SOIL-MAT ENGINEERS & CONSULTANTS LTD.

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PROJECT NO.: SM 188337-G

August 15, 2018

HALDIMAND COUNTY – ENGINEERING DIVISION
3-100 Haddington Street
Caledonia, Ontario
N3W 2N4

Attention: Lloyd Rollinson
Project Manager

GEOTECHNICAL INVESTIGATION
PROPOSED INTERSECTION IMPROVEMENTS
ARGYLE STREET SOUTH
CALEDONIA, ONTARIO

Dear Mr. Rollinson,

Further to your authorisation, SOIL-MAT ENGINEERS & CONSULTANTS LTD. has completed the fieldwork and laboratory testing, and report preparation in connection with the above noted project. The investigation and reporting were undertaken in general accordance with our proposal P7375, dated May 2, 2018 and revised May 28, 2018. Our comments and recommendations, based on our findings at the ten [10] borehole locations are presented herein.

1. INTRODUCTION

We understand that the project will involve improvements to the intersection of Argyle Street South and Haddington Street, as well as sanitary sewer replacement along Argyle Street from approximately Kinross Street, to Forfar Street in Caledonia, Ontario. The purpose of this geotechnical investigation work was to assess the subsurface soil conditions, and to provide our comments and recommendations with respect to the design and construction of the proposed improvements, from a geotechnical point of view.

This report is based on the above summarised project description, and on the assumption that the design and construction will be performed in accordance with applicable codes and standards. Any significant deviations from the proposed project design may void the recommendations given in this report. If significant changes are made to the proposed design, this office must be consulted to review the new design

with respect to the findings of this investigation. It is noted that, other than limited background testing detailed below, the information contained in this report does not reflect upon the environmental aspects of the site.

2. PROCEDURE

A total of ten [10] sampled boreholes were advanced at the locations illustrated in the attached Drawing Nos. 1 and 2, Borehole Location Plans. The boreholes were advanced using continuous flight power auger equipment on June 22, 2018 under the direction and supervision of a representative of SOIL-MAT ENGINEERS, to termination at depths of approximately 0.9 to 6.7 metres beneath the existing road surface. Upon completion of drilling all of the boreholes were backfilled in general accordance with Ontario Regulation 903, and the pavement surfaces reinstated with a pre-mixed asphaltic concrete 'cold patch' product.

Representative samples of the subsoils were recovered from the borings at selected depth intervals using split barrel sampling equipment driven in accordance with the requirements of the ASTM test specification D1586, Standard Penetration Resistance Testing. After undergoing a general field examination, the soil samples were preserved and transported to the SOIL-MAT laboratory for visual, tactile, and olfactory classifications. Routine moisture content tests were performed on all soil samples recovered from the borings, with hand penetrometer testing conducted on select cohesive samples.

In addition, twenty-one [21] selected samples were submitted for background analytical testing, in general accordance with the requirements set out in the RFQ document and subsequent emails. The samples were submitted to ALS Environmental, an accredited Canadian Environmental Laboratory for analytical testing for a standard panel of metal and inorganic parameters for comparison to the Soil, Ground Water and Sediment Standards for Use Under Part XV.1 of the *Environmental Protection Act*. The results of this testing can be found appended to the end of this report.

The boreholes were located in the field by a representative of SOIL-MAT ENGINEERS & CONSULTANTS LTD., in general accordance with the drawings provided to our office by Haldimand County. The ground surface elevation at the borehole locations has been referenced to the existing road surface.

Details of the conditions encountered in the boreholes, together with the results of the field and laboratory tests, are presented in Log of Borehole Nos. 1 through 10, inclusive, following the text of this report. It is noted that the boundaries of soil types indicated on

the borehole logs are inferred from non-continuous soil sampling and observations made during drilling. These boundaries are intended to reflect transition zones for the purpose of geotechnical design and therefore should not be construed as the exact planes of geological change.

3. SITE DESCRIPTION AND SUBSURFACE CONDITIONS

The project area consists of the section of Argyle Street from Haddington Street to Wigton Street in Caledonia, Ontario. The roadway is a three lane asphaltic concrete paved urban cross section with concrete curbs and catch basins. The roadway serves both commercial and residential properties, with moderate to heavy vehicle traffic. The pavement surface was noted to be in a relatively fair to poor condition with areas of frequent longitudinal, transverse, and alligator cracking, as well as occasional repair patches.

The subsurface conditions encountered at the borehole locations are summarised as follows:

Topsoil

A surficial veneer of topsoil approximately 300 millimetres in thickness was encountered at Borehole No. 3, which was advanced south of the intersection of Argyle Street or Haddington Street. It is noted that the depth of topsoil may vary significantly across the site from the depth encountered at this single borehole location. It is also noted that the term 'topsoil' has been used from a geotechnical point of view, and does not necessarily reflect its nutrient content or ability to support plant life.

Pavement Structure

Borehole No. 1 was advanced through the granular pavement structure of the gravel driveway north of the intersection, which was found to consist of approximately 300 millimeters of granular materials. Borehole No. 4 was advanced through the pavement of Haddington Street, while all boreholes other than Borehole Nos. 1, 3, and 4 were advanced through the existing pavement structure of Argyle Street. The pavement structure on these roadways was found to consist of approximately 100 to 380 millimetres of asphaltic concrete overlying 300 to 600 millimetres of compact granular base, summarised as follows:

Borehole No.	1	2	4	5	6	7	8	9	10
Asphaltic Concrete (mm)	N/A	380	100	100	200	300	200	300	200
Granular Base (mm)	300	400	600	600	600	600	600	600	600

Sand and Gravel Fill

A deposit of sand and gravel fill was encountered beneath the pavement structure at Borehole No. 10. The course granular material was brown to grey in colour and was noted to be in a compact state. It is noted that the amount of crushed limestone bedrock aggregate encountered made the transition from granular base materials of the pavement structure to the sand and gravel fill deposit somewhat indistinct. The sand and gravel fill deposit was proven to a depth of approximately 2.1 metres in Borehole No. 10.

Silty Clay

Native silty clay was encountered beneath the pavement structure or topsoil at all borehole locations. The silty clay soils encountered were brown to greyish brown in colour, transitioning to grey at depths of approximately 3.5 to 5.0 metres below grade, contained trace to some gravel, and were generally firm to very stiff in consistency. The upper layers of the silty clay encountered in the boreholes had a 'reworked' appearance with occasional organic inclusions likely associated with grading activities during construction of the roadway, as well as having been subjected to ongoing traffic loads and freeze-thaw cycles. Silty clay was proven to termination at depths ranging from approximately 0.9 to 6.7 metres below the existing road surface at all borehole locations.

Grain size analyses were conducted on a total of two [2] selected samples, the results of which can be found appended to the end of this report, and are summarised as follows:

TABLE A
Grain Size Analyses

Sample ID	Depth	% Clay	% Silt	% Sand	% Gravel
BH4 SS4	2.8	70	26	4	0
BH9 SS3	1.8	58	39	3	0

Atterberg limits testing was also conducted on the same selected samples which were subjected to grain size analyses. The results of these analyses are presented in the attached Drawing No. 2, Atterberg Limits, and summarised as follows:

TABLE B
Atterberg Limits

Sample ID	Approx. Depth [m]	Plastic Limit, w_P [% moisture]	Liquid Limit. w_L [% moisture]	Plasticity Index, I_P
BH4 SS4	2.8	55.3	26.1	29.2
BH9 SS3	1.8	51.6	23.4	28.2

The field and laboratory testing demonstrate the silty clay deposit to be inorganic clays of medium to high plasticity. These soils are a highly cohesive material, with moderate plasticity, and very low permeability on the order of 10^{-8} cm/sec or lower.

Groundwater Observations

All boreholes were recorded as 'dry' upon completion of drilling. It is noted that insufficient time would have passed for the static groundwater level to stabilise in the open boreholes. However, in cohesive soils such as the silty clay encountered in the boreholes, the static groundwater level generally coincides with the transition in colour from brown to grey. As such, based on our observations during drilling and experience in the area, the static groundwater is estimated at depths on the order of perhaps 3 to 5 metres below the existing road surface.

4. EXCAVATIONS

It is anticipated that the excavations for the proposed improvements and sanitary sewer replacement works will extend to depths of up to approximately 2 to 5 metres below the existing road surface. Excavations through surficial fill materials would be expected to remain stable at inclinations of up to 45 degrees to the horizontal. Excavations through the native silty clay should be relatively straightforward, with excavations remaining stable at inclinations of up to 60 degrees to the horizontal. Where wet seams are encountered, or during periods of extended precipitation, the sides of excavations should be expected to 'slough in' to as flat as 3 horizontal to 1 vertical, or flatter. Notwithstanding the foregoing, all excavations must comply with the requirements of the current Occupational Health and Safety Act and Regulations for Construction Projects. Excavation slopes steeper than those required in the Safety Act must be supported or a trench box must be provided, and a senior geotechnical engineer from this office should monitor the work.

Support of existing structures, underground services and roadways adjacent to the project area must also be considered in assessing the excavation support requirements. In this regard it is recommended that a pre-construction condition survey of the adjacent structures be conducted prior to the start of construction. It is anticipated that the majority of excavations for the proposed structure will be feasible as open cuts, as outlined above.

As noted above, the static groundwater level is estimated at depths of perhaps 3 to 5 metres, with some deeper excavations extending near to below this level. Some groundwater infiltration from permeable seams and from surface runoff should be expected. The rate of infiltration should be sufficiently low though the low permeability silty clay soils such that it should be readily controlled using conventional construction 'dewatering' techniques, such as pumping from sumps and ditches, even for excavations extending to or as much as 1 metre below the static groundwater level. Increased volumes of water should be anticipated when making connections to existing services. Surface water should be directed away from the excavations.

The base of the excavations in the silty clay encountered in the boreholes should remain firm and stable, however some localised instability may be experienced where excavations extend near the static groundwater level, or due to 'wet' seams, weather conditions, infiltration of groundwater, surface runoff, etc.. Excavation bases that experience localised base instability may require additional ballast stone, or other base stabilisation measures.

With firm and stable excavation base conditions, stabilised as required, standard pipe bedding material as specified by the Haldimand County or Ontario Provincial Standard Specification [OPSS] should be satisfactory. The bedding should be well compacted to provide sufficient support to the pipes and components (i.e. valve chambers, manholes etc.), and to minimise settlements of the roadway above the service trenches. Special attention should be paid to compaction under the pipe haunches.

Any utility poles, light poles, etc. located within 3 metres of the top of an excavation slope should be braced to ensure their stability. Likewise, temporary support might be required for other existing above and below ground structures, including existing underground services, depending on their proximity to the trench excavations.

5. BACKFILL CONSIDERATIONS

The majority of excavated materials will consist of the silty clay soils and granular fill materials, as encountered in the boreholes and described above. These materials are

generally considered suitable for use as trench backfill, provided they are free of organic or otherwise deleterious materials. It is noted that the silty clay soils are not considered to be free draining, and will present some difficulty in achieving compaction in narrow trench excavations where access with compaction equipment is difficult. The sand and gravel fill materials may be acceptable for such applications, however this would be best assessed at the time of construction. Care should be taken ensuring sufficient compaction efforts, including necessary moisture conditioning, utilising appropriate equipment, thinner lifts, etc. are applied during compaction activities. Proper handling of the soils based on the material's moisture content and prevailing weather conditions during construction will be important to achieving a successful compaction operation. The silty clay soils encountered are generally considered to be wet of the standard Proctor optimum moisture content. Some moisture conditioning may be required depending upon weather conditions at the time of construction.

The native cohesive soils encountered are sensitive to moisture absorption and will become practically impossible to compact using conventional compaction equipment if they become wet/saturated during 'wet' weather. After a period of heavy precipitation, any near-surface wet or softened material should be allowed to air dry, or be removed and discarded.

Alternatively, the service trenches may be backfilled with a quality imported material. The use of a well-graded granular material, such as an OPSS Granular 'B' Type II (crushed bedrock) would be preferred, as it is less sensitive to moisture conditions and more readily compacted in the often restricted access areas of service trenches. Any imported fill should have its moisture content within 3 per cent of its optimum moisture content, conform to the project specifications with regards to material type and gradation, and meet the necessary environmental guidelines.

We note that where backfill material is placed near or slightly above its optimum moisture content, the potential for long term settlements due to the ingress of groundwater and collapse of the fill structure is reduced. Correspondingly, the shear strength of the 'wet' backfill material is also lowered, thereby reducing its ability to support construction traffic and therefore impacting roadway construction. If the soil is well 'dry' of its optimum value, it will appear to be very strong when compacted, but will tend to settle with time as the moisture content in the fill increases to equilibrium condition. Cohesive soils such as the silty clay encountered may require high compaction energy to achieve acceptable densities if the moisture content is not close to their standard Proctor optimum value. It is therefore very important that the placement moisture content of the backfill soils be within 3 per cent of its standard Proctor optimum moisture content during placement and compaction.

The backfilling and compaction operations should be monitored by a representative of SOIL-MAT to confirm uniform compaction of the backfill material to project specification requirements. We recommend that the lower layers of service trench backfill should be compacted to a minimum of 95 per cent of the material's standard Proctor maximum dry density [SPMDD], and the upper one metre of backfill compacted to 100 per cent of its SPMDD. The backfill should be placed in loose lifts not exceeding 300 millimetres, and should be compacted with the heaviest possible equipment that will not damage the pipe installation. The appropriate compaction equipment should be employed based on soil type, i.e. pad-toe for cohesive soils and smooth drum/vibratory plate for granular soils. Close supervision is prudent in areas that are not readily accessible to compaction equipment, for instance near the end of compaction 'runs', and around manholes. A method should be developed to assess compaction efficiency employing the on-site compaction equipment and backfill materials during construction

6. MANHOLES, CATCH BASINS AND THRUST BLOCKS

Properly prepared bearing surfaces for valve chambers, etc. in the native silty clay, stabilised where required, will be practically non-yielding under the anticipated loads. Proper preparation of the founding soils will tend to accentuate the protrusion of these structures above the pavement surface if compaction of the fill around these structures is not adequate, causing settlement of the surrounding paved surfaces. Conversely, the pavement surfaces may rise above the valve chambers and around manholes under frost action. To alleviate the potential for these types of differential movements, free-draining, non-frost susceptible material should be employed as backfill around the structures located within the paved roadway limits, and compacted to 100 per cent of its standard Proctor maximum dry density.

The thrust blocks in the native soils may be conservatively sized as recommended by the applicable Ontario Provincial Standard Specification conservatively using a horizontal allowable bearing pressure of up to 150 kPa [~3,000 psf]. Any backfill required behind the blocks should be a well-graded granular product and should be compacted to 100 per cent of its standard Proctor maximum dry density.

7. PAVEMENT RECONSTRUCTION CONSIDERATIONS

As noted above, the existing pavement structure was noted to consist of approximately 100 to 380 millimetres of asphaltic concrete overlying 300 to 600 millimetres of compacted granular base material. The pavement surface was noted to generally be in a relatively fair to poor condition, with some areas exhibiting frequent longitudinal,

transverse, and alligator cracking, as well as repair patches. It is anticipated that the pavement structure will be simply saw cut along the limits of the excavation to allow for installation of the new sanitary system. In this regard, the contractor should exercise care along the saw cuts to prevent undermining of the granular base materials from beneath the asphaltic concrete, which would lead to future cracking of the asphalt. In the event that the asphaltic concrete surface becomes undermined, it will be necessary to extend the width of the saw cut portion beyond the undermined portion of the pavement. In such a case the pavement surface should be saw cut approximately 300 millimetres from the excavation edge. In the event that the excavation edge approaches the saw cut pavement edge closer than the 300 millimetre setback, it will be necessary to reinstate the saw cut setback prior to repaving. It is anticipated that the pavement structure will be reinstated to 'match' the existing road surface, or be replaced with the applicable Haldimand County Standards. Alternatively, the recommended pavement structure as detailed below may be implemented.

In the event that pavement reconstruction is to be completed as part of the sanitary replacement, based on the existing pavement structure and condition of the pavement surface, a partial depth reconstruction may be considered appropriate over the majority of the subject of roadway section, however, in areas of significant distress or where the existing pavement structure is considered deficient, a full depth reconstruction may be warranted. It is noted that a partial depth reconstruction would have a reduced lifespan and increased maintenance costs versus a full depth reconstruction.

PARTIAL DEPTH RECONSTRUCTION

Partial depth reconstruction of the pavement structure would typically consist of a 'peel and pave' method. This would involve the removal of the surficial asphalt, re-grading and compaction of the existing granular base material, and placement of new asphaltic concrete. It is recommended that after the existing asphalt layers have been removed the existing granular base material be re-compacted in place, and evaluated with a proof roll using a fully-loaded dump truck or large smooth drum roller in the presence of a representative of our office. Any areas of significant distress should be sub-excavated and replaced with quality granular material, compacted to 100 per cent of its standard Proctor maximum dry density [SPMDD].

The provision of good drainage will serve to improve the long-term performance of the pavement structure. Consideration should be given to the provision of new subdrains within the granular base material to promote drainage to existing catchbasins. Sub-drains would typically consist of 100-millimetre diameter perforated plastic pipe encased in a geofabric sock. The sub-drains should be placed slightly below the subgrade level to promote good drainage.

In terms of Granular Base Equivalence [GBE], it is noted that the total depth of the existing pavement structure over most of the study locations is generally equal to or greater than the pavement structure recommended below. As such, the placement of additional granular materials would generally be expected for levelling and grading purposes, or in areas of sub-excavation. The existing and any new granular base materials should be compacted to 100 per cent SPMDD. The recommended new asphaltic concrete pavement should consist of a minimum of 40 millimetres of HL3 surface course asphalt, over 80 millimetres of HL8 binder course asphalt. The new asphaltic concrete layers should be compacted to a minimum of 92 per cent of their Marshall maximum relative density [MRD]. Given the presence of existing concrete curbs and catchbasins, it is not anticipated that it will be feasible to raise the grade of the existing roadway, and as such a full depth reconstruction may be warranted if any areas are encountered with a reduced existing pavement structure.

Given the depth of existing asphalt, a partial depth reconstruction consisting of a 'mill and pave' approach may also be considered. This approach would involve milling off the upper 40 to 50 millimetres of existing asphalt and replacing with a new lift of HL3 surface course material. It is noted that after milling the exposed surface should be reviewed for evidence of significant damage or distress that may warrant localised full removal and replacement of the asphalt layers. As well it may be prudent to consider the provision of a fibreglass mesh material to reinforce between the existing and new asphalt layers, which would assist in preventing reflection cracking. This is best assessed in the field at the time of the work.

FULL DEPTH RECONSTRUCTION

A full depth reconstruction of the pavement structure would provide for the best long-term performance of the new pavement. This approach would involve the removal of the existing asphaltic concrete layers and granular base materials to the proposed subgrade elevation. The existing asphaltic concrete could be pulverised into the existing granular base, and possibly mixed in with new imported granular fill material, to create a well-graded granular product that could be re-used on the project as sub-base course material, depending on the material gradation. Laboratory sieve analyses would be required to assess the suitability of the pulverised/existing granular materials. The subgrade level would then be lowered to accommodate the required depths of the new pavement structure and finished grade.

The exposed subgrade should be proof rolled with 3 to 4 passes of a loaded tandem truck [over the same wheel path] in the presence of a representative of SOIL-MAT immediately prior to the placement of the sub-base material. Any areas of distress revealed by this or other means should be sub-excavated and replaced with suitable

backfill material, such as with suitable on-site granular materials or imported OPSS Granular 'B', Type II, compacted to 100 per cent of its SPMDD. Alternatively, the soft areas may be repaired by 'punching' coarse aggregate, such as a 50-millimetre clear crushed stone, into the soft areas. The need for sub-excavation of softened subgrade materials will be reduced if construction is undertaken during the dry summer months of the year and careful attention is paid to the compaction operations.

Good drainage provisions will optimise the long-term performance of the pavement structure. The subgrade must be properly crowned and shaped to promote drainage to the subdrain system. Subdrains should be installed to intercept excess subsurface water and to prevent softening of the subgrade material. Surface water should not be allowed to pond adjacent to the outer limits of the paved areas.

The most severe loading conditions on the subgrade typically occur during the course of construction. Therefore, precautionary measures may have to be taken to ensure that the subgrade is not unduly disturbed by construction traffic.

The new pavement structure should satisfy the typical Haldimand County specifications. Alternatively, a recommended pavement structure to support cars, emergency vehicles, etc. for an arterial roadway would consist of a minimum of:

HL3 asphalt surface course	40 millimetres
HL8 asphalt binder course	80 millimetres
Base course granular [OPSS Granular 'A']	150 millimetres
Sub-base course granular [OPSS Granular 'B', Type II]	350 millimetres

It is our opinion, that this design is suitable for use on the subject roadway, provided that the subgrade has been prepared as detailed above before the sub-base course material is placed. If the subgrade is soft, remedial measures as discussed above may have to be implemented and/or the sub-base thickness may have to be increased. The granular sub-base and base courses should be compacted to 100 per cent of their SPMDD, and asphaltic concrete layers should be compacted to a minimum of 92 per cent of their Marshall maximum relative density [MRD]. A program of in-place density testing must be carried out to monitor that compaction requirements are being met.

The outlined full depth pavement reconstruction may be expected to have an approximate 20 to 25 year service life, assuming that regular maintenance is performed. Should a more detailed pavement structure design be required, site specific traffic information would be needed, together with detailed laboratory testing of the subgrade soils.

GENERAL ASPHALT PLACEMENT CONSIDERATIONS

To minimise segregation of the finished asphalt mat, the asphalt temperature must be maintained uniform throughout the mat during placement and compaction. All too often, significant temperature gradients exist in the delivered and placed asphalt with the cooler portions of the mat resisting compaction and presenting a honey combed surface. As the spreader moves forward, a responsible member of the paving crew should monitor the pavement surface, to ensure a smooth uniform surface. Surface segregation can be mitigated by 'back-casting' or scattering shovels of the full mix material over the segregated areas and raking out the coarse particles during compaction operations. Of course, the above assumes that the asphalt mix is sufficiently hot to allow the 'back-casting' to be performed.

9. ENVIRONMENTAL CONSIDERATIONS

As noted above, twenty one [21] selected samples of the subsurface soils recovered from the boreholes were submitted to an independent Canadian accredited analytical laboratory for background environmental testing for a standard panel of metal and inorganic parameters. The results of this testing are presented in the attached ALS Certificate of Analysis [L2120222].

The laboratory test results received in our Office were compared to the applicable standard from the Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the *Environmental Protection Act*, as follows:

- **TABLE 1**: Full Depth Background Site Condition Standards for a Residential/ Parkland/ Institutional property use, [RPI], as well as for an Industrial/ Commercial/ Community [ICC] property use.
- **TABLE 2**: Full Depth Generic Site Condition Standards in a Potable Ground Water Condition for a Residential/Parkland/Institutional property use, [RPI], as well as for an Industrial/Commercial/Community [ICC] property use.
- **TABLE 3**: Full Depth Generic Site Condition Standards in a Non-Potable Ground Water Condition for a Residential/Parkland/Institutional property use, [RPI], as well as for an Industrial/Commercial/Community [ICC] property use.

Based on SOIL-MAT's field observations and the analytical test results from ALS, SOIL-MAT offers the following comments:

1. All samples were found to meet the Table 1 [ALL] Standards for all parameters tested, with the exception of Chromium Hexavalent in Sample BH1 SS2, Cobalt in Sample BH6 SS4, and Electrical Conductivity [EC] and/or Sodium Absorption Ratio [SAR] in all samples with the exception of Samples BH8 SS4 and BH8 SS5.
2. All samples were found to meet the Table 2 and 3 [RPI] Standards for all parameters tested, with the exception of Electrical Conductivity [EC] and/or Sodium Absorption Ratio [SAR], which were found to exceed the standards in 17 of the 21 samples.
3. All samples were found to meet the Table 2 and 3 [ICC] Standards for all parameters tested, with the exception Electrical Conductivity [EC] and/or Sodium Absorption Ratio [SAR], which was found to exceed the standards in 11 of 21 samples.
4. It is noted that the presence of elevated levels of EC and SAR is often observed in the area of municipal roadways and parking lots and is largely the result of the use of salt for winter de-icing operations. EC and SAR are essentially aesthetic parameters that do not present a hazard to human or animal life. Rather they tend to render the soil environment un-supportive of plant growth and corrosive to buried grey or cast iron pipe;
5. The samples secured for analytical testing are believed to be representative of the soil conditions. No evidence of potential impact, i.e. staining or odours was observed during the fieldwork. If any significant changes are noted, i.e., odours, staining etc., SOIL-MAT should be contacted to reassess the environmental characteristics of the soil.

Given the above test results the following disposal options are applicable under Regulation 153/04 [amended by Regulation 511/09 effective July 1, 2011].

- As the tested material has been shown to exceed the Table 1 Standards, surplus material may not be accepted at an off-site Table 1 property, including property subject to a Record of Site Condition or MOE Certificate of Authorisation;
- As the test results for some of the submitted samples show values of EC and SAR which exceed the Table 2 and 3 RPI and ICC Standards, strictly speaking, the tested materials may not be accepted at an off-site RPI or ICC property in a potable or non-potable groundwater condition.
- As the test results show only elevated levels of EC and/or SAR which exceed Table 2 and 3 RPI and ICC standards, noted above as essentially aesthetic parameters associated with the application of road de-icing salt, it would be reasonable to accept surplus material at an off-site RPI or ICC property under the 'beneficial use' concept. Such a use would require assessment of the receiving property and approval of the

receiving property owner, and depending on the location and nature of the property consultation with the local MOE District Engineer;

- Excavated soil may be reused as backfill on site.

10. GENERAL COMMENTS

The comments provided in this document are intended only for the guidance of the design team. The subsoil descriptions and borehole information are intended to describe conditions at the borehole locations. Contractors tendering or undertaking this project should carry out due diligence in order to verify the results of this investigation and to determine how the subsurface conditions will affect their operations.

We trust that this geotechnical report is sufficient for your present requirements. Should you require any additional information or clarification as to the contents of this document, please do not hesitate to contact the undersigned.

Yours very truly,
SOIL-MAT ENGINEERS & CONSULTANTS LTD.

Adam Roemmele, B.Eng., EIT

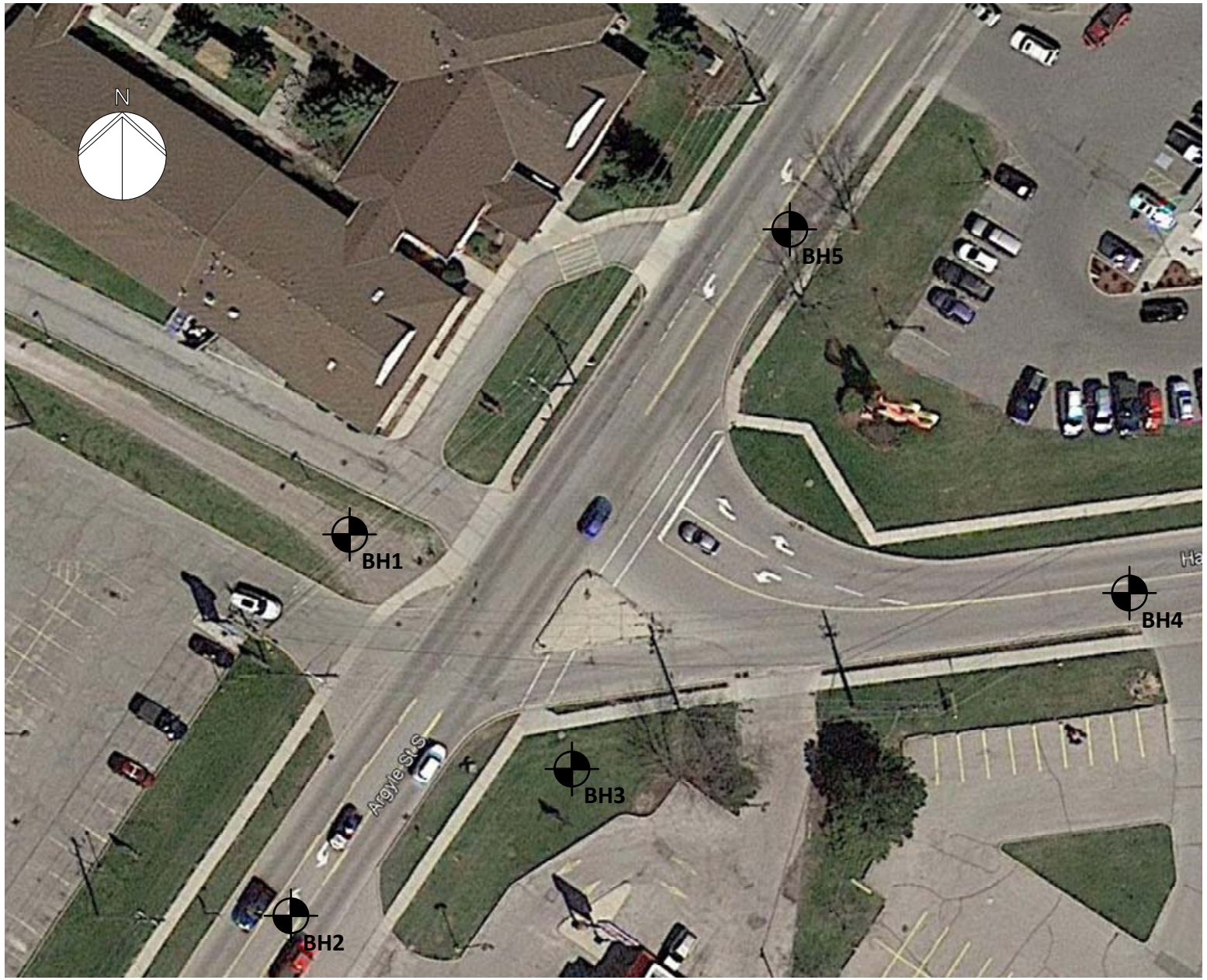
for Kyle Richardson, P.Eng.
Project Engineer

LICENSED PROFESSIONAL ENGINEER
M. M. LIVECCHI
100189574
PROVINCE OF ONTARIO

Matt LiVecchi, P. Eng.
Project Engineer

Enclosures: Drawing No. 1 to 2, Borehole Location Plans
Log of Borehole Nos. 1 through 10
ALS Certificates of Analysis [L2120222]

Distribution: Haldimand County [3, plus pdf]



LEGEND

BH# Borehole Location

NOTES

1. This drawing should be read in conjunction with Soil-Mat Engineers & Consultants Ltd. Report No. SM 188337-G.

2. Borehole locations are approximate.

SOIL-MAT

ENGINEERS & CONSULTANTS LTD.

Geotechnical Investigation
Proposed Intersection Improvements, Argyle Street
Caledonia, Ontario

Borehole Location Plan

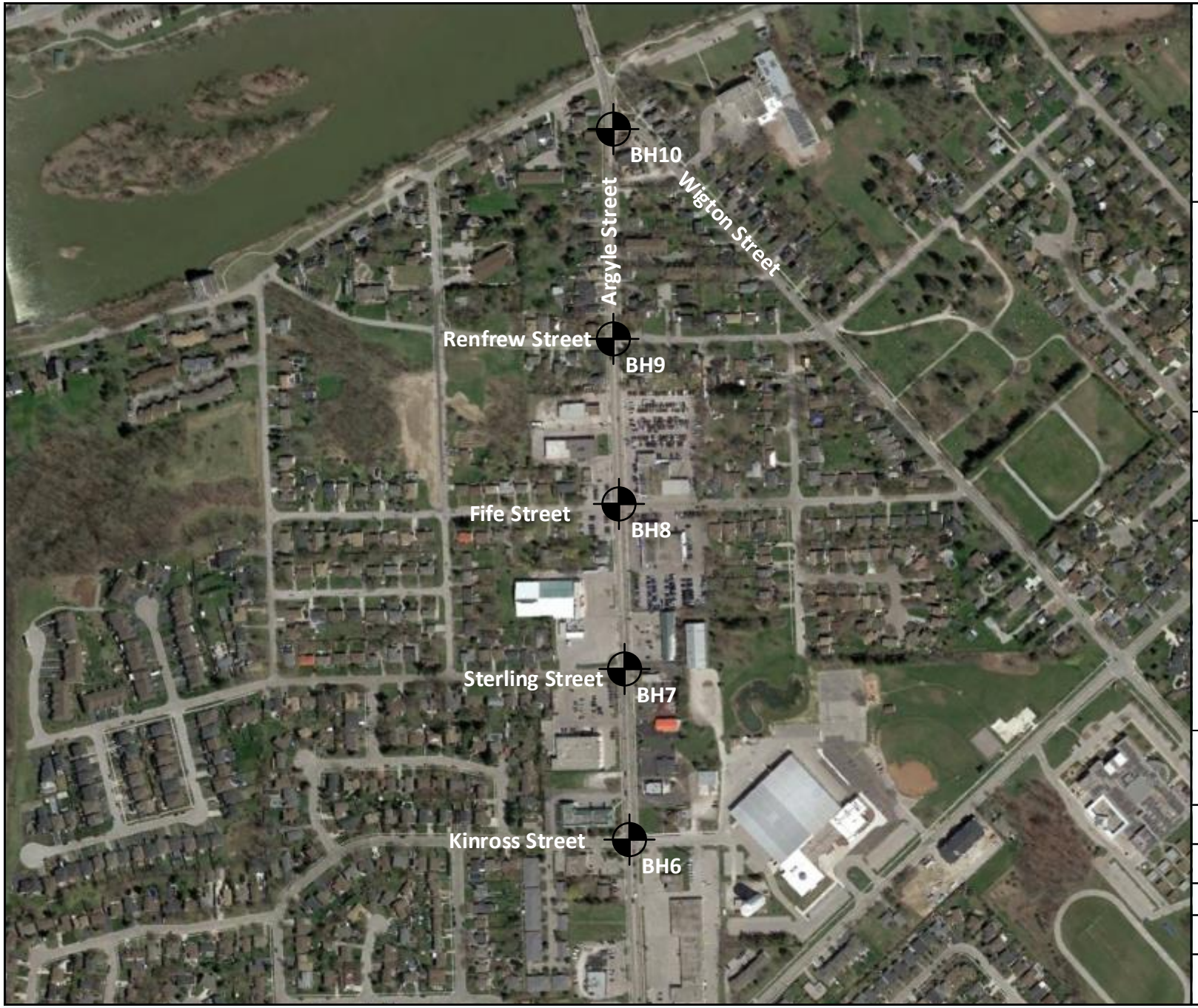
Project No. SM 188337-G

Date: June, 2018

Drawn: KF	Checked: KR

SM 188337-G Borehole Location Plan

Drawing No. 1



LEGEND

BH# Borehole Location

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SOIL-MAT

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Geotechnical Investigation
Proposed Intersection Improvements, Argyle Street
Caledonia, Ontario

Borehole Location Plan

Project No. SM 188337-G

Date: June, 2018

Drawn: KF | Checked: KR

SM 188337-G Borehole Location Plan

Drawing No. 2

Log of Borehole No. 1

Project No: SM 188337-G
Project Manager: Kyle Richardson, P.Eng.
Project: Proposed Intersection Improvements
Borehole Location: See Drawing No.1
Location: Argyle Street and Haddington Street :
Client: Haldimand County - Engineering Division :

Soil-Mat

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)	Moisture Content w% (10 20 30 40) / Standard Penetration Test blows/300mm (20 40 60 80)
0 / 0	0.00		Ground Surface									
0 / 0	-0.30		**Sand and Gravel Fill** Approximately 300 millimetres of crushed limestone aggregate.		SS	1	18 20 8	28				
2 / 1	-0.91		**Silty Clay** Brown, trace sand and gravel, reworked in upper levels, stiff to very stiff.		SS	2	6 8 7	15		>4.5		
3 / 1			End of Borehole									

NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 0.9 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 2

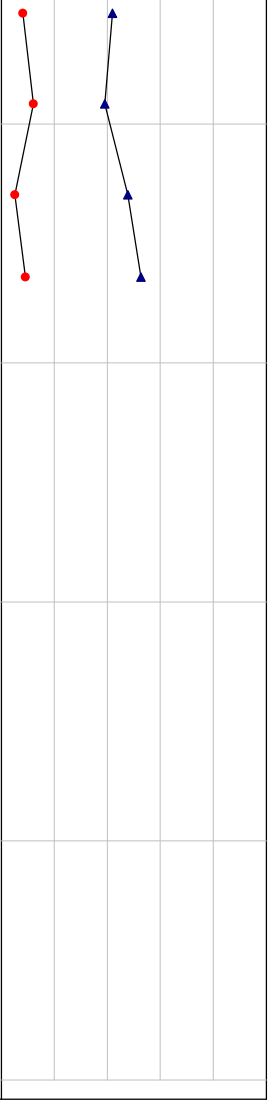
Project No: SM 188337-G
Project: Proposed Intersection Improvements
Location: Argyle Street South
Client: Haldimand County - Engineering Division

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	0.00	Ground Surface								
0–2 / 0–1		**Pavement Structure** Approximately 380 millimetres of asphatic concrete over 400 millimetres of compact granular base.								
2–11 / 1–3	-0.78	**Silty Clay** Brown to greyish brown, trace sand and gravel, trace organics and reworked in upper levels, firm to stiff.		SS	1	4 4 4 5	8		<1	
				SS	2	4 5 7 7	12		3.0	
				SS	3	3 4 4 4	8		<1	
				SS	4	3 4 5	9		<1	
11 / 3	-3.51	End of Borehole								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 3.5 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 3

Project No: SM 188337-G
Project Manager: Kyle Richardson, P.Eng.
Project: Proposed Intersection Improvements
Borehole Location: See Drawing No.1
Location: Argyle Street and Haddington Street :
Client: Haldimand County - Engineering Division :

Soil-Mat

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)	Moisture Content w% (10 20 30 40) / Standard Penetration Test blows/300mm (20 40 60 80)
0 / 0	0.00		Ground Surface									
0 / 0	-0.30		**Topsoil** Approximately 300 millimetres of topsoil.		SS	1	3 7 6 5	13				
3 / 1	-1.22		**Silty Clay** Brown, trace sand and gravel, trace organics and reworked in upper levels, firm to stiff.		SS	2	2 3 5	8		2.5		
			End of Borehole									

NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 1.2 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

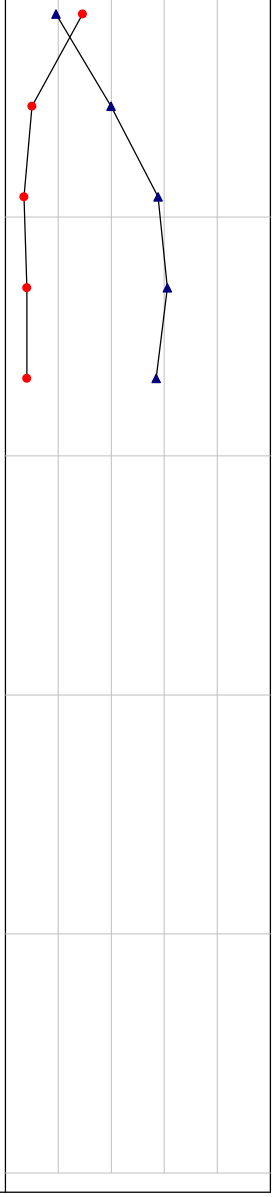
Log of Borehole No. 4

Project No: SM 188337-G
Project Manager: Kyle Richardson, P.Eng.
Project: Proposed Intersection Improvements
Borehole Location: See Drawing No.1
Location: Haddington Street
:
Client: Haldimand County - Engineering Division
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	0.00		Ground Surface								
0–2 / 0–0.6	0.00 to -0.70		**Pavement Structure** Approximately 100 millimetres of asphatic concrete over 600 millimetres of compact granular base.		SS	1	18 16 13 7	29			
2–11 / 0.6–3.4	-0.70 to -3.66		**Silty Clay** Brown to greyish brown, trace sand and gravel, reworked in upper levels, firm to stiff.		SS SS SS SS	2 3 4 5	4 5 5 7 3 3 4 6 3 3 5 6 2 3 5 5	10 7 8 8		2.5 2.5 2.5 2.0	
11 / 3.4	-3.66		End of Borehole								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 3.7 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 5

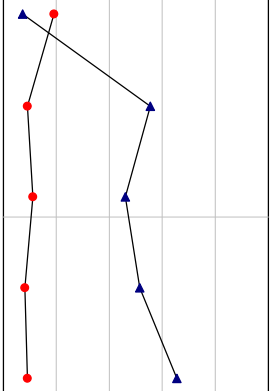
Project No: SM 188337-G
Project: Proposed Intersection Improvements
Location: Argyle Street South
Client: Haldimand County - Engineering Division

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Symbol	Description	Well Data	SAMPLE Type	SAMPLE Number	SAMPLE Blow Counts	SAMPLE Blows/300mm	SAMPLE Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
ft 0 / m 0	0.00		Ground Surface								
			Pavement Structure Approximately 100 millimetres of asphatic concrete over 600 millimetres of compact granular base.								
	-0.70		**Silty Clay** Brown to greyish brown, trace sand and gravel, reworked in upper levels, firm to stiff.		SS	1	22 12 7 6	19			
					SS	2	4 5 4 6	9		3.5	
					SS	3	4 4 7 8	11		3.5	
					SS	4	3 3 5 6	8		3.0	
					SS	5	2 4 5 7	9		2.0	
	-3.66		End of Borehole								

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 3.7 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
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Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 6

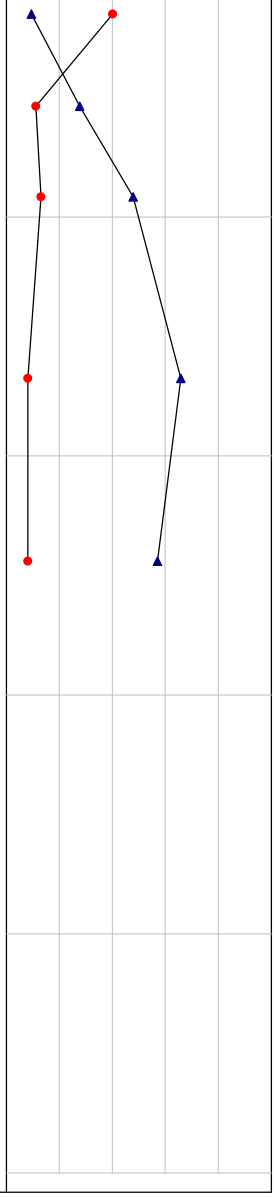
Project No: SM 188337-G
Project: Proposed Intersection Improvements
Location: Argyle Street South
Client: Haldimand County - Engineering Division

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	0.00	Ground Surface							
0–2 / 0–1		**Pavement Structure** Approximately 200 millimetres of asphatic concrete over 600 millimetres of compact granular base.							
2–5 / 1–2	-0.80	**Silty Clay** Brown to greyish brown, trace sand and gravel, reworked in upper levels, firm to stiff.	SS	1	11 21 19 17	40			
			SS	2	10 6 5 7	11		3.0	
			SS	3	4 5 8 9	13		3.5	
10–16 / 3–5			SS	4	2 3 5 7	8		2.5	
			SS	5	2 3 5 5	8		2.0	
16 / 5	-5.18	End of Borehole							

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
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Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 7

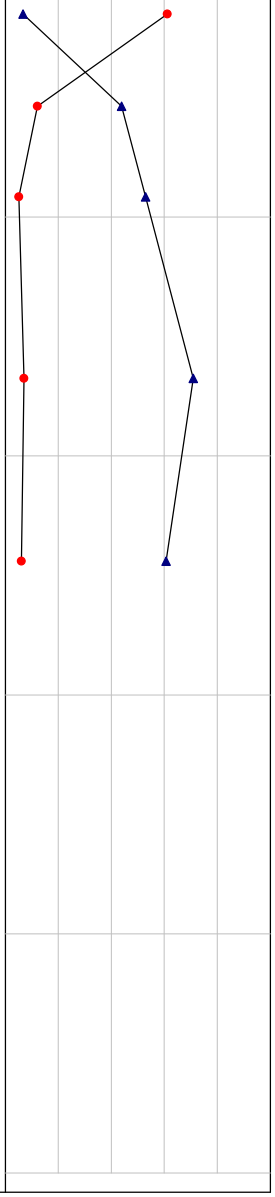
Project No: SM 188337-G
Project: Proposed Intersection Improvements
Location: Argyle Street South
Client: Haldimand County - Engineering Division

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	0.00	Ground Surface							
0–3 / 0–1	-0.90	**Pavement Structure** Approximately 300 millimetres of asphatic concrete over 600 millimetres of compact granular base.	SS	1	48 31 30 17	61			
3–16 / 1–5	-4.88	**Silty Clay** Brown to greyish brown, trace sand and gravel, reworked in upper levels, stiff to firm.	SS	2	10 5 7 7	12		3.5	
			SS	3	1 2 3 2	5		1.5	
			SS	4	1 3 4 5	7		1.5	
16–17 / 5	-5.18	Transition to grey in colour	SS	5	2 3 3 4	6		<1	
		End of Borehole							

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
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E: info@soil-mat.ca

Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 8

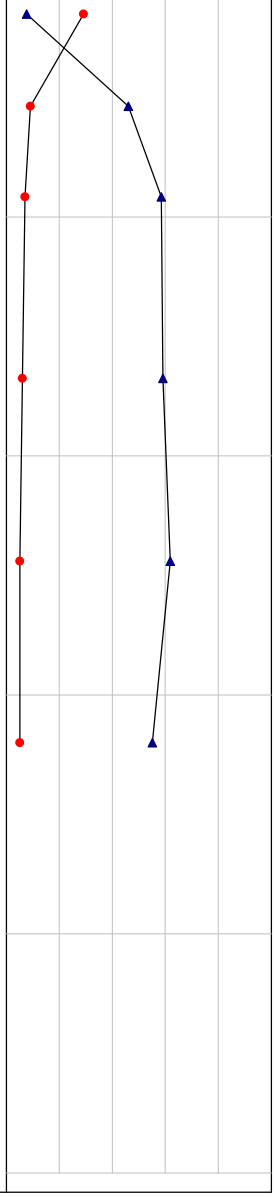
Project No: SM 188337-G
Project: Proposed Intersection Improvements
Location: Argyle Street South
Client: Haldimand County - Engineering Division

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	0.00	Ground Surface							
0–2 / 0–1		**Pavement Structure** Approximately 200 millimetres of asphatic concrete over 600 millimetres of compact granular base.							
2–11 / 1–3	-0.80	**Silty Clay** Brown to greyish brown, trace sand and gravel, reworked in upper levels, stiff to firm.	SS	1	6 13 16 8	29			
			SS	2	6 4 5 4	9		<1	
			SS	3	2 3 4 6	7		2.5	
11–16 / 3–5	-3.35	Transition to grey in colour.	SS	4	2 2 4 4	6		<1	
16–21 / 5–6			SS	5	2 2 3 5	5		<1	
21–22 / 6–7	-6.71		SS	6	2 2 3 3	5		<1	
		End of Borehole							

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 6.7 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 9

Project No: SM 188337-G
Project: Proposed Intersection Improvements
Location: Argyle Street South
Client: Haldimand County - Engineering Division

Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	0.00	Ground Surface							
0–3 / 0–1		**Pavement Structure** Approximately 300 millimetres of asphatic concrete over 600 millimetres of compact granular base.							
3–13 / 1–4	-0.90	**Silty Clay** Brown to greyish brown, trace sand and gravel, reworked in upper levels, stiff to firm.	SS	1	40 38 23 12	61			
			SS	2	6 3 4 5	7		3.0	
			SS	3	4 4 7 8	11		3.5	
			SS	4	4 4 5 6	9		4.0	
13–22 / 4–6.71	-4.10	Transition to grey in colour.	SS	5	1 3 2 2	5		<1	
			SS	6	2 2 3 2	5		<1	
22 / 6.71	-6.71	End of Borehole							

NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 6.7 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Moisture Content w% (10 20 30 40)
Standard Penetration Test blows/300mm (20 40 60 80)

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Log of Borehole No. 10

Project No: SM 188337-G
Project: Proposed Intersection Improvements
Location: Argyle Street South
Client: Haldimand County - Engineering Division

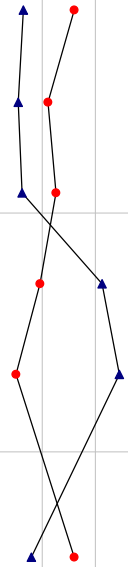
Project Manager: Kyle Richardson, P.Eng.
Borehole Location: See Drawing No.1
:
:

Soil-Mat

Depth (ft / m)	Elevation (m)	Description	Well Data	SAMPLE Type	Number	Blow Counts	Blows/300mm	Recovery	PP (kgf/cm2)	U.Wt.(kN/m3)
0 / 0	0.00	Ground Surface								
0–2 / 0–1	0.00 to -0.80	**Pavement Structure** Approximately 200 millimetres of asphatic concrete over 600 millimetres of compact granular base.		SS	1	11 19 13 14	32			
3–6 / 1–2	-0.80 to -2.10	**Sand and Gravel Fill** Brown, compact.		SS	2	13 12 10 12	22			
				SS	3	10 10 15 10	25			
7–16 / 2–5	-2.10 to -5.18	**Silty Clay** Brown to greyish brown, trace sand and gravel, reworked in upper levels, stiff to hard.		SS	4	6 8 11 12	19		3.5	
				SS	5	3 4 6 7	10		3.5	
				SS	6	4 14 18 19	32		>4.5	
17 / 5	-5.18	End of Borehole								

Moisture Content w% (10 20 30 40)

Standard Penetration Test blows/300mm (20 40 60 80)



NOTES:

1. Borehole was advanced using solid stem auger equipment on June 22, 2018 to termination at a depth of 5.2 metres.

2. Borehole was recorded as 'dry' upon completion of drilling and backfilled as per Ontario Regulation 903.

3. Soil samples will be discarded after 3 months unless otherwise directed by our client.

Drill Method: Solid Stem Augers
Drill Date: June 22, 2018
Hole Size: 150 Millimetres
Drilling Contractor: Elite Drilling

Soil-Mat Engineers & Consultants Ltd.
130 Lancing Drive, Hamilton, ON L8W 3A1
T: 905.318.7440 F: 905.318.7455
E: info@soil-mat.ca

Datum: Existing Road Surface
Field Logged by: KF
Checked by: KR
Sheet: 1 of 1

Soil Mat Engineers & Consulting Ltd.
(Hamilton)
ATTN: Kyle Richardson
130 Lancing Drive
Hamilton ON L8W 3A1

Date Received: 27-JUN-18
Report Date: 05-JUL-18 14:28 (MT)
Version: FINAL

Client Phone: 905-318-7440

Certificate of Analysis

Lab Work Order #: L2120222

Project P.O. #: NOT SUBMITTED
Job Reference: 188337
C of C Numbers:
Legal Site Desc:

Mary-Lynn Pike
Client Services Supervisor

Summary of Guideline Exceedances

ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Ontario Regulation 153/04 - April 15, 2011 Standards - T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use						
L2120222-1	BH1 SS2	Physical Tests	Conductivity	0.619	0.57	mS/cm
		Speciated Metals	Chromium, Hexavalent	1.01	0.66	ug/g
L2120222-2	BH3 SS2	Physical Tests	Conductivity	0.913	0.57	mS/cm
		Saturated Paste Extractables	SAR	11.9	2.4	SAR
L2120222-3	BH2 SS1	Physical Tests	Conductivity	5.61	0.57	mS/cm
		Saturated Paste Extractables	SAR	12.0	2.4	SAR
L2120222-4	BH2 SS2	Physical Tests	Conductivity	1.32	0.57	mS/cm
L2120222-5	BH2 SS3	Physical Tests	Conductivity	1.01	0.57	mS/cm
L2120222-6	BH4 SS2	Physical Tests	Conductivity	2.24	0.57	mS/cm
		Saturated Paste Extractables	SAR	30.0	2.4	SAR
L2120222-7	BH4 SS3	Physical Tests	Conductivity	1.50	0.57	mS/cm
		Saturated Paste Extractables	SAR	8.74	2.4	SAR
L2120222-8	BH4 SS4	Physical Tests	Conductivity	0.640	0.57	mS/cm
L2120222-9	BH5 SS2	Physical Tests	Conductivity	0.879	0.57	mS/cm
		Saturated Paste Extractables	SAR	13.5	2.4	SAR
L2120222-10	BH5 SS3	Physical Tests	Conductivity	0.761	0.57	mS/cm
		Saturated Paste Extractables	SAR	10.3	2.4	SAR
L2120222-11	BH5 SS4	Physical Tests	Conductivity	0.907	0.57	mS/cm
		Saturated Paste Extractables	SAR	8.78	2.4	SAR
L2120222-12	BH6 SS2	Physical Tests	Conductivity	8.18	0.57	mS/cm
		Saturated Paste Extractables	SAR	34.8	2.4	SAR
L2120222-13	BH6 SS3	Physical Tests	Conductivity	7.08	0.57	mS/cm
		Saturated Paste Extractables	SAR	17.0	2.4	SAR
L2120222-14	BH6 SS4	Physical Tests	Conductivity	0.913	0.57	mS/cm
		Saturated Paste Extractables	SAR	3.90	2.4	SAR
		Metals	Cobalt (Co)	21.3	21	ug/g
L2120222-15	BH8 SS2	Physical Tests	Conductivity	10.7	0.57	mS/cm
		Saturated Paste Extractables	SAR	31.2	2.4	SAR
L2120222-16	BH8 SS3	Physical Tests	Conductivity	6.73	0.57	mS/cm
		Saturated Paste Extractables	SAR	20.3	2.4	SAR
L2120222-19	BH10 SS2	Physical Tests	Conductivity	5.86	0.57	mS/cm

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Summary of Guideline Exceedances

Guideline ALS ID	Client ID	Grouping	Analyte	Result	Guideline Limit	Unit
Ontario Regulation 153/04 - April 15, 2011 Standards - T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use						
L2120222-19	BH10 SS2	Saturated Paste Extractables	SAR	17.4	2.4	SAR
L2120222-20	BH10 SS3	Physical Tests	Conductivity	2.67	0.57	mS/cm
		Saturated Paste Extractables	SAR	7.40	2.4	SAR
L2120222-21	BH10 SS5	Physical Tests	Conductivity	5.05	0.57	mS/cm
		Saturated Paste Extractables	SAR	9.46	2.4	SAR

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	L2120222-1	L2120222-2	L2120222-3	L2120222-4	L2120222-5	L2120222-6	L2120222-7	L2120222-8	L2120222-9
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH1 SS2	BH3 SS2	BH2 SS1	BH2 SS2	BH2 SS3	BH4 SS2	BH4 SS3	BH4 SS4	BH5 SS2
Conductivity	mS/cm	0.57	-		0.619	0.913	5.61	1.32	1.01	2.24	1.50	0.640	0.879
% Moisture	%	-	-		18.0	22.0	18.5	16.1	20.3	16.2	24.1	25.0	19.1
pH	pH units	-	-		7.36	7.43	6.90	7.46	7.45	7.75	7.73	7.66	7.28

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Physical Tests - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	L2120222-10	L2120222-11	L2120222-12	L2120222-13	L2120222-14	L2120222-15	L2120222-16	L2120222-17	L2120222-18
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH5 SS3	BH5 SS4	BH6 SS2	BH6 SS3	BH6 SS4	BH8 SS2	BH8 SS3	BH8 SS4	BH8 SS5
Conductivity	mS/cm	0.57	-		0.761	0.907	8.18	7.08	0.913	10.7	6.73	0.533	0.195
% Moisture	%	-	-		9.57	18.3	15.8	17.6	23.0	20.9	21.0	25.2	21.3
pH	pH units	-	-		7.65	7.54	7.83	7.64	7.61	7.62	7.68	7.75	7.76

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Physical Tests - SOIL

				Lab ID	L2120222-19	L2120222-20	L2120222-21
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH10 SS2	BH10 SS3	BH10 SS5
		Guide Limits					
Analyte	Unit	#1	#2				
Conductivity	mS/cm	0.57	-		5.86	2.67	5.05
% Moisture	%	-	-		8.54	5.93	25.6
pH	pH units	-	-		8.00	7.93	7.63

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Cyanides - SOIL

	Lab ID	L2120222-1	L2120222-2	L2120222-3	L2120222-4	L2120222-5	L2120222-6	L2120222-7	L2120222-8	L2120222-9
	Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
	Sample ID	BH1 SS2	BH3 SS2	BH2 SS1	BH2 SS2	BH2 SS3	BH4 SS2	BH4 SS3	BH4 SS4	BH5 SS2
Analyte	Unit	Guide Limits #1	#2							
Cyanide, Weak Acid Diss	ug/g	0.051	-	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Cyanides - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	L2120222-10	L2120222-11	L2120222-12	L2120222-13	L2120222-14	L2120222-15	L2120222-16	L2120222-17	L2120222-18
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH5 SS3	BH5 SS4	BH6 SS2	BH6 SS3	BH6 SS4	BH8 SS2	BH8 SS3	BH8 SS4	BH8 SS5
Cyanide, Weak Acid Diss	ug/g	0.051	-		<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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	L2120222-19	L2120222-20	L2120222-21
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH10 SS2	BH10 SS3	BH10 SS5
Analyte	Unit	#1	#2			
Cyanide, Weak Acid Diss	ug/g	0.051	-	<0.050	<0.050	<0.050

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Saturated Paste Extractables - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	Sample Date	Sample ID							
				L2120222-1	L2120222-2	L2120222-3	L2120222-4	L2120222-5	L2120222-6	L2120222-7	L2120222-8	L2120222-9
				22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				BH1 SS2	BH3 SS2	BH2 SS1	BH2 SS2	BH2 SS3	BH4 SS2	BH4 SS3	BH4 SS4	BH5 SS2
SAR	SAR	2.4	-	0.99	11.9	12.0	1.41	2.05	30.0	8.74	1.08	13.5 SAR:M
Calcium (Ca)	mg/L	-	-	50.9	12.6	239	138	89.3	11.3	38.0	23.9	10.5
Magnesium (Mg)	mg/L	-	-	8.1	1.3	37.2	7.3	3.6	2.6	7.7	25.8	<1.0
Sodium (Na)	mg/L	-	-	28.9	166	757	62.8	72.5	430	226	32.0	159

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Saturated Paste Extractables - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	L2120222-10	L2120222-11	L2120222-12	L2120222-13	L2120222-14	L2120222-15	L2120222-16	L2120222-17	L2120222-18
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH5 SS3	BH5 SS4	BH6 SS2	BH6 SS3	BH6 SS4	BH8 SS2	BH8 SS3	BH8 SS4	BH8 SS5
SAR	SAR	2.4	-		10.3 SAR:M	8.78	34.8	17.0	3.90	31.2	20.3	0.39	0.40
Calcium (Ca)	mg/L	-	-		11.5	16.9	92.8	251	43.3	196	163	36.1	9.0
Magnesium (Mg)	mg/L	-	-		<1.0	2.4	11.4	19.5	4.9	9.4	24.2	16.8	2.9
Sodium (Na)	mg/L	-	-		127	146	1340	1040	102	1650	1050	11.3	5.4

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Saturated Paste Extractables - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	Sample Date	Sample ID
				L2120222-19	22-JUN-18	BH10 SS2
				L2120222-20	22-JUN-18	BH10 SS3
				L2120222-21	22-JUN-18	BH10 SS5
SAR	SAR	2.4	-	17.4	7.40	9.46
Calcium (Ca)	mg/L	-	-	178	113	280
Magnesium (Mg)	mg/L	-	-	32.2	36.1	31.6
Sodium (Na)	mg/L	-	-	960	352	626

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	L2120222-1	L2120222-2	L2120222-3	L2120222-4	L2120222-5	L2120222-6	L2120222-7	L2120222-8	L2120222-9
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH1 SS2	BH3 SS2	BH2 SS1	BH2 SS2	BH2 SS3	BH4 SS2	BH4 SS3	BH4 SS4	BH5 SS2
Antimony (Sb)	ug/g	1.3	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	-		5.8	5.3	4.7	7.9	8.6	6.5	5.1	3.3	3.9
Barium (Ba)	ug/g	220	-		162	91.7	130	81.9	78.8	76.6	156	180	99.0
Beryllium (Be)	ug/g	2.5	-		0.90	0.71	0.95	0.66	0.67	0.59	0.86	1.12	0.73
Boron (B)	ug/g	36	-		8.4	7.3	5.7	8.5	8.5	8.4	14.9	17.2	<5.0
Boron (B), Hot Water Ext.	ug/g	36	-		0.20	0.68	0.55	<0.10	<0.10	<0.10	0.11	0.14	<0.10
Cadmium (Cd)	ug/g	1.2	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	70	-		34.2	25.1	28.9	23.1	23.9	20.6	31.6	37.4	28.6
Cobalt (Co)	ug/g	21	-		19.6	12.9	15.4	12.1	13.9	12.1	15.0	16.0	14.6
Copper (Cu)	ug/g	92	-		28.6	20.7	18.0	35.9	38.7	32.2	25.2	27.2	17.8
Lead (Pb)	ug/g	120	-		15.2	34.1	13.8	10.7	10.6	10.1	10.6	13.7	11.8
Mercury (Hg)	ug/g	0.27	-		0.0365	0.0389	0.0407	0.0185	0.0226	0.0188	0.0139	0.0139	0.0228
Molybdenum (Mo)	ug/g	2	-		<1.0	1.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	ug/g	82	-		29.9	23.1	25.6	27.8	29.1	25.4	31.1	38.3	26.5
Selenium (Se)	ug/g	1.5	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	0.5	-		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	1	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	2.5	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Vanadium (V)	ug/g	86	-		43.5	35.1	43.5	32.9	34.1	29.5	43.7	50.0	42.1
Zinc (Zn)	ug/g	290	-		80.1	100	76.3	63.9	66.1	60.5	67.8	77.9	71.6

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	L2120222-10	L2120222-11	L2120222-12	L2120222-13	L2120222-14	L2120222-15	L2120222-16	L2120222-17	L2120222-18
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH5 SS3	BH5 SS4	BH6 SS2	BH6 SS3	BH6 SS4	BH8 SS2	BH8 SS3	BH8 SS4	BH8 SS5
Antimony (Sb)	ug/g	1.3	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	-		6.1	8.0	7.2	7.3	5.9	8.2	5.6	4.0	5.1
Barium (Ba)	ug/g	220	-		44.3	85.5	61.6	55.7	180	96.8	150	130	80.2
Beryllium (Be)	ug/g	2.5	-		<0.50	0.70	0.55	0.54	1.03	0.65	0.89	0.93	0.64
Boron (B)	ug/g	36	-		6.3	8.4	7.7	7.7	16.9	9.2	12.7	14.9	11.5
Boron (B), Hot Water Ext.	ug/g	36	-		<0.10	<0.10	<0.10	<0.10	0.12	<0.10	0.12	0.16	0.12
Cadmium (Cd)	ug/g	1.2	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	70	-		16.5	24.0	19.1	19.2	37.7	24.0	30.2	34.3	24.3
Cobalt (Co)	ug/g	21	-		9.5	13.8	10.8	11.3	21.3	13.9	14.1	15.8	12.0
Copper (Cu)	ug/g	92	-		29.3	31.9	33.4	32.2	31.0	33.6	27.2	29.8	26.4
Lead (Pb)	ug/g	120	-		8.2	9.5	9.1	9.0	13.5	10.0	11.2	13.1	9.5
Mercury (Hg)	ug/g	0.27	-		0.0181	0.0191	0.0189	0.0192	0.0169	0.0195	0.0168	0.0158	0.0110
Molybdenum (Mo)	ug/g	2	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Nickel (Ni)	ug/g	82	-		20.3	28.5	23.4	24.3	38.4	28.6	31.2	35.9	26.0
Selenium (Se)	ug/g	1.5	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	0.5	-		<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	1	-		<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Uranium (U)	ug/g	2.5	-		<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1	<1.0
Vanadium (V)	ug/g	86	-		23.5	33.2	27.4	27.7	49.3	33.8	40.3	45.0	34.0
Zinc (Zn)	ug/g	290	-		49.0	63.8	56.0	55.3	86.2	65.3	66.4	80.0	62.1

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Metals - SOIL

			Lab ID	L2120222-19	L2120222-20	L2120222-21
			Sample Date	22-JUN-18	22-JUN-18	22-JUN-18
			Sample ID	BH10 SS2	BH10 SS3	BH10 SS5
		Guide Limits				
Analyte	**Unit**	**#1**	**#2**			
Antimony (Sb)	ug/g	1.3	-	<1.0	<1.0	<1.0
Arsenic (As)	ug/g	18	-	4.7	3.7	4.1
Barium (Ba)	ug/g	220	-	26.7	19.1	81.8
Beryllium (Be)	ug/g	2.5	-	<0.50	<0.50	0.63
Boron (B)	ug/g	36	-	12.9	14.2	10.7
Boron (B), Hot Water Ext.	ug/g	36	-	0.16	0.15	<0.10
Cadmium (Cd)	ug/g	1.2	-	<0.50	<0.50	<0.50
Chromium (Cr)	ug/g	70	-	11.8	14.0	24.6
Cobalt (Co)	ug/g	21	-	4.7	6.4	13.2
Copper (Cu)	ug/g	92	-	18.2	14.4	24.1
Lead (Pb)	ug/g	120	-	11.2	56.6	9.8
Mercury (Hg)	ug/g	0.27	-	0.0165	0.0234	0.0130
Molybdenum (Mo)	ug/g	2	-	<1.0	<1.0	<1.0
Nickel (Ni)	ug/g	82	-	12.5	15.1	29.3
Selenium (Se)	ug/g	1.5	-	<1.0	<1.0	<1.0
Silver (Ag)	ug/g	0.5	-	<0.20	<0.20	<0.20
Thallium (Tl)	ug/g	1	-	<0.50	<0.50	<0.50
Uranium (U)	ug/g	2.5	-	<1.0	<1.0	<1.0
Vanadium (V)	ug/g	86	-	19.1	19.6	35.3
Zinc (Zn)	ug/g	290	-	34.0	37.4	59.6

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Speciated Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	L2120222-1	L2120222-2	L2120222-3	L2120222-4	L2120222-5	L2120222-6	L2120222-7	L2120222-8	L2120222-9
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH1 SS2	BH3 SS2	BH2 SS1	BH2 SS2	BH2 SS3	BH4 SS2	BH4 SS3	BH4 SS4	BH5 SS2
Chromium, Hexavalent	ug/g	0.66	-		1.01	<0.20	<0.20	0.50	0.26	<0.20	<0.20	<0.20	<0.20

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Speciated Metals - SOIL

Analyte	Unit	Guide Limits #1	Guide Limits #2	Lab ID	L2120222-10	L2120222-11	L2120222-12	L2120222-13	L2120222-14	L2120222-15	L2120222-16	L2120222-17	L2120222-18
				Sample Date	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18	22-JUN-18
				Sample ID	BH5 SS3	BH5 SS4	BH6 SS2	BH6 SS3	BH6 SS4	BH8 SS2	BH8 SS3	BH8 SS4	BH8 SS5
Chromium, Hexavalent	ug/g	0.66	-		<0.20	0.22	<0.20	<0.20	<0.20	<0.20	0.39	<0.20	0.30

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

ANALYTICAL REPORT

Speciated Metals - SOIL

		Guide Limits				
Lab ID				L2120222-19	L2120222-20	L2120222-21
Sample Date				22-JUN-18	22-JUN-18	22-JUN-18
Sample ID				BH10 SS2	BH10 SS3	BH10 SS5
Analyte	**Unit**	**#1**	**#2**			
Chromium, Hexavalent	ug/g	0.66	-	<0.20	<0.20	0.23

Guide Limit #1: T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use

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.

* Please refer to the Reference Information section for an explanation of any qualifiers noted.

Reference Information

Qualifiers for Individual Parameters Listed:

Qualifier	Description
SAR:M	Reported SAR represents a maximum value. Actual SAR may be lower if both Ca and Mg were detectable.

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)

This method uses a heated strong acid digestion with HNO3 and HCl and is intended to liberate metals that may be environmentally available. Silicate minerals are not solubilized. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. Analysis is by Collision/Reaction Cell ICPMS.

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

MOISTURE-WT	Soil	% Moisture	Gravimetric: Oven Dried
PH-WT	Soil	pH	MOEE E3137A

Reference Information

Methods Listed (if applicable):

ALS Test Code	Matrix	Test Description	Method Reference**

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

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

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

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

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.

Quality Control Report

Workorder: L2120222 Report Date: 05-JUL-18

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
B-HWS-R511-WT	**Soil**							
Batch R4110400								
WG2812102-4 DUP		**L2121112-4**						
Boron (B), Hot Water Ext.		0.33	0.31		ug/g	5.8	30	03-JUL-18
WG2812102-2 IRM		**HOTB-SAL_SOIL5**						
Boron (B), Hot Water Ext.			91.9		%		70-130	03-JUL-18
WG2812102-3 LCS								
Boron (B), Hot Water Ext.			107.3		%		70-130	03-JUL-18
WG2812102-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	03-JUL-18
Batch R4112089								
WG2811007-4 DUP		**L2120222-11**						
Boron (B), Hot Water Ext.		<0.10	<0.10	RPD-NA	ug/g	N/A	30	03-JUL-18
WG2811007-2 IRM		**HOTB-SAL_SOIL5**						
Boron (B), Hot Water Ext.			100.2		%		70-130	03-JUL-18
WG2811007-3 LCS								
Boron (B), Hot Water Ext.			108.5		%		70-130	03-JUL-18
WG2811007-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	03-JUL-18
Batch R4112108								
WG2812103-4 DUP		**L2120250-2**						
Boron (B), Hot Water Ext.		<0.10	<0.10	RPD-NA	ug/g	N/A	30	03-JUL-18
WG2812103-2 IRM		**HOTB-SAL_SOIL5**						
Boron (B), Hot Water Ext.			92.0		%		70-130	03-JUL-18
WG2812103-3 LCS								
Boron (B), Hot Water Ext.			110.2		%		70-130	03-JUL-18
WG2812103-1 MB								
Boron (B), Hot Water Ext.			<0.10		ug/g		0.1	03-JUL-18
CN-WAD-R511-WT	**Soil**							
Batch R4110089								
WG2810320-3 DUP		**L2120222-1**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	03-JUL-18
WG2810479-3 DUP		**L2120250-2**						
Cyanide, Weak Acid Diss		<0.050	<0.050	RPD-NA	ug/g	N/A	35	03-JUL-18
WG2810320-2 LCS								
Cyanide, Weak Acid Diss			93.4		%		80-120	03-JUL-18
WG2810479-2 LCS								
Cyanide, Weak Acid Diss			94.3		%		80-120	03-JUL-18
WG2810320-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	03-JUL-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CN-WAD-R511-WT	**Soil**							
Batch R4110089								
WG2810479-1 MB								
Cyanide, Weak Acid Diss			<0.050		ug/g		0.05	03-JUL-18
WG2810320-4 MS		**L2120222-1**						
Cyanide, Weak Acid Diss			102.2		%		70-130	03-JUL-18
WG2810479-4 MS		**L2120250-2**						
Cyanide, Weak Acid Diss			98.3		%		70-130	03-JUL-18
CR-CR6-IC-WT	**Soil**							
Batch R4104042								
WG2809723-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			87.8		%		70-130	29-JUN-18
WG2809723-3 DUP		**L2119759-4**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	29-JUN-18
WG2809723-2 LCS								
Chromium, Hexavalent			94.9		%		80-120	29-JUN-18
WG2809723-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	29-JUN-18
Batch R4109452								
WG2809902-4 CRM		**WT-SQC012**						
Chromium, Hexavalent			88.6		%		70-130	03-JUL-18
WG2809902-3 DUP		**L2120222-8**						
Chromium, Hexavalent		<0.20	<0.20	RPD-NA	ug/g	N/A	35	03-JUL-18
WG2809902-2 LCS								
Chromium, Hexavalent			100.0		%		80-120	03-JUL-18
WG2809902-1 MB								
Chromium, Hexavalent			<0.20		ug/g		0.2	03-JUL-18
EC-WT	**Soil**							
Batch R4110550								
WG2812107-4 DUP		**WG2812107-3**						
Conductivity		0.140	0.132		mS/cm	5.5	20	03-JUL-18
WG2812347-1 LCS								
Conductivity			98.5		%		90-110	03-JUL-18
WG2812107-1 MB								
Conductivity			<0.0040		mS/cm		0.004	03-JUL-18
Batch R4110552								
WG2811033-4 DUP		**WG2811033-3**						
Conductivity		1.68	1.50		mS/cm	11	20	03-JUL-18
WG2812346-1 LCS								

Quality Control Report

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130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
EC-WT	**Soil**							
Batch R4110552								
WG2812346-1 LCS								
Conductivity			100.0		%		90-110	03-JUL-18
WG2811033-1 MB								
Conductivity			<0.0040		mS/cm		0.004	03-JUL-18
HG-200.2-CVAA-WT	**Soil**							
Batch R4110323								
WG2810978-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			101.3		%		70-130	03-JUL-18
WG2812091-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			101.1		%		70-130	03-JUL-18
WG2812092-2 CRM		**WT-CANMET-TILL1**						
Mercury (Hg)			103.1		%		70-130	03-JUL-18
WG2810978-6 DUP		**WG2810978-5**						
Mercury (Hg)		0.0956	0.0962		ug/g	0.7	40	03-JUL-18
WG2812091-6 DUP		**WG2812091-5**						
Mercury (Hg)		0.0181	0.0175		ug/g	3.4	40	03-JUL-18
WG2812092-6 DUP		**WG2812092-5**						
Mercury (Hg)		0.0192	0.0191		ug/g	0.8	40	03-JUL-18
WG2810978-3 LCS								
Mercury (Hg)			107.0		%		80-120	03-JUL-18
WG2812091-3 LCS								
Mercury (Hg)			103.0		%		80-120	03-JUL-18
WG2812092-3 LCS								
Mercury (Hg)			105.0		%		80-120	03-JUL-18
WG2810978-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	03-JUL-18
WG2812091-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	03-JUL-18
WG2812092-1 MB								
Mercury (Hg)			<0.0050		mg/kg		0.005	03-JUL-18
MET-200.2-CCMS-WT	**Soil**							
Batch R4111872								
WG2812091-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			98.0		%		70-130	03-JUL-18
Arsenic (As)			104.4		%		70-130	03-JUL-18
Barium (Ba)			103.2		%		70-130	03-JUL-18
Beryllium (Be)			92.6		%		70-130	03-JUL-18

Quality Control Report

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130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4111872								
WG2812091-2 CRM		**WT-CANMET-TILL1**						
Boron (B)			2.7		mg/kg		0-8.2	03-JUL-18
Cadmium (Cd)			101.7		%		70-130	03-JUL-18
Chromium (Cr)			100.8		%		70-130	03-JUL-18
Cobalt (Co)			103.1		%		70-130	03-JUL-18
Copper (Cu)			104.3		%		70-130	03-JUL-18
Lead (Pb)			100.6		%		70-130	03-JUL-18
Molybdenum (Mo)			98.0		%		70-130	03-JUL-18
Nickel (Ni)			102.2		%		70-130	03-JUL-18
Selenium (Se)			0.27		mg/kg		0.11-0.51	03-JUL-18
Silver (Ag)			0.23		mg/kg		0.13-0.33	03-JUL-18
Thallium (Tl)			0.118		mg/kg		0.077-0.18	03-JUL-18
Uranium (U)			102.5		%		70-130	03-JUL-18
Vanadium (V)			100.6		%		70-130	03-JUL-18
Zinc (Zn)			102.1		%		70-130	03-JUL-18
WG2812091-6 DUP		**WG2812091-5**						
Antimony (Sb)		0.13	0.14		ug/g	9.8	30	03-JUL-18
Arsenic (As)		6.08	6.82		ug/g	12	30	03-JUL-18
Barium (Ba)		44.3	49.4		ug/g	11	40	03-JUL-18
Beryllium (Be)		0.43	0.54		ug/g	23	30	03-JUL-18
Boron (B)		6.3	7.7		ug/g	20	30	03-JUL-18
Cadmium (Cd)		0.078	0.094		ug/g	18	30	03-JUL-18
Chromium (Cr)		16.5	18.3		ug/g	10	30	03-JUL-18
Cobalt (Co)		9.48	10.8		ug/g	13	30	03-JUL-18
Copper (Cu)		29.3	33.0		ug/g	12	30	03-JUL-18
Lead (Pb)		8.22	8.92		ug/g	8.1	40	03-JUL-18
Molybdenum (Mo)		0.36	0.39		ug/g	9.0	40	03-JUL-18
Nickel (Ni)		20.3	22.7		ug/g	12	30	03-JUL-18
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	03-JUL-18
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	03-JUL-18
Thallium (Tl)		0.086	0.099		ug/g	13	30	03-JUL-18
Uranium (U)		0.469	0.522		ug/g	11	30	03-JUL-18
Vanadium (V)		23.5	27.6		ug/g	16	30	03-JUL-18
Zinc (Zn)		49.0	55.6		ug/g	13	30	03-JUL-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
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Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4111872								
WG2812091-4 LCS								
Antimony (Sb)			106.6		%		80-120	03-JUL-18
Arsenic (As)			102.4		%		80-120	03-JUL-18
Barium (Ba)			101.3		%		80-120	03-JUL-18
Beryllium (Be)			90.2		%		80-120	03-JUL-18
Boron (B)			87.8		%		80-120	03-JUL-18
Cadmium (Cd)			101.3		%		80-120	03-JUL-18
Chromium (Cr)			99.8		%		80-120	03-JUL-18
Cobalt (Co)			99.7		%		80-120	03-JUL-18
Copper (Cu)			99.8		%		80-120	03-JUL-18
Lead (Pb)			101.9		%		80-120	03-JUL-18
Molybdenum (Mo)			98.1		%		80-120	03-JUL-18
Nickel (Ni)			99.97		%		80-120	03-JUL-18
Selenium (Se)			102.5		%		80-120	03-JUL-18
Silver (Ag)			100.4		%		80-120	03-JUL-18
Thallium (Tl)			98.4		%		80-120	03-JUL-18
Uranium (U)			102.6		%		80-120	03-JUL-18
Vanadium (V)			103.5		%		80-120	03-JUL-18
Zinc (Zn)			95.0		%		80-120	03-JUL-18
WG2812091-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	03-JUL-18
Arsenic (As)			<0.10		mg/kg		0.1	03-JUL-18
Barium (Ba)			<0.50		mg/kg		0.5	03-JUL-18
Beryllium (Be)			<0.10		mg/kg		0.1	03-JUL-18
Boron (B)			<5.0		mg/kg		5	03-JUL-18
Cadmium (Cd)			<0.020		mg/kg		0.02	03-JUL-18
Chromium (Cr)			<0.50		mg/kg		0.5	03-JUL-18
Cobalt (Co)			<0.10		mg/kg		0.1	03-JUL-18
Copper (Cu)			<0.50		mg/kg		0.5	03-JUL-18
Lead (Pb)			<0.50		mg/kg		0.5	03-JUL-18
Molybdenum (Mo)			<0.10		mg/kg		0.1	03-JUL-18
Nickel (Ni)			<0.50		mg/kg		0.5	03-JUL-18
Selenium (Se)			<0.20		mg/kg		0.2	03-JUL-18
Silver (Ag)			<0.10		mg/kg		0.1	03-JUL-18
Thallium (Tl)			<0.050		mg/kg		0.05	03-JUL-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4111872								
WG2812091-1 MB								
Uranium (U)			<0.050		mg/kg		0.05	03-JUL-18
Vanadium (V)			<0.20		mg/kg		0.2	03-JUL-18
Zinc (Zn)			<2.0		mg/kg		2	03-JUL-18
Batch R4111909								
WG2812092-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			111.9		%		70-130	03-JUL-18
Arsenic (As)			119.5		%		70-130	03-JUL-18
Barium (Ba)			119.9		%		70-130	03-JUL-18
Beryllium (Be)			95.8		%		70-130	03-JUL-18
Boron (B)			3.1		mg/kg		0-8.2	03-JUL-18
Cadmium (Cd)			118.7		%		70-130	03-JUL-18
Chromium (Cr)			115.7		%		70-130	03-JUL-18
Cobalt (Co)			118.1		%		70-130	03-JUL-18
Copper (Cu)			120.0		%		70-130	03-JUL-18
Lead (Pb)			113.2		%		70-130	03-JUL-18
Molybdenum (Mo)			106.8		%		70-130	03-JUL-18
Nickel (Ni)			118.0		%		70-130	03-JUL-18
Selenium (Se)			0.39		mg/kg		0.11-0.51	03-JUL-18
Silver (Ag)			0.26		mg/kg		0.13-0.33	03-JUL-18
Thallium (Tl)			0.141		mg/kg		0.077-0.18	03-JUL-18
Uranium (U)			115.0		%		70-130	03-JUL-18
Vanadium (V)			118.9		%		70-130	03-JUL-18
Zinc (Zn)			119.7		%		70-130	03-JUL-18
WG2812092-6 DUP		**WG2812092-5**						
Antimony (Sb)		0.14	0.12		ug/g	18	30	03-JUL-18
Arsenic (As)		7.33	5.92		ug/g	21	30	03-JUL-18
Barium (Ba)		55.7	44.6		ug/g	22	40	03-JUL-18
Beryllium (Be)		0.54	0.42		ug/g	24	30	03-JUL-18
Boron (B)		7.7	6.3		ug/g	21	30	03-JUL-18
Cadmium (Cd)		0.080	0.073		ug/g	8.8	30	03-JUL-18
Chromium (Cr)		19.2	15.5		ug/g	22	30	03-JUL-18
Cobalt (Co)		11.3	9.08		ug/g	22	30	03-JUL-18
Copper (Cu)		32.2	26.1		ug/g	21	30	03-JUL-18
Lead (Pb)		9.00	7.50		ug/g	18	40	03-JUL-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4111909								
WG2812092-6 DUP		**WG2812092-5**						
Molybdenum (Mo)		0.40	0.33		ug/g	19	40	03-JUL-18
Nickel (Ni)		24.3	19.5		ug/g	22	30	03-JUL-18
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	03-JUL-18
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	03-JUL-18
Thallium (Tl)		0.093	0.072		ug/g	26	30	03-JUL-18
Uranium (U)		0.603	0.512		ug/g	16	30	03-JUL-18
Vanadium (V)		27.7	22.3		ug/g	22	30	03-JUL-18
Zinc (Zn)		55.3	44.5		ug/g	22	30	03-JUL-18
WG2812092-4 LCS								
Antimony (Sb)			111.7		%		80-120	03-JUL-18
Arsenic (As)			116.8		%		80-120	03-JUL-18
Barium (Ba)			114.8		%		80-120	03-JUL-18
Beryllium (Be)			101.0		%		80-120	03-JUL-18
Boron (B)			95.1		%		80-120	03-JUL-18
Cadmium (Cd)			108.1		%		80-120	03-JUL-18
Chromium (Cr)			113.5		%		80-120	03-JUL-18
Cobalt (Co)			113.3		%		80-120	03-JUL-18
Copper (Cu)			112.6		%		80-120	03-JUL-18
Lead (Pb)			111.2		%		80-120	03-JUL-18
Molybdenum (Mo)			106.3		%		80-120	03-JUL-18
Nickel (Ni)			113.4		%		80-120	03-JUL-18
Selenium (Se)			115.9		%		80-120	03-JUL-18
Silver (Ag)			105.7		%		80-120	03-JUL-18
Thallium (Tl)			108.8		%		80-120	03-JUL-18
Uranium (U)			114.1		%		80-120	03-JUL-18
Vanadium (V)			117.1		%		80-120	03-JUL-18
Zinc (Zn)			110.5		%		80-120	03-JUL-18
WG2812092-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	03-JUL-18
Arsenic (As)			<0.10		mg/kg		0.1	03-JUL-18
Barium (Ba)			<0.50		mg/kg		0.5	03-JUL-18
Beryllium (Be)			<0.10		mg/kg		0.1	03-JUL-18
Boron (B)			<5.0		mg/kg		5	03-JUL-18
Cadmium (Cd)			<0.020		mg/kg		0.02	03-JUL-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4111909								
WG2812092-1 MB								
Chromium (Cr)			<0.50		mg/kg		0.5	03-JUL-18
Cobalt (Co)			<0.10		mg/kg		0.1	03-JUL-18
Copper (Cu)			<0.50		mg/kg		0.5	03-JUL-18
Lead (Pb)			<0.50		mg/kg		0.5	03-JUL-18
Molybdenum (Mo)			<0.10		mg/kg		0.1	03-JUL-18
Nickel (Ni)			<0.50		mg/kg		0.5	03-JUL-18
Selenium (Se)			<0.20		mg/kg		0.2	03-JUL-18
Silver (Ag)			<0.10		mg/kg		0.1	03-JUL-18
Thallium (Tl)			<0.050		mg/kg		0.05	03-JUL-18
Uranium (U)			<0.050		mg/kg		0.05	03-JUL-18
Vanadium (V)			<0.20		mg/kg		0.2	03-JUL-18
Zinc (Zn)			<2.0		mg/kg		2	03-JUL-18
Batch R4111915								
WG2810978-2 CRM		**WT-CANMET-TILL1**						
Antimony (Sb)			103.0		%		70-130	03-JUL-18
Arsenic (As)			110.3		%		70-130	03-JUL-18
Barium (Ba)			110.1		%		70-130	03-JUL-18
Beryllium (Be)			97.3		%		70-130	03-JUL-18
Boron (B)			5.4		mg/kg		0-8.2	03-JUL-18
Cadmium (Cd)			105.7		%		70-130	03-JUL-18
Chromium (Cr)			107.9		%		70-130	03-JUL-18
Cobalt (Co)			108.6		%		70-130	03-JUL-18
Copper (Cu)			110.3		%		70-130	03-JUL-18
Lead (Pb)			104.9		%		70-130	03-JUL-18
Molybdenum (Mo)			103.2		%		70-130	03-JUL-18
Nickel (Ni)			108.8		%		70-130	03-JUL-18
Selenium (Se)			0.35		mg/kg		0.11-0.51	03-JUL-18
Silver (Ag)			0.24		mg/kg		0.13-0.33	03-JUL-18
Thallium (Tl)			0.128		mg/kg		0.077-0.18	03-JUL-18
Uranium (U)			105.9		%		70-130	03-JUL-18
Vanadium (V)			107.1		%		70-130	03-JUL-18
Zinc (Zn)			109.4		%		70-130	03-JUL-18
WG2810978-6 DUP		**WG2810978-5**						
Antimony (Sb)		0.31	0.38		ug/g	21	30	03-JUL-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4111915								
WG2810978-6 DUP		**WG2810978-5**						
Arsenic (As)		1.59	1.92		ug/g	19	30	03-JUL-18
Barium (Ba)		20.6	23.7		ug/g	14	40	03-JUL-18
Beryllium (Be)		0.13	0.16		ug/g	25	30	03-JUL-18
Boron (B)		<5.0	<5.0	RPD-NA	ug/g	N/A	30	03-JUL-18
Cadmium (Cd)		0.084	0.096		ug/g	13	30	03-JUL-18
Chromium (Cr)		6.58	8.15		ug/g	21	30	03-JUL-18
Cobalt (Co)		2.31	2.79		ug/g	19	30	03-JUL-18
Copper (Cu)		7.96	9.60		ug/g	19	30	03-JUL-18
Lead (Pb)		21.3	23.0		ug/g	7.4	40	03-JUL-18
Molybdenum (Mo)		0.73	0.83		ug/g	13	40	03-JUL-18
Nickel (Ni)		4.48	5.61		ug/g	22	30	03-JUL-18
Selenium (Se)		<0.20	<0.20	RPD-NA	ug/g	N/A	30	03-JUL-18
Silver (Ag)		<0.10	<0.10	RPD-NA	ug/g	N/A	40	03-JUL-18
Thallium (Tl)		<0.050	<0.050	RPD-NA	ug/g	N/A	30	03-JUL-18
Uranium (U)		0.292	0.322		ug/g	9.7	30	03-JUL-18
Vanadium (V)		13.9	16.4		ug/g	17	30	03-JUL-18
Zinc (Zn)		32.1	40.3		ug/g	23	30	03-JUL-18
WG2810978-4 LCS								
Antimony (Sb)			103.7		%		80-120	03-JUL-18
Arsenic (As)			106.4		%		80-120	03-JUL-18
Barium (Ba)			107.5		%		80-120	03-JUL-18
Beryllium (Be)			97.4		%		80-120	03-JUL-18
Boron (B)			88.7		%		80-120	03-JUL-18
Cadmium (Cd)			104.8		%		80-120	03-JUL-18
Chromium (Cr)			106.9		%		80-120	03-JUL-18
Cobalt (Co)			107.0		%		80-120	03-JUL-18
Copper (Cu)			106.9		%		80-120	03-JUL-18
Lead (Pb)			106.8		%		80-120	03-JUL-18
Molybdenum (Mo)			100.8		%		80-120	03-JUL-18
Nickel (Ni)			107.3		%		80-120	03-JUL-18
Selenium (Se)			105.1		%		80-120	03-JUL-18
Silver (Ag)			101.3		%		80-120	03-JUL-18
Thallium (Tl)			103.9		%		80-120	03-JUL-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MET-200.2-CCMS-WT	**Soil**							
Batch R4111915								
WG2810978-4 LCS								
Uranium (U)			106.9		%		80-120	03-JUL-18
Vanadium (V)			110.6		%		80-120	03-JUL-18
Zinc (Zn)			103.6		%		80-120	03-JUL-18
WG2810978-1 MB								
Antimony (Sb)			<0.10		mg/kg		0.1	03-JUL-18
Arsenic (As)			<0.10		mg/kg		0.1	03-JUL-18
Barium (Ba)			1.05	B	mg/kg		0.5	03-JUL-18
Beryllium (Be)			<0.10		mg/kg		0.1	03-JUL-18
Boron (B)			<5.0		mg/kg		5	03-JUL-18
Cadmium (Cd)			<0.020		mg/kg		0.02	03-JUL-18
Chromium (Cr)			<0.50		mg/kg		0.5	03-JUL-18
Cobalt (Co)			<0.10		mg/kg		0.1	03-JUL-18
Copper (Cu)			<0.50		mg/kg		0.5	03-JUL-18
Lead (Pb)			<0.50		mg/kg		0.5	03-JUL-18
Molybdenum (Mo)			<0.10		mg/kg		0.1	03-JUL-18
Nickel (Ni)			<0.50		mg/kg		0.5	03-JUL-18
Selenium (Se)			<0.20		mg/kg		0.2	03-JUL-18
Silver (Ag)			<0.10		mg/kg		0.1	03-JUL-18
Thallium (Tl)			<0.050		mg/kg		0.05	03-JUL-18
Uranium (U)			<0.050		mg/kg		0.05	03-JUL-18
Vanadium (V)			<0.20		mg/kg		0.2	03-JUL-18
Zinc (Zn)			<2.0		mg/kg		2	03-JUL-18
MOISTURE-WT	**Soil**							
Batch R4102688								
WG2810111-3 DUP		**L2120219-9**						
% Moisture		15.2	15.3		%	0.7	20	29-JUN-18
WG2810111-2 LCS								
% Moisture			99.5		%		90-110	29-JUN-18
WG2810111-1 MB								
% Moisture			<0.10		%		0.1	29-JUN-18
Batch R4108989								
WG2810565-3 DUP		**L2121208-1**						
% Moisture		23.2	22.6		%	2.3	20	30-JUN-18
WG2810565-2 LCS								
% Moisture			99.97		%		90-110	30-JUN-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
MOISTURE-WT	**Soil**							
Batch R4108989								
WG2810565-1 MB								
% Moisture			<0.10		%		0.1	30-JUN-18
Batch R4109014								
WG2810417-3 DUP		**L2121054-7**						
% Moisture		10.6	10.2		%	4.0	20	30-JUN-18
WG2810417-2 LCS								
% Moisture			99.99		%		90-110	30-JUN-18
WG2810417-1 MB								
% Moisture			<0.10		%		0.1	30-JUN-18
PH-WT	**Soil**							
Batch R4104387								
WG2809820-1 DUP		**L2120222-4**						
pH		7.46	7.45	J	pH units	0.01	0.3	29-JUN-18
WG2810503-1 LCS								
pH			6.95		pH units		6.9-7.1	29-JUN-18
Batch R4105748								
WG2810007-1 DUP		**L2120249-8**						
pH		7.72	7.75	J	pH units	0.03	0.3	29-JUN-18
WG2810508-1 LCS								
pH			6.94		pH units		6.9-7.1	29-JUN-18
SAR-R511-WT	**Soil**							
Batch R4112111								
WG2812107-4 DUP		**WG2812107-3**						
Calcium (Ca)		4.2	3.8		mg/L	10	30	03-JUL-18
Sodium (Na)		9.1	10.7		mg/L	16	30	03-JUL-18
Magnesium (Mg)		<1.0	<1.0	RPD-NA	mg/L	N/A	30	03-JUL-18
WG2812107-2 IRM		**WT SAR2**						
Calcium (Ca)			111.0		%		70-130	03-JUL-18
Sodium (Na)			96.0		%		70-130	03-JUL-18
Magnesium (Mg)			109.3		%		70-130	03-JUL-18
WG2812107-1 MB								
Calcium (Ca)			<1.0		mg/L		1	03-JUL-18
Sodium (Na)			<1.0		mg/L		1	03-JUL-18
Magnesium (Mg)			<1.0		mg/L		1	03-JUL-18

Quality Control Report

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
SAR-R511-WT	**Soil**							
Batch R4112338								
WG2811033-4 DUP		**WG2811033-3**						
Calcium (Ca)		7.1	7.7		mg/L	8.4	30	04-JUL-18
Sodium (Na)		353	366		mg/L	3.7	30	04-JUL-18
Magnesium (Mg)		1.1	1.9	J	mg/L	0.8	2	04-JUL-18
WG2811033-2 IRM		**WT SAR2**						
Calcium (Ca)			96.3		%		70-130	03-JUL-18
Sodium (Na)			88.1		%		70-130	03-JUL-18
Magnesium (Mg)			92.4		%		70-130	03-JUL-18
WG2811033-1 MB								
Calcium (Ca)			<1.0		mg/L		1	03-JUL-18
Sodium (Na)			<1.0		mg/L		1	03-JUL-18
Magnesium (Mg)			<1.0		mg/L		1	03-JUL-18

Quality Control Report

Workorder: L2120222 Report Date: 05-JUL-18

Client: Soil Mat Engineers & Consulting Ltd. (Hamilton)
130 Lancing Drive
Hamilton ON L8W 3A1
Contact: Kyle Richardson

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
B	Method Blank exceeds ALS DQO. Associated sample results which are < Limit of Reporting or > 5 times blank level are considered reliable.
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.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2120222-COFC

COC Number: 17 -

Page 1 of 2

Report To	Contact and company name below will appear on the final report	Report Format / Distribution
Company:	Soil-Mat Engineers	Select Report Format: ☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Contact:	Kyle Richardson	Quality Control (QC) Report with Report ☑ YES ☐ NO
Phone:	905-318-7440	☐ Compare Results to Criteria on Report - provide details below if box checked
	Company address below will appear on the final report	Select Distribution: ☑ EMAIL ☐ MAIL ☐ FAX
Street:	130 Lancing Drive	Email 1 or Fax Kyle Richardson
City/Province:	Hamilton	Email 2
Postal Code:	L8W 3A1	Email 3
Invoice To	Same as Report To ☐ YES ☐ NO	**Invoice Distribution**
	Copy of Invoice with Report ☐ YES ☐ NO	Select Invoice Distribution: ☐ EMAIL ☐ MAIL ☐ FAX
Company:		Email 1 or Fax
Contact:		Email 2

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:	186337	Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:		Location:	
ALS Lab Work Order # (lab use only):	L2120222	ALS Contact:	Sampler:

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E1 - 100%] ☐ | Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs:

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals and Inorganics	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
1	BH1 SS2	22-06-18	8:00	S	✓			
2	BH3 SS2		8:15		✓			
3	BH2 SS1		8:25		✓			
4	BH2 SS2		8:35		✓			
5	BH2 SS3		8:45		✓			
6	BH4 SS2		9:22		✓			
7	BH4 SS3		9:25		✓			
8	BH4 SS4		9:32		✓			
9	BH5 SS2		9:55		✓			
10	BH5 SS3		10:05		✓			
11	BH5 SS4		10:10		✓			
12	BH6 SS2		10:20		✓			

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	Ontario Regulation 153/04 - April 15, 2011 Standards Table 1
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				18.7			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date: JUNE 27/18	Time: 17:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a **Regulated Drinking Water (DW) System**, please submit using an **Authorized DW COC form**.

Chain of Custody (COC) / Analytical Request Form

ALS Environmental
www.alsglobal.com

Canada Toll Free: 1 800 668 9878

L2120222-COFC

COC Number: 17 -

Report To	Contact and company name below will appear on the final report
Company:	Soil-Mat Engineers
Contact:	Kyle Richardson
Phone:	905-318-7440
	Company address below will appear on the final report
Street:	130 Lancing Drive
City/Province:	Hamilton
Postal Code:	L8W 3A1
Invoice To	Same as Report To ☐ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☐ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☑ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	Kyle Richardson
Email 2	
Email 3	

Invoice Distribution	
Select Invoice Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	
Email 2	

Project Information	
ALS Account # / Quote #:	
Job #:	180337
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only):	L2120222 07C

Oil and Gas Required Fields (client use)	
AFE/Cost Center:	PO#:
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler:

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E1 - 100%] ☐ | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hr:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Metals and Inorganics	SAMPLES ON HOLD	Sample is hazardous (please provide further details)	NUMBER OF CONTAINERS
13	BH6 553	22-06-18	10:30	S	✓			
14	BH6 554		10:38		✓			
15	BH8552		11:55		✓			
16	BH8553		11:57		✓			
17	BH8 554		12:02		✓			
18	BH8 555		12:06		✓			
19	BH 10 552		1:36		✓			
20	BH10553		1:40		✓			
21	BH 10 555		1:50		✓			

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

Ontario Regulation 153/04 - April 15, 2011 Standards Table 1

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				18.7			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date: JUNE 27/18	Time: 17:30

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

SEPT 2017 FRONT

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.