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Geotechnical Investigation
Proposed Commercial Building
1243 Teron Road
Ottawa, Ontario

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Submitted to:

Megha Holdings Inc.
1558 Blohm Drive
Ottawa, Ontario
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Geotechnical Investigation
Proposed Commercial Building
1243 Teron Road
Ottawa, Ontario

November 12, 2019
Project: 64742.02

experience • knowledge • integrity

GEMTEC Consulting Engineers and Scientists Limited
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November 12, 2019 File: 64742.02

Megha Holdings Inc.
1558 Blohm Drive
Ottawa, Ontario
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Attention: Mr. Ramesh Sarna - Director

**Re: Geotechnical Investigation
Proposed Commercial Building
1243 Teron Road
Ottawa, Ontario**

Enclosed is our draft geotechnical investigation report for the above noted project. This report was prepared in accordance with the scope of work provided in our proposal dated July 12, 2019. This report was prepared by Gregory Davidson, B.Eng., E.I.T. and reviewed by Johnathan A. Cholewa, Ph.D., P.Eng.

Greg Davidson, B.Eng., E.I.T.

Johnathan A. Cholewa, Ph.D., P.Eng.
Geotechnical Engineer

GD/JC

Enclosures
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1.0 INTRODUCTION

This report presents the results of a geotechnical investigation carried out for the proposed commercial building located at 1243 Teron Road in Kanata (Ottawa), Ontario (see Key Plan, Figure 1). The purpose of the investigation was to identify the general subsurface conditions at the site by means of a limited number of boreholes and, based on the factual information obtained, to provide engineering guidelines on the geotechnical design aspects of the project, including construction considerations that could influence design decisions.

This investigation was carried out in general accordance with our proposal dated July 12, 2019.

2.0 PROJECT DESCRIPTION AND SITE GEOLOGY

2.1 Project Description

In preparation for submission for a lot severance and Site Plan Approval, a geotechnical investigation is required to conform to City of Ottawa guidelines for the proposed commercial building located at 1243 Teron Road in Ottawa, Ontario.

Based on a preliminary drawing prepared by KWC Architects and provided to GEMTEC Consulting Engineers and Scientists Limited (GEMTEC), it is understood that a commercial structure is to be constructed on the (vacant) portion of the property at 1243 Teron Road (i.e., east side of the property). The site is currently vegetated with small to large trees. In addition, there is an existing stormwater management ditch located in the northwest corner of the vacant land.

The proposed building is to be approximately 213 metres by 46 metres and consist of slab on grade construction (i.e., basementless). Three (3) loading bays are to be constructed within the building. It is understood that the current proposed finished floor elevation is 85.7 metres, geodetic datum). Based on the ground surface elevations at the borehole locations, the existing grades at the site range between elevation 84.02 and 90.33 metres.

2.2 Site Geology

Surficial geology maps of the Ottawa area indicate that the north portion of the proposed site is underlain by about 10 to 15 metres of silty clay, and a thin layer of overburden material (2 metres or less) overlying bedrock underlies the south portion of the site. Bedrock geology maps of the area show that the overburden deposits are underlain by Precambrian bedrock of granitic origin. Fill material associated with the development of the adjacent portion of the site should be anticipated.

3.0 METHODOLOGY

3.1 Geotechnical Investigation

The field work for this investigation was carried out between August 15 and 16, 2019. During this time, eleven (11) boreholes numbered 19-1 and 19-3 to 19-12, inclusive, were advanced at the site by George Downing Estate Drilling Ltd. from Grenville-sure-la-Rouge, Quebec, to depths ranging from about 2.4 to 6.1 metres below existing grade (elevations 78.1 to 87.2 metres, geodetic datum). It should be noted that borehole 19-2 was not advanced at the site due to limited access from existing trees and vegetation.

Standard penetration tests (SPT) were carried out in the boreholes and samples of the soils encountered were recovered using a 50 millimetre diameter split barrel sampler.

The field work was observed throughout by a member of our engineering staff who directed the drilling operations and logged the samples and boreholes.

Two (2) standpipe piezometers were installed and sealed in the overburden at borehole locations 19-6 and 19-12 to facilitate groundwater level measurements.

Following completion of the drilling, the soil samples were returned to our laboratory for examination by a geotechnical engineer. Four (4) samples of the soil recovered from boreholes 19-3, 19-6, 19-7 and 19-10 were sent to Paracel Laboratories Ltd. for basic chemical testing relating to corrosion of buried concrete and steel.

The results of the boreholes are provided on the Record of Borehole sheets in Appendix A. The approximate locations and ground surface elevations of the boreholes are shown on the Borehole Location Plan, Figure 1. The laboratory testing results are provided on the Soils Grading and Plasticity charts in Appendix B. The results of the chemical analysis of soil samples relating to corrosion of buried concrete and steel are provided in Appendix C.

The borehole locations were selected by GEMTEC and positioned on site relative to existing features. The ground surface elevations at the location of the boreholes were determined using a Trimble R10 global positioning system. The coordinates and elevations of the boreholes are considered to be accurate within the tolerance of the instrument.

4.0 SUBSURFACE CONDITIONS

4.1 General

As previously indicated, the soil and groundwater conditions identified in the boreholes are given on the Record of Borehole sheets in Appendix A. The logs indicate the subsurface conditions at the specific test locations only. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface conditions are indicated depends on the method of drilling and excavation, the frequency and recovery of samples, the method of sampling, and the uniformity of the subsurface conditions. Subsurface conditions at other than the test locations may vary from the conditions encountered in the boreholes and test pits. In addition to soil variability, fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties.

The soil descriptions in this report are based on commonly accepted methods of classification and identification employed in geotechnical practice. Classification and identification of soil involves judgement and GEMTEC does not guarantee descriptions as exact, but infers accuracy to the extent that is common in current geotechnical practice.

The groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. Groundwater conditions may vary seasonally or as a consequence of construction activities in the area.

The following presents an overview of the subsurface conditions encountered in the boreholes and test pits advanced during this investigation.

4.2 Topsoil

A surficial layer of topsoil material was encountered at all borehole locations. The topsoil consists of dark brown silty sand with organic material. The thickness of the topsoil ranges from about 50 to 100 millimetres.

4.3 Fill Material

Fill material was encountered at all borehole locations below the surficial topsoil material. The fill material is variable across the site but can generally be described as brown silty sand with trace to some clay and gravel. The thickness of the fill material ranges from about 0.5 to 2.0 metres and extends to depths ranging from about 0.6 to 2.1 metres below existing grade.

Standard penetration tests carried out in the fill material gave N values ranging between 10 and 24 blows per 0.3 metres of penetration, which reflects a loose to compact relative density.

The results of grain size distribution testing on a sample of the fill material are provided on the Soils Grading Charts in Appendix B and summarized in Table 4.1.

Table 4.1 – Summary of Grain Size Distribution Testing (Fill Material)

Borehole	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
19-3	3	1.5 – 2.1	0	20	42	38

4.4 Weathered Crust

Native deposits of grey to brown silty clay with varying amounts of sand (herein referred to as weathered crust) were encountered at all borehole locations below the fill material at depths ranging from about 0.6 to 2.1 metres below existing grade. The thickness of the weathered crust at boreholes 19-6 to 19-12, inclusive, (where the boreholes were advanced through the weathered crust) ranges from about 1.7 to 5.0 metres and extends to depths ranging from about 2.7 to 5.8 metres below existing grade. Boreholes 19-1, 19-3, 19-4 and 19-5 were terminated within the weathered crust at a depth of about 6.0 metres below existing grade.

Standard penetration tests carried out in the weathered crust gave N values ranging between 3 and 17 blows per 0.3 metres of penetration. Based on our experience with native clays in the Ottawa region, N values of 2 or greater reflect a stiff to very stiff consistency.

The results of grain size distribution testing on samples of the weathered crust are provided on the Soils Grading Charts in Appendix B and summarized in Table 4.2.

Table 4.2 – Summary of Grain Size Distribution Testing (Weathered Crust)

Borehole	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
19-8	2	0.8 – 1.4	0	9	27	64
19-11	6	3.8 – 4.4	0	2	39	59

The results of Atterberg limit testing carried out on samples of the weathered crust are provided on Plasticity Charts in Appendix B and summarized in Table 4.3

Table 4.3 – Summary of Atterberg Limit Testing (Weathered Crust)

Borehole	Sample Number	Sample Depth (metres)	Water Content (%)	LL (%)	PL (%)	PI (%)
19-1	4	2.3 – 2.9	31	40	22	18
19-6	3	1.5 – 2.1	36	48	27	22
19-11	2	0.8 – 1.4	34	45	22	24
19-11	4	2.3 – 2.9	44	45	21	24

Moisture content testing carried out on samples of the weathered crust indicate moisture contents ranging from about 28 to 49 percent.

4.5 Glacial Till

Native deposits of glacial till were encountered in boreholes 19-6, 19-7, 19-9, 19-10 and 19-11 below the weathered crust at depths ranging from about 2.7 to 5.8 metres below existing grade. Glacial till is a heterogeneous mixture of all grain sizes; however, at this site the glacial till can generally be described as brown sand and silt with some gravel.

One standard penetration test carried out in the glacial till encountered in 19-11 gave an N value of 16 blows per 0.3 metres of penetration, which reflects a compact relative density.

The results of grain size distribution testing on a sample of the glacial till from borehole 19-11 are provided on the Soils Grading Charts in Appendix B and summarized in Table 4.4.

Table 4.4 – Summary of Grain Size Distribution Testing (Glacial Till)

Borehole	Sample Number	Sample Depth (metres)	Gravel (%)	Sand (%)	Silt and Clay (%)
19-11	8	5.3 – 5.9	11	52	37

Moisture content testing carried out on a sample of the glacial till indicates a moisture content of about 15 percent.

4.6 Auger refusal

Auger refusal was encountered in boreholes 19-6 to 19-12, inclusive, at depths ranging from about 2.4 to 6.1 metres below existing grade (elevations, 80.3 to 87.2 metres, geodetic datum). It should be noted that auger refusal can occur on the bedrock surface or on boulders within the glacial till.

4.7 Groundwater

The groundwater levels measured on August 23, 2019, are summarized in Table 4.5.

Table 4.5 – Groundwater Level Observations (August 23, 2019)

Borehole	Date	Depth Below Existing Ground Surface (metres)	Elevation – Geodetic Datum (metres)
19-6	August 23, 2019	2.8	83.6
19-12	August 23, 2019	Dry	-

It should be noted that the groundwater levels may be higher during wet periods of the year such as the early spring or following periods of precipitation.

4.8 Soil Chemistry Relating to Corrosion

The results of chemical testing of soil samples from borehole 19-3, borehole 19-6, borehole 19-7 and borehole 19-10 are provided in Appendix C and summarized in Table 4.6.

Table 4.6 – Chemical Testing of Soil Samples

BH	Sample	pH	Sulphate Content (micrograms per gram)	Chloride Content (micrograms per gram)	Resistiviy (Ohm metres)	Conductivity (mircosiemens per centimetre)
19-3	4	7.8	100	7	57.1	175
19-6	3	8.1	9	7	175	57
19-7	3	7.7	30	8	142	70
19-10	2	7.4	<5	6	265	38

5.0 GEOTECHNICAL GUIDELINES AND RECOMMENDATIONS

5.1 General

This section of the report provides engineering guidelines on the geotechnical design aspects of the project based on our interpretation of the boreholes advanced as part of this investigation and the project requirements. It is stressed that the information in the following sections is provided for the guidance of the designers and is intended for this project only. Contractors bidding on or undertaking the works should examine the factual results of the investigation, satisfy themselves as to the adequacy of the information for construction, and make their own interpretation of the factual data as it affects their construction techniques, schedule, safety and equipment capabilities.

The professional services retained for this project include only the geotechnical aspects of the subsurface conditions at this site. The presence or implications of possible surface and/or subsurface contamination resulting from previous uses or activities of this site or adjacent properties, and/or resulting from the introduction onto the site from materials from offsite sources are outside the terms of reference for this report and have not been investigated or addressed.

5.2 Proposed Commercial Building

5.2.1 Overburden Excavation

Based on the boreholes advanced in the vicinity of the proposed building, the excavations for the proposed buildings will be carried out mostly through topsoil, fill material and silty clay and/or glacial till. The sides of the excavation should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the fill material at this site can be classified as Type 3 soil and, accordingly, allowance should be made for excavation side slopes of 1 horizontal to 1 vertical, or flatter.

In the event that a granular pad is necessary below the foundations, the excavations should be sized to accommodate a pad of imported granular material which extends at least 0.5 metres horizontally beyond the edge of the footings and down and out from this point at 1 horizontal to 1 vertical, or flatter.

5.2.2 Bedrock Excavation

It should be noted that auger refusal on inferred bedrock was encountered in boreholes 19-6 to 19-12, inclusive, at between elevation 80.3 and 87.2 metres. Depending on the final design of the building, bedrock removal may be required.

Localized bedrock removal at this site could be carried out using (a) drill and blasting, (b) hoe ramming techniques in conjunction with line drilling on close centres or (c) a combination of both. Provided that good bedrock excavation techniques are used, the bedrock could be excavated using near vertical side walls. Any loose bedrock should be scaled from the sides of the excavation.

It is noted that the Precambrian bedrock is known to be abrasive and hard, and significant equipment wear should be expected.

Any blasting should be carried out under the supervision of a blasting specialist engineer. As a guideline for blasting, the peak vibration limits suggested at the nearest structure or service are provided in Table 5.1.

Table 5.1 – Peak Vibration Limits

Frequency of Virbration (Hz)	Vibration Limits (millimetres/second)
<10	5
10 to 40	5 to 50 (interpolated)
>40	50

It is pointed out that the limits provided in Table 5.1, although conservative, were established to prevent damage to existing buildings and services in good condition; more stringent criteria may be required to prevent damage to freshly placed (uncured) concrete or vibration sensitive equipment or utilities. Monitoring of the blasting should be carried out to ensure that the blasting meets the limiting vibration criteria. Pre-construction condition surveys of the nearby structures and existing buried services are considered essential. The effects due to vibration from blasting can be controlled by limiting the size and amount of charge, using delayed detonation techniques, and the like. To reduce the effects of vibration on nearby services, we suggest that the separation distance between any blasting and existing underground services be at least 6 metres. Any bedrock removal within these limits could be carried out using hoe ramming techniques in conjunction with line drilling on close centres. It is noted that the cost of bedrock removal generally increases the closer the bedrock removal is to any existing structures or services.

As an alternative to blasting, bedrock removal could be carried out using hoe ramming techniques in conjunction with line drilling on close centres. For the bedrock at this site, it is suggested that allowance be made for line drilling 75 to 100 millimetre diameter holes on 200 to 300 millimetre centres. The vibration effects of hoe ramming are usually minor and localized. Monitoring of the hoe ramming could be carried out, at least initially, to measure the vibrations to ensure that they are below the acceptable threshold value. Provided that good bedrock excavation techniques are used, the bedrock could be excavated using vertical side walls. Any loose rock should be scaled from the sides of the excavation.

The bedrock may contain numerous irregular discontinuities. As such, significant overbreak and underbreak should be expected in any bedrock removal. The bedrock below founding level will likely break at a horizontal bedding plane below the design depth of the footings, which may necessitate thickening of the footings and/or lowering of the footings.

5.2.3 Groundwater Pumping

Groundwater inflow from the overburden deposits into the excavations could be controlled by pumping from filtered sumps within the excavations. It is not expected that short term pumping during excavation will have any significant affect on nearby structures and services.

It is noted that groundwater inflow from the bedrock, if required, could be significant and an additional investigation is recommended if bedrock removal is required (in order to identify groundwater conditions within the bedrock and dewatering requirements).

Suitable detention and filtration will be required before discharging water. The contractor should be required to submit an excavation and groundwater management plan for review.

5.2.4 Footing Design

Based on the results of the current investigation, the proposed structure could be founded on conventional footings bearing on or within native, undisturbed weathered crust, glacial till or bedrock.

In areas where subexcavation of disturbed material is required below proposed founding level, the grade could be raised with compacted granular material (engineered fill). The engineered fill should consist of granular material meeting Ontario Provincial Standard Specifications (OPSS) requirements for Granular B Type II and should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density. To provide adequate spread of load beneath the footings, the engineered fill should extend horizontally at least 0.3 metres beyond the footings and then down and out from this point at 1 horizontal to 1 vertical, or flatter.

Spread footing foundations bearing directly on native deposits or on a pad of engineered fill above native soil deposits, should be sized using a net geotechnical reaction at Serviceability Limit State (SLS) of 100 kilopascals and a factored net geotechnical resistance at Ultimate Limit States (ULS) resistance of 250 kilopascals for weathered crust, a net geotechnical reaction at Serviceability Limit State (SLS) of 120 kilopascals and a factored net geotechnical resistance at Ultimate Limit States (ULS) resistance of 300 kilopascals for glacial till and a factored geotechnical resistance at Ultimate Limit States (ULS) resistance of 300 kilopascals for bedrock.

The post construction total and differential settlement of footings should be less than 25 and 15 millimetres, respectively, provided that all loose or disturbed soil is removed from the bearing surfaces and provided that any engineered fill material is compacted to the required density.

5.2.5 Seismic Design of Proposed Structures

Based on the blow counts and correlated shear strength values obtained as part of this investigation and Table 4.1.8.4.A of the Ontario Building Code, 2012, Site Class D should be used for the seismic design of the structures. It is pointed out that based on available shear wave velocity mapping, the site could potentially be classified as Site Class C; however, site specific testing would be required to confirm this opinion. Multi Channel Analysis of Surface Waves (MASW), a non-intrusive geophysical test method could be considered for this purpose.

5.2.6 Frost Protection of the Foundations and Slab

All exterior footings in unheated portions of the proposed structures or slabs should be provided with at least 1.5 metres of earth cover for frost protection purposes. Isolated, unheated exterior footings adjacent to surfaces which are cleaned of snow cover during the winter months should be provided with a minimum of 1.8 metres of earth cover. The required depth of frost protection can be reduced by the thickness of any engineered fill beneath the foundations. Alternatively, the required frost protection could be provided by means of a combination of earth cover and extruded polystyrene insulation. An insulation detail could be provided upon request.

5.2.7 Foundation Wall Backfill and Drainage

To avoid frost adhesion and possible heaving, the foundations should be backfilled with imported, free-draining, non-frost susceptible granular material such as that meeting OPSS Granular B Type I or II requirements.

Where the backfill will ultimately support areas of hard surfacing (pavement, sidewalks or other similar surfaces), the backfill should be placed in maximum 200 millimetre thick lifts and should be compacted to at least 95 percent of the standard Proctor maximum dry density value using suitable vibratory compaction equipment. Light, walk behind compaction equipment should be used next to foundation walls to avoid excessive compaction induced stress on the foundation walls. Where future landscaped areas will exist next to the proposed structures and if some settlement of the backfill is acceptable, the backfill could be compacted to at least 90 percent of the standard Proctor maximum dry density value.

Where areas of hard surfacing (pavement etc.) abut the proposed structures, a gradual transition should be provided between those areas of hard surfacing underlain by non-frost susceptible granular wall backfill and those areas underlain by existing frost susceptible material to reduce the effects of differential frost heaving. It is suggested that granular frost tapers be constructed from 1.5 metres below finished grade to the underside of the granular subbase material for the hard surfaced areas. The frost tapers should be sloped at 1 horizontal to 1 vertical, or flatter.

Perimeter foundation drainage is not considered necessary for slab on grade structures at this site, provided that the floor slab level is above the finished exterior ground surface level.

5.2.8 Slab on Grade Support

Based on the results of the investigation, the area in the vicinity of the buildings is generally underlain by topsoil, fill material and native overburden deposits. The existing topsoil and fill material should be removed from the slab on grade areas.

The grade below the concrete slabs on grade could be raised, where necessary, with granular material meeting OPSS requirements for Granular B Type I or II. The use of Granular B Type II material is preferred under wet conditions. The granular base for the proposed slab on grade should consist of at least 150 millimetres of OPSS Granular A.

All imported granular materials placed below the proposed floor slab should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density value.

Proper moisture protection with a vapour retarder should be used for the slabs where the floor will be covered by moisture sensitive flooring material or where moisture sensitive equipment, products or environments will exist. The “Guide for Concrete Floor and Slab Construction”, ACI 302.1R-04 should be considered for the design and construction of vapour retarders below the slabs.

Underfloor drainage is not considered necessary provided that the floor slab level is above the finished exterior ground surface level.

5.3 Existing Stormwater Management Ditch

There is an existing stormwater management ditch located in the northwest corner that extends towards the south side of the vacant parcel of land. The existing ditch has a maximum height of about 1.6 metres and a slope of about 3 horizontal to 1 vertical. We recommend that the proposed construction (i.e., parking lot etc.) not encroach within 3 metres of the top (crest) of the existing ditch.

5.4 Site Services

5.4.1 Excavation

Based on the available subsurface information, the excavations for the services within the site will be carried out through topsoil, fill material, silty clay, glacial till and possibly bedrock.

The sides of the excavations within overburden soils should be sloped in accordance with the requirements in Ontario Regulation 213/91 under the Occupational Health and Safety Act. According to the Act, the soils at this site can be classified as Type 3 soils. Therefore, for design purposes, allowance should be made for 1 horizontal to 1 vertical, or flatter, excavation slopes within the native soils at this site. As an alternative to sloping the excavations, all service installations could be carried out within a tightly fitting, braced steel trench box, which is specifically designed for this purpose.

The groundwater inflow should be controlled throughout the excavation and pipe laying operations by pumping from sumps within the excavation. Notwithstanding, some disturbance and loosening of the subgrade materials could occur, and allowance should be made for subexcavation and additional pipe bedding (sub-bedding) material, as discussed later in this report.

5.4.2 Bedrock Excavation

If bedrock excavation is required for any services at this site, excavation of bedrock should be carried out as described in Section 5.2.2.

5.4.3 Groundwater Pumping

Possible groundwater inflow from the overburden deposits into the excavations could be controlled by pumping from filtered sumps within the excavations. It is not expected that short term pumping during excavation will have any significant affect on nearby structures and services.

It is noted that groundwater inflow from the bedrock, if required, could be significant and an additional investigation is recommended if bedrock removal is required (in order to identify groundwater conditions within the bedrock and dewatering requirements).

Suitable detention and filtration will be required before discharging water. The contractor should be required to submit an excavation and groundwater management plan for review.

5.4.4 Pipe Bedding and Cover

The bedding for the sanitary sewers, storm sewers and watermains should be in accordance with OPSD 802.010/802.013 and 802.031/802.033 for flexible and rigid pipes in earth and bedrock excavations, respectively. The pipe bedding should consist of at least 150 millimetres of well graded crushed stone meeting OPSS requirements for Granular A. OPSS documents allow recycled asphaltic concrete and concrete to be used in Granular A and Granular B Type II material. Since the source of recycled material cannot be determined, it is suggested that any granular materials used in the service trenches be composed of virgin (i.e., not recycled) material only.

Allowance should be made for subexcavation of any existing fill, organic deposits, or disturbed material encountered at subgrade level.

Where bedrock is encountered at subgrade level, allowance should be made for additional bedding material due to possibility of overbreak of the bedrock below subgrade level.

Cover material, from pipe spring line to at least 300 millimetres above the top of the pipe, should consist of granular material, such as OPSS Granular A.

The use of clear crushed stone should not be permitted for the installation of site services, since it could exacerbate groundwater lowering of the overburden materials due to “French Drain” effects.

The bedding and cover materials should be compacted in maximum 200 millimetre thick lifts to at least 95 percent of the standard Proctor maximum dry density using suitable vibratory compaction equipment.

5.4.5 Trench Backfill

The general backfilling procedures should be carried out in a manner that is compatible with the future use of the area above the service trenches.

In areas where the service trench will be located below or in close proximity to existing or future roadway/parking lot areas, acceptable native materials should be used as backfill between the roadway/parking lot subgrade level and the depth of seasonal frost penetration in order to reduce the potential for differential frost heaving between the area over the trench and the adjacent section of roadway/parking lots. Where native backfill is used, it should match the native materials exposed on the trench walls. Backfill below the zone of seasonal frost penetration could consist of either acceptable native material or imported granular material conforming to OPSS Granular B Type I. The depth of frost penetration in areas that are kept clear of snow and where trench backfill consists of broadly graded shattered rock fill or earth fill is expected to be about 1.8 metres. It is our experience, however, that the frost penetration can be as much as 2.4 metres when the trench backfill consists solely of relatively open graded rock fill. Where cover requirements are not practicable, the pipes could be protected from frost using a combination of earth cover and insulation. Further details regarding insulation could be provided, if required.

It is anticipated that most of the inorganic overburden materials encountered during the subsurface investigation will be acceptable for reuse as trench backfill. Topsoil or other organic material should be wasted from the trench. If blast rock is used as backfill within the service trench, it should be mostly 300 millimetres, or smaller, in size and should be well graded. To prevent ingress of fine material into voids in the blast rock, the upper surface of the blast rock should be covered with a thin layer of well graded crushed stone (e.g. OPSS Granular B Type II).

To minimize future settlement of the backfill and achieve an acceptable subgrade for the roadways, parking lots curbs, etc., the trench backfill should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value. Rock fill should be placed in maximum 500 millimetre thick lifts and compacted with a large drum roller, the haulage and spreading equipment, or a combination of both. The specified density for compaction of the backfill materials may be reduced where the trench backfill is not located below or in close proximity to existing or future areas of hard surfacing and/or structures.

Most of the overburden deposits at this site are sensitive to changes in moisture content due to percipitation. Depending on the weather conditions at time of construction, the specified densities may not likely be possible to achieve and, as a consequence, some settlement of these backfill materials could occur. Consideration could be implementing one or a combination of the following measures to reduce post construction settlement above the trenches, depending on the weather conditions encountered during the construction:

- Allow the overburden materials to dry prior to compaction.
- Reuse any wet materials in the lower part of the trenches and make provision to defer final paving of any roadways for 6 months, or longer, to allow some the trench backfill settlement to occur and thereby improve the final roadway appearance.
- Reuse any wet materials outside hard surfaced areas and where post construction settlement is less of a concern (such as landscaped areas).

5.4.6 Seepage Barriers

The granular bedding in the service trench could act as a “French Drain”, which could promote groundwater lowering. As such, we suggest that seepage barriers be installed along the service trenches at strategic locations at a horizontal spacing of about 100 metres and where the property meets Teron Road. The seepage barriers should begin at subgrade level and extend vertically through the granular pipe bedding and granular surround to within the native backfill materials, and horizontally across the full width of the service trench excavation. The seepage barriers could consist of 1.5 metre wide dykes of compacted silty clay. The silty clay should be compacted in maximum 300 millimetre thick lifts to at least 95 percent of the standard Proctor dry density value. The locations of the seepage barriers could be provided as the design progresses.

5.5 Access Roadway/Parking Lot Areas

5.5.1 Subgrade Preparation

In preparation for access roadway/parking lot construction at this site, all surficial topsoil, fill material and any soft, wet or deleterious materials should be removed from the proposed roadway areas.

Prior to placing granular material for the internal roads, the exposed subgrade should be inspected and approved by geotechnical personnel. Any soft areas should be subexcavated and replaced with suitable (dry) earth borrow or well shattered and graded rock fill material that is frost compatible with the materials exposed on the sides of the area of subexcavation.

Similarly, should it be necessary to raise the roadway/parking lot grades at this site, material which meets OPSS specifications for Select Subgrade Material, Earth Borrow or well shattered and graded rock fill material may be used.

The Select Subgrade material or Earth Borrow should be placed in maximum 300 millimetre thick lifts and compacted to at least 95 percent of the standard Proctor maximum dry density value using vibratory compaction equipment. Rock fill should also be placed in maximum 500 millimetre thick lifts and suitably compacted either with a large drum roller, the haulage and spreading equipment, or a combination of both.

Truck traffic should be avoided on the native soil subgrade or the trench backfill within the roadways/parking lot areas especially under wet conditions.

5.5.2 Pavement Structure

For the parking areas to be used by light vehicles (cars, etc.) the following minimum pavement structure is recommended:

- 80 millimetres of hot mix asphaltic concrete (40 millimetres of Superpave 12.5 (Traffic Level B) over 40 millimetres of Superpave 19.0 (Traffic Level B)), over
- 150 millimetres of OPSS Granular A base over
- 300 millimetres of OPSS Granular B, Type II subbase

For parking areas and access roadways to be used by heavy truck traffic the suggested minimum pavement structure is:

- 100 millimetres of hot mix asphaltic concrete (40 millimetres of Superpave 12.5 (Traffic Level B) over 60 millimetres of Superpave 19.0 (Traffic Level B)), over
- 150 millimetres of OPSS Granular A base over
- 450 millimetres of OPSS Granular B, Type II subbase

If bedrock is encountered at subgrade level, it may be possible to reduce the granular subbase thickness provided above to 150 millimetres.

The above pavement structures assume that the access roadway and parking lot subgrade surfaces are prepared as described in this report. If the subgrade surfaces become disturbed or wetted due to construction operations or precipitation, the granular subbase thicknesses given above may not be adequate and it may be necessary to increase the thickness of the subbase and/or to incorporate a woven geotextile separator between the subgrade surfaces and the granular subbase material. The adequacy of the design pavement thicknesses should be assessed by geotechnical personnel at the time of construction.

If the granular pavement materials are to be used by construction traffic, it may be necessary to increase the thickness of the granular subbase layer, install a woven geotextile separator between the roadway subgrade surface and the granular subbase material, or a combination of both, to prevent pumping and disturbance to the subbase material. The contractor should be made responsible for their construction access.

5.5.3 Asphalt Cement Type

Performance grade PG 58-34 asphalt cement should be specified for Superpave asphaltic concrete mixes.

5.5.4 Pavement Transitions

As part of the access roadway/parking lot construction, the new pavement will abut the existing pavement at Teron Road and various locations. The following is suggested to improve the performance of the joint between the new and the existing pavements:

- Neatly saw cut the existing asphaltic concrete;

- Remove the asphaltic concrete and slope the bottom of the excavation within the existing granular base and subbase at 1 horizontal to 1 vertical, or flatter, to avoid undermining the existing asphaltic concrete.
- To avoid cracking of the asphaltic concrete due to an abrupt change in the thickness of the roadway granular materials where new pavement areas join with the existing pavements, the granular depths should taper up or down at 5 horizontal to 1 vertical, or flatter, to match the existing pavement structure.
- Remove (mill off) 40 to 50 millimetres of the existing asphaltic concrete to a distance of 300 millimetres at the joint and tack coat the asphaltic concrete at the joint in accordance with the requirements in OPSS 310.

5.5.5 Pavement Drainage

Adequate drainage of the pavement granular materials and subgrade is important for the long term performance of the pavement at this site. The subgrade surfaces should be crowned and shaped to drain to the ditches and/or catch basins to promote drainage of the pavement granular materials.

Catch basins should be equipped with minimum 3 metre long stub drains extending in two directions at the subgrade level.

5.5.6 Granular Material Compaction

The granular base and subbase materials should be compacted in maximum 300 millimetre thick lifts to at least 98 percent of the standard Proctor maximum dry density value.

6.0 ADDITIONAL CONSIDERATIONS

6.1 Supplemental Investigation

It should be noted that if bedrock removal is required based on proposed grades, an additional geotechnical investigation should be carried out to determine type and quality of bedrock and the groundwater level within the bedrock.

6.2 Effects of Construction Induced Vibration

Some of the construction operations (such as excavation, hoe ramming, granular material compaction, etc.) will cause ground vibration on and off of the site. The vibrations will attenuate with distance from the source, but may be felt at nearby structures. Assuming that any excavating is carried out in accordance with the guidelines in this report, the magnitude of the vibrations will be much less than that required to cause damage to the nearby structures or services in good condition, but may be felt at the nearby structures. We recommend that preconstruction surveys be carried out on the adjacent structures and that vibration monitoring be carried out during bedrock excavation to ensure that vibrations are below typical threshold values and so that any damage claims can be addressed in a fair manner.

6.3 Corrosion of Buried Concrete and Steel

The measured sulphate concentration from the samples of soil recovered from 19-3, 19-6, 19-7 and 19-10 range from <5 to 100 micrograms per gram. According to Canadian Standards Association (CSA) “Concrete Materials and Methods of Concrete Construction”, the concentration of sulphate can be classified as low. Therefore any concrete in contact with the native soil could be batched with General Use (GU) cement. The effects of freeze thaw in the presence of de-icing chemical (sodium chloride) use on the roadway should be considered in selecting the air entrainment and the concrete mix proportions for any concrete.

Based on the resistivity and pH of the samples, the soil in this area can be classified as non-aggressive towards unprotected steel. It should be noted that the corrosivity of the soil/groundwater could vary throughout the year due to the application sodium chloride for de-icing.

6.4 Winter Construction

The soils that exist at this site are highly frost susceptible and are prone to significant ice lensing. In the event that construction is required during freezing temperatures, the soil below the footings and floor slabs should be protected immediately from freezing using straw, propane heaters and insulated tarpaulins, or other suitable means.

Any service trenches should be opened for as short a time as practicable and the excavations should be carried out only in lengths which allow all of the construction operations, including backfilling, to be fully completed in one working day. The materials on the sides of the trenches should not be allowed to freeze. In addition, the backfill should be excavated, stored and replaced without being disturbed by frost or contaminated by snow or ice.

6.5 Excess Soil Management Plan

This report does not constitute an excess soil management plan. The disposal requirements for excess soil from the site have not been assessed.

6.6 Design Review

The design details of the proposed development were not available to us at the time of preparation of this report. It is recommended that the design drawings be reviewed by the geotechnical engineer as the design progresses to ensure that the guidelines provided in this report have been interpreted as intended.

The engagement of the services of the geotechnical consultant during construction is recommended to confirm that the subsurface conditions throughout the proposed excavations do not materially differ from those given in the report and that the construction activities do not adversely affect the intent of the design. The subgrade surfaces for the proposed development should be inspected by experienced geotechnical personnel to ensure that suitable materials have been reached and properly prepared. The placing and compaction of earth fill and imported granular materials should be inspected to ensure that the materials used conform to the grading and compaction specifications.

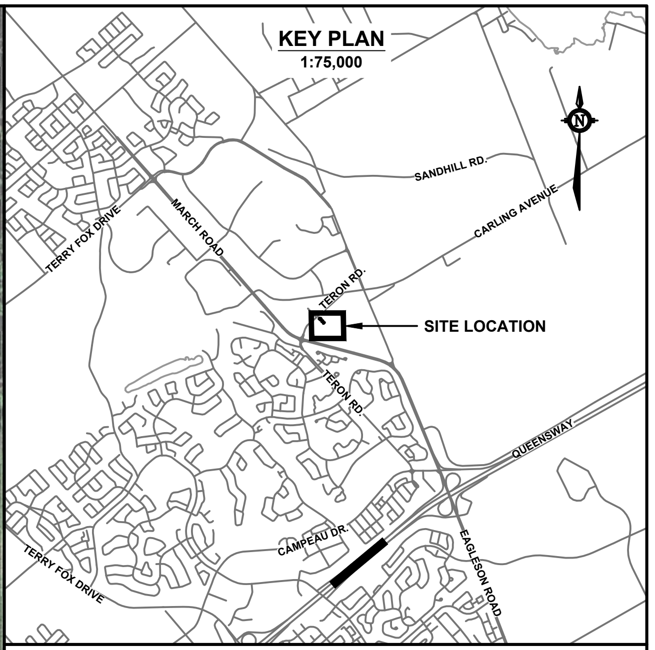
7.0 CLOSURE

We trust this report provides sufficient information for your present purposes. If you have any questions concerning this report, please do not hesitate to contact our office.

Gregory Davidson, B.Eng., E.I.T.

Johnathan A. Cholewa, Ph.D., P.Eng.
Geotechnical Engineer

GD/JC



LEGEND

BOREHOLE LOCATION IN PLAN (current investigation by GEMTEC)

BH # ← BH/TP ID
XX.XX ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM

× 84.93 ← GROUND SURFACE ELEVATION, IN METRES GEODETIC DATUM

NOTE:

LOCATION OF UTILITIES ON THIS PLAN ARE APPROXIMATE AND ARE FOR REFERENCE ONLY.

Scale 1:1000

0 20 40 60m

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ottawa@gemtec.ca

Client	Project
MEGHA HOLDINGS INC.	64742.02

Location: 1243 TERON ROAD, OTTAWA, ON

Drwn by	Chkd by	
P.C.	G.D.	BOREHOLE LOCATION PLAN

Date	Rev.	
SEPTEMBER 2019	0	**FIGURE 1**

APPENDIX A

List of Abbreviations and Terminology
Record of Borehole Sheets

Report to: Megha Holdings Inc.
Project: 64742.02 (November 12, 2019)

ABBREVIATIONS AND TERMINOLOGY USED ON RECORDS OF BOREHOLES AND TEST PITS

SAMPLE TYPES	
AS	Auger sample
CA	Casing sample
CS	Chunk sample
BS	Borros piston sample
GS	Grab sample
MS	Manual sample
RC	Rock core
SS	Split spoon sampler
ST	Slotted tube
TO	Thin-walled open shelby tube
TP	Thin-walled piston shelby tube
WS	Wash sample

SOIL TESTS	
w	Water content
PL, w_p	Plastic limit
LL, w_L	Liquid limit
C	Consolidation (oedometer) test
D_R	Relative density
DS	Direct shear test
G_S	Specific gravity
M	Sieve analysis for particle size
MH	Combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	Organic content test
UC	Unconfined compression test
γ	Unit weight

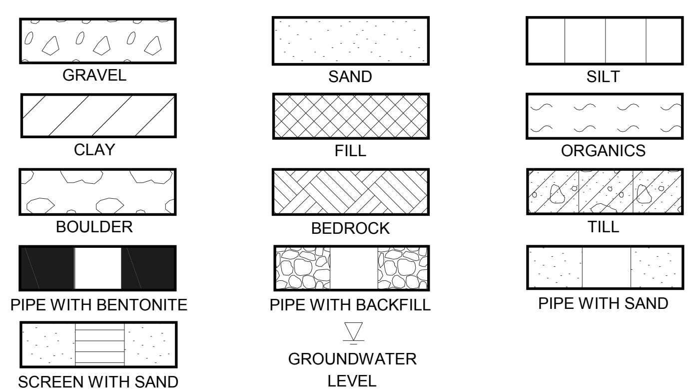
PENETRATION RESISTANCE

Standard Penetration Resistance, N
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 millimetres (30 in.) required to drive a 50 mm split spoon sampler for a distance of 300 mm (12 in.). For split spoon samples where less than 300 mm of penetration was achieved, the number of blows is reported over the sampler penetration in mm.

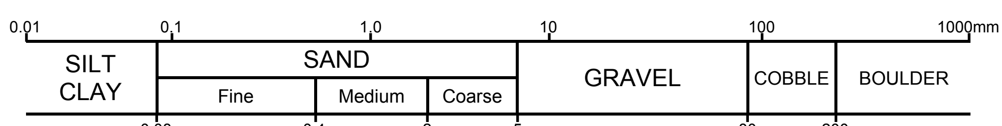
Dynamic Penetration Resistance
The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive a 50 mm (2 in.) diameter 60° cone attached to 'A' size drill rods for a distance of 300 mm (12 in.).

WH	Sampler advanced by static weight of hammer and drill rods
WR	Sampler advanced by static weight of drill rods
PH	Sampler advanced by hydraulic pressure from drill rig
PM	Sampler advanced by manual pressure

COHESIONLESS SOIL Compactness		COHESIVE SOIL Consistency	
SPT N-Values	Description	Cu, kPa	Description
0-4	Very Loose	0-12	Very Soft
4-10	Loose	12-25	Soft
10-30	Compact	25-50	Firm
30-50	Dense	50-100	Stiff
>50	Very Dense	100-200	Very Stiff
		>200	Hard



GRAIN SIZE



DESCRIPTIVE TERMINOLOGY
(Based on the CANFEM 4th Edition)

0–10	10–20	20–35	35
TRACE	SOME	ADJECTIVE	noun > 35% and main fraction
trace clay, etc	some gravel, etc.	silty, etc.	sand and gravel, etc.

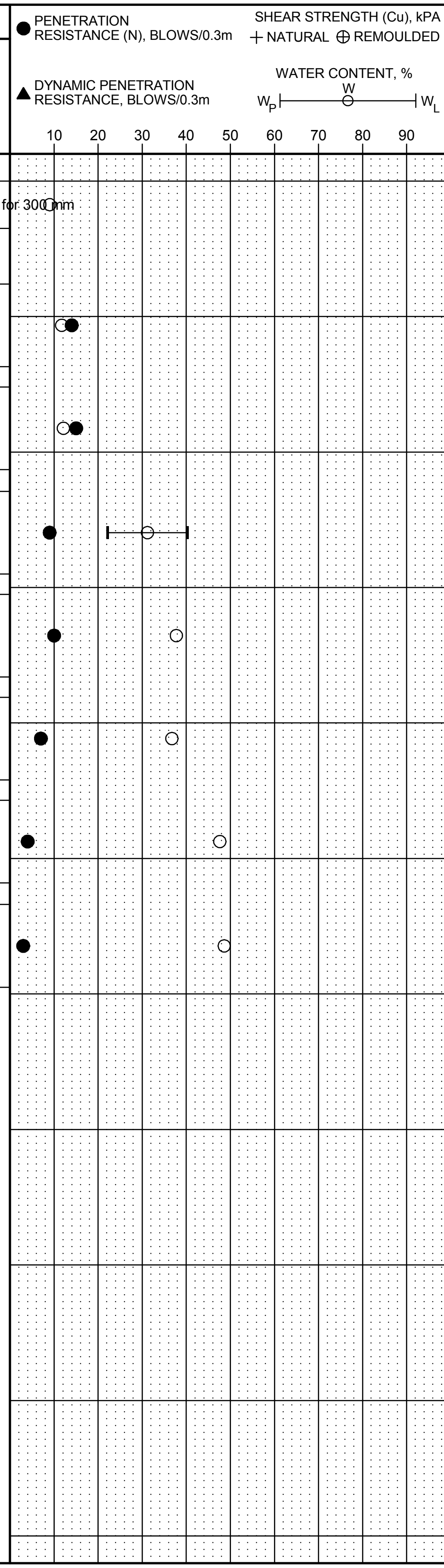
RECORD OF BOREHOLE 19-1

CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 15 2019

BORING METHOD: Power Auger, Hollow Stem Auger (210mm OD)

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Ground Surface	84.02				
	Dark brown silty sand with organic material (TOPSOIL)	83.92 0.10	1	SS	75	>50 for 300 mm
	Compact, brown silty sand, trace to some clay and gravel (FILL MATERIAL)					
1			2	SS	125	14
			3	SS	300	15
2	Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	81.89 2.13				
			4	SS	425	9
3			5	SS	600	10
4			6	SS	600	7
5			7	SS	600	4
			8	SS	600	3
6	End of Borehole	78.07 5.95				
7						
8						
9						
10						



ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION

Backfilled with soil cuttings

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CHECKED: G.D.

RECORD OF BOREHOLE 19-3

CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 15 2019

BORING METHOD: Power Auger — Hollow Stem Auger (210mm OD)

Soil Profile Description	Elev. / Depth (m)	Sample Number	Type	Recovery, mm	Blows/0.3m	Additional Lab. Testing	Piezometer or Standpipe Installation
Ground Surface	85.40						
Dark brown silty sand with organic material (TOPSOIL)	85.30 / 0.10						
Compact, brown silty sand, trace to some clay and gravel (FILL MATERIAL)		1	SS	100	18		Backfilled with soil cuttings
		2	SS	425	17		
		3	SS	300	10	MH	
Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	83.27 / 2.13	4	SS	425	7		
		5	SS	600	12		
		6	SS	600	9		
		7	SS	600	5		
		8	SS	600	4		
End of Borehole	79.45 / 5.95						

Legend: ● PENETRATION RESISTANCE (N), BLOWS/0.3m; ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED; WATER CONTENT, %: W_P — W — W_L

DEPTH SCALE METRES: 0–10

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LOGGED: M.L.
CHECKED: G.D.

RECORD OF BOREHOLE 19-4

CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 16 2019

BORING METHOD: Power Auger — Hollow Stem Auger (210mm OD)

DESCRIPTION	ELEV. / DEPTH (m)
Ground Surface	85.76
Dark brown silty sand with organic material (TOPSOIL)	85.66 / 0.10
Compact to dense, brown silty sand, trace to some clay and gravel (FILL MATERIAL)	83.63 / 2.13
Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	79.81 / 5.95
End of Borehole	

SAMPLES

NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
1	SS	50	53
2	SS	250	19
3	SS	350	24
4	SS	500	15
5	SS	600	11
6	SS	600	9
7	SS	600	5
8	SS	600	5

● PENETRATION RESISTANCE (N), BLOWS/0.3m
▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Backfilled with soil cuttings

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

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LOGGED: M.L.
CHECKED: G.D.

RECORD OF BOREHOLE 19-5

CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 15 2019

BORING METHOD: Power Auger – Hollow Stem Auger (210mm OD)

DESCRIPTION	ELEV. (m)	DEPTH (m)
Ground Surface	86.18	
Dark brown silty sand with organic material (TOPSOIL)	86.08	0.10
Compact, brown silty sand, trace to some clay and gravel (FILL MATERIAL)	84.66	1.52
Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	80.23	5.95
End of Borehole		

NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
1	SS	200	22
2	SS	300	12
3	SS	600	14
4	SS	600	10
5	SS	600	10
6	SS	600	9
7	SS	600	6
8	SS	600	4

PENETRATION RESISTANCE (N), BLOWS/0.3m
DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: NATURAL, REMOULDED
WATER CONTENT, %: W_P, W, W_L

PIEZOMETER OR STANDPIPE INSTALLATION: Backfilled with soil cuttings

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CHECKED: G.D.

RECORD OF BOREHOLE 19-6

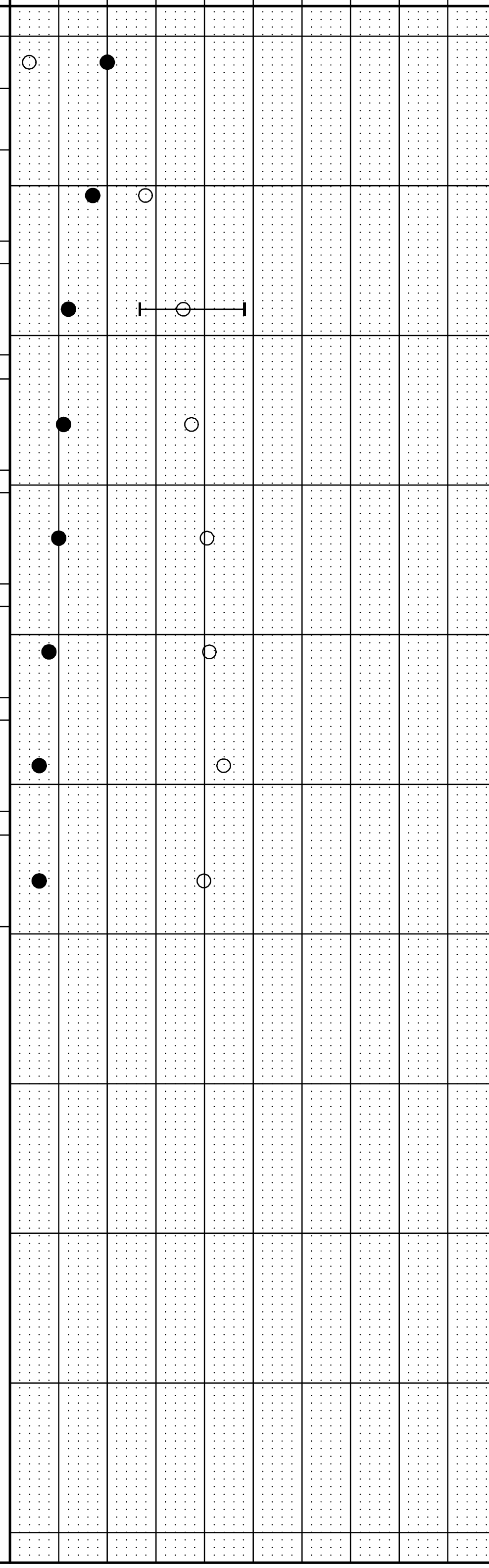
CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 16 2019

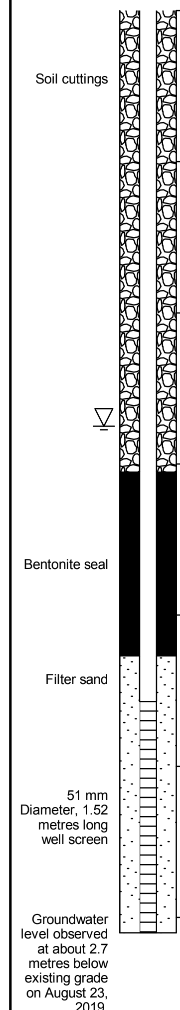
BORING METHOD: Power Auger, Hollow Stem Auger (210mm OD)

DEPTH (m)	DESCRIPTION	ELEV. (m) / DEPTH (m)
	Ground Surface	86.35
0	Dark brown silty sand with organic material (TOPSOIL)	86.27 / 0.08
	Brown silty sand, trace to some clay and gravel (FILL MATERIAL)	85.59 / 0.76
	Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	80.56 / 5.79
	Brown silt and sand, some gravel (GLACIAL TILL)	80.25 / 6.10
	End of Borehole Auger Refusal	

SAMPLE NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING
1	SS	325	20	
2	SS	200	17	
3	SS	425	12	wp
4	SS	600	11	
5	SS	600	10	
6	SS	600	8	
7	SS	600	6	
8	SS	600	6	



PIEZOMETER OR STANDPIPE INSTALLATION



GROUNDWATER OBSERVATIONS

DATE	DEPTH (m)	ELEV. (m)
19/08/23	2.8	83.6

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CHECKED: G.D.

GEO - BOREHOLE LOG GINT LOGS 64742.02.GPJ GEMTEC 2018.GDT 16/9/19

RECORD OF BOREHOLE 19-7

CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 16 2019

BORING METHOD: Power Auger, Hollow Stem Auger (210mm OD)

PENETRATION RESISTANCE (N), BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED; DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; WATER CONTENT, %: W_P — W — W_L; scale 10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Backfilled with soil cuttings

SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)
Ground Surface	86.98
Dark brown silty sand with organic material (TOPSOIL)	86.88 / 0.10
Brown silty sand, trace to some clay and gravel (FILL MATERIAL)	86.37 / 0.61
Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	81.95 / 5.03
Brown silt and sand, some gravel (GLACIAL TILL)	81.77 / 5.21
End of Borehole Auger Refusal	

SAMPLE NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
1	SS	200	13
2	SS	0	12
3	SS	600	14
4	SS	600	10
5	SS	600	6
6	SS	600	5
7	SS	450	4

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

GEO - BOREHOLE LOG GINT LOGS 64742.02.GPJ GEMTEC 2018.GDT 16/9/19

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LOGGED: M.L.

CHECKED: G.D.

RECORD OF BOREHOLE 19-8

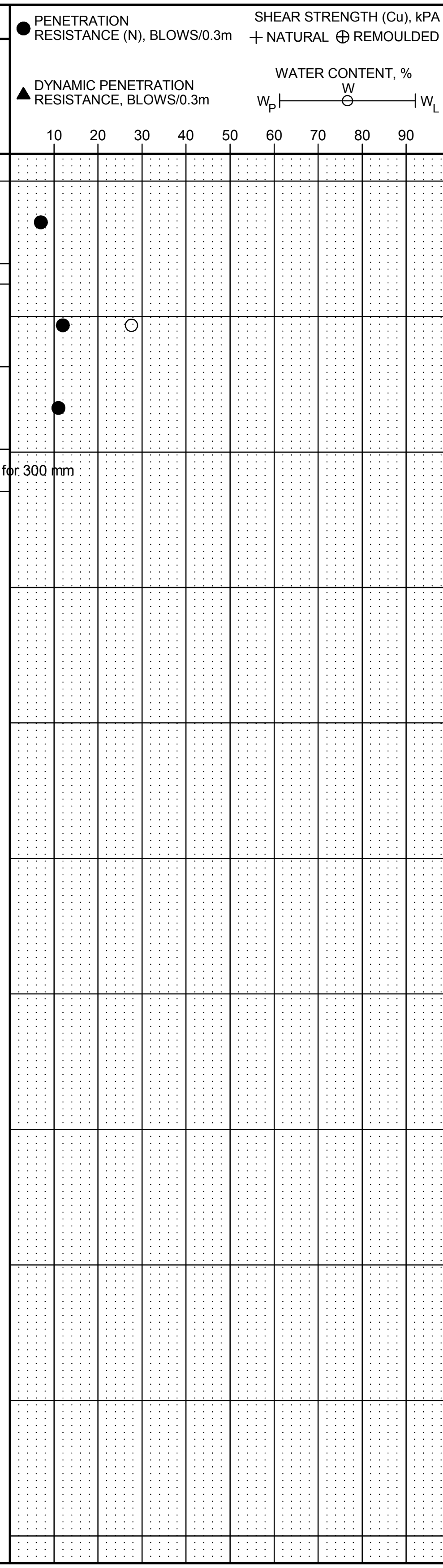
CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 16 2019

BORING METHOD: Power Auger – Hollow Stem Auger (210mm OD)

DEPTH SCALE METRES	SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
0	Ground Surface	89.68						
	Dark brown silty sand with organic material (TOPSOIL)	89.60 / 0.08						Backfilled with soil cuttings
	Loose, brown silty sand, trace to some clay and gravel (FILL MATERIAL)		1	SS	200	7		
	Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	89.07 / 0.61						
1			2	SS	300	12	MH	
			3	SS	450	11		
2			4	SS	200	>50 for 300 mm		
	End of Borehole Auger Refusal	87.24 / 2.44						

Depth scale continues to 10 m.



LOGGED: M.L.
CHECKED: G.D.

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GEO - BOREHOLE LOG GINT LOGS 64742.02.GPJ GEMTEC 2018.GDT 16/9/19

RECORD OF BOREHOLE 19-9

CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 16 2019

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	ELEV. / DEPTH (m)	NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	PIEZOMETER OR STANDPIPE INSTALLATION
0	Power Auger, Hollow Stem Auger (210mm OD)	Ground Surface	88.20					
		Dark brown silty sand with organic material (TOPSOIL)	88.10 / 0.10					Backfilled with soil cuttings
		Compact, brown silty sand, trace to some clay and gravel (FILL MATERIAL)		1	SS	200	11	
1		Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	87.13 / 1.07	2	SS	300	18	
2				3	SS	400	13	
				4	SS	100	8	
		Brown silt and sand, some gravel (GLACIAL TILL)	85.46 / 2.74					
3		End of Borehole Auger Refusal	85.23 / 2.97					

Legend: ● PENETRATION RESISTANCE (N), BLOWS/0.3m; ▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m; SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED; WATER CONTENT, %: W_P — W — W_L; scale 10 20 30 40 50 60 70 80 90. Columns: STRATA PLOT; ADDITIONAL LAB. TESTING.

Depth scale: 0 1 2 3 4 5 6 7 8 9 10

GEMTEC Consulting Engineers and Scientists

LOGGED: M.L.
CHECKED: G.D.

RECORD OF BOREHOLE 19-10

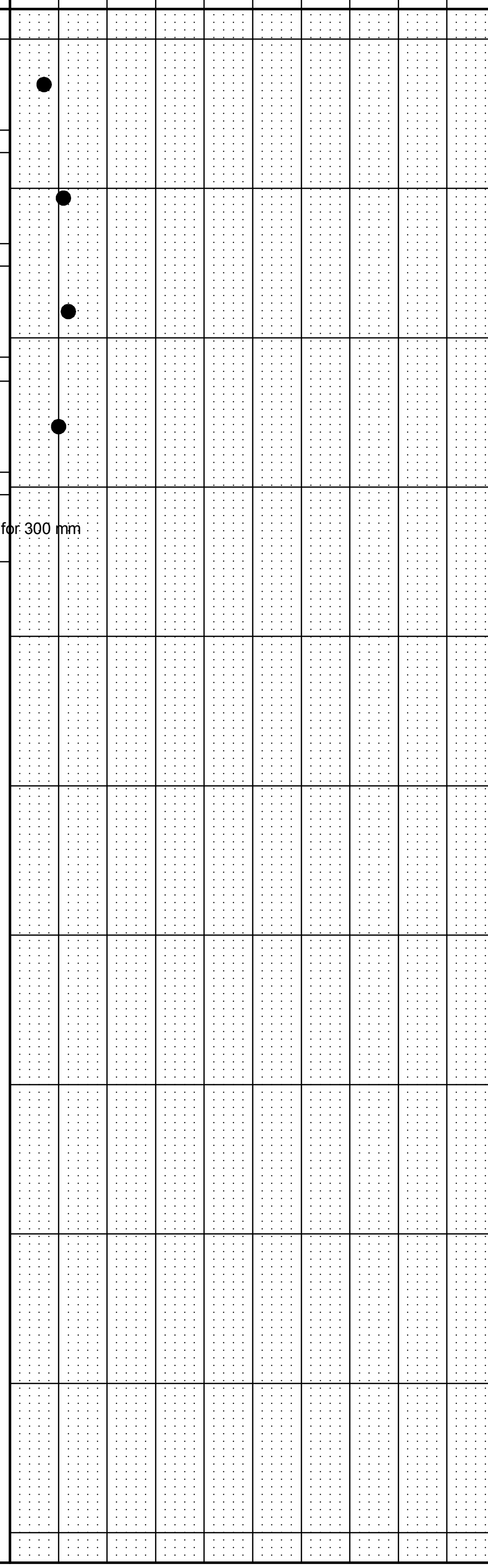
CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 16 2019

BORING METHOD: Power Auger — Hollow Stem Auger (210mm OD)

DEPTH SCALE METRES	SOIL PROFILE DESCRIPTION	ELEV. DEPTH (m)	SAMPLE NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m
0	Ground Surface	89.54				
	Dark brown silty sand with organic material (TOPSOIL)	89.48 0.06				
	loose, brown silty sand, trace to some clay and gravel (FILL MATERIAL)		1	SS	250	7
1	Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	88.71 0.83	2	SS	275	11
2			3	SS	450	12
			4	SS	600	10
3	Brown silt and sand, some gravel (GLACIAL TILL)	86.23 3.31	5	SS	450	>50 for 300 mm
	End of Borehole Auger Refusal	86.14 3.40				

● PENETRATION RESISTANCE (N), BLOWS/0.3m
▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L



ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION: Backfilled with soil cuttings

Depth scale: 0 1 2 3 4 5 6 7 8 9 10

GEMTEC
Consulting Engineers and Scientists

LOGGED: M.L.
CHECKED: G.D.

GEO - BOREHOLE LOG GINT LOGS 64742.02.GPJ GEMTEC 2018.GDT 16/9/19

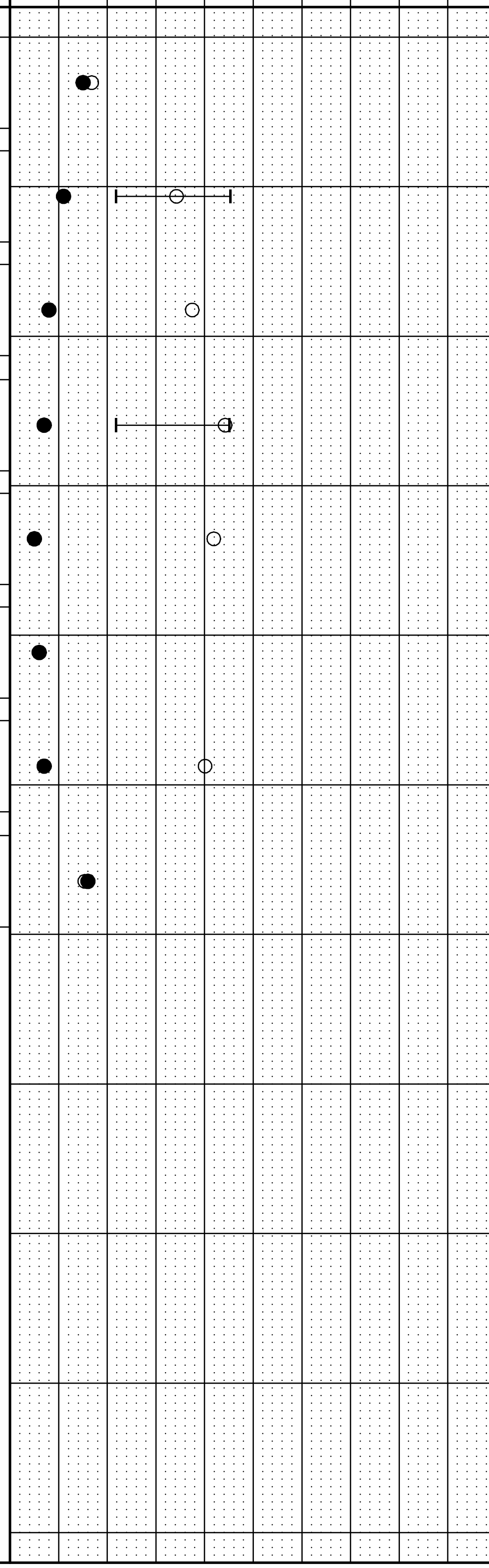
RECORD OF BOREHOLE 19-11

CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 15 2019

BORING METHOD: Power Auger — Hollow Stem Auger (210mm OD)

SOIL PROFILE – DESCRIPTION	ELEV. / DEPTH (m)	SAMPLE NUMBER	TYPE	RECOVERY, mm	BLOWS/0.3m	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
Ground Surface	88.26						
Dark brown silty sand with organic material (TOPSOIL)	88.16 / 0.10						Backfilled with soil cuttings
Compact, brown silty sand, trace to some clay and gravel (FILL MATERIAL)	87.65 / 0.61	1	SS	100	15		
Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)		2	SS	600	11		
		3	SS	600	8		
		4	SS	600	7		
		5	SS	600	5		
		6	SS	600	6	MH	
	82.92 / 5.34	7	SS	600	7		
Compact, grey silt and sand, some gravel (GLACIAL TILL)	82.31 / 5.95	8	SS	600	16	M	
End of Borehole Auger Refusal							



DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

GEMTEC Consulting Engineers and Scientists

LOGGED: M.L.
CHECKED: G.D.

RECORD OF BOREHOLE 19-12

CLIENT: Megha Holdings Inc.
PROJECT: Geotechnical Investigation - 1243 Teron Road
JOB#: 64742.02
LOCATION: See Borehole Location Plan, Figure 1

SHEET: 1 OF 1
DATUM: CGVD28
BORING DATE: Aug 16 2019

Boring method: Power Auger, Hollow Stem Auger (210mm OD)

Description	Elev. (m) / Depth (m)
Ground Surface	89.67
Dark brown silty sand with organic material (TOPSOIL)	89.62 / 0.05
Compact, brown silty sand, trace to some clay and gravel (FILL MATERIAL)	88.91 / 0.76
Stiff to very stiff, grey to brown silty clay (WEATHERED CRUST)	86.62 / 3.05
End of Borehole Auger Refusal	

Samples: Number	Type	Recovery, mm	Blows/0.3m
1	SS	300	6
2	SS	350	13
3	SS	600	9
4	SS	600	8

● PENETRATION RESISTANCE (N), BLOWS/0.3m
▲ DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m
SHEAR STRENGTH (Cu), kPA: + NATURAL ⊕ REMOULDED
WATER CONTENT, %: W_P — W — W_L
10 20 30 40 50 60 70 80 90

ADDITIONAL LAB. TESTING

PIEZOMETER OR STANDPIPE INSTALLATION:
Bentonite seal
Filter sand
51 mm Diameter, 1.52 metres long well screen
Monitoring well was dry on August 23, 2019.

DEPTH SCALE METRES: 0 1 2 3 4 5 6 7 8 9 10

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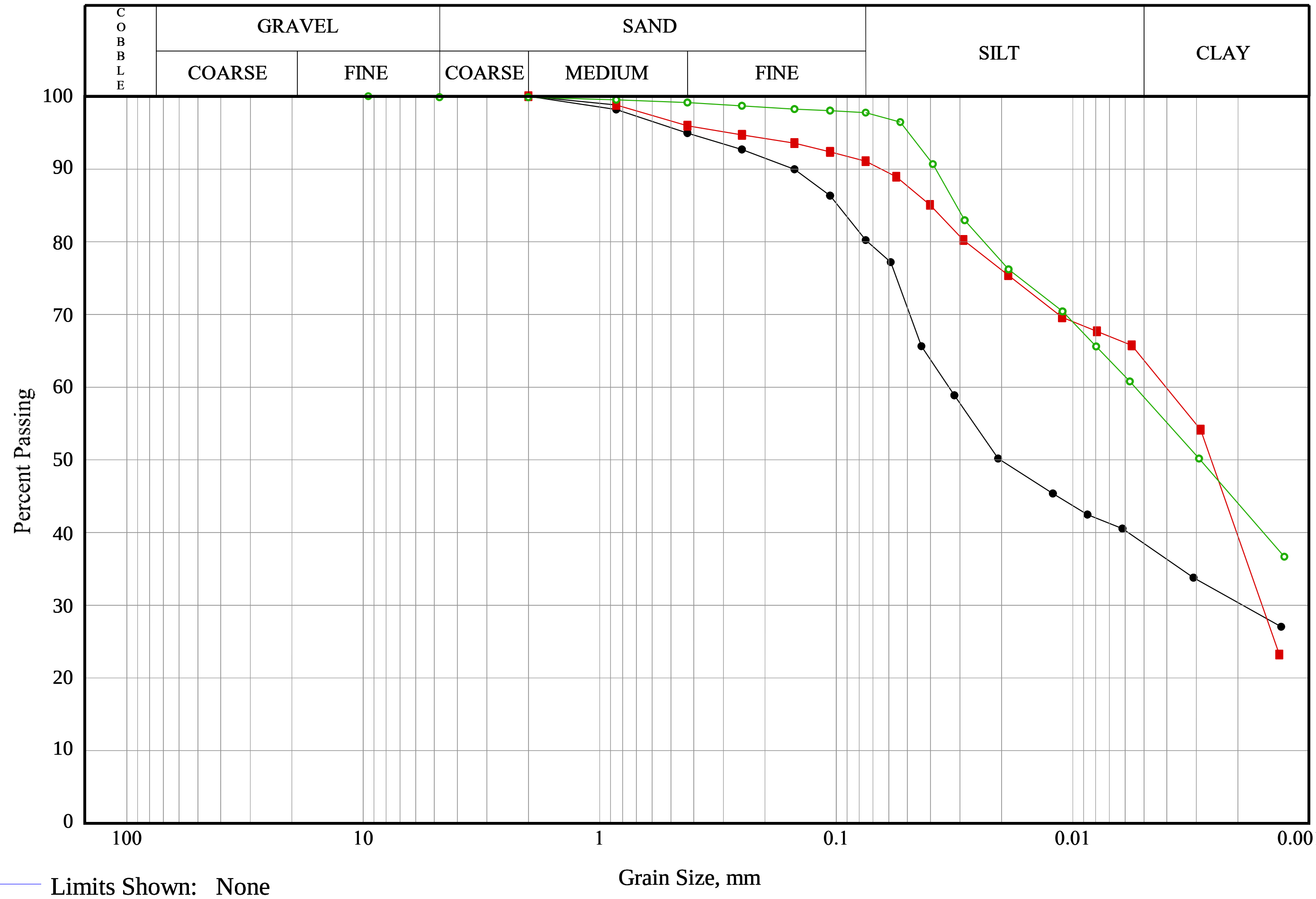
LOGGED: M.L.
CHECKED: G.D.

APPENDIX B

Laboratory Testing Results
Soils Grading Chart
Plasticity Chart

GEMTEC Consulting Engineers and Scientists	Client: Megha Holdings Inc.	Soils Grading Chart
	Project: 1243 Teron Road, Ottawa	
	Project #: 64742.02	

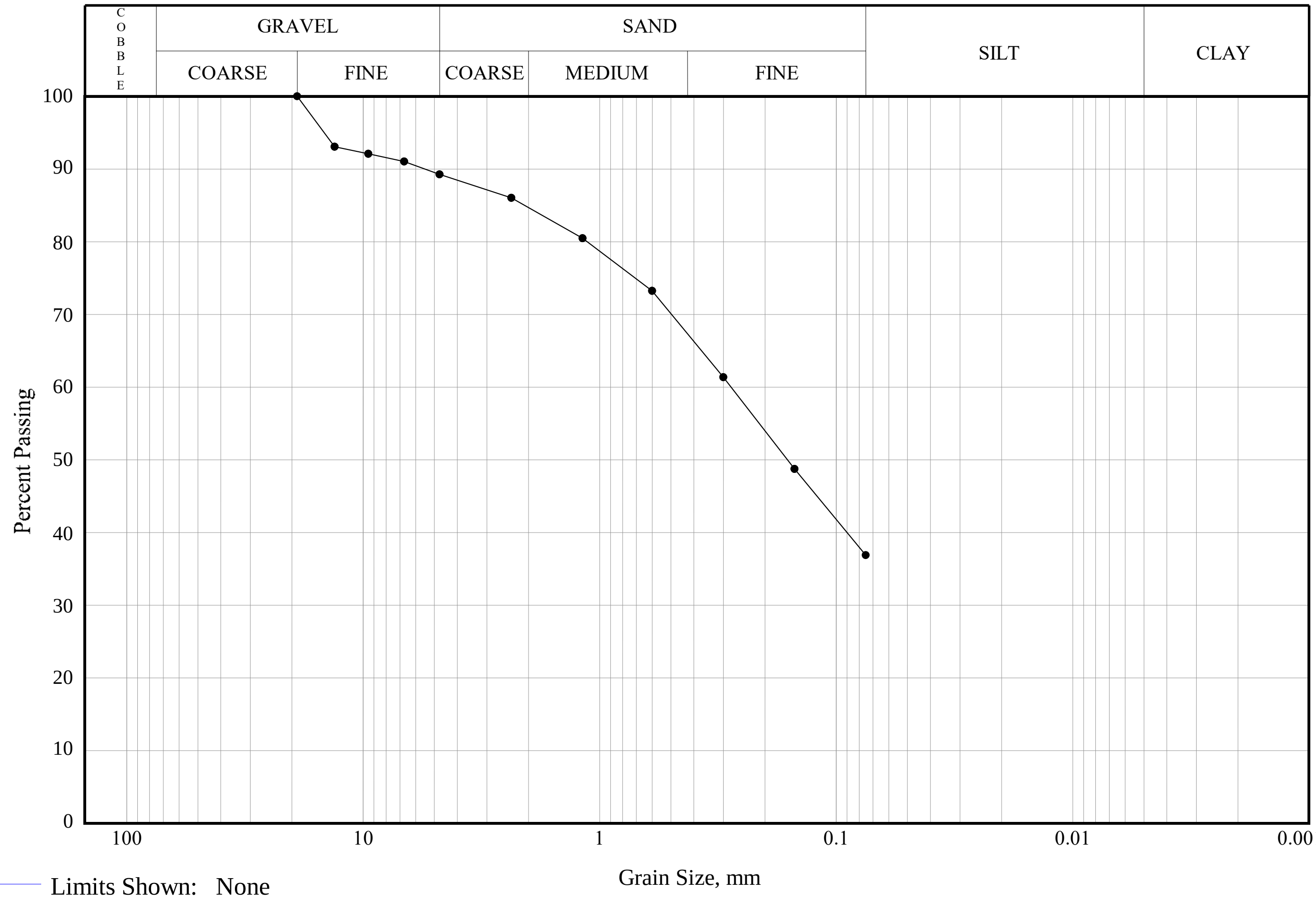


Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
●(black)	Fill Material	19-3	03	1.52-2.13	0.0	19.8	41.7	38.5
■(red)	Weathered Crust	19-8	02	0.76-1.37	0.0	8.9	27.4	63.7
○(green)	Weathered Crust	19-11	06	3.81-4.42	0.1	2.1	39.1	58.6

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
●(black)	Silt and clay , some sand	N/A	---	---	0.00	0.02	0.03	0.10	41.7
■(red)	Silty clay , trace sand	N/A	---	---	0.00	0.00	0.00	0.04	27.4
○(green)	Clay and silt , trace gravel, trace sand	N/A	---	---	---	0.00	0.01	0.03	39.1

GEMTEC Consulting Engineers and Scientists		Soils Grading Chart
Client:	Megha Holdings Inc.	
Project:	1243 Teron Road, Ottawa	
Project #:	6474202	

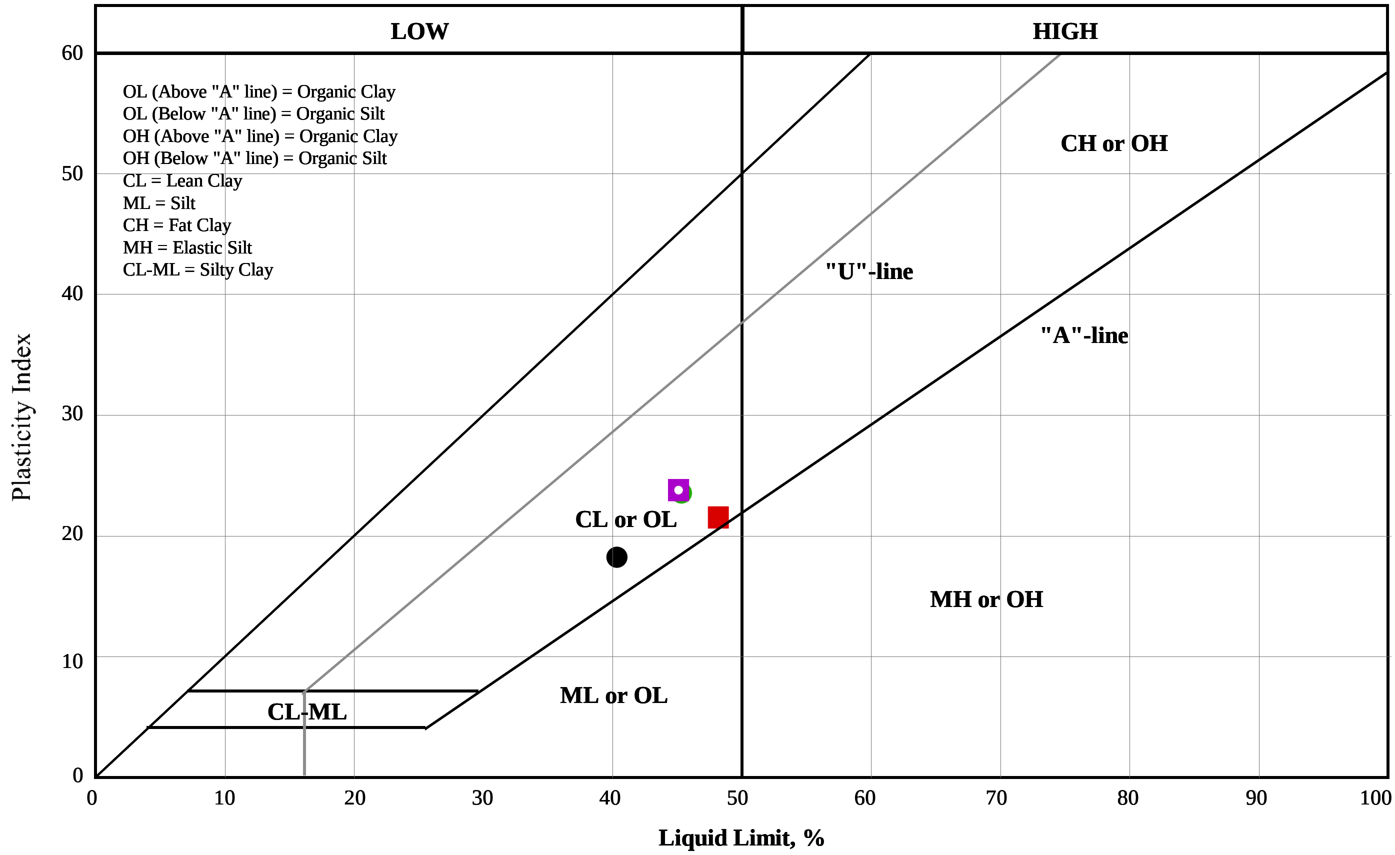


Limits Shown: None

Line Symbol	Sample	Borehole/ Test Pit	Sample Number	Depth	% Cob.+ Gravel	% Sand	% Silt	% Clay
—●—	Glacial Till	19-11	08	5.33-5.94	10.8	52.4	36.9	

Line Symbol	CanFEM Classification	USCS Symbol	D_{10}	D_{15}	D_{30}	D_{50}	D_{60}	D_{85}	% 5-75µm
—●—	Sand and silt , some gravel	N/A	---	---	---	0.16	0.28	2.08	---

GEMTEC Consulting Engineers and Scientists	Client: Megha Holdings Inc.	# Plasticity Chart
	Project: 1243 Teron Road, Ottawa	
	Project #: 6474202	



Symbol	Borehole /Test Pit	Sample Number	Depth	Liquid Limit	Plastic Limit	Plasticity Index	Non-Plastic	Moisture Content, %
●	19-1	04	2.29-2.90	40.3	22.1	18.2	☐	31.19
■	19-6	03	1.52-2.13	48.2	26.7	21.5	☐	35.62
○	19-11	02	0.76-1.37	45.3	21.8	23.5	☐	34.22
▣	19-11	04	2.29-2.90	45.1	21.3	23.8	☐	44.23

APPENDIX C

Chemical Analysis of Soil Sample Relating to Corrosion
(Paracel Laboratories Ltd. Order No. 1935274)

Report to: Megha Holdings Inc.
Project: 64742.02 (November 12, 2019)

Certificate of Analysis

Client: GEMTEC Consulting Engineers and Scientists Limited

Client PO:

Report Date: 30-Aug-2019

Order Date: 27-Aug-2019

Project Description: 64742.02

	Client ID:	19-3 SA4	19-6 SA3	19-7 SA3	19-10 SA2
	Sample Date:	16-Aug-19 09:00	16-Aug-19 09:00	16-Aug-19 09:00	16-Aug-19 09:00
	Sample ID:	1935274-01	1935274-02	1935274-03	1935274-04
	MDL/Units	Soil	Soil	Soil	Soil
Physical Characteristics					
% Solids	0.1 % by Wt.	78.8	75.1	75.3	75.9
General Inorganics					
Conductivity	5 uS/cm	175	57	70	38
pH	0.05 pH Units	7.82	8.13	7.71	7.43
Resistivity	0.10 Ohm.m	57.1	175	142	265
Anions					
Chloride	5 ug/g dry	7	7	8	6
Sulphate	5 ug/g dry	100	9	30	<5

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