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A REPORT TO
13750701 CANADA INC.

A GEOTECHNICAL INVESTIGATION FOR PROPOSED RESIDENTIAL SUBDIVISION

4646 COUNTY ROAD 2

MUNICIPALITY OF PORT HOPE

REFERENCE NO. 2402-S021

JULY 2024
(REVISION OF REPORT DATED APRIL 2024)

DISTRIBUTION

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ENCLOSURES

1.0 INTRODUCTION

In accordance with the authorization dated February 1, 2024, from Mr. Prasad Ari of 13750701 Canada Inc., a geotechnical investigation was carried out at 4646 County Road 2, in the Municipality of Port Hope.

The purpose of this investigation was to reveal the subsurface conditions and determine the engineering properties of the disclosed soils for the design and construction of a proposed Residential Subdivision. The geotechnical findings and resulting recommendations are presented in this Report.

2.0 SITE AND PROJECT DESCRIPTION

The Municipality of Port Hope is situated on Iroquois Lake plain, where drift has been partly eroded by the water action of the glacial lake and filled with reworked tills.

The site is located at the southeast corner of Dale Road and County Road 2, approximately 900 m north of Highway 401. It is currently a farm field with one dwelling and associated driveway at the northwest corner of the site. The existing site gradient descends slightly to the west.

Based on the Conceptual Plan prepared by Candevcon Limited, dated July 14, 2023, the existing dwelling will remain and the balance of the site will be developed into a residential subdivision with an access roadway and municipal services.

3.0 FIELD WORK

The field work, consisting of five (5) sampled boreholes extending to a depth of 6.6 m, was performed on February 28, 2024. Upon the completion of borehole drilling and sampling, a monitoring well was installed in each of the five (5) boreholes to facilitate groundwater monitoring and hydrogeological study. Details of the monitoring wells are included in the corresponding borehole logs. The locations of the boreholes and monitoring wells are shown on Drawing No. 1.

The boreholes were advanced at intervals to the sampling depths by a track-mounted machine using solid stem augers equipped with split spoon sampler for soil sampling. Standard Penetration Tests, using the procedures described on the enclosed “List of Abbreviations and Terms,” were performed at the sampling depths. The test results are recorded as the Standard Penetration Resistance (or ‘N’ values) of the subsoil. The relative density of the non-cohesive strata and the consistency of the cohesive strata are inferred from the ‘N’ values. Split-spoon samples were recovered for soil classification and laboratory testing. The fieldwork was supervised and the findings were recorded by a Geotechnical Technician.

The ground elevation at each borehole location was determined using a hand-held Global Navigation Satellite System (GNSS) equipment.

4.0 SUBSURFACE CONDITIONS

The investigation revealed that beneath topsoil, the site is underlain by a native stratum of silty sand till. Detailed descriptions of the encountered subsoils are presented on the Borehole Logs, comprising Figures 1 to 5, inclusive. The revealed stratigraphy is plotted on the Subsurface Profile, Drawing No. 2. The engineering properties of the disclosed soils are discussed herein.

4.1 Topsoil

The ground surface is covered by a topsoil veneer, approximately 25 to 36 cm in thickness. Thicker topsoil may occur in low lying areas beyond the borehole locations.

4.2 Silty Sand Till

The silty sand till was encountered beneath the topsoil veneer and extended to the termination depth in all boreholes. It consists of a random mixture of soil particle sizes ranging from clay to gravel, with the sand and silt being the predominant fraction. Grain size analyses were performed on three selected samples of the silty sand till; the results are plotted on Figure 6.

The obtained ‘N’ value is 10 to over 50, with a medium of 24 blows per 30 cm of penetration, showing that the relative density of the till is generally compact. The natural water content values range from 7% to 13%, with a median of 10%, indicating that the till is in a moist condition. The low ‘N’ values and high moisture contents were generally contacted near ground surface, indicating that the surface soil may have been weakened by weathering or disturbed during farming activities.

The engineering properties of the silty sand till are presented below:

- High frost susceptibility and low water erodibility.
- The till will be relatively stable in steep excavation; however, prolonged exposure may lead weathering of the sand and silt layers within the till, which may cause localized sloughing.

4.3 Compaction Characteristics of the Revealed Soils

The obtainable degree of compaction is primarily dependent on the soil moisture and, to a lesser extent, on the type of compactor used and the effort applied. As a general guide, the typical water content values of the revealed soils for Standard Proctor compaction are presented in Table 1.

Table 1 - Estimated Water Content for Compaction

Soil Type	**Determined Natural Water Content (%)**	**Water Content (%) for Standard Proctor Compaction**	
		100% (optimum)	**Range for 95% or +**
Silty Sand Till	7 to 13 (median 10)	10 to 11	6 to 16

The above values show that the on-site inorganic soils are mostly suitable for structural compaction, except the weathered soils with relatively high water content.

5.0 GROUNDWATER CONDITION

Groundwater level was recorded all boreholes on completion. The data are plotted on the Borehole Logs and summarized in Table 2.

Table 2 - Groundwater Level on completion

Borehole No.	**Borehole Depth (m)**	**Ground Elevation (m)**	**Measured Groundwater Level On Completion**	
			Depth (m)	**Elevation (m)**
1	6.6	138.1	6.1	132.0
2	6.6	140.7	4.6	136.1
3	6.6	140.0	4.3	135.7
4	6.6	140.1	2.7	137.4
5	6.6	140.3	2.1	138.2

Seepages from the sand layers were encountered in Borehole 8 at 2.3 m and 4.6 m below the prevailing ground surface.

Groundwater level was recorded in the monitoring wells on March 7 and 28, 2024. These records are summarized in Table 3.

Table 3 - Groundwater Level in Monitoring Wells

Monitoring Well/ Borehole No.	Ground Elevation (m)	Well Depth (m)	Measured Groundwater Level			
			March 7, 2024		March 28, 2023	
			Depth (m)	El. (m)	Depth (m)	El. (m)
1	138.1	6.2	1.0	137.1	0.7	137.4
2	140.7	6.1	0.4	140.3	0.3	140.4
3	140.0	6.1	0.3	139.7	0.2	139.8
4	140.1	6.1	0.7	139.4	0.6	139.5
5	140.3	6.2	0.8	139.5	0.6	139.7

Groundwater was recorded in the monitoring wells at depths ranging from 0.2 to 1.0 m, or between El. 137.1 m and El. 140.4 m. Detailed groundwater condition of the site will be discussed in the hydrogeological report, under separate cover.

6.0 DISCUSSION AND RECOMMENDATIONS

The investigation revealed that beneath topsoil, the site is underlain by a native stratum of silty sand till.

Groundwater was recorded in the monitoring wells on March 7th and 28th, 2024, at depths ranging from 0.2 to 1.0 m, or between El. 137.1 m and El. 140.4 m.

It is understood that the existing dwelling will remain and the balance of the site will be developed into a residential subdivision with an access roadway and municipal services.

The geotechnical findings which warrant special consideration are presented below:

1. Prior to site grading, the vegetation and topsoil must be removed and can only be reused in landscaped areas of the subdivision. Any surplus must be removed off site.
2. The badly weathered soils should be subexcavated, inspected, sorted free of organics and other deleterious material before reusing for structural backfill or engineered fill applications.

3. Any the existing structures within the future development limits will have to be demolished. The debris and any underground utilities must be removed and disposed off-site. The cavities must be backfilled with selected on-site material, free of organics, compacted to engineered fill specifications.
4. Where site grading with additional fill is required, the imported fill can be constructed in accordance with the engineered fill specifications for supporting the house footings, underground services and pavement construction. The final site grading plan needs to be reviewed by a geotechnical engineer to confirm the soil bearings.
5. The proposed structures can be supported on conventional footing founded on engineered fill or sound native soil below the frost penetration depth. The footing subgrade must be inspected by the geotechnical engineer or a senior geotechnical technician to ensure that the revealed conditions are compatible with the foundation design requirements.

The recommendations appropriate for the project described in Section 2.0 are presented herein. One must be aware that the subsurface conditions may vary between boreholes. Should this become apparent during construction, a geotechnical engineer must be consulted to determine whether the following recommendations require revision.

6.1 Site Preparation

The topsoil must be removed for site development. The topsoil may be re-used for landscaping in designated areas only. Any surplus should be also removed off site. Any earth fill should also be excavated, sorted free of organic or deleterious material, and compacted in layers.

After the demolition of the existing structures and disposal of debris within the future development limits, the cavities should be backfilled with selected organic-free material for development. Any existing buried structures should be removed, if any, prior to project construction. The cavity must be properly backfilled. The backfill material should be compacted to at least 98% Standard Proctor Dry Density (SPDD) in lift of 20 cm thick.

Where site grading with additional fill is required, the earth fill can be placed in accordance with the engineered fill specifications for supporting the house footings, underground services and pavement construction. The engineering requirements for a certifiable fill are presented below:

1. After removal of topsoil and weathered soil, the native soil subgrade must be inspected and proof-rolled prior to any fill placement. Any loose material and/or badly weathered

soil identified during proof-rolling must be subexcavated and backfilled with organic free material, compacted to engineered fill specifications.

2. Inorganic soils must be used for the fill, and they must be uniformly compacted in lifts 20 cm thick to 98% or + of their maximum SPDD up to the proposed finished grade. The soil moisture must be properly controlled on near the optimum. If the foundations are to be built soon after the fill placement, the densification process for the engineered fill must be increased to 100% SPDD.
3. If the engineered fill is compacted with the moisture content on the wet side of the optimum, the underground services and pavement construction should not begin until the pore pressure within the fill mantle has completely dissipated. This must be further assessed at the time of the engineered fill construction.
4. If imported fill is to be used, it should be inorganic soils, free of any deleterious material with environmental issue (contamination). Any potential imported earth fill from off-site must be reviewed for geotechnical and environmental quality by the appropriate personnel as authorized by the developer or agency, before it is hauled to the site.
5. The engineered fill must not be placed during the period where freezing ambient temperatures occur either persistently or intermittently. This is to ensure that the fill is free of frozen soils, ice and snow.
6. The fill operation must be supervised on a full-time basis and monitored by a technician under the direction of a geotechnical engineer.
7. The engineered fill envelope and finished elevations must be clearly and accurately defined in the field, and they must be precisely documented.
8. Despite stringent control in the placement of the engineered fill, variations in soil type and density may occur in the engineered fill. Therefore, the foundations must be reinforced and designed by a structural engineer for the project; an abrupt differential settlement of 20 mm should be considered in the design of the foundations.
9. The footing, slab-on-grade and underground services subgrade must be inspected by the geotechnical consulting firm that supervised the engineered fill placement. This is to ensure that the foundations and service pipes are placed within the engineered fill envelope, and the integrity of the fill has not been compromised by interim construction, environmental degradation and/or disturbance by the footing excavation.
10. Any excavation carried out in certified engineered fill must be reported to the geotechnical consultant who supervised the fill placement in order to document the locations of excavation and/or to supervise reinstatement of the excavated areas to engineered fill status. If construction on the engineered fill does not commence within a period of 2 years from the date of certification, the condition of the engineered fill must be assessed for recertification.

6.2 Foundations

The proposed dwellings can be supported on conventional spread and strip footings, founded on engineered fill or competent native soils. The recommended soil bearing pressures for the design of footings are presented below:

- Maximum Soil Bearing Pressure, at Serviceability Limit State (SLS) = 125 kPa
- Factored Ultimate Bearing Pressure, at Ultimate Limit State (ULS) = 200 kPa

The total and differential settlements of the conventional spread and strip footings, designed for the bearing pressure at SLS, are estimated to be 25 mm and 20 mm, respectively.

The foundation subgrade must be inspected by either a geotechnical engineer, or a geotechnical technician under the supervision of a geotechnical engineer, to ensure that the revealed conditions are compatible with the design of the foundation.

It should be noted that if groundwater seepage is encountered during footing excavations, or where the subgrade is found to be wet, the subgrade should be protected by a concrete mud-slab immediately after exposure. This will prevent construction disturbance and costly rectification.

Footings exposed to weathering or in unheated areas should have at least 1.2 m of earth cover for protection against frost action.

The building foundation must meet the requirements specified in the latest Ontario Building Code. As a guide, the structure should be designed to resist an earthquake force using Site Classification 'D' (stiff soil).

6.3 Basement Structures

Where basement structures are proposed, they should be designed for the lateral earth pressure using the soil parameters provided in Table 5.

It is recommended that the basement floor be founded at least 1.0 m above the seasonal high groundwater level. In conventional basement design, perimeter walls of the basement structure should be damp-proofed and provided with perimeter subdrains at the wall base. Backfill of the open excavation should consist of free-draining granular material (Drawing No. 3) unless prefabricated drainage board is installed over the entire wall below grade.

Should the basement floor be founded less than 1.0 m above the groundwater table, underfloor subdrains (Drawing No. 4) should be provided to supplement the perimeter subdrain system to relieve any groundwater upfiltration due to seasonal fluctuation.

If the basement floor is to be founded less than 0.5 m above the groundwater table, the basement structure should be waterproofed and designed for hydrostatic uplift pressure.

The subdrains, connected to a positive outlet, should be encased in a fabric filter to protect them against blockage by silting.

6.4 Slab-On-Grade Construction

The subgrade of the slab-on-grade must consist of sound native soil or well compacted inorganic earth fill or engineered fill. The subgrade should be inspected and assessed by proof-rolling prior to slab-on-grade construction. Where loose or soft subgrade is detected, it should be subexcavated and replaced with inorganic material, compacted to at least 98% SPDD. Any new material should also be compacted to 98% SPDD.

The concrete slab should be constructed on a minimum 15 cm thick granular base, consisting of 19-mm Crusher-Run Limestone (CRL), or equivalent, compacted to its maximum SPDD. Where underfloor weepers are required, the bedding should be increased to 30 cm in thickness. In addition, a vapor barrier should be placed between the granular bedding and the concrete slab to prevent upfiltration of water vapour.

6.5 Underground Services

The subgrade for underground services should consist of sound native soils or properly compacted earth fill. Where soft or loose soil is encountered at the invert level, it must be subexcavated and replaced with properly compacted bedding material.

A Class ‘B’ bedding is recommended for construction of the underground services. The bedding material should consist of compacted 19-mm CRL, or equivalent, compacted to at least 98% SPDD. Where the underground services extend into the saturated level, a Class ‘A’ concrete bedding should be considered for proper pipe support.

The pipe joints connecting into manholes and catch basins should be leak-proof or wrapped with an appropriate waterproof membrane to prevent migration of fines due to leakage, leading to a loss of subgrade support and subsequent pipe collapse.

Openings to subdrains and catch basins should be shielded by a fabric filter to prevent silting. In order to prevent pipe floatation when the service trench is deluged with water derived from precipitation, a soil cover of at least the diameter of the pipe should be in place at all times after completion of the pipe installation.

The service pipes and metal fittings should be protected against corrosion. For estimation of anode weight requirements, the electrical resistivities of the disclosed soils presented in Table 5 in Section 6.8 can be used. The proposed anode weight must meet the minimum requirements as specified by the Municipality of Port Hope.

6.6 Backfilling in Trenches and Excavated Areas

The on-site inorganic soils are suitable for trench backfill. The till should be sorted free of large cobbles and boulders (over 15 cm in size). The backfill material should be compacted to at least 98% SPDD. This is to provide the required stiffness for floor slab or pavement construction. The lift of each backfill layer should be limited to a thickness of 20 cm, or the thickness should be determined by test strips at the time of compaction.

In normal construction practice, the problem areas of pavement settlement largely occur adjacent to foundation walls, columns, manholes, catch basins and services crossings. In areas which are inaccessible to a heavy compactor, sand backfill which can be appropriately compacted using a smaller vibratory compactor, should be used.

One must be aware of possible consequences during trench backfilling and exercise caution as described below:

- To backfill a deep trench, one must be aware that the future settlement is to be expected, unless the sides is flattened to 1 Vertical:2 Horizontal, and the lifts of the fill and its moisture content are stringently controlled; i.e. lifts should be no more than 20 cm (or less if the backfilling conditions dictate) and uniformly compacted to achieve at least 98% SPDD, with the moisture content on the wet side of the optimum.
- It is often difficult to achieve uniform compaction of the backfill in the lower vertical section of a trench which is an open cut or is stabilized by a trench box, particularly in the sector close to the trench walls or the sides of the box. These sectors must be backfilled with sand and the compaction must be carried out diligently, prior to the placement of the backfill above this sector, i.e., in the upper sloped trench section. This measure is necessary in order to prevent consolidation of inadvertent voids and loose backfill which will compromise the compaction of the backfill in the upper section.

- In areas where the underground services construction is carried out during the winter months, prolonged exposure of the trench walls will result in frost heave within the soil mantle of the walls. This may result in some settlement as the frost recedes, and repair costs will be incurred prior to the final surfacing of the new pavement and slab-on-grade construction.
- When construction is carried out in the winter, frozen soil layers may inadvertently be mixed with the structural trench backfill. Should the in-situ soil have a water content on the dry side of the optimum, it would be impossible to wet the soil due to the freezing condition, rendering difficulties in obtaining uniform and proper compaction. Furthermore, the freezing condition will prevent flooding of the backfill when it is required, such as when the trench box is removed. The above will invariably cause backfill settlement that may become evident within several years after construction.
- In areas where groundwater movement is expected in the sand fill mantle, anti-seepage collars should be provided.

6.7 **Pavement Design**

The recommended pavement design for a residential local is provided in Table 4.

Table 4 - Pavement Design

Course	Thickness (mm)	OPS Specifications
Asphalt Surface	40	HL3
Asphalt Binder	50	HL8
Granular Base	150	Granular ‘A’ or equivalent
Granular Sub-base	300	Granular ‘B’ or equivalent

In preparation of the pavement subgrade, all topsoil and compressible material should be removed. The subgrade should be proof-rolled and inspected. Any soft spots identified must be subexcavated and replaced with inorganic earth fill. The subgrade within 1.0 m below the underside of the granular sub-base must be compacted to at least 98% SPDD, with a water content at 2% to 3% drier than the optimum. All the granular bases should be compacted to 100% SPDD.

The pavement subgrade will suffer a strength regression if water is allowed to infiltrate the mantle. The following measures should be incorporated in the construction procedures and pavement design:

- The pavement subgrade should be properly crowned and smooth-rolled to allow interim precipitation to be properly drained.

- Areas adjacent to the road should be properly graded to prevent ponding of large amounts of water. Otherwise, the water will seep into the subgrade mantle and induce a regression of the subgrade strength, with costly consequences for the pavement construction.
- In extreme cases during the wet seasons, if soft or weak subgrade is identified, it can be replaced by compacted granular material to compensate for the inadequate strength of the soft or weak subgrade. This can be assessed during construction.
- Fabric filter-encased curb subdrains are required.

6.8 Soil Parameters

The recommended soil parameters for the project design are given in Table 5.

Table 5 - Soil Parameters

Unit Weight and Bulk Factor	**Unit Weight (kN/m^3)**		**Estimated Bulk Factor**	
	Bulk	**Submerged**	**Loose**	**Compacted**
Silty Sand Till	22.5	12.5	1.33	1.05
Lateral Earth Pressure Coefficients		**Active K_a**	**At Rest K_o**	**Passive K_p**
Silty Sand Till		0.32	0.48	3.12
Estimated Coefficient of Permeability (K) and Percolation Time (T)			**K (cm/sec)**	**T (min/cm)**
Silty Sand Till			10^{-6}	50
Estimated Electrical Resistivity				**(ohm·cm)**
Silty Sand Till				4500
Coefficients of Friction				
Between Concrete and Granular Base				0.50
Between Concrete and Native Soils or Compacted Earth Fill				0.35

6.9 Excavation

Excavation should be carried out in accordance with Ontario Regulation 213/91. The types of soils to be excavated are classified in Table .

Table 6 - Classification of Soils for Excavation

Material	Type
Sound Till	2
Weathered Till	3

In excavation, the groundwater seepage from the till will likely be limited in quantity and can be removed by conventional pumping from sumps. However, excavation extending into the saturated sand and silt seams and layers in the till will require more extensive construction dewatering.

In order to provide a stable subgrade for the services or foundation construction, the groundwater should be depressed to at least 1.0 m below the intended bottom of excavation. Detailed groundwater profile and dewatering needs will be discussed in the hydrogeological report, under separate cover.

7.0 LIMITATIONS OF REPORT

This report was prepared by Soil Engineers Ltd. for the account of 13750701 Canada Inc., and for review by its designated consultants and government agencies. The material in the report reflects the judgement of Yinglin Xiao, B.A.Sc., EIT, and Kelvin Hung, P.Eng., in light of the information available to it at the time of preparation.

Use of this report is subject to the conditions and limitations of the contractual agreement. Any use which a Third Party makes of this report, or any reliance on decisions to be made based on it, is the responsibility of such Third Parties. Soil Engineers Ltd. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

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LIST OF ABBREVIATIONS AND DESCRIPTION OF TERMS

The abbreviations and terms commonly employed on the borehole logs and figures, and in the text of the report, are as follows:

SAMPLE TYPES

AS	Auger sample
CS	Chunk sample
DO	Drive open (split spoon)
DS	Denison type sample
FS	Foil sample
RC	Rock core (with size and percentage recovery)
ST	Slotted tube
TO	Thin-walled, open
TP	Thin-walled, piston
WS	Wash sample

PENETRATION RESISTANCE

Standard Penetration Resistance or 'N' Value:

The number of blows of a 63.5 kg hammer falling from a height of 76 cm required to advance a 51 mm outer diameter drive open sampler 30 cm into undisturbed soil, after an initial penetration of 15 cm.

Plotted as '○'

Dynamic Cone Penetration Resistance:

A continuous profile showing the number of blows per each 30 cm of penetration of a 51 mm diameter, 90° point cone driven by a 63.5 kg hammer falling from a height of 76 cm.

Plotted as '—●—'

WH	Sampler advanced by static weight
PH	Sampler advanced by hydraulic pressure
PM	Sampler advanced by manual pressure
NP	No penetration

SOIL DESCRIPTION

Cohesionless Soils:

'N' (blows/30 cm)	Relative Density
0 to 4	very loose
4 to 10	loose
10 to 30	compact
30 to 50	dense
>50	very dense

Cohesive Soils:

Undrained Shear Strength (kPa)	'N' (blows/30 cm)	Consistency
<12	<2	very soft
12 to <25	2 to <4	soft
25 to <50	4 to <8	firm
50 to <100	8 to <15	stiff
100 to 200	15 to 30	very stiff
>200	>30	hard

Method of Determination of Undrained Shear Strength of Cohesive Soils:

x 0.0	Field vane test in borehole; the number denotes the sensitivity to remoulding
△	Laboratory vane test

METRIC CONVERSION FACTORS

1 ft = 0.3048 m
1 inch = 25.4 mm
1 lb = 0.454 kg
1 ksf = 47.88 kPa

JOB NO.: 2402-S021

LOG OF BOREHOLE: 1

FIGURE NO.: 1

PROJECT DESCRIPTION: Proposed Residential Development

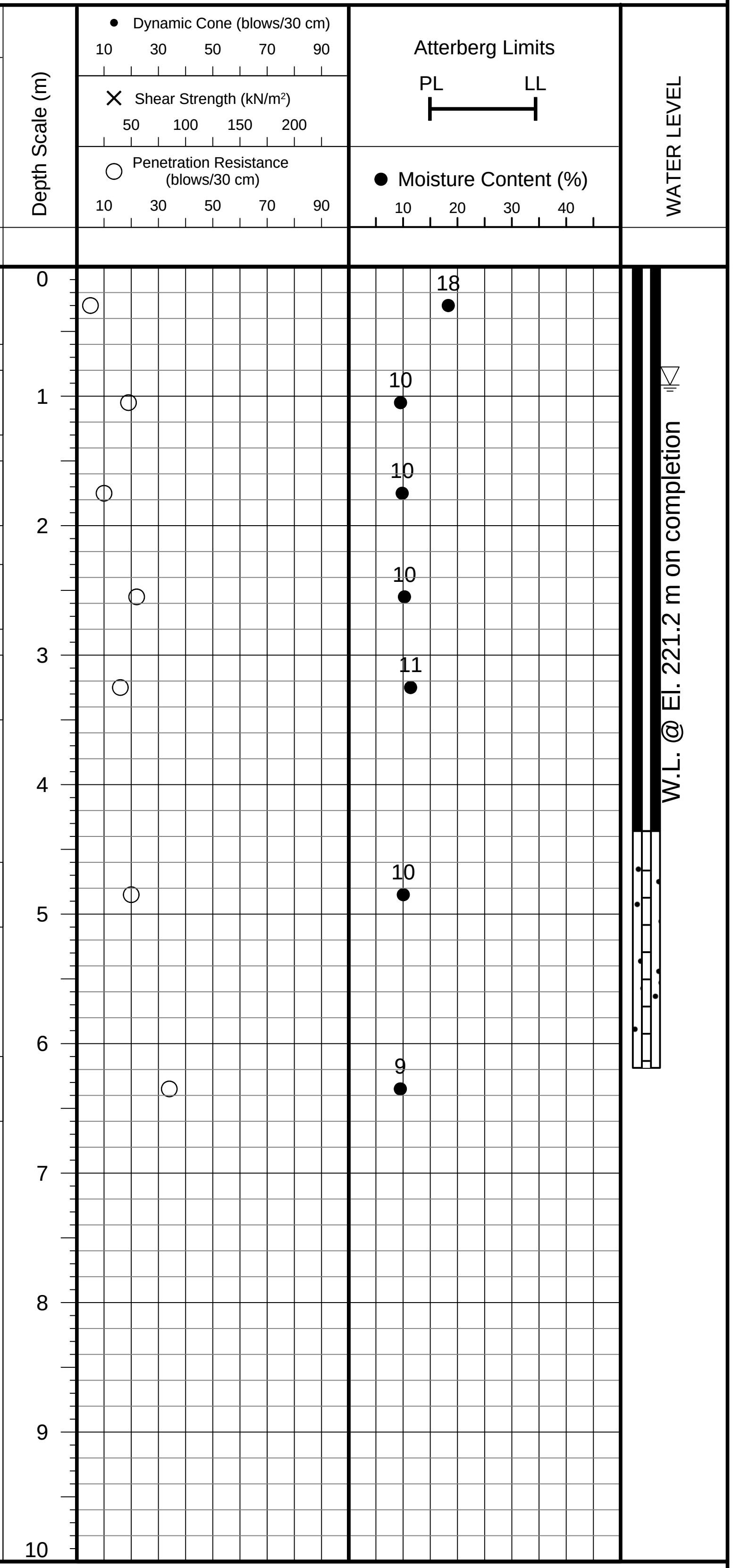
METHOD OF BORING: Soild Stem Augers

PROJECT LOCATION: 4646 County Road 2, Municipality of Port Hope

DRILLING DATE: February 28, 2024

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES		
		Number	Type	N-Value
138.1 0.0	Ground Surface **36 cm TOPSOIL**			
	weathered	1	DO	5
	Brown, loose to dense **SILTY SAND TILL** some clay a trace of gravel	2	DO	19
		3	DO	10
		4	DO	22
		5	DO	16
		6	DO	20
		7	DO	34
131.5 6.6	**END OF BOREHOLE**			

Installed 50 mm Ø PVC monitoring well
to 6.2 m with 1.5 m screen
Sand backfill from 4.4 to 6.2 m
Bentonite seal from 0.0 m to 4.4 m
Provided with monument casing



Soil Engineers Ltd.

JOB NO.: 2402-S021

LOG OF BOREHOLE: 2

FIGURE NO.: 2

PROJECT DESCRIPTION: Proposed Residential Development

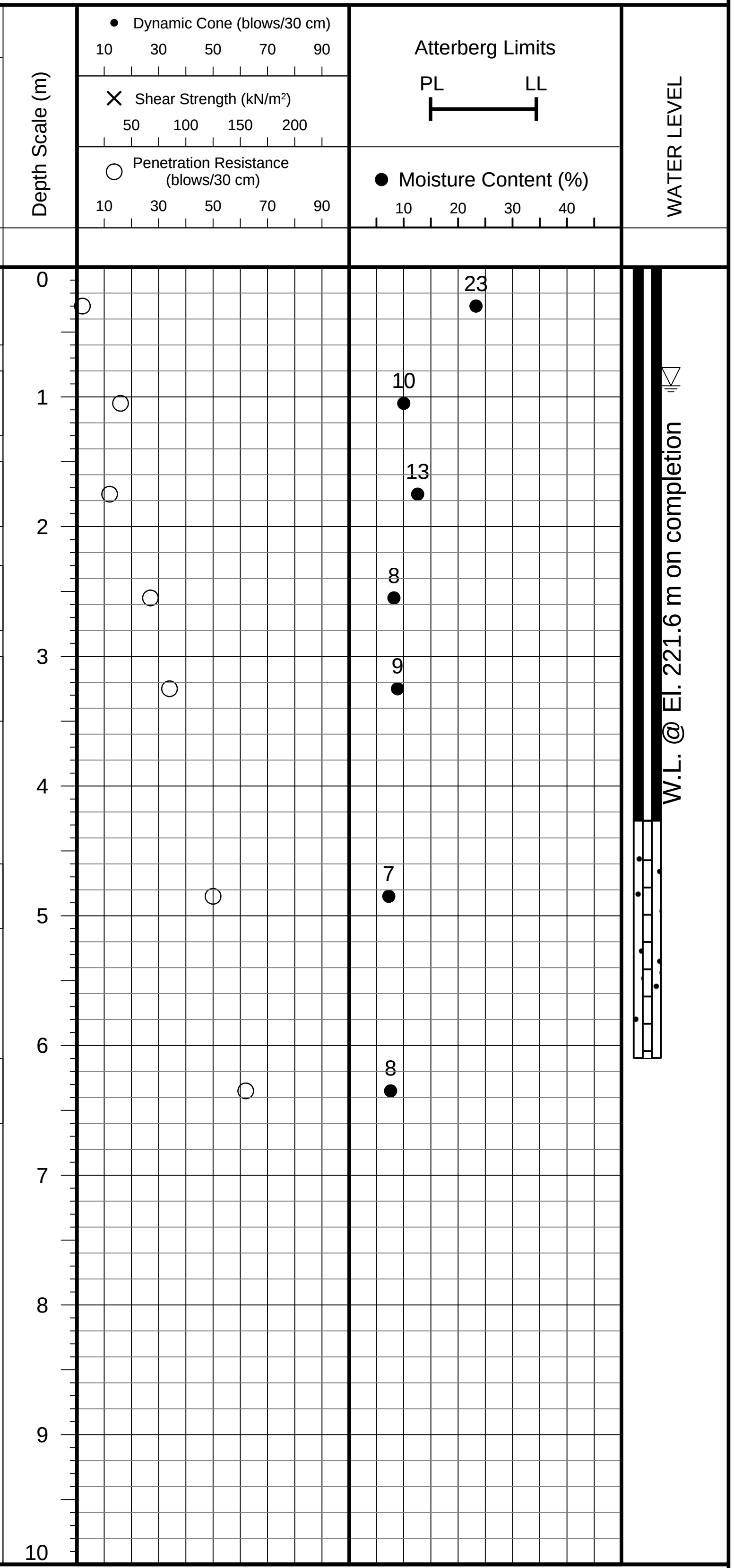
METHOD OF BORING: Soild Stem Augers

PROJECT LOCATION: 4646 County Road 2, Municipality of Port Hope

DRILLING DATE: February 28, 2024

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
140.7	Ground Surface			
0.0	**36 cm TOPSOIL**	1	DO	2
	weathered			
		2	DO	16
		3	DO	12
		4	DO	27
	Compact to very dense **SILTY SAND TILL** some clay a trace of gravel	5	DO	34
		6	DO	50
		7	DO	62
134.1 6.6	**END OF BOREHOLE**			

Installed 50 mm Ø PVC monitoring well
to 6.1 m with 1.5 m screen
Sand backfill from 4.3 to 6.1 m
Bentonite seal from 0.0 m to 4.3 m
Provided with monument casing



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JOB NO.: 2402-S021

LOG OF BOREHOLE: 3

FIGURE NO.: 3

PROJECT DESCRIPTION: Proposed Residential Development

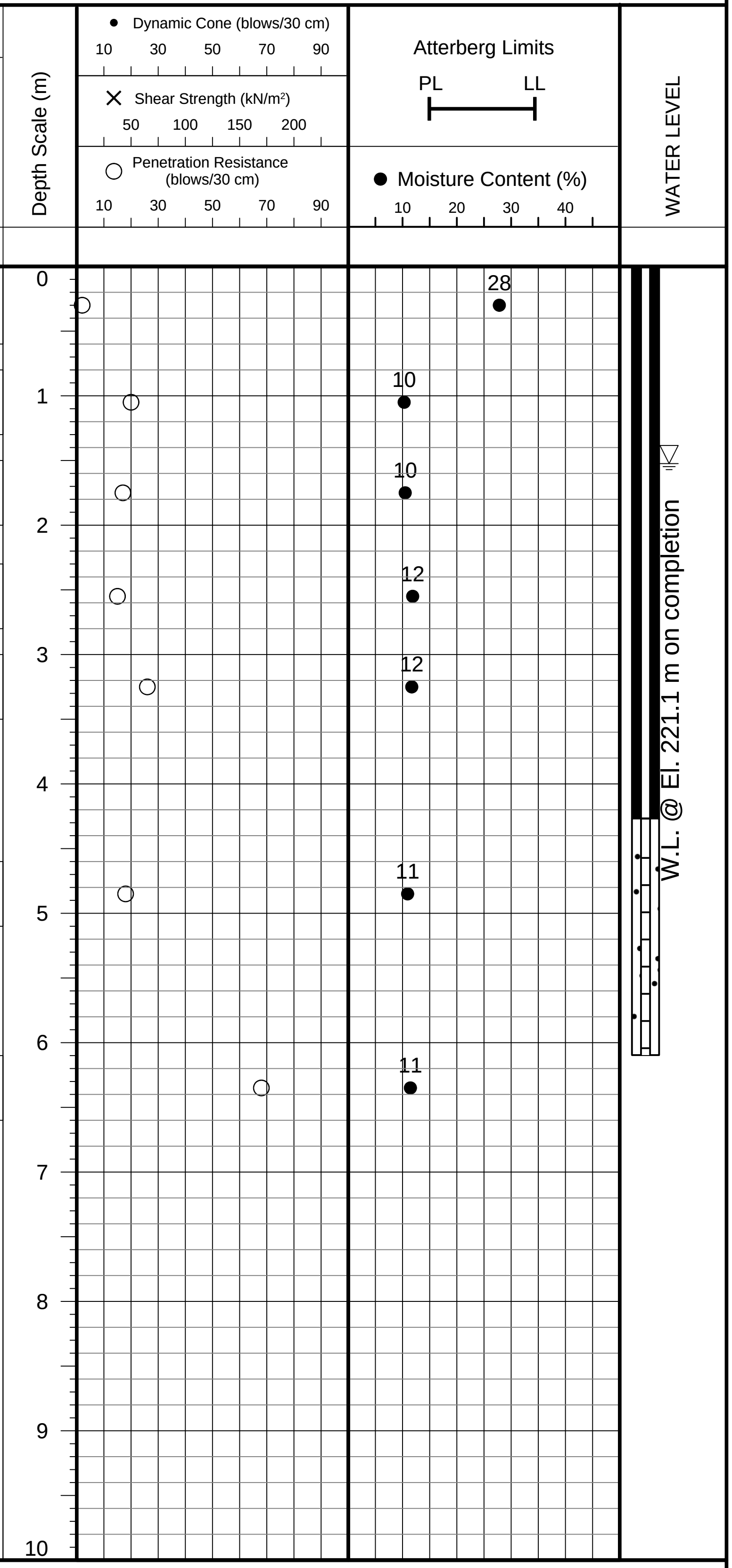
METHOD OF BORING: Soild Stem Augers

PROJECT LOCATION: 4646 County Road 2, Municipality of Port Hope

DRILLING DATE: February 28, 2024

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
140.0	Ground Surface			
0.0	**36 cm TOPSOIL**	1	DO	2
	weathered			
		2	DO	20
		3	DO	17
		4	DO	15
	Compact to very dense **SILTY SAND TILL** some clay a trace of gravel	5	DO	26
		6	DO	18
		7	DO	68
133.4 6.6	**END OF BOREHOLE**			

Installed 50 mm Ø PVC monitoring well
to 6.1 m with 1.5 m screen
Sand backfill from 4.3 to 6.1 m
Bentonite seal from 0.0 m to 4.3 m
Provided with monument casing



Soil Engineers Ltd.

JOB NO.: 2402-S021

LOG OF BOREHOLE: 4

FIGURE NO.: 4

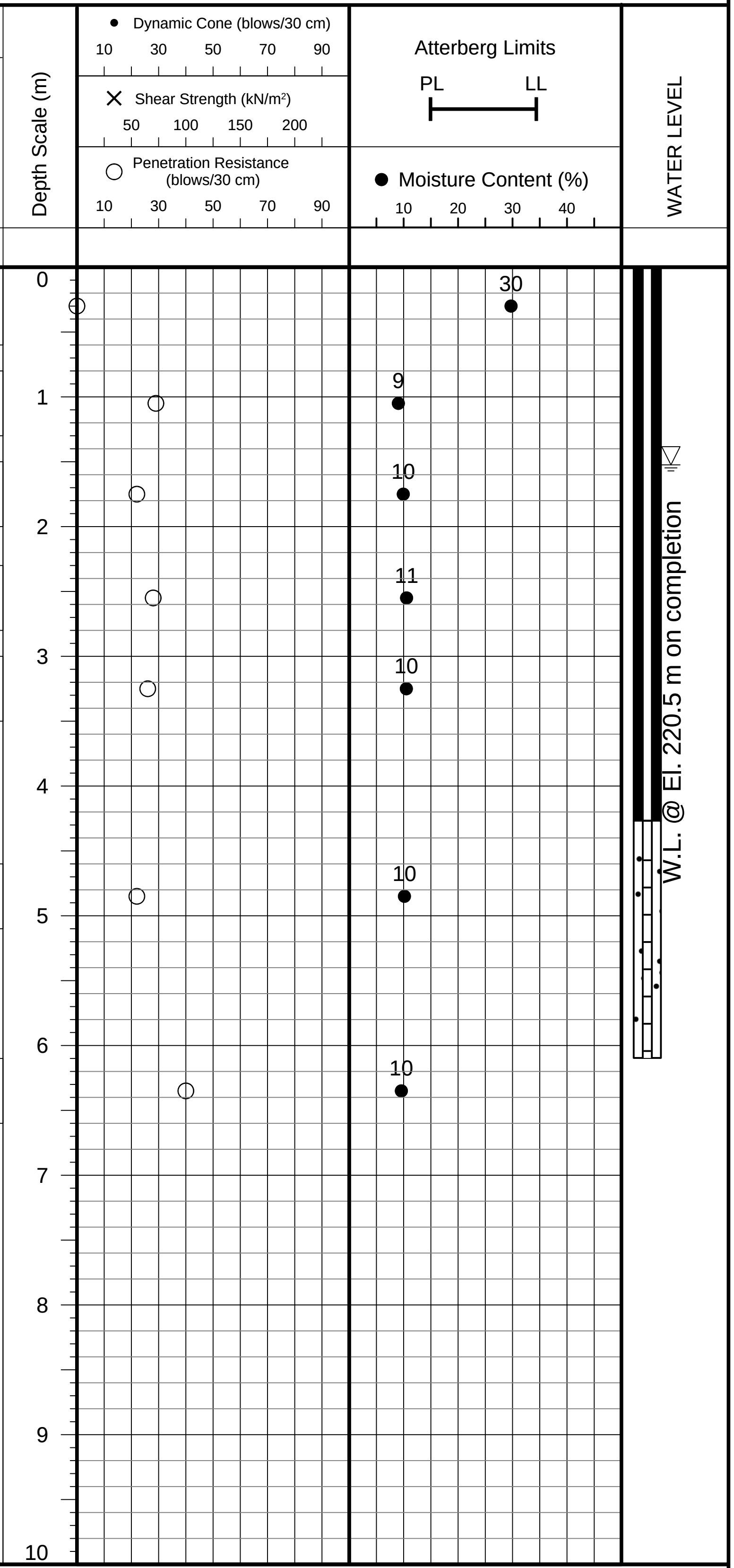
PROJECT DESCRIPTION: Proposed Residential Development

METHOD OF BORING: Soild Stem Augers

PROJECT LOCATION: 4646 County Road 2, Municipality of Port Hope

DRILLING DATE: February 28, 2024

El. (m) Depth (m)	SOIL DESCRIPTION	SAMPLES Number	SAMPLES Type	SAMPLES N-Value
140.1	Ground Surface			
0.0	**30 cm TOPSOIL**	1	DO	0
	weathered	2	DO	29
	Brown, compact to dense **SILTY SAND TILL** some clay a trace of gravel	3	DO	22
		4	DO	28
		5	DO	26
		6	DO	22
133.5 6.6		7	DO	40
	END OF BOREHOLE Installed 50 mm Ø PVC monitoring well to 6.1 m with 1.5 m screen Sand backfill from 4.3 to 6.1 m Bentonite seal from 0.0 m to 4.3 m Provided with monument casing			



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Page: 1 of 1

JOB NO.: 2402-S021

LOG OF BOREHOLE: 5

FIGURE NO.: 5

PROJECT DESCRIPTION: Proposed Residential Development

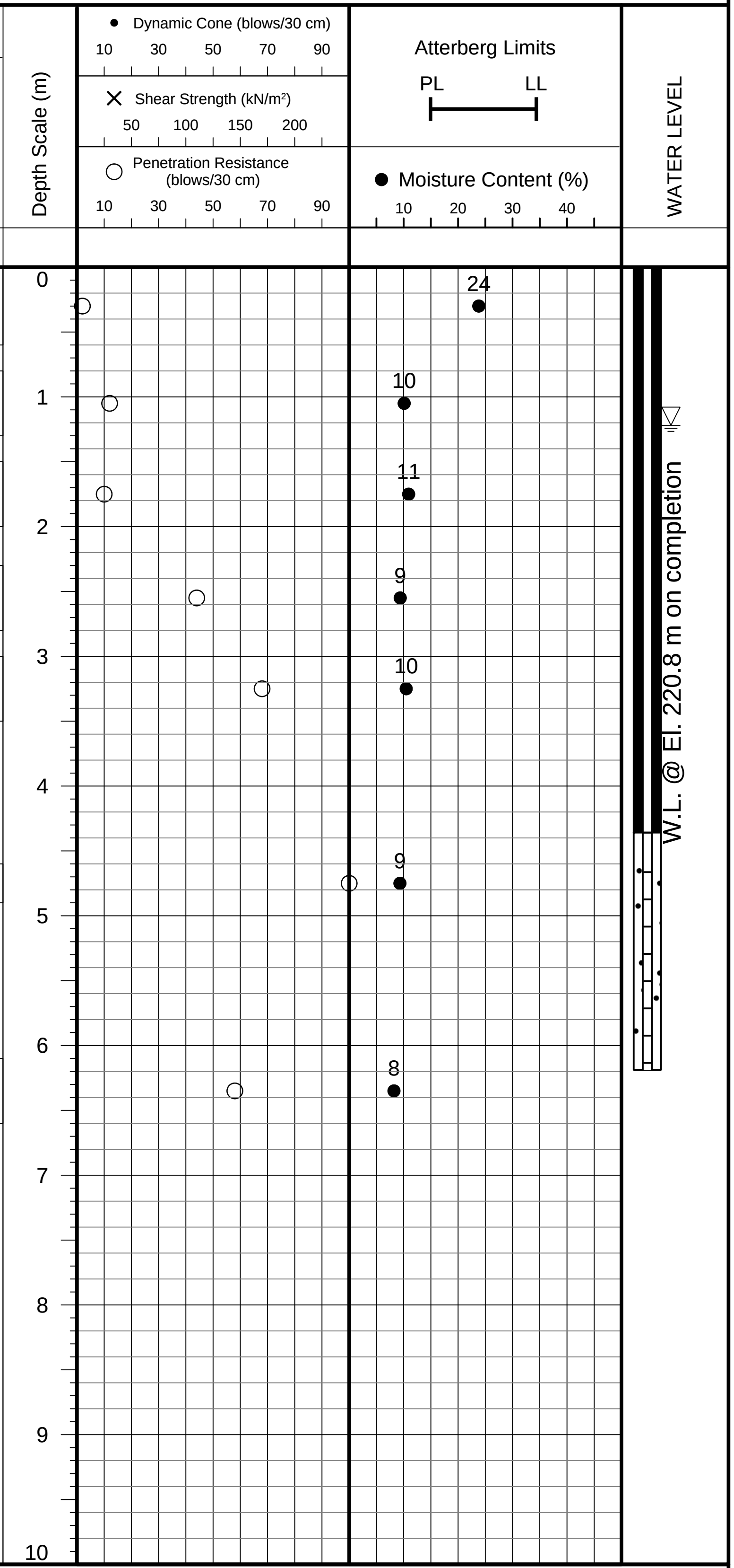
METHOD OF BORING: Soild Stem Augers

PROJECT LOCATION: 4646 County Road 2, Municipality of Port Hope

DRILLING DATE: February 28, 2024

El. (m) Depth (m)	SOIL DESCRIPTION
140.3	Ground Surface
0.0	**25 cm TOPSOIL**
	weathered
	Brown, loose to dense **SILTY SAND TILL** some clay a trace of gravel
133.7 6.6	**END OF BOREHOLE** Installed 50 mm Ø PVC monitoring well to 6.2 m with 1.5 m screen Sand backfill from 4.4 to 6.2 m Bentonite seal from 0.0 m to 4.4 m Provided with monument casing

SAMPLES		
Number	Type	N-Value
1	DO	2
2	DO	12
3	DO	10
4	DO	44
5	DO	68
6	DO	50/15
7	DO	58



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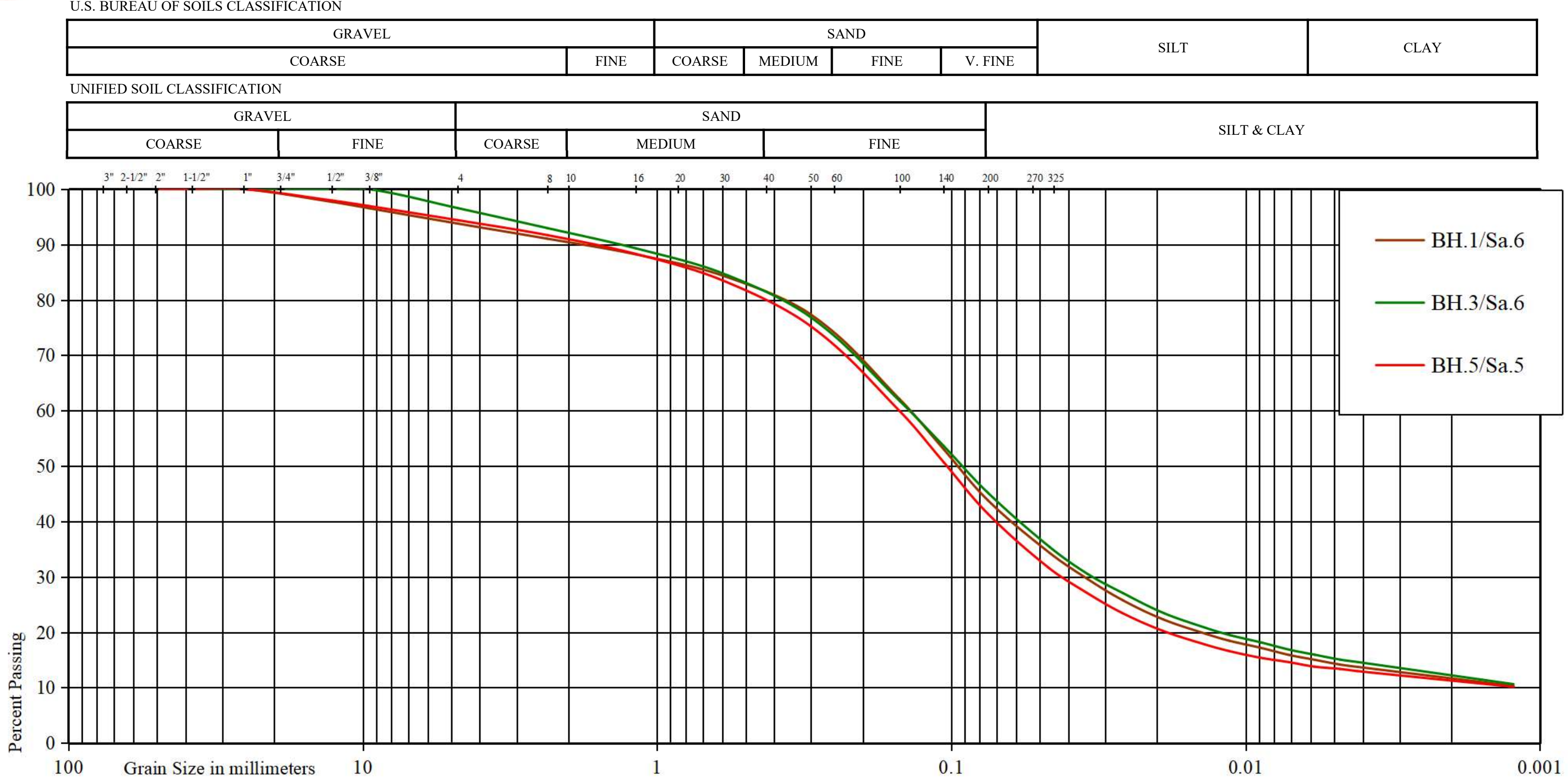
GRAIN SIZE DISTRIBUTION

Reference No: 2402-S021



Project: Proposed Residential Development

Location: 4646 County Road 2, Municipality of Port Hope

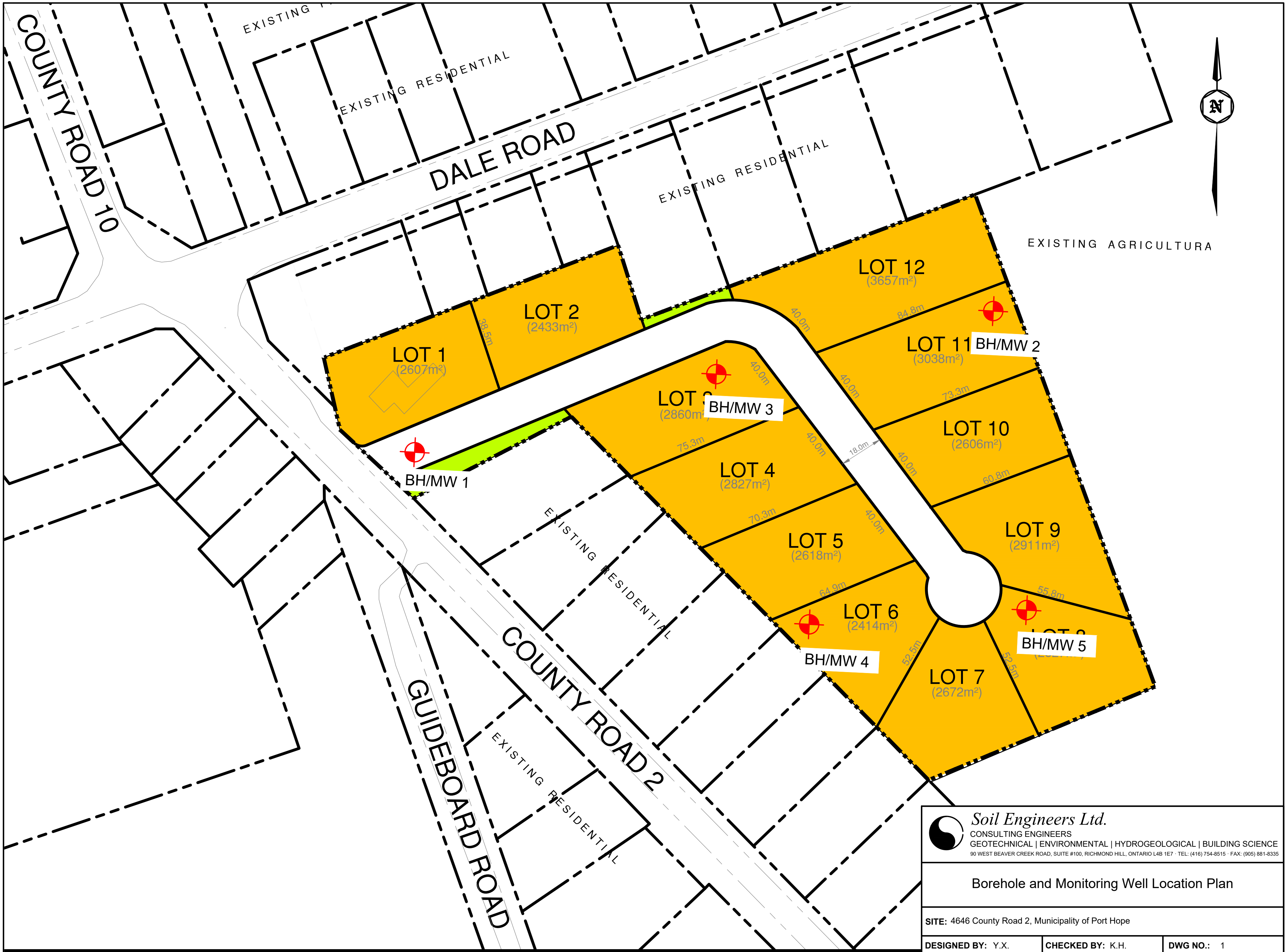
Borehole No:	1	3	5
Sample No:	6	6	5
Depth (m):	4.8	4.8	3.3
Elevation (m):	133.3	135.2	137.0

BH./Sa.	1/6	3/6	5/5
Liquid Limit (%) =	-	-	-
Plastic Limit (%) =	-	-	-
Plasticity Index (%) =	-	-	-
Moisture Content (%) =	10	11	10
Estimated Permeability (cm./sec.) =	10^{-6}	10^{-6}	10^{-6}

Classification of Sample [& Group Symbol]: SILTY SAND TILL

some clay, a trace of gravel

Figure: 6



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90 WEST BEAVER CREEK ROAD, SUITE #100, RICHMOND HILL, ONTARIO L4B 1E7 · TEL: (416) 754-8515 · FAX: (905) 881-8335

Borehole and Monitoring Well Location Plan

SITE: 4646 County Road 2, Municipality of Port Hope

DESIGNED BY: Y.X. **CHECKED BY:** K.H. **DWG NO.:** 1

SCALE: 1:2000 **REF. NO.:** 2402-S021 **DATE:** April 2024 **REV** -

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SUBSURFACE PROFILE
DRAWING NO. 2
SCALE: AS SHOWN

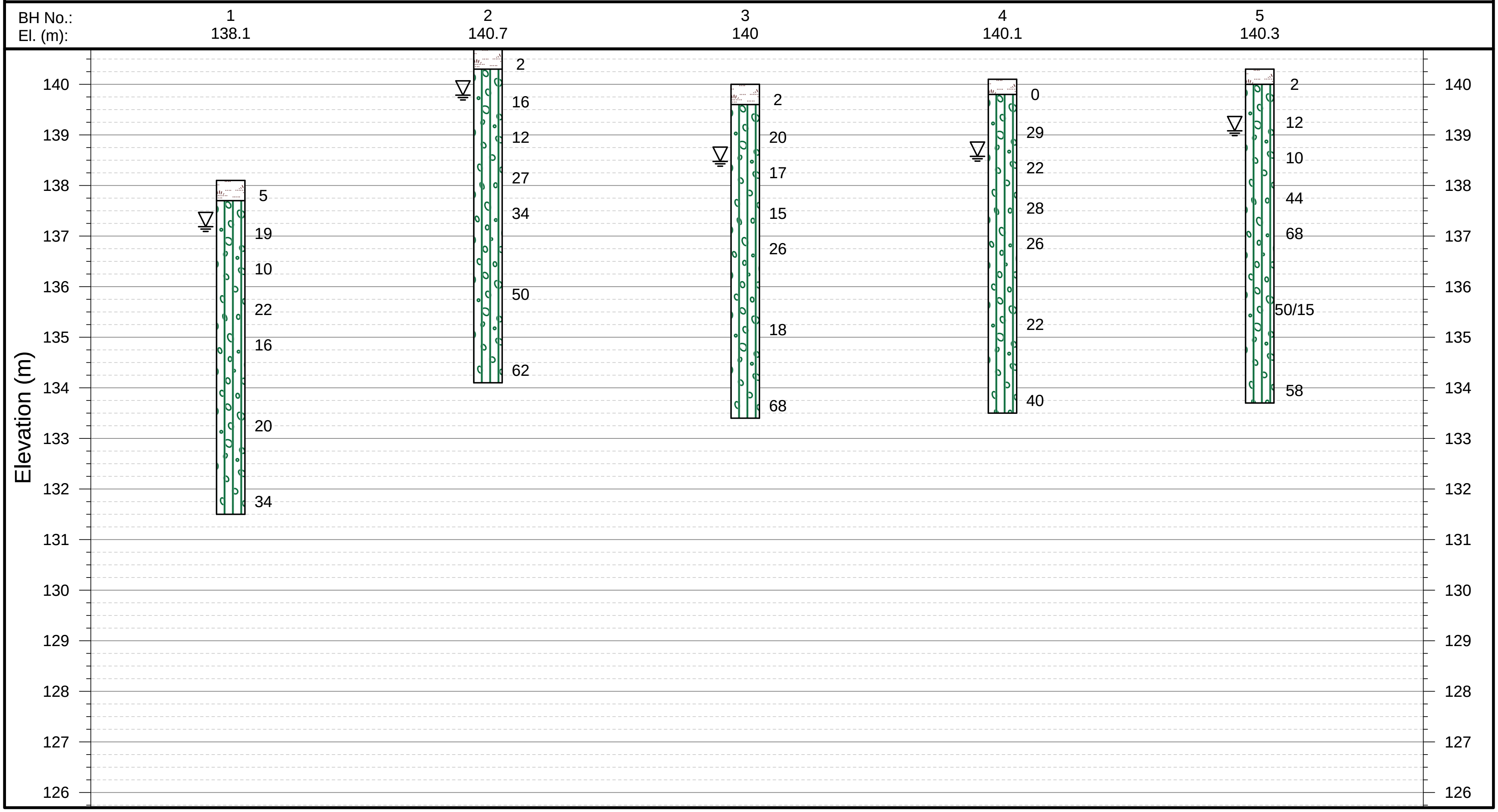
JOB NO.: 2402-S021
REPORT DATE: April 2024
PROJECT DESCRIPTION: Proposed Residential Development

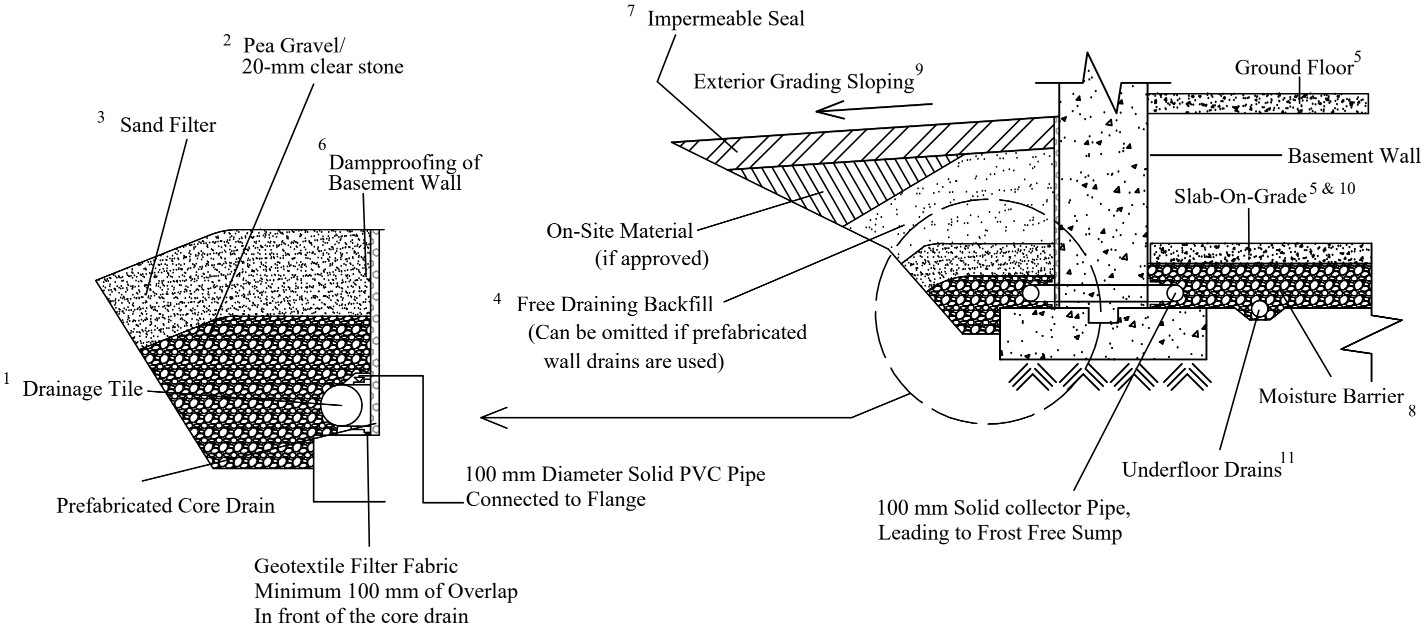
PROJECT LOCATION: 4646 County Road 2, Municipality of Port Hope

LEGEND

▥ SILTY SAND TILL ▤ TOPSOIL

▽ WATER LEVEL (END OF DRILLING)





NOTES:

1. **Drainage tile**: consists of 100 mm (4") diameter weeping tile or equivalent perforated pipe leading to a positive sump or outlet. Invert to be at minimum of 150 mm (6") below underside of basement floor slab.

2. **Pea gravel**: at 150 mm (6") on the top and sides of drain. If drain is not placed on concrete footing, provide 100 mm (4") of pea gravel below drain. The pea gravel may be replaced by 20 mm clear stone provided that the drain is covered by a porous geotextile membrane of Terrafix 270R or equivalent.

3. **Filter material**: consists of C.S.A. fine concrete aggregate. A minimum of 300 mm (12") on the top and sides of gravel. This may be replaced by an approved porous geotextile membrane of Terrafix 270R or equivalent.

4. **Free-draining backfill**: OPSS Granular 'B' or equivalent, compacted to 95% to 98% (maximum) Standard Proctor dry density. Do not compact closer than 1.8 m (6') from wall with heavy equipment. This may be replaced by on-site material if prefabricated wall drains (Miradrain) extending from the finished grade to the bottom of the basement wall are used.

5. **Do not backfill** until the wall is supported by the basement floor slab and ground floor framing, or adequate bracing.

6. **Dampproofing** of the basement wall is required before backfilling

7. **Impermeable backfill seal** of compacted clay, clayey silt or equivalent. If the original soil in the vicinity is a free-draining sand, the seal may be omitted.

8. **Moisture barrier**: 19-mm CRL or compacted OPSS Granular 'A', or equivalent. The thickness of this layer should be 150 mm (6") minimum.

9. **Exterior Grade**: slope away from basement wall on all the sides of the building.

10. **Slab-On-Grade** should not be structurally connected to walls or foundations.

11. **Underfloor drains*** should be placed in parallel rows at 6 to 8 m (20'-25') centre, on 100 mm (4") of pea gravel with 150 mm (6") of pea gravel on top and sides. The spacing should be at least 300 mm (12") between the underside of the floor slab and the top of the pipe. The drains should be connected to positive sumps or outlets. Do not connect the underfloor drains to the perimeter drains.

*Underfloor drains can be deleted where not required.

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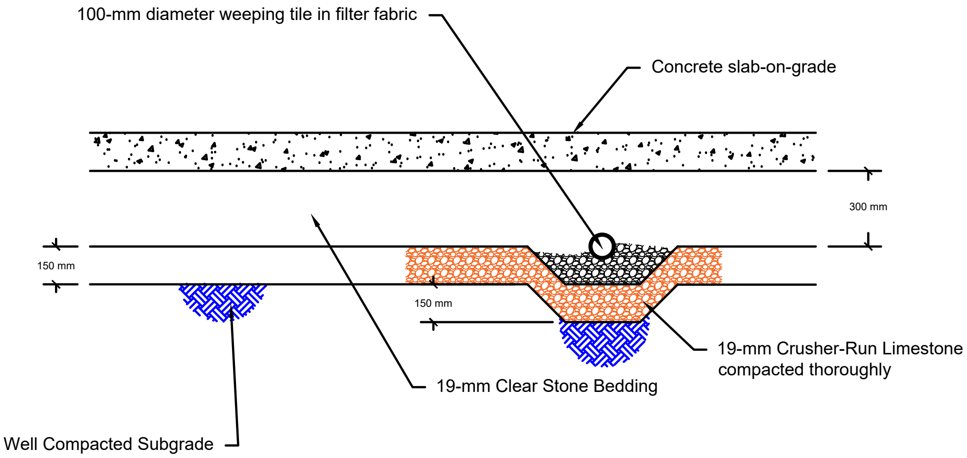
PERMANENT PERIMETER DRAINAGE SYSTEM
(FOR OPEN EXCAVATION)

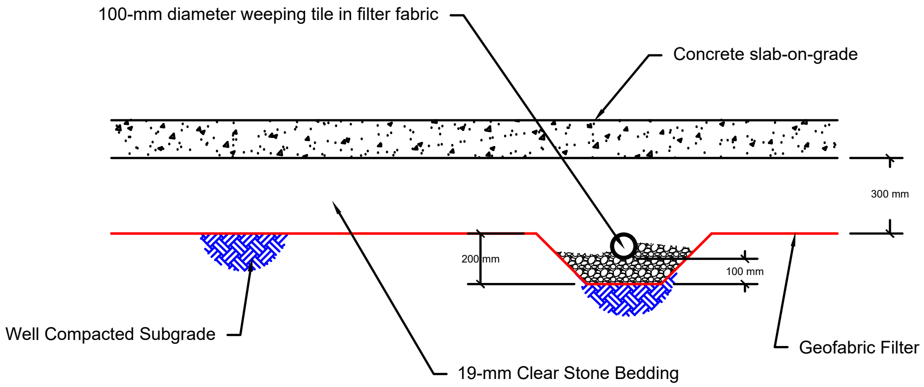
SITE: 4646 County Road 2, Municipality of Port Hope

DESIGNED BY: K.L. **CHECKED BY:** B.S. **DWG NO.:** 3

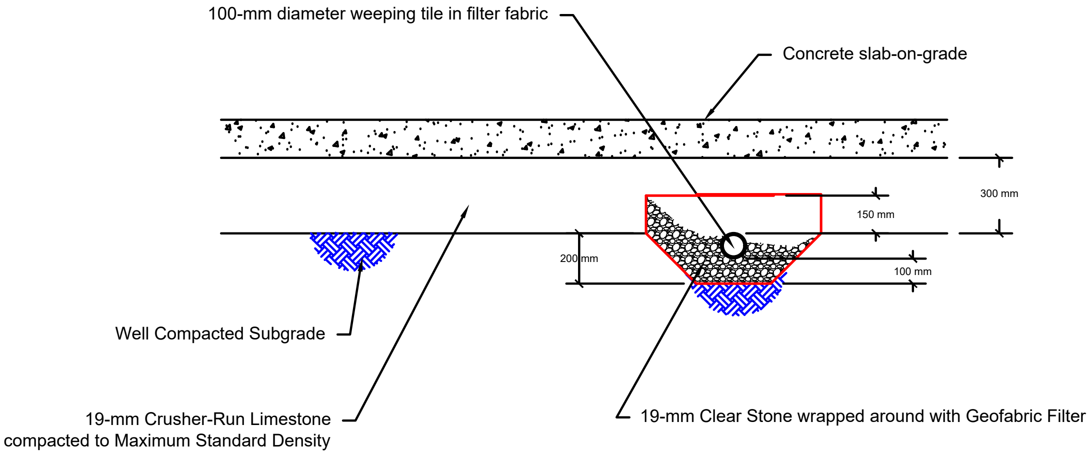
SCALE: N.T.S. **REF. NO.:** 2402-S021 **DATE:** April 2024 **REV** -



Option 'A'



Option 'B'



Option 'C'

Note:

1. Weepers should be placed in 6 m grids, draining in a positive gradient towards an outlet or a sump pit for removal by pumping.
2. A 10-mil polyethylene sheet should be specified between the gravel bedding and concrete slab.

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DETAILS OF UNDERFLOOR WEEPERS

SITE: 4646 County Road 2, Municipality of Port Hope

DESIGNED BY: K.L.
CHECKED BY: B.S.
DWG NO.: 4
SCALE: N.T.S.
REF. NO.: 2402-S021
DATE: April 2024
REV -