CHUNG & VANDER DOELEN
ENGINEERING LTD.

311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1
519-742-8979

GEOTECHNICAL INVESTIGATION & PRELIMINARY HYDROGEOLOGICAL ASSESSMENT PROPOSED RESIDENTIAL DEVELOPMENT

785 Gordon Street

Guelph, Ontario

SUBMITTED TO:
2371633 Ontario Inc.
1418 Ontario Street
Burlington, Ontario
L7S 1G4

ATTENTION:
Mr. Brian McMullan

FILE NO / G21241 / November 17, 2021

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2371633 Ontario Inc.
1418 Ontario Street
Burlington, Ontario
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Attention: Mr. Brian McMullan

RE: **Geotechnical Investigation & Preliminary Hydrogeological Assessment**
Proposed Residential Development
785 Gordon Street, Guelph, Ontario

We take pleasure in enclosing one (1) copy of our Geotechnical Investigation and Preliminary Hydrogeological Assessment Report carried out at the above-referenced Site. Soil samples will be retained for a period of three (3) months and will thereafter be disposed of unless we are otherwise instructed.

If you have any questions or clarifications are required, please contact the undersigned at your convenience.

We thank you for giving us this opportunity to be of service to you.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

Eric Y. Chung, M. Eng., P.Eng.
Principal Engineer

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LIST OF ENCLOSURES

1.0 INTRODUCTION

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) has been retained by 2371633 Ontario Inc. to carry out a geotechnical investigation for the proposed redevelopment of the property located at 785 Gordon Street in Guelph, Ontario.

It is understood that the existing 2-storey hotel building with basement will be demolished and the site will be redeveloped with a 5 to 10 storeys high residential building with one (1) level of underground parking. The proposed building will have a footprint of 3336± m^2 and consist of 389 residential units and 222 parking spaces. Surface-grade asphalt paved parking and driveway are proposed to the west and south of the proposed residential building. A portion of the site along the eastern property limit is to be dedicated parkland. The finished floor elevations and site grading plan were not provided at the time of reporting.

The purpose of this investigation was to determine the subsurface conditions at the site and, based on the findings, to make geotechnical recommendations for:

- Foundation design recommendations;
- Excavation condition;
- Groundwater control during and after construction;
- Hydrogeological assessment and dewatering requirement;
- Slab-on-grade design;
- Backfilling recommendations;
- Foundation soil classification for seismic design per OBC 2012;
- Foundation and retaining wall design; and
- Pavement design

Infiltration rates of the various soil deposits encountered during the investigation will also be provided for a potential storm water management feature.

2.0 FIELD WORK

To investigate the subsurface conditions at the site, eight (8) boreholes were advanced to depths between 9.60 and 12.65 m below ground surface on June 7 to 9, 2021 as part of the investigation. The borehole locations are indicated on the Borehole Location Plan, Drawing No. 1.

The field work was carried out under the supervision of a member of our engineering team, who logged the boreholes in the field, effected the subsurface sampling, and monitored the groundwater conditions. The boreholes were advanced using a track-mounted drilling rig, supplied, and operated by a specialized contractor. The drill rig was equipped with continuous flight augers and standard soil sampling equipment.

Standard penetration tests (SPTs) in accordance with ASTM Specification D1586, were carried out at frequent intervals of depth, and the results are shown on the Borehole Logs as Penetration Resistance or “N”-values. Dynamic Cone Penetration testing (DCPT) was conducted below the sampled depth of Borehole 4 between 8.10 and 12.65 m depth and beside Borehole 6 between 2.75 and 6.10 m depth below existing grades to confirm the compactness condition of the native deposits. The compactness condition of the soil strata has been inferred from these test results.

Groundwater conditions were monitored during advancement of the borehole augering and immediately following the withdrawal of the drilling augers at each borehole location. Two (2) monitoring wells were installed in order to determine the groundwater level/elevation and to provided hydrogeological information. In addition, one (1) vanEssan Diver data logger was installed in one (1) of the monitoring wells to determine the seasonal groundwater levels/elevations for the period of one (1) year.

Well response tests (slug tests) were completed on the two (2) monitoring wells to determine the hydraulic conductivity (or permeability) of the geologic materials located at the water table. The data was analyzed using Aquifer Test software and the results and graphical analyses are provided in Appendix B.

The borehole locations and associated ground surface elevations were surveyed by CVD for the purpose of this report using a Leica ICON GPS 70T Rover Global Navigation Satellite System (GNSS) Receiver. The vertical and horizontal accuracies of this instrument are 15 mm and 10 mm, respectively.

The geodetic data pertaining to the ground surface at each borehole location is provided in the following table:

Borehole No.	Easting (X)	Northing (Y)	Elevation (Z) (m)
1	562939.117	4819348.826	335.08
2	562961.542	4819382.515	335.49
3	563010.355	4819420.001	336.09
4	562970.135	4819349.182	335.21
5	563006.95	4819387.597	335.90
6	562962.175	4819317.962	334.45
7	562996.358	4819351.802	335.03
8	563034.661	4819391.679	335.81

3.0 LABORATORY TESTING

Soil samples obtained from the in-situ tests were examined in the field and subsequently brought to our laboratory for visual and tactile examination to confirm field classification. Moisture content determination of all retrieved samples occurred.

In addition, four (4) grain size distribution analyses were carried out on representative soil samples of the major soil deposits to establish the physical and engineering properties.

4.0 EXISTING SITE CONDITIONS

The site is bound to the east by Gordon Street, to the south by detached residential dwellings and townhouses, to the west by a commercial property and to the north by Harvard Road.

The site is currently occupied by an existing 2-storey Days Inn hotel building with basement located along the northern property limit. An asphalt paved parking lot is located to the south and west of the existing building with driveway access to Harvard Road and Gordon Street at the northwest and southeast corners of the site. The remainder of the site is grass-covered with manicured gardens located along the perimeter of the existing building and occasional to some mature trees outlining the property limits.

The ground surface of the site gradually decreases in elevation from the northeast to the southwest, with the exception of the area along the permitter of the existing building which declines in elevation away from the building. The ground surface elevation at the geotechnical borehole locations ranged between 334.45 and 336.09 m.

5.0 SUBSURFACE CONDITIONS

The detailed subsurface conditions encountered in the eight (8) boreholes advanced as part of this geotechnical investigation are shown on the Borehole Log Sheets, Enclosures 1 to 8, inclusive. The borehole locations are indicated on the Borehole Location Plan, Drawing No. 1.

The stratigraphic boundaries shown on the borehole logs are inferred from non-continuous sampling conducted during advancement of the borehole drilling procedures and, therefore, represent transitions between soil types rather than exact planes of geologic change. The subsurface conditions will vary between and beyond the borehole locations.

5.1 Topsoil and Pavement

Topsoil was contacted at the ground surface at Boreholes 2 and 3 with measured thicknesses of 150 and 200 mm, respectively.

Asphalt pavement was contacted at the ground surface at Boreholes 1 and 4 to 8 with measured asphalt thicknesses between 50 and 75 mm and granular thicknesses between 150 and 560 mm.

5.2 Fill

A layer of fill materials was encountered underlying the pavement structure at Boreholes 1, and 5 to 8 and the topsoil at Boreholes 2 and 3 which extended to depths between 1.35 and 2.15 m below existing grades. It is noted that the fill materials could be deeper adjacent to the foundation and basement of the existing building and infrastructure.

The fill was generally comprised of varying amounts of sand and silt ranging from silt with trace sand to silty sand with trace to some gravel and trace clay. The lower fill materials at Borehole 1 comprised of sand and gravel with silt in the range of some to silty. Occasional clayey pockets were encountered within the silt fill and occasional cobbles were encountered within the sand and gravel fill at Borehole 6. Trace to some topsoil/organics was encountered within the fill at Boreholes 1 to 3, 5 and 6 and brick fragments were encountered at Boreholes 1 and 7.

The SPT "N"-values measured within the fill materials ranged from 6 to 70 blows per 300 mm of penetration, indicating a variable loose to very dense compactness condition. Elevated "N"-values are likely due to gravel/cobble intrusions during sampling. Natural moisture contents were measured between 4 and 21%, indicating a damp to moist moisture condition. Elevated moisture contents are likely due to the presence of topsoil/organics.

5.3 Sand and Silt

A sand and silt deposit was encountered underlying the fill materials at Borehole 5 which extended to a depth of 2.90 m below existing grade.

The SPT "N"-value measured within this deposit 23 blows per 300 mm of penetration, indicating a compact compactness condition. The measured moisture content of the sample collected from this deposit was 12%, thus indicating a moist moisture condition.

5.4 Sand and Gravel

A sand and gravel deposit was encountered underlying the fill materials at Boreholes 1 to 3 and 6 to 8, the sand and silt deposit at Borehole 5 and the pavement structure at Borehole 4 and extended to depths between 3.65 and 4.45 m below existing grades.

The deposit contained silt in the range of trace to silty. Occasional to frequent cobbles were encountered throughout the deposit and occasional sand seams/layers encountered within the deposit at Boreholes 1 and 4 to 7. Results of three (3) grain size distribution analyses from Boreholes 1, 6 and 7 are shown graphically on Enclosures 9, 11 and 12.

The SPT "N"-values measured within this deposit ranged from 3 blows per 300 mm to 50 blows per 50 mm of penetration. A DCPT was conducted within sampled depths of the deposit at Borehole 6 at depths between 2.75 and 4.40 and yielded values between 10 and 24 blows per 300 mm of penetration. Based on the test results the deposit exhibited a compact to very dense compactness condition. The very loose condition encountered at Borehole 6 is likely due to hydrostatic pressure during sampling. The measured moisture content of the samples collected from this deposit ranged between 2 and 20%, thus indicating a damp to saturated moisture condition.

5.5 Silt

A silt deposit was encountered underlying the sand and gravel deposit at Boreholes 1, 3, 4, 5, 7 and 8, and underlying the sand deposit Borehole 6 which extended to depths between 4.40 and 9.40 m below existing grades. An interbedded silt deposit was encountered within the sand deposit at Borehole 2 between the depths of 5.5± and 7.0± m below existing grade.

The deposit contained sand in the range of trace to sandy. Occasional sand lenses/seams were encountered within the deposit at Boreholes 1 and 6 to 8 and occasional clayey lenses/seams were encountered at Boreholes 1 to 3 and 8. Results of one (1) grain size distribution analysis from Borehole 3 are shown graphically on Enclosure 10.

The SPT "N"-values measured within the deposit ranged from 12 to 21 blows per 300 mm of penetration, indicating a compact compactness condition. Natural moisture contents were measured between 13 and 22%, indicating a wet to saturated moisture condition.

5.6 Sand

A sand deposit was encountered underlying the silt deposit at Boreholes 1, 4, 5, 7 and 8 and the sand and gravel deposit at Boreholes 2 and 6. The deposit extended to depths between 7.65 and 9.55 m below existing grades at Boreholes 1, 2 and 5 to 8. Borehole 4 was terminated within the deposit which extended to a depth of 8.10 m below existing grade.

The sand deposit contained trace to some gravel and silt. Occasional silty seams/layers were encountered within the deposit at Boreholes 2, 4, 6 and 7 and occasional cobbles were encountered at Borehole 2. An interbedded silt deposit was encountered within the sand deposit at Borehole 2 between the depths of 5.5± and 7.0± m below existing grade.

The SPT "N"-values measured within the deposit ranged from 12 to 40 blows per 300 mm of penetration. A DCPT was conducted below the sampled sand deposit at Borehole 4 at depths between 8.10 and 12.65 m below existing grades and yielded values between 20 and 124 blows per 300 mm of penetration. Another DCPT was conducted within sampled depths of the deposit at Borehole 6 at depths between 4.40 and 6.10 and yielded values between 23 and 34 blows per 300 mm of penetration. Based on the test results, the deposit exhibited indicating a compact to dense compactness condition. Natural moisture contents were measured between 4 and 26%, indicating a damp to saturated moisture condition.

5.7 Till

A sand and silt to sandy silt till deposit was encountered underlying the silt deposit at Boreholes 3 and 6 and underlying the sand deposit at Boreholes 1, 2, 5, 7 and 8. All seven (7) boreholes were terminated within the till deposit which extended to depths between 9.60 and 12.65 m below existing grades.

The till contained trace to some gravel and trace clay. Occasional cobbles were encountered within the deposit at Boreholes 1 and 7, occasional silt seams were encountered at Borehole 8, occasional sand/sand and gravel seams were encountered at Boreholes 5 and 7.

The SPT "N"-values measured within this deposit ranged from 13 blows per 300 mm to 50 blows per 75 mm of penetration, indicating a compact to very dense compactness condition. Natural moisture contents were measured between 6 and 18%, indicating a saturated moisture condition.

5.8 Groundwater

Groundwater conditions were monitored during advancement of the borehole augering and immediately following the withdrawal of the drilling augers at each borehole location.

In addition, two (2) monitoring wells were installed to determine the groundwater level/elevation and to provided hydrogeological information. Groundwater was measured within the monitoring wells and the depths and corresponding elevations are shown in the following table:

Borehole No. (E20060)	Existing Ground Elevation (m)	Date	Measured Groundwater Depth (m)	Groundwater Elevation (m)
3	336.09	June 22, 2021	4.21	331.88
		July 21, 2021	4.18	331.91
6	334.45	June 22, 2021	3.02	331.43
		July 21, 2021	3.02	331.43

Upon withdrawal of the drilling augers at Boreholes 1, 4, 7 and 8, groundwater was observed at depths ranging between 3.05 and 4.90 m below existing grades. Boreholes 2 and 5 experienced dry cave-ins to a depth of 4.25 m below existing grades.

Based on the measured/observed groundwater levels in monitoring wells and in the boreholes upon withdrawal of the drilling augers during sampling and measured moisture contents, the groundwater table at the site exists at depths between 3.0± and 4.9± m below existing grades, corresponding to elevations between 331.2± and 331.9± m.

It is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

In addition, one (1) vanEssan Diver data logger was installed in one (1) of the monitoring wells to determine the seasonal groundwater levels/elevations for the period of one (1) year.

5.9 Hydraulic Testing

Appendix B provides well response recovery test (slug test) data collected on June 22, 2021, from the monitoring wells at Boreholes 3 and 6. The monitoring wells were purged by hand using polyethylene tubing and check valves. The water in the test well was lowered by pumping and the subsequent water level recovery was measured over time. The response was analyzed using AquiferTest software and the results are presented in Appendix B.

The following table summarizes the depth/elevation of the well screen and the materials screened/tested.

Borehole No. (E20060)	Existing Ground Elevation (m)	Screened depth/elevation (m)	Material Screened	Estimated Hydraulic Conductivity (m/sec)
3	336.09	4.27 to 7.32 (328.77 to 331.82)	Silt, Sandy Silt Till	3.2×10^{-6}
6	334.45	2.44 to 5.49 (328.96 to 332.01)	Sand and Gravel, Sand	4.6×10^{-6}

The hydraulic conductivity (permeability) of the native deposits at the monitoring well locations was in the range of 3.2×10^{-6} to 4.6×10^{-6} m/sec.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

It is understood that the existing 2-storey hotel building with basement will be demolished and the site will be redeveloped with a 5 to 10 storeys high residential building with one (1) level of underground parking. The proposed building will have a footprint of 3336± m^2 and consist of 389 residential units and 222 parking spaces. Surface-grade asphalt paved parking and driveway are proposed to the west and south of the proposed residential building. A portion of the site along the eastern property limit is to be dedicated parkland. The finished floor elevations and site grading plan were not provided at the time of reporting.

In general, the surficial topsoil and pavement structure were underlain by variable loose to very dense fill materials to depths between 1.35 and 2.15 m below existing grades. The fill materials and pavement structure were underlain by compact sand and silt and/or compact to very dense sand and gravel deposits followed by compact silt and/or compact to dense sand deposits. Borehole 4 was terminated in the sand deposit which extended to a depth of 8.10 m below existing grades. These deposits were then underlain by a compact to very dense sand and silt to sandy silt till deposit which extended to the maximum depths of exploration between 9.60 and 12.65 m below existing grades at Boreholes 1 to 3 and 5 to 8.

Based on the measured/observed groundwater levels in monitoring wells and in the boreholes upon withdrawal of the drilling augers during sampling and measured moisture contents, the groundwater table at the site exists at depths between 3.0± and 4.9± m below existing grades, corresponding to elevations between 331.2± and 331.9± m. The hydraulic conductivity (permeability) of the native deposits at the monitoring well locations was in the range of 3.2×10^{-6} to 4.6×10^{-6} m/sec.

In addition, one (1) vanEssan Diver data logger was installed in one (1) of the monitoring wells to determine the seasonal groundwater levels/elevations for the period of one (1) year. A supplemental letter/report addressing the groundwater table elevations and hydrogeological information will be provided by CVD upon completion of the ground water monitoring period.

6.2 One Level Basement

It is proposed that the building will have an underground basement/parking garage that occupies the majority of the site. The finished floor elevations were not available at the time of reporting

The groundwater table at the site exists at depths between 3.0± and 4.9± m below existing grades, corresponding to elevations between 331.2± and 331.9± m. Ideally, the basement floor and footings should be designed to founded above the groundwater table to circumvent dewatering during their construction. The basement finished floor is to be constructed a minimum of 0.6 m above the seasonal high groundwater table.

Dewatering will be required for any excavations carried out below the water table, as the soils will become “quick” and lose its integrity to support loads. The groundwater table must be lowered and controlled to at least 600 mm below the excavation level to facilitate the excavation and construction of raft foundation, footings, and walls to be carried out in the dry condition.

Based on the groundwater table elevation, the elevator pit will likely require water-proofing. The elevator pit will need to be structurally reinforced to withstand the hydrostatic pressure. This will be dependant on the finalized building design and proposed finished floor elevation which was not available at the time of reporting. It is recommended that CVD be retained to review the finalized building designs.

6.3 Footing Foundations

Conventional strip and spread footing foundations can be used to support the 5 to 10 storey high residential building. Footings cast on competent sand and gravel deposit can be designed using a Geotechnical Reaction at SLS of 200 kPa. The SLS value given above is based on a maximum settlement of 25 mm under the footing foundations. The Factored Geotechnical Resistance at ULS is 300 kPa.

The following table summarizes the highest founding level and elevation for the footing at each borehole location:

Borehole No.	Existing Ground Elevation (m)	Highest Founding Depth (m)	Highest Founding Elevation (m)
1	335.08	1.58	333.50
2	335.49	1.59	333.90
3	336.09	1.79	334.30
4	335.21	0.81	334.40
5	335.90	2.20	333.70
6	334.45	2.25	332.20
7	335.03	1.53	333.50
8	335.81	1.81	334.00

These soil bearing pressures can be achieved provided that the founding subgrade is undisturbed during construction. The majority of the settlements will take place during construction and the first loading cycle of the building.

In addition, the footings should be founded below any existing fill materials, building foundations and utility trenches, on competent native undisturbed soils.

The maximum total and differential settlements of footings designed to the above recommended soil bearing pressure are expected to be less than 25 and 20 mm, respectively, and these are considered tolerable for the structure being contemplated.

Exterior footings and footings in unheated portions of the building should be provided with a soil cover of not less than 1.2 m or equivalent synthetic thermal insulation for adequate frost protection. The founding subgrade soils must be protected from frost penetration during winter construction.

It is recommended that a lean concrete mat be placed over approved footing subgrade in wet to saturated areas to prevent further disturbance to the bearing soils resulting from construction activities.

It is recommended that the footing excavations be inspected by the geotechnical engineer to ensure adequate soil bearing and proper subgrade preparation.

6.4 Earthquake Considerations

In accordance with The Ontario Building Code 2012 (OBC), the proposed structure should be designed to resist earthquake load and effects as per OBC Subsection 4.1.8.

Based on the condition of the underlying soil encountered at the boreholes, the site can be classified as a Site Class C as per OBC Table 4.1.8.4.A (Page B4-24).

6.5 Open Cut Excavation and Groundwater Control

Excavations are expected to be in the order of 2 to 4 m deep for foundations, site servicing and basement construction. The excavations will penetrate topsoil, pavement structure, loose to very dense fill, compact sand and silt and compact to dense sand and gravel deposits. Provided the groundwater is controlled/lowered below the excavation depths, these materials are considered to be Type 3 Soils in accordance with the latest Occupational Health and Safety Act.

Above the groundwater table, excavations in the Type 3 Soils are expected to remain stable during the construction period provided that side slopes are cut to 1H : 1V from the bottom of the excavation. Where seepage or perched groundwater is encountered, side slopes should be cut to more stable angles of 3H : 1V. The side slopes should be suitably protected from erosion processes.

Above the groundwater table, rainwater or local perched groundwater can be controlled by pumping from filtered sump pits as and where required. It is recommended that excavation for the future development be done during the typically drier summer months when ground water conditions would be expected to lie at lower elevations.

Dewatering will be required for any excavations carried out below the water table, as the soils will become “quick” and lose its integrity to support loads. The groundwater table must be lowered and controlled to at least 600 mm below the excavation level to facilitate the excavation and construction of footings, and foundation walls to be carried out in the dry condition.

In wet to saturated subgrade condition, it will be necessary to excavate below founding level and pour a 75 mm thick mud slab of lean concrete to protect the founding soil from disturbance during the installation of reinforcing steel bars and form work.

6.6 Floor Slab Construction

The floor slab for the proposed residential building can be constructed as conventional slab-on-grade on the approved compacted engineered fill and/or native soil deposits. At the time of floor slab construction, the exposed subgrade should be proof-rolled with a heavy roller in conjunction with an inspection by the geotechnical engineer. Any soft and/or unstable areas detected should be replaced with imported granular fill which should be compacted to at least 95% SPMDD.

Following the proof-rolling of the subgrade, it is recommended that a minimum 150 mm thick layer of OPSS Granular “A” be placed and compacted to at least 100% SPMDD beneath the concrete floor slabs to provide uniform support.

A modulus of subgrade reaction (k_s) of 50 MN/m^3 may be used for the design of the floor slabs, considering the floor subgrade will consist of predominantly sand to sand and gravel soils.

The floor slabs should be separated structurally from the columns and foundation walls. Sawcut control joints should be provided at regular spacing (less than 30 times the concrete slab thickness) and to depths between one-third and one-quarter of the slab thickness.

Care should be taken to ensure that the backfill against foundation walls, interior piers/columns and concrete pits are placed in thin layers and each layer compacted to at least 95% SPMDD. These types of confined areas should be backfilled with excavated granular materials or imported granular soils such as OPSS Granular B Type I.

Moisture migration from the underlying soils through the concrete slab-on-grade will take place via “capillary action” and “diffusion” (due to vapour pressure differential). Although the Granular “A” layer will provide a capillary break, the low permeance of the concrete slab and floor coverings will result in 100% humidity under the concrete slab and, consequently, the moisture in the concrete will increase over time. The potential effect of the soil moisture should be considered in selecting the floor coverings.

A vapour retarder material (such as a 15-mil poly, ASTM E-1745) can be placed to reduce soil moisture migration. Reference is made to ACI 302.

In the basement level, vapour retarder should be considered in the enclosed areas such as the elevator lobby, mechanical/electrical rooms, and storage rooms.

6.7 Lateral Earth Pressure

The unbalanced foundation walls and any other soil retaining structures should be designed to resist the lateral earth pressure acting against these walls. The following formula may be used to calculate the unfactored earth pressure distribution. The factored resistance can be calculated by using a factor of 0.8.

$P = K (\gamma H + q)$

Where:

P =	lateral earth pressure	kPa
K =	earth pressure coefficient, 0.5 for non-yielding foundation wall earth pressure coefficient, 0.3 for yielding retaining wall	
γ =	unit weight of granular backfill, compacted to 95% SPMDD	21 kN/m^3
H =	unbalanced height of wall	m
q =	surcharge load at ground surface	kPa

The backfill for the foundation walls and retaining walls should be free-draining granular materials which should have less than 8% silt particles (OPSS Granular "B" Type I). The backfill should be placed in thin layers and compacted to 95% SPMDD. Over-compaction adjacent to the foundation/retaining walls should be avoided. Weeping tiles leading to a frost-free outlet or weep holes should be installed to effect drainage behind the retaining wall.

The sliding resistance of the retaining wall footings should be checked. The unfactored horizontal resistance against sliding between cast-in-place concrete and the various soils can be calculated using the following unit weight and friction coefficient:

Soil	Unit Weight (kN/m$^{3)}$	Friction Coefficient
Well-compacted granular backfill	21	0.45
Compact to Very Dense Sand and Gravel	21	0.40
Compact Sand and Silt	20	0.30

6.8 Access Driveway and Paved Parking Areas

Existing topsoil, pavement structure and any deleterious materials should be excavated from the pavement area. The excavated inorganic site materials can be reused to raise grades to the proposed subgrade level, if required. Based on the results of the field work, the predominant subgrade materials at the site will consist of fine-grained fill materials and native sand and silt and sand and gravel deposits.

The following flexible pavement structures are recommended based on the results of grain size distribution, assumed CBR values, groundwater conditions, frost susceptibility of subgrade soils and traffic volume.

Component	Light Duty Pavement (mm)	Heavy Duty Pavement (mm)
Asphaltic Concrete HL3 Asphaltic Concrete HL8	40 40	40 50
Granular “A” Base	150	150
Granular “B” Sub-base	300	400

The pavement design considers that pavement construction will be carried out during the drier time of the year and that the subgrade is stable, not heaving under construction equipment traffic. If the subgrade is wet or unstable, additional granular sub-base may be required.

Prior to the placement of the granular base, the subgrade will be stripped of existing pavements, topsoil, and deleterious materials. The exposed subgrade should be thoroughly recompacted with a heavy vibratory compactor and inspected by a qualified geotechnical inspector. Any soft spots encountered during the process should be excavated to the level of competent soil. The required grades can then be achieved by placing approved on-site soils in maximum 200 to 300 thick lifts which should be compacted to 95% SPMDD.

The base and sub-base materials should be produced in accordance with the current OPSS specifications and placed and uniformly compacted to at least 100% SPMDD. The asphaltic concrete should be placed and compacted in accordance with OPSS Form 310 and to at least 92% of the Marshall Density (MRD). Frequent in situ density testing by this office should be carried out to verify that the specified degree of compaction is being achieved and maintained.

It should be noted that even well compacted trench backfill could settle for a period of time after construction. In this regard, the surface course of the asphaltic concrete should be placed at least one (1) year after trench backfill is completed to allow any minor settlements to occur within the trench backfill. The incomplete pavement structure may not be capable of supporting construction traffic. Consequently, minor repairs of the sub-base, base and asphaltic concrete may be required prior to paving with the base course and/or the surface course asphaltic concrete.

The prepared earth subgrade and final pavement surfaces should be graded to direct water runoff away from buildings, sidewalks, and other similar pertinent structures. Positive drainage outlets should be provided at all low points of the prepared earth subgrade, such as stub drains extended from the catch-basins.

6.9 On Site infiltration

It is understood that the potential for a storm water management feature is to be considered at the site.

The top of the infiltration feature should be located below the footing drain/weeper and at least 5 m away from the proposed building footprints. It is noted that infiltration features should have the base located at least 1.0 m above the groundwater table and that a minimum infiltration rate of 15 mm/hr is required.

Grain size distribution analyses were conducted on a representative sample of the native deposits and the results are graphically presented on in the Enclosure 9 to 12.

Based on the results of grain size analyses and our experience, the hydraulic conductivity and infiltration rate of the native inorganic soil types encountered at the boreholes are estimated and provided in the following table and may be used for storm water management purposes:

MATERIAL	PERMEABILITY (K) (cm/sec)	INFILTRATION RATE (mm/hr)
Sand and Silt & Silt (Enclosure 10)	3×10^{-4}	3 to 15
Sand and Gravel (Enclosures 9, 11 & 12	5×10^{-3} to 3×10^{-2}	60 to 170
Sand	4×10^{-4} to 1×10^{-3}	20 to 30

Based on the infiltration rate of the native soil deposits, infiltration of storm water is considered feasible across the site.

6.10 Handling of Excess Soil

Excess soil will be generated due to the proposed site works. The management of excess soil is now governed by Ontario Regulation 406/19. In accordance with the regulation, the Project Leader is responsible for the handling, storage, reuse, transportation, and removal of all soil. To support off-site removal, the following is required:

- Planning Documentation
  - Assessment of Past Use
  - Sampling and Analysis Plan
  - Excess Soil Characterization Report
  - Excess Soil Destination Report
- Tracking
- Registry
- Record Keeping

CVD can provide further assistance on this matter as the project develops.

7.0 CLOSURE

The Limitations of Report, as quoted in Appendix A, is an integral part of this report.

We trust that the information presented in this report is complete within our terms of reference. If there are any further questions concerning this report, please do not hesitate to contact our office.

Yours truly,
CHUNG & VANDER DOELEN ENGINEERING LTD.

LICENSED PROFESSIONAL ENGINEER
E.Y. CHUNG
8345506
Nov 18, 2021
PROVINCE OF ONTARIO

Joe van der Zalm
Geotechnical Engineering Intern

Eric Y. Chung, M. Eng., P.Eng.
Principal Engineer

APPENDIX A

Limitations of Report

APPENDIX “A”

LIMITATIONS OF REPORT

The conclusions and recommendations given in this report are based on information determined at the testhole locations. Subsurface and groundwater conditions between and beyond the testholes may differ from those encountered at the testhole locations, and conditions may become apparent during construction which could not be detected or anticipated at the time of the site investigation. It is recommended practice that the Soils Engineer be retained during construction to confirm that the subsurface conditions throughout the site do not deviate materially from those encountered in the testholes.

The comments made in this report on potential construction problems and possible methods are intended only for the guidance of the designer. The number of testholes and their respective depths may not be sufficient to determine all the factors that may affect construction methods and costs. For example, the thickness of surficial topsoil or fill layers may vary markedly and unpredictably. The contractors bidding on this project or undertaking the construction should, therefore, make their own interpretation of the factual information presented and draw their own conclusion as to how the subsurface conditions may affect their work.

The benchmark and elevations mentioned in this report were obtained strictly for use in the geotechnical design of the project and by this office only, and should not be used by any other parties for any other purposes.

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

The design recommendations given in this report are applicable only to the project described in the text and then only if constructed substantially in accordance with the details stated in this report. Since all details of the design may not be known, we recommend that we be retained during the final design stage to verify that the design is consistent with our recommendations, and that assumptions made in our analysis are valid.

This report does not reflect the environmental issues or concerns unless otherwise stated in the report.

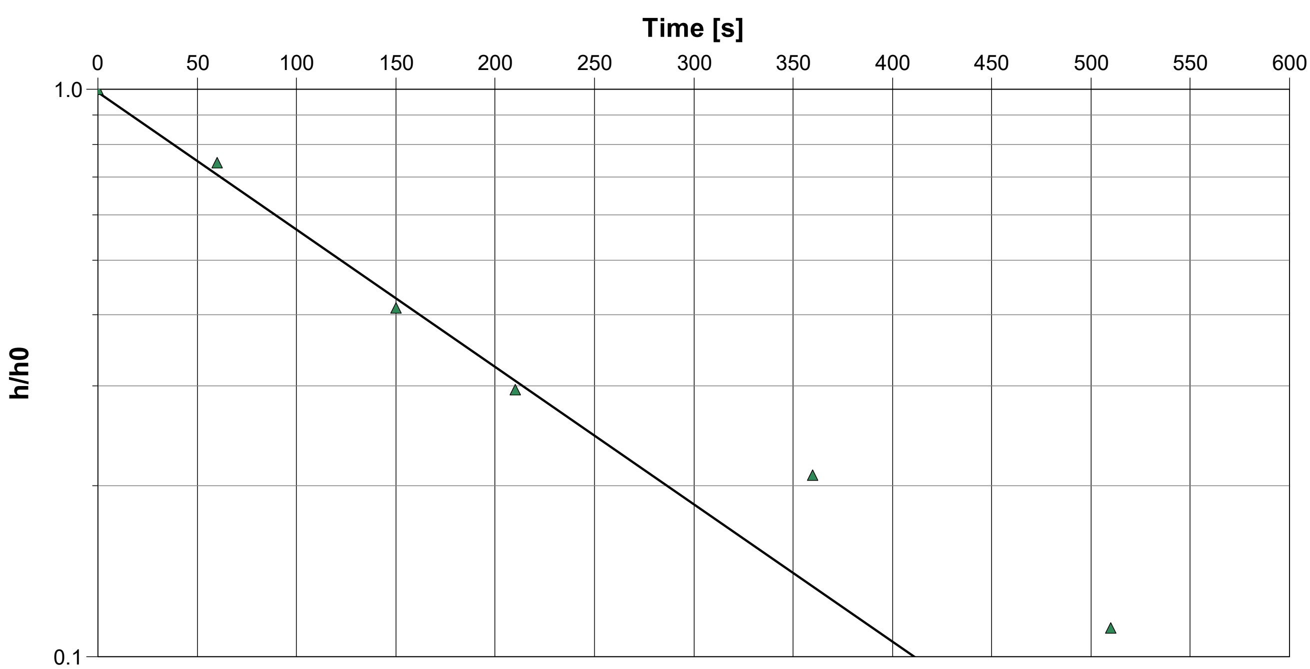
APPENDIX B

Well Response Test Analysis Charts

CHUNG & VANDER DOELEN ENGINEERING LTD. 311 Victoria Street North Kitchener / Ontario / N2H 5E1 519-742-8979	**Slug Test - Water Level Data** Page 1 of 2
	Project: Proposed Residential Building
	Number: G21241
	Client: 2371633 Ontario Inc.

Location: 785 Gordon Street, Guelph, ON	Slug Test: BH 3	Test Well: BH 3
Test Conducted by: YC	Test Date: 2021-06-22	Aquifer Thickness: 1.40 m
Water level at t=0 [m]: 5.79 bgs	Static Water Level [m]: 4.24 bgs	Water level change at t=0 [m]: 1.56

	Time [s]	Water Level [m]	WL Change [m]
1	0	5.793	1.555
2	60	5.393	1.155
3	150	4.878	0.64
4	210	4.698	0.46
5	360	4.563	0.325
6	510	4.413	0.175
7	660	4.336	0.098



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]
BH 3	3.16×10^{-6}

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Slug Test - Water Level Data

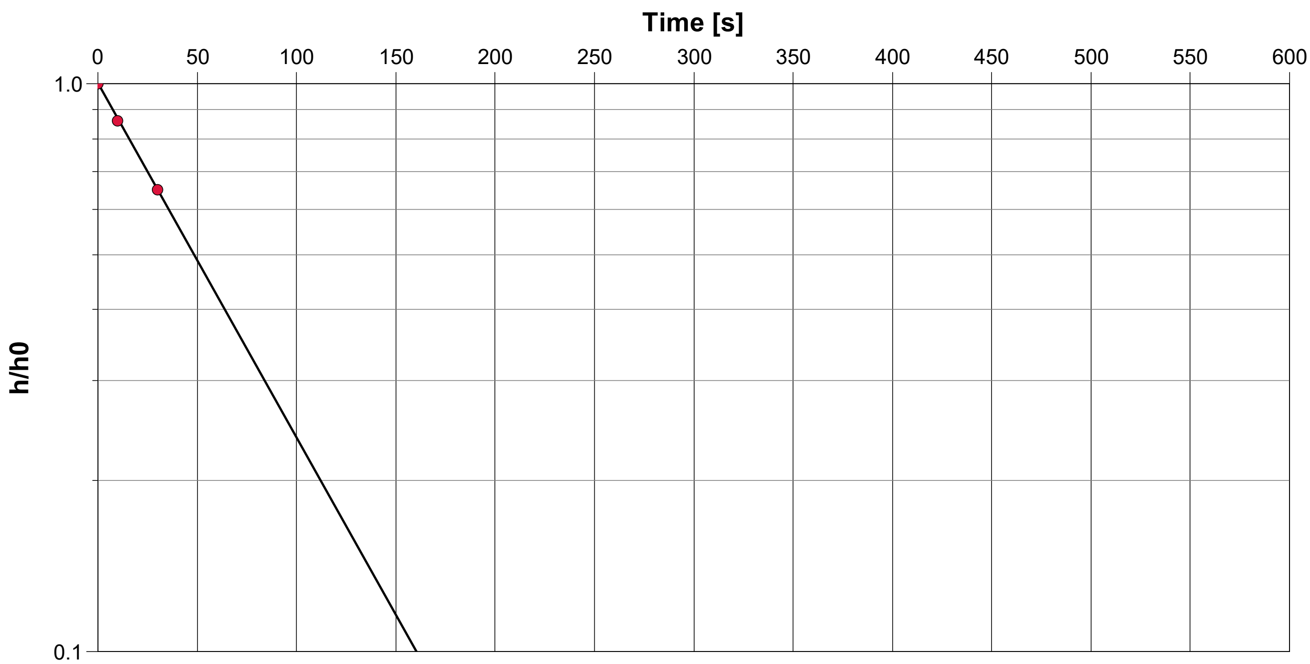
Project: Proposed Residential Building

Number: G21241

Client: 2371633 Ontario Inc.

Location: 785 Gordon Street, Guelph, ON	Slug Test: BH 6	Test Well: BH 6
Test Conducted by: JV	Test Date: 2021-11-18	Aquifer Thickness: 4.63 m
Water level at t=0 [m]: 3.42 bgs	Static Water Level [m]: 2.99 bgs	Water level change at t=0 [m]: 0.43

	Time [s]	Water Level [m]	WL Change [m]
1	0	3.42	0.43
2	10	3.36	0.37
3	30	3.27	0.28



Calculation using Bouwer & Rice

Observation Well	Hydraulic Conductivity [m/s]	
BH 6	4.57×10^{-6}	

ENCLOSURES

Enclosure No.: 1
Sheet 1 of 1

FILE No: G21241 — BOREHOLE No. 1

Client: **2371633 Ontario inc.**
Project: **Proposed Residential Development**
Location: **785 Gordon Street, Guelph, Ontario**

EQUIPMENT DATA
Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Jun 08 - 21** TO **Jun 08 - 21**

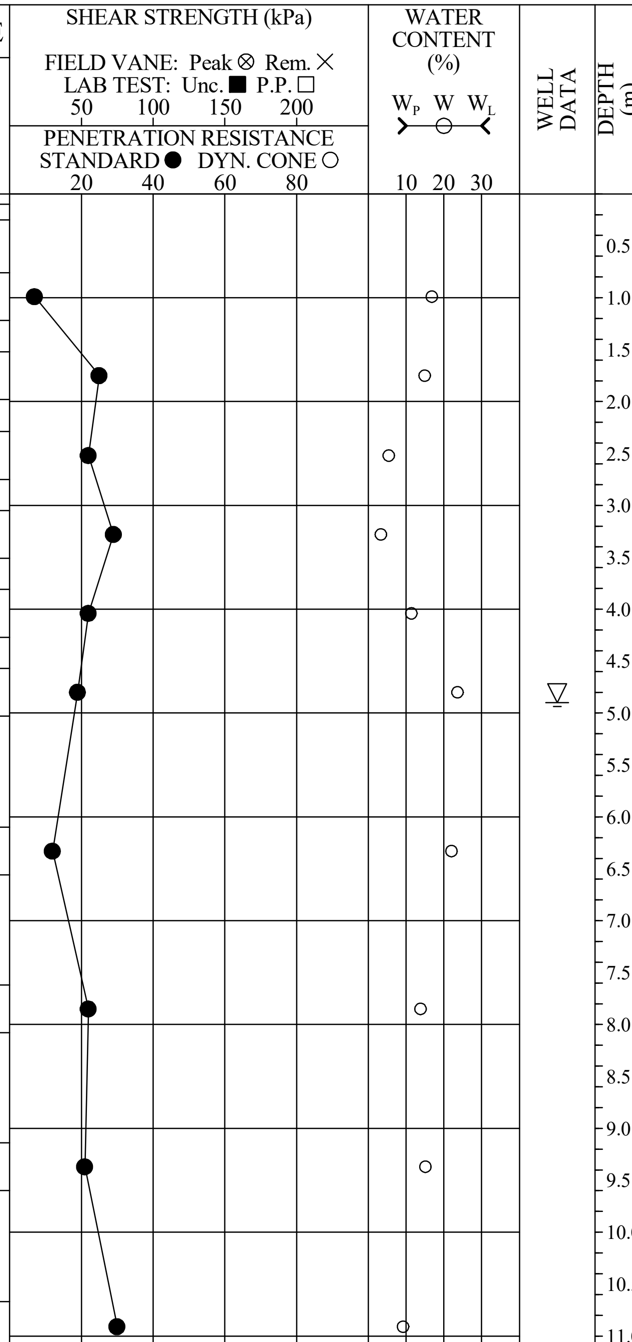
SOIL LITHOLOGY

Ground Elevation: **335.08 m**

ELEV./DEPTH (m)	DESCRIPTION
	65 mm ASPHALT 360 mm GRANULAR BASE
334.65 0.43	loose, dark brown, FILL, silt, some to sandy, trace clay, some topsoil, moist
333.73 1.35	compact, orangey brown to brown SAND AND GRAVEL trace to some silt occ. sand seams/ layers occ. to freq. cobbles damp ----------- saturated
330.68 4.40	sandy -------- compact, grey to brown SILT trace to some sand, trace clay oc. sand seams occ. clayey seams saturated
328.08 7.00	compact, brown SAND trac to some gravel, trace silt saturated
325.53 9.55	compact to dense, brown SAND AND SILT TILL some gravel, trace clay occ. cobbles saturated
323.93 11.15	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	AS	
2	SS	7
3	SS	25
4	SS	22
5	SS	29
6	SS	22
7	SS	19
8	SS	12
9	SS	22
10	SS	21
11	SS	30



DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5, 11.0, 11.5, 12.0, 12.5

REMARKS

- borehole water level at 4.90 m bgs upon withdrawal of drilling augers
- borehole cave-in to 7.60 m bgs upon withdrawal of the drilling augers hydrostatic pressure disturbance

PROJECT MANAGER: **EYC**

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Enclosure No.: 2
Sheet 1 of 1

FILE No: G21241 — BOREHOLE No. 2

Client:	**2371633 Ontario inc.**
Project:	**Proposed Residential Development**
Location:	**785 Gordon Street, Guelph, Ontario**

EQUIPMENT DATA

Machine:	**Diedrich D50T**
Method:	**Hollow Stem Auger**
Size:	**108 mm I.D.**
Date:	**Jun 09 - 21** TO **Jun 09 - 21**

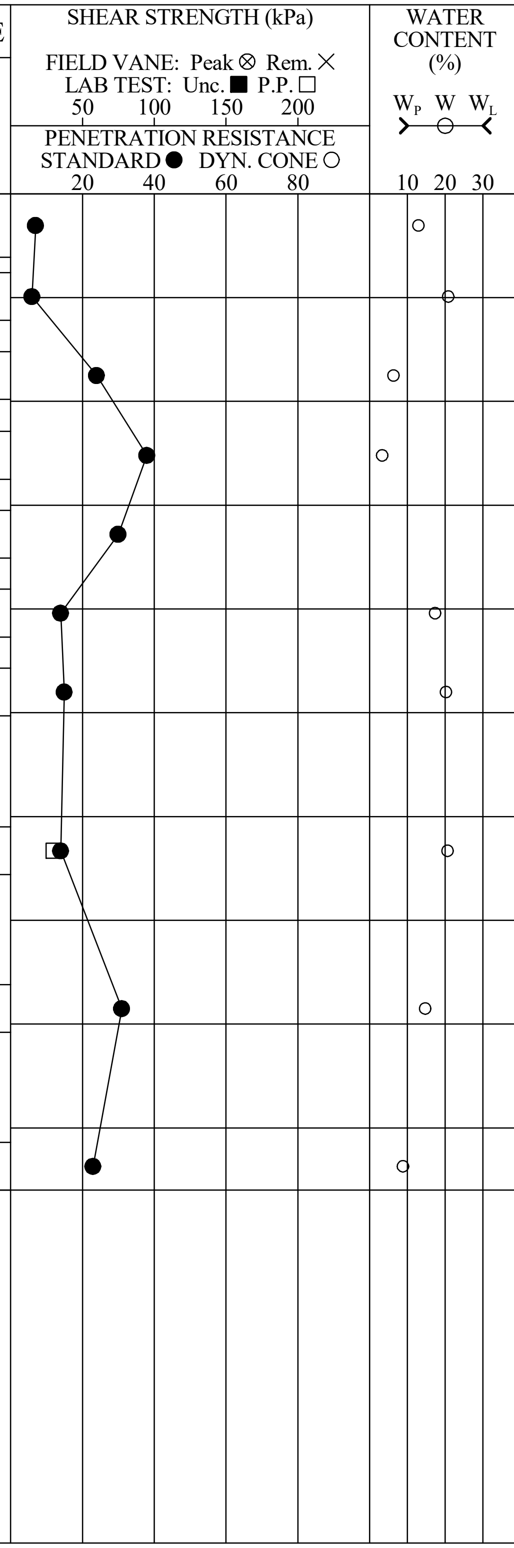
SOIL LITHOLOGY

Ground Elevation: **335.49 m**

ELEV./DEPTH (m)	DESCRIPTION
335.34 / 0.15	150 mm TOPSOIL
334.52 / 0.97	loose, brown FILL, silty sand, trace gravel trace organics, moist
334.14 / 1.35	loose, dark brown to brown FILL, silt, some sand trace clay, trace topsoil, moist
331.84 / 3.65	compact to dense, brown SAND AND GRAVEL some silt to silty occ. cobbles damp
329.99 / 5.50	compact, brown SAND trace to some silt, trace gravel occ. silty layers saturated
328.49 / 7.00	compact, grey SILT trace sand, trace clay occ. clayey seams saturated
326.94 / 8.55	dense, grey SAND some silt to silty, some gravel occ. cobbles saturated
325.89 / 9.60	compact, grey SANDY SILT TILL some gravel, trace clay saturated
	End of Borehole

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	7
2	SS	6
3	SS	24
4	SS	38
5	SS	30
6	SS	14
7	SS	15
8	SS	14
9	SS	31
10	SS	23



WELL DATA

REMARKS: borehole cave-in to 4.25 m bgs and dry upon withdrawal of the drilling augers

PROJECT MANAGER: **EYC**

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FILE No: G21241

BOREHOLE No. 3

Client: **2371633 Ontario inc.**

Project: **Proposed Residential Development**

Location: **785 Gordon Street, Guelph, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Jun 07 - 21** TO **Jun 07 - 21**

SOIL LITHOLOGY

Ground Elevation: **336.09 m**

ELEV./ DEPTH (m)	DESCRIPTION
335.89 0.20	200 mm TOPSOIL
334.39 1.70	compact to dense brown to dark brown FILL, silty sand to sandy silt trace to some gravel, trace topsoil damp to moist
331.99 4.10	dense to compact, brown SAND AND GRAVEL trace to some silt freq. cobbles moist to damp
330.59 5.50	compact, brown SANDY SILT trace gravel, trace clay occ. clay lenses wet to saturated
323.44 12.65	compact to very dense brown to grey SANDY SILT TILL some gravel, trace clay saturated
	End of Borehole

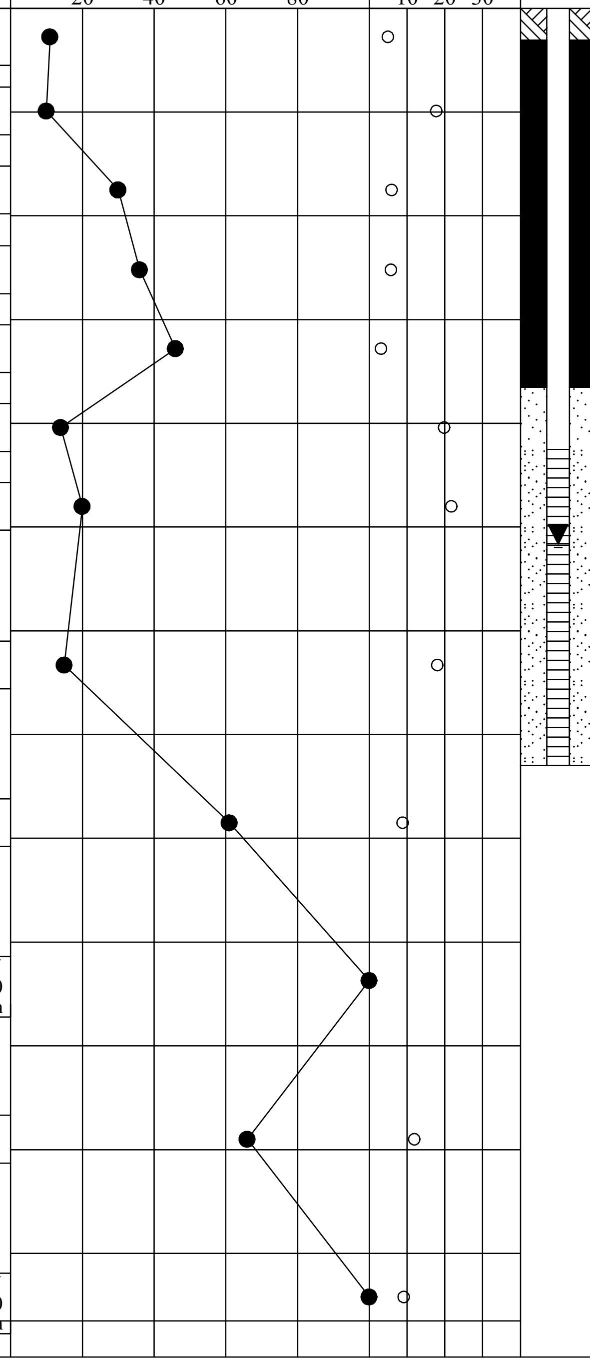
SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	SS	11
2	SS	10
3	SS	30
4	SS	36
5	SS	46
6	SS	14
7	SS	20
8	SS	15
9	SS	61
10	SS	50/ 130 mm
11	SS	66
12	SS	50/ 100 mm

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA



REMARKS

DEPTH (m)	REMARKS
0.0	monument casing set in concrete
1.0	50 mm I.D., PVC Riser with bentonite seal
3.7	3.05 m long, 50 mm I.D., PVC slotted screen with sandpack
11.5	water level in monitoring well measured to 4.21 m bgs on June 22, 2021
12.0	water level in monitoring well measured to 4.18 m bgs on July 21, 2021

PROJECT MANAGER: **EYC**

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FILE No: G21241 BOREHOLE No. 4

Client: **2371633 Ontario inc.**

Project: **Proposed Residential Development**

Location: **785 Gordon Street, Guelph, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Jun 08 - 21** TO **Jun 08 - 21**

SOIL LITHOLOGY

Ground Elevation: **335.21 m**

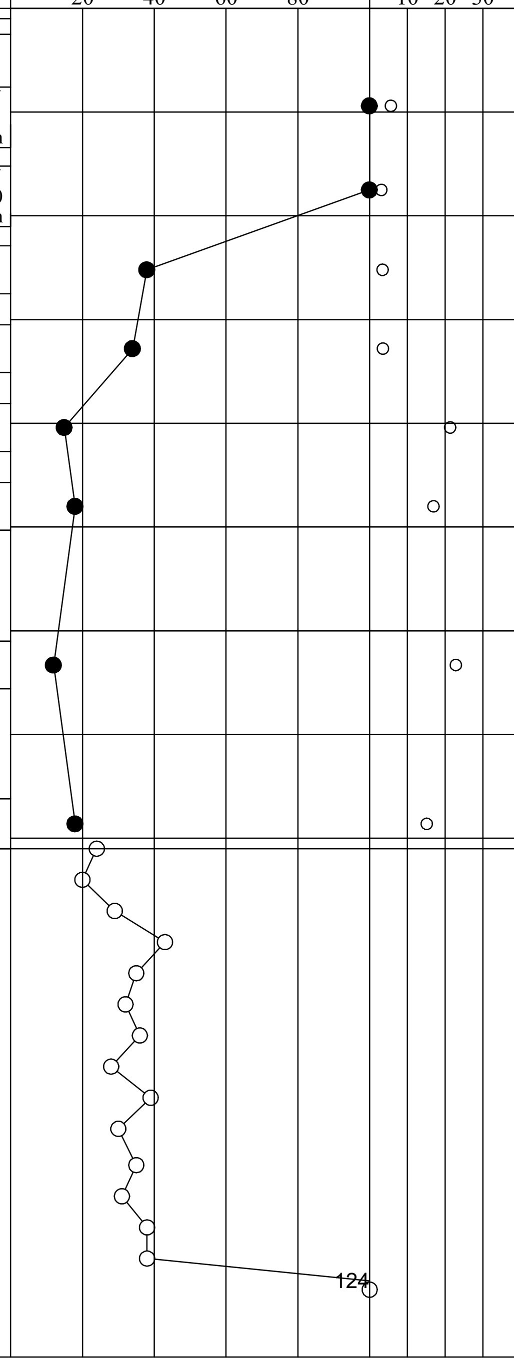
ELEV./ DEPTH (m)	DESCRIPTION
	65 mm ASPHALT 530 mm GRANULAR BASE
334.61 0.60	very dense to dense, brown SAND AND GRAVEL trace to some silt freq. cobbles occ. sand layers damp
331.56 3.65	compact, brown SILT some sand, trace clay wet to saturated
330.81 4.40	compact, brown SAND trace to some silt, trace gravel saturated -------- silt layer -------- ----------- some gravel
327.11 8.10	End of Borehole Start of DCPT
322.56 12.65	End of DCPT

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	AS	
2	SS	50/ 50 mm
3	SS	50/ 140 mm
4	SS	38
5	SS	34
6	SS	15
7	SS	18
8	SS	12
9	SS	18

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30



WELL DATA

DEPTH (m): 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 3.5, 4.0, 4.5, 5.0, 5.5, 6.0, 6.5, 7.0, 7.5, 8.0, 8.5, 9.0, 9.5, 10.0, 10.5, 11.0, 11.5, 12.0, 12.5

REMARKS

- 4.0 m: water level at 3.95 m bgs upon withdrawal of drilling augers
- 5.20 m: borehole cave-in to 5.20 m bgs upon withdrawal of the drilling augers
- 7.5 m: hydrostatic pressure disturbance

PROJECT MANAGER: **EYC**

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FILE No: G21241

BOREHOLE No. 5

Client: **2371633 Ontario inc.**

Project: **Proposed Residential Development**

Location: **785 Gordon Street, Guelph, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Jun 09 - 21** TO **Jun 09 - 21**

SOIL LITHOLOGY

Ground Elevation: **335.90 m**

ELEV./DEPTH (m)	DESCRIPTION
	50 mm ASPHALT 560 mm GRANULAR BASE
335.29 0.61	compact, dark brown FILL, silt trace to some sand, trace clay, trace topsoil contains asphalt fragements moist
333.75 2.15	compact, orangey brown to brown SAND AND SILT moist
333.00 2.90	dense to compact, brown SAND AND GRAVEL trace to some silt occ. cobbles occ. sand layers moist to saturated
331.45 4.45	compact, brown SILT trace to some sand, trace gravel, trace clay saturated
328.90 7.00	compact, brown SAND some silt, trace gravel saturated
328.05 7.85	compact to very dense, grey SAND AND SILT TILL some gravel, trace clay occ. sand and gravel seams saturated
326.30 9.60	End of Borehole

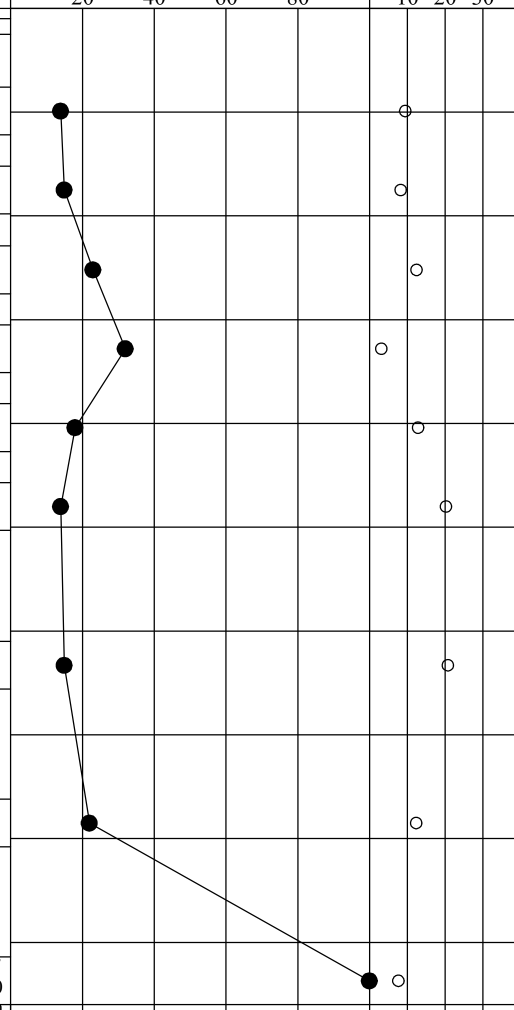
SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	AS	
2	SS	14
3	SS	15
4	SS	23
5	SS	32
6	SS	18
7	SS	14
8	SS	15
9	SS	22
10	SS	50/ 130 mm

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200

PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30



WELL DATA

REMARKS

borehole cave-in and dry to 4.25 m bgs upon withdrawal of the drilling augers

PROJECT MANAGER: **EYC**

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FILE No: G21241

BOREHOLE No. 6

Client: **2371633 Ontario inc.**

Project: **Proposed Residential Development**

Location: **785 Gordon Street, Guelph, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Jun 07 - 21** TO **Jun 07 - 21**

SOIL LITHOLOGY

Ground Elevation: **334.45 m**

ELEV./ DEPTH (m)	DESCRIPTION
334.22 / 0.23	75 mm ASPHALT; 150 mm GRANULAR BASE
333.10 / 1.35	compact, moist FILL, silt some sand, trace gravel, trace clay occ. clayey pockets moist
332.30 / 2.15	very dense, brown FILL, sand and gravel some silt to silty, occ. cobbles trace topsoil, damp
330.05 / 4.40	compact to very loose, brown SAND AND GRAVEL trace to some silt occ. cobbles occ. sand seams damp to saturated
326.80 / 7.65	compact, brown SAND trace to some gravel, trace to some silt occ. silt seams saturated
325.05 / 9.40	compact, brown to grey SILT trace sand, trace clay occ. sand seams saturated
321.80 / 12.65	compact to very dense brown SAND AND SILT TILL trace to some gravel, trace clay saturated
	End of Borehole

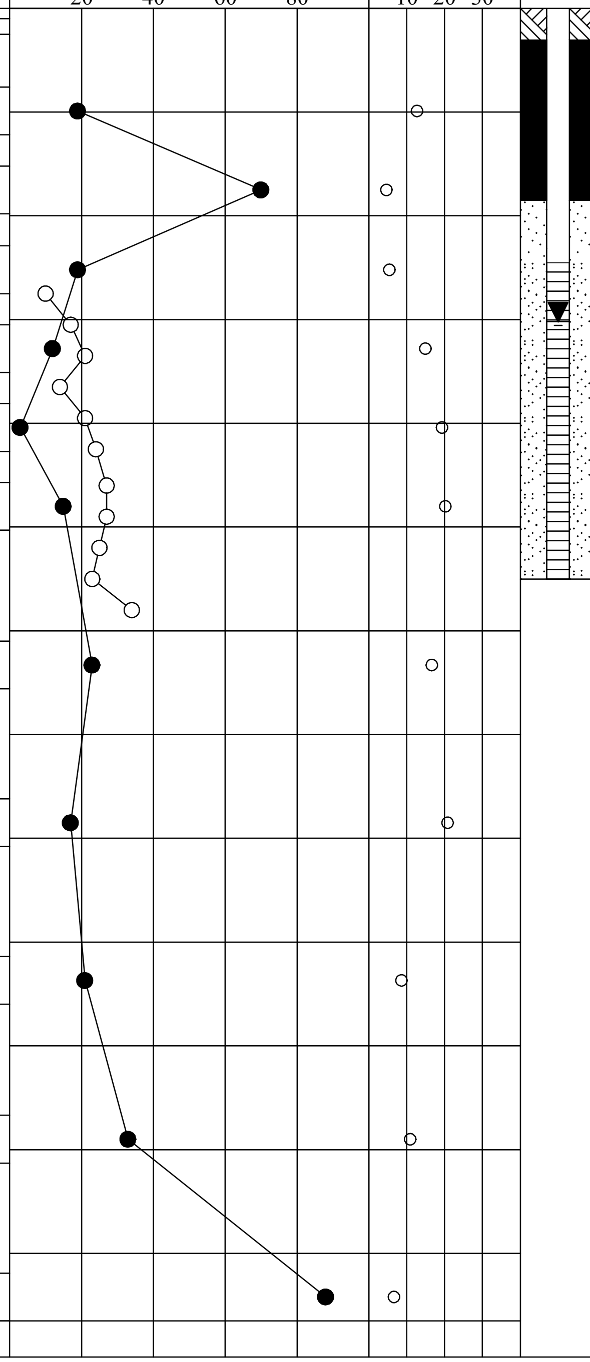
SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	AS	
2	SS	19
3	SS	70
4	SS	19
5	SS	12
6	SS	3
7	SS	15
8	SS	23
9	SS	17
10	SS	21
11	SS	33
12	SS	88

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA



REMARKS

DEPTH (m)	REMARKS
0.0	steel flushmount casing set in concrete
1.0	50 mm I.D., PVC riser with bentonite seal
2.0	3.05 m long, 50 mm I.D., PVC slotted screen with sandpack
2.75	Start of DCPT at 2.75 m bgs
4.0	hydrostatic pressure disturbance
6.1	End of DCPT at 6.10 m bgs
11.5	water level in monitoring well measured to 3.02 m bgs on June 22, 2021
12.0	water level in monitoring well measured to 3.02 m bgs on July 21, 2021

PROJECT MANAGER: **EYC**

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FILE No: G21241

BOREHOLE No. 7

Client:	**2371633 Ontario inc.**
Project:	**Proposed Residential Development**
Location:	**785 Gordon Street, Guelph, Ontario**

EQUIPMENT DATA

Machine:	**Diedrich D50T**
Method:	**Hollow Stem Auger**
Size:	**108 mm I.D.**
Date:	**Jun 08 - 21** TO **Jun 08 - 21**

SOIL LITHOLOGY

Ground Elevation: **335.03 m**

ELEV./DEPTH (m)	DESCRIPTION
	65 mm ASPHALT 550 mm GRANULAR BASE
334.41 0.62	compact, dark brown to brown FILL, sandy silt some gravel, trace clay moist
333.63 1.40	silty -------- compact to dense, brown SAND AND GRAVEL trace silt occ. cobbles occ. sand seams damp to saturated
331.03 4.00	compact, brown SILT some sand to sandy, trace clay occ. sand seams saturated
328.83 6.20	compact brown SAND some silt to silty, trace gravel occ. silt layers/seams saturated
325.73 9.30	dense to very dense, grey SAND AND SILT TILL trace to some gravel, trace clay occ. cobbles saturated -------- occ. sand seams --------
322.58 12.45	End of Borehole

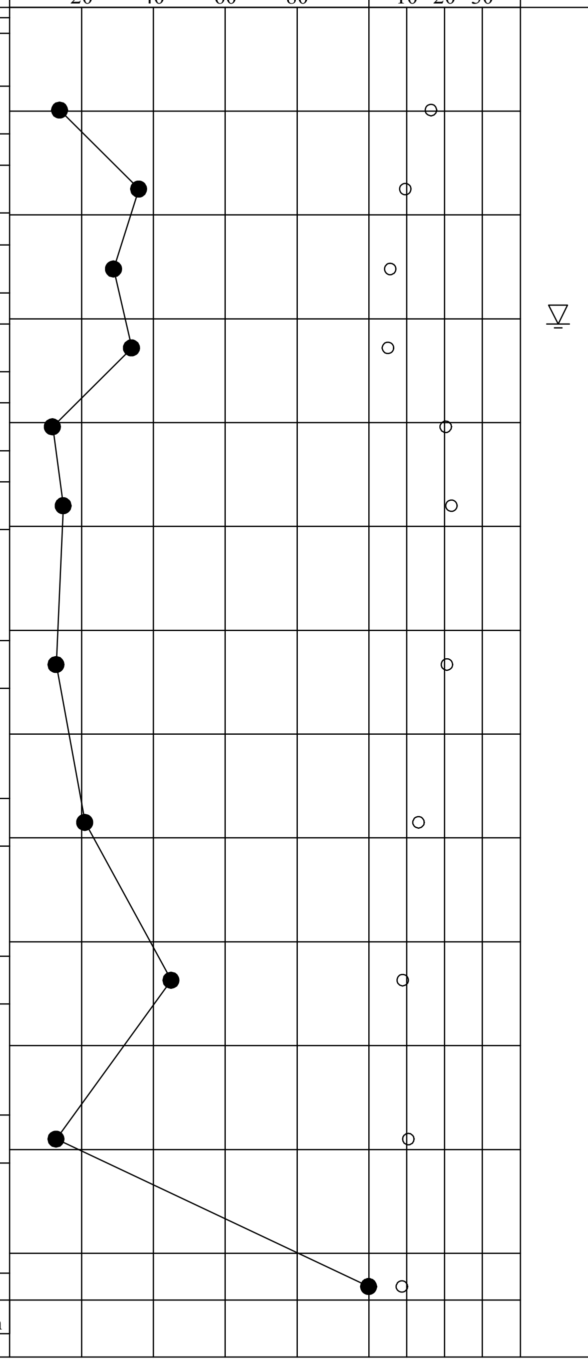
SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	AS	
2	SS	14
3	SS	36
4	SS	29
5	SS	34
6	SS	12
7	SS	15
8	SS	13
9	SS	21
10	SS	45
11	SS	13
12	SS	50/ 75 mm

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200
PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA



REMARKS

DEPTH (m)	REMARKS
3.0	water level at 3.05 m bgs upon withdrawal of drilling augers
4.5	borehole cave-in to 4.55 m bgs upon withdrawal of the drilling augers hydrostatic pressure disturbance
7.5	hydrostatic pressure disturbance
11.0	hydrostatic pressure disturbance

PROJECT MANAGER: **EYC**

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FILE No: G21241

BOREHOLE No. 8

Client: **2371633 Ontario inc.**

Project: **Proposed Residential Development**

Location: **785 Gordon Street, Guelph, Ontario**

EQUIPMENT DATA

Machine: **Diedrich D50T**
Method: **Hollow Stem Auger**
Size: **108 mm I.D.**
Date: **Jun 09 - 21** TO **Jun 09 - 21**

SOIL LITHOLOGY

Ground Elevation: **335.81 m**

ELEV./ DEPTH (m)	DESCRIPTION	SYMBOL
	50 mm ASPHALT 560 mm GRANULAR BASE	
335.20 0.61	loose, dark brown to brown FILL, silty sand to sandy silt trace gravel, trace clay moist	
334.01 1.80	very dense to compact, brown SAND AND GRAVEL trace to some silt occ. cobbles moist to saturated	
331.91 3.90	compact, brown SILT some sand to sandy, trace clay occ. clay seams/lenses occ. sand lenses wet to saturated ---------- trace sand	
328.81 7.00	dense, grey SAND, trace to some silt saturated	
328.11 7.70	dense to very dense, grey SAND AND SILT TILL trace to some gravel, trace clay occ. silt seams saturated	
326.21 9.60	End of Borehole	

SAMPLE

SAMPLE ID	TYPE	N-VALUE
1	AS	
2	SS	7
3	SS	32
4	SS	52
5	SS	35
6	SS	15
7	SS	17
8	SS	13
9	SS	40
10	SS	82

SHEAR STRENGTH (kPa)
FIELD VANE: Peak ⊗ Rem. ×
LAB TEST: Unc. ■ P.P. □
50 100 150 200

PENETRATION RESISTANCE
STANDARD ● DYN. CONE ○
20 40 60 80

WATER CONTENT (%)
W_P W W_L
10 20 30

WELL DATA

REMARKS

4.5 – borehole cave-in and water level at 4.55 m bgs upon withdrawal of drilling augers

PROJECT MANAGER: **EYC**

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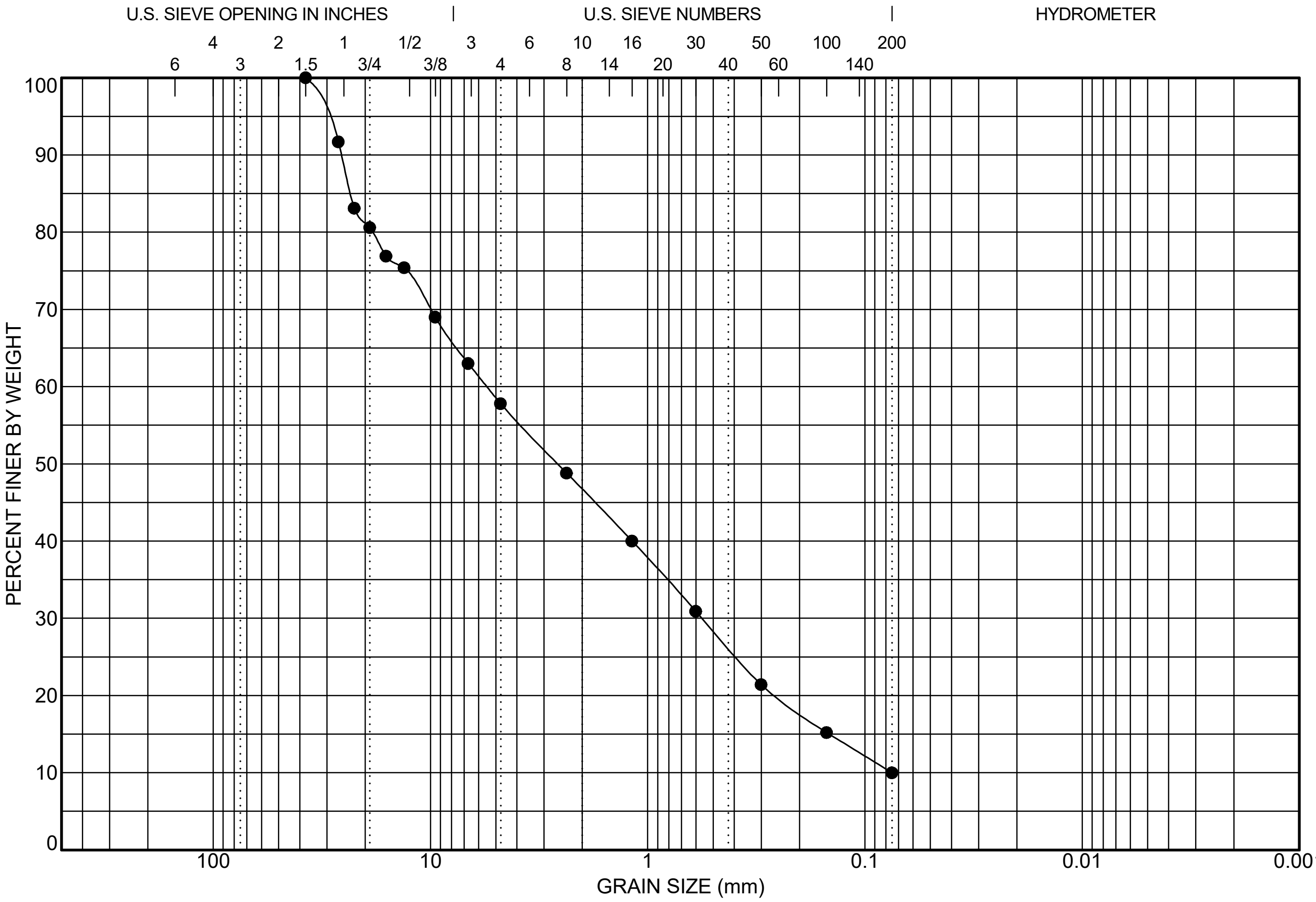

COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			0.77	73.25	37.5	5.494	0.562	0.075	42.2	47.8	10.0	

Date: Jun. 15 - 2021
Client: 2371633 Ontario inc.
Contractor:
Source:
Sampled From: BH 1 - SA 5, 3.05 to 3.50 m depth
Sample No.: 1-5
Date Sampled: Jun. 08 - 2021
Sampled By: JV
Lab No.: 0620
Date Tested: Jun. 15 - 2021
Type of Material: Sand and Gravel, trace to some silt

Sieve Size (mm)	Percent Passing	No Specifications

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Telephone: 519-742-8979
Fax: 519-742-7739
e-mail: info@cvdengineering.com

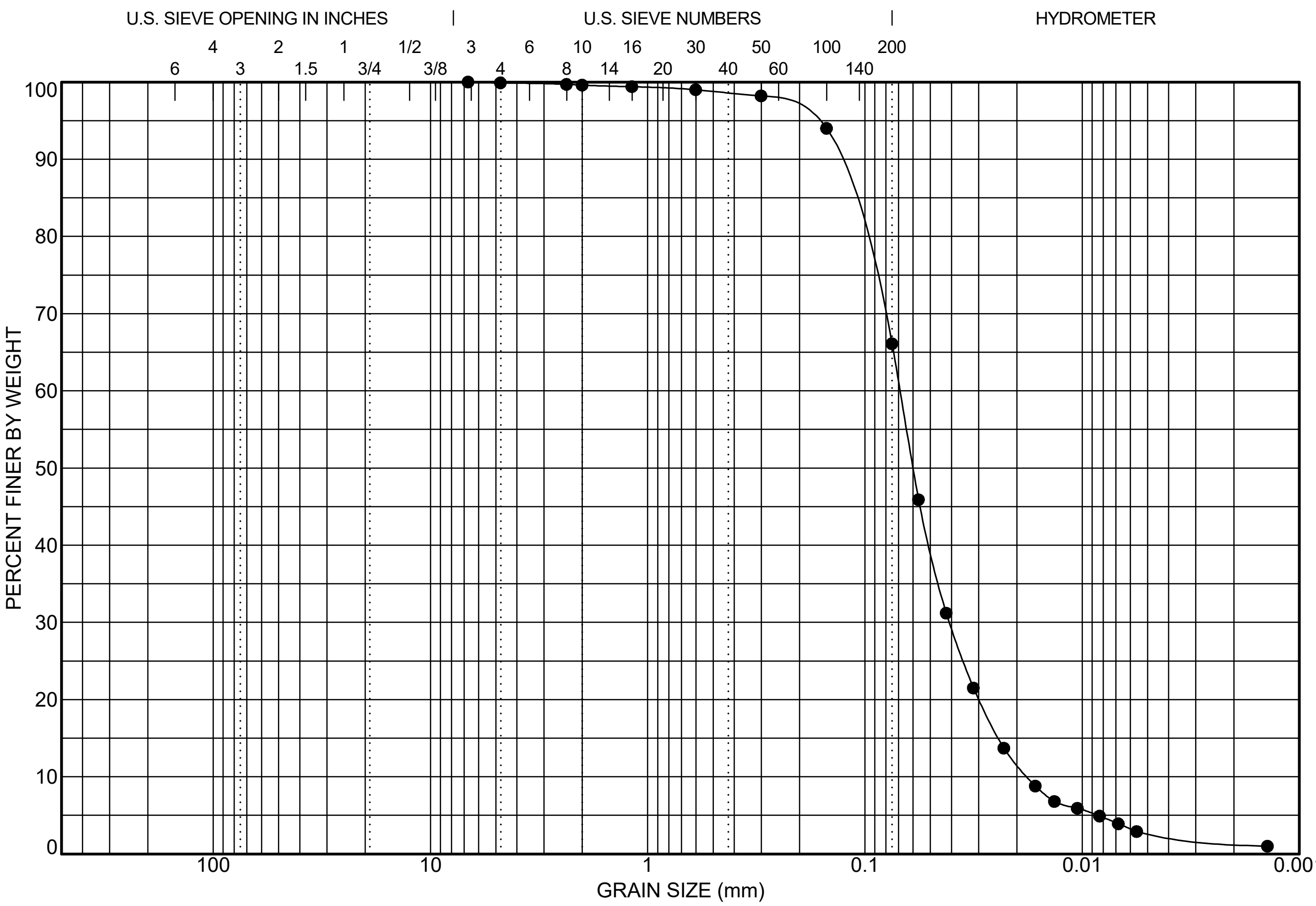
GRAIN SIZE DISTRIBUTION

Project: Proposed Residential Development

Location: 785 Gordon Street, Guelph, Ontario

File No.: G21241

Enclosure No.: 9



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.35	3.87	6.7	0.069	0.041	0.018	0.1	33.8	66.1	

Date: Jun. 15 - 2021
Client: 2371633 Ontario inc.
Contractor:
Source:
Sampled From: BH 3 - SA 7, 4.55 to 5.00 m depth
Sample No.: 3-7
Date Sampled: Jun. 07 - 2021
Sampled By: YC
Lab No.: 0621
Date Tested: Jun. 15 - 2021
Type of Material: Sandy Silt, trace gravel, trace clay

Sieve Size (mm)	Percent Passing	No Specifications

CHUNG & VANDER DOELEN
ENGINEERING LTD.
311 Victoria Street North
Kitchener, Ontario N2H 5E1
Telephone: 519-742-8979
Fax: 519-742-7739
e-mail: info@cvdengineering.com

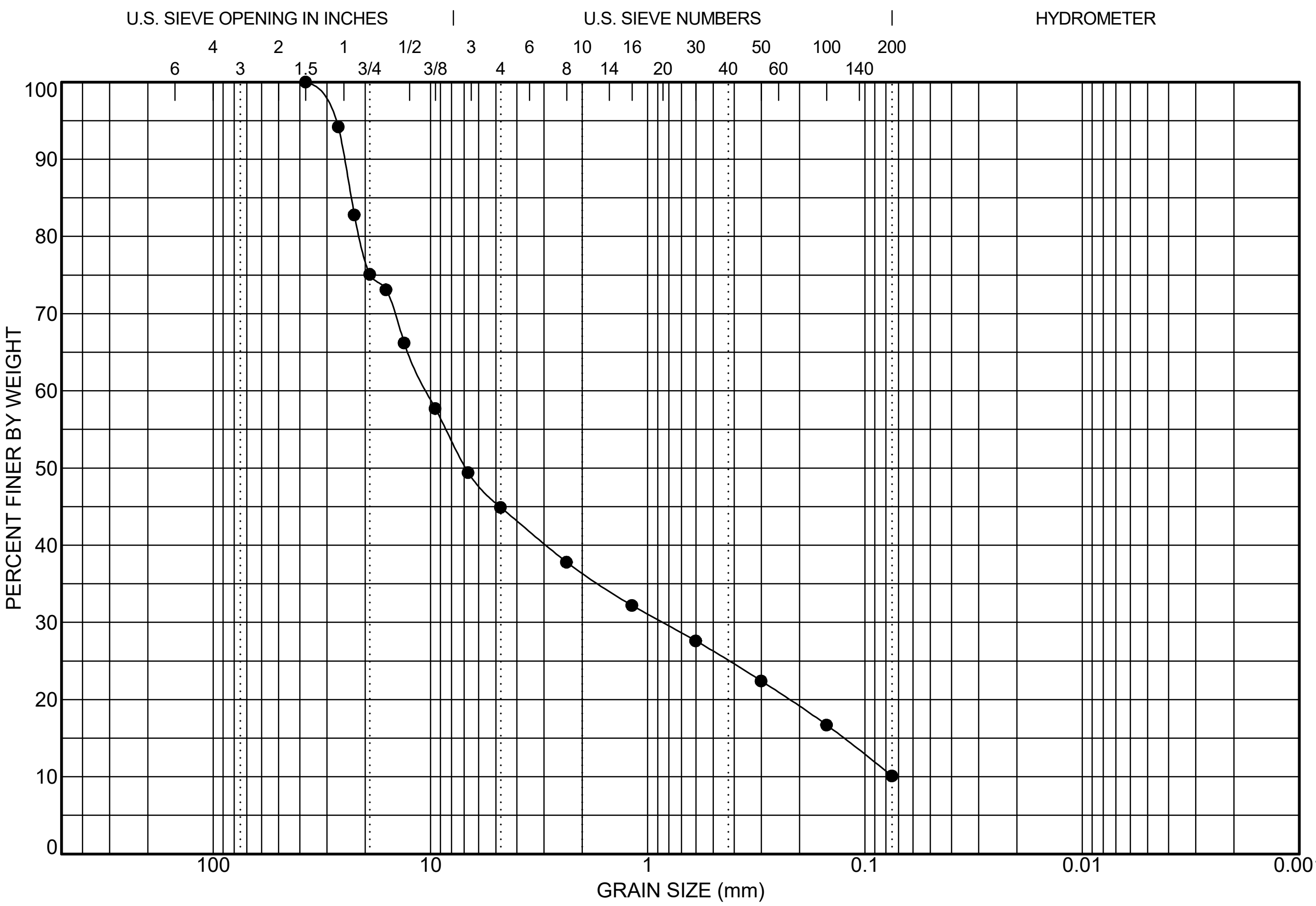
GRAIN SIZE DISTRIBUTION

Project: Proposed Residential Development

Location: 785 Gordon Street, Guelph, Ontario

File No.: G21241

Enclosure No.: 10



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			0.95	139.92	37.5	10.384	0.854		55.1	34.8	10.1	

Date: Jun. 15 - 2021
Client: 2371633 Ontario inc.
Contractor:
Source:
Sampled From: BH 6 - SA 4, 2.30 to 2.75 m depth
Sample No.: 6-4
Date Sampled: Jun. 07 - 2021
Sampled By: YC
Lab No.: 0623
Date Tested: Jun. 15 - 2021
Type of Material: Sand and Gravel, some silt, occ. sand seams

Sieve Size (mm)	Percent Passing	No Specifications

DM - NO SPECIFICATIONS G21241 785 GORDON STREET, GUELPH.GPJ LAW LNDN.GDT 21-11-16

CHUNG & VANDER DOELEN ENGINEERING LTD.
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e-mail: info@cvdengineering.com

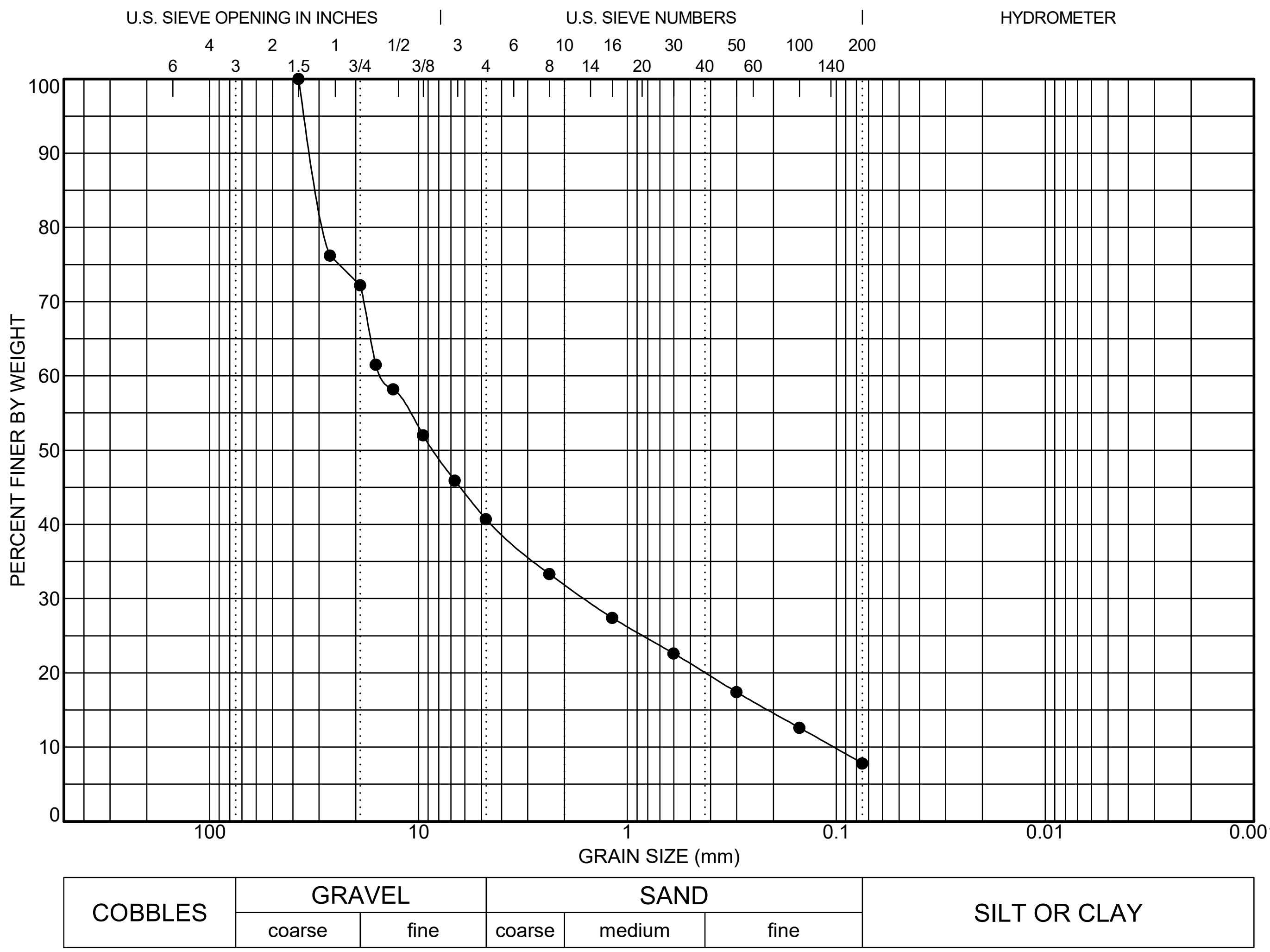
GRAIN SIZE DISTRIBUTION

Project: Proposed Residential Development

Location: 785 Gordon Street, Guelph, Ontario

File No.: G21241

Enclosure No.: 11



LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
			1.70	142.27	37.5	14.66	1.602	0.103	59.3	32.9	7.8	

Date: Jun. 15 - 2021
Client: 2371633 Ontario inc.
Contractor:
Source:
Sampled From: BH 7 - SA 4, 2.30 to 2.75 m depth
Sample No.: 7-4
Date Sampled: Jun. 08 - 2021
Sampled By: JV
Lab No.: 0622
Date Tested: Jun. 15 - 2021
Type of Material: Sand and Gravel, trace silt, occ. sand seams

Sieve Size (mm)	Percent Passing	No Specifications

CHUNG & VANDER DOELEN ENGINEERING LTD.
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Kitchener, Ontario N2H 5E1
Telephone: 519-742-8979
Fax: 519-742-7739
e-mail: info@cvdengineering.com

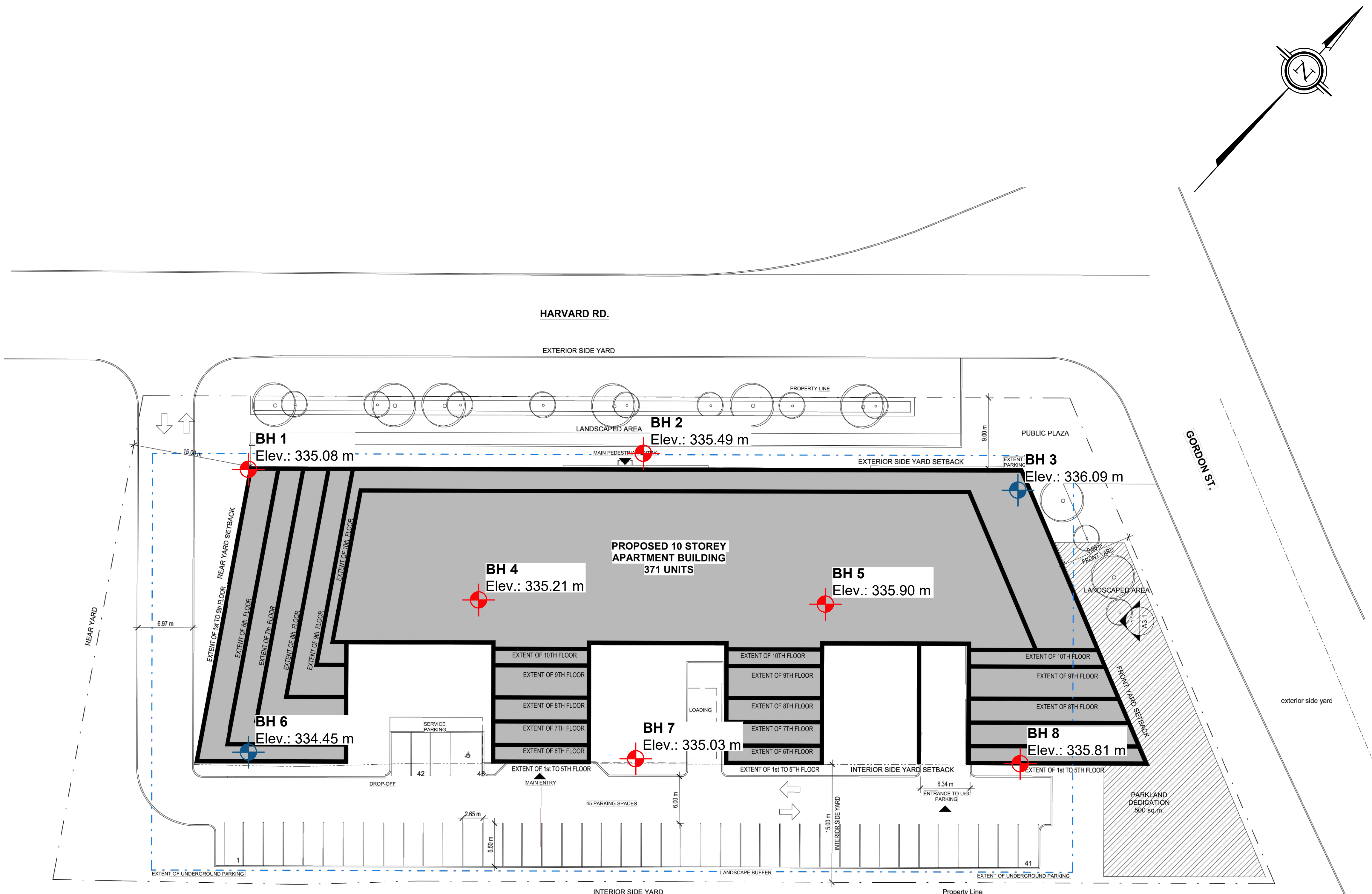
GRAIN SIZE DISTRIBUTION

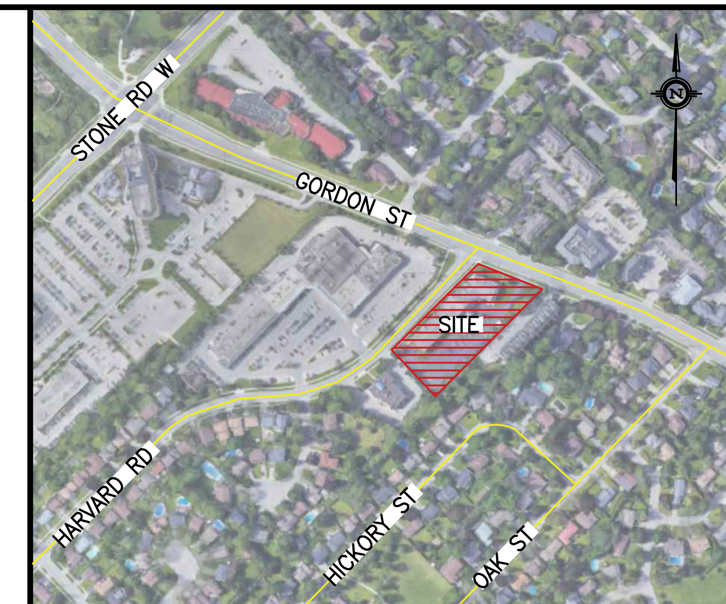
Project: Proposed Residential Development

Location: 785 Gordon Street, Guelph, Ontario

File No.: G21241

Enclosure No.: 12





KEY PLAN **SOURCE:** Google Earth

LEGEND

Borehole Location

Borehole/Monitoring Well Location

DWG. Ref.: *SRM Architects Inc.; 'Site Plan'; Project No. 21017; 785 Gordon Street; Drawing No. A1.-r1; 2021-11-09*
Elev. Ref.: *Ground surface elevations at the borehole locations was obtained with a Leica CC80 Field Tablet and an ICON GPS 70T (Tilt Compensated Network RTK Rover) Global Navigation Satellite System (GNSS) Receiver*

BOREHOLE LOCATION PLAN

Proposed Residential Development

785 Gordon Street
Guelph, Ontario

CHUNG & VANDER DOELEN
ENGINEERING LTD.
311 VICTORIA STREET NORTH
KITCHENER / ONTARIO / N2H 5E1 / 519-742-8979

Drawn By: YC	Date: September, 2021	File No.: G21241
Checked By: EYC	Scale: N.T.S.	Drawing No.: 1