 2020
Water level measured at 243.57m asl on February 4, 2020

ID Number: BH102-19

Project: 10125 Oxbow Drive Development

Project No: 43705-301

Client: 2270942 Ontario Ltd.

Site Location: 10125 Oxbow Drive, Komoka, ON

Drill Date: 12/10/2019

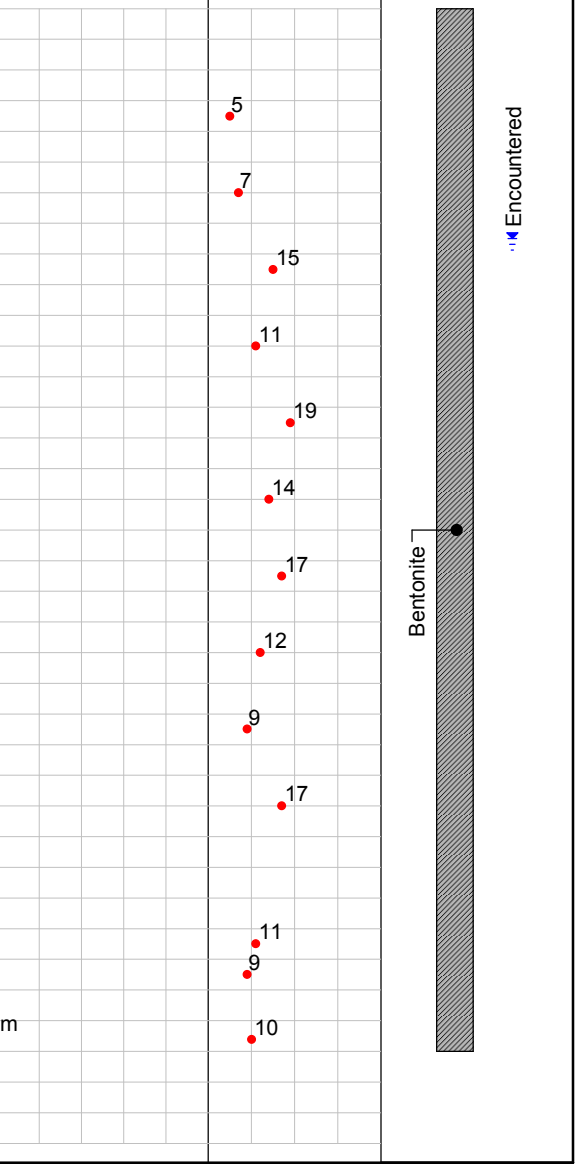
Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Augers

Protective Cover: N/A

Depth (ft)	Depth (m)	Symbol	Soil Description	Elevation (masl)	Depth (m)	Sample Number	Sample Type
0	0		Ground Surface	251.6	0.0		
			FILL (TOPSOIL) dark brown, clayey topsoil, some silt, very moist (150mm)				
			FILL compact brown silty sand, some clay, some gravel, moist			1	SS
			grey at 1.5mbgs	250.1	1.5	2	SS
2	2		stiff to very stiff grey clayey silt, some sand, some gravel, saturated with wood pieces	249.4	2.2	3	SS
			black sand and gravel layer (50mm) at 2.8mbgs	248.8	2.8	4	SS
4	4		firm brown with grey silt veins from at 4.5mbgs	247.1	4.5	5	SS
			grey-brown with some organics at 5.3mbgs	246.3	5.3	6	SS
6	6		compact grey sand, some gravel, wet	245.0	6.6	7	SS
			stiff grey clayey silt, some sand, some gravel, wet with grey mottling			8	SS
8	8		grey at 8.7mbgs	242.9	8.7	9	SS
			SAND compact to very dense brown sand, trace silt, gravel and clay, wet	242.2	9.4	10	SS
10	10		Drilling Terminated	241.2	10.4	11	SS
						12	SS



Field Technician: M. Costello

Drafted by: M. Costello

Reviewed by: B. Thorner

Sheet: 1 of 1

Water encountered at 2.3mbgs during drilling

ID Number: MW103-19

Project: 10125 Oxbow Drive Development

Project No: 43705-301

Client: 2270942 Ontario Ltd.

Site Location: 10125 Oxbow Drive, Komoka, ON

Drill Date: 12/10/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft)	Depth (m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (Dynamic Cone)	Shear Strength (PP) kPa	Shear Strength (FV) kPa	Water Content %
0	0	Ground Surface	250.9 / 0.0						
		TOPSOIL brown/orange sandy topsoil, some silt, with roots (180mm)							
		SAND loose to compact brown sand, trace to some silt, moist		1	SS	5			4
				2	SS	11			5
			248.6 / 2.3	3	SS	12			4
		trace to some gravel		4	SS	19			4
				5	SS	24			4
				6	SS	19			5
		very dense from 5.3 to 6.9 m with occasional cobbles		7	SS	52			2
				8	SS	47			2
			244.0 / 6.9	9	SS	20			7
		SAND AND GRAVEL compact brown sand and gravel, trace silt and clay, wet with occasional cobbles		10	SS	17			7
				11	SS	27			14
			241.1 / 9.8	12	SS	25			14
		Drilling Terminated							

Groundwater Observations and Standpipe Details: Concrete; Bentonite; 7.2 mbgs (Feb. 4, 2020); Encountered; 51 mm PVC Riser; Sand Pack; 51mm Slotted Screen

Field Technician: M. Costello

Drafted by: M. Costello

Reviewed by: B. Thorner

Sheet: 1 of 1

Top of pipe elevation: 251.74m asl
Water encountered at 6.9mbgs during drilling
Water level measured at 243.45m asl on January 7, 2020
Water level measured at 243.73m asl on February 4, 2020

ID Number: MW104-19

Project: 10125 Oxbow Drive Development

Project No: 43705-301

Client: 2270942 Ontario Ltd.

Site Location: 10125 Oxbow Drive, Komoka, ON

Drill Date: 12/19/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Augers

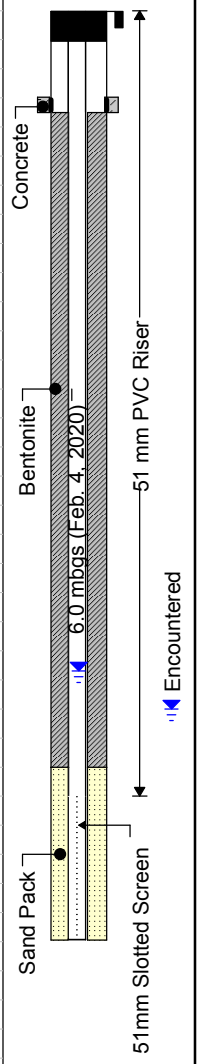
Protective Cover: Monument Casing

Depth (ft)	Depth (m)	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type	Standard Penetration (Dynamic Cone)	Shear Strength (PP) kPa	Shear Strength (FV) kPa	Water Content %
		Ground Surface	250.2 / 0.0						
0	0	**FILL (TOPSOIL)** dark brown silty topsoil, very moist with roots (500mm)	249.7 / 0.5						
2		**FILL** loose brown silty sand, some gravel, moist	248.8 / 1.4	1	SS	5			8
4				2	SS	4			5
6	2	**SAND** loose sand, trace to some silt, trace to some gravel, brown		3	SS	4			3
8				4	SS	4			4
10		compact	246.5 / 3.7	5	SS	22			3
12	4								
14		**GRAVELLY SAND** dense brown gravelly sand, trace silt and clay, moist with occasional cobbles	245.8 / 4.4	6	SS	39			2
16				7	SS	35			2
18									
20	6	wet	243.8 / 6.4	8	SS	30			7
22									
24									
26	8			9	SS	37			
28									
30		**SILT** very dense brown silt, some sand, wet	240.9 / 9.3	10	SS	78			18
32	10	Drilling Terminated							
34									
36									

Standard Penetration: 20 40 60 80

Shear Strength (FV) kPa: 50 100 150 200

Water Content %: 10 20 30



Field Technician: M. Costello

Drafted by: M. Costello

Reviewed by: B. Thorner

Sheet: 1 of 1

Top of pipe elevation: 251.13m asl
Water encountered at 6.4mbgs during drilling
Water level measured at 243.91m asl on January 7, 2020
Water level measured at 244.19m asl on February 4, 2020

ID Number: BH105-19

Project: 10125 Oxbow Drive Development

Project No: 43705-301

Client: 2270942 Ontario Ltd.

Site Location: 10125 Oxbow Drive, Komoka, ON

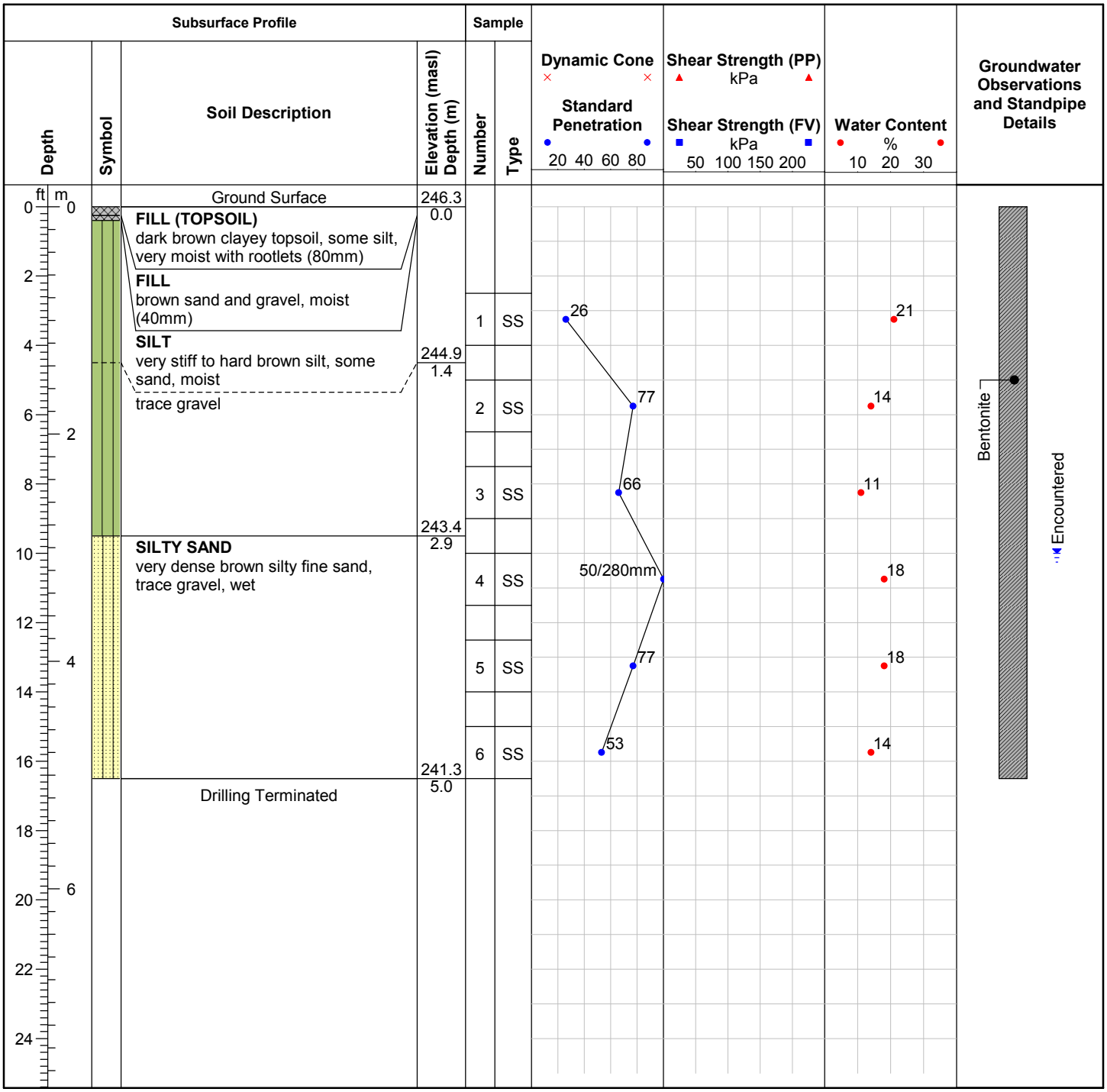
Drill Date: 12/18/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Augers

Protective Cover: N/A



Field Technician: M. Costello

Drafted by: M. Costello

Reviewed by: B. Thorner

MTE

Sheet: 1 of 1

Water encountered at 3.0mbgs during drilling

ID Number: BH106-19

Project: 10125 Oxbow Drive Development

Project No: 43705-301

Client: 2270942 Ontario Ltd.

Site Location: 10125 Oxbow Drive, Komoka, ON

Drill Date: 12/18/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Augers

Protective Cover: N/A

Depth (ft)	Depth (m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
0	0		Ground Surface	245.3		
			FILL (TOPSOIL) dark brown sandy topsoil, some clay, very moist with rootlets (150mm)	0.0		
			FILL brown sand and gravel, moist (150mm)		1	SS
4			**SAND** dense brown sand, some silt, trace gravel, moist	243.9 1.4		
6	2		**SILTY SAND** very dense brown silty sand, trace clay, wet		2	SS
8					3	SS
10						
12	4				4	SS
14					5	SS
			SILT hard brown silt, some sand, wet	240.9 4.4		
16				240.3	6	SS
18			Drilling Terminated	5.0		
20	6					
22						
24						

Dynamic Cone – Standard Penetration: 20 40 60 80

47 61 75 68 72 50/280mm

Shear Strength (PP) kPa

Shear Strength (FV) kPa: 50 100 150 200

Water Content %: 10 20 30

17 19 17 18 20 20

Groundwater Observations and Standpipe Details

Encountered

Bentonite

Field Technician: M. Costello

Drafted by: M. Costello

Reviewed by: B. Thorner

MTE

Sheet: 1 of 1

Water encountered at 1.5mbgs during drilling

ID Number: MW107-19

Project: 10125 Oxbow Drive Development

Project No: 43705-301

Client: 2270942 Ontario Ltd.

Site Location: 10125 Oxbow Drive, Komoka, ON

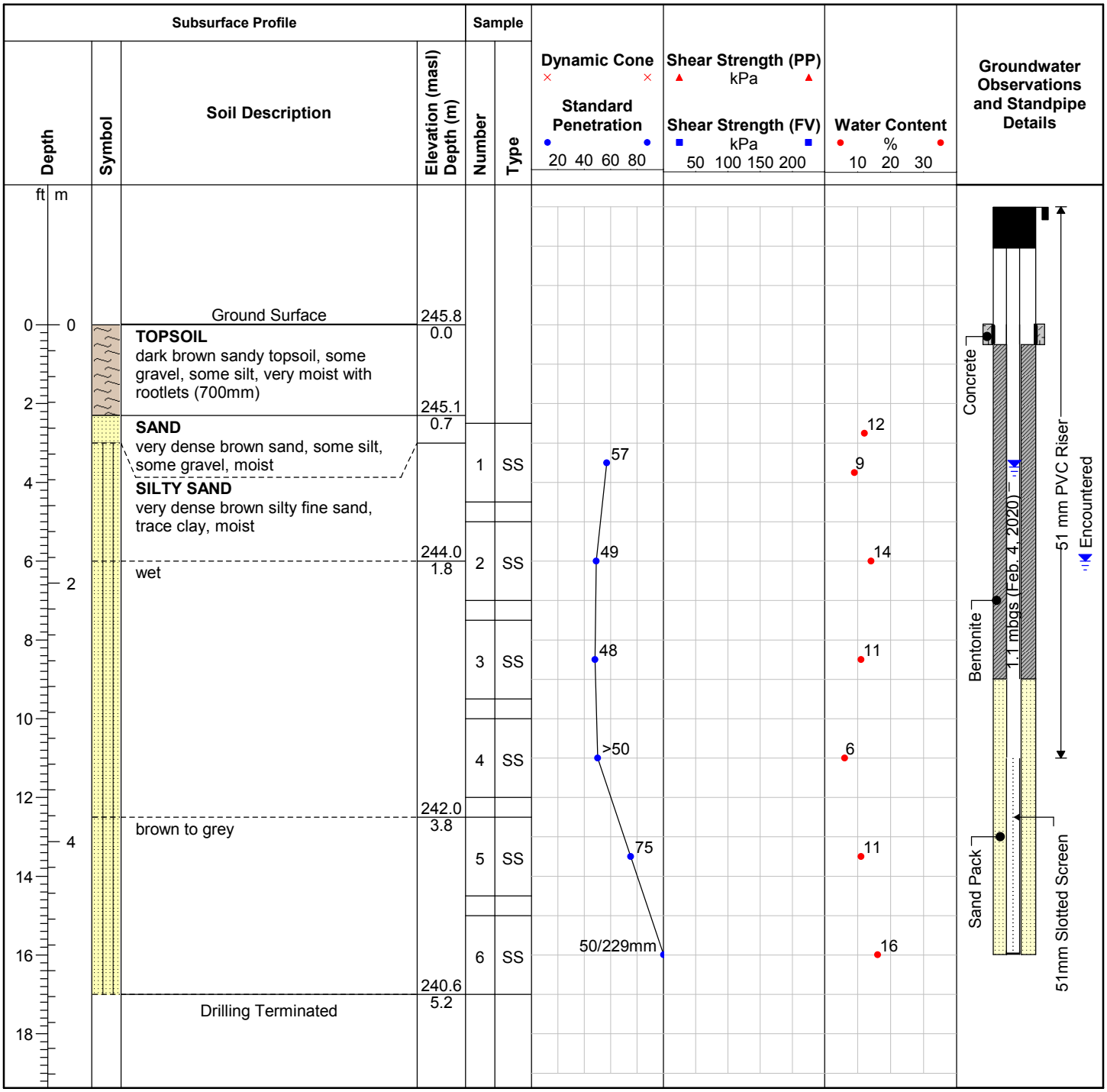
Drill Date: 12/18/2019

Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing



Field Technician: M. Costello

Drafted by: M. Costello

Reviewed by: B. Thorner

Sheet: 1 of 1

Top of pipe elevation: 247.12m asl
Water encountered at 1.8mbgs during drilling
Water level measured at 244.08m asl on January 7, 2020
Water level measured at 244.70m asl on February 4, 2020

ID Number: MW108-19

Project: 10125 Oxbow Drive Development

Project No: 43705-301

Client: 2270942 Ontario Ltd.

Site Location: 10125 Oxbow Drive, Komoka, ON

Drill Date: 12/12/2019

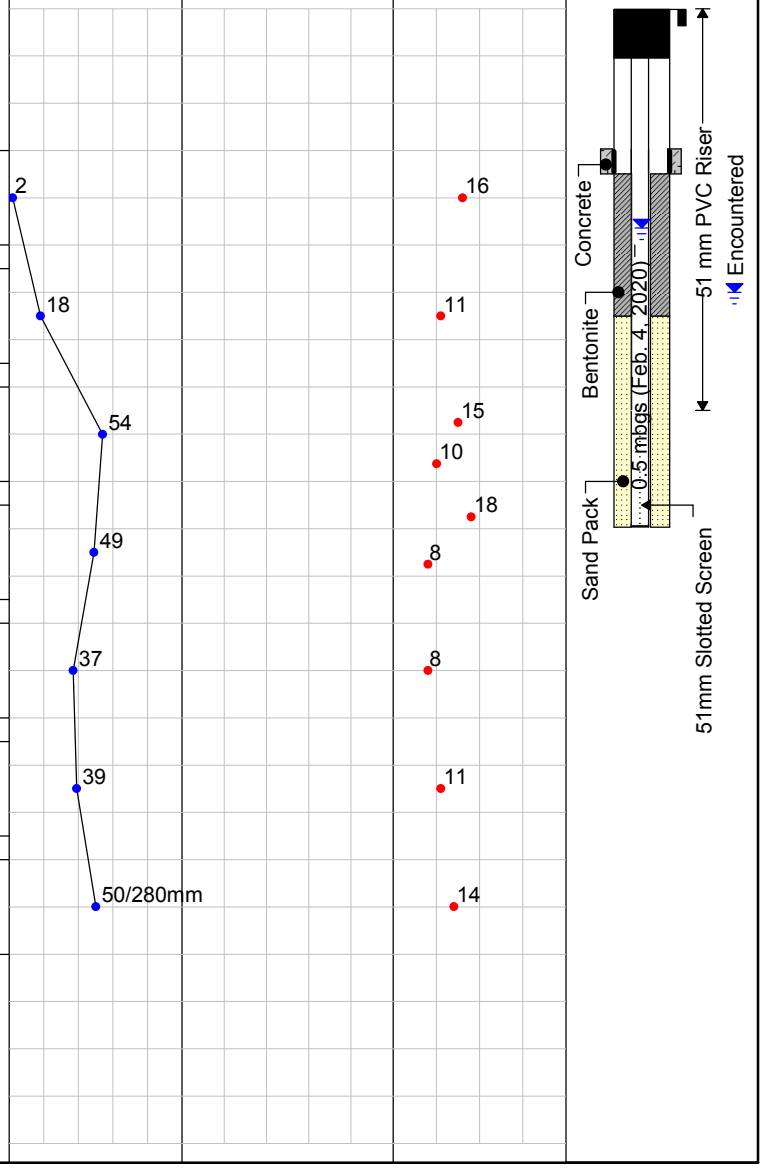
Drilling Contractor: London Soil Test Ltd.

Drill Rig: D50T Track

Drill Method: Hollow Stem Augers

Protective Cover: Monument Casing

Depth (ft / m)	Symbol	Soil Description	Elevation (masl) / Depth (m)	Sample Number	Sample Type
0 / 0		Ground Surface	245.3		
0 / 0		**FILL (TOPSOIL)** very loose brown silty sand topsoil, some gravel, moist with rootlets (760mm)	0.0	1	SS
			244.5		
2 /		**SILTY SAND** compact brown silty fine sand, moist	0.8 / 244.2	2	SS
4 /		**TOPSOIL** compact brown silty sand topsoil layer (30mm)	1.1		
6 / 2		**SAND** compact brown sand, trace silt, gravel and clay, wet	243.4 / 1.9	3	SS
		dense to very dense, some gravel	242.9		
8 /		**CLAYEY SILT** hard grey clayey silt, trace sand, some gravel, wet	2.4	4	SS
10 /				5	SS
12 / 4				6	SS
14 /			240.8		
		silt seams	4.5	7	SS
16 /			240.1		
		Drilling Terminated	5.2		
18 /					
20 / 6					



Field Technician: M. Costello

Drafted by: M. Costello

Reviewed by: B. Thorner

Sheet: 1 of 1

Top of pipe elevation: 246.63m asl
Water encountered at 0.9mbgs during drilling
Water level measured at 244.45m asl on January 7, 2020
Water level measured at 244.76m asl on February 4, 2020

L V M

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 **Phone: 519-685-6400 Fax: 519-685-0943**

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
01-15

Encl. No. 1 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

251.1

Elev. metres	Depth metres	DESCRIPTION (SUBSURFACE PROFILE)	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	NATURAL WATER %
99.93	0	Soft to firm, brown, clayey silt FILL, wood fragments.					
				1	ss	4	21
				2	ss	3	21
	4	Loose, brown silt & sand FILL, trace to some clay, trace of gravel.					
				3	ss	7	17
	6	Very dense, brown, fine sandy SILT to silty fine SAND.					
				4	ss	62	15
			∇ (7.3m)				
				5	ss	97/10"	20
	8	End of Borehole. Water levl at 7.3m depth at completion.					

Penetration Resistance Blows/ft: 20 40 60 80
Undrained Shear Strength kPa: ▲ Field Vane Test ★ Compression Test: 20 40 60 80
PLASTIC LIMIT % | NATURAL WATER % | LIQUID LIMIT %

Elevation scale: 99, 98, 97, 96, 95, 94, 93, 92; Depth scale: 0, 1, 2, 3, 4, 5, 6, 7, 8

L V M

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
02-15

Encl. No. 2 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 15, 2015

251.5

SUBSURFACE PROFILE												
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	● Penetration Resistance Blows/ft 20 40 60 80 / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test 20 40 60 80	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
100.35	0										
100		Stiff, brown, clayey silt to silty clay FILL, sand & gravel seams.			1	ss	14			17	
99	1										
		Loose, brown silt, sand & gravel FILL, asphalt fragments.			2	ss	9			7	
98	2										
					3	ss	11			16	
97	3	Stiff brown, sandy, clayey silt to silty clay FILL, trace to some gravel.			4	ss	10			19	
96	4										
					5	ss	8			12	
95	5										
	6				6	ss	11			10	
94											
	7										
93		Very dense, brown, moist, SAND & GRAVEL, some silt to silty.			7	ss	50/5"	50/5"		3	
		End of Borehole. Hole dry & open at completion.									

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

L V M

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO. 03-15

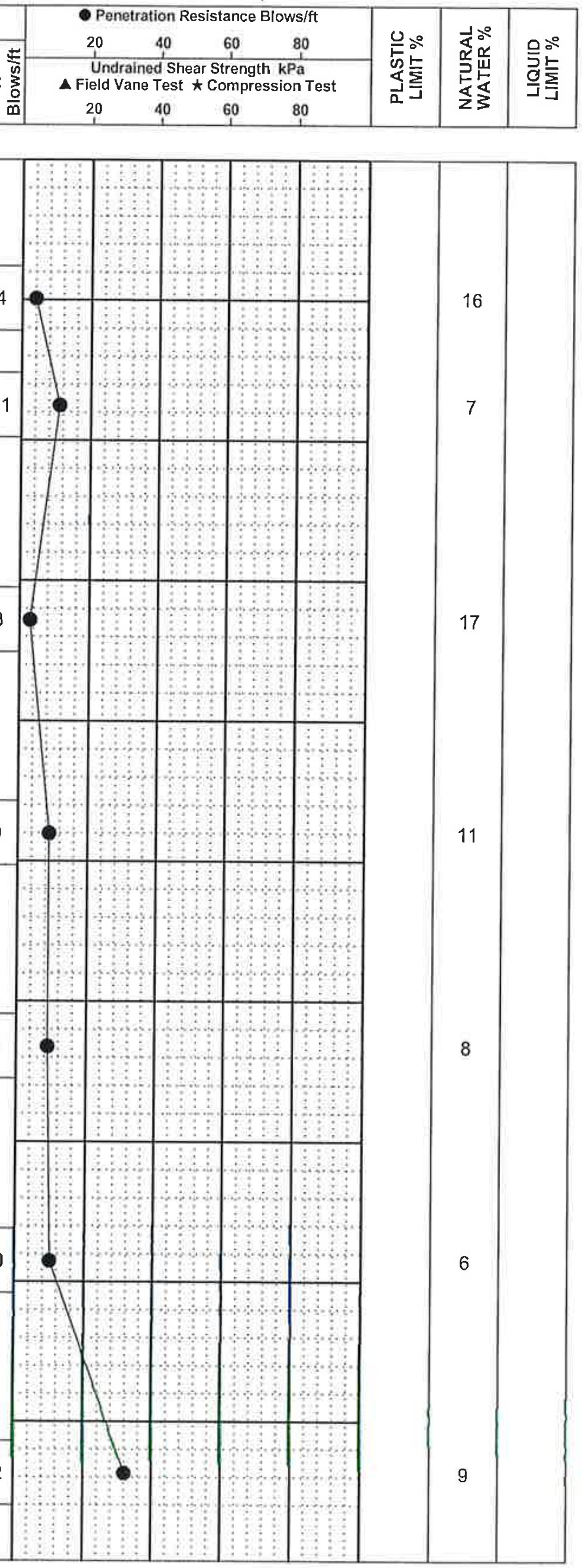
Encl. No. 3 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 15, 2015

252.2

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION
101.06	0	Loose, brown, gravelly silt & sand FILL, some clay.
		Compact to loose, brown to dark brown, silt & sand FILL, trace to some clay, trace of gravel, occasional clayey layers.
		Loose, brown sand FILL, some silt.
		Loose to compact, brown sand & gravel FILL, trace to some silt.
		Dense, grey SAND & GRAVEL, trace of silt.
		End of Borehole. Water levl at 8.5m depth at completion.

NUMBER	TYPE	"N" Blows/ft	NATURAL WATER %
1	SS	4	16
2	SS	11	7
3	SS	3	17
4	SS	9	11
5	SS	9	8
6	SS	10	6
7	SS	32	9



L V M

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6   Phone: 519-685-6400   Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO. 04-15

Encl. No. 4 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

251.5

SUBSURFACE PROFILE (ground surface elev. 100.38)

Elev. metres	Depth metres	DESCRIPTION
100.38	0	Compact, brown silt, sand & gravel FILL, wood fragments, clay seams.
	~1.4	Firm to stiff, brown, sandy clayey silt FILL, trace to some gravel, upper sandy seams, occasional silty sand layer.
	~5.5	Loose, brown silt, sand & gravel FILL, clayey seams.
	~7.0	Firm, brown, silty clay FILL.
	~8.1	End of Borehole. Hole dry & open at completion.

NUMBER	TYPE	"N" Blows/ft	Approx. Depth (m)	NATURAL WATER %
1	ss	15	1.0	4
2	ss	9	1.8	11
3	ss	16	3.3	5
4	ss	6	4.8	19
5	ss	8	6.3	17
6	ss	6	7.8	13

Columns: SYMBOL, GROUND WATER, NUMBER, TYPE, "N" Blows/ft; ● Penetration Resistance Blows/ft (20, 40, 60, 80); Undrained Shear Strength kPa (▲ Field Vane Test ★ Compression Test) (20, 40, 60, 80); PLASTIC LIMIT %; NATURAL WATER %; LIQUID LIMIT %

L V M

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
05-15

Encl. No. 5 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 15, 2015

251.1

Elev. metres	Depth metres	DESCRIPTION	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.96	0	Compact, dark brown silt, sand & gravel FILL, upper topsil seams.							
99	1		1	ss	13			9	
		Loose, dark brown silt FILL.	2	ss	9			15	
98	2								
		Loose, rusty brown silt & sand FILL.	3	ss	8			9	
97	3								
		Loose, brown sand FILL, some silt & gravel.	4	ss	5			6	
96	4								
		Loose to compact, brown sand FILL, some silt, trace to some gravel.	5	ss	10			8	
95	5								
		Compact, grey SAND & GRAVEL, trace of silt.	6	ss	19			10	
94	6								
93	7								
92	8	End of Borehole. Water level at 7.2m depth at completion.							

GROUND WATER ▽

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

L V M

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
06-15

Encl. No. 6 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
246.6											
95.49	0	Loose, dark brown, silty sand FILL, trace to some gravel.									
95					1	ss	41			2	
	1	Compact to dense, brown SAND & GRAVEL, trace to some silt.									
94					2	ss	40			2	
	2										
93				▽	3	ss	23			9	
	3	Compact to very dense, brown SILT & fine SAND.									
92					4	ss	16			14	
	4				5	ss	59			19	
91											
	5	End of Borehole. Water level at 2.8m depth at completion.			6	ss	75			19	

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

LVM
CONSULTING SOILS AND MATERIALS ENGINEERS
12 - 60 Meg Drive, London, ON, N6E 3T6
Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO. 07-15

Encl. No. 7 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
245.4											
94.24	0	150mm TOPSOIL.									
94		Very dense, brown SILT, upper sand seams.			1	ss	64			13	
93	1			▽	2	ss	85			18	
92	2	Very dense, silty fine SAND, occasional silt seams.			3	ss	56			18	
91	3				4	ss	90/ 9"	90/9"		15	
90	4				5	ss	71			20	
		End of Borehole. Water level at 1.6m depth at completion.			6	ss	50/ 6"	50/6"		18	

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

L V M

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
08-15

Encl. No. 8 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

245.5

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
94.33	0	Dense, brown SAND & GRAVEL, trace to some silt.									
				▽	1	ss	40			7	
94	1										
		Very dense, brown SILT, sand seams.			2	ss	83			16	
93	2										
					3	ss	54			18	
92	3	Very dense, brown SILT & fine SAND.									
					4	ss	60			18	
91	4	Compact to very dense, brown, fine SAND, some silt to silty.									
					5	ss	26			18	
90	5										
		End of Borehole. Water level at 1.0m depth at completion.			6	ss	78			16	

L V M

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
09-15

Encl. No. 9 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

244.1

93.02

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
93	0	Compact, brown SAND & GRAVEL, trace to some silt.		▽							
					1	ss	10			13	
92	1										
					2	ss	15			6	
91	2										
		Very dense, brown SILT & fine SAND, clayey seam.			3	ss	63			15	
90	3	Very dense, brown SAND & GRAVEL, some silt.			4	ss	50/4"	50/4"		10	
		Very stiff to hard, grey, clayey SILT to silty CLAY till.			5	as				9	
89	4										
					6	ss	39			12	
88	5	End of Borehole. Water level at 0.2m depth at completion.									

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

Appendix C

Laboratory Test Results

Table 101

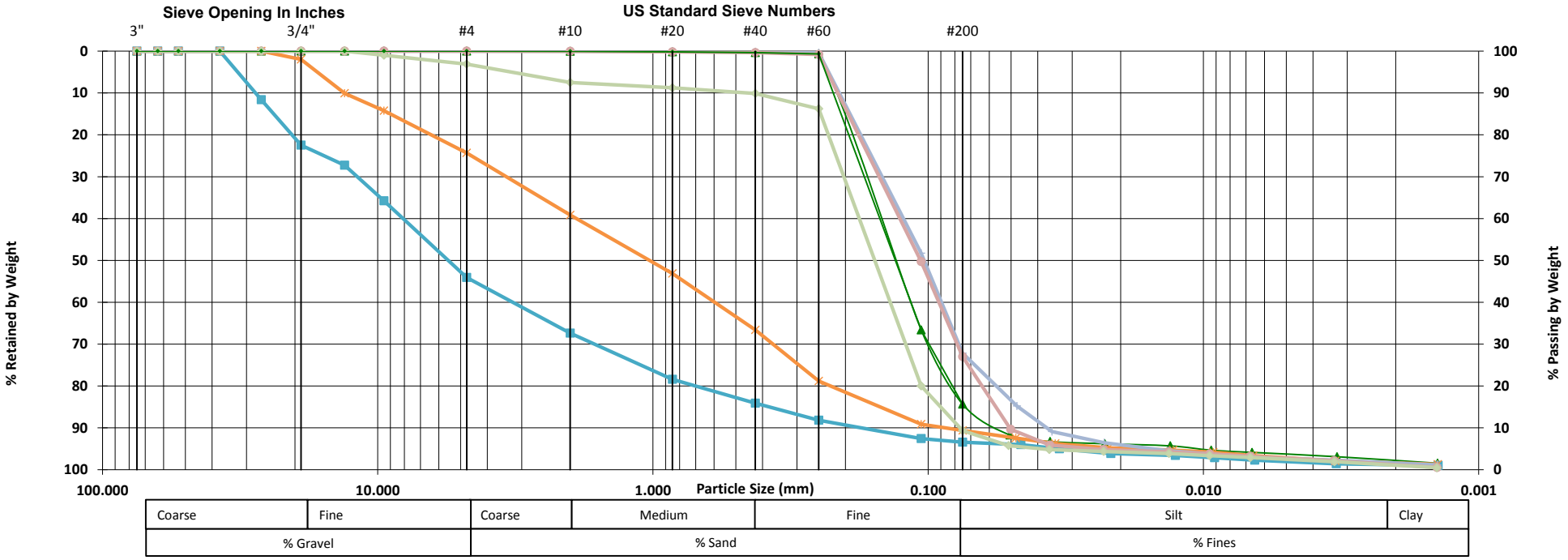
Particle Size Distribution Analysis Test Results

Project Name: 10125 Oxbow Drive Additional Investigation
Client: 2270942 Ontario Ltd.
Project Location: 10125 Oxbow Drive, Middlesex Centre, ON

Date Sampled: Dec. 10-12, 2019
Date Tested: Jan. 7-10, 2020

MTE File No.: 43705-301
Table No: 101

Unified Soil Classification



Symbol	Borehole ID	Sample #	*Sample Depth*	Description
▲	MW101-19	SS-12	10.7-11.3 mbgs	SAND, some Silt, trace Clay
■	MW103-19	SS-10	7.6-8.2 mbgs	SAND and GRAVEL, trace Silt and Clay
✳	MW104-19	SS-9	7.6-8.1 mbgs	Gravelly SAND, trace Silt and Clay
+	MW106-19	SS-5	3.8-4.3 mbgs	Silty SAND, trace Clay
●	MW107-19	SS-5	3.8-4.4 mbgs	Silty SAND, trace Clay
◆	MW108-19	SS-3	1.5-2.0 mbgs	SAND, trace Silt, Gravel and Clay

CERTIFIED BY CCIL Canadian Council of Independent Laboratories
For specific tests as listed on www.ccil.com

NOTES:

LVM

2270942 Ontario Ltd.

Planned Residential Development
10125 Oxbow Drive
Komoka, Ontario

Geotechnical Engineering Report
161-P-0008182-01-100-GE-R-0001-00

Prepared by:

Stephen W. Burt, P.Eng.
Consulting Geotechnical Engineer

Reviewed by:

Robert J. Helwig, P.Geo.
Senior Geoscientist

LVM

Soil and Materials Engineering
Environmental Engineering
Building Science
Supply Chain Quality

2270942 Ontario Ltd.

Planned Residential Development
10125 Oxbow Drive
Komoka, Ontario

Geotechnical Engineering Report

Date: May 20, 2015
Ref. N°: 161-P-0008182-01-100-GE-R-0001-00

LVM, a division of EnGlobe Corp.

LVM

TABLE OF CONTENTS

G:\161\PROJECTS\2015\P-0008182 OXBOW DRIVE, KOMOKA\25_CAD\P-8182-01-100_DRAWING 2_ SITE PLAN.DWG

0 1 2 3 4 5 10 cm

LEGEND :

BH-01-15 — BOREHOLE LOCATION

99.93 — GROUND SURFACE ELEVATION (m)

B.M.-1 — TEMPORARY BENCHMARK

NOTES :

1-REFERENCES : County of Middlesex Online Interactive Map (2010), Accessed April 2015.

2-TEMPORARY BENCHMARK : Top of Fire Hydrant Spindle Located NW of Intersection of Oxbow Drive. and Union St., Elevation 100.00 m (assumed local datum).

3-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

0 25 50 75 100 m

SCALE 1:2500

Project

Planned Residential Development

10125 Oxbow Drive, Komoka

Title

Site Plan

LVM

12-60 Meg Drive
London (Ontario) N6E 3T6
Telephone : 519.685 6400
Fax : 519.685.0943

Prepared A.Stewart	Discipline GEOTECHNICAL	Project manager R.Helwig	
Drawn A.Stewart	Scale 1 : 2500	Sequence no. 02 of 02	
Checked S.Burt	Date 2015-04-28		

M. dept	Project	Disc.	Dwg no.	Rev.
161	P-0008182-01-100	GE	002	00

Property and Confidentiality

2270942 Ontario Ltd.
42663 Huron-Bruce Road
R.R. #1
Wroxeter, Ontario N0G 2X0

Attention: Ms. Heather Johnston-Inglis, President

REVISION AND PUBLICATION REGISTER		
Revision N°	**Date**	**Modification And/Or Publication Details**
00	2015-05-20	Report Issued

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1 original	File

INTRODUCTION

LVM, a division of EnGlobe Corp., (LVM) was retained by 2270942 Ontario Ltd. to perform a Geotechnical Investigation at 10125 Oxbow Drive, Komoka, Ontario, shown on the Location Plan, Drawing 1 in Appendix 1. This work was authorized by Ms. Heather Johnston-Inglis of 2270942 Ontario Ltd. on March 6, 2015.

The conception plan for the residential development includes creating 77 building lots as well as three condominium blocks. The purpose of this investigation was to determine the composition of the fill and native soils at the site and, based on that information, provide geotechnical recommendations for the reuse of the soil as engineered fill material.

1 INVESTIGATION PROCEDURE

1.1 FIELD PROGRAM

The fieldwork for this investigation was performed on April 14 and 15, 2015, and involved drilling nine boreholes located as shown on the Site Plan, Drawing 2 in Appendix 1.

The boreholes were advanced to sampling depths of 4.9 to 9.6 metres (m) using a power auger machine equipped with conventional soil sampling equipment, which was supplied and operated by a specialist drilling company.

Soil samples were recovered from the boreholes at frequent intervals of depth using a 50 mm O.D. split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure. The SPT N-values are shown on the borehole logs in Appendix 2.

Groundwater observations were carried out in the boreholes during and upon completion of the drilling operations. The observations are summarized on the appended borehole logs.

The fieldwork was monitored throughout by a member of our engineering staff who directed the drilling and sampling procedures, documented the soil stratigraphies, and cared for the recovered soil samples.

The level of the ground surface at each borehole location was related to a local benchmark, which was taken as the top of the spindle of a fire hydrant located as shown on the Site Plan, Drawing 2 in Appendix 1. The benchmark was assigned an arbitrary elevation of 100.0 m.

1.2 LABORATORY TESTING

All soil samples recovered during this investigation were returned to our laboratory for visual examination and moisture content testing. The moisture content values are shown on the appended borehole logs.

Nine samples of the fill materials revealed in Boreholes 1 to 5 were submitted to the ALS Environmental London office and subjected to metals, inorganics, PHC and BTEX analyses. The Certificate of Analysis is provided in Appendix 4.

The soil samples will be stored for a period of three months from the date of this report. After this time, they will be discarded unless prior arrangements have been made for longer storage.

2 SUMMARIZED SUBSURFACE CONDITIONS

Refer to the borehole logs in Appendix 2 for descriptions of the soil stratigraphies, results of SPT testing, moisture content values, and groundwater observations. The following notes are intended only to amplify this data.

From the ground surface, Boreholes 1 to 6 revealed layers of soft to stiff clayey silt to silty clay fill and loose to compact silt, sand and gravel fill materials, and Borehole 4 was terminated within the fill at a depth of 8.1 m. The fill samples yielded moisture contents ranging from 4 to 21%. Borehole 7 revealed a 150mm thick surface layer of topsoil.

Beneath the fill and topsoil layers, and at the ground surface in Boreholes 8 and 9, layers of compact to very dense silt, sand and gravel materials were encountered, and Boreholes 1, 2, 3, and 5 to 8, were terminated within these layers at depths of 4.9 to 9.6 m. The silt and sand strata displayed natural moisture contents of 13 to 20%, and the sand and gravel displayed values of 6 to 13% near and below the groundwater levels and 2 to 3% above the groundwater level.

Borehole 9 penetrated the silt, sand and gravel layers at a depth of 3.5 m, and it was terminated within very stiff to hard clayey silt to silty clay till at a depth of 5.0 m. The two till samples yielded natural moisture contents of 9 and 12%.

At the completion of the drilling operations, groundwater levels were measured in Boreholes 1, 3, and 5 to 9 at depths of 0.2 to 8.5 m (Elevations 92.6 to 93.3), and groundwater seepage was not observed in Boreholes 2 and 4.

3 DISCUSSION AND RECOMMENDATIONS

3.1 EXCAVATIONS AND GROUNDWATER CONTROL

The soils revealed on this site which are not excessively wet can be classified as Type 3 soil in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. Any saturated and submerged soil shall be classified as Type 4 soil.

The sides of open excavations within a Type 3 soil must be carried out using side slopes not steeper than 1 vertical to 1 horizontal from the bottom of the excavation. Type 4 may be dewatered to be classified as Type 3 soil, or be adequately braced, otherwise side slopes of 1 vertical to 3 horizontal or flatter will be required for excavations intersecting type 4 soil.

Based on the borehole findings it is anticipated that groundwater and surface water entering open excavations may be controlled by gravity drainage and filtered pumps up to 0.5 to 1.0 m below the groundwater table. The borehole findings indicate that the level of the prevailing groundwater table at the site is near Elevation 92.7. Lowering the water level by more than one metre will require a permit to take water (PTTW) and positive dewatering system installed by a specialist dewatering contractor.

Where groundwater seepage is occurring it will be necessary to provide stability by flattening the excavation side slopes.

3.2 SITE PREPARATION AND GRADING

It is understood that sand and gravel materials have been mined from the site and fill has been placed along the northwestern part of the site represented by Borehole 1 to 5 locations. Although final design grades had not been established at the time of this investigation, it is anticipated that low-lying areas would be filled by utilizing the fill material cut from the higher area in the northwest part of the site. It is recommended that houses and other structures be supported on engineered fill constructed with Granular 'B' type material with a maximum aggregate size of 50 mm. The borehole findings and grain size distribution analysis test results, shown graphically on Figures 1 and 2 in Appendix 3, indicate that the fill materials revealed in Boreholes 1 to 5 are generally not suitable for reuse as engineered fill. The onsite fill which is not excessively wet may be used as bulk fill. The bulk fill is not considered suitable for supporting house foundations or other structures, and reference is made to Section 3.3 'Engineered Fill' for preparation requirements for the construction of house foundations.

Site preparation would consist of stripping the surface topsoil layer from within fill placement areas to expose an approved inorganic native subgrade. The groundwater level within the pond will need to be dewatered to accommodate the placement and compaction of fill materials, and the use of well graded stoney Granular 'B' type material is recommended for the

initial lift of fill placed on approved wet to saturated subgrades. During fill placement it is recommended that slopes steeper than 1 vertical to 3 horizontal (18 degrees) be benched in accordance with Ontario Provincial Standard Drawing (OPSD) 208.010 provided in Appendix 5. Within road way right-of-ways and house lot landscaped areas, bulk fill should be placed in controlled lifts and compacted throughout to at least 95% of the material's maximum standard Proctor dry density (MSPDD).

3.3 FOUNDATION DESIGN

It is anticipated that the residential development will feature buildings designed in accordance with Part 9 of the Ontario Building Code.

The topsoil and fill materials must be removed from new foundation areas, and the following table provides the highest founding levels at each borehole location where conventional spread footings founded on the approved native subgrades will provide a maximum allowable design soil bearing pressure of 143 kPa (3,000 psf).

Table 1 - Highest Foundation Founding Levels

BOREHOLE	HIGHEST EL. / DEPTH FOR A SLS DESIGN PRESSURE OF 143 KPA (3,000 PSF)
01-15	93.8 / 6.1 m
02-15	92.7 / 7.6 m
03-15	92.4 / 8.6 m
04-15	Below 92.3 / 8.1 m
05-15	92.8 / 7.1 m
06-15	94.7 / 0.8 m
07-15	93.4 / 0.8 m
08-15	93.5 / 0.8 m
09-15	92.2 / 0.8 m

at g/w elevation

For ultimate limit states design, a factored geotechnical resistance value (φR_n) of 215 kPa (4,500 psf) may be used, where the resistance factor (φ) is equal to 0.5.

3.4 ENGINEERED FILL

In areas where bulk fill has been placed, sub-excavation may be required within the influence of footings to expose an approved native subgrade and a structural fill pad must be constructed or the footings stepped down by extending the foundation walls. It is recommended that the engineered fill consist of Granular 'B' type material with a maximum aggregate size of 50 mm. It is considered that some of the native sand and gravel and the lower layers of sand and gravel fill materials revealed in Boreholes 3 and 5 below Elevation 96 may be considered for

use as engineered fill material, provided it is segregated for use without contamination with other materials. Engineered fill must extend outside the foundation area for a minimum horizontal distance equal to the depth of fill placed below the footing founding level. The engineered fill shall be placed in maximum 300 mm thick lifts, and each lift must be compacted to a minimum of 98% of its MSPDD under the direction and testing of the geotechnical consultant. Approved engineered fill can also support a maximum allowable design soil bearing pressure of 143 kPa (3,000 psf).

Where deep bulk fill requires excavation for the construction of engineered fill to extend onto adjacent building lots, constructing engineered fill pads on a lot by lot basis will not be feasible due to the risk of undermining pre-constructed house foundations. In this regard a strip of engineered fill will need to be constructed to provide support for the building envelopes over a row of building lots. Once final grades have been established, a review should be done by the geotechnical engineer to identify which building lots require construction of engineered fill pads and provide recommended construction methods.

The total and differential settlements of footings not more than three metres in width and subjected to the maximum allowable design pressure of 143 kPa (3,000 psf) are estimated to be less than 25 and 20 mm respectively.

To provide sufficient protection against heave due to frost action, all exterior footings and footings in non-heated areas must incorporate a minimum depth of soil cover of 1.2 m between the footing subgrade and the finished ground surface.

In order to minimize the disturbance of soil subgrades it is recommended that foundation excavations be carried out using a smooth-blade bucket.

3.5 ENVIRONMENTAL TESTING

Nine representative samples of fill from the boreholes were submitted to the ALS Environmental Laboratory in London and subjected to metals, inorganics, PHC and BTEX analyses, and the Certificate of Analysis is provided in Appendix 4. The test results indicate that the applicable Table 2 Soil Standards under Ont. Reg. 153/04 as amended have been exceeded for SAR and conductivity for the samples tested from Boreholes 3 and 4.

Elevated SAR and conductivity levels are indicative of salt impacts. Materials with salt impacts are phytotoxic to plants and must be placed at least 1.5 m below final grades. No other exceedances of the applicable MOE Table 2 soil standards were obtained.

4 STATEMENT OF LIMITATIONS

The geotechnical recommendations provided 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. Since all details of the design may not be known at the time of report preparation, we recommend that we be retained during the final design stage to verify that the geotechnical recommendations have been correctly interpreted in the design. Also, if any further clarification and/or elaboration are needed concerning the geotechnical aspects of the project, LVM, a division of EnGlobe Corp. should be contacted. We recommend that we be retained during construction to confirm that the subsurface conditions do not deviate materially from those encountered in the test holes and to ensure that our recommendations are properly understood. Quality assurance testing and inspection services during construction are a necessary part of the evaluation of the subsurface conditions.

The geotechnical recommendations provided in this report are intended for the use of the Client or its' agent and may not be used by a Third Party without the expressed written consent of LVM and the Client. They are not intended as specifications or instructions to contractors. Any use which a contractor makes of this report, or decisions made based on it, are the responsibility of the contractor. The contractor must also accept the responsibility for means and methods of construction, seek additional information if required, and draw their own conclusions as to how the subsurface conditions may affect their work. LVM accepts no responsibility and denies any liability whatsoever for any damages arising from improper or unauthorized use of the report or parts thereof.

It is important to note that the geotechnical assessment involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered and in accordance with normally accepted practices. The subsurface geotechnical, hydrogeological, environmental and geologic conditions between and beyond the test holes will differ from those encountered at the test holes. Also such conditions are not uniform and can vary over time. Should subsurface conditions be encountered which differ materially from those indicated at the test holes, we request that we be notified in order to assess the additional information and determine whether or not changes should be made as a result of the conditions. LVM will not be responsible to any party for damages incurred as a result of failing to notify LVM that differing site or subsurface conditions are present upon becoming aware of such conditions.

The professional services provided for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise stated specifically in the report. The recommendations and opinions given in this report are based on our professional judgment and are for the guidance of the Client or its' Agent in the design of the specific project. No other warranties or guarantees, expressed or implied, are made.

Appendix 1 Drawings

Drawing 1: Location Plan
Drawing 2: Site Plan

G:\161\PROJECTS\2015\P-0008182 OXBOW DRIVE, KOMOKA\25_CAD\P-8182-01-100_DRAWING 1_LOCATION PLAN.DWG

0 100 200 300 400 500 m

SCALE 1:10000

NOTES :
1-REFERENCES : © OpenStreetMap contributors (2015).
2-Drawing scale may be distorted due to file conversion and/or copying. Measurements taken from the drawing must be verified in the field.

Project

Planned Residential Development

10125 Oxbow Drive, Komoka

Title

Location Plan

LVM

12-60 Meg Drive
London (Ontario) N6E 3T6
Telephone : 519 685 6400
Fax : 519.685.0943

Prepared	A.Stewart	Discipline	GEOTECHNICAL	Project manager	R.Helwig
Drawn	A.Stewart	Scale	1 : 10000	Sequence no.	01 of 02
Checked	S.Burt	Date	2015-04-28		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	P-0008182-01-100	GE	001	00

Appendix 2 Boreholes

List of Abbreviations
Boreholes 01-15 to 09-15

LIST OF ABBREVIATIONS

The abbreviations commonly employed on the borehole logs, on the figures, and in the text of the report, are as follows:

Sample Types		Soil Tests and Properties	
AS	Auger Sample	SPT	Standard Penetration Test
CS	Chunk Sample	UC	Unconfined Compression
RC	Rock Core	FV	Field Vane Test
SS	Split Spoon	ø	Angle of internal friction
TW	Thinwall, Open	γ	Unit weight
WS	Wash Sample	w_p	Plastic limit
BS	Bulk Sample	w	Water content
GS	Grab Sample	w_l	Liquid limit
WC	Water Content Sample	I_L	Liquidity index
TP	Thinwall, Piston	I_p	Plasticity index
		PP	Pocket penetrometer

Penetration Resistances	
Dynamic Penetration Resistance	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) diameter 60 ° cone a distance 300 m (12 in.). The cone is attached to 'A' size drill rods and casing is not used.
Standard Penetration Resistance, N (ASTM D1586)	The number of blows by a 63.5 kg (140 lb.) hammer dropped 760 mm (30 in.) required to drive a standard split spoon sampler 300 m (12 in.)
WH	sampler advanced by static weight of hammer
PH	sampler advanced by hydraulic pressure
PM	sampler advanced by manual pressure

Soil Description

Cohesionless Soils Compactness Condition	SPT N-Value (blows per 0.30 m)	Relative Density (D_r) (%)
Very Loose	0 to 4	0 to 20
Loose	4 to 10	20 to 40
Compact	10 to 30	40 to 60
Dense	30 to 50	60 to 80
Very Dense	over 50	80 to 100

Cohesive Soils	Undrained Shear Strength (C_u)	
Consistency	kPa	psf
Very Soft	less than 12	less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000

DTPL	Drier than plastic limit
APL	About plastic limit
WTPL	Wetter than plastic limit

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CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
01-15

Encl. No. 1 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.93	0										
99	1	Soft to firm, brown, clayey silt FILL, wood fragments.			1	ss	4			21	
98	2										
97	3				2	ss	3			21	
96	4	Loose, brown silt & sand FILL, trace to some clay, trace of gravel.									
95	5				3	ss	7			17	
94	6	Very dense, brown, fine sandy SILT to silty fine SAND.		▽	4	ss	62			15	
93	7										
92	8	End of Borehole. Water levl at 7.3m depth at completion.			5	ss	97/ 10"	97/10"		20	

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

LVM

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
02-15

Encl. No. 2 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 15, 2015

SUBSURFACE PROFILE				GROUND WATER	SAMPLES			Penetration Resistance Blows/ft (20 40 60 80); Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
Elev. metres	Depth metres	DESCRIPTION	SYMBOL		NUMBER	TYPE	"N" Blows/ft				
100.35	0										
100		Stiff, brown, clayey silt to silty clay FILL, sand & gravel seams.									
	1				1	ss	14			17	
99		Loose, brown silt, sand & gravel FILL, asphalt fragments.			2	ss	9			7	
	2										
98					3	ss	11			16	
	3										
97		Stiff brown, sandy, clayey silt to silty clay FILL, trace to some gravel.			4	ss	10			19	
	4										
96											
	5				5	ss	8			12	
95											
	6				6	ss	11			10	
94											
	7										
93		Very dense, brown, moist, SAND & GRAVEL, some silt to silty.			7	ss	50/5"	50/5"		3	
		End of Borehole. Hole dry & open at completion.									

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

LVM

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO. 03-15

Encl. No. 3 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 15, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
101.06											
101	0	Loose, brown, gravelly silt & sand FILL, some clay.									
					1	ss	4			16	
100	1										
					2	ss	11			7	
99	2	Compact to loose, brown to dark brown, silt & sand FILL, trace to some clay, trace of gravel, occasional clayey layers.									
98	3				3	ss	3			17	
97	4										
					4	ss	9			11	
96	5										
95	6	Loose, brown sand FILL, some silt.			5	ss	9			8	
94	7	Loose to compact, brown sand & gravel FILL, trace to some silt.									
					6	ss	10			6	
93	8			▽							
92	9	Dense, grey SAND & GRAVEL, trace of silt.			7	ss	32			9	
		End of Borehole. Water levl at 8.5m depth at completion.									

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

LVM

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO. 04-15

Encl. No. 4 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
100.38	0										
100		Compact, brown silt, sand & gravel FILL, wood fragments, clay seams.			1	ss	15			4	
99	1				2	ss	9			11	
98	2	Firm to stiff, brown, sandy clayey silt FILL, trace to some gravel, upper sandy seams, occasional silty sand layer.									
97	3				3	ss	16			5	
96	4				4	ss	6			19	
95	5										
94	6	Loose, brown silt, sand & gravel FILL, clayey seams.			5	ss	8			17	
93	7	Firm, brown, silty clay FILL.			6	ss	6			13	
	8	End of Borehole. Hole dry & open at completion.									

NP Good

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

LVM

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO. 06-15

Encl. No. 6 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
95.49	0	Loose, dark brown, silty sand FILL, trace to some gravel. sieve									
95	1	Compact to dense, brown SAND & GRAVEL, trace to some silt.			1	ss	41			2	
94	2				2	ss	40			2	
93	3	Compact to very dense, brown SILT & fine SAND.		▽	3	ss	23			9	
92	4				4	ss	16			14	
91	5	End of Borehole. Water level at 2.8m depth at completion.			5	ss	59			19	
					6	ss	75			19	

can be use as eng fill.

can be used as eng fill.

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

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CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
05-15

Encl. No. 5 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 15, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.96	0										
		Compact, dark brown silt, sand & gravel FILL, upper topsil seams.			1	ss	13			9	
99	1										
		Loose, dark brown silt FILL.			2	ss	9			15	
98	2										
		Loose, rusty brown silt & sand FILL.			3	ss	8			9	
97	3										
		Loose, brown sand FILL, some silt & gravel.			4	ss	5			6	
96	4										
95	5										
		Loose to compact, brown sand FILL, some silt, trace to some gravel.			5	ss	10			8	
94	6										
93	7			▽							
		Compact, grey SAND & GRAVEL, trace of silt.			6	ss	19			10	
92	8										
		End of Borehole. Water level at 7.2m depth at completion.									

can be used as eng fill.

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

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CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
07-15

Encl. No. 7 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
94.24	0	150mm TOPSOIL.									
94		Very dense, brown SILT, upper sand seams.			1	ss	64			13	
93	1			▽	2	ss	85			18	
92	2	Very dense, silty fine SAND, occasional silt seams.			3	ss	56			18	
91	3				4	ss	90/9"	90/9"		15	
90	4				5	ss	71			20	
					6	ss	50/6"	50/6"		18	
		End of Borehole. Water level at 1.6m depth at completion.									

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CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO.
08-15

Encl. No. 8 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
94.33	0										
94		Dense, brown SAND & GRAVEL, trace to some silt.			1	ss	40			7	
93	1										
		Very dense, brown SILT, sand seams.			2	ss	83			16	
92	2				3	ss	54			18	
	3	Very dense, brown SILT & fine SAND.			4	ss	60			18	
91											
	4	Compact to very dense, brown, fine SAND, some silt to silty.			5	ss	26			18	
90											
	5	End of Borehole. Water level at 1.0m depth at completion.			6	ss	78			16	

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

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CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6 Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: P-0008182-01-100
CLIENT: 2270942 Ontario Ltd.
PROJECT: Planned Residential Development
LOCATION: 10125 Oxbow Drive, Komoka
DATUM ELEVATION: Top of Fire Hydrant Spindle, 100.0m

LOG OF BOREHOLE NO. 09-15

Encl. No. 9 (Sheet 1 of 1)
DRILLING DATA: Morooka
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Apr 14, 2015

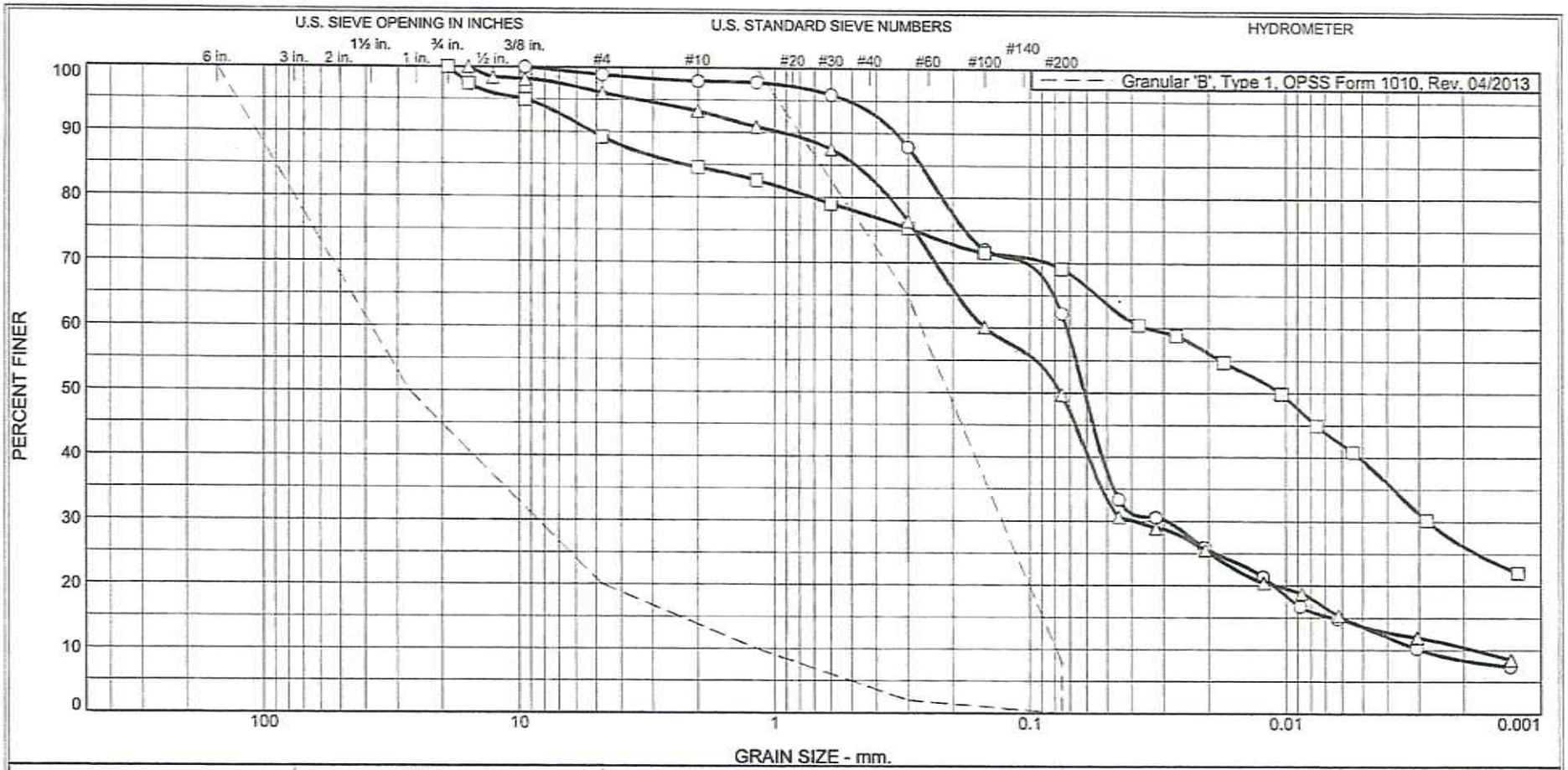
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	Penetration Resistance Blows/ft (20 40 60 80) / Undrained Shear Strength kPa ▲ Field Vane Test ★ Compression Test (20 40 60 80)	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
93.02											
93	0	Compact, brown SAND & GRAVEL, trace to some silt.		▽							
					1	ss	10			13	
92	1										
					2	ss	15			6	
91	2										
					3	ss	63			15	
		Very dense, brown SILT & fine SAND, clayey seam.									
90	3	Very dense, brown SAND & GRAVEL, some silt.			4	ss	50/4"	50/4"		10	
					5	as				9	
89	4	Very stiff to hard, grey, clayey SILT to silty CLAY till.									
					6	ss	39			12	
88	5	End of Borehole. Water level at 0.2m depth at completion.									

LOG OF BOREHOLE P-0008182-01-100.GPJ ATK_DAV.GDT 19/5/15

Appendix 3 Grain Size Distribution Analyses

Figures 1 and 2: Grain Size Distribution Analyses

LVM



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

	Location	Source	Sample #	Depth/Elev.	Sample Information
○	Borehole 01-15		Sample 3	4.8m / 95.1	Silt & Sand FILL, some clay, trace gravel.
□	Borehole 02-15		Sample 4	3.3m / 97.0	Sandy, silty clay FILL, some gravel.
△	Borehole 03-15		Sample 3	3.3m / 97.8	Silt & Sand FILL, traces of clay & gravel.

Project No. P-0008182-01-100 **Client** 2270942 Ontario Ltd. **Figure 1**

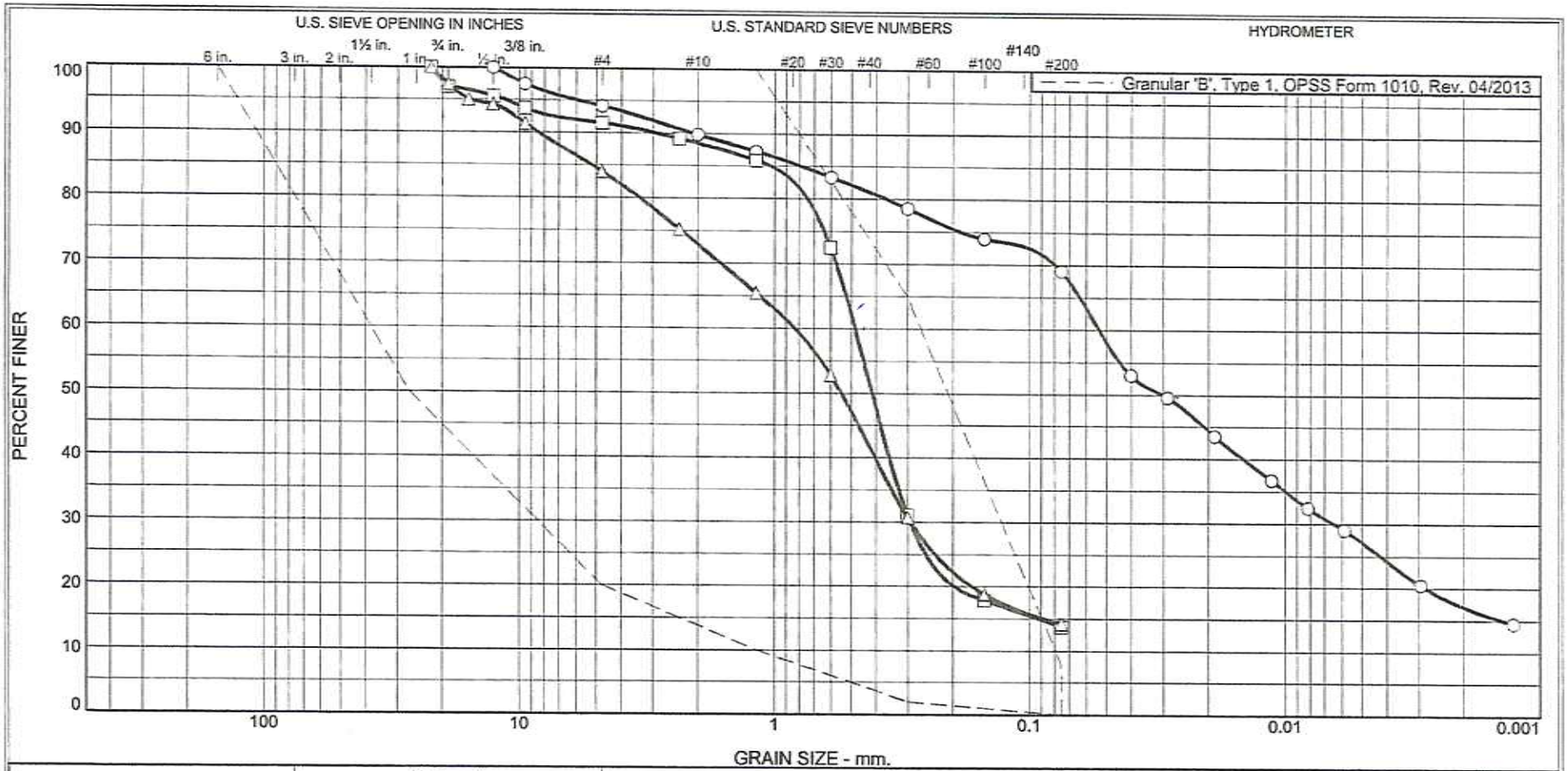
LVM, a division of EnGlobe Corp.

Grain Size Analysis

Planned Residential Development, 10125 Oxbow Drive, Komoka

London, Ontario

Tested By: AH/JH **Checked By:** SB



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

	Location	Source	Sample #	Depth/Elev.	Sample Information
○	Borehole 04-15		Sample 2	1.7m / 98.7	Sandy, clayey silt FILL, trace gravel.
□	Borehole 05-15		Sample 5	6.3m / 93.7	Sand FILL, some silt, trace gravel.
△	Borehole 06-15		Sample 1	1.0m / 94.5	SAND, some silt, some gravel.
					FILL

Project No. P-0008182-01-100 **Client** 2270942 Ontario Ltd. **Figure 2**

LVM, a division of EnGlobe Corp.

Grain Size Analysis

Planned Residential Development, 10125 Oxbow Drive, Komoka

London, Ontario

Tested By: AH/JH **Checked By:** SB

Appendix 4 Chemical Analysis

ALS Work Order: L1600418

LVM, a Division of EnGlobe Corp.
ATTN: ROB HELWIG
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6

Date Received: 17-APR-15
Report Date: 23-APR-15 14:13 (MT)
Version: FINAL

Client Phone: 519-685-6400

Certificate of Analysis

Lab Work Order #: L1600418
Project P.O. #: A01072
Job Reference: P-8182-0-01-100
C of C Numbers:
Legal Site Desc:

Gayle Braun
Senior Account Manager

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1600418-1	L1600418-2	L1600418-3	L1600418-4	L1600418-5	L1600418-6	L1600418-7	L1600418-8	L1600418-9
					Sampled Date	14-APR-15	14-APR-15	15-APR-15	15-APR-15	15-APR-15	15-APR-15	14-APR-15	14-APR-15	15-APR-15
					Sampled Time	12:00	12:00	12:00	12:00	12:00	12:00	12:00	12:00	12:00
					Sample ID	BH1 SA1	BH1 SA2	BH2 SA2	BH2 SA5	BH3 SA2	BH3 SA4	BH4 SA1	BH4 SA3	BH5 SA1
Grouping	Analyte	Unit	Guide Limits #1	#2										
Physical Tests	Conductivity	mS/cm	0.7	-		0.180	0.206	0.543	0.334	0.750	0.155	0.703	0.369	0.252
	% Moisture	%	-	-		18.5	17.5	12.5	17.8	10.7	10.9	10.4	12.0	9.37
	pH	pH units	-	-		7.31	7.05	7.73	7.60	7.81	7.32	7.53	7.67	7.35
Cyanides	Cyanide, Weak Acid Diss	ug/g	0.051	-		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Saturated Paste Extractables	SAR	SAR	5	-		<0.10	<0.10	4.90	2.65	7.68	0.27	7.55	2.10	0.48
	Calcium (Ca)	mg/L	-	-		26.6	28.1	34.5	26.6	32.5	20.0	18.6	27.4	29.9
	Magnesium (Mg)	mg/L	-	-		2.26	2.74	1.17	1.75	1.21	1.65	1.35	2.26	3.25
	Sodium (Na)	mg/L	-	-		1.13	1.61	108	52.3	164	4.70	125	42.5	10.4
Metals	Antimony (Sb)	ug/g	7.5	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Arsenic (As)	ug/g	18	-		3.7	3.8	3.9	4.0	3.8	3.2	3.2	2.9	3.4
	Barium (Ba)	ug/g	390	-		52.2	55.3	58.0	65.4	47.3	41.6	40.1	57.4	43.0
	Beryllium (Be)	ug/g	4	-		<0.50	<0.50	<0.50	0.56	<0.50	<0.50	<0.50	0.51	<0.50
	Boron (B)	ug/g	120	-		5.9	5.9	11.9	13.2	10.2	5.1	10.2	15.7	8.9
	Boron (B), Hot Water Ext.	ug/g	1.5	-		0.46	0.46	0.15	0.19	0.22	0.18	0.14	0.84	0.25
	Cadmium (Cd)	ug/g	1.2	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Chromium (Cr)	ug/g	160	-		28.6	28.8	20.7	22.5	17.4	14.7	15.5	21.1	16.2
	Cobalt (Co)	ug/g	22	-		5.8	6.6	7.2	7.7	5.8	5.0	5.6	6.6	5.0
	Copper (Cu)	ug/g	140	-		10.5	11.6	16.3	14.8	16.5	11.2	12.5	13.2	11.7
	Lead (Pb)	ug/g	120	-		12.5	12.4	12.6	15.1	11.9	10.6	9.9	7.5	13.6
	Mercury (Hg)	ug/g	0.27	-		0.0634	0.0623	0.0226	0.0260	0.0243	0.0260	0.0165	0.0145	0.0454
	Molybdenum (Mo)	ug/g	6.9	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.2	<1.0
	Nickel (Ni)	ug/g	100	-		11.3	12.8	17.3	19.0	14.1	10.2	13.7	16.3	11.0

Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1600418-1	L1600418-2	L1600418-3	L1600418-4	L1600418-5	L1600418-6	L1600418-7	L1600418-8	L1600418-9
					Sampled Date	14-APR-15	14-APR-15	15-APR-15	15-APR-15	15-APR-15	15-APR-15	14-APR-15	14-APR-15	15-APR-15
					Sampled Time	12:00	12:00	12:00	12:00	12:00	12:00	12:00	12:00	12:00
					Sample ID	BH1 SA1	BH1 SA2	BH2 SA2	BH2 SA5	BH3 SA2	BH3 SA4	BH4 SA1	BH4 SA3	BH5 SA1
Grouping	Analyte	Unit	Guide Limits #1	#2										
Metals	Selenium (Se)	ug/g	2.4	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Silver (Ag)	ug/g	20	-		0.29	0.25	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
	Thallium (Tl)	ug/g	1	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
	Uranium (U)	ug/g	23	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
	Vanadium (V)	ug/g	86	-		28.9	31.3	30.8	32.4	28.0	26.2	23.2	26.7	31.5
	Zinc (Zn)	ug/g	340	-		44.2	48.0	52.3	56.1	53.5	49.9	42.2	47.8	44.7
Speciated Metals	Chromium, Hexavalent	ug/g	8	-		<0.20	<0.20	<0.20	0.41	0.34	<0.20	<0.20	0.53	<0.20
Volatile Organic Compounds	Benzene	ug/g	0.21	-		<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068	<0.0068
	Ethylbenzene	ug/g	1.1	-		<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018	<0.018
	Toluene	ug/g	2.3	-		<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080	<0.080
	o-Xylene	ug/g	-	-		<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020
	m+p-Xylenes	ug/g	-	-		<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
	Xylenes (Total)	ug/g	3.1	-		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
	Surrogate: 4-Bromofluorobenzene	%	-	-		99.9	99.2	96.6	94.7	97.1	97.8	97.1	100.3	98.6
	Surrogate: 1,4-Difluorobenzene	%	-	-		101.3	101.2	101.1	100.3	100.5	102.4	99.8	100.7	101.1
Hydrocarbons	F1 (C6-C10)	ug/g	55	-		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	F1-BTEX	ug/g	55	-		<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
	F2 (C10-C16)	ug/g	98	-		<10	<10	<10	<10	<10	<10	<10	<10	<10
	F3 (C16-C34)	ug/g	300	-		<50	<50	56	81	96	<50	<50	<50	<50
	F4 (C34-C50)	ug/g	2800	-		<50	<50	114	256	271	<50	136	<50	<50
	F4G-SG (GHH-Silica)	mg/kg	2800	-						980				
	Total Hydrocarbons (C6-C50)	ug/g	-	-		<72	<72	171	337	367	<72	136	<72	<72

Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

SOIL - Ontario Regulation 153/04 - April 15, 2011 Standards

					ALS ID	L1600418-1	L1600418-2	L1600418-3	L1600418-4	L1600418-5	L1600418-6	L1600418-7	L1600418-8	L1600418-9
					Sampled Date	14-APR-15	14-APR-15	15-APR-15	15-APR-15	15-APR-15	15-APR-15	14-APR-15	14-APR-15	15-APR-15
					Sampled Time	12:00	12:00	12:00	12:00	12:00	12:00	12:00	12:00	12:00
					Sample ID	BH1 SA1	BH1 SA2	BH2 SA2	BH2 SA5	BH3 SA2	BH3 SA4	BH4 SA1	BH4 SA3	BH5 SA1
Grouping	Analyte	Unit	Guide Limits #1	#2										
Hydrocarbons	Chrom. to baseline at nC50		-	-		YES	YES	YES	YES	NO	YES	YES	YES	YES
	Surrogate: 2-Bromobenzotrifluoride	%	-	-		75.4	76.3	72.4	74.5	76.6	75.2	74.9	76.9	76.1
	Surrogate: 3,4-Dichlorotoluene	%	-	-		86.4	89.8	95.5	85.5	96.1	92.1	89.2	91.9	93.1

Guide Limit #1: T2-Soil-Res/Park/Inst. Property Use (Coarse)

Detection Limit for result exceeds Guideline Limit. Assessment against Guideline Limit cannot be made.
Analytical result for this parameter exceeds Guide Limits listed. See Summary of Guideline Exceedances.

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Ontario Regulation 153/04 - April 15, 2011 Standards - T2-Soil-Res/Park/Inst. Property Use (Coarse)						
L1600418-5	BH3 SA2	Physical Tests	Conductivity	0.750	0.7	mS/cm
		Saturated Paste Extractables	SAR	7.68	5	SAR
L1600418-7	BH4 SA1	Physical Tests	Conductivity	0.703	0.7	mS/cm
		Saturated Paste Extractables	SAR	7.55	5	SAR

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
B-HWS-R511-WT	Soil	Boron-HWE-O.Reg 153/04 (July 2011)	HW EXTR, EPA 6010B

A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

BTX-511-HS-WT	Soil	BTEX-O.Reg 153/04 (July 2011)	SW846 8260

BTX is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/MS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CN-WAD-R511-WT	Soil	Cyanide (WAD)-O.Reg 153/04 (July 2011)	MOE 3015/APHA 4500CN I-WAD

The sample is extracted with a strong base for 16 hours, and then filtered. The filtrate is then distilled where the cyanide is converted to cyanogen chloride by reacting with chloramine-T, the cyanogen chloride then reacts with a combination of barbituric acid and isonicotinic acid to form a highly colored complex.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

CR-CR6-IC-WT	Soil	Hexavalent Chromium in Soil	SW846 3060A/7199

This analysis is carried out using procedures adapted from "Test Methods for Evaluating Solid Waste" SW-846, Method 7199, published by the United States Environmental Protection Agency (EPA). The procedure involves analysis for chromium (VI) by ion chromatography using diphenylcarbazide in a sulphuric acid solution.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

EC-R511-WT	Soil	Conductivity-O.Reg 153/04 (July 2011)	MOEE E3138

A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

F1-F4-511-CALC-WT	Soil	F1-F4 Hydrocarbon Calculated Parameters	CCME CWS-PHC DEC-2000 - PUB# 1310-S

Analytical methods used for analysis of CCME Petroleum Hydrocarbons have been validated and comply with the Reference Method for the CWS PHC.

Hydrocarbon results are expressed on a dry weight basis.

In cases where results for both F4 and F4G are reported, the greater of the two results must be used in any application of the CWS PHC guidelines and the gravimetric heavy hydrocarbons cannot be added to the C6 to C50 hydrocarbons.
In samples where BTEX and F1 were analyzed , F1-BTEX represents a value where the sum of Benzene, Toluene, Ethylbenzene and total Xylenes has been subtracted from F1.

In samples where PAHs, F2 and F3 were analyzed, F2-Naphth represents the result where Naphthalene has been subtracted from F2. F3-PAH represents a result where the sum of Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Dibenzo(a,h)anthracene, Fluoranthene, Indeno(1,2,3-cd)pyrene, Phenanthrene, and Pyrene has been subtracted from F3.

Unless otherwise qualified, the following quality control criteria have been met for the F1 hydrocarbon range:
1. All extraction and analysis holding times were met.
2. Instrument performance showing response factors for C6 and C10 within 30% of the response factor for toluene.
3. Linearity of gasoline response within 15% throughout the calibration range.

Unless otherwise qualified, the following quality control criteria have been met for the F2-F4 hydrocarbon ranges:

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

1. All extraction and analysis holding times were met.
2. Instrument performance showing C10, C16 and C34 response factors within 10% of their average.
3. Instrument performance showing the C50 response factor within 30% of the average of the C10, C16 and C34 response factors.
4. Linearity of diesel or motor oil response within 15% throughout the calibration range.

F1-HS-511-WT Soil F1-O.Reg 153/04 (July 2011) E3398/CCME TIER 1-HS

Fraction F1 is determined by extracting a soil or sediment sample as received with methanol, then analyzing by headspace-GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F2-F4-511-WT Soil F2-F4-O.Reg 153/04 (July 2011) MOE DECPH-E3398/CCME TIER 1

Fractions F2, F3 and F4 are determined by extracting a soil sample with a solvent mix. The solvent recovered from the extracted soil sample is dried and treated to remove polar material. The extract is analyzed by GC/FID.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

F4G-ADD-511-WT Soil F4G SG-O.Reg 153/04 (July 2011) MOE DECPH-E3398/CCME TIER 1

F4G, gravimetric analysis, is determined if the chromatogram does not return to baseline at or before C50. A soil sample is extracted with a solvent mix, the solvent is evaporated and the weight of the residue is determined.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

HG-200.2-CVAA-WT Soil Mercury in Soil by CVAAS EPA 200.2/1631E (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CVAAS.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

MET-200.2-CCMS-WT Soil Metals in Soil by CRC ICPMS EPA 200.2/6020A (mod)

Soil samples are digested with nitric and hydrochloric acids, followed by analysis by CRC ICPMS.

Method Limitation: This method is not a total digestion technique. It is a very strong acid digestion that is intended to dissolve those metals that may be environmentally available. This method does not dissolve all silicate materials and may result in a partial extraction. depending on the sample matrix, for some metals, including, but not limited to Al, Ba, Be, Cr, Sr, Ti, Tl, and V.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011), unless a subset of the Analytical Test Group (ATG) has been requested (the Protocol states that all analytes in an ATG must be reported).

MOISTURE-WT Soil % Moisture Gravimetric: Oven Dried

PH-R511-WT Soil pH-O.Reg 153/04 (July 2011) MOEE E3137A

A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

SAR-R511-WT Soil SAR-O.Reg 153/04 (July 2011) SW846 6010C

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES.

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).

XYLENES-SUM-CALC-WT	Soil	Sum of Xylene Isomer Concentrations	CALCULATION

Total xylenes represents the sum of o-xylene and m&p-xylene.

**ALS test methods may incorporate modifications from specified reference methods to improve performance.

Chain of Custody Numbers:

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.
mg/kg - milligrams per kilogram based on dry weight of sample
mg/kg wwt - milligrams per kilogram based on wet weight of sample
mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight
mg/L - unit of concentration based on volume, parts per million.
< - Less than.
D.L. - The reporting limit.
N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.
UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.
Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information.

Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6

Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	Soil							
Batch R3177129								
WG2073524-3 DUP		**L1600218-19**						
Boron (B), Hot Water Ext.		0.21	0.21		ug/g	1.7	40	21-APR-15
WG2073524-2 IRM		**SALINITY_SOIL4**						
Boron (B), Hot Water Ext.			85.4		%		70-130	21-APR-15
WG2073524-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	21-APR-15
WG2073524-4 MS		**L1600218-19**						
Boron (B), Hot Water Ext.			84.4		%		60-140	21-APR-15
BTX-511-HS-WT	Soil							
Batch R3176973								
WG2073160-3 DUP		**WG2073160-5**						
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	20-APR-15
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	20-APR-15
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	20-APR-15
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	20-APR-15
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	20-APR-15
WG2073160-2 LCS								
Benzene			99.4		%		70-130	21-APR-15
Ethylbenzene			95.0		%		70-130	21-APR-15
m+p-Xylenes			95.6		%		70-130	21-APR-15
o-Xylene			96.0		%		70-130	21-APR-15
Toluene			96.6		%		70-130	21-APR-15
WG2073160-1 MB								
Benzene			<0.0068		ug/g		0.0068	20-APR-15
Ethylbenzene			<0.018		ug/g		0.018	20-APR-15
m+p-Xylenes			<0.030		ug/g		0.03	20-APR-15
o-Xylene			<0.020		ug/g		0.02	20-APR-15
Toluene			<0.080		ug/g		0.08	20-APR-15
Surrogate: 1,4-Difluorobenzene			101.4		%		70-130	20-APR-15
Surrogate: 4-Bromofluorobenzene			102.0		%		70-130	20-APR-15
WG2073160-4 MS		**WG2073160-5**						
Benzene			96.0		%		60-140	20-APR-15
Ethylbenzene			97.7		%		60-140	20-APR-15
m+p-Xylenes			99.8		%		60-140	20-APR-15
o-Xylene			95.3		%		60-140	20-APR-15
Toluene			95.7		%		60-140	20-APR-15

Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
BTX-511-HS-WT	Soil							
Batch R3176999								
WG2073262-3 DUP		**L1600418-8**						
Benzene		<0.0068	<0.0068	RPD-NA	ug/g	N/A	40	21-APR-15
Ethylbenzene		<0.018	<0.018	RPD-NA	ug/g	N/A	40	21-APR-15
m+p-Xylenes		<0.030	<0.030	RPD-NA	ug/g	N/A	40	21-APR-15
o-Xylene		<0.020	<0.020	RPD-NA	ug/g	N/A	40	21-APR-15
Toluene		<0.080	<0.080	RPD-NA	ug/g	N/A	40	21-APR-15
WG2073262-2 LCS								
Benzene			99.8		%		70-130	21-APR-15
Ethylbenzene			93.9		%		70-130	21-APR-15
m+p-Xylenes			97.2		%		70-130	21-APR-15
o-Xylene			94.3		%		70-130	21-APR-15
Toluene			94.2		%		70-130	21-APR-15
WG2073262-1 MB								
Benzene			<0.0068		ug/g		0.0068	21-APR-15
Ethylbenzene			<0.018		ug/g		0.018	21-APR-15
m+p-Xylenes			<0.030		ug/g		0.03	21-APR-15
o-Xylene			<0.020		ug/g		0.02	21-APR-15
Toluene			<0.080		ug/g		0.08	21-APR-15
Surrogate: 1,4-Difluorobenzene			94.9		%		70-130	21-APR-15
Surrogate: 4-Bromofluorobenzene			89.0		%		70-130	21-APR-15
WG2073262-4 MS		**L1600418-8**						
Benzene			102.4		%		60-140	21-APR-15
Ethylbenzene			96.1		%		60-140	21-APR-15
m+p-Xylenes			98.4		%		60-140	21-APR-15
o-Xylene			96.3		%		60-140	21-APR-15
Toluene			97.3		%		60-140	21-APR-15
CN-WAD-R511-WT	Soil							
Batch R3177212								
WG2072484-3 DUP		**L1600418-1**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	20-APR-15
WG2072484-2 LCS								
Cyanide, Weak Acid Diss			98.5		%		80-120	20-APR-15
WG2072484-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	20-APR-15
WG2072484-4 MS		**L1600418-1**						
Cyanide, Weak Acid Diss			90.8		%		70-130	20-APR-15

Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CR-CR6-IC-WT	Soil							
Batch R3176826								
WG2072597-3 CRM Chromium, Hexavalent		**WT-SQC012**	88.6		%		70-130	20-APR-15
WG2072597-4 DUP Chromium, Hexavalent		**L1600485-1** 0.26	0.25		ug/g	4.3	25	20-APR-15
WG2072597-2 LCS Chromium, Hexavalent			95.4		%		70-130	20-APR-15
WG2072597-1 MB Chromium, Hexavalent			<0.20		ug/g		0.2	20-APR-15
EC-R511-WT	Soil							
Batch R3177103								
WG2073525-4 DUP Conductivity		**WG2073525-3** 0.0970	0.0990		mS/cm	2.0	20	21-APR-15
WG2073883-1 LCS Conductivity			99.8		%		90-110	21-APR-15
WG2073883-2 LCS Conductivity			98.0		%		90-110	21-APR-15
WG2073525-1 MB Conductivity			<0.0040		mS/cm		0.004	21-APR-15
F1-HS-511-WT	Soil							
Batch R3176973								
WG2073160-3 DUP F1 (C6-C10)		**WG2073160-5** <5.0	<5.0	RPD-NA	ug/g	N/A	50	20-APR-15
WG2073160-2 LCS F1 (C6-C10)			102.0		%		80-120	20-APR-15
WG2073160-1 MB F1 (C6-C10)			<5.0		ug/g		5	20-APR-15
Surrogate: 3,4-Dichlorotoluene			85.3		%		60-140	20-APR-15
WG2073160-7 MS F1 (C6-C10)		**WG2073160-6**	94.5		%		60-140	20-APR-15
Batch R3176999								
WG2073262-3 DUP F1 (C6-C10)		**L1600418-8** <5.0	<5.0	RPD-NA	ug/g	N/A	50	21-APR-15
WG2073262-2 LCS F1 (C6-C10)			102.8		%		80-120	21-APR-15
WG2073262-1 MB F1 (C6-C10)			<5.0		ug/g		5	21-APR-15
Surrogate: 3,4-Dichlorotoluene			97.4		%		60-140	21-APR-15

Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F1-HS-511-WT	Soil							
Batch R3176999								
WG2073262-7 MS		**L1600418-9**						
F1 (C6-C10)			113.4		%		60-140	21-APR-15
F2-F4-511-WT	Soil							
Batch R3176940								
WG2072486-3 CRM		**ALS PHC2 IRM**						
F2 (C10-C16)			96.8		%		70-130	20-APR-15
F3 (C16-C34)			113.5		%		70-130	20-APR-15
F4 (C34-C50)			119.5		%		70-130	20-APR-15
WG2073249-1 CVS								
F2 (C10-C16)			109.8		%		80-120	20-APR-15
F3 (C16-C34)			110.3		%		80-120	20-APR-15
F4 (C34-C50)			115.5		%		80-120	20-APR-15
WG2073249-2 CVS								
F2 (C10-C16)			108.6		%		80-120	20-APR-15
F3 (C16-C34)			109.7		%		80-120	20-APR-15
F4 (C34-C50)			114.8		%		80-120	20-APR-15
WG2073249-3 CVS								
F2 (C10-C16)			108.2		%		80-120	21-APR-15
F3 (C16-C34)			110.1		%		80-120	21-APR-15
F4 (C34-C50)			114.2		%		80-120	21-APR-15
WG2072486-5 DUP		**WG2072486-4**						
F2 (C10-C16)		950	1060		ug/g	11	40	20-APR-15
F3 (C16-C34)		719	734		ug/g	2.2	40	20-APR-15
F4 (C34-C50)		<50	<50	RPD-NA	ug/g	N/A	40	20-APR-15
WG2072486-2 LCS								
F2 (C10-C16)			89.9		%		80-120	20-APR-15
F3 (C16-C34)			99.5		%		80-120	20-APR-15
F4 (C34-C50)			100.1		%		80-120	20-APR-15
WG2072486-1 MB								
F2 (C10-C16)			<10		ug/g		10	20-APR-15
F3 (C16-C34)			<50		ug/g		50	20-APR-15
F4 (C34-C50)			<50		ug/g		50	20-APR-15
Surrogate: 2-Bromobenzotrifluoride			72.5		%		60-140	20-APR-15
F4G-ADD-511-WT	Soil							

Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
F4G-ADD-511-WT	Soil							
Batch R3177419								
WG2074262-2 LCS								
F4G-SG (GHH-Silica)			80.1		%		60-140	19-APR-15
WG2074262-3 LCSD		**WG2074262-2**						
F4G-SG (GHH-Silica)		80.1	84.0		%	4.7	50	19-APR-15
WG2074262-1 MB								
F4G-SG (GHH-Silica)			<250		mg/kg		250	19-APR-15
HG-200.2-CVAA-WT	Soil							
Batch R3176925								
WG2073530-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			85.8		%		70-130	21-APR-15
WG2073530-6 DUP		**L1600418-1**						
Mercury (Hg)		0.0634	0.0640		ug/g	0.9	40	21-APR-15
WG2073530-4 LCS								
Mercury (Hg)			101.0		%		80-120	21-APR-15
WG2073530-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	21-APR-15
Batch R3176927								
WG2073531-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			90.3		%		70-130	21-APR-15
WG2073531-6 DUP		**L1600418-7**						
Mercury (Hg)		0.0165	0.0156		ug/g	5.5	40	21-APR-15
WG2073531-4 LCS								
Mercury (Hg)			98.0		%		80-120	21-APR-15
WG2073531-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	21-APR-15
MET-200.2-CCMS-WT	Soil							
Batch R3177896								
WG2073530-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			101.0		%		70-130	21-APR-15
Arsenic (As)			111.4		%		70-130	21-APR-15
Barium (Ba)			109.7		%		70-130	21-APR-15
Beryllium (Be)			100.4		%		70-130	21-APR-15
Boron (B)			99.2		%		70-130	21-APR-15
Cadmium (Cd)			104.5		%		70-130	21-APR-15
Chromium (Cr)			118.1		%		70-130	21-APR-15
Cobalt (Co)			111.3		%		70-130	21-APR-15
Copper (Cu)			108.3		%		70-130	21-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6

Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3177896								
WG2073530-2 CRM		**WT-CANMET-TILL1**						
Lead (Pb)			95.6		%		70-130	21-APR-15
Molybdenum (Mo)			88.0		%		70-130	21-APR-15
Nickel (Ni)			113.1		%		70-130	21-APR-15
Selenium (Se)			95.2		%		70-130	21-APR-15
Silver (Ag)			100.0		%		70-130	21-APR-15
Thallium (Tl)			98.7		%		70-130	21-APR-15
Uranium (U)			112.2		%		70-130	21-APR-15
Vanadium (V)			119.4		%		70-130	21-APR-15
Zinc (Zn)			111.0		%		70-130	21-APR-15
WG2073530-6 DUP		**L1600418-1**						
Antimony (Sb)		<1.0	0.15		ug/g	17	30	21-APR-15
Arsenic (As)		3.7	3.71		ug/g	0.6	30	21-APR-15
Barium (Ba)		52.2	53.0		ug/g	1.4	40	21-APR-15
Beryllium (Be)		<0.50	0.41		ug/g	11	30	21-APR-15
Boron (B)		5.9	<5.0	RPD-NA	ug/g	N/A	30	21-APR-15
Cadmium (Cd)		<0.50	0.282		ug/g	7.5	30	21-APR-15
Chromium (Cr)		28.6	27.9		ug/g	2.4	30	21-APR-15
Cobalt (Co)		5.8	5.87		ug/g	1.1	30	21-APR-15
Copper (Cu)		10.5	10.6		ug/g	0.6	30	21-APR-15
Lead (Pb)		12.5	12.6		ug/g	0.4	40	21-APR-15
Molybdenum (Mo)		<1.0	0.31		ug/g	4.4	40	21-APR-15
Nickel (Ni)		11.3	11.8		ug/g	4.0	30	21-APR-15
Selenium (Se)		<1.0	<0.20	RPD-NA	ug/g	N/A	30	21-APR-15
Silver (Ag)		0.29	0.29		ug/g	0.9	40	21-APR-15
Thallium (Tl)		<0.50	0.096		ug/g	4.5	30	21-APR-15
Uranium (U)		<1.0	0.527		ug/g	2.2	30	21-APR-15
Vanadium (V)		28.9	28.9		ug/g	0.2	30	21-APR-15
Zinc (Zn)		44.2	45.6		ug/g	3.1	30	21-APR-15
WG2073530-3 LCS								
Antimony (Sb)			101.7		%		80-120	21-APR-15
Arsenic (As)			95.2		%		80-120	21-APR-15
Barium (Ba)			95.6		%		80-120	21-APR-15
Beryllium (Be)			92.5		%		80-120	21-APR-15

Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3177896								
WG2073530-3 LCS								
Boron (B)			93.9		%		80-120	21-APR-15
Cadmium (Cd)			96.1		%		80-120	21-APR-15
Chromium (Cr)			95.8		%		80-120	21-APR-15
Cobalt (Co)			95.5		%		80-120	21-APR-15
Copper (Cu)			93.6		%		80-120	21-APR-15
Lead (Pb)			99.0		%		80-120	21-APR-15
Molybdenum (Mo)			94.5		%		80-120	21-APR-15
Nickel (Ni)			95.6		%		80-120	21-APR-15
Selenium (Se)			95.6		%		80-120	21-APR-15
Silver (Ag)			93.7		%		80-120	21-APR-15
Thallium (Tl)			95.6		%		80-120	21-APR-15
Uranium (U)			93.6		%		80-120	21-APR-15
Vanadium (V)			97.9		%		80-120	21-APR-15
Zinc (Zn)			92.1		%		80-120	21-APR-15
WG2073530-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	21-APR-15
Arsenic (As)			<0.10		mg/kg		0.1	21-APR-15
Barium (Ba)			<0.50		mg/kg		0.5	21-APR-15
Beryllium (Be)			<0.10		mg/kg		0.1	21-APR-15
Boron (B)			<5.0		mg/kg		5	21-APR-15
Cadmium (Cd)			<0.020		mg/kg		0.02	21-APR-15
Chromium (Cr)			<0.50		mg/kg		0.5	21-APR-15
Cobalt (Co)			<0.10		mg/kg		0.1	21-APR-15
Copper (Cu)			<0.50		mg/kg		0.5	21-APR-15
Lead (Pb)			<0.50		mg/kg		0.5	21-APR-15
Molybdenum (Mo)			<0.10		mg/kg		0.1	21-APR-15
Nickel (Ni)			<0.50		mg/kg		0.5	21-APR-15
Selenium (Se)			<0.20		mg/kg		0.2	21-APR-15
Silver (Ag)			<0.10		mg/kg		0.1	21-APR-15
Thallium (Tl)			<0.050		mg/kg		0.05	21-APR-15
Uranium (U)			<0.050		mg/kg		0.05	21-APR-15
Vanadium (V)			<0.20		mg/kg		0.2	21-APR-15
Zinc (Zn)			<2.0		mg/kg		2	21-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3177901								
WG2073531-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			93.1		%		70-130	21-APR-15
Arsenic (As)			97.4		%		70-130	21-APR-15
Barium (Ba)			94.2		%		70-130	21-APR-15
Beryllium (Be)			94.1		%		70-130	21-APR-15
Boron (B)			120.4		%		70-130	21-APR-15
Cadmium (Cd)			90.3		%		70-130	21-APR-15
Chromium (Cr)			104.8		%		70-130	21-APR-15
Cobalt (Co)			96.7		%		70-130	21-APR-15
Copper (Cu)			93.3		%		70-130	21-APR-15
Lead (Pb)			83.8		%		70-130	21-APR-15
Molybdenum (Mo)			85.3		%		70-130	21-APR-15
Nickel (Ni)			99.0		%		70-130	21-APR-15
Selenium (Se)			95.0		%		70-130	21-APR-15
Silver (Ag)			90.6		%		70-130	21-APR-15
Thallium (Tl)			92.2		%		70-130	21-APR-15
Uranium (U)			98.0		%		70-130	21-APR-15
Vanadium (V)			106.2		%		70-130	21-APR-15
Zinc (Zn)			96.5		%		70-130	21-APR-15
WG2073531-6 DUP		**L1600418-7**						
Antimony (Sb)		<1.0	<0.10	RPD-NA	ug/g	N/A	30	21-APR-15
Arsenic (As)		3.2	2.97		ug/g	7.4	30	21-APR-15
Barium (Ba)		40.1	38.0		ug/g	5.3	40	21-APR-15
Beryllium (Be)		<0.50	0.33		ug/g	7.2	30	21-APR-15
Boron (B)		10.2	9.5		ug/g	7.3	30	21-APR-15
Cadmium (Cd)		<0.50	0.102		ug/g	6.2	30	21-APR-15
Chromium (Cr)		15.5	14.3		ug/g	7.7	30	21-APR-15
Cobalt (Co)		5.6	5.26		ug/g	5.4	30	21-APR-15
Copper (Cu)		12.5	12.0		ug/g	3.9	30	21-APR-15
Lead (Pb)		9.9	9.38		ug/g	5.0	40	21-APR-15
Molybdenum (Mo)		<1.0	0.40		ug/g	11	40	21-APR-15
Nickel (Ni)		13.7	13.2		ug/g	4.1	30	21-APR-15
Selenium (Se)		<1.0	<0.20	RPD-NA	ug/g	N/A	30	21-APR-15
Silver (Ag)		<0.20	<0.10	RPD-NA	ug/g	N/A	40	21-APR-15

Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3177901								
WG2073531-6 DUP		**L1600418-7**						
Thallium (Tl)		<0.50	0.089		ug/g	8.5	30	21-APR-15
Uranium (U)		<1.0	0.632		ug/g	2.4	30	21-APR-15
Vanadium (V)		23.2	21.4		ug/g	8.0	30	21-APR-15
Zinc (Zn)		42.2	39.5		ug/g	6.6	30	21-APR-15
WG2073531-3 LCS								
Antimony (Sb)			101.7		%		80-120	21-APR-15
Arsenic (As)			95.2		%		80-120	21-APR-15
Barium (Ba)			95.6		%		80-120	21-APR-15
Beryllium (Be)			92.5		%		80-120	21-APR-15
Boron (B)			93.9		%		80-120	21-APR-15
Cadmium (Cd)			96.1		%		80-120	21-APR-15
Chromium (Cr)			95.8		%		80-120	21-APR-15
Cobalt (Co)			95.5		%		80-120	21-APR-15
Copper (Cu)			93.6		%		80-120	21-APR-15
Lead (Pb)			99.0		%		80-120	21-APR-15
Molybdenum (Mo)			94.5		%		80-120	21-APR-15
Nickel (Ni)			95.6		%		80-120	21-APR-15
Selenium (Se)			95.6		%		80-120	21-APR-15
Silver (Ag)			93.7		%		80-120	21-APR-15
Thallium (Tl)			95.6		%		80-120	21-APR-15
Uranium (U)			93.6		%		80-120	21-APR-15
Vanadium (V)			97.9		%		80-120	21-APR-15
Zinc (Zn)			92.1		%		80-120	21-APR-15
WG2073531-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	21-APR-15
Arsenic (As)			<0.10		mg/kg		0.1	21-APR-15
Barium (Ba)			<0.50		mg/kg		0.5	21-APR-15
Beryllium (Be)			<0.10		mg/kg		0.1	21-APR-15
Boron (B)			<5.0		mg/kg		5	21-APR-15
Cadmium (Cd)			<0.020		mg/kg		0.02	21-APR-15
Chromium (Cr)			<0.50		mg/kg		0.5	21-APR-15
Cobalt (Co)			<0.10		mg/kg		0.1	21-APR-15
Copper (Cu)			<0.50		mg/kg		0.5	21-APR-15
Lead (Pb)			<0.50		mg/kg		0.5	21-APR-15

Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	Soil							
Batch R3177901								
WG2073531-1 MB								
Molybdenum (Mo)			<0.10		mg/kg		0.1	21-APR-15
Nickel (Ni)			<0.50		mg/kg		0.5	21-APR-15
Selenium (Se)			<0.20		mg/kg		0.2	21-APR-15
Silver (Ag)			<0.10		mg/kg		0.1	21-APR-15
Thallium (Tl)			<0.050		mg/kg		0.05	21-APR-15
Uranium (U)			<0.050		mg/kg		0.05	21-APR-15
Vanadium (V)			<0.20		mg/kg		0.2	21-APR-15
Zinc (Zn)			<2.0		mg/kg		2	21-APR-15
MOISTURE-WT	Soil							
Batch R3176280								
WG2072498-3 DUP		**L1600509-4**						
% Moisture		13.2	13.4		%	2.0	20	19-APR-15
WG2072498-2 LCS								
% Moisture			100.0		%		70-130	19-APR-15
WG2072498-1 MB								
% Moisture			<0.10		%		0.1	19-APR-15
Batch R3176283								
WG2072503-3 DUP		**L1587803-21**						
% Moisture		10.5	10.3		%	1.3	20	19-APR-15
WG2072503-2 LCS								
% Moisture			99.9		%		70-130	19-APR-15
WG2072503-1 MB								
% Moisture			<0.10		%		0.1	19-APR-15
PH-R511-WT	Soil							
Batch R3176288								
WG2072483-1 DUP		**L1600418-1**						
pH		7.31	7.17	J	pH units	0.14	0.3	20-APR-15
WG2072952-1 LCS								
pH			7.03		pH units		6.7-7.3	20-APR-15
SAR-R511-WT	Soil							
Batch R3177137								
WG2073525-4 DUP		**WG2073525-3**						
Calcium (Ca)		14.2	12.4		mg/L	14	40	21-APR-15
Sodium (Na)		3.85	3.94		mg/L	2.3	40	21-APR-15
Magnesium (Mg)		1.67	1.48		mg/L	12	40	21-APR-15

Quality Control Report

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	Soil							
Batch R3177137								
WG2073525-2 IRM		**WT SAR1**						
Calcium (Ca)			83.1		%		70-130	21-APR-15
Sodium (Na)			90.0		%		70-130	21-APR-15
Magnesium (Mg)			83.4		%		70-130	21-APR-15
WG2073525-1 MB								
Calcium (Ca)			<0.10		mg/L		0.1	21-APR-15
Sodium (Na)			<0.50		mg/L		0.5	21-APR-15
Magnesium (Mg)			<0.10		mg/L		0.1	21-APR-15

Quality Control Report

Workorder: L1600418 Report Date: 23-APR-15

Client: LVM, a Division of EnGlobe Corp.
60 MEG DRIVE, UNIT 12A
LONDON ON N6E 3T6
Contact: ROB HELWIG

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
J	Duplicate results and limits are expressed in terms of absolute difference.
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.

118516

C of C # 00000

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

ALS Environmental

CHAIN OF CUSTODY / ANALYTICAL SERVICES REQUEST FORM

Page 1 of 1

Note: all TAT Quoted material is in business days which exclude statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required

Service requested: 5 day (regular) X; 3-4 day (25%); 2 day TAT (50%); Next day TAT (100%); Same day TAT (200%)

COMPANY NAME: LVM
OFFICE: London
PROJECT MANAGER: Rob Herlwig
PROJECT #: P-8182-001-100
PHONE: 519-685-6400
FAX: 519-685-0443
ACCOUNT #:
QUOTATION #:
PO #: A01072

CRITERIA — Criteria on report YES ✓ NO
Reg 153/04 ☐ Reg 511/09 ☒
Table 1 (2) 3 4 5 6 7 8 9
TCLP ____ MISA ____ PWQO ____
ODWS ____ OTHER ____

REPORT FORMAT/DISTRIBUTION
EMAIL ✓ FAX ____ BOTH ____
SELECT: PDF ____ DIGITAL ____ BOTH ____
EMAIL 1 ____
EMAIL 2 ____

ANALYSIS REQUEST

PLEASE INDICATE FILTERED, PRESERVED OR BOTH <--- (F, P, F/P)

SUBMISSION #: L1600418
ENTERED BY: PStaSny
DATE/TIME ENTERED: 17 Apr-15
BIN #:

SAMPLING INFORMATION

Date (dd-mm-yy)	Time (24hr) (hh:mm)	TYPE: COMP	TYPE: GRAB	MATRIX: WATER	MATRIX: SOIL	MATRIX: OTHER	SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	METALS+INORGANICS	PHC F1-F4	BTEX	COMMENTS	LAB ID
14/04/15					✓		BH1 Sa1	4	✓	✓	✓		-1
14/04/15					✓		BH1 Sa2		✓	✓	✓		-2
15/04/15					✓		BH2 Sa2		✓	✓	✓		-3
15/04/15					✓		BH2 Sa5		✓	✓	✓		-4
15/04/15					✓		BH3 Sa2		✓	✓	✓		-5
15/04/15					✓		BH3 Sa4		✓	✓	✓		-6
14/04/15					✓		BH4 Sa1		✓	✓	✓		-7
14/04/15					✓		BH4 Sa3		✓	✓	✓		-8
15/04/15					✓		BH5 Sa1	✓	✓	✓	✓		-9

L1600418-COFC

SPECIAL INSTRUCTIONS/COMMENTS: TABLE 2 coarse grained RESIDENTIAL

THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)
Are any samples taken from a regulated DW System? Yes ☐ No ☐
If yes; an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ☐ No ☐

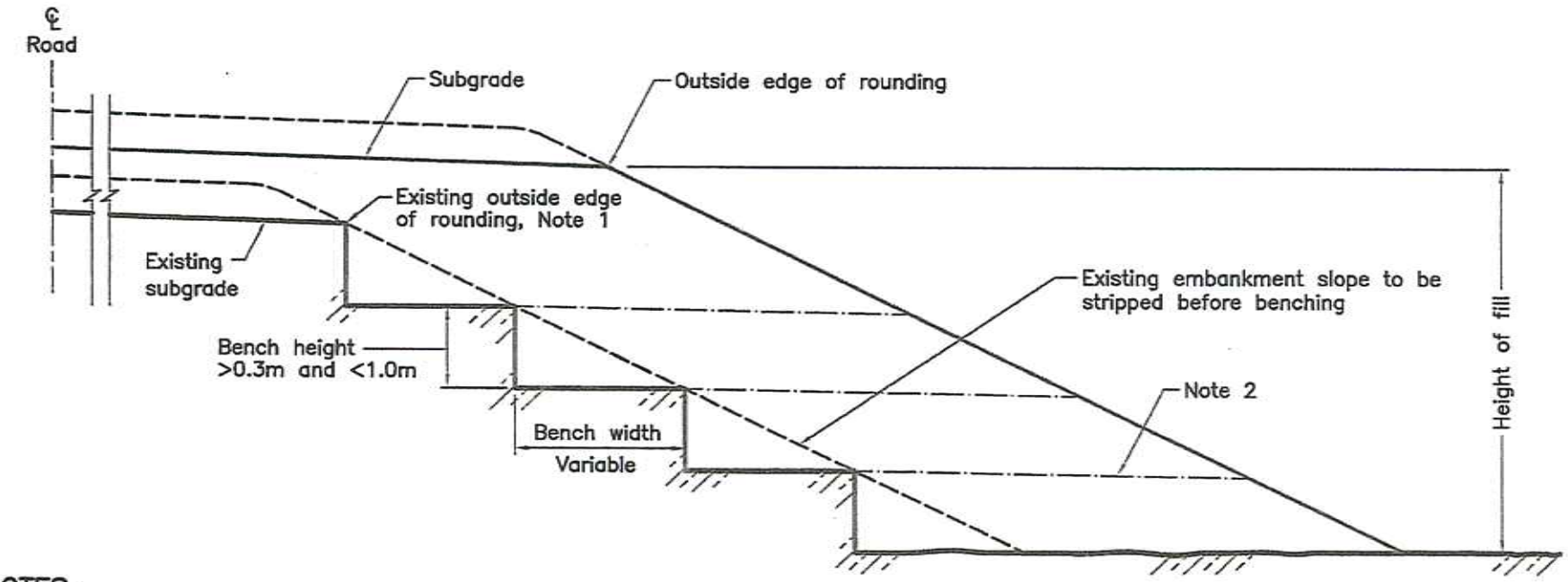
SAMPLE CONDITION: FROZEN ☐ COLD ☐ COOLING INITIATED ☑ AMBIENT ☐ MEAN TEMP 10°C
OBSERVATIONS Yes ☐ No ☐ If applicable IF
INT PS

SAMPLED BY: ED Van Puymbroeck
DATE & TIME: Apr 15, 2015
RECEIVED BY: R. Herlwig
DATE & TIME: Apr 15, 2015
RELINQUISHED BY:
DATE & TIME:
RECEIVED AT LAB BY: PStaSny
DATE & TIME: 17 Apr-15 @ 8:30

Notes
1. Quote number must be provided to ensure proper pricing
2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.
3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

Appendix 5 Benching of Earth Slopes

OPSD 208.010



NOTES:

1 When the subgrade is below the existing outside edge of rounding, benching shall be carried out below the point where the subgrade intersects the existing slope.

2 Benches are to be excavated one level at a time and the fill placed and compacted before the next bench is excavated.

A Benching is not required on existing slopes flatter than 3H:1V.

B All dimensions are in metres unless otherwise shown.

ONTARIO PROVINCIAL STANDARD DRAWING

BENCHING OF EARTH SLOPES

Nov 2008 | Rev 2

OPSD 208.010