AME

Materials Engineering

[redacted]

Geotechnical Investigation
Gananoque Town Hall
Proposed Expansion
Gananoque, Ontario

Reference No. 60218.002

Prepared for:

Corporation of the Town of Gananoque
30 King Street East, Box 100
Gananoque, Ontario K7G 2T6

By:

Aecon Materials Engineering Corp.
104 - 215 Stafford Road West
Ottawa, ON K2H 9C1

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June 2016

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Materials Engineering

104 - 215 Stafford Rd. West
Ottawa (Nepean), Ontario,
K2H 9C1 Canada
Tel: (613) 726-3039
Fax: (613) 726-3004

Report No. 60218.002

June 8th, 2016

Corporation of the Town of Gananoque
30 King Street East, Box 100
Gananoque, ON K7G 2T6

Attention: Chris Wager
Director of Public Works

RE: Preliminary Geotechnical Investigation – Proposed Gananoque Town Hall Expansion Gananoque, Ontario

Dear Mr. Wagar,

Please find attached our geotechnical report for the above mentioned project. A geotechnical investigation was conducted to assess the soil and groundwater conditions at the site and to provide recommendations for design and construction, including: excavation requirements, compaction requirements and backfill materials, dewatering requirements, groundwater conditions, reuse of existing materials and pavement design.

The soil samples obtained from the boreholes will be stored for a six-month period, after which they will be discarded, unless we hear to the contrary from the Corporation of the Town of Gananoque.

We trust that this report provides sufficient information for your current requirements. If you have any questions concerning this report, please do not hesitate to contact the undersigned.

Sincerely,

AECON MATERIALS ENGINEERING CORP.

Andrew O'Keefe, P.Eng
Geotechnical Engineer

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1.0 INTRODUCTION

This report discusses the findings of a limited preliminary geotechnical investigation carried out in support of the proposed Gananoque Town Hall Expansion, Gananoque, Ontario. A Site Location Plan is provided as Figure A1, Appendix A.

This report has been prepared based on our Proposal No. P16021 dated February 22nd, 2016 and authorized by Mr. Chris Wager, Director of Public Works, of The Corporation of the Town of Gananoque on February 29th, 2016.

The purpose of the investigation was to advance a limited number of boreholes across the site in order to provide recommendations concerning site preparation, groundwater conditions and other pertinent subsoil conditions which may affect construction and/or material selection during the design process.

2.0 PROJECT DESCRIPTION

The project consists of the proposed construction of an addition to the existing commercial building at the site. The size and dimensions of the proposed addition was not known at the time of the investigation, however, it is assumed that the addition will be similar in construction to the existing structure, which consists of an above grade two (2) storey structure with a full basement. It is also assumed that the existing asphaltic concrete pavement will be designated a Fire Route.

3.0 SITE DESCRIPTION

The site is located at 30 King Street East in Gananoque, Ontario. The existing two storey commercial brick building was constructed in 1831 and it is assumed to be supported on conventional shallow foundations. The building was originally built and occupied as a residential home, until deeded to the Town of Gananoque in 1911.

The existing Town Hall is located in the middle of an approximate three (3) acre lot. The building is surrounded by small asphaltic concrete parking areas to the northwest and southwest. The remainder of the lot is comprised of landscaped areas. The site is generally flat, with a gentle slope southwest towards Park Street.

The site is surrounded by commercial buildings and businesses to the south along King Street East. Residential lots are located along Brock Street to the north and west. West of the site, beyond Park Street, is the Gananoque River.

4.0 METHODOLOGY

4.1. GEOTECHNICAL FIELD INVESTIGATION

As requested by the Corporation of the Town of Gananoque, the field investigation consisted of advancing four (4) boreholes designated Borehole BH16-01 to BH16-04 at the locations shown on the Borehole Location Plan presented as Figures A2, Appendix A. A complete description of the stratigraphy encountered at each location is presented in Appendix B.

The geotechnical investigation was performed on March 7th, 2016. Soil sampling was completed using a truck-mounted CME drill rig operating under the supervision of experienced AME personnel. Soil samples were secured at regular intervals in the overburden with a 51mm diameter Standard Penetration Test split-spoon sampler. Sampling procedures were performed in accordance with ASTM Standard D-1586, which provides the penetration resistance ("N-value") of the soils.

All soil samples were examined in the field upon retrieval for type, texture, colour and odour. The samples were sealed in air tight plastic bags and transferred to AME's laboratory where they were examined by a geotechnical engineer to verify the accuracy of the initial soil descriptions and to select appropriate samples for laboratory testing. These samples will be stored for a six-month period, after which they will be discarded unless we hear to the contrary from The Corporation of the Town of Gananoque. One (1) composite sample was also obtained and placed in laboratory supplied sample containers for chemistry analytical testing (pH, Resistivity, Sulphates and Chlorides).

Existing ground surface elevations were measured at the borehole locations and were referenced to an arbitrary benchmark established as the top of the foundation wall of the existing Town Hall, as shown on Figure A2, Appendix A.

Groundwater conditions within the boreholes were observed during the course of the drilling operations, prior to backfilling. The boreholes were backfilled upon completion with auger cuttings and bentonite clay pellets ("Hole Plug") in accordance with O.Reg. 903, as amended.

Table No. 1 below summarizes the borehole numbers and final drilling depths.

Table No. 1: Borehole Numbers and Drilling Depths

Borehole No.	Drilling Depth Below Existing Ground Surface (m)	Comment
BH16-01	6.10	Borehole terminated within sand layer
BH16-02	4.57	Borehole terminated within sand and silt layer
BH16-03	4.57	Borehole terminated within sand and silt layer
BH16-04	6.10	Borehole terminated within sand and silt layer

4.2 LABORATORY TESTING

All borehole samples were returned to our laboratory where they were subjected to a visual examination and classification. A laboratory soil testing program, as summarized in Table No. 2 below, was completed on selected soil samples to confirm the textural classifications and provide geotechnical parameters for the encountered materials. The results of the following lab analyses are presented in Appendix C.

Table No. 2: Laboratory Soil Testing Program

Test	ASTM Standard	Number of Samples
Natural Moisture Content	ASTM D2216	12
Particle Size Analysis	ASTM D6913	2
Atterberg Limit Test	ASTM D4318	1
Hydrometer Analysis	ASTM D422	1

One (1) composite sample was obtained from BH16-01. The retained sample was placed in laboratory supplied sample containers for chemistry analytical testing (pH, Resistivity, Chlorides and Sulphates) to determine the corrosion potential of the soils on subsurface structures. The results are discussed in Section 5.9, with laboratory test results presented in Appendix C.

The selected samples were submitted under chain of custody documentation to AGAT Laboratories in Ottawa, Ontario. AGAT Laboratories is an accredited member of the Canadian Association of Laboratory Accreditation Inc. (CALA).

5.0 SUBSURFACE CONDITIONS

5.1. SUMMARY

The subsurface conditions observed in the boreholes are presented in detail on the AME Borehole records in Appendix B. An explanation of the symbols and terms used to describe the Borehole records is also provided.

In general, the subsurface soils at the site generally consist of a topsoil layer or asphaltic concrete overlying a native brown silt and clay, overlying a brown silt, some sand, overlying a brown sand, some silt. The following sections describe the subsurface conditions in greater detail.

5.2 TOPSOIL

From the surface, a layer of brown topsoil was encountered at each borehole location, with the exception of Borehole BH16-04. The thickness of the topsoil was measured to range between 110 mm to 180 mm.

5.3 ASPHALTIC CONCRETE

From the surface, an asphaltic concrete was encountered at Borehole BH16-04. The asphaltic layer had a thickness of 100mm.

5.4 GRANULAR FILL

Underlying the asphaltic concrete at Borehole BH16-04, a layer of grey crushed gravelly sand, some silt, was encountered. The gravelly sand layer had a thickness of 430 mm. Standard Penetration Tests (N-values) in the gravelly sand layer had 'N'-values of 37 blows per 300 mm, indicative of a dense relative density. It should be noted that the granular fill material did appear to be frozen at the time of the investigation, and the recorded N-values may not be representative.

5.5 FILL

Underlying the surficial topsoil layer in Boreholes BH16-01, BH16-03 and BH16-04, a fill material was encountered that had a matrix ranging from a brown sand, some silt to a brown sandy clay, trace organics. The fill material had a thickness ranging from 360mm to 460mm.

Standard Penetration Tests (N-values) in the fill layer had 'N'-values ranging from 7 to 13 blows per 300 mm, indicative of a compact relative density.

5.6 LEAN CLAY

Underlying the surficial topsoil at Borehole BH16-02 and the fill at Boreholes BH16-01, BH16-03 and BH16-04, a brown silt and clay, trace sand, trace gravel, was encountered and would be classified as Lean Clay (CL) as per the Unified Soil Classification System ASTM No. D2487. The lean clay layer was measured to extend to a depth below ground surface ranging from 3.53 m to 4.32 m, corresponding to a Local Elevation of 96.06m to 95.28m.

Standard Penetration Test results (N-values) recorded in the lean clay ranged from 7 to 26 blows per 300 mm, indicative of a stiff to very stiff consistency. The undrained shear strength of the silt and clay layer was not recorded as the material did not shear during testing.

Laboratory particle size distribution and Atterburg Limits test analyses were completed on one (1) sample of the silt and clay. The results are summarized below in Table No. 3 and presented in Appendix C. Laboratory testing determined moisture contents of the clay to range from 22.0% to 36.0% by weight.

Table No. 3: Silt and Clay Laboratory Test Results

Sample	Gravel (greater than 4.75mm size)	Sand (0.075mm to 4.75 mm size)	Silt (< 0.002 mm to 0.075 mm size)	Clay (< 0.002 mm size)	Liquid Limit (LL)	Plastic Limit (PL)	Plasticity Index (PI)
BH16-01 SS-3	0.9%	1.5%	59.0%	38.6%	39	20	19

Due to the above noted silt content, this lean clay layer susceptiblilty to frost heaving would be considered high.

5.7 SILT

Underlying the brown lean clay layer at Boreholes BH16-01 and BH16-02, a thin layer of brown silt, some sand was encountered. The silt layer was measured to extend to a depth below ground surface ranging from 4.3 m to 4.4 m, corresponding to a Local Elevation of 95.27m to 95.06m.

Standard Penetration Test results (N-values) recorded in the silt and sand ranged from 11 to 20 blows per 300 mm, indicative of a very stiff consistency. Laboratory testing determined moisture contents of the silt to be 19.8% by weight.

5.8 SAND

Underlying the brown silt layer, a brown sand, some silt, trace gravel, was encountered at all four borehole locations. The sand layer was measured to extend to the termination depth of Boreholes BH16-01 and BH16-04 at a depth of 6.10m (Local Elevation 93.36m and 93.46m) and a depth of 4.57 m (Local Elevation 95.02m and 95.44 m) in Borehole BH16-02 and BH16-03.

Standard Penetration Test results (N-values) recorded in the sand ranged from 6 to 11 blows per 300 mm, indicative of a loose to compact relative density.

A laboratory particle size distribution analysis was completed on one (1) sample of the sand material. The results are summarized below in Table No. 4 and presented in Appendix C. Laboratory testing determined moisture contents of the sand to be 15.9% by weight.

Table No. 4: Sand Laboratory Test Results

Sample	Gravel (greater than 4.75mm size)	Sand (0.075mm to 4.75 mm size)	Silt & Clay (< 0.075mm size)
BH16-01 SS1B	7.6%	77.3%	15.1%

5.9 ANALYTICAL CHEMISTRY TESTING

One (1) composite soil sample was selected for chemistry analytical testing for pH, Resistivity, chlorides and sulphate, in order to evaluate the potential of the existing soil to corrode buried structures. The following Table No. 5 below presents the results obtained for the soil sample tested.

Table No. 5: Analytical Chemistry Testing

Borehole No.	pH	Resistivity (Ohm.cm)	Chlorides (ppm)	Sulphates (ppm)
BH16-01 SS-3	7.96	1610	324	21

According to CSA Standard A23.1-04, sulphate concentrations in soil should not exceed 1,000 ppm. It is generally recognized that chloride concentrations should be below 250 ppm, for both soil and groundwater.

The analytical chemistry test results indicate that the soil sample tested yielded sulphate concentrations less than the criteria considered damaging to concrete, therefore, there should be negligible sulphate attack on concrete at this site. The chloride concentrations were found to be above the generally recognized limit, therefore, there is a potential for the chloride contained in the soil at this site to produce corrosion of embedded reinforcing steel in concrete. The test results indicate that the soil samples tested have generally neutral pH and relatively low resistivity. Based on the sample tested, the soil corrosiveness is considered to be Severe.

The complete results of the analytical chemistry testing are presented in Appendix C.

5.10 GROUNDWATER LEVELS

Groundwater observations were made in the open boreholes during the progress of the drilling and upon completion of the investigation. No standpipes were installed as part of this investigation. During the limits of this investigation, water was observed in the open borehole at 4.5 m below ground surface (Local Elev. 94.963 m) due to medium permeability of the sand layer defined in section 5.8. Soil sample appearance and resulting moisture contents exhibit signs of the static groundwater level approaching ground surface.

Based on the water level of the adjacent Gananoque River, it is assumed the water level gradient flows from east to west for the site. Groundwater levels are expected to fluctuate seasonally and with periods of prolonged precipitation.

6.0 DISCUSSION AND RECOMMENDATIONS

Although the data provided by this investigation provides preliminary information relevant to defining general site conditions and identifying a potential foundation support system, together with other items related to building design, construction and pavement structures, it should be noted that a detailed investigation may be required for the final foundation design. Additional test pit and borehole information may be required once the structure location, founding depth, loads and parking lot locations are identified to provide site preparation recommendations for the building and associated parking areas.

Based upon the borehole results and assuming them to be representative of subsoil conditions across the entire area, the following comments and recommendations are provided for the proposed at the test locations only.

A deposit of silt and clay was encountered across the entire subject area. Due to the compressible nature of the silt and clay, grade raises across the site should be restricted to minimize total settlements. For the purpose of this preliminary report, the recommendations below are under the assumption that a maximum of 1.0 meter grade raise will be required for the construction of the proposed structures, as this will tend to minimize settlements. The geotechnical engineer should be consulted if higher grades are proposed.

Additional consideration should be given to excavations in close proximity to existing foundations and structures, so that there is minimal loss of ground support. Temporary shoring and/or underpinning may be required in areas where excavations intersect an imaginary line extending down from the existing footings at an inclination of approximately 45° to the horizontal.

6.1 FOUNDATION RECOMMENDATIONS

Details regarding the structure location, founding depth and loads were not available at the time of this report. Hence, the following comments are considered preliminary in nature. Once any additional details for the proposed structure is available, more specific information can be provided following a review of the existing data which may warrant a more detailed geotechnical investigation.

The subsurface conditions observed from the preliminary geotechnical investigation, reveal that lightly load structures such as a single or two storey commercial building are suitable to be founded on spread and strip footings. A heavily load structure will likely have to be founded on sound bedrock, piles or caissons which is dependent on the proposed location and founding depth.

6.1.1 SHALLOW FOUNDATIONS ON NATIVE SOIL

For the proposed structure, surficial vegetation/organics, existing fill, service lines and other deleterious materials should be entirely removed from beneath the influence zone of these footings. The influence zone is defined by a line drawn at 1 horizontal to 1 vertical, outward and downward from the edge of the footings, down to the competent native soil.

The following geotechnical resistances are appropriate for a footing with a minimum 0.8 m width and a maximum 2.5 meter width on the undisturbed native silt and clay or compacted granular fill overlying undisturbed native silt and clay for a founding level not less than 1.4 m below ground surface.

- Factored Geotechnical Resistance at Ultimate Limit State (ULS) = 150 kPa
- Geotechnical Resistance at Serviceability Limit State (SLS) = 100 kPa

The Geotechnical Resistance at Serviceability Limit State (SLS) is based on maximum total and differential settlements of 25 mm and 20 mm, respectively.

The founding subsoil must be inspected by the Geotechnical Engineer to confirm that it is suitable to support the design loads, and to confirm that all disturbed or unsuitable founding soils are properly removed from below all footing areas. It should be noted that silt and clay material at the anticipated founding level can be easily disturbed by foot traffic. A mud slab of lean concrete (minimum thickness of 50 mm) placed immediately after inspection and approval should be considered. All soft or disturbed areas revealed during the subgrade inspection should be removed and replaced with approved Structural Fill or concrete.

If Structural Fill is required below the underside of footing, it should conform to OPSS Granular B Type II or OPSS Granular A. It should be compacted in lifts no thicker than 300 mm to at least 100% Standard Proctor Maximum Dry Density (SPMDD) in accordance with ASTM D689. The structural fill should be placed in order to provide support within the influence zone of these footings.

Resistance to Lateral Loads for Footing on Native Lean Clay

Resistance to lateral forces/sliding between the concrete footings and subsoils should be calculated in accordance with Section 6.7.5 of the CHBDC. The coefficient of friction, (tan δ) may be taken as 0.38 for cast in place concrete footings constructed on undisturbed native soil layers. This represents an unfactored value; in accordance with CHBDC, a factor of 0.8 is to be applied in calculating the horizontal resistance.

Resistance to lateral loads could be increased by constructing a shear key at the bottom of the footing. The design of shear keys would require a specific analysis taking into consideration the magnitude of the horizontal loading, the magnitude of the vertical loading, and any variations in the bearing pressure due to overturning moments.

The above guidelines assume that the subgrade materials will not be disturbed by construction activities.

6.2 FROST PROTECTION DEPTH

The recommended design frost protection depth for the site area is 1.4 m (Source: OPSD 3090 / 101). Therefore, a permanent soil cover of about 1.4 m or its thermal equivalent of high density insulation is required for frost protection of foundations for unheated structures.

6.3 CONCRETE FLOOR SLABS

In regards to the foundation design for the proposed expansion of the Town Hall, any compressible organic or weak soils should be removed below the proposed ground floor or sub floor slab unless a dependent floor slab or pile support system is implemented.

The brown silt and clay material observed at each borehole location may remain underside of the concrete floor slab provided it is proven competent by proof-rolling using a heavy roller in the presence of geotechnical personnel. Any soft/disturbed areas that discovered should be removed and replaced with Structural Fill such as select subgrade (SSM) material or equivalent as outlined in OPSS 1010. It should be noted that the recommendations provided herein are based on the assumption that the average net floor slab loads will not exceed 10 kPa.

A layer of free draining granular material, such as OPSS Granular A, at least 300 mm in thickness should be placed immediately beneath the floor slab for leveling, drainage and support purposes and should be compacted to at least 100% of SPMDD. Perimeter drains should be installed at where final grades around the building expansion are higher than the underside of the slab.

Building pad preparation recommendations should be made available in the detailed investigation.

6.4 LATERAL EARTH PRESSURES

The appropriate value for use in the design of structures subject to earth pressures at this site are tabulated as follows:

Parameter	Definition	Units
Φ'	internal angle of friction	degrees
Y	bulk unit weight of soil	kN / m^3
K_a	active earth pressure coefficient (Rankin)	dimensionless
K_o	at-rest earth pressure coefficient (Rankin)	dimensionless
K_p	passive earth pressure coefficient (Rankin)	dimensionless

The appropriate unfactored values for use in the design of structures subject to unbalanced earth pressures at this site are tabulated as follows:

Material	Φ'	γ	K_a	K_p	K_o
Compact Granular Fill Granular 'A' (OPSS 1010)	35°	23.0	0.27	3.7	0.43
Compact Granular Fill Granular 'B type 2' (OPSS 1010)	32°	21.0	0.31	3.2	0.47
Existing native stiff silt and clay	27°	19.0	0.38	2.7	0.55

The walls or bracings subject to unbalanced earth pressures must be designed to resist a pressure that can be calculated based on the following formula:

$$\mathbf{P = K [\gamma (h-h_w) + \gamma' h_w + q] + \gamma_w h_w}$$

Where:
P = lateral pressure in kPa acting a depth h (m) below ground surface
K = applicable lateral earth pressure coefficient
h_w = depth below the groundwater level at point of interest (m)
γ = bulk unit weight of backfill (kN / m^3)
γ' = the submerged unit weight (kN / m^3) of exterior soil ($\gamma' = \gamma - \gamma_w$)
γ_w = unit weight of water, assume a value of 9.8 kN/m^3
q = the complete surcharge loading (kPa)

Where the basement perimeter can be drained effectively to eliminate hydrostatic pressure on the wall, this equation can be simplified to:

$$\mathbf{P = K [\gamma h + q]}$$

The basement wall of the structure will be relatively unyielding. It is normal practice to use an earth pressure coefficient for basement wall design that is greater than the active earth pressure coefficient and less than the at rest condition.

6.5 SEISMIC SITE CLASSICIFICATION

The Ontario Building Code (OBC) specifies that the structure should be designed to withstand forces due to earthquakes. For the purpose of earthquake design the information relevant to the geotechnical conditions at this site is the 'Site Class'. Based on the explored soil properties and in accordance with Table 4.1.8.4.A of the Ontario Building Code (2012), it is recommended that Site **Class 'D'** be applied for structural design at this site.

Seismic information for the site location referenced in this report is provided in Table No. 6 below. Data from the 2010 National Building Code Seismic Hazard Calculation is provided in this table to be consistent with the 2012 Ontario Building Code.

Table No. 6: Summary of Seismic Parameters

Parameter	Site	Source
Site Class	D	2012 Ontario Building Code Table 4.1.8.4.A
$S_a(0.2)$	0.304	2010 National Building Code Seismic Hazard Calculation
$S_a(1.0)$	0.105	2010 National Building Code Seismic Hazard Calculation
F_a	1.3	2012 Ontario Building Code Table 4.1.8.4.B
F_v	1.4	2012 Ontario Building Code Table 4.1.8.4.C

6.6 SUITABLE RE-USES FOR SITE GENERATED MATERIAL

If on-site excavated soils become excessively wetter than optimum moisture contents, the soils should be dried sufficiently in order to achieve the specified degree of compaction. In general, the crushed granular fill materials described in Section 5.4 would be considered as compactable fill provided that the materials are separated during the excavation process and the natural moisture content is within 2% of optimum. If construction is carried out in inclement weather, there is a likelihood that some amount of granular supplement will be required (i.e. some sub-excavation followed by granular replacement). It should be noted that the existing sand with clay fill material described in Section 5.5 and the lean clay described in section 5.6 should only be reused in landscape areas.

6.7 FOUNDATION BACKFILL

Exterior foundation backfill should consist of a material meeting the requirements of OPSS Granular 'B" fill. The existing granular material (free of asphalt and organic material) described in Section 5.4, is suitable for backfilling purposes provided that the materials are separated during the excavation process and the natural moisture content is within 2% of optimum. The fill material described in Section 5.5 and the silt and clay described in Section 5.6, would not be suitable for backfilling.

6.8 EXCAVATIONS

It is anticipated that the excavations for the proposed expansion will be associated with the foundation footings and utility services. Based on the minimum anticipated excavation depth of 2.0 meters, temporary excavation side-slopes should not exceed 1.0 horizontal to 1.0 vertical, although some flattening of the side slopes may be required for excavations below the water table.

All excavations must be carried out in accordance with Occupational Health and Safety Act (OHSA). With respect to OHSA, the existing fill can be classified as Type 3 soils. For excavations through multiple soil types, the side slope geometry is governed by the soil with the highest number designation. Locally, where loose or soft soil is encountered at shallow depths or within zones of persistent seepage, it may be necessary to flatten the side slopes. Excavation side slopes should not be unduly left exposed to inclement weather. During the excavation, no excavated material should be piled, nor machinery or equipment placed, closer than 2.0 m from the edge of the top of the slope. No vertical unbraced excavations should be performed in the soil.

An examination of the slopes should be carried out by qualified soils personnel before any worker enters the excavation. The exposed subsoils should be protected against erosion from water run-off or rain.

If excavations require vertical slopes within the overburden due to space restrictions, trenches should be braced with tightly fitted steel trench boxes. It is the responsibility of the contractor to select and design the proposed excavation support method and recommended that the successful bidder be required to submit a shoring plan, if required.

6.9 DEWATERING AND DRAINAGE

It is not anticipated that the foundation excavation will encounter significant groundwater infiltration for the anticipated excavation depth of 2.0 meters. Groundwater levels can change and fluctuate seasonally at the site, in response to weather conditions and/or prolong precipitation events. It is anticipated that adequate control of any groundwater seepage can likely be achieved by pumping from properly filtered sumps in the base of the excavation. Surface water should be directed away from the open excavations at all times.

In general, the fine-grained silt and clay found at the site within the anticipated excavation depths is generally of low permeability and precludes the free flow of groundwater. Groundwater may also be found in the granular fill described in section 5.4 and represents a "*perched water table*" or water that is trapped above the underlying low permeable silt and clay. As such, water levels in the perched zone can be expected to vary on a seasonal basis with the highest levels occurring in the spring.

It is not anticipated pumping rates will exceed 50,000 L/day. If so, the Contractor should obtain a Permit to Take Water under Section 34 of the Ontario Water Resources Act. Please consider the services of a hydrogeologist to carry out the required analysis and reporting for the PTTW.

6.10 PAVEMENT AREAS

A preliminary pavement structure to be used for vehicle parking areas and heavy duty access roads assumed. Please note, that a detailed geotechnical investigation will include site preparation recommendations for the associated pavement structures once the actual locations are known.

It has been assumed that the parking areas will be used primarily by passenger vehicles and the access roads will be used by delivery trucks and fire vehicles, in addition to passenger vehicles. Minimum pavement designs are provided in Table No. 7 where new pavement is proposed:

Table No. 7: Recommended Minimum Pavement Structures

	Vehicle Parking Areas	Truck and Access Roads
Hot Mix Asphaltic Concrete	80 mm of Superpave 12.5 (OPSS 1151) or HL3 (OPSS 1150) with PG 58-34	40 mm of Superpave 12.5 (OPSS 1151) or HL3 (OPSS 1150) with PG 58-34
		60 mm of Superpave 19.0 (OPSS 1151) or HL8 (OPSS 1150) with PG 58-34
OPSS Granular A Base	150 mm	150 mm
OPSS Granular B Type II Subbase	300 mm	450 mm

All materials, placement, compaction and quality testing should be in conformance with the appropriate Ontario Provincial Standards Specifications (OPSS). The pavement surface and underlying subgrade should be graded to direct runoff water toward a suitable drainage system. Due to the high frost susceptiblilty of the existing lean clay layer, backfilling or excavation operations within the upper 1.4 metres from final pavement grade in this area should provide a frost taper of (3H:1V) in order to minimize differential frost movement. It is recommended that the asphalt mix design be submitted to the consulting engineer for review and approval prior to paving.

7.0 LIMITATION OF THE INVESTIGATION

This report is intended solely for the Client named. The material in it reflects our best judgement in light of the information available to Aecon Materials Engineering Corp. at the time of preparation. No portion of this report may be used as a separate entity, it is written to be read in its entirety. 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.

The recommendations made in this report are in accordance with our present understanding of the project. We request that we be permitted to review our recommendations when the drawings and specifications are complete, or if the proposed construction should differ from that mentioned in this report.

It is also important to emphasize that a soils investigation is, in fact, a random sampling of a site and the comments are based on the results obtained at the locations of the test results only. It is, therefore, assumed that these results are representative of the subsoil conditions across the site. Should any conditions at the site be encountered which differ from those found at the test locations, we request that we be notified immediately in order to permit a reassessment of our recommendations.

We trust that this report meets with your present requirements. Please do not hesitate to contact us should any questions arise.

Respectfully,

AECON MATERIALS ENGINEERING CORP

Andrew O'Keefe, P.Eng.
Geotechnical Engineer

Adam Stamplicoski, A.Sc.T
Senior Technologist

LICENSED PROFESSIONAL ENGINEER
A. J. O'KEEFE
100060239
June 8, 2016
PROVINCE OF ONTARIO

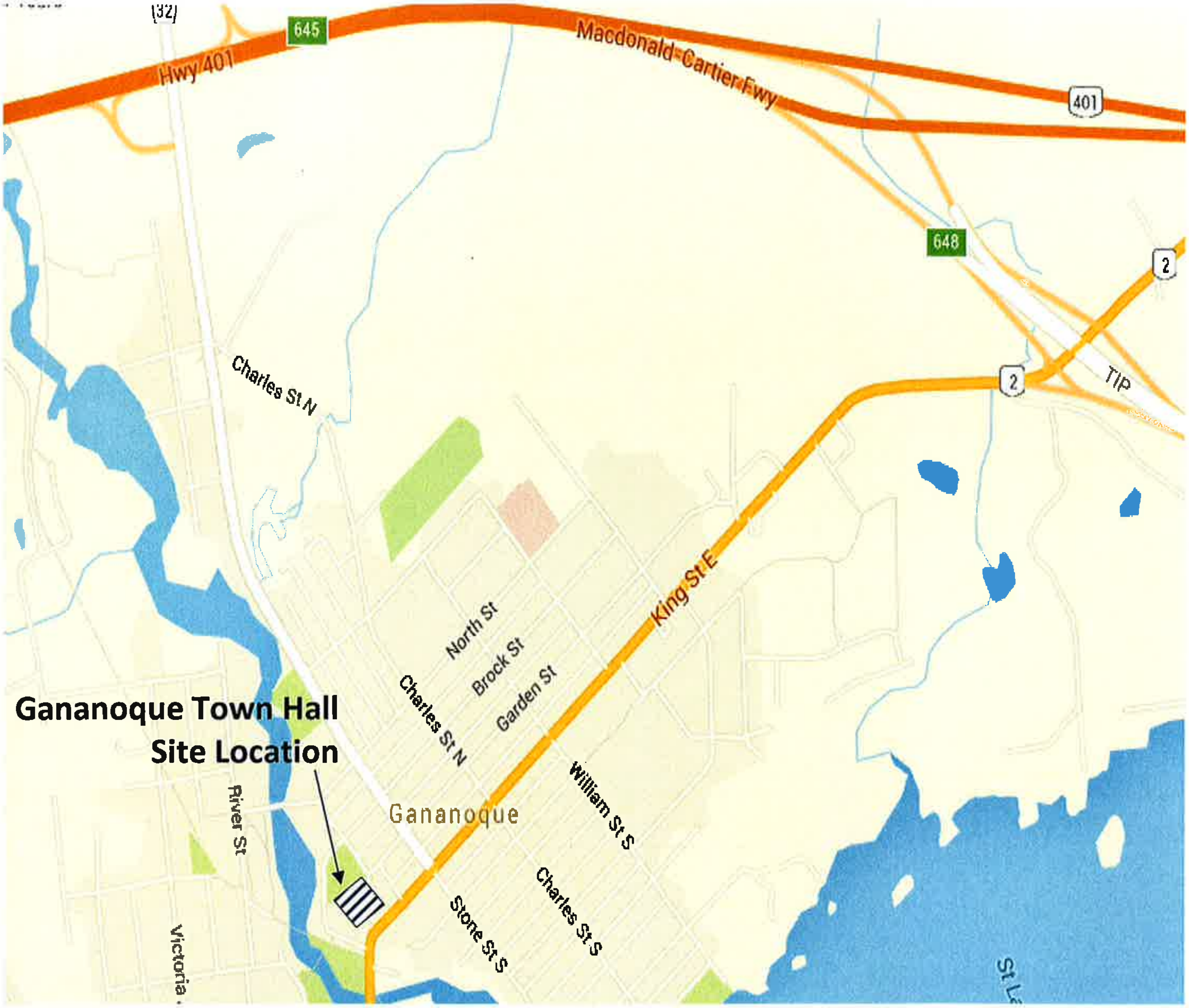
APPENDIX A

Site Location Plan

Figure A1

Borehole Location Plan

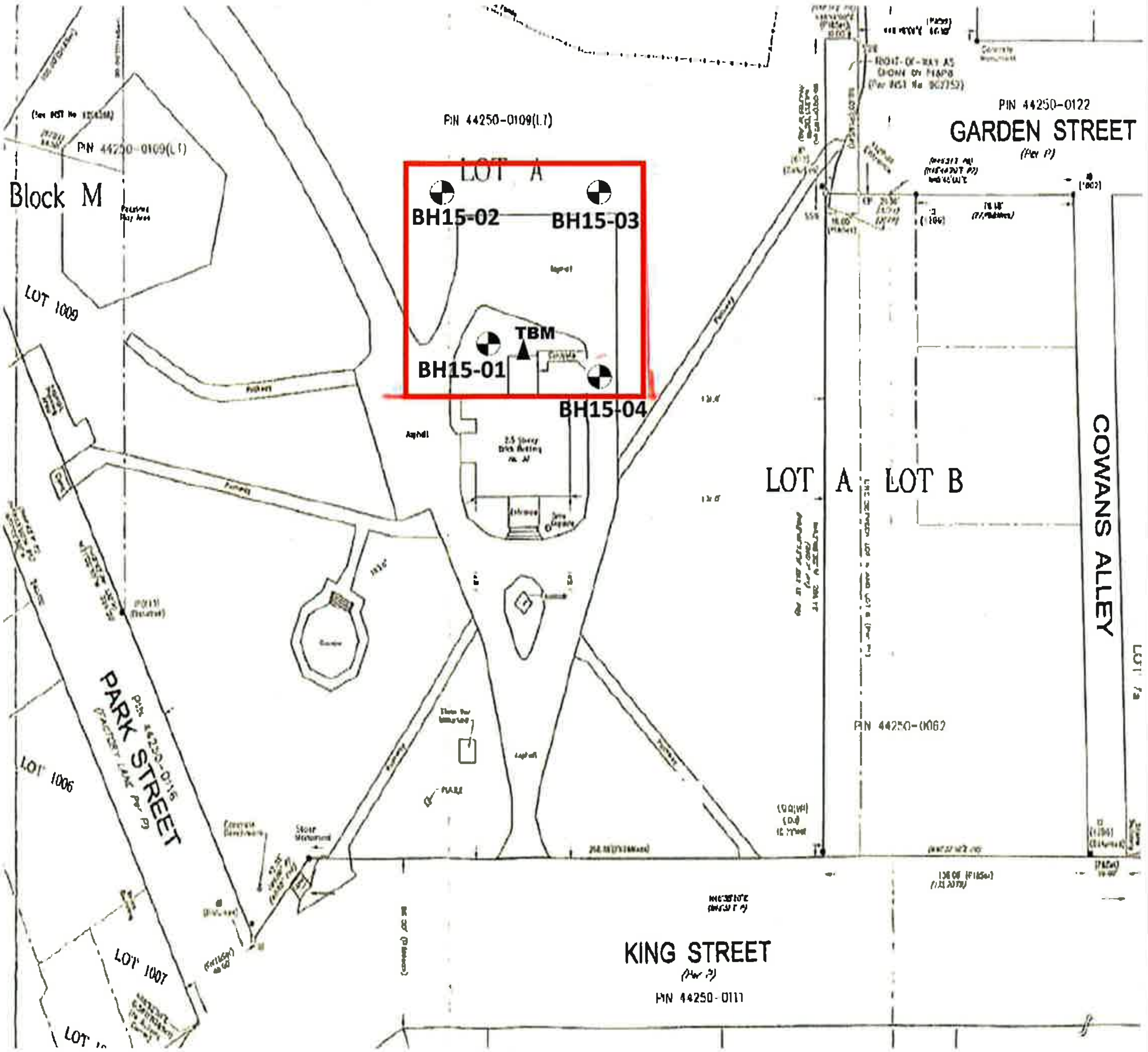
Figure A2 and A3



AMe
Materials Engineering

Aecon Materials Engineering
104-215 Stafford Road West
Ottawa, ON, K2H 9C1
Tel: (613) 726-3039 Fax: (613) 726-3004

Project: **Preliminary Geotechnical Investigation**			
Client Name: **The Corporation of the Town of Gananoque**			
Project Location: **30 King Street East, Gananoque, Ontario**			
Drawing Name: **SITE LOCATION PLAN**			Fig. No. **A1**
Scale: **N.T.S**	Project No. **60218.002**	Date: **June 2016**	



AME
Materials Engineering

Aecon Materials Engineering
104-215 Stafford Road West
Ottawa, ON, K2H 9C1
Tel: (613) 726-3039 Fax: (613) 726-3004

Project:
Preliminary Geotechnical Investigation

Client Name:
The Corporation of the Town of Gananoque

Project Location:
30 King Street East, Gananoque, Ontario

Drawing Name:
BOREHOLE LOCATION PLAN

Fig. No.
A2

Scale:
N.T.S

Project No.
60218.002

Date:
June 2016

APPENDIX B

Symbols and Terms

Borehole Logs
(BH16-01 to BH16-04)

SYMBOLS AND TERMS

SOIL DESCRIPTION

SOIL GENISIS

Topsoil :Mixture of soils and humus capable of supporting vegetative growth.
Peat : Mixture of visible and invisible fragments of decayed organic matter
Till :Unstratified glacial deposit which may range from clay to boulders
Fill :Materials below the surface identified as placed by humans (excluding buried services)

SOIL STRUCTURE

Desiccated : Having visible signs of weathering by oxidization of clay minerals, shrinkage cracks, etc.
Fissured : Having cracks and hence a blocky structure
Varved : Composed of regular alternating layers of silt and clay
Stratified : Composed of alternating successions of different soil types, e. g. silt and sand
Layer : > 75 mm in thickness
Seam : 2 mm to 75 mm in thickness
Parting : < 2 mm in Thickness

GRAIN SIZE DISTRIBUTION

MC% : Natural moisture content or water content of sample, %
LL : Liquid limit, % (water content above which soils behaves as a liquid)
PL : Plastic limit, % (water content above which soil behaves plastically)
PI : Plastic index. % (difference between LL and PL)
Dxx : Grain size at which xx% of the soil, by weight, is of finer grain sizes. These grain size descriptions are not used below 0.075 mm grain size.
D10 : Grain size at which 10% of the soil is finer (effective grain size)
D60 : Grain size at which 60% of the soil is finer.
Cc : Concavity coefficient= (D30)' / (D10 X D60)
Cu : Uniformity coefficient= D60 / D10

SAMPLE TYPE

SS : Spilt spoon sample (obtained by performing the standard penetration test)
ST : Shelby tube or thin wall tube
DP : Direct-Push sample (small diameter tube sampler hydraulically advanced)
PS : Piston Sample
BS : Bulk Sample
WS : Wash Sample
HQ, NQ, BQ, etc. : Rock core samples obtained with the use of standard size diamond coring bits

N-VALUE- STANDARD PENETRATION RESISTANCE

Numbers in this column are the field results of the Standard Penetration Test(SPT): the number of blows of a 140 pound(64kg) hammer falling 30 inches (760mm), required to drive a 2 inch (50.8mm) O.D. split spoon sampler one foot (305mm) into the soil. For split spoon samples where insufficient penetration was achieved and N-values cannot be presented, the number of blows are reported over sampler penetration in millimeters (e.g. 50/75). Some design methods make use of N-value corrected for various factors such as overburden pressure, energy ratio, borehole diameter, etc. No corrections have been applied to the N-value presented on the log.

SOIL DESCRIPTION

A) COHESIONLESS SOILS

Density Index (Relative Density)	(Blows/300mm or Blows / ft)
Very Loose	0 to4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	Over 50

B) COHESIVE SOILS

Consistency	Undrained Shear Strength	
	kPa	Psf
Very Soft	0to 12	0to250
Soft	12 to 25	250 to 500
Firm	25 to 50	500 to 1000
Stiff	50 to 100	1000 to 2000
Very Stiff	100 to 200	2000 to 4000
Hard	Over 200	Over 4000

RECOVERY

For soil samples, the recovery is recorded as the length of the soil sample recovered divided by the total length of sampling and is recorded as a percentage on a per sample basis.

SYMBOLS AND TERMS (CONT'D)

DYNAMIC CONE PENETRATION TEST (DCPT)

Dynamic cone penetration tests are performed using a standard 60 degree apex cone connected to 'A' size drill rods with the same standard fall height and weight as the standard penetration test. The DCPT is used as a probe to assess soil variability.

CONSOLIDATION TEST

P'o	: Present effective overburden pressure at sample depth.
P'c	: Preconsolidation pressure of (maximum past pressure on) sample
Ccr	: Recompression index (in effect at pressures below P'c)
Cc	: Compression index (in effect at pressures above P'c)
OC ratio	: Overconsolidation retio = P'c / P'o
Void Ratio	: Initial sample void retio =Volume of Voids / Volume of solids
Wo	: Initial water content (at start of consolidation test)

ROCK DESCRIPTION

ROCK WEATHERING

Term	Description
Fresh	: No Visible signs of rock weathering. Slight discoloration along major discontinuities,
Slightly Weathered	: Discoloration indicates weathering of rock on discontinuity surfaces. All the rock material may be discolored.
Moderately Weathered	: Less than half the rock is decomposed and/or disintegrated into the soil.
Highly Weathered	: More than half the rock is decomposed and/or disintegrated into the soil.
Completely Weathered	: All the rock material is decomposed and/or disintegrated into the soil. The original mass structure is still largely intact

ROCK MASS:

Spacing (mm)	Joint Classification	Bedding Laminates, Bands
> 6000	Extremely Wide	-
2000-6000	Very Wide	Very Thick
600-2000	Wide	Thick
200-600	Moderate	Medium
60-200	Close	Thin
20-60	Very Close	Very Thin
< 20	Extremely Close	Laminated
<6	-	Thinly Laminated

CORE CONDITION

Total Core Recovery (TCR): The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run

Solid Core Recovery (SCR): The percentage of solid drill core, regardless the length, recovered at the full diameter, measure relative to the length of the total core run.

Rock Quality Designation (RQD): Rock quality classification is based on a modified core recovery percentage (Rock Quality Designation) RQD in which all pieces of sound core over 10Dmm long are counted as recovery. The smaller pieces are considered to be due to close shearing, jointing, faulting or weathering in the mass and are not counted. RQD was originally intended to be done on NW core; however it can be used on different core sizes if the bulk of the fractures caused by drilling stresses are easily distinguishable from in situ fractures. The terminology describing rock mass quality based on ROD is subjective and is underlain by the resumption that sound strong rock is of higher engineering value than fractured weak rock.

ROCK QUALITY

BQQ	Rock Mass Quality
0 to 25	Very Poor
25 to 50	Poor
50 to 75	Fair
75 to 90	Good
90 to 100	Excellent

ROCK STRENGTH

Strength Classification	Unconfined Compressive Strength (MPa)
Extremely Weak	< 1
Very Weak	1-5
Weak	5-25
Medium Strong	25-50
Strong	50-100
Very Strong	100-250
Extremely Strong	> 250

WATER LEVEL MEASUREMENT

▼: Measured in Standpipe,
Piezometer, or well

∇ Inferred

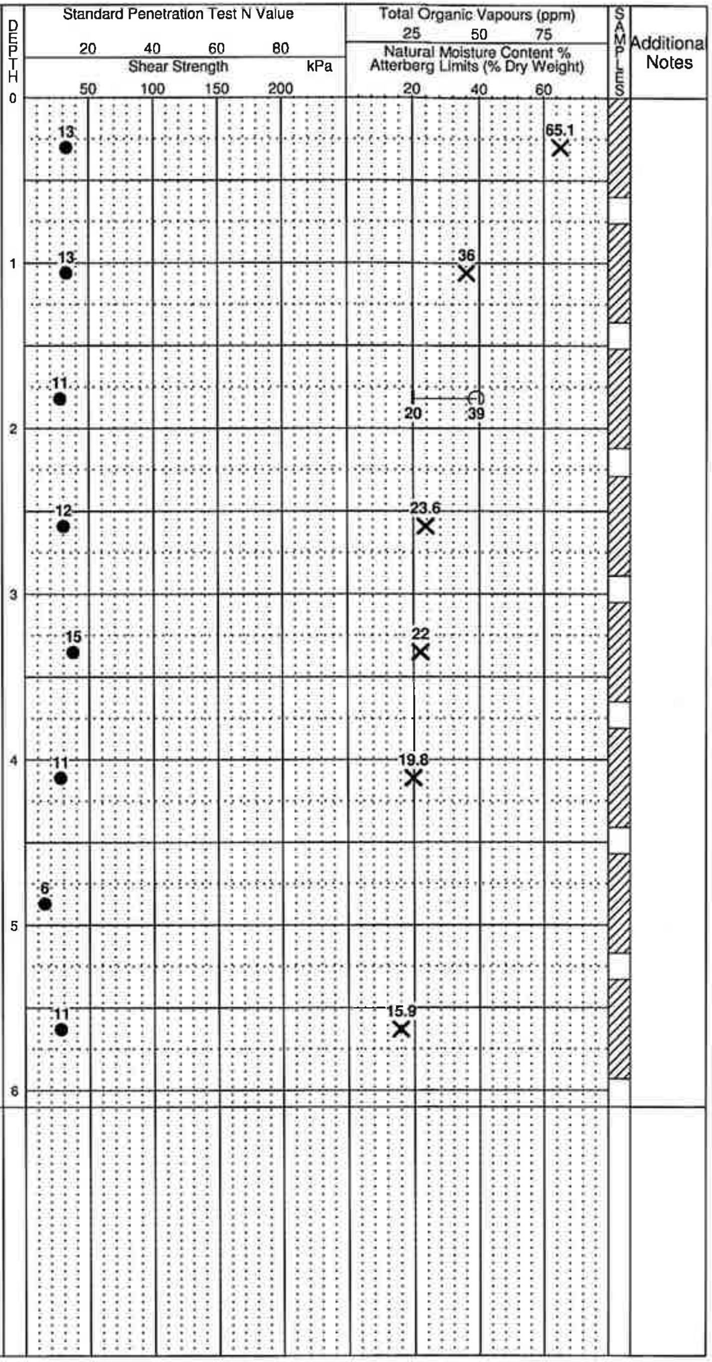
Log of Borehole BH16-01

AME
Materials Engineering

Project No.: 60218.002
Project Name: Gananoque Town Hall Proposed Expansion
Figure No. 2-1
Location: 30 King Street East, Gananoque, Ontario
18T 407172 4909063
Date Drilled: 3/7/16
Drill Type: Hollow Stem Auger
Datum: Arbitrary

Split Spoon Sample	▨	Combustible Vapour Reading	☐
Auger Sample	☒	Natural Moisture Content	✕
SPT (N) Value	●	Atterberg Limits	⊢○
Dynamic Cone Test	—	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	✚ S		

GWL	SOIL DESCRIPTION	ELEV. m
	TOPSOIL (110mm)	99.46 99.35
	FILL: sand, some silt, brown, compact, moist	99.17
	FILL: sand, trace gravel, trace clay, brown, compact, moist	98.85
	SILT AND CLAY, trace gravel, trace sand, brown, firm to hard, moist	
	SILT, some sand, some clay, brown, very stiff, wet	95.65
▼	SAND, some silt, trace gravel, brown, loose to compact, wet	95.06 94.96
	End of borehole at 6.10 m Borehole terminated at 6.10 m within brown sand	93.36



Notes:

Date/Time	Water Level (m)	Depth to Cave (m)
March 7/16	4.50	

Sheet No. 1 of 1

Log of Borehole **BH16-02**

AME Materials Engineering

Project No.: 60218.002

Project Name: Gananoque Town Hall Proposed Expansion

Figure No. 2-2

Location: 30 King Street East, Gananoque, Ontario

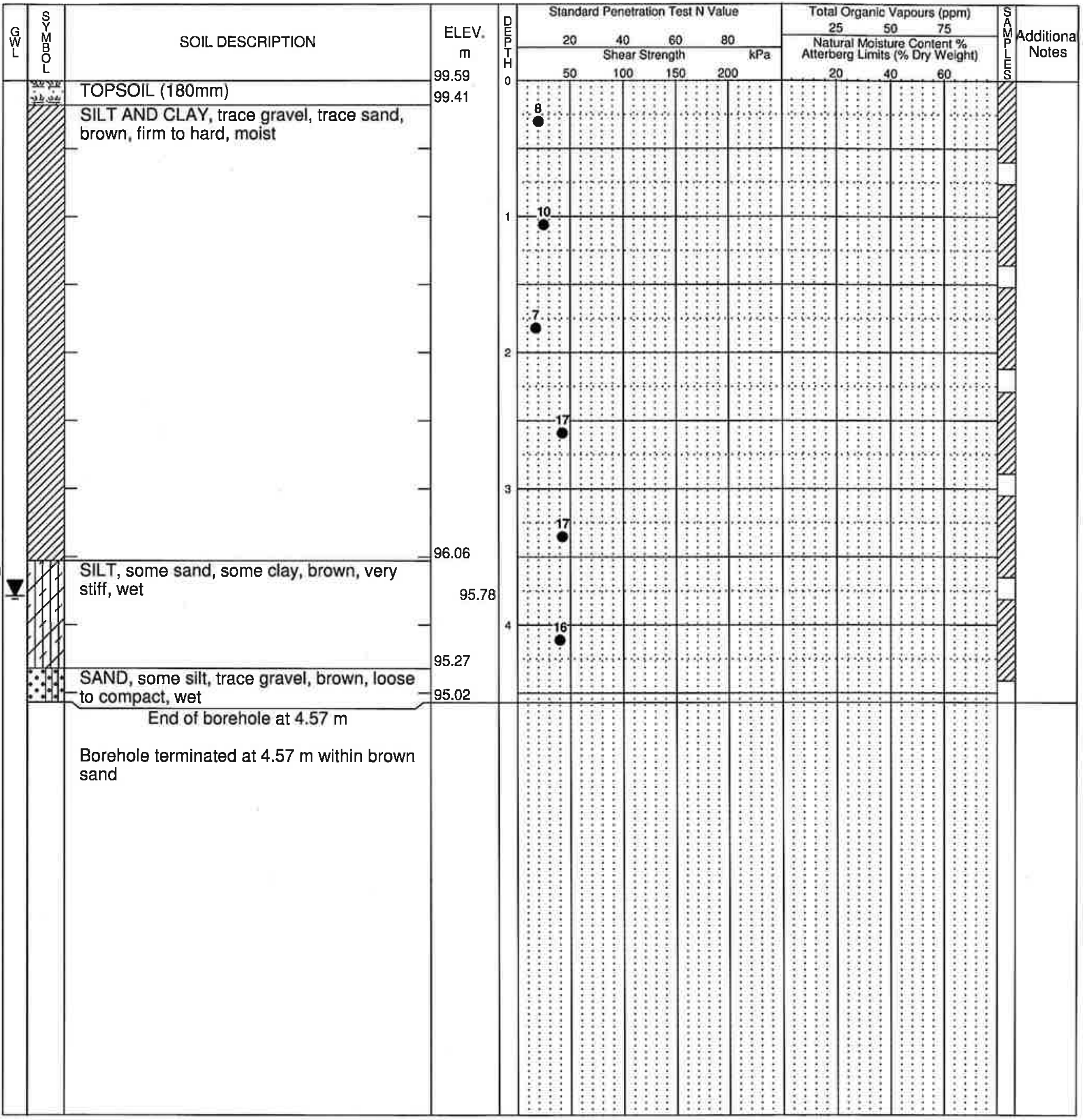
18T 407136 4909074

Date Drilled: 3/7/16

Drill Type: Hollow Stem Auger

Datum: Arbitrary

Split Spoon Sample	▨	Combustible Vapour Reading	☐
Auger Sample	☒	Natural Moisture Content	✕
SPT (N) Value	●	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	✚ S	Shear Strength by Penetrometer Test	▲



SOIL DESCRIPTION	ELEV. m
	99.59
TOPSOIL (180mm)	99.41
SILT AND CLAY, trace gravel, trace sand, brown, firm to hard, moist	96.06
SILT, some sand, some clay, brown, very stiff, wet	95.27
SAND, some silt, trace gravel, brown, loose to compact, wet	95.02
End of borehole at 4.57 m	

Borehole terminated at 4.57 m within brown sand

LOG OF BOREHOLE OLD 60218.002 GANANOQUE TOWN HALL EXPANSION.GPJ AME_ON.GDT 3/21/16

Notes:

Sheet No. 1 of 1

Date/Time	Water Level (m)	Depth to Cave (m)
March 7/16	3.81	

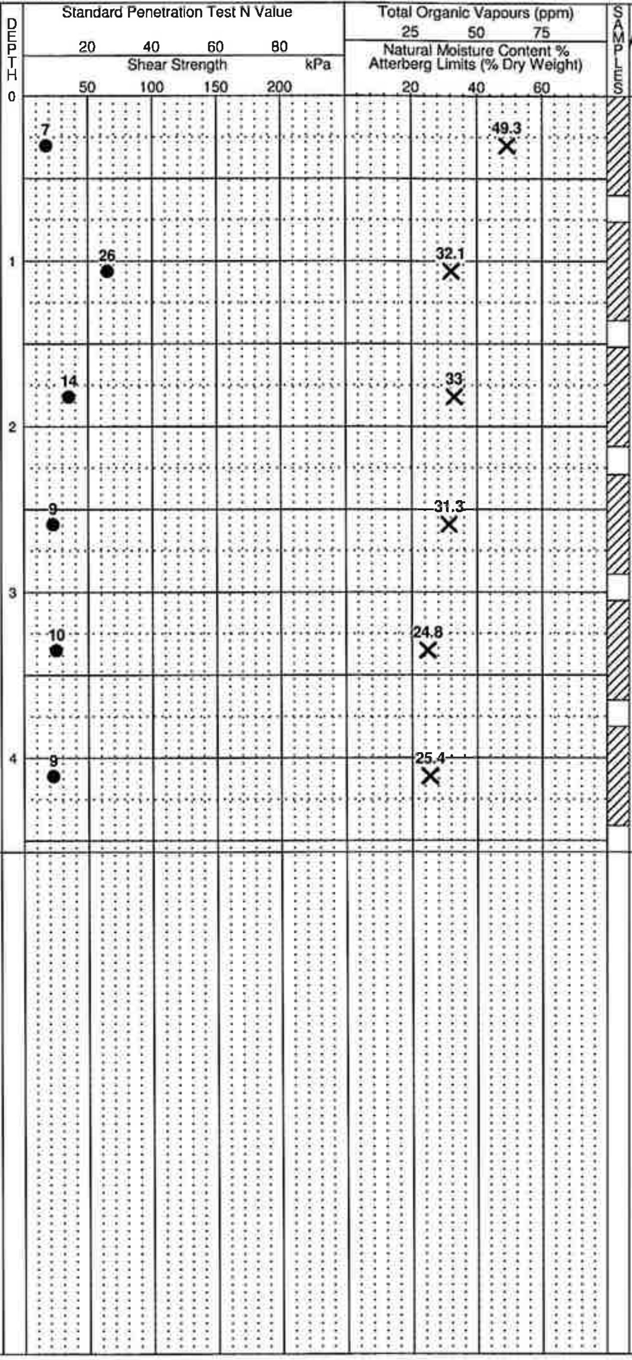
Log of Borehole **BH16-03**

AME Materials Engineering

Project No.: 60218.002
Project Name: Gananoque Town Hall Proposed Expansion
Figure No. 2-3
Location: 30 King Street East, Gananoque, Ontario
18T 407102 4909078
Date Drilled: 3/7/16
Drill Type: Hollow Stem Auger
Datum: Arbitrary

Split Spoon Sample	▨	Combustible Vapour Reading	☐
Auger Sample	☒	Natural Moisture Content	✕
SPT (N) Value	●	Atterberg Limits	├─○
Dynamic Cone Test	───	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■	Shear Strength by Penetrometer Test	▲
Shear Strength by Vane Test	✚ S		

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m
			100.01
		TOPSOIL (100mm)	99.91
	☒	FILL: sandy clay, trace organics, brown, moist	99.50
	▨	SILT AND CLAY, trace gravel, trace sand, brown, firm to hard, moist	95.69
		SAND, some silt, trace gravel, brown, loose to compact, wet	95.44
		End of borehole at 4.57 m Borehole terminated at 4.57 m within brown sand and silt	



Additional Notes

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)

Sheet No. 1 of 1

Log of Borehole **BH16-04**

AME Materials Engineering

Project No.: 60218.002

Project Name: Gananoque Town Hall Proposed Expansion

Figure No. 2-4

Location: 30 King Street East, Gananoque, Ontario

18T 407118 4909094

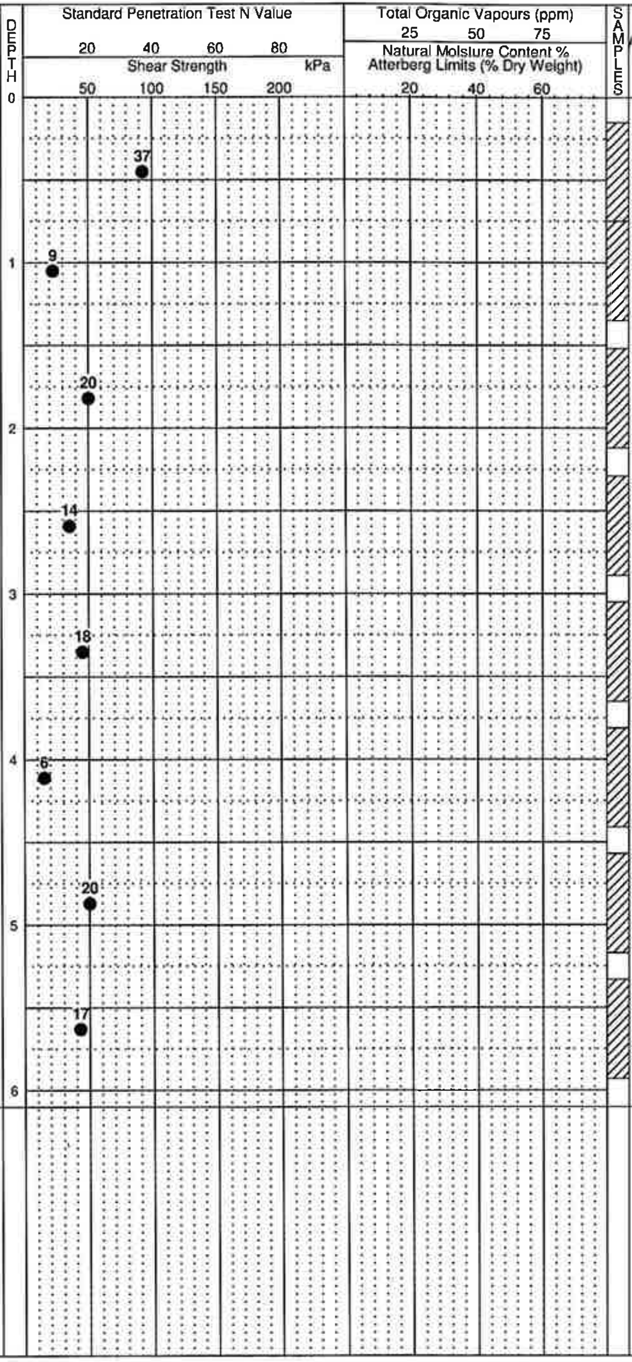
Date Drilled: 3/7/16

Drill Type: Hollow Stem Auger

Datum: Arbitrary

Split Spoon Sample	▨	Combustible Vapour Reading	☐
Auger Sample	☒	Natural Moisture Content	✕
SPT (N) Value	●	Atterberg Limits	├─○
Dynamic Cone Test	─	Undrained Triaxial at % Strain at Failure	⊕
Shelby Tube	■		
Shear Strength by Vane Test	✚ S	Shear Strength by Penetrometer Test	▲

GWL	SYMBOL	SOIL DESCRIPTION	ELEV. m
	■	ASPHALTIC CONCRETE (100m)	99.56
	☒	FILL: crushed gravelly sand, some silt, grey, dense, moist	99.46
	☒	FILL: sandy clay, brown, moist	98.98
	▨	SILT AND CLAY, trace gravel, trace sand, brown, firm to hard, moist	98.65
		SAND, some silt, trace gravel, brown, loose to compact, wet	95.28
		End of borehole at 6.10 m Borehole terminated at 6.10 m within brown sand and silt	93.46



Additional Notes

LOG OF BOREHOLE OLD 60218.002 GANANOQUE TOWN HALL EXPANSION.GPJ AME_ON.GDT 3/21/16

Notes:

Date/Time	Water Level (m)	Depth to Cave (m)

Sheet No. 1 of 1

APPENDIX C

AME Laboratory Test Results

Analytical Environmental Test Results

AME
Materials Engineering

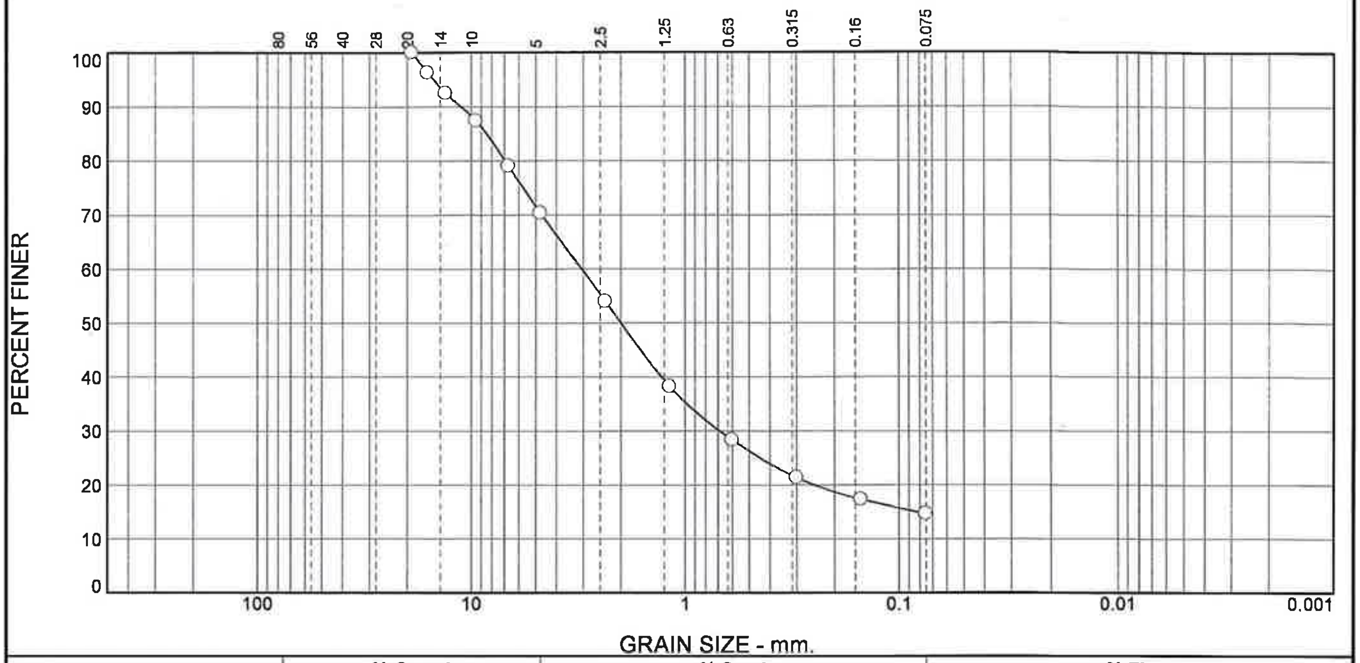
AME - Materials Engineering
Borehole / Soil Sample Moisture Content (LS-700)

Sample No.: MG-25239
Job No.: 60218.002
Job Name: Gananoque Town Hall Expansion
Source: Onsite
Material Type: Borehole Soil Sample

Date Sampled: 07-Mar-16
Date Tested: 11-Mar-16
Tested By: TZ
Reviewed By: MS
Results To: Adam

Borehole No.	Tin No.:	Depth Sample Taken	Wet Sample + Tare (A)	Dry Sample + Tare (B)	Tare (C)	Mass of Sample (D) (B-C)	% Moisture (A-B)/D x100
16-1	A3	SS1A / 0 - 2'	129.7	94.1	39.4	54.7	65.1
16-1	R17	SS2 / 2.5' - 4.5'	192.8	152.0	38.8	113.2	36.0
16-1	40	SS4 / 7.5' - 9.5'	230.7	194.2	39.4	154.8	23.6
16-1	B7	SS5 / 10' - 12'	236.4	200.9	39.5	161.4	22.0
16-1	48	SS6A / 12.5' - 14.5'	198.1	171.8	39.0	132.8	19.8
16-1	T12	SS8 / 17.5' - 19.5'	241.0	213.2	38.7	174.5	15.9
16-3	R12	SS1A / 0 - 2'	143.0	106.3	31.8	74.5	49.3
16-3	G98	SS2 / 2.5' - 4.5'	191.6	154.7	39.7	115.0	32.1
16-3	Z12	SS3 / 5' - 7'	208.1	166.1	38.9	127.2	33.0
16-3	K11	SS4 / 7.5' - 9.5'	188.4	151.3	32.9	118.4	31.3
16-3	B45	SS5 / 10' - 12'	233.6	195.0	39.6	155.4	24.8
16-3	H65	SS6A / 12.5' - 14.5'	235.8	196.1	39.6	156.5	25.4

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	0.0	29.7	20.3	25.5	9.8	14.7	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
19.0 mm	100.0		
16.0 mm	96.3		
13.2 mm	92.5		
9.5 mm	87.4		
6.7 mm	79.0		
4.75 mm	70.3		
2.36 mm	54.0		
1.18 mm	38.2		
0.600 mm	28.3		
0.300 mm	21.3		
0.150 mm	17.3		
0.075 mm	14.7		

* (no specification provided)

Soil Description

Gravelly sand, some silt

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 11.1960	D_{85}= 8.4781	D_{60}= 3.0556
D_{50}= 1.9999	D_{30}= 0.6908	D_{15}= 0.0825
D_{10}=	C_u=	C_c=

Remarks

14.2% passed #200 sieve after washing.

Date Received: March 7,16 **Date Tested:** March 14, 2016

Tested By: TZ

Checked By: MS

Title:

Location: BH16-4
Sample Number: MG-25240 - SS1A

Date Sampled: March 10,16

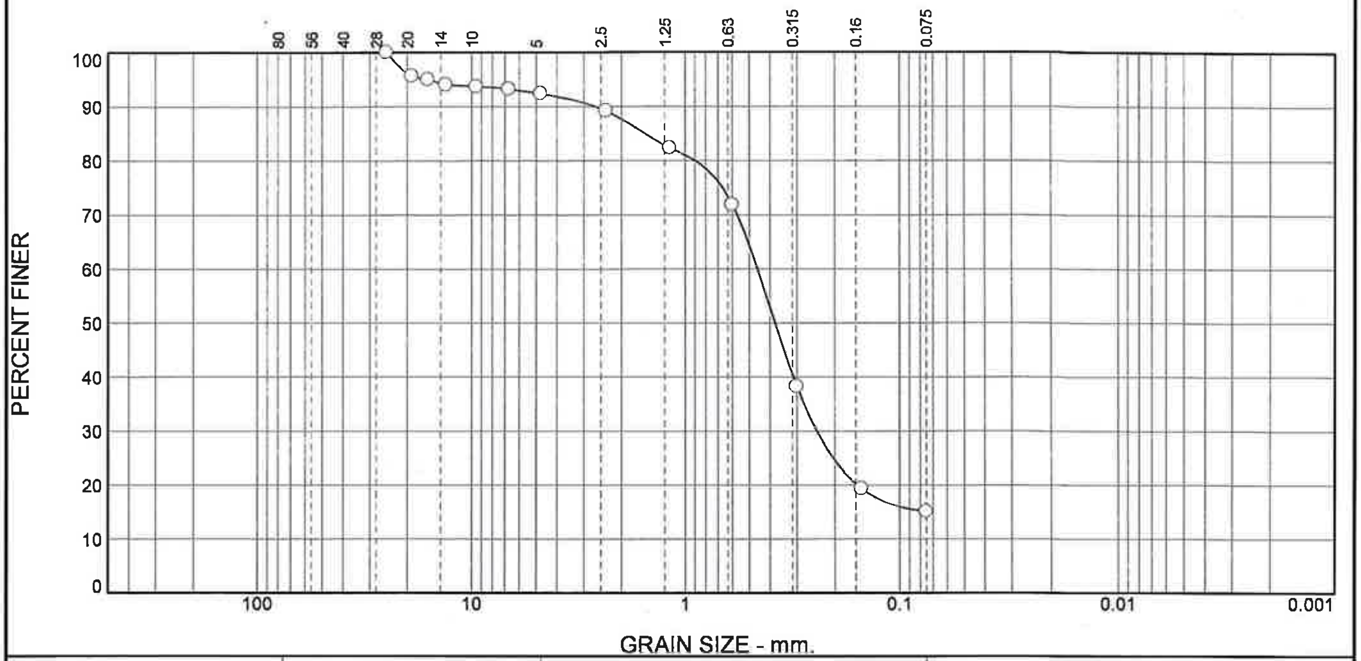
AME
Materials Engineering

Client: Corporation of the Town of Gananoque
Project: Gananoque Town Hall Expansion

Project No: 60218.002

Checked By:

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.3	3.3	4.7	31.7	40.9	15.1	

TEST RESULTS			
Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
25.0 mm	100.0		
19.0 mm	95.6		
16.0 mm	95.0		
13.2 mm	94.1		
9.5 mm	93.7		
6.7 mm	93.2		
4.75 mm	92.4		
2.36 mm	89.2		
1.18 mm	82.3		
0.600 mm	71.8		
0.300 mm	38.2		
0.150 mm	19.3		
0.075 mm	15.1		

* (no specification provided)

Soil Description

Sand, some silt, trace gravel

Atterberg Limits (ASTM D 4318)

PL= **LL=** **PI=**

Classification

USCS (D 2487)= **AASHTO (M 145)=**

Coefficients

D_{90}= 2.6421 D_{85}= 1.5530 D_{60}= 0.4586
D_{50}= 0.3795 D_{30}= 0.2428 D_{15}=
D_{10}= C_u= C_c=

Remarks

14.6% passed #200 sieve after washing.

Date Received: March 10, 16 **Date Tested:** March 14, 16
Tested By: TZ
Checked By: MS
Title:

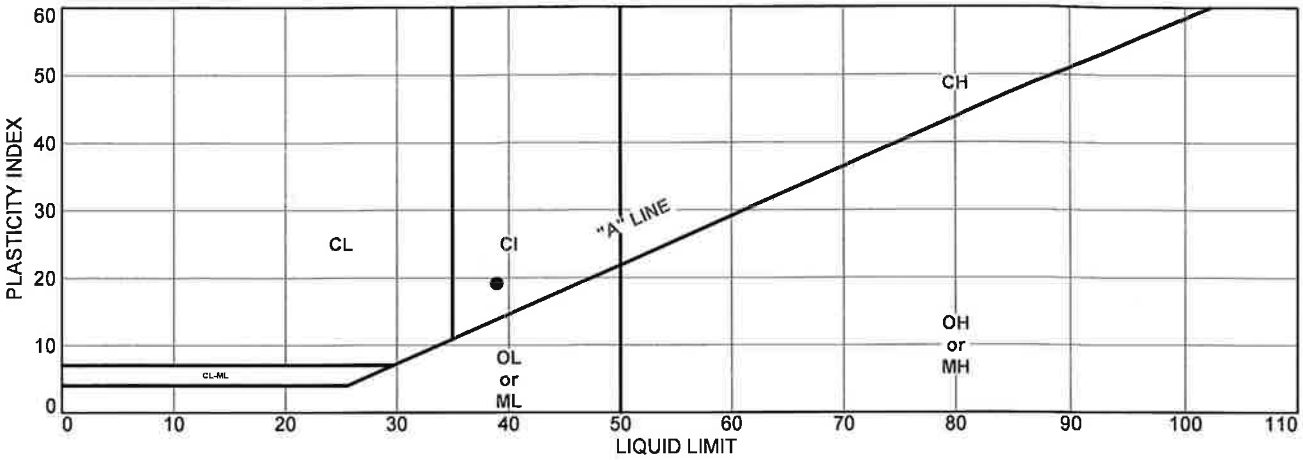
Location: BH16-1
Sample Number: MG-25241 - SS7
Date Sampled: March 7, 16

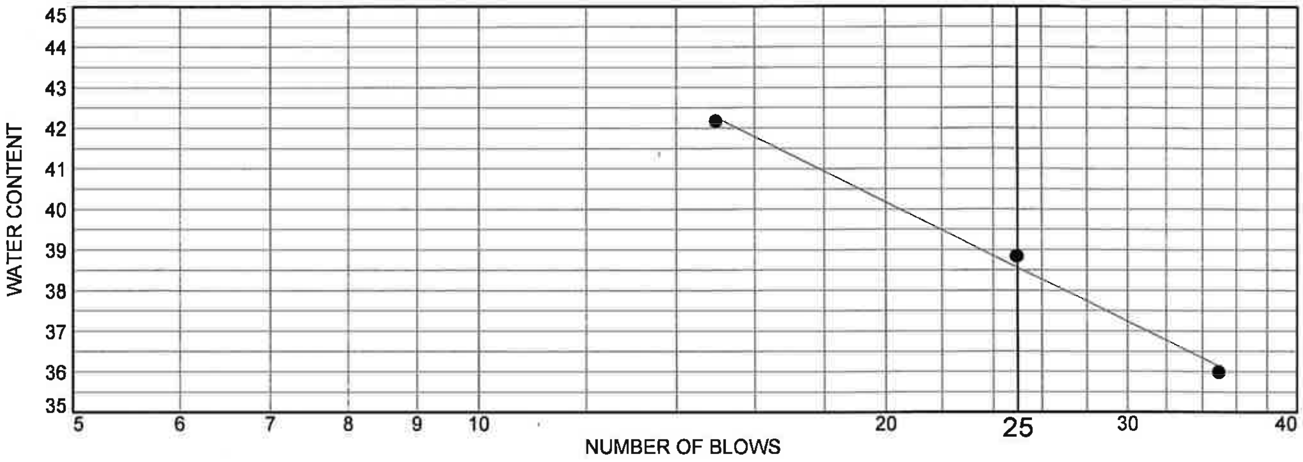
AME
Materials Engineering

Client: Corporation of the Town of Gananoque
Project: Gananoque Town Hall Expansion
Project No: 60218.002

Checked By: ____________________

LIQUID AND PLASTIC LIMITS TEST REPORT





	MATERIAL DESCRIPTION	LL	PL	PI	%<.425mm	%<.075mm	AS1726
●	Silt and clay, trace sand, trace gravel	39	20	19	98.5	97.6	CI

Project No. 60218.002 **Client:** Corporation of the Town of Gananoque

Project: Gananoque Town Hall Expansion

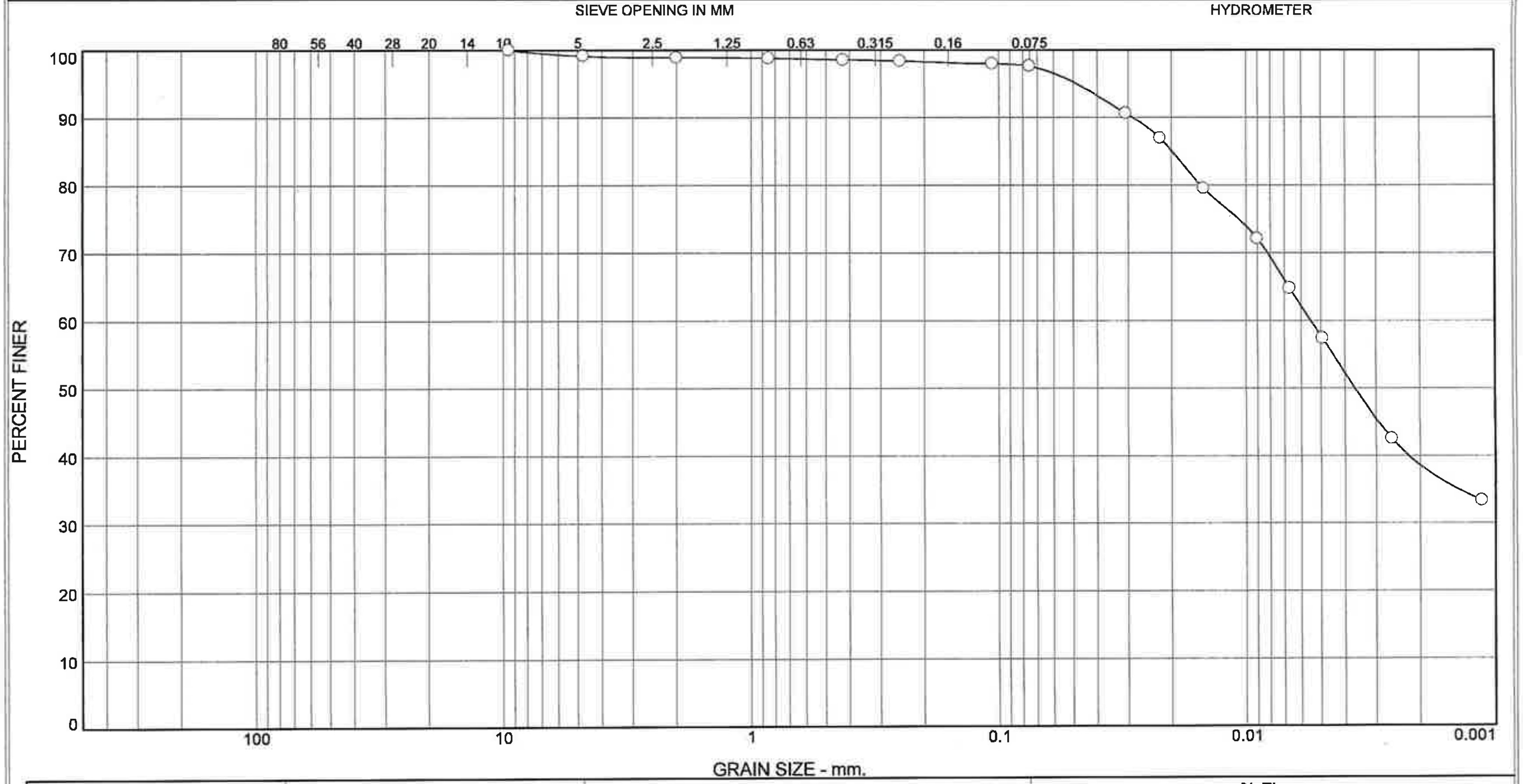
●**Location:** BH16-1 **Sample Number:** MG-25242- SS3

Remarks:

AME
Materials Engineering

Tested By: TZ **Checked By:** MS

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.9	0.2	0.4	0.9	59.0	38.6

Identification		Date Sampled	Date Received	Date Tested
Location: BH16-1	Sample Number: MG-25242- SS3	March 7, 16	March 11, 16	March 14, 16

Client Corporation of the Town of Gananoque

Project Gananoque Town Hall Expansion

Project No. 60218.002

AME
Materials Engineering

○ Silt and Clay, trace sand, trace gravel

Tested By: TZ **Checked By:** MS

AGAT Laboratories

5835 COOPERS AVENUE
MISSISSAUGA, ONTARIO
CANADA L4Z 1Y2
TEL (905)712-5100
FAX (905)712-5122
http://www.agatlabs.com

Certificate of Analysis

AGAT WORK ORDER: 16Z077468
PROJECT: Gananoque Town Hall

CLIENT NAME: AME MATERIALS ENGINEERING
SAMPLING SITE:

ATTENTION TO: ADAM STAMPLICOSKI
SAMPLED BY:AS

Corrosivity Package

DATE RECEIVED: 2016-03-17

DATE REPORTED: 2016-03-24

			SAMPLE DESCRIPTION:	BH16-01 SS-3
			SAMPLE TYPE:	Soil
			DATE SAMPLED:	3/7/2016
Parameter	Unit	G / S	RDL	7451170
Chloride (2:1)	µg/g		2	324
Sulphate (2:1)	µg/g		2	21
pH (2:1)	pH Units		NA	7.96
Resistivity (2:1)	ohm.cm		1	1610

Comments: RDL - Reported Detection Limit; G / S - Guideline / Standard

7451170 EC/Resistivity, pH, Chloride, Sulphate and Redox Potential were determined on the extract obtained from the 2:1 leaching procedure (2 parts DI water: 1 part soil).

Certified By: Sofiea Pehlyova

Quality Assurance

CLIENT NAME: AME MATERIALS ENGINEERING
PROJECT: Gananoque Town Hall
SAMPLING SITE:

AGAT WORK ORDER: 16Z077468
ATTENTION TO: ADAM STAMPLICOSKI
SAMPLED BY:AS

Soil Analysis

RPT Date: Mar 24, 2016			DUPLICATE			Method Blank	REFERENCE MATERIAL			METHOD BLANK SPIKE			MATRIX SPIKE		
PARAMETER	Batch	Sample Id	Dup #1	Dup #2	RPD		Measured Value	Acceptable Limits		Recovery	Acceptable Limits		Recovery	Acceptable Limits	
								Lower	Upper		Lower	Upper		Lower	Upper
Corrosivity Package															
Chloride (2:1)	7449485		2	2	NA	< 2	104%	80%	120%	101%	80%	120%	110%	70%	130%
Sulphate (2:1)	7449485		37	39	5.3%	< 2	98%	80%	120%	99%	80%	120%	109%	70%	130%
pH (2:1)	7449485		8.18	8.19	0.1%	NA	101%	90%	110%	NA			NA		

Comments: NA signifies Not Applicable.
Duplicate Qualifier: As the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Certified By: Sofia Pehlyova

Method Summary

CLIENT NAME: AME MATERIALS ENGINEERING
PROJECT: Gananoque Town Hall
SAMPLING SITE:

AGAT WORK ORDER: 16Z077468
ATTENTION TO: ADAM STAMPLICOSKI
SAMPLED BY:AS

PARAMETER	AGAT S.O.P	LITERATURE REFERENCE	ANALYTICAL TECHNIQUE
Soil Analysis			
Chloride (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
Sulphate (2:1)	INOR-93-6004	McKeague 4.12 & SM 4110 B	ION CHROMATOGRAPH
pH (2:1)	INOR 93-6031	MSA part 3 & SM 4500-H+ B	PH METER
Resistivity (2:1)	INOR-93-6036	McKeague 4.12, SM 2510 B,SSA #5 Part 3	CALCULATION