PRELIMINARY GEOTECHNICAL INVESTIGATION 321 DEVINE STREET SARNIA, ONTARIO

MAY 13, 2019

PRELIMINARY GEOTECHNICAL INVESTIGATION 321 DEVINE STREET SARNIA, ONTARIO

FINAL REPORT

PROJECT NO.: 191-04081-00

DATE: MAY 2019

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by _____ to undertake a preliminary geotechnical investigation for the proposed redevelopment of property located at 321 Devine Street in Sarnia, Ontario.

The site is currently occupied by a former Devine Street School two-storey building structure with one level of basement. The proposed structure is understood to be a retirement residence which will consist of 5 to 8 storey towers with one level of underground parking (refer to **Appendix D**). Finished floor elevation (FFE) is proposed at 183.25m.

This report deals with the preliminary geotechnical aspects of the site. Environmental aspects are discussed in separate Phase I report completed by others. The information contained in the report does not reflect on the environmental or hydrogeological aspects of the site, other then what is stated in this report.

The purpose of this geotechnical investigation is to determine the subsurface conditions at four (4) borehole locations and from the findings in the boreholes make preliminary engineering recommendations for the following:

- Foundations
- Floor Slabs and Permanent Drainage
- Elevator Pits
- Frost Protection
- Earth and Water Pressures
- Earthquake Considerations
- Excavation and Groundwater Control
- Temporary Shoring
- Pavements

This report is provided on the basis of the terms of reference presented above and on the assumption that the design will be in accordance with the applicable codes and standards. If there are any changes in the design features relevant to the geotechnical analyses, or if any questions arise concerning the geotechnical aspects of the codes and standards, this office should be contacted to review the design. It may then be necessary to carry out additional borings and reporting before the recommendations of this office can be relied upon.

The site investigation and recommendations follow generally accepted practice for geotechnical consultants in Ontario. The format and contents are guided by client specific needs and economics and do not conform to generalized standards for services. Laboratory testing for most part follows ASTM or CSA Standards or modifications of these standards that have become standard practice.

This report has been prepared for _____ and its architects and designers. Third party use of this report without WSP consent is prohibited. The limitation conditions presented in this report form an integral part of the report and they must be considered in conjunction with this report.

2 FIELD AND LABORATORY WORK

Four (4) boreholes (BH19-1, BH19-3, BH19-6 and BH19-7) were drilled at the subject site to depths ranging from 11.4 to 35.5m. Boreholes BH19-2, BH19-4, BH19-5 and BH19-8 to BH19-10 were initially staked out, but were subsequently cancelled at the client's request.

The boreholes were drilled with hollow stem augers under the direction and supervision of WSP personnel. Samples were retrieved at regular intervals with a 50mm O.D. split-barrel sampler driven with a hammer weighing 624N and dropping 760mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to the WSP laboratory for detailed examination by the engineer who assigned geotechnical laboratory testing.

Dynamic cone penetration testing (DCPT) was completed at borehole BH19-1 from 25.3 to 35.6m depth. The DCPT is a continuous test which utilizes a dropping weight to drive a cone and rod into the ground. The number of blows for each 300mm of penetration is recorded. The test was terminated at practical refusal at a depth of 35.6m.

As well as visual examination in the laboratory, all soil samples were tested for moisture contents. Grain size distribution testing was conducted for selected soil samples. Selected soil samples were subjected to Atterberg Limits Tests and results are provided on the respective borehole logs. The Gradation Curves for the grain size analyses and the Plasticity Charts are presented in **Appendix B**.

Three (3) field vane shear tests were completed at borehole BH19-1 to determine the undrained strength of clay.

Water level observations were made during drilling and in open boreholes upon completion of the drilling operations. For the monitoring of the long-term groundwater levels, three (3) monitoring wells of 50mm dia. were installed in boreholes BH19-1, BH19-3 and BH19-7 at different elevations and water level measurements were taken on April 1, April 5 and April 16, 2019.

A RKI Eagle combustible vapour meter was used to measure possible combustible gas in the overburden during borehole drilling and in monitoring wells. Small amounts (puffs) of air were detected upon releasing the j-plug from the monitoring wells, however no combustible vapour (methane) were detected in the select boreholes on April 1, 5 and 16, 2019.

A number of soil samples were selected for environmental and chemical analyses (BH19-3/SS3, BH19-6/SS1 and BH19-7/SS1) to determine their environmental quality for off-site disposal. These three (3) soil samples were analyzed for metal an and inorganic parameters. Certificate of analysis is provided in **Appendix C**.

The surface elevations at the borehole locations were surveyed by WSP and were referenced to a geodetic benchmark.

3 SITE AND SUBSURFACE CONDITIONS

The Borehole locations are shown on **Drawing 1**. The subsurface conditions in the boreholes are presented in the individual borehole logs in **Appendix A** and are summarized in the following paragraphs.

3.1 SOIL CONDITIONS

TOPSOIL/ASPHALTIC CONCRETE/FILL MATERIAL

At boreholes BH19-1 and BH19-6, a pavement structure consisting of asphaltic concrete underlain by granular base/subbase materials was contacted at the surface. At boreholes BH19-3 and BH19-7, topsoil layer was contacted at the surface. Thicknesses of these layers were not measured due to hollow stem augers used during drilling and due to monitoring well installation.

Fill material was encountered at all boreholes and consisted of silty clay, trace gravel, trace sand, with rootlets and topsoil and was found extending to depths varying from 1.4 to 1.6m below ground surface. Fill material was found to be of a firm consistency with measured SPT 'N' values of 5 to 8 blows per 300mm penetration.

Moisture content measured in fill material ranged from 16 to 20%.

GLACIAL TILL DEPOSITS

Glacial till deposits consisting of silty clay till, trace gravel, trace to some sand were encountered in all boreholes and were found to be of a firm to very stiff consistency up to 4.5 to 5.5m depth with measured SPT 'N' values of 5 to 20 blows per 300mm penetration and very soft to firm, thereafter, to 11.4 to 35m depth with measured SPT 'N' values of 0 to 8 blows per 300mm penetration. Boreholes BH19-3, BH19-6 and BH19-7 were terminated in this deposit.

Field vane testing was carried out in this weaker lower till deposits and indicated in-situ undrained shear strengths of 37 to 48kPa (corresponding to a firm consistency). Upper till indicated in-situ undrained shear strengths of 80kPa (corresponding to a stiff consistency). Clay Sensitivity of 1.4 to 1.5 was measured.

Grain size analyses of two (2) samples from the till deposit (BH19-7/SS2 and BH19-7/SS8) were conducted and the results are presented in **Figures B1 and B2** in **Appendix B**, with the following fractions:

Clay: 37 to 40%

Silt: 43 to 45%

Sand: 11 to 18%

Gravel: 1 to 6%

The two (2) samples from the till deposit were subjected to Atterberg Limits Testing (BH19-7/SS2 and BH19-7/SS8). The results are shown on the respective borehole log and on the Plasticity Chart on **Figure B3 and B4** in **Appendix B** and are summarized as follows:

Liquid Limit (W_L) = 32 to 33%

Plastic Limit (W_P) = 15%

Plasticity Index (PI) = 17 to 18%

The silty clay is classified as inorganic clay of medium plasticity (Cl) based on its Atterberg Limits.

Dynamic cone penetration testing (DCPT) was completed at borehole BH19-1 from 25.3 to 35.6m depth until practical refusal. DCPT penetration values increased with depth, which could be partially attributed to skin friction.

Moisture content measured in till material ranged from 14 to 33%.

COHESIONLESS DEPOSIT OF SILT

A layer of cohesionless deposits of silt, trace sand, trace clay, were found interbedded within the till deposits between 8.7 and 14.4m depths in boreholes BH19-1 and BH19-6 and were found to be in very loose to compact state, with measured SPT 'N' values of 3 to 10 blows per 300mm penetration.

Moisture content measured in silt material ranged from 11 to 16%.

INFERRED SHALE BEDROCK

DCPT was completed at borehole BH19-1 to 35.6m depth where the bedrock was inferred. Bedrock coring and sampling was not completed as part of this preliminary geotechnical investigation and would be required in order to confirm these findings if deep foundation (end-bearing) alternatives were to be considered for this project.

3.2 GROUNDWATER CONDITIONS

During drilling, no groundwater was found in the open boreholes. The groundwater table observed in the monitoring wells on April 1, April 5 and April 16, 2019 and was reported to be as following:

Table 3.2 Measured Water Levels in Monitoring Wells

WELL ID	DIAMETER (MM)	GROUND SURFACE ELEV. (M)	SOIL TYPE AT SCREEN LOCATION (DEPTH)	DATE OF MEASUREMENT	WATER LEVEL DEPTH (M)	WATER LEVEL ELEVATION (M)
BH19-1	50	182.5	Silty clay till (2.7 – 3.3)	April 5, 2019	Dry	NA
				April 16, 2019	2.4	180.1

WELL ID	DIAMETER (MM)	GROUND SURFACE ELEV. (M)	SOIL TYPE AT SCREEN LOCATION (DEPTH)	DATE OF MEASUREMENT	WATER LEVEL DEPTH (M)	WATER LEVEL ELEVATION (M)
BH19-3	50	182.8	Silty clay till (2.7 – 5.7)	April 1, 2019	Dry	NA
				April 5, 2019	Dry	NA
				April 16, 2019	5.5	177.3
BH19-7	50	182.5	Silty clay till (5.3 – 8.3)	April 1, 2019	Dry	NA
				April 5, 2019	Dry	NA
				April 16, 2019	Dry	NA

4 FOUNDATIONS

It is understood that the proposed residential development will consist of mid- to high-rise retirement building with one (1) underground basement level. The basement floor is, therefore, estimated at about 3m± below ground surface. The footings are expected to be about 1m below the top of basement floor slab (El: 179m±).

The boreholes reveal presence of a variety of soil types ranging in texture from fill material over glacial till, interbedded with cohesionless silt underlain by bedrock (inferred).

SPREAD, STRIP FOOTINGS, RAFT ON NATIVE SILTY CLAY TILL

Based on the preliminary findings, the proposed building with one level of basement can be supported by spread and strip footings, depending on the sizes of footings, founded on the undisturbed silty clay till deposit for a bearing capacity of 50kPa at Serviceability Limit States (SLS) and for a factored geotechnical resistance of 75kPa at Ultimate Limit States (ULS).

Foundations designed to the specified bearing capacities at the SLS are expected to undergo less than 25mm of total and 19mm of differential settlement.

If a raft foundation is used for the building with a basement, the preliminary SLS bearing capacity can be taken as 25kPa and the factored bearing capacity can be taken as 40kPa. A total settlement of 25mm and differential settlement of 19mm needs to be confirmed with additional CPT testing and oedometer testing during later design stages if the raft foundation is selected for building support.

A preliminary modulus of subgrade reaction of 2MPa/m can be used for preliminary raft footing design. This value would have to be confirmed with additional CPT testing and oedometer testing (to be completed as part of final design).

Where it is necessary to place footings at different levels, the upper footing must be founded below an imaginary 10 horizontal to 7 vertical line drawn up from the base of the lower footing. The lower footing must be installed first to help minimize the risk of undermining the upper footing.

It should be noted that the recommended bearing capacities have been calculated by WSP from the borehole information for the preliminary design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. For example, more specific information is available with respect to conditions between boreholes when foundation construction is underway. The interpretation between boreholes and the recommendations of this report must therefore be checked through field inspections provided by WSP to validate the information for use during the construction stage.

GROUND IMPROVEMENT

As an alternative, the use of an aggregate pier system could be considered at this site to improve the bearing capacity and settlement control of the existing soil to support the proposed structures. The aggregate pier system is constructed by

installing compacted layers of aggregate into a boring. Higher bearing capacities than what is given in section above are achieved by the compaction of the aggregate in layers, which densifies the adjacent soils. Specialty contractors are to be retained for design and to consult on ground improvement systems.

DRIVEN PILES

In the worst scenario, should the raft option prove to be untenable, then the building foundations need to be supported on piled foundations and this is addressed below.

Based on the borehole information, the proposed buildings can be supported on driven piles founded in bedrock. The piles can consist of steel H-piles such as HP 310x110, to be driven to practical refusal in bedrock.

For design purpose, the ultimate axial bearing capacity of the piles driven to practical refusal in bedrock can be taken as:

HP 310x110 piles:

Factored geotechnical resistance at ULS	= 1,700 kN/pile
Bearing capacity at SLS:	= 1,250 kN/pile

The proposed pile capacity is based on the assumption of no grade raising. If the grades were to be raised, negative skin friction due to clayey soil consolidation under the earth loading will occur and the negative skin friction needs to be deducted from the proposed pile capacity. A detailed analysis would be required.

The factored horizontal resistance at ULS can be taken as 100kN/pile and SLS horizontal resistance can be taken as 70kN/pile. Pile driving refusal can be assumed to be within 2 m below the bedrock surface. The actually required depth of the piles must be determined by field PDA testing, which may be shorter or longer than the design depth. The bearing capacity of the piles must be proven by field PDA testing by PDA Consultant. The measured ultimate capacity (Ru) of the pile from the PDA testing should be at least two times the ULS capacity, i.e. minimum Ru = 3400 kN/pile.

The bearing capacity of the piles and the driving criteria for practical refusal in bedrock must be determined by field pile diving analyzer (PDA) tests. All piles should be designed and installed in accordance with OPSS 903. Rock points are required for the piles.

Based on the depth/elevation of the bedrock at the borehole locations provided, bedrock was not cored to confirm its quality during this phase of investigation as it was not part of the scope of work. Additional boreholes with bedrock coring will be required prior to the final design of the proposed buildings. Due to potentially variable bedrock depths, the actual pile tip elevation will vary. The contractor should allow for some variation in pile lengths and this aspect should be taken into consideration when ordering the piles. The tips of the piles may need to be stiffened to minimize damage to the piles. Care must be taken to avoid overdriving and damaging the pile tip, i.e. the structural capacity of the piles should not be exceeded.

It is recommended that prior to the final design of the foundations, a total of 4 test piles be installed across the site to confirm the available bearing capacity and the required depth of the piles by PDA consultant. The bearing capacity and depth of these 4 test piles must be determined by field pile tests using the Pile Driving Analyzer (PDA). The depth of the piles will be economized from the results of this initial stage PDA testing.

Pile PDA testing will also be required for 10% to 20% of the production piles.

The pile driving should be observed, on a full-time basis, by an experienced soil technician, who will record penetration resistance, pile toe elevation, etc. The technician must be supervised by a professional engineer experienced in this type of work.

In order to avoid group effect on the bearing capacity of the piles, the horizontal spacing of adjacent piles should be at least 3 times its dimension/diameter.

All foundations/pile caps exposed to seasonal freezing conditions must have at least 1.2m of soil cover for frost protection.

It should be noted that the recommended bearing resistances have been calculated by WSP Canada Inc. from the borehole information for the preliminary design stage only. The investigation and comments are necessarily on-going as new information of the underground conditions becomes available. The interpretation between boreholes and the

recommendations of this report must therefore be checked through field inspections provided by WSP Canada Inc. to validate the information for use during the construction stage.

5 FLOOR SLAB AND PERMANENT DRAINAGE

With one level of basement, the basement floor can be supported on grade provided any disturbed/loose materials are removed and the base thoroughly proof rolled. Any backfill required to raise the grade can consist of inorganic soil, placed in shallow lifts and compacted to 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

A moisture barrier consisting of at least 200 mm of 19 mm clear crushed stone should be installed under the floor slab.

A perimeter and underfloor drainage system will be required. Typical drainage and backfill recommendations are illustrated on **Drawings 6 and 7** for shored excavation system. Where the exposed subgrade consists of cohesionless soil below the water table, all openings including the subgrade must be covered or wrapped with filter fabric, typically a Class II non-woven textile with a filtration opening size (F.O.S.) of 50 to 100 µm.

6 ELEVATOR PITS

It is anticipated that some elevator pits will be installed in the silty clay till below the water table. In this case, drainage systems at the base level of the elevator pits is recommended or elevator pits can be designed as water tight structures.

7 FROST PROTECTION

All footings exposed to seasonal freezing conditions must have at least 1.2 metres of soil cover for frost protection.

It is also emphasized that underfloor drainage and/or an adequate free draining gravel base is required to minimize the risk of floor dampness. Floor dampness could lead to temporary icing and the risk of accidents.

8 EARTH AND WATER PRESSURES

The lateral earth pressure acting at any depth on basement walls can be calculated as follows:

Above groundwater table ($h < H1$): $p = K (\gamma 1 h + q)$

Below the groundwater table ($h > H1$): $p = K (\gamma 1 H1 + q + \gamma 2(h-H1)) + Pw$

where p	=	lateral earth pressure in kPa acting at depth h
K	=	earth pressure coefficient K=0.4 for overburden soil
$\gamma 1$	=	unit weight of overburden soil above the water table, assuming $\gamma 1$ = 21 kN/m3
$\gamma 2$	=	submerged unit weight of overburden soil below the water table, assuming $\gamma 2$ = 11 kN/m3
h	=	depth below exterior grade

H1	=	thickness of soil above the groundwater table, assuming groundwater table at Elev. 175.9m
q	=	value of surcharge in kPa
Pw	=	hydrostatic water pressure, assume Elev. 177m

9 EARTHQUAKE CONSIDERATIONS

Based on the borehole information and according to Table 4.1.8.4.A of OBC 2012, the subject site for the proposed building with one level of basement may be classified as 'Class D' for seismic site response based on the preliminary information. Additional boreholes and tests will be required to confirm the seismic classification.

10 EXCAVATION AND GROUNDWATER CONTROL

With one level of basement, excavation is expected to continue to about 3 to 4m below the existing grade. Based on the borehole and monitoring well information, the groundwater at the site is expected to be as shallow as 180m± elevation. No major problems with groundwater are anticipated for excavation to a depth of about 4 m below the existing grade. It is expected that any seepage, which occurs during wet periods or from perched water in the fill material can be removed by pumping from sumps. Contractors should be prepared to employ more elaborate dewatering procedures if the flow from fill deposits becomes a problem.

All excavations can be carried out with heavy hydraulic backhoe. All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill material, cohesionless soils, clayey soils can be classified as Type 3 Soil above the groundwater and Type 4 Soil below the groundwater. Silt deposits below the groundwater table can be classified as Type 4 Soil.

It should be noted that the till is a non-sorted sediment and, therefore, may contain boulders. Possible large obstructions such as buried concrete pieces are also anticipated in the fill material. Provisions must be made in the excavation contract for the removal of possible boulders in the till or obstructions in the fill material. Provisions must be made for removing foundation elements and below ground structures from existing school building structure.

The select inorganic native soils can be re-used as general construction backfill, provided its moisture content is within two percent of its optimum moisture content. Loose lifts of soil, which are to be compacted, should not exceed 200mm. The excavated soils are not considered to be free draining. Where free draining backfill is required, imported granular fill such as OPSS Granular B should be used. Underfloor fill should be compacted to at least 98 percent of Standard Proctor Maximum Dry Density (SPMDD).

It should be noted that the excavated soils are subject to moisture content increase during wet weather, which would make these materials too wet for adequate compaction. Stockpiles should be compacted at the surface or be covered with tarpaulins to minimize moisture uptake.

11 PAVEMENTS

The recommended pavement structures provided in Table 11.1 are based upon an estimate of the subgrade soil properties determined from visual examination and textural classification of the soil samples. The values may need to be adjusted based on the city /regional standards. Consequently, the recommended pavement structures should be considered for preliminary design purposes only. A functional design life of eight to ten years has been used to establish the pavement

recommendations. This represents the number of years to the first rehabilitation, assuming regular maintenance is carried out. If required, a more refined pavement structure design can be performed based on specific traffic data and design life requirements and will involve specific laboratory tests to determine frost susceptibility and strength characteristics of the subgrade soils, as well as specific data input from the client.

Table 11.1 Recommended Pavement Structure Thickness

PAVEMENT LAYER	COMPACTION REQUIREMENTS	LIGHT DUTY PARKING (CARS)	HEAVY DUTY PARKING(DELIVERY TRUCKS)
Asphaltic Concrete	92.0 to 96.5% MRD*	40 mm HL 3 or SP 12.5 40 mm HL 8 or SP 19.0	40 mm HL 3 or SP 12.5 80 mm HL 8 or SP 19.0
OPSS Granular A Base (or 20mm Crusher Run Limestone	100% SPMDD**	150 mm	150 mm
OPSS Granular B (or 50mm Crusher Run Limestone)	100% SPMDD	200 mm	300 mm

** Denotes Maximum Relative Density; ** Denotes Standard Proctor Maximum Dry Density, ASTM-D698

The subgrade of all pavements must be compacted to 98% SPMDD for at least the upper 300 mm unless accepted by WSP Canada Inc.

The long term performance of the pavement structure is highly dependent upon the subgrade support conditions. Stringent construction control procedures should be maintained to ensure uniform subgrade moisture and density conditions are achieved. In addition, the need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying subgrade should be free of depressions and should be sloped (preferably at a minimum grade of two percent) to provide effective surface drainage toward catch basins. Surface water should not be allowed to pond adjacent to the outside edges of pavement areas. Subdrains should be installed to intercept excess subsurface moisture and prevent subgrade softening. This is particularly important in heavy-duty pavement areas.

Additional comments on the construction of parking areas and access roadways are as follows:

As part of the subgrade preparation, proposed parking areas and access roadways should be stripped of topsoil and other obvious objectionable material. Fill required to raise the grades to design elevations should conform to backfill requirements outlined in previous sections of this report. The subgrade should be properly shaped, crowned then proof-rolled in the full time presence of a representative of this office. Soft or spongy subgrade areas should be sub-excavated and properly replaced with suitable approved backfill compacted to 98% SPMDD.

The locations and extent of sub-drainage required within the paved areas should be reviewed by this office in conjunction with the proposed lot grading. Assuming that satisfactory crossfalls in the order of two percent have been provided, subdrains extending from and between catch basins may be satisfactory. In the event that shallower crossfalls are considered, a more extensive system of sub-drainage may be necessary and should be reviewed by WSP Canada Inc.

The most severe loading conditions on light-duty pavement areas and the subgrade may occur during construction. Consequently, special provisions such as restricted access lanes, half-loads during paving, etc., may be required, especially if construction is carried out during unfavourable weather.

It is recommended that WSP Canada Inc. be retained to review the final pavement structure designs and drainage plans prior to construction to ensure that they are consistent with the recommendations of this report.

12 LIMITATIONS OF REPORT

This report is intended solely for the Client named. The material in it reflects our best judgment in light of the information available to WSP Canada Inc.at the time of preparation. Unless otherwise agreed in writing by WSP Consultants Limited, it shall not be used to express or imply warranty as to the fitness of the property for a particular purpose. No portion of this report may be used as a separate entity, it is written to be read in its entirety.

The conclusions and recommendations given in this report are based on information determined at the test hole locations. The information contained herein in no way reflects on the environment aspects of the project, unless otherwise stated. Subsurface and groundwater conditions between and beyond the test holes may differ from those encountered at the test hole locations, and conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

The design recommendations given 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.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusions as to how the subsurface conditions may affect their work. This work has been undertaken in accordance with normally accepted geotechnical engineering practices.

Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. WSP Canada Inc. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

We accept no responsibility for any decisions made or actions taken as a result of this report unless we are specifically advised of and participate in such action, in which case our responsibility will be as agreed to at that time.

We trust that the information contained in this report is satisfactory. Should you have any questions, please do not hesitate to contact this office.

DRAWINGS

BOREHOLE LOCATION PLAN (DRAWING 1)
DRAINAGE AND BACKFILL RECOMMENDATIONS (DRAWINGS 2-3)
GUIDELINES FOR UNDERPINNING (DRAWING 4)

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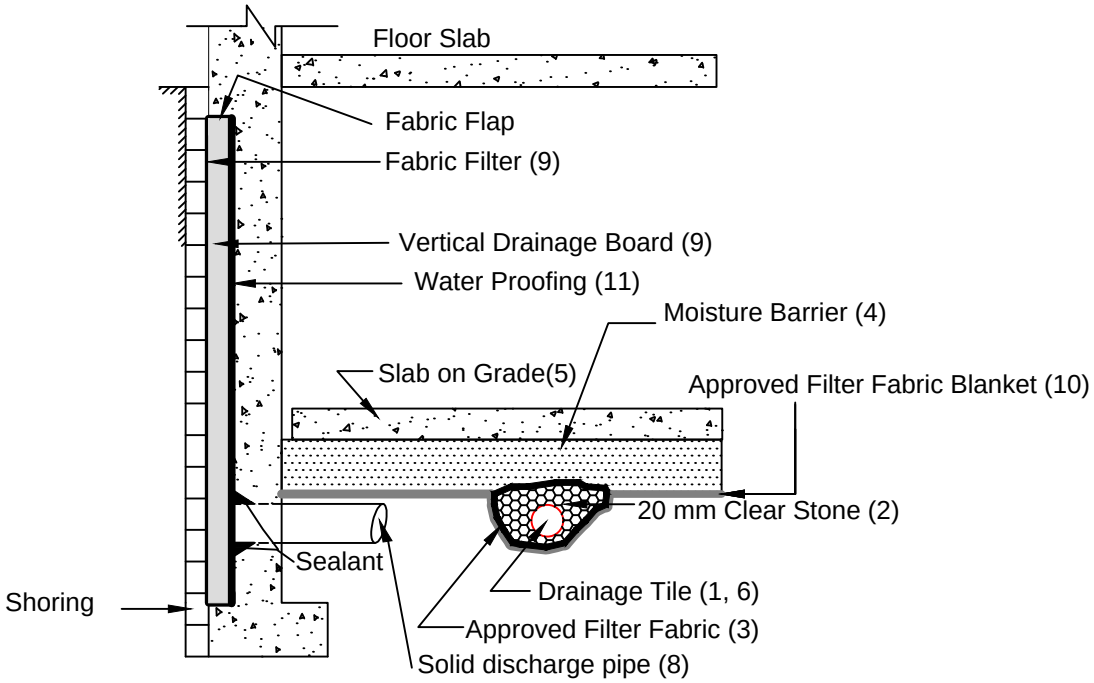
CLIENT: BRONTE GROUP DEVELOPMENT INC.		PROJECT NO: 191-04081-00	DRAWING NO: 1
TITLE: BOREHOLE LOCATION PLAN		DRAWN BY: MP	CHECKED BY: LC
PROJECT: GEOTECHNICAL INVESTIGATION - 321 DEVINE STREET, SARNIA ON		DATE: APRIL 2019	SCALE: NTS
		ORIGINAL SIZE: LETTER	REV. # N/A

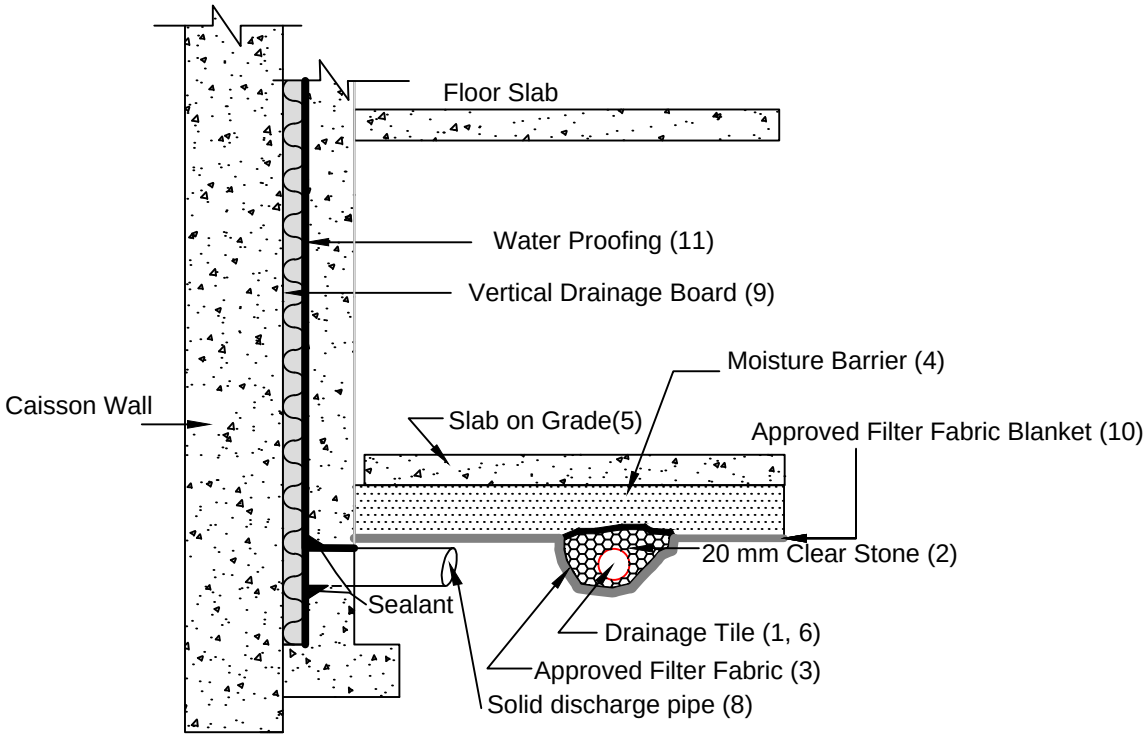


EXTERIOR FOOTING

Notes

1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet, spaced between columns.
2. 20 mm (3/4") clear stone - 150 mm (6") top and side of drain. If drain is not on footing, place100 mm (4 inches) of stone below drain .
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
5. Slab on grade should not be structurally connected to the wall or footing.
6. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
7. Do not connect the underfloor drains to perimeter drains.
8. Solid discharge pipe located at the middle of each bay between the solider piles, approximate spacing 2.5 m, outletting into a solid pipe leading to a sump.
9. Vertical drainage board with filter cloth should be kept a minium of 1.2 m below exterior finished grade.
10. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
11. The basement walls should be water proofed using bentonite or equivalent water-proofing system.
12. Review the geotechnical report for specific details. Final detail must be approved before system is considered acceptable.

DRAINAGE RECOMMENDATIONS
Shored Basement wall with Underfloor Drainage System
(not to scale)



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1. Drainage tile to consist of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet, spaced between columns.
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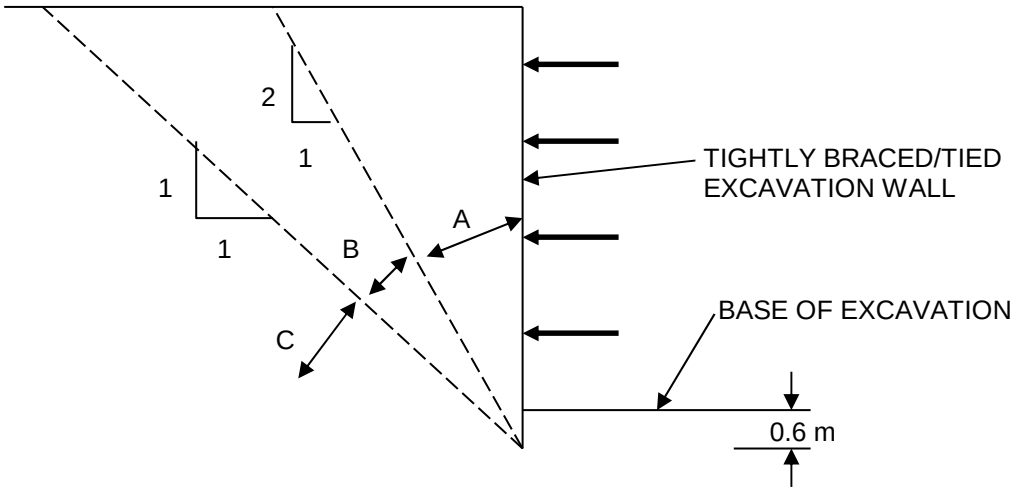
3. Wrap the clear stone with an approved filter membrane (Terrafix 270R or equivalent).
4. Moisture barrier to be at least 200 mm (8") of compacted clear 20 mm (3/4") stone or equivalent free draining material. A vapour barrier may be required for specialty floors.
5. Slab on grade should not be structurally connected to the wall or footing.
6. Underfloor drain invert to be at least 300 mm (12") below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m (20 to 25') centers one way. Place drain on 100 mm (4") clear stone with 150 mm (6") of clear stone on top and sides. Enclose stone with filter fabric as noted in (3).
7. Do not connect the underfloor drains to perimeter drains.
8. Solid discharge pipe located at the middle of each bay between the solider piles, approximate spacing 2.5 m, outletting into a solid pipe leading to a sump.
9. Vertical drainage board mira-drain 6000 or eqivalent with filter cloth should be continous from bottom to 1.2 m below exterior finished grade.
10. The entire subgrade to be sealed with approved filter fabric (Terrafix 270R or equivalent) if non-cohesive (sandy) soils below ground water table encountered.
11. The basement walls must be water proofed using bentonite or equivalent water-proofing system.
12. Review the geotechnical report for specific details. Final detail must be approved before system is considered acceptable.

DRAINAGE RECOMMENDATIONS
Shored Basement wall with Underfloor Drainage System
(not to scale)

Project: 191-04081 **Drawing 4**

Guidelines for Underpinning in Soil and Excavation Support

Existing foundations located within Zone A normally require underpinning, especially for heavy structures. For some foundations in Zone A, it may be possible to eliminate underpinning and control foundation movement by tightly braced excavation walls, such as caisson walls.



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 normally do not require underpinning. Horizontal and vertical pressures on the excavation wall of 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

(Reference: Figure 26.27 from Canadian Foundation Engineering Manual, 4th Edition)

APPENDIX

A

EXPANATION OF TERMS USED IN BOREHOLE LOG
BOREHOLE LOGS BH19-1, BH19-3, BH19-6 AND BH19-7

Explanation of Terms Used in the Record of Borehole

Sample Type

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO	Drive open
DS	Dimension type sample
FS	Foil sample
NR	No recovery
RC	Rock core
SC	Soil core
SS	Spoon sample
SH	Shelby tube sample
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

Penetration Resistance

Standard Penetration Resistance (SPT), N:
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) drive open sampler for a distance of 300 mm (12 in).

WH – Samples sinks under "weight of hammer"

Dynamic Cone Penetration Resistance, N_d:
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in) to drive uncased a 50 mm (2 in) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in).

Textural Classification of Soils (ASTM D2487-10)

Classification	Particle Size
Boulders	> 300 mm
Cobbles	75 mm - 300 mm
Gravel	4.75 mm - 75 mm
Sand	0.075 mm - 4.75 mm
Silt	0.002 mm - 0.075 mm
Clay	<0.002 mm(*)

(*) Canadian Foundation Engineering Manual (4th Edition)

Coarse Grain Soil Description (50% greater than 0.075 mm)

Terminology	Proportion
Trace	0-10%
Some	10-20%
Adjective (e.g. silty or sandy)	20-35%
And (e.g. sand and gravel)	> 35%

Soil Description

a) Cohesive Soils(*)

Consistency	Undrained Shear Strength (kPa)	SPT "N" Value
Very soft	<12	0-2
Soft	12-25	2-4
Firm	25-50	4-8
Stiff	50-100	8-15
Very stiff	100-200	15-30
Hard	>200	>30

(*) Hierarchy of Shear Strength prediction
1. Lab triaxial test
2. Field vane shear test
3. Lab. vane shear test
4. SPT "N" value
5. Pocket penetrometer

b) Cohesionless Soils

Density Index (Relative Density)	SPT "N" Value
Very loose	<4
Loose	4-10
Compact	10-30
Dense	30-50
Very dense	>50

Soil Tests

w	Water content
w_p	Plastic limit
w_l	Liquid limit
C	Consolidation (oedometer) test
CID	Consolidated isotropically drained triaxial test
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement
D_R	Relative density (specific gravity, Gs)
DS	Direct shear test
ENV	Environmental/ chemical analysis
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified proctor compaction test
SPC	Standard proctor compaction test
OC	Organic content test
U	Unconsolidated Undrained Triaxial Test
V	Field vane (LV-laboratory vane test)
γ	Unit weight

LOG OF BOREHOLE 19-1

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
ENCL NO.: 2
PROJECT LOCATION: Sarnia, ON
Method: Hollow Stem Augers
ORIGINATED BY MQ
DATUM: Geodetic
Diameter: 175 mm
COMPILED BY MP
BH LOCATION: N 4757788.97 E 385469.1
Date: Apr/05/2019
CHECKED BY LC

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
182.5	Ground Surface						
0.0	**FILL:** asphaltic-concrete pavement; granular base; silty clay, trace sand, trace gravel, rootlets, topsoil, brown-black, moist, firm.		1	SS	8		Concrete
181.1							Holeplug
1.4	**SILTY CLAY TILL:** some sand, trace gravel, brown-grey, moist, firm to very stiff.		2	SS	10		
			3	SS	20	W. L. 180.1 m Apr 16, 2019	Sand Screen
			4	SS	15		
			5	SS	9		
			6	SS	5		
177.0			8	VANE			
5.5	**SILTY CLAY TILL:** some sand, trace gravel, grey, moist, soft to firm.		7	SS	3		
			9	SS	2		
			10	SS	3		

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

1.4

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

LOG OF BOREHOLE 19-1

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
Method: Hollow Stem Augers
ENCL NO.: 2
PROJECT LOCATION: Sarnia, ON
Diameter: 175 mm
ORIGINATED BY MQ
DATUM: Geodetic
Date: Apr/05/2019
COMPILED BY MP
BH LOCATION: N 4757788.97 E 385469.1
CHECKED BY LC

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
	Continued				
	SILTY CLAY TILL: some sand, trace gravel, grey, moist, soft to firm.(Continued)				
		11	VANE		
169.3		12	SS	2	
13.3	**SILT:** trace sand, trace clay, grey, moist to wet, very loose.	13	SS	3	
168.1					
14.4	**SILTY CLAY TILL:** trace sand, trace gravel, grey, moist, soft to firm.	14	SS	5	
		15	SS	3	

DRAFT

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 19-1

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
Method: Hollow Stem Augers
ENCL NO.: 2
PROJECT LOCATION: Sarnia, ON
Diameter: 175 mm
ORIGINATED BY MQ
DATUM: Geodetic
Date: Apr/05/2019
COMPILED BY MP
BH LOCATION: N 4757788.97 E 385469.1
CHECKED BY LC

ELEV / DEPTH (m)	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
	Continued				
21	**SILTY CLAY TILL:** trace sand, trace gravel, grey, moist, soft to firm.(Continued)				162
22		16	SS	8	161
23		17	VANE		160
24		18	SS	5	159
25		19	DCPT	8	158
		20	DCPT	9	
26		21	DCPT	11	157
		22	DCPT	12	
		23	DCPT	15	156
27		24	DCPT	12	
		25	DCPT	15	
		26	DCPT	17	155
28		27	DCPT	20	
		28	DCPT	20	
		29	DCPT	21	154
29		30	DCPT	22	
		31	DCPT	27	
		32	DCPT	28	153
30		33	DCPT	30	

SOIL PROFILE | SAMPLES | GROUND WATER CONDITIONS | STRATA PLOT

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED
● QUICK TRIAXIAL
+ FIELD VANE & Sensitivity
× LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)
NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

1.5

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

LOG OF BOREHOLE 19-1

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
ENCL NO.: 2
PROJECT LOCATION: Sarnia, ON
Method: Hollow Stem Augers
ORIGINATED BY MQ
DATUM: Geodetic
Diameter: 175 mm
COMPILED BY MP
BH LOCATION: N 4757788.97 E 385469.1
Date: Apr/05/2019
CHECKED BY LC

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION
	Continued						
	SILTY CLAY TILL: trace sand, trace gravel, grey, moist, soft to firm.(Continued)		34	DCPT	29		
			35	DCPT	32		
			36	DCPT	35		
31			37	DCPT	36		
			38	DCPT	37		
			39	DCPT	38		
32			40	DCPT	39		
			41	DCPT	41		
			42	DCPT	41		
33			43	DCPT	42		
			44	DCPT	43		
			45	DCPT	44		
34			46	DCPT	45		
			47	DCPT	45		
			48	DCPT	47		
			49	DCPT	50		
147.6							
35 34.9	**INFERRED BEDROCK:** no sample collected.		50	DCPT	108		
			51	DCPT	50/ 50mm		
147.0							
35.6	**END OF BOREHOLE**						

Notes:
1) 50mm dia. monitoring well was installed upon completion, screened at 2.65 to 3.26m.
2) Borehole remained dry upon completion.

Water level readings

Date	W. L. Depth (m)
April 16, 2019	2.4

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED + FIELD VANE & Sensitivity
● QUICK TRIAXIAL × LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

152
151
150
149
148
147

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8=3% Strain at Failure

LOG OF BOREHOLE 19-3

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
ENCL NO.: 3
PROJECT LOCATION: Sarnia, ON
Method: Hollow Stem Augers
ORIGINATED BY MQ
DATUM: Geodetic
Diameter: 175 mm
COMPILED BY MP
BH LOCATION: N 4757798.28 E 385530.77
Date: Mar/29/2019
CHECKED BY LC

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
182.8	Ground Surface						
0.0	**FILL:** topsoil layer; silty clay, trace sand, trace gravel, rootlets, topsoil, brown-grey, moist, firm.						
			1	SS	7		
181.4							
1.4	**SILTY CLAY TILL:** some sand, trace gravel, brown-grey, moist, firm to very stiff.						
			2	SS	10		
			3	SS	20		
			4	SS	14		
			5	SS	8		
178.3							
4.5	**SILTY CLAY TILL:** some sand, trace gravel, grey, moist, very soft to firm.						
			6	SS	5		
			7	SS	3		
			8	SS	3		
			9	SS	2		
10							

Concrete
Holeplug
Sand
Screen
W. L. 177.3 m
Apr 16, 2019

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED
● QUICK TRIAXIAL
+ FIELD VANE & Sensitivity
× LAB VANE
20 40 60 80 100

PLASTIC LIMIT W_P | NATURAL MOISTURE CONTENT W | LIQUID LIMIT W_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 19-3

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
Method: Hollow Stem Augers
ENCL NO.: 3
PROJECT LOCATION: Sarnia, ON
Diameter: 175 mm
ORIGINATED BY MQ
DATUM: Geodetic
Date: Mar/29/2019
COMPILED BY MP
BH LOCATION: N 4757798.28 E 385530.77
CHECKED BY LC

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS / 0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT W_P / NATURAL MOISTURE CONTENT W / LIQUID LIMIT W_L — WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued										
	SILTY CLAY TILL: some sand, trace gravel, grey, moist, very soft to firm.(Continued)										
							172				
11			10	SS	0				○		
171.4											
11.4	**END OF BOREHOLE**										

Notes:
1) 50mm dia. monitoring well was installed upon completion, screened at 2.63 to 5.67m.
2) Borehole remained dry upon completion.

Water level readings

Date	W. L. Depth (m)
April 1, 2019	Dry
April 5, 2019	Dry
April 16, 2019	5.5

GROUNDWATER ELEVATIONS
Measurement 1st ▽ 2nd ▼ 3rd ▼ 4th ▼

GRAPH NOTES: +3, ×3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE 19-6

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
ENCL NO.: 4
PROJECT LOCATION: Sarnia, ON
Method: Hollow Stem Augers
ORIGINATED BY MQ
DATUM: Geodetic
Diameter: 175 mm
COMPILED BY MP
BH LOCATION: N 4757734.63 E 385519.61
Date: Mar/29/2019
CHECKED BY LC

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION
182.7	Ground Surface						
0.0	**FILL:** asphaltic-concrete pavement; granular base; silty clay, trace sand, trace gravel, rootlets, topsoil, brown-grey, moist, firm.		1	SS	5		182
181.3							
1.4	**SILTY CLAY TILL:** some sand, trace gravel, brown-grey, moist, firm to very stiff.		2	SS	13		181
			3	SS	18		180
			4	SS	10		179
			5	SS	5		
178.2							178
4.5	**SILTY CLAY TILL:** some sand, trace gravel, grey, moist, very soft to firm.		6	SS	4		
			7	SS	2		177
			8	SS	2		176
174.0							175
8.7	**SILT:** trace sand, trace clay, grey, moist to wet, compact.		9	SS	10		174
173.3							
9.5	**SILTY CLAY TILL:** trace sand, trace gravel, grey, moist, very soft to firm.		10	SS			173
10							

DYNAMIC CONE PENETRATION RESISTANCE PLOT
20 40 60 80 100

SHEAR STRENGTH (kPa)
○ UNCONFINED
● QUICK TRIAXIAL
+ FIELD VANE & Sensitivity
× LAB VANE
20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%)
10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE 19-6

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
Method: Hollow Stem Augers
ENCL NO.: 4
PROJECT LOCATION: Sarnia, ON
Diameter: 175 mm
ORIGINATED BY MQ
DATUM: Geodetic
Date: Mar/29/2019
COMPILED BY MP
BH LOCATION: N 4757734.63 E 385519.61
CHECKED BY LC

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: "N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa): ○ UNCONFINED, ● QUICK TRIAXIAL, + FIELD VANE & Sensitivity, × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued										
	SILTY CLAY TILL: trace sand, trace gravel, grey, moist, very soft to firm.(Continued)										
							172				
11			11	SS	1				○		
171.3											
11.4	**END OF BOREHOLE** Notes: 1) Boreholes remained dry and open upon completion.										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ 8 ε=3% Strain at Failure

LOG OF BOREHOLE 19-7

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
ENCL NO.: 5
PROJECT LOCATION: Sarnia, ON
Method: Hollow Stem Augers
ORIGINATED BY MQ
DATUM: Geodetic
Diameter: 175 mm
COMPILED BY MP
BH LOCATION: N 4757703.29 E 385471.68
Date: Mar/29/2019
CHECKED BY LC

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m
182.5	Ground Surface			
0.0	**FILL:** topsoil layer; silty clay, trace sand, trace gravel, rootlets, topsoil, brown-grey, moist, firm.	1	SS	8
180.9				
1.6	**SILTY CLAY TILL:** some sand, trace gravel, brown-grey, moist, firm to very stiff.	2	SS	15
		3	SS	10
		4	SS	15
		5	SS	6
178.0				
4.5	**SILTY CLAY TILL:** some sand, trace gravel, brown-grey, moist, soft.	6	SS	5
		7	SS	3
		8	SS	2
		9	SS	3
		10	SS	

Concrete
Holeplug
Sand
Screen

ELEVATION: 181, 180, 179, 178, 177, 175, 174, 173

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)

	GR	SA	SI	CL
1	1	18	45	37
8	6	11	43	40

DRAFT

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
+3, ×3: Numbers refer to Sensitivity
○ε=3%: Strain at Failure

LOG OF BOREHOLE 19-7

PROJECT: Preliminary Geotechnical Investigation - 321 Devine St., Sarnia ON
REF. NO.: 191-04081-00
CLIENT:
ENCL NO.: 5
PROJECT LOCATION: Sarnia, ON
Method: Hollow Stem Augers
ORIGINATED BY MQ
DATUM: Geodetic
Diameter: 175 mm
COMPILED BY MP
BH LOCATION: N 4757703.29 E 385471.68
Date: Mar/29/2019
CHECKED BY LC

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS/0.3 m	GROUND WATER CONDITIONS	ELEVATION	DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100) / SHEAR STRENGTH (kPa) ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE & Sensitivity × LAB VANE (20 40 60 80 100)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L / WATER CONTENT (%) (10 20 30)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	Continued											
	SILTY CLAY TILL: some sand, trace gravel, brown-grey, moist, soft.(Continued)											
11			11	SS	2		172		○			
171.1												
11.4	**END OF BOREHOLE**						171					
12	Notes: 1) 50mm dia. monitoring well was installed upon completion, screened at 5.27 to 8.31m. 2) Borehole remained dry upon completion.						170					
13	Water level readings Date W. L. Depth (m) April 1, 2019 Dry April 5, 2019 Dry April 16, 2019 Dry						169					
14							168					
15							167					
16												

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

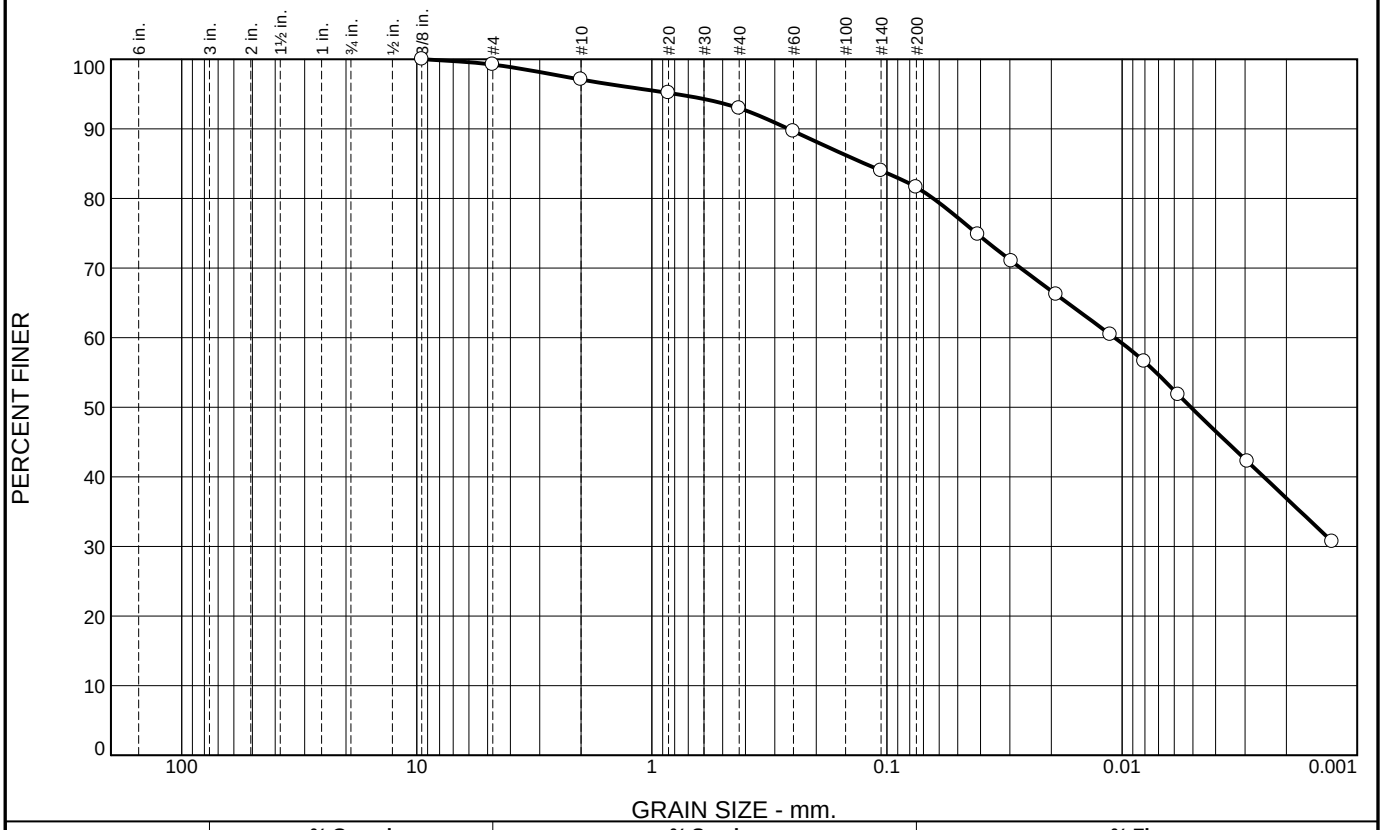
GRAPH NOTES
+ 3, × 3: Numbers refer to Sensitivity
○ 8 ε=3% Strain at Failure

APPENDIX

B

GRAIN SIZE DISTRIBUTION CURVES AND PLASTICITY CHARTS

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	0.8	2.1	4.1	11.4	44.7	36.9

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
9.5mm	100.0		
4.75mm	99.2		
2.00mm	97.1		
.850mm	95.2		
.425mm	93.0		
.250mm	89.7		
.106mm	84.0		
.075mm	81.6		
0.0410 mm.	74.8		
0.0295 mm.	71.0		
0.0191 mm.	66.2		
0.0112 mm.	60.4		
0.0081 mm.	56.6		
0.0058 mm.	51.8		
0.0029 mm.	42.2		
0.0013 mm.	30.7		

* (no specification provided)

Soil Description

Silty clay, some sand

Atterberg Limits

PL= 15 LL= 32 PI= 17

Coefficients

D_{90}= 0.2625 D_{85}= 0.1241 D_{60}= 0.0108
D_{50}= 0.0051 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(12)

Remarks

Lab No: 29-19

Sample Number: BH19-7 SS2B

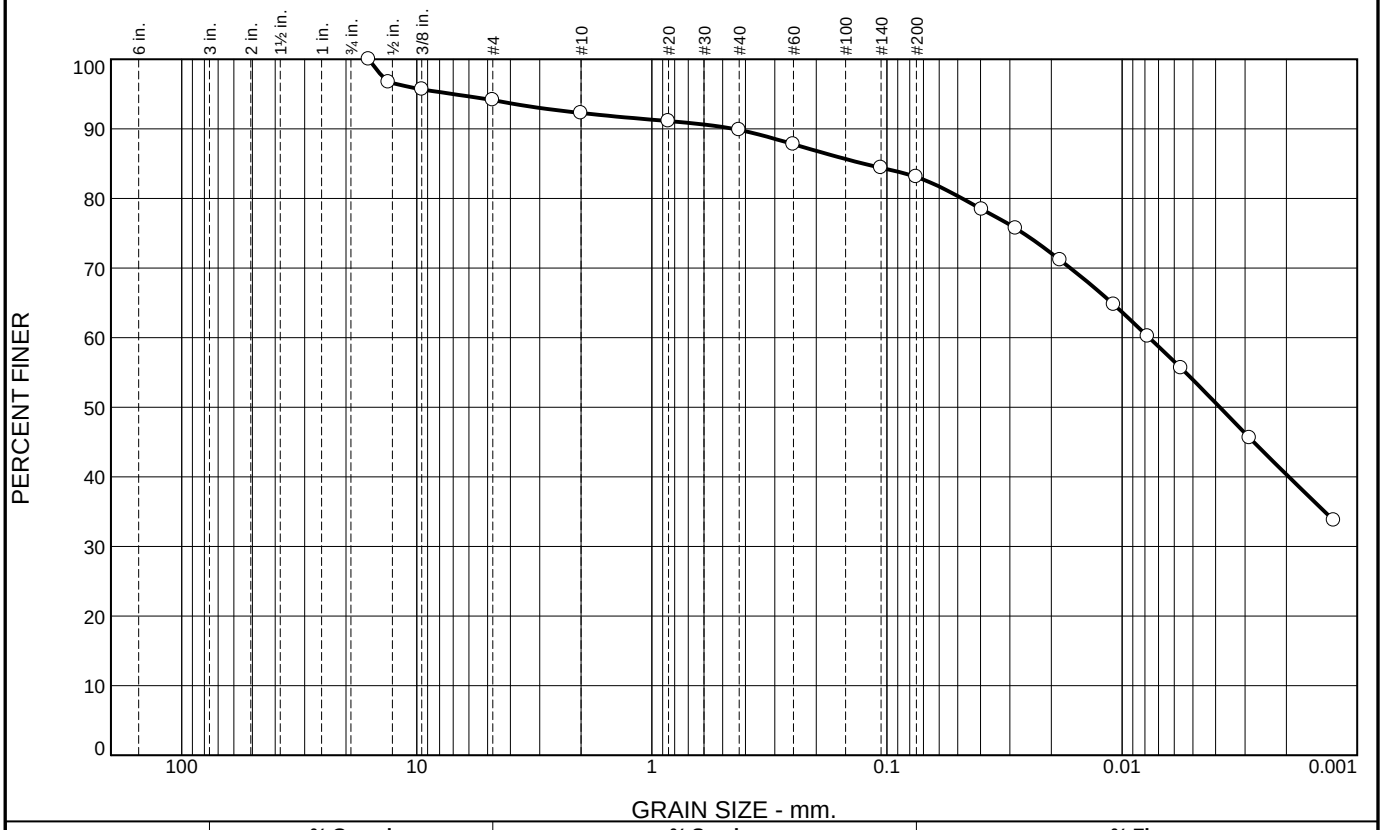
Date: Apl. 10, 2019

Client:

Project: MEQ, Sarnia

Project No: 191-04081-00 **Figure** B-1

Particle Size Distribution Report



% +75mm	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	5.9	1.8	2.5	6.7	42.8	40.3

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
16.0mm	100.0		
13.2mm	96.7		
9.5mm	95.7		
4.75mm	94.1		
2.00mm	92.3		
.850mm	91.1		
.425mm	89.8		
.250mm	87.8		
.106mm	84.4		
.075mm	83.1		
0.0395 mm.	78.4		
0.0283 mm.	75.7		
0.0183 mm.	71.1		
0.0109 mm.	64.8		
0.0078 mm.	60.2		
0.0056 mm.	55.6		
0.0029 mm.	45.6		
0.0013 mm.	33.7		

* (no specification provided)

Soil Description

Silty clay, some sand, trace gravel

Atterberg Limits

PL= 15 LL= 33 PI= 18

Coefficients

D_{90}= 0.4493 D_{85}= 0.1257 D_{60}= 0.0077
D_{50}= 0.0038 D_{30}= D_{15}=
D_{10}= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(13)

Remarks

Lab No: 29-19

Sample Number: BH19-7 SS8

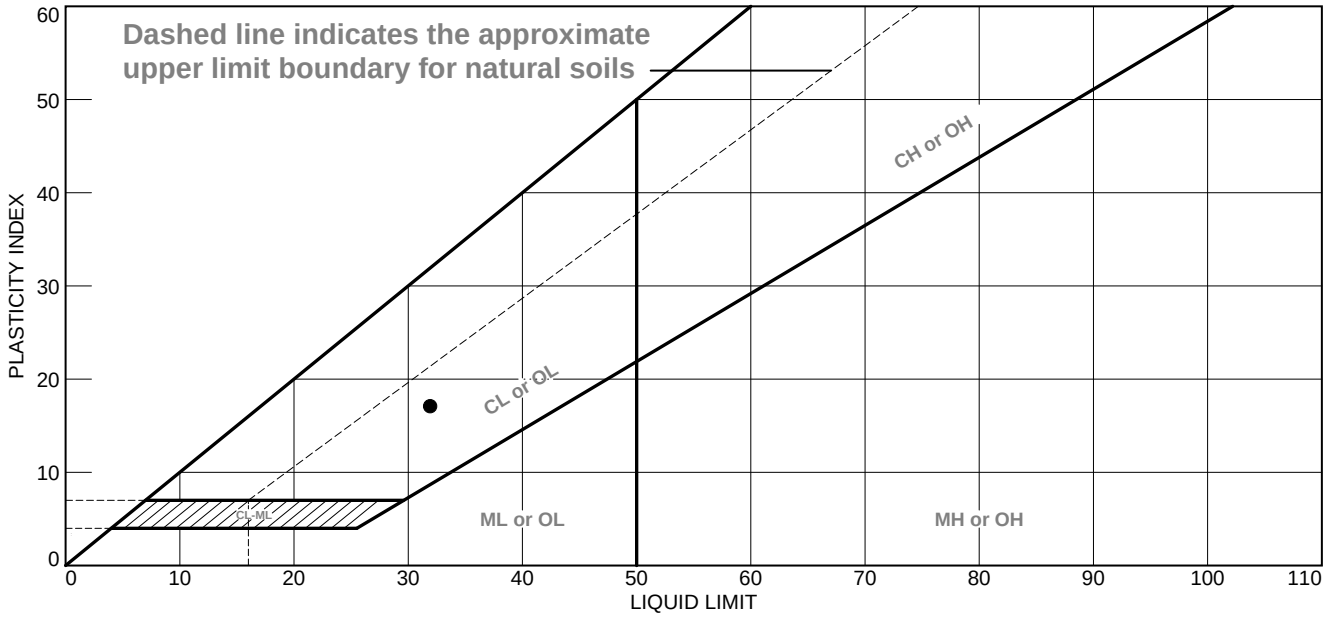
Date: Apl. 10, 2019

Client:

Project: MEQ, Sarnia

Project No: 191-04081-00 **Figure** B-2

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty clay, some sand	32	15	17	93.0	81.6	CL

Project No. 191-04081- **Client:**

Project: MEQ, Sarnia

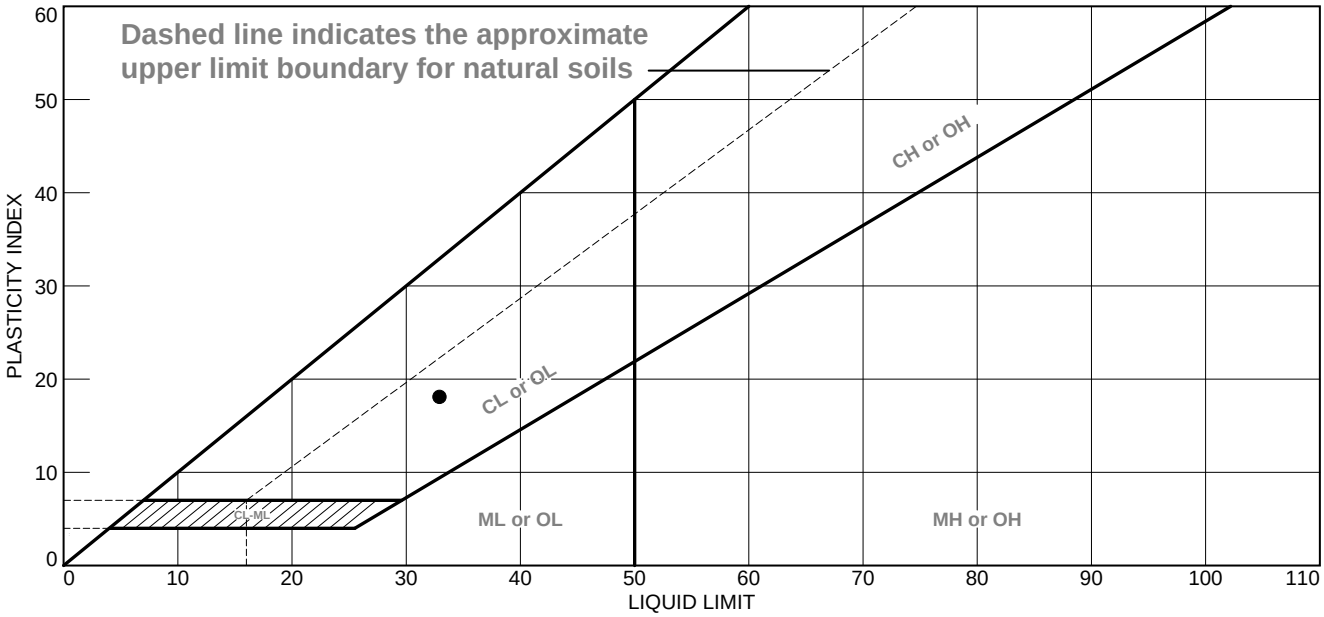
Sample Number: BH19-7 SS2B

Remarks:

●# Project No: 191-04081-00
Lab No: 29-19

Figure B-3

LIQUID AND PLASTIC LIMITS TEST REPORT



	MATERIAL DESCRIPTION	LL	PL	PI	%<#40	%<#200	USCS
●	Silty clay, some sand, trace gravel	33	15	18	89.8	83.1	CL

Project No. 191-04081- **Client:**

Project: MEQ, Sarnia

Sample Number: BH19-7 SS8

Remarks:

●# Project No: 191-04081-00
Lab No: 29-19

Figure

APPENDIX

C

CERTIFICATE OF ANALYSIS BY ALS

WSP Canada Inc. (Hamilton)
ATTN: Max Prokudin
4 Hughson Street South
Suite 300
Hamilton ON L8N 3Z1

Date Received: 02-APR-19
Report Date: 09-APR-19 13:18 (MT)
Version: FINAL

Client Phone: 905-529-4414

Certificate of Analysis

Lab Work Order #: L2251922

Project P.O. #: 191-04081-00-100-1002
Job Reference: 191-04081-00-100-1002
C of C Numbers: 167516
Legal Site Desc:

Emily Hansen
Account Manager

ANALYTICAL REPORT

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Guideline						
Ontario Regulation 153/04 - April 15, 2011 Standards - T3-Soil-Ind/Com/Commu. Property Use (Coarse)						
(No parameter exceedances)						
Ontario Regulation 153/04 - April 15, 2011 Standards - T3-Soil-Ind/Com/Commu. Property Use (Fine)						
(No parameter exceedances)						

ANALYTICAL REPORT

Physical Tests - SOIL

			Lab ID	L2251922-1	L2251922-2	L2251922-3	L2251922-4
			Sample Date	29-MAR-19	29-MAR-19	29-MAR-19	29-MAR-19
			Sample ID	BH19-7 SS1	BH19-3 SS3	BH19-6 SS1	BH-DUP1
Analyte	**Unit**	**Guide Limits #1**	**#2**				
Conductivity	mS/cm	1.4	1.4	0.169	0.534	0.201	0.517
% Moisture	%	-	-	17.0	13.4	18.1	12.7
pH	pH units	-	-	7.69	7.85	7.68	7.85

Guide Limit #1: T3-Soil-Ind/Com/Commu. Property Use (Coarse)
Guide Limit #2: T3-Soil-Ind/Com/Commu. Property Use (Fine)

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

ANALYTICAL REPORT

Cyanides - SOIL

		Guide Limits					
				Lab ID	L2251922-1	L2251922-2	L2251922-3	L2251922-4
				Sample Date	29-MAR-19	29-MAR-19	29-MAR-19	29-MAR-19
				Sample ID	BH19-7 SS1	BH19-3 SS3	BH19-6 SS1	BH-DUP1
Analyte	Unit	#1	#2					
Cyanide, Weak Acid Diss	ug/g	0.051	0.051	<0.050	<0.050	<0.050	<0.050

Guide Limit #1: T3-Soil-Ind/Com/Commu. Property Use (Coarse)
Guide Limit #2: T3-Soil-Ind/Com/Commu. Property Use (Fine)

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

ANALYTICAL REPORT

Saturated Paste Extractables - SOIL

		Guide Limits					
Analyte	**Unit**	**#1**	**#2**				
Lab ID				L2251922-1	L2251922-2	L2251922-3	L2251922-4
Sample Date				29-MAR-19	29-MAR-19	29-MAR-19	29-MAR-19
Sample ID				BH19-7 SS1	BH19-3 SS3	BH19-6 SS1	BH-DUP1
SAR	SAR	12	12	0.10	0.29	1.89	0.28
Calcium (Ca)	mg/L	-	-	24.6	62.0	13.5	59.8
Magnesium (Mg)	mg/L	-	-	3.69	20.9	9.16	21.9
Sodium (Na)	mg/L	-	-	2.07	10.5	36.8	10.1

Guide Limit #1: T3-Soil-Ind/Com/Commu. Property Use (Coarse)
Guide Limit #2: T3-Soil-Ind/Com/Commu. Property Use (Fine)

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

ANALYTICAL REPORT

Metals - SOIL

		Guide Limits					
Lab ID				L2251922-1	L2251922-2	L2251922-3	L2251922-4
Sample Date				29-MAR-19	29-MAR-19	29-MAR-19	29-MAR-19
Sample ID				BH19-7 SS1	BH19-3 SS3	BH19-6 SS1	BH-DUP1
Analyte	**Unit**	**#1**	**#2**				
Antimony (Sb)	ug/g	40	50	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	18	8.4	5.7	8.4	6.4
Barium (Ba)	ug/g	670	670	79.8	80.8	70.4	87.3
Beryllium (Be)	ug/g	8	10	0.73	0.65	0.80	0.69
Boron (B)	ug/g	120	120	12.3	16.5	16.4	19.4
Boron (B), Hot Water Ext.	ug/g	2	2	0.59	0.21	0.20	0.26
Cadmium (Cd)	ug/g	1.9	1.9	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	160	160	23.5	24.1	27.3	26.2
Cobalt (Co)	ug/g	80	100	11.3	8.5	9.5	10.0
Copper (Cu)	ug/g	230	300	18.7	17.6	17.2	19.2
Lead (Pb)	ug/g	120	120	28.2	8.5	9.8	8.7
Mercury (Hg)	ug/g	3.9	20	0.0636	0.0303	0.0339	0.0264
Molybdenum (Mo)	ug/g	40	40	2.8	3.7	2.6	4.1
Nickel (Ni)	ug/g	270	340	28.3	27.6	27.6	29.6
Selenium (Se)	ug/g	5.5	5.5	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	40	50	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	3.3	3.3	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	33	33	<1.0	1.4	<1.0	1.5
Vanadium (V)	ug/g	86	86	34.8	31.9	41.9	34.4
Zinc (Zn)	ug/g	340	340	52.1	51.0	46.1	49.9

Guide Limit #1: T3-Soil-Ind/Com/Commu. Property Use (Coarse)
Guide Limit #2: T3-Soil-Ind/Com/Commu. Property Use (Fine)

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

ANALYTICAL REPORT

Speciated Metals - SOIL

			Lab ID	L2251922-1	L2251922-2	L2251922-3	L2251922-4
			Sample Date	29-MAR-19	29-MAR-19	29-MAR-19	29-MAR-19
			Sample ID	BH19-7 SS1	BH19-3 SS3	BH19-6 SS1	BH-DUP1
		Guide Limits					
Analyte	Unit	#1	#2				
Chromium, Hexavalent	ug/g	8	10	<0.20	0.22	0.34	<0.20

Guide Limit #1: T3-Soil-Ind/Com/Commu. Property Use (Coarse)
Guide Limit #2: T3-Soil-Ind/Com/Commu. Property Use (Fine)

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

Reference Information

Methods Listed (if applicable):

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

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

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

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

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

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

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

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

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

EC-WT	Soil	Conductivity (EC)	MOEE E3138

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

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

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

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

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

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

Soil/sediment is dried, disaggregated, and sieved (2 mm). For tests intended to support Ontario regulations, the <2mm fraction is ground to pass through a 0.355 mm sieve. Strong Acid Leachable Metals in the <2mm fraction are solubilized by heated digestion with nitric and hydrochloric acids. Instrumental analysis is by Collision / Reaction Cell ICPMS.

Limitations: This method is intended to liberate environmentally available metals. Silicate minerals are not solubilized. Some metals may be only partially recovered (matrix dependent), including Al, Ba, Be, Cr, S, Sr, Ti, Tl, V, W, and Zr. Elemental Sulfur may be poorly recovered by this method. Volatile forms of sulfur (e.g. sulfide, H2S) may be excluded if lost during sampling, storage, or digestion.

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

MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A

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

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

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**
SAR-R511-WT	Soil	SAR-O.Reg 153/04 (July 2011)	SW846 6010C

A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES. The concentrations of Na, Ca and Mg are reported as per CALA requirements for calculated parameters. These individual parameters are not for comparison to any guideline.

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

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

Chain of Custody Numbers:

167516

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

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

GLOSSARY OF REPORT TERMS

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

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

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to, fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guideline limits are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Quality Control Report

Workorder: L2251922 Report Date: 09-APR-19

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	**Soil**							
Batch R4590910								
WG3021483-4 DUP		**L2252458-1**						
Boron (B), Hot Water Ext.		0.81	0.80		ug/g	1.9	30	05-APR-19
WG3021483-2 IRM		**HOTB-SAL_SOIL5**						
Boron (B), Hot Water Ext.			102.7		%		70-130	05-APR-19
WG3021483-3 LCS								
Boron (B), Hot Water Ext.			107.0		%		70-130	05-APR-19
WG3021483-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	05-APR-19
CN-WAD-R511-WT	**Soil**							
Batch R4593016								
WG3020207-3 DUP		**L2252458-1**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	09-APR-19
WG3020207-2 LCS								
Cyanide, Weak Acid Diss			92.2		%		80-120	09-APR-19
WG3020207-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	09-APR-19
WG3020207-4 MS		**L2252458-1**						
Cyanide, Weak Acid Diss			84.5		%		70-130	09-APR-19
CR-CR6-IC-WT	**Soil**							
Batch R4590886								
WG3020084-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			92.4		%		70-130	04-APR-19
WG3020084-3 DUP		**L2251330-11**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	04-APR-19
WG3020084-2 LCS								
Chromium, Hexavalent			94.6		%		80-120	04-APR-19
WG3020084-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	04-APR-19
EC-WT	**Soil**							
Batch R4591212								
WG3021489-4 DUP		**WG3021489-3**						
Conductivity		0.807	0.836		mS/cm	3.5	20	05-APR-19
WG3021489-2 IRM		**WT SAR2**						
Conductivity			102.2		%		70-130	05-APR-19
WG3021666-1 LCS								
Conductivity			99.1		%		90-110	05-APR-19
WG3021489-1 MB								

Quality Control Report

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-WT	**Soil**							
Batch R4591212								
WG3021489-1 MB								
Conductivity			<0.0040		mS/cm		0.004	05-APR-19
HG-200.2-CVAA-WT	**Soil**							
Batch R4591256								
WG3021158-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			112.1		%		70-130	05-APR-19
WG3021158-6 DUP		**WG3021158-5**						
Mercury (Hg)		0.0303	0.0262		ug/g	15	40	05-APR-19
WG3021158-3 LCS								
Mercury (Hg)			119.0		%		80-120	05-APR-19
WG3021158-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	05-APR-19
Batch R4591259								
WG3021476-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			103.1		%		70-130	05-APR-19
WG3021476-6 DUP		**WG3021476-5**						
Mercury (Hg)		0.0264	0.0265		ug/g	0.5	40	05-APR-19
WG3021476-3 LCS								
Mercury (Hg)			119.5		%		80-120	05-APR-19
WG3021476-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	05-APR-19
MET-200.2-CCMS-WT	**Soil**							
Batch R4591244								
WG3021476-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			101.7		%		70-130	05-APR-19
Arsenic (As)			99.5		%		70-130	05-APR-19
Barium (Ba)			97.2		%		70-130	05-APR-19
Beryllium (Be)			96.6		%		70-130	05-APR-19
Boron (B)			2.9		mg/kg		0-8.2	05-APR-19
Cadmium (Cd)			113.9		%		70-130	05-APR-19
Chromium (Cr)			101.2		%		70-130	05-APR-19
Cobalt (Co)			100.8		%		70-130	05-APR-19
Copper (Cu)			104.6		%		70-130	05-APR-19
Lead (Pb)			122.0		%		70-130	05-APR-19
Molybdenum (Mo)			100.0		%		70-130	05-APR-19

Quality Control Report

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4591244								
WG3021476-2 CRM		**WT-CANMET-TILL1**						
Nickel (Ni)			100.2		%		70-130	05-APR-19
Selenium (Se)			0.34		mg/kg		0.11-0.51	05-APR-19
Silver (Ag)			0.23		mg/kg		0.13-0.33	05-APR-19
Thallium (Tl)			0.123		mg/kg		0.077-0.18	05-APR-19
Uranium (U)			97.4		%		70-130	05-APR-19
Vanadium (V)			100.7		%		70-130	05-APR-19
Zinc (Zn)			97.1		%		70-130	05-APR-19
WG3021476-6 DUP		**WG3021476-5**						
Antimony (Sb)		0.42	0.45		ug/g	5.4	30	05-APR-19
Arsenic (As)		6.42	6.96		ug/g	8.0	30	05-APR-19
Barium (Ba)		87.3	90.8		ug/g	4.0	40	05-APR-19
Beryllium (Be)		0.69	0.72		ug/g	4.1	30	05-APR-19
Boron (B)		19.4	21.1		ug/g	8.8	30	05-APR-19
Cadmium (Cd)		0.304	0.303		ug/g	0.2	30	05-APR-19
Chromium (Cr)		26.2	27.9		ug/g	6.3	30	05-APR-19
Cobalt (Co)		9.99	10.2		ug/g	1.9	30	05-APR-19
Copper (Cu)		19.2	20.6		ug/g	6.9	30	05-APR-19
Lead (Pb)		8.70	9.41		ug/g	7.8	40	05-APR-19
Molybdenum (Mo)		4.12	4.26		ug/g	3.3	40	05-APR-19
Nickel (Ni)		29.6	31.2		ug/g	5.3	30	05-APR-19
Selenium (Se)		0.43	0.38		ug/g	14	30	05-APR-19
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	05-APR-19
Thallium (Tl)		0.301	0.315		ug/g	4.5	30	05-APR-19
Uranium (U)		1.50	1.64		ug/g	8.7	30	05-APR-19
Vanadium (V)		34.4	37.9		ug/g	9.6	30	05-APR-19
Zinc (Zn)		49.9	53.5		ug/g	6.9	30	05-APR-19
WG3021476-4 LCS								
Antimony (Sb)			99.5		%		80-120	05-APR-19
Arsenic (As)			97.5		%		80-120	05-APR-19
Barium (Ba)			103.2		%		80-120	05-APR-19
Beryllium (Be)			99.9		%		80-120	05-APR-19
Boron (B)			96.6		%		80-120	05-APR-19
Cadmium (Cd)			98.1		%		80-120	05-APR-19

Quality Control Report

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4591244								
WG3021476-4 LCS								
Chromium (Cr)			98.4		%		80-120	05-APR-19
Cobalt (Co)			97.8		%		80-120	05-APR-19
Copper (Cu)			96.4		%		80-120	05-APR-19
Lead (Pb)			99.7		%		80-120	05-APR-19
Molybdenum (Mo)			100.3		%		80-120	05-APR-19
Nickel (Ni)			96.4		%		80-120	05-APR-19
Selenium (Se)			100.8		%		80-120	05-APR-19
Silver (Ag)			98.4		%		80-120	05-APR-19
Thallium (Tl)			99.99		%		80-120	05-APR-19
Uranium (U)			99.6		%		80-120	05-APR-19
Vanadium (V)			101.2		%		80-120	05-APR-19
Zinc (Zn)			92.5		%		80-120	05-APR-19
WG3021476-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	05-APR-19
Arsenic (As)			<0.10		mg/kg		0.1	05-APR-19
Barium (Ba)			<0.50		mg/kg		0.5	05-APR-19
Beryllium (Be)			<0.10		mg/kg		0.1	05-APR-19
Boron (B)			<5.0		mg/kg		5	05-APR-19
Cadmium (Cd)			<0.020		mg/kg		0.02	05-APR-19
Chromium (Cr)			<0.50		mg/kg		0.5	05-APR-19
Cobalt (Co)			<0.10		mg/kg		0.1	05-APR-19
Copper (Cu)			<0.50		mg/kg		0.5	05-APR-19
Lead (Pb)			<0.50		mg/kg		0.5	05-APR-19
Molybdenum (Mo)			<0.10		mg/kg		0.1	05-APR-19
Nickel (Ni)			<0.50		mg/kg		0.5	05-APR-19
Selenium (Se)			<0.20		mg/kg		0.2	05-APR-19
Silver (Ag)			<0.10		mg/kg		0.1	05-APR-19
Thallium (Tl)			<0.050		mg/kg		0.05	05-APR-19
Uranium (U)			<0.050		mg/kg		0.05	05-APR-19
Vanadium (V)			<0.20		mg/kg		0.2	05-APR-19
Zinc (Zn)			<2.0		mg/kg		2	05-APR-19

Quality Control Report

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4591384								
WG3021158-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			116.6		%		70-130	05-APR-19
Arsenic (As)			112.4		%		70-130	05-APR-19
Barium (Ba)			111.0		%		70-130	05-APR-19
Beryllium (Be)			114.3		%		70-130	05-APR-19
Boron (B)			2.9		mg/kg		0-8.2	05-APR-19
Cadmium (Cd)			112.8		%		70-130	05-APR-19
Chromium (Cr)			108.4		%		70-130	05-APR-19
Cobalt (Co)			109.4		%		70-130	05-APR-19
Copper (Cu)			111.4		%		70-130	05-APR-19
Lead (Pb)			114.8		%		70-130	05-APR-19
Molybdenum (Mo)			115.0		%		70-130	05-APR-19
Nickel (Ni)			109.2		%		70-130	05-APR-19
Selenium (Se)			0.31		mg/kg		0.11-0.51	05-APR-19
Silver (Ag)			0.26		mg/kg		0.13-0.33	05-APR-19
Thallium (Tl)			0.135		mg/kg		0.077-0.18	05-APR-19
Uranium (U)			110.9		%		70-130	05-APR-19
Vanadium (V)			109.7		%		70-130	05-APR-19
Zinc (Zn)			105.8		%		70-130	05-APR-19
WG3021158-6 DUP		**WG3021158-5**						
Antimony (Sb)		0.47	0.55		ug/g	14	30	05-APR-19
Arsenic (As)		5.68	6.27		ug/g	9.9	30	05-APR-19
Barium (Ba)		80.8	88.7		ug/g	9.3	40	05-APR-19
Beryllium (Be)		0.65	0.73		ug/g	12	30	05-APR-19
Boron (B)		16.5	19.7		ug/g	18	30	05-APR-19
Cadmium (Cd)		0.304	0.335		ug/g	9.6	30	05-APR-19
Chromium (Cr)		24.1	26.6		ug/g	9.6	30	05-APR-19
Cobalt (Co)		8.51	9.76		ug/g	14	30	05-APR-19
Copper (Cu)		17.6	21.5		ug/g	20	30	05-APR-19
Lead (Pb)		8.47	9.52		ug/g	12	40	05-APR-19
Molybdenum (Mo)		3.75	4.18		ug/g	11	40	05-APR-19
Nickel (Ni)		27.6	30.2		ug/g	9.2	30	05-APR-19
Selenium (Se)		0.29	0.31		ug/g	9.0	30	05-APR-19
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	05-APR-19

Quality Control Report

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4591384								
WG3021158-6 DUP		**WG3021158-5**						
Thallium (Tl)		0.286	0.318		ug/g	11	30	05-APR-19
Uranium (U)		1.42	1.56		ug/g	9.6	30	05-APR-19
Vanadium (V)		31.9	35.6		ug/g	11	30	05-APR-19
Zinc (Zn)		51.0	68.3		ug/g	29	30	05-APR-19
WG3021158-4 LCS								
Antimony (Sb)			101.2		%		80-120	05-APR-19
Arsenic (As)			93.3		%		80-120	05-APR-19
Barium (Ba)			97.2		%		80-120	05-APR-19
Beryllium (Be)			96.2		%		80-120	05-APR-19
Boron (B)			90.9		%		80-120	05-APR-19
Cadmium (Cd)			90.7		%		80-120	05-APR-19
Chromium (Cr)			92.3		%		80-120	05-APR-19
Cobalt (Co)			90.5		%		80-120	05-APR-19
Copper (Cu)			89.8		%		80-120	05-APR-19
Lead (Pb)			97.8		%		80-120	05-APR-19
Molybdenum (Mo)			99.8		%		80-120	05-APR-19
Nickel (Ni)			90.5		%		80-120	05-APR-19
Selenium (Se)			92.0		%		80-120	05-APR-19
Silver (Ag)			100.1		%		80-120	05-APR-19
Thallium (Tl)			97.8		%		80-120	05-APR-19
Uranium (U)			98.2		%		80-120	05-APR-19
Vanadium (V)			94.4		%		80-120	05-APR-19
Zinc (Zn)			90.1		%		80-120	05-APR-19
WG3021158-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	05-APR-19
Arsenic (As)			<0.10		mg/kg		0.1	05-APR-19
Barium (Ba)			<0.50		mg/kg		0.5	05-APR-19
Beryllium (Be)			<0.10		mg/kg		0.1	05-APR-19
Boron (B)			<5.0		mg/kg		5	05-APR-19
Cadmium (Cd)			<0.020		mg/kg		0.02	05-APR-19
Chromium (Cr)			<0.50		mg/kg		0.5	05-APR-19
Cobalt (Co)			<0.10		mg/kg		0.1	05-APR-19
Copper (Cu)			<0.50		mg/kg		0.5	05-APR-19
Lead (Pb)			<0.50		mg/kg		0.5	05-APR-19

Quality Control Report

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4591384								
WG3021158-1 MB								
Molybdenum (Mo)			<0.10		mg/kg		0.1	05-APR-19
Nickel (Ni)			<0.50		mg/kg		0.5	05-APR-19
Selenium (Se)			<0.20		mg/kg		0.2	05-APR-19
Silver (Ag)			<0.10		mg/kg		0.1	05-APR-19
Thallium (Tl)			<0.050		mg/kg		0.05	05-APR-19
Uranium (U)			<0.050		mg/kg		0.05	05-APR-19
Vanadium (V)			<0.20		mg/kg		0.2	05-APR-19
Zinc (Zn)			<2.0		mg/kg		2	05-APR-19
MOISTURE-WT	**Soil**							
Batch R4589813								
WG3019859-3 DUP		**L2251568-2**						
% Moisture		0.87	0.85		%	2.0	20	04-APR-19
WG3019859-2 LCS								
% Moisture			99.6		%		90-110	04-APR-19
WG3019859-1 MB								
% Moisture			<0.10		%		0.1	04-APR-19
PH-WT	**Soil**							
Batch R4590615								
WG3020017-1 DUP		**L2251981-1**						
pH		7.82	7.86	J	pH units	0.04	0.3	04-APR-19
WG3020767-1 LCS								
pH			7.02		pH units		6.9-7.1	04-APR-19
SAR-R511-WT	**Soil**							
Batch R4591057								
WG3021489-4 DUP		**WG3021489-3**						
Calcium (Ca)		11.6	12.5		mg/L	7.5	30	05-APR-19
Sodium (Na)		134	139		mg/L	3.7	30	05-APR-19
Magnesium (Mg)		<0.50	<0.50	RPD-NA	mg/L	N/A	30	05-APR-19
WG3021489-2 IRM		**WT SAR2**						
Calcium (Ca)			105.2		%		70-130	05-APR-19
Sodium (Na)			94.4		%		70-130	05-APR-19
Magnesium (Mg)			101.8		%		70-130	05-APR-19
WG3021489-5 LCS								
Calcium (Ca)			111.0		%		70-130	05-APR-19
Sodium (Na)			104.2		%		70-130	05-APR-19

Quality Control Report

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	**Soil**							
Batch R4591057								
WG3021489-5 LCS								
Magnesium (Mg)			105.4		%		70-130	05-APR-19
WG3021489-1 MB								
Calcium (Ca)			<0.50		mg/L		0.5	05-APR-19
Sodium (Na)			<0.50		mg/L		0.5	05-APR-19
Magnesium (Mg)			<0.50		mg/L		0.5	05-APR-19

Quality Control Report

Workorder: L2251922 Report Date: 09-APR-19

Client: WSP Canada Inc. (Hamilton)
4 Hughson Street South Suite 300
Hamilton ON L8N 3Z1
Contact: Max Prokudin

Legend:

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

Sample Parameter Qualifier Definitions:

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

Hold Time Exceedances:

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

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

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

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

C of C # 00000

L2251922 COFC

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

ICAL SERVICES REQUEST FORM

Page 1 of 1

Note: all T... Statutory holidays and weekends. TAT samples received past 3:00 pm or Saturday/Sunday begin the next day.

Specify date required	Service requested			
	5 day (regular)	X	Next day TAT	
	3-4 day (25%)		Same day TAT (200%)	
			2 day TAT (50%)	

COMPANY NAME	WSP Canada Inc
OFFICE	4 Hughson St South Suite 300, Hamilton Ont.
PROJECT MANAGER	Max Prokudin
PROJECT #	191-04081-00-100-1002
PHONE	226-765-0236
FAX	
ACCOUNT #	
QUOTATION #	
PO #	191-04081-00-100-1002

CRITERIA — Criteria on report YES NO

Reg 153/04 X Reg 511/09 ☐
Table 1 2 (3) 4 5 6 7 8 9

TCLP ___ MISA PWQO ___
ODWS ___ OTHER

REPORT FORMAT/DISTRIBUTION

EMAIL X FAX ___ BOTH ___
SELECT: PDF DIGITAL ___ BOTH X
EMAIL 1 max.prokudin@wsp.com
EMAIL 2

ANALYSIS REQUEST

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

SUBMISSION # L2251922
ENTERED BY:
DATE/TIME ENTERED:
BIN #

SAMPLING INFORMATION

Date (dd-mm-yy)	Time (24hr) (hh:mm)	COMP	GRAB	WATER	SOIL	OTHER	SAMPLE DESCRIPTION TO APPEAR ON REPORT	NUMBER OF CONTAINERS	Metals & Inorganics	COMMENTS	LAB ID
29/03/19	8:40				X		BH19-7 SS1	2	X		
29/03/19	1300				X		BH19-3 SS3	2	X		
29/03/19	1450				X		BH19-6 SS1	2	X		
29/03/19	—				X		BH-DUP1	2	X		

SPECIAL INSTRUCTIONS/COMMENTS

THE QUESTIONS BELOW MUST BE ANSWERED FOR WATER SAMPLES (CHECK Yes OR No)

Are any samples taken from a regulated DW System? Yes ☐ No X
If yes, an authorized drinking water COC MUST be used for this submission.
Is the water sampled intended to be potable for human consumption? Yes ☐ No ☐

SAMPLE CONDITION
FROZEN ☐ COLD ☐ COOLING INITIATED ☐ AMBIENT ☐ — MEAN TEMP 8.3
OBSERVATIONS Yes ☐ No ☐ If yes add SIF — INIT

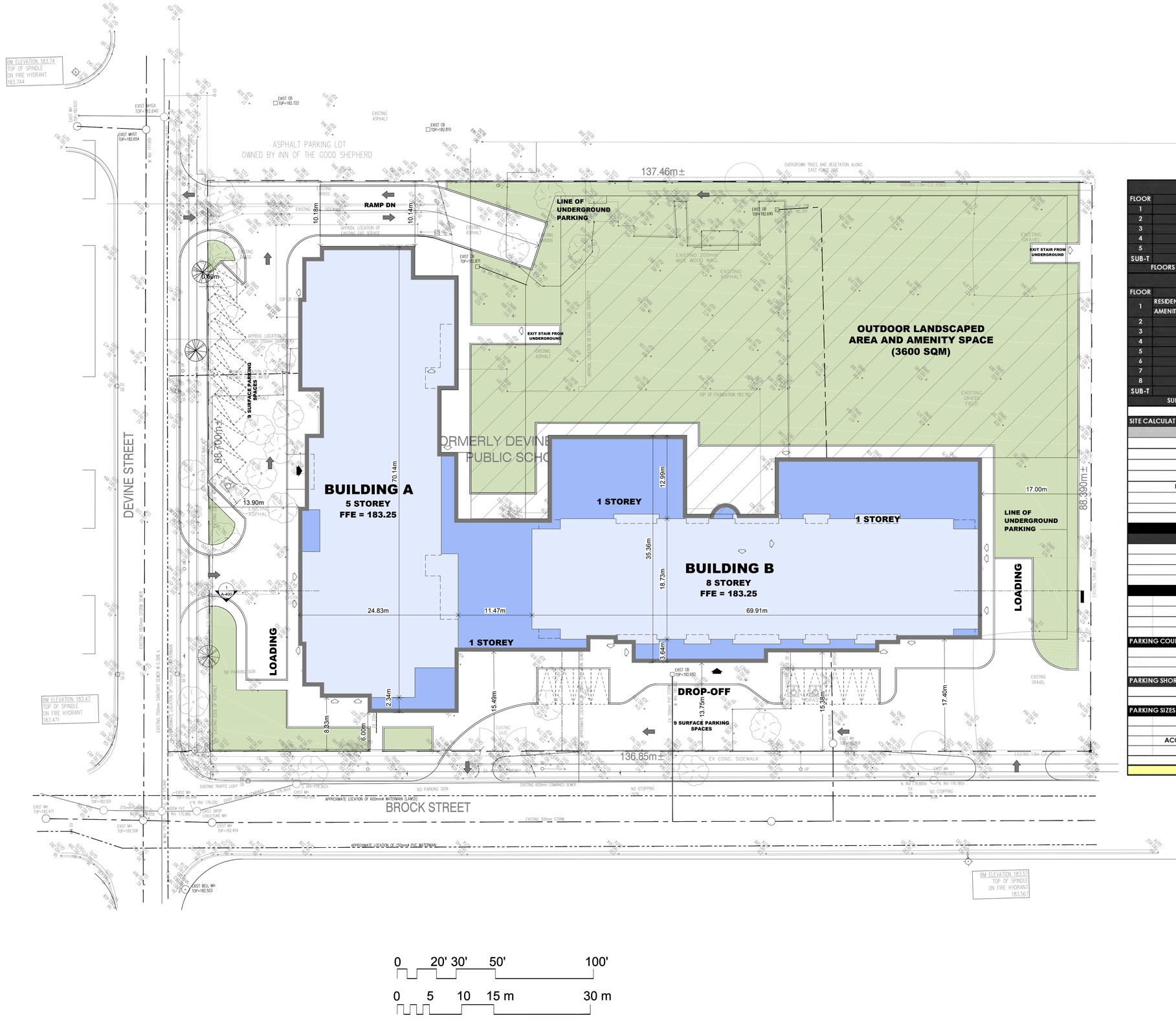
SAMPLED BY	Marcel Quenneville	DATE & TIME	Apr 1, 2019	RECEIVED BY	DATE & TIME
RELINQUISHED BY	Marcel Quenneville	DATE & TIME		RECEIVED AT LAB BY [signature] 2-APR-19	DATE & TIME 11:05

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

APPENDIX

D

SITE PLAN DRAWING BY OTHERS (MSP-100)



BUILDING "A" MEMORY CARE- BUILDING STATS						
FLOOR		HT (ft)	HT (m)	SUITE	GFA (SF)	GFA (SM)
1		13.78	4.20	14	16,921	1,572.0
2		10.00	3.05	28	15,035	1,396.8
3		10.00	3.05	28	15,035	1,396.8
4		10.00	3.05	28	15,035	1,396.8
5		10.00	3.05	28	15,035	1,396.8
SUB-T		53.78	16.39	126	77,061	7,159.2
FLOORS ABOVE GRADE				RATIO	611.6	56.8

BUILDING "B" SENIORS RESIDENCE- BUILDING STATS						
FLOOR		HT (ft)	HT (m)	SUITE	GFA (SF)	GFA (SM)
1	RESIDENTIAL	13.78	4.20	1	570	53.0
	AMENITY				23,371	2,171.2
2		10.00	3.05	19	12,984	1,206.3
3		10.00	3.05	19	12,984	1,206.3
4		10.00	3.05	19	12,984	1,206.3
5		10.00	3.05	19	12,984	1,206.3
6		10.00	3.05	19	12,984	1,206.3
7		10.00	3.05	19	12,984	1,206.3
8		10.00	3.05	19	12,984	1,206.3
SUB-T		83.78	25.54	134	114,829	10,668.0
SUITE RATIO					856.9	79.6

SITE CALCULATIONS		
	SF	SM
BLDG A - BUILDING AREA	16,921	1,572.0
BLDG A - GFA	77,061	7,159.2
BLDG B- BUILDING AREA	23,941	2,224.2
BLDG B - GFA	114,829	10,668.0
BLDG A+B - TOTAL BUILDING AREA	40,862	3,796.2
TOTAL GFA OF BLDG A+B	191,890	17,827.2
SITE AREA	130,815.5	12,153.2
SITE AREA - ACRES	3.003	
UR5 - Urban Residential-High Density Zone		
		%
SITE COVERAGE	3,796.2	31.2%
MAX LOT COVERAGE	35%	
BUILDING HEIGHT (FLAT ROOF)		25.54
FLOOR AREA RATIO (F.A.R.)	1.47	
	REQ'D (SM/M)	PROV. (SM/M)
FRONT YARD DEPTH (DEVINE ST)	9.00	13.76
SIDE YARD DEPTH (BROCK ST)	6.00	6.00
SIDE YARD DEPTH	6.00	10.23
REAR YARD DEPTH	7.50	16.65
PARKING COUNT	REQ'D	PROV'D
RETIREMENT HOME	134	
NURSING HOME (MEMORY CARE)	32	
TOTAL PARKING	166	166
PARKING SHORTFALL	NONE	
ACCESSIBLE PARKING (TYPE A)	4	17
LOADING	2	2
PARKING SIZES	REQ'D	COMPLY
PARKING SPACES	2.75 X 5.5	YES
DRIVE AISLE	7.3	YES
ACCESSIBLE PARKING SPACE (TYPE A)	3.4 X 5.5	YES
ADJACENT ACCESS AISLE	1.5 X 5.5	YES
LOADING SPACE	3.5 X 9.0	YES

ISSUE	BY	DESCRIPTION	DATE (YY-MM-DD)
01	ZK	OPA/ZBA	17-05-08

GENERAL NOTES

DO NOT SCALE DRAWINGS. USE ONLY DRAWINGS MARKED "ISSUED FOR CONSTRUCTION". VERIFY CONFIGURATIONS & DIMENSIONS ON SITE BEFORE BEGINNING WORK. NOTIFY ARCHITECT IMMEDIATELY OF ANY ERRORS, OMISSIONS OR DISCREPANCIES.

DEVELOPMENT CONSULTANTS
OAKVILLE OFFICE
P: 905.337.7249
Project Co-ordinator: Cristy Wilson
E: cwilson@apiconsultants.net

ARCHITECT
610 FORD DRIVE,
SUITE 338
OAKVILLE, ONTARIO L6J 7W4
P: 416.771.6460
E: linsaplys@aol.com

OWNER
OVERTURE
INVESTMENTS INC.

NORTH

TRUE NORTH

PROFESSIONAL CERTIFICATION

PROJECT NAME

SARNIA RETIREMENT COMMUNITY

PROJECT ADDRESS

DEVINE & BROCK STREETS, SARNIA, ONTARIO

DRAWING TITLE

SITE PLAN

BY	CHECKED	ISSUED FOR
ZK	ED	

PROJECT No.	SHEET No.	SHEET REVISION
A15-038	MSP-100	1.0

SCALE 1=300

M-DD/MM/YY

DRAWING LOCATION: R:\2015\15-038 A15-038 SARNIA, RETIREMENT DEVELOPMENT\15-0 - DESIGN\SITE PLAN\15-038-M2 - DRAWING\15-1 - DESIGN\SITE PLAN\15-038-M2 - DRAWING\15-1 - SARNIA SITE PLAN 17-04-14_ PLOT DATE: