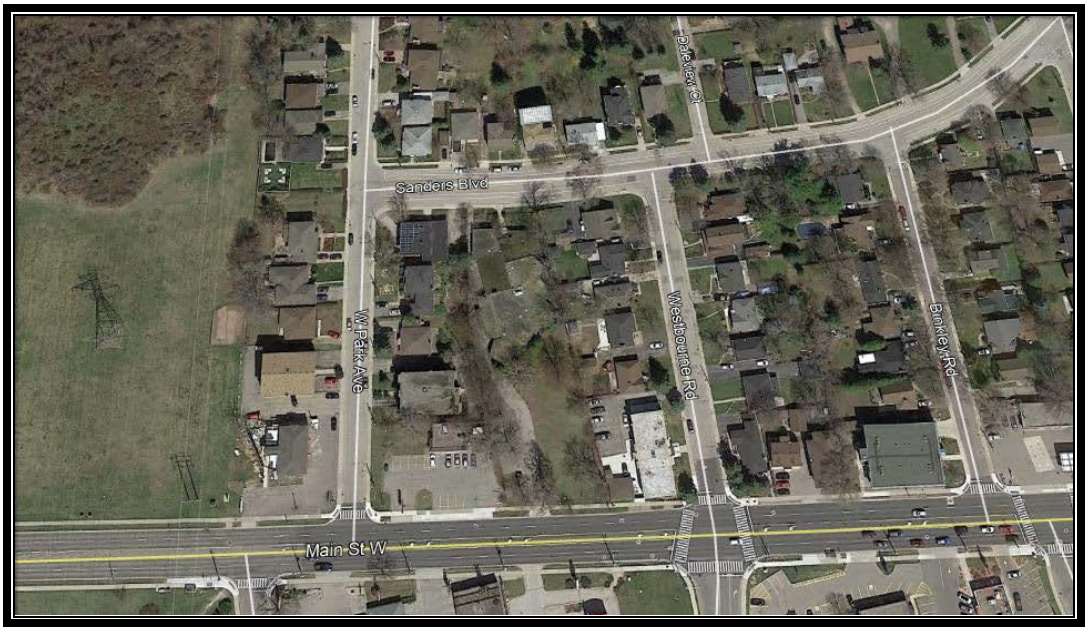
Candec Engineering Consultants Inc.
consulting engineers and environmental scientists

The Report on the Hydrogeological Assessment Of the Property at 69 Sanders Boulevard & 1630 Main Street West Hamilton, Ontario



Prepared for
Bloomfield Homes

Our project number: 18-1565
Date: May 10, 2018

25 West Beaver Creek Road, Unit 11, Richmond Hill, Ontario, L4B 1K2 Phone: (905) 707-9272 Fax: (905) 707-9273

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Candec Engineering Consultants Inc.
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May 10, 2018

Bloomfield Homes
9120 Leslie Street, Suite 203
Richmond Hill, Ontario
L4B 3J9

Attention: Mr. Selva Chelliah

Re: 69 Sanders Boulevard & 1630 Main Street West, Hamilton, Ontario

Dear Sir;

1.0 INTRODUCTION

Candec Engineering Consultants Inc. has carried out a hydrogeological assessment of the property, comprised of two parcels of land located at 69 Sanders Boulevard and 1630 Main Street West, Hamilton, Ontario. One of the parcels was used previously for institutional and residential purposes, and although it is currently unoccupied, it is understood that it will continue to be used as such for the near foreseeable future. The other parcel was and is currently being used for commercial purposes. It is understood that the aggregate property is being considered for eventual redevelopment and use for residential purposes. This will comprise the construction of blocks of townhouses or low-rise multi-unit buildings with one level of underground parking.

It is expected also that standard civil works and sewerage will be installed, and that potable water will be obtained from the municipal supply system. It is assumed that the design will comply with the applicable building and municipal codes and standards.

Standard exterior permanent drainage is to be installed around and possibly under the building; and the exterior ground surface is to be graded to channel surface run off water away from the building.

Generally, the ground surface is flat with the elevation across the property being ±100m.

2.0 SUBSURFACE CONDITIONS

2.1 Geology

The subject property is located approximately 14kms west of Lake Ontario. Based on published geological information, the geology of the subject property is expected to be characterized by Halton Till (Ontario – Erie Lobe). This deposit is predominantly a silt and silty clay matrix. The sequences of unconsolidated overburden deposits overlie Upper Ordovician shale, dolostone and limestone of the Georgian Bay Formation (Bedrock Geology of Ontario, Map 2544). Bedrock is expected to be located at a depth of approximately 3m to 8m below the ground surface.

2.2 Soil and Ground Water Conditions

The ground surface throughout the property is covered mostly with gravel or fragmented asphalt concrete pavements, with areas of scrub vegetation interspersed throughout. Below these surface materials, the uppermost stratum of the soil profile is comprised of fine to medium grained sand mixed with varying amounts of gravel and silt-sized particles. The consistency and appearance of this material in-place suggests that it was placed and compacted as fill. dark brown loamy silt. Traces proportions of brick and concrete fragments as well as coal and slag were noted through this surface stratum

The ground surface is relatively flat. The boreholes that were drilled at the property revealed that below the ground surface cover (pavement or sod/topsoil), the uppermost stratum was a silty sand fill while the uppermost stratum of native soil profile is comprised of 1900mm to 2300mm of brown to grey very fine sand. This layer is underlain by grey very fine silty sand to very fine sandy silt, which in turn are underlain by clay to silty clay strata.

Groundwater was encountered in all the boreholes at depths that ranged from of 5.1m to 5.8m below the existing ground surface. The indicated groundwater flow direction is to the north east.

Along with the particle size distributions generated during the execution of a phase two ESA of the property, Hazen's formulation was used to estimate the permeability of the soil strata comprising the soil profile, and in particular the strata comprising the aquifer. This has resulted in an estimated permeability of between $2x10^{-4}$ and $5x10^{-5}$cm/sec., with an average value of $1x10^{-5}$cm/sec.

3.0 LOCAL WATER SUPPLIES

The area in which the property is located is supplied by piped municipal water. No wells are located in this area that are used to supplement the potable water supply. Therefore, water supplies will not be affected by dewatering. Historic supply wells in the indicated municipally serviced areas were likely abandoned or are inactive.

Therefore, it is unlikely that there will be any impact on areal drinking water supplies based on any dewatering that is likely to be carried out at the subject property during construction.

We have collated data from the files of the Ministry of the Environment and Climate Change (MOECC) and the Ministry of Natural Resources (MNR) regarding active ground water wells that are within a 250m radius of the subject property.

Based on the data that has been collated and observations made during our site visits, we have determined that the ground water observation wells that are present within 250m of the property were installed as part of subsurface investigation work and are no longer being used actively for that purpose.

4.0 CONSTRUCTION DEWATERING & ESTIMATED EXTRACTION RATE

Ground water was encountered in the boreholes at a depth of approximately 3.5m to 4.5m below the existing ground surface. As such, it is likely that the ground water table will have to be lowered by as much as 3m in order to construct the planned building and install the sewerage.

By approximating the property as a large circular well of equivalent area, the dewatering rate for an assumed drawdown can be estimated by analysing radial flow to a well in an unconfined aquifer and using Darcy's Law, the following formulation is derived that permits the unit pumping rate to be estimated.

$$Q = \pi \bullet k\,(H^2 - h^2) \,/\, \mathrm{Ln}(R/r)^{1}$$

where
- Q = pumping rate (m^3/sec)
- k = permeability, m/sec
- H = head of the pre-construction water level above an assumed datum
- h = head of after dewatering
- R = Radius of influence, m
- r = effective radius of a circular area of equivalent size

The radius of influence can be estimated using the formulation below

$$R = r_w + \{(T \cdot t)/(C_4 \cdot C_s)\}^{½\ 2}$$

where
- R = Radius of influence, m
- r_w = effective radius of rectangular excavation, 80m
- T = transmissivity, $3x10^{-5}m^2$/sec
- t = duration of dewatering to achieve req'd drawdown (1day)
- C_s = Storage coefficient (0.05)
- C_4 = correlation coefficient (7400)

The maximum extraction rate is estimated to be 1100 US Gal. per day. It is expected that once steady state drawdown has been achieved, the pumping rate required to maintain it at that level will be significantly less.

The estimated maximum radius of drawdown influence is 85m, measured from the centroid of the assessment property.

5.0 GROUND WATER QUALITY & DISPOSAL OPTION

A sample of the groundwater was extracted and analyzed by AGAT Analytical Labs for compliance with the MOECC land use criteria. The results of these tests revealed that soil contains PHC impacts in concentrations ranging to 2.8mg/l. By-Law No. 2-03 of the

1 Harry R. Cedergren; Seepage, Drainage and Flow Nets, 3rd Edition; pp269-276
2 Construction Dewatering and Groundwater Control – New Methods & Applications, 3rd Edition; Patrick Powers, Arthur Brown, Paul C. Schmall, & Walter E Kaeck; 2007

Regional Municipality of Halton lists the maximum allowable concentration of mineral oil & grease concentration as 15mg/L.

Although the permissible limit has not been exceeded based on the results that are in-hand, it is possible that higher concentrations may be present in other areas of the plume of contamination.

Therefore, based on these results, the ground water at the property, if it is generated as a liquid waste at this time, will need to be treated to remove the contaminants so that it will be suitable for disposal in the sanitary or combined sewer system. It is expected that a program of restoration of the ground water conditions is to be undertaken to bring these conditions into compliance with the MOECC land use criteria. It is expected that in doing so compliance with the Halton Region sewer use criteria will also be achieved.

Further testing will be required to confirm this condition once clean-up has been completed.

It should be noted that PHC impacts in ground water can be removed easily by employing a granular activated carbon (GAC) filter. The filters typically are provided in the form of a drum or canister, similar in size to that of a 50-gal. drum, each with an inlet and an outlet FPT connection. They can be used either individually or in series.

Although a flow-through system will be more efficient, it is expected the system will require an on-site storage of the effluent after the filtration process to permit sampling and testing to confirm compliance with the criteria.

However, the expectation is that this will not be necessary once the site restoration work has been completed.

6.0 DEWATERING IMPACTS

6.1 Geotechnical Considerations

Dewatering effects on sand and silt strata that do not contain a dominant clayey component are known to be minimal because the shear strength parameters are not altered by moisture content.

In clayey strata, the increase in effective pressure is evaluated using the following equation;[3]

$$\Delta H \gamma_w$$

where ΔH = the change in the water level, and
γ_w = the unit weight of water, 9.8kN/m^3

It is understood that there will be one level of underground parking. In this event, it may be necessary to draw the water table down by as much as 3m on-site. Such a change in the water level will occasion an insignificant change in the effective pressure (30Kpa), and thus no impact on the soil bearing capacity, either SLS or ULS.

Given that the soil throughout the area is dense to very dense with a relatively unimpactful clay signature, and with an estimated effective shear strength of 110kPa, there will be virtually no consolidation-related reduction in the thickness of any of the strata. Consequently, none of the buildings within the likely zone of influence will undergo any settlement-related movement as a result of any dewatering that may be needed in order to carry the civil works for this project.

6.2 Surface Water Resources

The proposed development is not located within the area of the property that is designated as wetlands. No areas of ground surface accumulations of water were noted throughout the property and the area in which it is located. The closest surface water body is Lake Ontario which is well beyond the possible zone of influence of any likely dewatering activity to be carried out on-site.

Given these considerations, it is not likely that the potential dewatering scenario that has been examined herein (where an assumed drawdown of 3m has occurred at the site boundaries), will have any impact on any surface water resource.

6.3 Groundwater Resources

The radius of influence is estimated to be 90m and does not extend to any active water supply wells in the area. The areal subdivisions and all of the institutional and commercial properties are provided with potable water from the municipal supplies. Therefore, no

3 Soil Mechanics in Engineering Practice, 2nd Edition; Karl Terzaghi & Ralph Peck; 1967; pp581

adverse impacts from dewatering are likely.

Depending on the program and schedule of construction, it is possible that a sufficiently significant volume of water will be extracted so as to require that a permit to take water is required. It is recommended that a determination in this regard be made as soon as possible so that the process of application and review can be completed in a timely manner.

7.0 CLOSURE

The report that has been prepared is predicated on our understanding of the proposed plan of development. In the event the plan is changed, it may be necessary to review and revise some of the recommendations we have set out herein. It is essential that we should be informed in a timely manner to be able monitor the excavation along with any dewatering facilities that are in-place and note any such conditions with a view to estimating the potential impact on the recommendations made herein.

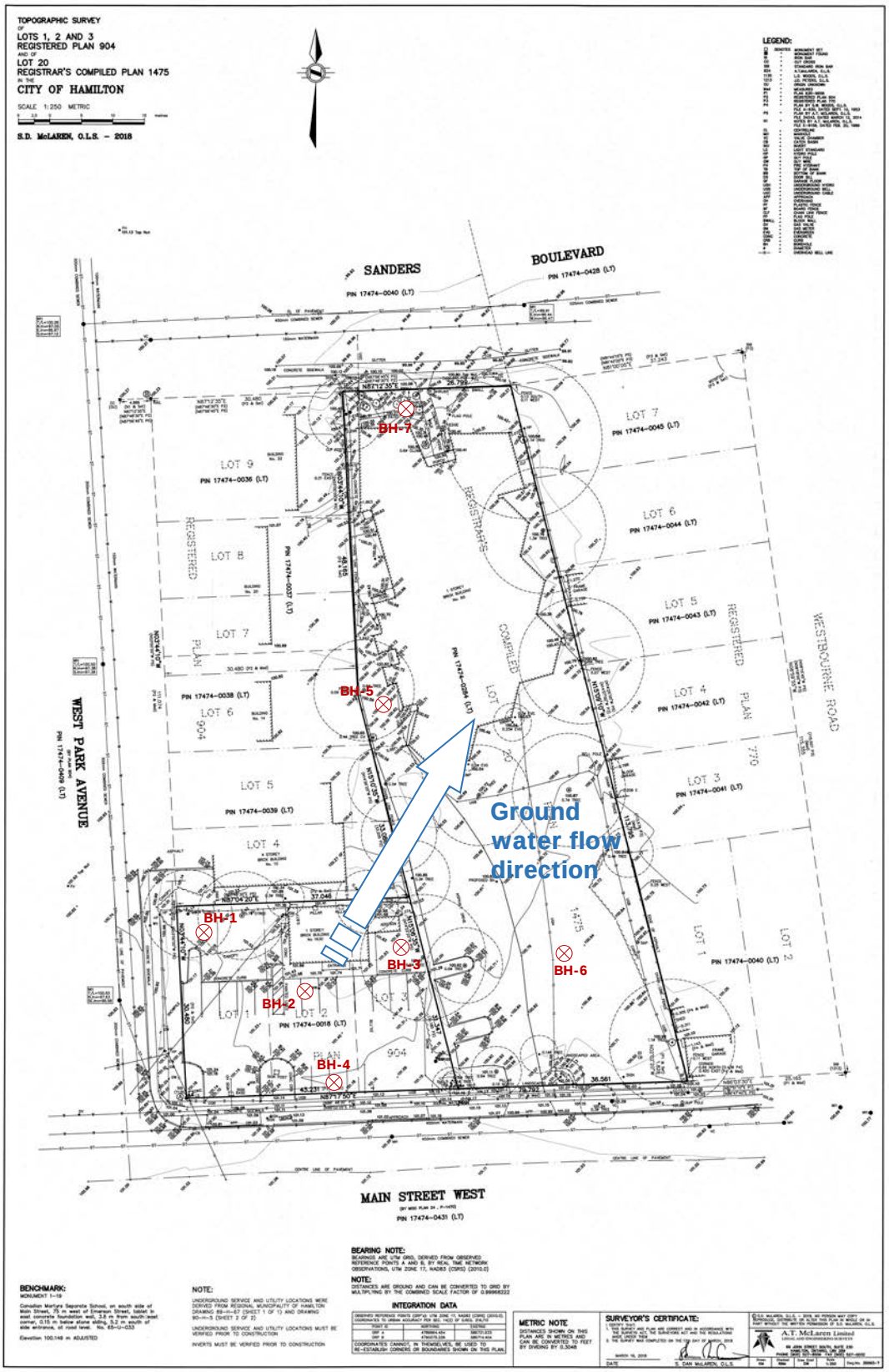
We trust that this report satisfies your requirements at this time. Please do not hesitate to call us in the event we can be of further service.

Yours truly,
CANDEC ENGINEERING CONSULTANTS INC.

Bernard F. Moore, P. Eng., M. Eng.
Principal

Bloomfield\sanders & main west\hydrogeo rpt.doc

Appendix A



Borehole Location Plan

Appendix B

Borehole Logs

Candec Engineering Consultants Inc.
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Client: Bloomfield Homes

Project: Sanders Boul. & Main St. W

Location: Hamilton, Ontario

AUGER SAMPLE | LL & PL 0—0
SPLIT SPOON SAMPLE | LAB VANE V
SHELBY TUBE | POCKET PEN
DUTCH CONE | VANE & SENSITIVITY + (S)

PROJECT NO: 18-1565
DATE: APRIL 30, 2018
BOREHOLE NO: 1
PREPARED BY: SF

Datum: local

ELEV. / DEPTH	SOIL DESCRIPTION	SAMPLE	PENETRATION (blows per 300mm) 20 40 60 80	MOISTURE CONTENT (%) 5 10 15 20	% RET'D	SOIL GAS (%)	WELL
0.0m	Dark Brown Silty Loam **TOPSOIL** - wet				65	0	
	Brown to dark br. **Sandy Silt Fill**						
1.0m	Brown to br. **Sandy Silt** w/ a trace of gravel • Compact to dense • Moist to very moist				94	0	
					98	0	
2.0m					84	0	
3.0m	Brown to grey **Silty Sand**; with some Gravel & a trace of Clay				89	0	
4.0m					89	0	
5.0m							
6.0m					89	0	
	End of Borehole **Gwl @5.2m**						

Note:

This borehole log should only be read and interpreted in conjunction with the report of which it forms a part. It is otherwise invalid
Candec Engineering Consultants Inc. must be contacted to provide assistance in the interpretation of the information in this borehole record

Candec Engineering Consultants Inc.
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Client: Bloomfield Homes

Project: Sanders Boul. & Main St. W

Location: Hamilton, Ontario

AUGER SAMPLE | LL & PL 0—0
SPLIT SPOON SAMPLE | LAB VANE v
SHELBY TUBE | POCKET PEN
DUTCH CONE | VANE & SENSITIVITY + (S)

PROJECT NO: 18-1565
DATE: APRIL 30, 2018
BOREHOLE NO: 2
PREPARED BY: SF

Datum: local

ELEV. / DEPTH	SOIL DESCRIPTION	SAMPLE	PENETRATION (blows per 300mm) 20 40 60 80	MOISTURE CONTENT (%) 5 10 15 20	% RET'D	SOIL GAS (%)	WELL
0.0m	Asphalt concrete pavement – 350m Loamy Silt Topsoil - 100mm Moist				70	0	
1.0m	Brown **Silt Fine Sand** with a trace of gravel • *Compact to dense* • *Moist to very moist*				92	0	
					89	0	
2.0m					98	0	
3.0m	Grey **silty SAND**, trace of clay & gravel • *Compact to dense* • *Moist to very moist*				89	0	
4.0m							
5.0m	Grey **fine SAND**, some silt • *Compact to dense* • *Moist to wet*				89	0	
6.0m					92	0	
6.5m	**End of Borehole** **GWL @ 5.2mbeg**						

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Client: Bloomfield Homes

Project: Sanders Boul. & Main St. W

Location: Hamilton, Ontario

AUGER SAMPLE | LL & PL 0—0
SPLIT SPOON SAMPLE | LAB VANE v
SHELBY TUBE | POCKET PEN
DUTCH CONE | VANE & SENSITIVITY + (S)

PROJECT NO: 18-1565
DATE: APRIL 30, 2018
BOREHOLE NO: 3
PREPARED BY: SF

Datum: local

ELEV. / DEPTH	SOIL DESCRIPTION	SAMPLE	PENETRATION (blows per 300mm) 20 40 60 80	MOISTURE CONTENT (%) 5 10 15 20	% RET'D	SOIL GAS (%)	WELL
0.0m	Dark Brown Silty Loam **TOPSOIL** Silty Sand Fill Moist		★		74	0	
1.0m			★	+	65	0	
	Brown **Silt Fine Sand** with a trace of gravel • *Compact to dense* • *Moist to very moist*		★		89	0	
2.0m			★		89	0	
3.0m			★		74	0	
	Grey **silty SAND**, trace of clay & gravel • *Compact to dense* • *Moist to very moist*		★		89	0	
4.0m							
5.0m	Grey **fine SAND**, some silt • *Compact to dense* • *Moist to wet*						
6.0m			★	+	89	0	
6.5m	**End of Borehole** **GWL @ 5.3mbeg**						

Note:

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Client: Bloomfield Homes

Project: Sanders Boul. & Main St. W

Location: Hamilton, Ontario

AUGER SAMPLE | LL & PL 0—0
SPLIT SPOON SAMPLE | LAB VANE v
SHELBY TUBE | POCKET PEN
DUTCH CONE | VANE & SENSITIVITY + (S)

PROJECT NO: 18-1565
DATE: APRIL 30, 2018
BOREHOLE NO: 4
PREPARED BY: SF

Datum: local

ELEV. / DEPTH	SOIL DESCRIPTION	SAMPLE	PENETRATION (blows per 300mm) 20 40 60 80	MOISTURE CONTENT (%) 5 10 15 20	%RET'D	SOIL GAS (%)	WELL
0.0m	Asphalt concrete pavement – 300m Loamy Silt Topsoil - 200mm Moist				89	0	
1.0m	Brown **Silt Fine Sand** with a trace of gravel • *Compact to dense* • *Moist to very moist*				89	0	
2.0m					89	0	
3.0m					99	0	
	Grey **silty SAND**, trace of clay & gravel • *Compact to dense* • *Moist to very moist*				92	0	
4.0m							
5.0m	Grey **fine SAND**, some silt • *Compact to dense* • *Moist to wet*				89	0	
6.0m					98	0	
6.4m	**End of Borehole** **GWL @ 5.1mbeg**						

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Client: Bloomfield Homes

Project: Sanders Boul. & Main St. W

Location: Hamilton, Ontario

AUGER SAMPLE | LL & PL 0—0
SPLIT SPOON SAMPLE | LAB VANE v
SHELBY TUBE | POCKET PEN
DUTCH CONE | VANE & SENSITIVITY + (S)

PROJECT NO: 18-1565
DATE: APRIL 30, 2018
BOREHOLE NO: 5
PREPARED BY: SF

Datum: local

ELEV. / DEPTH	SOIL DESCRIPTION	SAMPLE	PENETRATION (blows per 300mm) 20 40 60 80	MOISTURE CONTENT (%) 5 10 15 20	% RET'D	SOIL GAS (%)	WELL
0.0m	Asphalt concrete pavement – 300m				63	0	
	Brown **Silt Fine Sand** with a trace of gravel • *Compact to dense* • *Moist*				90	0	
1.0m							
					74	0	
2.0m					98	0	
	Grey **silty SAND**, trace of clay & gravel • *Compact to dense* • *Moist to very moist*				89	0	
3.0m							
4.0m	Grey **fine SAND**, some silt • *Compact to dense* • *Moist to wet*				89	0	
5.0m							
6.0m					94	0	
6.5m	**End of Borehole** **GWL @ 5.6mbeg**						

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Client: Bloomfield Homes

Project: Sanders Boul. & Main St. W

Location: Hamilton, Ontario

AUGER SAMPLE | LL & PL 0—0
SPLIT SPOON SAMPLE | LAB VANE V
SHELBY TUBE | POCKET PEN
DUTCH CONE | VANE & SENSITIVITY + (S)

PROJECT NO: 18-1565
DATE: APRIL 30, 2018
BOREHOLE NO: 6
PREPARED BY: SF

Datum: local

ELEV. / DEPTH	SOIL DESCRIPTION	SAMPLE	PENETRATION (blows per 300mm) 20 40 60 80	MOISTURE CONTENT (%) 5 10 15 20	% RET'D	SOIL GAS (%)	WELL
0.0m	Dark brown Loamy **Silt Topsoil**				72	0	
	Brown to dark br. **Sandy Silt** w/ a trace of gravel • Compact to dense • Moist to very moist				89	0	
1.0m					89	0	
2.0m					95	0	
	Brown to grey **Silty Sand**; with some Gravel & a trace of Clay				90	0	
3.0m							
4.0m					98	0	
5.0m							
6.0m					94	0	
	End of Borehole **Gwl @5.3m**						

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Client: Bloomfield Homes

Project: Sanders Boul. & Main St. W

Location: Hamilton, Ontario

AUGER SAMPLE | LL & PL 0—0
SPLIT SPOON SAMPLE | LAB VANE V
SHELBY TUBE | POCKET PEN
DUTCH CONE | VANE & SENSITIVITY + (S)

PROJECT NO: 18-1565
DATE: APRIL 30, 2018
BOREHOLE NO: 7
PREPARED BY: SF

Datum: local

ELEV. / DEPTH	SOIL DESCRIPTION	SAMPLE	PENETRATION (blows per 300mm) 20 40 60 80	MOISTURE CONTENT (%) 5 10 15 20	% RET'D	SOIL GAS (%)	WELL
0.0m	Dark Brown Silty Loam **TOPSOIL** - moist				**72**	0	
	Brown to dark br. **Sandy Silt** w/ a trace of gravel • Compact to dense • Moist to very moist				**89**	0	
1.0m					**89**	0	
2.0m					**95**	0	
	Brown to grey **Silty Sand**; with some Gravel & a trace of Clay				**90**	0	
3.0m							
4.0m					**98**	0	
5.0m							
6.0m							
	End of Borehole **Gwl @5.8m**						

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