GEOTECHNICAL SITE INVESTIGATION

PROPOSED SIX (6) STOREY RESIDENTIAL DEVELOPMENT
441-443 ECHO DRIVE, OTTAWA, ONTARIO

JB Holdings

107 Pretoria Avenue,
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FINAL

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Project No.: 2512064

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EXECUTIVE SUMMARY

A geotechnical site investigation was completed by GeoTerra for the proposed six-storey residential building with two levels of underground parking located at 441–443 Echo Drive, Ottawa, Ontario. The existing four-storey apartment building will be demolished and replaced by a new structure supported on a raft foundation bearing on the silty clay deposit at a depth of approximately 8.5 m below the existing grade. Four boreholes (BH26-1 to BH26-4) were advanced along the perimeter of the existing building footprint, with two monitoring wells installed, and a program of laboratory testing consisting of index, grain-size, consolidation and chemical tests was carried out on representative samples.

The subsurface conditions comprise asphalt or topsoil over 2.3 to 3.7 m of sand and gravel fill, underlain by stiff to very stiff, lightly overconsolidated silty clay deposit extending to a depth of approximately 12.5 to 13.1 m, and followed by a sand and gravelly till deposit to the maximum explored depth of 28 m below the existing grade. Groundwater levels measured in March 2026 were approximately 2.1 to 2.2 m below existing grade, likely influenced by the sand layer overlying the low-permeability silty clay layer. Laboratory testing indicates that the silty clay has low to medium plasticity, measured undrained shear strengths of about 84 to 150 kPa, overconsolidation ratios of about 1.5 to 1.9 and low hydraulic conductivity, all typical of stiff silty clay deposits in the Rideau Canal corridor.

For preliminary design, the raft foundation bearing on the native silty clay at a depth of approximately 8.5 m may be designed for factored net bearing resistance ranging from 200 to 250 kPa and net service contact pressures of 125 to 150 kPa, subject to confirmation once detailed structural loads are available. At these service pressures, ultimate bearing failure is not expected to govern and total long-term settlements of approximately 25 to 30 mm with differential settlements on the order of 10 to 15 mm are anticipated, assuming a reasonably stiff raft and relatively uniform loading. Excavation for the two basement levels will extend through fill and sand into stiff silty clay and will require a Temporary Protection System (such as soldier pile and lagging, secant piles or equivalent) designed by a shoring engineer to control ground movements and protect adjacent buildings, utilities and the Echo Drive right-of-way.

Given the measured and expected groundwater levels and low permeability of the clay, the below-grade structure, including the raft, should incorporate a local groundwater control system supplemented by interior perimeter drainage and internal sump pumping to control seepage, while avoiding significant drawdown in the surrounding clay deposits. A concrete mud slab is recommended at founding level to protect the silty clay subgrade and to act as a horizontal hydraulic barrier beneath the raft. Seismic site classification for the project is Site Class D in accordance with the Ontario Building Code, and preliminary spectral acceleration values corresponding to the NBC 2020 hazard maps have been provided for structural design.

Chemical testing of two soil samples at depths near the founding level indicates pH ≈ 8, sulphate contents of 0.01–0.02%, low chloride and moderate resistivity, corresponding to a moderate-to-low risk of sulphate attack on concrete and non-aggressive to moderately aggressive conditions for buried steel; normal or moderately sulphate-resistant cements are considered suitable, with standard corrosion protection measures recommended for ductile iron pipes in accordance with AWWA C105.

Tree planting for the development will follow the City of Ottawa's 2017 Tree Planting in Sensitive Marine Clay Soils guidelines; given the depth of the raft and the moderate plasticity of the clay, the risk of tree-induced shrinkage affecting the foundation is considered low, although planting near shallow elements should be controlled. The recommendations in this report are preliminary and should be reviewed and refined once final architectural, structural and civil designs are available, and during construction through appropriate geotechnical inspection and monitoring.

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1.0 INTRODUCTION

GeoTerracs Inc. (GeoTerra) has been retained by JB Holdings (the Client) to conduct a geotechnical investigation for the proposed development of a new six (6) storey residential building (the "Project") at 441-443 Echo Drive, Ottawa, Ontario (the "Site").

This investigation was carried out in accordance with the professional services proposal prepared by GeoTerra on December 19, 2025 (Proposal No.: 2512064).

This report is specifically and exclusively for the Client and consultants potentially collaborating on the project. The use of this report or the reliance on it by a third party is the sole responsibility of such third party. Any modifications to the project must be reported to GeoTerra so that the scope and relevance of the geotechnical study and the recommendations contained in this report can be reviewed and adjusted, if necessary. The recommendations in this report are based on a pre-design level of information and are intended for preliminary planning and design purposes. Final geotechnical parameters and recommendations should be confirmed once detailed architectural, structural and civil design information (including column and wall loads, raft thickness and final excavation geometry) becomes available. This report is subject to the limitations presented in Section 8.0 "Scope of the Report and Limitation of Liability".

1.1 Project Understanding

Our understanding of the Project is based on the Client's email request, and based on the following document received from the Client:

- Architectural Render Package, 441 Echo Drive, prepared by Project1 Studio Incorporated, Project No. 2514, dated December 2, 2025.
- Topographic Plan of Survey, Lots 11 and 12 and Part of Lots 3 and 4, Block 'K', Registered Plan 102, City of Ottawa, prepared by Annis, O'Sullivan, Vollebekk Ltd., dated December 10, 2014 (File No. 2014-211).

It is understood that the existing development consists of a four-storey residential apartment building which is intended to be demolished. The Client is considering a new residential building with two levels of underground parking occupying the property boundary. At the time of issuing this report, no detailed structural or civil engineering drawings for the proposed development were available. Accordingly, this study has been carried out as a pre-design geotechnical investigation, and the recommendations should be considered preliminary.

For the purposes of this study, a raft foundation bearing at approximately 8.5 m below ground surface (mbgs) within the native silty clay has been adopted as the design basis. If alternative shallow foundation systems (e.g., strip and pad footings) are considered at a later stage, the parameters and settlement assessments in this report should be reviewed and updated. The assumed raft founding level of approximately 8 to 9 mbgs places the foundation entirely within the native silty clay deposit, below the

existing fill, and is used as the basis for the settlement and bearing evaluations in this report.

Given the proposed excavation depth of approximately 8 to 9 mbgs for the two levels of underground parking, together with the presence of the silty clay deposit and adjacent structures, it is anticipated that temporary protection system (shoring) and groundwater control measures will be required. The type and configuration of these systems will be developed as part of the geotechnical recommendations once the final excavation geometry and staging are better defined.

The actual excavation depth, foundation configuration and shoring layout may differ from the assumptions described above; any significant change should be reviewed by GeoTerra so that the geotechnical recommendations can be updated, if required.

1.2 Scope of Work

The scope of work included drilling four (4) boreholes (BH26-1, BH26-2, BH26-3, and BH26-4) advanced approximately at the corners of the existing residential building on the Site. Disturbed and undisturbed soil samples were collected, and a program of laboratory testing was carried out in accordance with the site investigation findings and the project understanding.

The scope of work also included the preparation of this geotechnical report to: (i) describe the subsurface and groundwater conditions at the Site; (ii) present the borehole location plan, records of borehole logs, and laboratory test results; and (iii) provide an assessment of the anticipated geotechnical conditions influencing the design and construction of the proposed foundation system and temporary protection system (excavation support and groundwater control).

The recommendations provided herein include preliminary foundation design parameters, excavation and shoring guidance, groundwater control considerations, and comments on seismic site classification and durability of below-grade elements.

2.0 SITE DESCRIPTION AND GEOLOGICAL FORMATION

2.1 Summary of Site Description

The proposed residential redevelopment is located at 441–443 Echo Drive, in the City of Ottawa, Ontario. The Site is currently occupied by an existing four-storey residential apartment building fronting Echo Drive on the east side of the Rideau Canal. The property consists of a combination of hard-surfaced (asphalt and concrete) and landscaped/grassed areas. Adjacent land use is predominantly low- to mid-rise residential and mixed-use: Echo Drive and the Rideau Canal corridor to the west, existing low-rise residential buildings to the east, and additional residential development to the north and south. The Site location is shown on Figure 1 in Appendix A.

2.2 Geological Formation

Based on published geological mapping, the Site is located within the Ottawa–St. Lawrence Lowland, part of the Great Lakes–St. Lawrence physiographic region. The area is underlain by relatively flat-lying Paleozoic sedimentary bedrock, consisting primarily of limestone and shale, with local dolostone and sandstone, which in turn unconformably overlie Precambrian crystalline rocks of the Canadian Shield. Over this bedrock, the Ottawa basin is mantled by Quaternary deposits comprising glacial till and post-glacial marine sediments of the Champlain Sea. In the vicinity of 441–443 Echo Drive, these surficial deposits are dominated by soft to stiff marine silty clay deposits with interbedded sand and silt lenses overlying glacial till and Paleozoic bedrock at depth, consistent with regional stratigraphy along the Rideau Canal corridor.

3.0 FIELD INVESTIGATION AND TESTING

3.1 Underground Utility Clearance

Underground utility clearance was completed before commencing the fieldwork. Utility clearance requisitions were submitted to Ontario One Call (ON1Call) to obtain public utility locates. Public utility owners were informed, and all utility clearance documents were obtained before the commencement of drilling work. Private utility clearances were completed by a sub-contractor assigned by GeoTerra.

3.2 Site Layout and Surveying Operations

A geodetic survey for the boreholes was completed using an Emlid Reach RS2+ Multi-band RTK GNSS receiver, which was operated in Real-Time Kinematic (RTK) mode using Networked Transport of RTCM via Internet Protocol (NTRIP) to receive real-time correction data and enable centimeter-level accuracy.

The coordinates and elevations of the boreholes are referenced to the Canadian Spatial Reference System (CSRS) UTM NAD 1983 Zone 18 North coordinate system.

The location, coordinates, and elevation of the boreholes in this geotechnical investigation report are presented on Table 1, Figure 1 in Appendix A, and their respective logs in Appendix B.

Table 1: Borehole Information Summary

BOREHOLE	DRILLING DATE	COORDINATES (NAD83(CSRS)/UTM ZONE 18N)			BOREHOLE INFORMATION	
		NORTHING	EASTING	GEODETIC ELEVATION (M)	DEPTH (M)	EL. (MASL)
BH26-1	Feb. 18-19, 2026	5028257.04	446789.69	65.16	15.9	49.26
BH26-2	Feb. 19, 2026	5028270.80	446784.70	65.12	9.60	55.52
BH26-3	Feb. 23, 2026	5028267.38	446762.18	65.05	28.00	37.05
BH26-4	Feb. 26, 2026	5028240.28	446767.72	65.53	17.98	47.55

3.3 Fieldwork

The field investigation was carried out on February 18, 19, 23, and 26, 2026. It comprised drilling four (4) boreholes (BH26-1, BH26-2, BH26-3, and BH26-4), two of which (BH26-1 and BH26-2) were instrumented with groundwater monitoring wells.

Drilling was completed using a CME 55 track- and CME 75 truck-mounted drill rig equipped with hollow-stem augers and NQ casing for wash boring. The drilling equipment was owned and operated by Marathon Underground, Ottawa, Ontario. Boreholes BH26-1, BH26-2, and BH26-3 were advanced using the CME 75 rig; BH26-4 was completed using the CME 55 rig due to access and space constraints on Site.

In BH26-1 and BH26-3, drilling was undertaken using hollow-stem augers to depths of about 13.7 m below ground surface (mbgs) (EL. 51.45 masl and EL. 51.34 masl, respectively) and then continued using wash boring with NQ casing to the final depths. BH26-2 was advanced entirely with hollow-stem augers to its termination depth of 9.6 mbgs (EL. 55.52 masl). BH26-4 was advanced with hollow-stem augers to 10.36 mbgs (EL. 55.17 masl), followed by a Dynamic Cone Penetration Test (DCPT) to refusal at 17.98 mbgs (EL. 47.55 masl).

Soil samples were generally obtained at 0.76 m depth intervals using a 51 mm outside-diameter split-spoon sampler in accordance with the Standard Penetration Test (SPT) procedure, except in BH26-1 where continuous sampling was carried out from ground surface to 4.42 mbgs (EL. 60.74 masl). Within the clayey silty deposits, SPT sampling was alternated with Field Vane Shear (FVS) testing. Sampling intervals were increased and varied below about 13.7 mbgs (EL. 51.45 masl in BH26-1 and EL. 51.34 masl in BH26-3) to reflect the subsurface conditions and investigation objectives. Two (2) undisturbed tube samples of the native silty clay were obtained for consolidation testing, one from each of BH26-1 and BH26-3.

Two (2) 51 mm diameter flush-mount groundwater monitoring wells were installed in BH26-1 and BH26-2, with the bottom of well set at approximately 4.6 mbgs. Each installation consisted of a 3 m long well screen attached to 51 mm diameter PVC riser pipe, terminating in a flush-mount protective cover at ground surface. The wells were developed following installation, and groundwater level measurements were subsequently obtained.

The drilling and sampling were supervised on a full-time basis by GeoTerra personnel. All boreholes were logged during drilling, and all samples were labelled sequentially as recovered. Disturbed samples were sealed in zip-lock plastic bags to minimize moisture loss and transported to the GeoTerra office for examination and testing. Following completion of drilling and well installation, the boreholes were backfilled with clean sand within the screened intervals and then with sand and hole plug materials up to ground surface.

4.0 LABORATORY WORK DESCRIPTION

The soil samples collected during fieldwork were transported to GeoTerra's office for the purposes of sample and log reviews, analysis, identification, and classification. All samples underwent a thorough visual examination by a geotechnical engineer. Geotechnical laboratory testing was performed by Stantec Laboratories on representative soil samples, and included:

- Grain size analysis on two (2) representative soil samples
- Hydrometer analysis on three (3) representative soil samples
- Water content on eleven (11) representative soil samples
- Atterberg limits on eight (8) representative soil samples
- Consolidation analysis on two (2) representative soil samples
- Specific gravity on one (1) representative soil sample

Eurofins Environment Testing in Ottawa carried out chemical tests on two (2) representative soil samples including pH, chloride, sulphate, resistivity, electric conductivity, RedOx potential, and sulphide.

Laboratory test results are included in Appendix C.

All samples taken from the boreholes that were not subjected to laboratory testing will be stored for a period of three (3) months from the date of the final report. Afterward, they will be destroyed unless a written notice regarding their disposition is provided to GeoTerra in the meantime.

5.0 SOIL STRATIGRAPHY AND PROPERTIES

A summary of the soil stratigraphy at the Site based on the drilled boreholes is summarized in the table below and detailed in the borehole log record presented in Appendix B.

For the purposes of this study, the proposed raft founding level of approximately 8.5 mbgs will be within the native silty clay layer, below the overlying fill, and this stratigraphic arrangement forms the basis for the foundation and settlement assessments presented in Section 6.0.

Table 2: Summary of the Stratigraphy in the Boreholes

BOREHOLE	GROUND EL. (masl)	TOPSOIL DEPTH (m) [EL. (masl)]	ASPHALT DEPTH (m) [EL. (masl)]	FILL DEPTH (m) [EL. (masl)]	SILTY CLAY DEPTH (m) [EL. (masl)]	TILL DEPTH (m) [EL. (masl)]
BH26-1	65.16	--	0.0 – 0.08 [65.16 – 65.08]	0.08 – 2.44 [65.08 – 62.72]	2.23 – 12.95 [62.72 – 52.21]	12.95 – 15.9* [52.21 – 49.26]
BH26-2	65.12	--	0.0 – 0.08 [65.12 – 65.04]	0.08 – 2.29 [65.04 – 62.83]	2.29 – 9.60* [62.83 – 55.52]	--
BH26-3	65.05	--	0.0 – 0.08 [65.05 – 64.97]	0.08 – 3.7 [64.97 – 61.35]	3.7 – 13.1 [61.35 – 51.95]	13.1 – 28* [51.95 – 37.05]
BH26-4	65.53	0.0 – 0.15 [65.53 – 65.38]	--	0.15 – 3.05 [65.38 – 62.48]	3.05– 12.5 [62.48 – 53.03]	12.5 – 17.98* [53.03 – 47.54]

* Denotes the termination depth of boreholes

5.1 Soil Stratigraphy

5.1.1 Topsoil

A layer of topsoil was observed in BH26-4. The topsoil consisted of brown sandy silt with some organics, rootlets, and a trace of clay, and was frozen at the time of drilling.

5.1.2 Asphalt

A layer of asphalt was observed in BH26-1, BH26-2, and BH26-3. The asphalt was observed to be approximately 80 mm. The asphalt was broken through using the auger teeth before sampling the fill material.

5.1.3 Fill

A thick layer of fill material was encountered in all boreholes below the asphalt and topsoil and extended to the silty clay layer at depths ranging approximately 2.29 to 3.7 mbgs (EL. 62.83 to 61.35 masl).

The fill layer was observed to consist of sand and gravel, some to trace of silt and clay, brown to grey in colour and a moisture content of frozen to wet.

The recorded SPT 'N' value in the fill layer ranged from 2 to 12 blows/300 mm, indicating that the fill is very loose to compact in accordance with Canadian Foundation Engineering Manual (CFEM) 5th Edition 2023.

5.1.4 Silty Clay

The silty clay to silt and clay layer, locally containing sand lenses, was encountered below the fill and extended to depths of about 12.5 to 13.1 mbgs (EL. 53.03 to 51.95 masl). The silty clay was grey in colour and wet at the time of drilling.

Based on field vane and laboratory data, the silty clay is generally stiff to very stiff, with measured undrained shear strengths in the range of about 84 to 150 kPa, and is lightly overconsolidated, which is consistent with clay deposits elsewhere along the Rideau Canal corridor.

The sensitivity of the silty clay layer based on the FVS tests ranged between 2 to 8 indicating that the silty clay layer has low to medium sensitivity in accordance with Table 4.2 in CFEM 5th Edition 2023.

Atterberg limit and moisture content testing (Table 3) indicate that the silty clay typically exhibits low to medium plasticity, with plasticity indices generally in the range of about 15 to 25 percent and natural water contents close to the liquid limit in several samples.

Eight (8) samples underwent Atterberg Limit tests, three (3) samples underwent sieve and hydrometer analysis testing, and ten (10) samples underwent moisture content testing. The test results are summarized in Table 3 and included in Appendix C.

Table 3: Atterberg Limit, Sieve and Hydrometer, and Moisture Content Tests Summary – Silty Clay

BOREHOLE [SAMPLE ID]	DEPTH (m) [EL. (masl)]	SIZE FRACTION (%)				w (%)	ATTERBERG LIMIT (%)			REMARKS
		G	S	M	C		W_L	W_P	I_P	
BH26-1 [SS13]	9.91 – 10.52 [55.25 – 54.64]					36.8	36.0	19.5	16.5	Medium Plasticity Clay per USCS
BH26-1 [SS14]	10.67 – 11.28 [54.49 – 53.88]	0	2	46	52	47.4				Silty Clay
BH26-1 [SS15]	11.43 – 12.04 [53.73 – 53.12]					47.1	49.1	23.6	25.5	Medium Plasticity Clay per USCS
BH26-2 [SS9]	6.86 – 7.47 [58.26 – 57.65]					34.0	34.4	19.1	15.3	Low Plasticity Clay per USCS
BH26-2 [SS10]	8.38 – 8.99 [56.74 – 56.13]					35.3	35.3	19.4	15.9	Medium Plasticity Clay per USCS
BH26-3 [SS8]	6.10 – 6.71 [58.95 – 58.34]					37.8	36.8	19.9	16.8	Medium Plasticity Clay per USCS
BH26-3 [SS10]	7.62 – 8.23 [57.43 – 56.82]					36.9	35.6	19.3	16.2	Medium Plasticity Clay per USCS
BH26-3 [SS11]	9.14 – 9.75 [55.91 – 55.30]	0	23	35	42	35.9				Sandy Silty Clay
BH26-3 [SS12]	10.67 – 11.28 [54.38 – 53.77]					39.4	48.0	23.9	24.1	Medium Plasticity Clay per USCS
BH26-3 [SS13]	12.19 – 12.80 [52.86 – 52.25]					48.0				
BH26-4 [SS8]	6.1 – 6.7 [59.43 – 58.82]	0	10	50	40	48.0				Silty Clay with some Sand
BH26-4 [SS10]	9.14 – 9.75 [56.39 – 55.78]					35.2	34.1	19.0	15.1	Low Plasticity Clay per USCS

* G = Gravel, S = Sand, M = Silt, C = Clay, w = Moisture Content, W_L = Liquid Limit, W_P = Plastic Limit, I_P = Plastic Index, USCS = Unified Soil Classification System

Two (2) undisturbed soil samples were collected from approximate depths of 9.14 to 9.75 mbgs (EL. 56.02 to 55.41 masl) from BH26-1 and 6.86 to 7.47 mbgs (EL. 58.19 to 57.58) from BH26-3. Two specimens were subjected to one-dimensional consolidation testing, and the results are summarized in Table 4. In addition, specific gravity (G_s), and total unit weight of the saturated clay were measured.

The measured preconsolidation pressures and overconsolidation ratios (Table 4) confirm that the native clay is lightly overconsolidated, and these parameters have been used directly in estimating primary consolidation settlement beneath the proposed raft foundation.

The laboratory index data and consolidation parameters indicate that, although the silty clay is of marine origin, it is of low to medium plasticity and only lightly overconsolidated, which implies moderate compressibility but a lower shrink–swell potential than highly plastic Champlain Sea clays elsewhere in Ottawa.

Table 4: Consolidation Parameters of Silty Clay

Borehole	Sample	Depth (mbgs)	Estimated P'_o (kPa)	P'_C (kPa)	OCR	C_r	C_c	e_o	G_s	γ_t (kN/m^3)
BH26-1	ST12	9.14 to 9.75	110	160	1.5	0.09	0.68	1.09	2.74	18
BH26-3	ST9	6.86 to 7.47	90	170	1.9	0.09	0.78	1.11	2.74	18

Note: P'_o: Effective overburden stress below ground surface – P'_c: Preconsolidation Pressure – OCR: Overconsolidation ratio - C_r: Recompression Index – C_c: Compression Index – e_o: Initial void ratio – γ_t: Total unit weight

5.1.5 Till

A layer of sand, some silt and clay/sandy silt with some clay and gravel was encountered below the native silty clay or silt and clay layer and inferred to extend to the maximum drilling depth of 28 m. It was observed to be grey in colour with a moisture content of wet.

The recorded SPT 'N' value within the till layer ranged from 5 to over 59 blows/300 mm, indicating that the till layer compactness ranges from loose to very dense, but predominantly dense to very dense based on the observed "N" values.

Two (2) soil samples underwent sieve analysis testing, and their results have been summarized in Table 5 below.

Table 5: Grain Size Analysis – Till

BOREHOLE [SAMPLE ID]	DEPTH (m) [EL. (masl)]	SIZE FRACTION (%)				REMARKS
		G	S	M	C	
BH26-3 [SS15]	15.24 – 15.85 [49.81 – 49.20]	0	76	24		Silty Sand or Clayey Sand
BH26-3 [SS18]	25.91 – 26.52 [39.14 – 38.53]	15	40	45		Silty Gravelly Sand

For the purposes of lateral earth pressure and seismic response evaluations, the till has been treated as a predominantly cohesionless soil with relatively dense to very dense character, consistent with the SPT N-values and grain size data summarized in Table 5.

5.2 Groundwater

GeoTerra instrumented Boreholes BH26-1 and BH26-2 with a monitoring well installation. Groundwater levels were measured in the monitoring wells during well development. The measurements and details are presented in Table 6 below.

Table 6: Groundwater Observation and Monitoring Well Summary

BOREHOLE	SCREEN INTERVAL (mbgs)	WATER LEVEL OBSERVATION			REMARKS
		INSTALLATION DATE	MEASUREMENT DATE	DEPTH (mbgs) [EL. (masl)]	
BH26-1	1.52 – 4.57	Feb. 19, 2026	Mar. 04, 2026	2.14 [63.02]	51 mm standpipe well
BH26-2	1.52 – 4.57	Feb. 19, 2026	Mar. 04, 2026	2.19 [62.93]	51 mm standpipe well

Groundwater conditions at the Site should be interpreted with caution, as the observed levels reflect conditions only at the specific monitoring locations and dates noted in this report. Groundwater levels may vary seasonally and annually in response to precipitation, snowmelt, proximity to the Rideau Canal, and changes in site or adjacent-site conditions.

For preliminary design, a perched water table is interpreted near the sand/silty clay interface at about 2 m below grade. A deeper regional groundwater level may be present within the silty clay/till sequence; for design purposes, a groundwater level between about 2 and 4 m below grade should be considered, recognizing short-term fluctuations above and below this range. This implies that excavation for the two basement levels and raft foundation will be carried out below the water table, and temporary

groundwater control measures will be required to maintain stable working conditions.

5.3 Chemical Analysis

Chemical analyses were conducted by Eurofins Environment Testing in Ottawa on two (2) representative soil samples collected near the anticipated founding level. The laboratory results for the chemical analysis are shown in Table 7 and included in Appendix C.

Table 7: Chemical Test Results Summary

BOREHOLE [SAMPLE ID]	DEPTH (m) [EL. (masl)]	PH	SULPHATE (%)	CHLORIDE (%)	RESISTIVITY (ohm-cm)	REDOX (mV)	SULPHIDE (%)	ELECTRIC CONDUCTIVITY (mS/cm)
BH26-2 [SS10]	8.38 – 8.99 [56.74 – 56.13]	8.04	0.01	0.005	3130	191	0.03	0.32
BH26-4 [SS9]	7.62 – 8.23 [57.91 – 57.30]	8.00	0.02	0.005	2940	167	0.03	0.34

6.0 DISCUSSIONS AND GEOTECHNICAL RECOMMENDATIONS

6.1 General

The following discussion is provided to assist the Client and Design Team with the preliminary selection and design of the foundation system, temporary support of excavation, and groundwater control measures for the proposed development. The recommendations are based on the subsurface information and laboratory testing obtained for this project, together with applicable City of Ottawa guidance and current Canadian foundation engineering practice. At this stage, detailed structural loading information has not yet been provided; accordingly, the foundation recommendations are expressed in terms of preliminary ranges of net contact pressure and expected settlements rather than a full load-specific design.

The contemplated structure includes two levels of underground parking founded on the silty clay deposit. As a result, the design must address both bearing capacity and settlement performance of the clay beneath the shallow foundation, as well as the interaction between excavation, groundwater conditions, and adjacent properties. A raft foundation is being considered primarily to distribute loads over the clay deposit, limit differential settlement, and provide an effective base for groundwater and waterproofing details. Final verification of the raft design will be required once structural load data become available.

Particular attention is required for:

- the magnitude of vertical stresses imposed on the native clay relative to its preconsolidation pressure and corresponding settlements.
- the anticipated primary and secondary settlements of the raft under the selected net contact pressures.
- control of groundwater during and after excavation, including the choice of waterproofing and water-suppression systems and their implications for long-term performance.
- the selection of a temporary shoring system that balances constructability, ground movements, and risk to neighbouring structures.

The construction-related comments presented in this section are intended to highlight geotechnical issues that may affect foundation performance, excavation stability, and groundwater management. They are not intended to dictate construction means, methods, sequencing, or temporary works design. Contractors and specialty shoring or dewatering designers who rely on this report are responsible for reviewing the factual data, carrying out their own assessments, and developing and verifying their own designs, procedures, and interpretations appropriate to their chosen methods and equipment.

On this basis, the sections that follow present geotechnical design parameters for the native soils, preliminary ultimate and serviceability limit state (i.e., ULS and SLS) evaluations for the raft foundation, recommendations for excavation support and groundwater control, and comments on construction considerations specific to the silty clay deposit at this site.

6.2 Site Preparation

Site preparation for the proposed development will include demolishing the existing four-storey residential apartment building and removing the associated debris, existing foundations, floor slabs, pavements, fills and buried obstructions from within the proposed building and shoring limits. Excavations to accommodate the two levels of underground parking and foundation system will extend through existing fill and sand deposits down to the native silty clay. Excavation will need to be carried out in stages and in conjunction with the selected Temporary Protection System (TPS) to protect adjacent buildings, municipal services and the Rideau Canal corridor, and to maintain worker safety.

Any unknown or abandoned underground tanks, pits, or utilities encountered during demolition and excavation should be made safe, removed or appropriately decommissioned in consultation with the Owner and relevant authorities.

Given the constrained urban setting and proximity to neighbouring residential properties, it is recommended that construction sequencing be planned to limit open excavation widths and durations, and to maintain the integrity of adjacent structures and services. Excavation should proceed to the founding level under the protection of the TPS, and a mud slab or working slab should be considered on the approved subgrade to provide a clean, level working surface and assist with groundwater and surface water management, if warranted by site conditions.

Appropriate provisions should be made for the temporary collection, treatment and disposal of groundwater, perched water and stormwater runoff, including provision of an adequate pumping system and discharge arrangements in accordance with City of Ottawa requirements. Excavated materials and any excess soil should be managed and disposed of in accordance with applicable environmental regulations and any separate environmental assessments. Evaluation of environmental quality and detailed excess soil management are outside the scope of this geotechnical investigation and should be addressed under a separate environmental program.

6.2.1 Buried Services

Public and private utility owners should be notified prior to the commencement of any construction activities at the Site. Existing underground utilities (water, sewer, gas, electrical, communications, etc.) in the vicinity of the proposed excavation should be located and reviewed before undertaking excavation to identify any potential conflict or damage hazards associated with the planned shoring and excavation. Any utilities that are exposed or intersected as part of the works will need to be supported, protected, temporarily diverted or permanently relocated, as appropriate, during construction.

The shoring system should be designed to lessen the effects of inward movement and minor ground settlement adjacent to the excavation. The Contractor should advise the respective utility owners of all existing utilities prior to excavation and confirm acceptable limits of movement or distortion for each service.

Shoring shop drawings and any support details for temporary utility protection should be prepared and stamped by a professional shoring engineer on record.

6.2.2 Excavation Impact on Adjacent Structures

The Designer and Contractor should account for the influence of the proposed deep excavation on adjacent buildings, municipal services and the Echo Drive right-of-way surrounding the Site. Excavation for the two basement levels and raft foundation will extend to about 8.5 m below existing grade in the silty clay deposit and will require a well-designed Temporary Protection System.

For preliminary assessment, the potential zone of influence of the excavation on nearby foundations may be taken as extending outward and downward from the bottom of existing footings at a nominal slope of 1H:1V. Where the planned excavation or shoring line encroaches into this zone of influence, a case-specific review should be carried out by the Structural Engineer and GeoTerra to determine appropriate support measures.

In view of the urban setting and the depth of excavation, it is recommended that a monitoring program (e.g., building condition surveys, settlement points, and, where applicable, inclinometers on or behind the shoring) be implemented for nearby sensitive structures and services. The monitoring program should be designed by the shoring engineer (or their specialist) and reviewed by GeoTerra, with trigger values and contingency actions established in advance of construction as per City of Ottawa guidelines.

6.3 Excavation

6.3.1 Overburden Excavation

Excavation for the proposed 6-storey residential building with two underground parking levels is expected to extend to a depth of approximately 8.5 m below existing ground surface to accommodate the lowest parking level and the underside of the raft foundation. The excavation will extend through existing fill and sand deposits and into the underlying very stiff silty clay. All excavations are to be carried out within the confines of a Temporary Protection System (TPS) or engineered shoring system designed and stamped by a Professional Engineer and constructed in accordance with the requirements of the Occupational Health and Safety Act (OHSA) of Ontario and O. Reg. 213/91 for Construction Projects.

Given the depth of excavation in silty clay and the proximity of neighbouring structures and buried services, a temporary shoring system will be required. The temporary shoring system should be designed by the shoring expert with consideration given to respecting acceptable limits for adjacent buildings and services.

The TPS/shoring will be required to support the excavation sidewalls in the overburden soil and to limit ground movements affecting adjacent structures, buried services, and the Echo Drive right-of-way. Depending on the final shoring arrangement, a concrete mud slab or working slab at the raft founding level may be used to provide a clean, stable working surface and to act as a barrier against local seepage or softening of the exposed subgrade. Removal of water within the excavation is discussed in Section 6.3.4.

All demolition debris, fills, pavements and abandoned foundations should be removed from within the footprint of the proposed excavation to expose undisturbed native subgrade. Excavation of the overburden soils is expected to be carried out using conventional mechanical excavation equipment. Any localized soft, disturbed or unsuitable soils encountered at the design founding level should be undercut and replaced with a 25 MPa mudslab fill as directed by the Geotechnical Engineer during construction review.

All temporary slopes or excavations outside the shored portion of the excavation must conform to acceptable side-slope and stabilization requirements of OHSA. The general geotechnical parameters summarized in this report may be used for preliminary evaluation of temporary slope stability. However, final excavation support details and construction sequencing should be confirmed by the shoring designer based on the selected TPS system and method of excavation

6.3.2 Temporary Support System

A Temporary Protection System (TPS) or engineered shoring system will be required during both excavation and construction stages to protect the adjacent low-rise residential buildings, the Echo Drive right-of-way and associated utilities, and to protect public safety. The design and performance of the shoring system will be the responsibility of the Contractor's shoring designer and must be carried out by a Professional Engineer experienced in excavation support design.

Engineered shoring systems such as soldier pile and timber lagging walls, secant or sheet-pile walls, or other suitable systems may be considered. The final selection of shoring type and details should take into account the Site geometry, subsurface conditions, groundwater conditions, property boundaries, adjacent structures and services, and the proposed excavation sequence and construction loads. The shoring designer must consider lateral earth, surcharge and hydrostatic pressures, any construction surcharges from equipment or stockpiles placed near the excavation, seasonal frost effects on exposed soils and shoring elements and long-term compatibility with the foundation, waterproofing and drainage details for the basement structure.

The TPS must be designed and constructed in accordance with applicable Ontario regulations and relevant standards (e.g., OHSA O. Reg. 213/91 for Construction Projects) and should be designed to limit horizontal movements at the top of the shoring to values that are acceptable for the nearby buildings, utilities and roadways. Performance criteria, including maximum permissible deflections and tolerable ground movements, should be established as part of the detailed shoring design, in consultation with the Structural Engineer and the project team.

Depending on the selected system and excavation depth, an anchoring and/or internal bracing system may be required to resist lateral earth and surcharge loads. The protection system should extend to sufficient depth below the excavation level to provide adequate toe restraint and global stability. The need for pre-construction condition surveys and monitoring (e.g., survey points, inclinometers or settlement gauges) for adjacent structures and services should be evaluated during the detailed shoring design stage, based on the final excavation geometry, shoring system and the sensitivity of nearby assets.

Specific construction methods, including sequence of installation, excavation stages, and backfilling behind the shoring, should follow the shoring designer's recommendations and shop drawings. Any changes to the shoring geometry, excavation depth or loading conditions relative to the design basis are to be reviewed and approved by the shoring designer prior to implementation

6.3.3 Subgrade Preparation

Subgrade preparation for the proposed raft foundation should extend below all fill and sand deposits down to the native undisturbed silty clay. Based on the boreholes, the native silty clay is encountered at depths of approximately 2.3 to 3.7 mbgs and continues to below the anticipated founding level at about 8.5 mbgs.

The native silty clay at this depth is sensitive and very stiff but may lose strength if it is disturbed or remoulded by over-excavation, heavy machinery traffic, or exposure to excess water. Contractors should use excavation methods that minimize disturbance of the silty clay subgrade. Final trimming of the subgrade should be carried out using a smooth-edged digging bucket rather than teeth or ripping. A Geotechnical Engineer should review and approve the foundation subgrade to confirm that the exposed silty clay is uniform and free of organics, loose fill, soft zones and other unsuitable materials.

Following approval of the subgrade, a 25 MPa concrete mud slab with a nominal thickness of about 100 mm should be placed directly on the exposed silty clay to provide a stable, clean working surface for construction of the foundation and to protect the silty clay from softening and disturbance. Where localized soft or disturbed zones are encountered at the founding level, these should be excavated to a depth as directed by the Geotechnical Engineer and backfilled with additional concrete mud slab (i.e., deepened mud slab) rather than engineered granular fill.

The mud slab should be placed as soon as practical after subgrade approval to limit exposure of the silty clay to adverse weather and construction traffic. Any areas of the mud slab damaged during subsequent construction activities should be repaired prior to raft concrete placement to maintain a continuous and stable bearing surface.

6.3.4 Temporary Construction Dewatering

Groundwater was encountered in the monitoring wells at depths indicative of a perched condition in the overburden, and for preliminary design the longer-term groundwater level is inferred to be about 4 m below existing grade. Groundwater and surface water may accumulate at the bottom of the excavation due to seasonal changes, precipitation events and seepage from the surrounding soil during construction.

The quantity of water will depend on seasonal conditions, the depth and extent of excavation, and the duration that the excavation is kept open.

Contractors should be prepared to handle surface water and any seepage or groundwater infiltration by ditching, pumping or other methods to maintain dry working conditions. For the full-depth excavation to about 8.5 mbgs, it is anticipated that localized perched water and seepage from the overburden may be managed using conventional sump and pump methods and perimeter drainage measures. If higher than anticipated inflows are encountered, or if more aggressive dewatering is required to control groundwater levels outside the excavation, a specialty dewatering contractor should be engaged to assess the need for additional measures (e.g., well points or deep wells) and to design an appropriate system.

The exposed silty clay subgrade must be kept as dry as practical and protected from softening and disturbance. The concrete mud slab recommended in Section 6.3.3 should be placed promptly on the approved subgrade to minimize disturbance from construction traffic and residual seepage.

Given the low permeability and compressible nature of the silty clay, dewatering strategies should be selected to limit the extent and magnitude of groundwater drawdown outside the excavation. As a general principle, localized sump pumping and a relatively tight excavation support system are preferred to aggressive well-point or deep-well systems that could induce significant drawdown and consolidation settlement in the surrounding clay. Where external pumping systems are proposed, a specific assessment of potential ground movements and impacts on adjacent properties should be carried out by the dewatering designer and reviewed by GeoTerra.

If the anticipated groundwater inflow rates, based on detailed design and Contractor means and methods, are such that daily pumped volumes could exceed the thresholds defined in O. Reg. 63/13 and O. Reg. 387/04, the need for a Permit to Take Water (PTTW) and/or an Environmental Activity and Sector Registry (EASR) registration should be confirmed with the Ministry of the Environment, Conservation and Parks (MECP).

6.4 Foundation

Based on our understanding of the proposed development, the foundation system for the main building is recommended to consist of a raft foundation only, bearing on the native silty clay deposit. The foundation recommendations in this section are based on the pre-design assumptions described in Subsection 1.1 and the stratigraphy summarized in Section 5.0 and should be confirmed once detailed structural load information and final foundation geometry are available. The underside of the raft is anticipated to be at an elevation of approximately 8.5 mbgs, beneath the overlying fill and sand deposits and within the very stiff portion of the silty clay profile. At this depth, the clay exhibits relatively high undrained shear strength and preconsolidation pressure, which are favourable for shallow foundation support, provided that settlements are appropriately controlled.

The foundation recommendations provided herein are preliminary and are based on the current understanding of the structural configuration and geotechnical conditions; they should be confirmed once detailed structural loading information (e.g., column and wall reactions, raft stiffness) becomes available.

6.4.1 Geotechnical Bearing Resistance on Silty Clay

For preliminary design, the silty clay at the anticipated raft founding depth has been assessed using undrained shear strength data and one-dimensional consolidation test results. Using a representative undrained shear strength and a geotechnical resistance factor for shallow foundations of $\phi \approx 0.5$, the average net bearing resistance of the raft foundation at the Ultimate Limit State (ULS) is estimated to correspond to a factored net bearing resistance of approximately 200 to 250 kPa over the raft. At the Serviceability Limit State (SLS), the recommended net bearing resistance range for preliminary design is approximately 125 to 150 kPa, taken as an average net service contact pressure over the raft. These values reflect the measured undrained shear strengths of approximately 84 to 150 kPa, the lightly overconsolidated state of the silty clay (OCR about 1.5 to 1.9), and the need to limit stress increases relative to the preconsolidation pressure to control long-term settlements.

At these serviceability-level net pressures, ULS bearing capacity is not expected to govern because the factored bearing resistance significantly exceeds the factored load effects associated with these pressure levels. Settlement considerations therefore control the recommended SLS net bearing range. Preliminary settlement analyses indicate that, for average net service pressures in the 125 to 150 kPa range, total long-term settlements of the raft are expected to be on the order of 25 to 30 mm, and differential settlement across the raft is expected to be on the order of about 10 to 15 mm. These settlement estimates assume a relatively stiff raft with reasonably uniform load distribution, excavation stress relief, and do not account for highly concentrated or eccentric load effects from localized cores or transfer elements, which should be evaluated separately by the Structural Engineer.

The Structural Engineer should confirm that the anticipated total and differential settlements are compatible with the performance criteria for the proposed structure. If more stringent settlement limits are required, options such as increasing raft stiffness, redistributing loads, or locally thickening the raft beneath heavily loaded areas should be considered and reviewed with GeoTerra.

6.4.2 Floor Slab

Typical options for slab floor for underground parking would be a flexible asphalt pavement, a rigid free-floating slab on grade, or alternatively a structural slab. GeoTerra was not provided with information with respect to design criteria for floor slab loadings and traffic loadings of the underground parking garage. Therefore, GeoTerra has assumed that floor slabs are lightly loaded with automobile traffic.

A typical floor slab loading for a lightly loaded slab on grade would involve a maximum pressure of 25 kPa. For design purposes and based upon a properly prepared subgrade surface covered with minimum 300 mm of Ontario Provincial Standard Specification (OPSS) 1010 Granular A, a typical preliminary modulus of subgrade reaction appropriate for the slab design would be approximately 25 MPa/m on engineered fill compacted to 100% of its Standard Proctor Maximum Dry Density (SPMDD). Alternative values would require additional analysis and testing.

For the unheated portions of the buildings or slabs that are exposed to cold temperatures (such as ventilation shafts), the slab subgrade shall be insulated. The insulation shall be load-bearing and spread below the slab for the entire width. It is the Designers' responsibility to determine the thickness of insulation based on the required R-value, equivalent to 1.8 m of earth material insulation value. The insulation shall extend beyond the slab thickenings to a distance equivalent to 1.8 m of earth material insulation value.

6.5 Frost Protection

Frost penetration depth is 1.8 m below the surface for the subject Site. Frost penetration depth is estimated based on the OPSD 3090.101. For protection against frost effects, earth cover of 1.8 m must be provided for all footings in unheated or isolated structures. In the absence of adequate soil cover, equivalent synthetic insulation material can be used.

Should construction take place during winter, surfaces that support foundations or engineered fill must be protected by contractors against freezing for the entire duration of construction or until adequate soil cover is in place. Backfill soils should not be placed in a frozen condition or placed on frozen subgrades.

6.6 Seismic Parameters

6.6.1 Seismic Site Classification

Seismic site classification for this project has been completed in accordance with the Ontario Building Code, Division B, Article 4.1.8.4, "Site Properties," which specifies that the Site Class for ground shall be determined based on average shear-wave velocity, energy-corrected average Standard Penetration Resistance N_{60}, or average undrained shear strength in the upper 30 m of the profile. In particular, Table 4.1.8.4.A of the OBC defines Site Class D (Stiff Soil) as soil profiles with average shear-wave velocity between 180 m/s and 360 m/s, average N_{60} between 15 and 50 blows per 0.3 m, or average undrained shear strength between 50 kPa and 100 kPa in the top 30 m. Based on the borehole data and interpreted stiffness of the silty clay and underlying till at this site, the subsurface conditions fall within these parameter ranges and the site is therefore classified as Seismic Site Class D in accordance with Article 4.1.8.4 and Table 4.1.8.4.A of the Ontario Building Code.

6.6.2 Spectral Acceleration

The spectral acceleration values for different periods and the Peak Ground Acceleration (PGA) value for various cities and municipalities are specified in the National Building Code. The spectral acceleration data for different periods in the general vicinity of the site for a 2% chance of exceedance in 50 years (2475 years return period) are presented in the following table.

Table 8: Seismic Spectral Responses for Site Class D (2% in 50 Yrs)

Spectral Acceleration							
Sa (0.2)	Sa (0.5)	Sa (1.0)	Sa (2.0)	Sa (5.0)	Sa (10.0)	PGA (g)	PGV (m/s)
0.637	0.518	0.308	0.147	0.041	0.0128	0.372	0.362
Note: Seismic Data from the Interpolation Tool of Natural Resources Canada website: 2025 - 2020 National Building Code of Canada Seismic Hazard Tool							

The spectral accelerations and PGA values in Table 8 represent hazard values for Site Class D at the site location, derived from the Natural Resources Canada interpolation tool for the 2020 National Building Code. The Structural Engineer is responsible for incorporating these values into the overall seismic design, including any adjustments or modifications required by the applicable building code and structural design procedures.

6.7 Lateral Earth Pressures

The following lateral earth pressure parameters are provided to assist Contractors and Designers with the design of the proposed structures and temporary protection system or Engineered Shoring systems. The provided discussion below is for fully drained backfill. The Designer should consider any potential for hydrostatic pressure buildup. Compaction of backfill behind foundation wall and retaining structures can induce loads greater than the active or at-rest earth pressures. Therefore, the induced lateral earth pressure due to compaction should be added to the calculated earth pressure in accordance with Section 20.4 of CFEM (2023).

The lateral earth pressure coefficients and unit weights presented in Table 9 are based on the stratigraphy and laboratory/field data summarized in Section 5.0. For design purposes, the till is treated as a predominantly cohesionless, dense to very dense soil, consistent with the SPT N-values and grain size distributions in Table 5.

Table 9: Lateral Earth Pressure Design Parameters for Backfill and Native Soil

Material	Parameter					
	ϕ' (°)	c' (kPa)	γ(kN/m^3)	K_o	K_a	K_p
Granular A	34	0	22	0.44	0.28	3.54
Granular B II	32	0	22	0.47	0.31	3.25
Existing Fill	30	0	20	0.50	0.33	3.00
Silty Clay	28	0	18	0.53	0.35	2.86
Till	32	--	21	0.47	0.32	3.13
Note: ϕ': effective friction angle – c': effective cohesion – γ: unit weight – K_o: coefficient of lateral earth pressure at rest – K_a: coefficient of active earth pressure – K_p: coefficient of passive earth pressure (for a vertical slope and a horizontal surface)						

The shoring and retaining wall designers are responsible for selecting the appropriate set of lateral pressure conditions (at-rest, active, passive) based on wall type, deformation tolerances and construction sequence. Where wall movements are intentionally limited (e.g., to protect adjacent structures or services), at-rest earth pressure conditions should be assumed unless project-specific analyses demonstrate that lower pressures are appropriate.

Static lateral earth pressure can be calculated by using the following equation:

$$\sigma_h = K \times (\gamma h + q)$$

where K is the lateral earth pressure coefficient. For yielding retaining walls, the active earth pressure coefficient, K_a, is recommended for design. For non-yielding permanent walls, such as foundation walls, the at-rest, K_o, is recommended for design. The resultant of the applicable static or at-rest force is assumed to act at h = 1/3H above the base of the wall where H is the Height of the wall. The unit weight of the retained soil "γ" is given in Table 9, and "q" is the value of any applied surcharge.

The above noted lateral pressure coefficients are calculated assuming the wall back angle is vertical and the backslope of the retained soil is horizontal. The wall-soil interaction angle is assumed to equal to 0.5 ϕ' as per CFEM. If a temporary protection system is used, then designers should refer to CFEM for design assistance and a geotechnical engineer should be retained to perform the shoring design review.

6.8 Permanent Drainage

Consideration should be given to a permanent groundwater control system to reduce long-term groundwater inflows to the below-grade structure. For this project, the underside of the raft foundation is assumed to be at approximately 8.5 m below existing grade, the P1 suspended slab at about 4 m below grade, and the long-term groundwater level at a depth of approximately 4 m below grade. The raft and P2 basement level will therefore be permanently below the groundwater table and should be treated as a waterproofed structure, supplemented by a local groundwater control system consisting of interior perimeter drainage and internal sump pumping to control seepage while avoiding significant drawdown in the surrounding clay deposits.

A nominal 100 mm thick 25 MPa concrete mud slab should be placed on the prepared native silty clay subgrade at the base of the excavation to provide a clean, stable working platform and to act as a horizontal hydraulic barrier beneath the raft. The raft foundation slab should be poured directly on the mud slab, with construction joints detailed with appropriate PVC or hydrophilic waterstops and joint sealants to limit seepage paths beneath the basement.

Waterproofing and tanking details should include the following:

- A continuous vertical bentonite or equivalent tanking membrane fixed to the inside face of the shoring and carried down to overlap and seal to the concrete mud slab, with joints staggered and taped in accordance with the manufacturer's recommendations.
- Pouring the raft slab directly against the vertical membrane to provide continuity between horizontal and vertical waterproofing elements and to minimize leakage at the wall–slab interface.

- Installation of a composite drainage board or geocomposite outside the membrane from finished grade down to at least the top of the raft, to protect the membrane during concrete placement and to provide a drainage path to the perimeter drains.
- A waterproofing membrane will be required for the P-1 level and should be placed between the foundation wall and the composite drainage system.
- Provision of waterstops at all construction and cold joints in the raft and walls, at wall–slab junctions, and around penetrations such as service pipes and tie-backs.
- Careful detailing of corners, changes in level, terminations at grade and at raft edges, and local features such as elevator pits and sump pits to maintain continuity of the tanking system.
- Cast 100 mm in diameter sleeves at 3 m centres at the bottom of the foundation wall to collect the water within the composite drainage layer.

The composite drainage layer behind the walls should be connected to perimeter granular drains positioned at or just above raft level, discharging by gravity where feasible or to interior sump pits equipped with duplex pumps (duty/standby) and appropriate power backup. This system is intended to intercept seepage, relieve hydrostatic pressures on the walls and waterproofing, and convey inflows to the sump without requiring significant long-term regional drawdown of the groundwater table. Drainage sleeves or weepholes may be cast through the wall just above raft level, at suitable spacing, to direct any incidental seepage that bypasses the membrane into the interior perimeter drain.

The detailed design of the permanent drainage and waterproofing system, including pump sizing, backup provisions, and final selection and detailing of the membrane and jointing systems, should be completed by the Structural consultant and waterproofing specialist, in consultation with the Geotechnical Engineer, to confirm that the system provides an acceptable factor of safety against uplift and adequately controls long-term groundwater inflow to the basement.

6.9 Tree Planting on Sensitive Marine Clay

Tree planting for this development will follow the City of Ottawa's Tree Planting in Sensitive Marine Clay Soils – 2017 Guidelines and associated Clay Soils Policy, as they apply to areas underlain by Champlain Sea (sensitive marine) clay. The subsurface conditions at this site comprise about 2.3 to 3.7 m of fill over stiff to very stiff silty clay extending to the raft level at approximately 8.5 m depth; given this stratigraphy and the moderate plasticity indicated by the laboratory index data, the risk of appreciable foundation movement due to tree-induced shrinkage at raft level is considered low and is not expected to govern structural design, consistent with City practice for similar profiles.

In accordance with the City guidelines and the Landscape Plan Terms of Reference, tree species and planting locations will be selected to limit water demand and concentrated drying of the near-surface clay in areas where shallow foundations, exterior slabs or utilities may be present, and to respect any minimum setback distances from building foundations prescribed by the City for sensitive marine clay sites. Given the depth of the proposed raft foundation and the low to medium plasticity of the silty clay at foundation

level, the risk of tree-induced shrinkage significantly affecting the raft is considered low. The primary geotechnical concerns associated with tree planting are potential effects on shallow elements such as near-surface slabs, pavements, service laterals and any future light structures founded at relatively shallow depths.

The final landscape plan should therefore identify areas underlain by sensitive clay, demonstrate compliance with the City's tree-planting guidelines, and be coordinated with this geotechnical report so that soil–structure interaction considerations required by the Ontario Building Code serviceability provisions are satisfied. The foundation walls and any other below-grade structural elements should be designed accordingly, recognizing the adopted assumptions regarding low shrinkage potential at raft level and the control measures applied to tree planting and near-surface moisture variations.

6.10 Backfill

6.10.1 Engineered Fill

Any over excavation shall be leveled with lean concrete or a concrete mix of the same strength as the foundation system. A 100 mm thick concrete mud slab should be placed over the undisturbed excavation bottom, as approved by the Geotechnical Engineer, to create a horizontal hydraulic barrier beneath the raft foundation.

All new fill soils that underlie floor slab, or other structural applications are considered as engineered fill. Engineered fill must meet the strict requirements as shown below:

- Engineered fill shall not be placed in frozen condition or placed on a frozen subgrade.
- Typically, a crushed well-graded material such as an OPSS 1010 Granular A or Granular B Type II is suitable. However, other suitable granular materials may be proposed and considered depending on the Site-specific conditions.
- Before placing any engineered fill, all debris, and unsuitable fill must be removed, and the subgrade proof rolled and approved by a geotechnical engineer. Any deficient areas should be repaired before Engineered Fill placement.
- Engineered fill shall be placed in maximum loose lifts of 300 mm and adequately compacted to achieve 100% of its SPMDD. Engineered fill must have full-time compaction testing by geotechnical personnel.

6.10.2 General Backfill and Grade Raise

The backfill placed against exterior foundations shall be free draining granular material meeting the grading requirements of an OPSS 1010 Granular B Type I, or Selected Subgrade Material (SSM), or equivalent granular material.

The exterior backfill should be placed and compacted as outlined below:

- Backfill should not be placed in frozen condition, or placed on a frozen subgrade;

- Backfill should be placed and compacted in maximum loose lift thickness compatible with the selected construction equipment, but not thicker than 300 mm. Each lift should be uniformly compacted to achieve 95% of its SPMDD;
- In landscaped areas the upper 0.3 m of backfill below landscape details should be a low permeable soil to reduce surface water infiltration;
- For backfill that would underlie paved areas, sidewalks or exterior slabs-on-grade, each lift should be uniformly compacted to achieve 98% of its SPMDD;
- For backfill on the building exterior that would underlie landscaped areas, each lift should be uniformly compacted to at least 95% of its SPMDD;
- Exterior grades should be sloped away from the foundation wall, and roof drainage downspouts should be placed so that water flows away from the foundation wall;
- Entrance slabs should be founded on frost walls or alternatively have insulation details developed to prevent frost heaving at the building entrances; and
- In areas where the building backfill underlies pavement, sidewalk, or other hard landscaping, the excavation should have a frost taper incorporated to prevent differential heaving around the building.

6.11 Underground Utilities

At the subject Site, the burial depth of water-bearing utility lines is typically 1.8 m below the ground surface or as dictated by local applicable codes. If this depth is not achievable, equivalent thermal insulation should be provided. The Contractor should retain a professional engineer to provide detailed drawings for excavation and temporary support of the excavation walls during construction.

The Occupational Health and Safety Act (OHSA) of Ontario indicates that side slopes in the fill and sand above the water could be classified as Type 3 soil and sloped no steeper than 1H:1V or be shored. Below the groundwater level, the soils are considered to be Type 4 Soil, and the excavation side slopes must be sloped from their bottom cut back at 3H:1V. Otherwise, lateral support for all excavations such as trench boxes should be used.

The engineer designing utilities shall ensure the proposed utility pipes can tolerate compaction loads.

The recommendations within this section are intended to be a supplement to, and not a replacement of the most recent local municipal requirements.

6.11.1 Bedding and Cover

The following are recommendations for service trench bedding and cover materials:

- Bedding for buried utilities should consist of an OPSS 1010 "Granular A" material and be placed in accordance with municipal requirements, assuming the subgrade soils are not allowed to become disturbed. All utility pipes and high amps electrical conduits shall receive a minimum of 150 mm

bedding.

- The use of clear stone is not recommended for use as pipe bedding. The voids in the stone may result in a low gradient water flow and infiltration of fines from the surrounding soils and cover materials, causing settlement and loss of support to pipes and structures.
- The cover material should be a service sand material or an OPSS 1010 "Granular A". The dimensions should comply with the pertinent specification section.
- The bedding, spring line, and cover should be compacted to at least 98% of its SPMDD.
- All covers are to be compacted to 100% SPMDD if they are intersecting structural elements.
- Compaction equipment should be used in such a way that the utility pipes are not damaged during construction.

6.11.2 Trench Backfill

Backfill above the cover for buried utilities should be in accordance with the following recommendations:

- For service trenches underlying pavement areas, the backfill should be placed and compacted in uniform lift thickness compatible with the selected compaction equipment and not thicker than 300 mm. Each lift should be compacted to a minimum of 95% of its SPMDD.
- The backfill placed in the upper 300 mm below the pavement subgrade elevation should be compacted to a minimum of 98% of its SPMDD.
- During backfilling, care should be taken to ensure the backfill proceeds in equal stages simultaneously on both sides of the pipe; and
- No frozen material should be used as backfill; neither should the trench base be allowed to freeze.

The quality and workmanship in the construction are as important as the compaction standards themselves. It is imperative that the guidelines for the compaction be followed for the full depth of the trench to achieve satisfactory performance.

6.12 Cement Type and Corrosion Potential

Two (2) soil samples were submitted to Eurofins Environment Testing Ottawa for testing of chemical properties relevant to exposure of concrete elements to sulphate attacks as well as potential soil corrosivity effects on buried metallic structural elements. Test results are presented in Table 10 and the laboratory results for the chemical analysis are shown in Appendix C.

Electrical resistivity, pH-value, and chloride concentration can provide an indication of the corrosion potential to buried steel elements in contact with subsurface environment. Using a corrosion nomograph proposed by King (1977) for buried metals and based on electrical resistivity results and pH-value, the corrosion potential for buried steel elements is within the non-aggressive range. It is noted that the King (1977) scoring system indicates non-aggressive to mildly aggressive conditions for buried carbon steel,

whereas the AWWA C105 methodology classifies the soils as moderately corrosive for ductile iron; this difference reflects the differing criteria and safety margins inherent in the two assessment approaches. Concrete mix design and cover requirements should be confirmed by the Structural Engineer and materials supplier in accordance with CSA A23.1, considering the moderate-to-low sulphate exposure indicated by the test results.

The American Water Works Association (AWWA) publication 'Polyethylene Encasement for Ductile-Iron Pipe Systems' ANSI/AWWA C105/A21.5-10 dated October 1, 2010, assigns points based on the results of the above tests. A soil that has a total point score of 10 or more is considered to be potentially corrosive to ductile iron pipe. Based on the results obtained for the samples submitted, the Site soils are moderately corrosive to ductile iron pipe. The corrosive effects of road de-icing salts should also be considered.

The analytical results of the soil samples were compared with applicable Canadian Standards Association (CSA) A23.1-04 and are given in Table 10 below.

Table 10: Additional Requirements for Concrete Subjected to Sulphate Attack

CLASS OF EXPOSURE	DEGREE OF EXPOSURE	WATER SOLUBLE SULPHATE IN SOIL SAMPLE (%)	CEMENTING MATERIAL TO BE USED
S-1	Very Severe	>2.0	HS or HSb
S-2	Severe	0.2 – 2.0	HS or HSb
S-3	Moderate	0.1 – 0.2	MS, MSb, LH, HS, or HSb

The chemical sulphate content analyses for selected soil sample test indicate a sulphate concentration of 0.01 to 0.02% in soil, as shown in Table 10, indicating a "moderate to low" risk for sulphate attack on concrete material.

Accordingly, for ductile iron and similar ferrous utilities, the use of polyethylene encasement and other corrosion protection measures should be evaluated in accordance with AWWA C105 and the pipe supplier's recommendations.

7.0 CONSTRUCTION CONSIDERATIONS

The recommendations presented in this report assume that an adequate level of construction monitoring by qualified geotechnical personnel during construction will be provided. All bearing surfaces should be inspected and approved by experienced geotechnical personnel before placing the footings or mud slabs.

In addition, an adequate level of construction monitoring should include laboratory and field tests during construction. This includes full-time compaction testing of engineered fill and part-time compaction testing of exterior foundation wall backfill with laboratory testing for the proposed fill soils for this Site. Also, periodic testing of concrete is required.

All backfilling shall comply with the OPSS.MUNI 501 unless the design recommendations included in this report exceed provisions of OPSS.MUNI 501.

The vibration should be kept at a minimal level to avoid soil disturbance and associated unexpected settlement to the nearby roadway, load bearing elements, and utilities. Also, the noise level should be kept at a tolerance level of noise per the municipality requirements. Vibration and deformation monitoring will be required throughout the construction.

GeoTerra should be retained to review relevant shoring, dewatering and foundation shop drawings, and to provide geotechnical field review during excavation, subgrade preparation, placement of engineered fill and foundation construction. Such involvement will assist in confirming that the design assumptions remain valid and in addressing any unforeseen subsurface conditions that may arise.

8.0 SCOPE OF THE REPORT AND LIMITATION OF LIABILITY

The characteristics of the soil and rock described in this report are based on boreholes and exploration trenches conducted at a specific period and depict the nature of the Site precisely where these boreholes were carried out. Thus, the characteristics between sampling points can vary significantly from the conditions encountered at the exact location where the samples were taken.

Furthermore, it should be noted that soil and rock formations may differ on the same site, and the boundaries between the various formations presented in this report should not be considered fixed. GeoTerracs Inc. cannot guarantee the accuracy of these boundaries, which depend on factors such as the number of boreholes or the sampling method.

Additionally, the properties of the soil and rock can be significantly altered after construction activities are carried out on the site or on adjacent sites. They can also be indirectly affected by exposure to freezing or weather conditions.

The groundwater conditions presented in this report apply solely to the study site. The groundwater levels indicated correspond only to the levels observed during the specified works, on the specified date and location. It should be noted that these conditions may vary depending on precipitation, snowmelt, or seasons. Moreover, construction activities or modifications to the physical conditions of the study site or adjacent sites can also alter groundwater conditions.

In this report, the descriptions of the sampled materials were conducted using commonly recognized methods of identification and classification in geotechnical engineering. These methods may involve judgment and interpretation. In practice, these descriptions are presumed to be accurate and correct.

The results of tests and analyses are valid only for the samples described in this report. The interpretation of field and laboratory results, as well as the recommendations provided, is applicable only to the study site and the information available for the project at the time of writing this report. They do not apply to any other project or site.

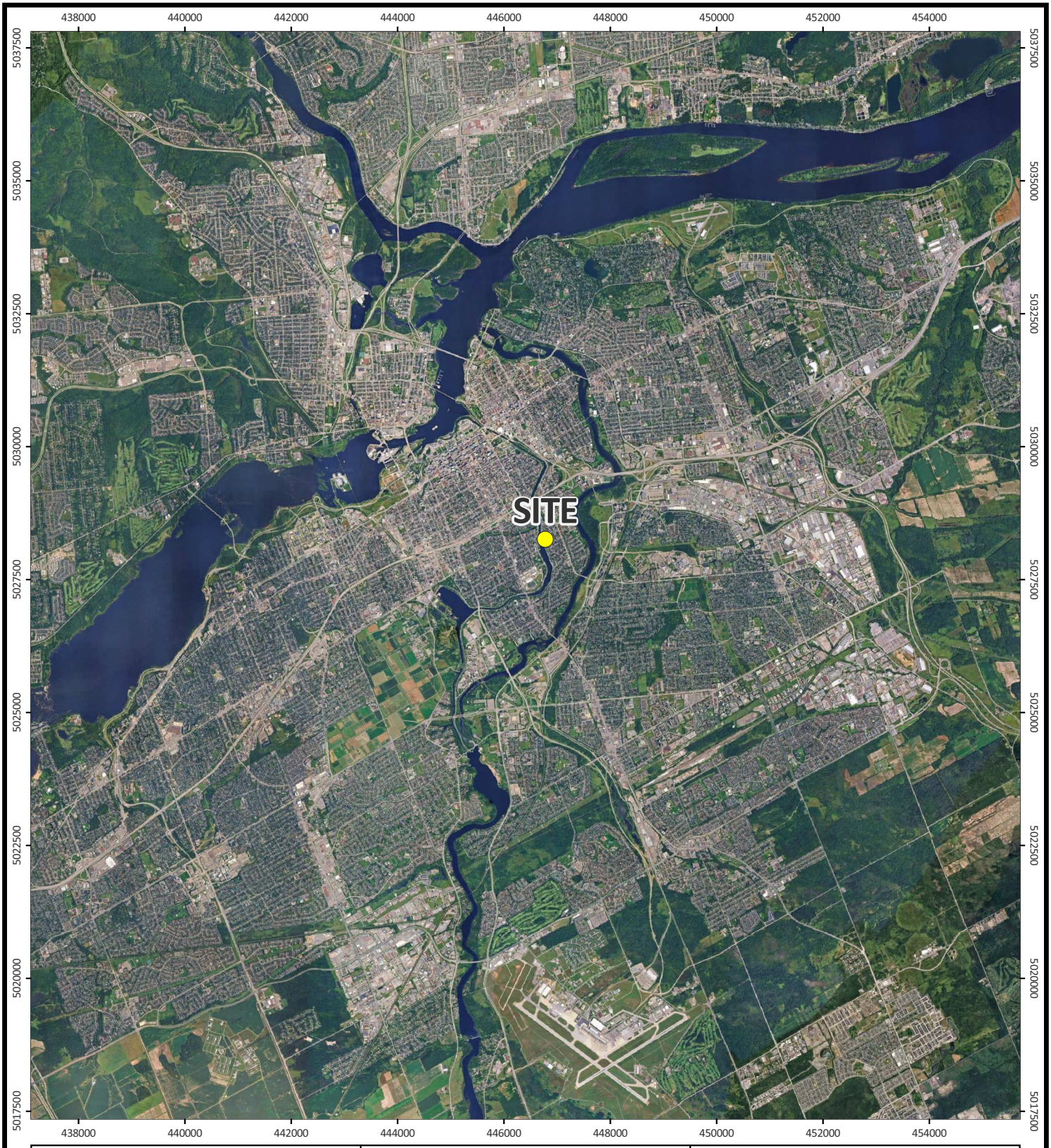
The recommendations given in this report are primarily intended for the project design team. The number of boreholes needed to determine all subsurface conditions may exceed the number of boreholes conducted for design purposes. If the project design is modified, GeoTerracs Inc. should be consulted to ensure that the recommendations in this report are still valid. In the event of modifications to the recommendations, additional field or laboratory work may be necessary.

It is recommended that site visits be conducted by GeoTerracs Inc. as the work progresses to confirm, and if necessary, modify the interpretations or recommendations provided in this report. If such verifications are not possible, GeoTerracs Inc. will assume no responsibility for the geotechnical interpretation that third parties may make of this report, especially if the design is altered or if site conditions differ from those described in this report.

This report should not be reproduced, in whole or in part, without the permission of GeoTerracs Inc.

Finally, this report does not constitute a legal opinion and should not be interpreted as such.

APPENDIX A – FIGURES



GeoTerra

0 2,000 4,000 m

N

Location: 441-443 Echo Drive, Ottawa, ON K1S 1N6			Project: 441-443 Echo Drive
Client: JB Holdings			Title: Site Location Plan
Drawn by: J. Brooks		Ref.: 2512064	Figure: FIG-01
Approved by: A. Lamrani		Date: April 2026	
Version: 1		Scale: 1:100,000	

GeoTerra

Legend

- Borehole location
- Property Boundary

Title: Site Plan

Project: 441-443 Echo Drive

Location: 441-443 Echo Drive, Ottawa, ON K1S 1N6

Client: JB Holdings

Drawn by:	J. Brooks	Ref.:	2512064
Approve by:	A. Lamrani	Date:	April 2026
Version:	1	Scale:	1:260

Figure: FIG-02

0 7 14 m

N

APPENDIX B – BOREHOLE LOGS

BOREHOLE LOG: BH26-1

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,789.693
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,257.044
CLIENT:	JB Holdings	**DRILLING DATE:**	February 18, 2026	**GROUND ELEV.:**	65.16 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	15.9 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Ground Surface EL 65.16 m

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value
0	0	Asphalt 0.08 m Fill EL 65.08 m Sand and gravel, frozen, brown		1	SS	63
2		0.61 m EL 64.55 m Sand, brown, frozen to moist, compact		2	SS	11
3	1					
4		becomes moist to wet		3	SS	12
5						
6		becomes wet, loose		4	SS	7
7	2	2.44 m EL 62.72 m NATIVE Silty Clay, trace sand, grey, wet, very stiff		5	SS	2
8						
9						
10	3			6	SS	1
11						
12						
13	4			7	SS	WH
14						
15						
16	5			8	SS	2

Field Tests: Su_rs (45 90 135 180); Su_pk (45 90 135 180); NValue (20 40 60 80)

Laboratory Tests: Plastic Index (20 40 60 80); Liquid Limit (10 20 30 40); Moisture (10 20 30 40)

Gradation (%): Gravel, Sand, Silt, Clay, Fines

Additional Observations

Piezometer / Well

BOREHOLE LOG: BH26-1

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,789.693
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,257.044
CLIENT:	JB Holdings	**DRILLING DATE:**	February 18, 2026	**GROUND ELEV.:**	65.16 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	15.9 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%)	Additional Observations	Piezometer / Well
							+ Su_rs (45 90 135 180); × Su_pk (45 90 135 180); NValue (20 40 60 80)	○ Plastic Index (20 40 60 80); ● Liquid Limit (10 20 30 40); □ Moisture (10 20 30 40)	Gravel; Sand; Silt; Clay; Fines		
17	5			8	SS						
18				9	SS	WH					
19											
20	6			10	SS	1					
21											
22					VANE		+ 21 × 132				
23	7				VANE		+ 27 × 120				
24											
25				11	SS	2					
26	8										
27					VANE		+ 18 × 120				
28					VANE		+ 27 × 120				
29											
30	9			12	ST						
31											
32											
10				13	SS	3					

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BOREHOLE LOG: BH26-1

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,789.693
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,257.044
CLIENT:	JB Holdings	**DRILLING DATE:**	February 18, 2026	**GROUND ELEV.:**	65.16 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	15.9 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%) Gravel	Sand	Silt	Clay	Fines	Additional Observations	Piezometer / Well
33	10						Su_rs + / Su_pk × (45 90 135 180); NValue (20 40 60 80)	Plastic Index ○ / Liquid Limit ● (20 40 60 80); Moisture □ (10 20 30 40)							
34				13	SS										
35															
36	11			14	SS	2				2	46	52	98		
37															
38				15	SS	3									
39	12														
40					VANE		150								
41					VANE		150								
42															
		12.95 m EL 52.21 m													
43	13	Silty Sand, trace clay, grey, wet, loose to compact		16	SS	9									
44															
45				17	SS	13									
46	14														
47															
48															
49	15														

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BOREHOLE LOG: BH26-1

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,789.693
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,257.044
CLIENT:	JB Holdings	**DRILLING DATE:**	February 18, 2026	**GROUND ELEV.:**	65.16 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	15.9 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%) Gravel	Sand	Silt	Clay	Fines	Additional Observations	Piezometer / Well
50	15														
51				18	SS	9									
52		15.85 m EL 49.31 m													
	16	End of Hole (15.9 m)													
53															
54															
55															
56	17														
57															
58															
59	18														
60															
61															
62															
63	19														
64															
65															
20															

Field Tests: Su_rs (45 90 135 180); Su_pk (45 90 135 180); NValue (20 40 60 80)

Laboratory Tests: Plastic Index (20 40 60 80); Liquid Limit (10 20 30 40); Moisture (10 20 30 40)

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BOREHOLE LOG: BH26-2

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,784.701
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,270.797
CLIENT:	JB Holdings	**DRILLING DATE:**	February 19, 2026	**GROUND ELEV.:**	65.12 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	9.6 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Ground Surface EL 65.12 m

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value
0	0	Asphalt 0.08 m				
		Fill EL 65.04 m				
1		Sand, some gravel, brown to grey, frozen		1	SS	69
2		0.61 m EL 64.51 m				
		Sand, trace silt and clay, grey to brown, frozen to wet, loose		2	SS	8
3	1					
4						
5		some silt, brown, wet		3	SS	6
6						
7	2	2.29 m EL 62.83 m				
		NATIVE				
8		Silty Clay, some to trace of sand, brown to grey, wet, stiff to very stiff		4	SS	5
9						
10	3	becomes grey				
11				5	SS	2
12						
13	4			6	SS	WH
14						
15						
16	5			7	SS	1

Field Tests: Su_rs (45 90 135 180); Su_pk (45 90 135 180); NValue (20 40 60 80)

Laboratory Tests: Plastic Index (20 40 60 80); Liquid Limit (10 20 30 40); Moisture (10 20 30 40)

Gradation (%): Gravel, Sand, Silt, Clay, Fines

Additional Observations

Piezometer / Well

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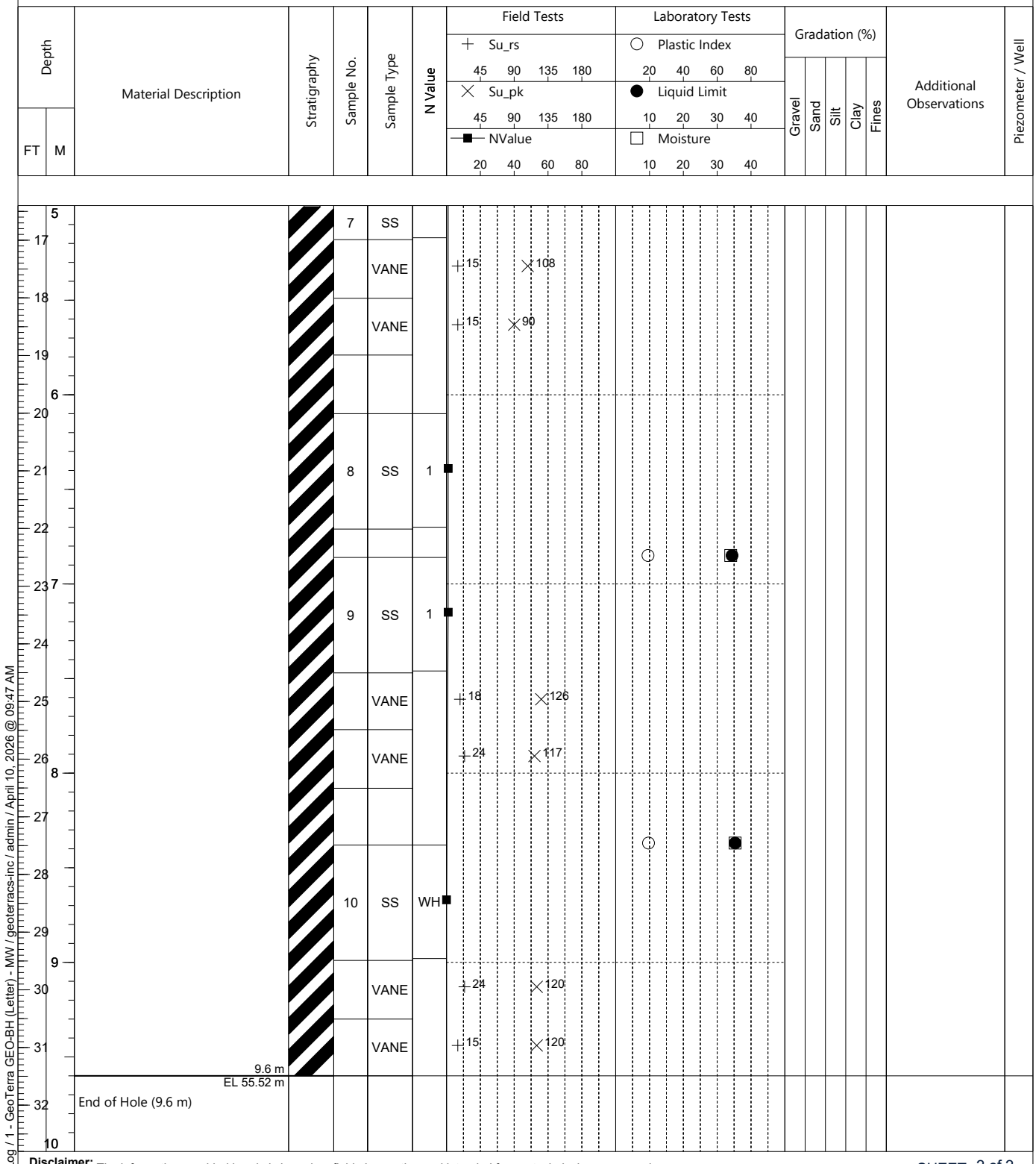
BOREHOLE LOG: BH26-2

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,784.701
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,270.797
CLIENT:	JB Holdings	**DRILLING DATE:**	February 19, 2026	**GROUND ELEV.:**	65.12 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	9.6 m	**COORDINATE SYSTEM:**	UTM

NOTES:



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BOREHOLE LOG: BH26-3

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,762.181
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,267.383
CLIENT:	JB Holdings	**DRILLING DATE:**	February 23, 2026	**GROUND ELEV.:**	65.05 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	28 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Ground Surface EL 65.05 m

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value
0	0	Asphalt 0.08 m				
		Fill EL 64.97 m				
1		Sand and gravel, trace silt and clay, grey, frozen to damp		1	SS	52
2		Sand, some gravel, greyish brown, frozen to moist				
3	1			2	SS	5
4						
5		Sand, brown, wet, very loose		3	SS	2
6						
7	2					
8		some silt, trace clay, loose		4	SS	7
9						
10	3					
11		some clay		5	SS	3
12		3.7 m				
		NATIVE EL 61.35 m				
13	4	Silty Clay, some to trace of sand, grey, wet, very stiff		6	SS	2
14						
15						
16	5			7	SS	1

Field Tests: Su_rs (45 90 135 180); Su_pk (45 90 135 180); NValue (20 40 60 80)

Laboratory Tests: Plastic Index (20 40 60 80); Liquid Limit (10 20 30 40); Moisture (10 20 30 40)

Gradation (%): Gravel | Sand | Silt | Clay | Fines

Additional Observations

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BOREHOLE LOG: BH26-3

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,762.181
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,267.383
CLIENT:	JB Holdings	**DRILLING DATE:**	February 23, 2026	**GROUND ELEV.:**	65.05 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	28 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%) Gravel	Sand	Silt	Clay	Fines	Additional Observations
							+ Su_rs 45 90 135 180; × Su_pk 45 90 135 180; NValue 20 40 60 80	○ Plastic Index 20 40 60 80; ● Liquid Limit 10 20 30 40; □ Moisture 10 20 30 40						
5				7	SS		+ 21 × 114							
17					VANE									
18					VANE		+ 30 × 126							
19														
6														
20														
21				8	SS	2								
22														
23	7			9	ST									
24														
25														
26	8			10	SS	4								
27					VANE		+ 18 × 120							
28					VANE		+ 27 × 120							
29														
9														
30														
31				11	SS	3			0	23	35	42	77	
32														
10					VANE		+ 21 × 144							

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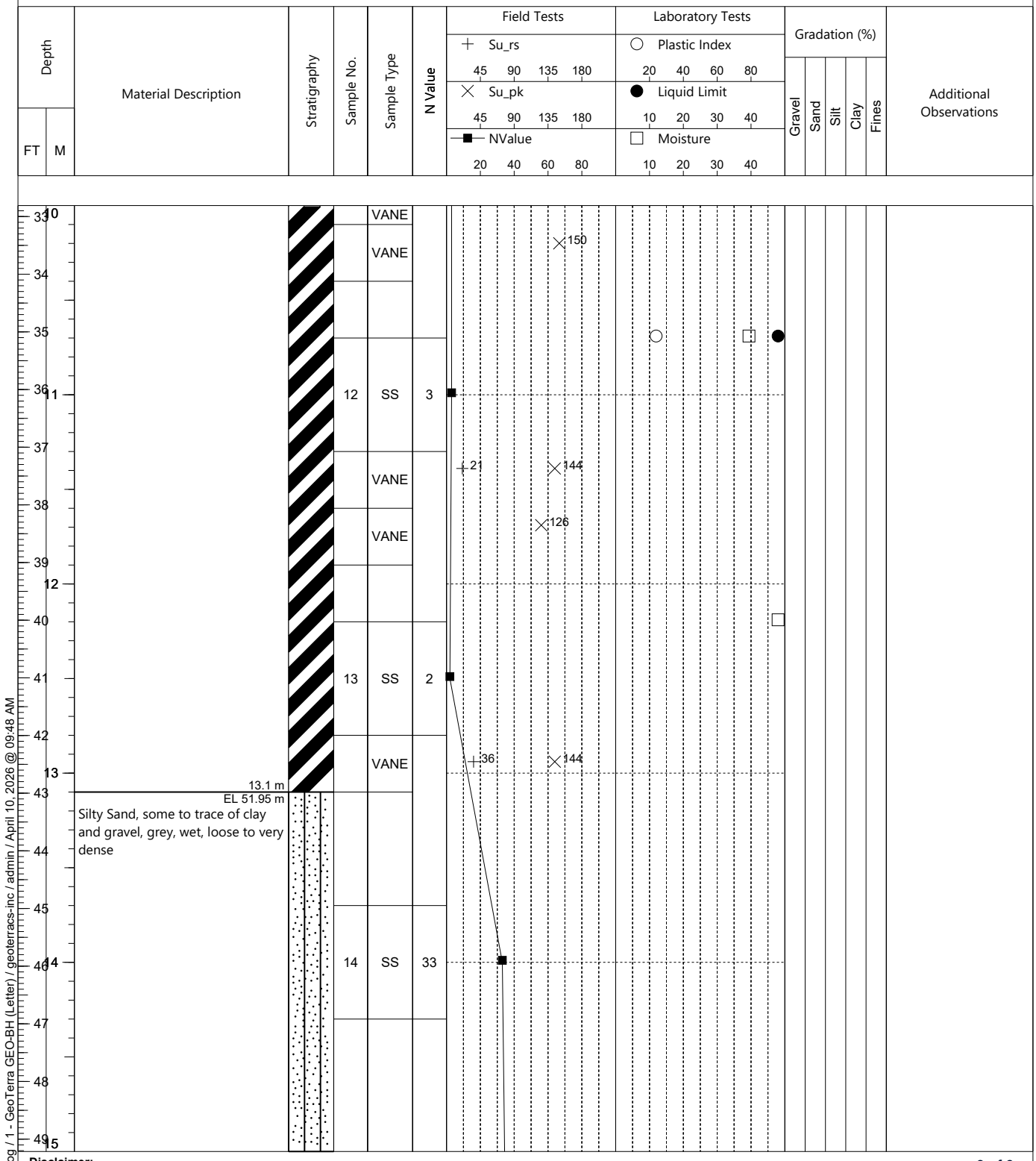
BOREHOLE LOG: BH26-3

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,762.181
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,267.383
CLIENT:	JB Holdings	**DRILLING DATE:**	February 23, 2026	**GROUND ELEV.:**	65.05 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	28 m	**COORDINATE SYSTEM:**	UTM

NOTES:



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Disclaimer: The information provided herein is based on field observation and intended for geotechnical purposes only.

BOREHOLE LOG: BH26-3

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,762.181
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,267.383
CLIENT:	JB Holdings	**DRILLING DATE:**	February 23, 2026	**GROUND ELEV.:**	65.05 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	28 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%) Gravel	Sand	Silt	Clay	Fines	Additional Observations
	15						+ Su_rs 45 90 135 180	○ Plastic Index 20 40 60 80						
							× Su_pk 45 90 135 180	● Liquid Limit 10 20 30 40						
							—■— NValue 20 40 60 80	□ Moisture 10 20 30 40						
	50													
	51			15	SS	35			0	76			24	
	52													
16	53													
	54													
	55													
17	56													
	57													
	58													
18	59													
	60	trace silt and gravel												
	61			16	SS	17								
	62													
19	63													
	64													
	65													
20														

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BOREHOLE LOG: BH26-3

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,762.181
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,267.383
CLIENT:	JB Holdings	**DRILLING DATE:**	February 23, 2026	**GROUND ELEV.:**	65.05 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	28 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%)	Additional Observations
							+ Su_rs (45 90 135 180); × Su_pk (45 90 135 180); —■— NValue (20 40 60 80)	○ Plastic Index (20 40 60 80); ● Liquid Limit (10 20 30 40); □ Moisture (10 20 30 40)	Gravel; Sand; Silt; Clay; Fines	
20	66	some silt		17	SS	5				
	67									
	68									
21	69									
	70									
	71									
	72									
22	73									
	74									
	75									
23	76									
	77									
	78									
24	79									
	80									
	81									
25	82									

BOREHOLE LOG: BH26-3

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,762.181
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,267.383
CLIENT:	JB Holdings	**DRILLING DATE:**	February 23, 2026	**GROUND ELEV.:**	65.05 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	28 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%) Gravel	Sand	Silt	Clay	Fines	Additional Observations
25							+ Su_rs (45 90 135 180)	○ Plastic Index (20 40 60 80)						
							× Su_pk (45 90 135 180)	● Liquid Limit (10 20 30 40)						
							—■— NValue (20 40 60 80)	□ Moisture (10 20 30 40)						
	83													
	84													
	85													
26		trace cobbles		18	SS	54			15	40			46	
	86													
	87													
	88													
27														
	89													
	90													
	91			19	SS	59								
28		28 m												
	92	EL 37.05 m End of Hole (28 m)												
	93													
	94													
29	95													
	96													
	97													
	98													
30														

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BOREHOLE LOG: BH26-4

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,767.724
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,240.281
CLIENT:	JB Holdings	**DRILLING DATE:**	February 26, 2026	**GROUND ELEV.:**	65.53 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	17.98 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Ground Surface EL 65.53 m

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value
0	0	Topsoil Sandy Silt, some organics and rootlets, trace clay, brown, frozen		1	SS	21
1		0.15 m EL 65.38 m Fill Sand, reddish brown, trace organics, moist, loose				
2				2	SS	6
3	1					
4						
5		trace clay, moist to wet, compact		3	SS	12
6						
7	2	wet		4	SS	5
8						
9						
10	3	3.05 m EL 62.48 m NATIVE Silty Clay, some to trace sand, grey, wet, stiff to very stiff		5	SS	2
11						
12						
13	4			6	SS	2
14						
15						
16	5			7	SS	1

Field Tests: N (20 40 60 80); Su_rs (45 90 135 180); Su_pk (45 90 135 180); NValue (20 40 60 80)

Laboratory Tests: Plastic Index (20 40 60 80); Liquid Limit (10 20 30 40); Moisture (10 20 30 40)

Gradation (%): Gravel | Sand | Silt | Clay | Fines

Additional Observations

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BOREHOLE LOG: BH26-4

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,767.724
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,240.281
CLIENT:	JB Holdings	**DRILLING DATE:**	February 26, 2026	**GROUND ELEV.:**	65.53 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	17.98 m	**COORDINATE SYSTEM:**	UTM

NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%) Gravel	Sand	Silt	Clay	Fines	Additional Observations
17	5			7	SS									
					VANE		12 84							
18					VANE		24 90							
19														
	6													
20														
21				8	SS	1								
22					VANE		21 114							
23	7				VANE		21 114							
24														
25					SS	1								
26	8													
27					VANE		12 132							
28					VANE		21 120							
29														
30	9													
31				10	SS	3								
32														
	10				VANE		150							

10 50 40 90

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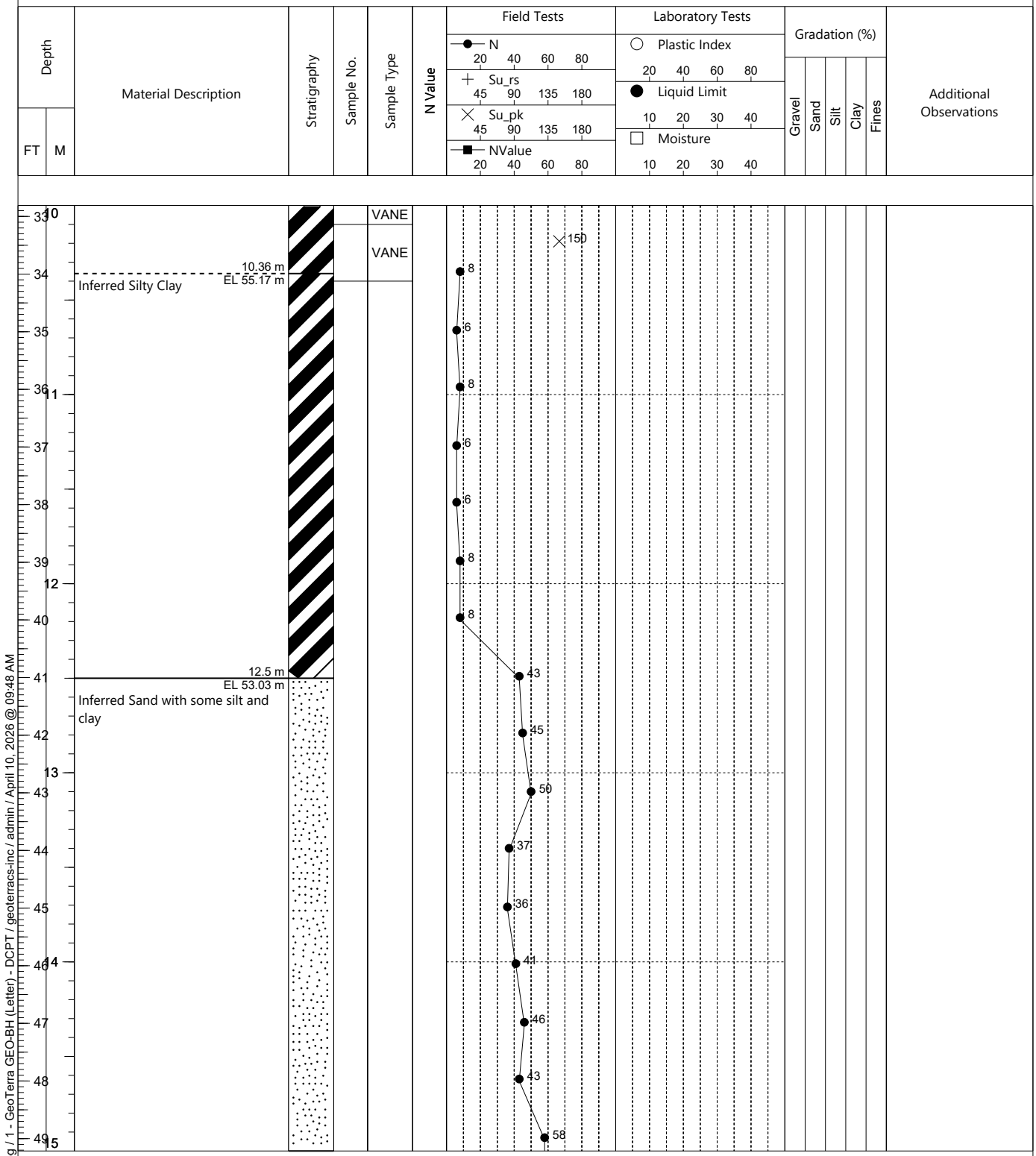
BOREHOLE LOG: BH26-4

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,767.724
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,240.281
CLIENT:	JB Holdings	**DRILLING DATE:**	February 26, 2026	**GROUND ELEV.:**	65.53 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	17.98 m	**COORDINATE SYSTEM:**	UTM

NOTES:



RSLog / 1 - GeoTerra GEO-BH (Letter) - DCPT / geoterracs-inc / admin / April 10, 2026 @ 09:48 AM

BOREHOLE LOG: BH26-4

GeoTerra

PROJECT NAME:	441-443 Echo Drive	**LOGGED BY:**	ARS	**EASTING:**	446,767.724
PROJECT NO.:	2512064	**REVIEWED BY:**	ARS	**NORTHING:**	5,028,240.281
CLIENT:	JB Holdings	**DRILLING DATE:**	February 26, 2026	**GROUND ELEV.:**	65.53 m
ADDRESS:	441-443 Echo Drive, Ottawa, ON	**TOTAL DEPTH:**	17.98 m	**COORDINATE SYSTEM:**	UTM

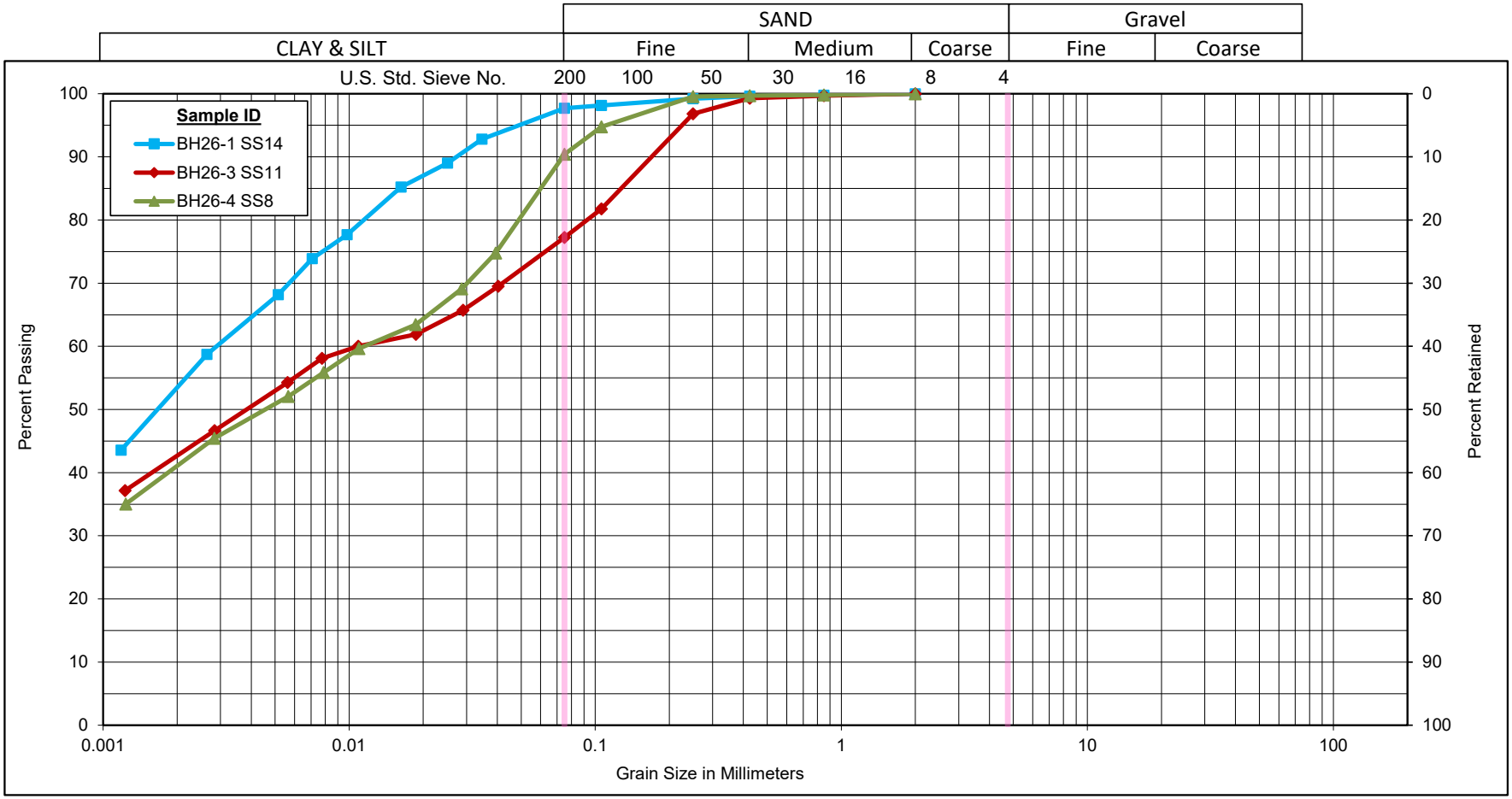
NOTES:

Depth FT	Depth M	Material Description	Stratigraphy	Sample No.	Sample Type	N Value	Field Tests	Laboratory Tests	Gradation (%)	Additional Observations
							N (20 40 60 80); Su_rs (45 90 135 180); Su_pk (45 90 135 180); NValue (20 40 60 80)	Plastic Index (20 40 60 80); Liquid Limit (10 20 30 40); Moisture (10 20 30 40)	Gravel; Sand; Silt; Clay; Fines	
50	15									
51							58			
52							70			
	16						75			
53							80			
54							92			
55							92			
	17						(102)			
56							(102)			
57							(105)			
58							(106)			
	18	17.98 m EL 47.54 m End of Hole (17.98 m)								
59										
60										
61										
	19									
62										
63										
64										
65										
	20									

RSLog / 1 - GeoTerra GEO-BH (Letter) - DCPT / geoterracs-inc / admin / April 10, 2026 @ 09:48 AM

APPENDIX C – LABORATORY TESTS

Unified Soil Classification System



Sample ID	Depth	% Gravel	% Sand	% Silt	% Clay
BH26-1 SS14	10.67-11.28 m	0.0	2.3	45.7	52.0
BH26-3 SS11	9.14-9.75 m	0.0	22.8	35.2	42.0
BH26-4 SS8	6.1-6.7 m	0.0	9.6	50.4	40.0

Stantec

GRAIN SIZE DISTRIBUTION

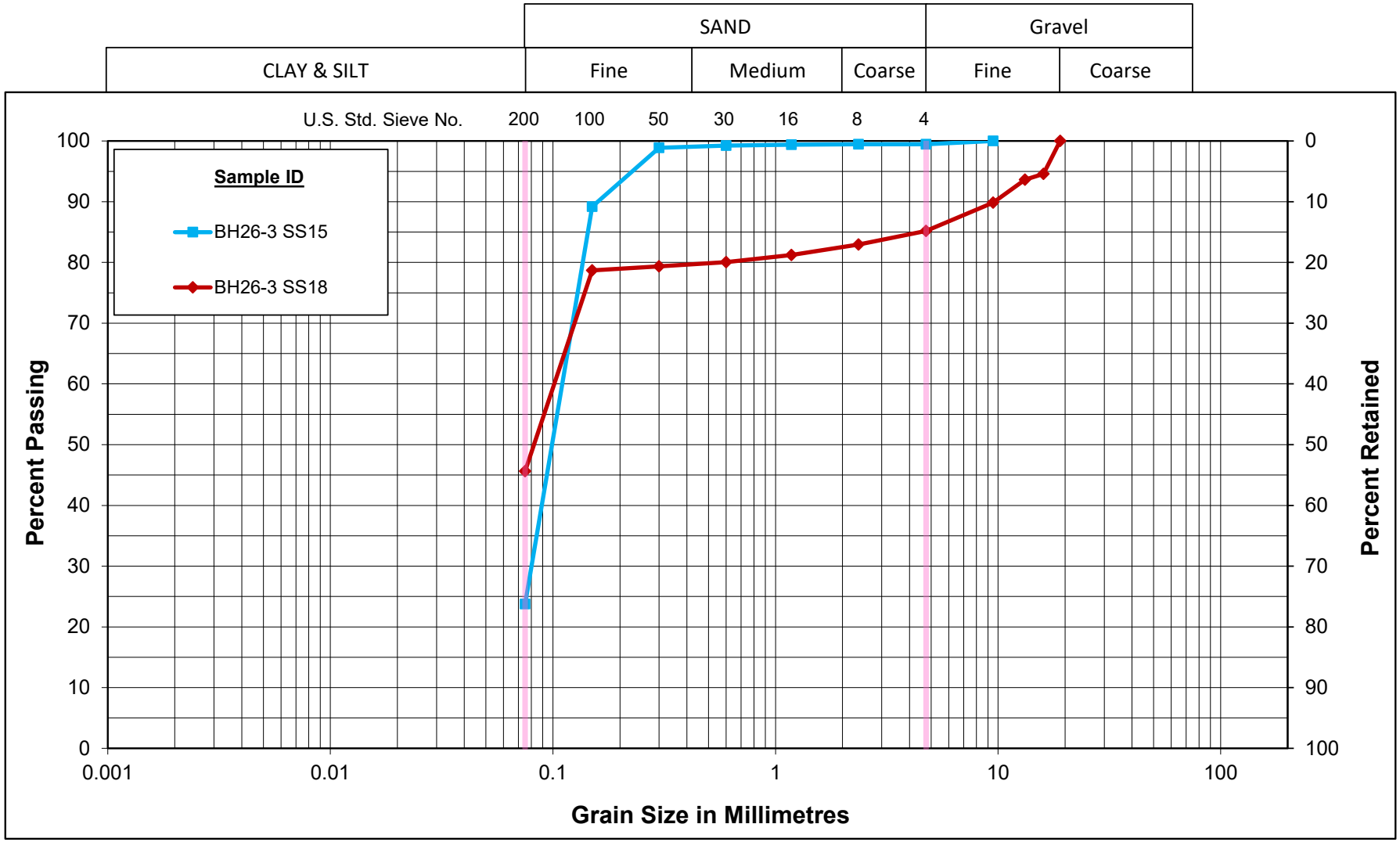
Geo Terra, File# 2512064

441-443 Echo Drive, Ottawa, ON

Figure No.

Project No. 121626390

Unified Soil Classification System



Stantec

GRAIN SIZE DISTRIBUTION

Geo Terra

441-443 Echo Drive, Ottawa, ON

Figure No.

Project No. 121626390

Stantec Consulting Ltd.
2781 Lancaster Rd, Suite 100 A&B, Ottawa ON K1B 1A7

March 20, 2026
File: 121626390

Client: Geo Terra, File #2512064

Reference: ASTM D4318 Atterberg Limit & ASTM D2216 Moisture Content
Proposed Residential Development, 441-443 Echo Drive, Ottawa, Ontario

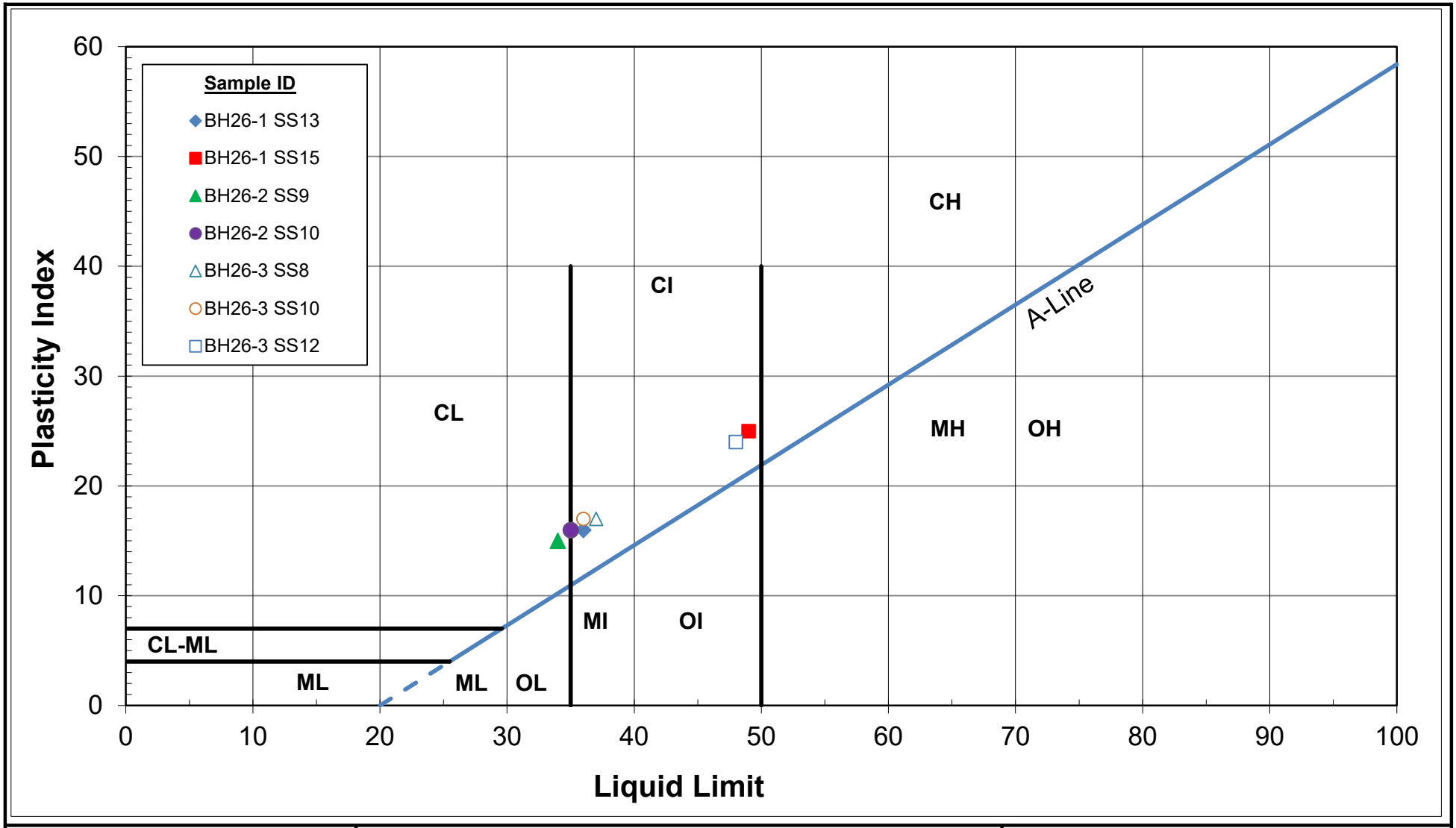
The following table summarizes Atterberg Limit & Moisture Content results.

Source	Depth (m)	Moisture Content (%)	Liquid Limit	Plastic Limit	Plasticity Index
BH26-1, SS13	9.91-10.52	36.8	36.0	19.5	16.5
BH26-1, SS14	10.67-11.28	47.4			
BH26-1, SS15	11.43-12.04	47.1	49.1	23.6	25.5
BH26-2, SS9	6.86-7.47	34.0	34.4	19.1	15.3
BH26-2, SS10	8.38-8.99	35.3	35.3	19.4	15.9
BH26-3, SS8	6.1-6.71	37.8	36.8	19.9	16.8
BH26-3, SS10	7.62-8.23	36.9	35.6	19.3	16.2
BH26-3, SS11	9.14-9.75	35.9			
BH26-3, SS12	10.67-11.28	39.4	48.0	23.9	24.1
BH26-3, SS13	12.19-12.80	48.0			
BH26-4, SS10	9.14-9.75	35.2	34.1	19.0	15.1

Sincerely,

Stantec Consulting Ltd.

Brian Prevost
Laboratory Supervisor
Tel: 613-738-6075
brian.prevost@stantec.com
Attachments: Plasticity Charts



Stantec

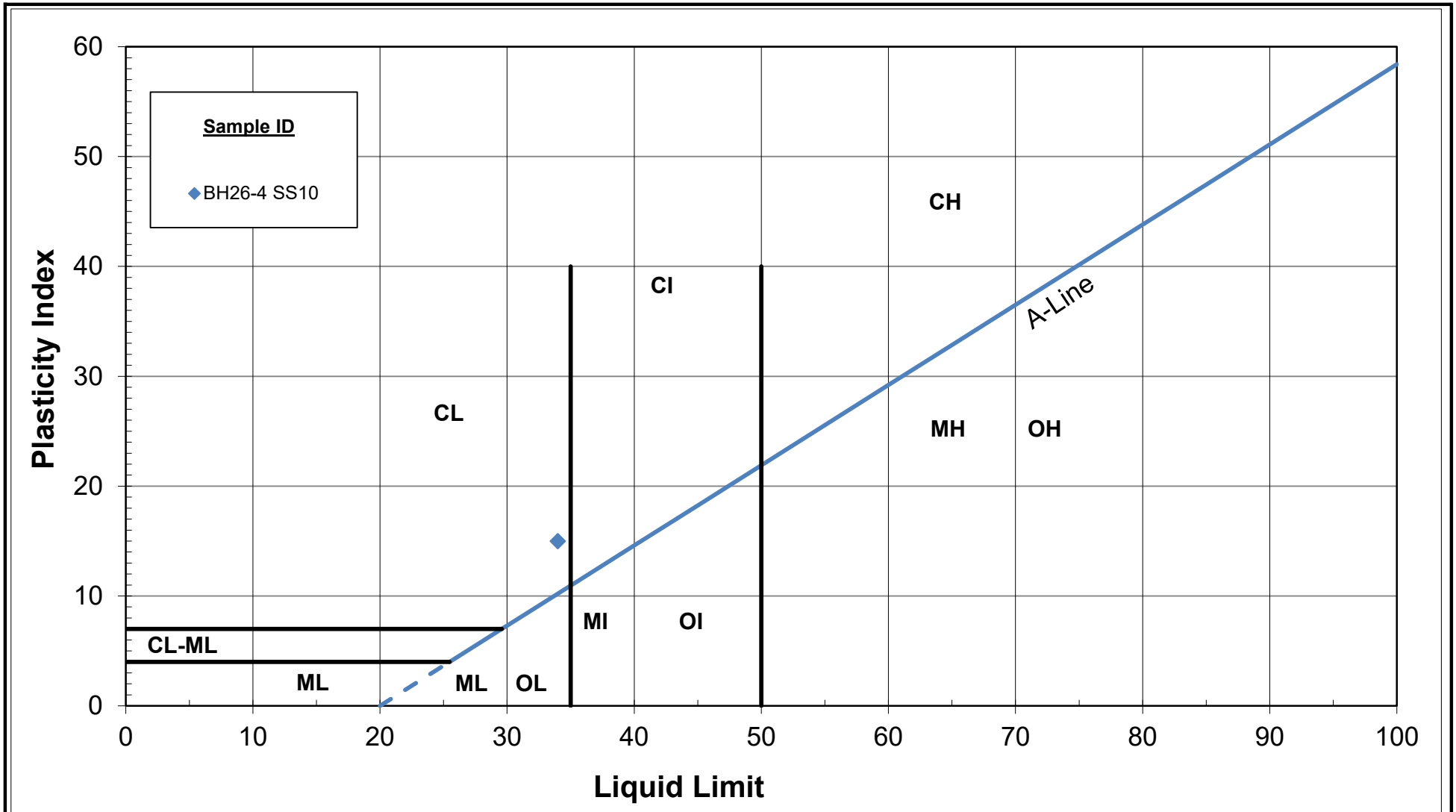
Geo Terra, File# 2512064

441-443 Echo Drive, Ottawa, ON

PLASTICITY CHART

Figure No.

Project No. 121626390



Stantec

Geo Terra, File# 2512064

441-443 Echo Drive, Ottawa, ON

PLASTICITY CHART

Figure No.

Project No. 121626390

Stantec Consulting Ltd.
400 - 1331 Clyde Avenue, Ottawa ON K2C 3G4

March 20, 2026
File: 121626390

Attention: Alpesh Ramesh Senghani
Geo Terra
204-1339 Wellington Street West
Ottawa, Ontario, Canada, K1Y 3B8
26B Ninth Street East
Cornwall, Ontario, Canada, K6H 2T8

Tel: 1-613-913-9702
E-mail: arsenghani@geoterracs.com

Dear Mr. Senghani,

Reference: Consolidation Test Results: BH26-1, ST12 & BH26-3, ST9, Geo Terra Project # 2512064

This letter presents the results of a one-dimensional consolidation test carried out on two shelby tube samples in accordance with ASTM D2435/D2435M – 11(2020). The tests result is provided in the attached tables and figures.

Summary of the sample tested.

Sample ID	Depth (m)	Date sampled
BH26-1, ST12	9.14-9.75	February 18, 2026
BH26-3, ST9	6.86-7.47	February 23, 2026

This letter provides test results only and does not constitute any interpretation or engineering recommendations with respect to material suitability or specification compliance.

We trust the information presented herein meets your present requirements. Should you have any questions or require additional information, please do not hesitate to contact us.

Regards,

Stantec Consulting Ltd.

Ramin Ghassemi Ph.D., P.Eng.
Associate, Geotechnical Engineer
Direct: 613 722-4420
Mobile: 437 775-7625
Ramin.ghassemi@stantec.com

CONSOLIDATION TEST SUMMARY

SAMPLE IDENTIFICATION

Borehole No. :	BH26-1	Sample No. :	ST12
		Sample Depth (m) :	9.14-9.75

TEST CONDITIONS

Test Type :	ASTM D2435/D2435M	Date Started :	13-Mar-26
Load Duration (hr) :	Method B	Date Completed :	17-Mar-26

SAMPLE DIMENSIONS AND PROPERTIES _ INITIAL

Sample Height (mm) :	20.00	Unit Weight (kN/m^3) :	17.94
Sample Diameter (mm) :	50.00	Dry Unit Weight (kN/m^3) :	12.87
Area (cm^2) :	19.63	Specific Gravity : (Assumed)	2.736
Volume (cm^3) :	39.27	Solid Height (mm) :	9.59
Water Content (%) :	39.37	Volume of Solids (cm^3) :	18.84
Wet Mass (g) :	71.83	Volume of Voids (cm^3) :	20.43
Dry Mass (g) :	51.54	Degree of Saturation (%) :	99.30

TEST COMPUTATIONS

Axial Stress (kPa)	Height (H) (mm)	Corrected Deformation (ΔH) (mm)	Axial Strain (ε_a) (%)	Void Ratio e	t_{90} (sec)	C_v (cm^2/s)	m_v (m^2/kN)	k (m/s)
0	20.0000	0.0000	0.00	1.085				
5	19.8750	0.1250	0.63	1.072	130.37	6.44E-03	1.25E-03	7.90E-09
10	19.7810	0.2190	1.10	1.062	95.00	8.77E-03	9.40E-04	8.09E-09
20	19.6419	0.3581	1.79	1.047	144.00	5.71E-03	6.95E-04	3.89E-09
40	19.4904	0.5096	2.55	1.032	133.96	6.05E-03	3.79E-04	2.25E-09
80	19.3187	0.6813	3.41	1.014	120.91	6.60E-03	2.15E-04	1.39E-09
20	19.3804	0.6196	3.10	1.020				
5	19.4386	0.5614	2.81	1.026				
20	19.4124	0.5876	2.94	1.023	115.18	6.94E-03	8.73E-05	5.95E-10
80	19.2992	0.7008	3.50	1.012	89.77	8.83E-03	9.43E-05	8.17E-10
120	19.1981	0.8019	4.01	1.001	169.22	4.65E-03	1.26E-04	5.76E-10
160	19.0949	0.9051	4.53	0.990	250.89	3.10E-03	1.29E-04	3.93E-10
320	18.6645	1.3355	6.68	0.945	135.30	5.61E-03	1.35E-04	7.40E-10
640	17.3404	2.6596	13.30	0.807	289.89	2.43E-03	2.07E-04	4.94E-10
1280	15.8732	4.1268	20.63	0.654	188.72	3.18E-03	1.15E-04	3.58E-10
2560	14.7961	5.2039	26.02	0.542	147.80	3.43E-03	4.21E-05	1.41E-10
640	14.9365	5.0635	25.32	0.557				
160	15.1677	4.8323	24.16	0.581				
40	15.4668	4.5332	22.67	0.612				
10	15.7565	4.2435	21.22	0.642				
5	15.8704	4.1296	20.65	0.654				

SAMPLE DIMENSIONS AND PROPERTIES _ FINAL

Sample Height (mm) :	15.87	Unit Weight (kN/m^3) :	20.52
Sample Diameter (mm) :	50.00	Dry Unit Weight (kN/m^3) :	16.22
Area (cm^2) :	19.63	Specific Gravity (Assumed) :	2.736
Volume (cm^3) :	31.16	Solid Height (mm) :	9.59
Water Content (%) :	26.52	Volume of Solids (cm^3) :	18.84
Wet Mass (g) :	65.21	Volume of Voids (cm^3) :	12.32
Dry Mass (g) :	51.54		

Project No. :	121626390	Prepared By :	DB
Date :	20-Mar-26	Checked By :	RG

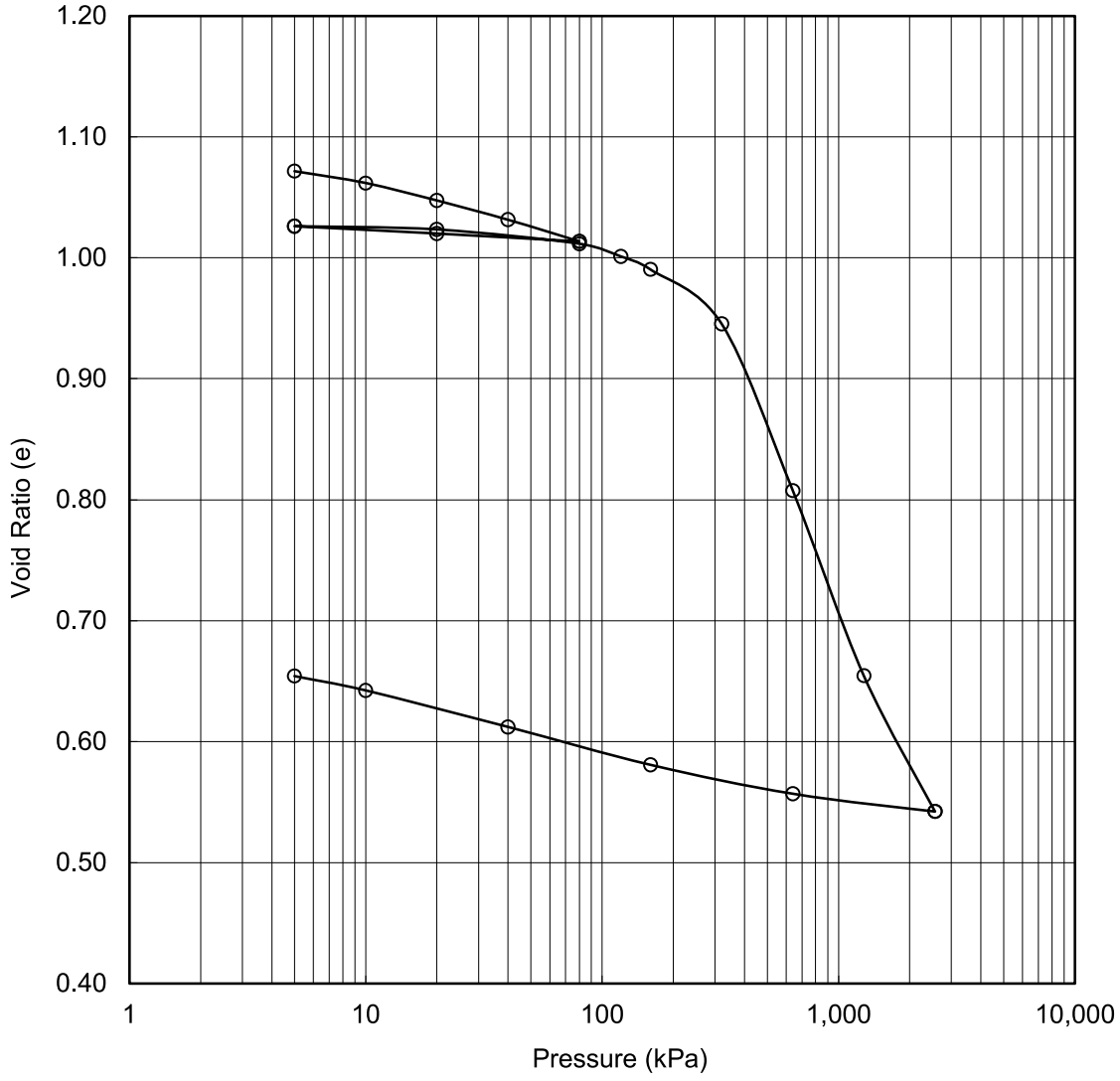
Stantec

CONSOLIDATION TEST	FIGURE 1

Geo Terra, File# 2512064

BH26-1, ST12

Void Ratio vs Pressure



Soil Type :	*Silty clay, grey, lensed, moist*				
	e_o =	1.085		w_L =	N/A
	w =	39.4%		w_P =	N/A
	γ =	17.9	kN/m^3	PI =	N/A
	Gs =	2.736			

Project No. : 121626390
Date : 20-Mar-26

Stantec

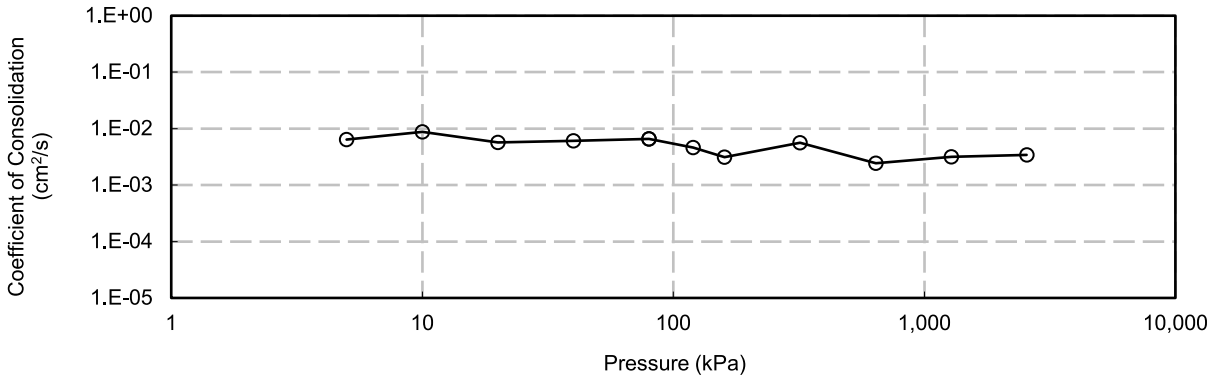
Prepared By : DB
Checked By : RG

CONSOLIDATION TEST	FIGURES 2, 3 & 4

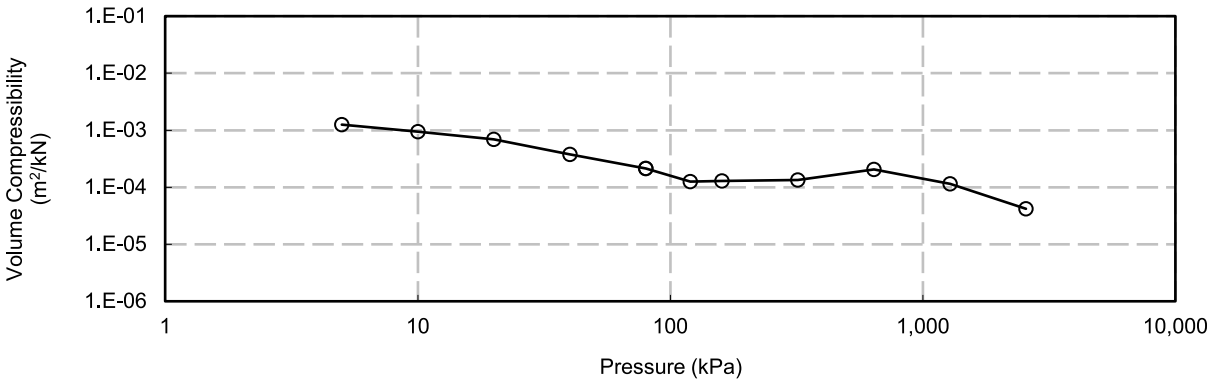
Geo Terra, File# 2512064

BH26-1, ST12

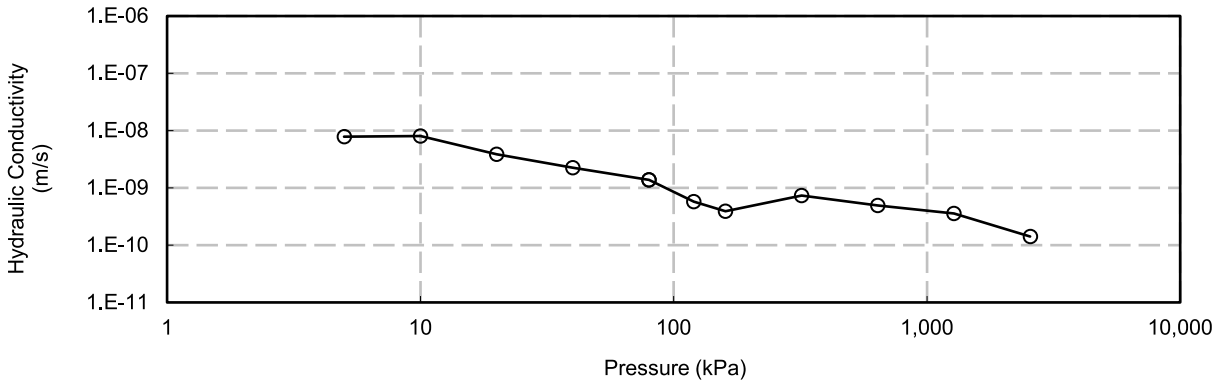
Cv vs Pressure



mv vs Pressure



k vs Pressure

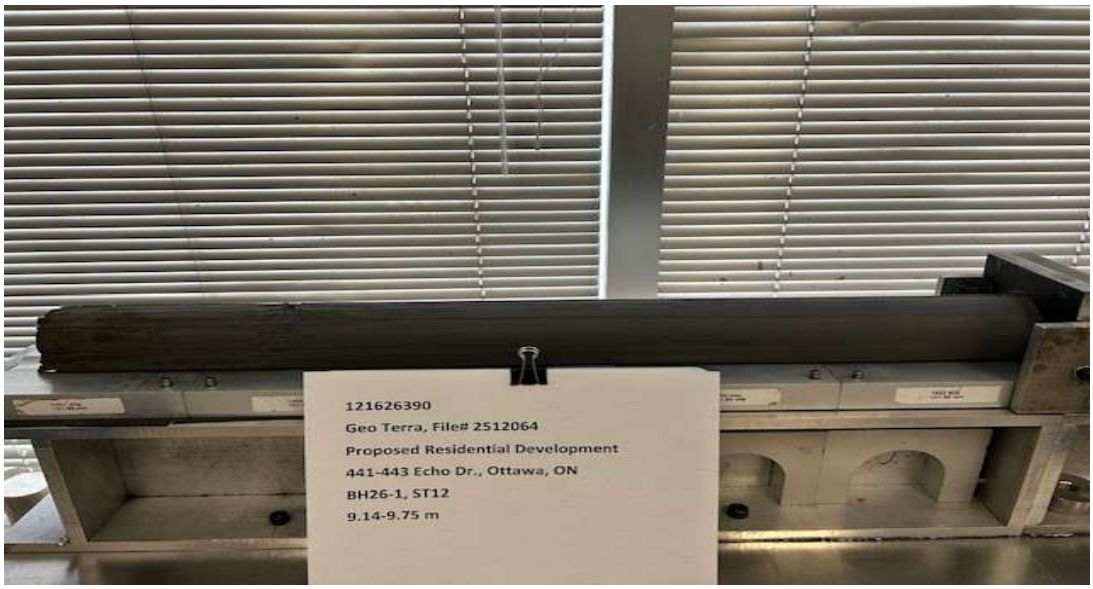


Project No. :	121626390	Prepared By :	DB
Date :	20-Mar-26	Checked By :	RG

Geo Terra, File# 2512064	PHOTOS 1 & 2

441-443 Echo Drive, Ottawa, ON

Silty clay, grey, lensed, moist



BH26-1, ST12

BH26-1, ST12

Project No. : 121626390
Date : 20-Mar-2026

Stantec

Prepared by : DB
Checked by : RG

CONSOLIDATION TEST SUMMARY

SAMPLE IDENTIFICATION

Borehole No. :	BH26-3	Sample No. :	ST9
		Sample Depth (m) :	6.86-7.47

TEST CONDITIONS

Test Type :	ASTM D2435/D2435M	Date Started :	13-Mar-26
Load Duration (hr) :	Method B	Date Completed :	17-Mar-26

SAMPLE DIMENSIONS AND PROPERTIES _ INITIAL

Sample Height (mm) :	20.00	Unit Weight (kN/m^3) :	17.85
Sample Diameter (mm) :	50.00	Dry Unit Weight (kN/m^3) :	12.71
Area (cm^2) :	19.63	Specific Gravity :	2.736
Volume (cm^3) :	39.27	Solid Height (mm) :	9.47
Water Content (%) :	40.46	Volume of Solids (cm^3) :	18.60
Wet Mass (g) :	71.48	Volume of Voids (cm^3) :	20.67
Dry Mass (g) :	50.89	Degree of Saturation (%) :	99.61

TEST COMPUTATIONS

Axial Stress (kPa)	Height (H) (mm)	Corrected Deformation (ΔH) (mm)	Axial Strain (ε_a) (%)	Void Ratio e	t_{90} (sec)	C_v (cm^2/s)	m_v (m^2/kN)	k (m/s)
0	20.0000	0.0000	0.00	1.111				
5	19.9293	0.0707	0.35	1.104	513.58	1.64E-03	7.07E-04	1.14E-09
10	19.8297	0.1703	0.85	1.093	355.76	2.35E-03	9.96E-04	2.30E-09
20	19.6062	0.3938	1.97	1.070	87.34	9.39E-03	1.12E-03	1.03E-08
40	19.4148	0.5852	2.93	1.049	179.57	4.48E-03	4.79E-04	2.10E-09
80	19.2048	0.7952	3.98	1.027	146.08	5.40E-03	2.63E-04	1.39E-09
20	19.2776	0.7224	3.61	1.035				
5	19.3570	0.6430	3.22	1.043				
20	19.3152	0.6848	3.42	1.039	85.70	9.24E-03	1.39E-04	1.26E-09
80	19.1797	0.8203	4.10	1.025	83.63	9.36E-03	1.13E-04	1.04E-09
120	19.0663	0.9337	4.67	1.013	187.47	4.14E-03	1.42E-04	5.75E-10
160	18.9544	1.0456	5.23	1.001	278.56	2.76E-03	1.40E-04	3.78E-10
320	18.4086	1.5914	7.96	0.943	132.73	5.62E-03	1.71E-04	9.40E-10
640	16.7742	3.2258	16.13	0.771	309.31	2.19E-03	2.55E-04	5.49E-10
1280	15.3665	4.6335	23.17	0.622	262.55	2.11E-03	1.10E-04	2.28E-10
2560	14.3116	5.6884	28.44	0.511	143.85	3.30E-03	4.12E-05	1.33E-10
640	14.4404	5.5596	27.80	0.524				
160	14.6822	5.3178	26.59	0.550				
40	14.9854	5.0146	25.07	0.582				
10	15.2652	4.7348	23.67	0.611				
5	15.3812	4.6188	23.09	0.624				

SAMPLE DIMENSIONS AND PROPERTIES _ FINAL

Sample Height (mm) :	15.38	Unit Weight (kN/m^3) :	20.86
Sample Diameter (mm) :	50.00	Dry Unit Weight (kN/m^3) :	16.52
Area (cm^2) :	19.63	Specific Gravity :	2.736
Volume (cm^3) :	30.20	Solid Height (mm) :	9.47
Water Content (%) :	26.21	Volume of Solids (cm^3) :	18.60
Wet Mass (g) :	64.23	Volume of Voids (cm^3) :	11.60
Dry Mass (g) :	50.89		

Project No. :	121626390	Prepared By :	DB
Date :	20-Mar-26	Checked By :	RG

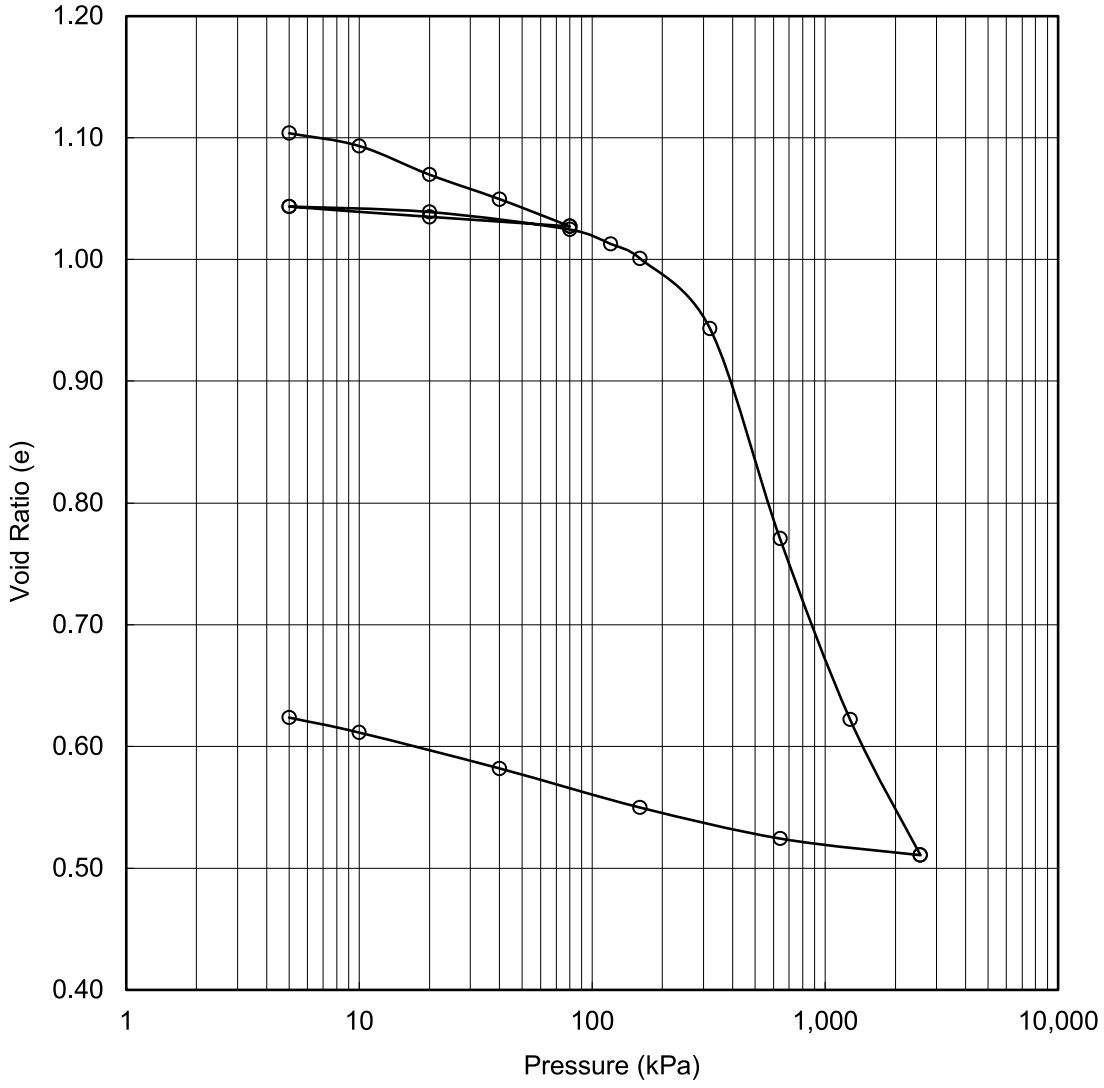
Stantec

CONSOLIDATION TEST	FIGURE 1

Geo Terra, File# 2512064

BH26-3, ST9

Void Ratio vs Pressure



Soil Type : *Silty clay, grey, lensed, moist*

e_o =	1.111	w_L =	N/A
w =	40.5%	w_P =	N/A
γ =	17.9 kN/m^3	PI =	N/A
Gs =	2.736		

Project No. : 121626390
Date : 20-Mar-26

Stantec

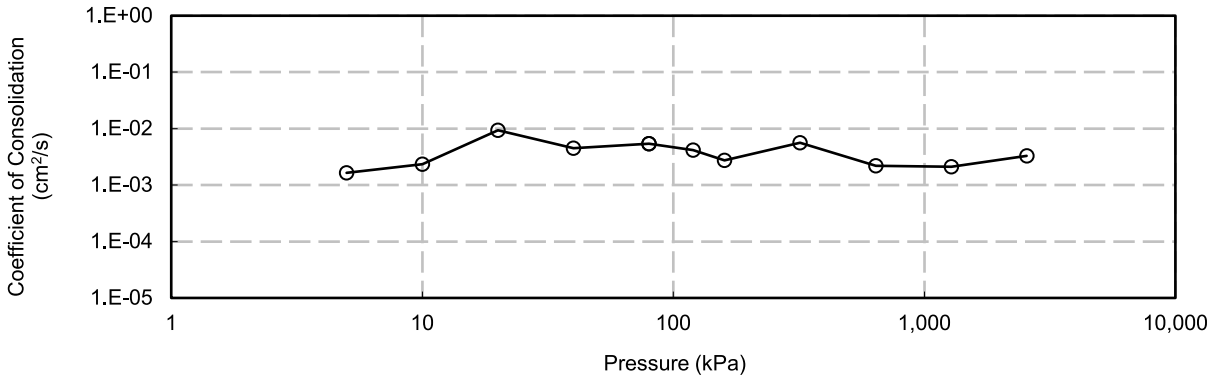
Prepared By : DB
Checked By : RG

CONSOLIDATION TEST	FIGURES 2, 3 & 4

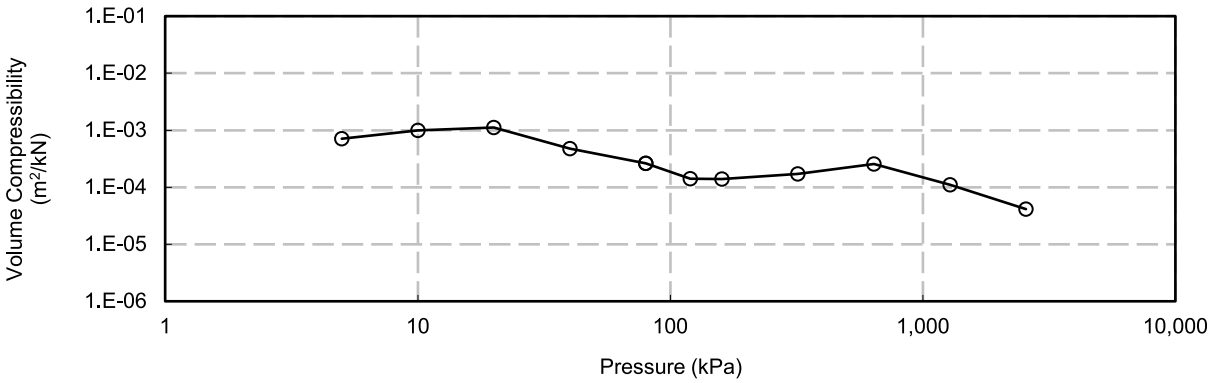
Geo Terra, File# 2512064

BH26-3, ST9

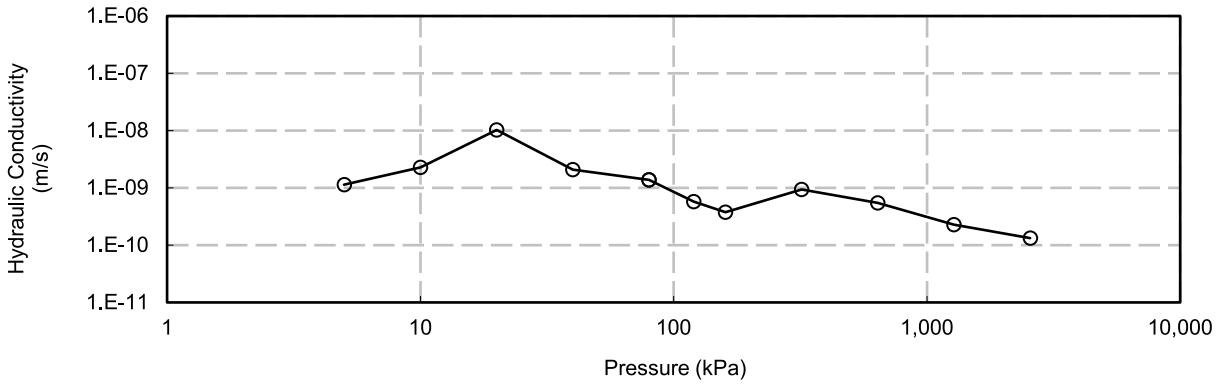
Cv vs Pressure



mv vs Pressure



k vs Pressure

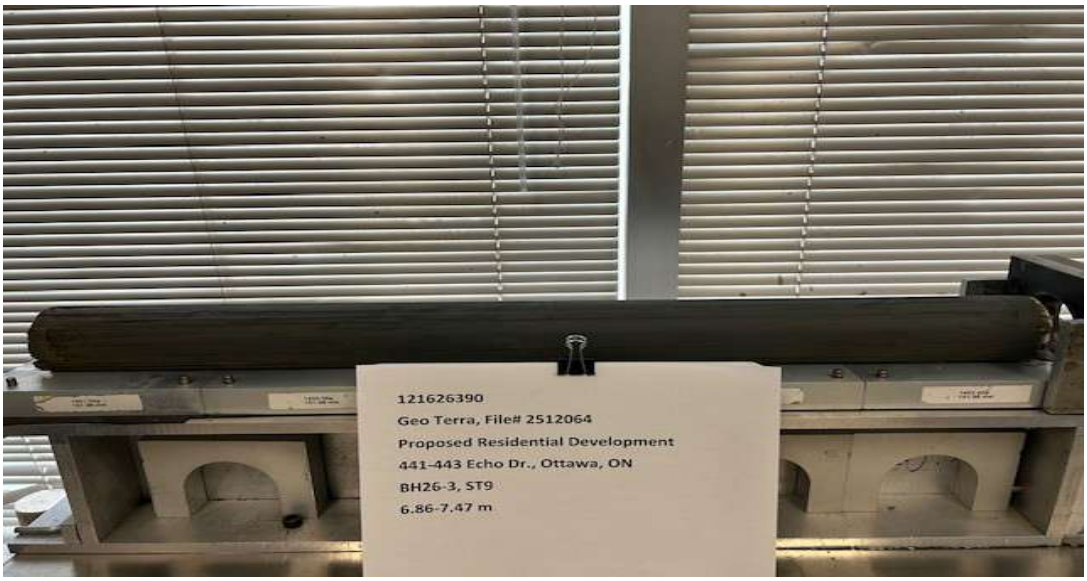


Project No. :	121626390	Prepared By :	DB
Date :	20-Mar-26	Checked By :	RG

Geo Terra, File# 2512064	PHOTOS 1 & 2

441-443 Echo Drive, Ottawa, ON

Silty clay, grey, lensed, moist



BH26-3, ST9

BH26-3, ST9

Project No. : 121626390
Date : 20-Mar-2026

Stantec

Prepared by : DB
Checked by : RG

eurofins | Environment Testing
146 Colonnade Rd, Unit 8, Ottawa, ON K2E 7Y1 (613) 727-5692

OFFICIAL CERTIFICATE OF ANALYSIS : 4637851

WORK REQUEST : 100419760

Report Date : 2026-03-25

GEOTerracs Inc
204-1339 Welington Street West
Ottawa, Ontario
K1Y 3B8
Attention : Alpesh Ramesh Senghani

Reception Date : 2026-03-16
Project : 441-443 Echo Drive (2512064)
Sampler : NA
PO Number : Not Applicable
Temperature : 15 °C

Analysis	Quantity	External Method
Chloride (Soil, Water Sol, ISE)	2	Modified from CSA A23.2-4B
Conductivity (Soil, Manual Meter)	2	Modified from MECP E3530
Moisture (Soil, Gravimetric)	2	CCME Petroleum Hydrocarbons in Soil, Tier 1 Method
pH (Soil, 1:1, Manual Meter)	2	Modified from WESTERN REGION (S-2.20)
Redox Potential (Soil, Electrode)	2	Modified from ASTM G200
Resistivity (Soil, Calculation)	2	Modified from MECP E3530
Sulphate (Soil, Gravimetric)	2	Modified from 28-3, Methods of Soil Analysis
* Sulphide, Acid Volatile (Soil, Subcontract)	2	

Sample status upon receipt :

9482885 9482886

Non-Conforme

Certificate Comments :

9482885 9482886

Sample past holding time for Sulphide and Redox Potential analyses.

Notes :

- All analysis is completed at Eurofins Environment Testing Canada Inc. (Ottawa, Ontario) unless otherwise stated.
- Eurofins Environment Testing Canada Inc. is accredited by CALA, Canadian Association for Laboratory Accreditation to ISO/IEC 17025 for tests which appear on the scope of accreditation. The scope is available at https://directory.cala.ca/
- Please note: Field data, where presented on the report, has been provided by the client and is presented for informational purposes only. Guideline or regulatory limits listed on this report are provided for ease of use (informational purposes) only. Eurofins recommends consulting the official guideline or regulation as required. Unless otherwise stated, measurement uncertainty is not taken into account when determining guideline or regulatory exceedances.

Legend :

RL : Reporting limit
QC : Reference material (QC)
N/A : Not applicable
1 : Results in annex
* : Analysis conducted by external subcontracting
^ : Analysis not accredited

eurofins | Environment Testing
146 Colonnade Rd, Unit 8, Ottawa, ON K2E 7Y1 (613) 727-5692

OFFICIAL CERTIFICATE OF ANALYSIS - RESULTS

Client : GEOTerracs Inc
Project : 441-443 Echo Drive (2512064)

Reception Date: 2026-03-16

Eurofins Sample No :			**9482885**	**9482886**
Matrix :			Soil	Soil
Sampling Date :			2026-02-19	2026-02-26
Client Sample Identification :			BH26-2 SS10	BH26-4 SS9
Anions	**RL**	**Unit**		
Sulphate^	0.01	%	0.01	0.02

Eurofins Sample No :			**9482885**	**9482886**
Matrix :			Soil	Soil
Sampling Date :			2026-02-19	2026-02-26
Client Sample Identification :			BH26-2 SS10	BH26-4 SS9
Chloride	**RL**	**Unit**		
Chloride (Water Soluble)	0.002	%	0.005	0.005

Eurofins Sample No :			**9482885**	**9482886**
Matrix :			Soil	Soil
Sampling Date :			2026-02-19	2026-02-26
Client Sample Identification :			BH26-2 SS10	BH26-4 SS9
General Chemistry	**RL**	**Unit**		
Electrical Conductivity	0.05	mS/cm	0.32	0.34
pH (1:1)	1		8.04	8.00
Resistivity^	0.05	ohm-cm	3130	2940

Eurofins Sample No :			**9482885**	**9482886**
Matrix :			Soil	Soil
Sampling Date :			2026-02-19	2026-02-26
Client Sample Identification :			BH26-2 SS10	BH26-4 SS9
Redox Potential	**RL**	**Unit**		
Redox Potential^		mV	191.1	167.0

Eurofins Sample No :			**9482885**	**9482886**
Matrix :			Soil	Soil
Sampling Date :			2026-02-19	2026-02-26
Client Sample Identification :			BH26-2 SS10	BH26-4 SS9
Sample Preparation	**RL**	**Unit**		
Moisture	0.1	%	25.5	24.8

Eurofins Sample No :			**9482885**	**9482886**
Matrix :			Soil	Soil
Sampling Date :			2026-02-19	2026-02-26
Client Sample Identification :			BH26-2 SS10	BH26-4 SS9
Subcontracted	**RL**	**Unit**		
Sulphide, Acid Volatile*	0.01	ug/g	0.03	0.03

Approved by :

Emma-Dawn Ferguson, M.Sc.
Environmental Chemist

eurofins | Environment Testing
146 Colonnade Rd, Unit 8, Ottawa, ON K2E 7Y1 (613) 727-5692

OFFICIAL CERTIFICATE OF ANALYSIS - QUALITY CONTROL

Client : GEOTerracs Inc
Project : 441-443 Echo Drive (2512064)

Reception Date: 2026-03-16

Parameter	Unit	RL	Blank	QC		Matrix Spike		Duplicate	
				Recovery %	Range %	Recovery %	Range %	RPD %	Range %
Chloride (Soil, Water Sol, ISE)									
Method : Chloride, water soluble (Soil/Concrete, CSA, ISE). Internal method: AMCLCRE8.									
Chloride (Water Soluble)	%	0.002	<0.002	84	80-118			2	0-50
Associated Samples : 9482885, 9482886								Prep Date: 2026-03-18 Analysis Date: 2026-03-19	
Conductivity (Soil, Manual Meter)									
Method : Conductivity (soil, manual meter). Internal method: AMPHCNX2.									
Electrical Conductivity	mS/cm	0.05	<0.05	110	70-130			1	0-40
Associated Samples : 9482885, 9482886								Prep Date: 2026-03-19 Analysis Date: 2026-03-19	
pH (Soil, 1:1, Manual Meter)									
Method : pH (Soil, 1:1 Water Extraction, Manual Meter). Internal method: AMPHCNX2.									
pH (1:1)		1	7.10	101	98-102			0	0-40
Associated Samples : 9482885, 9482886								Prep Date: 2026-03-19 Analysis Date: 2026-03-19	
Redox Potential (Soil, Electrode)									
Method : Redox Potential (Soil, Electrode). Internal method: AMREDXE1.									
Redox Potential^	mV		207	100	80-120			1	0-50
Associated Samples : 9482885, 9482886								Prep Date: 2026-03-19 Analysis Date: 2026-03-19	
Sulphate (Soil, Gravimetric)									
Method : Sulphate (Soil, Gravimetric). Internal method: AMSO4SE2.									
Sulphate^	%	0.01	<0.01	94	90-110	114	70-130	-	0-40
Associated Samples : 9482885, 9482886								Prep Date: 2026-03-21 Analysis Date: 2026-03-23	

Where RPD % is reported as "-" the calculation is not available because one or both of the duplicates is within 5 times the RL.

eurofins 238859

STANDARD CHAIN-OF-CUSTODY

146 Colonnade Road, Unit #8, Ottawa, ON, K2E 7Y1 - Phone: 613-727-5692, Fax: 613-727-5222

CLIENT INFORMATION

Company: GeoTerraCS Inc.
Contact: Alpesh R. Senghani
Address: 300-275 Bank Street, Ottawa, ON
Telephone: Cell: 613-619-4157
Email: #1: arsenghani@geoterracs.com
Email: #2:
Project: 441-443 Echo Drive (25120647) Quote #: 192904

INVOICE INFORMATION (SAME AS CLIENT INFORMATION: YES ☑ NO ☐)

Company:
Contact: Email: #1:
Address: Email: #2:
Telephone: PO #:

TURN-AROUND TIME (Business Days)

☐ 1 Day* (100%) ☐ 2 Day** (50%) ☐ 3-5 Days (25%) ☑ 5-7 Days (Standard)

Please contact Lab in advance to determine rush availability. *For results reported after rush due date, surcharges will apply: before 12:00 - 100%, after 12:00 - 50%. **For results reported after rush due date, surcharges will apply: before 12:00 - 50%, after 12:00 - 25%.

TCLP, SPLP, PFAS, and NP/NPE the rush surcharges are 100% (3 day) and 50% (4 day). For farm soils the rush surcharge is 100% (3-5 days). Regular TAT is 10 days.

The optimal temperature conditions during transport is 4 - 10°C. Sample(s) cannot be frozen, unless otherwise indicated or agreed upon with the Laboratory. This COC must not be used for drinking water samples. The COC must be complete upon submission of the samples, there will be a $25 surcharge if required information is missing (required fields are shaded in grey).

Occasionally, situations arise in which Eurofins Environment Testing Canada (Ottawa) is unable to process a sample after receipt. By signing this chain-of-custody form, the client agrees that Eurofins Environment Testing Canada (Ottawa) may subcontract samples to a laboratory that is similarly accredited. This subcontracted laboratory will perform the same analysis using the same or similar methodology. Agreements made in advance to subcontract to a specific laboratory will be honored.

REGULATION/GUIDELINE REQUIRED

☐ Sanitary Sewer, City:
☐ Storm Sewer, City:
☐ ODWSOG (Use DW COC if samples are for human consumption)
☐ PWQO
☐ O.Reg. 347 (TCLP)
☐ Other:

☐ O. Reg. 153/04
The sample results from this submission will form part of a formal Record of Site Condition (RSC) under O.Reg. 153/04. Analysis of full parameter list only Yes ☐ No ☐
Table # ___, Coarse / Fine, Surface / subsurface
Type: Com-Ind / Res-Park / Agri / GW / All Other / Sediment

☐ O. Reg 406 Excess Soils
Table # _____ Full depth/Strat/Celling/mSPLP Leachate
Type: Com-Ind /Res-Park /Agri/All Other
Category: Surface /Subsurface

Sample Details

Sample ID	Date/Time Collected	Sample Matrix	# of Containers	O.Reg.153/04 parameters: PHC F1 - F4	BTEX	VOCs	PAHs	PCBs	Metals + Inorganics	Metals only	Corrosivity	RN# (Lab Use Only)
BH26-2 SS10	26/02/19	S	1								J	94828855
BH26-4 SS9	26/02/26	S	1								J	86

	PRINT NAME	LOCATION	SIGN	DATE/TIME	TEMP (°C)
Sampled By:	Alpesh R. Senghani	Ottawa		26/02/19-26	
Relinquished By:	Dylan Base	Ottawa	Dylanbase	26/03/16	
Received By:					
Received By:	S. Stu	OTT		March 16/26 11:00	15

COMMENTS: Please use the corrosivity Packtax for these geotechnical borehole samples,

100419760

Printed On : 2026-03-16 11:35:46

CUSTODY SEAL: ☐ YES ☐ NO | Ice packs submit ☐ Yes ☐ No