Geotechnical Investigation

Proposed Residential Development
280 Clair Road West
Guelph, Ontario

Client:
John Farley and Home Opportunities

Attention: John Farley
Development Consultant

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1. Introduction

JLP Services Inc. (JLP) was retained by John Farley and Home Opportunities to carry out a geotechnical investigation for the proposed residential development to be constructed on a vacant property at the south side of Clair Road West in City of Guelph, Ontario.

As per the information presented in the drawings from Architecture Unfolded, it is understood that the proposed residential development will consist of about 960 units spread over thirty-one (31) cluster townhouse buildings with 318 units, two (2) apartment buildings with 16-storey and 14-storey towers with one (1) level of underground and a 6-storey parking structure with a partial basement. An on-grade parking lot is located on the northwestern portion of the site and associated driveway and greenspace areas are proposed throughout the site.

The purpose of this investigation was to reveal the subsurface soil and groundwater conditions at the site and to provide geotechnical recommendations for the design and construction of the building foundations, floor slab, shoring system, and pavement for access roads and parking areas.

The conclusions and recommendations given in this report are based on the assumption that the design concept and intent mentioned above will proceed into construction. If changes are made in the design phase and/or during construction, JLP must be retained to review these changes. The outcome of this review may lead to modifications to our recommendations or may require additional field and/or laboratory analyses to determine if the proposed changes are acceptable from a geotechnical standpoint.

The Terms of Reference for this project also included environmental site assessments and hydrogeological assessment. The results of these assessments will be presented under separate covers.

2. Site Description

The site is located on south side of Clair Road West about 300m west of Poppy Drive West in the City of Guelph, Ontario. The site is currently vacant and undeveloped overgrown with surface vegetation.

The site is surrounded by an existing high school on northeast side, residential properties on north side, commercial properties on northwest and southwest sides and a water tower towards the west side. The site is sloping from south end towards the north end with a difference in ground surface elevation of about 8.9m between borehole locations.

3. Field Work

The fieldwork was carried out over the period of April 3 to 5, 2024 and consisted of fifteen (15) boreholes at the locations shown on the Borehole Location Plan, Enclosure 1.

Prior to the commencement of drilling and sampling operations at the site, the borehole locations were cleared of underground utilities by Ontario One Call contractors and by a private utility locator.

The boreholes were advanced to the sampling depths by means of a track-mounted, power auger machine, equipped with hollow stem augers and split spoon samplers for soil sampling. Standard Penetration tests were carried out at frequent intervals of depth and the results are shown on the Borehole Logs as N-values. The subsurface soils were visually examined, logged and sampled at the borehole locations.

Ground water conditions were observed in the open boreholes during the drilling and sampling operations. Monitoring wells were installed in Boreholes 1, 5, 8, 9, 10, 11 and 15 for subsequent water level readings.

JLP Services Inc. engineering staff supervised and directed the fieldwork. The layout of borehole locations was carried out in the field using a handheld global positioning system with UTM coordinates. The coordinates and ground surface elevation at the borehole locations were obtained using a Sokkia GcX3 global position system referenced to the coordinate

system known as NAD83 (CSRS), which is the North American Datum of 1983 of the Canadian Spatial Reference System, and the Universal Transverse Mercator (UTM) Zone 17. The Canadian HT2_0 Geoid, Topnet Live was used for Real Time Kinematic (RTK) positioning corrections.

The approximate coordinates and ground surface elevation at the borehole locations are listed in Table 1 below.

Table 1: Borehole Location and Ground Surface Elevations

Borehole	Northing	Easting	Ground Surface Elevation (m)
BH/MW1	4815636	565116	341.392
BH2	4815612	565090	341.544
BH3	4815567	565050	342.149
BH4	4815581	565004	337.354
BH/MW5	4815554	564941	335.445
BH6	4815596	564938	335.99
BH7	4815639	565009	341.596
BH/MW8	4815723	565062	341.207
BH/MW9	4815660	564934	335.795
BH/MW10	4815656	564860	335.437
BH/MW11	4815746	564855	336.406
BH12	4815798	564971	340.741
BH13	4815875	564906	333.883
BH14	4815879	564874	333.491
BH/MW15	4815930	564864	333.209

4. Subsurface Conditions

Full details of the soil conditions encountered in each borehole are given on the Borehole Logs, Enclosures 2 to 16, inclusive and the following notes are intended to summarize this data.

A layer of **topsoil,** about 175 to 400mm thick, was encountered at the surface of all boreholes. The topsoil consisted of dark brown to brown silty sand, some gravel with scattered organics

inclusions. The topsoil was generally dark brown in colour.

Based on visual and tactile examination of the soil samples, the topsoil was in moist condition.

It should be noted that the thickness of topsoil may vary significantly between boreholes locations and should not be used to estimate the quantity of topsoil removal.

Below the topsoil in Boreholes 1, 4, 5, 8, 9, 10, 11, 12, 13, 14 and 15 inclusive, a discontinuous deposit of **fill** was encountered to depths of about 0.8 to 1.3 metres below grade. In Borehole 1, 8, 9, 10, 13 and 14 the fill consisted of dark brown to brown silty sand, some gravel, and occasional organic inclusions. In Boreholes 4, 5, 11, 12 and 15 the fill consisted of brown sand and gravel, some silt. Standard Penetration tests in the fill gave N-values ranging from 5 to 35 blows/300mm. The natural moisture content was found to range from 7 to 35%. The relatively high moisture content of a portion the fill material was due to the presence of organics.

Based on visual and tactile examination of the soil samples and the test results, the silty sand fill and sand and gravel fill are considered to be in a loose to dense state of compactness and in moist condition.

The silty sand and sand and gravel fill at Boreholes 1, 4, 5, 8, 9, 10, 11, 12, 13, 14 and 15 and topsoil at Boreholes 2, 3, 6 and 7 were underlain by a deposit of **sand and gravel** to the depth of 6.1 metres below grade in Borehole 14 and to the full depth of investigation in all other Boreholes at about 2.3 to 9.0 metres below grade. The sand and gravel was brown in colour and contained trace to some silt inclusions and scattered sandy silt seams. Standard Penetration tests in this material gave N-values ranging from 5 to greater than 100 blows/300mm, with typical values between 27 and 65 blows/300mm. The natural moisture content was found to range between 1 and 18%, with typical values between 3 and 13. Typical grain size distribution curves for this material can be found on Enclosures 18, 19, 20 and 21.

Based on visual and tactile examination of the soil samples and the test results, the sand and gravel is typically in a compact to very dense state of compactness and in moist to wet condition.

A discontinuous layer of **silt till** was found at Borehole 12 between the sand and gravel ranging from 2.4 to 3.8 metres below grade and to the full depth of investigation i.e. 7.6 metres below grade in Borehole 14. The silt till was brown or grey in colour and contained trace to some sand inclusions. Standard Penetration tests in this material gave N-values ranging from 5 to 69 blows/300mm. The natural moisture content was found to range between 7 and 10%.

Based on visual and tactile examination of the soil samples and the test results, the silt till is typically in a loose to very dense state of compactness and in moist condition.

It is noted that auger refusal on probable boulder was encountered at Boreholes 1, 2, 3, 6, 7, 8 and 10 at depths of about 2.3 to 7.6 metres below grade.

5.0 Groundwater Conditions

Boreholes 2, 3, 4, 6, 7, 12, 13, and 14 were dry and open on completion of the fieldwork. No water level measurement was obtained from Boreholes 1, 5, 8, 9, 10, 11 and 15 due to well installation.

A monitoring well was installed in each of Boreholes 11, 5, 8, 9, 10, 11 and 15. The monitoring wells were sealed with bentonite between 0.3 metres below ground surface and 0.3 metres above top of well screen for groundwater level monitoring. The monitoring well consisted of 50mm diameter polyvinyl chloride (PVC) pipe with slotted well screen and unslotted riser and a metal protective casing above ground. Free water surface levels were subsequently measured by JLP at depths and elevations noted in Tables 2A and 2B below.

Table 2A: Observed Groundwater Levels

Location	Ground Elevation (m)	End of Borehole		April 16, 2024	
		Depth Below Existing Grade (m±)	Water Level Elevation (m±)	Depth Below Existing Grade (m±)	Water Level Elevation (m±)
BH/MW1	341.392	--	--	DRY	--
BH/MW5	335.445	--	--	DRY	--
BH/MW8	341.207	--	--	DRY	--
BH/MW9	335.795	--	--	6.12	329.68
BH/MW10	335.437	--	--	DRY	--
BH/MW11	336.406	--	--	6.91	329.50
BH/MW15	333.209	--	--	3.57	329.64

Table 2B: Observed Groundwater Levels

Location	Ground Elevation (m)	July 9, 2024		August 13, 2024	
		Depth Below Existing Grade (m±)	Water Level Elevation (m±)	Depth Below Existing Grade (m±)	Water Level Elevation (m±)
BH/MW1	341.392	DRY	--	7.43	333.96
BH/MW5	335.445	5.85	329.60	5.49	329.96
BH/MW8	341.207	DRY	--	DRY	--
BH/MW9	335.795	5.98	329.82	5.86	329.94
BH/MW10	335.437	5.83	329.61	5.47	329.97
BH/MW11	336.406	6.81	329.60	6.47	329.94
BH/MW15	333.209	3.65	329.56	3.31	329.90

An examination of the soil samples indicated that the materials were generally moist to wet. It is noted that no sub-artesian water pressure was encountered in any of the boreholes.

Based on the foregoing and the moisture content profiles of the soil samples, the observed groundwater level at the site is considered to be located at about 3.6 to 6.8 metres below

grade, approximately Elevations 329.6 to 329.8m. Seasonal fluctuation of the groundwater level should be anticipated.

6.0 Discussion and Recommendations

6.1 General

The proposed residential development will include about 960 units distributed across 31 cluster townhouse buildings, two apartment buildings with 16-storey and 14-storey towers with one level of underground parking and a partial basement. A 6-storey parking structure with partial basement will be situated on the southeastern part of the site, with associated driveways and green spaces proposed throughout the area.

The boreholes generally encountered a surficial deposit of topsoil over a deposit of silty sand or sand and gravel fill, underlain by sand and gravel and discontinuous deposits of silt till in generally very loose to very dense state of compactness.

The groundwater table at the site is located at about 3.6 to 6.8 metres below grade, approximate Elevations 329.6 to 329.8m. However, perched groundwater should be expected in the fill deposits. Seasonal fluctuation of the groundwater level should be anticipated.

6.2 Site Grading

It is assumed some re-grading will be required at the site depending on the design finished grades of the proposed development. Following clearing and grubbing as required, the surficial topsoil may be removed and stockpiled for re-use and/or off-site disposal.

The design site grades may be achieved by cut and fill operations. All cut and fill to support the proposed buildings; site services and pavement areas should be carried out following the procedure for “engineered fill” construction below:

1. All vegetation, surficial topsoil and any other deleterious materials encountered should be removed from the proposed building and pavement areas. Any organic, excessively wet or otherwise deleterious materials should not be used as “engineered fill” materials.

2. Existing groundwater monitoring wells and/or potable water wells, if any, should be properly decommissioned in accordance with the Ontario Water Resources Act, R.R.O. 1990, Ontario (O.Reg.) 903 – amended to O.Reg. 128/03.
3. The exposed subgrade should be proof-rolled with a heavy-duty equipment, such as a loaded dump truck, and examined by geotechnical personnel from JLP. Any loose or soft areas encountered during the proof-rolling process should be further sub-excavated and replaced with approved on-site or imported soil materials compacted to a minimum of 98% of the Standard Proctor Maximum Dry Density (SPMDD).
4. Low areas can then be brought up to the design pre-grade level with approved on-site or imported soil materials placed in maximum 300mm thick lifts and compacted to a minimum of 98% of the SPMDD.
5. Moisture conditioning should be applied to the engineered fill materials for effective compaction. Some of the on-site soil materials may require air drying or addition of moisture before they can be properly compacted.
6. The “engineered fill” under all building structures to be supported should extend to at least 2.0 metre laterally beyond the edge of their perimeter at the founding level and at least a distance equal to the depths of the fill pad, at the level of the approved subgrade.
7. Temporary fill slopes should be no steeper than 1 vertical to 2 horizontal and should be protected from surface erosion.
8. All imported fill materials should be assessed by JLP prior to transport to the site in accordance with the “On-Site and Excess Soil Management Regulation”, O.Reg. 406/19 and supporting amendments.
9. All imported fill materials should be free from organics and debris and should be tested geotechnically by JLP prior to transport to the site.
10. All topsoil and unsuitable material removal, subgrade preparation, fill placement and compaction should be monitored on a full-time basis by geotechnical staff from JLP to approve materials and to verify that the specified degree of compaction have been achieved.

6.3 Building Foundations

The existing topsoil, silty sand or sand and gravel fill are not considered to be suitable bearing strata. The foundations for the proposed structure should, therefore, extend to the underlying sand and gravel for support.

Boreholes 7, 8, 12, 13, 14 and 15 are located under the footprint of proposed townhouse structure. Final site grades are unavailable at the time of this report. However, it is anticipated that the depth of the footings is considered to be around 1.5 to 2.5 metres below finished site grades.

The proposed townhouses can be supported on conventional spread footings founded a minimum of 0.3m into native undisturbed sand and gravel in generally compact to very dense state of compactness or on engineered fill and designed to a geotechnical reaction of 200 kPa at Serviceability Limit States (S.L.S.) and a factored geotechnical resistance of 300 kPa at Ultimate Limit States (U.L.S.).

Boreholes 1, 2, 3, 4, 6 and 9 are located around the footprint of the proposed 14 and 16 storey buildings and the proposed 6-storey parking structure. These buildings have a partial or full basement level. Final details concerning the proposed site grades and foundations are unavailable at the time of this report. As such, it is assumed that the depth of the footings for the proposed 14 and 16 storey buildings and the proposed 6-storey parking structure with a basement level is considered to be around 2 to 4 metres below finished site grades.

The proposed 14 and 16 storey buildings and the proposed 6-storey parking structure with a basement level can be supported on conventional spread footings founded a minimum of 0.5m into native undisturbed sand and gravel in generally dense to very dense state of compactness, but not on engineered fill, and designed to a geotechnical reaction of 400 kPa at Serviceability Limit States (S.L.S.) and a factored geotechnical resistance of 600 kPa at Ultimate Limit States (U.L.S.).

Based on the data obtained at the borehole locations, suitable foundation grades and their respective factored geotechnical resistance at depth will be as presented in Table 3:

Table 3: Suitable Foundation Grades and Respective Factored Geotechnical Resistance

Location	Ground Surface Elevation (m)	Depth to Suitable Bearing Stratum Below Existing Grade / Elevation (m±)	Bearing Stratum	Geotechnical Reaction at S.L.S. (kPa)	Factored Geotechnical Resistance at U.L.S. (kPa)
Proposed 14 to 16 storey buildings and 6-storey parking structure					
BH/MW1	341.392	2.4 / 339.0	Very Dense Sand and Gravel	400	600
BH2	341.544	2.5 / 339.0	Dense Sand and Gravel	400	600
BH3	342.149	1.5 / 340.6	Very Dense Sand and Gravel	400	600
BH4	337.354	2.0 / 335.3	Very Dense Sand and Gravel	400	600
BH6	335.99	1.0 / 335.0	Very Dense Sand and Gravel	400	600
BH/MW9	335.795	1.2 / 334.6	Very Dense Sand and Gravel	400	600
Proposed Townhouses					
BH7	341.596	1.0 / 340.6	Very Dense Sand and Gravel	200	300
BH/MW8	341.207	1.2 / 340.0	Dense Sand and Gravel	200	300
BH12	340.741	1.2 / 339.5	Dense Sand and Gravel	200	300
BH13	333.883	1.2 / 332.7	Dense Sand and Gravel	200	300
BH14	333.491	1.2 / 332.3	Very Dense Sand and Gravel	200	300
BH/MW15	333.209	1.2 / 332.0	Dense Sand and Gravel	200	300

All exterior footings or footings in unheated areas should be located at least 1.4 metres below finished grade or provided with equivalent thermal insulation for adequate frost protection.

Elevation differences between adjacent footings should not be more than 0.5 times of the horizontal distance between them.

It is estimated that the total and differential settlements of spread footings designed to these bearing pressures will be less than 25mm and 20mm respectively, which are normally considered acceptable for the type of the proposed structures.

It is recommended that all foundation excavations be inspected by geotechnical personnel from JLP Services Inc. to ensure the founding surfaces are capable of supporting the design bearing pressures.

Based on the 2024 Building Code Compendium, it is preferred to determine the site designation, Xv, on the basis of in-situ measurements of shear wave velocity, Vs30. However, if the in-situ measurements of shear wave velocity are not available, the site designation can be determined using the energy-corrected average standard penetration resistance, N60, or the average undrained shear strength, su. The Site Class for seismic design should be based on the average properties of the upper 30 metres (below the lowest floor level) of the soil profile. The deepest boreholes for this project were only 9.0 metres below grade and were terminated in compact sand and gravel. Assuming this deposit extends to depth, the Site Class for this site may be taken as 'D' under the 2024 Building Code Compendium which reference to National Building Code (NBC) 2020 Tables 4.1.8.4.A and 4.1.8.4.B. Further information on Site Class can be found in the Commentary titled "Design for Seismic Effects" in the "Structural Commentaries (User's Guide – NBC 2020: Part 4 of Division B).

6.4 Basement Walls

The proposed buildings and parking structure will likely have a partial or full level of basement. The basement walls should be designed to resist lateral earth pressures, the magnitude of which can be determined from:

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

where;

- p = earth pressure, kN/m^2
- K = active earth pressure coefficient, Ka, if retaining structure is permitted to move, otherwise, Ko
- γ = unit weight of backfill
- d = depth below finished grade, metres
- q = all adjacent surcharge kN/m^2

The above equation assumes that there is no hydrostatic pressure build up against the basement walls. As such, the waterproofing system behind the basement walls should consist of synthetic drainage layer diverting groundwater into the proposed building for collection and disposal. A perimeter subdrain system should be installed at footing level outside or inside the building envelope, depending on design, to facilitate drainage. The perimeter subdrain system should consist of 150mm diameter perforated pipe surrounded with a minimum of 300mm of 19mm clear stone all wrapped with a filter fabric, such as Texel 100C or other products with equivalent apparent opening size (AOS).

The following unfactored geotechnical coefficients and parameters listed in Table 4 may be used in the design:

Table 4: Soil Types and Respective Unfactored Geotechnical Parameters

Soil Material	Unit Weight of Soil (kN/m^3)	Angle of Internal Friction (°)	Coefficient of Active Earth Pressure, Ka	Coefficient of Earth Pressure at Rest, Ko	Coefficient of Passive Earth Pressure, Kp
Existing Fill (very loose to compact silty sand or sand and gravel)-	22	30	0.33	0.50	3.00
Compact to Very Dense Sand and Gravel	23	32	0.31	0.47	3.25

Soil Material	Unit Weight of Soil (kN/m^3)	Angle of Internal Friction (°)	Coefficient of Active Earth Pressure, Ka	Coefficient of Earth Pressure at Rest, Ko	Coefficient of Passive Earth Pressure, Kp
Compact to Very Dense Silt Till	23	32	0.31	0.47	3.25
Granular 'B' Modified	23	30	0.33	0.50	3.00
OPSS Granular 'A'	23	35	0.27	0.43	3.69

Water collected in the drainage system should be connected to the local storm drainage system either by gravity or by a permanent sump pump. Surface drainage around the building should be directed away from the building.

The basement floors should be located at least 0.5 metres above the observed groundwater level, approximate Elevations 329.6 to 329.8m, otherwise sub-floor drainage systems together with continual pumping from the drainage systems will be required.

Alternatively, the basement foundations, walls and floors can be sealed tight using waterproofing systems and designed to resist full hydrostatic pressures.

6.5 Floor Slabs

It is expected that all topsoil, existing fill and any deleterious materials have been stripped from the proposed building areas. Any loose material encountered should be sub-excavated and replaced with approved fill. The exposed subgrade should be re-compacted from the surface to at least 98% of the standard Proctor maximum dry density.

Backfill around the footings and basement walls inside the proposed buildings should be compacted to at least 98% of the standard Proctor maximum dry density. The backfill may consist of approved on-site soil or imported granular fill. All backfill outside of the proposed buildings should be placed in 200 to 250mm thick lifts and compacted to at least 98% of the Standard Proctor maximum dry density.

A layer of well-graded, free-draining material, such as OPSS Granular 'A' (natural sand and gravel), at least 200mm thick and compacted to 100% of its Standard Proctor maximum dry density should be placed under the floor slabs to provide a uniform bearing surface and act as a moisture barrier.

Perimeter drainage is required to remove any water adjacent to the exterior side of the basement walls, hence, to prevent the build-up of hydrostatic pressures against the basement walls.

If the basement walls are constructed directly against the shoring system, then commercially available synthetic wall drains, such as Mira-Drain 6000 by Carlisle or similar products, will be required to cover the entire basement wall surface to reduce the risk of water penetration. The wall drains should extend continuously from about 0.3m below ground level to the bottom of the basement walls and outlet through the basement walls into the basement for collection. Water from the wall drains should be collected with a non-perforated pipe and directed to the sump pit for storage and removal.

If the basement walls are not cast directly against the shoring system, perimeter drains should be installed at the bottom of the basement walls to remove groundwater from the perimeter of the structure. Water from the perimeter drains may be collected with a perforated pipe outside the basement and then transferred to a non-perforated pipe inside the basement leading to the sump pit for storage and removal.

It is anticipated that underfloor drains will not be required below the underground parking or basement floor slabs as the observed groundwater levels in this investigation is at about Elevations 329.6 to 329.8m. However, if the underfloor drains are required, they should be installed at about midway between the column bays and/or spaced at 2.0 m centre to centre leading to a sump pit for storage and removal. The drains may consist of 100 mm diameter perforated pipe surrounded by 150 mm of clear stone all wrapped in geotextile filter fabric, such as Texel 100C or similar products with equivalent apparent opening size (AOS). The drains can be placed in an approximately 0.3 m wide by 0.2 m deep trench and backfilled with 100 mm of concrete sand. Cleanouts should be provided at each underfloor drain line.

Perimeter drains and underfloor drains should not be connected into the same collector pipe to prevent possible backflow.

Around the perimeter of the proposed buildings, the ground surface should be sloped on a positive grade away from the structure to promote surface water run-off and reduce groundwater infiltration adjacent to the foundations.

Frequent inspections by geotechnical personnel from JLP Services Inc. should be carried out during construction to verify the competency of subgrade and the compaction of granular base courses by in-situ density testing using nuclear gauges

6.6 Excavation and Groundwater Control

Excavations must be carried out in accordance with the current Occupation Health and Safety Act (OHSA) and local regulations. For guidance, the side slopes should be cut back to maximum 1 vertical to 1 horizontal as the existing silty sand or sand and gravel fill in loose to compact state and native sand and gravel or silt till in very loose to very dense state are considered to be Type 3 soils within the meaning of the OHSA.

For discussion purposes, it is assumed that the lowest underground parking garage or basement floor slab will be at about Elevation 337.0m, which is about 3.5 to 4.0 metres below existing grade. Excavation to reach one level of underground parking and of partial or full basement will extend to about 3.5 to 4.0 metres below existing grade and to reach founding levels on dense to very dense sand and gravel deposit at similar depths. No major construction problems due to groundwater are anticipated with excavation above Elevation 331.0 as the groundwater table at the site is located about Elevations 329.6 to 329.8m.

It should be possible to control and remove seepage water from the existing fill or surface water from precipitation by pumping on as and where required basis. However, where excavations are below the groundwater table, provisions will be required to lower the groundwater level to at least 0.6 metres below the lowest excavation level through pumping from deep sumps or through the use of vacuum well points. Further flattening of the side slopes and/or use of temporary shoring systems will be required where excavations extend below the groundwater table.

Temporary shoring system consisting of soldier pile and lagging, supported with tiebacks or rakers, may be used to support the excavation to reach the proposed basement and footing founding levels depending on the space limitation.

Recommendations for any temporary shoring systems, if required, are presented below. The shoring system should be designed in accordance with the 'State-of-the-Art' guidelines provided in the Canadian Foundation Engineering Manual (CFEM). Based on the manual, the following earth-pressure coefficients are recommended.

0.25	Where minor movements can be tolerated.
0.35	Where utilities, roads, sidewalks must be protected from significant movement or where vibration from traffic is a factor.
0.40	Where movements are to be minimized such as near adjacent building footings or movement sensitive services (i.e. gas and watermain).

Natural Unit Weight = 22 kN/m^3 (existing very loose to compact sand and gravel or silty sand fill)

Natural Unit Weight = 23 kN/m^3 (native loose to very dense sand and gravel and silt till)

Bond resistance for soil anchors in compact to very dense sand and gravel or silt till below 4.0m from existing grade = 20 kPa

For raker footings socketed into the compact to very dense sand and gravel, a geotechnical reaction of 150 kPa at SLS and a factored geotechnical resistance of 225 kPa at ULS may be used for the design. The rakers should be proof tested to 1.33 times the design load prior to lock in.

The recommended design parameters should be confirmed by load testing a number of soil anchors to 200% design load in accordance with the current edition of the CFEM. At least two (2) anchors tested to 200% of design load should be carried out to verify the capacity of the anchors. The design for the production anchors should then be modified based on the test results, where necessary. All remaining anchors must be installed in similar procedures and proof tested to 1.33 times the design load prior to lock in.

6.7 Site Services

The inverts of the proposed site services are not available at the time of this report. However, it is expected that the on-site sanitary sewer, storm sewer and watermain inverts will be located at depths ranging between 2 and 4 metres below the finished grades. All sewers and watermains should be protected from frost actions by at least 1.4m of soil cover or equivalent thermal insulation.

Reference to the Borehole Logs indicates that the subgrade will likely consist of existing silty sand to sand and gravel fill, native sand and gravel and/or silt till, in generally compact to very dense state. Subgrade in these deposits will generally provide adequate support for the pipes and allow the use of OPSD 802.010 and/or OPSD 802.031 Class 'B' bedding using OPSS.MUNI 1010 Granular 'A' material. Where the exposed subgrade is less competent than the materials identified in the Borehole Logs, the bedding thickness may have to be increased.

Clear crushed stone should not be used as bedding as fine-grained particles may migrate into the voids of the stone and cause undesirable settlements.

The trench excavation, in most cases, will be above the observed groundwater levels, the sides of the open cut excavation should either be cut back at a side slope of 1 vertical to 1 horizontal or supported with trench box or temporary shoring system.

However, if the trench excavation is below the observed groundwater levels, construction dewatering by means of pumping from deep sump within the excavation may be required to lower the groundwater level to at least 600mm below the bottom of the trench to facilitate construction. The sides of the open cut excavation should either be cut back at a side slope of 1 vertical to 3 horizontal or supported with trench box or temporary shoring system.

The excavated materials will be generally suitable for re-use as trench backfill provided that they are free of topsoil, organic material and cobbles/boulders. If the on-site materials become wet, they should be air dried prior to re-use as trench backfill. The trench backfill should be placed in maximum 300mm thick layers and uniformly compacted to at least 95% of its Standard Proctor Maximum Dry Density (SPMDD).

The backfill around maintenance holes, catchbasins, valve chambers, thrust blocks and/or service connections should consist of free-draining granular material, such as the OPSS Granular 'B' Type I material or the City of Guelph Granular 'B' modified material and compacted to a minimum of 95% of its SPMDD.

To minimize potential problems and wetting of the subgrade material, backfilling operations should follow closely after excavations, so that only a minimal length of trench is exposed at a time. Should construction be carried out in the winter season, particular attention should be given to make sure no frozen material is used for backfilling.

Cobbles and/or boulders may be present in the native sand and gravel and silt till deposits, and some difficulty or delays may be anticipated during excavation. Cobbles and/or boulders with nominal diameter larger than 150mm should not be re-used as trench backfill.

6.8 Pavement Design and Construction

All topsoil and any deleterious materials encountered should be stripped from the proposed pavement area. The exposed subgrade may consist of existing fill and/or native sand and gravel and should be re-compacted from the surface to at least 98% of its Standard Proctor maximum dry density prior to the construction of the pavement structure. Any loose areas which are detected during the proofrolling of subgrade should be sub-excavated and backfilled with imported granular fill. All granular fill materials should be placed in 150 to 200mm thick lifts and compacted to 100% of the Standard Proctor maximum dry density.

Considering the probable traffic requirements, subgrade conditions and a functional design life of about 10 years, the following pavement designs outlined in Table 5 are recommended for the proposed driveway and parking lot area supported on soil:

Table 5: Recommended Pavement Structures

Pavement Components	Passenger Car Parking (Light Duty) (mm)	Driveway/Fire Route (Medium Duty) (mm)
Asphaltic Concrete – HL3	40	40
Asphaltic Concrete – HL8	50	50
Granular 'A' Base Course	150	150
Granular 'B' Modified Subbase Course	150	300

The granular base and sub-base materials should consist of natural sand and gravel materials and should meet Ontario Provincial Standard Specification OPSS.MUNI.1010 and City of Guelph requirements. The granular materials should be compacted to 100% of the Standard Proctor maximum dry density as per OPSS.MUNI.501 requirements. The asphaltic concrete should conform to OPSS.MUNI.1150 and should be compacted to a minimum of 92.0% of the Maximum Relative Density (MRD) as per OPSS.MUNI.310 requirements.

Frequent inspections by geotechnical personnel from JLP Services Inc. should be carried out during construction to verify the compaction of the subgrade, base courses and asphaltic concrete by in-situ density testing using nuclear gauges.

7.0 Statement of Limitation

The Statement of Limitation including the Terms and Conditions of this report is presented on Appendix 'A' is an integral part of this report.

8.0 Closure

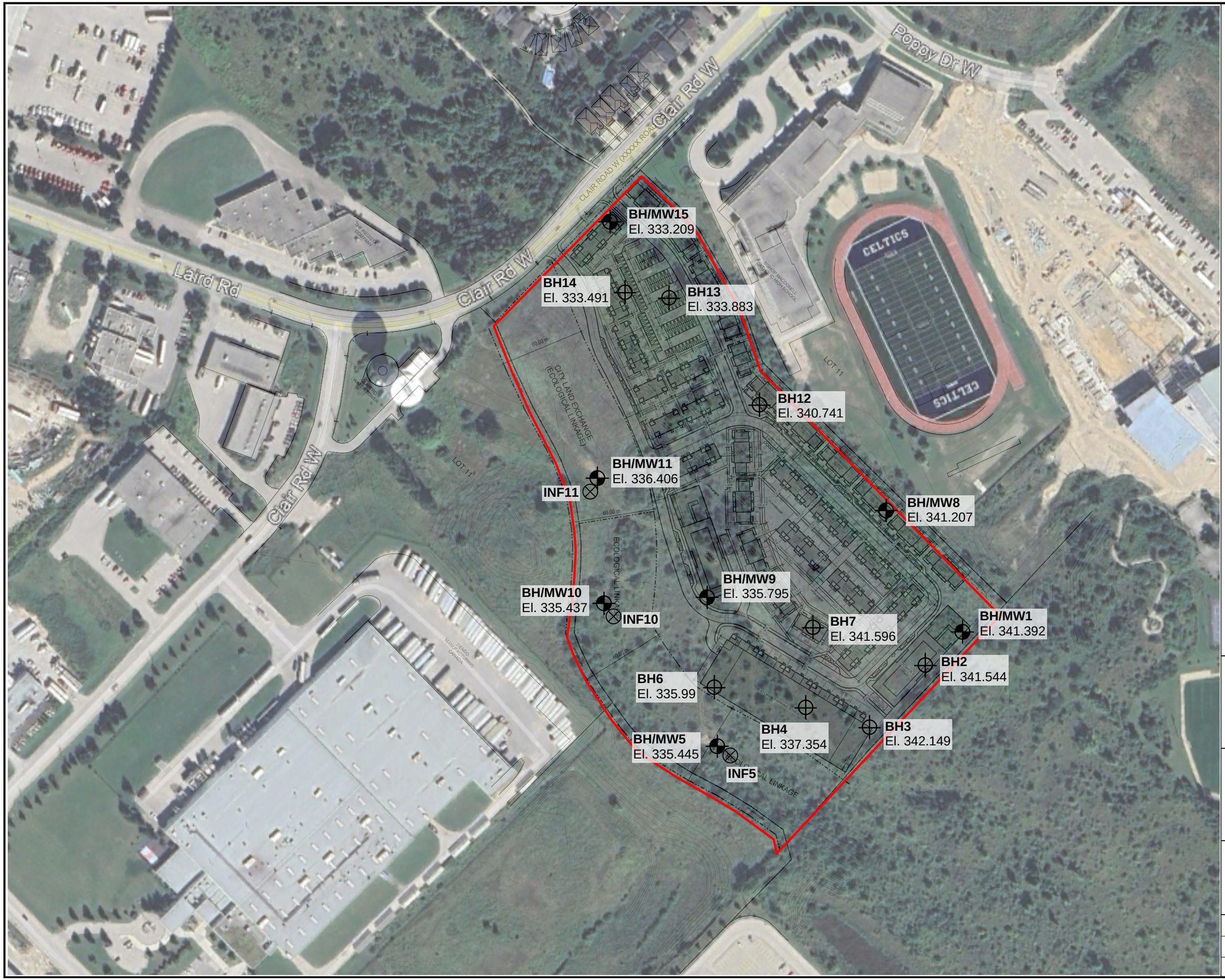
We trust this report is satisfactory for your purposes. Should you have any questions, please do not hesitate to contact this office.

Sincerely,
JLP Services Inc.

Aakash Kuruvath, M.Eng.
Project Coordinator

Alexander Lee, M.Sc. (Eng.), P.Eng.
Senior Geotechnical Engineer

Enclosure 1: Borehole Location Plan



Legend

- Project Area
- Borehole (JLP, 2024)
- Borehole with Monitor (JLP, 2024)
- Infiltration Test Location

N

True North

- This drawing shall be read in conjunction with the associated technical report.
- El = Elevation
- The ground surface elevations were obtained using a Sokkia GcX3 global position system referenced to the coordinate system known as NAD83 no trans, which is the North American Datum of 1983 of the Canadian Spatial Reference System, and the Universal Transverse Mercator (UTM) Zone 17.
- The soil types and boundaries are applicable only at the location of the boreholes. Between boreholes, they are assumed and may change substantially. The topsoil thicknesses quoted in the report are used for discussion purposes only and should not be used for estimating purposes.
- The soil samples will be retained for three months from the date of issue of the final report and then discarded, unless the client has requested to extend the storage period with fees.

JLP

Geotechnical & Environmental Consultants

Borehole Location Plan
Proposed Residential Development
280 Clair Road West,
Guelph, Ontario

Date: Jan. 24, 2025	Ref. No. G4836-24-3	
Prepared By: CL	Checked By: AL	Encl. No. 1
Source: Google Earth, 2025 Architecture Unfolded, A101 Site Plan (2024.12.04)	Scale: 10 20 40 60 metres	

Enclosures 2 to 16: Borehole Logs

BORING NUMBER BH 1 (MW)

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-3 **COMPLETED** 24-4-3
GROUND ELEVATION 341.392 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR Arrow
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY MC **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
341	1		**TOPSOIL** 250mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	1-2-3-3 (5)	41	ND		
			FILL silty sand trace gravel, trace organic inclusions; brown, moist no odour, no staining	0.8	SS 2	2-5-7-9 (12)	36	ND		
340	2		**SAND AND GRAVEL** medium to coarse grained, brown, moist, compact to very dense no odour, no staining		SS 3	9-8-19-31 (27)	30	ND		
339	3				SS 4	18-39-31-34 (70)	3	ND		
338	4				SS 5	19-23-20-27 (43)	43	ND		
					SS 6	50/0.08	0	ND		
337	5				SS 7	10-7-9-6 (16)	25	ND		
336	6									
335	7									
334				7.6						

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

>>

End of Borehole at 7.62 mbgs Due to Auger Refusal

BORING NUMBER BH 2

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-3 **COMPLETED** 24-4-3
GROUND ELEVATION 341.544 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR Arrow
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY MC **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
341	1		**TOPSOIL** 250mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	4-5-9-13 (14)	41	ND		
			SAND AND GRAVEL medium to coarse grained, brown, moist, compact to very dense no odour, no staining		SS 2	26-17-15-20 (32)	25	ND		
340	2				SS 3	14-15-14-20 (29)	36	ND		
339	3				SS 4	28-29-17-14 (46)	41	ND		
					SS 5	25-50/0.08	0	ND		
338	4				SS 6	27-46-23-19 (69)	30	ND		
337	5				SS 7	25-50/0.13	33	ND		
336	6				SS 8	50/0.10	15	ND		
335	7									
334	8									
333				8.8						

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

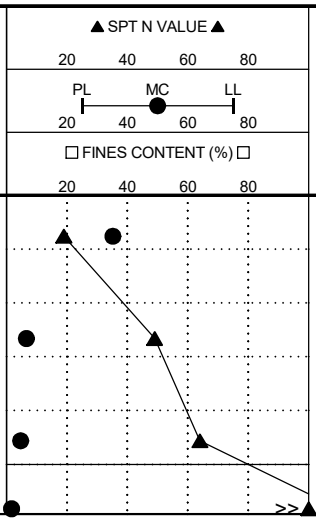
End of Borehole at 8.83 mbgs Due to Auger Refusal

BORING NUMBER BH 3

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-3 **COMPLETED** 24-4-3
GROUND ELEVATION 342.149 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR Arrow
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY MC **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
342			**TOPSOIL** 300mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	2-9-10-22 (19)	36	ND		
	1				SS 2	15-24-25-36 (49)	30	ND		
341			**SAND AND GRAVEL** brown, moist, dense to very dense no odour, no staining		SS 3	27-40-24-21 (64)	30	ND		
	2									
340				2.4	SS 4	50/0.08	0	ND		
			End of Borehole at 2.37 mbgs Due to Auger Refusal							



BORING NUMBER BH 4

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-4 **COMPLETED** 24-4-4
GROUND ELEVATION 337.354 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR Arrow
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY MC **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
337			**TOPSOIL** 300mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	2-2-3-3 (5)	41	ND		
	1		**FILL** sand and gravel, some silt; brown, moist no odour, no staining	1.1	SS 2	4-6-13-20 (19)	28	ND		
336			**SAND AND GRAVEL** medium to coarse grained, brown, moist, compact to very dense no odour, no staining		SS 3	18-27-50-47 (77)	41	ND		
	2									
335					SS 4	14-28-25-23 (53)	38	ND		
	3									
334					SS 5	23-23-31-43 (54)	41	ND		
	4									
333					SS 6	21-41-43-32 (84)	53	ND		
	5				SS 7	15-13-10-25 (23)	38	ND		
332				5.9	SS 8	22-17-28-50 (45)	38	ND		

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

End of Borehole at 5.94 mbgs

BORING NUMBER BH 5 (MW)

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-5 **COMPLETED** 24-4-5
GROUND ELEVATION 335.445 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR Arrow
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY MC **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING 5.85 m / Elev 329.60 m

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
335	1		**TOPSOIL** 400mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.4	SS 1	2-3-7-6 (10)	15	ND		
			FILL sand and gravel, some silt; brown, moist no odour, no staining	1.3	SS 2	3-4-5-9 (9)	51	ND		
334	2		**SAND AND GRAVEL** trace silt, brown, moist, very dense no odour, no staining		SS 3	50	0	ND		
333	3				SS 4	35-44-50 (94)	25	ND		
332	4				SS 5	40-33-50 (83)	28	ND		
331	5				SS 6	50	0	ND		
					SS 7	24-33-36-50 (69)	38	ND		
330			wet at 5.6 mbgs	5.9	SS 8	19-30-25-26 (55)	41	ND		

▲ SPT N VALUE ▲ 20 40 60 80
PL MC LL 20 40 60 80
☐ FINES CONTENT (%) ☐ 20 40 60 80

End of Borehole at 5.94 mbgs

BORING NUMBER BH 6

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-4 **COMPLETED** 24-4-4
GROUND ELEVATION 335.99 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR Arrow
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY MC **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	▲SPT N VALUE▲ 20 40 60 80 / PL MC LL 20 40 60 80 / ☐FINES CONTENT (%)☐ 20 40 60 80	WELL CONSTRUCTION
			TOPSOIL 175mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.2	SS 1	1-2-3-3 (5)	18	ND			
335	1		**SAND AND GRAVEL** trace silt, brown, moist, very dense no odour, no staining		SS 2	17-29-30-44 (59)	38	ND			
334	2				SS 3	23-29-37-41 (66)	43	ND			
				2.3	AU 4	50/0.03					
			End of Borehole at 2.32 mbgs Due to Auger Refusal								

BORING NUMBER BH 7

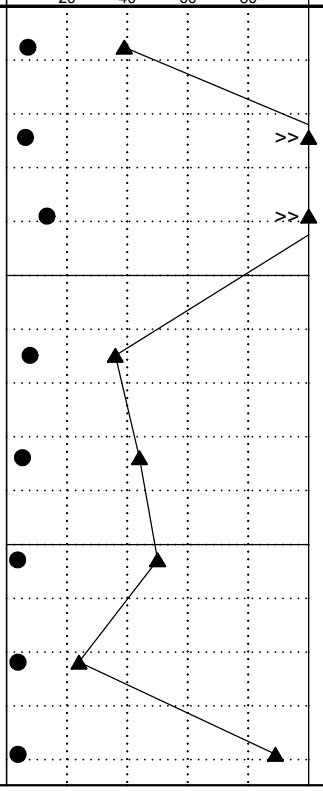
JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-4 **COMPLETED** 24-4-4
GROUND ELEVATION 341.596 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR Arrow
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY MC **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
341	1		**TOPSOIL** 200mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.2	SS 1	5-15-24-26 (39)	33	ND		
					SS 2	19-18-50/0.13	30	ND		
340	2		**SAND AND GRAVEL** trace silt, brown, moist, compact to very dense no odour, no staining		SS 3	50/0.08	3	ND		
339	3				SS 4	30-18-18-15 (36)	33	ND		
					SS 5	10-21-23-26 (44)	33	ND		
338	4				SS 6	21-29-21-23 (50)	28	ND		
337	5				SS 7	14-13-11-22 (24)	38	ND		
336				5.8	SS 8	40-39-50 (89)	43	ND		

End of Borehole at 5.79 mbgs Due to Auger Refusal

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80



BORING NUMBER BH 8 (MW)

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-5 **COMPLETED** 24-4-5
GROUND ELEVATION 341.207 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR 3D Drilling
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY SJ **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	SPT N VALUE / PL MC LL / FINES CONTENT (%)	WELL CONSTRUCTION
341			**TOPSOIL** 300mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	1-2-4-17 (6)	36	ND			
	1		**FILL** silty sand trace gravel, trace organic inclusions; brown, moist no odour, no staining	0.8	SS 2	16-15-21-17 (36)	25	ND			
340					SS 3	18-30-32-43 (62)	33	ND			
	2		**SAND AND GRAVEL** medium to coarse grained, brown, moist, compact to very dense no odour, no staining		SS 4	10-23-39-32 (62)	23	ND			
339											
	3				SS 5	15-33-44-50 (77)	36	ND			
338											
	4				SS 6	50/0.01					
337				4.4							

End of Borehole at 4.42 mbgs Due to Auger Refusal

BORING NUMBER BH 9 (MW)

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-4 **COMPLETED** 24-4-4
GROUND ELEVATION 335.795 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR Arrow
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY MC **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING 5.98 m / Elev 329.82 m

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	SPT N VALUE / PL MC LL / FINES CONTENT (%)	WELL CONSTRUCTION
335	1		**TOPSOIL** 300mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	1-1-2-3 (3)	25	ND			
			FILL silty sand trace gravel; brown, moist no odour, no staining	0.9	SS 2	13-30-37-38 (67)	41	ND			
334	2		**SAND AND GRAVEL** medium to coarse grained, brown, moist to wet, very dense no odour, no staining		SS 3	20-34-48-50/0.08	36	ND			
					SS 4	34-50/0.08	25	ND			
333	3				SS 5	26-29-31-37 (60)	38	ND			
332	4				SS 6	15-36-37-46 (73)	38	ND			
331	5				SS 7	32-50-50/0.13	30	ND			
330	6				SS 8	20-27-32-37 (59)	38	ND			
329	7				SS 9	13-12-23-16 (35)	50	ND			
328	8										
327				9.0	SS 10	5-13-16-10 (29)	35	ND			

End of Borehole at 8.99 mbgs

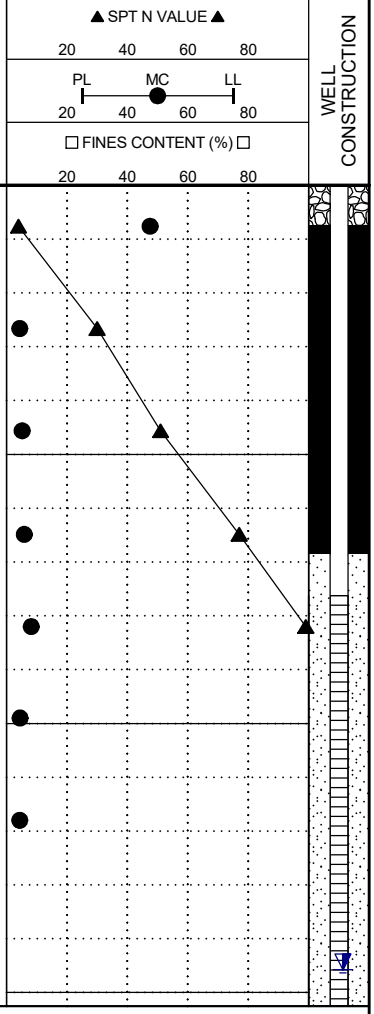
BORING NUMBER BH10 (MW)

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-5 **COMPLETED** 24-4-5
GROUND ELEVATION 335.437 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR 3D Drilling
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY SJ **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING 5.83 m / Elev 329.61 m

ELEV. (m)	DEPTH (m)	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS
335	0	**TOPSOIL** 400mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.4	SS 1	1-2-2-3 (4)	51	ND	
	1	**FILL** silty sand trace gravel; brown, moist no odour, no staining	0.8	SS 2	29-12-18-22 (30)	51	ND	
334	2	**SAND AND GRAVEL** medium to coarse grained, some silt, brown, moist to wet, very dense no odour, no staining		SS 3	15-26-25-50 (51)	41	ND	
333	3			SS 4	17-30-47-43 (77)	41	ND	
332	4			SS 5	27-49-50 (99)	25	ND	
331	5			SS 6	49-50	25	ND	
330	6		6.1	SS 7	50	20	ND	

End of Borehole at 6.10 mbgs Due to Auger Refusal



BORING NUMBER BH11 (MW)

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-5 **COMPLETED** 24-4-5
GROUND ELEVATION 336.406 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR 3D Drilling
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY SJ **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING 6.81 m / Elev 329.60 m

ELEV. (m)	DEPTH (m)	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS
336		**TOPSOIL** 300mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	6-12-23-27 (35)	41	ND	
	1	**FILL** sand and gravel, trace silt; brown, moist no odour, no staining	0.8	SS 2	45-33-23-43 (56)	36	ND	
335	2	**SAND AND GRAVEL** medium to coarse grained, some silt, brown, moist to wet, very dense no odour, no staining		SS 3	34-32-32-22 (64)	53	ND	
334	3			SS 4	14-30-23-19 (53)	36	ND	
333	4			SS 5	16-42-19-33 (61)	48	ND	
332	5			SS 6	18-22-41-49 (63)	46	ND	
331	6			SS 7	11-33-27-28 (60)	43	ND	
330	7							
329		sand seams at 7.2mbgs wet	7.6	SS 8	20-17-18-14 (35)	43	ND	
		End of Borehole at 7.62 mbgs						

SPT N VALUE
20 40 60 80
PL MC LL
20 40 60 80
FINES CONTENT (%)
20 40 60 80

WELL CONSTRUCTION

BORING NUMBER BH12

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-5 **COMPLETED** 24-4-5
GROUND ELEVATION 340.741 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR 3D Drilling
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY SJ **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	SPT N VALUE / FINES CONTENT (%)	WELL CONSTRUCTION
340	1		**TOPSOIL** 225mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.2	SS 1	1-4-7-7 (11)	43	ND			
			FILL sand and gravel, trace silt; brown, moist no odour, no staining	0.8	SS 2	10-26-12-14 (38)	33	ND			
339	2		**SAND AND GRAVEL** some silt, brown, moist to wet, dense no odour, no staining		SS 3	17-22-20-17 (42)	28	ND			
				2.4	SS 4	16-23-17-36 (40)	25	ND			
338	3		**SILT TILL** silt, trace gravel, brown, wet, no odour, no staining		SS 5	25-29-31-45 (60)	33	ND			
337	4		**SAND AND GRAVEL** medium to coarse grained, some silt, brown, wet, dense no odour, no staining	3.8	SS 6	11-25-46-20 (71)	43	ND			
336	5				SS 7	17-31-34-46/-0.17	33	ND			
			End of Borehole at 5.33 mbgs	5.3	SS 8	50/0.00					

BORING NUMBER BH13

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CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-5 **COMPLETED** 24-4-5
GROUND ELEVATION 333.883 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR 3D Drilling
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY SJ **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
333	1		**TOPSOIL** 200mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.2	SS 1	1-8-7-3 (15)	25	ND		
			FILL silt sand, trace gravel, scattered organics; brown, moist no odour, no staining	0.9	SS 2	8-15-19-23 (34)	25	ND		
332	2		**SAND AND GRAVEL** medium to coarse grained, some silt, brown, moist, dense to very dense no odour, no staining		SS 3	16-31-27-30 (58)	33	ND		
					SS 4	31-49-50 (99)	15	ND		
331	3				SS 5	38-35-50 (85)	28	ND		
330	4		cobbles and boulders at about 4.0mbgs							
329	5				SS 6	16-17-16-16 (33)	43	ND		
328	6		wet at 4.6mbgs	6.7	SS 7	4-4-4-11 (8)	43	ND		

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

End of Borehole at 6.71 mbgs

BORING NUMBER BH14

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-5 **COMPLETED** 24-4-5
GROUND ELEVATION 333.491 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR 3D Drilling
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY SJ **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING ---

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
333			**TOPSOIL** 300mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	1-1-2-5 (3)	15	ND		
	1		**FILL** silt sand, trace gravel; brown, moist no odour, no staining	0.8	SS 2	14-26-41-49 (67)	43	ND		
332					SS 3	50		ND		
	2		**SAND AND GRAVEL** medium to coarse grained, some silt, scattered cobbles; brown, moist, compact to very dense no odour, no staining							
331					SS 4	29-22-33-34 (55)	41	ND		
	3		cobbles and boulder at about 3.2mbgs		SS 5	18-50	13	ND		
330										
	4				SS 6	15-19-16-12 (35)	41	ND		
329										
	5				SS 7	2-4-14-15 (18)	41	ND		
328										
	6			6.1						
327			**SILT TILL** some sand, trace gravel; grey, wet, loose to very dense no odour, no staining		SS 8	1-2-3-3 (5)	25	ND		
	7									
326				7.6	SS 9	16-33-36-39 (69)	61	ND		

▲ SPT N VALUE ▲
20 40 60 80
PL MC LL
20 40 60 80
☐ FINES CONTENT (%) ☐
20 40 60 80

End of Borehole at 7.62 mbgs

BORING NUMBER BH15 (MW)

JLP
Geotechnical & Environmental Consultants

CLIENT John Farley and Home Opportunities
PROJECT NAME Proposed Residential Development
PROJECT NUMBER G4836-24-3
PROJECT LOCATION 280 Clair Road West, Guelph, ON
DATE STARTED 24-4-5 **COMPLETED** 24-4-5
GROUND ELEVATION 333.209 m Geodetic **HOLE SIZE** 150mm
DRILLING CONTRACTOR 3D Drilling
GROUND WATER LEVELS:
DRILLING METHOD CME-45 Truck
AT TIME OF DRILLING ---
LOGGED BY SJ **CHECKED BY** AL
AT END OF DRILLING ---
NOTES
AFTER DRILLING 3.65 m / Elev 329.56 m

ELEV. (m)	DEPTH (m)	GRAPHIC LOG	MATERIAL DESCRIPTION	DEPTH (m)	SAMPLE TYPE NUMBER	BLOW COUNTS (N VALUE)	RECOVERY %	HEADSPACE VAPOUR	ANALYSIS	WELL CONSTRUCTION
333			**TOPSOIL** 200mm of silty sand, some gravel, scattered organic inclusions, dark brown, moist no odour, no staining	0.3	SS 1	1-4-6-12 (10)	15	ND		
	1		**FILL** sand and gravel, trace silt; brown, moist no odour, no staining	0.8	SS 2	20-14-28-27 (42)	18	ND		
332			**SAND AND GRAVEL** medium to coarse grained, some silt, brown, moist, dense to very dense no odour, no staining		SS 3	44-50	15	ND		
	2				SS 4	25-31-25-27 (56)	48	ND		
331					SS 5	36-37-39-27 (76)	48	ND		
	3									
330			wet at 3.8 mbgs		SS 6	7-15-11-13 (26)	30	ND		
	4				SS 7	14-14-21-26 (35)	20	ND		
329										
	5									
328										
	6									
327			sand seams at 6.10mbgs	6.7	SS 8	1-1-1-2 (2)		ND		

▲ SPT N VALUE ▲ (20 40 60 80)
PL MC LL (20 40 60 80)
☐ FINES CONTENT (%) ☐ (20 40 60 80)

End of Borehole at 6.71 mbgs

Enclosure 17: Abbreviations and Terms used in Borehole Logs

Abbreviations and Terms used in Borehole & Test Pit Logs

Material description:

Unified Soil Classification System (USCS)							
Grain diameter in mm							
<0.002	0.002-0.075	0.075-0.42	0.42-2.00	2.00-4.75	4.75-19.00	19.00-75.00	75 <
Clay	Silt	Fine	Medium	Coarse	Fine	Coarse	
Silt & Sand		Sand			Gravel		Cobbles

Penetration Resistance:

Standard penetration test (SPT), N: is defined as the number of blows from a freefalling hammer weighing 140 lb [63.5 kg] dropped 30 in. [750 mm], required to drive a standard 2'' [50 mm] external diameter split-spoon sampler over the depth of 12" [150 mm].

Dynamic cone penetration test (DCPT), N_d: is defined as the number of blows from a freefalling hammer weighing 140 lb [63.5 kg] dropped 30 in. [750 mm], required to continuously drive a 2'' [50 mm] external diameter, 60° conical steel point attached to an 'A' size drill rod, over the depth of 12" [150 mm].

Soil Description:

Cohesionless soils	
Relative density	**N value**
Very Loose	0 – 4
Loose	4 – 10
Compact	10 – 30
Dense	30 – 50
Very Dense	> 50

Cohesive soils		
Consistency	**N value**	**Undrained shear strength (kPa)**
Very Soft	0 – 2	0 – 12
Soft	2 – 4	12 – 25
Firm	4 – 8	25 – 50
Stiff	8 – 15	50 – 100
Very Stiff	15 – 30	100 – 200
Hard	> 30	> 200

Sample types:

Abbreviation	Description
AS	Auger sample
RC	Rock core
TW	Thin-walled open
SS	Split spoon sample

Coarse Grain Soil Description:

Terminology	Proportion
Trace	Less than 10%
Some	10 – 20 %
Adjective (e.g. sandy or silty)	20 – 35%
And (e.g. sand and gravel)	35 – 50%

Field Moisture descriptions:

Dry: Used to describe a soil sample that has an absence of moisture and is dry to the touch, indicating a moisture content well below the optimum ($w < w_{opt}$).

Moist: Used to describe a soil sample that is moist to the touch, indicating a moisture content close to the optimum ($w \approx w_{opt}$).

Wet: Used to describe a soil sample that is wet to the touch, indicating a moisture content that is well above the optimum ($w > w_{opt}$).

Geodetic Elevation or Temporary Benchmark (TBM):

Geodetic Elevation: The ground surface elevations were obtained using a Sokkia GcX3 global position system referenced to the coordinate system known as NAD83(CSRS), which is the North American Datum of 1983 of the Canadian Spatial Reference System, and the Universal Transverse Mercator (UTM) Zone 17.

Temporary Benchmark: A fixed point with a known elevation is chosen on site and marked.

Headspace vapour:

Headspace vapour was measured using an RKI Eagle II.

Enclosures 18 to 22: Grain Size Distribution Curves

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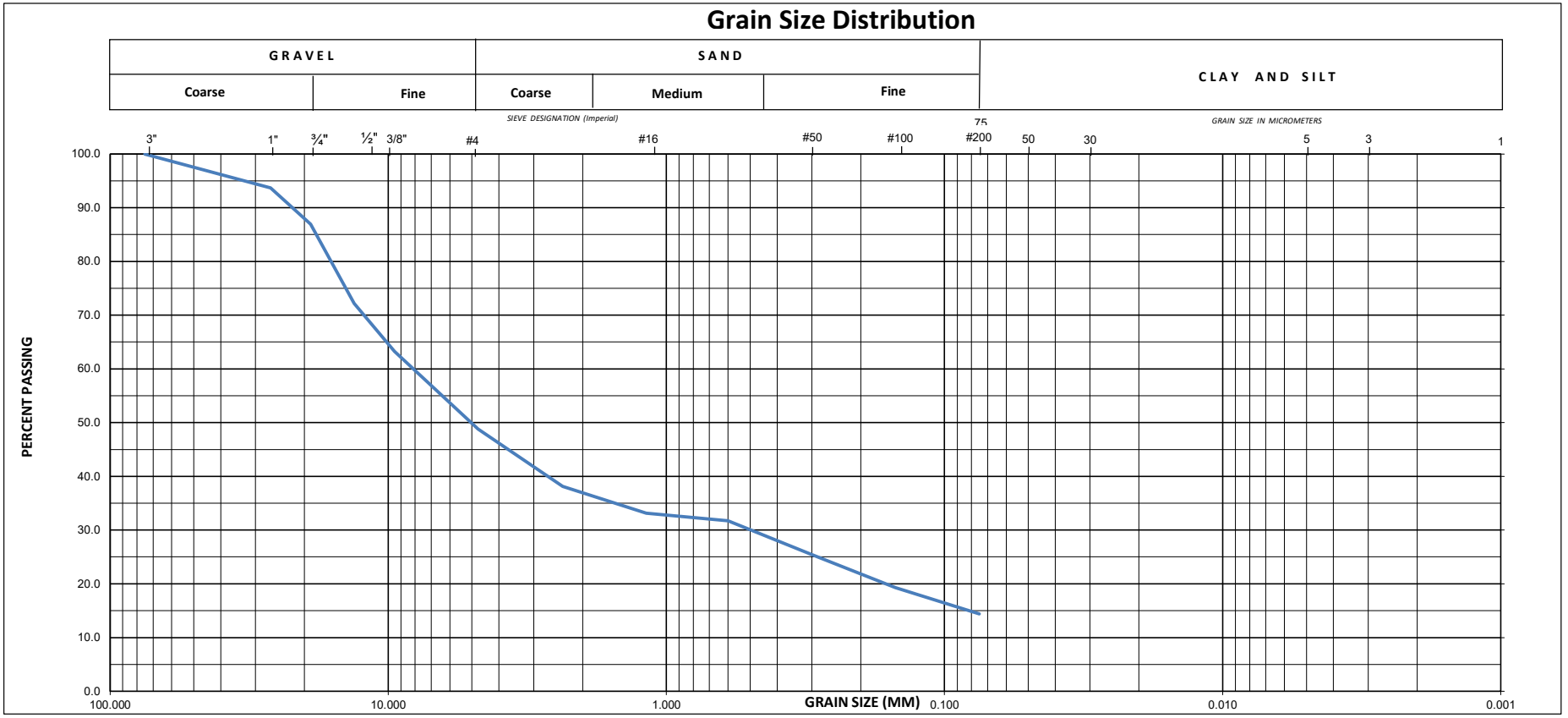
Grain Size Distribution



Classification of Sample and Group Symbol: SAND and GRAVEL, some silt (GW)

Project No:	G4836-24-3		
Location:	280 Clair Road West, Guelph, ON		
Borehole No:	2		
Sample No:	3		
Depth (m):	1.5	-	2.1
Elevation (m):	340.0	-	339.4

D10 =	#N/A
D30 =	0.52
D60 =	8.44
Coefficient of Uniformity:	#N/A
Coefficient of Curvature:	#N/A

PLASTIC PROPERTIES		
Liquid Limit	% =	NP
Plastic Limit	% =	NP
Plasticity Index	% =	NP
Moisture Content	% =	3.1
Enclosure Number:		18

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Grain Size Distribution

Classification of Sample and Group Symbol: SAND and GRAVEL, some silt (GW)

Project No:	G4836-24-3		
Location:	280 Clair Road West, Guelph, ON		
Borehole No:	8		
Sample No:	5		
Depth (m):	3.0	-	3.7
Elevation (m):	338.2	-	337.5

D10 =	#N/A
D30 =	0.57
D60 =	8.92
Coefficient of Uniformity:	#N/A
Coefficient of Curvature:	#N/A

PLASTIC PROPERTIES		
Liquid Limit	% =	NP
Plastic Limit	% =	NP
Plasticity Index	% =	NP
Moisture Content	% =	2.7
Enclosure Number:		19

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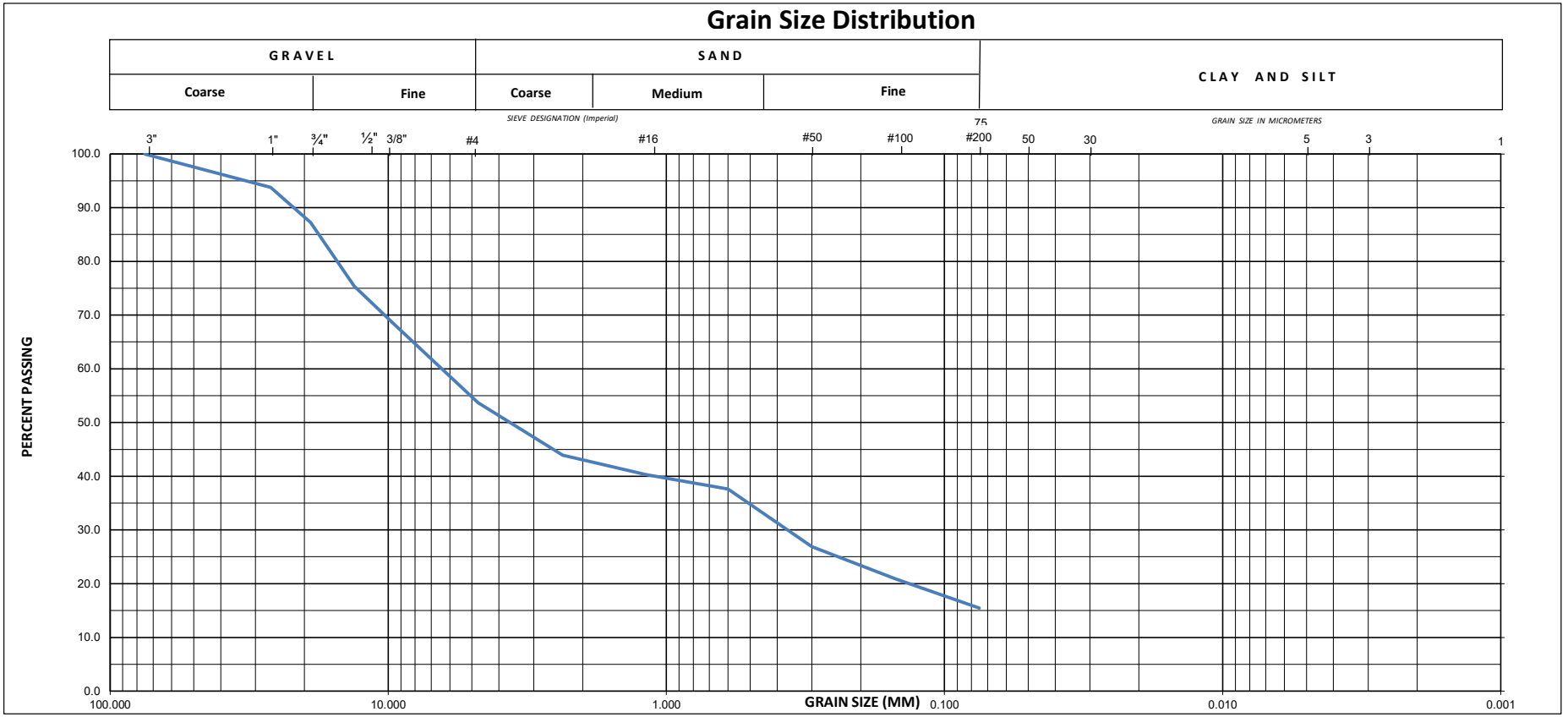
Grain Size Distribution



Classification of Sample and Group Symbol: SAND and GRAVEL, some silt (GW)

Project No:	G4836-24-3		
Location:	280 Clair Road West, Guelph, ON		
Borehole No:	11		
Sample No:	2		
Depth (m):	0.8	-	1.4
Elevation (m):	335.6	-	335.0

D10 =	#N/A
D30 =	0.39
D60 =	6.80
Coefficient of Uniformity:	#N/A
Coefficient of Curvature:	#N/A

PLASTIC PROPERTIES		
Liquid Limit	% =	NP
Plastic Limit	% =	NP
Plasticity Index	% =	NP
Moisture Content	% =	3.7
Enclosure Number:		20

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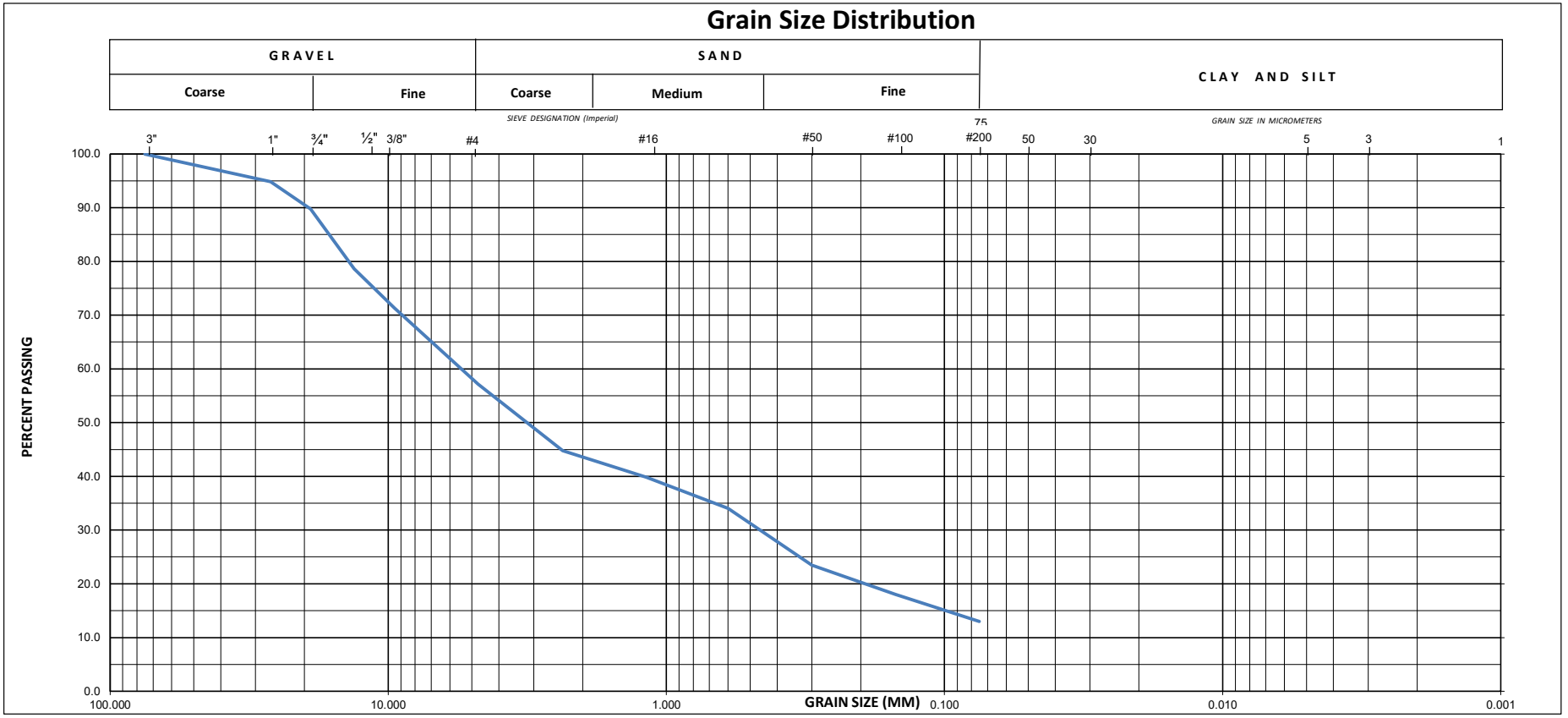
Grain Size Distribution



Classification of Sample and Group Symbol: SAND and GRAVEL, some silt (GW)

Project No:	G4836-24-3		
Location:	280 Clair Road West, Guelph, ON		
Borehole No:	11		
Sample No:	6		
Depth (m):	4.7 - 5.3		
Elevation (m):	331.7 - 331.1		

D10 =	#N/A
D30 =	0.49
D60 =	5.71
Coefficient of Uniformity:	#N/A
Coefficient of Curvature:	#N/A

PLASTIC PROPERTIES		
Liquid Limit	% =	NP
Plastic Limit	% =	NP
Plasticity Index	% =	NP
Moisture Content	% =	2.7
Enclosure Number:		21

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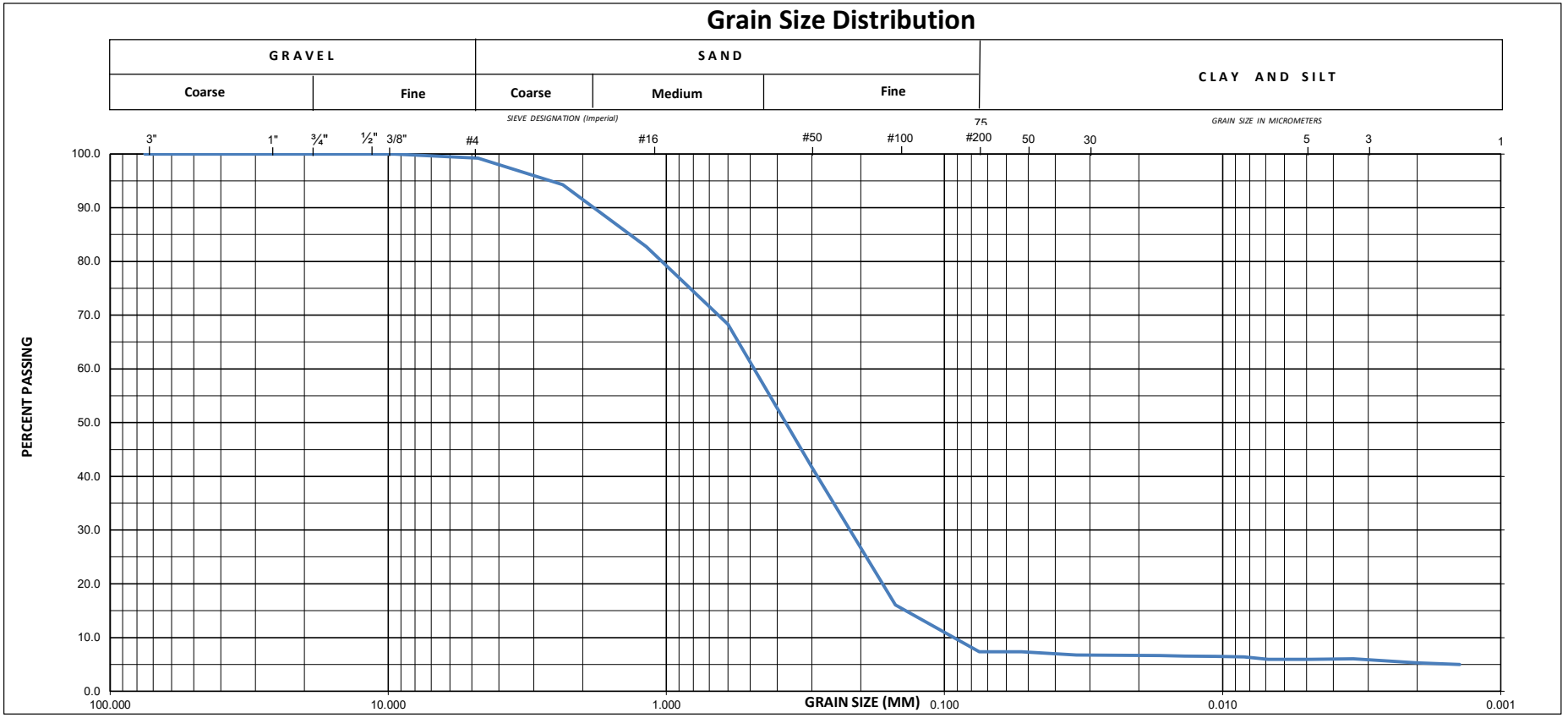
Grain Size Distribution



Classification of Sample and Group Symbol: SAND, trace clay, trace silt, trace gravel (SP)

Project No:	G4836-24-3		
Location:	280 Clair Road West, Guelph, ON		
Borehole No:	15		
Sample No:	8		
Depth (m):	6.1	-	6.7
Elevation (m):	327.1	-	326.5

D10 =	0.10
D30 =	0.23
D60 =	0.51
Coefficient of Uniformity:	5.18
Coefficient of Curvature:	4.68

PLASTIC PROPERTIES		
Liquid Limit	% =	NP
Plastic Limit	% =	NP
Plasticity Index	% =	NP
Moisture Content	% =	17.9
Enclosure Number:		22

Appendix A – Limitations and Use of Report

TERMS AND CONDITIONS

NOTICE: THE FOLLOWING PROVISIONS SET FORTH IMPORTANT QUALIFICATIONS AND LIMITATIONS ON THE FINDINGS AND RECOMMENDATIONS IN THE REPORT AS WELL AS THE USE OF, AND RELIANCE ON, THE REPORT.

1. **DEFINITIONS**. The following capitalized terms have the following meanings:

(a) "**Additional Investigations**" means investigations that JLP has indicated to the Client should be undertaken to take into account any Out-of-Scope Requirements, but that are not otherwise specifically within the scope of investigations conducted for the purpose of the Report.

(b) "**Applicable Laws**" means and includes without limitation all applicable provincial laws, regulations, guidelines, policies, standards, protocols, and objectives administered by the Ministry of the Environment and Climate Change or any other duly-constituted governmental authority, all as in force as of the date of the Report.

(c) "**Client**" means the Client as referred to in the Report.

(d) "**Client Information**" means the information, representations, and instructions provided by the Client, the Client's representatives, and/or others and upon which the Report is based, in whole or in part.

(e) "**Findings**" means the evaluations and conclusions set forth in the Report.

(f) "**JLP**" means JLP Services Inc.

(g) "**Out-of-Scope Requirements**" means special concerns or requirements of the Client in respect of the subject matter of the Report.

(h) "**Recommendations**" mean the findings and recommendations referred to in the Report, taking into account any Out-of-Scope Requirements that were disclosed to JLP prior to the date of the Report.

(i) "**Report**" means the report to which these Terms and Conditions are attached and form part.

(j) "**Report Documents**" means the underlying documents, records, data, and files, in any medium whatsoever, generated in connection with the preparation of the Report, including without limitation, the instructions and objectives communicated to JLP by the Client, communications between JLP and the Client, and other reports, proposals, or documents prepared by JLP for the Client in connection with the Site.

(k) "**Site**" means the site in respect of which the Report was prepared.

(l) "**Site Conditions**" means Site conditions known as a result of, or reasonably imputed by, the investigations that were undertaken as of the date of the Report.

2. **BASIS OF REPORT**. The Report is based on the Site Conditions. Any changes to the Site Conditions after the date of the Report that could or will affect the Site Conditions may or will have a corresponding effect on the Recommendations. The Report does not take into account any (a) Additional Investigations that were not undertaken, or (b) Out-of-Scope Requirements that were not communicated prior to completion of the investigations that were been undertaken as of the date of the Report. Where recommended field services are referred to, they are the minimum services necessary to determine compliance of construction with Applicable Laws, generally accepted industry-standard practices, and the Recommendations.

3. **RELIANCE & USE**. The Report has been prepared only for the Site and the related design, development, building, or building assessment objectives identified by the Client. The Findings and Recommendations are based on the Site Conditions and the Client Information. In preparing the Report, JLP has relied upon the Client Information and disclaims any responsibility for any inaccuracy, misstatement, omission, unintentional misrepresentation, or other deficiency contained in the Report as a result of such reliance. Unless specifically stated otherwise, the applicability and reliability of the Findings and the Recommendations expressed in the Report are only valid to the extent that (a) there has been no material change to or variation from any of the Client Information, (b) the Client Information contains no untrue statement of a material fact, or (c) the Client Information omits no statement of a material fact necessary in order to make the Client Information not misleading.

   The Report and the Findings and Recommendations are for the sole benefit of the Client. No other party may use or rely upon the Report in whole or in part without the prior written consent of JLP, which may be arbitrarily withheld or conditioned.

   RELIANCE UPON THE REPORT OR ANY OF THE DETERMINATIONS MADE HEREIN BY A THIRD PARTY WITHOUT JLP'S CONSENT IS PROHIBITED AND JLP MAKES NO REPRESENTATION, GUARANTEE, OR WARRANTY IN FAVOUR OF ANY THIRD PARTY WITH RESPECT TO THE REPORT WHATSOEVER. JLP FULLY DISCLAIMS, AND WILL HAVE NO LIABILITY FOR, ANY LOSS, DAMAGES, OR EXPENSES WHICH ANY THIRD PARTY MAY INCUR OR SUFFER AS A RESULT OF THE USE OF OR RELIANCE ON THIE REPORT WHERE JLP HAS NOT EXPRESSLY AUTHORIZED SAME. ANY THIRD PARTY WHO RELIES ON THE REPORT TO ANY EXTENT DOES SO AT SUCH PARTY'S OWN RISK AND COMPLETELY WAIVES ANY AND ALL CLAIMS AGAINST JLP IN CONNECTION WITH THE REPORT, REGARDLESS OF THE THEORY OF LAW (WHETHER IN CONTRACT, TORT, OR ANY THEORY OF LAW COMING INTO EXISTENCE HEREAFTER).

4. **STANDARD OF CARE**. The Report has been prepared in a manner consistent with the degree of care and skill exercised by engineering consultants currently practicing under similar circumstances. No other warranty, expressed or implied, is made or intended in the Report. It is intended that the Findings and Recommendations are meant to assist in reducing the Client's risk associated with environmental impairment at the Site. The Report should not be considered risk mitigation.

5. **ENTIRE REPORT**. The Report also includes the Report Documents. In order to properly understand the Findings and Recommendations, reference must be made to the Report in its entirety. JLP is not responsible for use by any party of a part of the Report only.

6. **GOVERNING FORMAT**. Notwithstanding that JLP may have submitted an electronic version of the Report or any document forming part of the Report, only the signed and sealed physical copy of the Report shall be deemed to be the original and in the event of any dispute or discrepancy, the physical copy shall govern. JLP makes no representation about the compatibility of its electronic or digital file format with the Client's current or future software and/or hardware systems. The documents described herein are JLP's instruments of professional service and shall not be altered without the written consent of JLP.

7. **GENERAL LIMITATIONS**.

   (a) Unless specifically stated otherwise, the Report does not contain environmental consulting advice.

   (b) The Report contains no opinion or determination as to any matters governed by laws other than the laws of the Province of Ontario and the federal laws of Canada applicable therein as of the date hereof.

   (c) During any future development of the Site, conditions not observed during JLP's investigations may become apparent. If this occurs, JLP should be contacted to assess the situation and whether there is a need for additional testing.