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Soils Materials Environment

Johnston Brothers (Bothwell) Ltd.

Maes Pit, Part of Lots 1 and 2, Concession 2 Municipality of Middlesex Centre, Middlesex County

Aggregate Assessment Report

Date: March 6, 2017
Ref. N°: 161-B-0015494-1-GE-R-0001-00

Johnston Brothers (Bothwell) Ltd.

Maes Pit Part of Lots 1 and 2, Concession 2, Municipality of Middlesex Centre Middlesex County, Ontario

Aggregate Assessment Report |
161-B-0015494-1-GE-R-0001-00

Prepared by:

Robert J. Helwig, B.Sc., P.Geo.
Manager, London Operations

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Property and Confidentiality

Johnston Brothers (Bothwell) Ltd.
PO Box 220
Bothwell, Ontario N0P 1C0

Attention: Mr. Lloyd Johnston

REVISION AND PUBLICATION REGISTER		
Revision N°	**Date**	**Modification And/Or Publication Details**
00	2017-03-06	Draft Report Issued for Client Review

DISTRIBUTION	
1 electronic copy	Client and Mr. Wm. Bradshaw
2 copies	Client
1 original	File

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INTRODUCTION

We have completed this project in accordance with your instruction and authorization. This report contains a record of our findings and presents our conclusions with respect to the possible use of aggregate from the subject property located as shown on Drawing 1 in Appendix 1.

1 FIELDWORK

The fieldwork, consisting of five (5) sampled boreholes and seven (7) test pits, was carried out between August 22 and November 14 2016, at the locations shown on Drawing 2 in Appendix 1. The test pits were dug with a track-mounted excavator, and the boreholes were advanced to the sampling depths by a track mounted power auger machine, which was equipped with conventional soil sampling equipment. Fifty millimetre diameter monitoring wells were installed in the boreholes and they are identified as MW01-16 to MW05-16.

Bulk samples were retrieved from the test pits and split spoon samples were recovered from the boreholes. The samples were then transferred to our laboratory for grain size analyses. The fieldwork was supervised by a soil technician, who also related strata changes to the ground surface at each test pit and borehole location. Geodetic top of pipe and ground surface elevations and a site plan were provided by Wm. Bradshaw, P.Eng.

2 SUBSURFACE CONDITIONS

Detailed descriptions of the strata, which were encountered at each location, are given on the borehole and test pit logs comprising Enclosures 1 to 6 in Appendix 2. The following notes are intended only to amplify this data.

The test pits and boreholes generally encountered a surface layer of topsoil which ranged in thickness from 300 to 450 millimetres (mm). The topsoil is underlain by an extensive granular deposit ranging in gradation from silty sand to sand and gravel which extends beyond the lower limit of all 8 test pits, and boreholes MW01-16 to MW04-16. Borehole MW-05-16 was terminated in silt at a depth of 10.6 metres. The granular material becomes more silty below 10 metres depth.

3 GRAIN SIZE ANALYSES

Grain size analyses were performed on representative samples of the granular material to obtain an indication of the grading, and the results are plotted on the grain size distribution curves comprising Figures 1 to 3 in Appendix 3.

4 GROUNDWATER CONDITIONS

Groundwater levels were measured in the open test pits and are shown on the test pit summary in Appendix 2. The following groundwater levels were measured in the monitoring wells from top of pipe on August 24, 2016.

Table 1 Groundwater Measurements

TEST LOCATION	DEPTH TO GROUNDWATER (METRES)	GROUNDWATER ELEVATION (METRES)
MW01-16	3.05	235.44
MW02-16	2.59	235.02
MW03-16	4.23	234.52
MW04-16	3.29	234.85
MW05-16	2.67	235.09

5 DISCUSSION AND RECOMMENDATIONS

The investigation has revealed that the property contains significant quantities of aggregate of commercial value. The granular deposit has an estimated minimum average thickness of 10.0 metres and covers the entire property. Taking into account 15 metre and 30 metres setbacks from site boundaries the estimated extraction area is approximately 20 hectares.

Using an average thickness of 10 m, it is estimated that 2 million cubic metres of granular material could be extracted, which would translate to approximately 3.7 million metric tonnes by weight.

The sand and gravel could be manufactured into Granular 'B', which is a classification of the Provincial Ministries for road sub-base material. The sandier materials could be blended into the sand and gravel to produce Granular "B'. The sand could also be used to manufacture winter sand and Granular 'C'.

Approximately 90% of the deposit will require a below water extraction license.

The estimated quantities in the report are based on the results of the test pits and boreholes. Developers of the property should form their own opinions with regard to the potential net value of subsoil excavated for commercial purposes.

6 CONCLUSIONS

The investigation has revealed that 3.7 million metric tonnes of granular material of commercial value could be extracted from the property. The estimated quantities in the report are based on the results of the test pits and boreholes and assumed 15 to 30m setbacks from site boundaries. Developers of the property should form their own opinions with regard to the potential net value of subsoil excavated for commercial purposes.

7 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, EnGlobe 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 Englobe 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. Englobe 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. Englobe will not be responsible to any party for damages incurred as a result of failing to notify Englobe that differing site or subsurface conditions are present upon becoming aware of such conditions.

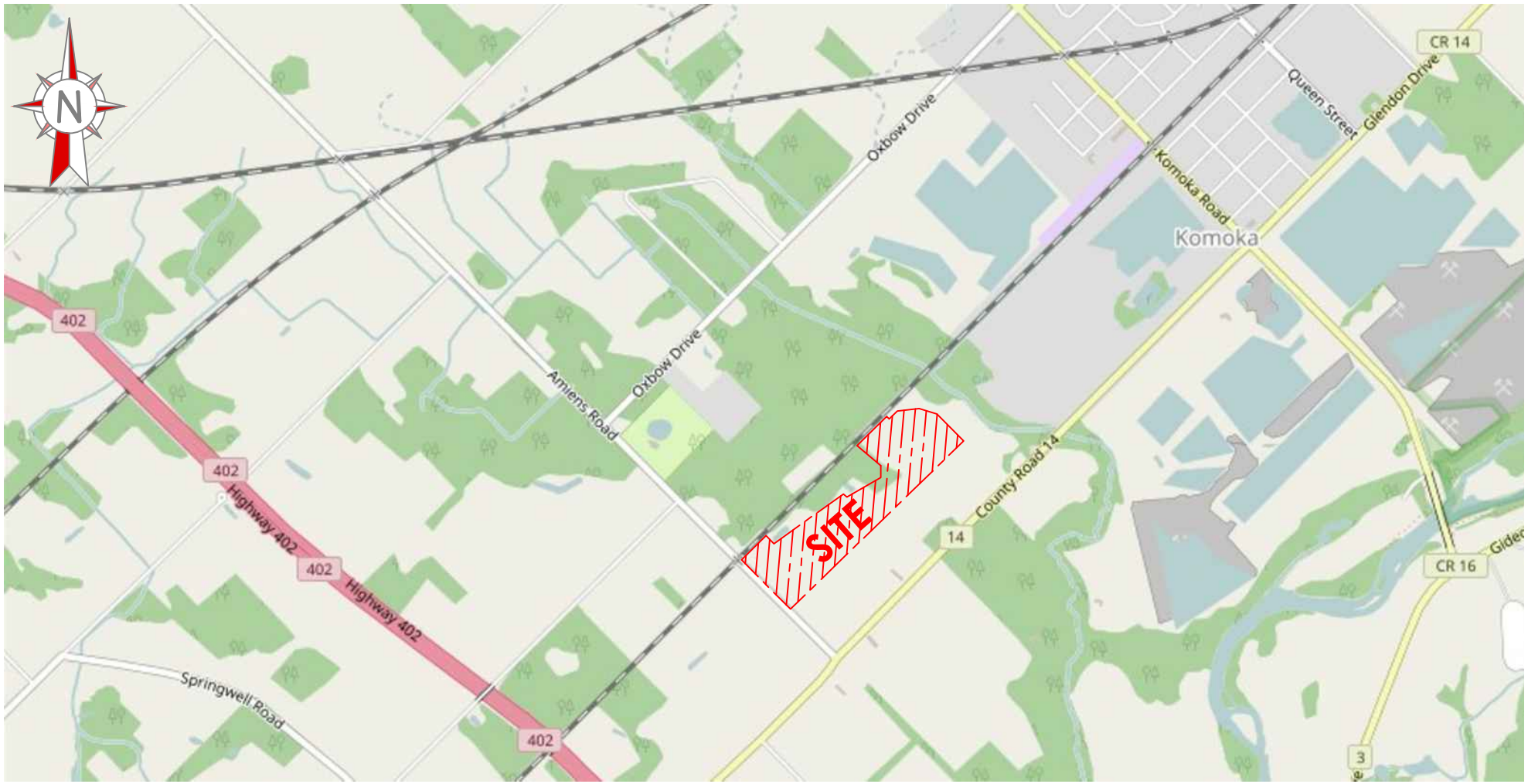
The professional services provided for this project include only the geotechnical aspects of the subsurface conditions at the site, unless otherwise stated specifically in the report. The recommendations and opinions given in this report are based on our professional judgment and are for the guidance 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: Site Location Plan
Drawing 2: Borehole and Test Pit Locations

G:\161\PROJECTS\2016\B-0015494 AGGREGATE ASSESSMENT, JOHNSTON BROS\Z4_CAD\B-15494-1_DWG 1 LOCAION PLAN.DWG

0 1 2 3 4 5 10 cm



0 250 500 750 1000 m

SCALE 1:25000

NOTES :

1-REFERENCES : © OpenStreetMap contributors (2017).

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

Aggregate Assessment

Part of Lots 1 & 2, Concession 2, Township of Middlsex Centre, County of Middlesex, ON

Title

Location Plan

Englobe

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 : 25000	Sequence no.	01 of 02
Checked	R.Helwig	Date	2017-01-17		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	B-0015494-1	GE	001	00

G:\161\PROJECTS\2016\B-0015494 AGGREGATE ASSESSMENT, JOHNSTON BROS\Z4_CAD\B-15494-1_DWG 2 SITE PLAN.DWG

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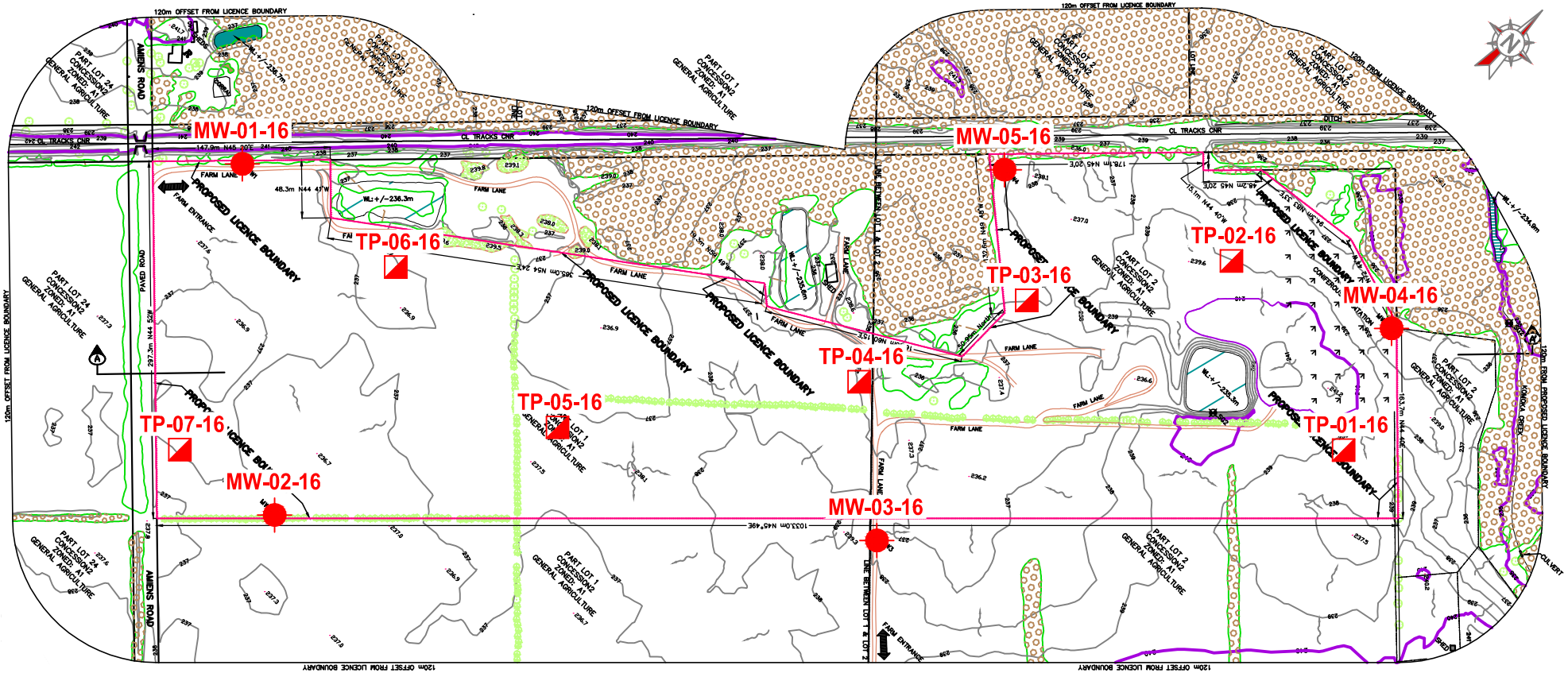

LEGEND :

MW-01-16
MONITORING WELL LOCATION

TP-05-16
TEST PIT LOCATION

0 50 100 150 200 m
SCALE 1:5000

NOTES :
1-REFERENCES : COMPANY: Johnson Brothers (Bothwell) Limited, PROJECT: Maes Pit, PLAN: Existing Features, DATE: October 9, 2016.

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

Aggregate Assessment

Part of Lots 1 & 2, Concession 2, Township of Middlsex Centre, County of Middlesex, ON

Title

Site Plan

Englobe
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 : 5000	Sequence no.	02 of 02
Checked	R.Helwig	Date	2017-01-17		

M. dept.	Project	Disc.	Dwg no.	Rev.
161	B-0015494-1	GE	002	00

Appendix 2 Borehole Logs & Test Pit Summary

List of Abbreviations
Borehole Logs MW01-16 to MW05-16
Test Pit Summary

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 º cone a distance 300 mm (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 mm (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	**SPT N-Value**	**Relative Density (D_r)**
Compactness Condition	(blows per 0.30 m)	(%)
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.: B-15494-1 **LOG OF BOREHOLE NO.** **Encl. No.** 1 (Sheet 1 of 1)
CLIENT: Johnston Brothers (Bothwell) Ltd. **MW01-16** **DRILLING DATA:** D50T
PROJECT: Geotechnical Investigation **METHOD:** Hollow stem
LOCATION: Part of Lots 1,2,3, Concession 2, Lobo Twp **DIAMETER:** 200mm
DATUM ELEVATION: Geodetic **DATE:** Aug 22, 2016

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
237.64	0	300mm topsoil									0.85m stickup
237	1										Cemented protector
236	2	Fine sand, trace to some silt		▼	1	ss	11				
235	3				2	ss	25				Bentonite seal
234	4										
233	5				3	ss	21				Native sand
232	6										
231	7	Sand, some gravel, trace of silt			4	ss	17				
230	8				5	ss	54				50mm pipe with filter pack
229	9										
228	10				6	ss	20				
227	11	Fine sand, some silt and gravel									Slough
226	12										
225					7	ss	22				
		End of Borehole									

LOG OF BOREHOLE B-15494-1.GPJ ATK_DAV.GDT 6/3/17

CONSULTING SOILS AND MATERIALS ENGINEERS

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

REF. NO.: B-15494-1 **LOG OF BOREHOLE NO.** **Encl. No.** 2 (Sheet 1 of 1)
CLIENT: Johnston Brothers (Bothwell) Ltd. **MW02-16** **DRILLING DATA:** D50T
PROJECT: Geotechnical Investigation **METHOD:** Hollow stem
LOCATION: Part of Lots 1,2,3, Concession 2, Lobo Twp **DIAMETER:** 200mm
DATUM ELEVATION: Geodetic **DATE:** Aug 24, 2016

SUBSURFACE PROFILE												
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
236.78	0	300mm topsoil									0.83m stickup
											Cemented protector
236	1	Fine sand, some silt									
235	2			▼	1	ss	21				Bentonite seal
234	3				2	ss	18				
233	4	Sand, some gravel, trace of silt									
232	5				3	ss	20				Native sand
231	6				4	ss	32				
230	7										
229	8				5	ss	20				
228	9										50mm pipe with filter pack
					6	ss	23				
227	10										
226	11	Silty sand									Slough
225	12				7	ss	26				
		End of Borehole									

LOG OF BOREHOLE B-15494-1.GPJ ATK_DAV.GDT 6/3/17

CONSULTING SOILS AND MATERIALS ENGINEERS

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

REF. NO.: B-15494-1 **LOG OF BOREHOLE NO.** **Encl. No.** 3 (Sheet 1 of 1)
CLIENT: Johnston Brothers (Bothwell) Ltd. **MW03-16** **DRILLING DATA:** D50T
PROJECT: Geotechnical Investigation **METHOD:** Hollow stem
LOCATION: Part of Lots 1,2,3, Concession 2, Lobo Twp **DIAMETER:** 200mm
DATUM ELEVATION: Geodetic **DATE:** Aug 22, 2016

SUBSURFACE PROFILE												
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
237.88	0	400mm sandy topsoil									0.77m stickup; Cemented protector
237	1										
236	2	Fine sand, trace to some silt			1	ss	5				
235	3			▼	2	ss	11				Bentonite seal
234	4										
233	5				3	ss	15				
232	6				4	ss	30				
231	7										
230	8	Sand and gravel, trace of silt			5	ss	35				50mm pipe with filter pack
229	9										
228	10				6	ss	39				
227	11				7	ss	19				Slough
226	12	Fine sand, some silt									
					8	ss	18				
		End of Borehole									

LOG OF BOREHOLE B-15494-1.GPJ ATK_DAV.GDT 6/3/17

CONSULTING SOILS AND MATERIALS ENGINEERS

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

REF. NO.: B-15494-1 **LOG OF BOREHOLE NO.** **Encl. No.** 4 (Sheet 1 of 1)
CLIENT: Johnston Brothers (Bothwell) Ltd. **MW04-16** **DRILLING DATA:** D50T
PROJECT: Geotechnical Investigation **METHOD:** Hollow stem
LOCATION: Part of Lots 1,2,3, Concession 2, Lobo Twp **DIAMETER:** 200mm
DATUM ELEVATION: Geodetic **DATE:** Aug 23, 2016

SUBSURFACE PROFILE												
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
237.36	0	300mm topsoil									0.77 stickup
237	1				1	ss	8				Cemented protector
236	2	Fine sand, trace of silt		▼							Bentonite seal
235	3				2	ss	25				
234	4										
233	5				3	ss	18				Native sand
232	6	Sand, some gravel, trace of silt									
231	7				4	ss	7				
230	8										50mm pipe with filter pack
229	9	Fine sand, trace to some silt			5	ss	18				
228	10				6	ss	16				
227	11	Silty sand to sandy silt									
226	12				7	ss	12				
225					8	ss	19				
		End of Borehole									

LOG OF BOREHOLE B-15494-1.GPJ ATK_DAV.GDT 6/3/17

CONSULTING SOILS AND MATERIALS ENGINEERS

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

REF. NO.: B-15494-1 **LOG OF BOREHOLE NO.** **Encl. No.** 5 (Sheet 1 of 1)
CLIENT: Johnston Brothers (Bothwell) Ltd. **MW05-16** **DRILLING DATA:** D50T
PROJECT: Geotechnical Investigation **METHOD:** Hollow stem
LOCATION: Part of Lots 1,2,3, Concession 2, Lobo Twp **DIAMETER:** 200mm
DATUM ELEVATION: Geodetic **DATE:** Aug 23, 2016

SUBSURFACE PROFILE												
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	LEL %	NATURAL WATER %	GAS %	WELL CONSTRUCTION
236.94	0	450mm sandy topsoil									0.82m stickup; Cemented protector
236	1										
235	2	Fine sand, trace of sand and gravel		▼	1	ss	1				Bentonite seal
234	3				2	ss	9				
233	4										
232	5				3	ss	24				Native sand
231	6				4	ss	24				
230	7	Sand, some gravel, trace of silt									
229	8				5	ss	25				50mm pipe with filter pack
228	9										
227	10				6	ss	57				
226	11				7	ss	15				Slough
225	12	Grey sandy silt									
					8	ss	13				
		End of Borehole									

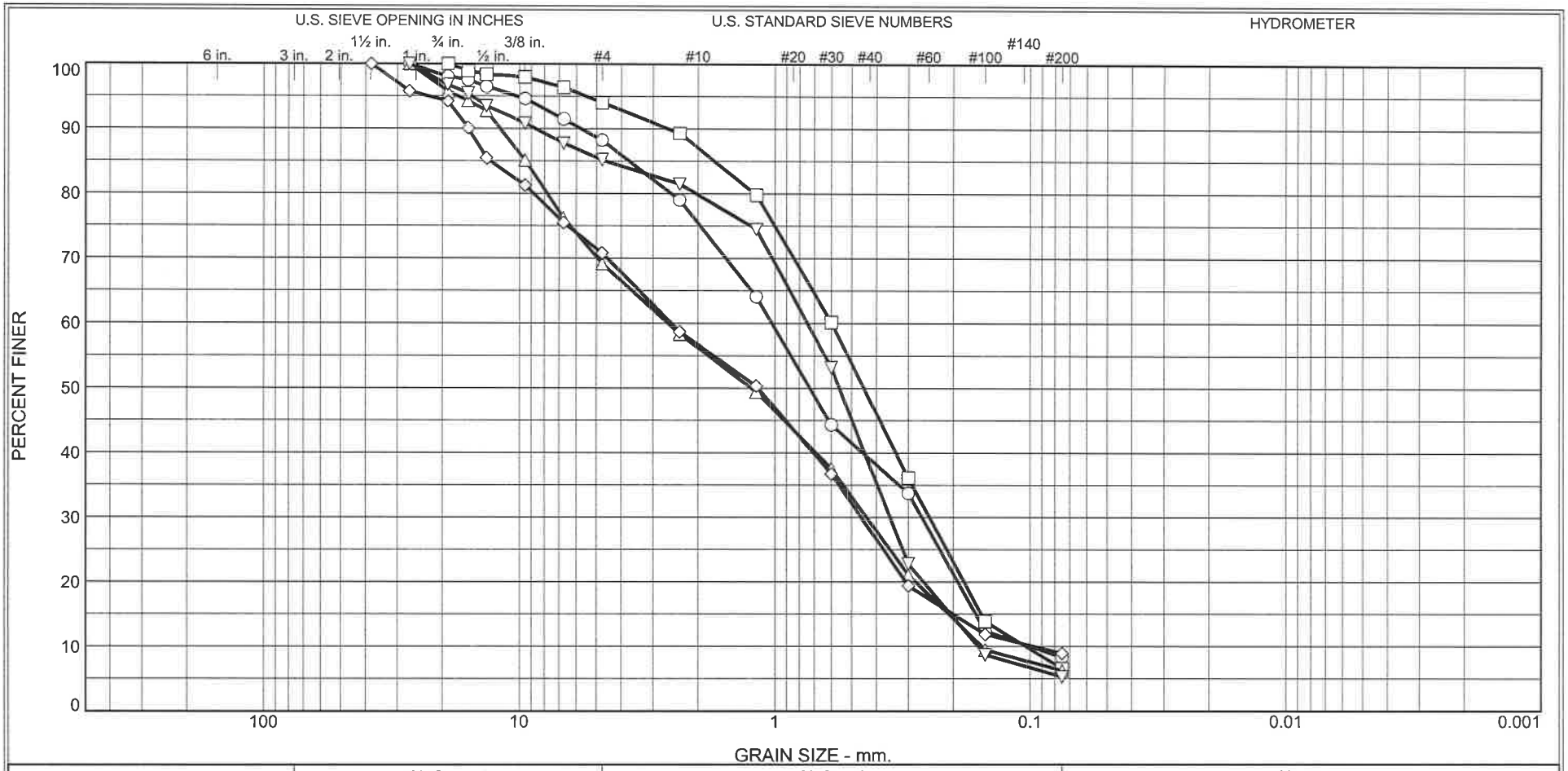
LOG OF BOREHOLE B-15494-1 GPJ ATK_DAV.GDT 6/3/17

Appendix 2

TEST PIT SUMMARY			
Test Pit	**Depth (metres)**	**Description**	**Remarks (water level)**
01-16	0 – 0.3	Sandy topsoil	4.5 m
	0.3 – 3.2	Fine to medium sand	
	3.2 – 4.3	Fine sand, silt seams	
	4.3 – 4.9	Fine sand, trace of silt	
02-16	0 – 0.3	Sandy topsoil	3.2 m
	0.3 – 4.0	Fine sand, trace of silt	
03-16	0 – 0.4	Sandy topsoil	1.8 m
	0.4 – 3.0	Fine sand, trace of silt	
04-16	0 – 0.3	Sandy topsoil	2.1 m
	0.3 – 3.7	Fine sand, trace of silt	
05-16	0 – 0.3	Sandy topsoil	2.4 m
	0.3 – 4.1	Fine sand, trace of silt	
06-16	0 – 0.45	Sandy topsoil	2.1 m
	0.45 – 3.7	Fine sand, trace of silt	
07-16	0 – 0.3	Sandy topsoil	2.1 m
	0.3 – 3.3	Fine sand, trace of silt	

Appendix 3 Grain Size Distribution Analyses

Figure 1: Boreholes 1 to 5
Figure 2: Test Pits 1 to 4
Figure 3: Test Pits 5 to 7



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

	Location	Source	Sample #	Depth/Elev.	Sample Information
○	BH-01		3 to 5	4.5 to 9.4	Sand, some Gravel, trace of Silt
□	BH-02		2 to 5	3.0 to 8.0	Sand, some Gravel, trace of Silt
△	BH-03		4 to 6	6.0 to 9.5	Sand and Gravel, trace of Silt
◇	BH-04		2 to 4	3.0 to 6.5	Sand and Gravel, trace of Silt
▽	BH-05		2 to 6	3.0 to 9.5	Sand, some Gravel, trace of Silt

Project No. B-0015494-1 **Client** Johnston Brothers (Bothwell) Limited . **Figure 1** 1

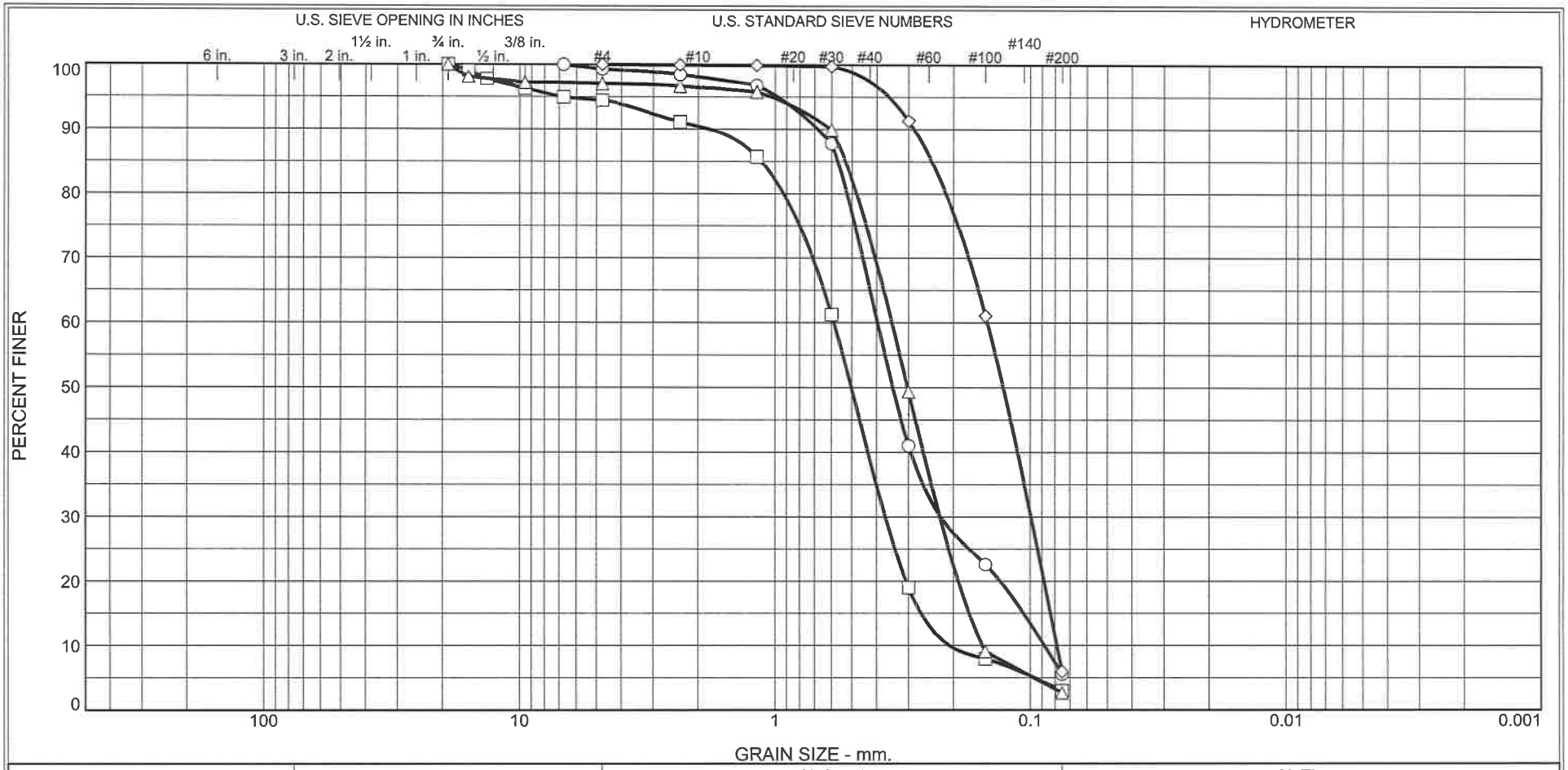
Grain Size Analysis

Aggregate Assessment,Part of Lots 1, 2 and 3 Concession, Lobo Township

EnGlobe

London, Ontario

Tested By: D.McBay **Checked By:** R.Helwig



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

	Location	Source	Sample #	Depth/Elev.	Sample Information
○	TP-01		4	4.3 to 4.9	Fine Sand, trace of Silt
□	TP-02		3	2.2 to 4.0	Fine to Medium Sand, trace of Silt
△	TP-03		2	1.5 to 3.0	Fine Sand, trace of Silt
◇	TP-04		2	1.0 to 3.7	Fine Sand, trace of Silt

Project No. B-0015494-1 **Client** Johnston Brothers (Bothwell) Limited . **Figure** 2

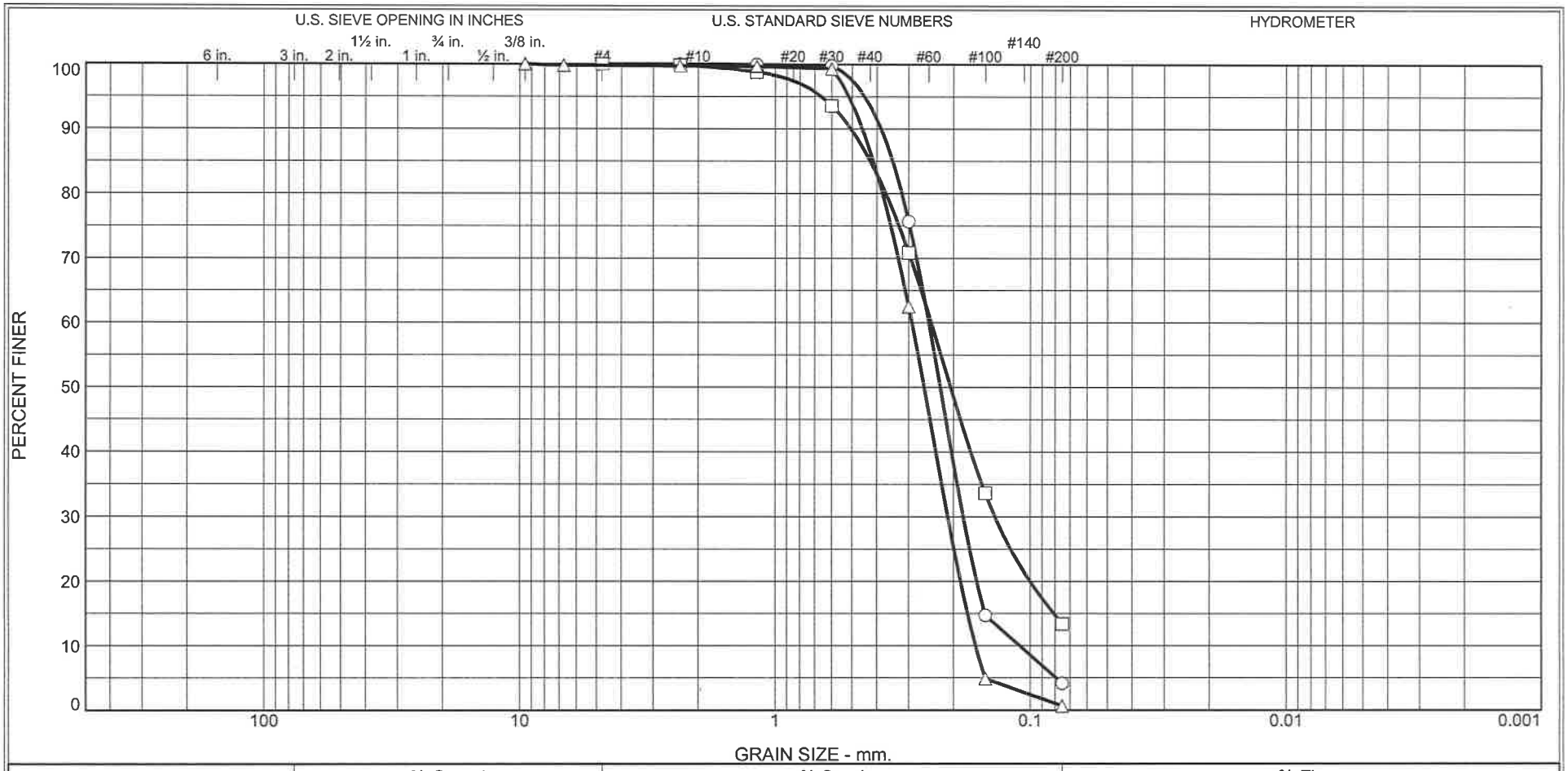
Grain Size Analysis

Aggregate Assessment,Part of Lots 1, 2 and 3 Concession, Lobo Township

EnGlobe

London, Ontario

Tested By: D.McBay **Checked By:** R.Helwig



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

	Location	Source	Sample #	Depth/Elev.	Sample Information
○	TP-05		3	1.1 to 4.1	Fine Sand, trace of Silt
□	TP-06		2	0.6 to 3.7	Fine Sand, some Silt
△	TP-07		2	1.0 to 3.3	Fine Sand, trace of Silt

Project No. B-0015494-1 **Client** Johnston Brothers (Bothwell) Limited . **Figure** 3

Grain Size Analysis

Aggregate Assessment,Part of Lots 1, 2 and 3 Concession, Lobo Township

EnGlobe

London, Ontario

Tested By: D.McBay **Checked By:** R.Helwig