Geotechnical Investigation
Proposed Mixed Residential and Commercial Development
17 St. Andrew Street
Toronto, Ontario

Prepared for
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1. Introduction

This report presents the results of a geotechnical investigation carried out in the property located at 17 St. Andrew Street in Toronto, Ontario.

The project involves the proposed design and construction of a five (5) storey building plus rooftop mechanical and amenity level (6 storey) and; surface paved parking area and driveway. The proposed mixed use building will also have one (1) basement level and one (1) sunken courtyard. The preliminary site plan shows the basement floor slab will be placed at approximately 3.6 m below road grade on St. Andrew Street.

The Site is currently occupied in parts by a two (2) storey mixed residential and commercial building, surface paved parking area and driveway. The existing on-site building will be demolished to accommodate the construction of the proposed building.

The geotechnical investigation was carried out in conjunction with the hydro-geological site assessment. Results of the hydro-geological site assessment are provided under separate cover.

The purpose of this geotechnical investigation was to determine the subsoil and groundwater conditions at the Site and, based on this information, to provide geotechnical engineering guidelines for the design and construction of the proposed mixed residential and commercial building. Recommendations and/or comments regarding foundation type, allowable bearing pressures, groundwater conditions, excavation and backfill, pipe installation, slab-on-grade construction, permanent drainage requirements, site seismic classifications, lateral earth pressures on subsurface wall, temporary shoring requirements, pavement design and construction were to be provided.

Our Terms of Reference includes environmental testing on soil and groundwater samples. The tests were carried out to provide a preliminary assessment of environmental quality of the soil and groundwater at the Site and to determine the disposal options for excess soils and groundwater to be generated during construction at the Site. In addition, one (1) groundwater sample was tested for pH value, dissolved sulphate and chloride with regards to attack on buried concrete structures.

The comments and recommendations given in this report are based on the assumption that the above-described design concept will proceed into construction. If changes are made either in the design phase or during construction, this office must be retained to review these modifications. The result of this review may be a modification of our recommendations or the requirement of additional field or laboratory work to check whether the changes are acceptable from a geotechnical viewpoint.

2. Procedure

2.1 Soil Sampling

The fieldworks were carried out on February 21, 2019. Three (3) sampled boreholes (Boreholes 1, 2 and 3) were drilled to a depth of about 7.95 m below grades at the approximate locations shown on the attached Borehole and Section Location Plan (Drawing No. 2).

The boreholes were advanced, using a truck-mounted drill rig equipped with continuous flight hollow stem augers owned, supplied and operated by a specialist drilling Contractor. The overburden soils were recovered using a conventional split spoon sampler in conjunction with standard penetration test (SPT). The fieldwork was supervised throughout by Edward Wong's geotechnical personnel who monitored the drilling and sampling operations and logged the borings.

Tests for the generation of methane gas and Total Organic Vapors were carried out in Boreholes 1, 2 and 3, using a portable combustible gas tester (RKI Eagle multi-gas detector).

The groundwater conditions in the open boreholes were closely monitored during and upon completion of drilling. Monitoring well, 50 mm in diameter, was installed in each of Boreholes 1, 2 and 3 for subsequent groundwater level measurements and groundwater sampling and testing.

The soil samples were examined in the field for lithology as well as aesthetic of impacts (i.e. stains, odors and debris). Soil samples were placed in plastic bags and reserved for headspace combustible vapor measurements. The headspace measurements were made inside the plastic samples bags using a RKI Eagle multi-gas detector calibrated for hexane. The headspace monitoring was carried out for preliminary screening for hydrocarbons or volatile organic compounds to assist with the selection of soil samples for chemical analysis.

Soil samples for chemical testing were kept in laboratory supplied jars and vials. The jars and vials were kept in a portable cooler during field storage and transportation to the Maxxam Analytics in Mississauga for chemical analysis.

All recovered soil samples were transported to Edward Wong' geotechnical laboratory for detailed visual examinations and soil classifications. Moisture content determinations were carried out on all recovered soil samples.

Grain size analysis and hydrometer tests were carried out on two (2) representative soil samples, with the test results provided in Appendix B.

Borehole locations were established in the field by Edward Wong & Associates Inc. Prior to the commencement of drilling, the borehole locations were cleared for underground utilities

by a private locator retained by Edward Wong & Associates Inc. to minimize the potential of contacting them during drilling.

2.2 Development of Monitoring Well and Groundwater Sampling

Monitoring wells were installed in Boreholes 1, 2 and 3 to a depth of 7.95 m below grades. The monitoring wells were completed with a flush mount well cover. The monitoring well construction was shown in the relevant logs of borehole.

Development of the monitoring well and sampling of groundwater was carried out on February 28, 2019, seven (7) days after completion of drilling. Groundwater levels in Boreholes 1, 2 and 3 were measured at a depth of about 3.95 m, 2.5 m and 2.63 m below grade, respectively

Groundwater was recovered from Boreholes 1 and 3. Prior to groundwater sampling, Boreholes 1 and 3 were developed and purged of more than three (3) well volumes of water, using clean polyethylene bailers. No free product or sheen was detected on the surface of the groundwater samples recovered from Boreholes 1 and 3.

Groundwater samples were collected and stored in laboratory supplied bottles and jars. The bottles and jars were kept in a portable cooler during field storage and transportation to Maxxam Analytics in Mississauga for chemical analysis.

Results of the groundwater testing are provided in Section 6.3.2 of the report.

3. Subsurface Conditions

The subsurface stratigraphy at the Site, as revealed in the logs of borehole, consisted of a pavement structure over a fill stratum followed by a native deposit of clayey silt. Soil profile is shown on attached Drawing 2.

3.1 Subsoil

A brief description of the soil profiles, in order of depth, are as follow.

3.1.1 Pavement Structure

Pavement structure was encountered at the ground surface in Boreholes 1, 2 and 3 advanced in the pavement areas. The pavement structure consisted of about 50 mm to 100 mm of asphaltic concrete over about 100 mm to 175 mm of crushed limestone. The granular materials were very moist.

3.1.2 Fill

Fill, extending to depths of about 2.25 m to 3 m below grade, was contacted at the ground surface in Boreholes 1, 2 and 3. The fill materials consisted of silty clay with topsoil and organic inclusions. Brick fragments were found in the fill sample recovered from Borehole 1 at about 2.25 m depth. SPT "N" values ranged from 4 blows per 300 mm penetration to 11 blows per 300 mm penetration. Based on the "N" values, the fill materials were considered as soft to stiff. The fill materials were very moist. Moisture contents ranged from 11 percent to 30 percent.

3.1.3 Clayey Silt

The predominant native soils at the Site was clayey silt. Clayey silt was found below the fill at depths of about 2.25 m to 3.0 m below grade in Boreholes 1, 2 and 3 and extended to termination depth of 7.95 m. SPT "N" values ranged from 10 blows per 300 mm penetration to 35 blows per 300 mm penetration. Un-confined compressive strength measured from the pocket penetrometer gave the values of un-drained shear strength from 75 kPa to greater than 225 kPa, corresponding to stiff to hard consistency. Moisture contents ranged from 9 percent to 26 percent, indicating a very moist condition.

Grain size analysis and hydrometer test was carried out on two (2) selected clayey silt samples. The test result is provided in Appendix B and summarized in Table 1 below.

Table 1: Result of Grain Size Analysis and Hydrometer Test - Clayey Silt

Borehole No.	Depth	Composition (%) Gr, Sa, Si & Cl	Estimated Coefficient of Permeability (m/s)	Unified Soil Classification	Comments
1	4.5 - 4.95	3.5,15.8, 57.1, 23.6	$< 1x\ 10^{-6}$	ML (clayey silt)	Low Permeable
2	3.0 - 3.45	5.9, 10.1, 61.0, 23.0	$< 1 \times 10^{-6}$	ML (clayey silt)	Low Permeable

Note: Gr, Sa, Si, Cl - Gravel, Sand, Silt and Clay

3.2 Groundwater

Groundwater conditions were assessed in the open boreholes during the course of the fieldwork. Short term groundwater level measurements are shown in Table 2 below.

Table 2: Groundwater Level Measurements

Borehole Location	Ground Surface Elevation (m)	Depth (Elevation (m))		
		Upon Completion of Drilling	Upon Completion of Drilling	Feb. 28, 2019 (7 days after completion of drilling)
1	100	Dry	6.8	3.95
2	100	2.25	2.3	2.05
3	100	Dry	Dry	2,63

The measured groundwater levels in Boreholes 1, 2 and 3 were originated from water perched in the fill or more previous seams within the clayey silt deposit. Table 2 above indicates the groundwater flow direction is to the southeast towards the Lake Ontario, which is located at 2 km to the south of the Site. The groundwater levels are expected to fluctuate on seasonal basis (± 1 m) and could be higher in spring or after prolonged period of rain.

4. Slug Test

On February 26, 2019, slug test was carried out in Boreholes 2 and 3 to assess the hydraulic conductivity of the in-situ conductivity of the subsoil. Screen of the monitoring well was placed within the clayey silt. Groundwater levels in Boreholes 2 and 3 were likely originated from water perched in the fill or more pervious seams within the clayey silt. At the time of the slug test, groundwater levels in Boreholes 2 and 3 was measured at about 2.05 m and 2.63 m below grade.

Water level readings and results of the slug test are provided in Appendix C of the report. The hydraulic conductivity of the native clayey silt in Boreholes 2 and 3 was found to be 8.95×10^{-10} m/ sec and 1.23×10^{-10} m/s. Water level readings and results of slug test analysis are provided in Appendix C.

5. Engineering Discussions and Recommendations

5.1 General

The project involves the proposed design and construction of a five (5) storey building plus rooftop mechanical and amenity level (6 storey) and; surface paved parking area and driveway. The proposed mixed use building will also have one (1) basement level and one (1) sunken courtyard. The preliminary site plan shows the basement floor slab will be placed at approximately 3.6 m below road grade on St. Andrew Street.

The Site is currently occupied in parts by a two (2) storey mixed commercial and residential building with surface paved parking area and driveway. The existing on-site building will be demolished to accommodate the construction of the proposed building.

5.2 Building Construction

The results of the geotechnical investigation reveals that the Site is covered by a pavement structure over a fill stratum which was in turn underlain by a native deposit of clayey silt. Perched groundwater levels were measured at depths of about 2.05 m to 3.95 m below grade. The groundwater flow direction is to the southeast towards the Lake Ontario, which is located at about 2 km to the south of the Site.

5.2.1 Foundation Considerations

Based on the results of the investigation, the use of spread and strip footings to support the proposed mixed use building with a basement.

Providing effective groundwater measures are implemented at the Site, footings founded on competent undisturbed native soils (stiff to very stiff clayey silt) below the pavement structure, existing fill and all soft and/ or loose soils may be designed for the following recommended bearing capacities:

- Bearing Capacity at Serviceability Limit State (SLS) = 150 kPa
- Factored Bearing Capacity at Ultimate Limit State (ULS) = 225 kPa

Table 3 below shows the highest elevations at the borehole locations where the recommended bearing values can be applied.

Table 3: Highest Elevation at Borehole Locations where Recommended Bearing Values can be applied Proposed Mixed Residential and Commercial Building

Borehole Location	Ground Surface Elevation (m)	Spread and Strip Footing 150 kPa at SLS and 225 KPa ULS	
		Founding Soil	Depth (Elevation (m))
1	98.5	Stiff Clayey Silt	3.0 (95.5)
2	98.5	Very Stiff Clayey Silt	2.25 (96.25)
3	98.4	Hard Clayey Silt	2.25 (96.15)

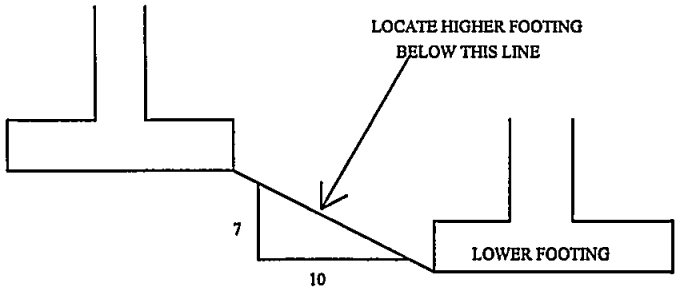
Excavation leftover after the removal of buried foundations and site services may be backfilled with engineered fill. Guideline for engineered fill construction is provided in Appendix C. Footings founded on an engineered fill pad constructed as described in Appendix C may be designed for the following bearing pressures: 150 kPa at SLS and 225 kPa at ULS.

5.2.1.1 Foundation General

New footings constructed immediately adjacent to the existing building should be founded at the same level as the existing footings to eliminate underpinning requirements.

Where footings are stepped, a maximum level difference of 600 mm should be maintained.

Footings which are to be placed on overburden at different elevations should be located such that the higher footings are set below a line drawn up at 10 horizontal to 7 vertical from the near edge of the lower footing, as indicated on the following sketch:



FOOTINGS AT DIFFERENT ELEVATIONS

Footings should be stepped down below any loose soils, fill and or site services and placed on competent and approved subgrade.

All footings exposed to seasonal freezing conditions should be protected from frost action by at least 1.2 m of soil cover or equivalent insulation, depending on the final design requirements.

The total and differential settlements of well designed and constructed footings placed on undisturbed native soils in accordance with the above recommendations are expected to be less than 25 mm and 15 mm, respectively.

Prior to placement of structural concrete, all founding surfaces must be evaluated by geotechnical personnel from Edward Wong & Associates Inc. to ensure that the founding soils are similar to those identified in the boreholes and are capable of supporting the design soil bearing pressure.

5.2.2 Groundwater Control

5.2.2.1 Short Term - Construction Phase

The highest groundwater level, which was measured in Borehole 2, was 2.05 m below grade. In view of the clayey nature of the subsoil, no major groundwater problems are anticipated during construction. Groundwater entering into the excavation may be controlled by temporary sump pumps.

At construction phase, the estimated zone of influence is less than 0.5 m (0.32 m). The estimated factored dewatering flow rate and direct precipitation is 0.61 m^3 per day and 31.5 m^3 per day, respectively. The estimated total factored dewatering flow rate including direct precipitation is 32.11 m^3 per day. Detailed calculations are provided in Appendix D.

Under the new regulations, a Permit-To-Take Water (PTTW) is required from the Ministry of Environmental and Climate Change (MOECC) if a volume of water greater than 400 m^3/ day is pumped from the excavations. If the volume of water to be pumped will be greater than 50 m^3/ day but less than 400 m^3/ day, the groundwater taking will not require a PPTW, but will need to be registered in the Environmental Activity and Sector Registry (EASR) as a prescribed activity. Based on the results of dewatering calculations, no PTTW and registration in the EASR will be required.

5.2.2.2 Long Term - Post Construction Phase

If the basement is a water-proofed structure, no long term dewatering is required. In this case, the dewatering flow rate is could be 0 m^3/ day.

If the basement is a drained structure then a permanent dewatering system will be required. Weeping tiles may be installed along the perimeter wall footings and below the floor slab to control the groundwater. The estimated total factored dewatering rate for the mixed use building is 0.28 m^3 per day. Detailed calculations are shown in Appendix D.

5.2.2.3 Assessment of Potential Impacts

At the construction phase, the groundwater may be discharged to low lying area for percolation and evaporation. The chemical quality of the tested groundwater complied with

the City of Toronto Sanitary Use By Law criteria. Should groundwater be discharged into the local sanitary sewer system, a permit or approval from the City of Toronto is required.

The on-site dewatering activities will lower down the local groundwater level, increase the effective stress on the existing footing founding level and increase the potential risk of consolidation.

The estimated zone of influence at construction phase and post construction phase is less than 0.32 m and 0.23 m, respectively. The estimated zone of influence will not extend beyond the property limits. Based on the above, the on-site dewatering activities will not compromise the stability and integrity of adjacent buildings, site services, landscaped and walkway. To avoid unjustified construction claims, it was recommended that a pre-construction survey be carried out.

The closest surface water feature to the Site is the Don River, which is located at about 3.62 km to the east of the Site. The Lake Ontario is located at about 2.04 km to the south of the Site. The groundwater control activities will result in localized depression of the groundwater level. The zone of influence is not expected to extend beyond the property limits. The on-site dewatering activities will not have any negative impacts to surface water features.

The Site and surrounding area are provided with municipal piped water and sewer supply. Groundwater is not used for water supply. There would be no impacts to drinking water wells.

No gasoline stations, auto garages and dry cleaner were noted in surrounding properties. The drawdown resulting from the on-site dewatering activities will be localized. The on-site dewatering activities are not expected to draw contaminates from neighborhood properties towards the Site.

5.2.3 Excavation

Footing base excavation for the proposed mixed use building will extend to depths of about 4 m to 5 m below grade. Groundwater seepages are expected to enter the excavation, during construction. It is anticipated that the groundwater inflow can be controlled by conventional sump pumping techniques. No aggressive groundwater control measures will be required.

Providing that effective groundwater control measures are implemented at the Site, excavation in the overburden may be carried out in the open cuts using a backhoe. Boulders and cobbles are common in the glacial deposits and their presence may influence the progress of the excavation. Consequently, provisions should be made in the contract documents to cover any delays caused by boulder obstructions.

All construction works must conform to the latest edition of the Occupational Health and Safety Act (OHSA) and local regulations. With respect to the OHSA, the native soils below groundwater table are considered as Type 4 soils. The dewatered native soils, the existing fill

and the stiff clayey silt are considered as Type 3 soils. The very stiff and hard clayey silt are considered as Type 2 and 1 soil, respectively.

The OHSA requires that excavation slopes be cut at predetermined inclinations, based on the highest number of the soil types. If an excavation contains more than one soil type, trench and excavation slope geometry shall be governed by the highest numbered soil.

For guideline, side slopes of 1 vertical to 1 horizontal may be used for the temporary excavation anticipated, subject to geotechnical inspection during construction. Where loose soil is encountered at shallow depth or within persistent seepage at depth, it may be necessary to locally flatten the side slopes.

The exact locations and depths of the existing structures and services adjacent to the excavation should be determined and a support system be implemented, if the structure or services are within the zone of influence defined on the attached Drawing No. 3. It will be necessary to support existing services in the excavation, if any, where the excavation extends below the existing services.

5.2.4 Shoring

Where there is insufficient room to permit sloping of the sides of the excavation, a shoring system may be required. Conventional soldier piles and timber lagging walls may be used in the areas where no adjacent buildings and structures were located. A rigid caisson walls would be required to support structural loads from adjacent existing building. Where and if required, tiebacks (soil anchors), rakers and wales could be installed to provide lateral supports.

Footing base excavation for the proposed mixed use building will extend to a depth of approximately 4 m to 5 m below grade. A single level of support will likely be required for shoring system. A triangular earth pressure distribution similar to that used for the basement wall design is appropriate.

$$P_s = k(\gamma h + q)$$

where P_s = lateral earth pressure in kPa acting at depth h;

k = un-factored earth pressure coefficient; use 0.35 where small movement is permissible, 0.45 where movements are to be minimized

γ = unit weight of backfill, assume 21.0 kN/m^3

h = depth to point of interest in m; and

q = equivalent value of surcharge on ground surface, use 12 kPa

Conventional soil anchors made on the hard clayey silt are expected to develop an ultimate adhesion of about 60 kPa on the perimeter area of the bored hole. During installation of the soil anchors, the holes should be cased to prevent caving in the wet sand/ silt zones.

Pile toes will be made in the hard clayey silt. The horizontal resistance of the soldier pile toes will be developed by embedment below the base of the excavation, where resistance is developed from the passive earth pressure. A passive earth pressure coefficient K_p equals to 3.0 may be used.

Positive measures will be required to prevent the loss of soil through the spaces between the timber lagging boards. This could probably achieved by placing well graded sand and gravel and a geotextile behind the lagging board.

Where and if tiebacks are installed, at least one full scale test should be carried out on an anchor. This test should be taken to 200 percent of the design load or until there is a significant increase in the pull out rate. The test should be undertaken in accordance with the procedure outlined in the Canadian Foundation Manual. Based on the results of the pull out test, it may be necessary to modify the anchor design and place limits on the tieback capacity.

In addition, each working anchor must be proof-loaded. This is achieved by loading the anchor to 133 percent of the design load and the anchor must be capable of sustaining this load for 20 minutes without creep. The load may then be relaxed to 100 percent and locked in.

Movement of the shoring system is inevitable. Vertical movements will result from the inward horizontal movement resulting from the surcharges, soil and water pressures. The magnitude of this movement can be controlled by sound construction practices. It is anticipated that the horizontal movement will be in the ranged of 0.1 to 0.25 percent of the excavation depth.

To ensure that the shoring movements are within the acceptable limits, monitoring must be carried out. This may be carried out, using inclinometer and/ or survey targets. Vertical and horizontal survey targets may be installed and surveyed before excavation begins. Weekly readings during excavation should show that the movements will be within those predicted; if not, the monitoring results will enable directions to be given to improve the shoring design.

As per convention prevailing in the Greater Toronto area, the Contractor and his shoring designers are fully responsible for the design, construction and performance of the shoring system.

It is recommended that a pre-construction survey of the adjacent buildings and structures should be carried out.

5.2.5 Pipe Installation

The invert levels of the proposed sewer have not been established at the time of preparation of the report. Excavation for the sewer pipe installation is expected to be extended to about 5 m to 6 m below grades.

Providing that positive groundwater control measure is implemented at the Site, no bearing capacity is envisaged for the pipes founded on the undisturbed native soils. Any unsuitable materials encountered at the design pipe subgrade level should be removed and replaced with thin lifts of approved materials compacted to at least 98 percent standard Proctor maximum dry density.

The bases of the excavation in the competent native soils would remain stable providing that the excavation are not left open for extended period of time and the work is done in accordance with good construction practice.

Class "B" granular bedding (minimum 150 mm of compacted 19 mm crusher run limestone) may be used for the proposed pipes. If the subgrade becomes unduly wet during construction, the wet subgrade materials should be removed and additional lifts of bedding materials be placed.

Clear 19 mm crushed limestone may also be used as pipe bedding material on the clay subgrade. Where sand or silt or other wet material is encountered during excavation, the clear crushed limestone should be wrapped with approved geotextile filter fabric (Terrafix 270R or approved equivalent) to prevent migration of subgrade materials into voids of the bedding materials and help prevent consequent loss of subgrade support.

Granular material (Granular "B" Type I) should be used as pipe cover material. The pipe cover material should be carried up as backfill to at least 300 mm above the top of the pipe.

The cover and bedding materials should be placed in thin lifts not more than 200 mm thick and compacted to at least 95 percent SPMDD. The first lift above the pipe should be at least 300 mm in thickness in order to minimize the risk of pipe damage. Particular attention should be given to ensure material placed beneath the bottom quadrants of the pipe is adequately compacted.

The trench backfill should be placed in maximum 300 mm thick loose lifts and compacted to minimum 95 percent standard Proctor maximum dry density to within 600 mm of final subgrade level and 98 percent SPMDD for the upper 600 mm.

All backfilling and compaction operations should be monitored by qualified geotechnical personnel. Refer to Section 5.2.8 "Backfill Considerations" for additional comments on backfilling.

5.2.6 Floor Slab Construction and Permanent Drainage

The floor slab may be poured as a slab-on-grade on prepared and approved subgrade. Slab-on-grade construction may be carried out in accordance with the following recommendations.

Prior to slab-on-grade construction, all buried building foundations, existing asphalt pavement structures, site services, topsoil and all obviously unsuitable materials should be removed from the entire floor area. The exposed subgrade should be proof-rolled with a heavy roller and examined by qualified geotechnical personnel. Any soft areas detected during the proof-rolling process should be dug out. The area can then be brought up to design subgrade level with approved on-site or imported materials.

The fill materials should be clean and inorganic soil with its moisture content close to its optimum moisture content determined in standard Proctor test. The fill materials should be placed in lifts not more than 200 mm thick in the loose state, each lift being compacted to at least 98 percent standard Proctor maximum dry density (SPMDD).

All backfilling and compaction operations should be monitored by qualified geotechnical personnel to approve material, evaluate placement operations and ensure the specified degree of compaction is achieved uniformly throughout the fill

A minimum 200 mm thick layer of 19 mm clear crushed limestone is recommended directly beneath the floor slab to serve as a moisture barrier.

If a moisture sensitive floor finish is to be provided, polyethylene sheeting should be used as a vapor barrier.

A coefficient of subgrade reaction of 28 MPa/ m may be used for the slab-on-grade constructed as recommended as above.

Within any un-heated areas and entrances to service areas, adequate insulation should be provided below the floor slab and adjacent perimeter walls to protect them against movement due to frost heave.

Both under-floor and perimeter wall drains are required for proposed residential building with a basement. Drainage and backfill recommendations for basement are provided in Drawing No. 4. Schematic drainage details against shoring system (soldier pile and lagging or caisson wall) is provided in Drawing No. 5.

Around the perimeter of the proposed residential building, the ground surfaces should be sloped away from the structures to promote surface water run-off and reduce groundwater infiltration adjacent to the foundations.

5.2.7 Site Seismic Classifications

Based on the investigation results, the Site can be classified as "Class D" (Stiff soil) in accordance with Table 4.1.8.4.A, OBC 2012.

The seismic hazard design values for Toronto (City Hall) area are shown on Table 4 below (Table 1.2, Design Data for Selected Location in Ontario, OBC 2012; Supplementary Standard SB-1):

Table 4: Seismic Hazard Design Values for Toronto (City Hall) Area

Sa (0.2)	Sa(0.5)	Sa(1.0)	Sa(2.0)	PGA
0.22	0.13	0.067	0.021	0.12g

PGA is the peak ground acceleration in unit of g. Sa (T) is the spectral acceleration. T is the period in seconds.

Based on OBC Table 4.1.8.4B and OBC Table 4.1.8.4C, an acceleration based site coefficient (Fa) and a velocity based site coefficient (FV) value of 1.3 and 1.4 may be used, respectively.

5.2.8 Backfill Considerations

Backfill used to satisfy underfloor slab requirements, and service trenches, etc., should be compactible fill, i.e. clean inorganic soil with its moisture content close to its optimum moisture content determined in a Standard Proctor test.

The fill should be placed in lifts not exceeding 200 mm and compacted to the following requirements:

I. Within the building area - minimum 98 percent SPMDD for slab-on-grade support.

II. Pavement areas - minimum of 95 percent SPMDD to within 600 mm of final subgrade level and 98 percent SPMDD for the upper 600 mm.

III. General Backfill including trench backfill, backfill adjacent to foundation walls - minimum of 95 percent SPMDD.

Backfill should be placed simultaneously on both sides of the foundation walls. Heavy compactors, which generate large lateral stress, should be kept at a safe distance from subsurface walls to avoid structural damage.

Selected portion of the existing fill and excavated native soils (clayey silt) which are not mixed with topsoil, debris or other obviously unsuitable materials may be reused as backfill.

Any organic or excessively wet or otherwise deleterious materials should not be used for backfilling purposes. Some moisture content adjustments may be required for efficient compaction depending upon weather conditions at the time of construction.

The wet native soils should not be used for backfilling purposes, unless they can be adequately air-dried. Any shortfall of suitable on-site excavated material can be made up with suitable earth fill or imported granular material, OPSS Granular 'B' or equivalent.

Imported granular materials conforming OPSS 1010 Granular "B" gradation requirement should be used in areas where free-draining characteristics are required.

All backfilling and compaction operations should be monitored by qualified geotechnical personnel to approve material, evaluate placement operations and ensure the specified degree of compaction is achieved uniformly throughout the fill.

In areas where substantial cutting and filling is required, the compaction of the fill should be monitored full-time by a representative of Edward Wong & Associates Inc. This is particularly important within the building area where structural supports will be required as well as in the pavement area.

5.2.9 Earth Pressures on Subsurface Walls

The lateral earth pressure acting on subsurface walls may be calculated from the following equation:

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

where p = lateral earth pressure in kPa acting at depth h;

k = un-factored earth pressure coefficient; use 0.35

γ = unit weight of backfill, assume 21.0 kN/m^3

h = depth to point of interest in m; and

q = equivalent value of any surcharge the ground surface in kPa.

Free draining materials (OPSS Granular "B" Type I) should be used as backfill behind the wall. The above expression assumes that perimeter wall drainage system prevents the build-up of any hydrostatic pressure behind the wall.

The basement walls should be suitably damp-proofed. In order to minimize infiltration of surface water, the ground surface should be sloped away from the structures.

5.2.10 Sub-surface Concrete Requirements

One (1) groundwater sample was recovered from Borehole 3 and tested for pH, dissolved sulphate and chloride (Table 7, Section 6.3 of the report).

A pH value of 7.86 was recorded in the tested groundwater sample. The concentrations of dissolved sulphate and chloride in the tested groundwater sample was 26 mg/L and 270 mg/L, respectively, indicating negligible degree of sulphate and chloride attack on buried concrete structures. Normal Portland cement (Type 10) can be used in the sub-surface concrete, in accordance with CSA A23.1 - Table 3.

5.3 Pavement Design and Construction

The anticipated subgrade for the proposed driveway and parking area consists of compacted fill and competent native soils (stiff to hard clayey silt). Based on the strength and frost susceptibility of the subgrade materials, loading requirements and assuming adequate drainage, the recommended flexible pavement structures are provided in Table 5 below:

Table 5: Recommended Flexible Pavement Structure Thickness

Pavement Layer	Compaction Requirements	Light-Duty Parking (Cars)	Medium-Duty Parking and Access Road (Trucks)	Heavy-Duty Parking and Access Road (Trucks)
Asphaltic Concrete	97 percent Bulk Marshall Density	40 mm HL3 over 40 mm HL8	40 mm HL3 over 50 mm HL8	40 mm HL3 over 80 mm HL8
19 mm crusher-run limestone Granular Base	100 percent SPMDD*	150 mm	150 mm	150 mm
50 mm crusher-run limestone Granular Sub-base	100 percent SPMDD*	150 mm	300 mm	400 mm

* Denotes standard Proctor maximum dry density, ASTM-D698

The subgrade should be compacted to 98 percent SPMDD.

Hot mix asphalt should conform to the requirements of OPSS 1150. Performance grade (PG) asphalt should be specified (OPSS 1101). PG asphalt binders are identified by both the maximum and minimum temperatures by which they are expected to perform. PG 58-28 is recommended for this project. It is recommended that the asphalt mix design should be

The granular base and sub-base courses should conform the gradation requirements provided in OPSS Form 1010 for Granular "A" and Granular "B", respectively.

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

1. As part of the subgrade preparation, all obviously unsuitable materials should be removed from areas for the proposed pavement.

2. The exposed subgrade should be properly shaped, crowned and then proof-rolled in the full-time presence of a qualified geotechnical personnel. Soft or spongy areas should be sub-excavated and properly replaced with suitable approved backfill compacted 98 percent SPMDD.

3. The need for adequate drainage cannot be over-emphasized. The finished pavement surface and underlying granular and subgrade surfaces should be free from depressions and sloped to provide effective surface drainage towards catch-basins.

4. Perimeter sub-drains should be provided around parking areas. In addition, sub-drains extending from and between catch-basins should also be installed. This will ensure no water collects in the granular course which could result in pavement failure during the spring thaw.

5. To minimize the problems of differential movement between the pavement and catch-basins/manhole due to frost action, the backfill around the structures should consist of free-draining granular. In addition, the catch-basin should be perforated just above the drain and the holes screened with filter cloth.

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

7. It is recommended that the final pavement structure design and drainage plans be reviewed by the Geotechnical Engineer, prior to construction.

8. Use a step key in joint treatment where old and new asphalt pavement layer is abutted. A step key-in-joint consisting of milling the surface layer approximately 300 mm wide and 50 mm deep should be used to provide better pavement tie in to adjacent asphalt pavement structure and to minimize surface water seeping into the granular base materials.

9. All construction joints at the ends of the pavement structure treatment should be cleaned with stiff bristle brooms and compressed air to remove all dusts, dirt and other foreign matters. A tack coat should be applied to all construction joints prior to the placement of asphaltic concrete to ensure an adequate bond between the old and new pavements.

10. Placement and compaction of the asphaltic concrete, granular road base and sub-base materials should be carried out in accordance with the applicable City of Toronto Standard Specifications and OPSS.

11. All compaction operations should be monitored on a full-time basis by qualified geotechnical personnel to approve materials, evaluate placement operations and ensure the specified degree of compaction is achieved.

6. Environmental Testing

6.1 Gas Vapor Monitoring

Tests for the generation of methane gas and Total Organic Vapors were carried out in Boreholes 1,2 and 3, using a portable combustible gas tester (RKI Eagle multi-gas detector).

No chemical odors or staining which may be indicative of contamination were noted in the soil samples recovered from Boreholes 1, 2 and 3.

6.2 Assessment Criteria

The results of the soil chemical analyses were evaluated using the Site Condition Standards contained in the MOE Document entitled "Soil, Groundwater and Sediment Standards for Use under Part XV.1 of the Environment Protective Act", dated April 15, 2011.

The Site was assessed using the MOE Document Table 3 (non-potable groundwater condition) Standard. The use of Table 3 Standard is considered appropriate, based on the following:

- The Site is not located within 30 m of a water body;
- The Site is not located adjacent to a provincial or municipal park, adjacent to an area of natural significance or a wetland and based on this; it is not anticipated to provide a habitat of endangered or threatened species identified by the Ministry of Natural Resources;
- The Site is not located within areas where the Niagara Escarpment Planning and Development Act or the Oak Ridges Moraine Conservations Act, 2011 apply and;
- Bedrock was not encountered within 2 m of the ground surface at any of the borehole locations completed for this investigation.

The texture of the soils encountered on the Site is considered to be fine to medium texture.

Based on these considerations, the standard for "Residential/ Parkland/ Institutional" (RPI) property land use in a non-potable groundwater condition for fine to medium textured soil contained in Table 3 of the MOE Document were used to evaluate the environmental quality of the soil at the Site.

Since some receivers of excess soils require conformance with MOE Document Table 1 (Background Site Condition) criteria, a comparison to Table 1 "Residential/ Parkland/ Institutional/ Industry/ Commercial/ Community" (RPIICC) property use criteria were also made.

6.3 Laboratory Testing Program

Three (3) soil samples and two (2) groundwater samples were submitted to Maxxam Analytics in Mississauga for chemical analysis. The results of the chemical analysis results were used to determine the disposal options for the excess soil materials and groundwater collected in dewatering devises. The Certificates of Chemical Analyses are provided in Appendix E.

Table 7: Sample Locations and Analytical Data

Sample I.D.	Borehole Location and Depth	Matrix	Analytical Data
JBY882	BH 1, SS3 1.5 - 2.25 m depth	Soil	General and Inorganic Parameters
JBY884	BH 3, SS2 0.75 - 1.2 m depth	Soil	General and Inorganic Parameters
JBY883	BH2, SS2 0.75 -1.2 m depth	Soil	PHC (F1- F4) and VOCs
JBY879	BH 1	Groundwater	General and Inorganic Parameters
JBY880	BH 2	Groundwater	Toronto Storm and Sanitary Sewer By Law
JBY881	BH 3	Groundwater	pH, Dissolved Sulphate and Chloride

Notes: PHC - Petroleum Hydrocarbons; VOC's - Volatile Organic Compounds

6.3.1 Subsoil

6.3.1.1 Comparison to the MOE Document entitled "Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the *Environment Protection Act*"

6.3.1.1 General and Inorganic Parameters

The analytical concentrations of the soil samples generally complied with the applicable MOE Document Table 1 and 3 criteria for general and inorganic parameters, with the following exceptions.

A Sodium Adsorption Ratio (SAR) value of 14 was recorded in the soil sample from Borehole 3. The recorded SAR value exceeded the MOE Document Table 1 RPIICC and Table 3 RPI property use criterion of 2.4 and 5 for SAR, respectively.

concentration exceeded the MOE Document Table 1 RPIICC and Table 3 RPI property use criterion of 0.57 mS/cm and 0.7 mS/cm for EC, respectively.

6.3.1.1.2 Petroleum Hydrocarbons (F1 - F4 Fractions)

The analytical concentrations were below the laboratory detective limits and therefore complied the applicable MOE Document Table 1 and 3 criteria for Petroleum Hydrocarbons (F1- F4 Fractions)

6.3.1.1.3 Benzene, Toluene, Ethyl-benzene and Xylene

The measured concentrations were below the laboratory detective limits and complied the applicable MOE Document Table 1 and 3 criteria for Benzene, Toluene, Ethyl-benzene and Xylene.

6.3.1.1.4 Volatile Organic Compounds

The analytical concentrations were below the laboratory detective limits and therefore complied the applicable MOE Document Tables 1 and 3 criteria for Volatile Organic Compounds.

6.3.1.2 Comments

The SAR and EC parameters were associated with winter road salting activities. It should be noted that the elevated SAR and EC level are not considered to be harmful for human health, but could interference with the growth of certain species of plants and vegetation. Therefore, near surface placement of these materials are not recommended for landscaping, parkland or agricultural purposes. As such, elevated levels of SAR and EC do not automatically preclude disposal at development Sites accepting clean fill.

Excess soil generated at 17 St Andrew may be disposed of at any land based sites in Ontario that are being developed for "Residential/ Institutional/ Commercial/ Industrial/ Community" land uses in the areas where landscaping is not intended, subject to approval from individual receiving Site authorities.

6.3.2 Groundwater

6.3.2.1 Comparison to MOE's Document entitled "Soil, Ground Water and Sediment Standards for Use under Part XV.1 of the Environmental Protection Act", dated April 2011

The analytical concentrations of the groundwater sample recovered from Borehole 1 complied with the applicable MOE Document Table 3 criteria for general and inorganic parameters. Based on the results of chemical analysis, groundwater remediation is not required.

The concentrations of dissolved chloride, barium and sodium (1,800 mg/L, 1,400 ug/L and 490,000 ug/L) in the groundwater sample recovered from Borehole 1 exceeded the applicable MOE Document Table 1 criteria but below the corresponding MOE Document Table 3 criteria.

6.3.2.2 Comparison to Toronto Sanitary and Storm Sewer Use By Law Guidelines

The analytical concentrations in the groundwater sample recovered from Borehole 2 were below the City of Toronto Sanitary Sewer Use by Law Guideline criteria. Subject to the approval of the City of Toronto, groundwater collected from the dewatering devise may be discharged into the existing sanitary system.

With the following exceptions, the analytical concentrations in the groundwater sample recovered from Borehole 2 were below the City of Toronto Storm Sewer Use by Law Guideline criteria.

The measured concentrations of Total Suspended Solid and Total Manganese in the groundwater sample was 52 mg/L and 970 mg/ L, respectively, which exceeded the City of Toronto Storm Sewer Use by Law criterion of 15 mg/L and 50 mg/L The groundwater collected from the dewatering devise should be treated to remove excess Total Suspended Solid and Total Manganese, prior to the discharge off at the existing storm sewer system. This, however, should be approved by the City of Toronto.

7. General Comments

The recommendations in this report have been based on the findings in the boreholes. Soil conditions may vary between and beyond the boreholes. Consequently, during the future development of the property, conditions not observed during this investigation may become apparent; should this occur, Edward Wong & Associates Inc. should be contacted to assess the situation and additional testing and reporting may be required. Edward Wong & Associates Inc. has qualified personnel to provide assistance in regards to future geotechnical and environmental issues related to this property.

The comments given in this report are intended only for the guidance of design engineers. Edward Wong & Associates Inc. should be retained for a general review of the final design and specifications to verify that this report has been properly interpreted and implemented. If not accorded the privilege of making this review, Edward Wong & Associates Inc. will assume no responsibility for interpretation of the recommendations in the report.

We trust that this report is satisfactory for your purposes. Should you have any questions or comments, please do not hesitate to contact this office.

Yours truly,

Edward Wong & Associates Inc.

Edward B.H. Wong, M. Eng. P. Eng.

Distribution: Client (2)

Appendix A
Logs of Borehole

EDWARD WONG

WELL NUMBER 1

CLIENT Neuhaus Development Inc. **PROJECT NAME** 17 St. Andrew Street

PROJECT NUMBER Ma004003a **PROJECT LOCATION** Toronto

DATE STARTED 2/21/19 **COMPLETED** 2/21/19 **GROUND ELEVATION** 98.5 m **HOLE SIZE** 150 mm

DRILLING CONTRACTOR Sonic Soil Sampling **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Augers **AT TIME OF DRILLING** Dry

LOGGED BY J.T. **CHECKED BY** E.W. **AT END OF DRILLING** 6.80 m / Elev 91.70 m

NOTES **AFTER DRILLING** 3.95 m / Elev 94.55 m

DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	AU				0.18 **PAVEMENT STRUCTURE** - ~75 mm of asphaltic concrete over ~100 mm of grey, crushed limestone, very moist. 98.33	Portland Cement
	SS 1	18-12-13-12 (25)	MC = 15%		**FILL** - silty clay, topsoil and organic inclusions, grey and dark grey, very moist.	Bentonite
	SS 2	3-4-7 (11)	MC = 12%			
	SS 3	4-4-7 (11)	MC = 11%			
2						
	SS 4	2-4-6 (10)	MC = 26%		-occasional brick fragments at ~2.25 m depth	
					3.00 95.50	
	SS 5	3-5-7 (12)	PP = 300 kPa MC = 14%		**CLAYEY SILT** - some sand, trace gravel, scattered sand seams, brown, stiff, very moist.	Filter Sand, 50 mm dia. PVC Riser
4						
	SS 6	3-4-6 (10)	PP = 150 kPa MC = 16%		-becoming grey and below ~4.5 m depth	
6						
	SS 7	3-6-7 (13)	PP = 150 kPa MC = 10%			Filter Sand, Filter Sockm 50 mm dia. PVC Slotted Pipe
	SS 8	3-7-22 (29)	PP >450 kPa MC = 9%		-becoming moist and hard below ~7.5 m depth	
					7.95 90.55	
					Bottom of hole at 7.95 m.	

EDWARD WONG

WELL NUMBER 2

CLIENT Neuhaus Development Inc. **PROJECT NAME** 17 St. Andrew Street

PROJECT NUMBER Ma004003a **PROJECT LOCATION** Toronto

DATE STARTED 2/21/19 **COMPLETED** 2/21/19 **GROUND ELEVATION** 98.5 m **HOLE SIZE** 150 mm

DRILLING CONTRACTOR Sonic Soil Sampling **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Augers ▽ **AT TIME OF DRILLING** 2.25 m / Elev 96.25 m

LOGGED BY J.T. **CHECKED BY** E.W. ▼ **AT END OF DRILLING** 2.30 m / Elev 96.20 m

NOTES ▽ **AFTER DRILLING** 2.05 m / Elev 96.45 m

DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	AU				0.23 **PAVEMENT STRUCTURE** - ~100 mm of asphaltic concrete over ~125 mm of grey, crushed limestone, very moist. 98.28	Portland Cemen
	SS 1	14-22-17-9 (39)	MC = 25%		**FILL** - silty clay, occasional gravel, topsoil and organic inclusions, grey and dark grey, very moist.	
	SS 2	3-2-2 (4)	MC = 28%			Bentonite
	SS 3	2-2-2 (4)	MC = 11%			
2					2.25 ▽ 96.25	
	SS 4	3-7-11 (18)	PP = 350 kPa MC = 12%		**CLAYEY SILT** - trace sand, trace gravel, scattered sand seams, mottled brown and grey, very moist, very stiff. -groundwater was first encountered at ~2.25 m depth	
	SS 5	5-6-9 (15)	PP = 350 kPa MC = 12%		-becoming brown below ~ 3 m depth.	Filter Sand, 50 mm dia. PVC Riser
4						
	SS 6	6-8-12 (20)	PP = 300 kPa MC = 16%		-becoming grey below ~4.5 m depth	
6						
	SS 7	4-6-9 (15)	PP = 250 kPa MC = 11%			Filter Sand, Filter Sock, 50 mm dia. PVC Slotted Pipe
	SS 8	7-13-22 (35)	PP >450 kPa MC = 16%		-becoming hard below ~7.5 m depth	
					7.95 90.55 Bottom of hole at 7.95 m.	

EDWARD WONG

WELL NUMBER 3

CLIENT Neuhaus Development Inc. **PROJECT NAME** 17 St. Andrew Street

PROJECT NUMBER Ma004003a **PROJECT LOCATION** Toronto

DATE STARTED 2/21/19 **COMPLETED** 2/21/19 **GROUND ELEVATION** 98.4 m **HOLE SIZE** 150 mm

DRILLING CONTRACTOR Sonic Soil Sampling **GROUND WATER LEVELS:**

DRILLING METHOD Solid Stem Augers **AT TIME OF DRILLING** Dry

LOGGED BY J.T. **CHECKED BY** E.W. **AT END OF DRILLING** Dry

NOTES **AFTER DRILLING** 2.63 m / Elev 95.77 m

DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	TESTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
	AU				0.23 **PAVEMENT STRUCTURE** - ~50 mm of asphaltic concrete over ~175 mm of grey, crushed limestone, very moist. 98.18	Portland Cement
	SS 1	19-13-8-5 (21)	MC = 21%		**FILL** - silty clay, topsoil and organic inclusions, grey and dark grey, very moist.	
	SS 2	2-3-1 (4)	MC = 17%			Bentonite Seal
	SS 3	3-2-5 (7)	MC = 30%			
2					2.25 96.15	
	SS 4	5-9-10 (19)	PP = 400 kPa MC = 26%		**CLAYEY SILT** - trace sand, trace gravel, scattered sand seams, mottled brown and grey, very moist, hard.	
	SS 5	5-6-7 (13)	PP = 400 kPa MC = 21%			Filter Sand, 50 mm dia. PVC Riser
4						
	SS 6	4-6-10 (16)	PP = 350 kPa MC = 13%		-becoming grey and very stiff below ~4.5 m depth.	
6						
	SS 7	3-6-9 (15)	PP = 300 kPa MC = 9%		-becoming moist below ~6 m depth	Filter Sand, Filter Sock, 50 mm dia. OVC Slotted Pipe
	SS 8	7-13-21 (34)	PP >450 kPa MC = 10%		-becoming hard below ~7.5 m depth	
					7.95 90.45	
					Bottom of hole at 7.95 m.	

Appendix B
Results of Grain Size Analysis and Hydrometer Test

EDWARD WONG

Edward Wong & Associates Inc.
441 Esna Park Drive, Unit 19
Markham, Ontario, L3R 1H7
Telephone: (416) 903-4288
Fax: (905) 964-1188

Grain Size Analysis and Hydrometer Test

Sample Test No.: S1 **Report No.:** 1 **Date Reported:** 22/02/2019

Project No.: Ma004003a
Project Name: 17 St. Andrew Street, Toronto

Grain Size Proportion (%)

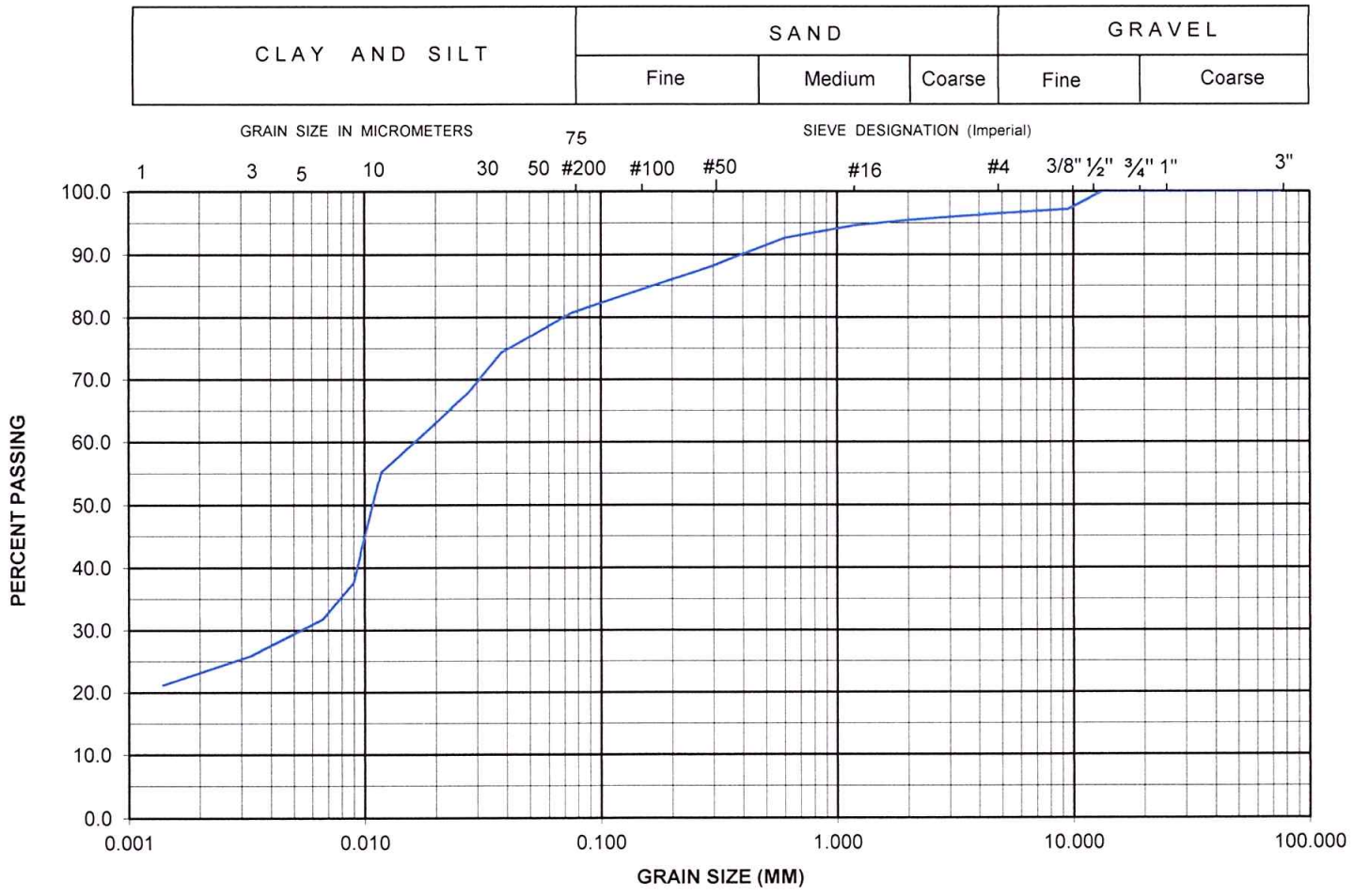
Gravel (> 4.75mm):	**3.5**
Sand (> 75μm, < 4.75mm):	**15.8**
Silt (> 2μm), < 75μm):	**57.1**
Clay (< 2μm):	**23.6**

Sample Information

Sample Location: BH 1
Sample No.: 5
Sample Method: SPT
Depth (m): 4.5 - 4.95 m
Sample Description: Brown Clayey Silt some sand trace gravel
Sampled By: J.T
Sampling Date: Feb. 21, 2019
Client Sample ID:
Comments:

Grain Size (mm)	% Passing	Grain Size (mm)	% Passing
75.00	100.0	**0.009**	37.6
26.50	100.0	**0.007**	31.8
19.00	100.0	**0.003**	25.9
13.25	100.0	**0.001**	21.2
9.50	97.2		
4.75	96.5		
2.00	95.5		
1.180	94.6		
0.600	92.7		
0.300	88.3		
0.150	84.5		
0.075	80.7		
0.039	74.3		
0.028	67.7		
0.018	61.5		
0.012	55.2		

UNIFIED SOIL CLASSIFICATION SYSTEM



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441 Esna Park Drive, Unit 19
Markham, Ontario, L3R 1H7
Telephone: (416) 903-4288
Fax: (905) 964-1188

Grain Size Analysis and Hydrometer Test

Sample Test No.: S2 **Report No.:** 2 **Date Reported:** 22/02/2019

Project No.: Ma004003a
Project Name: 17 St. Andrew Street, Toronto

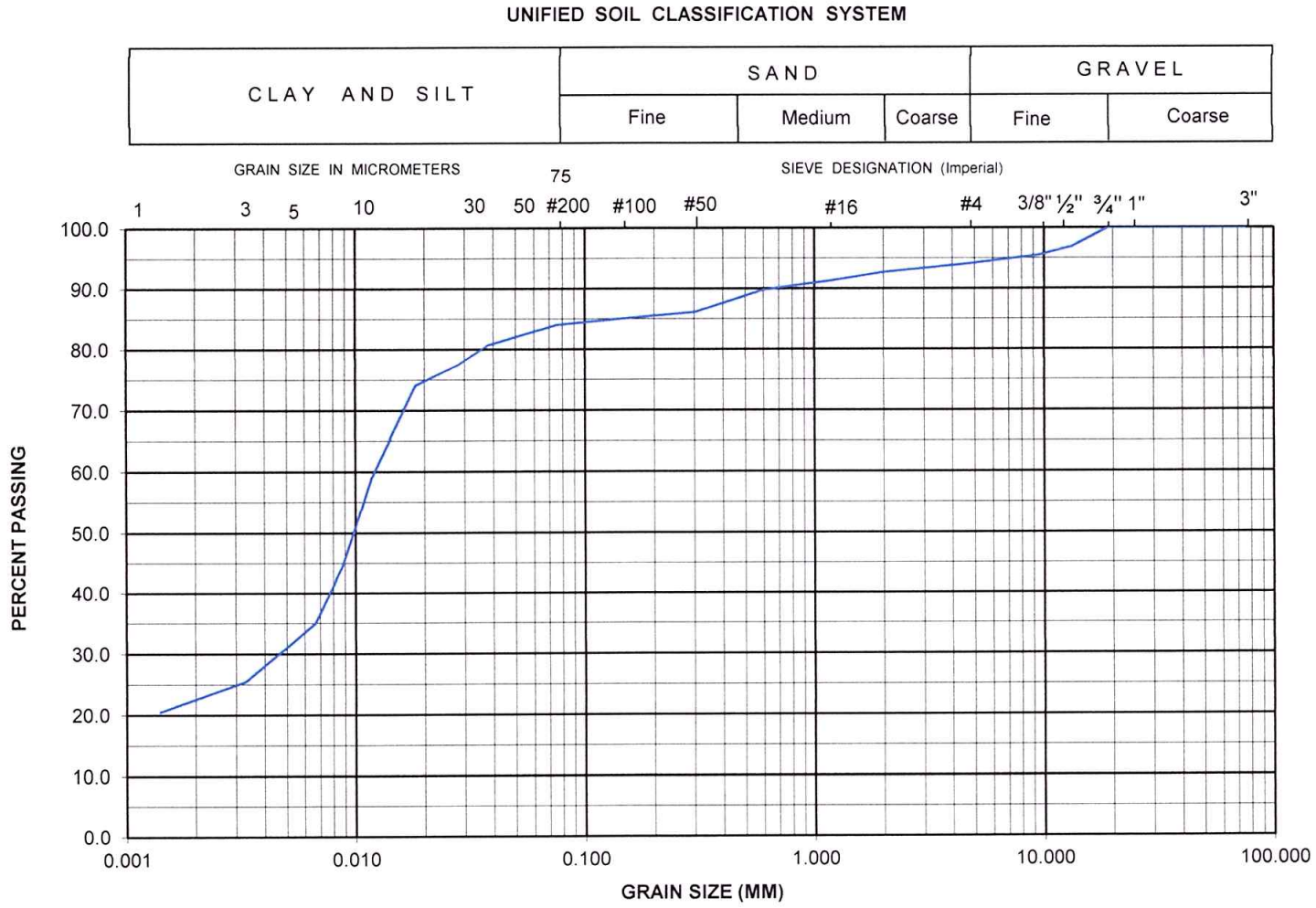
Grain Size Proportion (%)

Gravel (> 4.75mm):	**5.9**
Sand (> 75μm, < 4.75mm):	**10.1**
Silt (> 2μm), < 75μm):	**61.0**
Clay (< 2μm):	**23.0**

Sample Information

Sample Location: BH 2
Sample No.: 4
Sample Method: SPT
Depth (m): 3.0 - 3.45
Sample Description: Mottled brown and grey Clayey Silt some sand trace gravel
Sampled By: J.T
Sampling Date: Feb. 21, 2019
Client Sample ID:
Comments:

Grain Size (mm)	% Passing	Grain Size (mm)	% Passing
75.00	100.0	**0.009**	44.5
26.50	100.0	**0.007**	35.0
19.00	100.0	**0.003**	25.5
13.25	96.9	**0.001**	20.5
9.50	95.5		
4.75	94.1		
2.00	92.7		
1.180	91.3		
0.600	89.8		
0.300	86.1		
0.150	85.1		
0.075	84.0		
0.038	80.7		
0.028	77.4		
0.018	74.1		
0.012	58.8		



Appendix C
Results of Slug Test

Edward Wong & Associates Inc.
441 Esna Park Drive, Unit 19
Markham, Ontario
L3R 1H7

Slug Test - Water Level Data

Project: 17 St. Andrew Street

Number: Ma004003a

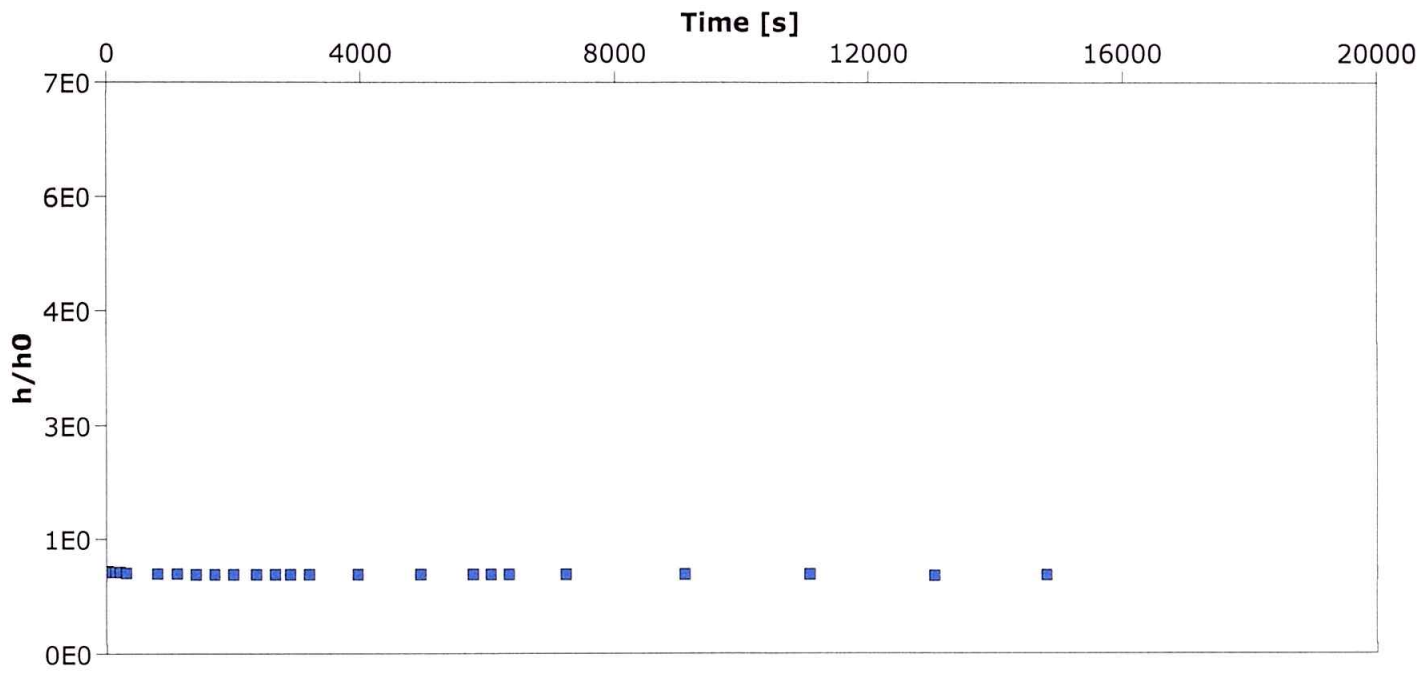
Client: The Impression Group

Location: Toronto, Ontario	Slug Test: Slug Test 1	Test Well: BH 2
Test conducted by: JT.	Test date: 2/26/2019	
Water level at t=0 [m]: 7.70	Static water level [m]: 2.05	Water level change at t=0 [m]: 5.65

	Time [s]	Water Level [m]	WL Change [m]
1	22	7.68	5.63
2	87	7.65	5.60
3	147	7.632	5.582
4	211	7.614	5.564
5	309	7.562	5.512
6	804	7.5571	5.5071
7	1108	7.5309	5.4809
8	1405	7.4754	5.4254
9	1703	7.4752	5.4252
10	2003	7.487	5.437
11	2358	7.502	5.452
12	2653	7.5009	5.4509
13	2900	7.4986	5.4486
14	3198	7.4939	5.4439
15	3960	7.4907	5.4407
16	4941	7.4877	5.4377
17	5766	7.486	5.436
18	6055	7.483	5.433
19	6342	7.48	5.43
20	7229	7.4776	5.4276
21	9097	7.4742	5.4242
22	11065	7.468	5.418
23	13033	7.395	5.345
24	14796	7.45	5.40

Edward Wong & Associates Inc. 441 Esna Park Drive, Unit 19 Markham, Ontario L3R 1H7	**Slug Test Analysis Report**
	Project: 17 St. Andrew Street
	Number: Ma004003a
	Client: The Impression Group

Location: Toronto, Ontario	Slug Test: Slug Test 1	Test Well: BH 2
Test conducted by: JT.		Test date: 2/26/2019
Analysis performed by:	Hvorslev	Analysis date: 3/30/2019
Aquifer Thickness: 7.95 m		



Calculation after Hvorslev

Observation well	Hydraulic Conductivity [m/s]	
BH 2	8.95×10^{-10}	

Edward Wong & Associates Inc.
441 Esna Park Drive, Unit 19
Markham, Ontario
L3R 1H7

Slug Test - Water Level Data

Project: 17 St. Andrew Street

Number: Ma004003a

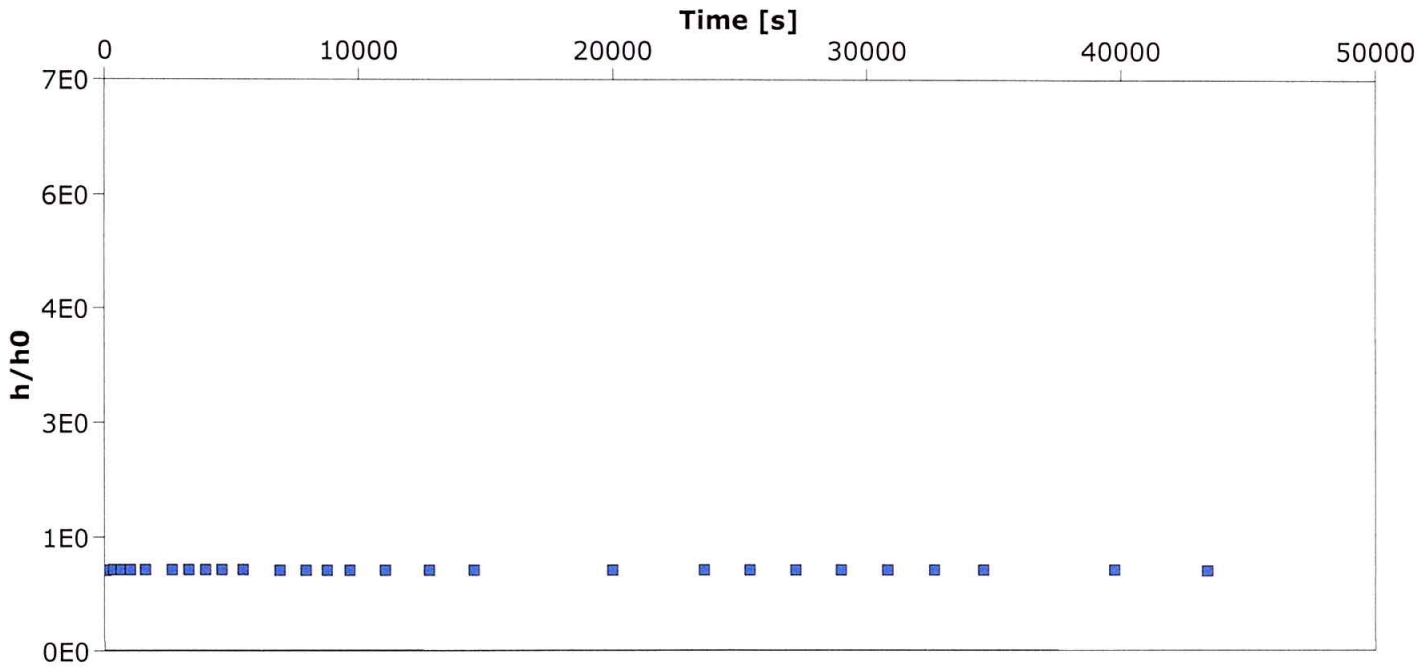
Client: The Impression Group

Location: Toronto, Ontario	Slug Test: Slug Test 1	Test Well: BH 3
Test conducted by:	Test date: 2/26/2019	
Water level at t=0 [m]: 7.79	Static water level [m]: 2.63	Water level change at t=0 [m]: 5.16

	Time [s]	Water Level [m]	WL Change [m]
1	60	7.7139	5.0839
2	360	7.7805	5.1505
3	660	7.7796	5.1496
4	1020	7.7786	5.1486
5	1620	7.7762	5.1462
6	2640	7.7718	5.1418
7	3300	7.7697	5.1397
8	3960	7.7682	5.1382
9	4620	7.765	5.135
10	5460	7.763	5.133
11	6900	7.759	5.129
12	7920	7.7585	5.1285
13	8760	7.7581	5.1281
14	9660	7.754	5.124
15	11040	7.751	5.121
16	12780	7.744	5.114
17	14520	7.74	5.11
18	19980	7.7339	5.1039
19	23580	7.73	5.10
20	25380	7.7287	5.0987
21	27180	7.724	5.094
22	28980	7.726	5.096
23	30780	7.722	5.092
24	32640	7.7179	5.0879
25	34560	7.7166	5.0866
26	39720	7.7179	5.0879
27	43380	7.71	5.08

Edward Wong & Associates Inc. 441 Esna Park Drive, Unit 19 Markham, Ontario L3R 1H7	Slug Test Analysis Report
	Project: 17 St. Andrew Street
	Number: Ma004003a
	Client: The Impression Group

Location: Toronto, Ontario	Slug Test: Slug Test 1	Test Well: BH 3
Test conducted by:		Test date: 2/26/2019
Analysis performed by:	Hvorslev	Analysis date: 3/30/2019
Aquifer Thickness: 7.95 m		



Calculation after Hvorslev

Observation well	Hydraulic Conductivity [m/s]	
BH 3	1.23×10^{-10}	

Appendix D
Dewatering Calculations

Project No.: Ma004003a
Location: 17 St. Andrew Street, Toronto
Title: Dewatering Flow Rates

Ro = 3000 x dhx K ^0.5 (confined aquifer)
a= 32.3 m
b= 26.1 m
rs = (a +b)/ 3.14 when a/b < 1.5
rs = ((a x b) / 3.14)^ 0.5
rs = 18.6 m

$$Q = \frac{3.14 \times K \times (H^2 - h^2)}{\ln (R0 + rs / rs)}$$

	Construction Phase		Post Construction Phase
K (m^3/s)	8.95 x 10-10		8.95 x 10-10
H (m)	5.55		3.05
h (m)	1.5		0
dH (m)	4.05		3.05
R0 (m)	0.32		0.23
rs (m)	18.6		18.6
rs +R0 (m)	18.92		18.83
Q (m^3/ sec.)	4.7 x 10-6		2.1 x 10-6
Q (m^3/ day)	0.41		0.18
Qf (m^3/ day)	0.61		0.28
Q rain (m^3/ day)	21		0
Qf rain	31.5		0
Q total	**32.11**		**0.28**
	(pre-construction)		**(post construction)**
Data			
Borehole	3		3
Ground Surface (masl)	100		100
Highest W.L. (masl)	97.95		97.95
Base of Excavation (m)	94.9	(1.5 m below slab)	94.9
Draw down target (m)	93.9	(1 m below excav.)	94.9
Aquifer Bottom (masl)	92.4	(1.5 m below target water level)	94.9
Rainfall (mm)	25		0 (roof cover)
Factor of Safety	1.5		1.5

Reference : J.Patrick Powers, Construction Dewatering and Groundwater Control, 2007

Appendix E
Certificate of Chemical Analysis

Maxxam
A Bureau Veritas Group Company

Your Project #: 17 ST ANDREW TORONTO
Site#: MA004003A
Your C.O.C. #: 101208

Attention: Edward Wong

Edward Wong & Associates Inc
441 Esna Park Dr
Unit 19
Markham, ON
CANADA L3R 1H7

Report Date: 2019/03/08
Report #: R5621774
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B953064
Received: 2019/02/28, 13:54

Sample Matrix: Soil
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Hot Water Extractable Boron	2	2019/03/04	2019/03/04	CAM SOP-00408	R153 Ana. Prot. 2011
Free (WAD) Cyanide	2	2019/03/01	2019/03/04	CAM SOP-00457	OMOE E3015 m
Conductivity	2	2019/03/05	2019/03/05	CAM SOP-00414	OMOE E3530 v1 m
Hexavalent Chromium in Soil by IC (1)	2	2019/03/04	2019/03/04	CAM SOP-00436	EPA 3060/7199 m
Petroleum Hydrocarbons F2-F4 in Soil (2)	1	2019/03/02	2019/03/02	CAM SOP-00316	CCME CWS m
Strong Acid Leachable Metals by ICPMS	2	2019/03/04	2019/03/04	CAM SOP-00447	EPA 6020B m
Moisture	3	N/A	2019/03/01	CAM SOP-00445	Carter 2nd ed 51.2 m
pH CaCl2 EXTRACT	2	2019/03/04	2019/03/04	CAM SOP-00413	EPA 9045 D m
Sodium Adsorption Ratio (SAR)	2	N/A	2019/03/06	CAM SOP-00102	EPA 6010C

Sample Matrix: Water
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Chloride by Automated Colourimetry	2	N/A	2019/03/04	CAM SOP-00463	EPA 325.2 m
Chromium (VI) in Water	1	N/A	2019/03/04	CAM SOP-00436	EPA 7199 m
Free (WAD) Cyanide	1	N/A	2019/03/05	CAM SOP-00457	OMOE E3015 m
Mercury	1	2019/03/04	2019/03/04	CAM SOP-00453	EPA 7470A m
Dissolved Metals by ICPMS	1	N/A	2019/03/05	CAM SOP-00447	EPA 6020B m
pH	1	N/A	2019/03/04	CAM SOP-00413	SM 4500H+ B m
Sulphate by Automated Colourimetry	1	N/A	2019/03/04	CAM SOP-00464	EPA 375.4 m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed

Maxxam
A Bureau Veritas Group Company

Your Project #: 17 ST ANDREW TORONTO
Site#: MA004003A
Your C.O.C. #: 101208

Attention: Edward Wong

Edward Wong & Associates Inc
441 Esna Park Dr
Unit 19
Markham, ON
CANADA L3R 1H7

Report Date: 2019/03/08
Report #: R5621774
Version: 1 - Final

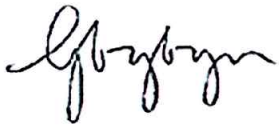
CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B953064
Received: 2019/02/28, 13:54

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Soils are reported on a dry weight basis unless otherwise specified.
(2) All CCME PHC results met required criteria unless otherwise stated in the report. The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following "Alberta Environment's Interpretation of the Reference Method for the Canada-Wide Standard for Petroleum Hydrocarbons in Soil Validation of Performance-Based Alternative Methods September 2003". Documentation is available upon request. Modifications from Reference Method for the Canada-wide Standard for Petroleum Hydrocarbons in Soil-Tier 1 Method: F2/F3/F4 data reported using validated cold solvent extraction instead of Soxhlet extraction.

Encryption Key



Gina Baybayan
Project Manager
08 Mar 2019 16:56:54

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Gina Baybayan, Project Manager
Email: GBaybayan@maxxam.ca
Phone# (905)817-5766

==========

Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B953064
Report Date: 2019/03/08

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

O.REG 153 METALS & INORGANICS PKG (SOIL)

Maxxam ID			JBY882	JBY884	JBY884	
Sampling Date			2019/02/21	2019/02/21	2019/02/21	
COC Number			101208	101208	101208	
	UNITS	Criteria	BH1, SS3	BH3, SS2	BH3, SS2 Lab-Dup	RDL
Calculated Parameters						
Sodium Adsorption Ratio	N/A	2.4	2.3	**14**	N/A	N/A
Inorganics						
Conductivity	mS/cm	0.57	**1.3**	**2.1**	**2.0**	0.002
Moisture	%	-	19	16	N/A	1.0
Available (CaCl2) pH	pH	-	7.47	7.94	N/A	N/A
WAD Cyanide (Free)	ug/g	0.051	<0.01	<0.01	N/A	0.01
Chromium (VI)	ug/g	0.66	0.2	<0.2	N/A	0.2
Metals						
Hot Water Ext. Boron (B)	ug/g	-	0.17	0.46	N/A	0.050
Acid Extractable Antimony (Sb)	ug/g	1.3	<0.20	0.96	N/A	0.20
Acid Extractable Arsenic (As)	ug/g	18	2.7	4.7	N/A	1.0
Acid Extractable Barium (Ba)	ug/g	220	110	89	N/A	0.50
Acid Extractable Beryllium (Be)	ug/g	2.5	0.83	0.38	N/A	0.20
Acid Extractable Boron (B)	ug/g	36	8.1	6.6	N/A	5.0
Acid Extractable Cadmium (Cd)	ug/g	1.2	<0.10	0.16	N/A	0.10
Acid Extractable Chromium (Cr)	ug/g	70	40	14	N/A	1.0
Acid Extractable Cobalt (Co)	ug/g	21	13	5.4	N/A	0.10
Acid Extractable Copper (Cu)	ug/g	92	23	20	N/A	0.50
Acid Extractable Lead (Pb)	ug/g	120	11	93	N/A	1.0
Acid Extractable Molybdenum (Mo)	ug/g	2	<0.50	0.76	N/A	0.50
Acid Extractable Nickel (Ni)	ug/g	82	31	12	N/A	0.50
Acid Extractable Selenium (Se)	ug/g	1.5	<0.50	<0.50	N/A	0.50
Acid Extractable Silver (Ag)	ug/g	0.5	<0.20	<0.20	N/A	0.20
Acid Extractable Thallium (Tl)	ug/g	1	0.20	0.090	N/A	0.050
Acid Extractable Uranium (U)	ug/g	2.5	0.60	0.40	N/A	0.050
Acid Extractable Vanadium (V)	ug/g	86	45	23	N/A	5.0
Acid Extractable Zinc (Zn)	ug/g	290	58	70	N/A	5.0
Acid Extractable Mercury (Hg)	ug/g	0.27	<0.050	**0.28**	N/A	0.050

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 1: Full Depth Background Site Condition Standards
Soil - Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
N/A = Not Applicable

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Maxxam Job #: B953064
Report Date: 2019/03/08

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

O.REG 153 PETROLEUM HYDROCARBONS (SOIL)

Maxxam ID			JBY883	
Sampling Date			2019/02/21	
COC Number			101208	
	UNITS	Criteria	BH2, SS2	RDL
Inorganics				
Moisture	%	-	11	1.0
F2-F4 Hydrocarbons				
F2 (C10-C16 Hydrocarbons)	ug/g	10	<10	10
F3 (C16-C34 Hydrocarbons)	ug/g	240	<50	50
F4 (C34-C50 Hydrocarbons)	ug/g	120	<50	50
Reached Baseline at C50	ug/g	-	Yes	N/A
Surrogate Recovery (%)				
o-Terphenyl	%	-	99	N/A

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 1: Full Depth Background Site Condition Standards
Soil -
Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
N/A = Not Applicable

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Maxxam Job #: B953064
Report Date: 2019/03/08

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

RESULTS OF ANALYSES OF WATER

Maxxam ID			JBY881		JBY881
Sampling Date			2019/02/28		2019/02/28
COC Number			101208		101208
	UNITS	Criteria	BH3	RDL	BH3 Lab-Dup
Inorganics					
pH	pH	-	7.86	N/A	7.96
Dissolved Sulphate (SO4)	mg/L	-	26	1.0	N/A
Dissolved Chloride (Cl-)	mg/L	790	270	3.0	N/A

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 1: Full Depth Background Site Condition Standards
Ground Water - All Types of Property Uses
N/A = Not Applicable

Maxxam Analytics International Corporation o/a Maxxam Analytics 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.maxxam.ca

Maxxam Job #: B953064
Report Date: 2019/03/08

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

O.REG 153 METALS & INORGANICS PKG (WTR)

Maxxam ID			JBY879	
Sampling Date			2019/02/28	
COC Number			101208	
	UNITS	Criteria	BH1	RDL
Inorganics				
WAD Cyanide (Free)	ug/L	5	<1	1
Dissolved Chloride (Cl-)	mg/L	790	**1800**	20
Metals				
Chromium (VI)	ug/L	25	<0.50	0.50
Mercury (Hg)	ug/L	0.1	<0.1	0.1
Dissolved Antimony (Sb)	ug/L	1.5	**1.9**	0.50
Dissolved Arsenic (As)	ug/L	13	1.5	1.0
Dissolved Barium (Ba)	ug/L	610	**1400**	2.0
Dissolved Beryllium (Be)	ug/L	0.5	<0.50	0.50
Dissolved Boron (B)	ug/L	1700	110	10
Dissolved Cadmium (Cd)	ug/L	0.5	<0.10	0.10
Dissolved Chromium (Cr)	ug/L	11	<5.0	5.0
Dissolved Cobalt (Co)	ug/L	3.8	1.4	0.50
Dissolved Copper (Cu)	ug/L	5	1.9	1.0
Dissolved Lead (Pb)	ug/L	1.9	<0.50	0.50
Dissolved Molybdenum (Mo)	ug/L	23	18	0.50
Dissolved Nickel (Ni)	ug/L	14	**15**	1.0
Dissolved Selenium (Se)	ug/L	5	<2.0	2.0
Dissolved Silver (Ag)	ug/L	0.3	<0.10	0.10
Dissolved Sodium (Na)	ug/L	490000	**1700000**	500
Dissolved Thallium (Tl)	ug/L	0.5	<0.050	0.050
Dissolved Uranium (U)	ug/L	8.9	5.1	0.10
Dissolved Vanadium (V)	ug/L	3.9	1.5	0.50
Dissolved Zinc (Zn)	ug/L	160	<5.0	5.0

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
Criteria: Ontario Reg. 153/04 (Amended April 15, 2011)
Table 1: Full Depth Background Site Condition Standards
Ground Water - All Types of Property Uses

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Maxxam Job #: B953064
Report Date: 2019/03/08

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.7°C

Results relate only to the items tested.

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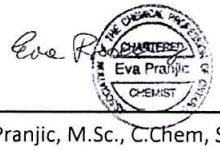
Maxxam Job #: B953064
Report Date: 2019/03/08

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).



Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

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MAXXAM / MICRO
A Bureau Veritas Group Company

6740 Campobello Road, Mississauga, Ontario L5N 2L8
Phone 905-817-5700 Fax 905-817-5779 Toll Free 800-563-6266
CAM FCD-01191/3

CHAIN OF CUSTODY RECORD

101208 Page ____ of ____

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)	
Company Name:	Edward Wong & Associates Inc	Company Name:		Quotation #:	
Contact Name:	Ed. Wong	Contact Name:		P.O. #/ AFE#:	
Address:	441 Esna Park Drive Unit 19 Markham	Address:		Project #:	17 St Andrew Toronto
				Site Location:	
Phone: / Fax:		Phone: / Fax:		Site #:	Ma004003a
Email:		Email:		Sampled By:	S.H

Turnaround Time (TAT) Required
- [x] Regular TAT (5-7 days) Most analyses

PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS

Rush TAT (Surcharges will be applied)
- [ ] 1 Day
- [ ] 2 Days
- [ ] 3-4 Days

Date Required:

Rush Confirmation #:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Regulation 153
- [ ] Table 1 [ ] Res/Park [ ] Med/ Fine
- [ ] Table 2 [ ] Ind/Comm [ ] Coarse
- [ ] Table 3 [ ] Agri/ Other
- [ ] Table ____

FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations
- [ ] CCME [ ] Sanitary Sewer Bylaw
- [ ] MISA [ ] Storm Sewer Bylaw
- [ ] PWQO Region
- [ ] Other (Specify)
- [ ] REG 558 (MIN 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

#	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/ PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	General and Inorganic	parameters	Toronto storm and	Sanitary sewer use	SO4 + Cl	Sulphate	pH, soluble chloride and	HOLD- DO NOT ANALYZE
1	BH 1	Feb 28, 19	a.m	GW									✓							
2	BH 2	Feb 28, 19	"	"											✓					
3	BH3	Feb. 28	"	"															✓	
4	BH 1, [illegible] 553	Feb 21, 19		Soil						✓										
5	BH 2, [illegible] 552	Feb 21, 19		"				✓												
6	BH 3, 552	Feb 21, 19		"						✓			[illegible]							
7																				
8																				
9																				
10																				

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
N	N	6 / 8 / 6

COOLING MEDIA PRESENT: (Y) / N

COMMENTS

Contact Gina

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
Paiz Jiy	Feb 28, 19	p.m	MAM [illegible]	2019/02/28	13:54

28-Feb-19 13:54
Gina Baybayan
B953064
CA2 ENV-895

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COC-1004 (03/17)

White: Maxxam - Yellow: Client

Maxxam
A Bureau Veritas Group Company

Your Project #: 17 ST ANDREW TORONTO
Site#: MA004003A
Your C.O.C. #: 101208

Attention: Edward Wong

Edward Wong & Associates Inc
441 Esna Park Dr
Unit 19
Markham, ON
CANADA L3R 1H7

Report Date: 2019/03/13
Report #: R5627015
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B953064
Received: 2019/02/28, 13:54

Sample Matrix: Water
Samples Received: 1

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Reference
Sewer Use By-Law Semivolatile Organics	1	2019/03/05	2019/03/06	CAM SOP 00301	EPA 8270 m
Biochemical Oxygen Demand (BOD)	1	2019/03/02	2019/03/07	CAM SOP-00427	SM 23 5210B m
Chromium (VI) in Water	1	N/A	2019/03/04	CAM SOP-00436	EPA 7199 m
Total Cyanide	1	2019/03/05	2019/03/05	CAM SOP-00457	OMOE E3015 5 m
Fluoride	1	2019/03/01	2019/03/04	CAM SOP-00449	SM 23 4500-F C m
Mercury in Water by CVAA	1	2019/03/04	2019/03/04	CAM SOP-00453	EPA 7470A m
Total Metals Analysis by ICPMS	1	N/A	2019/03/05	CAM SOP-00447	EPA 6020B m
E.coli, (CFU/100mL)	1	N/A	2019/02/28	CAM SOP-00552	MOE LSB E3371
Total Nonylphenol in Liquids by HPLC	1	2019/03/04	2019/03/05	CAM SOP-00313	In-house Method
Nonylphenol Ethoxylates in Liquids: HPLC	1	2019/03/04	2019/03/05	CAM SOP-00313	In-house Method
Animal and Vegetable Oil and Grease	1	N/A	2019/03/05	CAM SOP-00326	EPA1664B m,SM5520B m
Total Oil and Grease	1	2019/03/05	2019/03/05	CAM SOP-00326	EPA1664B m,SM5520A m
Polychlorinated Biphenyl in Water	1	2019/03/02	2019/03/04	CAM SOP-00309	EPA 8082A m
pH	1	2019/03/01	2019/03/04	CAM SOP-00413	SM 4500H+ B m
Phenols (4AAP)	1	N/A	2019/03/04	CAM SOP-00444	OMOE E3179 m
Total Kjeldahl Nitrogen in Water	1	2019/03/04	2019/03/05	CAM SOP-00938	OMOE E3516 m
Total PAHs (1)	1	N/A	2019/03/07	CAM SOP - 00301	EPA 8270 m
Mineral/Synthetic O & G (TPH Heavy Oil) (2)	1	2019/03/05	2019/03/05	CAM SOP-00326	EPA1664B m,SM5520F m
Total Suspended Solids	1	2019/03/01	2019/03/02	CAM SOP-00428	SM 23 2540D m
Volatile Organic Compounds in Water	1	N/A	2019/03/04	CAM SOP-00228	EPA 8260C m

Remarks:

Maxxam Analytics' laboratories are accredited to ISO/IEC 17025:2005 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Maxxam are based upon recognized Provincial, Federal or US method compendia such as CCME, MDDELCC, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Maxxam's profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Maxxam in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Maxxam Analytics' liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed

Your Project #: 17 ST ANDREW TORONTO
Site#: MA004003A
Your C.O.C. #: 101208

Attention: Edward Wong

Edward Wong & Associates Inc
441 Esna Park Dr
Unit 19
Markham, ON
CANADA L3R 1H7

Report Date: 2019/03/13
Report #: R5627015
Version: 3 - Revision

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B953064
Received: 2019/02/28, 13:54

or implied. Maxxam has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Maxxam, unless otherwise agreed in writing. Maxxam is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Maxxam, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix "m" indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Total PAHs include only those PAHs specified in the sewer use by-by-law.
(2) Note: TPH (Heavy Oil) is equivalent to Mineral / Synthetic Oil & Grease

Encryption Key

Gina Baybayan
Project Manager
13 Mar 2019 11:53:32

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Gina Baybayan, Project Manager
Email: GBaybayan@maxxam.ca
Phone# (905)817-5766

==========

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Maxxam Job #: B953064
Report Date: 2019/03/13

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

RESULTS OF ANALYSES OF WATER

Maxxam ID				JBY880	
Sampling Date				2019/02/28	
COC Number				101208	
	UNITS	San	Stm	BH2	RDL
Calculated Parameters					
Total Animal/Vegetable Oil and Grease	mg/L	150	-	1.8	0.50
Inorganics					
Total BOD	mg/L	300	15	<2	2
Fluoride (F-)	mg/L	10	-	0.18	0.10
Total Kjeldahl Nitrogen (TKN)	mg/L	100	-	9.5	0.50
pH	pH	6.0:11.5	6.0:9.5	7.59	N/A
Phenols-4AAP	mg/L	1.0	0.008	<0.0010	0.0010
Total Suspended Solids	mg/L	350	15	**52**	10
Total Cyanide (CN)	mg/L	2	0.02	<0.0050	0.0050
Petroleum Hydrocarbons					
Total Oil & Grease	mg/L	-	-	1.8	0.50
Total Oil & Grease Mineral/Synthetic	mg/L	15	-	<0.50	0.50

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

San,Stm: Toronto Sanitary and Storm Sewer Use By Law Guidelines, respectively. Referenced to Chapter 681

N/A = Not Applicable

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Maxxam Job #: B953064
Report Date: 2019/03/13

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

NONYL PHENOL AND NONYL PHENOL ETHOXYLATE (WATER)

Maxxam ID				JBY880	
Sampling Date				2019/02/28	
COC Number				101208	
	UNITS	**San**	**Stm**	**BH2**	**RDL**
Miscellaneous Parameters					
Nonylphenol Ethoxylate (Total)	mg/L	0.2	0.01	<0.005	0.005
Nonylphenol (Total)	mg/L	0.02	0.001	<0.001	0.001

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

San,Stm: Toronto Sanitary and Storm Sewer Use By Law Guidelines, respectively. Referenced to Chapter 681

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Maxxam Job #: B953064
Report Date: 2019/03/13

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

ELEMENTS BY ATOMIC SPECTROSCOPY (WATER)

Maxxam ID				JBY880	JBY880	
Sampling Date				2019/02/28	2019/02/28	
COC Number				101208	101208	
	UNITS	San	Stm	BH2	BH2 Lab-Dup	RDL
Metals						
Chromium (VI)	ug/L	2000	40	<0.50	N/A	0.50
Mercury (Hg)	mg/L	0.01	0.0004	<0.0001	<0.0001	0.0001
Total Aluminum (Al)	ug/L	50000	-	650	N/A	5.0
Total Antimony (Sb)	ug/L	5000	-	2.2	N/A	0.50
Total Arsenic (As)	ug/L	1000	20	2.0	N/A	1.0
Total Cadmium (Cd)	ug/L	700	8	<0.10	N/A	0.10
Total Chromium (Cr)	ug/L	4000	80	<5.0	N/A	5.0
Total Cobalt (Co)	ug/L	5000	-	1.7	N/A	0.50
Total Copper (Cu)	ug/L	2000	40	1.6	N/A	1.0
Total Lead (Pb)	ug/L	1000	120	2.3	N/A	0.50
Total Manganese (Mn)	ug/L	5000	50	**970**	N/A	2.0
Total Molybdenum (Mo)	ug/L	5000	-	9.5	N/A	0.50
Total Nickel (Ni)	ug/L	2000	80	5.4	N/A	1.0
Total Phosphorus (P)	ug/L	10000	400	<100	N/A	100
Total Selenium (Se)	ug/L	1000	20	<2.0	N/A	2.0
Total Silver (Ag)	ug/L	5000	120	<0.10	N/A	0.10
Total Tin (Sn)	ug/L	5000	-	1.4	N/A	1.0
Total Titanium (Ti)	ug/L	5000	-	20	N/A	5.0
Total Zinc (Zn)	ug/L	2000	40	8.6	N/A	5.0

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

Lab-Dup = Laboratory Initiated Duplicate

San,Stm: Toronto Sanitary and Storm Sewer Use By Law Guidelines, respectively. Referenced to Chapter 681

N/A = Not Applicable

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Maxxam Job #: B953064
Report Date: 2019/03/13

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID				JBY880	
Sampling Date				2019/02/28	
COC Number				101208	
	UNITS	San	Stm	BH2	RDL
Semivolatile Organics					
Di-N-butyl phthalate	ug/L	80	15	<2	2
Bis(2-ethylhexyl)phthalate	ug/L	12	8.8	<2	2
3,3'-Dichlorobenzidine	ug/L	2	0.8	<0.8	0.8
Pentachlorophenol	ug/L	5	2	<1	1
Phenanthrene	ug/L	-	-	<0.2	0.2
Anthracene	ug/L	-	-	<0.2	0.2
Fluoranthene	ug/L	-	-	<0.2	0.2
Pyrene	ug/L	-	-	<0.2	0.2
Benzo(a)anthracene	ug/L	-	-	<0.2	0.2
Chrysene	ug/L	-	-	<0.2	0.2
Benzo(b/j)fluoranthene	ug/L	-	-	<0.2	0.2
Benzo(k)fluoranthene	ug/L	-	-	<0.2	0.2
Benzo(a)pyrene	ug/L	-	-	<0.2	0.2
Indeno(1,2,3-cd)pyrene	ug/L	-	-	<0.2	0.2
Dibenz(a,h)anthracene	ug/L	-	-	<0.2	0.2
Benzo(g,h,i)perylene	ug/L	-	-	<0.2	0.2
Dibenzo(a,i)pyrene	ug/L	-	-	<0.2	0.2
Benzo(e)pyrene	ug/L	-	-	<0.2	0.2
Perylene	ug/L	-	-	<0.2	0.2
Dibenzo(a,j) acridine	ug/L	-	-	<0.4	0.4
7H-Dibenzo(c,g) Carbazole	ug/L	-	-	<0.4	0.4
1,6-Dinitropyrene	ug/L	-	-	<0.4	0.4
1,3-Dinitropyrene	ug/L	-	-	<0.4	0.4
1,8-Dinitropyrene	ug/L	-	-	<0.4	0.4
Calculated Parameters					
Total PAHs (18 PAHs)	ug/L	5	2	<1	1
Surrogate Recovery (%)					
2,4,6-Tribromophenol	%	-	-	79	N/A
2-Fluorobiphenyl	%	-	-	90	N/A
D14-Terphenyl (FS)	%	-	-	105	N/A
D5-Nitrobenzene	%	-	-	100	N/A

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
San,Stm: Toronto Sanitary and Storm Sewer Use By Law Guidelines, respectively. Referenced to Chapter 681
N/A = Not Applicable

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Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

SEMI-VOLATILE ORGANICS BY GC-MS (WATER)

Maxxam ID				JBY880	
Sampling Date				2019/02/28	
COC Number				101208	
	UNITS	San	Stm	BH2	RDL
D8-Acenaphthylene	%	-	-	94	N/A

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
San,Stm: Toronto Sanitary and Storm Sewer Use By Law Guidelines, respectively. Referenced to Chapter 681
N/A = Not Applicable

Maxxam Job #: B953064
Report Date: 2019/03/13

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

VOLATILE ORGANICS BY GC/MS (WATER)

Maxxam ID				JBY880	
Sampling Date				2019/02/28	
COC Number				101208	
	UNITS	San	Stm	BH2	RDL
Volatile Organics					
Benzene	ug/L	10	2	<0.20	0.20
Chloroform	ug/L	40	2	<0.20	0.20
1,2-Dichlorobenzene	ug/L	50	5.6	<0.50	0.50
1,4-Dichlorobenzene	ug/L	80	6.8	<0.50	0.50
cis-1,2-Dichloroethylene	ug/L	4000	5.6	<0.50	0.50
trans-1,3-Dichloropropene	ug/L	140	5.6	<0.40	0.40
Ethylbenzene	ug/L	160	2	<0.20	0.20
Methylene Chloride(Dichloromethane)	ug/L	2000	5.2	<2.0	2.0
1,1,2,2-Tetrachloroethane	ug/L	1400	17	<0.50	0.50
Tetrachloroethylene	ug/L	1000	4.4	<0.20	0.20
Toluene	ug/L	16	2	<0.20	0.20
Trichloroethylene	ug/L	400	7.6	<0.20	0.20
p+m-Xylene	ug/L	1400	4.4	<0.20	0.20
o-Xylene	ug/L	1400	4.4	<0.20	0.20
Total Xylenes	ug/L	1400	4.4	<0.20	0.20
Surrogate Recovery (%)					
4-Bromofluorobenzene	%	-	-	95	N/A
D4-1,2-Dichloroethane	%	-	-	110	N/A
D8-Toluene	%	-	-	94	N/A

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
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N/A = Not Applicable

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Report Date: 2019/03/13

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Sampler Initials: SH

POLYCHLORINATED BIPHENYLS BY GC-ECD (WATER)

Maxxam ID				JBY880	
Sampling Date				2019/02/28	
COC Number				101208	
	UNITS	San	Stm	BH2	RDL
PCBs					
Total PCB	ug/L	1	0.4	<0.05	0.05
Surrogate Recovery (%)					
Decachlorobiphenyl	%	-	-	90	N/A

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit
San,Stm: Toronto Sanitary and Storm Sewer Use By Law Guidelines, respectively. Referenced to Chapter 681
N/A = Not Applicable

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Maxxam Job #: B953064
Report Date: 2019/03/13

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

MICROBIOLOGY (WATER)

Maxxam ID			JBY880	
Sampling Date			2019/02/28	
COC Number			101208	
	UNITS	Stm	BH2	RDL
Microbiological				
Escherichia coli	CFU/100mL	200	<10	10

No Fill	No Exceedance
Grey	Exceeds 1 criteria policy/level
Black	Exceeds both criteria/levels

RDL = Reportable Detection Limit

Stm: Toronto Sanitary and Storm Sewer Use By Law Guidelines, respectively. Referenced to Chapter 681

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Maxxam Job #: B953064
Report Date: 2019/03/13

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

GENERAL COMMENTS

Each temperature is the average of up to three cooler temperatures taken at receipt

Package 1	6.7°C

Results relate only to the items tested.

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Maxxam Job #: B953064
Report Date: 2019/03/13

Edward Wong & Associates Inc
Client Project #: 17 ST ANDREW TORONTO
Sampler Initials: SH

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Anastassia Hamanov, Scientific Specialist

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Krishnakant Patel, Analyst 1

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Phone 905-817-5700 Fax 905-817-5779 Toll Free 800-563-6266
CAM FCD-01191/3

CHAIN OF COUSTODY RECORD

101208 Page ____ of ____

Invoice Information		Report Information (if differs from invoice)		Project Information (where applicable)		Turnaround Time (TAT) Required
Company Name:	Edward Wong & Associates Inc	Company Name:		Quotation #:		✓ Regular TAT (5-7 days) Most analyses
Contact Name:	Ed. Wong	Contact Name:		P.O. #/ AFE#:		PLEASE PROVIDE ADVANCE NOTICE FOR RUSH PROJECTS
Address:	441 Esna Park Drive	Address:		Project #:	17 St Andrew Toronto	Rush TAT (Surcharges will be applied)
	Unit 19 Markham			Site Location:		☐ 1 Day ☐ 2 Days ☐ 3-4 Days
Phone: / Fax:		Phone: / Fax:		Site #:	Ma C04003a	
Email:		Email:		Sampled By:	S.H	Date Required:

MOE REGULATED DRINKING WATER OR WATER INTENDED FOR HUMAN CONSUMPTION MUST BE SUBMITTED ON THE MAXXAM DRINKING WATER CHAIN OF CUSTODY

Rush Confirmation #:

Regulation 153: ☐ Table 1 ☐ Res/Park ☐ Med/Fine ☐ Table 2 ☐ Ind/Comm ☐ Coarse ☐ Table 3 ☐ Agri/Other ☐ Table ____

FOR RSC (PLEASE CIRCLE) Y / N

Other Regulations: ☐ CCME ☐ Sanitary Sewer Bylaw ☐ MISA ☐ Storm Sewer Bylaw ☐ PWQO Region ☐ Other (Specify) ☐ REG 558 (MIN 3 DAY TAT REQUIRED)

Include Criteria on Certificate of Analysis: Y / N

SAMPLES MUST BE KEPT COOL (< 10 °C) FROM TIME OF SAMPLING UNTIL DELIVERY TO MAXXAM

Analysis Requested

#	SAMPLE IDENTIFICATION	DATE SAMPLED (YYYY/MM/DD)	TIME SAMPLED (HH:MM)	MATRIX	# OF CONTAINERS SUBMITTED	FIELD FILTERED (CIRCLE) Metals / Hg / CrVI	BTEX/PHC F1	PHCs F2 - F4	VOCs	REG 153 METALS & INORGANICS	REG 153 ICPMS METALS	REG 153 METALS (Hg, Cr VI, ICPMS Metals, HWS - B)	General and Inorganic parameters	Toronto storm and Sanitary sewer use (By + Cu)	pH, soluble chloride and sulphate	HOLD- DO NOT ANALYZE
1	BH 1	Feb 28, 19	am	GW									✓			
2	BH 2	Feb 28, 19	"	"										✓		
3	BH 3 -	Feb. 28 '	"	"											✓	
4	BH 1, [illegible] 553	Feb 21, 19		Soil						✓						
5	BH 2, [illegible] 552	Feb 21, 19		"				✓								
6	BH 3, 552	Feb 21, 19		"						✓			[illegible]			
7																
8																
9																
10																

RELINQUISHED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)	RECEIVED BY: (Signature/Print)	DATE: (YYYY/MM/DD)	TIME: (HH:MM)
[signature]	Feb 28, 19	7 pm	[signature]	2019/02/28	13:54

LABORATORY USE ONLY

CUSTODY SEAL Y / N		COOLER TEMPERATURES
Present	Intact	
N	N	6/8/6

COOLING MEDIA PRESENT: (Y) / N

COMMENTS: Contact Gina

28-Feb-19 13:54
Gina Baybayan
B953064
CA2 ENV-895

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COC-1004 (03/17) White: Maxxam - Yellow: Client

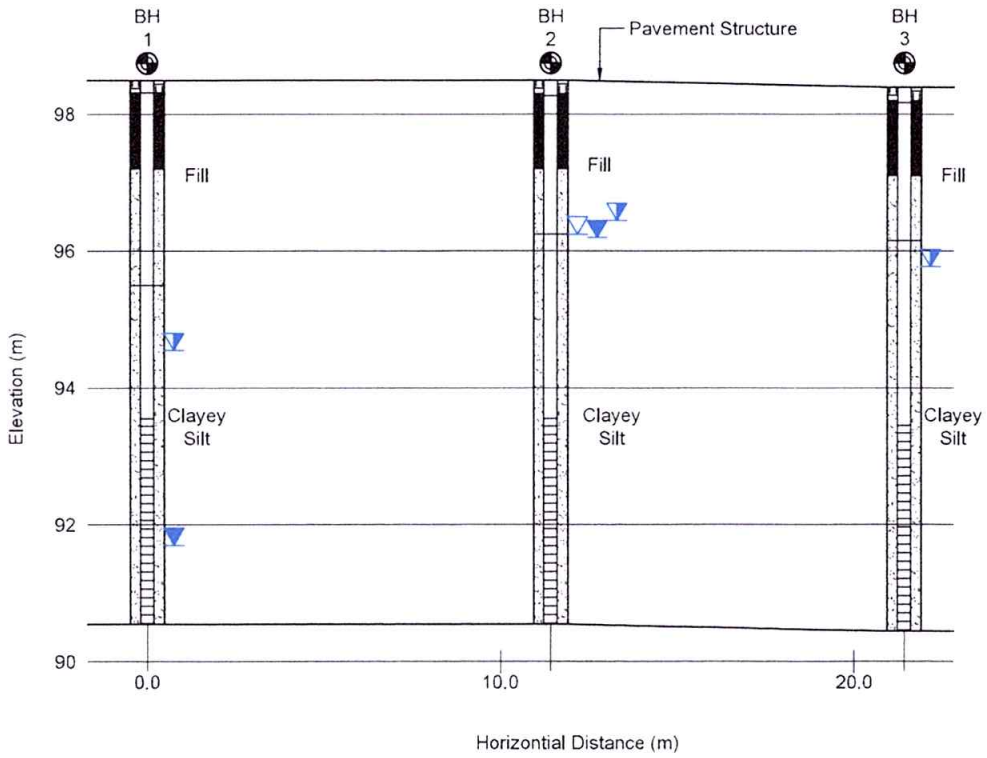
Drawings

Borehole and Section Location Plan
Soil Profile - Cross Section A-A
Guideline for Underpinning in Soil
Drainage and Backfill Recommendations
for Basement Construction
Exterior Drainage against Soldier Pile
and Lagging Shoring System

Title: Borehole and Section Location Plan
Project: Proposed Mixed Commercial and Residential Development
Location: 17 St. Andrew Street, Toronto

Legend:
——— - Property Boundary;
- Borehole with 50 mm monitoring well.

Date: April 2, 2019
Project No.: Ma004003a
Drawing No.: 1
Edward Wong



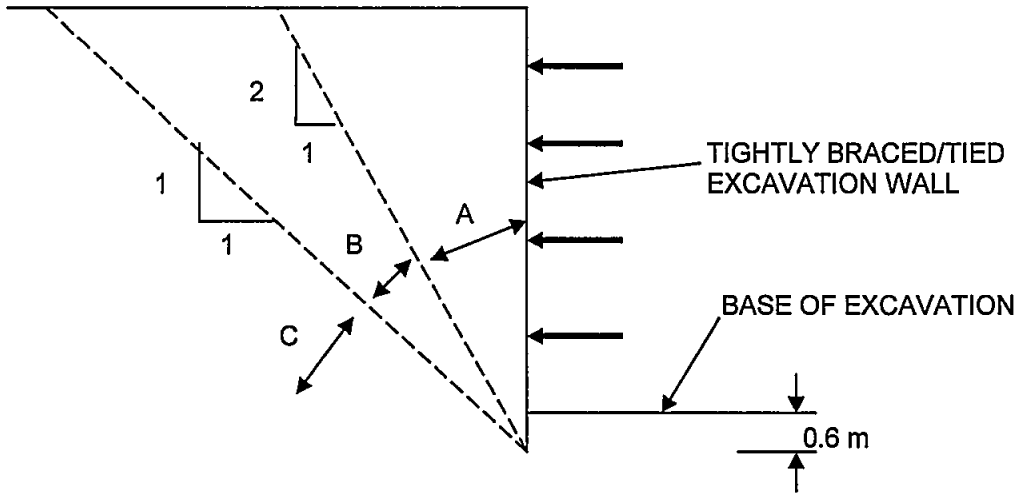
Groundwater Level Measurements				
Borehole	Ground Surface Elevation	Depth (Elevation) at Time of Drilling (m)	Depth (Elevation) at End of Drilling (m)	Depth (Elevation) after Drilling (m)
1	98.50	Dry	6.80 (91.70)	3.95 (94.55)
2	98.50	2.25 (96.25)	2.30 (96.20)	2.05 (96.45)
3	98.40	Dry	Dry	2.63 (95.77)

Title: Section A - A
Project: Proposed Mixed Commercial and Residential Development
Location: 17 St. Andrew Street, Toronto

Legend:
- Borehole with 50 mm monitoring well;
- Groundwater level at time of drilling;
- Groundwater level at end of drilling;
- Groundwater level after drilling.

Date: April 2, 2019
Project No.: Ma004003a
Drawing No.: 2
Edward Wong

Project: Ma004003a **Drawing No. 3**



Zone A Foundations located within this zone normally require underpinning. Horizontal and vertical pressures on the excavation wall of non underpinned foundations must be considered

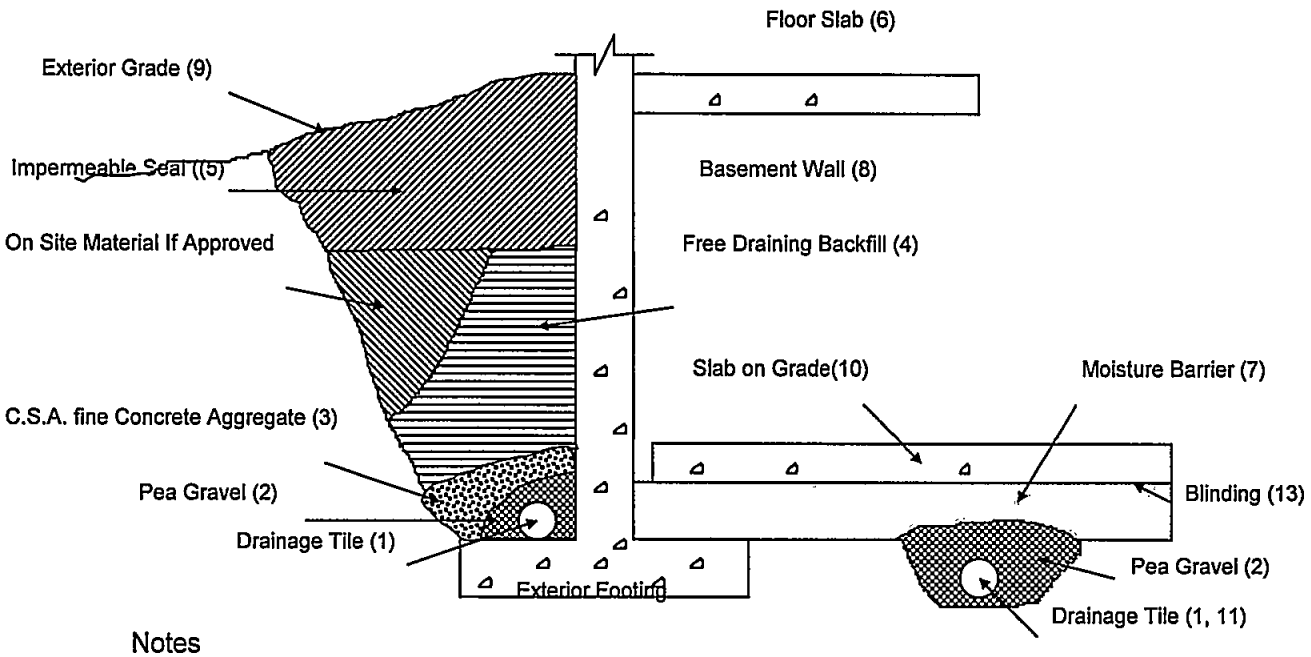
Zone B Foundations located within this zone normally do not require underpinning. Horizontal and vertical pressures on the excavation wall of non underpinned foundations must be considered

Zone C Underpinning to structures is normally founded in this zone. Lateral pressure from underpinning is not normally considered

(Figure 27.16 from Canadian Foundation Engineering Manual, 3rd Edition)

Guidelines for Underpinning in Soil

Project: Ma004003a **Drawing No: 4**



Notes

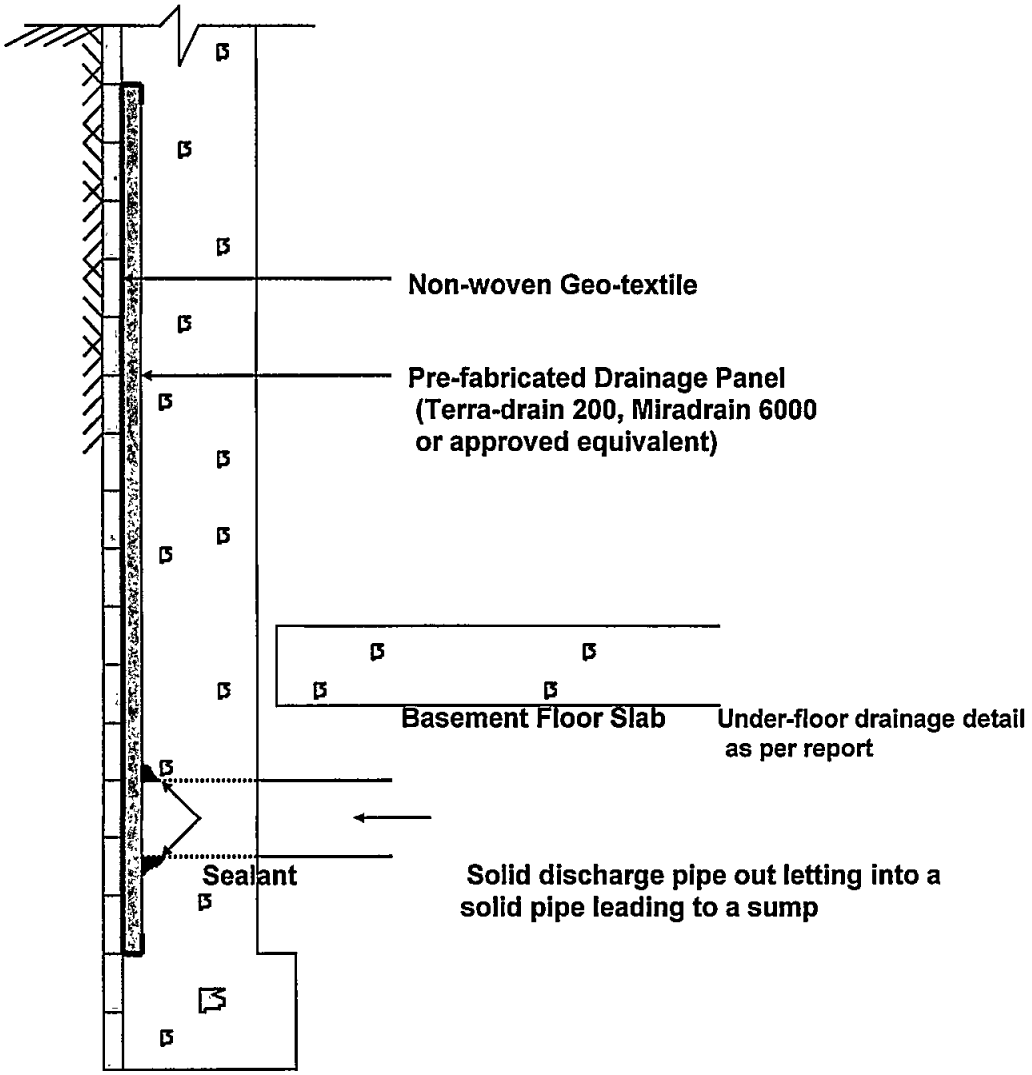
1. Drainage tile to consist of 100 mm diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be a minimum of 150 mm below underside of floor slab.
2. Pea gravel - 150 mm top and side of drain. If drain is not on footing, place 100 mm of pea gravel below drain. 20 mm clear stone is an alternative provided it is surrounded by an approved porous plastic membrane (Terrafix 270R or equivalent).
3. C.S.A. fine concrete aggregate to act as filter material. Minimum 300 mm top and side of tile drain. This may be replaced by an approved porous plastic membrane as indicated in (2).
4. Free Draining backfill - OPSS Granular B or equivalent compacted to the specified density. Do not use heavy compaction equipment within 450 mm of the wall. Use hand controlled light compaction equipment within 1.8 m of wall.
5. Impermeable backfill seal - compacted clay, clayey silt or equivalent. If original soil is free-draining, seal may be omitted.
6. Do not backfill until wall is supported by basement and floor slabs or adequate bracing.
7. Moisture barrier to be at least 200 mm of compacted clear 20 mm stone or equivalent free draining material.
8. Basement wall to be damp-proofed.
9. Exterior grade to slope away from building.
10. Slab on grade should not be structurally connected to the wall or footing.
11. Underfloor drain invert to be at least 300 mm below underside of floor slab. Drainage tile placed in parallel rows 6 to 8 m centers one way. Place drain on 100 mm pea gravel with 150 mm of pea gravel on top and sides. Provide filter material as noted in (3) if moisture barrier is not clear crushed stone.
12. Do not connect the underfloor drains to perimeter drains.
13. If the 20 mm stone requires surface blinding, use 6 mm clear stone chips.

DRAINAGE AND BACKFILL RECOMMENDATIONS FOR BASEMEMT CONSTRUCTION

(not to scale)

Project: Ma004003a

Drawing No. 5



Drawing No. 4 - SCHEMATIC DRAINAGE DETAIL
SOLDIER PILE AND LAGGING SHORING SYSTEM