GEOTECHNICAL INVESTIGATION

2650 MAYFIELD ROAD
CALEDON, ONTARIO

project nº 161-01959-00

Prepared for:

Lormel Joint Venture Inc.

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1 INTRODUCTION

WSP Canada Inc. (WSP) was retained by Lormel Joint Venture Inc. to undertake a geotechnical investigation for the proposed residential subdivision located at 2650 Mayfield Road, Caledon, Ontario.

It is understood that the project will entail a residential subdivision consisting of single family houses, serviced with roads and underground services. A new Storm Water Management (SWM) Pond will be constructed at the south end of the site.

The purpose of this geotechnical investigation is to obtain information about the subsurface conditions by means of fifteen (15) boreholes and from the findings in the boreholes to make recommendations pertaining to the geotechnical design of underground utilities, SWM Pond and subdivision roads and to comment on the foundation conditions for general house construction.

This report will deals with the geotechnical aspect of the investigation only. The chemical test results will be submitted under separate cover.

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

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

This report has been prepared for Lormel Joint Venture Inc. and its designers. Third party use of this report without WSP consent is prohibited.

2 FIELD AND LABORATORY WORK

Fifteen boreholes (BH16-1 to BH16-15) were drilled to depth of 7.4 m to 9.6 m with solid stem continuous flight auger equipment by a drilling sub-contractor under the direction and supervision of WSP's personnel. Samples were retrieved at regular intervals with a 50 mm O.D. split-barrel sampler driven with a hammer weighing 624 N and dropping 760 mm in accordance with the Standard Penetration Test (SPT) method. The samples were logged in the field and returned to the WSP's laboratory for detailed examination by the project engineer and for laboratory testing.

As well as visual examination in the laboratory, all soil samples were tested for moisture contents.

Water level observations were made during drilling and in the open boreholes at the completion of the drilling operations. Monitoring wells of 50 mm diameter were installed in Boreholes BH16-1, BH16-4, BH16-5, BH16-13, BH16-14 and BH16-15 for long-term groundwater level monitoring.

Upon completion of the fieldwork, the ground surface elevations at the borehole locations were measured by WSP personnel using a differential GPS and were referenced to a Monument Station BM 042050257, with a geodetic elevation of 254.978 m.

3 SITE AND SUBSURFACE CONDITION

The borehole location plan is shown on Drawing 1. General comments on the sample descriptions are presented on Drawing 1A. The subsurface conditions in the boreholes are presented in the individual borehole logs (Drawings 2 to 16 inclusive) and can be summarized as follow.

3.1 SOIL CONDITIONS

Topsoil: Topsoil with a thickness ranging from 150 mm to 450 mm was encountered surficially in all boreholes. The thickness of the topsoil in each borehole is shown in the borehole logs. It should be noted that the thickness of the topsoil at these borehole locations may not be representative for the site and should not be relied on to calculate the amount of topsoil at the site.

Fill: Beneath the topsoil, fill material was encountered in all boreholes. The general depths of the fill ranged from 0.7 m to 0.9 m except for BH16-11 where the fill extended to a depth of 4.7 m. The fill generally consisted of silty clay/clayey silt with organics material or asphalt. The fill was generally moist, and in a soft to stiff consistency with a measured SPT 'N" value varying from 3 to 12 blows per 300 mm penetration.

Silty Clay Till to Clayey Silt Till: Cohesive silty clay to clayey silt glacial tills were encountered underlying the topsoil or fill material in all boreholes and extend to the bottom of the exploration, with sandy silt till/silty clay interbedded in some boreholes. The silty clay till/clayey silt till was presented in stiff to hard consistency, with measured SPT 'N' values ranging from 14 to over 30 blows per 300mm of penetration. Water contents measured in the samples range from 7% to 18%.

Grain size analyses of three clayey silt till to silty clay till samples (BH16-1/SS5, BH16-6/SS6 and BH16-10/SS6) were conducted and the results are presented in Drawing 17, with the following fractions:

Clay:	17% to 21%
Silt:	44% to 49%
Sand:	22% to 33%
Gravel:	6% to 8%

Atterberg Limit tests of these three silty clay till samples (BH16-1/SS5, BH16-6/SS6 and BH16-10/SS6) were conducted. The results are shown on the respective borehole logs and are summarized as follows:

Liquid Limit (WL):	21% to 24%
Plastic Limit (WP):	14%
Plasticity Index (PI):	7 to 10

The soil is classified as clayey silt to Silty Clay of low plasticity (CL).

Grain size analysis of one clayey silt till samples (BH16-15/SS6) was conducted and the result is presented in Drawing 17, with the following fractions:

Clay: 19%
Silt: 67%
Sand: 12%
Gravel: 2%

Atterberg Limit tests of this clayey silt till samples (BH16-15/SS6) were conducted. The results are shown on the respective borehole logs and are summarized as follows:

Liquid Limit (WL): 22%
Plastic Limit (WP): 15%
Plasticity Index (PI): 7

The soil is classified as clayey silt of low plasticity (CL-ML).

Silty Clay: Cohesive silty clay layers were encountered below or interbedded within clayey glacial till in some boreholes. SPT 'N' values in the silty clay were in the range of 15 to greater than 30 blows per 300mm penetration, corresponding to very stiff to hard consistency. Water contents were measured in the test samples to range from 12% to 30%.

One (1) tested sample of silty clay (BH16-13/SS7) contain 1% gravel, 8% sand, 67% silt and 24% clay size particles. The grain size distribution curve for the sample is presented on drawing 17 of this report.

Consistency (Atterberg) limits test on the silty clay sample (BH16-13/SS7) indicates a Liquid Limit of 25, a Plastic Limit of 16 and a Plasticity Index of 9. The soil is classified as low plasticity Silty Clay (CL) based on the Unified Soil Classification System.

Sandy Silt Till/Sandy Silt/Silty Sand Till: Fine to coarse graded silty sand to sandy silt glacial tills were encountered in compact to very dense conditions generally interbedded within or below clayey glacial till in BH16-1, BH16-3 to BH16-8, BH16-12 and BH16-15. The natural moisture content measured in the test samples ranged from 6% to 16%.

From the frequent grinding of augers during drilling and the high SPT N-values, we infer that cobbles and boulders are plentiful within the sandy silt / silty sand glacial till.

Two (2) tested samples of silty sand till (BH16-7/SS5 and BH16-12/SS6) contain 8% to 10% gravel, 43% to 44% sand, 38% to 40% silt and 8% to 9% clay size particles. The grain size distribution curves for the samples are presented on drawing 18.

Till/Shale Complex: Clayey silt to silty clay till/shale complex was encountered in Boreholes BH16-1, BH16-2, BH16-4, BH16-7, BH16-13 and BH16-14. The "till/shale complex" consists of a rather heterogeneous, hard clayey silt to silty clay till matrix containing extensive broken bedrock (shale, limestone and siltstone) slabs and fragments. This stratum was reportedly difficult to auger due to the fragmented shale/limestone/siltstone content and it is in very dense/hard condition. Water content was measured in the test samples to range from 7% to 13%.

3.2 GROUNDWATER CONDITIONS

Six (6) monitoring wells were installed for the longer-term monitoring of groundwater level. The piezometric levels were measured on March 9, 2016 at depths of 0.3 m to 1.6 m below existing grade (Elev. 253.7 m to 258.2 m). The water levels were re-measured on March 30, 2016 after the wells being completely emptied by pumping on March 29, 2016. Over the long term, seasonal fluctuations in the groundwater level are expected. For design and construction purposes, a seasonal water table variability of plus or minus 1 metre should be assumed.

Groundwater level in the monitoring wells is shown on the attached borehole logs and also summarized on Table 3.2.

Table 3.2 – Measured Water Levels in Monitoring Wells

WELL ID	DIAMETER (MM)	GROUND SURFACE ELEV. (M)	SOIL TYPE AT SCREEN LOCATION (DEPTH)	DATE OF MEASUREMENT	WATER LEVEL DEPTH (M)	WATER LEVEL ELEVATION (M)
BH16-1	50	259.5	Sandy silty till, silty clay till (4.6m – 7.6m)	March 9, 2016 March 30, 2016	1.3 1.6	258.2 257.9
BH16-4	50	258.5	Clayey silt till, sandy silt till (3.1m – 6.1m)	March 9, 2016 March 30, 2016	1.5 1.6	257.0 256.9
BH16-5	50	257.5	Silty clay till, sandy silt till, clayey silt till (4.6m – 7.6m)	March 9, 2016 March 30, 2016	0.5 0.8	256.9 256.6
BH16-13	50	258.7	Silty clay, clayey silt till/shale complex (6.1m – 9.1m)	March 9, 2016	1.5 2.2	257.2 256.6
BH16-14	50	255.3	Silty clay (till), sandy silt till (3.1m – 6.1m)	March 9, 2016	0.3 Damaged	255.0
BH16-15	50	254.4	Silty clay till, clayey silt (3.1m – 6.1m)	March 9, 2016	0.7 0.7	253.7 253.7

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4 DISCUSSION AND RECOMMENDATIONS

In general, the field exploration revealed that below the firm to very stiff reworked / disturbed soil layer, the site is predominantly underlain by stiff to hard silty clay till/clayey silt tills deposits and interbedded by very dense silty sand till/sandy silt till. A layer of till/shale complex was also encountered in some boreholes. Groundwater was encountered in the process of drilling as well as in monitoring wells.

It is proposed to develop the site as a residential subdivision. The lots will be serviced by a network of roads, storm and sanitary sewers and watermains. A new Storm Water Management (SWM) Pond will be constructed at the south end of the site.

4.1 ROADS

The investigation has shown that the predominant subgrade soil after stripping loose surface material (reworked / disturbed) and un-compacted fill (if any), will generally consist of compacted fill or silty clay till deposit.

Based on the above and assuming that traffic usage will be residential minor local or local, the following minimum pavement thickness is recommended:

For 18m Wide Local Streets

40 mm HL3 Asphaltic Concrete
65 mm HL8 Asphaltic Concrete
150 mm Granular ‘A’
300 mm Granular ‘B’

For 22m Wide Collector Local Streets

40 mm HL3 Asphaltic Concrete
90 mm HL8 Asphaltic Concrete
150 mm Granular ‘A’
450 mm Granular ‘B’

For 26m Wide ROW

40 mm DFC
90 mm HDBC
150 mm Granular ‘A’
450 mm Granular ‘B’

The site subgrade and weather conditions (i.e. if wet) at the time of construction may necessitate the placement of geogrid/filter fabric and/or thicker granular sub-base layer in order to facilitate the construction. Furthermore, heavy construction equipment may have to be kept off the newly constructed roads before the placement of asphalt and/or immediately thereafter, to avoid damaging the weak subgrade by heavy truck traffic.

4.1.1 STRIPPING, SUB-EXCAVATION AND GRADING

The site should be stripped off all topsoil (if any); loose fill and any organic or otherwise unsuitable soils to the full depth of the roads, both in cut and fill areas under roads.

Following stripping, the site should be graded to the subgrade level and approved. The subgrade should then be proof-rolled, in the presence of the Geotechnical Engineer, by at least several passes of a heavy compactor having a rated capacity of at least 8 tonnes. Any soft spots thus exposed should be removed and replaced by select fill material, similar to the existing subgrade soil and approved by the Geotechnical Engineer. The subgrade should then be re-compacted from the surface to at least 98% of its Standard Proctor Maximum Dry Density (SPMDD). The final subgrade should be cambered or otherwise shaped properly to facilitate rapid drainage and to prevent the formation of local depressions in which water could accumulate.

Due to the clayey (i.e. impervious) nature of the subsoil in the upper portions, proper cambering and allowing the water to escape towards the sides (where it can be removed by means of sub-drains) is considered to be beneficial for this project. Otherwise, any water collected in the granular sub-base materials could be trapped thus causing problems due to softened subgrade, differential frost heave, etc. For the same reason damaging the subgrade during and after placement of the granular materials by heavy construction traffic should be avoided. If the moisture content of the local material cannot be maintained at ±2% of the optimum moisture content, imported granular material may be required.

Any fill required for regrading the site or backfill should be select, clean material, free of topsoil, organic or other foreign and unsuitable matter. The fill should be placed in layers and compacted to at least 95% of its SPMDD. The degree of compaction should be increased to 98% within the top 1.0 m of the subgrade. The compaction of the new fill should be checked by sufficient number of field compaction tests.

4.1.2 CONSTRUCTION

Once the subgrade has been inspected and approved, the granular base and sub-base course materials should be placed in layers not exceeding 200mm (uncompacted thickness) and should be

compacted to at least 100% of their respective SPMDD. The grading of the material should conform to current OPS Specifications.

The placing, spreading and rolling of the asphalt should be in accordance with OPS Specifications or, as required by the local authorities.

Frequent field compaction tests should be carried out on both the asphalt and granular base and sub-base materials to ensure that the required degree of compaction is achieved.

4.1.3 DRAINAGE

Installation of full-length sub-drains is required on all roads. The sub-drains should be properly filtered to prevent the loss of (and clogging by) soil fines.

All paved surfaces should be sloped to provide satisfactory drainage towards Catch Basins. As discussed in Section 4.1.1, by means of good planning any water trapped in the granular sub-base materials should be drained rapidly towards sub-drains or other interceptors.

4.2 SEWERS

As a part of the site development, a network of new storm and sanitary sewers is to be constructed.

4.2.1 TRENCHING

As no detail drawing is available for us at the time of writing this report, we estimated that trenches will probably be 3 m to 5 m below the existing ground levels,

As indicated in the boreholes, the trenches will be dug through the fill and silty clay (till)/clayey silt till (sandy silt till/silty sand till in BH16-1, BH16-4, BH16-5, BH16-7, BH16-8 and BH16-12). Based on the borehole information, dewatering will be required prior to any excavation in the sandy silt to silty sand deposits below the water table.

It should be noted that the till is a non-sorted sediment and therefore may contain boulders. Possible large obstructions such as buried concrete pieces are also anticipated in the fill material. Provisions must be made in the excavation contract for the removal of possible boulders in the till or obstructions in the fill material.

Any loose fill or other unsuitable material below the pipe invert level must be removed and replaced with inorganic material compacted to at least 95% of its Standard Proctor Maximum Dry Density (SPMDD) and to 98% of SPMDD within 0.5 m below the pipe invert level.

All excavations must be carried out in accordance with the most recent Occupational Health and Safety Act (OHSA). In accordance with OHSA, the fill and stiff silty clay above the water table can be classified as Type 3 soils. Fill below groundwater table or in perched water can be classified as Type 4 soil. The very stiff to hard silty clay till and clayey silt deposits above the water table are classified as Type 2 soils and as Type 3 soil below the ground water table. The sandy silt to silty sand deposit can be classified as Type 3 soil above ground and as Type 4 soil below groundwater.

4.2.2 BEDDING

The undisturbed very stiff to hard silty clay till/ very dense sandy silt till as described in Section 3.1 of this report will provide adequate support for the sewer pipes and allow the use of normal Class B type bedding. The recommended minimum thickness of granular bedding below the invert of the pipes is 150mm. The thickness of the bedding may, however, have to be increased depending on the pipe diameter or if wet or weak subgrade conditions are encountered. The bedding material should consist of well graded granular material such as Granular 'A' or equivalent. After installing the pipe on the bedding, a granular surround of approved bedding material, which extends at least 300mm above the obvert of the pipe, or as set out by the local Authority, should be placed.

To avoid the loss of soil fines from the subgrade, uniformly graded clear stone should not be used unless, below the granular bedding material, a suitable, approved filter fabric (geotextile) is placed. The geotextile should extend along the sides of the trench and should be wrapped all around the poorly (i.e. uniformly) graded bedding material.

4.2.3 BACKFILLING OF TRENCHES

Based on visual and tactile examination, the on-site excavated organic free silty clay/silty clay till/clayey silt till deposits can generally be re-used as backfill in the service trenches provided their moisture contents at the time of construction are at or near optimum.

The silty clay till is likely to be excavated in cohesive chunks or blocks and will be difficult to compact in confined areas. For use as backfill, the clayey material will have to pulverized and placed in thin layers. The clayey soils will have to be compacted using heavy equipment suitable for these soils which may be difficult to operate in the narrow confines of the trenches. Unless the clayey materials are properly pulverized and compacted in sufficiently thin lifts post-construction settlements could occur.

The backfill should be placed in maximum 200mm thick layers at or near (±2%) their optimum moisture content, and each layer should be compacted to at least 95% SPMDD. The range of compaction should be increased to at least 98% SPMDD for the top 1.2 m subgrade in pavement area. Unsuitable materials such as organic soils, boulders, cobbles, frozen soils, etc. should not be used for backfilling.

The on-site excavated soils and especially the clayey soils should not be used in confined areas (e.g. around catch basins and laterals under roadways) where heavy compaction equipment cannot be operated. The use of imported granular fill together with an appropriate frost taper would be preferable in confined areas and around structures, such as catch basins.

4.3 ENGINEERED FILL

In the areas where earth fill is required for site grading purposes, an engineered fill may be constructed below house foundations, roads, boulevards, etc.

General guidelines for the placement and preparation of engineered fill are presented on Appendix A. A geotechnical reaction of 150 KPa at the Serviceability Limit States (SLS), and a factored geotechnical resistance of 225 KPa at the Ultimate Limit States (ULS) can be used on engineered fill, provided all requirements on the Appendix be adhered to. To reduce the risk of improperly placed engineered compacted fill, full-time supervision of the contractor is essential. Despite full time supervision, it has been found that contractors frequently bulldoze loose fill into areas and compact only the surface. The owner and his representatives must accept the risk involved in the use of engineered fill and offset this risk with the monetary savings of avoiding deep foundations. This potential problem must be recognized and discussed at a pre-construction meeting. Procedures can then be instigated to reduce the risk of settlement resulting from un-compacted fill.

The following is a recommended procedure for an engineered fill:

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and WSP Canada Inc. Without this confirmation no responsibility for the performance of the structure can be accepted by WSP. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped off all topsoil, all loose fill materials and any organic or otherwise unsuitable soils. Subgrade must be proofrolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a engineer from WSP prior to placement of fill.

5. The approved engineered fill must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Granular Fill preferred. Engineered fill should not be placed (where it will support footings) during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur.

6. Full-time geotechnical inspection by WSP during placement of engineered fill is required. Work cannot commence or continue without the presence of the WSP representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2m. The base of the compacted pad extends 2m plus the depth of excavation beyond the edge of the footing.

8. A geotechnical reaction of 150 KPa at the serviceability limit states (SLS), and a factored geotechnical resistance of 225 KPa at the ultimate limit states (ULS) can be used on engineered fill, provided that all requirements on Appendix A are adhered to. A minimum footing width of 500 mm (20inches) is suggested and footings should be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

10. After completion of the pad a second contractor may be selected to install footings. All excavations must be backfilled under full time supervision by WSP to the same degree as

the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of SPL Consultants.

11. After completion of compaction, the surface of the pad must be protected from disturbance from traffic, rain and frost.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

The inorganic silt, sandy silt, silt and sand, sand and clayey silt to silty clay are considered suitable for use as engineered fill, provided that their moisture contents at the time of construction are at or near optimum. Soils excavated from below the groundwater level will have higher than optimum in-situ moisture content, and will have to be aerated prior to use as engineered fill. It is therefore imperative that the earth works are carried out in summer months, at favorable conditions, so there is an opportunity to aerate the soils prior to their re-use. As mentioned before in Section 4.2.3 of this report, the clayey silt to silty clay is likely to be excavated in cohesive chunks or blocks and will be difficult to compact. It should be pulverized and placed in thin layers not exceeding 150 to 200 mm and compacted using heavy equipment suitable for these types of soils (e.g. heavy sheepsfoot compactors).

4.4 HOUSE FOUNDATIONS

The proposed normal single family dwellings can be supported by spread and strip footings founded on undisturbed native soil or engineered fill for a bearing capacity of 150 KPa at the Serviceability Limit States (SLS) and for a factored geotechnical resistance of 225 KPa at the Ultimate Limit States (ULS). The requirements for engineered fill are presented in Appendix B.

The existing fill is not suitable for the supporting of house foundation. The existing fill must be sub-excavated and replaced with engineered fill.

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

Provided that the founding soil is undisturbed during construction, total and differential settlements of foundations designed and constructed in accordance with the specified design bearing values should not exceed 25 mm and 19mm respectively.

In the vicinity of the existing buried utilities, all footings must be lowered to undisturbed native soils, or alternatively the services must be structurally bridged.

During winter construction, foundations and slab on grades must not be poured on frozen soil. Foundations must be adequately protected at all times from cold weather and freezing conditions.

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

All footings exposed to seasonal freezing conditions should be provided with at least 1.2m of earth cover or equivalent thermal insulation against frost.

4.5 EARTH PRESSURE ON PERMANENT WALLS

The lateral earth pressures acting on basement walls or possible retaining walls may be calculated from the following expression:

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

Where p = Lateral earth pressure in KPa acting at depth h

K = Earth pressure coefficient equal to 0.4 for vertical walls and horizontal Granular B backfill used for permanent construction. Water pressure must be considered, if continuous mira-drains are not used.

γ = Unit weight of backfill, a value of 20.5 KN/m3 may be assumed

h = Depth to point of interest in meters

q = Equivalent value of surcharge on the ground surface in KPa

The above expression assumes that the perimeter drainage system prevents the buildup of any hydrostatic pressure behind the wall.

4.6 STORM WATER MANAGEMENT PONDS

It is understood that a Storm Water Management Pond (SWMP) will be constructed at the south end of the site, within the vicinity of BH16-13 and BH16-14. The design normal water level and bottom elevation of SWMP are not known to WSP at the time of writing this report.

The existing grade is about 258.7 m at BH16-13 and 255.3 m at BH16-14. The measured water level is at elevation 257.2 m and 255.0 m respectively.

As the site is characterized by a high water table as typically indicated in Boreholes BH16-13 and BH16-14, we recommend that the elevation of the bottom of the ponds be kept as high as possible for the ease of construction and for stability considerations. The pond can be constructed by excavation to design elevation. Temporary dewatering might be required for construction of the SWMP.

The existing silty clay to clayey silt till deposits contain layers of silty sand. If the pond need to be designed as water-tight, then the pond can be water-tightened by one of the following methods:

- Covering the surface of pond with flexible membrane such as vinyl liner or similar products.
- Constructing a minimum 500 mm thick clay liner compacted to 100% Standard Proctor Maximum Dry Density (SPMDD).

Selected on site clayey silt to silty clay deposit as encountered in the boreholes might be suitable for reuse as backfill for the clay liner, provided laboratory testing on the excavated material is to be carried out to confirm that the material has at least 22% of clay content and a minimum Plasticity Index (PI) of 7%. During the construction stage, this office should be retained to inspect the excavation base and to confirm the suitability of the excavated material for re-use as backfill.

We recommend that the side slopes be no steeper than 3H:1V above water level and 4H:1V below water table and should be adequately protected against erosion. The cut slope and the liner must be re-inspected during excavation to confirm the cohesive silty clay deposit.

5 GENERAL COMMENTS AND LIMITATIONS OF REPORT

WSP should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, WSP will assume no responsibility for interpretation of the recommendations in the report.

The comments given in this report are intended only for the guidance of designer. The number of boreholes required to determine the localized underground conditions between test holes (i.e. boreholes and/or test pits) affecting construction costs, techniques, sequencing, equipment, scheduling, etc., would be much greater than has been carried out for design purposes. The number of test holes may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. Contractors bidding on or undertaking the works should, in this light, decide on their own investigations, as well as their own interpretations of the factual borehole and test pit results, so that they may draw their own conclusions as to how the subsurface conditions may affect them.

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

The conclusions and recommendations given in this report are based on the information determined at the test-hole location only. The Subsurface soil and groundwater conditions beyond the test hole may differ from those encountered at the test hole location, and these variable conditions may become apparent during construction, which could not be detected or anticipated at the time of the site investigation. The benchmark and elevations used in this report are primarily to establish relative elevation differences between the test-hole locations and should not be used for other purposes, such as grading, excavating, planning, development, etc.

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

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

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

Regards,

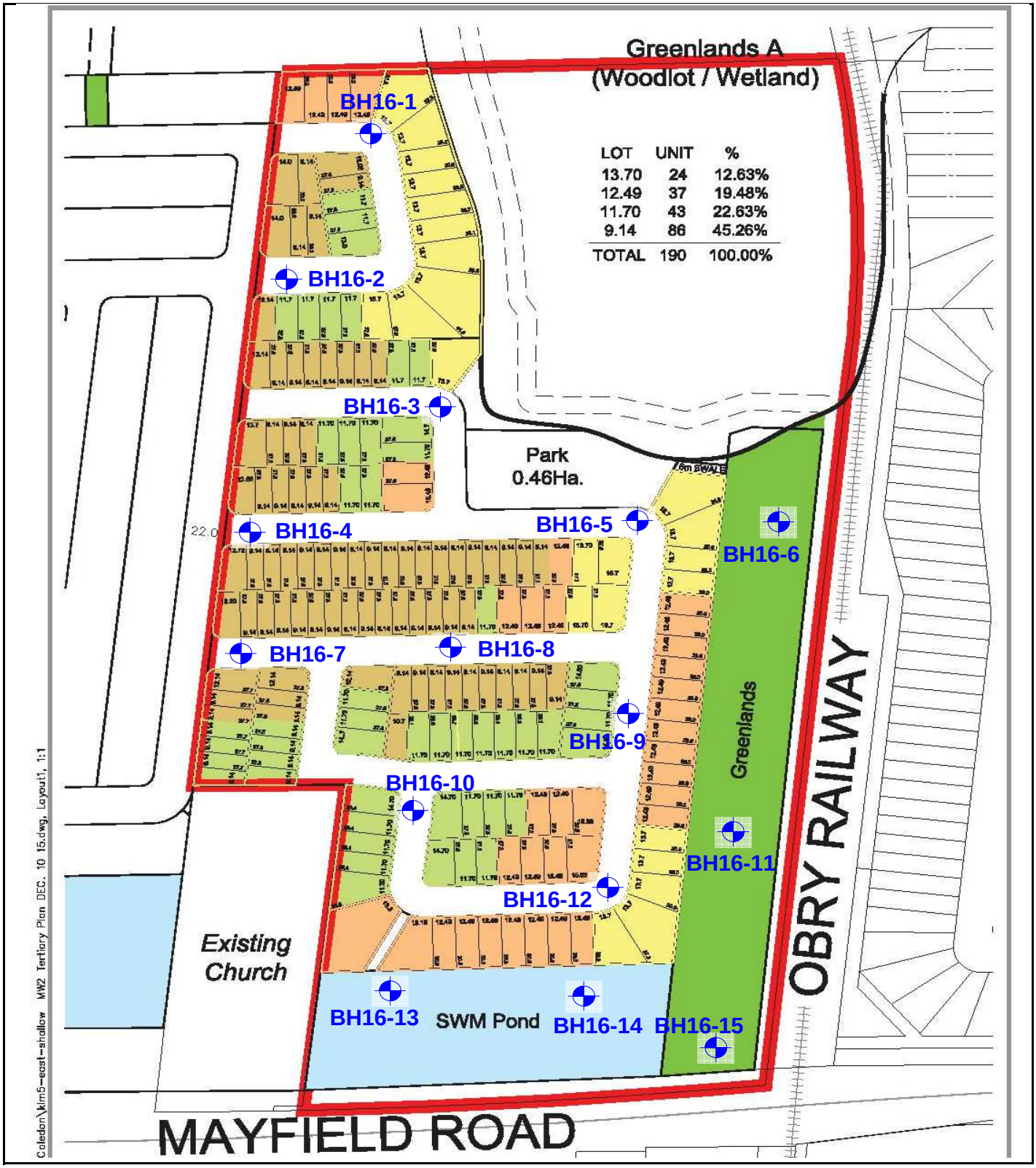
WSP Canada Inc

Thomas Yan, B. Eng., P.Eng.

Fanyu Zhu, Ph.D., P.Eng.

Shabbir Bandukwala, M.Eng., P.Eng.

Drawings



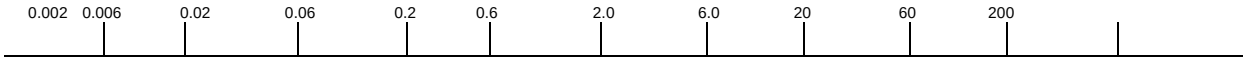
Client:	Lormel Ioint Venture Inc.		Project No:	161-01959-00	Drawing No: 1
Drawn:	TY	Approved: NW	Title:	Borehole Location Plan	
Date:	23-Mar-16	Scale: N.T.S	Project:	Geotechnical Investigation, 2650 Mayfield Road Caledon, ON	
Original Size:	Letter	Rev: N/A	WSP	WSP CANADA INC.	

Drawing 1A: Notes On Sample Descriptions

1. All sample descriptions included in this report generally follow the Unified Soil Classification. Laboratory grain size analyses provided by SPL also follow the same system. Different classification systems may be used by others, such as the system by the International Society for Soil Mechanics and Foundation Engineering (ISSMFE). Please note that, with the exception of those samples where a grain size analysis and/or Atterberg Limits testing have been made, all samples are classified visually. Visual classification is not sufficiently accurate to provide exact grain sizing or precise differentiation between size classification systems.

ISSMFE SOIL CLASSIFICATION

CLAY	SILT			SAND			GRAVEL			COBBLES	BOULDERS
	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE	FINE	MEDIUM	COARSE		



EQUIVALENT GRAIN DIAMETER IN MILLIMETRES

CLAY (PLASTIC) TO	FINE	MEDIUM	CRS.	FINE	COARSE
SILT (NONPLASTIC)	SAND			GRAVEL	

UNIFIED SOIL CLASSIFICATION

2. Fill: Where fill is designated on the borehole log it is defined as indicated by the sample recovered during the boring process. The reader is cautioned that fills are heterogeneous in nature and variable in density or degree of compaction. The borehole description may therefore not be applicable as a general description of site fill materials. All fills should be expected to contain obstruction such as wood, large concrete pieces or subsurface basements, floors, tanks, etc., none of these may have been encountered in the boreholes. Since boreholes cannot accurately define the contents of the fill, test pits are recommended to provide supplementary information. Despite the use of test pits, the heterogeneous nature of fill will leave some ambiguity as to the exact composition of the fill. Most fills contain pockets, seams, or layers of organically contaminated soil. This organic material can result in the generation of methane gas and/or significant ongoing and future settlements. Fill at this site may have been monitored for the presence of methane gas and, if so, the results are given on the borehole logs. The monitoring process does not indicate the volume of gas that can be potentially generated nor does it pinpoint the source of the gas. These readings are to advise of the presence of gas only, and a detailed study is recommended for sites where any explosive gas/methane is detected. Some fill material may be contaminated by toxic/hazardous waste that renders it unacceptable for deposition in any but designated land fill sites; unless specifically stated the fill on this site has not been tested for contaminants that may be considered toxic or hazardous. This testing and a potential hazard study can be undertaken if requested. In most residential/commercial areas undergoing reconstruction, buried oil tanks are common and are generally not detected in a conventional preliminary geotechnical site investigation.

3. Till: The term till on the borehole logs indicates that the material originates from a geological process associated with glaciation. Because of this geological process the till must be considered heterogeneous in composition and as such may contain pockets and/or seams of material such as sand, gravel, silt or clay. Till often contains cobbles (60 to 200 mm) or boulders (over 200 mm). Contractors may therefore encounter cobbles and boulders during excavation, even if they are not indicated by the borings. It should be appreciated that normal sampling equipment cannot differentiate the size or type of any obstruction. Because of the horizontal and vertical variability of till, the sample description may be applicable to a very limited zone; caution is therefore essential when dealing with sensitive excavations or dewatering programs in till materials.

LOG OF BOREHOLE BH16-1

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842655.41 E 593645.86

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/02/2016

REF. NO.: 161-01959-00
ENCL NO.: 2

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.5											
0.0 / 259.0	**TOPSOIL:** 450mm	1	SS	6		259					
0.5 / 258.7	**FILL:** silty clay, some sand, trace gravel, trace organics, brown, moist, firm.										
0.8	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard. oxidized between 0.8m to 2.9m	2	SS	16	▽						
		3	SS	16	▽				200		
	contain sandy silt seams between 2.3m to 2.9m	4	SS	34		257			>225		
	sandy, grey below 3.0m	5	SS	31		256			>225	23.2	8 22 49 21
255.4											
4.1 / 253.8	**SANDY SILT TILL:** trace to some clay, trace gravel, grey, moist, very dense.	6	SS	60		255					
5.6 / 252.3	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand to sandy, trace gravel, trace shale fragments, reddish brown, moist, hard.	7	SS	62		254					
7.2 / 251.6	**SILTY CLAY TILL / SHALE COMPLEX:** sandy, trace gravel, contain shale/limestone fragments, reddish brown, moist, hard.	8	SS	50/ 125mm		253					
7.9	**END OF BOREHOLE**					252					

W. L. 258.2 m Mar 09, 2016
W. L. 257.9 m Mar 30, 2016
Holeplug
Sand
Screen
Sand

Notes:
1) Borehole was open upon completion.
2) 50mm dia. monitoring well was installed upon completion.
3) Water Level Readings:

Date	W. L. Depth (m)
Mar. 09, 2016	1.30
Mar. 30, 2016	1.57

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH16-2

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842498.96 E 593788.13

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Feb/29/2016

REF. NO.: 161-01959-00
ENCL NO.: 3

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.1								2 4 6 8 10	10 20 30			
0.0 / 258.8	**TOPSOIL:** 300mm						259					
0.3 / 258.3	**FILL:** silty clay, some sand to sandy, trace gravel, trace organics, brown, moist, firm.		1	SS	6							
0.8	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, oxidized, brown, moist, very stiff.		2	SS	17		258			>225		
1			3	SS	19					>225		
2							257					
			4	SS	29					>225		
3 256.0												
3.1	**CLAYEY SILT TILL:** sandy, trace gravel, grey, moist, very stiff to hard.		5	SS	25		256					
4							255					
	400mm sandy silt till layer		6	SS	49							
5 253.4							254					
5.6	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand to sandy, trace gravel, trace shale fragments, reddish brown, moist, very stiff.		7	SS	27		253					spoon wet
7 251.9							252					
7.2 / 251.3	**SILTY CLAY TILL / SHALE COMPLEX:** some sand, trace gravel, contain shale fragments, reddish brown, moist, hard.		8	SS	100/ initial 125mm							
7.8	**END OF BOREHOLE** Notes: 1) Borehole was open upon completion. 2) Water level was at 6.1m during drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH16-3

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842385.71 E 593784.74

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/01/2016

REF. NO.: 161-01959-00
ENCL NO.: 4

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
260.2									
260.0	**TOPSOIL:** 150mm								
0.2	**FILL:** silty clay, some sand, trace gravel, trace organics, brown, moist, stiff to very stiff.	1	SS	8		260			
259.3									
0.9	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff. oxidized between 0.9m to 3.6m	2	SS	16		259			
		3	SS	23			>225		
		4	SS	25		258	>225		
	brown to grey below 3.0m	5	SS	27		257	>225		
	trace shale fragments, gey below 4.6m	6	SS	16		256			
254.6						255			
5.6	**SANDY SILT TILL:** trace clay, trace gravel, grey, moist to wet, compact.	7	SS	27		254			spoon wet
253.7									
6.6	**CLAYEY SILT TILL:** some sand to sandy, trace gravel, trace shale/limestone fragments, reddish brown, moist, very stiff to hard.					253			
		8	SS	90/ 300mm					
252.2									
8.1	**END OF BOREHOLE** Notes: 1) Borehole was open upon completion. 2) Water level was at 7.0m during drilling.								

Head Space Combustible Vapor Reading (ppm): 2, 4, 6, 8, 10

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

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH16-4

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842385.93 E 593784.85

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Feb/29/2016

REF. NO.: 161-01959-00
ENCL NO.: 5

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	Head Space Combustible Vapor Reading (ppm)	WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
258.5										
258.0	**TOPSOIL:** 150mm									
0.2	**FILL:** silty clay, trace sand, trace gravel, trace organics, brown, moist, stiff.	1	SS	12	258					
257.6										
0.9	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, stiff to hard. oxidized between 0.9m to 2.9m	2	SS	14						
		3	SS	21	257			>225		
	some sand to sandy, greyish brown below 2.3m	4	SS	33	256			>225		
	gey below 4.6m contain clayey silt layers between 3.0m to 3.6m	5	SS	18	255					
253.8					254					
4.7	**SANDY SILT TILL:** trace clay, trace gravel, reddish brown, moist to wet, compact.	6	SS	23						spoon wet
252.9					253					
5.6	**SILTY CLAY TILL / SHALE COMPLEX:** some sand, trace gravel, contain shale fragments, reddish brown, moist, hard.	7	SS	61	252					
250.8		8	SS	100/ initial 75mm	251					
7.7	trace limestone fragments below 7.6m									
	END OF BOREHOLE									

Notes:
1) Borehole was open upon completion.
2) 50mm dia. monitoring well was installed upon completion.
3) Water Level Readings:

Date	W. L. Depth (m)
Mar. 09, 2016	1.50
Mar. 30, 2016	1.57

Holeplug
W. L. 257.0 m
Mar 09, 2016
Sand
Screen
Sand
Holeplug

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH16-5

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842538.51 E 593896.97

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/03/2016

REF. NO.: 161-01959-00
ENCL NO.: 6

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS "N" 0.3 m	ELEVATION
257.5 / 0.0	**TOPSOIL:** 300mm				
257.2 / 0.3	**FILL:** silty clay, some sand, trace gravel, trace organics, brown, moist, firm to very stiff.	1	SS	4	
256.6 / 0.9	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, oxidized, brown, moist, very stiff to hard.	2	SS	21	257
		3	SS	23	256
	contain silty sand seams/layers below 2.3m	4T			Holeplug
254.9 / 2.6	**SANDY SILT:** trace clay, trace gravel, dilatant, grey, saturated, dense.	4B	SS	36	255
254.3 / 3.2	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand to sandy, trace gravel, brown to grey, moist, very stiff.	5T			
		5B	SS	30	254
	contain silt layers, grey below 4.6m	6	SS	19	Sand
252.3 / 5.2	**SANDY SILT TILL:** trace clay, trace gravel, grey, moist to wet, very dense.				252
251.2 / 6.3	**CLAYEY SILT TILL:** sandy, trace gravel, trace shale/limestone fragments, grey, moist, hard.	7T			Screen
		7B	SS	52	251
	reddish brown below 7.6m				250
249.2 / 8.2	**END OF BOREHOLE**	8	SS	67	Sand

Notes:
1) Borehole was open upon completion.
2) 50mm dia. monitoring well was installed upon completion.
3) Water Level Readings:

Date	W. L. Depth (m)
Mar. 09, 2016	0.55
Mar. 30, 2016	0.85

GROUND WATER CONDITIONS: W. L. 256.9 m Mar 09, 2016; W. L. 256.6 m Mar 30, 2016

Head Space Combustible Vapor Reading (ppm): 2, 4, 6, 8, 10

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

POCKET PEN. (Cu) (kPa): >225 at 0.9 m

NATURAL UNIT WT (kN/m³)

REMARKS AND GRAIN SIZE DISTRIBUTION (%)
GR SA SI CL
spoon wet at 6.3 m

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH16-6

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842329.18 E 593831.82

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/03/2016

REF. NO.: 161-01959-00
ENCL NO.: 7

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
258.8								2 4 6 8 10	10 20 30			
0.0 / 258.5	**TOPSOIL:** 300mm		1	SS	4							
0.3 / 258.1	**FILL:** silty clay, trace sand, trace gravel, trace organics, brown, moist, firm.											
0.8	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard.		2	SS	37		258					
	oxidized between 0.8m to 3.6m											
	cobbles/ boulders(inferred)		3	SS	17		257					
			4	SS	44					225		
							256					
	cobbles/ boulders(inferred)		5	SS	45							
							255					
	sandy, grey below 4.6m		6	SS	21		254			225	22.9	6 29 46 19
							253					
	contain silt seams below 6.1m		7	SS	20					175		
251.7							252					
7.2 / 251.0	**SANDY SILT TILL:** trace clay, trace gravel, grey, moist, very dense.		8	SS	50/ 100mm		251					
7.9	**END OF BOREHOLE** Note: 1) Borehole was open upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH16-7

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842538.41 E 593897.09

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/01/2016

REF. NO.: 161-01959-00
ENCL NO.: 8

ELEV / DEPTH (m)	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
256.9								2 4 6 8 10	10 20 30			
256.7 / 0.0	**TOPSOIL:** 200mm											
0.2 / 256.0	**FILL:** silty clay, some sand, trace gravel, trace organics, brown, moist, firm to very stiff.		1	SS	4							
0.9	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, oxidized, brown, moist, very stiff.		2	SS	16		256					
	contain wet clayey silt layers below 1.5m		3	SS	50/ 125mm		255					cobbles /boulders(inferred)
254.5			4T									
2.4	**SILTY SAND TILL:** trace clay, trace gravel, trace shale fragments, contain silty sand seams/layers, brown, wet to moist, very dense.		4B	SS	83/ 300mm							spoon wet
	reddish brown below 3.0m		5	SS	53		254					8 44 40 8
252.7							253					
4.3	**CLAYEY SILT TILL:** some sand to sandy, trace gravel, trace shale fragments, reddish brown, moist, hard.		6	SS	64		252					auger grinding about 20 min,cobbles /boulders(inferred)
251.6												
5.3	**CLAYEY SILT TILL / SHALE COMPLEX:** some sand to sandy, trace gravel, contain shale/limestone fragments, reddish brown, moist, hard.		7	SS	50/ 25mm		251					
249.6							250					auger refusal
7.4	**END OF BOREHOLE**		8	NR	50/ initial 50mm							

Notes:
1)Auger refusal at 2.3m, Borehole was moved 0.5m west from original location.
2) Borehole was open upon completion.
3) Water level was at 7.0m during drilling.

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; $\circ^{\varepsilon=3\%}$ Strain at Failure

WSP SOIL LOG /W VOC 0~12 PPM-2016 161-01959-00(APR.4.2016).GPJ SPL.GDT 16/4/13

LOG OF BOREHOLE BH16-8

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842673.12 E 593909.07

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/01/2016

REF. NO.: 161-01959-00
ENCL NO.: 9

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
258.2											
0.0 / 257.8	**TOPSOIL:** 400mm	1	SS	8		258					
0.4 / 257.4	**FILL:** silty clay, trace sand, trace gravel, trace organics, greyish brown, moist, firm to stiff.										
0.8	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, oxidized, brown, moist, very stiff.	2	SS	22		257					
		3	SS	20					>225		
	contain sand seams below 2.3m					256					
		4	SS	25					>225		
	greyish brown below 3.0m										
		5	SS	39		255			>225		
254.1											
4.1	**SANDY SILT TILL:** trace to some clay, trace gravel, trace shale/limestone fragments, reddish grey, moist, very dense.	6	SS	50/ 150mm		254					
						253					
		7	SS	50/ initial 150mm		252					
251.5											
6.7	**SILTY CLAY TILL:** some sand to sandy, trace gravel, trace shale fragments, reddish brown, moist, hard.					251					
		8	SS	80/ 300mm							spoon wet
250.1											
8.1	**END OF BOREHOLE** Notes: 1) Borehole was open upon completion. 2) Water level was at 7.6m during drilling.										

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

LOG OF BOREHOLE BH16-9

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842329.18 E 593831.82

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/03/2016

REF. NO.: 161-01959-00
ENCL NO.: 10

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	POCKET PEN. (Cu) (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
257.8							
0.0 / 257.4	**TOPSOIL:** 350mm	1	SS	7			
0.4 / 257.0	**FILL:** silty clay, some sand, trace gravel, trace organics, brown, moist, firm.						
0.8	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff. oxidized between 0.8m to 3.6m	2	SS	21	257		
		3	SS	20	256	225	
		4	SS	20	255		
	greyish brown below 4.6m	5	SS	26		>225	
	grey below 4.6m	6	SS	15	254		
252.1					253		
5.6	**SILTY CLAY:** trace sand, trace gravel, contain silt layers and sandy silt seams, grey, moist, very stiff.	7	SS	26	252	>225	
250.6					251		
7.2	**CLAYEY SILT TILL:** sandy, trace gravel, trace shale/limestone fragments, reddish brown, moist to wet, hard.	8	SS	85	250		spoon wet
249.5							
8.2	**END OF BOREHOLE** Notes: 1) Borehole was open upon completion. 2) Water level was at 7.3m during drilling.						

Head Space Combustible Vapor Reading (ppm): 2, 4, 6, 8, 10

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

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH16-10

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842420.16 E 593899.57

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Feb/29/2016

REF. NO.: 161-01959-00
ENCL NO.: 11

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS "N" 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
259.8								2 4 6 8 10	10 20 30			
0.0 / 259.8	**TOPSOIL:** 200mm											
0.2 / 259.0	**FILL:** silty clay with sand and gravel layers, some sand, trace asphalt pieces, trace organics, dark brown to brown, moist, stiff.		1	SS	14							
0.8	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, stiff to very stiff.		2	SS	9		259					
	oxidized between 0.8m to 3.6m											
	cobbles /boulders(inferred)		3	SS	27		258			>225		
			4	SS	24					>225		
	contain sand layers between 3.0m to 3.6m		5	SS	27		257			>225		
							256					
	sandy, grey below 4.6m		6	SS	18		255			>225	22.9	6 33 44 17
254.2												
5.6	**CLAYEY SILT TILL:** sandy, trace gravel, reddish grey, moist, hard.		7	SS	42		254					
							253					
	trace shale/limestone fragments, reddish brown below 7.6m		8	SS	85/ 300mm		252					
251.7												
8.1	**END OF BOREHOLE** Note: 1) Borehole was open upon completion.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES
$+^{3}$, $\times^{3}$: Numbers refer to Sensitivity
○ ε=3% Strain at Failure

LOG OF BOREHOLE BH16-11

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842453.49 E 593983.83

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/03/2016

REF. NO.: 161-01959-00
ENCL NO.: 12

(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
256.7								2 4 6 8 10	10 20 30			
0.0 / 256.5	**TOPSOIL:** 200mm											
0.2 / 255.9	**FILL:** silty sand, trace clay, trace gravel, trace asphalt pieces, brown, moist, firm to stiff.		1	SS	8		256					
0.8	**FILL:** silty clay to clayey silt, some sand to sandy, trace to some gravel, trace organics, brown, moist, stiff to soft.		2	SS	6							
	wet between 1.5m to 2.9m		3	SS	12		255					
			4	SS	5		254					
			5	SS	3		253					
252.0												
4.7 / 251.1	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand to sandy, trace gravel, grey, moist, hard.		6	SS	35		252					
5.6	**SILTY CLAY:** trace sand, occasional gravel, contain silt seams/layers, grey, wet, very stiff to hard.		7	SS	30		251			100		
249.5							250					
7.2 / 248.8	**CLAYEY SILT TILL:** sandy, trace gravel, grey to reddish brown , moist, hard.		8	SS	50/ 125mm		249					
7.9	**END OF BOREHOLE** Notes: 1) Borehole was open upon completion. 2) Water level was at 5.2m during drilling.											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

GRAPH NOTES: $+^3$, $\times^3$: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure

WSP SOIL LOG /W VOC 0~12 PPM-2016 161-01959-00(APR.4.2016).GPJ SPL.GDT 16/4/13

LOG OF BOREHOLE BH16-12

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842343.58 E 593963.17

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/04/2016

REF. NO.: 161-01959-00
ENCL NO.: 13

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	POCKET PEN. (Cu) (kPa)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
255.6							
0.0 / 255.3	**TOPSOIL:** 300mm	1	SS	5			
0.3 / 254.9	**FILL:** silty clay, some sand, trace gravel, trace organics, brown, moist, firm.				255		
0.8	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard. oxidized between 0.8m to 2.1m	2	SS	24			
	contain silty sand seams below 1.5m	3	SS	28	254	>225	
	grey below 2.3m	4	SS	34	253	>225	
		5	SS	19			
251.5					252		
4.1	**SILTY SAND TILL:** trace to some gravel, trace clay, grey, moist, dense to very dense.	6	SS	31	251		10 43 38 9
	contain silty clay till layers and silt seams, trace shale fragments, reddish brown below 6.1m	7	SS	70	250		
248.5					249		
7.2	**SILTY CLAY TILL:** some sand, trace gravel, trace shale fragments, reddish brown, moist, hard.	8	SS	80/ 300mm	248		
247.5							
8.1	**END OF BOREHOLE** Note: 1) Borehole was open upon completion.						

Head Space Combustible Vapor Reading (ppm): 2 4 6 8 10

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

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH16-13

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842485.25 E 594073.61

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/04/2016

REF. NO.: 161-01959-00
ENCL NO.: 14

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L — WATER CONTENT (%)	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
258.7							2 4 6 8 10	10 20 30			
0.0 / 258.4	**TOPSOIL:** 300mm	1	SS	4							
0.3 / 257.8	**FILL:** silty clay, some sand to sandy, trace gravel, trace organics, brown, moist, firm to very stiff.	2	SS	18		258					
0.9	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff. oxidized between 0.9m to 3.6m	3	SS	25	W. L. 257.2 m Mar 09, 2016				>225		
		4	SS	20	W. L. 256.6 m Mar 30, 2016	256			>225		
		5	SS	30	Holeplug				>225		
	grey below 4.6m	6	SS	17		255					
253.1						254					
5.6	**SILTY CLAY:** trace sand, trace gravel, grey, moist, very stiff.	7	SS	19	Sand	253				21.6	1 8 67 24
251.6						252					
7.2	**CLAYEY SILT TILL:** sandy, trace gravel, trace shale fragments, reddish brown, moist, hard.	8	SS	58	Screen	251					
250.0						250					
8.7	**CLAYEY SILT TILL / SHALE COMPLEX:** some sand to sandy , trace gravel, contain shale fragments, reddish brown, moist, hard.	9	SS	87/ 275m	Sand						
249.2											
9.6	**END OF BOREHOLE** Note: 1) Borehole was open upon										

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842485.25 E 594073.61

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/04/2016

REF. NO.: 161-01959-00
ENCL NO.: 14

SOIL PROFILE (m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES "N" BLOWS 0.3 m	GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm) 2 4 6 8 10	PLASTIC LIMIT w_P / NATURAL MOISTURE CONTENT w / LIQUID LIMIT w_L WATER CONTENT (%) 10 20 30	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
	completion. 2) 50mm dia. monitoring well was installed upon completion. 3) Water Level Readings: Date W. L. Depth (m) Mar. 09, 2016 1.57 Mar. 30, 2016 2.17											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH16-14

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842317.82 E 594024.87

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/04/2016

REF. NO.: 161-01959-00
ENCL NO.: 15

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION
255.3					
0.0 / 254.9	**TOPSOIL:** 400mm	1	SS	4	255
0.4 / 254.5	**FILL:** silty clay, trace sand, trace gravel, trace organics, brown, moist, firm.				
0.8	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff to hard. oxidized between 0.8m to 2.9m	2	SS	22	
		3	SS	20	254
		4	SS	41	253
	contain silty sand layers, grey below 3.0m	5	SS	28	252
251.2					
4.1 / 249.7	**SILTY CLAY:** trace sand, contain silt seams/layers, grey, moist, stiff to very stiff.	6	SS	15	251
5.6 / 248.1	**SANDY SILT TILL:** trace to some clay, trace gravel, trace shale fragments, reddish brown, moist, very dense.	7	SS	50/ initail 150mm	250
7.2 / 246.6	**CLAYEY SILT TILL:** sandy, trace gravel, trace shale fragments, reddish brown, moist, hard.	8	SS	80/ 300mm	248
8.7 / 246.1	**CLAYEY SILT TILL / SHALE COMPLEX:** sandy , trace gravel, contain shale fragments, reddish brown, moist, hard.				247
9.2	**END OF BOREHOLE** Notes: 1) Borehole was open upon completion. 2) 50mm dia. monitoring well was	9	SS	50/ initail 75mm	

W. L. 255.0 m Mar 09, 2016
Holeplug
Sand
Screen
Sand
Holeplug

Head Space Combustible Vapor Reading (ppm): 2, 4, 6, 8, 10

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

POCKET PEN. (Cu) (kPa): >225, >225, 125

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

Continued Next Page

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

WSP SOIL LOG /W VOC 0~12 PPM-2016 161-01959-00(APR.4.2016).GPJ SPL.GDT 16/4/13

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842317.82 E 594024.87

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/04/2016

REF. NO.: 161-01959-00
ENCL NO.: 15

SOIL PROFILE			SAMPLES			GROUND WATER CONDITIONS	ELEVATION	Head Space Combustible Vapor Reading (ppm)	PLASTIC LIMIT / NATURAL MOISTURE CONTENT / LIQUID LIMIT	POCKET PEN. (Cu) (kPa)	NATURAL UNIT WT (kN/m³)	REMARKS AND GRAIN SIZE DISTRIBUTION (%)
(m) ELEV / DEPTH	DESCRIPTION	STRATA PLOT	NUMBER	TYPE	"N" BLOWS 0.3 m			2 4 6 8 10	w_P w w_L WATER CONTENT (%) 10 20 30			GR SA SI CL
	installed upon completion. 3) Water Level Readings: Date W. L. Depth (m) Mar. 09, 2016 0.32											

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

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

LOG OF BOREHOLE BH16-15

PROJECT: 2650 Mayfield Road
CLIENT: Lormel Joint Venture Inc.
PROJECT LOCATION: 2650 Mayfield Road, Caledon, ON
DATUM: Geodetic
BH LOCATION: N 4842386.23 E 594164.06

DRILLING DATA
Method: Solid Stem Auger
Diameter: 150 mm
Date: Mar/04/2016

REF. NO.: 161-01959-00
ENCL NO.: 16

(m) ELEV / DEPTH	DESCRIPTION	NUMBER	TYPE	BLOWS 0.3 m "N"	ELEVATION	REMARKS AND GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
254.4 / 0.0	**TOPSOIL:** 300mm					
254.1 / 0.3	**FILL:** silty clay, some sand, trace gravel, trace organics, brown, moist, firm to stiff.	1	SS	4	254	
253.5 / 0.9	**CLAYEY SILT TILL TO SILTY CLAY TILL:** some sand, trace gravel, brown, moist, very stiff. oxidized between 0.9m to 2.9m	2	SS	15	W. L. 253.7 m Mar 09, 2016	
		3	SS	17	Holeplug	
		4	SS	26	252	
	grey below 3.0m	5	SS	21	Sand	
	wet sand and gravel layer at 3.7m				251	
249.9 / 4.6	**CLAYEY SILT TILL:** some sand, trace gravel, contain silt seams/layers, grey, moist, hard.	6	SS	48	250 Screen	spoon wet 20.7 2 12 67 19
248.8 / 5.6	**SANDY SILT TILL:** trace to some clay, trace gravel, trace shale fragments, reddish brown, moist, very dense. cobbles /boulders(inferred)	7	SS	50/ initial 150mm	249 Sand 248	spoon bouncing
		8	SS	51	Holeplug 247	
246.2 / 8.2	**END OF BOREHOLE** Notes: 1) Borehole was open upon completion. 2) 50mm dia. monitoring well was installed upon completion. 3) Water Level Readings: Date W. L. Depth (m) Mar. 09, 2016 0.70 Mar. 30, 2016 0.70					

Head Space Combustible Vapor Reading (ppm): 2 4 6 8 10

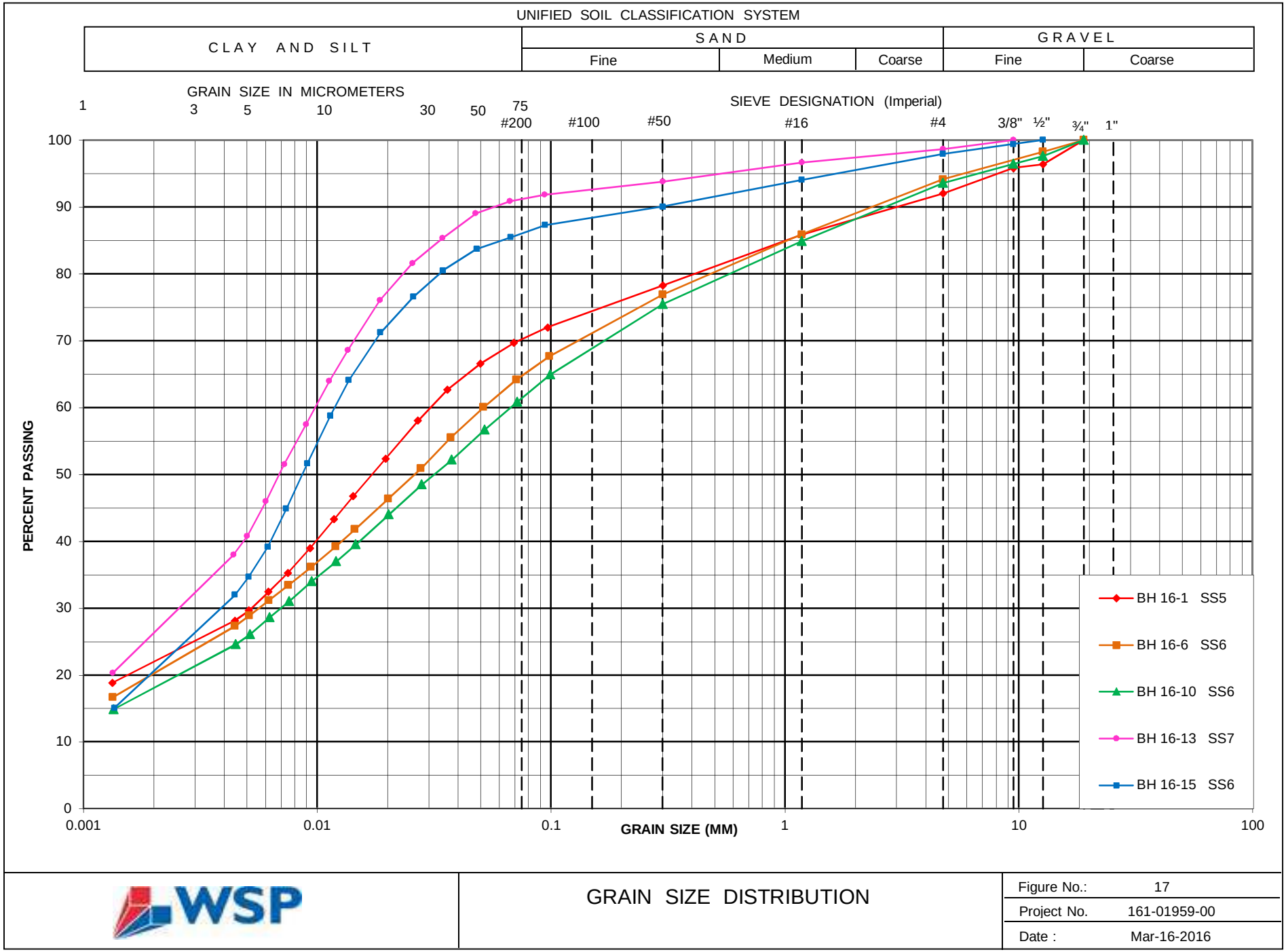
PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L
WATER CONTENT (%): 10 20 30

POCKET PEN. (Cu) (kPa)

NATURAL UNIT WT (kN/m³)

GROUNDWATER ELEVATIONS
Measurement 1st 2nd 3rd 4th

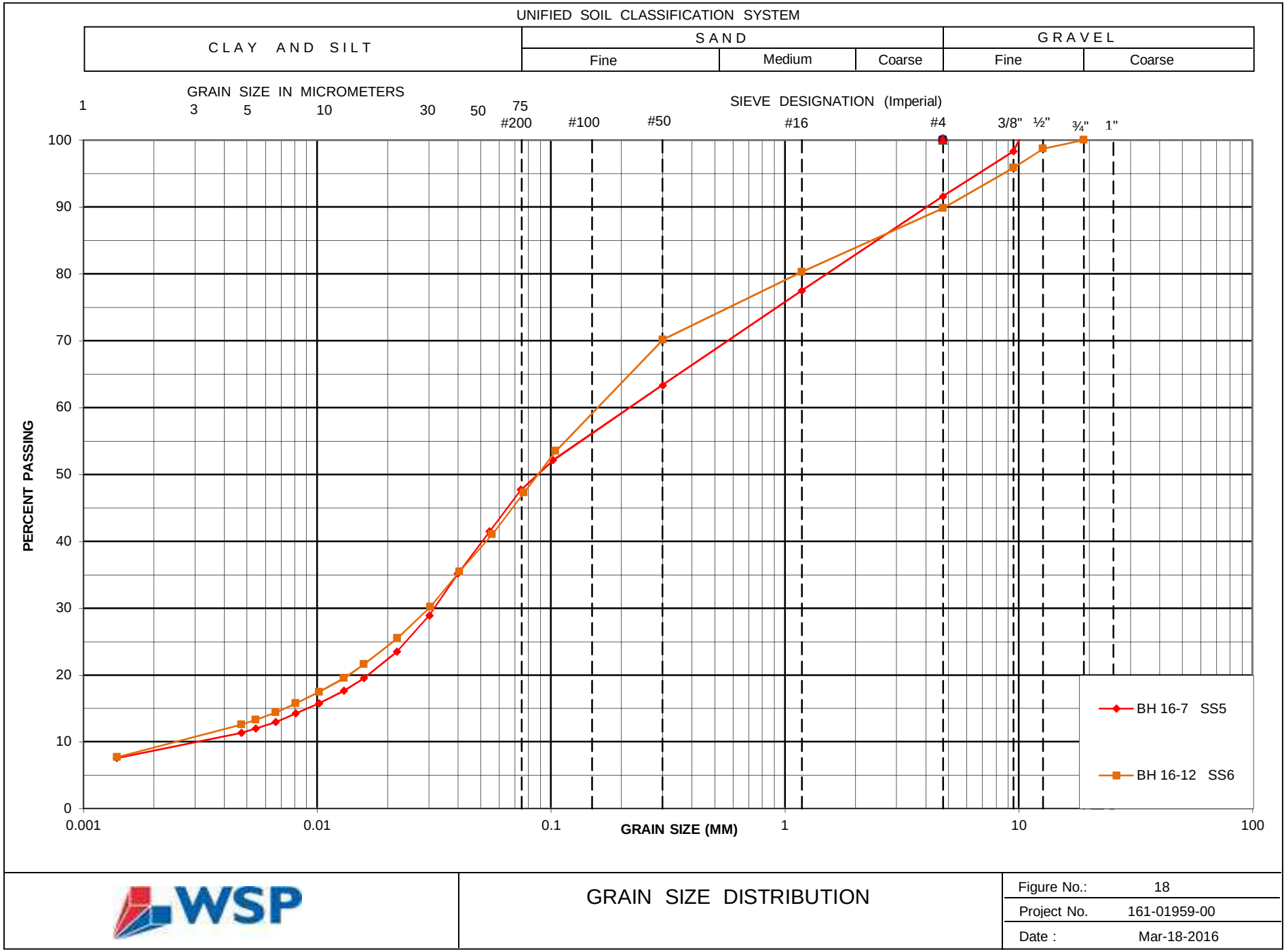
GRAPH NOTES: + 3, × 3: Numbers refer to Sensitivity; ○ ε=3% Strain at Failure



WSP

GRAIN SIZE DISTRIBUTION

Figure No.:	17
Project No.	161-01959-00
Date :	Mar-16-2016



WSP

GRAIN SIZE DISTRIBUTION

Figure No.:	18
Project No.	161-01959-00
Date :	Mar-18-2016

GENERAL REQUIREMENTS FOR ENGINEERED FILL

Compacted imported soil that meets specific engineering requirements and is free of organics and debris and that has been continually monitored on a full-time basis by a qualified geotechnical representative is classified as engineered fill. Engineered fill that meets these requirements and is bearing on suitable native subsoil can be used for the support of foundations.

Imported soil used as engineered fill can be removed from other portions of a site or can be brought in from other sites. In general, most of Ontario soils are too wet to achieve the 100% Standard Proctor Maximum Dry Density (SPMDD) and will require drying and careful site management if they are to be considered for engineered fill. Imported non-cohesive granular soil is preferred for all engineered fill. For engineered fill, we recommend use of OPSS Granular 'B' sand and gravel fill material.

Adverse weather conditions such as rain make the placement of engineered fill to the required degree of density difficult or impossible; engineered fill cannot be placed during freezing conditions, i.e. normally not between December 15 and April 1 of each year.

The location of the foundations on the engineered fill pad is critical and certification by a qualified surveyor that the foundations are within the stipulated boundaries is mandatory. Since layout stakes are often damaged or removed during fill placement, offset stakes must be installed and maintained by the surveyors during the course of fill placement so that the contractor and engineering staff are continually aware of where the engineered fill limits lie. Excavations within the engineered fill pad must be backfilled with the same conditions and quality control as the original pad.

To perform satisfactorily, engineered fill requires the cooperation of the designers, engineers, contractors and all parties must be aware of the requirements. The minimum requirements are as follows, however, the geotechnical report must be reviewed for specific information and requirements.

1. Prior to site work involving engineered fill, a site meeting to discuss all aspects must be convened. The surveyor, contractor, design engineer and geotechnical engineer must attend the meeting. At this meeting, the limits of the engineered fill will be defined. The contractor must make known where all fill material will be obtained from and samples must be provided to the geotechnical engineer for review, and approval before filling begins.

2. Detailed drawings indicating the lower boundaries as well as the upper boundaries of the engineered fill must be available at the site meeting and be approved by the geotechnical engineer.

3. The building footprint and base of the pad, including basements, garages, etc. must be defined by offset stakes that remain in place until the footings and service connections are all constructed. Confirmation that the footings are within the pad, service lines are in place, and that the grade conforms to drawings, must be obtained by the owner in writing from the surveyor and WSP. Without this confirmation no responsibility for the performance of the structure can be accepted by WSP. Survey drawing of the pre and post fill location and elevations will also be required.

4. The area must be stripped of all topsoil and fill materials. Subgrade must be proof-rolled. Soft spots must be dug out. The stripped native subgrade must be examined and approved by a WSP engineer prior to placement of fill.

5. The approved engineered fill material must be compacted to 100% Standard Proctor Maximum Dry Density throughout. Engineered fill should not be placed during the winter months. Engineered fill compacted to 100% SPMDD will settle under its own weight approximately 0.5% of the fill height and the structural engineer must be aware of this settlement. In addition to the settlement of the fill, additional settlement due to consolidation of the underlying soils from the structural and fill loads will occur and should be evaluated prior to placing the fill.

6. Full-time geotechnical inspection by WSP during placement of engineered fill is required. Work cannot commence or continue without the presence of the WSP representative.

7. The fill must be placed such that the specified geometry is achieved. Refer to the attached sketches for minimum requirements. Take careful note that the projection of the compacted pad beyond the footing at footing level is a minimum of 2 m. The base of the compacted pad extends 2 m plus the depth of excavation beyond the edge of the footing.

8. A bearing capacity of 150 KPa at SLS (225 KPa at ULS) can be used provided that all conditions outlined above are adhered to. A minimum footing width of 500 mm (20 inches) is suggested and footings must be provided with nominal steel reinforcement.

9. All excavations must be done in accordance with the Occupational Health and Safety Regulations of Ontario.

10. After completion of the engineered fill pad a second contractor may be selected to install footings. The prepared footing bases must be evaluated by engineering staff from WSP prior to footing concrete placements. All excavations must be backfilled under full time supervision by WSP to the same degree as the engineered fill pad. Surface water cannot be allowed to pond in excavations or to be trapped in clear stone backfill. Clear stone backfill can only be used with the approval of WSP.

11. After completion of compaction, the surface of the engineered fill pad must be protected from disturbance from traffic, rain and frost. During the course of fill placement, the engineered fill must be smooth-graded, proof-rolled and sloped/crowned at the end of each day, prior to weekends and any stoppage in work in order to promote rapid runoff of rainwater and to avoid any ponding surface water. Any stockpiles of fill intended for use as engineered fill must also be smooth-bladed to promote runoff and/or protected from excessive moisture take up.

12. If there is a delay in construction, the engineered fill pad must be inspected and accepted by the geotechnical engineer. The location of the structure must be reconfirmed that it remains within the pad.

13. The geometry of the engineered fill as illustrated in these General Requirements is general in nature. Each project will have its own unique requirements. For example, if perimeter sidewalks are to be constructed around the building, then the projection of the engineered fill beyond the foundation wall may need to be greater.

14. These guidelines are to be read in conjunction with WSP report attached.