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Kevlar Development Group
Arva, ON N0M 1C0

July 19, 2023
SBM-23-1072

Attn: **Jeff McLachlan, SCMP – Director of Operations**

Re: **Storm and Sanitary Servicing Feasibility Study**
Proposed Drive-Thru Restaurant
4366 Colonel Talbot Road, London, Ontario

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1. INTRODUCTION

This Storm and Sanitary Servicing Feasibility Study (Study) has been prepared by Strik, Baldinelli, Moniz Ltd. (SBM) for Kevlar Development Group to address the servicing feasibility for the proposed drive thru restaurant located at 4366 Colonel Talbot Road, London, Ontario. It is our understanding that vacant site is part of the former McEachren Elementary School. The site is currently zoned for commercial activities. The site shares the entrance to Colonel Talbot Road with 4402 Colonel Talbot Road. The total site area is approximately 0.163 ha and is located north of Broadway Ave and to the west of Colonel Talbot Road. The site is vacant.

The Site is located beside residential homes to the north and east and commercial site to the south, with Colonel Talbot Road to the west.

This Study is to determine the adequacy of the existing City of London (City) services in support of a Zoning By-law Amendment (ZBA) application for the proposed development.

2. SANITARY SERVICING

A 200mm sanitary sewer exists on Colonel Talbot Road as per the City Record Drawings 30883, 30884, and 30885 dated February 16, 2023.

The site is 0.163 ha and using Section 3.8.1 from the DS&RM, a design flow of 100 people/per hectare (commercial) was used. As a result, a design population of 16 was calculated. As per Section 3.9 of the DS&RM, a per capita flow of 230 L/day was used to determine peak flow. The calculated infiltration flow was 0.02 L/s and sewage flow was 0.21L/s resulting in a total sewage flow of 0.23 L/s. As per pre-application comments, the design sheets for the Record Drawings 30883 and 30884 have been revised to include the proposed development as well as all properties that front the sewer with an appropriate population allocation (based on commercial or residential land use) to verify there is adequate capacity. The “pinch point” (SL258-SL259-SL260) has been reviewed to verify the calculated flows will not exceed its capacity (18.85L/s). The calculated flow of 18.73 L/s at SL260 is 99% of the available capacity. Therefore, the existing sewer system has capacity to accommodate the proposed site. It is noted that new sewers should be designed to (in general) 80-90% of their capacity, however this situation is unique considering the following:

- All fronting properties are currently serviced via septic systems and the sewer was not primarily intended to eliminate these septic systems. There is potential that all fronting properties will connect, however this may not occur in the short-term or foreseeable future.
- The commercial population density has been applied to the R.O.W. as well as the commercial properties, resulting in a slightly conservative population.

The attached sanitary sewer design sheet shows that a 150mm diameter sanitary PDC at 0.5% (capacity of 10.78 L/s while achieving cleansing velocity) has sufficient capacity for the proposed development. It is assumed the 150mm sanitary PDC will directly connect to the 200mm sewer system on Colonel Talbot Road R.O.W. A 1.0% slope is the typical minimum specified in the DS&RM which will be achieved if possible through detailed design, however 0.5% may be required due to the shallow sanitary sewer depth.

Detailed design of the site sanitary servicing will occur as part of Site Plan Approval, including updated record drawings for the fronting sanitary sewer and design sheet.

3. STORM SERVICING AND STORMWATER MANAGEMENT

A 600mm storm sewer exists on Colonel Talbot Road based on the Site and Servicing Grading Plan dated May 1997. However, according to the pre-consultation comments, the site is not tributary to this storm sewer. As a result, runoff will be contained on site.

Post-development conditions were based on the conceptual site plan by Siv-ik dated July 17, 2023. The site will contain a building (209.50m^2), combined parking lot, drive-thru, and sidewalk, and patio (932.92m^2), and landscaping (494.29m^2). Preliminary SWM calculations show that the post-development C value is 0.69 and produces 2-year and 100-year flows of 21.76 L/s and 50.37 L/s. In order to retain the runoff on site, onsite infiltration galleries are proposed. According to the Englobe's "Geotechnical Engineering Report" dated September 19, 2018, borehole 01-18 is located closest to the site and showed that there is no groundwater present. For the adjacent development at 4402 Colonel Talbot Rd, infiltration trenches were implemented to capture and infiltrate the minor 2-year design storm. An infiltration rate of 25 mm/hr can be used for detailed design per Englobe's "Geotechnical Engineering Report Addendum" dated September 19, 2018, or 47 mm/hr based on the letter provided by Englobe dated February 14th, 2019. The storm flows are to be distributed/conveyed to the proposed trenches via perforated pipes. As per the Ministry of the Environment, Conservation and Parks (MECP) SWM Planning & Design Manual (SWMP&DM) requirements, the trenches are to be constructed 1.0m min. above the anticipated high groundwater elevation. Based on the letter from Englobe dated February 14th, 2019, provided in this study, the seasonal high groundwater is estimated to be approximately 6.7 meters below ground surface, and it is anticipated adequate depth is available for the proposed infiltration trenches to exceed the required 1 m of separation.

Detailed design will be provided for Site Plan Approval.

4. LIMITATIONS

This Study was prepared by SBM for the Kevlar Development Group and the City of London. Use of this report by any third party, or any reliance upon its findings, is solely the responsibility of that party. SBM. accepts no responsibility for damages, if any, suffered by a third party as a result of decisions made or actions undertaken as a result of this report. Third party use of this report, without the express written consent of the Consultant, denies any claims, whether in contract, tort, and/or any other cause of action in law, against the Consultant.

All findings and conclusions presented in this design brief are based on site conditions as they appeared during the period of the investigation. This report is not intended to be exhaustive in scope, or to imply a risk-free development. It should be recognized that the passage of time may alter the opinions, conclusions, and recommendations provided herein.

The design was limited to the documents referenced herein and SBM accepts no responsibility for the accuracy of the information provided by others. All designs and recommendations presented in this brief are based on the information available at the time of the review.

This document is deemed to be the intellectual property of SBM in accordance with Canadian copyright law.

5. CLOSURE

We trust this Study meets your satisfaction. Should you have any questions or require further information, please do not hesitate to contact us.

Respectfully submitted,

Strik, Baldinelli, Moniz Ltd.
Planning • Civil • Structural • Mechanical • Electrical

LICENSED PROFESSIONAL ENGINEER
B. R. HYLAND
100223591
July 19, 2023
SBM-23-1072
PROVINCE OF ONTARIO

Michelle

Ben Hyland, P.Eng., PMP
Civil Project & Team Lead, Eng III
Associate I

Michelle Alegria, EIT
Civil EIT I

Encl: Sanitary Extension Catchment Area Plan by Strik Baldinelli Moniz, City Record Drawing No.30883 dated February 2023
Sewer Design Sheet by Strik Baldinelli Moniz, City Record Drawing No.30884 dated February 2023 (with proposed changes)
Sanitary Extension Plan and Profile by Strik Baldinelli Moniz, City Record Drawing No.30885 dated February 2023
Site Sanitary Design Sheet
Site Survey by AGM dated December 12, 2017
Conceptual Site Plan by Siv-ik dated July 17, 2023
Site Grading and Sanitary Plan by Parker Consultants dated May 1997
Stormwater Management Calculations
Geotechnical Engineering Report by Englobe dated June 2018
Geotechnical Engineering Report Addendum by Englobe dated September 19, 2018
Geotechnical Letter by Englobe dated February 14, 2019

SANITARY SEWER CATCHMENT AREA MARKER

N.T.S.

SITE BENCHMARK:

MONUMENT TYPE: TOP OF SPINDLE

LOCATION: HYDRANT ON WEST END OF MARINNA DRIVE ON NORTH SIDE OF THE ROAD

GEODETIC ELEVATION: 261.71

MONUMENT TYPE: TOP OF SPINDLE

LOCATION: HYDRANT ON WEST SIDE OF COLONEL TALBOT ROAD AT MUNICIPAL NUMBER 4391

GEODETIC ELEVATION: 261.60

(TO BE CONFIRMED PRIOR TO CONSTRUCTION)

LEGAL INFORMATION

ALL OF LOT 15, PART OF LOT 16
EAST OF TALBOT ROAD PART OF
LOT 70, EAST OF THE NORTH
BRANCH OF THE TALBOT ROAD
(GEOGRAPHIC TOWNSHIP OF
WESTMINSTER) REGISTERED PLAN
NO.443(C)
IN THE
CITY OF LONDON
COUNTY OF MIDDLESEX

EXISTING SERVICES	DRAWING #, SOURCE	CONSTRUCTION DATE	CONSTRUCTED SERVICES	COMPLETION	DETAILS	No.	REVISIONS	DATE	CONSULTANT
STORM & WATER	14609	APR 1988	SANITARY SEWER	NOV. 2022	DESIGN JH/JF/KEK	1	RECORD DRAWINGS	JAN. 2023	SBM
STORM, SANITARY, & WATER	T18–11–09	MAY 2018	ROAD SURFACE	NOV. 2022	DRAWN BY JSF/IAC	2	RECORD DRAWINGS REV.1	JAN. 2023	SBM
					CHECKED BH/KAM	3	RECORD DRAWINGS REV.2	FEB. 2023	SBM
					APPROVED BH/KAM	4	RECORD DRAWINGS REV.3	FEB. 2023	SBM
					DATE 16/02/2023	5	RECORD DRAWINGS REV.4	FEB. 2023	SBM

CONSULTANT

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ENGINEER'S STAMP
B. R. HYLAND
100223591
March 6, 2023
SBM-18-0182

CORPORATION OF THE
CITY OF LONDON

SCALE
SCALE – 1:1500
15.0 0 30.0m

TITLE
SANITARY EXTENSION CATCHMENT AREA PLAN

COLONEL TALBOT ROAD
FROM MAIN STREET TO 300m±
SOUTH OF BROADWAY AVENUE

PROJECT No.
2009 LOCAL

SHEET No.
1 OF 4

PLAN FILE No.
30883

SITE BENCHMARK:

MONUMENT TYPE: TOP OF SPINDLE

LOCATION: HYDRANT ON WEST END OF MARINNA DRIVE ON NORTH SIDE OF THE ROAD

GEODETIC ELEVATION: 261.71

MONUMENT TYPE: TOP OF SPINDLE

LOCATION: HYDRANT ON WEST SIDE OF COLONEL TALBOT ROAD AT MUNICIPAL NUMBER 4391

GEODETIC ELEVATION: 261.60

(TO BE CONFIRMED PRIOR TO CONSTRUCTION)

LEGAL INFORMATION

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EAST OF TALBOT ROAD PART OF
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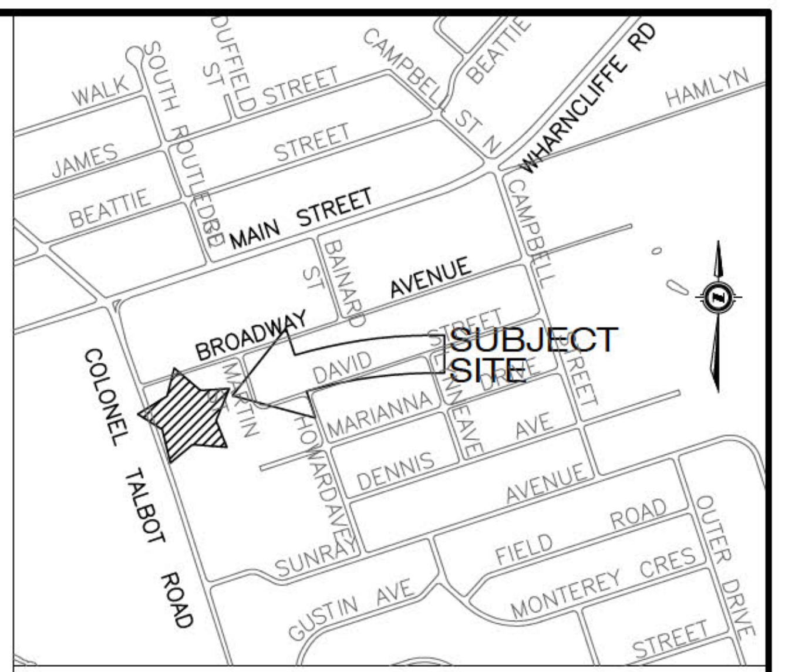

KEY PLAN

Sanitary Sewer Design Sheet

City of London

Date: January 9, 2023
Job Number: SBM-18-0182
Client: Lambeth Health Organization
Project: Lambeth Community Health and Wellness Centre
Designed By: JSF
Reviewed By: KM/BH
Project File No.: SBM-18-0182

Area Basis
Commercial/Institutional = 100 People/hectare (some properties may have other current uses, design based on zoning)
A205 population based on proposed R7 zoning (85 uph)

Design Critera (Litres/capita/day) 230
Sewage Infiltration (Litres/hectare/day) 8640
Harmon Formula (Peaking Factor)
M = (1 + 14/(4+P^0.5))
Uncertain Development Factor of 1.1 applied to sewage peak flow

Location				Area							Sewage Flows				Sewer design							Profile Design					
Area No.	Street Name	From MH	To MH	Delta Hectare	Total Hectare	No. of Units/Lots	People Per Unit/Lot	People Per Hectare	Delta Pop.	Total Pop.	Harmon Peaking Factor	Infilt L/S	Sewage L/S	Total L/S	n	Pipe Slope %	Calc'd Dia. mm	Dia. mm	Capacity L/S	Percentage Full %	Velocity m/s	Length m	Fall in Sewer	Headloss	Drop in U.S. MH	U.S. Invert	D.S. Invert
PROPOSED CONDITIONS																											
A205	4402 Colonel Talbot Road	Stub	SAMH 7	0.82	0.82	70	2.4		168	168	4.1747	0.08	2.05	2.14	0.013	0.33%	88.40	200	18.85	11.33%	0.60	7.9	0.03	0.018	-	259.25	259.22
	4402 Colonel Talbot Road	SAMH 7	SAMH 6	0	0.82				0	168	4.1747	0.08	2.05	2.14	0.013	0.33%	88.40	200	18.85	11.33%	0.60	26.4	0.09	0.013	0.02	259.20	259.12
	4402 Colonel Talbot Road	SAMH 6	SAMH 5	0	0.82				0	168	4.1747	0.08	2.05	2.14	0.013	0.33%	88.40	200	18.85	11.33%	0.60	28.5	0.09	0.013	0.01	259.10	259.01
	4402 Colonel Talbot Road	SAMH 5	SAMH 3	0	0.82				0	168	4.1747	0.08	2.05	2.14	0.013	0.33%	88.40	200	18.85	11.33%	0.60	17.2	0.06	0.017	0.01	259.00	258.94
A204	4402 Colonel Talbot Road	SAMH 4	TEE	1.14	1.14			100	114	114	4.2276	0.11	1.41	1.53	0.013	0.50%	72.07	150	10.78	14.16%	0.61						
A203	Colonel Talbot Road	SAMH 3	SAMH 2	0.2	2.16				0	282	4.0898	0.22	3.38	3.59	0.013	0.31%	108.71	200	18.27	19.66%	0.58	93.8	0.29	0.000	0.02	258.92	258.63
A202	Colonel Talbot Road	SAMH 2	SAMH 1	0.2	2.36				0	282	4.0898	0.24	3.38	3.61	0.013	0.33%	107.66	200	18.85	19.17%	0.60	95.3	0.31	0.001	0.02	258.61	258.29
A201	Colonel Talbot Road	SAMH 1	SL267	0.21	2.57				0	282	4.0898	0.26	3.38	3.63	0.013	0.32%	108.52	200	18.56	19.58%	0.59	99.0	0.32	0.000	0.02	258.27	257.95
EXISTING DOWNSTREAM CONDITIONS - per City of London Record Drawings 29347 & 29348																											
* A11	Colonel Talbot Road South	SL267	SL258	0.04	2.61				0	282	4.0898	0.26	3.38	3.64	0.013	0.33%		200	18.85	19.30%	0.60	20.2	0.067	0.028	0.028	257.922	257.855
P-01	Longwoods Road (Possible Pumped)		SL256	3.05	3.05			100	305	305	4.0754	0.31	3.64	3.94													
A1	Longwoods Road	SL256	SL257	0.84	3.89				50	355	4.0462	0.39	4.21	4.60	0.013	0.33%		200	18.85	24.37%	0.60	48.5	0.16	0.019	0.025	258.099	257.939
P-02	Beattie Street (Possible Pumped)			6.81	6.81	3	18	100	252	252	4.1097	0.68	3.03	3.71													
P-03	Colonel Talbot Road North (Possible Pumped)		SL269	0.35	7.16	3	3		9	261	4.1036	0.72	3.14	3.85													
A12	Colonel Talbot Road North	SL269	SL268	0.15	7.31				0	261	4.1036	0.73	3.14	3.87	0.013	0.33%		200	18.85	20.51%	0.60	28.2	0.09	0.019	0.025	258.144	258.051
	Colonel Talbot Road North	SL268	SL259	0	7.31				0	261	4.1036	0.73	3.14	3.87	0.013	0.33%		200	18.85	20.51%	0.60	25.4	0.08	0.028	0.028	258.026	257.942
A2	Longwoods Road	SL259	SL258	0.03	11.23				0	616	3.9259	1.12	7.08	8.20	0.013	0.33%		200	18.85	43.52%	0.60	26.4	0.09	0.003	0.025	257.914	257.827
A3	Main Street	SL258	SL259	1.34	15.18			100	99	997	3.8008	1.52	11.10	12.61	0.013	0.33%		200	18.85	66.91%	0.60	90.7	0.30	0.000	0.028	257.802	257.503
A4	Main Street	SL259	SL260	1.37	16.55			100	137	1134	3.7641	1.66	12.50	14.15	0.013	0.33%		200	18.85	75.08%	0.60	94.3	0.31	0.000	0.100	257.478	257.167
EXT02	South Routledge Road	CAP	SL260	0.24	0.24	2	3		6	6	4.4335	0.02	0.08	0.10	0.013	0.33%		200	18.85	0.54%	0.60	17	0.06	0.000	0.500	257.623	257.567
A5	Main Street	SL260	SL261	1.6	18.39			100	160	1300	3.7236	1.84	14.17	16.01	0.013	0.32%		300	54.73	29.26%	0.77	94.2	0.30	0.000	0.025	257.067	256.765
A6	Main Street	SL261	SL262	1.71	20.1			100	171	1471	3.6857	2.01	15.88	17.89	0.013	0.29%		300	52.11	34.33%	0.74	95.8	0.28	0.000	0.025	256.740	256.462
EXT04	Bainard Street	CAP	SL262	0.43	0.43	2	3		6	6	4.4335	0.04	0.08	0.12	0.013	0.33%		200	18.85	0.64%	0.60	15	0.05	0.000	1.314	257.801	257.751
A7	Main Street	SL262	SL263	1.48	22.01			100	148	1625	3.6542	2.20	17.39	19.59	0.013	0.27%		300	50.28	38.96%	0.71	88.7	0.24	0.000	0.025	256.437	256.197
A8	Main Street	SL263	SL264	1.4	23.41			100	140	1765	3.6274	2.34	18.75	21.09	0.013	0.25%		300	48.38	43.59%	0.68	86.1	0.22	0.000	0.025	256.172	255.957
A9	Main Street	SL264	SL265	1.38	24.79			100	138	1903	3.6025	2.48	20.07	22.55	0.013	0.23%		300	46.40	48.60%	0.66	86.1	0.20	0.000	0.025	255.932	255.734
A10	Main Street	SL265	SL266	1.18	25.97			100	118	2021	3.5823	2.60	21.20	23.80	0.013	0.21%		300	44.34	53.67%	0.63	54.1	0.11	0.000	2.970	255.079	255.595
	Main Street	SL266	EX CAP	0	25.97				0	2021	3.5823	2.60	21.20	23.80	0.013	0.29%		300	52.11	45.67%	0.74	13.6	0.04			252.625	252.586
	Main Street	EX CAP	EXSAMH10	0	25.97				0	2021	3.5823	2.60	21.20	23.80	0.013	0.29%		300	52.11	45.67%	0.74	22.7	0.07			252.586	252.520

EXISTING SERVICES	DRAWING #, SOURCE	CONSTRUCTION DATE	CONSTRUCTED SERVICES	COMPLETION	DETAILS	No.	REVISIONS	DATE	CONSULTANT
STORM & WATER	14609	APR 1988	SANITARY SEWER	NOV. 2022	DESIGN JH/JF/KEK	1	RECORD DRAWINGS	JAN. 2023	SBM
STORM, SANITARY, & WATER	T18-11-09	MAY 2018	ROAD SURFACE	NOV. 2022	DRAWN BY JSF/IAC	2	RECORD DRAWINGS REV.1	JAN. 2023	SBM
					CHECKED BH/KAM	3	RECORD DRAWINGS REV.2	FEB. 2023	SBM
					APPROVED BH/KAM	4	RECORD DRAWINGS REV.3	FEB. 2023	SBM
					DATE 16/02/2023	5	RECORD DRAWINGS REV.4	FEB. 2023	SBM

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ENGINEER'S STAMP
B. R. HYLAND
100223591
March 6, 2023
SBM-18-0182

CORPORATION OF THE CITY OF LONDON

SCALE
N/A

TITLE
SANITARY SEWER DESIGN SHEET

COLONEL TALBOT ROAD
FROM MAIN STREET TO 300m±
SOUTH OF BROADWAY AVENUE

PROJECT No.
2009 LOCAL

SHEET No.
2 OF 4

PLAN FILE No.

EXISTING SERVICES	DRAWING #, SOURCE	CONSTRUCTION DATE	CONSTRUCTED SERVICES	COMPLETION
STORM & WATER	14609	APR 1988	SANITARY SEWER	NOV. 2022
STORM, SANITARY, & WATER	T18–11–09	MAY 2018	ROAD SURFACE	NOV. 2022

DETAILS	
DESIGN	JH/JF/KEK
DRAWN BY	JSF/IAC
CHECKED	BH/KAM
APPROVED	BH/KAM
DATE	16/02/2023

No.	REVISIONS	DATE	CONSULTANT
1	RECORD DRAWINGS	JAN. 2023	SBM
2	RECORD DRAWINGS REV.1	JAN. 2023	SBM
3	RECORD DRAWINGS REV.2	FEB. 2023	SBM
4	RECORD DRAWINGS REV.3	FEB. 2023	SBM
5	RECORD DRAWINGS REV.4	FEB. 2023	SBM

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March 6, 2023
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CORPORATION OF THE CITY OF LONDON

SCALE
HORIZ SCALE – 1:500
VERT. SCALE – 1:50

TITLE
SANITARY EXTENSION PLAN & PROFILE

COLONEL TALBOT ROAD
FROM MAIN STREET TO 300m±
SOUTH OF BROADWAY AVENUE

PROJECT No. 2009 LOCAL
SHEET No. 3 OF 4
PLAN FILE No. 30885

Sanitary Sewer Design Sheet

City of London

Area Basis

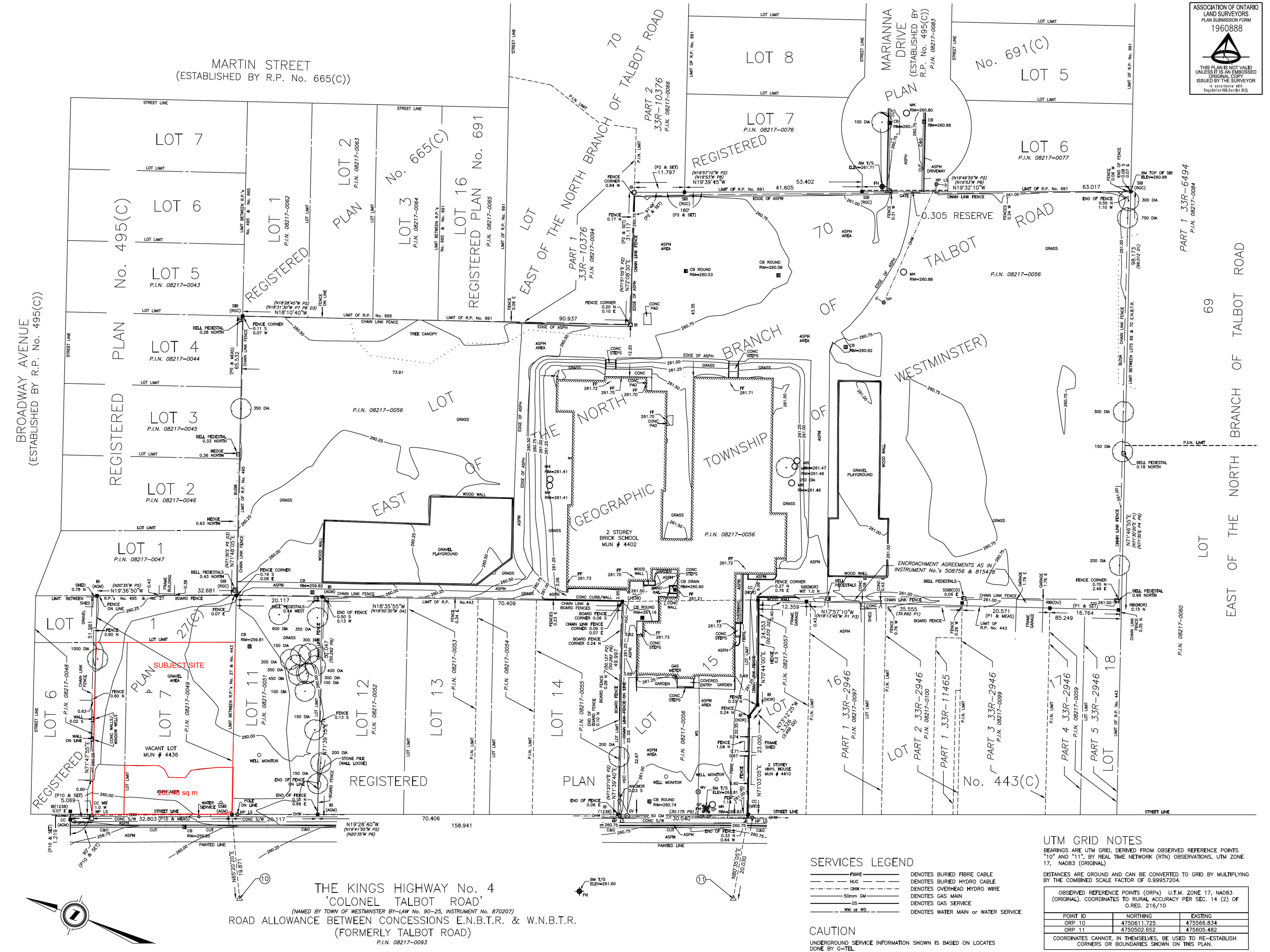
Low Density = 3.0 people/unit
Medium Density = 2.4 people/unit
Commercial/Institutional = 100 People/hectare (some properties may have other current uses, design based on zoning)
A205 population based on proposed R7 zoning (85 uph)

Design Critera (Litres/capita/day) 230
Sewage Infiltration (Litres/hectare/day) 8640
Harmon Formula (Peaking Factor)
M = (1 + 14/(4+P^0.5))
Uncertain Development Factor of 1.1 applied to sewage peak flow

Date: July 19, 2023
Job Number: SBM-23-1072
Client: Kevlar Development Group
Project: 43366 Colonel Talbot Rd
Designed By: MA
Reviewed By: BH
Project File No.: SBM-23-1072

Location				Area							Sewage Flows				Sewer design							Profile Design					
Area No.	Street Name	From MH	To MH	Delta Hectare	Total Hectare	No. of Units/Lots	People Per Unit/Lot	People Per Hectare	Delta Pop.	Total Pop.	Harmon Peaking Factor	Infilt L/S	Sewage L/S	Total L/S	n	Pipe Slope %	Calc'd Dia. mm	Dia. mm	Capacity L/S	Percentage Full %	Velocity m/s	Length m	Fall in Sewer	Headloss	Drop in U.S. MH	U.S. Invert	D.S. Invert
PROPOSED DEVELOPMENT																											
	4366 Colonel Talbot Road	SAMH1	TEE	0.163	0.163			100	16	16	4.3917	0.02	0.21	0.23	0.013	0.50%	35.22	150	10.78	2.10%	0.61						
EXISTING UPSTREAM CONDITIONS - per City of London Record Drawings 29347, 29348 and 30885																											
A205	4402 Colonel Talbot Road	SAMH 5	SL565	0	0.82	62	2.4		148.8	316.8	4.0683	0.08	3.77	3.86	0.013	0.33%	110.32	200	18.85	20.45%	0.60	17.2	0.06	0.017	0.01	259.00	258.94
A204	4402 Colonel Talbot Road	SAMH 4	TEE	1.14	1.14			100	114	114	4.2276	0.11	1.41	1.53	0.013	0.50%	72.07	150	10.78	14.16%	0.61						
EXISTING DOWNSTREAM CONDITIONS - per City of London Record Drawings 29347, 29348 and 30885																											
A203	Colonel Talbot Road	SL565	SL564	1.08	3.04			100	108	538.8	3.9573	0.30	6.24	6.55	0.013	0.31%	136.14	200	18.27	35.83%	0.58	93.8	0.29	0.000	0.02	258.92	258.63
A202	Colonel Talbot Road	SL564	SL563	1.03	4.07			100	103	641.9	3.9159	0.41	7.36	7.77	0.013	0.33%	143.46	200	18.85	41.20%	0.60	95.3	0.31	0.001	0.02	258.61	258.29
A201	Colonel Talbot Road	SL563	SL267	0.76	4.83			100	76	717.9	3.8882	0.48	8.17	8.66	0.013	0.32%	150.27	200	18.56	46.63%	0.59	99.0	0.32	0.000	0.02	258.27	257.95
* A11	Colonel Talbot Road South	SL267	SL258	0.04	4.87				0	717.9	3.8882	0.49	8.17	8.66	0.013	0.33%		200	18.85	45.94%	0.60	20.2	0.067	0.028	0.028	257.922	257.855
P-01	Longwoods Road (Possible Pumped)		SL256	3.05	3.05			100	305	305	4.0754	0.31	3.64	3.94													
A1	Longwoods Road	SL256	SL257	0.84	3.89				50	355	4.0462	0.39	4.21	4.60	0.013	0.33%		200	18.85	24.37%	0.60	48.5	0.16	0.019	0.025	258.099	257.939
P-02	Beattie Street (Possible Pumped)			6.81	6.81	3	18	100	252	252	4.1097	0.68	3.03	3.71													
P-03	Colonel Talbot Road North (Possible Pumped)		SL269	0.35	7.16	3	3		9	261	4.1036	0.72	3.14	3.85													
A12	Colonel Talbot Road North	SL269	SL268	0.15	7.31				0	261	4.1036	0.73	3.14	3.87	0.013	0.33%		200	18.85	20.51%	0.60	28.2	0.09	0.019	0.025	258.144	258.051
	Colonel Talbot Road North	SL268	SL259	0	7.31				0	261	4.1036	0.73	3.14	3.87	0.013	0.33%		200	18.85	20.51%	0.60	25.4	0.08	0.028	0.028	258.026	257.942
A2	Longwoods Road	SL259	SL258	0.03	11.23				0	616	3.9259	1.12	7.08	8.20	0.013	0.33%		200	18.85	43.52%	0.60	26.4	0.09	0.003	0.025	257.914	257.827
A3	Main Street	SL258	SL259	1.34	17.44			100	99	1432.9	3.6938	1.74	15.50	17.24	0.013	0.33%		200	18.85	91.46%	0.60	90.7	0.30	0.000	0.028	257.802	257.503
A4	Main Street	SL259	SL260	1.37	18.81			100	137	1569.9	3.6652	1.88	16.85	18.73	0.013	0.33%		200	18.85	99.35%	0.60	94.3	0.31	0.000	0.100	257.478	257.167
EXT02	South Routledge Road	CAP	SL260	0.24	0.24	2	3		6	6	4.4335	0.02	0.08	0.10	0.013	0.33%		200	18.85	0.54%	0.60	17	0.06	0.000	0.500	257.623	257.567
A5	Main Street	SL260	SL261	1.6	20.651			100	160	1735.9	3.6328	2.07	18.47	20.53	0.013	0.32%		300	54.73	37.51%	0.77	94.2	0.30	0.000	0.025	257.067	256.765
A6	Main Street	SL261	SL262	1.71	22.361			100	171	1906.9	3.6018	2.24	20.11	22.35	0.013	0.29%		300	52.11	42.89%	0.74	95.8	0.28	0.000	0.025	256.740	256.462
EXT04	Bainard Street	CAP	SL262	0.43	0.43	2	3		6	6	4.4335	0.04	0.08	0.12	0.013	0.33%		200	18.85	0.64%	0.60	15	0.05	0.000	1.314	257.801	257.751
A7	Main Street	SL262	SL263	1.48	24.271			100	148	2060.9	3.5756	2.43	21.58	24.01	0.013	0.27%		300	50.28	47.75%	0.71	88.7	0.24	0.000	0.025	256.437	256.197
A8	Main Street	SL263	SL264	1.4	25.671			100	140	2200.9	3.5531	2.57	22.90	25.47	0.013	0.25%		300	48.38	52.64%	0.68	86.1	0.22	0.000	0.025	256.172	255.957
A9	Main Street	SL264	SL265	1.38	27.051			100	138	2338.9	3.5319	2.71	24.19	26.89	0.013	0.23%		300	46.40	57.96%	0.66	86.1	0.20	0.000	0.025	255.932	255.734
A10	Main Street	SL265	SL266	1.18	28.231			100	118	2456.9	3.5146	2.82	25.29	28.11	0.013	0.21%		300	44.34	63.39%	0.63	54.1	0.11	0.000	2.970	255.079	255.595
	Main Street	SL266	EX CAP	0	28.231				0	2456.9	3.5146	2.82	25.29	28.11	0.013	0.29%		300	52.11	53.95%	0.74	13.6	0.04			252.625	252.586
	Main Street	EX CAP	EXSAMH10	0	28.231				0	2456.9	3.5146	2.82	25.29	28.11	0.013	0.29%		300	52.11	53.95%	0.74	22.7	0.07			252.586	252.520

*Area A11 includes proposed conditions and areas A201-A205.
**Flows added to A11 to calculate the downflow from the general area.
***A205 will contain 62 units at 2.4 ppu as per servicing feasibility study prepared by SBM, Project No SBM-22-3114.



TOPOGRAPHICAL PLAN OF SURVEY
OF ALL OF
LOT 7
AND PART OF
LOTS 1 AND 6, SOUTH OF
BROADWAY AVENUE
(FORMERLY JACKSON STREET)
REGISTERED PLAN No. 27(C)
AND ALL OF
LOT 11 AND 15
AND PART OF
LOT 16, EAST OF THE NORTH
BRANCH OF TALBOT ROAD
REGISTERED PLAN No. 433(C)
AND PART OF
LOT 70, EAST OF THE NORTH
BRANCH OF TALBOT ROAD
(GEOGRAPHIC TOWNSHIP OF WESTMINSTER)
IN THE
CITY OF LONDON
COUNTY OF MIDDLESEX

SCALE 1:400

10 8 6 4 2 0 10 20
SCALE IN METRES

2015
ARCHIBALD, GRAY & McKAY LTD.
ONTARIO LAND SURVEYORS

SURVEYOR'S CERTIFICATE:

I CERTIFY THAT:

1) THIS SURVEY AND PLAN ARE CORRECT AND IN ACCORDANCE WITH THE SURVEYS ACT, THE SURVEYORS ACT AND THE LAND TITLES ACT AND THE REGULATIONS MADE UNDER THEM.

2) THE SURVEY WAS COMPLETED ON THE 24th DAY OF DECEMBER, 2015.

DECEMBER 24, 2015

JASON WILBAND
ONTARIO LAND SURVEYOR

TOPOGRAPHIC LEGEND

ASPH	DENOTES ASPHALT
BM	DENOTES BENCHMARK
BPED	DENOTES BELL PEDESTAL
CB	DENOTES CATCH BASIN
CONC	DENOTES CONCRETE
C&G	DENOTES CURB AND GUTTER
DIA	DENOTES DIAMETER IN mm
FF	DENOTES FINISHED FLOOR
FH	DENOTES FIRE HYDRANT
GMR	DENOTES GAS METER
GP	DENOTES GUARD POST
GV	DENOTES GAS VALVE
HP	DENOTES HYDRO POLE
LS	DENOTES LIGHT STANDARD
MH	DENOTES MANHOLE
S/W	DENOTES SIDEWALK
T/S	DENOTES TOP SPINDLE OF FIRE HYDRANT
WV	DENOTES WATER VALVE
←	DENOTES POLE ANCHOR
þ	DENOTES SIGN
✳	DENOTES CONIFEROUS TREE
○	DENOTES DECIDUOUS TREE

LEGAL LEGEND

■	DENOTES MONUMENT FOUND
□	DENOTES MONUMENT PLANTED
RIB	DENOTES ROUND IRON BAR
SIB	DENOTES STANDARD IRON BAR
SSIB	DENOTES SHORT STANDARD IRON BAR
IB	DENOTES IRON BAR
CC	DENOTES CUT CROSS
AGM	DENOTES ARCHIBALD, GRAY & McKAY LTD., O.L.S.'s
HOR	DENOTES HOLSTEAD & REDMOND., O.L.S.'s
MTO	DENOTES MINISTRY OF TRANSPORTATIONOF ONTARIO
OU	DENOTES ORIGIN UNKNOWN
RGC	DENOTES R.G. CODE, O.L.S.
1238	DENOTES DENOTES MURRAY FRASER LIMITED O.L.S.
WIT	DENOTES WITNESS
P1	DENOTES PLAN 33R-2946
P2	DENOTES PLAN 33R-10376
P3	DENOTES PLAN 33R-11465
P4	DENOTES PLAN 33R-6494
P5	DENOTES REGISTERED PLAN No. 495(C)
P6	DENOTES REGISTERED PLAN No. 27(C)
P7	DENOTES REGISTERED PLAN No. 665(C)
P8	DENOTES REGISTERED PLAN No. 691(C)
P9	DENOTES REGISTERED PLAN No. 443(C)
P10	DENOTES AGM PLAN 2-A-1963 DATED OCTOBER 26, 1990
D1	DENOTES INSTRUMENT No. 31936
D2	DENOTES INSTRUMENT No. 56425
D3	DENOTES INSTRUMENT No. 109015
D4	DENOTES INSTRUMENT No. 264474
ENBTR	DENOTES EAST OF THE NORTH BRANCH OF TALBOT ROAD
WNBTR	DENOTES WEST OF THE NORTH BRANCH OF TALBOT ROAD

SERVICES LEGEND

FIBRE	DENOTES BURIED FIBRE CABLE
HUC	DENOTES BURIED HYDRO CABLE
OHW	DENOTES OVERHEAD HYDRO WIRE
50mm GM	DENOTES GAS MAIN
GS	DENOTES GAS SERVICE
WM or WS	DENOTES WATER MAIN or WATER SERVICE

CAUTION

UNDERGROUND SERVICE INFORMATION SHOWN IS BASED ON LOCATES DONE BY G-TEL.
ALL UTILITY LOCATIONS SHOWN ARE APPROXIMATE ONLY AND MUST BE VERIFIED BY FIELD LOCATES PRIOR TO EXCAVATIONS WITHIN THE VICINITY OF ANY UTILITY SERVICE INDICATED OR SUSPECTED.
THERE IS NO GUARANTEE THAT ALL UTILITY INFORMATION SHOWN ON THIS DRAWING IS COMPLETE OR ACCURATE.

UTM GRID NOTES

BEARINGS ARE UTM GRID, DERIVED FROM OBSERVED REFERENCE POINTS "10" AND "11", BY REAL TIME NETWORK (RTN) OBSERVATIONS, UTM ZONE 17, NAD83 (ORIGINAL)

DISTANCES ARE GROUND AND CAN BE CONVERTED TO GRID BY MULTIPLYING BY THE COMBINED SCALE FACTOR OF 0.99957204.

OBSERVED REFERENCE POINTS (ORPs) U.T.M. ZONE 17, NAD83 (ORIGINAL). COORDINATES TO RURAL ACCURACY PER SEC. 14 (2) OF O.REG. 216/10

POINT ID	NORTHING	EASTING
ORP 10	4750611.725	475566.834
ORP 11	4750502.652	475605.482

COORDINATES CANNOT, IN THEMSELVES, BE USED TO RE-ESTABLISH CORNERS OR BOUNDARIES SHOWN ON THIS PLAN.

METRIC: DISTANCES AND COORDINATES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO FEET BY DIVIDING BY 0.3048.

BENCHMARK

ELEVATIONS ARE DERIVED FROM GEODETIC DATUM AND ARE REFERRED TO CITY OF LONDON VERTICAL CONTROL MONUMENT NO. V010955005, BEING A BRONZE CAP IN CONCRETE CURB, LOCATED ON HIGHWAY 4 (COLONEL TALBOT ROAD) 4.5 METRES NORTH OF THE CENTRELINE OF SUNRAY AVENUE, 15.5 METRES EAST OF THE CENTRELINE OF THE HIGHWAY. ELEVATION = 260.122m.

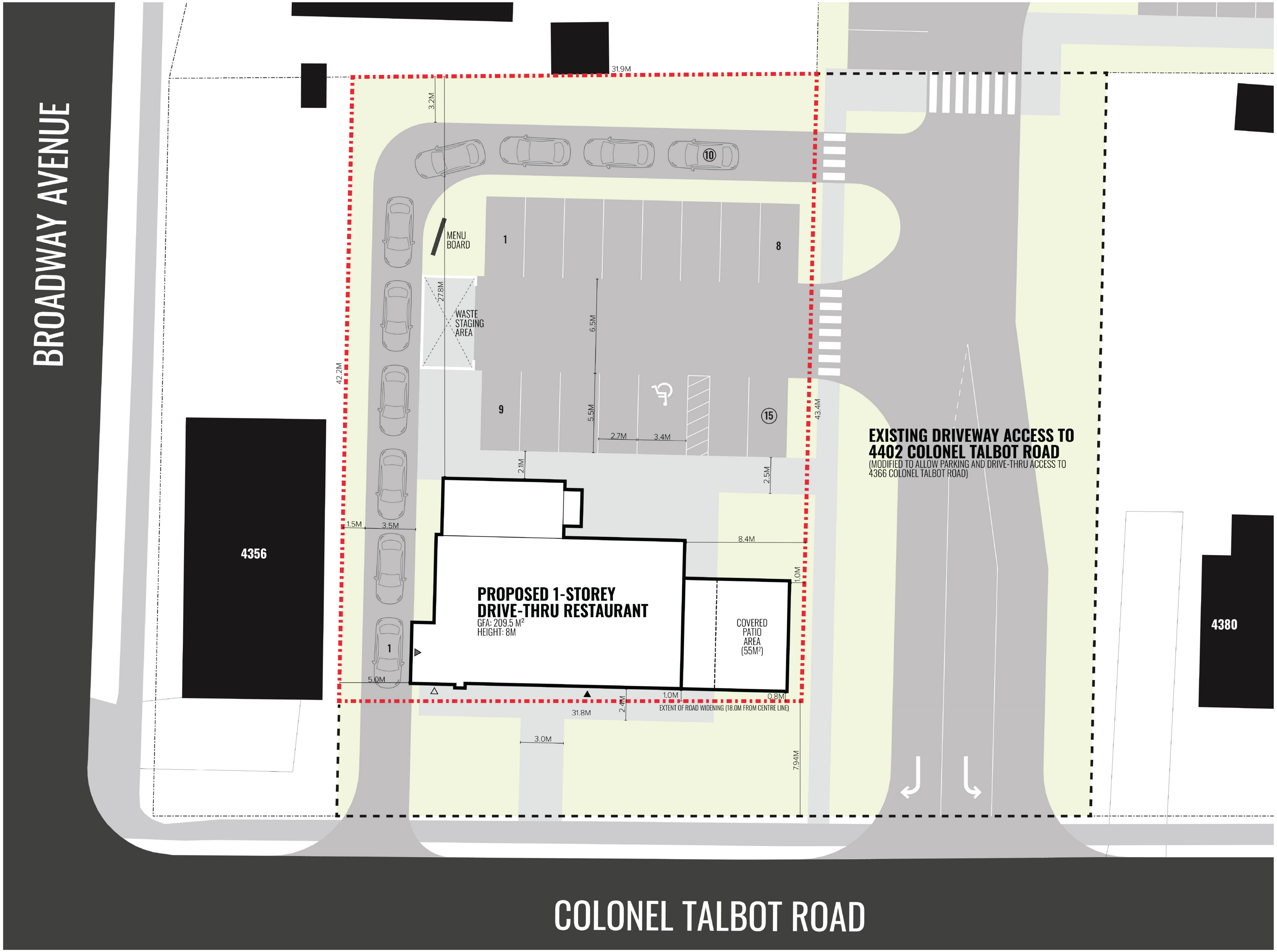
SITE BENCHMARKS

AS INDICATED ON THE FACE OF THIS PLAN.

AGM
PLAN • SURVEY • ENGINEER
ARCHIBALD, GRAY & McKAY LTD.
3514 WHITE OAK ROAD, LONDON, ON, N6E 2Z9
PHONE 519-685-5300
FAX 519-685-5303
EMAIL info@agm.on.ca
WEB www.agm.on.ca

DRAWN BY: BLB	DIGITAL FILE: Final Survey.dwg	PLAN No:
CHECKED BY: JPW	COGO FILE: WT1522C1.COG	8-L-4692
Plot date: Dec 12, 2017	FILE No: WT-ENBTR-70-8	

Z:\AA-Projects\2017\1736-Lambeth Health\0-Drawings\0.2 AutoCAD\0.2.1 Baseplans\Final Survey.dwg

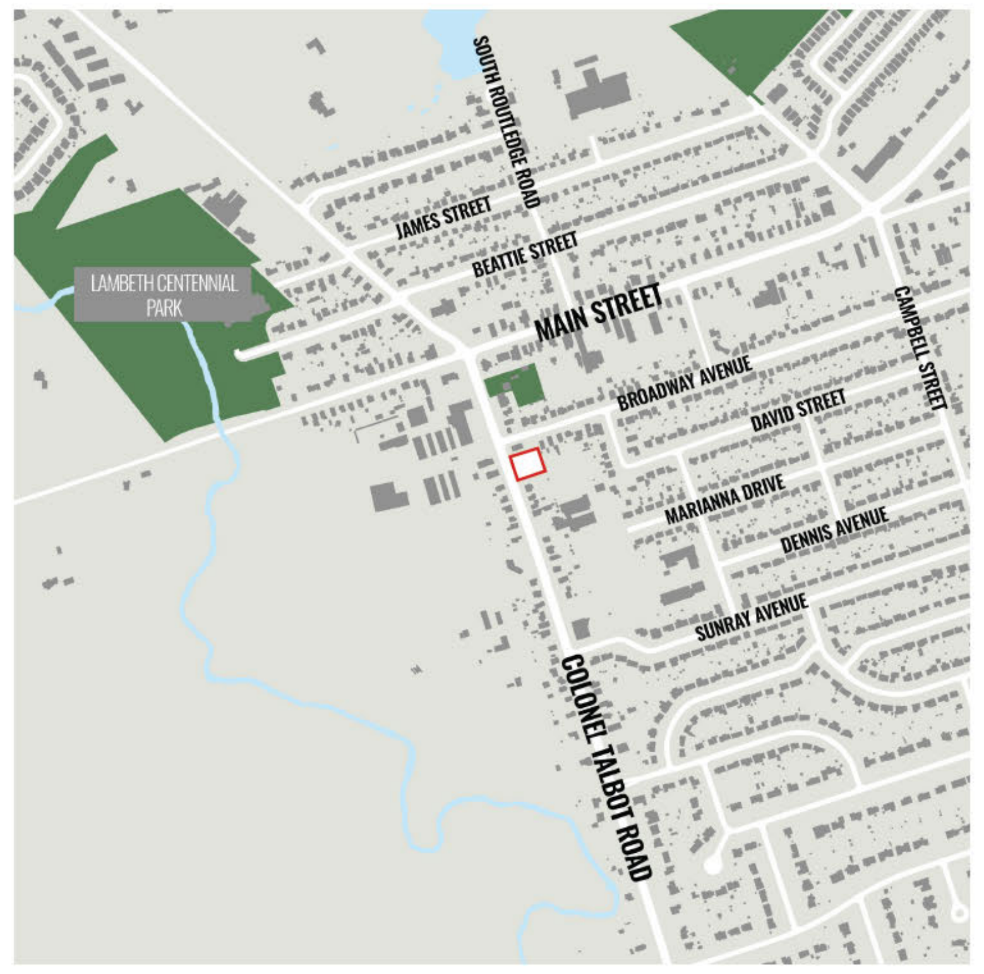


Lot Boundary Disclaimer: *Site dimensions have been derived from publicly available Parcel Data from The City of London. Siv-ik planning and design inc. makes no warranties or guarantees regarding the accuracy of the lot boundaries*

CONCEPT PLAN

01 DWG

PROJECT SITE
4366 Colonel Talbot Road



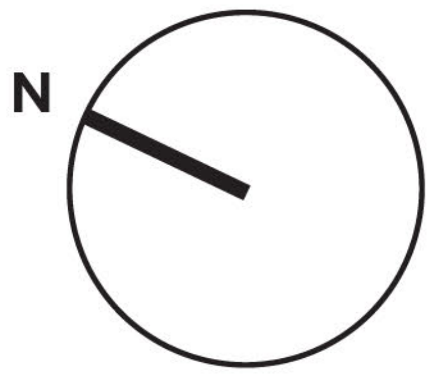
SITE DATA

NSA5 ZONE

Regulations	Required	Proposed
Permitted Uses:	Section 23.2	Restaurant
Lot Frontage:	25.0m (min)	31.8m
Lot Depth:	40.0m (min)	51.3m
Front and Exterior Side Yard:	0.0m (min)	1.0m
Interior Side Yard and Rear Yard:	Abutting a Residential Zone: 8.0m Abutting a Non-Residential Zone: 3.0 metres (9.8 feet) from any other zone boundary and 0.0 metres within the same NSA zone.	East: 27.8m South: 1.0m North: 5.0
Landscape OS:	15% (min)	30.2%
Lot Coverage:	30% (max)	12.8%
Height:	8.0m (max)	8.0m
Gross Floor Area:	2,000m² (max)	209.5m²
Gross Floor Area for Specific Uses:	Restaurants: 500.0m² (max)	209.5m²
Parking:	Restaurant: 1 per 20m² Patio: 1 per 20m² Stacking: 12 25 total parking spaces required	Parking: 15 Stacking: 10* 25 total provided

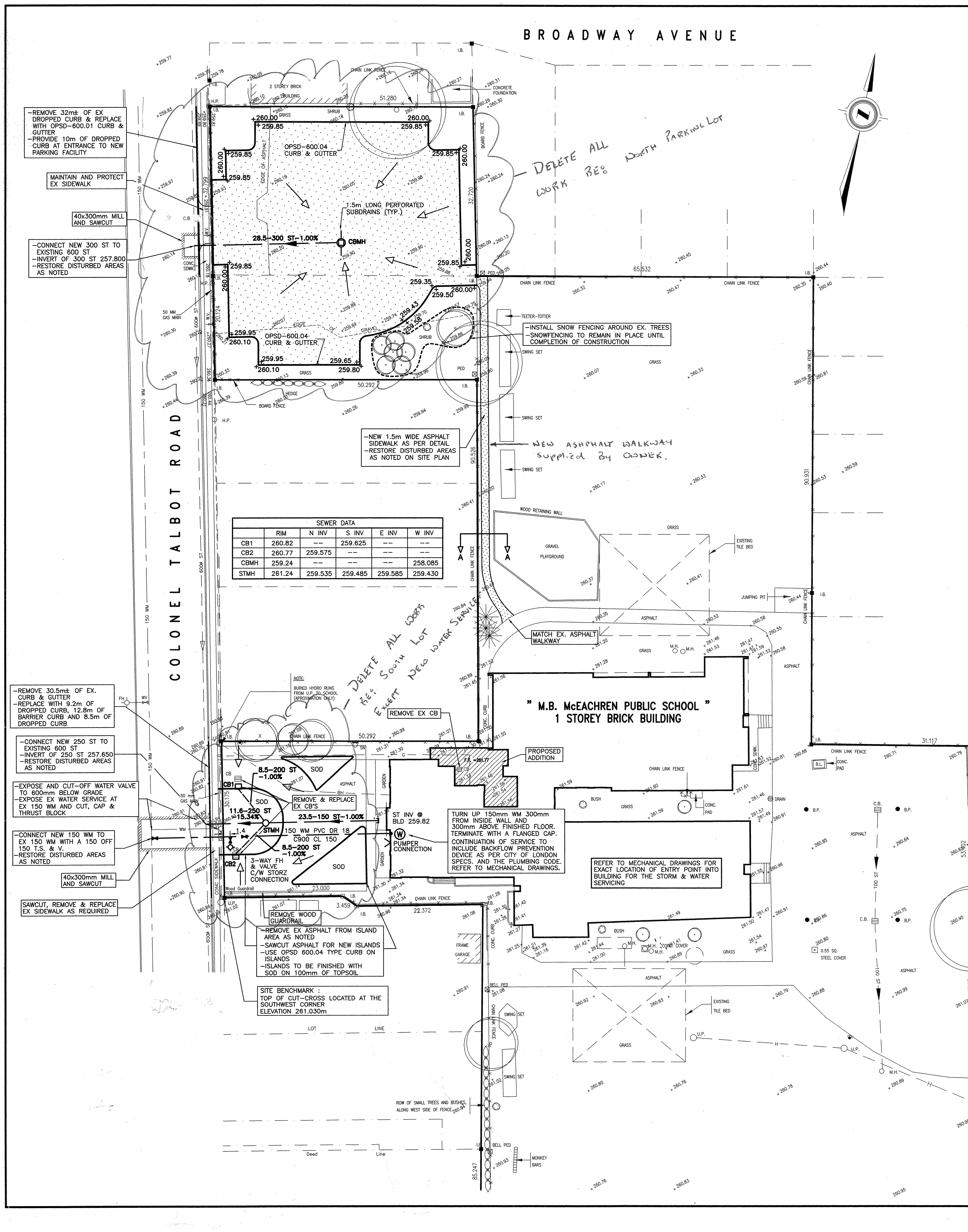
* Requires Special Provision

Client:	Kevlar Development Group
Date:	[07.17.23]
Drawn By:	D. Murphy
Plan Scale:	nts
File No:	4366CTR
Version	1.1



[siv-ik] PLANNING / DESIGN

Contact Us
www.siv-ik.ca
info@siv-ik.ca
905.921.9029



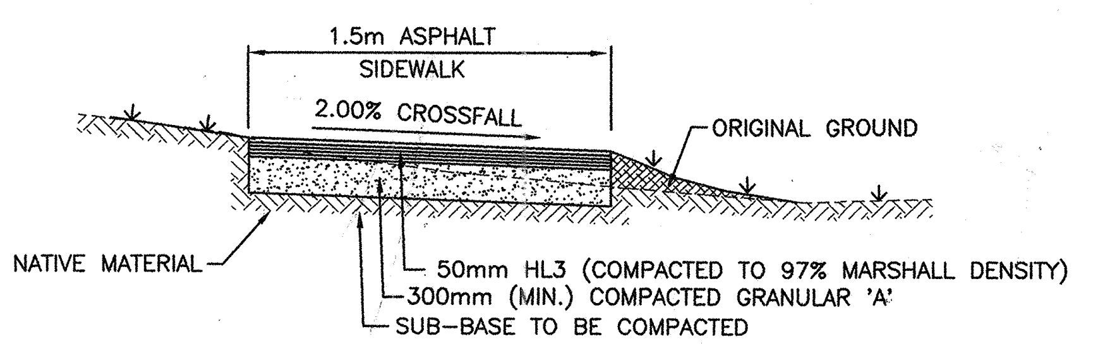
SEWER DATA					
	RIM	N INV	S INV	E INV	W INV
CB1	260.82	--	259.625	--	--
CB2	260.77	259.575	--	--	--
CBMH	259.24	--	--	--	258.085
STMH	261.24	259.535	259.485	259.585	259.430

WATERMAIN NOTES

1. All watermain pipe up to and including 300mm dia. to be polyvinyl chloride (PVC) C900, Class 150, DR 18. Ductile Iron (DI) Cl 52 c/w polyethylene wrap may be substituted if approved by City of London Sewer, Water & Drainage Department.
2. All watermains to have 1.7 m to 1.9 m cover. All backfill to be imported granular 'C' fill
3. Thrust blocks (25 MPa concrete strength) to be used at all tees and bends and to be poured against undisturbed soil.
4. All watermain construction shall conform to the City of London Supplemental Standards for Sewer & Water

LEGEND :

━━━ ━━━	PROPOSED STORM SEWER
─── ───	EXISTING STORM SEWER
━━━ ━ ━━━	PROPOSED WATERMAIN
─── ─ ───	EXISTING WATERMAIN
Ⓦ	PROPOSED WATERMETER LOCATION
⊡	CATCHBASIN MANHOLE
3-WAY FH + VALVE C/W STORZ CONNECTION	FIRE HYDRANT C/W STORZ CONNECTION
◎	EXISTING TREES
× 260.59	EXISTING GRADES
+ 287.50	PROPOSED GRADES
⬚	NEW ASPHALT PARKING AREA
▨	NEW ASPHALT SIDEWALK



TYPICAL ASPHALT SIDEWALK SECTION 'A-A'

N.T.S.

NOTES TO CONTRACTOR

1. Contractor to verify location of all existing utilities prior to construction.
2. Site Benchmark: In the Town of Westminster, Brass cap at the intersection of HWY #2 and HWY #4, in the concrete curb 0.6m southwest of a hydro pole on the northeast corner of the intersection.
   Elevation 261.388m (Control Monument No. 010880987)
3. Contractor to notify Parker Consultants and The City of London 48 hours before commencing construction within the road allowance.
4. The contractor shall remove all concrete, asphalt, unused and unsuitable material as required and dispose offsite.
5. On excavations in which existing curbs are affected, Granular 'B' shall extend 300mm behind back of curbs as part of restoration.
6. All catchbasins and manholes located within the parking lot and driveway areas are to be set at final asphalt elevation.
7. All drainage from abutting lands must not be adversely affected during or after construction.
8. The Contractor shall control all sediment from entering the storm sewer system to the satisfaction of the Engineer See Sediment and Erosion Control Notes.
9. The Contractor shall control traffic on Colonel Talbot Road to the satisfaction of the City of London Engineering and Traffic Departments.
10. The accuracy of the surface and subsurface details shown on the drawings are not guaranteed. The Contractor shall investigate and verify for himself whether the information is correct and complete.
11. Refer to the site plan prepared by The London Board of Education for layout of curbs, line painting, ramps, sidewalks, islands and buildings.
12. Restore Colonel Talbot road as follows :

40mm	HL3 Surface asphalt	(compacted to 97% Marshall density)
60mm	HL8 Binder asphalt	(compacted to 97% Marshall density)
150mm	Granular 'A'	(compacted to 98% STD Proctor dry density)

* Backfill within right-of-way with imported Granular 'C'

13. Roadway and parking areas to be constructed as follows :

50mm	HL3 Surface asphalt	(compacted to 97% Marshall density)
100mm	Granular 'A'	(compacted to 98% STD Proctor dry density)
300mm	Granular 'B'	(compacted to 95% STD Proctor dry density)

SEWER NOTES

1. All sanitary and storm sewer installation shall be in accordance to current City of London Standards and Specifications and the Plumbing Code.
2. The following OPSD Engineering Standards shall be used on this project:

OPSD-400.02	CAST IRON FRAME AND FLAT SQUARE GRATE
OPSD-600.01	BARRIER CURB & GUTTER
OPSD-600.04	BARRIER CURB & GUTTER
OPSD-701.01	PRECAST MANHOLE (1200ø)
OPSD-704.01	MANHOLE AND CATCHBASIN, PRECAST CONCRETE ADJUSTMENT UNITS
OPSD-705.01	PRECAST CATCHBASIN

   City of London Standards:

Dwg. No. SW-1	BEDDING STANDARD FOR GRAVITY AND PRESSURE PIPE
Dwg.No. SR-1.0	CONCRETE SIDEWALK

3. All storm sewers to be PVC SDR 35 Type 1 Bed unless otherwise noted. All backfill to be imported granular 'C' fill.
4. All catchbasin manholes to have 300mm sumps & catchbasins to have 600mm sumps.
5. All catchbasins and catchbasin manholes to be installed with 150mm ø pvc perforated underdrains, 1.5m long, surrounded by filter fabric and 19mm ø clear stone.
6. Remove all trench water when pipe laying is in progress.
7. Pull the "PIG" through the P.V.C. sewers in the presence of the Engineer.

SEDIMENT AND EROSION CONTROL NOTES

1. Protect all exposed surfaces and control all runoff during construction.
2. All erosion control measures to be in place before starting construction and remain in place until restoration is complete.
3. Maintain erosion control measures during construction.
4. Minimize area disturbed during construction.
5. All collected sediment to be disposed of at an approved location.
6. All dewatering to be disposed of in an approved sediment basin.
7. Protect all catchbasins, manholes and pipe ends from sediment intrusion. All catchbasin grates to be installed with filter fabric under the grating and surrounded with staked straw bales. Contractor to remove filter fabric and straw bales upon completion of the project.
8. Keep all sumps clean during construction.
9. Prevent wind blown dust.
10. Staked straw bales or filter fencing to be used in localized areas as shown and as directed by the Engineer during construction.

DESIGN AND CONSTRUCTION DEPARTMENT

The Board of Education
for the City of London

GENERAL NOTES:

1. CONTRACTOR TO VERIFY ALL DIMENSIONS ON SITE AND REPORT ANY DISCREPANCIES TO THE ARCHITECT PRIOR TO PROCEEDING WITH WORK.

40

PARKER CONSULTANTS

C.C. Parker Consultants Limited
Consulting Professional Engineers
562 Wellington Street, London
Ontario N6A 3R5 (519)432-7591

JOB No. 97104

"Asbuilts."

DATE	DESCRIPTION	No.

PLOTTING INFORMATION:
PLOTTED DATE = 00/00/00
PLOTTED SCALE = 1:400

D.C. CARTER
JUNE 19/97

PROJECT TITLE:

M.B. McEACHREN PUBLIC SCHOOL FIRE AND LIFE RENOVATIONS

DRAWING TITLE:

SITE SERVICING AND GRADING PLAN

DATE: MAY 1997
SCALE: 1:400
DRAWN: DJ
CHECKED BY: DCC
PROJECT No. 97104
DRAWING No. SS1

D:\97104\SS1 Fri Jun 20 08:48:26 1997

STRIK
BALDINELLI
sbm MONIZ
PLANNING · CIVIL · STRUCTURAL · MECHANICAL · ELECTRICAL

LONDON LOCATION
1599 Adelaide St. N., Units 301 & 203
London, ON N5X 4E8
P: 519-471-6667

www.sbmltd.ca

KITCHENER LOCATION
1415 Huron Rd., Unit 225
Kitchener, ON N2R 0L3
P: 519-725-8093

sbm@sbmltd.ca

Stormwater Management Calculations

DATE: July 19, 2023
JOB NO.: SBM-23-1072

Client: **Kevlar Development Group**
Project: **Proposed Drive-Thru Restaurant**
Location: **4366 Colonel Talbot Road**

PRE-DEVELOPMENT CONDITIONS *

	Area (m^2)	C	A*C
Total Area:	1636.71		
Building Area:	0.00	0.9	0.00
Asphalt/Concrete:	265.48	0.9	238.93
Gravel:	1371.23	0.9	1234.11
Landscaped/Open:	0.00	0.2	0.00
Totals:	1636.71		1473.04
C_{eq} = Sum(A*C)/Sum(A) =	0.90		

POST-DEVELOPMENT CONDITIONS **

	Area (m^2)	C	A*C
Total Area:	1636.71		
Building Area:	209.50	0.9	188.55
Asphalt/Concrete:	932.92	0.9	839.63
Gravel:	0.00	0.9	0.00
Landscaped/Open:	494.29	0.2	98.86
Totals:	1636.71		1127.04
C_{eq} = Sum(A*C)/Sum(A) =	0.69		

The proposed development will have a C-value of 0.69 which is greater than the allowable C-value of 0.9, and therefore additional SWM quantity controls are not required.

* Pre-Development Conditions were obtained from the Final Survey Plan No. 8-L-4692 by AGM dated December 12, 2017. Quantities will be verified at the time of Site Plan Approval Application.
** Post-Development Conditions are based on the Conceptual Site Plan by Siv-ik dated July 17, 2023.

PRELIMINARY FLOWS

CITY OF LONDON-3 CHICAGO RAINFALL DISTRIBUTION PARAMETERS*

Return Period (years)	A,B,C Parameters		
	A	B	C
2	754.360	6.011	0.810
5	1183.740	7.641	0.838
10	1574.382	9.025	0.860
25	2019.372	9.824	0.875
50	2270.665	9.984	0.876
100	2619.363	10.500	0.884
250	3048.220	10.030	0.888

*Intensity i=A/(t+B)^C (mm/hr)
* Refer to the City of London Design Specification & Requirments Manual (DS&RM), Section 6.4

PRE-DEVELOPMENT AREA (A101)

2 Year Pre-Development Area (A101) Flows

C = 0.90
**Time of concentration t_c = 10.4 min
Intensity, i (@ t_c) = 78.22 mm/hr
Pre Development Flow, Q_r = 2.78*C*i*A = 32.03 l/s

100 Year Pre-Development Area (A101) Flows

C = 0.90
**Time of concentration t_c = 10.4 min
Intensity, i (@ t_c) = 178.31 mm/hr
Pre Development Flow, Q_r = 2.78*C*i*A = 73.02 l/s

POST-DEVELOPMENT AREA (A201)

2 Year Post-Development Area (A201) Flows

C = 0.69
**Time of concentration t_c = 13 min
Intensity, i (@ t_c) = 69.44 mm/hr
Pre Development Flow, Q_r = 2.78*C*i*A = 21.76 l/s

100 Year Post-Development Area (A201) Flows

C = 0.69
**Time of concentration t_c = 13 min
Intensity, i (@ t_c) = 160.76 mm/hr
Pre Development Flow, Q_r = 2.78*C*i*A = 50.37 l/s

Englobe
Soils Materials Environment

Lambeth Health Organization Inc.

GEOTECHNICAL ENGINEERING REPORT

Lambeth Health and Wellness Centre
4402 Colonel Talbot Road
London, Ontario

June 2018

160-B-0019446-1-GE-R-0001-00

FINAL REPORT

Englobe

LICENSED PROFESSIONAL ENGINEER
July 3/18
S. W. BURT
PROVINCE OF ONTARIO

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Table of Contents

Tables

Appendixes

Introduction

Englobe Corp. (Englobe) was retained by Lambeth Health Organization Inc. to perform a Geotechnical Investigation at 4402 Colonel Talbot Road, London, Ontario, shown on the Location Plan, Drawing 1 in Appendix 1. This work, in accordance with Englobe Proposal 2018-P160-0249 dated April 9, 2018, was authorized by Ms. Michele Whatley by returning a signed copy of the proposal.

The project involves the renovating the site and involves installing a new elevator, on-site sewage disposal systems, and new pavements. The purpose of this investigation was to determine the subsurface conditions at the site and, based on that information, provide geotechnical recommendations for the design of foundations and pavements, and provide a recommended percolation T-time for the design of the on-site sewage disposal systems.

1 Investigation Procedure

1.1 Field Program

The fieldwork for this investigation was performed on June 14, 2018, and involved drilling eight (8) boreholes at the locations shown on the Site Plan, Drawing 2 in Appendix 1.

The boreholes were advanced to sampling depths of 1.5 to 4.6 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 various intervals of depth using a 50 mm O.D. split spoon sampler in accordance with the Standard Penetration Test (SPT) procedure (ASTM 1586). The SPT N-values are shown on the Borehole Logs in Appendix 2.

Groundwater observations were carried out in the boreholes during and upon the completion of drilling operations and the observations are noted on the Borehole Logs.

The fieldwork was monitored by an experienced geotechnical technician who directed the drilling and sampling procedures, documented the soil stratigraphy, and collected the soil samples.

The level of the ground surface at each borehole location was related to a local benchmark, which was taken as the finished floor level in a doorway 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 as well as moisture content determinations. The moisture content test results are shown on the appended borehole logs.

Grain size distribution analyses (MTO LS-702) (ASTM D422-63) were performed on samples of the native sand materials from Boreholes 6 and 8, and the test results are shown on Figure 1 in Appendix 3.

The soil samples will be stored for a period of three months from the date of storage. 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 stratigraphy, results of SPT testing, moisture content values, and groundwater observations. The following notes are intended only to summarize this data.

Boreholes 1 and 2 revealed surface layers of topsoil measuring 300 mm thick. Boreholes 3, 4, 5, and 7, revealed 50 to 100 mm thick surface layers of asphalt supported by 100 to 150 mm of granular fill materials at Borehole 4 and 7 locations. Borehole 6 and 8 revealed surface layers of pea stone fill measuring 75 and 380 mm thick respectively.

Beneath the layers of topsoil, pea stone fill, granular fill, and/or asphalt materials, the boreholes, with exception of Borehole 2 location, encountered layers of firm clayey silt fill and very loose to compact silt and sand fill materials. Borehole 1 was terminated within the fill at a depth of 1.5 m, and the remaining boreholes penetrated the fill at depths of 530 mm to 3.5 m. The fill samples yielded moisture contents ranging from 2 to 12%.

The underlying soil within the borehole depths consists of layers of compact to dense sand and gravel materials displaying natural moisture contents of 2 to 5%.

The boreholes remained dry and open at completion of the drilling operations.

The grain size distribution analysis test results, plotted on Figure 1 in Appendix 3, indicate that the native sand samples tested form Boreholes 6 and 8 contain 3 to 12% gravel, 78 to 88% sand, and 9 to 10% silt.

3 Discussion and Recommendations

3.1 Excavations and Groundwater Control

The soil revealed on this site can be classified as Type 3 soil in accordance with the Occupational Health and Safety Act and Regulations for Construction Projects. 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.

The boreholes remained dry and open at completion of the drilling operations and, based on the borehole findings, it is anticipated that any groundwater or surface water entering open excavations maintained within the borehole depths may be controlled with filtered pumps, as and when required.

3.2 Spread Footing Foundation Design

The new elevator structure is represented by the location of Borehole 4. All topsoil, fill, and loose soil must be removed from new foundation areas, and the following table provides the highest founding level at Borehole 4 location where conventional spread footings founded on the approved native sand subgrade will provide a maximum serviceability limits states (SLS) design pressure of 143 kPa (3,000 psf). Due to the variable relative density of the sand it is recommended as a minimum requirement that two continuous 15M reinforcing steel bars be placed in the top and the bottom of all foundation walls.

Table 1 Highest Foundation Founding Level

Borehole	Highest El./Depth for a SLS Design Pressure of 143 kPa (3,000 psf)
04-18	96.1 / 3.5 m

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

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

The approved native subgrade can be raised to a higher founding level by constructing engineered fill consisting of approved on-site sand and/or imported Granular 'B' Type 1 material each with a maximum aggregate size of 50 mm. Engineered fill must extend outside the foundation area for a minimum horizontal distance equal to the depth of fill placed below the 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 standard Proctor maximum dry density (SPMDD) under the supervision and testing of the geotechnical consultant.

The total and differential settlements of footings not more than three metres in width and subjected to the maximum serviceability limit states pressures are estimated to not exceed 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.

Based on the borehole findings, the soil on this site can be categorized as Site Class D in accordance with Table 4.1.8.4.A of the Ontario Building Code.

Particular care may be required for the installation of the elevator pit to avoid undermining of nearby foundations. Underpinning of nearby foundations and/or adequate bracing of excavations may be required in accordance with the recommendations provided in Appendix 4.

3.3 Lateral Earth Pressures

In the design of retaining walls with rigid lateral support, the lateral earth pressure will increase uniformly with depth, and the pressure, p, at any depth, h, can be calculated with the equation:

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

where K_o = earth pressure coefficient at rest, 0.5

γ = unit weight of backfill, 22.0 kN/m^3 (140 pcf)

q = effective value of any surcharge acting close to the wall.

The above expression assumes level grades beside the wall, the backfill consisting of free-draining granular material, and a drainage tile placed at the footing level to prevent the build-up of hydrostatic pressures behind the wall.

For non-rigid retaining wall design, the coefficient of earth pressure may be reduced to 0.35.

3.4 Slab on Ground Construction

All fill, topsoil, wet, soft, frozen and otherwise deleterious materials shall be removed from the ground surface and it is recommended that the approved native sand subgrade be compacted to 98% of the materials SPMDD. The foundation trench excavations shall be backfilled with approved on-site sand and/or imported granular pit-run material compacted throughout to a minimum of 98% MSPDD.

It is recommended that concrete floor slabs be constructed on a minimum 150 mm thickness of Granular 'A' material compacted to 100% SPMDD. To minimize shrinkage cracking and curling of the slab, the top of the floor slab must be kept moist as the concrete cures.

To prevent the migration of moisture vapour into the building from beneath ground floor slabs, particularly where moisture sensitive floor coverings are placed, a vapour retarder shall be placed directly beneath the floor slab that meets the requirements of the designer and flooring manufacturer. Prior to installing moisture sensitive floor coverings, the moisture content of the concrete slab must be determined at operational conditions by internal relative humidity testing to ensure an acceptable slab moisture level. It should be noted that it typically takes more than 90 days at operational conditions to lower the slabs internal relative humidity to 85%. Different flooring systems have different responses to slab moisture (i.e. some systems can tolerate more moisture than others), and the flooring contractor must assess the floor moisture levels with respect to their flooring components

3.5 Site Drainage

Buildings with floor levels at or above the surrounding ground surface and the ground surface sloping away from the building will not require perimeter tile drains. Basement or pit areas can be provided with a perimeter tile drain at the footing level to prevent a build-up of hydrostatic pressure against the foundation wall, with the tile out-letting to a permanent drainage system, such as a sump pump or sewer with a check valve to prevent the back wash of water into the tile system. To provide adequate filter protection against removal of the subsoil, the tile must be surrounded by 150 mm of pea gravel (10 mm aggregate) or 19 mm crushed gravel, and the gravel must be wrapped with a non-woven filter fabric, such as Terrafix 270R, Mirafi 140NS, Amoco 4535 or equivalent. It is recommended that the basement or pit foundation walls be damp-proofed to prevent moisture penetration.

3.6 Sewer Construction

It is assumed that the pipe invert depths will not extend below the explored depths, and it may be assumed that the inorganic soil will provide adequate indirect support for pipes. Pipe bedding and cover materials may consists of approved on-site sand or City of London bedding sand materials.

Excavated material which is not excessively wet may be used as trench backfill. All bedding and backfill materials shall be placed in maximum 300 mm thick lifts and each lift must be compacted to a minimum of 95% of the materials MSPDD.

3.7 Pavement Structure Recommendation

Approved pavement subgrades may be raised to design subgrade level with approved compactable on-site soil, providing it is placed in maximum 300 mm thick lifts and each lift is compacted to at least 95% of the materials MSPDD.

It is anticipated that new pavement areas will be subjected to either light or heavy traffic. Light duty areas are defined as passenger car parking only. Heavy duty areas are main driveways and routes where trucks would travel. Under dry subgrade and weather conditions during construction, the following pavement designs are recommended.

Table 2 Pavement Designs

Pavement Classification	HL 3 Surface Asphalt	HL 8 Base Asphalt	Granular 'A' Base	Granular 'B' Sub-base
Light Duty	40 mm	50 mm	150 mm	300 mm
Heavy Duty	50 mm	60 mm	150 mm	400 mm

To provide adequate support for the asphalt layers, the pavement granular materials shall be compacted to 100% of the materials MSPDD. The asphalt must be supplied and placed in accordance with OPSS forms 310 and 1150.

3.8 Haul Roads

Where required, construction roads for concrete trucks and other heavily loaded vehicles may consist of a minimum of 450 mm of stony Granular 'B' material placed on a woven geotextile to preclude mixing or pumping of the subgrade into the Granular 'B'. The geotextile may consist of Terratrack 24-15, Amoco 2002, Mirafi 500XL, or equivalent. A skim coat of Granular 'A' or recycled asphalt can be placed on the surface to provide a seal.

3.9 On-Site Sewage Disposal

Grain size distribution analyses were performed on the underlying native sand materials from Borehole 6 and 8 locations, which represent the leaching bed areas, and the test results are plotted on Figure 1 in Appendix 3.

The distribution curves prepared from the sieve analysis results on the samples tested was compared to the family of curves presented in the Supplementary Standard SB-6 Ontario Building Code (2012). The plotted results were found to be most similar to curves for silty sand, and a design percolation T-time of 12 minutes per centimetre is recommended for leaching beds extending into the native sand. In this regard the leaching bed may comprise filter beds with filter medium penetrating the upper fill layers.

The tile beds must be designed and constructed in accordance with Part 8 of the Ontario Building Code, and satisfy the requirements of the regulating authorities.

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, 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 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.

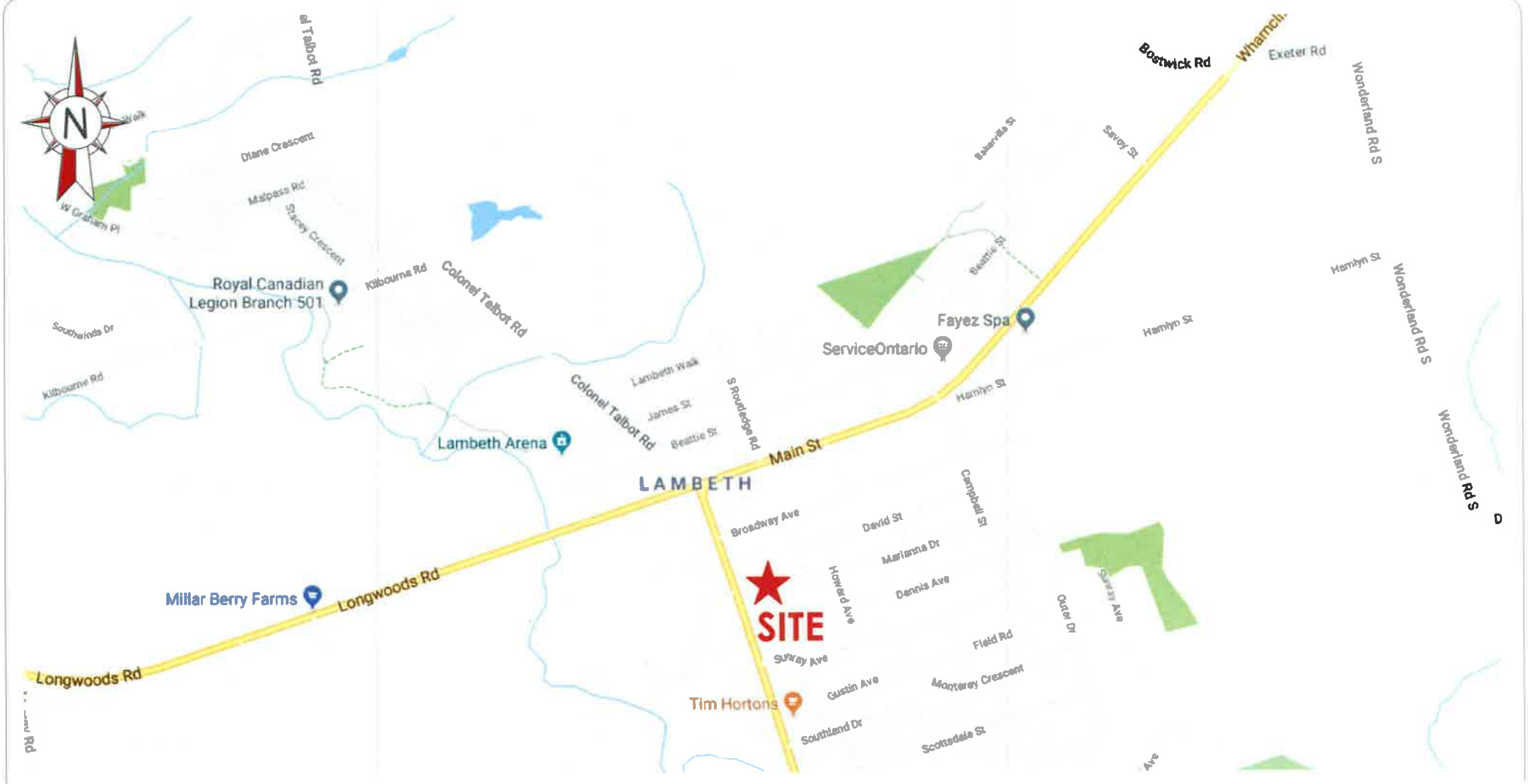
It is important to note that the geotechnical assessment involves a limited sampling of the site gathered at specific test hole locations and the conclusions in this report are based on this information gathered and in accordance with normally accepted practices. The subsurface geotechnical, hydrogeological, 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: Location Plan
Drawing 2: Site Plan

G:\160\1_PROJECTS\2018\B-0019446 LAMBETH COMMUNITY HEALTH AND WELLNESS CENTRE\Z4_CAD\B-0019446-1_LOCATION PLAN_DWG 1.DWG



0 100 200 300 400 500 m

SCALE 1:10000

NOTES :
1-REFERENCES : © Google Maps (2018).
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

New Helath and Wellness Centre

4402 Colonel Talbot Road, London

Title

Location Plan

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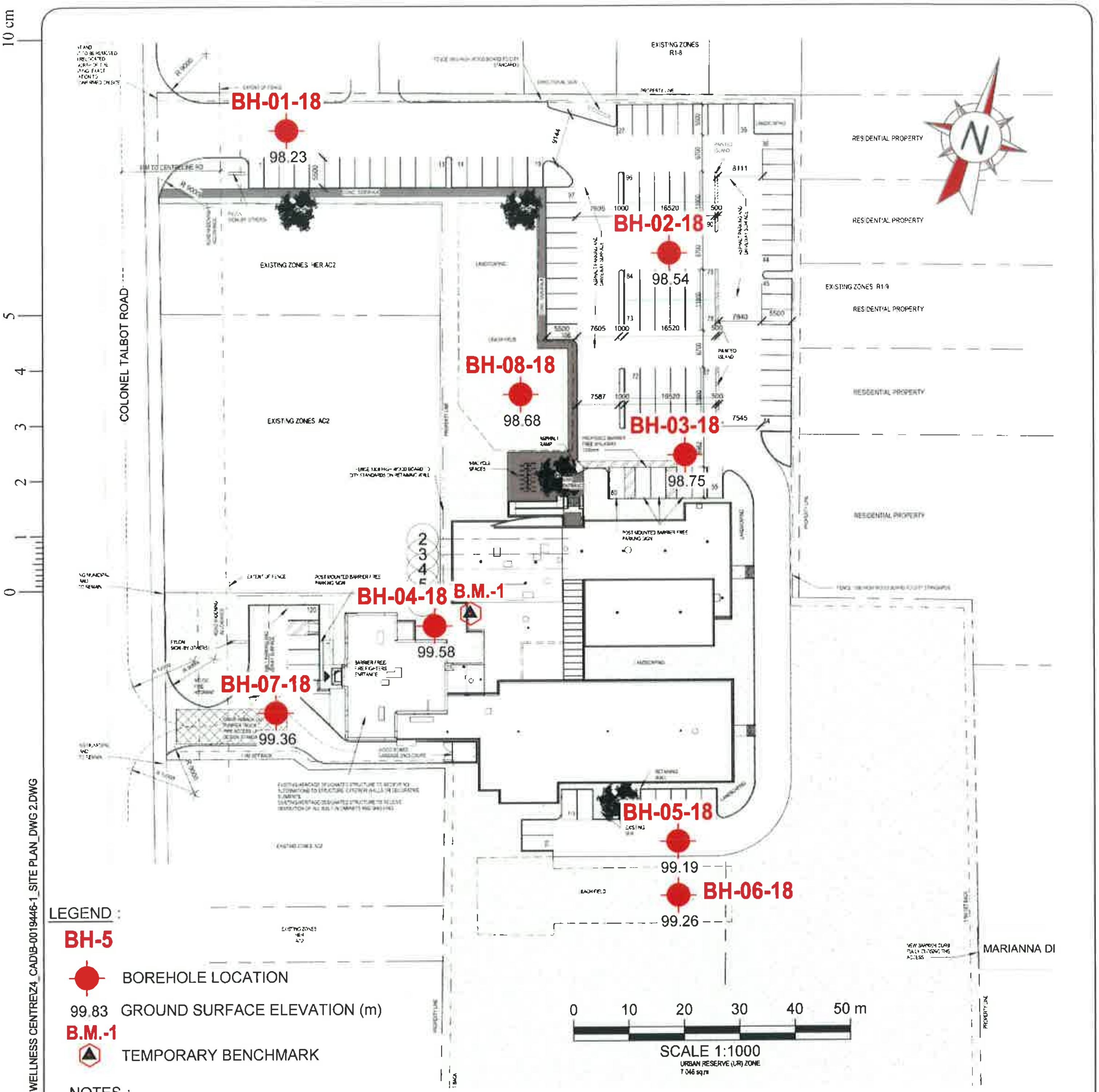
Drawn A.Stewart
Checked S.Burt

Discipline GEOTECHNICAL
Scale 1 : 10000
Date 2018-06-19

Project manager
R.Helwig
Sequence no.
01 of 02

M. dept.	Project	Disc.	Dwg no.	Rev.
160	B-0019446-1	GE	001	00



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NOTES :

1-REFERENCES : COMPANY: Endri Poletti Architect Inc., PROJECT: Lambeth Community Health and Wellness Centre, PLAN: Site Plan Boreholes, DATE: 11/05/2018.

2-TEMPORARY BENCHMARK : Finished Floor Level, 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.

Project

New Helath and Wellness Centre

4402 Colonel Talbot Road, London

Title

Site Plan

Englobe

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Checked	**S.Burt**	Date	**2018-06-19**		

M. dept.	Project	Disc.	Dwg no.	Rev.
160	**B-0019446-1**	**GE**	**002**	**00**

Appendix 2 Borehole Logs

List of Abbreviations
Boreholes 01-18 to 08-18

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	
AS	Auger Sample
CS	Chunk Sample
RC	Rock Core
SS	Split Spoon
TW	Thinwall, Open
WS	Wash Sample
BS	Bulk Sample
GS	Grab Sample
WC	Water Content Sample
TP	Thinwall, Piston

Soil Tests and Properties	
SPT	Standard Penetration Test
UC	Unconfined Compression
FV	Field Vane Test
ø	Angle of internal friction
γ	Unit weight
w_p	Plastic limit
w	Water content
w_l	Liquid limit
I_L	Liquidity index
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 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 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

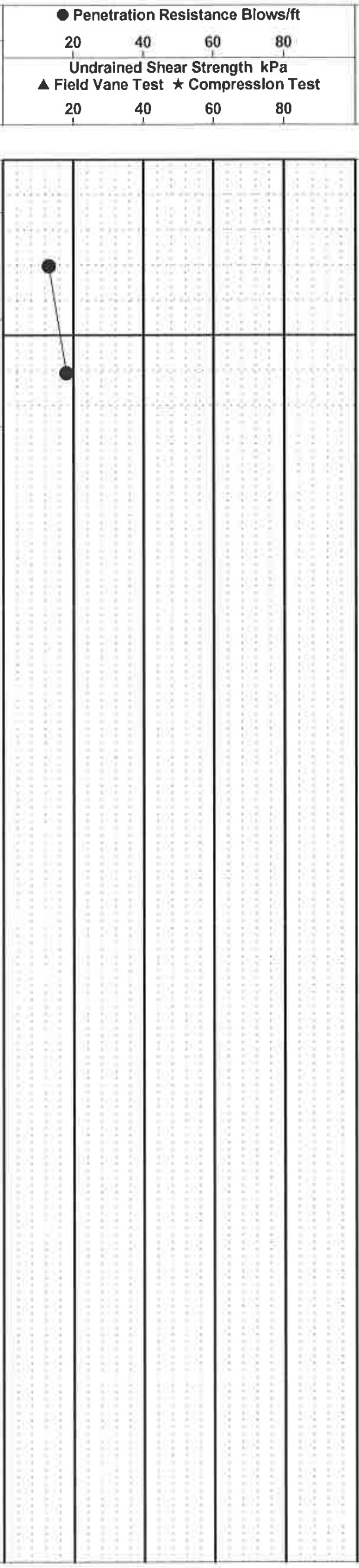
Cohesive Soils	Undrained Shear Strength (C_u)	
Consistency	kPa	psf
Very Soft	less than 12	less than 250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	over 200	over 4000

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

REF. NO.: B-0019446-1
CLIENT: Lambeth Health Organization
PROJECT: Lambeth Helath and Wellness Centre
LOCATION: 4402 Colonel Talbot Road, London
DATUM ELEVATION: Finished Floor Level, 100.0 m

LOG OF BOREHOLE NO.
01-18

Encl. No. 1 (Sheet 1 of 1)
DRILLING DATA: Diedrich D50T
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Jun 14, 2018



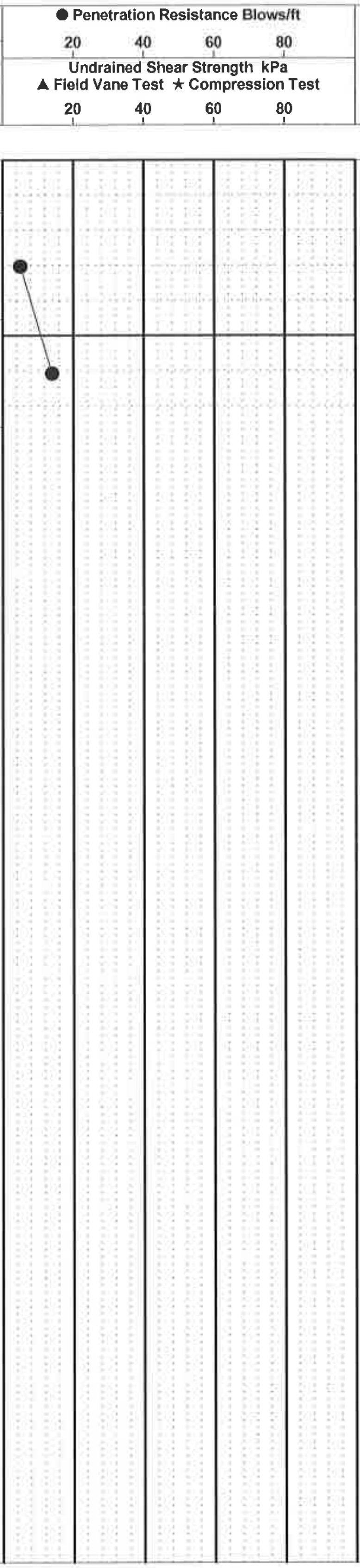
SUBSURFACE PROFILE										
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
98.23	0	300mm Sandy TOPSOIL.								
98										
		Compact, brown sand FILL, trace to some silt & gravel, lower clay seam.	▨		1	ss	13		3	
	1		▨							
97			▨		2	ss	18		6	
		End of Borehole. Hole dry and open at completion.								

REF. NO.: B-0019446-1
CLIENT: Lambeth Health Organization
PROJECT: Lambeth Helath and Wellness Centre
LOCATION: 4402 Colonel Talbot Road, London
DATUM ELEVATION: Finished Floor Level, 100.0 m

LOG OF BOREHOLE NO.
02-18

Encl. No. 2 (Sheet 1 of 1)
DRILLING DATA: Diedrich D50T
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Jun 14, 2018

SUBSURFACE PROFILE								PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft			
98.54	0	300mm Sandy TOPSOIL.								
98		Loose to compact, brown SAND, trace to some gravel, trace silt.			1	ss	5		3	
	1				2	ss	14		4	
		End of Borehole. Hole dry and open at completion.								



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

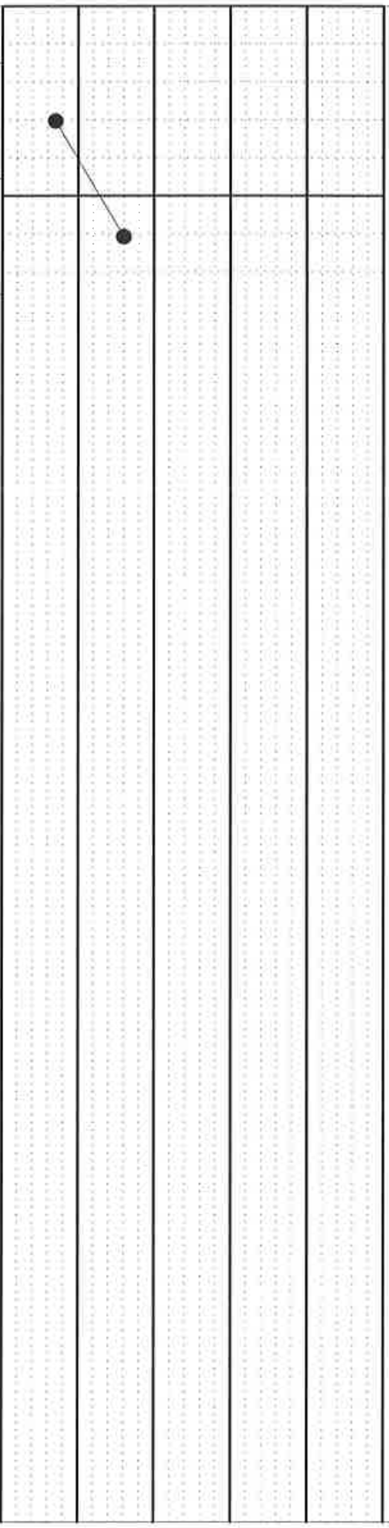
LOG OF BOREHOLE NO.
03-18

REF. NO.: B-0019446-1
CLIENT: Lambeth Health Organization
PROJECT: Lambeth Helath and Wellness Centre
LOCATION: 4402 Colonel Talbot Road, London
DATUM ELEVATION: Finished Floor Level, 100.0 m

Encl. No. 3 (Sheet 1 of 1)
DRILLING DATA: Diedrich D50T
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Jun 14, 2018

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 %
98.75	0	50mm ASPHALT over 480mm dark brown silt and sand FILL, some gravel.									
98	1	Compact to dense, brown SAND and GRAVEL, trace to some silt.			1	ss	14			4	
					2	ss	32			3	
		End of Borehole. Hole dry and open at completion.									



LOG OF BOREHOLE B-0019446-1.GPJ ATK_DAV.GDT 26/6/18

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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-0019446-1

LOG OF BOREHOLE NO.

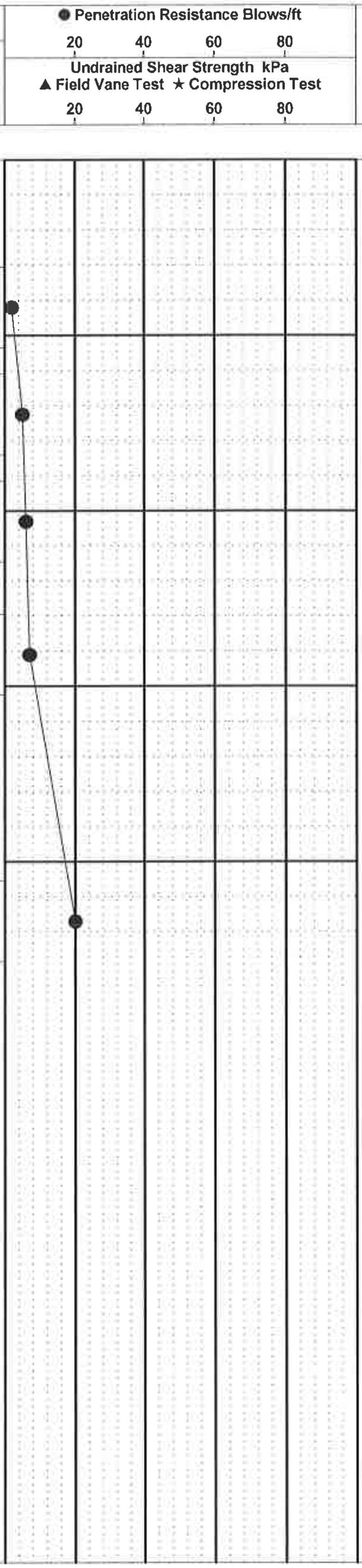
04-18

CLIENT: Lambeth Health Organization
PROJECT: Lambeth Helath and Wellness Centre
LOCATION: 4402 Colonel Talbot Road, London
DATUM ELEVATION: Finished Floor Level, 100.0 m

Encl. No. 4 (Sheet 1 of 1)
DRILLING DATA: Diedrich D50T
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Jun 14, 2018

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.58	0	100mm ASPHALT over 150mm Sand & Gravel FILL.								
99		Very loose, dark brown silt and sand FILL, clayey seam.			1	ss	2		12	
	1									
98		Loose, brown sand FILL, trace silt, gravelly seams, lower silty seams.			2	ss	5		4	
	2				3	ss	6		3	
97					4	ss	7		8	
	3									
96		Compact, brown, SAND, some gravel, trace silt.								
	4				5	ss	20		4	
		End of Borehole. Hole dry and open at completion.								



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CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6

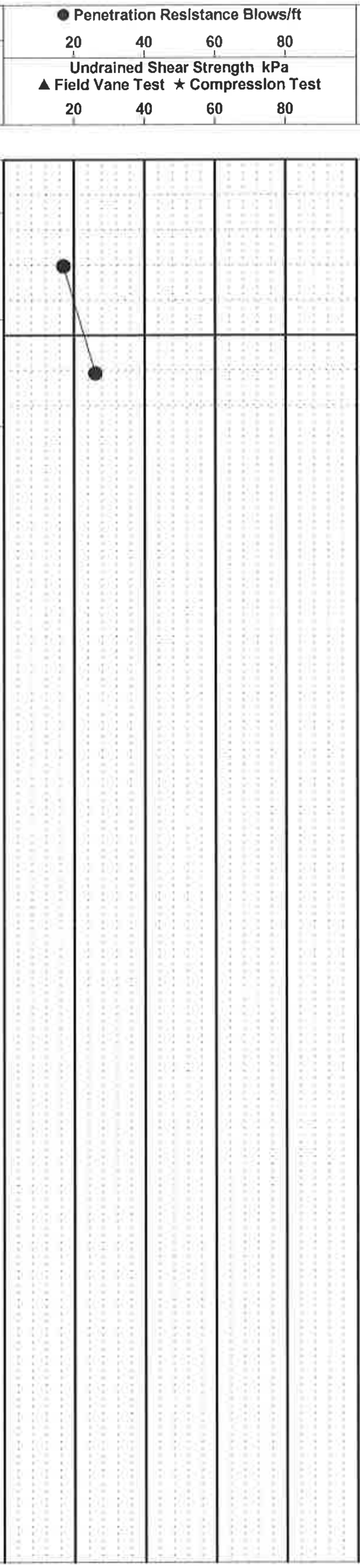
Phone: 519-685-6400 Fax: 519-685-0943

REF. NO.: B-0019446-1
CLIENT: Lambeth Health Organization
PROJECT: Lambeth Helath and Wellness Centre
LOCATION: 4402 Colonel Talbot Road, London
DATUM ELEVATION: Finished Floor Level, 100.0 m

LOG OF BOREHOLE NO.
05-18

Encl. No. 5 (Sheet 1 of 1)
DRILLING DATA: Diedrich D50T
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Jun 14, 2018

Elev. metres	Depth metres	DESCRIPTION	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.19	0	50mm ASPHALT over 460mm dark brown silt and sand FILL.							
99		Compact, brown gravelly SAND, trace to some silt.		1	ss	17		3	
98	1			2	ss	26		3	
		End of Borehole. Hole dry and open at completion.							



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

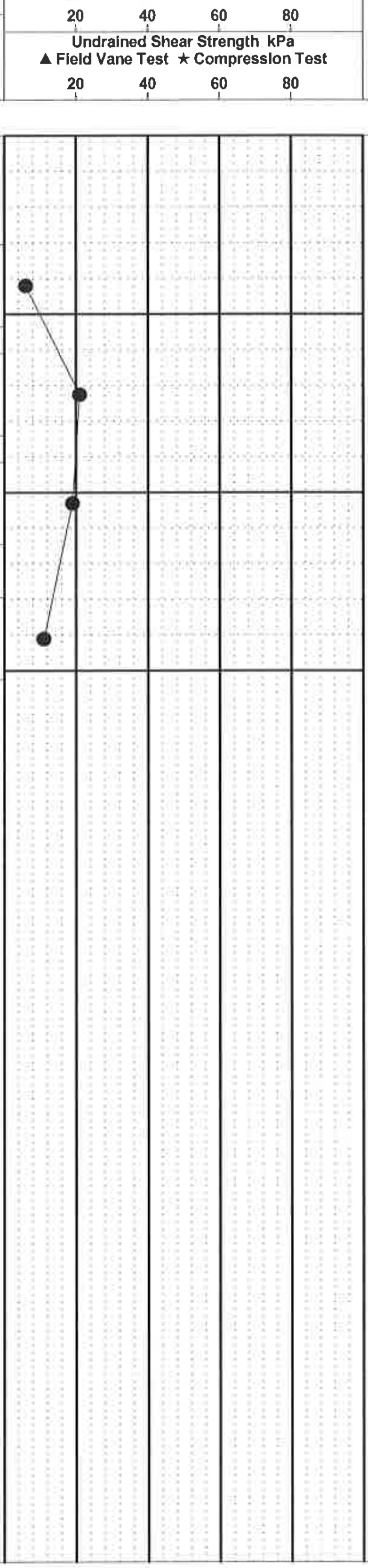
REF. NO.: B-0019446-1
CLIENT: Lambeth Health Organization
PROJECT: Lambeth Helath and Wellness Centre
LOCATION: 4402 Colonel Talbot Road, London
DATUM ELEVATION: Finished Floor Level, 100.0 m

LOG OF BOREHOLE NO.
06-18

Encl. No. 6 (Sheet 1 of 1)
DRILLING DATA: Diedrich D50T
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Jun 14, 2018

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.26	0	75mm Pea Stone FILL.								
		Loose, brown, sand FILL, some gravel, upper silty layer.			1	ss	6		2	
		Compact, brown SAND, trace to some silt and gravel.			2	ss	21		2	
					3	ss	19		3	
					4	ss	11		3	
		End of Borehole. Hole dry and open at completion.								

● Penetration Resistance Blows/ft
Undrained Shear Strength kPa
▲ Field Vane Test ★ Compression Test



Englobe

CONSULTING SOILS AND MATERIALS ENGINEERS

12 - 60 Meg Drive, London, ON, N6E 3T6

Phone: 519-685-6400 Fax: 519-685-0943

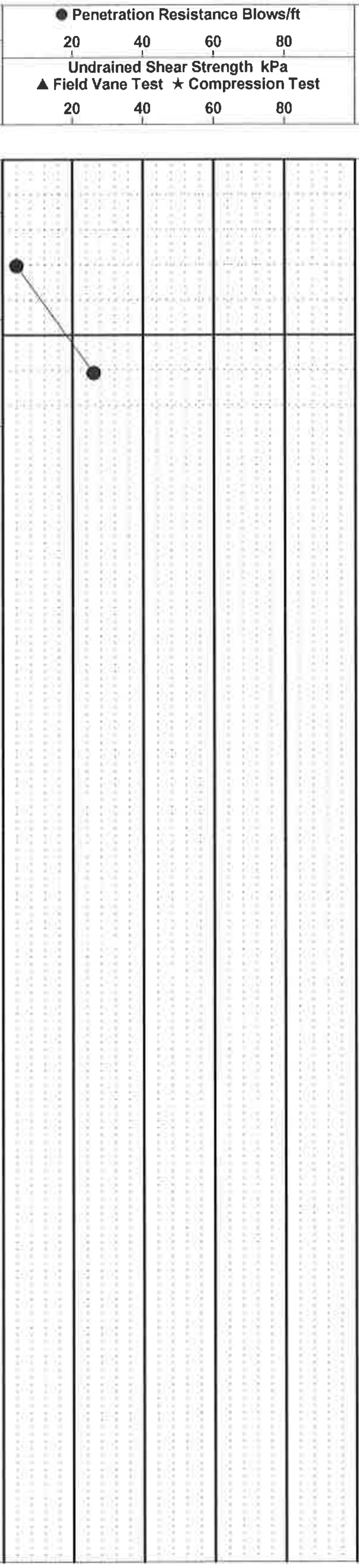
LOG OF BOREHOLE NO.
07-18

REF. NO.: B-0019446-1
CLIENT: Lambeth Health Organization
PROJECT: Lambeth Helath and Wellness Centre
LOCATION: 4402 Colonel Talbot Road, London
DATUM ELEVATION: Finished Floor Level, 100.0 m

Encl. No. 7 (Sheet 1 of 1)
DRILLING DATA: Diedrich D50T
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Jun 14, 2018

SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
99.36	0	65mm ASPHALT over 100mm sand FILL, some silt & gravel.								
99		Firm, brown clayey silt FILL, some sand.			1	ss	4		11	
98	1	Compact, brown, gravelly SAND, trace to some silt.			2	ss	26		4	
		End of Borehole. Hole dry and open at completion.								



REF. NO.: B-0019446-1
CLIENT: Lambeth Health Organization
PROJECT: Lambeth Helath and Wellness Centre
LOCATION: 4402 Colonel Talbot Road, London
DATUM ELEVATION: Finished Floor Level, 100.0 m

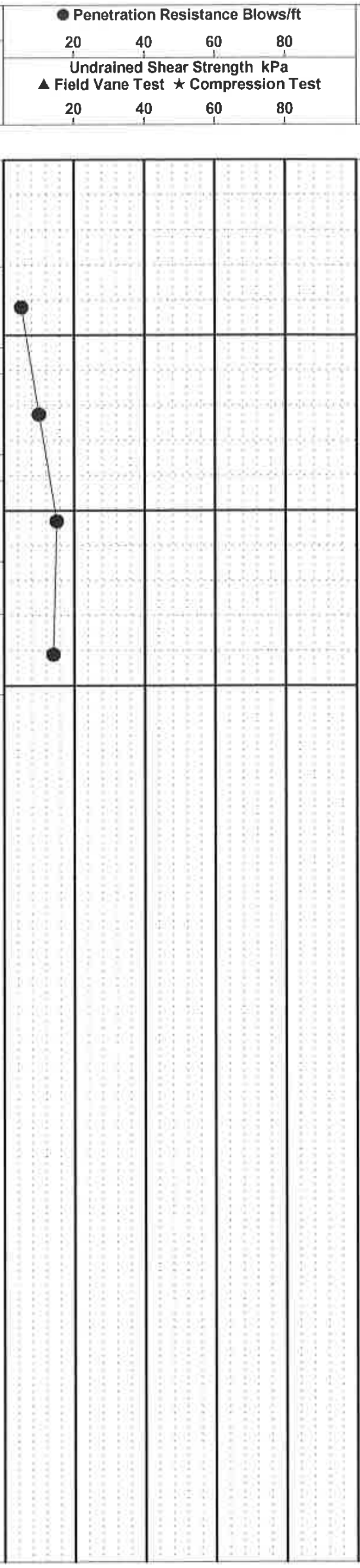
LOG OF BOREHOLE NO.

08-18

Encl. No. 8 (Sheet 1 of 1)
DRILLING DATA: Diedrich D50T
METHOD: Solid Stem Augers
DIAMETER: 150mm
DATE: Jun 14, 2018

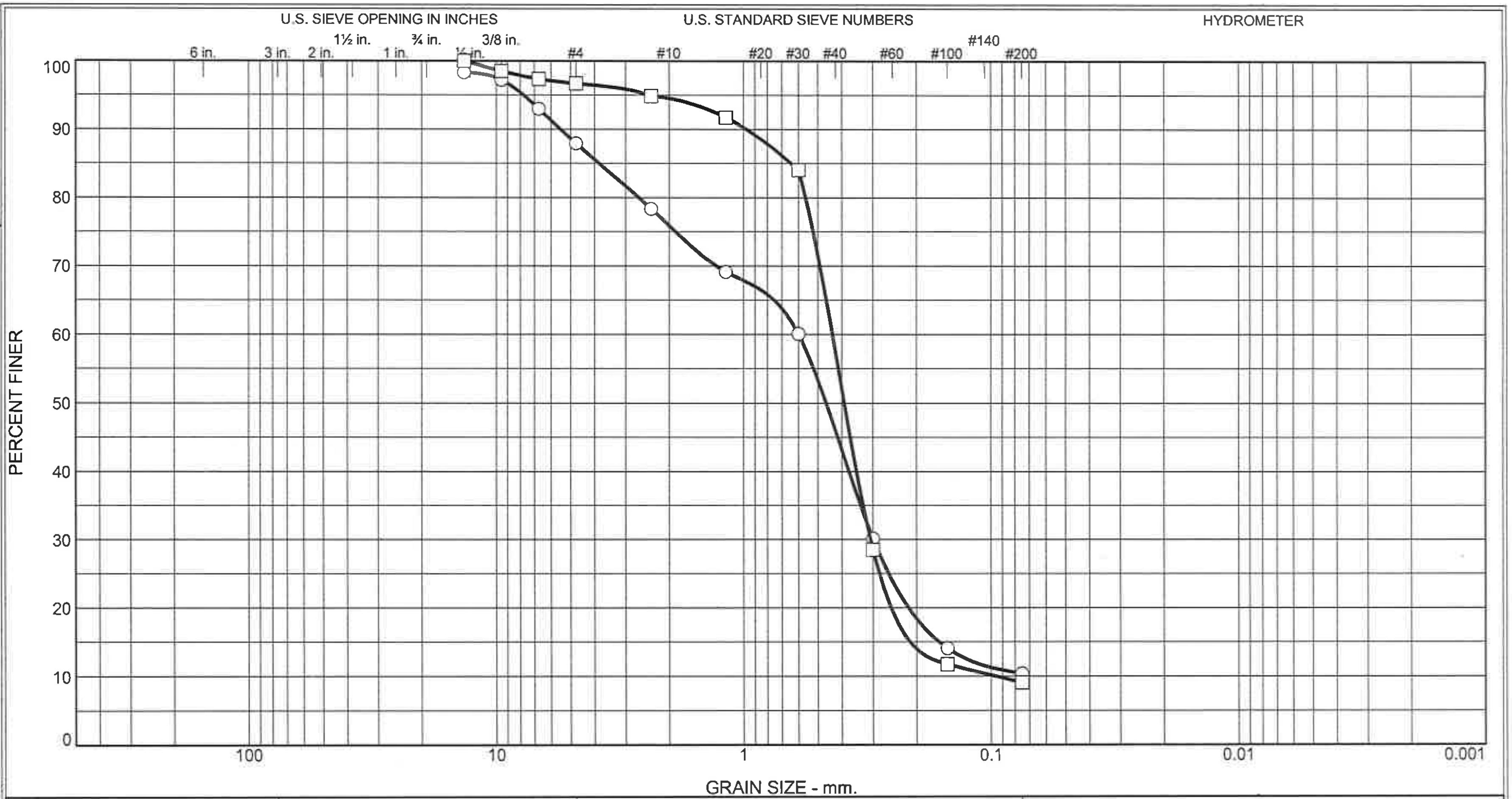
SUBSURFACE PROFILE

Elev. metres	Depth metres	DESCRIPTION	SYMBOL	GROUND WATER	NUMBER	TYPE	"N" Blows/ft	PLASTIC LIMIT %	NATURAL WATER %	LIQUID LIMIT %
98.68	0	380mm Pea Stone FILL.	▨							
98	1	Loose, brown, sand FILL, some gravel, upper silty layer.	▨		1	ss	5		3	
97		Compact, brown SAND, traces of silt and gravel.	░		2	ss	10		5	
	2		░		3	ss	15		5	
96	3		░		4	ss	14		4	
		End of Borehole. Hole dry and open at completion.								



Appendix 3 Figure 1

Grain Size Distribution Analyses



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

	Location	Source	Sample #	Depth/Elev.	Sample Information
○	BH 06-18		2	1.4m / 97.8	SAND, some silt, some gravel.
□	BH 08-18		2	1.4m / 97.3	SAND, trace silt, trace gravel.

Project No. B-0019446-1 **Client** Lambeth Health Organization Inc. **Figure 1**

Grain Size Analysis

Lambeth Health and Wellness Centre, 4402 Colonel Talbot Road, London

EnGlobe

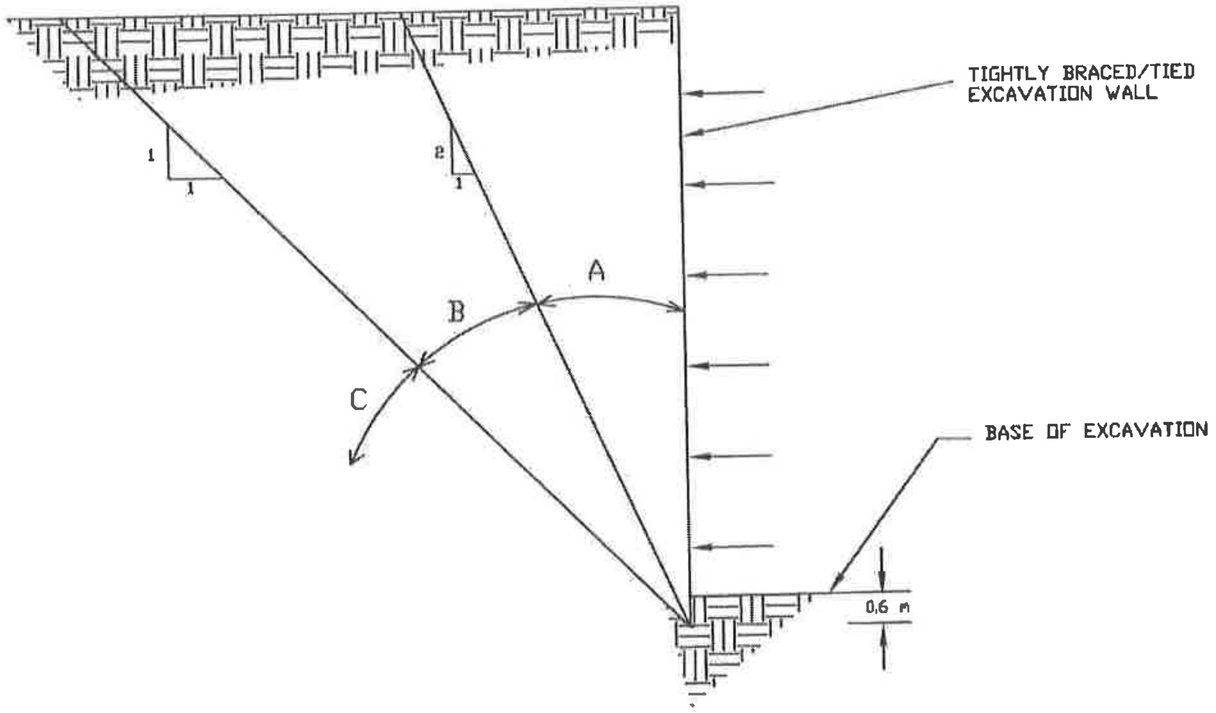
London, Ontario

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicative of apparently identical samples. The Statement of Limitations should be read in connection with this report.

Tested By: D.M. **Checked By:** S.B.

Appendix 4 Excavation Support Requirements

EXCAVATION SUPPORT REQUIREMENTS



ZONE A: Foundations located within this zone normally require underpinning. Horizontal and vertical pressures on the excavation wall of non-underpinned foundations must be considered.

ZONE B: Foundations located within this zone do not normally require underpinning. Horizontal and vertical forces on the excavation wall for non-underpinned foundations must be considered.

ZONE C: Underpinning to structures is normally founded in this zone. Lateral pressure from underpinning is not normally considered.

Englobe
englobecorp.com

February 14, 2019

Ms. Nanda Lobato, B.Arch., PG. Dip. PM, PG.Dip. Real Estate Management
Project Manager
Endri Poletti Architects
355 Oxford Street East
London, Ontario N6V 1V6

Subject : City of London Comments 7 – 9, Proposed Lambeth Health and Wellness Centre, 4402 Colonel Talbot Road, London, Ontario

Our ref. : 128-P-0017664-0-01-300-HD-L-0001-00

Ms. Lobato:

On February 05, 2019, Endri Poletti Architects provided Englobe Corporation (Englobe) with the City of London's (City) 2nd Submission Drawing Review Comments (City Reference SP-17053 / SPA18-041) pertaining to documents prepared by Strik, Baldinelli, Moniz Ltd. (SBM) in support of the proposed redevelopment of 4402 Colonel Talbot Road, London, Ontario (the Site), as the future location of the Lambeth Health and Wellness Centre. It should be noted that the only document prepared by Englobe that was submitted was the "Geotechnical Engineering Report, 4402 Colonel Talbot Road, London, Ontario" (Englobe Reference 160-B-0019446-1) dated June 2018. At the time of writing, a hydrogeological study is ongoing.

The purpose of this report is to provide responses to Comments 7 through 9 of the City's 2nd Submission Drawing Review Comments.

Comment 7 (depth to seasonal high water table): A Phase II Environmental Site Assessment was undertaken at the Site by Concentric Associates International Inc. ("Concentric") in 2014 (Concentric Reference # 14-5760-E). As part of its work program, Concentric installed five monitoring wells at the Site. Static depths to water were reported as ranging from 7.66 to 8.83 metres below ground surface (mBGS). This is consistent with findings reported for nearby investigations completed by Englobe.

It is considered prudent to allow for a 1 metre (m) potential rise in the water table due to seasonal variation (i.e., spring high water level). Thus, Englobe estimates the seasonal high water table at the Site as being approximately 6.7 mBGS.

Comment 8 (infiltration): It is intended to carry out Guelph Permeameter testing at the planned location of the septic tile field as part of the ongoing hydrogeological study, and the results will be used to estimate the performances of the proposed infiltration trenches and septic tile field. In the interim, a preliminary assessment has been made using the results of grain size analysis performed during Englobe's geotechnical investigation at the Site.

The grain size distribution data for both samples collected during the geotechnical investigation were analyzed using the spreadsheet HydroGeosieve v. 2.2., J.F. Devlin, University of Kansas, 2015 (copies attached). This spreadsheet includes fifteen methods of analyzing the grain size distribution data. Only those methods for which the sample meets the acceptance criteria, highlighted in blue in the appended output sheets, are carried through in the calculation of the geometric mean hydraulic conductivity. The estimates were 1.2 x 10^{-4} metres per second (m/s) and 1.4 x 10^{-4} m/s. The lower value was used in subsequent calculations as a conservative measure.

Table 101 presents the corresponding infiltration factors. Given that there is some variability within the soil column at different locations, the use of a safety factor of 3.5 is recommended in accordance with the recommendation of the Toronto Region Conservation Authority (TRCA). [redacted]

Table 102 presents a water balance for the Site under pre- and post-development conditions using design data provided by SBM and a local annual evapotranspiration rate released by the Upper Thames River Conservation Authority (UTRCA). The post-development annual infiltration deficit that would result if mitigative measures were not implemented is 406 cubic metres per year (m^3/yr).

Six spreadsheets using the United States Geological Survey's (USGS's) spreadsheet 5201-2010, which implements the Hantush (1967) solution for groundwater mounding beneath an infiltration facility are attached. *Note: USGS 5201-2010 is in feet (ft).* The input parameters used in all cases were a hydraulic conductivity of 1.2 x 10^{-4} m/s (the lower estimate), an initial saturated aquifer thickness of 1.2 m (the lowest documented in Concentric's 2014 Phase II ESA) and an assumed specific yield of 0.15 (slightly conservative for sand). Infiltration trench and septic tile field specifications are taken from SBM's Sheet C-3: Servicing Plan, rev. October 11, 2018.

It should be noted that the infiltration rate entered in the spreadsheet is per square foot of the infiltration facility footprint and is converted to m within this letter. The infiltration rate has been adjusted, where required, for the size of the catchment area, e.g., if the catchment area, including its internal infiltration facility, was ten times the size of the infiltration facility and a rainfall event resulting in a runoff of 10 millimetres per day (mm/day) was being simulated, the infiltration rate used over the footprint of the infiltration facility would be 100 mm/day. In addition, simulations of one year (other than those for the septic tile field) use 1.5 times the infiltration rate and a duration of infiltration of eight months so as to avoid simulating infiltration during the winter months when the ground is frozen.

The first three spreadsheets assess all infiltration trenches (one main trench with laterals in the northeastern portion of the Site and a shorter trench in the western portion of the Site) with a total length of 284 m and a width of 1.5 m as a single entity. The first spreadsheet assesses groundwater mounding under a rate equal to that required to infiltrate 406 m^3/yr (the potential annual infiltration deficit) over a period of eight months (i.e., excluding winter months when infiltration/runoff would be minor). The resulting groundwater mound beneath the centreline of the trench is 0.105 ft (3.2 centimetres; cm) (note: this represents the first year of operation). The second spreadsheet simulates 20 years of operation and results in a mound beneath the centre line of the trench of 0.27 ft (8.3 cm). The third spreadsheet assesses mounding under a 100 year (yr) storm, set at 110 millimetres (mm) of precipitation in 24 hours, all of which infiltrates (conservative approach). Mounding under the centreline of the trench at the end of the storm is 7.17 ft (2.19 m).

The next three spreadsheets assess conditions beneath the 30 m long infiltration trench located in the western portion of the Site due to its proximity to the Site boundary (i.e., to investigate the potential, in conjunction with the nearby septic tile field, to cause mounding beneath a neighbouring basement). The catchment area of this trench is 1,638 square metres (m^2), almost all of which has impervious surface materials with an assumed infiltration of 100% of precipitation. Mounding under the centre line of the trench after one year of operation is 1.1 ft (0.34 m) and mounding after 20 years of operation is 5.8 ft (1.77 m). Mounding at the end of a 100 year storm is 5.4 ft (1.6 m).

The final three spreadsheets assess mounding beneath the proposed septic tile field under normal conditions (inflow of 15,000 Litres per day; L/day) for one year and twenty years of continuous operation and (final spreadsheet) normal daily inflow combined with the effects of a 100 yr storm, all of which infiltrates. The resulting mounds under the centre line of the trench are 1.9 ft (0.58 m) after one year of operation, 3.7 ft (1.14 m) after 20 years of operation, and 1.7 ft (0.52 m) at the end of a hundred year storm.

The off-site residence closest to the small infiltration trench and septic tile field is located approximately 9 m from the southern end of the small infiltration trench, approximately 60 m south of the proposed septic bed and approximately 100 m from the nearest point on the main infiltration trench. The mounding beneath this off-site residence is assessed as the sum of the contribution from all three facilities. The worst case mound results from 20 years of operation and, in combination, is 9.5 ft (2.9 m). Even with a conservatively assessed depth to shallow water table of 6 m, this mound would not impact a conventional basement.

Comment 9 (dewatering): Based on design drawings/specifications provided to Englobe by SBM, the maximum depth of excavation for utility installations will be approximately 2.5 mBGS. An additional allowance of 1 m (3.5 mBGS) must be made to guarantee dry working conditions. This is still 2.5 m above the estimated seasonal high water table. Consequently, dewatering (other than stormwater) is not expected to be required.

We trust this summary letter is suitable for your present requirements. If additional information should be required at this time, please do not hesitate to communicate with the undersigned.

Yours very truly,

PROFESSIONAL GEOSCIENTIST
15 Feb. 2019
STEPHEN J. HODGSON
PRACTISING MEMBER
0325
ONTARIO

CBarnes

Stephen Hodgson, P.Geo.
Senior Hydrogeologist

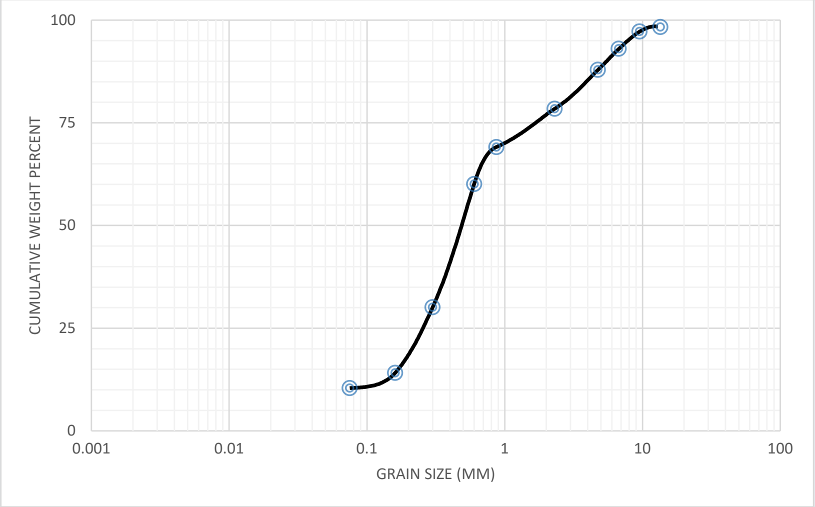
Carrie Barnes, CET, P.Geo.
Project Manager

Encl. HydroGeosieve v. 2.2 Analysis, BH06-18 1.4 m
HydroGeosieve v. 2.2 Analysis, BH08-18 1.4 m
Table 101 – Hydraulic Conductivity Estimates and Infiltration Rates
Table 102 – Water Balance
USGS Spreadsheet 2010-5102, Required Infiltration Rate, 1 Year (Entire Site)
USGS Spreadsheet 2010-5102, Required Infiltration Rate, 20 Years (Entire Site)
USGS Spreadsheet 2010-5102, 100 Year Storm (Entire Site)
USGS Spreadsheet 2010-5102, Required Infiltration Rate, 1 Year (South Trench)
USGS Spreadsheet 2010-5102, Required Infiltration Rate, 20 Years (South Trench)
USGS Spreadsheet 2010-5102, 100 Year Storm (South Trench)
USGS Spreadsheet 2010-5102, Septic Tile Field (Normal Operation, 1 Year)
USGS Spreadsheet 2010-5102, Septic Tile Field (Normal Operation, 20 Years
USGS Spreadsheet 2010-5102, Septic Tile Field (Normal Operation with 100 Year Storm)

g:\128\p0017664 - hydrogeological investigation for lssds, lambeth health and wellness centre, london, on\300 - hydrogeology\300\2_technical\draftcopydel\128-p-0017664-0-01-300-hd-l-0001-00.doc

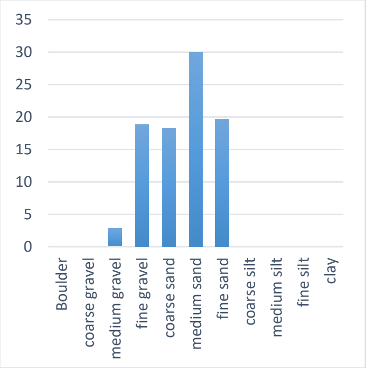
BH06-18, 1.4 m: Poorly sorted gravelly sand low in fines

		Mass Sample (g):		T (°C)
		100		20
Sieve opening *d* $_i$ (ϕ)	Sieve opening (ps) *d* $_i$ (mm)	Mass of retained (mr) (g)	mass fraction (mf)	Percent Passing (pp)
3.747853	13.462	1.7	0.017	98.3
3.249147	9.525	1.1	0.011	97.2
2.748645	6.731	4.2	0.042	93
2.246149	4.75	5.1	0.051	87.9
1.200683	2.3	9.5	0.095	78.4
0.200754	0.87	9.3	0.093	69.1
0.736383	0.6	9	0.09	60.1
1.735591	0.3	30	0.3	30.1
2.641765	0.16	16	0.16	14.1
3.734009	0.075	3.7	0.037	10.4



	Estimation of Hydraulic Conductivity	cm/s	m/s	m/d
	Hazen	.463E-02	.463E 04	3.997
	Hazen K (cm/s) d_{10}^2 (mm^2)	.520E 02	.520E 04	4.493
	Slichter	.109E-02	.109E 04	0.942
	Terzaghi	.178E-02	.178E 04	1.542
✓	Beyer	.478E-02	.478E 04	4.130
✓	Sauerbrei	.835E-02	.835E 04	7.218
✓	Kruger	.775E-01	.775E 03	67.003
	Kozeny-Carmen	.113E+00	.113E 02	97.731
✓	Zunker	.736E-01	.736E 03	63.568
✓	Zamarin	.901E-01	.901E 03	77.868
	USBR	.134E-01	.134E 03	11.578
✓	Barr	.129E-02	.129E 04	1.112
✓	Alyamani and Sen	.862E-03	.862E 05	0.745
	Chapuis	.868E-03	.868E 05	0.750
✓	Krumbein and Monk	.221E-01	.221E 03	19.092
	geometric mean	.122E 01	.122E 03	.106E+02
	arithmetic mean	.348E 01	.348E 03	.301E+02

Effective Grain Diameters (mm)		Other Useful Parameters		
d10	0.072	Uniformity Coef.	8.31	
d17	0.185	n computed	0.309249	0.309249
d20	0.212	g (cm/s^2)		
d50	0.499	ρ (g/cm^3)		
d60	0.599	μ (g/cm s)		
$d_{\text{geometric mean}}$	0.769	ρg/μ (1/cm s)		
de (Kruger)	0.526	tau (Sauerbrei)		
de (Kozeny)	0.470	$d5_\phi$		
de (Zunker)	0.488	$d16_\phi$		
de (Zamarin)		$d50_\phi$	1.002	
Io (Alyameni)	0.035	$d84_\phi$	1.905	
		$d95_\phi$	3.011	
		σ_ϕ	2.284	



mm		% in sample
>64	Boulder	
16 - 64	coarse gravel	
8 - 16	medium gravel	
2 8	fine gravel	
0.5 - 2	coarse sand	
0.25 - 0.5	medium sand	
0.063 - 0.25	fine sand	
0.016 - 0.063	coarse silt	
0.008 - 0.016	medium silt	
0.002 - 0.008	fine silt	
<0.002	clay	

K from Grain Size Analysis Report

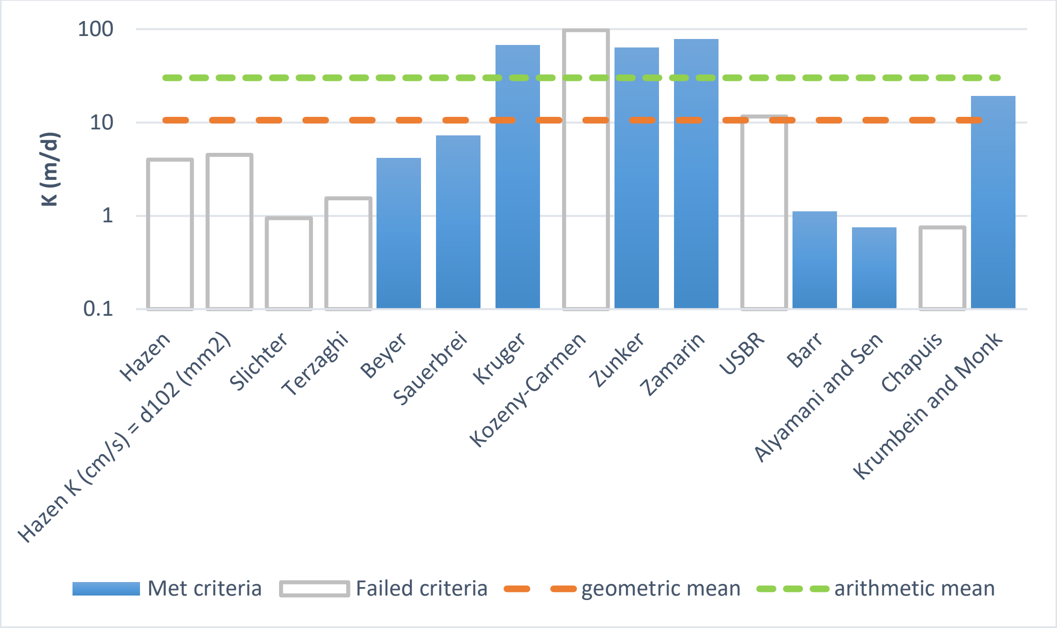
Date:

Sample Name:

Mass Sample (g): 100

T (oC) 20

BH06-18, 1.4 m: Poorly sorted gravelly sand low in fines



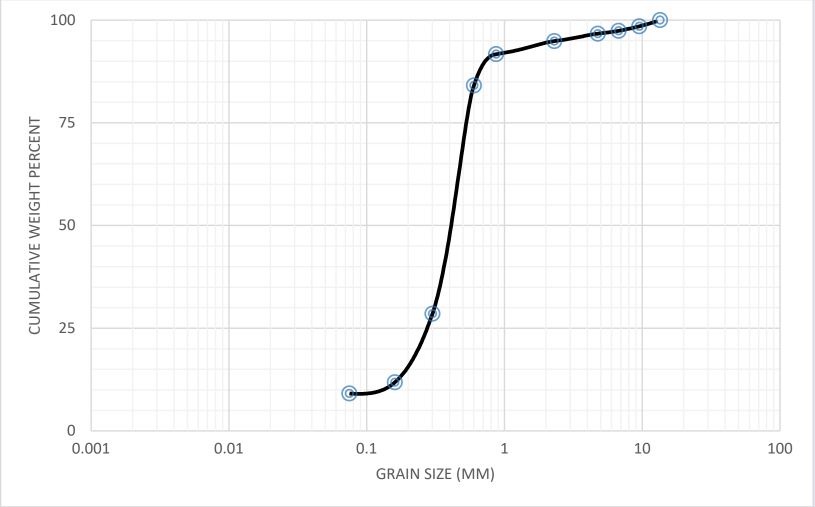
Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	4.6E-03	4.6E-05	4.00	
Hazen K (cm/s) = d_{10} (mm)	5.2E-03	5.2E-05	4.49	
Slichter	1.1E-03	1.1E-05	0.94	
Terzaghi	1.8E-03	1.8E-05	1.54	
Beyer	4.8E-03	4.8E-05	4.13	
Sauerbrei	8.4E-03	8.4E-05	7.22	
Kruger	7.8E-02	7.8E-04	67.00	
Kozeny-Carmen	1.1E-01	1.1E-03	97.73	
Zunker	7.4E-02	7.4E-04	63.57	
Zamarin	9.0E-02	9.0E-04	77.87	
USBR	1.3E-02	1.3E-04	11.58	
Barr	1.3E-03	1.3E-05	1.11	
Alyamani and Sen	8.6E-04	8.6E-06	0.74	
Chapuis	8.7E-04	8.7E-06	0.75	
Krumbein and Monk	2.2E-02	2.2E-04	19.09	
geometric mean	1.2E-02	1.2E-04	10.57	
arithmetic mean	3.5E-02	3.5E-04	30.09	

BH08-18, 1.4 m: Moderately well sorted sand low in fines

Mass Sample (g): 100

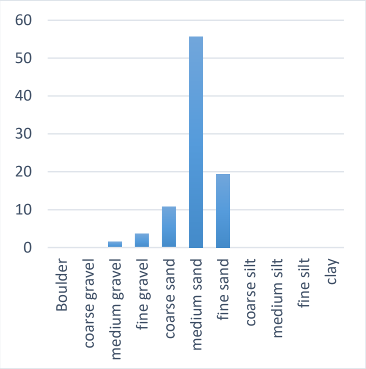
T (°C) 20

Sieve opening d_i (ϕ)	Sieve opening (ps) d_i (mm)	Mass of retained (mr) (g)	mass fraction (mf)	Percent Passing (pp)
3.747853	13.462	0	0	100
3.249147	9.525	1.5	0.015	98.5
2.748645	6.731	1.1	0.011	97.4
2.246149	4.75	0.7	0.007	96.7
1.200683	2.3	1.8	0.018	94.9
0.200754	0.87	3.2	0.032	91.7
0.736383	0.6	7.6	0.076	84.1
1.735591	0.3	55.6	0.556	28.5
2.641765	0.16	16.7	0.167	11.8
3.734009	0.075	2.7	0.027	9.1



	Estimation of Hydraulic Conductivity	cm/s	m/s	m/d
✓	Hazen	.130E-01	.130E 03	11.231
	Hazen K (cm/s) d_{10}^2 (mm^2)	.107E 01	.107E 03	9.226
✓	Slichter	.384E-02	.384E 04	3.315
	Terzaghi	.661E-02	.661E 04	5.714
✓	Beyer	.113E-01	.113E 03	9.726
✓	Sauerbrei	.194E-01	.194E 03	16.800
	Kruger	.721E-01	.721E 03	62.298
	Kozeny-Carmen	.146E+00	.146E 02	126.337
✓	Zunker	.807E-01	.807E 03	69.709
✓	Zamarin	.939E-01	.939E 03	81.096
✓	USBR	.160E-01	.160E 03	13.846
✓	Barr	.510E-02	.510E 04	4.406
✓	Alyamani and Sen	.164E-02	.164E 04	1.414
	Chapuis	.525E-02	.525E 04	4.535
✓	Krumbein and Monk	.329E-01	.329E 03	28.436
	geometric mean	.143E 01	.143E 03	.124E+02
	arithmetic mean	.278E 01	.278E 03	.240E+02

Effective Grain Diameters (mm)		Other Useful Parameters		
d10	0.103	Uniformity Coef.	4.55	
d17	0.204	n computed	0.364271	0.364271
d20	0.229	g (cm/s^2)		
d50	0.416	ρ (g/cm^3)		
d60	0.470	μ (g/cm s)		
$d_{geometric\ mean}$	0.491	ρg/μ (1/cm s)		
de (Kruger)	0.430	tau (Sauerbrei)		
de (Kozeny)	0.385	$d5_\phi$		
de (Zunker)	0.400	$d16_\phi$		
de (Zamarin)		$d50_\phi$	1.264	
Io (Alyameni)	0.025	$d84_\phi$	-0.738	
		$d95_\phi$	1.285	
		σ_ϕ	1.296	



mm		% in sample
>64	Boulder	
16 - 64	coarse gravel	
8 - 16	medium gravel	
2 8	fine gravel	
0.5 - 2	coarse sand	
0.25 - 0.5	medium sand	
0.063 - 0.25	fine sand	
0.016 - 0.063	coarse silt	
0.008 - 0.016	medium silt	
0.002 - 0.008	fine silt	
<0.002	clay	

K from Grain Size Analysis Report

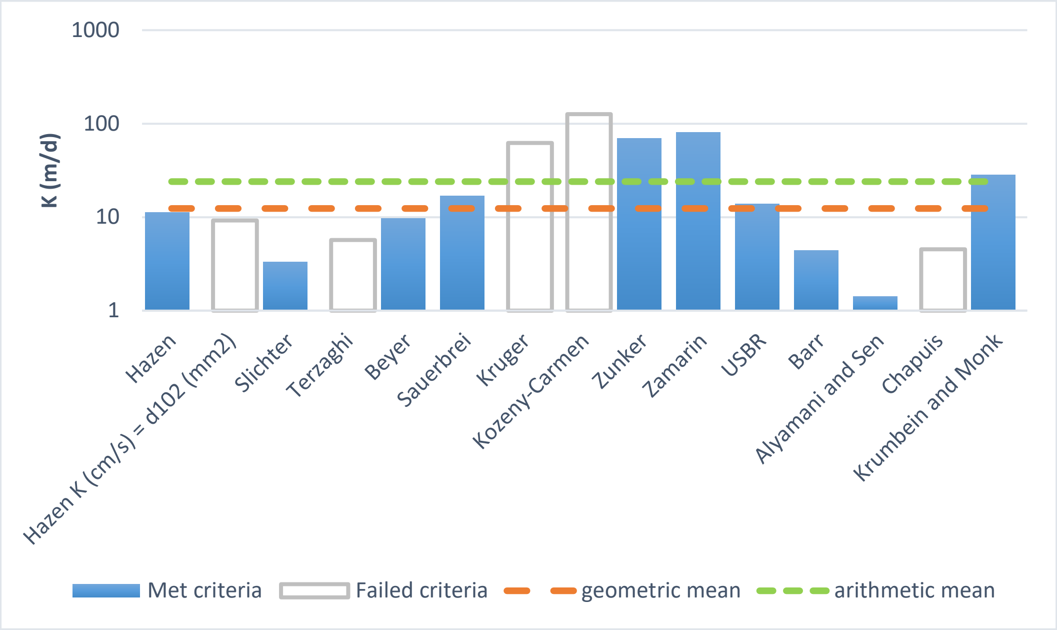
Date:

Sample Name:

Mass Sample (g): 100

T (oC) 20

BH08-18, 1.4 m: Moderately well sorted sand low in fines



Estimation of Hydraulic Conductivity	cm/s	m/s	m/d	de
Hazen	1.3E-02	1.3E-04	11.23	
Hazen K (cm/s) = d_{10} (mm)	1.1E-02	1.1E-04	9.23	
Slichter	3.8E-03	3.8E-05	3.31	
Terzaghi	6.6E-03	6.6E-05	5.71	
Beyer	1.1E-02	1.1E-04	9.73	
Sauerbrei	1.9E-02	1.9E-04	16.80	
Kruger	7.2E-02	7.2E-04	62.30	
Kozeny-Carmen	1.5E-01	1.5E-03	126.34	
Zunker	8.1E-02	8.1E-04	69.71	
Zamarin	9.4E-02	9.4E-04	81.10	
USBR	1.6E-02	1.6E-04	13.85	
Barr	5.1E-03	5.1E-05	4.41	
Alyamani and Sen	1.6E-03	1.6E-05	1.41	
Chapuis	5.2E-03	5.2E-05	4.53	
Krumbein and Monk	3.3E-02	3.3E-04	28.44	
geometric mean	1.4E-02	1.4E-04	12.38	
arithmetic mean	2.8E-02	2.8E-04	24.00	

TABLE 101

HYDRAULIC CONDUCTIVITY ESTIMATES AND INFILTRATION RATES

4020 COLONEL TALBOT ROAD, LONDON

Test ID	Test Used	Depth (m)	K (cm/s)	LN(I)	Infiltration Rate (mm/hour)	Safety factor of 2.5	Safety factor of 3.5
BH06-18 1.4 m	Grain size	1.4	1.2E-02	5.1	167	67	48
BH08-18 1.4 m	Grain size	1.4	1.6E-02	5.2	180	72	51

For Guelph Permeameter:

$y=6E\text{-}11(X^{3.7363})$

$LN(K)=LN6-11LN10+3.7363LN(I)$

K = cm/s

I = mm/hour

$LN(I)=(LN(K)+11LN(10)-LN(6))/3.7363$

Table 102
Water Balance
Proposed Lambeth Health and Wellness Centre, 4402 Colonel Talbot Road, London, Ontario

1. Climate Information

Precipitation (collected from Env. Canada data)	1011.5	mm/a
Evapotranspiration (UTRCA value used [conservative])	565	mm/a
Water Surplus	446.5	mm/a

2. Infiltration Rates

Infiltration Factors (Table 2, Chapter 4 of MOE, 1995)

Hilly Land (average slope of 28 m to 47 m per km)	0.1
Open sandy loam	0.4
Cover (% landscaped/open x cultivate dland infiltration factor)	0.058
TOTAL	0.5579

Infiltration (0.525 x 446.5 mm/a)	249.1	mm/a
Run-off (Water Surplus - Infiltration)	197.4	mm/a

Typical Recharge Rates (Table 3, Chapter 4, MOE, 1995)

silty sand to sandy silt	150-200	mm/a
fine to medium sand	200-250	mm/a
coarse sand and gravel	250+	mm/a

Site development area is underlain by glaciolacustrine material (sand to sand and gravel).

Based on the above, the recharge rate is approximately 234.4 mm/a

with runoff of 212.1 mm/a

3. Site Statistics

Pre-Development:

Building roofs	0.00	ha	0	m^2
Parking Areas, Roadways, Other impervious Areas	0.00	ha	0	m^2
Green space, open space, natural areas	1.58	ha	15,750	m^2
TOTAL	1.58	ha	15,750	m^2

Post-Development:

Building roofs	0.39	ha	3,906	m^2
Driveways	0.10	ha	1,008	m^2
Roadways, Other impervious Areas	0.68	ha	6,800	m^2
Green space, natural areas	0.40	ha	4,036	m^2
TOTAL	1.58	ha	15,750	m^2

Table 102
Water Balance
Proposed Lambeth Health and Wellness Centre,
4402 Colonel Talbot Road, London, Ontario

4. Annual Pre-Development Water Balance

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building Roofs	2,562	2,591	-	-	2,591
Green space/open space/gravel	12,839	12,987	7,254	3,009	2,723
Concrete/asphalt	4,007	4,053	-	-	4,053
TOTAL	19,408	19,631	7,254	3,009	9,368

5. Annual Post-Development Water Balance

Land Use	Area (m^2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building Roofs	2,675	2,706	-	-	2,706
Concrete/asphalt	5,625	5,690	-	-	5,690
Green space/open space	11,107	11,235	6,275	2,603	2,356
TOTAL	19,407	19,630	6,275	2,603	10,751

6. Annual Post-Development Water Balance using LID techniques

Land Use	Area (m2)	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Building Roofs	2,675	2,706	1,511	627	567
Concrete/asphalt	5,625	5,690	3,178	1,193	2,512
Green space/open space	11,107	11,235	6,275	2,603	2,356
TOTAL	19,407	19,630	10,965	4,424	5,435

7. Comparison of Pre-Development and Post-Development

	Precipitation (m^3)	Evapotranspiration (m^3)	Infiltration (m^3)	Run-Off (m^3)
Pre-Development	19,631	7,254	3,009	9,368
Post-Development	19,630	6,275	2,603	10,751
Post-Development using LID Techniques	19,630	10,965	4,424	5,435

8. Pre-development run-off

Total run-off in Pre-Development	9,368	m^3
Total annual precipitation	19,631	m^3
Estimated annual run-off on site in Pre-Development	47.7	%

9. Post development run-off

Total run-off in Post-Development	10,751	m^3
Total annual precipitation	19,630	m^3
Estimated annual run-off on site in Post-Development	54.8	%

10. Post development run-off using LID Techniques

Total run-off in Post-Development using LID techniques	5,435	m^3
Total annual precipitation	19,630	m^3
Estimated annual run-off on site in Post-Development using LID techniques	27.7	%

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use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.0129	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
2.460	**x**	**1/2 length of basin (x direction, in feet)**
465.760	**y**	**1/2 width of basin (y direction, in feet)**
243.333	**t**	**duration of infiltration period (days)**
3.936	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

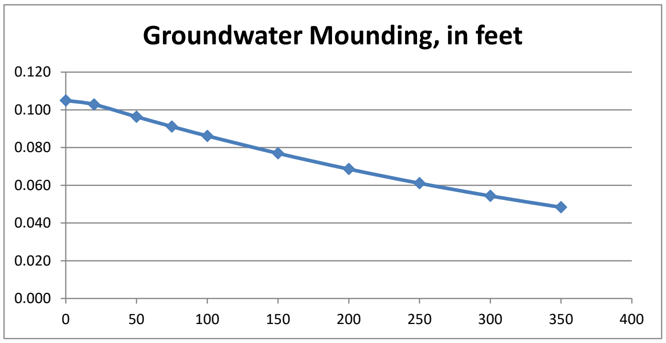
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

4.041	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.105	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.105	**0**
0.103	**20**
0.096	**50**
0.091	**75**
0.086	**100**
0.077	**150**
0.069	**200**
0.061	**250**
0.054	**300**
0.048	**350**

Re-Calculate Now



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use consistent units (e.g. feet & days **or** inches & hours)

Input Values

0.0086	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
2.460	**x**	**1/2 length of basin (x direction, in feet)**
465.760	**y**	**1/2 width of basin (y direction, in feet)**
7300.000	**t**	**duration of infiltration period (days)**
3.936	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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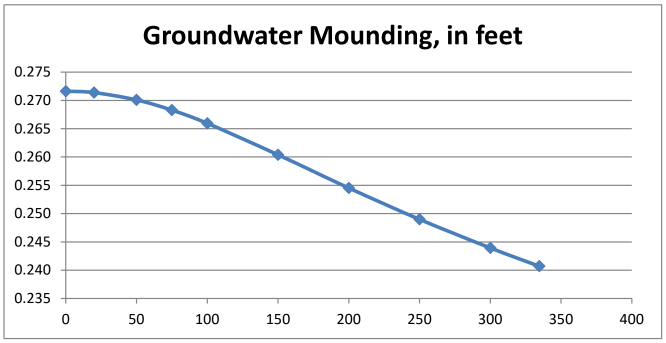
4.208	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
0.272	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
0.272	**0**
0.271	**20**
0.270	**50**
0.268	**75**
0.266	**100**
0.260	**150**
0.255	**200**
0.249	**250**
0.244	**300**
0.241	**335**

Re-Calculate Now



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Input Values

16.4367	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
2.460	**x**	**1/2 length of basin (x direction, in feet)**
465.760	**y**	**1/2 width of basin (y direction, in feet)**
1.000	**t**	**duration of infiltration period (days)**
3.936	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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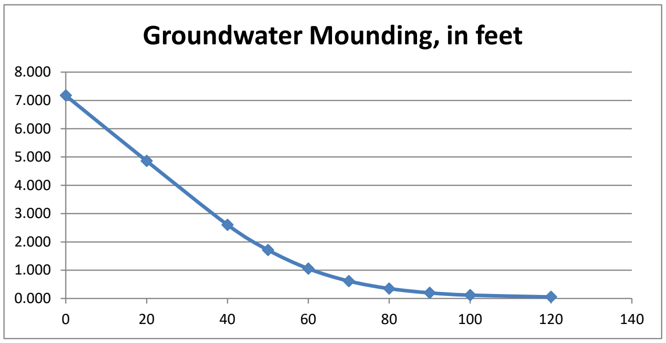
11.108	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
7.172	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
7.172	**0**
4.859	**20**
2.603	**40**
1.714	**50**
1.054	**60**
0.615	**70**
0.349	**80**
0.198	**90**
0.117	**100**
0.054	**120**

Re-Calculate Now



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Input Values		
0.4963	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
2.460	**x**	**1/2 length of basin (x direction, in feet)**
49.200	**y**	**1/2 width of basin (y direction, in feet)**
243.333	**t**	**duration of infiltration period (days)**
3.936	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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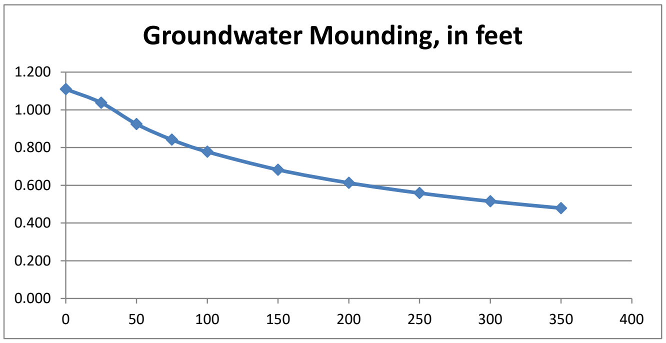
5.046	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.110	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.110	**0**
1.038	**25**
0.925	**50**
0.842	**75**
0.778	**100**
0.682	**150**
0.613	**200**
0.559	**250**
0.515	**300**
0.479	**350**

Re-Calculate Now



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Input Values

0.3309	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
2.460	**x**	**1/2 length of basin (x direction, in feet)**
49.200	**y**	**1/2 width of basin (y direction, in feet)**
7300.000	**t**	**duration of infiltration period (days)**
3.936	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

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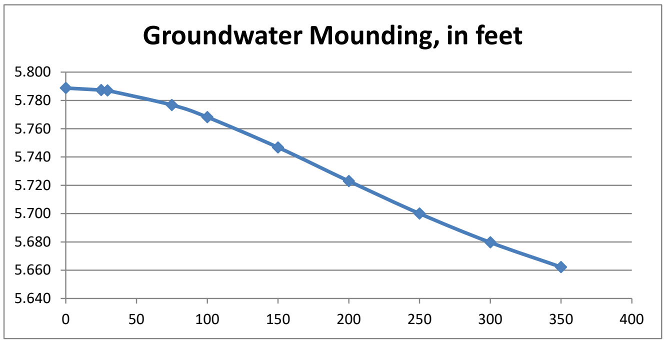
9.725	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
5.789	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
5.789	**0**
5.787	**25**
5.787	**29.52**
5.777	**75**
5.768	**100**
5.747	**150**
5.723	**200**
5.700	**250**
5.680	**300**
5.662	**350**

Re-Calculate Now



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use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
13.1331	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
2.460	**x**	**1/2 length of basin (x direction, in feet)**
49.200	**y**	**1/2 width of basin (y direction, in feet)**
1.000	**t**	**duration of infiltration period (days)**
3.936	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

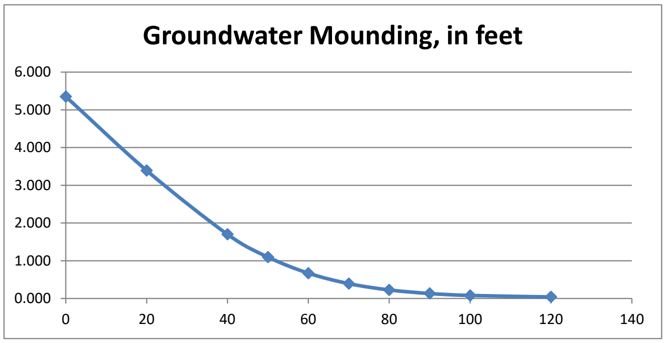
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

9.289	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
5.353	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
5.353	**0**
3.393	**20**
1.700	**40**
1.097	**50**
0.670	**60**
0.393	**70**
0.226	**80**
0.131	**90**
0.080	**100**
0.040	**120**

Re-Calculate Now



Disclaimer

This spreadsheet solving the Hantush (1967) equation for ground-water mounding beneath an infiltration basin is made available to the general public as a convenience for those wishing to replicate values documented in the USGS Scientific Investigations Report 2010-5102 "Groundwater mounding beneath hypothetical stormwater infiltration basins" or to calculate values based on user-specified site conditions. Any changes made to the spreadsheet (other than values identified as user-specified) after transmission from the USGS could have unintended, undesirable consequences. These consequences could include, but may not be limited to: erroneous output, numerical instabilities, and violations of underlying assumptions that are inherent in results presented in the accompanying USGS published report. The USGS assumes no responsibility for the consequences of any changes made to the spreadsheet. If changes are made to the spreadsheet, the user is responsible for documenting the changes and justifying the results and conclusions.

This spreadsheet will calculate the height of a groundwater mound beneath a stormwater infiltration basin. More information can be found in the U.S. Geological Survey Scientific Investigations Report 2010-5102 "Simulation of groundwater mounding beneath hypothetical stormwater infiltration basins".

The user must specify infiltration rate (R), specific yield (Sy), horizontal hydraulic conductivity (Kh), basin dimensions (x, y), duration of infiltration period (t), and the initial thickness of the saturated zone (hi(0), height of the water table if the bottom of the aquifer is the datum). For a square basin the half width equals the half length (x = y). For a rectangular basin, if the user wants the water-table changes perpendicular to the long side, specify x as the short dimension and y as the long dimension. Conversely, if the user wants the values perpendicular to the short side, specify y as the short dimension, x as the long dimension. All distances are from the center of the basin. Users can change the distances from the center of the basin at which water-table aquifer thickness are calculated.
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use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.1302	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
29.520	**x**	**1/2 length of basin (x direction, in feet)**
34.440	**y**	**1/2 width of basin (y direction, in feet)**
365.000	**t**	**duration of infiltration period (days)**
3.936	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

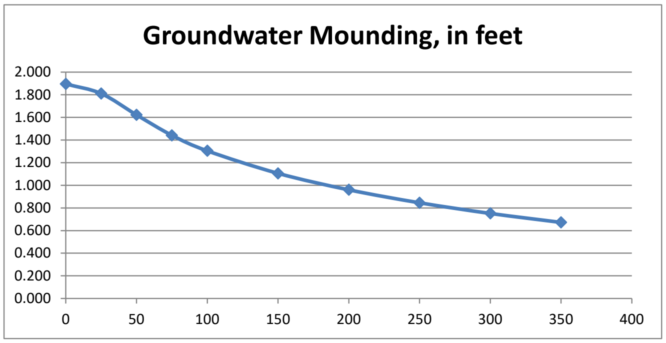
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

5.832	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.896	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.896	**0**
1.811	**25**
1.622	**50**
1.442	**75**
1.304	**100**
1.105	**150**
0.960	**200**
0.845	**250**
0.751	**300**
0.672	**350**

Re-Calculate Now



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use consistent units (e.g. feet & days **or** inches & hours)

Input Values		
0.1302	*R*	**Recharge (infiltration) rate (feet/day)**
0.150	Sy	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	K	**Horizontal hydraulic conductivity, Kh (feet/day)***
29.520	x	**1/2 length of basin (x direction, in feet)**
34.440	y	**1/2 width of basin (y direction, in feet)**
7300.000	t	**duration of infiltration period (days)**
3.936	hi(0)	**initial thickness of saturated zone (feet)**

Conversion Table

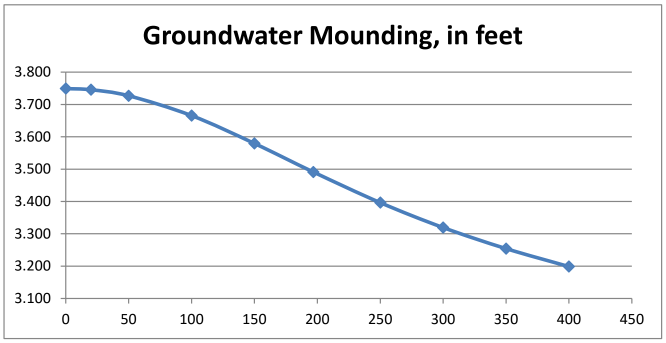
inch/hour	feet/day
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

7.685	h(max)	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
3.749	Δh(max)	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
3.749	0
3.745	20
3.727	50
3.666	100
3.579	150
3.491	196.8
3.396	250
3.319	300
3.254	350
3.199	400

Re-Calculate Now



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use consistent units (e.g. feet & days **or** inches & hours)

Input Values

0.4908	***R***	**Recharge (infiltration) rate (feet/day)**
0.150	**Sy**	**Specific yield, Sy (dimensionless, between 0 and 1)**
34.01	**K**	**Horizontal hydraulic conductivity, Kh (feet/day)***
29.520	**x**	**1/2 length of basin (x direction, in feet)**
34.440	**y**	**1/2 width of basin (y direction, in feet)**
1.000	**t**	**duration of infiltration period (days)**
3.936	**hi(0)**	**initial thickness of saturated zone (feet)**

Conversion Table

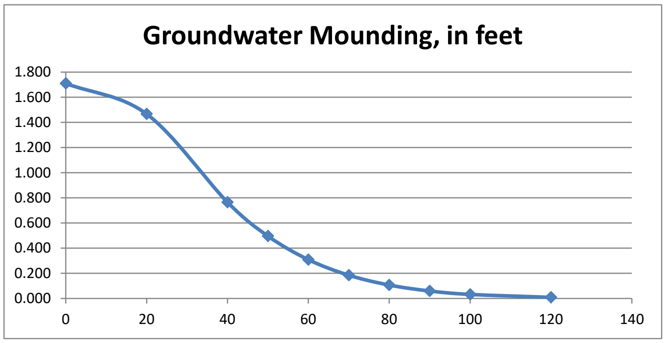
inch/hour	**feet/day**
0.67	1.33
2.00	4.00
hours	**days**
36	1.50

In the report accompanying this spreadsheet (USGS SIR 2010-5102), vertical soil permeability (ft/d) is assumed to be one-tenth horizontal hydraulic conductivity (ft/d).

5.646	**h(max)**	**maximum thickness of saturated zone (beneath center of basin at end of infiltration period)**
1.710	**Δh(max)**	**maximum groundwater mounding (beneath center of basin at end of infiltration period)**

Ground-water Mounding, in feet	**Distance from center of basin in x direction, in feet**
1.710	**0**
1.467	**20**
0.765	**40**
0.496	**50**
0.309	**60**
0.185	**70**
0.107	**80**
0.060	**90**
0.032	**100**
0.009	**120**

Re-Calculate Now



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Englobe
englobecorp.com

September 19, 2018

Lambeth Health Organization Inc.
4366 Colonel Talbot Road
London, Ontario
N6P 1B6

Attention: Ms. Michelle Whatley

Subject: Geotechnical Engineering Report Addendum
Lambeth Health and Wellness Centre
4402 Colonel Talbot Road, London, Ontario
160-B-0019446-1-GE-L-0001-00

Grain size distribution analysis testing was performed on two samples of the sand materials from the above captioned site, and the enclosed test results were used to empirically estimate the hydraulic conductivity of sand to be 5.0 x 10^{-4} cm/second.

[redacted] based on recommendations found in the ''Low Impact Development Stormwater Management Planning and Design Guide, published by the Toronto and Region (TRCA) and the Credit Valley (CVCA) Conservation Authorities.

It should be noted that hydraulic conductivity and infiltration rate are two different concepts, and that conversion from one parameter to another cannot be done through unit conversion. A factor of safety of 2.5 was applied to the approximate infiltration rate to account for soil variability, gradual accumulation of fine soil sediments during the lifespan of the facility, and compaction during construction.

Infiltration facilities generally require native soils with a minimum infiltration rate of 15 mm/hour and a minimum separation of 1.0 m between the bottom of the pit and the seasonally high water table (MOE, 2003). Test pits should be excavated within the planned areas of the infiltration facilities to confirm the subgrade conditions.

We trust this letter report is sufficient for your present requirements. Please contact our office if further discussion is required.

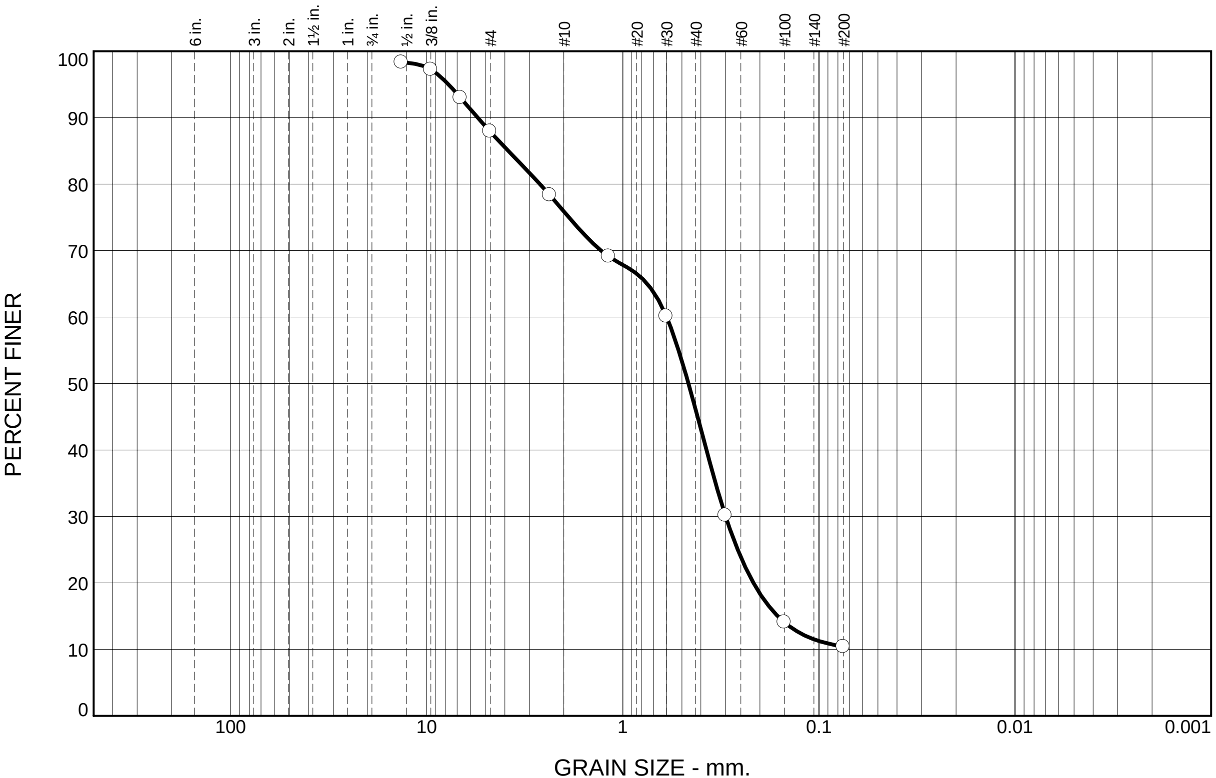
Yours very truly,
Englobe Corp.

SW Burt.

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

Enclosures: Two Grain Size Distribution Analyses

Grain Size Analysis



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
			12.0	29.9	35.6	10.4	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.530"	98.3		
3/8"	97.2		
0.265"	93.0		
#4	87.9		
#8	78.4		
#16	69.1		
#30	60.1		
#50	30.1		
#100	14.1		
#200	10.4		

* (no specification provided)

Sample Information

SAND, some silt, some gravel.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 5.4920	D_{85}= 3.8399	D_{60}= 0.5980
D_{50}= 0.4630	D_{30}= 0.2990	D_{15}= 0.1622
D_{10}=	C_u=	C_c=

Classification

USCS= AASHTO=

Remarks

Material: SAND, some silt, some gravel
Coefficient of permeability: 10^-3 to 10^-4 cm per sec.
Estimated 'T' time: 12 mins/cm

Location: BH 06-18
Sample Number: 2 **Depth:** 1.4m / 97.8 **Date:**

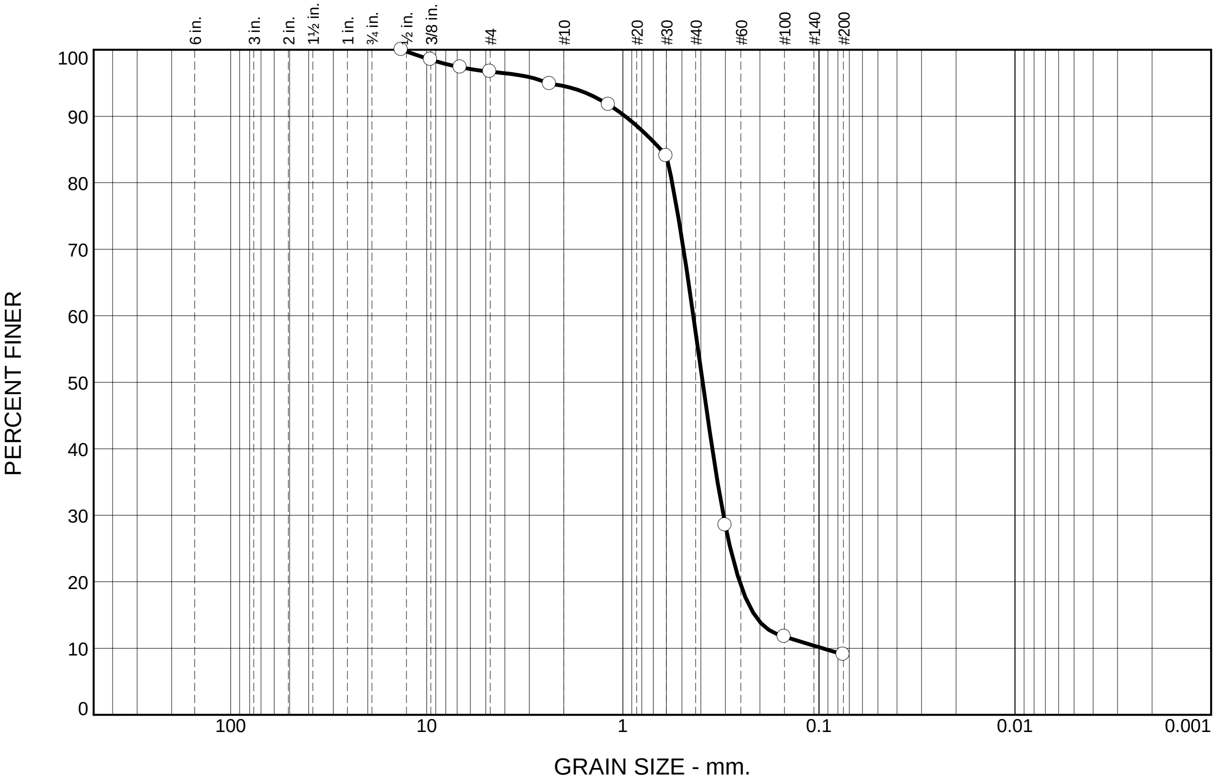
EnGlobe

London, Ontario

Client: Lambeth Health Organization Inc.
Project: Lambeth Health and Wellness Centre, 4402 Colonel Talbot Road, London
Project No: B-0019446-1 **Figure 1**

Tested By: D.M. **Checked By:** S.B.

Grain Size Analysis



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	3.3	2.2	37.1	48.3	9.1	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
0.530"	100.0		
3/8"	98.5		
0.265"	97.4		
#4	96.7		
#8	94.9		
#16	91.7		
#30	84.1		
#50	28.5		
#100	11.8		
#200	9.1		

* (no specification provided)

Sample Information

SAND, trace silt, trace gravel.

Atterberg Limits

PL= LL= PI=

Coefficients

D_{90}= 0.9733 D_{85}= 0.6408 D_{60}= 0.4374
D_{50}= 0.3918 D_{30}= 0.3069 D_{15}= 0.2128
D_{10}= 0.0957 C_u= 4.57 C_c= 2.25

Classification

USCS= AASHTO=

Remarks

Material: SAND, trace of silt, trace of gravel
Coefficient of permeability: 10^-3 to 10^-4 cm per sec.
Estimated 'T' time: 12 mins/cm

Location: BH 08-18
Sample Number: 2 **Depth:** 1.4m / 97.3 **Date:**

EnGlobe

London, Ontario

Client: Lambeth Health Organization Inc.
Project: Lambeth Health and Wellness Centre, 4402 Colonel Talbot Road, London
Project No: B-0019446-1 **Figure 1**

Tested By: D.M. **Checked By:** S.B.