



CHUNG & VANDER DOELEN
ENGINEERING LTD.

GEOTECHNICAL INVESTIGATION
PROPOSED 34-STOREY MIXED-USE BUILDING
87 to 95 Seagram Drive
Waterloo, Ontario

SUBMITTED TO:
14688210 Canada Inc.
316 Batavia Place
Waterloo, Ontario
N2L 3W1

ATTENTION:
Mr. Parker Zhang



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File No.: 1161 Rev. 2

14688210 Canada Inc.
315 Batavia Place
Waterloo, Ontario
N2L 3W2

Attention: Mr. Parker Zhang

RE: Geotechnical Investigation
Proposed 34-Storey Mixed-Use Building
87 to 95 Seagram Drive, Waterloo, Ontario

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

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

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

Yours truly,

CHUNG & VANDER DOELEN ENGINEERING LTD.

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

TABLE OF CONTENTS

	Page
Letter of Transmittal	i
Table of Contents	ii
List of Enclosures	iii
1.0 INTRODUCTION	1
2.0 FIELD WORK	1
3.0 LABORATORY TESTING	2
3.1 Geotechnical Laboratory Testing	2
3.2 Analytical Laboratory Testing	2
4.0 EXISTING SITE CONDITIONS	3
5.0 SUBSURFACE CONDITIONS	3
5.1 Topsoil.....	4
5.2 Fill.....	4
5.3 Fine to Medium Granular Deposits.....	4
5.4 Sandy Clayey Silt	4
5.5 Silty Clay Till	5
5.6 Sand and Silt Till	5
5.7 Lower Sand.....	6
5.8 Groundwater.....	6
5.9 Hydraulic Testing	6
6.0 DISCUSSION AND RECOMMENDATIONS.....	8
6.1 General.....	8
6.2 One-Level Underground Parking	8
6.3 Conventional Footing Foundations – Podium	9
6.4 Tower Raft Foundation	10
6.5 Earthquake Considerations.....	12
6.6 Open Cut Excavation and Groundwater Control	12
6.7 Hydrogeological Assessment and Dewatering	12
6.8 Floor Slab Construction.....	14
6.9 Floor Slab Design Against Hydrostatic Pressure	14
6.10 Shored Excavation.....	14
6.11 Site Servicing.....	15
6.11.1 Excavation Conditions.....	15
6.11.2 Pipe Bedding	16
6.11.3 Trench Backfill.....	16
6.11.4 Corrosion Potential and Cement Type.....	16
6.12 Lateral Earth Pressure.....	17
6.13 Access Driveway and Paved Parking Areas	18
6.13.1 Access Driveways Pavement.....	18
6.13.2 Pavement Above Underground Parking Garage.....	19



7.0	GEO-ENVIRONMENTAL CONSIDERATIONS	20
7.1	Applicable Regulatory Standards	20
7.2	Handling of Excess Soils	21
8.0	CLOSURE.....	22

LIST OF ENCLOSURES

Appendix A	Limitations of Report
Appendix B	Soil Chemistry Results (ALS Laboratories)
Appendix C	Comparison of the Soil Chemistry Results to the Applicable Regulatory Criteria
Appendix D	Table of Seasonal Groundwater Levels and Elevations
Appendix E	Slug Test Analysis Reports
Appendix F	PMT Results
Enclosure A	Soil Abbreviations and Terms Used on Record of Borehole Log Sheets
Enclosures 1 to 12	Borehole Log Sheets and PMT Log Sheets
Enclosures 13 to 19	Grain Size Distribution Charts
Enclosure 20	Plasticity Chart
Drawing No. 1	Borehole Location Plan



1.0 INTRODUCTION

CHUNG & VANDER DOELEN ENGINEERING LTD. (CVD) has been retained by 14688210 Canada Inc. to carry out a geotechnical investigation for the proposed residential development to be located at 87 to 95 Seagram Drive, Waterloo, Ontario.

It is understood that the proposed development will consist of two (2) 34-storey buildings, each consisting of 27 storeys above a seven-storey residential/mixed-use podium, with the towers connected through the podium. One (1) level of underground parking is proposed beneath the building structures. Due to differential site grading, the finished ground floor elevations (FFE) for Towers 1 and 2 have been established at 334.75 m and 333.70 m, respectively.

Commercial units are proposed at the ground level in the middle section of the rectangular structure, with a finished floor elevation of 334.30 m. The basement finished floor has been established at elevation 331.15 m at the garage door, 330.75 m underneath the east lobby, and 328.95 m at the lowest point of the basement (northwest corner).

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

- Foundation design recommendations;
- Settlement assessment, provide magnitude of settlement and its impact on construction;
- Excavation condition;
- Groundwater control during construction;
- Backfilling recommendations;
- Shoring design;
- Foundation soil classification for seismic design per OBC 2012; and
- Foundation walls and shoring design.

2.0 FIELD WORK

Eight (8) boreholes were advanced to depths between 9.60 and 24.60 m below ground surface at 85 and 87 Seagram Drive between June 15 and 22, 2023. To further assess the subsurface conditions in the area of newly acquired lots, an additional three (3) boreholes and one (1) Pressuremeter test (PMT) were completed between August 5 and 11, to depths ranging from 24.50 to 30.75 m below existing grade. The borehole locations are indicated on the Borehole Location Plan, Drawing No. 1.

The field work was carried out under the supervision of a member of our engineering team, who logged the boreholes in the field, effected the subsurface sampling, and monitored the groundwater conditions. Monitoring wells were installed in Boreholes 6, 7 and 9 to confirm the depth/elevation of the groundwater table and assist with the design of the proposed underground parking.

The boreholes were advanced using a track-mounted drilling rig, supplied, and operated by a specialized contractor. The drill rig was equipped with mud rotary tooling and standard soil sampling equipment. Standard penetration tests (SPTs) in accordance with ASTM Specification D1586, were carried out at



frequent intervals of depth, and the results are shown on the Borehole Logs as Penetration Resistance or “N”-values. The undrained shear strength of the cohesive soil deposit was determined on the slightly disturbed SPT samples using a field pocket penetrometer. The compactness condition or consistency of the soil strata has been inferred from these test results.

The location and ground surface elevation of the boreholes were surveyed by CVD with reference to a local temporary benchmark (TBM). The temporary benchmark elevation and ground surface elevations at the boreholes were surveyed by CVD for the purpose of this report using a Network RTK Global Navigation Satellite System (GNSS) Receiver. The survey data was collected using the UTM Zone 17N Projection, NAD83(CSRs)v7-2010 datum and Canada Geoid Model HT2_2010v70 (CGVD28).

TBM: Top of catch basin in westbound bicycle lane, just east of the intersection with Lester Street, as shown on Drawing No. 1

Elevation: 333.74 m (Geodetic)

3.0 LABORATORY TESTING

3.1 Geotechnical Laboratory Testing

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

In addition, seven (7) grain size distribution analyses were conducted, and the results are presented in Enclosures 13 to 19.

Four (4) Atterberg limits tests were carried out on representative soil samples of the major soil deposits to establish the physical and engineering properties. The Atterberg Limits test results are shown on the borehole log sheets and also summarized on the plasticity chart provided in Enclosure 20.

3.2 Analytical Laboratory Testing

Two (2) soil samples were submitted to ALS Laboratory Group of Waterloo, Ontario for corrosion potential to ductile iron (to support watermain anode sizing) and buried concrete. The samples were tested for conductivity, moisture content, pH, redox potential, resistivity, chloride, sulphate, and sulphides.

The following table presents the location, depth and description for each soil sample collected and submitted.



Sample I.D.	Sample Depth	Sample Description
BH 1 – SA 3	1.50 to 1.95 mbeg	Sand, some silt
BH 6 – SA 3	1.50 to 1.95 mbeg	Sand and Silt Fill

*mbeg denotes metres below existing grade

Four (4) soil samples were submitted to ALS Laboratory Group of Waterloo, Ontario for analysis of metals and inorganics, benzene, ethylbenzene, toluene, and xylene (BTEX), and Petroleum Hydrocarbons (PHCs F1-F4). The chemical testing was conducted to provide a preliminary assessment of the environmental quality of potential excess soil which may be generated and removed off-site during construction.

The following table presents the location, depth and description for each soil sample collected and submitted.

Sample I.D.	Sample Depth	Sample Description
BH 2 – SA 1	0.00 to 0.60 mbeg	Sandy Silt Fill
BH 4 – SA 1	0.00 to 0.60 mbeg	Sand and Silt Fill
BH 5 – SA 1	0.00 to 0.60 mbeg	Sand and Silt Fill
BH 6 – SA 1	0.00 to 0.60 mbeg	Sand and Silt Fill

*mbeg denotes metres below existing grade

The laboratory certificates of chemical analysis and results provided by ALS Laboratory Group of Waterloo are enclosed in Appendix B.

4.0 EXISTING SITE CONDITIONS

The site consists of five (5) properties (87 to 95 Seagram Drive), and each occupied by a residential dwelling. The site is bounded by Seagram Drive to the north, Laurier University Stadium parking lot to the south and residential properties to the east and a commercial building to the west.

The ground surface gradually decreases in southerly direction. The ground surface elevations at the borehole locations ranged between 333.53 and 335.13 m.

5.0 SUBSURFACE CONDITIONS

The detailed subsurface conditions encountered in the twelve (12) boreholes advanced as part of these investigations are shown on the Borehole Log Sheets, Enclosures 1 to 12. The following sections provide descriptions of the major soil deposits encountered in the boreholes. Enclosure A provides explanations of the various soil abbreviations and terms used on the borehole log sheets.



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

5.1 Topsoil

Topsoil was encountered at the ground surface at all borehole locations with measured thicknesses between 100 and 360 mm.

5.2 Fill

A layer of fill materials was encountered underlying the topsoil in all boreholes and extended to depths between 0.70 and 2.10 m below ground surface. The fill materials generally comprised of varying amounts of sand and silt, with trace gravel and trace rootlets. Traces of topsoil/organics were contacted within the fill at Borehole 7. Occasional clay seams, brick and pottery fragments were contacted within the fill at Boreholes 2 and 5.

The SPT “N”-values measured within the fill materials ranged from 3 to 12 blows per 300 mm of penetration, indicating a variable very loose to compact compactness condition. The measured water content of the samples collected from this deposit ranged between 3 and 18%, indicating a damp to moist moisture condition.

5.3 Fine to Medium Granular Deposits

A layer of fine to medium granular deposits with varying percentage of sand and silt was encountered at all borehole locations below the fill materials and extended to depths between 4.40 and 8.50 m below ground surface. Trace clay and/or occasional to frequent clayey silt lenses/seams/layers were encountered within the deposits at Boreholes 1 to 9.

Results of three (3) grain size distribution analyses from Boreholes 6 and 7 are shown graphically on Enclosures 14, 15 and 17.

The SPT “N”-values measured within the fine to medium granular deposits ranged from 7 to 36 blows per 300 mm of penetration, indicating a variable loose to dense condition. The water content of the samples collected from this deposit were measured between 4 and 25%, indicating a damp to saturated moisture condition.

5.4 Sandy Clayey Silt

A layer of sandy clayey silt was locally encountered within the fine granular deposits in Borehole 7. The sandy clayey silt deposit extended from 2.10 to 2.90 m below ground surface. The deposit contained



trace gravel and occasional sand lenses. Results of one (1) grain size distribution analysis from Borehole 7 are shown graphically on Enclosure 16.

The SPT “N”-value measured within the sandy clayey silt was 9 blows per 300 mm of penetration. The undrained shear strength obtained on the retrieved sample was 108 kPa. Based on the above test results and tactile examination, the sandy clayey silt is considered to have a stiff consistency. The measured water content of the sample collected from this deposit was 15%, indicating an APL (About Plastic Limit) moisture condition.

5.5 Silty Clay Till

A layer of silty clay till was encountered below the fine granular deposits at all boreholes. The silty clay till extended to depths between 13.10 and 16.85 m below ground surface, at Boreholes 1 to 4, 9 to 11 and PMT 1. Boreholes 5 to 8 were terminated within the deposit at a depth of 9.60 m, the maximum depths of exploration. The cohesive deposit contained trace to some sand, occasional to frequent sand/silt seams/lenses/pockets. Borehole 2 contained an interbedded saturated sand and silt layer within the silty clay till at 9.40 m below ground surface.

Results of three (3) grain size distribution analysis from Boreholes 3, 10 and 11 are shown graphically on Enclosures 13, 18 and 19. The results of three (3) Atterberg Limit tests yielded Liquid Limit between 31 and 41%, Plastic Limit between 15 and 17%, and Plastic Index between 15 and 24%. The test results indicate an inorganic clay with low to medium plasticity (CL-CI).

The SPT “N”-value measured within this deposit was 8 blows per 300 mm to 50 blows per 150 mm of penetration. The undrained shear strength obtained on the retrieved samples was 72 to greater than 250 kPa. Based on the above test results and tactile examination, the silty clay till is considered to have a stiff to hard consistency. The measured water content of the samples collected from this deposit ranged between 11 and 33%, indicating an DTPL (Drier Than Plastic Limit) to WTPL (Wetter Than Plastic Limit) moisture condition.

5.6 Sand and Silt Till

The silty clay till encountered at Boreholes 1 to 4, 9 to 11 and PMT 1 was further underlain by a layer of sand and silt till which extended to a depth of 28.35 m below ground surface at Borehole PMT 1. Boreholes 1 to 4 and 9 to 11 were terminated within the deposit at depths between 24.45 and 24.65 m below ground surface. The deposit contained trace gravel, trace clay and containing occasional cobbles.

The SPT “N”-values measured within this deposit ranged from 42 blows per 300 mm to 50 blows per 25 mm of penetration, indicating a dense to very dense compactness condition. The measured water content of the samples collected from this deposit ranged between 6 and 18%, indicating a moist moisture condition.



5.7 Lower Sand

Locally at Borehole PMT 1, a fine sand deposit with trace silt was encountered underneath the sand and silt till deposit and extended to at least the borehole termination depth of 30.75 m below existing grade.

The SPT “N”-value measured within this deposit was 50 blows per 100 mm of penetration, indicating a very dense compactness condition. The measured water content of the sample collected from this deposit was 13%, indicating a saturated moisture condition.

5.8 Groundwater

Groundwater conditions were monitored during and following completion of borehole sampling.

Monitoring wells were installed in Boreholes 6, 7 and 9. The groundwater levels measured on August 19, 2025, ranged from 2.29 to 3.15 m below ground surface, corresponding to elevations between 331.27 and 331.89 m. The groundwater table declines in a southerly direction, following the site topography.

A table summarizing seasonal groundwater levels from July 2023 to August 2025 is included in Appendix D.

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

5.9 Hydraulic Testing

Appendix E provides well response recovery test (slug test) data collected on July 4, 2023, from the two (2) monitoring wells installed at Boreholes 6 and 7. The monitoring wells were purged by hand using polyethylene tubing and check valves. The water in the test well was lowered by pumping and the subsequent water recovery was measured over time. The response test was analyzed using AquiferTest software.

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

Borehole No.	Existing Ground Elevation (m)	Screened depth/Elevation (m)	Material Screened	Estimated Hydraulic Conductivity (m/sec)
6	335.03	3.05 to 6.10 (331.98 to 328.93)	Sand and Silt	1.09×10^{-6}



Borehole No.	Existing Ground Elevation (m)	Screened depth/Elevation (m)	Material Screened	Estimated Hydraulic Conductivity (m/sec)
7	334.22	3.05 to 6.10 (331.17 to 328.12)	Sandy Clayey Silt & Silty Sand	1.73×10^{-7}

The hydraulic conductivity (permeability) of the native sand and silt deposit at Borehole 6 monitoring well location was of 1.09×10^{-6} m/sec. The hydraulic conductivity of the sandy clayey silt deposit at Borehole 7 monitoring well was of 1.73×10^{-7} m/sec, which corresponded to that of sandy clayey silt (with the saturated silty sand).

The hydraulic conductivity for the confined silty sand deposits at Borehole 7 was estimated from the deposits' grain size distribution to be 7.80×10^{-6} m/s (Freeze and Cherry, 1979).



6.0 DISCUSSION AND RECOMMENDATIONS

6.1 General

It is understood that the proposed development will consist of two (2) 34-storey buildings, each consisting of 27 storeys above a seven-storey residential/mixed-use podium, with the towers connected through the podium. One (1) level of underground parking is proposed beneath the building structures. Due to differential site grading, the finished ground floor elevations (FFE) for Towers 1 and 2 have been established at 334.75 m and 333.70 m, respectively.

Commercial units are proposed at the ground level in the middle section of the rectangular structure, with a finished floor elevation of 334.30 m. The basement finished floor has been established at elevation 331.15 m at the garage door, 330.75 m underneath the east lobby, and 328.95 m at the lowest point of the basement (northwest corner).

In general, the surficial topsoil and fill materials were underlain by loose to dense fine to medium granular deposits at all borehole locations. The fine granular deposits were underlain by stiff to hard silty clay till which was further underlain by a layer of dense to very dense sand and silt till.

The groundwater levels measured on August 19, 2025, ranged from 2.29 to 3.15 m below ground surface, corresponding to elevations between 331.27 and 331.89 m. The groundwater table declines in a southerly direction, following the site topography. It is noted that the observed groundwater table will fluctuate seasonally and in response to major weather events.

6.2 One-Level Underground Parking

It is understood that one (1) level of underground parking is proposed at the site. The lower portion of P1 level has been established at elevation 328.95 m, therefore, the maximum depths of excavation could be in the range of 7.0± to 8.0± m, considering the additional depths of excavations for raft/footings and elevator pit.

The groundwater levels measured on August 19, 2025, ranged from 2.29 to 3.15 m below ground surface, corresponding to elevations between 331.27 and 331.89 m. Since the proposed underground parking will be below the groundwater table, the basement walls and floor slabs will have to be water-proofed. The basement floor slabs will need to be structurally reinforced to withstand the hydrostatic pressure and may require to be anchored down dependent on the final structural design and analysis.

Foundation excavations will be made in the damp to moist fill, damp to saturated fine to medium granular deposits and DTPL to WTPL cohesive deposits. Considering the saturated fine to medium granular soil deposits underlying the site, the excavation will need to be pre-drained, and it will require a dewatering system in order to work in a “dry condition” and to maintain the integrity of the fine granular foundation soils from becoming “quick”.

There is insufficient space for open cut excavations based on the footprint of the proposed building on the site. Therefore, a shoring system will be required to support the excavation and not compromise



the foundations of the bordering roadways and neighbouring properties.

As a layer of silty clay till was encountered throughout the site, concrete caisson wall can be considered for support of the excavation side slopes and to provide positive cut-off of water ingress from the upper perched water zone into the excavation. With the concrete caisson wall constructed to cut off water ingress, groundwater control will be reduced to dewater the saturated fine granular deposits so it can be excavated and sump pumping to control rainfall/surface runoff and seepage through the caisson wall.

6.3 Conventional Footing Foundations – Podium

Conventional strip and spread footing foundations can be used to support the sections where the 7-level podium is proposed, as well as the underground parking areas located outside the tower footprints. Footings cast on competent native compact to very dense fine to medium granular deposits and stiff to hard silty clay till can be designed using a Geotechnical Reaction at SLS of 200 kPa. The SLS value given above is based on a maximum settlement of 25 mm under the footing foundations. The Factored Geotechnical Resistance at ULS is 300 kPa.

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

Borehole No.	Existing Ground Elevation (m)	Highest Founding Depth (m)	Highest Founding Elevation (m)
1	334.50	1.50	333.00
2	335.13	6.43	328.70
3	334.37	5.67	328.70
4	334.75	5.75	329.00
5	334.16	4.66	329.50
6	335.03	2.33	332.70
7	334.22	6.12	328.10
8	334.30	3.10	331.20
9	333.55	2.25	331.30
10	333.53	4.53	329.00
11	333.54	5.34	328.20



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

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

In addition, the footings should be founded below any existing fill materials, on competent native undisturbed soils. Spacing between adjacent footing steps should not be steeper than 10H to 7V.

Adjacent to the raft foundation which will be used to support the apartment tower, footings must be founded below any disturbed soil and must be located below a 1H : 1V slope projected from the base of the adjacent excavation.

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

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

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

6.4 Tower Raft Foundation

The 34-storey residential tower can be supported on a raft foundation. It is understood that the tower footprints will be approximately $26.1\pm$ by $25.3\pm$ m. The raft foundations will likely have dimensions similar to the tower footprints.

It is understood that the lowest point of the underground parking has been established at elevation 328.95 m. Thus, the raft foundation is expected to be founded at elevation $326.9\pm$ m (assuming 0.6 m thick clear stone + 1.5 m thick raft).

Preliminary settlement analysis has been undertaken in order to estimate raft settlement for the purposes of preliminary design considerations. Using the soil parameters obtained from SPT values correlations and a soil pressure assumed to be approximately 350 kPa (10 kPa per level, 34 storeys + 1 level underground parking).

Soil models were created using Settle 3D software by Rocscience Inc. based on the test results of Borehole PMT 1. The preliminary analysis results indicate that the maximum total settlements of a rigid raft supporting the 34-level buildings could be up to approximately $30\pm$ to $40\pm$ mm (assuming the raft foundation will be founded at the same elevation at $326.9\pm$ m). The settlement response will be "immediate" once the loading is imposed.



The following design and construction criteria are recommended:

- Modulus of vertical subgrade reaction of 13 MPa/m can be used for preliminary structural design of the raft foundation.
- Garage footings located adjacent to the residential tower could be affected by the settlement of the raft foundation.
- Design the structures to accommodate the relative settlement/movement between the residential tower and podium/parking garage.
- Accommodate relative movements for services connecting to the building.
- Remove any loose or soft soils exposed at the raft founding subgrade and replace such materials with lean concrete.
- Place a 50 to 100 mm thick lean concrete working pad to facilitate placement of water-proofing and reinforcement steel.
- Groundwater must be properly controlled during the raft slab construction.
- The Factored Geotechnical Resistance at ULS for the raft foundation is 900 kPa.

Final raft foundation design will be completed once the actual pressure distribution under the raft is established by the structural engineer. CVD will update the preliminary settlement model and provide a refined modulus of subgrade reaction and settlement estimate for the final raft design.

Monitoring of the tower settlement will be required in order to ensure that the majority of settlement due to the dead loads has completed. It may be necessary (pending final analysis and design) to wait until the settlement is completed before the connection of the tower to the podium can be made.

Assuming the dead load of the apartment will be 80± % of the total loading, settlement due to live loading will be minimal (less than 8 mm). The designer must take into consideration that the relative settlement between the residential towers and the podium/garage structure could be up to 8 mm due to the live loads if the underground garage structure is connected to the residential towers at the end of construction.

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

It should be noted that a layer of stiff silty clay till, with a recorded N-value of 8, was encountered in Borehole 10, located in the southwest corner of the property. Additional boreholes will be required to delineate the extent of this softer soil layer, as larger settlements are anticipated in this area. Alternative solutions, such as incorporating a second level of underground parking or using caissons, may be considered to address the settlement concerns. CVD will provide further recommendations once the design is finalized.



6.5 Earthquake Considerations

In accordance with The Ontario Building Code 2024 (OBC), the proposed structure should be designed to resist earthquake load and effects as per OBC Subsection 4.1.8.

Based on the anticipated condition of the engineered fill materials and the underlying soil condition encountered at the boreholes, the site can be classified as a Site Class C in accordance with OBC Table 4.1.8.4.B.

6.6 Open Cut Excavation and Groundwater Control

Excavations are expected to be in the order of 7.0± to 8.0± m deep for basement, footing/raft foundation and site servicing. The excavations will penetrate loose to compact fill, compact to dense fine granular deposits and stiff to hard silty clay till. These materials are considered to be Type 3 Soils in accordance with the latest Occupational Health and Safety Act.

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

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

In wet to saturated subgrade condition, it will be necessary to excavate below founding level and pour a 50 to 100 mm thick mud slab of lean concrete to protect the founding soil from disturbance during the installation of reinforcing steel bars and form work.

6.7 Hydrogeological Assessment and Dewatering

As the anticipated excavation depth will be 4.0± to 5.0± m below the water table, a dewatering system must be installed to lower the groundwater table to at least 600 mm below the footing founding levels to enable construction to be carried out in a relatively dry condition.

Appendix E provides well response recovery test (slug test) data collected on July 4, 2023, from the monitoring wells at Boreholes 6 and 7. The water levels of the aquifer were measured at elevations between 331.41 and 331.87 m. Additionally, well response tests were performed on both wells and analysed using the Bower and Rice Method through the AquiferTest software. Based upon these results, the hydraulic conductivity ranged from 1.73×10^{-7} to 1.09×10^{-6} m/s, with the lower estimate corresponding to that of the sandy clayey silt confining the saturated silty sand deposits (Borehole 7). The hydraulic conductivity for the confined silty sand deposits at Borehole 7 was estimated from the deposits' grain size distribution to be 7.80×10^{-6} m/s (Freeze and Cherry, 1979). It should be noted that



the confined aquifer located in the silty sand layer was encountered locally at Borehole 7.

The objective of a properly installed and operated dewatering system, to be designed by the dewatering contractor, should:

- Lower the water table inside the excavation and intercept seepage which will emerge from the banks and the bottom of the excavation.
- Improve the stability of the bottom of the excavation to prevent disturbance due to hydrostatic pressure.
- Provide a reasonably dry working area in the bottom of the excavation.
- Provide for the collection and removal of surface runoff water and rainfall.

The dewatering system should be monitored to ensure that “silt” is not removed during pumping. It is noted that the selection of the appropriate dewatering system is the responsibility of the contractor. The dewatering system proposed by the contractor should be reviewed by the geotechnical engineer.

The dewatering system should be kept effective until backfilling to the foundations is completed. And the weight of the structure is sufficient to withstand the hydrostatic pressure. The dewatering system should be decommissioned gradually.

As of July 1, 2025, Ontario Regulation 63/16 under the Environmental Protection Act was amended to allow for temporary construction dewatering of volumes exceeding 400,000 L/day, whereas a Permit to Take Water (PTTW) would have been required prior to this date. As such, only an Environment and Sector Registry (EASR) for temporary construction dewatering will need to be registered with the Ministry of Environment Conservation and Parks (MECP) to support temporary construction dewatering. Nonetheless, to meet EASR requirements, a detailed discharge monitoring and mitigation plan must be supplied by a qualified person (QP) which provides clear and detailed instructions for the Client and dewatering contractor. The EASR will be registered by Owner/QP during contractor mobilization, but prior to any actual works taking place.

Prior to commencement of construction dewatering activities, and once finalized design drawings are available, a dewatering discharge monitoring and mitigation plan will be provided as a separate technical memorandum as required under O.Reg. 63/16 for EASR registration. This plan will address potential impacts of water taking and will provide detailed instructions pertaining to construction dewatering and discharge, which must be followed, for the dewatering contractor / owner. These instructions will specifically address construction dewatering methods and estimated quantities, required groundwater / surface water testing and allowable concentration limits prior to, during, and after the commencement of water taking, dewatering effluent treatment prior to discharge, if required, potential discharge locations, flow monitoring, and erosion control.

CVD can provide further assistance in preparing a supplemental hydrogeological report to support application the expected EASR.



6.8 Floor Slab Construction

The basement floor slab will be constructed as slab on grade, on the 600± mm thick granular fill which will be placed on top of the raft foundation and/or the water-proofed basement floor slab. The granular fill layer is intended to allow utilities to be buried between the slab on grade and raft.

It is recommended that the granular fill layer be consisted of clear crushed stone (9 mm size preferred for the ease of handling and installing utilities). The clear crushed stone should be suitably compacted/densified to ensure settlement does not take place.

At the time of floor slab construction, the exposed clear crushed stone subgrade should be proof-rolled with a heavy roller in conjunction with an inspection by the geotechnical engineer.

A modulus of subgrade reaction (k_s) of 80 MN/m³ may be used for the design of the floor slabs, considering the floor subgrade will consist of clear crushed stone.

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

6.9 Floor Slab Design Against Hydrostatic Pressure

Since the proposed P1 level is below the measured groundwater table, the basement walls and floor slabs will have to be water-proofed. The basement floor slabs will need to be structurally reinforced to withstand the hydrostatic pressure and may require to be anchored down dependent on the final structural design and analysis.

6.10 Shored Excavation

As excavation is expected to be between 7.0± to 8.0± m deep, a shoring system will be required for temporary excavation support during construction where sufficient space is not available for open cut excavation and to support the adjacent structures. Possible shoring supports include soldier pile and timber lagging system, caisson wall or soil nail retaining system with shotcrete facing.

The shoring system is generally designed and built by a specialized shoring contractor. The shoring system should be designed in accordance with the guidelines provided in the Canadian foundation Engineering Manual (CFEM) 5th Edition.

The shoring system will have to withstand the lateral earth pressure, the adjacent roadways, buried services and the traffic loads as well as the adjacent building structures. Frost pressures on the shoring system should be considered if the system is exposed to winter freezing condition. The shoring system should be monitored to ensure deflection and lateral movements are acceptable, and modifications made to the shoring system if deflection and lateral movements become a problem.



The following soil parameters may be used in the design of shoring. K_o (at rest condition) should be used where the shoring will need to support any existing building/structure.

Soil	Unit Weight (kN/m ³)	Friction Angle (ϕ°)	K_o	K_a	K_p
Loose to compact Fill Materials	19	28	0.53	0.36	2.77
Compact to dense sands and silts	21	31	0.47	0.31	3.23
Stiff to Hard Cohesive	21	29	0.52	0.35	2.85

The shoring system can be supported by soil anchor tie-backs and/or raker footings. Soil anchors will provide an unobstructed open space for construction whereas raker supports will obstruct the forming and construction of footings and foundation walls.

If a soldier pile and timber lagging system is adopted, the augering/installation of the soldier piles and timber laggings, especially where they are located adjacent existing structures, should be carried out with caution such that the installation process will not cause future settlements to the adjacent existing structures. The geotechnical engineer should be retained to perform inspection during the installation.

6.11 Site Servicing

It is anticipated that water and sewer servicing will generally be in the range of 1.5 to 2.5 m deep.

6.11.1 Excavation Conditions

Trenching can be carried out using conventional open cut procedures. The excavations will generally intersect very loose to compact fill, and loose to very dense native fine granular deposits. The loose, unstable, and/or organic soils encountered at or below the pipe invert should be sub-excavated and replaced with well compacted OPSS Granular "A" which should be placed in 150 mm thick layers and compacted to at least 95% SPMDD. The support of pipes in these areas can also be achieved with non-shrinkable fill if poor soil is encountered at the subgrade level and fully removed.

As described in Section 6.6, the soils encountered at the boreholes are generally considered to be Type 3 Soils in accordance with the latest Occupational Health and Safety Act and trenches should be cut to 1H to 1V throughout. The side slopes should be suitably protected from erosion processes. Where seepage zones are intersected, side slopes are to be flattened locally, and the groundwater controlled by suitable means. Excavations can also be supported using trench box or timber lagging.



6.11.2 Pipe Bedding

As noted in Section 6.11.1, any unsuitable soils exposed at the pipe subgrade should be sub-excavated and replaced with imported Granular "A", placed in thin layers, and compacted to at least 95% SPMDD, or can be removed and supported on non-shrinkable fill.

The bedding requirements for the services should be in accordance with Ontario Provincial Standard Drawings OPSD - 802 for flexible and rigid pipes. The bedding shall be a Class "B" and consist of at least 150 mm thick Granular "A" compacted to at least 95% SPMDD. Granular "A" should be used to backfill around the pipe to at least 150 mm above the top of the pipe.

Particular attention should be given to ensure material placed beneath the haunches of the pipe is adequately compacted. Recycled asphalt will not be allowed to be used in Granular "A" bedding material.

6.11.3 Trench Backfill

Excavated inorganic materials are considered suitable for reuse as trench backfill. If necessary, potential mixing of drier and wetter excavated soils in proper ratios can be done to produce a suitable mixture near the material's optimum moisture content in order to achieve the required compaction specification. Conversely, judicious addition of water may be required if the soils are significantly drier than their optimum moisture content in order to facilitate suitable compaction.

The backfill should be placed in thin layers, 300 mm thick or less dependant on the demonstrated success of compaction based on in-situ density test results. Other types of materials such as organic soils, overly wet soils, and frozen materials (if work is carried out in the winter months) should not be used for backfilling. All backfill should be compacted to at least 95% SPMDD.

Backfilling operations should follow closely after excavation so that only a minimal length of trench slope is exposed at any one time so as to minimize potential problems. This will potentially minimize over-wetting of the subgrade material. Particular attention should be given to make sure frozen material is not used as backfill should construction extend into the winter season.

6.11.4 Corrosion Potential and Cement Type

Two (2) soil samples were submitted to ALS Laboratory Group of Waterloo, Ontario for analysis of resistivity, pH, redox potential, concentration of sulphides and concentration of water-soluble sulphates. The testing was conducted to assess the conditions associated with the potential for degradation of buried concrete in the presence of soluble sulphates and the corrosion potential to watermain/metal fittings.

The corrosion potential test results of two (2) selected soil sample are included in Appendix and are summarized below with reference to "AWWA C105 Appendix A":



Soil Characteristics	BH 1 – SA 3 1.5 to 1.95 mbeg (Sand, some silt)	BH 6 – SA 3 1.5 to 1.95 mbeg (Sand and Silt Fill)
Resistivity (Ω -cm)	850 (10)	9,710 (0)
pH	8.02 (0)	7.83 (0)
Redox Potential (mV)	234 (0)	250 (0)
Sulphides (ppm*)	Trace (2)	Trace (2)
Moisture	Fair Drainage (1)	Fair Drainage (1)
Total Points	13	3

*1 mg/kg = 1 ppm

In accordance with “AWWA C105 Appendix A”, when the total point counts are then (10) points or greater, the soil is corrosive to ductile iron and protection is needed.

The Canadian Standards Association (CSA) recognizes four (4) categories of potential sulphate attack of buried concrete based on percent sulphate in soil. From 0 to 0.10% the potential is negligible, from 0.10 to 0.20% the potential is mild but positive, from 0.20 to 0.50% the potential is considerable, and 0.50% and greater the potential is severe. Sulphate concentrations of less than 20 mg/kg (<0.002%) were measured on the two (2) samples submitted for analysis which are considered negligible for sulphate attack on buried concrete.

6.12 Lateral Earth Pressure

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

$$P = K (\gamma h_1 + \gamma' h_2 + q) + \gamma_w h_2$$

Where:

P	=	lateral earth pressure, kPa
K	=	theoretical earth pressure coefficient (0.5 for level free-draining granular backfill)
γ	=	unit weight of retained soil, 20.0 kN/m ³
γ'	=	submerged unit weight of backfill, 10.2 kN/m ³
γ_w	=	unit weight of water, 9.8 kN/m ³
h_1	=	depth below top of backfill to water table, m
h_2	=	depth below water table to bottom of wall, m
q	=	surcharge, kPa



The backfill for the foundation walls and retaining walls should be free-draining granular materials which should have less than 8% silt particles (OPSS Granular “B” Type I). The backfill should be placed in thin layers and compacted to 95% SPMDD. Over-compaction adjacent to the foundation/retaining walls should be avoided. Compaction should be carried out with hand operated equipment within 1 m of the foundation wall or retaining wall. Weeping tiles leading to a frost-free outlet or weep holes should be installed to effect drainage behind the retaining wall.

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

Soil	Unit Weight (kN/m ³)	Friction Coefficient
Well-compacted granular backfill	21	0.45
Compact to dense sands and silts	21	0.35
Stiff to hard silty clay	21	0.45

6.13 Access Driveway and Paved Parking Areas

6.13.1 Access Driveways Pavement

Based on the results of the field work, the predominant subgrade materials at the site will consist of fill materials and fine granular deposits. All topsoil should be removed under pavement areas and replaced with on site fill, placed in 300 mm thick lift and each lift compacted to at least 95% SPMDD.

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

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

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



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

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

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

6.13.2 Pavement Above Underground Parking Garage

It is anticipated that asphalt pavement may be constructed above the underground garage on concrete slab and the following pavement structure is recommended:

Component	Component Thickness (mm)
Superpave 12.5 Surface Course	45
Asphaltic Concrete HL4 Base Course	45
Granular "A" Base (less than 5% silt)	Variable

A water-proofing membrane should be installed above the concrete slab to prevent moisture migration into the underground parking level, protect the concrete slab and reinforcing steel rebar, and aid the drainage of infiltrated water from the Granular "A" base layer to area drains. The structural concrete slab should be sloped to direct water runoff to area drains. Protection board should be installed above the waterproofing membrane in order protect it from damage and improve the durability and performance of the pavement structure.

The granular base thickness above the underground parking structure will be variable. The granular base materials should contain less than 5% silt and be uniformly compacted to at least 100% SPMDD. The prepared earth subgrade and final pavement surfaces should be graded to direct water runoff to area drains.



7.0 GEO-ENVIRONMENTAL CONSIDERATIONS

Excess soil may be generated and removed off-site during the construction activities associated with the proposed site works. The management of excess soil is now governed by O.Reg. 406/19, MECP document entitled “On-Site and Excess Soil Management Regulation”. In accordance with the regulation, the Project Leader is responsible for the handling, storage, reuse, transportation, and removal of all soil. To support off-site removal of excess soil, the following is required:

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

An initial testing program was conducted during the geotechnical investigation, and the analytical results are discussed in the following sections of this report. Additional soil sampling and analysis may be required as per the above-noted MECP document and/or as per the requirement of the receiving site owner(s), depending on the volume of excess soil generated during construction. The analytical results and environmental assessment findings must be disclosed to the receiving site owner(s) and approval by the receiving site owner(s) be obtained prior to exporting/transferring the materials.

It is noted that the soils condition may differ between and beyond the sampled locations. If any impacted soils are discovered during construction, CVD should be contacted for further sampling and testing to determine the limit of the impacted soils.

Any soils identified during construction to have been environmentally impacted are to be separately stockpiled and analysed to determine the appropriate measures for handling and disposal. Waste characterization testing (TCLP) to classify the material for disposal as prescribed in O.Reg. 347/558 is required. Leachate analysis (mSPLP) is to be carried out if the excess soil is to be disposed to receiving sites under O.Reg. 406/19.

Similarly, groundwater encountered during construction works must also be suitably assessed and handled.

7.1 Applicable Regulatory Standards

The Soil, Ground Water and Sediment Standards for Use Under the New Soil Rules and Excess Soil Quality Standards established in accordance with the O.Reg. 406/19 as amended were consulted in the assessment of the soil at the project site.



The analytical results for soils were compared to the following “applicable regulatory standards”:

- Table 1 (Full Depth Background Site Condition Standards) for Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use
- Table 2.1 (Full Depth Generic Site Condition Standards in a Potable Ground Water Condition) for Residential/Parkland/Institutional Property Use
- Table 2.1 (Full Depth Generic Site Condition Standards in a Potable Ground Water Condition) for Industrial/Commercial/Community Property Use

7.2 Handling of Excess Soils

Four (4) soil samples were submitted to ALS Laboratory Group, Waterloo for analysis of Metals and Inorganics, Petroleum Hydrocarbons (PHCs F1 to F4), and Benzene, Toluene, Ethylbenzene and Xylene (BTEX). The chemical testing was conducted to initially assess the environmental quality of potential excess soil which may be generated and removed off-site during construction activities.

The results and laboratory certificates of chemical analysis are enclosed in Appendix B. A comparison of the soil chemistry results to the applicable regulatory standard is included in Appendix C.

The analytical results for electrical conductivity (EC) indicate that the tested soils from Borehole 2, Sample 1 exceed the allowable concentration limits under Table 2.1 RPI standards.

The analytical results for sodium adsorption ratio (SAR) indicate that the tested soils from Borehole 2, Sample 1 and Borehole 5, Sample 1 exceed the allowable concentration limits under Table 2.1 ICC and Table 1 standards, respectively.

The analytical results for metals and inorganics indicate that the tested soils do not exceed the allowable concentration limits under Table 1 and Table 2.1 standards.

The analytical results for PHCs (F1-F4) indicate that the tested soils do not exceed the allowable concentration limits under Table 1 and Table 2.1 standards.

The analytical results for BTEX indicate that the tested soils do not exceed the allowable concentration limits under Table 1 and Table 2.1 standards.

Any soils identified during construction to have been environmentally impacted are to be separately stockpiled and analysed to determine appropriate measures for handling and disposal. Waste characterization testing (TCLP) to classify the material for disposal as prescribed in Ontario Regulation 347/558 is required.

CVD further recommends that a disposal plan for excess soils be established to manage the quantity, as well as where and how the excess soils can be disposed of off-site.



8.0 CLOSURE

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

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

Yours truly,

CHUNG & VANDER DOELEN ENGINEERING LTD.

Nandou Zhao, M.Eng., P.Eng.
Manager – Geotechnical Services



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



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APPENDIX A

LIMITATIONS OF REPORT



APPENDIX “A”

LIMITATIONS OF REPORT

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

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

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

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

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

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



APPENDIX B

SOIL CHEMISTRY RESULTS



CERTIFICATE OF ANALYSIS (GUIDELINE EVALUATION)

Work Order	: WT2318542	Page	: 1 of 24
Client	: Chung and Vander Doelen Engineering Ltd.	Laboratory	: Waterloo - Environmental
Contact	: Marcelo Pereira	Account Manager	: Andrew Martin
Address	: 311 Victoria St. N. Kitchener ON Canada N2H 5E1	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 1161	Date Samples Received	: 23-Jun-2023 13:00
PO	: ----	Date Analysis Commenced	: 24-Jun-2023
C-O-C number	: 17-869862	Issue Date	: 30-Jun-2023 15:18
Sampler	: Marcelo Pereira		
Site	: ----		
Quote number	: Q84362 - Excess Soils		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Guideline Comparison

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	Position	Laboratory Department
Amanda Ganouri-Lumsden	Department Manager - Microbiology and Prep	Centralized Prep, Waterloo, Ontario
Jeremy Gingras	Team Leader - Semi-Volatile Instrumentation	Organics, Waterloo, Ontario
Sarah Birch	VOC Section Supervisor	VOC, Waterloo, Ontario
Wayne Smith	Client Services Specialist	Inorganics, Waterloo, Ontario
Wayne Smith	Client Services Specialist	Metals, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Application of guidelines is provided "as is" without warranty of any kind, either expressed or implied, including, but not limited to fitness for a particular purpose, or non-infringement. ALS assumes no responsibility for errors or omissions in the information. Guidelines are not adjusted for the hardness, pH or temperature of the sample (the most conservative values are used). Measurement uncertainty is not applied to test results prior to comparison with specified criteria values.

Key : LOR: Limit of Reporting (detection limit).

Unit	Description
-	no units
%	percent
µS/cm	microsiemens per centimetre
mg/kg	milligrams per kilogram
mg/L	milligrams per litre
mS/cm	millisiemens per centimetre
mV	millivolts
ohm cm	ohm centimetres (resistivity)
pH units	pH units

>: greater than.

<: less than.

Red shading is applied where the result or the LOR is greater than the Guideline Upper Limit (or lower than the Guideline Lower Limit, if applicable).

For drinking water samples, Red shading is applied where the result for E.coli, fecal or total coliforms is greater than or equal to the Guideline Upper Limit .



Analytical Results

				Client sample ID						
				Sampling date/time						
					BH1- SA3					
					23-Jun-2023 00:00					
Sub-Matrix: Soil/Solid (Matrix: Soil/Solid)	Method/Lab	LOR	Unit	WT2318542-001	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	5.00	µS/cm	1180	1400 µS/cm	700 µS/cm	--	--	--	--
Moisture	E144/WT	0.25	%	9.47	--	--	--	--	--	--
Oxidation-reduction potential [ORP]	E125/WT	0.10	mV	234	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	8.02	--	--	--	--	--	--
Resistivity	EC100R/WT	100	ohm cm	850	--	--	--	--	--	--
Inorganics										
Sulfides, acid volatile	E396-L/WT	0.20	mg/kg	<0.22	--	--	--	--	--	--
Leachable Anions & Nutrients										
Chloride, soluble ion content	E236.Cl/WT	5.0	mg/kg	818	--	--	--	--	--	--
Sulfate, soluble ion content	E236.SO4/WT	20	mg/kg	<20	--	--	--	--	--	--
Analyte	Method/Lab	LOR	Unit	WT2318542-001 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	5.00	µS/cm	1180	570 µS/cm	1400 µS/cm	1400 µS/cm	700 µS/cm	700µS/cm	570 µS/cm
Moisture	E144/WT	0.25	%	9.47	--	--	--	--	--	--
Oxidation-reduction potential [ORP]	E125/WT	0.10	mV	234	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	8.02	--	--	--	--	--	--
Resistivity	EC100R/WT	100	ohm cm	850	--	--	--	--	--	--
Inorganics										
Sulfides, acid volatile	E396-L/WT	0.20	mg/kg	<0.22	--	--	--	--	--	--
Leachable Anions & Nutrients										
Chloride, soluble ion content	E236.Cl/WT	5.0	mg/kg	818	--	--	--	--	--	--
Sulfate, soluble ion content	E236.SO4/WT	20	mg/kg	<20	--	--	--	--	--	--

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Summary of Guideline Breaches by Sample

SampleID/Client ID	Matrix	Analyte	Analyte Summary	Guideline	Category	Result	Limit
BH1- SA3	Soil/Solid	Conductivity (1:2 leachate)		ON153/04	T1-RPIICC	1180 µS/cm	570 µS/cm
	Soil/Solid	Conductivity (1:2 leachate)		ON153/04	T2-RPI-C	1180 µS/cm	700 µS/cm
	Soil/Solid	Conductivity (1:2 leachate)		ON153/04	T2-RPI-F	1180 µS/cm	700 µS/cm
	Soil/Solid	Conductivity (1:2 leachate)		ON406/20	T1-RPIICC	1180 µS/cm	570 µS/cm
	Soil/Solid	Conductivity (1:2 leachate)		ON406/20	T2.1-S-RPI	1180 µS/cm	700 µS/cm

Key:

ON153/04	Ontario Regulation 153/04 - April 15, 2011 Standards (JUL, 2011)
T1-RPIICC	153 T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use
T2-ICC-C	153 T2-Soil-Ind/Com/Commu Property Use (Coarse)
T2-ICC-F	153 T2-Soil-Ind/Com/Commu Property Use (Fine)
T2-RPI-C	153 T2-Soil-Res/Park/Inst. Property Use (Coarse)
T2-RPI-F	153 T2-Soil-Res/Park/Inst. Property Use (Fine)
ON406/20	Ontario Regulation 406/19 - Excess Soils - 17-December-20
T1-RPIICC	406 T1 - Soil - Res/Park/Inst/Ind/Com/Commu Property Use
T2.1-S-ICC	406 T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use
T2.1-S-RPI	406 T2.1 - Volume Independent Soil - Res/Park/Inst Property Use



Analytical Results

				Client sample ID						
				Sampling date/time						
					BH6- SA3					
					23-Jun-2023 00:00					
					WT2318542-002	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	5.00	µS/cm	103	1400 µS/cm	700 µS/cm	--	--	--	--
Moisture	E144/WT	0.25	%	6.22	--	--	--	--	--	--
Oxidation-reduction potential [ORP]	E125/WT	0.10	mV	250	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.83	--	--	--	--	--	--
Resistivity	EC100R/WT	100	ohm cm	9710	--	--	--	--	--	--
Inorganics										
Sulfides, acid volatile	E396-L/WT	0.20	mg/kg	<0.21	--	--	--	--	--	--
Leachable Anions & Nutrients										
Chloride, soluble ion content	E236.Cl/WT	5.0	mg/kg	23.0	--	--	--	--	--	--
Sulfate, soluble ion content	E236.SO4/WT	20	mg/kg	<20	--	--	--	--	--	--
Analyte	Method/Lab	LOR	Unit	WT2318542-002 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	5.00	µS/cm	103	570 µS/cm	1400 µS/cm	1400 µS/cm	700 µS/cm	700µS/cm	570 µS/cm
Moisture	E144/WT	0.25	%	6.22	--	--	--	--	--	--
Oxidation-reduction potential [ORP]	E125/WT	0.10	mV	250	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.83	--	--	--	--	--	--
Resistivity	EC100R/WT	100	ohm cm	9710	--	--	--	--	--	--
Inorganics										
Sulfides, acid volatile	E396-L/WT	0.20	mg/kg	<0.21	--	--	--	--	--	--
Leachable Anions & Nutrients										
Chloride, soluble ion content	E236.Cl/WT	5.0	mg/kg	23.0	--	--	--	--	--	--
Sulfate, soluble ion content	E236.SO4/WT	20	mg/kg	<20	--	--	--	--	--	--

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

No Breaches Found



Key:

ON153/04	Ontario Regulation 153/04 - April 15, 2011 Standards (JUL, 2011)
T1-RPIICC	153 T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use
T2-ICC-C	153 T2-Soil-Ind/Com/Commu Property Use (Coarse)
T2-ICC-F	153 T2-Soil-Ind/Com/Commu Property Use (Fine)
T2-RPI-C	153 T2-Soil-Res/Park/Inst. Property Use (Coarse)
T2-RPI-F	153 T2-Soil-Res/Park/Inst. Property Use (Fine)
ON406/20	Ontario Regulation 406/19 - Excess Soils - 17-December-20
T1-RPIICC	406 T1 - Soil - Res/Park/Inst/Ind/Com/Commu Property Use
T2.1-S-ICC	406 T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use
T2.1-S-RPI	406 T2.1 - Volume Independent Soil - Res/Park/Inst Property Use



Analytical Results

				Client sample ID						
				Sampling date/time						
					BH2- SA1					
					23-Jun-2023 00:00					
Analyte	Method/Lab	LOR	Unit	WT2318542-003	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	0.00500	mS/cm	1.29	1.4 mS/cm	0.7 mS/cm	--	--	--	--
Moisture	E144/WT	0.25	%	12.2	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.89	--	--	--	--	--	--
Cyanides										
Cyanide, weak acid dissociable	E336A/WT	0.050	mg/kg	<0.050	0.051 mg/kg	0.051 mg/kg	--	--	--	--
Fixed-Ratio Extractables										
Calcium, soluble ion content	E484/WT	0.50	mg/L	8.28	--	--	--	--	--	--
Magnesium, soluble ion content	E484/WT	0.50	mg/L	9.58	--	--	--	--	--	--
Sodium, soluble ion content	E484/WT	0.50	mg/L	274	--	--	--	--	--	--
Sodium adsorption ratio [SAR]	E484/WT	0.10	-	15.4	12 -	5 -	--	--	--	--
Metals										
Antimony	E440C/WT	0.10	mg/kg	0.14	40 mg/kg	7.5 mg/kg	--	--	--	--
Arsenic	E440C/WT	0.10	mg/kg	2.83	18 mg/kg	18 mg/kg	--	--	--	--
Barium	E440C/WT	0.50	mg/kg	47.0	670 mg/kg	390 mg/kg	--	--	--	--
Beryllium	E440C/WT	0.10	mg/kg	0.36	8 mg/kg	4 mg/kg	--	--	--	--
Boron, hot water soluble	E487/WT	0.10	mg/kg	0.13	2 mg/kg	1.5 mg/kg	--	--	--	--
Boron	E440C/WT	5.0	mg/kg	<5.0	120 mg/kg	120 mg/kg	--	--	--	--
Cadmium	E440C/WT	0.020	mg/kg	0.167	1.9 mg/kg	1.2 mg/kg	--	--	--	--
Chromium	E440C/WT	0.50	mg/kg	32.0	160 mg/kg	160 mg/kg	--	--	--	--
Cobalt	E440C/WT	0.10	mg/kg	4.16	80 mg/kg	22 mg/kg	--	--	--	--
Copper	E440C/WT	0.50	mg/kg	9.34	230 mg/kg	140 mg/kg	--	--	--	--
Lead	E440C/WT	0.50	mg/kg	16.2	120 mg/kg	120 mg/kg	--	--	--	--
Mercury	E510C/WT	0.0050	mg/kg	0.0478	0.27 mg/kg	0.27 mg/kg	--	--	--	--
Molybdenum	E440C/WT	0.10	mg/kg	0.38	40 mg/kg	6.9 mg/kg	--	--	--	--
Nickel	E440C/WT	0.50	mg/kg	8.60	270 mg/kg	100 mg/kg	--	--	--	--
Selenium	E440C/WT	0.20	mg/kg	<0.20	5.5 mg/kg	2.4 mg/kg	--	--	--	--
Silver	E440C/WT	0.10	mg/kg	<0.10	40 mg/kg	20 mg/kg	--	--	--	--
Thallium	E440C/WT	0.050	mg/kg	0.073	3.3 mg/kg	1 mg/kg	--	--	--	--
Uranium	E440C/WT	0.050	mg/kg	0.391	33 mg/kg	23 mg/kg	--	--	--	--
Vanadium	E440C/WT	0.20	mg/kg	25.7	86 mg/kg	86 mg/kg	--	--	--	--
Zinc	E440C/WT	2.0	mg/kg	53.1	340 mg/kg	340 mg/kg	--	--	--	--



Analyte	Method/Lab	LOR	Unit	WT2318542-003 (Continued)	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Speciated Metals										
Chromium, hexavalent [Cr VI]	E532/WT	0.10	mg/kg	0.61	8 mg/kg	8 mg/kg	--	--	--	--
Volatile Organic Compounds										
Benzene	E611A/WT	0.0050	mg/kg	<0.0050	0.02 mg/kg	0.02 mg/kg	--	--	--	--
Ethylbenzene	E611A/WT	0.015	mg/kg	0.018	0.05 mg/kg	0.05 mg/kg	--	--	--	--
Toluene	E611A/WT	0.050	mg/kg	<0.050	0.2 mg/kg	0.2 mg/kg	--	--	--	--
Xylene, m+p-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylene, o-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylenes, total	E611A/WT	0.050	mg/kg	<0.050	0.091 mg/kg	0.091 mg/kg	--	--	--	--
BTEX, total	E611A/WT	0.10	mg/kg	<0.10	--	--	--	--	--	--
Hydrocarbons										
F1 (C6-C10)	E581.F1/WT	5.0	mg/kg	<5.0	25 mg/kg	25 mg/kg	--	--	--	--
F2 (C10-C16)	E601.SG-L/WT	10	mg/kg	<10	26 mg/kg	10 mg/kg	--	--	--	--
F3 (C16-C34)	E601.SG-L/WT	50	mg/kg	<50	240 mg/kg	240 mg/kg	--	--	--	--
F4 (C34-C50)	E601.SG-L/WT	50	mg/kg	<50	3300 mg/kg	2800 mg/kg	--	--	--	--
F1-BTEX	EC580/WT	5.0	mg/kg	<5.0	25 mg/kg	25 mg/kg	--	--	--	--
Hydrocarbons, total (C6-C50)	EC581/WT	80	mg/kg	<80	--	--	--	--	--	--
Chromatogram to baseline at nC50	E601.SG-L/WT		-	YES	--	--	--	--	--	--
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	E601.SG-L/WT	1.0	%	89.8	--	--	--	--	--	--
Dichlorotoluene, 3,4-	E581.F1/WT	1.0	%	73.0	--	--	--	--	--	--
Bromofluorobenzene, 4-	E611A/WT	0.10	%	83.1	--	--	--	--	--	--
Difluorobenzene, 1,4-	E611A/WT	0.10	%	108	--	--	--	--	--	--



Analyte	Method/Lab	LOR	Unit	WT2318542-003 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	0.00500	mS/cm	1.29	0.57 mS/cm	1.4 mS/cm	1.4 mS/cm	0.7 mS/cm	0.7mS/cm	0.57 mS/cm
Moisture	E144/WT	0.25	%	12.2	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.89	--	--	--	--	--	--
Cyanides										
Cyanide, weak acid dissociable	E336A/WT	0.050	mg/kg	<0.050	0.051 mg/kg	0.051 mg/kg	0.051 mg/kg	0.051 mg/kg	0.051mg/kg	0.051 mg/kg
Fixed-Ratio Extractables										
Calcium, soluble ion content	E484/WT	0.50	mg/L	8.28	--	--	--	--	--	--
Magnesium, soluble ion content	E484/WT	0.50	mg/L	9.58	--	--	--	--	--	--
Sodium, soluble ion content	E484/WT	0.50	mg/L	274	--	--	--	--	--	--
Sodium adsorption ratio [SAR]	E484/WT	0.10	-	15.4	2.4 -	12 -	12 -	5 -	5-	2.4 -
Metals										
Antimony	E440C/WT	0.10	mg/kg	0.14	1.3 mg/kg	40 mg/kg	50 mg/kg	7.5 mg/kg	7.5mg/kg	1.3 mg/kg
Arsenic	E440C/WT	0.10	mg/kg	2.83	18 mg/kg	18 mg/kg	18 mg/kg	18 mg/kg	18mg/kg	18 mg/kg
Barium	E440C/WT	0.50	mg/kg	47.0	220 mg/kg	670 mg/kg	670 mg/kg	390 mg/kg	390mg/kg	220 mg/kg
Beryllium	E440C/WT	0.10	mg/kg	0.36	2.5 mg/kg	8 mg/kg	10 mg/kg	4 mg/kg	5mg/kg	2.5 mg/kg
Boron, hot water soluble	E487/WT	0.10	mg/kg	0.13	--	2 mg/kg	2 mg/kg	1.5 mg/kg	1.5mg/kg	--
Boron	E440C/WT	5.0	mg/kg	<5.0	36 mg/kg	120 mg/kg	120 mg/kg	120 mg/kg	120mg/kg	36 mg/kg
Cadmium	E440C/WT	0.020	mg/kg	0.167	1.2 mg/kg	1.9 mg/kg	1.9 mg/kg	1.2 mg/kg	1.2mg/kg	1.2 mg/kg
Chromium	E440C/WT	0.50	mg/kg	32.0	70 mg/kg	160 mg/kg	160 mg/kg	160 mg/kg	160mg/kg	70 mg/kg
Cobalt	E440C/WT	0.10	mg/kg	4.16	21 mg/kg	80 mg/kg	100 mg/kg	22 mg/kg	22mg/kg	21 mg/kg
Copper	E440C/WT	0.50	mg/kg	9.34	92 mg/kg	230 mg/kg	300 mg/kg	140 mg/kg	180mg/kg	92 mg/kg
Lead	E440C/WT	0.50	mg/kg	16.2	120 mg/kg	120 mg/kg	120 mg/kg	120 mg/kg	120mg/kg	120 mg/kg
Mercury	E510C/WT	0.0050	mg/kg	0.0478	0.27 mg/kg	3.9 mg/kg	20 mg/kg	0.27 mg/kg	1.8mg/kg	0.27 mg/kg
Molybdenum	E440C/WT	0.10	mg/kg	0.38	2 mg/kg	40 mg/kg	40 mg/kg	6.9 mg/kg	6.9mg/kg	2 mg/kg
Nickel	E440C/WT	0.50	mg/kg	8.60	82 mg/kg	270 mg/kg	340 mg/kg	100 mg/kg	130mg/kg	82 mg/kg
Selenium	E440C/WT	0.20	mg/kg	<0.20	1.5 mg/kg	5.5 mg/kg	5.5 mg/kg	2.4 mg/kg	2.4mg/kg	1.5 mg/kg
Silver	E440C/WT	0.10	mg/kg	<0.10	0.5 mg/kg	40 mg/kg	50 mg/kg	20 mg/kg	25mg/kg	0.5 mg/kg
Thallium	E440C/WT	0.050	mg/kg	0.073	1 mg/kg	3.3 mg/kg	3.3 mg/kg	1 mg/kg	1mg/kg	1 mg/kg
Uranium	E440C/WT	0.050	mg/kg	0.391	2.5 mg/kg	33 mg/kg	33 mg/kg	23 mg/kg	23mg/kg	2.5 mg/kg
Vanadium	E440C/WT	0.20	mg/kg	25.7	86 mg/kg	86 mg/kg	86 mg/kg	86 mg/kg	86mg/kg	86 mg/kg
Zinc	E440C/WT	2.0	mg/kg	53.1	290 mg/kg	340 mg/kg	340 mg/kg	340 mg/kg	340mg/kg	290 mg/kg
Speciated Metals										
Chromium, hexavalent [Cr VI]	E532/WT	0.10	mg/kg	0.61	0.66 mg/kg	8 mg/kg	10 mg/kg	8 mg/kg	10mg/kg	0.66 mg/kg
Volatile Organic Compounds										
Benzene	E611A/WT	0.0050	mg/kg	<0.0050	0.02 mg/kg	0.32 mg/kg	0.4 mg/kg	0.21 mg/kg	0.17mg/kg	0.02 mg/kg
Ethylbenzene	E611A/WT	0.015	mg/kg	0.018	0.05 mg/kg	1.1 mg/kg	1.6 mg/kg	1.1 mg/kg	1.6mg/kg	0.05 mg/kg



Analyte	Method/Lab	LOR	Unit	WT2318542-003 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Volatile Organic Compounds - Continued										
Toluene	E611A/WT	0.050	mg/kg	<0.050	0.2 mg/kg	6.4 mg/kg	9 mg/kg	2.3 mg/kg	6mg/kg	0.2 mg/kg
Xylene, m+p-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylene, o-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylenes, total	E611A/WT	0.050	mg/kg	<0.050	0.05 mg/kg	26 mg/kg	30 mg/kg	3.1 mg/kg	25mg/kg	0.05 mg/kg
BTEX, total	E611A/WT	0.10	mg/kg	<0.10	--	--	--	--	--	--
Hydrocarbons										
F1 (C6-C10)	E581.F1/WT	5.0	mg/kg	<5.0	25 mg/kg	55 mg/kg	65 mg/kg	55 mg/kg	65mg/kg	25 mg/kg
F2 (C10-C16)	E601.SG-L/WT	10	mg/kg	<10	10 mg/kg	230 mg/kg	250 mg/kg	98 mg/kg	150mg/kg	10 mg/kg
F3 (C16-C34)	E601.SG-L/WT	50	mg/kg	<50	240 mg/kg	1700 mg/kg	2500 mg/kg	300 mg/kg	1300mg/kg	240 mg/kg
F4 (C34-C50)	E601.SG-L/WT	50	mg/kg	<50	120 mg/kg	3300 mg/kg	6600 mg/kg	2800 mg/kg	5600mg/kg	120 mg/kg
F1-BTEX	EC580/WT	5.0	mg/kg	<5.0	25 mg/kg	55 mg/kg	65 mg/kg	55 mg/kg	65mg/kg	25 mg/kg
Hydrocarbons, total (C6-C50)	EC581/WT	80	mg/kg	<80	--	--	--	--	--	--
Chromatogram to baseline at nC50	E601.SG-L/WT		-	YES	--	--	--	--	--	--
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	E601.SG-L/WT	1.0	%	89.8	--	--	--	--	--	--
Dichlorotoluene, 3,4-	E581.F1/WT	1.0	%	73.0	--	--	--	--	--	--
Bromofluorobenzene, 4-	E611A/WT	0.10	%	83.1	--	--	--	--	--	--
Difluorobenzene, 1,4-	E611A/WT	0.10	%	108	--	--	--	--	--	--

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.



Summary of Guideline Breaches by Sample

SampleID/Client ID	Matrix	Analyte	Analyte Summary	Guideline	Category	Result	Limit
BH2- SA1	Soil/Solid	Conductivity (1:2 leachate)		ON153/04	T1-RPIICC	1.29 mS/cm	0.57 mS/cm
	Soil/Solid	Sodium adsorption ratio [SAR]		ON153/04	T1-RPIICC	15.4 -	2.4 -
	Soil/Solid	Sodium adsorption ratio [SAR]		ON153/04	T2-ICC-C	15.4 -	12 -
	Soil/Solid	Sodium adsorption ratio [SAR]		ON153/04	T2-ICC-F	15.4 -	12 -
	Soil/Solid	Conductivity (1:2 leachate)		ON153/04	T2-RPI-C	1.29 mS/cm	0.7 mS/cm
	Soil/Solid	Sodium adsorption ratio [SAR]		ON153/04	T2-RPI-C	15.4 -	5 -
	Soil/Solid	Conductivity (1:2 leachate)		ON153/04	T2-RPI-F	1.29 mS/cm	0.7 mS/cm
	Soil/Solid	Sodium adsorption ratio [SAR]		ON153/04	T2-RPI-F	15.4 -	5 -
	Soil/Solid	Conductivity (1:2 leachate)		ON406/20	T1-RPIICC	1.29 mS/cm	0.57 mS/cm
	Soil/Solid	Sodium adsorption ratio [SAR]		ON406/20	T1-RPIICC	15.4 -	2.4 -
	Soil/Solid	Sodium adsorption ratio [SAR]		ON406/20	T2.1-S-ICC	15.4 -	12 -
	Soil/Solid	Conductivity (1:2 leachate)		ON406/20	T2.1-S-RPI	1.29 mS/cm	0.7 mS/cm
	Soil/Solid	Sodium adsorption ratio [SAR]		ON406/20	T2.1-S-RPI	15.4 -	5 -

Key:

ON153/04	Ontario Regulation 153/04 - April 15, 2011 Standards (JUL, 2011)
T1-RPIICC	153 T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use
T2-ICC-C	153 T2-Soil-Ind/Com/Commu Property Use (Coarse)
T2-ICC-F	153 T2-Soil-Ind/Com/Commu Property Use (Fine)
T2-RPI-C	153 T2-Soil-Res/Park/Inst. Property Use (Coarse)
T2-RPI-F	153 T2-Soil-Res/Park/Inst. Property Use (Fine)
ON406/20	Ontario Regulation 406/19 - Excess Soils - 17-December-20
T1-RPIICC	406 T1 - Soil - Res/Park/Inst/Ind/Com/Commu Property Use
T2.1-S-ICC	406 T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use
T2.1-S-RPI	406 T2.1 - Volume Independent Soil - Res/Park/Inst Property Use



Analytical Results

				Client sample ID						
				Sampling date/time						
					BH4- SA1					
					23-Jun-2023 00:00					
Analyte	Method/Lab	LOR	Unit	WT2318542-004	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	0.00500	mS/cm	0.138	1.4 mS/cm	0.7 mS/cm	--	--	--	--
Moisture	E144/WT	0.25	%	9.66	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.46	--	--	--	--	--	--
Cyanides										
Cyanide, weak acid dissociable	E336A/WT	0.050	mg/kg	<0.050	0.051 mg/kg	0.051 mg/kg	--	--	--	--
Fixed-Ratio Extractables										
Calcium, soluble ion content	E484/WT	0.50	mg/L	11.3	--	--	--	--	--	--
Magnesium, soluble ion content	E484/WT	0.50	mg/L	1.09	--	--	--	--	--	--
Sodium, soluble ion content	E484/WT	0.50	mg/L	1.73	--	--	--	--	--	--
Sodium adsorption ratio [SAR]	E484/WT	0.10	-	0.13	12 -	5 -	--	--	--	--
Metals										
Antimony	E440C/WT	0.10	mg/kg	0.12	40 mg/kg	7.5 mg/kg	--	--	--	--
Arsenic	E440C/WT	0.10	mg/kg	7.68	18 mg/kg	18 mg/kg	--	--	--	--
Barium	E440C/WT	0.50	mg/kg	37.9	670 mg/kg	390 mg/kg	--	--	--	--
Beryllium	E440C/WT	0.10	mg/kg	0.33	8 mg/kg	4 mg/kg	--	--	--	--
Boron, hot water soluble	E487/WT	0.10	mg/kg	0.26	2 mg/kg	1.5 mg/kg	--	--	--	--
Boron	E440C/WT	5.0	mg/kg	<5.0	120 mg/kg	120 mg/kg	--	--	--	--
Cadmium	E440C/WT	0.020	mg/kg	0.240	1.9 mg/kg	1.2 mg/kg	--	--	--	--
Chromium	E440C/WT	0.50	mg/kg	12.7	160 mg/kg	160 mg/kg	--	--	--	--
Cobalt	E440C/WT	0.10	mg/kg	3.43	80 mg/kg	22 mg/kg	--	--	--	--
Copper	E440C/WT	0.50	mg/kg	10.1	230 mg/kg	140 mg/kg	--	--	--	--
Lead	E440C/WT	0.50	mg/kg	13.0	120 mg/kg	120 mg/kg	--	--	--	--
Mercury	E510C/WT	0.0050	mg/kg	0.0378	0.27 mg/kg	0.27 mg/kg	--	--	--	--
Molybdenum	E440C/WT	0.10	mg/kg	0.45	40 mg/kg	6.9 mg/kg	--	--	--	--
Nickel	E440C/WT	0.50	mg/kg	6.49	270 mg/kg	100 mg/kg	--	--	--	--
Selenium	E440C/WT	0.20	mg/kg	0.29	5.5 mg/kg	2.4 mg/kg	--	--	--	--
Silver	E440C/WT	0.10	mg/kg	<0.10	40 mg/kg	20 mg/kg	--	--	--	--
Thallium	E440C/WT	0.050	mg/kg	0.076	3.3 mg/kg	1 mg/kg	--	--	--	--
Uranium	E440C/WT	0.050	mg/kg	0.466	33 mg/kg	23 mg/kg	--	--	--	--
Vanadium	E440C/WT	0.20	mg/kg	26.2	86 mg/kg	86 mg/kg	--	--	--	--
Zinc	E440C/WT	2.0	mg/kg	55.2	340 mg/kg	340 mg/kg	--	--	--	--



Analyte	Method/Lab	LOR	Unit	WT2318542-004 (Continued)	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Speciated Metals										
Chromium, hexavalent [Cr VI]	E532/WT	0.10	mg/kg	<0.10	8 mg/kg	8 mg/kg	--	--	--	--
Volatile Organic Compounds										
Benzene	E611A/WT	0.0050	mg/kg	<0.0050	0.02 mg/kg	0.02 mg/kg	--	--	--	--
Ethylbenzene	E611A/WT	0.015	mg/kg	<0.015	0.05 mg/kg	0.05 mg/kg	--	--	--	--
Toluene	E611A/WT	0.050	mg/kg	<0.050	0.2 mg/kg	0.2 mg/kg	--	--	--	--
Xylene, m+p-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylene, o-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylenes, total	E611A/WT	0.050	mg/kg	<0.050	0.091 mg/kg	0.091 mg/kg	--	--	--	--
BTEX, total	E611A/WT	0.10	mg/kg	<0.10	--	--	--	--	--	--
Hydrocarbons										
F1 (C6-C10)	E581.F1/WT	5.0	mg/kg	<5.0	25 mg/kg	25 mg/kg	--	--	--	--
F2 (C10-C16)	E601.SG-L/WT	10	mg/kg	<10	26 mg/kg	10 mg/kg	--	--	--	--
F3 (C16-C34)	E601.SG-L/WT	50	mg/kg	<50	240 mg/kg	240 mg/kg	--	--	--	--
F4 (C34-C50)	E601.SG-L/WT	50	mg/kg	<50	3300 mg/kg	2800 mg/kg	--	--	--	--
F1-BTEX	EC580/WT	5.0	mg/kg	<5.0	25 mg/kg	25 mg/kg	--	--	--	--
Hydrocarbons, total (C6-C50)	EC581/WT	80	mg/kg	<80	--	--	--	--	--	--
Chromatogram to baseline at nC50	E601.SG-L/WT		-	YES	--	--	--	--	--	--
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	E601.SG-L/WT	1.0	%	91.3	--	--	--	--	--	--
Dichlorotoluene, 3,4-	E581.F1/WT	1.0	%	85.0	--	--	--	--	--	--
Bromofluorobenzene, 4-	E611A/WT	0.10	%	87.4	--	--	--	--	--	--
Difluorobenzene, 1,4-	E611A/WT	0.10	%	110	--	--	--	--	--	--



Analyte	Method/Lab	LOR	Unit	WT2318542-004 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	0.00500	mS/cm	0.138	0.57 mS/cm	1.4 mS/cm	1.4 mS/cm	0.7 mS/cm	0.7mS/cm	0.57 mS/cm
Moisture	E144/WT	0.25	%	9.66	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.46	--	--	--	--	--	--
Cyanides										
Cyanide, weak acid dissociable	E336A/WT	0.050	mg/kg	<0.050	0.051 mg/kg	0.051 mg/kg	0.051 mg/kg	0.051 mg/kg	0.051mg/kg	0.051 mg/kg
Fixed-Ratio Extractables										
Calcium, soluble ion content	E484/WT	0.50	mg/L	11.3	--	--	--	--	--	--
Magnesium, soluble ion content	E484/WT	0.50	mg/L	1.09	--	--	--	--	--	--
Sodium, soluble ion content	E484/WT	0.50	mg/L	1.73	--	--	--	--	--	--
Sodium adsorption ratio [SAR]	E484/WT	0.10	-	0.13	2.4 -	12 -	12 -	5 -	5-	2.4 -
Metals										
Antimony	E440C/WT	0.10	mg/kg	0.12	1.3 mg/kg	40 mg/kg	50 mg/kg	7.5 mg/kg	7.5mg/kg	1.3 mg/kg
Arsenic	E440C/WT	0.10	mg/kg	7.68	18 mg/kg	18 mg/kg	18 mg/kg	18 mg/kg	18mg/kg	18 mg/kg
Barium	E440C/WT	0.50	mg/kg	37.9	220 mg/kg	670 mg/kg	670 mg/kg	390 mg/kg	390mg/kg	220 mg/kg
Beryllium	E440C/WT	0.10	mg/kg	0.33	2.5 mg/kg	8 mg/kg	10 mg/kg	4 mg/kg	5mg/kg	2.5 mg/kg
Boron, hot water soluble	E487/WT	0.10	mg/kg	0.26	--	2 mg/kg	2 mg/kg	1.5 mg/kg	1.5mg/kg	--
Boron	E440C/WT	5.0	mg/kg	<5.0	36 mg/kg	120 mg/kg	120 mg/kg	120 mg/kg	120mg/kg	36 mg/kg
Cadmium	E440C/WT	0.020	mg/kg	0.240	1.2 mg/kg	1.9 mg/kg	1.9 mg/kg	1.2 mg/kg	1.2mg/kg	1.2 mg/kg
Chromium	E440C/WT	0.50	mg/kg	12.7	70 mg/kg	160 mg/kg	160 mg/kg	160 mg/kg	160mg/kg	70 mg/kg
Cobalt	E440C/WT	0.10	mg/kg	3.43	21 mg/kg	80 mg/kg	100 mg/kg	22 mg/kg	22mg/kg	21 mg/kg
Copper	E440C/WT	0.50	mg/kg	10.1	92 mg/kg	230 mg/kg	300 mg/kg	140 mg/kg	180mg/kg	92 mg/kg
Lead	E440C/WT	0.50	mg/kg	13.0	120 mg/kg	120 mg/kg	120 mg/kg	120 mg/kg	120mg/kg	120 mg/kg
Mercury	E510C/WT	0.0050	mg/kg	0.0378	0.27 mg/kg	3.9 mg/kg	20 mg/kg	0.27 mg/kg	1.8mg/kg	0.27 mg/kg
Molybdenum	E440C/WT	0.10	mg/kg	0.45	2 mg/kg	40 mg/kg	40 mg/kg	6.9 mg/kg	6.9mg/kg	2 mg/kg
Nickel	E440C/WT	0.50	mg/kg	6.49	82 mg/kg	270 mg/kg	340 mg/kg	100 mg/kg	130mg/kg	82 mg/kg
Selenium	E440C/WT	0.20	mg/kg	0.29	1.5 mg/kg	5.5 mg/kg	5.5 mg/kg	2.4 mg/kg	2.4mg/kg	1.5 mg/kg
Silver	E440C/WT	0.10	mg/kg	<0.10	0.5 mg/kg	40 mg/kg	50 mg/kg	20 mg/kg	25mg/kg	0.5 mg/kg
Thallium	E440C/WT	0.050	mg/kg	0.076	1 mg/kg	3.3 mg/kg	3.3 mg/kg	1 mg/kg	1mg/kg	1 mg/kg
Uranium	E440C/WT	0.050	mg/kg	0.466	2.5 mg/kg	33 mg/kg	33 mg/kg	23 mg/kg	23mg/kg	2.5 mg/kg
Vanadium	E440C/WT	0.20	mg/kg	26.2	86 mg/kg	86 mg/kg	86 mg/kg	86 mg/kg	86mg/kg	86 mg/kg
Zinc	E440C/WT	2.0	mg/kg	55.2	290 mg/kg	340 mg/kg	340 mg/kg	340 mg/kg	340mg/kg	290 mg/kg
Speciated Metals										
Chromium, hexavalent [Cr VI]	E532/WT	0.10	mg/kg	<0.10	0.66 mg/kg	8 mg/kg	10 mg/kg	8 mg/kg	10mg/kg	0.66 mg/kg
Volatile Organic Compounds										
Benzene	E611A/WT	0.0050	mg/kg	<0.0050	0.02 mg/kg	0.32 mg/kg	0.4 mg/kg	0.21 mg/kg	0.17mg/kg	0.02 mg/kg
Ethylbenzene	E611A/WT	0.015	mg/kg	<0.015	0.05 mg/kg	1.1 mg/kg	1.6 mg/kg	1.1 mg/kg	1.6mg/kg	0.05 mg/kg



Analyte	Method/Lab	LOR	Unit	WT2318542-004 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Volatile Organic Compounds - Continued										
Toluene	E611A/WT	0.050	mg/kg	<0.050	0.2 mg/kg	6.4 mg/kg	9 mg/kg	2.3 mg/kg	6mg/kg	0.2 mg/kg
Xylene, m+p-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylene, o-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylenes, total	E611A/WT	0.050	mg/kg	<0.050	0.05 mg/kg	26 mg/kg	30 mg/kg	3.1 mg/kg	25mg/kg	0.05 mg/kg
BTEX, total	E611A/WT	0.10	mg/kg	<0.10	--	--	--	--	--	--
Hydrocarbons										
F1 (C6-C10)	E581.F1/WT	5.0	mg/kg	<5.0	25 mg/kg	55 mg/kg	65 mg/kg	55 mg/kg	65mg/kg	25 mg/kg
F2 (C10-C16)	E601.SG-L/WT	10	mg/kg	<10	10 mg/kg	230 mg/kg	250 mg/kg	98 mg/kg	150mg/kg	10 mg/kg
F3 (C16-C34)	E601.SG-L/WT	50	mg/kg	<50	240 mg/kg	1700 mg/kg	2500 mg/kg	300 mg/kg	1300mg/kg	240 mg/kg
F4 (C34-C50)	E601.SG-L/WT	50	mg/kg	<50	120 mg/kg	3300 mg/kg	6600 mg/kg	2800 mg/kg	5600mg/kg	120 mg/kg
F1-BTEX	EC580/WT	5.0	mg/kg	<5.0	25 mg/kg	55 mg/kg	65 mg/kg	55 mg/kg	65mg/kg	25 mg/kg
Hydrocarbons, total (C6-C50)	EC581/WT	80	mg/kg	<80	--	--	--	--	--	--
Chromatogram to baseline at nC50	E601.SG-L/WT		-	YES	--	--	--	--	--	--
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	E601.SG-L/WT	1.0	%	91.3	--	--	--	--	--	--
Dichlorotoluene, 3,4-	E581.F1/WT	1.0	%	85.0	--	--	--	--	--	--
Bromofluorobenzene, 4-	E611A/WT	0.10	%	87.4	--	--	--	--	--	--
Difluorobenzene, 1,4-	E611A/WT	0.10	%	110	--	--	--	--	--	--

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

No Breaches Found

Key:

ON153/04	Ontario Regulation 153/04 - April 15, 2011 Standards (JUL, 2011)
T1-RPIICC	153 T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use
T2-ICC-C	153 T2-Soil-Ind/Com/Commu Property Use (Coarse)
T2-ICC-F	153 T2-Soil-Ind/Com/Commu Property Use (Fine)
T2-RPI-C	153 T2-Soil-Res/Park/Inst. Property Use (Coarse)
T2-RPI-F	153 T2-Soil-Res/Park/Inst. Property Use (Fine)
ON406/20	Ontario Regulation 406/19 - Excess Soils - 17-December-20
T1-RPIICC	406 T1 - Soil - Res/Park/Inst/Ind/Com/Commu Property Use
T2.1-S-ICC	406 T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use
T2.1-S-RPI	406 T2.1 - Volume Independent Soil - Res/Park/Inst Property Use



Analytical Results

				Client sample ID						
				Sampling date/time						
					BH5- SA1					
					23-Jun-2023 00:00					
Analyte	Method/Lab	LOR	Unit	WT2318542-005	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	0.00500	mS/cm	0.253	1.4 mS/cm	0.7 mS/cm	--	--	--	--
Moisture	E144/WT	0.25	%	12.0	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.70	--	--	--	--	--	--
Cyanides										
Cyanide, weak acid dissociable	E336A/WT	0.050	mg/kg	<0.050	0.051 mg/kg	0.051 mg/kg	--	--	--	--
Fixed-Ratio Extractables										
Calcium, soluble ion content	E484/WT	0.50	mg/L	8.82	--	--	--	--	--	--
Magnesium, soluble ion content	E484/WT	0.50	mg/L	2.88	--	--	--	--	--	--
Sodium, soluble ion content	E484/WT	0.50	mg/L	44.8	--	--	--	--	--	--
Sodium adsorption ratio [SAR]	E484/WT	0.10	-	3.35	12 -	5 -	--	--	--	--
Metals										
Antimony	E440C/WT	0.10	mg/kg	0.52	40 mg/kg	7.5 mg/kg	--	--	--	--
Arsenic	E440C/WT	0.10	mg/kg	6.48	18 mg/kg	18 mg/kg	--	--	--	--
Barium	E440C/WT	0.50	mg/kg	95.3	670 mg/kg	390 mg/kg	--	--	--	--
Beryllium	E440C/WT	0.10	mg/kg	0.34	8 mg/kg	4 mg/kg	--	--	--	--
Boron, hot water soluble	E487/WT	0.10	mg/kg	0.33	2 mg/kg	1.5 mg/kg	--	--	--	--
Boron	E440C/WT	5.0	mg/kg	7.0	120 mg/kg	120 mg/kg	--	--	--	--
Cadmium	E440C/WT	0.020	mg/kg	0.420	1.9 mg/kg	1.2 mg/kg	--	--	--	--
Chromium	E440C/WT	0.50	mg/kg	20.3	160 mg/kg	160 mg/kg	--	--	--	--
Cobalt	E440C/WT	0.10	mg/kg	4.01	80 mg/kg	22 mg/kg	--	--	--	--
Copper	E440C/WT	0.50	mg/kg	17.4	230 mg/kg	140 mg/kg	--	--	--	--
Lead	E440C/WT	0.50	mg/kg	114	120 mg/kg	120 mg/kg	--	--	--	--
Mercury	E510C/WT	0.0050	mg/kg	0.124	0.27 mg/kg	0.27 mg/kg	--	--	--	--
Molybdenum	E440C/WT	0.10	mg/kg	0.49	40 mg/kg	6.9 mg/kg	--	--	--	--
Nickel	E440C/WT	0.50	mg/kg	10.7	270 mg/kg	100 mg/kg	--	--	--	--
Selenium	E440C/WT	0.20	mg/kg	0.24	5.5 mg/kg	2.4 mg/kg	--	--	--	--
Silver	E440C/WT	0.10	mg/kg	<0.10	40 mg/kg	20 mg/kg	--	--	--	--
Thallium	E440C/WT	0.050	mg/kg	0.092	3.3 mg/kg	1 mg/kg	--	--	--	--
Uranium	E440C/WT	0.050	mg/kg	0.360	33 mg/kg	23 mg/kg	--	--	--	--
Vanadium	E440C/WT	0.20	mg/kg	22.0	86 mg/kg	86 mg/kg	--	--	--	--
Zinc	E440C/WT	2.0	mg/kg	146	340 mg/kg	340 mg/kg	--	--	--	--



Analyte	Method/Lab	LOR	Unit	WT2318542-005 (Continued)	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Speciated Metals										
Chromium, hexavalent [Cr VI]	E532/WT	0.10	mg/kg	<0.10	8 mg/kg	8 mg/kg	--	--	--	--
Volatile Organic Compounds										
Benzene	E611A/WT	0.0050	mg/kg	<0.0050	0.02 mg/kg	0.02 mg/kg	--	--	--	--
Ethylbenzene	E611A/WT	0.015	mg/kg	0.023	0.05 mg/kg	0.05 mg/kg	--	--	--	--
Toluene	E611A/WT	0.050	mg/kg	<0.050	0.2 mg/kg	0.2 mg/kg	--	--	--	--
Xylene, m+p-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylene, o-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylenes, total	E611A/WT	0.050	mg/kg	<0.050	0.091 mg/kg	0.091 mg/kg	--	--	--	--
BTEX, total	E611A/WT	0.10	mg/kg	<0.10	--	--	--	--	--	--
Hydrocarbons										
F1 (C6-C10)	E581.F1/WT	5.0	mg/kg	<5.0	25 mg/kg	25 mg/kg	--	--	--	--
F2 (C10-C16)	E601.SG-L/WT	10	mg/kg	<10	26 mg/kg	10 mg/kg	--	--	--	--
F3 (C16-C34)	E601.SG-L/WT	50	mg/kg	<50	240 mg/kg	240 mg/kg	--	--	--	--
F4 (C34-C50)	E601.SG-L/WT	50	mg/kg	<50	3300 mg/kg	2800 mg/kg	--	--	--	--
F1-BTEX	EC580/WT	5.0	mg/kg	<5.0	25 mg/kg	25 mg/kg	--	--	--	--
Hydrocarbons, total (C6-C50)	EC581/WT	80	mg/kg	<80	--	--	--	--	--	--
Chromatogram to baseline at nC50	E601.SG-L/WT		-	YES	--	--	--	--	--	--
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	E601.SG-L/WT	1.0	%	94.4	--	--	--	--	--	--
Dichlorotoluene, 3,4-	E581.F1/WT	1.0	%	102	--	--	--	--	--	--
Bromofluorobenzene, 4-	E611A/WT	0.10	%	119	--	--	--	--	--	--
Difluorobenzene, 1,4-	E611A/WT	0.10	%	123	--	--	--	--	--	--



Analyte	Method/Lab	LOR	Unit	WT2318542-005 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	0.00500	mS/cm	0.253	0.57 mS/cm	1.4 mS/cm	1.4 mS/cm	0.7 mS/cm	0.7mS/cm	0.57 mS/cm
Moisture	E144/WT	0.25	%	12.0	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.70	--	--	--	--	--	--
Cyanides										
Cyanide, weak acid dissociable	E336A/WT	0.050	mg/kg	<0.050	0.051 mg/kg	0.051 mg/kg	0.051 mg/kg	0.051 mg/kg	0.051mg/kg	0.051 mg/kg
Fixed-Ratio Extractables										
Calcium, soluble ion content	E484/WT	0.50	mg/L	8.82	--	--	--	--	--	--
Magnesium, soluble ion content	E484/WT	0.50	mg/L	2.88	--	--	--	--	--	--
Sodium, soluble ion content	E484/WT	0.50	mg/L	44.8	--	--	--	--	--	--
Sodium adsorption ratio [SAR]	E484/WT	0.10	-	3.35	2.4 -	12 -	12 -	5 -	5-	2.4 -
Metals										
Antimony	E440C/WT	0.10	mg/kg	0.52	1.3 mg/kg	40 mg/kg	50 mg/kg	7.5 mg/kg	7.5mg/kg	1.3 mg/kg
Arsenic	E440C/WT	0.10	mg/kg	6.48	18 mg/kg	18 mg/kg	18 mg/kg	18 mg/kg	18mg/kg	18 mg/kg
Barium	E440C/WT	0.50	mg/kg	95.3	220 mg/kg	670 mg/kg	670 mg/kg	390 mg/kg	390mg/kg	220 mg/kg
Beryllium	E440C/WT	0.10	mg/kg	0.34	2.5 mg/kg	8 mg/kg	10 mg/kg	4 mg/kg	5mg/kg	2.5 mg/kg
Boron, hot water soluble	E487/WT	0.10	mg/kg	0.33	--	2 mg/kg	2 mg/kg	1.5 mg/kg	1.5mg/kg	--
Boron	E440C/WT	5.0	mg/kg	7.0	36 mg/kg	120 mg/kg	120 mg/kg	120 mg/kg	120mg/kg	36 mg/kg
Cadmium	E440C/WT	0.020	mg/kg	0.420	1.2 mg/kg	1.9 mg/kg	1.9 mg/kg	1.2 mg/kg	1.2mg/kg	1.2 mg/kg
Chromium	E440C/WT	0.50	mg/kg	20.3	70 mg/kg	160 mg/kg	160 mg/kg	160 mg/kg	160mg/kg	70 mg/kg
Cobalt	E440C/WT	0.10	mg/kg	4.01	21 mg/kg	80 mg/kg	100 mg/kg	22 mg/kg	22mg/kg	21 mg/kg
Copper	E440C/WT	0.50	mg/kg	17.4	92 mg/kg	230 mg/kg	300 mg/kg	140 mg/kg	180mg/kg	92 mg/kg
Lead	E440C/WT	0.50	mg/kg	114	120 mg/kg	120 mg/kg	120 mg/kg	120 mg/kg	120mg/kg	120 mg/kg
Mercury	E510C/WT	0.0050	mg/kg	0.124	0.27 mg/kg	3.9 mg/kg	20 mg/kg	0.27 mg/kg	1.8mg/kg	0.27 mg/kg
Molybdenum	E440C/WT	0.10	mg/kg	0.49	2 mg/kg	40 mg/kg	40 mg/kg	6.9 mg/kg	6.9mg/kg	2 mg/kg
Nickel	E440C/WT	0.50	mg/kg	10.7	82 mg/kg	270 mg/kg	340 mg/kg	100 mg/kg	130mg/kg	82 mg/kg
Selenium	E440C/WT	0.20	mg/kg	0.24	1.5 mg/kg	5.5 mg/kg	5.5 mg/kg	2.4 mg/kg	2.4mg/kg	1.5 mg/kg
Silver	E440C/WT	0.10	mg/kg	<0.10	0.5 mg/kg	40 mg/kg	50 mg/kg	20 mg/kg	25mg/kg	0.5 mg/kg
Thallium	E440C/WT	0.050	mg/kg	0.092	1 mg/kg	3.3 mg/kg	3.3 mg/kg	1 mg/kg	1mg/kg	1 mg/kg
Uranium	E440C/WT	0.050	mg/kg	0.360	2.5 mg/kg	33 mg/kg	33 mg/kg	23 mg/kg	23mg/kg	2.5 mg/kg
Vanadium	E440C/WT	0.20	mg/kg	22.0	86 mg/kg	86 mg/kg	86 mg/kg	86 mg/kg	86mg/kg	86 mg/kg
Zinc	E440C/WT	2.0	mg/kg	146	290 mg/kg	340 mg/kg	340 mg/kg	340 mg/kg	340mg/kg	290 mg/kg
Speciated Metals										
Chromium, hexavalent [Cr VI]	E532/WT	0.10	mg/kg	<0.10	0.66 mg/kg	8 mg/kg	10 mg/kg	8 mg/kg	10mg/kg	0.66 mg/kg
Volatile Organic Compounds										
Benzene	E611A/WT	0.0050	mg/kg	<0.0050	0.02 mg/kg	0.32 mg/kg	0.4 mg/kg	0.21 mg/kg	0.17mg/kg	0.02 mg/kg
Ethylbenzene	E611A/WT	0.015	mg/kg	0.023	0.05 mg/kg	1.1 mg/kg	1.6 mg/kg	1.1 mg/kg	1.6mg/kg	0.05 mg/kg



Analyte	Method/Lab	LOR	Unit	WT2318542-005 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Volatile Organic Compounds - Continued										
Toluene	E611A/WT	0.050	mg/kg	<0.050	0.2 mg/kg	6.4 mg/kg	9 mg/kg	2.3 mg/kg	6mg/kg	0.2 mg/kg
Xylene, m+p-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylene, o-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylenes, total	E611A/WT	0.050	mg/kg	<0.050	0.05 mg/kg	26 mg/kg	30 mg/kg	3.1 mg/kg	25mg/kg	0.05 mg/kg
BTEX, total	E611A/WT	0.10	mg/kg	<0.10	--	--	--	--	--	--
Hydrocarbons										
F1 (C6-C10)	E581.F1/WT	5.0	mg/kg	<5.0	25 mg/kg	55 mg/kg	65 mg/kg	55 mg/kg	65mg/kg	25 mg/kg
F2 (C10-C16)	E601.SG-L/WT	10	mg/kg	<10	10 mg/kg	230 mg/kg	250 mg/kg	98 mg/kg	150mg/kg	10 mg/kg
F3 (C16-C34)	E601.SG-L/WT	50	mg/kg	<50	240 mg/kg	1700 mg/kg	2500 mg/kg	300 mg/kg	1300mg/kg	240 mg/kg
F4 (C34-C50)	E601.SG-L/WT	50	mg/kg	<50	120 mg/kg	3300 mg/kg	6600 mg/kg	2800 mg/kg	5600mg/kg	120 mg/kg
F1-BTEX	EC580/WT	5.0	mg/kg	<5.0	25 mg/kg	55 mg/kg	65 mg/kg	55 mg/kg	65mg/kg	25 mg/kg
Hydrocarbons, total (C6-C50)	EC581/WT	80	mg/kg	<80	--	--	--	--	--	--
Chromatogram to baseline at nC50	E601.SG-L/WT		-	YES	--	--	--	--	--	--
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	E601.SG-L/WT	1.0	%	94.4	--	--	--	--	--	--
Dichlorotoluene, 3,4-	E581.F1/WT	1.0	%	102	--	--	--	--	--	--
Bromofluorobenzene, 4-	E611A/WT	0.10	%	119	--	--	--	--	--	--
Difluorobenzene, 1,4-	E611A/WT	0.10	%	123	--	--	--	--	--	--

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Summary of Guideline Breaches by Sample

SampleID/Client ID	Matrix	Analyte	Analyte Summary	Guideline	Category	Result	Limit
BH5- SA1	Soil/Solid	Sodium adsorption ratio [SAR]		ON153/04	T1-RPIICC	3.35 -	2.4 -
	Soil/Solid	Sodium adsorption ratio [SAR]		ON406/20	T1-RPIICC	3.35 -	2.4 -



Key:

ON153/04	Ontario Regulation 153/04 - April 15, 2011 Standards (JUL, 2011)
T1-RPIICC	153 T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use
T2-ICC-C	153 T2-Soil-Ind/Com/Commu Property Use (Coarse)
T2-ICC-F	153 T2-Soil-Ind/Com/Commu Property Use (Fine)
T2-RPI-C	153 T2-Soil-Res/Park/Inst. Property Use (Coarse)
T2-RPI-F	153 T2-Soil-Res/Park/Inst. Property Use (Fine)
ON406/20	Ontario Regulation 406/19 - Excess Soils - 17-December-20
T1-RPIICC	406 T1 - Soil - Res/Park/Inst/Ind/Com/Commu Property Use
T2.1-S-ICC	406 T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use
T2.1-S-RPI	406 T2.1 - Volume Independent Soil - Res/Park/Inst Property Use



Analytical Results

				Client sample ID						
				Sampling date/time						
					BH6- SA1					
					23-Jun-2023 00:00					
Analyte	Method/Lab	LOR	Unit	WT2318542-006	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	0.00500	mS/cm	0.189	1.4 mS/cm	0.7 mS/cm	--	--	--	--
Moisture	E144/WT	0.25	%	7.17	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.56	--	--	--	--	--	--
Cyanides										
Cyanide, weak acid dissociable	E336A/WT	0.050	mg/kg	<0.050	0.051 mg/kg	0.051 mg/kg	--	--	--	--
Fixed-Ratio Extractables										
Calcium, soluble ion content	E484/WT	0.50	mg/L	9.40	--	--	--	--	--	--
Magnesium, soluble ion content	E484/WT	0.50	mg/L	2.52	--	--	--	--	--	--
Sodium, soluble ion content	E484/WT	0.50	mg/L	23.6	--	--	--	--	--	--
Sodium adsorption ratio [SAR]	E484/WT	0.10	-	1.76	12 -	5 -	--	--	--	--
Metals										
Antimony	E440C/WT	0.10	mg/kg	0.18	40 mg/kg	7.5 mg/kg	--	--	--	--
Arsenic	E440C/WT	0.10	mg/kg	3.59	18 mg/kg	18 mg/kg	--	--	--	--
Barium	E440C/WT	0.50	mg/kg	39.1	670 mg/kg	390 mg/kg	--	--	--	--
Beryllium	E440C/WT	0.10	mg/kg	0.34	8 mg/kg	4 mg/kg	--	--	--	--
Boron, hot water soluble	E487/WT	0.10	mg/kg	0.20	2 mg/kg	1.5 mg/kg	--	--	--	--
Boron	E440C/WT	5.0	mg/kg	5.5	120 mg/kg	120 mg/kg	--	--	--	--
Cadmium	E440C/WT	0.020	mg/kg	0.208	1.9 mg/kg	1.2 mg/kg	--	--	--	--
Chromium	E440C/WT	0.50	mg/kg	14.4	160 mg/kg	160 mg/kg	--	--	--	--
Cobalt	E440C/WT	0.10	mg/kg	4.09	80 mg/kg	22 mg/kg	--	--	--	--
Copper	E440C/WT	0.50	mg/kg	21.7	230 mg/kg	140 mg/kg	--	--	--	--
Lead	E440C/WT	0.50	mg/kg	24.8	120 mg/kg	120 mg/kg	--	--	--	--
Mercury	E510C/WT	0.0050	mg/kg	0.0375	0.27 mg/kg	0.27 mg/kg	--	--	--	--
Molybdenum	E440C/WT	0.10	mg/kg	0.30	40 mg/kg	6.9 mg/kg	--	--	--	--
Nickel	E440C/WT	0.50	mg/kg	9.24	270 mg/kg	100 mg/kg	--	--	--	--
Selenium	E440C/WT	0.20	mg/kg	<0.20	5.5 mg/kg	2.4 mg/kg	--	--	--	--
Silver	E440C/WT	0.10	mg/kg	<0.10	40 mg/kg	20 mg/kg	--	--	--	--
Thallium	E440C/WT	0.050	mg/kg	0.071	3.3 mg/kg	1 mg/kg	--	--	--	--
Uranium	E440C/WT	0.050	mg/kg	0.440	33 mg/kg	23 mg/kg	--	--	--	--
Vanadium	E440C/WT	0.20	mg/kg	22.2	86 mg/kg	86 mg/kg	--	--	--	--
Zinc	E440C/WT	2.0	mg/kg	63.2	340 mg/kg	340 mg/kg	--	--	--	--



Analyte	Method/Lab	LOR	Unit	WT2318542-006 (Continued)	ON406/20 T2.1-S-ICC	ON406/20 T2.1-S-RPI	--	--	--	--
Speciated Metals										
Chromium, hexavalent [Cr VI]	E532/WT	0.10	mg/kg	<0.10	8 mg/kg	8 mg/kg	--	--	--	--
Volatile Organic Compounds										
Benzene	E611A/WT	0.0050	mg/kg	<0.0050	0.02 mg/kg	0.02 mg/kg	--	--	--	--
Ethylbenzene	E611A/WT	0.015	mg/kg	<0.015	0.05 mg/kg	0.05 mg/kg	--	--	--	--
Toluene	E611A/WT	0.050	mg/kg	<0.050	0.2 mg/kg	0.2 mg/kg	--	--	--	--
Xylene, m+p-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylene, o-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylenes, total	E611A/WT	0.050	mg/kg	<0.050	0.091 mg/kg	0.091 mg/kg	--	--	--	--
BTEX, total	E611A/WT	0.10	mg/kg	<0.10	--	--	--	--	--	--
Hydrocarbons										
F1 (C6-C10)	E581.F1/WT	5.0	mg/kg	<5.0	25 mg/kg	25 mg/kg	--	--	--	--
F2 (C10-C16)	E601.SG-L/WT	10	mg/kg	<10	26 mg/kg	10 mg/kg	--	--	--	--
F3 (C16-C34)	E601.SG-L/WT	50	mg/kg	<50	240 mg/kg	240 mg/kg	--	--	--	--
F4 (C34-C50)	E601.SG-L/WT	50	mg/kg	<50	3300 mg/kg	2800 mg/kg	--	--	--	--
F1-BTEX	EC580/WT	5.0	mg/kg	<5.0	25 mg/kg	25 mg/kg	--	--	--	--
Hydrocarbons, total (C6-C50)	EC581/WT	80	mg/kg	<80	--	--	--	--	--	--
Chromatogram to baseline at nC50	E601.SG-L/WT		-	YES	--	--	--	--	--	--
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	E601.SG-L/WT	1.0	%	97.6	--	--	--	--	--	--
Dichlorotoluene, 3,4-	E581.F1/WT	1.0	%	81.9	--	--	--	--	--	--
Bromofluorobenzene, 4-	E611A/WT	0.10	%	93.8	--	--	--	--	--	--
Difluorobenzene, 1,4-	E611A/WT	0.10	%	98.9	--	--	--	--	--	--



Analyte	Method/Lab	LOR	Unit	WT2318542-006 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Physical Tests										
Conductivity (1:2 leachate)	E100-L/WT	0.00500	mS/cm	0.189	0.57 mS/cm	1.4 mS/cm	1.4 mS/cm	0.7 mS/cm	0.7mS/cm	0.57 mS/cm
Moisture	E144/WT	0.25	%	7.17	--	--	--	--	--	--
pH (1:2 soil:CaCl2-aq)	E108A/WT	0.10	pH units	7.56	--	--	--	--	--	--
Cyanides										
Cyanide, weak acid dissociable	E336A/WT	0.050	mg/kg	<0.050	0.051 mg/kg	0.051 mg/kg	0.051 mg/kg	0.051 mg/kg	0.051mg/kg	0.051 mg/kg
Fixed-Ratio Extractables										
Calcium, soluble ion content	E484/WT	0.50	mg/L	9.40	--	--	--	--	--	--
Magnesium, soluble ion content	E484/WT	0.50	mg/L	2.52	--	--	--	--	--	--
Sodium, soluble ion content	E484/WT	0.50	mg/L	23.6	--	--	--	--	--	--
Sodium adsorption ratio [SAR]	E484/WT	0.10	-	1.76	2.4 -	12 -	12 -	5 -	5-	2.4 -
Metals										
Antimony	E440C/WT	0.10	mg/kg	0.18	1.3 mg/kg	40 mg/kg	50 mg/kg	7.5 mg/kg	7.5mg/kg	1.3 mg/kg
Arsenic	E440C/WT	0.10	mg/kg	3.59	18 mg/kg	18 mg/kg	18 mg/kg	18 mg/kg	18mg/kg	18 mg/kg
Barium	E440C/WT	0.50	mg/kg	39.1	220 mg/kg	670 mg/kg	670 mg/kg	390 mg/kg	390mg/kg	220 mg/kg
Beryllium	E440C/WT	0.10	mg/kg	0.34	2.5 mg/kg	8 mg/kg	10 mg/kg	4 mg/kg	5mg/kg	2.5 mg/kg
Boron, hot water soluble	E487/WT	0.10	mg/kg	0.20	--	2 mg/kg	2 mg/kg	1.5 mg/kg	1.5mg/kg	--
Boron	E440C/WT	5.0	mg/kg	5.5	36 mg/kg	120 mg/kg	120 mg/kg	120 mg/kg	120mg/kg	36 mg/kg
Cadmium	E440C/WT	0.020	mg/kg	0.208	1.2 mg/kg	1.9 mg/kg	1.9 mg/kg	1.2 mg/kg	1.2mg/kg	1.2 mg/kg
Chromium	E440C/WT	0.50	mg/kg	14.4	70 mg/kg	160 mg/kg	160 mg/kg	160 mg/kg	160mg/kg	70 mg/kg
Cobalt	E440C/WT	0.10	mg/kg	4.09	21 mg/kg	80 mg/kg	100 mg/kg	22 mg/kg	22mg/kg	21 mg/kg
Copper	E440C/WT	0.50	mg/kg	21.7	92 mg/kg	230 mg/kg	300 mg/kg	140 mg/kg	180mg/kg	92 mg/kg
Lead	E440C/WT	0.50	mg/kg	24.8	120 mg/kg	120 mg/kg	120 mg/kg	120 mg/kg	120mg/kg	120 mg/kg
Mercury	E510C/WT	0.0050	mg/kg	0.0375	0.27 mg/kg	3.9 mg/kg	20 mg/kg	0.27 mg/kg	1.8mg/kg	0.27 mg/kg
Molybdenum	E440C/WT	0.10	mg/kg	0.30	2 mg/kg	40 mg/kg	40 mg/kg	6.9 mg/kg	6.9mg/kg	2 mg/kg
Nickel	E440C/WT	0.50	mg/kg	9.24	82 mg/kg	270 mg/kg	340 mg/kg	100 mg/kg	130mg/kg	82 mg/kg
Selenium	E440C/WT	0.20	mg/kg	<0.20	1.5 mg/kg	5.5 mg/kg	5.5 mg/kg	2.4 mg/kg	2.4mg/kg	1.5 mg/kg
Silver	E440C/WT	0.10	mg/kg	<0.10	0.5 mg/kg	40 mg/kg	50 mg/kg	20 mg/kg	25mg/kg	0.5 mg/kg
Thallium	E440C/WT	0.050	mg/kg	0.071	1 mg/kg	3.3 mg/kg	3.3 mg/kg	1 mg/kg	1mg/kg	1 mg/kg
Uranium	E440C/WT	0.050	mg/kg	0.440	2.5 mg/kg	33 mg/kg	33 mg/kg	23 mg/kg	23mg/kg	2.5 mg/kg
Vanadium	E440C/WT	0.20	mg/kg	22.2	86 mg/kg	86 mg/kg	86 mg/kg	86 mg/kg	86mg/kg	86 mg/kg
Zinc	E440C/WT	2.0	mg/kg	63.2	290 mg/kg	340 mg/kg	340 mg/kg	340 mg/kg	340mg/kg	290 mg/kg
Speciated Metals										
Chromium, hexavalent [Cr VI]	E532/WT	0.10	mg/kg	<0.10	0.66 mg/kg	8 mg/kg	10 mg/kg	8 mg/kg	10mg/kg	0.66 mg/kg
Volatile Organic Compounds										
Benzene	E611A/WT	0.0050	mg/kg	<0.0050	0.02 mg/kg	0.32 mg/kg	0.4 mg/kg	0.21 mg/kg	0.17mg/kg	0.02 mg/kg
Ethylbenzene	E611A/WT	0.015	mg/kg	<0.015	0.05 mg/kg	1.1 mg/kg	1.6 mg/kg	1.1 mg/kg	1.6mg/kg	0.05 mg/kg



Analyte	Method/Lab	LOR	Unit	WT2318542-006 (Continued)	ON153/04 T1-RPIICC	ON153/04 T2-ICC-C	ON153/04 T2-ICC-F	ON153/04 T2-RPI-C	ON153/04 T2-RPI-F	ON406/20 T1-RPIICC
Volatile Organic Compounds - Continued										
Toluene	E611A/WT	0.050	mg/kg	<0.050	0.2 mg/kg	6.4 mg/kg	9 mg/kg	2.3 mg/kg	6mg/kg	0.2 mg/kg
Xylene, m+p-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylene, o-	E611A/WT	0.030	mg/kg	<0.030	--	--	--	--	--	--
Xylenes, total	E611A/WT	0.050	mg/kg	<0.050	0.05 mg/kg	26 mg/kg	30 mg/kg	3.1 mg/kg	25mg/kg	0.05 mg/kg
BTEX, total	E611A/WT	0.10	mg/kg	<0.10	--	--	--	--	--	--
Hydrocarbons										
F1 (C6-C10)	E581.F1/WT	5.0	mg/kg	<5.0	25 mg/kg	55 mg/kg	65 mg/kg	55 mg/kg	65mg/kg	25 mg/kg
F2 (C10-C16)	E601.SG-L/WT	10	mg/kg	<10	10 mg/kg	230 mg/kg	250 mg/kg	98 mg/kg	150mg/kg	10 mg/kg
F3 (C16-C34)	E601.SG-L/WT	50	mg/kg	<50	240 mg/kg	1700 mg/kg	2500 mg/kg	300 mg/kg	1300mg/kg	240 mg/kg
F4 (C34-C50)	E601.SG-L/WT	50	mg/kg	<50	120 mg/kg	3300 mg/kg	6600 mg/kg	2800 mg/kg	5600mg/kg	120 mg/kg
F1-BTEX	EC580/WT	5.0	mg/kg	<5.0	25 mg/kg	55 mg/kg	65 mg/kg	55 mg/kg	65mg/kg	25 mg/kg
Hydrocarbons, total (C6-C50)	EC581/WT	80	mg/kg	<80	--	--	--	--	--	--
Chromatogram to baseline at nC50	E601.SG-L/WT		-	YES	--	--	--	--	--	--
Bromobenzotrifluoride, 2- (F2-F4 surrogate)	E601.SG-L/WT	1.0	%	97.6	--	--	--	--	--	--
Dichlorotoluene, 3,4-	E581.F1/WT	1.0	%	81.9	--	--	--	--	--	--
Bromofluorobenzene, 4-	E611A/WT	0.10	%	93.8	--	--	--	--	--	--
Difluorobenzene, 1,4-	E611A/WT	0.10	%	98.9	--	--	--	--	--	--

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

No Breaches Found

Key:

ON153/04	Ontario Regulation 153/04 - April 15, 2011 Standards (JUL, 2011)
T1-RPIICC	153 T1-Soil-Res/Park/Inst/Ind/Com/Commu Property Use
T2-ICC-C	153 T2-Soil-Ind/Com/Commu Property Use (Coarse)
T2-ICC-F	153 T2-Soil-Ind/Com/Commu Property Use (Fine)
T2-RPI-C	153 T2-Soil-Res/Park/Inst. Property Use (Coarse)
T2-RPI-F	153 T2-Soil-Res/Park/Inst. Property Use (Fine)
ON406/20	Ontario Regulation 406/19 - Excess Soils - 17-December-20
T1-RPIICC	406 T1 - Soil - Res/Park/Inst/Ind/Com/Commu Property Use
T2.1-S-ICC	406 T2.1 - Volume Independent Soil - Ind/Com/Commu Property Use
T2.1-S-RPI	406 T2.1 - Volume Independent Soil - Res/Park/Inst Property Use

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: WT2318542	Page	: 1 of 17
Client	: Chung and Vander Doelen Engineering Ltd.	Laboratory	: Waterloo - Environmental
Contact	: Marcelo Pereira	Account Manager	: Andrew Martin
Address	: 311 Victoria St. N. Kitchener ON Canada N2H 5E1	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: ----	Telephone	: +1 519 886 6910
Project	: 1161	Date Samples Received	: 23-Jun-2023 13:00
PO	: ----	Issue Date	: 30-Jun-2023 15:19
C-O-C number	: 17-869862		
Sampler	: Marcelo Pereira		
Site	: ----		
Quote number	: Q84362 - Excess Soils		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO: Data Quality Objective.

LOR: Limit of Reporting (detection limit).

RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "----" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- Matrix Spike outliers occur - please see following pages for full details.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- Reference Material (RM) Sample outliers occur - please see the following pages for full details.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.



Outliers : Quality Control Samples

Duplicates, Method Blanks, Laboratory Control Samples and Matrix Spikes

Matrix: **Soil/Solid**

Analyte Group	Laboratory sample ID	Client/Ref Sample ID	Analyte	CAS Number	Method	Result	Limits	Comment
Reference Material (RM) Sample								
Metals	QC-MRG2-1007678 003	----	Molybdenum	7439-98-7	E440C	136 % ^{MES}	70.0-130%	Recovery greater than upper control limit

Result Qualifiers

Qualifier	Description
MES	Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).

Matrix Spike (MS) Recoveries

Hydrocarbons	Anonymous	Anonymous	F3 (C16-C34)	----	E601.SG-L	151 % ^E	60.0-140%	Recovery greater than upper data quality objective
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Result Qualifiers

Qualifier	Description
E	Matrix Spike recovery outside ALS DQO due to heterogeneous analyte background in sample.



Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: Soil/Solid

Evaluation: * = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E336A	23-Jun-2023	25-Jun-2023	14 days	2 days	✓	27-Jun-2023	14 days	2 days	✓
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E336A	23-Jun-2023	25-Jun-2023	14 days	2 days	✓	27-Jun-2023	14 days	2 days	✓
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E336A	23-Jun-2023	25-Jun-2023	14 days	2 days	✓	27-Jun-2023	14 days	2 days	✓
Cyanides : WAD Cyanide (0.01M NaOH Extraction)										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E336A	23-Jun-2023	25-Jun-2023	14 days	2 days	✓	27-Jun-2023	14 days	2 days	✓
Fixed-Ratio Extractables : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E484	23-Jun-2023	28-Jun-2023	180 days	6 days	✓	29-Jun-2023	180 days	1 days	✓
Fixed-Ratio Extractables : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E484	23-Jun-2023	28-Jun-2023	180 days	6 days	✓	29-Jun-2023	180 days	1 days	✓
Fixed-Ratio Extractables : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E484	23-Jun-2023	28-Jun-2023	180 days	6 days	✓	29-Jun-2023	180 days	1 days	✓



Matrix: Soil/Solid

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Fixed-Ratio Extractables : Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E484	23-Jun-2023	28-Jun-2023	180 days	6 days	✓	29-Jun-2023	180 days	1 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP] BH2- SA1	E581.F1	23-Jun-2023	27-Jun-2023	14 days	5 days	✓	27-Jun-2023	40 days	0 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP] BH4- SA1	E581.F1	23-Jun-2023	27-Jun-2023	14 days	5 days	✓	27-Jun-2023	40 days	0 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP] BH5- SA1	E581.F1	23-Jun-2023	27-Jun-2023	14 days	5 days	✓	27-Jun-2023	40 days	0 days	✓
Hydrocarbons : CCME PHC - F1 by Headspace GC-FID										
Glass soil methanol vial [ON MECP] BH6- SA1	E581.F1	23-Jun-2023	27-Jun-2023	14 days	5 days	✓	27-Jun-2023	40 days	0 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E601.SG-L	23-Jun-2023	26-Jun-2023	14 days	4 days	✓	27-Jun-2023	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E601.SG-L	23-Jun-2023	26-Jun-2023	14 days	4 days	✓	27-Jun-2023	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E601.SG-L	23-Jun-2023	26-Jun-2023	14 days	4 days	✓	27-Jun-2023	40 days	1 days	✓
Hydrocarbons : CCME PHCs - F2-F4 by GC-FID (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E601.SG-L	23-Jun-2023	26-Jun-2023	14 days	4 days	✓	27-Jun-2023	40 days	1 days	✓



Matrix: Soil/Solid

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH1- SA3	E396-L	23-Jun-2023	26-Jun-2023	14 days	4 days	✓	26-Jun-2023	7 days	0 days	✓
Inorganics : Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA3	E396-L	23-Jun-2023	26-Jun-2023	14 days	4 days	✓	26-Jun-2023	7 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH1- SA3	E236.Cl	23-Jun-2023	29-Jun-2023	30 days	7 days	✓	29-Jun-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Chloride by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA3	E236.Cl	23-Jun-2023	29-Jun-2023	30 days	7 days	✓	29-Jun-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH1- SA3	E236.SO4	23-Jun-2023	29-Jun-2023	30 days	7 days	✓	29-Jun-2023	28 days	0 days	✓
Leachable Anions & Nutrients : Water Extractable Sulfate by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA3	E236.SO4	23-Jun-2023	29-Jun-2023	30 days	7 days	✓	29-Jun-2023	28 days	0 days	✓
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E487	23-Jun-2023	28-Jun-2023	180 days	6 days	✓	28-Jun-2023	180 days	0 days	✓
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E487	23-Jun-2023	28-Jun-2023	180 days	6 days	✓	28-Jun-2023	180 days	0 days	✓
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E487	23-Jun-2023	28-Jun-2023	180 days	6 days	✓	28-Jun-2023	180 days	0 days	✓



Matrix: Soil/Solid

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Metals : Boron-Hot Water Extractable by ICPOES										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E487	23-Jun-2023	28-Jun-2023	180 days	6 days	✓	28-Jun-2023	180 days	0 days	✓
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E510C	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	28 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E510C	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	28 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E510C	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	28 days	7 days	✓
Metals : Mercury in Soil/Solid by CVAAS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E510C	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	28 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E440C	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	180 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E440C	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	180 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E440C	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	180 days	7 days	✓
Metals : Metals in Soil/Solid by CRC ICPMS (<355 µm)										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E440C	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	180 days	7 days	✓



Matrix: Soil/Solid

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH1- SA3	E100-L	23-Jun-2023	27-Jun-2023	----	----		27-Jun-2023	30 days	5 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA3	E100-L	23-Jun-2023	27-Jun-2023	----	----		27-Jun-2023	30 days	5 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E100-L	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E100-L	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E100-L	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	30 days	7 days	✓
Physical Tests : Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E100-L	23-Jun-2023	28-Jun-2023	----	----		29-Jun-2023	30 days	7 days	✓
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH1- SA3	E144	23-Jun-2023	----	----	----		24-Jun-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E144	23-Jun-2023	----	----	----		24-Jun-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E144	23-Jun-2023	----	----	----		24-Jun-2023	----	----	



Matrix: Soil/Solid

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E144	23-Jun-2023	----	----	----		24-Jun-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E144	23-Jun-2023	----	----	----		24-Jun-2023	----	----	
Physical Tests : Moisture Content by Gravimetry										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA3	E144	23-Jun-2023	----	----	----		24-Jun-2023	----	----	
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH1- SA3	E125	23-Jun-2023	27-Jun-2023	----	----		27-Jun-2023	180 days	5 days	✔
Physical Tests : ORP by Electrode										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA3	E125	23-Jun-2023	27-Jun-2023	----	----		27-Jun-2023	180 days	5 days	✔
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E108A	23-Jun-2023	25-Jun-2023	----	----		26-Jun-2023	30 days	3 days	✔
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E108A	23-Jun-2023	25-Jun-2023	----	----		26-Jun-2023	30 days	3 days	✔
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E108A	23-Jun-2023	25-Jun-2023	----	----		26-Jun-2023	30 days	3 days	✔
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E108A	23-Jun-2023	25-Jun-2023	----	----		26-Jun-2023	30 days	3 days	✔



Matrix: Soil/Solid

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH1- SA3	E108A	23-Jun-2023	26-Jun-2023	----	----		27-Jun-2023	30 days	5 days	✓
Physical Tests : pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA3	E108A	23-Jun-2023	26-Jun-2023	----	----		27-Jun-2023	30 days	5 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH2- SA1	E532	23-Jun-2023	25-Jun-2023	30 days	2 days	✓	27-Jun-2023	7 days	2 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH4- SA1	E532	23-Jun-2023	25-Jun-2023	30 days	2 days	✓	27-Jun-2023	7 days	2 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH5- SA1	E532	23-Jun-2023	25-Jun-2023	30 days	2 days	✓	27-Jun-2023	7 days	2 days	✓
Speciated Metals : Hexavalent Chromium (Cr VI) by IC										
Glass soil jar/Teflon lined cap [ON MECP] BH6- SA1	E532	23-Jun-2023	25-Jun-2023	30 days	2 days	✓	27-Jun-2023	7 days	2 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass soil methanol vial [ON MECP] BH2- SA1	E611A	23-Jun-2023	27-Jun-2023	14 days	5 days	✓	27-Jun-2023	40 days	0 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass soil methanol vial [ON MECP] BH4- SA1	E611A	23-Jun-2023	27-Jun-2023	14 days	5 days	✓	27-Jun-2023	40 days	0 days	✓
Volatile Organic Compounds : BTEX by Headspace GC-MS										
Glass soil methanol vial [ON MECP] BH5- SA1	E611A	23-Jun-2023	27-Jun-2023	14 days	5 days	✓	27-Jun-2023	40 days	0 days	✓

Page : 11 of 17
 Work Order : WT2318542
 Client : Chung and Vander Doelen Engineering Ltd.
 Project : 1161



Matrix: Soil/Solid

Evaluation: ✖ = Holding time exceedance ; ✔ = Within Holding Time

Analyte Group	Method	Sampling Date	Extraction / Preparation				Analysis			
Container / Client Sample ID(s)			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
				Volatile Organic Compounds : BTEX by Headspace GC-MS						
Glass soil methanol vial [ON MECP] BH6- SA1	E611A	23-Jun-2023	27-Jun-2023	14 days	5 days	✓	27-Jun-2023	40 days	0 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).



Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type	Method	QC Lot #	Count		Frequency (%)		
Analytical Methods			QC	Regular	Actual	Expected	Evaluation
Laboratory Duplicates (DUP)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1009312	1	8	12.5	4.7	✓
Boron-Hot Water Extractable by ICPOES	E487	1007677	1	13	7.6	5.0	✓
BTEX by Headspace GC-MS	E611A	1011090	2	40	5.0	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	1011091	2	40	5.0	5.0	✓
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L	1007625	1	20	5.0	5.0	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1007675	2	36	5.5	5.0	✓
Hexavalent Chromium (Cr VI) by IC	E532	1007623	1	20	5.0	5.0	✓
Mercury in Soil/Solid by CVAAS (<355 µm)	E510C	1007679	1	13	7.6	5.0	✓
Metals in Soil/Solid by CRC ICPMS (<355 µm)	E440C	1007678	1	16	6.2	5.0	✓
Moisture Content by Gravimetry	E144	1007270	1	20	5.0	5.0	✓
ORP by Electrode	E125	1009933	1	8	12.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1007622	2	40	5.0	5.0	✓
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1007676	1	16	6.2	5.0	✓
WAD Cyanide (0.01M NaOH Extraction)	E336A	1007624	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1015824	1	13	7.6	5.0	✓
Water Extractable Sulfate by IC	E236.SO4	1015823	1	13	7.6	5.0	✓
Laboratory Control Samples (LCS)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1009312	1	8	12.5	4.7	✓
Boron-Hot Water Extractable by ICPOES	E487	1007677	2	13	15.3	10.0	✓
BTEX by Headspace GC-MS	E611A	1011090	2	40	5.0	5.0	✓
CCME PHC - F1 by Headspace GC-FID	E581.F1	1011091	2	40	5.0	5.0	✓
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L	1007625	1	20	5.0	5.0	✓
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1007675	4	36	11.1	10.0	✓
Hexavalent Chromium (Cr VI) by IC	E532	1007623	2	20	10.0	10.0	✓
Mercury in Soil/Solid by CVAAS (<355 µm)	E510C	1007679	2	13	15.3	10.0	✓
Metals in Soil/Solid by CRC ICPMS (<355 µm)	E440C	1007678	2	16	12.5	10.0	✓
Moisture Content by Gravimetry	E144	1007270	1	20	5.0	5.0	✓
ORP by Electrode	E125	1009933	1	8	12.5	5.0	✓
pH by Meter (1:2 Soil:0.01M CaCl2 Extraction) - As Received	E108A	1007622	2	40	5.0	5.0	✓
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1007676	2	16	12.5	10.0	✓
WAD Cyanide (0.01M NaOH Extraction)	E336A	1007624	1	20	5.0	5.0	✓
Water Extractable Chloride by IC	E236.Cl	1015824	2	13	15.3	10.0	✓
Water Extractable Sulfate by IC	E236.SO4	1015823	2	13	15.3	10.0	✓
Method Blanks (MB)							
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L	1009312	1	8	12.5	4.7	✓



Matrix: Soil/Solid

Evaluation: ✖ = QC frequency outside specification; ✔ = QC frequency within specification.

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	Method	QC Lot #	QC	Regular	Actual	Expected	Evaluation
Method Blanks (MB) - Continued							
Boron-Hot Water Extractable by ICPOES	E487	1007677	1	13	7.6	5.0	✔
BTEX by Headspace GC-MS	E611A	1011090	2	40	5.0	5.0	✔
CCME PHC - F1 by Headspace GC-FID	E581.F1	1011091	2	40	5.0	5.0	✔
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L	1007625	1	20	5.0	5.0	✔
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L	1007675	2	36	5.5	5.0	✔
Hexavalent Chromium (Cr VI) by IC	E532	1007623	1	20	5.0	5.0	✔
Mercury in Soil/Solid by CVAAS (<355 µm)	E510C	1007679	1	13	7.6	5.0	✔
Metals in Soil/Solid by CRC ICPMS (<355 µm)	E440C	1007678	1	16	6.2	5.0	✔
Moisture Content by Gravimetry	E144	1007270	1	20	5.0	5.0	✔
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484	1007676	1	16	6.2	5.0	✔
WAD Cyanide (0.01M NaOH Extraction)	E336A	1007624	1	20	5.0	5.0	✔
Water Extractable Chloride by IC	E236.Cl	1015824	1	13	7.6	5.0	✔
Water Extractable Sulfate by IC	E236.SO4	1015823	1	13	7.6	5.0	✔
Matrix Spikes (MS)							
BTEX by Headspace GC-MS	E611A	1011090	2	40	5.0	5.0	✔
CCME PHC - F1 by Headspace GC-FID	E581.F1	1011091	2	40	5.0	5.0	✔
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L	1007625	1	20	5.0	5.0	✔
WAD Cyanide (0.01M NaOH Extraction)	E336A	1007624	1	20	5.0	5.0	✔



Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Conductivity in Soil (1:2 Soil:Water Extraction) (Low Level)	E100-L Waterloo - Environmental	Soil/Solid	CSSS Ch. 15 (mod)/APHA 2510 (mod)	Conductivity, also known as Electrical Conductivity (EC) or Specific Conductance, is measured by immersion of a conductivity cell with platinum electrodes into a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Conductance is measured in the fluid that is observed in the upper layer.
pH by Meter (1:2 Soil:0.01M CaCl ₂ Extraction) - As Received	E108A Waterloo - Environmental	Soil/Solid	MECP E3137A	pH is determined by potentiometric measurement with a pH electrode, and is conducted at ambient laboratory temperature (normally 20 ± 5°C) and is carried out in accordance with procedures described in the Analytical Protocol (prescriptive method). A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling, or decanting and then analyzed using a pH meter and electrode.
ORP by Electrode	E125 Waterloo - Environmental	Soil/Solid	APHA 2580 (mod)	Oxidation Reduction Potential (ORP) is reported as the oxidation-reduction potential of the platinum metal-reference electrode employed in the analysis, measured in mV.
Moisture Content by Gravimetry	E144 Waterloo - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Moisture is measured gravimetrically by drying the sample at 105°C. Moisture content is calculated as the weight loss (due to water) divided by the wet weight of the sample, expressed as a percentage.
Water Extractable Chloride by IC	E236.Cl Waterloo - Environmental	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
Water Extractable Sulfate by IC	E236.SO ₄ Waterloo - Environmental	Soil/Solid	EPA 300.1	Inorganic anions are analyzed by Ion Chromatography with conductivity and/or UV detection using a soil sample that has been added in a defined ratio of soil to deionized water, then shaken well and allowed to settle. Anions are measured in the fluid that is observed in the upper layer.
WAD Cyanide (0.01M NaOH Extraction)	E336A Waterloo - Environmental	Soil/Solid	APHA 4500-CN I (mod)	Weak Acid Dissociable (WAD) cyanide is determined after extraction by Continuous Flow Analyzer (CFA) with in-line distillation followed by colourimetric analysis.
Acid Volatile Sulfide in Soil by Colourimetry (0.2 mg/kg)	E396-L Waterloo - Environmental	Soil/Solid	APHA 4500S2J	This analysis is carried out in accordance with the method described in APHA 4500 S2-J. After extraction the Acid Volatile Sulphide is determined colourimetrically.



Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Metals in Soil/Solid by CRC ICPMS (<355 µm)	E440C Waterloo - Environmental	Soil/Solid	EPA 6020B (mod)	This method is intended to liberate metals that may be environmentally available. Samples are dried, then sieved through a 355 µm sieve, and digested with HNO₃ and HCl. Dependent on sample matrix, some metals may be only partially recovered, including Al, Ba, Be, Cr, Sr, Ti, Tl, V, W, and Zr. Silicate minerals are not solubilized. Volatile forms of sulfur (including sulfide) may not be captured, as they may be lost during sampling, storage, or digestion. This method does not adequately recover elemental sulfur, and is unsuitable for assessment of elemental sulfur standards or guidelines. Analysis is by Collision/Reaction Cell ICPMS.
Sodium Adsorption Ratio (SAR) - 1:2 Soil:Water (Dry)	E484 Waterloo - Environmental	Soil/Solid	SW846 6010C	A dried, disaggregated solid sample is extracted with deionized water, the aqueous extract is separated from the solid, acidified and then analyzed using a ICP/OES. The concentrations of Na, Ca and Mg are reported as per CALA requirements for calculated parameters. These individual parameters are not for comparison to any guideline.
Boron-Hot Water Extractable by ICPOES	E487 Waterloo - Environmental	Soil/Solid	HW EXTR, EPA 6010B	A dried solid sample is extracted with calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES. Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).
Mercury in Soil/Solid by CVAAS (<355 µm)	E510C Waterloo - Environmental	Soil/Solid	EPA 200.2/1631 Appendix (mod)	Samples are sieved through a 355 µm sieve, and digested with HNO ₃ and HCl, followed by CVAAS analysis.
Hexavalent Chromium (Cr VI) by IC	E532 Waterloo - Environmental	Soil/Solid	APHA 3500-CR C	Instrumental analysis is performed by ion chromatography with UV detection.
CCME PHC - F1 by Headspace GC-FID	E581.F1 Waterloo - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	CCME Fraction 1 (F1) is analyzed by static headspace GC-FID. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law. Analytical methods for CCME Petroleum Hydrocarbons (PHCs) are validated to comply fully with the Reference Method for the Canada-Wide Standard for PHC. Test results are expressed on a dry weight basis. Unless qualified, all required quality control criteria of the CCME PHC method have been met, including response factor and linearity requirements.



Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
CCME PHCs - F2-F4 by GC-FID (Low Level)	E601.SG-L Waterloo - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Sample extracts are subjected to in-situ silica gel treatment prior to analysis by GC-FID for CCME hydrocarbon fractions (F2-F4). Analytical methods for CCME Petroleum Hydrocarbons (PHCs) are validated to comply fully with the Reference Method for the Canada-Wide Standard for PHC. Test results are expressed on a dry weight basis. Unless qualified, all required quality control criteria of the CCME PHC method have been met, including response factor and linearity requirements.
BTEX by Headspace GC-MS	E611A Waterloo - Environmental	Soil/Solid	EPA 8260D (mod)	Volatile Organic Compounds (VOCs) are analyzed by static headspace GC-MS. Samples are prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
Resistivity Calculation for Soil Using E100-L	EC100R Waterloo - Environmental	Soil/Solid	APHA 2510 B	Soil Resistivity (calculated) is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.
F1-BTEX	EC580 Waterloo - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	F1-BTEX is calculated as follows: F1-BTEX = F1 (C6-C10) minus benzene, toluene, ethylbenzene and xylenes (BTEX).
Sum F1 to F4 (C6-C50)	EC581 Waterloo - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1	Hydrocarbons, total (C6-C50) is the sum of CCME Fractions F1(C6-C10), F2(C10-C16), F3(C16-C34), and F4(C34-C50). F4G-sg is not used within this calculation due to overlap with other fractions.
Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Leach 1:2 Soil:Water for pH/EC	EP108 Waterloo - Environmental	Soil/Solid	BC WLAP METHOD: PH, ELECTROMETRIC, SOIL	The procedure involves mixing the dried (at <60°C) and sieved (No. 10 / 2mm) sample with deionized/distilled water at a 1:2 ratio of sediment to water.
Leach 1:2 Soil : 0.01CaCl2 - As Received for pH	EP108A Waterloo - Environmental	Soil/Solid	MOEE E3137A	A minimum 10g portion of the sample, as received, is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil by centrifuging, settling or decanting and then analyzed using a pH meter and electrode.
Preparation of ORP by Electrode	EP125 Waterloo - Environmental	Soil/Solid	APHA 2580 (mod)	Field-moist sample is extracted in a 1:2 ratio with DI water and then analyzed by ORP meter.
Anions Leach 1:10 Soil:Water (Dry)	EP236 Waterloo - Environmental	Soil/Solid	EPA 300.1	5 grams of dried soil is mixed with 50 grams of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.



Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Cyanide Extraction for CFA (0.01M NaOH)	EP333A Waterloo - Environmental	Soil/Solid	ON MECP E3015 (mod)	Extraction for various cyanide analysis is by rotary extraction of the soil with 0.01M Sodium Hydroxide.
Distillation for Acid Volatile Sulfide in Soil	EP396-L Waterloo - Environmental	Soil/Solid	APHA 4500S2J	Acid Volatile Sulfide is determined by colourimetric measurement on a sediment sample that has been treated with hydrochloric acid within a purge and trap system, where the evolved hydrogen sulfide gas is carried into a basic solution by argon gas for analysis.
Digestion for Metals and Mercury (355 µm Sieve)	EP440C Waterloo - Environmental	Soil/Solid	EPA 200.2 (mod)	Samples are sieved through a 355 µm sieve, and digested with HNO ₃ and HCl. This method is intended to liberate metals that may be environmentally available.
Boron-Hot Water Extractable	EP487 Waterloo - Environmental	Soil/Solid	HW EXTR, EPA 6010B	A dried solid sample is extracted with weak calcium chloride, the sample undergoes a heating process. After cooling the sample is filtered and analyzed by ICP/OES. Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011)
Preparation of Hexavalent Chromium (Cr VI) for IC	EP532 Waterloo - Environmental	Soil/Solid	EPA 3060A	Field moist samples are digested with a sodium hydroxide/sodium carbonate solution as described in EPA 3060A.
VOCs Methanol Extraction for Headspace Analysis	EP581 Waterloo - Environmental	Soil/Solid	EPA 5035A (mod)	VOCs in samples are extracted with methanol. Extracts are then prepared in headspace vials and are heated and agitated on the headspace autosampler, causing VOCs to partition between the aqueous phase and the headspace in accordance with Henry's law.
PHCs and PAHs Hexane-Acetone Tumbler Extraction	EP601 Waterloo - Environmental	Soil/Solid	CCME PHC in Soil - Tier 1 (mod)	Samples are subsampled and Petroleum Hydrocarbons (PHC) and PAHs are extracted with 1:1 hexane:acetone using a rotary extractor.

QUALITY CONTROL REPORT

Work Order	: WT2318542	Page	: 1 of 13
Client	: Chung and Vander Doelen Engineering Ltd.	Laboratory	: Waterloo - Environmental
Contact	: Marcelo Pereira	Account Manager	: Andrew Martin
Address	: 311 Victoria St. N. Kitchener ON Canada N2H 5E1	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: 1161	Date Samples Received	: 23-Jun-2023 13:00
PO	: ----	Date Analysis Commenced	: 24-Jun-2023
C-O-C number	: 17-869862	Issue Date	: 30-Jun-2023 15:25
Sampler	: Marcelo Pereira		
Site	: ----		
Quote number	: Q84362 - Excess Soils		
No. of samples received	: 6		
No. of samples analysed	: 6		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Matrix Spike (MS) Report; Recovery and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Laboratory Department</i>
Amanda Ganouri-Lumsden	Department Manager - Microbiology and Prep	Waterloo Centralized Prep, Waterloo, Ontario
Jeremy Gingras	Team Leader - Semi-Volatile Instrumentation	Waterloo Organics, Waterloo, Ontario
Sarah Birch	VOC Section Supervisor	Waterloo VOC, Waterloo, Ontario
Wayne Smith	Client Services Specialist	Waterloo Inorganics, Waterloo, Ontario
Wayne Smith	Client Services Specialist	Waterloo Metals, Waterloo, Ontario



General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.

CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.

DQO = Data Quality Objective.

LOR = Limit of Reporting (detection limit).

RPD = Relative Percent Difference

= Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.



Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: Soil/Solid					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Physical Tests (QC Lot: 1007270)											
WT2318379-027	Anonymous	Moisture	----	E144	0.25	%	7.04	7.01	0.398%	20%	----
Physical Tests (QC Lot: 1007622)											
WT2318379-011	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	9.66	9.66	0.00%	5%	----
Physical Tests (QC Lot: 1007675)											
WT2318542-003	BH2- SA1	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	1.29 mS/cm	1310	2.15%	20%	----
Physical Tests (QC Lot: 1007814)											
WT2318507-001	Anonymous	Conductivity (1:2 leachate)	----	E100-L	5.00	µS/cm	1.09 mS/cm	1100	0.733%	20%	----
Physical Tests (QC Lot: 1008921)											
WT2315856-021	Anonymous	pH (1:2 soil:CaCl2-aq)	----	E108A	0.10	pH units	7.20	7.49	3.95%	5%	----
Physical Tests (QC Lot: 1009933)											
WT2318494-001	Anonymous	Oxidation-reduction potential [ORP]	----	E125	0.10	mV	237	225	5.19%	25%	----
Cyanides (QC Lot: 1007624)											
WT2318379-013	Anonymous	Cyanide, weak acid dissociable	----	E336A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
Inorganics (QC Lot: 1009312)											
WT2318047-011	Anonymous	Sulfides, acid volatile	----	E396-L	0.23	mg/kg	0.36	0.53	0.17	Diff <2x LOR	----
Metals (QC Lot: 1007676)											
WT2318542-003	BH2- SA1	Calcium, soluble ion content	7440-70-2	E484	0.50	mg/L	8.28	9.80	16.8%	30%	----
		Magnesium, soluble ion content	7439-95-4	E484	0.50	mg/L	9.58	12.9	29.5%	30%	----
		Sodium, soluble ion content	17341-25-2	E484	0.50	mg/L	274	280	2.17%	30%	----
Metals (QC Lot: 1007677)											
WT2318542-003	BH2- SA1	Boron, hot water soluble	7440-42-8	E487	0.10	mg/kg	0.13	0.12	0.005	Diff <2x LOR	----
Metals (QC Lot: 1007678)											
WT2318542-003	BH2- SA1	Antimony	7440-36-0	E440C	0.10	mg/kg	0.14	0.15	0.007	Diff <2x LOR	----
		Arsenic	7440-38-2	E440C	0.10	mg/kg	2.83	3.04	7.25%	30%	----
		Barium	7440-39-3	E440C	0.50	mg/kg	47.0	49.7	5.49%	40%	----
		Beryllium	7440-41-7	E440C	0.10	mg/kg	0.36	0.39	0.03	Diff <2x LOR	----
		Boron	7440-42-8	E440C	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----
		Cadmium	7440-43-9	E440C	0.020	mg/kg	0.167	0.174	3.65%	30%	----
		Chromium	7440-47-3	E440C	0.50	mg/kg	32.0	35.5	10.6%	30%	----
		Cobalt	7440-48-4	E440C	0.10	mg/kg	4.16	4.48	7.44%	30%	----



Sub-Matrix: Soil/Solid					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Metals (QC Lot: 1007678) - continued											
WT2318542-003	BH2- SA1	Copper	7440-50-8	E440C	0.50	mg/kg	9.34	10.2	9.08%	30%	----
		Lead	7439-92-1	E440C	0.50	mg/kg	16.2	16.7	2.84%	40%	----
		Molybdenum	7439-98-7	E440C	0.10	mg/kg	0.38	0.40	0.02	Diff <2x LOR	----
		Nickel	7440-02-0	E440C	0.50	mg/kg	8.60	9.03	4.96%	30%	----
		Selenium	7782-49-2	E440C	0.20	mg/kg	<0.20	<0.20	0	Diff <2x LOR	----
		Silver	7440-22-4	E440C	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
		Thallium	7440-28-0	E440C	0.050	mg/kg	0.073	0.076	0.003	Diff <2x LOR	----
		Uranium	7440-61-1	E440C	0.050	mg/kg	0.391	0.373	4.64%	30%	----
		Vanadium	7440-62-2	E440C	0.20	mg/kg	25.7	27.0	4.75%	30%	----
		Zinc	7440-66-6	E440C	2.0	mg/kg	53.1	57.6	8.15%	30%	----
Metals (QC Lot: 1007679)											
WT2318542-003	BH2- SA1	Mercury	7439-97-6	E510C	0.0050	mg/kg	0.0478	0.0458	4.20%	40%	----
Speciated Metals (QC Lot: 1007623)											
WT2318379-012	Anonymous	Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.10	mg/kg	<0.10	<0.10	0	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1015823)											
WT2318494-001	Anonymous	Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	125	125	0.1	Diff <2x LOR	----
Leachable Anions & Nutrients (QC Lot: 1015824)											
WT2318494-001	Anonymous	Chloride, soluble ion content	16887-00-6	E236.Cl	5.0	mg/kg	256	269	5.07%	30%	----
Volatile Organic Compounds (QC Lot: 1011090)											
WT2318762-001	Anonymous	Benzene	71-43-2	E611A	0.0050	mg/kg	<0.0050 µg/g	<0.0050	0	Diff <2x LOR	----
		Ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015 µg/g	<0.015	0	Diff <2x LOR	----
		Toluene	108-88-3	E611A	0.050	mg/kg	<0.050 µg/g	<0.050	0	Diff <2x LOR	----
		Xylene, m+p-	179601-23-1	E611A	0.030	mg/kg	<0.030 µg/g	<0.030	0	Diff <2x LOR	----
		Xylene, o-	95-47-6	E611A	0.030	mg/kg	<0.030 µg/g	<0.030	0	Diff <2x LOR	----
Volatile Organic Compounds (QC Lot: 1011443)											
WT2318816-009	Anonymous	Benzene	71-43-2	E611A	0.0050	mg/kg	<0.0050	<0.0050	0	Diff <2x LOR	----
		Ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	<0.015	0	Diff <2x LOR	----
		Toluene	108-88-3	E611A	0.050	mg/kg	<0.050	<0.050	0	Diff <2x LOR	----
		Xylene, m+p-	179601-23-1	E611A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
		Xylene, o-	95-47-6	E611A	0.030	mg/kg	<0.030	<0.030	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 1007625)											
WT2318379-014	Anonymous	F2 (C10-C16)	----	E601.SG-L	10	mg/kg	19	11	8	Diff <2x LOR	----
		F3 (C16-C34)	----	E601.SG-L	50	mg/kg	89	56	33	Diff <2x LOR	----
		F4 (C34-C50)	----	E601.SG-L	50	mg/kg	94	51	42	Diff <2x LOR	----



Sub-Matrix: Soil/Solid					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Hydrocarbons (QC Lot: 1011091)											
WT2318762-001	Anonymous	F1 (C6-C10)	----	E581.F1	5.0	mg/kg	<5.0 µg/g	<5.0	0	Diff <2x LOR	----
Hydrocarbons (QC Lot: 1011444)											
WT2318816-009	Anonymous	F1 (C6-C10)	----	E581.F1	5.0	mg/kg	<5.0	<5.0	0	Diff <2x LOR	----



Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: Soil/Solid

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Physical Tests (QCLot: 1007270)						
Moisture	----	E144	0.25	%	<0.25	----
Physical Tests (QCLot: 1007675)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Physical Tests (QCLot: 1007814)						
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	<5.00	----
Cyanides (QCLot: 1007624)						
Cyanide, weak acid dissociable	----	E336A	0.05	mg/kg	<0.050	----
Inorganics (QCLot: 1009312)						
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	<0.20	----
Metals (QCLot: 1007676)						
Calcium, soluble ion content	7440-70-2	E484	0.5	mg/L	<0.50	----
Magnesium, soluble ion content	7439-95-4	E484	0.5	mg/L	<0.50	----
Sodium, soluble ion content	17341-25-2	E484	0.5	mg/L	<0.50	----
Metals (QCLot: 1007677)						
Boron, hot water soluble	7440-42-8	E487	0.1	mg/kg	<0.10	----
Metals (QCLot: 1007678)						
Antimony	7440-36-0	E440C	0.1	mg/kg	<0.10	----
Arsenic	7440-38-2	E440C	0.1	mg/kg	<0.10	----
Barium	7440-39-3	E440C	0.5	mg/kg	<0.50	----
Beryllium	7440-41-7	E440C	0.1	mg/kg	<0.10	----
Boron	7440-42-8	E440C	5	mg/kg	<5.0	----
Cadmium	7440-43-9	E440C	0.02	mg/kg	<0.020	----
Chromium	7440-47-3	E440C	0.5	mg/kg	<0.50	----
Cobalt	7440-48-4	E440C	0.1	mg/kg	<0.10	----
Copper	7440-50-8	E440C	0.5	mg/kg	<0.50	----
Lead	7439-92-1	E440C	0.5	mg/kg	<0.50	----
Molybdenum	7439-98-7	E440C	0.1	mg/kg	<0.10	----
Nickel	7440-02-0	E440C	0.5	mg/kg	<0.50	----
Selenium	7782-49-2	E440C	0.2	mg/kg	<0.20	----
Silver	7440-22-4	E440C	0.1	mg/kg	<0.10	----
Thallium	7440-28-0	E440C	0.05	mg/kg	<0.050	----
Uranium	7440-61-1	E440C	0.05	mg/kg	<0.050	----



Sub-Matrix: **Soil/Solid**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Metals (QCLot: 1007678) - continued						
Vanadium	7440-62-2	E440C	0.2	mg/kg	<0.20	----
Zinc	7440-66-6	E440C	2	mg/kg	<2.0	----
Metals (QCLot: 1007679)						
Mercury	7439-97-6	E510C	0.005	mg/kg	<0.0050	----
Speciated Metals (QCLot: 1007623)						
Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	<0.10	----
Leachable Anions & Nutrients (QCLot: 1015823)						
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	<20	----
Leachable Anions & Nutrients (QCLot: 1015824)						
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	<5.0	----
Volatile Organic Compounds (QCLot: 1011090)						
Benzene	71-43-2	E611A	0.005	mg/kg	<0.0050	----
Ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	----
Toluene	108-88-3	E611A	0.05	mg/kg	<0.050	----
Xylene, m+p-	179601-23-1	E611A	0.03	mg/kg	<0.030	----
Xylene, o-	95-47-6	E611A	0.03	mg/kg	<0.030	----
Volatile Organic Compounds (QCLot: 1011443)						
Benzene	71-43-2	E611A	0.005	mg/kg	<0.0050	----
Ethylbenzene	100-41-4	E611A	0.015	mg/kg	<0.015	----
Toluene	108-88-3	E611A	0.05	mg/kg	<0.050	----
Xylene, m+p-	179601-23-1	E611A	0.03	mg/kg	<0.030	----
Xylene, o-	95-47-6	E611A	0.03	mg/kg	<0.030	----
Hydrocarbons (QCLot: 1007625)						
F2 (C10-C16)	----	E601.SG-L	10	mg/kg	<10	----
F3 (C16-C34)	----	E601.SG-L	50	mg/kg	<50	----
F4 (C34-C50)	----	E601.SG-L	50	mg/kg	<50	----
Hydrocarbons (QCLot: 1011091)						
F1 (C6-C10)	----	E581.F1	5	mg/kg	<5.0	----
Hydrocarbons (QCLot: 1011444)						
F1 (C6-C10)	----	E581.F1	5	mg/kg	<5.0	----



Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: Soil/Solid

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Physical Tests (QCLot: 1007270)									
Moisture	----	E144	0.25	%	50 %	99.8	90.0	110	----
Physical Tests (QCLot: 1007622)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	100	98.0	102	----
Physical Tests (QCLot: 1007675)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1409 µS/cm	96.2	90.0	110	----
Physical Tests (QCLot: 1007814)									
Conductivity (1:2 leachate)	----	E100-L	5	µS/cm	1409 µS/cm	99.1	90.0	110	----
Physical Tests (QCLot: 1008921)									
pH (1:2 soil:CaCl2-aq)	----	E108A	----	pH units	7 pH units	99.8	98.0	102	----
Cyanides (QCLot: 1007624)									
Cyanide, weak acid dissociable	----	E336A	0.05	mg/kg	1.25 mg/kg	97.8	80.0	120	----
Inorganics (QCLot: 1009312)									
Sulfides, acid volatile	----	E396-L	0.2	mg/kg	2.376 mg/kg	87.5	70.0	130	----
Metals (QCLot: 1007676)									
Calcium, soluble ion content	7440-70-2	E484	0.5	mg/L	300 mg/L	106	80.0	120	----
Magnesium, soluble ion content	7439-95-4	E484	0.5	mg/L	50 mg/L	102	80.0	120	----
Sodium, soluble ion content	17341-25-2	E484	0.5	mg/L	50 mg/L	104	80.0	120	----
Metals (QCLot: 1007677)									
Boron, hot water soluble	7440-42-8	E487	0.1	mg/kg	1.33333 mg/kg	104	70.0	130	----
Metals (QCLot: 1007678)									
Antimony	7440-36-0	E440C	0.1	mg/kg	100 mg/kg	93.5	80.0	120	----
Arsenic	7440-38-2	E440C	0.1	mg/kg	100 mg/kg	92.2	80.0	120	----
Barium	7440-39-3	E440C	0.5	mg/kg	25 mg/kg	88.4	80.0	120	----
Beryllium	7440-41-7	E440C	0.1	mg/kg	10 mg/kg	83.6	80.0	120	----
Boron	7440-42-8	E440C	5	mg/kg	100 mg/kg	84.3	80.0	120	----
Cadmium	7440-43-9	E440C	0.02	mg/kg	10 mg/kg	88.5	80.0	120	----
Chromium	7440-47-3	E440C	0.5	mg/kg	25 mg/kg	86.1	80.0	120	----
Cobalt	7440-48-4	E440C	0.1	mg/kg	25 mg/kg	86.4	80.0	120	----
Copper	7440-50-8	E440C	0.5	mg/kg	25 mg/kg	87.2	80.0	120	----
Lead	7439-92-1	E440C	0.5	mg/kg	50 mg/kg	92.1	80.0	120	----



Sub-Matrix: Soil/Solid					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		Qualifier
					Concentration	LCS	Low	High	
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Metals (QCLot: 1007678) - continued									
Molybdenum	7439-98-7	E440C	0.1	mg/kg	25 mg/kg	90.9	80.0	120	----
Nickel	7440-02-0	E440C	0.5	mg/kg	50 mg/kg	87.0	80.0	120	----
Selenium	7782-49-2	E440C	0.2	mg/kg	100 mg/kg	92.1	80.0	120	----
Silver	7440-22-4	E440C	0.1	mg/kg	10 mg/kg	83.9	80.0	120	----
Thallium	7440-28-0	E440C	0.05	mg/kg	100 mg/kg	92.6	80.0	120	----
Uranium	7440-61-1	E440C	0.05	mg/kg	0.5 mg/kg	89.1	80.0	120	----
Vanadium	7440-62-2	E440C	0.2	mg/kg	50 mg/kg	88.1	80.0	120	----
Zinc	7440-66-6	E440C	2	mg/kg	50 mg/kg	88.9	80.0	120	----
Metals (QCLot: 1007679)									
Mercury	7439-97-6	E510C	0.005	mg/kg	0.1 mg/kg	118	80.0	120	----
Speciated Metals (QCLot: 1007623)									
Chromium, hexavalent [Cr VI]	18540-29-9	E532	0.1	mg/kg	0.8 mg/kg	96.1	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1015823)									
Sulfate, soluble ion content	14808-79-8	E236.SO4	20	mg/kg	5000 mg/kg	101	80.0	120	----
Leachable Anions & Nutrients (QCLot: 1015824)									
Chloride, soluble ion content	16887-00-6	E236.Cl	5	mg/kg	5000 mg/kg	99.5	80.0	120	----
Volatile Organic Compounds (QCLot: 1011090)									
Benzene	71-43-2	E611A	0.005	mg/kg	3.475 mg/kg	101	70.0	130	----
Ethylbenzene	100-41-4	E611A	0.015	mg/kg	3.475 mg/kg	106	70.0	130	----
Toluene	108-88-3	E611A	0.05	mg/kg	3.475 mg/kg	102	70.0	130	----
Xylene, m+p-	179601-23-1	E611A	0.03	mg/kg	6.95 mg/kg	97.1	70.0	130	----
Xylene, o-	95-47-6	E611A	0.03	mg/kg	3.475 mg/kg	101	70.0	130	----
Volatile Organic Compounds (QCLot: 1011443)									
Benzene	71-43-2	E611A	0.005	mg/kg	3.475 mg/kg	90.7	70.0	130	----
Ethylbenzene	100-41-4	E611A	0.015	mg/kg	3.475 mg/kg	101	70.0	130	----
Toluene	108-88-3	E611A	0.05	mg/kg	3.475 mg/kg	101	70.0	130	----
Xylene, m+p-	179601-23-1	E611A	0.03	mg/kg	6.95 mg/kg	101	70.0	130	----
Xylene, o-	95-47-6	E611A	0.03	mg/kg	3.475 mg/kg	104	70.0	130	----
Hydrocarbons (QCLot: 1007625)									
F2 (C10-C16)	----	E601.SG-L	10	mg/kg	821.775 mg/kg	101	70.0	130	----
F3 (C16-C34)	----	E601.SG-L	50	mg/kg	1151.486 mg/kg	108	70.0	130	----
F4 (C34-C50)	----	E601.SG-L	50	mg/kg	719.6893 mg/kg	105	70.0	130	----



Sub-Matrix: Soil/Solid					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
					Concentration	LCS	Low	High	Qualifier
AnalyteCAS NumberMethodLORUnit									
Hydrocarbons (QCLot: 1011091)									
F1 (C6-C10)	----	E581.F1	5	mg/kg	69.1875 mg/kg	103	80.0	120	----
Hydrocarbons (QCLot: 1011444)									
F1 (C6-C10)	----	E581.F1	5	mg/kg	69.1875 mg/kg	109	80.0	120	----

Matrix Spike (MS) Report

A Matrix Spike (MS) is a randomly selected intra-laboratory replicate sample that has been fortified (spiked) with test analytes at known concentration, and processed in an identical manner to test samples. Matrix Spikes provide information regarding analyte recovery and potential matrix effects. MS DQO exceedances due to sample matrix may sometimes be unavoidable; in such cases, test results for the associated sample (or similar samples) may be subject to bias. ND – Recovery not determined, background level >= 1x spike level.

Sub-Matrix: Soil/Solid					Matrix Spike (MS) Report					
					Spike		Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	Concentration	Target	MS	Low	High	Qualifier
Cyanides (QCLot: 1007624)										
WT2318379-013	Anonymous	Cyanide, weak acid dissociable	----	E336A	1.29 mg/kg	1.25 mg/kg	104	70.0	130	----
Volatile Organic Compounds (QCLot: 1011090)										
WT2318762-001	Anonymous	Benzene	71-43-2	E611A	2.30 mg/kg	3.125 mg/kg	99.5	60.0	140	----
		Ethylbenzene	100-41-4	E611A	2.51 mg/kg	3.125 mg/kg	108	60.0	140	----
		Toluene	108-88-3	E611A	2.42 mg/kg	3.125 mg/kg	105	60.0	140	----
		Xylene, m+p-	179601-23-1	E611A	4.50 mg/kg	6.25 mg/kg	97.3	60.0	140	----
		Xylene, o-	95-47-6	E611A	2.38 mg/kg	3.125 mg/kg	103	60.0	140	----
Volatile Organic Compounds (QCLot: 1011443)										
WT2318816-009	Anonymous	Benzene	71-43-2	E611A	1.75 mg/kg	3.125 mg/kg	92.0	60.0	140	----
		Ethylbenzene	100-41-4	E611A	1.81 mg/kg	3.125 mg/kg	95.2	60.0	140	----
		Toluene	108-88-3	E611A	1.81 mg/kg	3.125 mg/kg	95.0	60.0	140	----
		Xylene, m+p-	179601-23-1	E611A	3.87 mg/kg	6.25 mg/kg	102	60.0	140	----
		Xylene, o-	95-47-6	E611A	1.92 mg/kg	3.125 mg/kg	101	60.0	140	----
Hydrocarbons (QCLot: 1007625)										
WT2318379-014	Anonymous	F2 (C10-C16)	----	E601.SG-L	642 mg/kg	821.775 mg/kg	100	60.0	140	----
		F3 (C16-C34)	----	E601.SG-L	1350 mg/kg	1151.486 mg/kg	151	60.0	140	E
		F4 (C34-C50)	----	E601.SG-L	735 mg/kg	719.6893 mg/kg	131	60.0	140	----
Hydrocarbons (QCLot: 1011091)										
WT2318762-001	Anonymous	F1 (C6-C10)	----	E581.F1	38.4 mg/kg	62.5 mg/kg	83.0	60.0	140	----
Hydrocarbons (QCLot: 1011444)										
WT2318816-009	Anonymous	F1 (C6-C10)	----	E581.F1	40.8 mg/kg	62.5 mg/kg	107	60.0	140	----



Qualifiers

Qualifier	Description
E	Matrix Spike recovery outside ALS DQO due to heterogeneous analyte background in sample.



Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

Sub-Matrix:					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method			Low	High	
Physical Tests (QCLot: 1007675)									
	RM	Conductivity (1:2 leachate)	----	E100-L	2168 µS/cm	95.0	70.0	130	----
Physical Tests (QCLot: 1007814)									
	RM	Conductivity (1:2 leachate)	----	E100-L	2168 µS/cm	92.7	70.0	130	----
Physical Tests (QCLot: 1009933)									
	RM	Oxidation-reduction potential [ORP]	----	E125	475 mV	95.8	90.0	110	----
Metals (QCLot: 1007676)									
	RM	Calcium, soluble ion content	7440-70-2	E484	82.58 mg/L	102	70.0	130	----
	RM	Magnesium, soluble ion content	7439-95-4	E484	25.79 mg/L	103	70.0	130	----
	RM	Sodium, soluble ion content	17341-25-2	E484	103.41 mg/L	102	70.0	130	----
Metals (QCLot: 1007677)									
	RM	Boron, hot water soluble	7440-42-8	E487	1.971 mg/kg	99.4	60.0	140	----
Metals (QCLot: 1007678)									
	RM	Antimony	7440-36-0	E440C	3.99 mg/kg	113	70.0	130	----
	RM	Arsenic	7440-38-2	E440C	3.73 mg/kg	102	70.0	130	----
	RM	Barium	7440-39-3	E440C	105 mg/kg	106	70.0	130	----
	RM	Beryllium	7440-41-7	E440C	0.349 mg/kg	96.2	70.0	130	----
	RM	Boron	7440-42-8	E440C	8.5 mg/kg	116	70.0	130	----
	RM	Cadmium	7440-43-9	E440C	0.91 mg/kg	108	70.0	130	----
	RM	Chromium	7440-47-3	E440C	101 mg/kg	106	70.0	130	----
	RM	Cobalt	7440-48-4	E440C	6.9 mg/kg	103	70.0	130	----
	RM	Copper	7440-50-8	E440C	123 mg/kg	100	70.0	130	----
	RM	Lead	7439-92-1	E440C	267 mg/kg	108	70.0	130	----
	RM	Molybdenum	7439-98-7	E440C	1.03 mg/kg	# 136	70.0	130	MES
	RM	Nickel	7440-02-0	E440C	26.7 mg/kg	107	70.0	130	----
	RM	Silver	7440-22-4	E440C	4.06 mg/kg	94.2	70.0	130	----
	RM	Thallium	7440-28-0	E440C	0.0786 mg/kg	110	70.0	130	----
	RM	Uranium	7440-61-1	E440C	0.52 mg/kg	113	70.0	130	----
	RM	Vanadium	7440-62-2	E440C	32.7 mg/kg	104	70.0	130	----



Sub-Matrix:					Reference Material (RM) Report				
					RM Target Concentration	Recovery (%) RM	Recovery Limits (%)		Qualifier
							Low	High	
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method					
Metals (QCLot: 1007678) - continued									
	RM	Zinc	7440-66-6	E440C	297 mg/kg	103	70.0	130	----
Metals (QCLot: 1007679)									
	RM	Mercury	7439-97-6	E510C	0.0585 mg/kg	107	70.0	130	----
Speciated Metals (QCLot: 1007623)									
	RM	Chromium, hexavalent [Cr VI]	18540-29-9	E532	172 mg/kg	96.4	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1015823)									
	RM	Sulfate, soluble ion content	14808-79-8	E236.SO4	1070 mg/kg	113	70.0	130	----
Leachable Anions & Nutrients (QCLot: 1015824)									
	RM	Chloride, soluble ion content	16887-00-6	E236.Cl	432 mg/kg	102	70.0	130	----

Qualifiers

Qualifier	Description
MES	Data Quality Objective was marginally exceeded (by < 10% absolute) for < 10% of analytes in a Multi-Element Scan / Multi-Parameter Scan (considered acceptable as per OMOE & CCME).



Chain of Custody (COC) / Analytical Request Form

Request Form

Affix ALS barcode label here
(lab use only)

COC Number: 17

Environmental Division
Waterloo
Work Order Reference
WT2318542

WT2318542

Page

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Company: CDD Engineering Ltd.		Email 1 or Fax: marcello.pereira@cddengineering.com		Date and Time Required for all E&P TATs: DATE	
Contact: Marcello Pereira		Email 2: marcello.pereira@cddengineering.com		Date and Time Required for all E&P TATs: DATE	
Phone: 514 655 4197		Email 3: marcello.pereira@cddengineering.com		Date and Time Required for all E&P TATs: DATE	
Company address below will appear on the final report		Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
Street: 311 Victoria St. N		Select Invoice Distribution: ☒ EMAIL ☐ MAIL ☐ FAX		Analysis Request	
City/Province: Kitchener, ON		Email 1 or Fax: marcello.pereira@cddengineering.com		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
Postal Code: N2H 5E1		Email 2: marcello.pereira@cddengineering.com		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
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Company: CDD Engineering Ltd.		Email 1 or Fax: marcello.pereira@cddengineering.com		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
Contact: Marcello Pereira		Email 2: marcello.pereira@cddengineering.com		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
Project Information		Oil and Gas Required Fields (client use)		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
ALS Account # / Quote #: 1161		Major/Minor Code: Oil and Gas Required Fields (client use)		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
Job #: 1161		Routing Code: Oil and Gas Required Fields (client use)		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
PO / AFE: 1161		Requisitioner: Oil and Gas Required Fields (client use)		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
LSD: 1161		Location: Oil and Gas Required Fields (client use)		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
ALS Lab Work Order # (lab use only): WT2318542		ALS Contact: MP		Indicate Filtered (F), Preserved (P) or Filtered and Preserved (FP) below	
Sample Identification and/or Coordinates (This description will appear on the report)		Date (dd-mm-yy)		Time (hh:mm)	
GH1 - SA3		23-06-23		5:01	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
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BH6 - SA3		"		"	
GH2 - SA1		"		"	
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BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
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BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
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BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
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BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil		Soil	
BH6 - SA3		"		"	
GH2 - SA1		"		"	
BH4 - SA1		"		"	
BH5 - SA1		"		"	
BH6 - SA1		"		"	
Sample Type		Sample Type		Sample Type	
GH1 - SA3		Soil			

APPENDIX C

COMPARISON OF THE SOIL CHEMISTRY RESULTS TO THE APPLICABLE REGULATORY CRITERIA



ANALYTICAL RESULTS FOR SOIL

**MECP Soil, Ground Water and Sediment Standards for Use Under Part XV.1
of the Environmental Protection Act, December 17, 2020 (O.Reg. 406/19)**

		Table 1 Residential/ Parkland/ Institutional/ Industrial/ Commercial/ Community Property Use Standard	Table 2.1 Residential/ Parkland/ Institutional Property Use Standard	Table 2.1 Industrial/ Commercial/ Community Property Use Standard	BH 2 - SA 1	BH 4 - SA 1	BH 5 - SA 1	BH 6 - SA 1
Metals & Inorganics	Conductivity (mS/cm)	0.57	0.7	1.4	1.29	0.138	0.253	0.189
	% Moisture (%)	-	-	-	12.2	9.66	12.0	7.17
	pH (pH units)	-	-	-	7.89	7.46	7.70	7.56
	Cyanide, Weak Acid Diss. (mg/kg)	0.051	0.051	0.051	<0.050	<0.050	<0.050	<0.050
	Sodium Adsorption Ratio (SAR)	2.4	5	12	15.4	0.13	3.35	1.76
	Antimony (Sb)	1.3	7.5	40	0.14	0.12	0.52	0.18
	Arsenic (As)	18	18	18	2.83	7.68	6.48	3.59
	Barium (Ba)	220	390	670	47.0	37.9	95.3	39.1
	Beryllium (Be)	2.5	4	8	0.36	0.33	0.34	0.34
	Boron (B)	36	120	120	<5.0	<5.0	7.0	5.5
	Boron (B), Hot Water Ext. Available	-	1.5	2	0.13	0.26	0.33	0.20
	Cadmium (Cd)	1.2	1.2	1.9	0.167	0.240	0.420	0.208
	Chromium (Cr)	70	160	160	32.0	12.7	20.3	14.4
	Cobalt (Co)	21	22	80	4.16	3.43	4.01	4.09
	Copper (Cu)	92	140	230	9.34	10.1	17.4	21.7
	Lead (Pb)	120	120	120	16.2	13.0	114	24.8
	Mercury (Hg)	0.27	0.27	0.27	0.0478	0.0378	0.124	0.0375
	Molybdenum (Mo)	2	6.9	40	0.38	0.45	0.49	0.30
	Nickel (Ni)	82	100	270	8.60	6.49	10.7	9.24
	Selenium (Se)	1.5	2.4	5.5	<0.20	0.29	0.24	<0.20
	Silver (Ag)	0.5	20	40	<0.10	<0.10	<0.10	<0.10
	Thallium (Tl)	1	1	3.3	0.073	0.076	0.092	0.071
	Uranium (U)	2.5	23	33	0.391	0.466	0.360	0.440
	Vanadium (V)	86	86	86	25.7	26.2	22.0	22.2
	Zinc (Zn)	290	340	340	53.1	55.2	146	63.2
	Chromium, Hexavalent	0.66	8	8	0.61	<0.10	<0.10	<0.10
Petroleum Hydrocarbons F1-F4	F1 (C6-C10)	25	25	25	<5.0	<5.0	<5.0	<5.0
	F1 (C6 to C10) minus BTEX	25	25	25	<5.0	<5.0	<5.0	<5.0
	F2 (C10-C16)	10	10	26	<10	<10	<10	<10
	F3 (C16-C34)	240	240	240	<50	<50	<50	<50
	F4 (C34-C50)	120	2800	3300	<50	<50	<50	<50
BTEX	Benzene	0.02	0.02	0.02	<0.0050	<0.0050	<0.0050	<0.0050
	Ethylbenzene	0.05	0.05	0.05	0.018	<0.015	0.023	<0.015
	Toluene	0.2	0.2	0.2	<0.050	<0.050	<0.050	<0.050
	Xylenes (Total)	0.05	0.091	0.091	<0.050	<0.050	<0.050	<0.050

NOTES:

1. Units = mg/kg

2. "-" - Parameter not included in chemical analysis

3. "nv" - no value

4. Test results shown in highlighted text exceed the Table 1 Standard for Residential/Parkland/Institutional/Industrial/Commercial/Community Property Use

5. Test results shown in highlighted text exceed the Table 2.1 Standard for Volume Independent Soil for Residential/Parkland/Institutional Property Use

6. Test results shown in highlighted text exceed the Table 2.1 Standard for Volume Independent Soil for Industrial/Commercial/Community Property Use

APPENDIX D

TABLE OF SEASONAL GROUNDWATER LEVELS AND ELEVATIONS



Table 1 - Summary of Water Levels, Elevations & Fluctuations

87 to 95 Seagram Drive, Waterloo
CVD Engineering - 1161

August 19-2025

Well	Ground Elevation (m ASL)	Top Pipe Elevation (m ASL)	Water Level (m Below Ground)						Water Elevation (m Above Sea Level)					
			04-Jul-23	12-Oct-23	02-Feb-24	14-May-24	Aug 11-25	Aug 19-25	04-Jul-23	12-Oct-23	02-Feb-24	14-May-24	Aug 11-25	Aug 19-25
BH6	335.03	-	3.16	3.04	3.24	3.06	-	3.15	331.87	331.99	331.80	331.97	-	331.89
BH7	334.22	335.10	2.81	2.27	2.89	2.52	2.95	2.95	331.41	331.96	331.34	331.71	331.27	331.27
BH9	333.55	334.43	-	-	-	-	2.25	2.29	-	-	-	-	331.30	331.27

Notes: 1) All Elevations Referenced to Geodetic Survey

APPENDIX E

SLUG TEST ANALYSIS REPORTS





CHUNG & VANDER DOELEN ENGINEERING LTD.

311 Victoria Street North
Kitchener / Ontario / N2H 5E1
519-742-8979

Response Test - Water Level Data and Analysis

Page 1 of 2

Project: Proposed 33-Storey Mixed-Use Building

Number: 1161

Client: 14688210 Canada Inc.

Location: 87-89 Seagram Drive, Waterloo, Ontario

Response Test: BH 6

Test Well: BH 6

Test Conducted by: Y.C.

Test Date: 2023-07-04

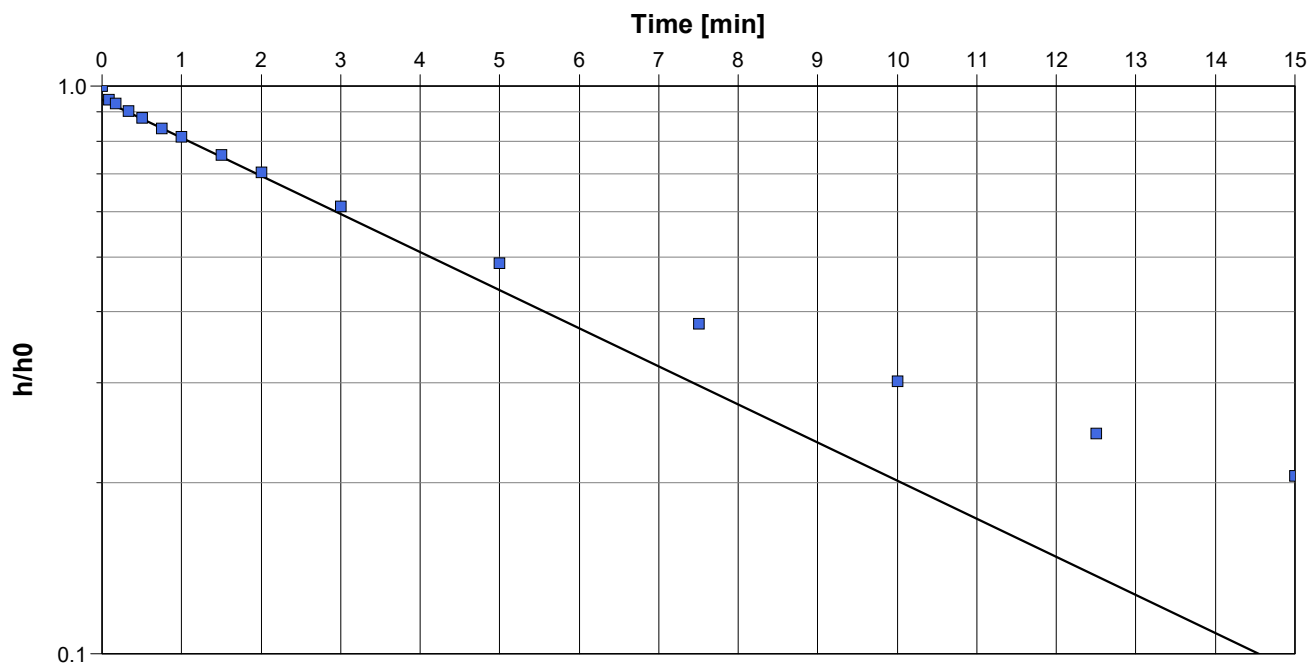
Aquifer Thickness: 2.80 m

Water level at t=0 [m]: 3.85

Static Water Level [m]: 3.16

Water level change at t=0 [m]: 0.70

	Time [min]	Water Level [m]	WL Change [m]
1	0	3.85	0.695
2	0.0833	3.813	0.658
3	0.1667	3.803	0.648
4	0.3333	3.783	0.628
5	0.5	3.765	0.61
6	0.75	3.74	0.585
7	1	3.72	0.565
8	1.5	3.68	0.525
9	2	3.645	0.49
10	3	3.582	0.427
11	5	3.494	0.339
12	7.5	3.42	0.265
13	10	3.365	0.21
14	12.5	3.325	0.17
15	15	3.298	0.143



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

BH 6

1.09×10^{-6}

**CHUNG & VANDER DOELEN**
ENGINEERING LTD.

311 Victoria Street North
Kitchener / Ontario / N2H 5E1
519-742-8979

Response Test - Water Level Data and Analysis

Page 2 of 2

Project: Proposed 33-Storey Mixed-Use Building

Number: 1161

Client: 14688210 Canada Inc.

Location: 87-89 Seagram Drive, Waterloo, Ontario

Response Test: BH 7

Test Well: BH 7

Test Conducted by: Y.C.

Test Date: 2023-07-04

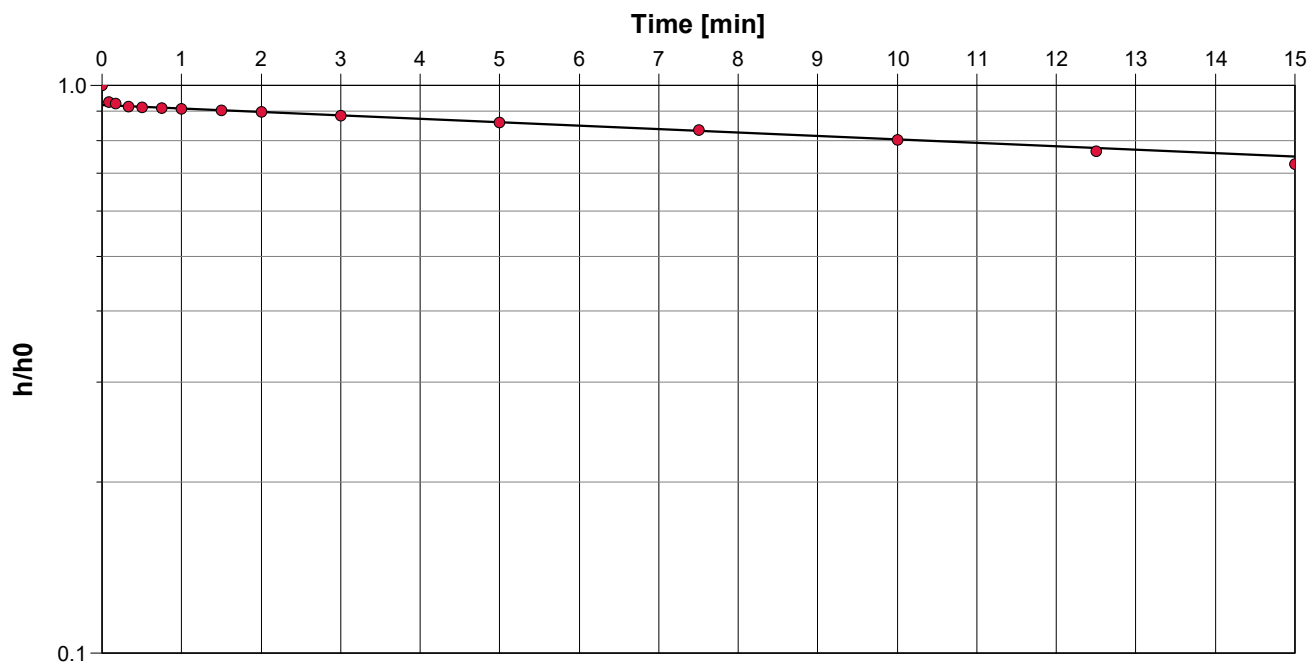
Aquifer Thickness: 1.60 m

Water level at t=0 [m]: 3.27

Static Water Level [m]: 2.81

Water level change at t=0 [m]: 0.46

	Time [min]	Water Level [m]	WL Change [m]
1	0	3.268	0.457
2	0.0833	3.238	0.427
3	0.1667	3.236	0.425
4	0.3333	3.231	0.42
5	0.5	3.229	0.418
6	0.75	3.228	0.417
7	1	3.227	0.416
8	1.5	3.224	0.413
9	2	3.222	0.411
10	3	3.215	0.404
11	5	3.204	0.393
12	7.5	3.192	0.381
13	10	3.177	0.366
14	12.5	3.161	0.35
15	15	3.143	0.332



Calculation using Bouwer & Rice

Observation Well

Hydraulic Conductivity
[m/s]

BH 7

 1.73×10^{-7}

APPENDIX F

PMT Results





In-Situ Pressuremeter Testing
95 Seagram Drive, Waterloo, Ontario
Borehole PMT-01
Revised on August 26th, 2025

Project No. IDG 250862

Prepared for:
Nandou Zhao, M.Eng., P.Eng.
Chung & Vander Doelen Engineering Ltd.
311 Victoria St. North
Kitchener, Ontario
N2H 5E1

In-Depth Geotechnical Inc.
20 Ravenscliffe Avenue
Hamilton, Ontario
L8P 3M4
Phone: (905) 541 9937

Table of Contents

1. Introduction		1
2. Field Testing Procedures		2
3. Pressuremeter Test Results		3
4. Closure		8
Appendix One	Pressuremeter Results – Graphic Data	One-1
Appendix Two	Pressuremeter Data Interpretation	Two-1
Appendix Three	Calibration Data	Three-1
Appendix Four	Pressure Gauge Calibration Data	Four-1

1. Introduction

In-Depth Geotechnical Inc. was retained by Chung & Vander Doelen Engineering Ltd. to conduct Pressuremeter testing in relation to their Geotechnical Investigation at 95 Seagram Drive site, in Waterloo, Ontario.

This report presents the results of pressuremeter testing (PMT) carried out at one borehole location with the purpose of evaluating specific parameters related to a) shear strength; and b) deformation properties of the encountered soils.

This report includes data obtained by use of a pre-bored pressuremeter system. Inferred characteristics of the data are also presented including initial contact pressure, limit pressure, secant deformation modulus values during loading, unloading and reloading cycles, and yield pressure if and when justified by the data. Multiple methods are available for interpretation of this data to estimate engineering properties of soils but such methods are not discussed or included in this report except for the characteristics of the data plots as described above.

2. Field Testing Procedures

Pressuremeter testing was performed at one borehole location, as follows:

Borehole	Number of Tests	Ground Elevation (masl)	Water Elevation (masl)	Maximum Depth (m)
PMT-01	10	333.74	331.27	30

Field work was completed on August 7 and 8, 2025. Drilling procedures were undertaken by Davis Drilling Contractor. The borehole was advanced using mud rotary drilling technique with a track-mounted CME 55 rig. This boring was dedicated to PMT and SPT testing procedures.

HWT casing was installed to a depth of about 1.6 m below the ground surface to prevent soil collapsing on the upper part of the boring (collar).

The test sections of the borings were drilled with a tricone. The bit was advanced using continuous circulation of drilling mud to flush soil cuttings, producing a controlled diameter hole for the pressuremeter probe. A positive water head was kept inside the surface casing throughout drilling and in-situ testing procedures. In general, the drilling fluid remained at the top of casing.

Pre-boring pressuremeter testing was completed using a TEXAM unit. The testing procedure was in general accordance with Procedure B, volume-controlled loading, as outlined in the ASTM D 4719-00 Standard Test Method for Pre-bored Pressuremeter Testing of Soils. The testing equipment was calibrated for pressure and volume losses as indicated in the above-mentioned standard. The Records of Calibration for the PMT probes utilized in this job are attached on Appendix Three. The control unit was de-aired prior to every test. Also, checks were completed to ensure that the probe, tubing, and control unit assembly were fully saturated, and that the probe membrane was leakage-free at high pressures. Two readings were taken for each volume step, namely for time delays of 15, and 30 seconds.

Test procedures also included completion of up to two unload-reload cycles per test, wherever possible.

Probe and pressure gauge calibration data is included in Appendix Three and Appendix Four, respectively.

3. Pressuremeter Test Results

3.1 PMT test parameters

Pressuremeter test data is presented in Appendix One, and the summary of test results are illustrated in Table No. 1, below.

3.2 PMT-Inferred soil parameters

A general guideline to interpret and infer soil properties based on available PMT test data is attached to Appendix Two. This guideline suggests accepted current procedures to estimate or infer shear strength, deformation properties, and other related soil parameters. These inferred properties are summarized in Table No. 2 below.

It is recognized that the values of in-situ total horizontal stresses, σ_{ho} , presented in this report correspond to best possible estimates. These estimates were obtained using the *corrected pressure* versus *1/Volume* method and are used in this report to infer values of the at-rest stress ratio k_0 . The following subsurface soil conditions were assumed to apply:

- Ground Surface and Ground Water elevations: as indicated on Table No. 2 below
- Average wet and saturated unit weights: $\gamma_{wet} = 20 \text{ kN/m}^3$ and $\gamma_{sat} = 21 \text{ kN/m}^3$
- Total horizontal stresses taken as direct values of p_0 (PMT test results).

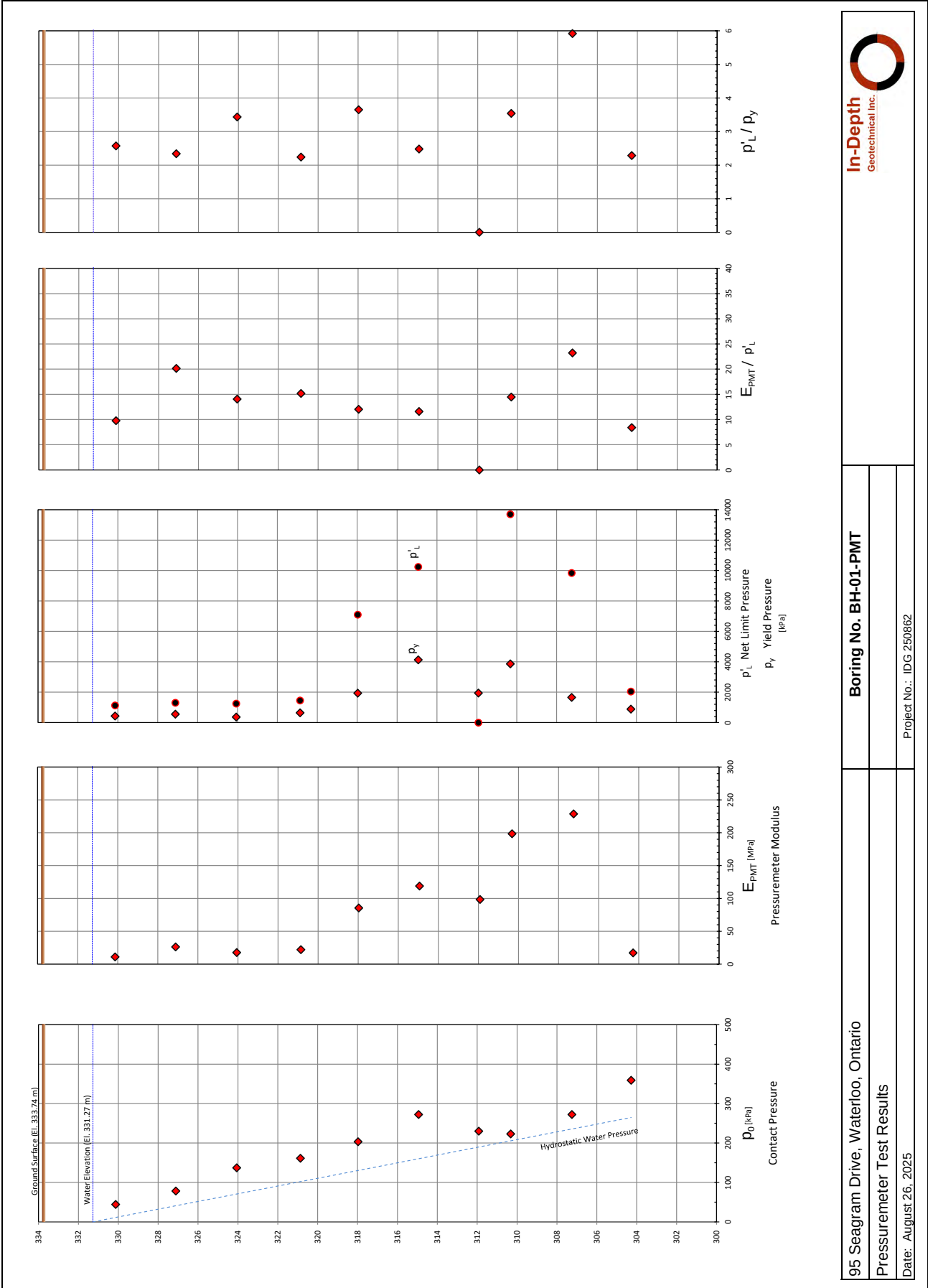
It is considered that stresses within the soil mass are defined by geostatic conditions, that is to say:

1. No surcharges are applied on the surface (structural loads from existing buildings nearby are negligible),
2. Static groundwater conditions (no seepage occurs),
3. Surface topography is horizontal (no slopes or excavations), and
4. Total vertical stresses are defined by the *wet* (unsaturated soils) and *saturated* (submerged soils) unit weights, γ_{wet} and γ_{sat} , respectively.

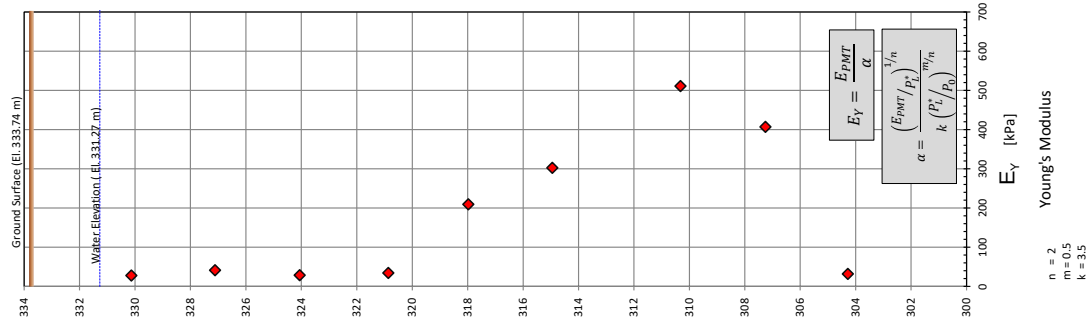
It must be mentioned that those geostatic conditions mentioned above, do not consider the actions of overconsolidation, nor the effects related to the evapo-transpiration process typically acting on surficial soil deposits.

Using the *Pressiorama* and the associated *Pressiorama Cyclique Charts* inferred values of Young's Moduli (E_v), Classification Index (I_c), and drained friction angle (ϕ') are also shown in Table No. 2.

Boring No. BH-01-PMT																			
TABLE No. 1 Summary of Pressuremeter Test Results																			
Test No.	Surface Elevation (m): 333.50 (assumed)		Contact Pressure p_0	PMT Modulus E_{PMT}	Unload - Reload Cycles										Yield Pressure p_y	Net Limit Pressure p^*_L	E_{PMT} / p^*_L	p^*_L / p_y	
	Depth	Elevation			[m]	Stresses			Strains			$\Delta R/R_0$							
						$E_{Unload\ 1}$	$E_{Reload\ 1}$	Point 1	Point 2	Point 3	Point 1	Point 2	Point 3						
						$E_{Unload\ 2}$	$E_{Reload\ 2}$												
						[MPa]	[MPa]	[kPa]	[kPa]	[kPa]	[kPa]	[kPa]	[kPa]	[kPa]					[kPa]
1	3.61	329.9	44	11.1	70.5	43.0	505.5	213.1	512.6	10.5	9.9	10.9	10.5	9.9	10.9	440	1133	9.8	2.6
2	6.63	326.9	78	26.3	96.5	49.6	667.7	300.0	657.5	13.2	12.6	13.6	13.2	12.6	13.6	557	1304	20.2	2.3
					89.6	51.5	660.9	295.8	664.5	9.5	8.9	10.0	9.5	8.9	10.0				
3	9.68	323.8	137	17.7	113.0	55.5	869.7	444.1	853.0	12.2	11.6	12.7	12.2	11.6	12.7	366	1257	14.1	3.4
					40.1	31.4	528.2	344.0	554.6	7.7	7.0	8.2	7.7	7.0	8.2				
4	12.88	320.6	161	22.1	49.3	32.8	722.0	509.6	734.6	10.4	9.8	10.9	10.4	9.8	10.9	648	1454	15.2	2.2
					52.9	38.8	844.6	607.4	870.0	7.6	7.0	8.1	7.6	7.0	8.1				
5	15.77	317.7	203	85.5	58.5	37.0	1050.4	802.0	1059.0	10.3	9.7	10.8	10.3	9.7	10.8	1944	7099	12.0	3.7
					524.7	193.1	1943.9	730.5	1834.1	11.0	10.7	11.5	11.0	10.7	11.5				
6	18.80	314.7	272	118.9	1290.5	337.9	3056.5	1358.8	2951.3	13.4	13.2	13.9	13.4	13.2	13.9	4130	10246	11.6	2.5
					3203.7	645.5	4130.2	2068.5	4186.5	13.1	13.0	13.6	13.1	13.0	13.6				
7	21.82	311.7	230	98.5	423.3	244.5	1950.6	921.9	2028.4	16.4	16.0	16.8	16.4	16.0	16.8	1951	> 5661	< 17.4	> 2.9
8	23.42	310.1	223	198.5	1694.4	771.9	3868.9	1773.8	4152.3	11.6	11.4	11.9	11.6	11.4	11.9	3869	13703	14.5	3.5
9	26.49	307.0	272	228.7	727.8	403.1	2525.4	960.3	2727.8	10.1	9.7	10.5	10.1	9.7	10.5	1663	9843	23.2	5.9
10	29.46	304.0	359	17.2	61.1	39.4	1401.0	1149.9	1413.4	13.1	12.4	13.5	13.1	12.4	13.5	894	2044	8.4	2.3
					69.1	40.4	1605.2	1335.8	1606.4	15.7	15.1	16.1	15.7	15.1	16.1				



PMT-Inferred Parameters										Boring No. BH-01-PMT			
PMT Test	z depth	z _w water	Hydrostatic Pressure	Total Stresses		Effective Stresses		Stress Ratio	Young's Modulus α Menard's Parameter	Shear Strength		Classification Index	
				Vertical	Horizontal	Vertical	Horizontal			Undrained	Drained		
No.	[m]	[m]	[kPa]	[kPa]	[kPa]	[kPa]	[kPa]	k	[MPa]	c _u [kPa]	φ' [degrees]	I _c	
1	3.61	-3.39	0	72	44	72	44	0.61	0.40	174	32	2.83	
2	6.63	-0.37	0	133	78	133	78	0.59	0.63	201	27	2.53	
3	9.68	2.68	26	196	137	170	111	0.65	0.62	193	24	2.33	
4	12.88	5.88	58	263	161	206	103	0.50	0.64	224	24	2.31	
5	15.77	8.77	86	324	203	238	117	0.49	0.41	1092	33	2.93	
6	18.80	11.80	116	388	272	272	156	0.57	0.39	1576	34	2.96	
7	21.82	14.82	145	451	230	306	85	0.28					
8	23.42	16.42	161	485	223	324	62	0.19	0.39	2108	36	3.14	
9	26.49	19.49	191	549	272	358	81	0.23	0.56	1514	32	2.85	
10	29.46	22.46	220	612	359	391	139	0.35	0.54	314	23	2.22	
Notes													
1. Assumed Ground surface elevation (m)				333.50		Assumed Water elevation 1326.50		Assumed Water depth (m)		7.00			
2. Wet unit weight of soil				20.0		[kN/m ³]		Saturated unit weight of soil		21.0		[kN/m ³]	
3. Observations on Shear Strength Parameters (SSP): SSP are considered either for Undrained Conditions (Short Term) or Drained Conditions (Long Term). These two conditions are mutually exclusive. Undrained Conditions imply cohesion is c_u , and φ = 0. Drained Conditions imply negligible cohesion or c'=0, and φ = φ' Based on the Classification Index I_c (Soil Behavior Type), the suggested values of the SSP are highlighted in green (Thick box border)													
4. The Classification Index parameter, I _c , is indicative of the soil type of behavior. It does not exactly relate to the Soil Classification types as those obtained via Grain-Size Distribution analyses. I _c varies from 1.0 to 4.5, from soft clays (cohesive) to dense coarse sands (frictional), correspondingly.													



95 Seagram Drive, Waterloo, Ontario	Boring No. BH-01-PMT	 In-Depth Geotechnical Inc.
PMT - Inferred Soil Parameters		
Date: August 26, 2025		

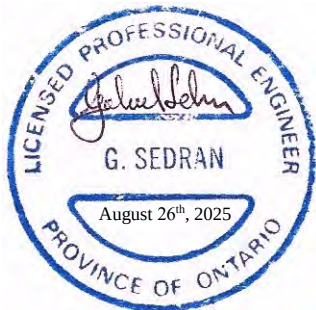
4. Closure

The subsoils data presented in this report is based on in-situ PMT testing and interpretation procedures. It should be noted that soil conditions may vary within the site and interpreted data may not be entirely representative of conditions at locations away from the tested boring. Therefore, care should be exercised when extrapolating or inferring subsoil conditions away from the borehole location.

We trust that the present report fulfills your requirements. Should you have any questions, please feel free to contact the undersigned.

Sincerely,

In-Depth Geotechnical Inc.



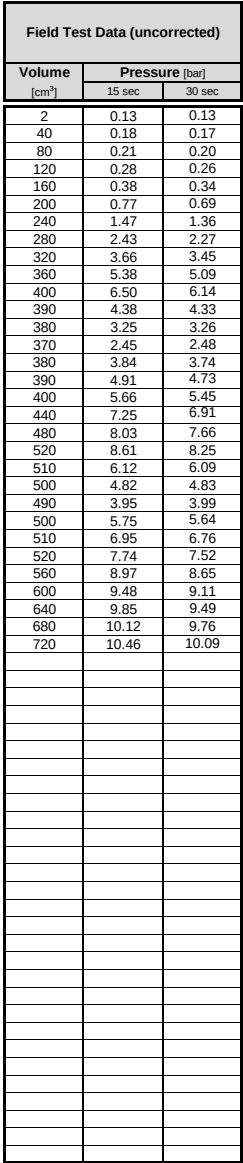
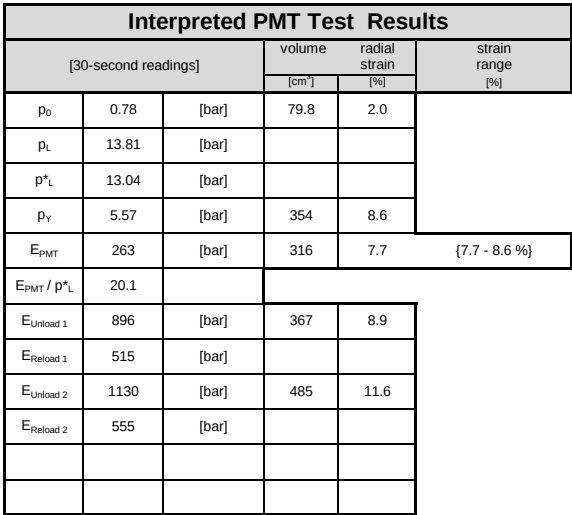
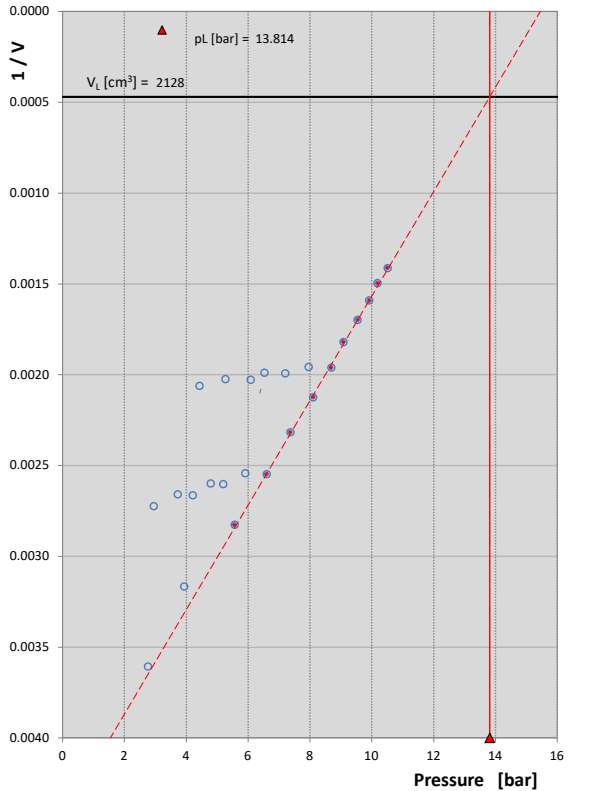
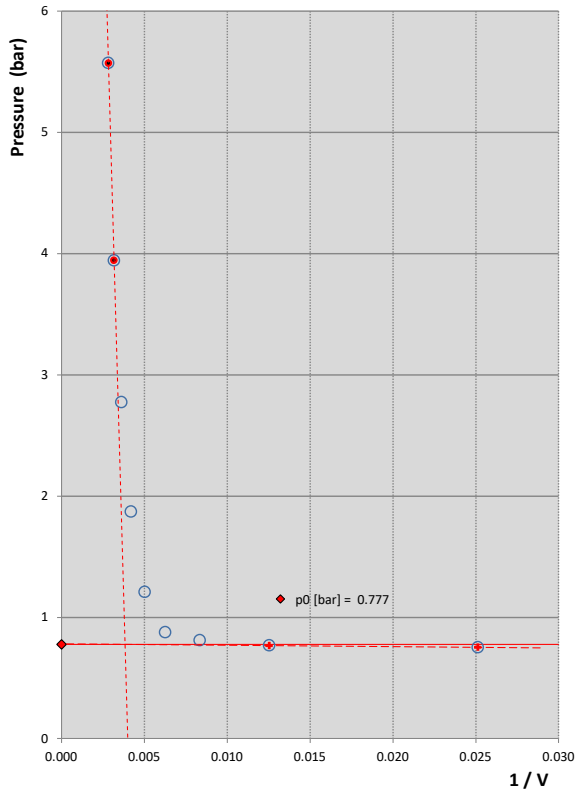
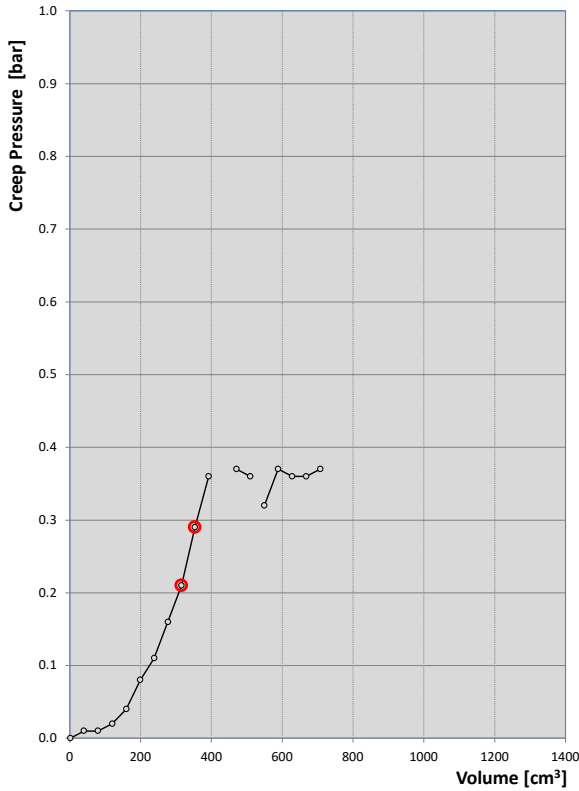
Gabriel Sedran, P.Eng., Ph.D.
President

Appendix One

Pressuremeter Results - Data

BH PMT-01

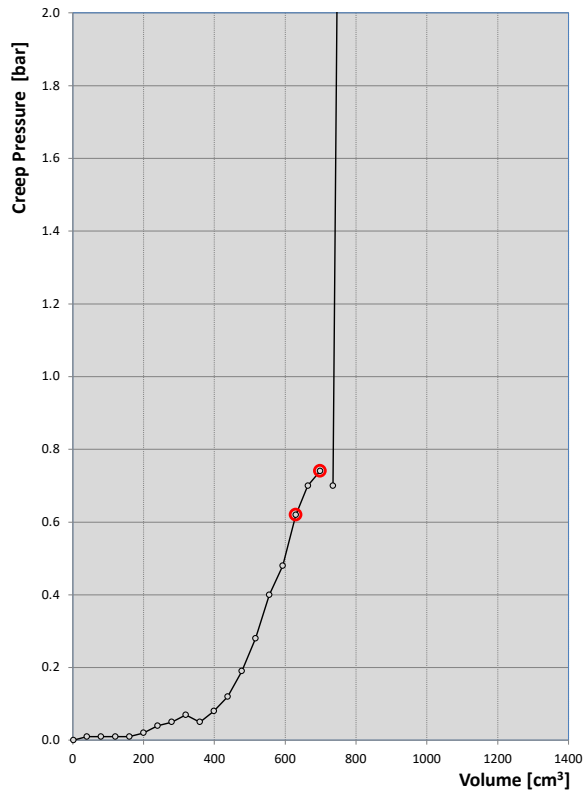
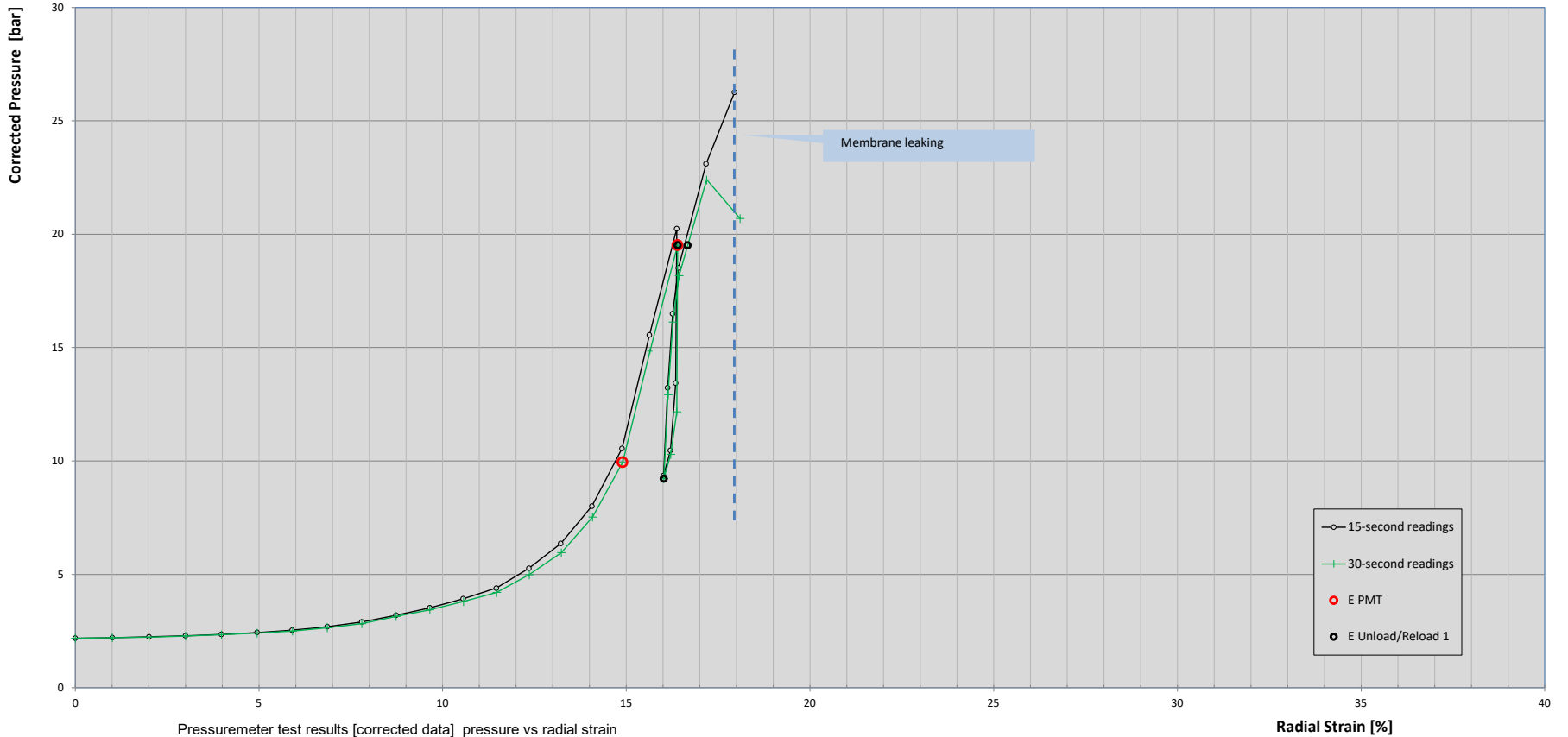
pages 1 to 10

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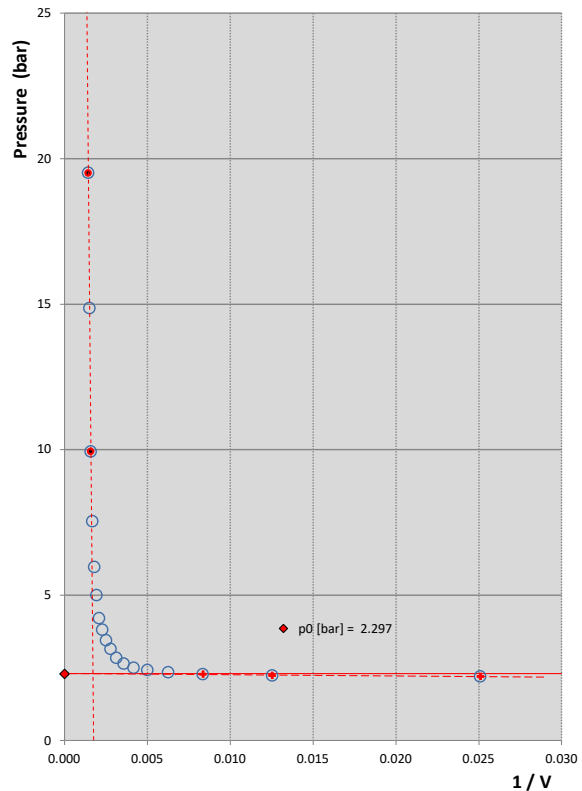
Pressuremeter Equipment: TEXAM Model		Probe Designation : NX Probe (76 mm OD)		Drilling Method: Mud Rotary Drilling		Test Date: August 7, 2025		Project: 95 Seagram Drive, Waterloo, Ontario		PMT TEST No.: 2		In-Depth Geotechnical Inc. 	
Volume-controlled test- ASTM D4719-Method B		Probe No.: B 540 Calibration Record No.: II		Drilling Bit: Tricone Drilling Company: Davis Drilling		Test Depth [m]: 6.63							
Volume increments: 40 cm³		Tubing Length: 120 [ft]		Time elapsed from hole drilling to testing ~ 5 minutes		Digital Pressure Gauge		Model: Additel 680A - 20-GP2K-PSI-N		Client: Chung & Vander Doelen Engineering Ltd.			
Maximum Volume: 1400 cm³		Probe Length: 0.46 [m]		Engineer: Gabriel Sedran, P.Eng., Ph.D.		Capacity: 2000 psi (~138 bar)		Serial number: 218A 2403 3078					
Maximum Pressure: 100 bar		Probe Initial Volume: 1968 cm³		Operator: Agustín Sedran-Enríci									
In-Depth Geotechnical Project No.: IDG 250862												Borehole No.: PMT-1	



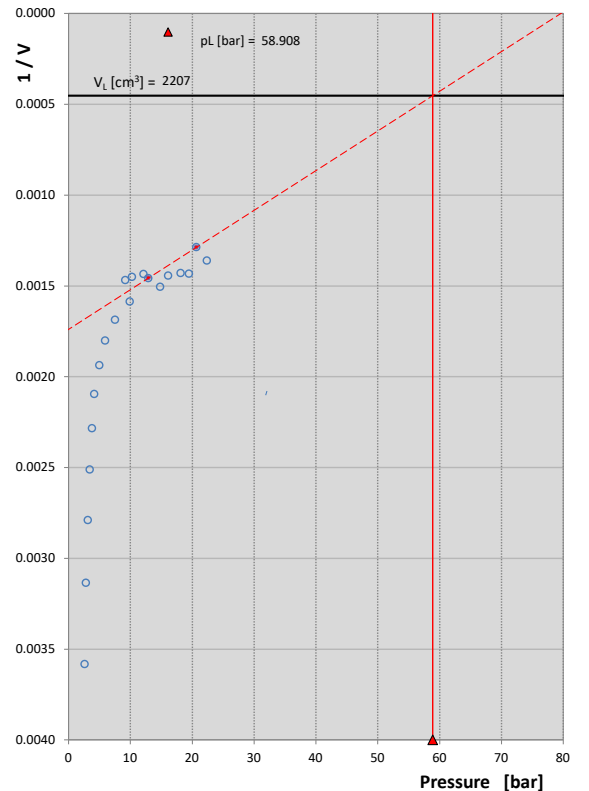
Field Test Data (uncorrected)			Corrected Test data						Creep		Auxiliary Data	
Volume [cm³]	Pressure [bar]		15-second readings			30-second readings			Volume [cm³]	Δp_{30-15} [bar]	30 sec	
	15 sec	30 sec	Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]	Pressure [bar]	Volume [cm³]	$\Delta r/r_0$ [%]			Pressure [bar]	1 / V
2	0.09	0.09	2.18	2	0.00	2.18	2	0.00	2	0.00	2.18	0.52970
40	0.14	0.13	2.21	39.8	1.01	2.20	39.8	1.01	39.8	0.01	2.20	0.02510
80	0.19	0.18	2.25	79.8	2.01	2.24	79.8	2.01	79.8	0.01	2.24	0.01254
120	0.25	0.24	2.29	119.7	3.00	2.28	119.7	3.00	119.7	0.01	2.28	0.00835
160	0.33	0.32	2.35	159.6	3.98	2.34	159.6	3.98	159.6	0.01	2.34	0.00627
200	0.43	0.41	2.44	199.5	4.95	2.42	199.5	4.95	199.5	0.02	2.42	0.00501
240	0.54	0.50	2.54	239.3	5.91	2.50	239.4	5.91	239.4	0.04	2.50	0.00418
280	0.70	0.65	2.69	279.1	6.86	2.64	279.2	6.86	279.2	0.05	2.64	0.00358
320	0.92	0.85	2.90	318.9	7.80	2.83	318.9	7.80	318.9	0.07	2.83	0.00314
360	1.22	1.17	3.19	358.5	8.73	3.14	358.5	8.73	358.5	0.05	3.14	0.00279
400	1.56	1.48	3.52	398.1	9.65	3.44	398.2	9.65	398.2	0.08	3.44	0.00251
440	1.97	1.85	3.92	437.5	10.56	3.80	437.7	10.56	437.7	0.12	3.80	0.00228
480	2.45	2.26	4.39	476.9	11.46	4.20	477.2	11.47	477.2	0.19	4.20	0.00210
520	3.33	3.05	5.27	515.9	12.35	4.99	516.2	12.35	516.2	0.28	4.99	0.00194
560	4.43	4.03	6.36	554.5	13.22	5.96	555.0	13.23	555.0	0.40	5.96	0.00180
600	6.08	5.60	8.01	592.4	14.06	7.53	593.0	14.08	593.0	0.48	7.53	0.00169
640	8.63	8.01	10.55	629.2	14.88	9.93	630.0	14.90	630.0	0.62	9.93	0.00159
680	13.63	12.93	15.55	663.0	15.63	14.85	663.9	15.65	663.9	0.70	14.85	0.00151
720	18.33	17.59	20.25	697.2	16.37	19.51	698.1	16.39	698.1	0.74	19.51	0.00143
710	11.52	10.25	13.44	695.6	16.34	12.17	697.2	16.38	12.17	0.00143	12.17	0.00143
700	8.54	8.38	10.46	689.4	16.20	10.30	689.6	16.21	10.30	0.00145	10.30	0.00145
690	7.44	7.30	9.36	680.7	16.02	9.22	680.9	16.02	9.22	0.00147	9.22	0.00147
700	11.31	11.01	13.23	685.9	16.13	12.93	686.3	16.14	12.93	0.00146	12.93	0.00146
710	14.57	14.21	16.49	691.8	16.26	16.13	692.3	16.27	16.13	0.00144	16.13	0.00144
720	16.60	16.25	18.52	699.3	16.42	18.17	699.8	16.43	18.17	0.00143	18.17	0.00143
760	21.19	20.49	23.10	733.6	17.17	22.40	734.5	17.19	22.40	0.00136	22.40	0.00136
800	24.35	18.78	26.26	769.7	17.95	20.69	776.6	18.10	20.69	0.00129	20.69	0.00129



Pressure difference from 15 to 30 sec. readings $\Delta p_{[15-30 \text{ sec}]}$



Determination of total contact pressure p_0



Determination of Limit Pressure p_L

Interpreted PMT Test Results				
[30-second readings]			volume [cm³]	radial strain [%]
p_0	2.30	[bar]	119.7	3.0
p_L	>58.91	[bar]		
p^*_L	>56.61	[bar]		
p_V	19.51	[bar]	698	16.4
E_{PMT}	985	[bar]	630	14.9
E_{PMT} / p^*_L	>17.4			{14.9 - 16.4 %}
$E_{Unload 1}$	4233	[bar]	681	16.0
$E_{Reload 1}$	2445	[bar]		

Pressuremeter Equipment: TEXAM Model	Probe Designation : NX Probe (76 mm OD)	Drilling Method: Mud Rotary Drilling	Test Date: August 8, 2025	Project: 95 Seagram Drive, Waterloo, Ontario	PMT TEST No.: 7	In-Depth Geotechnical Inc.
Volume-controlled test- ASTM D4719-Method B	Probe No.: B 540	Drilling Bit: Tricone	Test Depth [m]: 21.82	Client: Chung & Vander Doelen Engineering Ltd.	Borehole No.: PMT-1	
Volume increments: 40 cm³	Calibration Record No.: II	Drilling Company: Davis Drilling	Digital Pressure Gauge	In-Depth Geotechnical Project No.: IDG 250862		
Maximum Volume: 1400 cm³	Tubing Length: 120 [ft]	Time elapsed from hole drilling to testing ~ 5 minutes	Model: Addital 680A - 20-GP2K-PSI-N			
Maximum Pressure: 100 bar	Probe Length: 0.46 [m]	Engineer: Gabriel Sedran, P.Eng., Ph.D.	Capacity: 2000 psi (~138 bar)			
	Probe Initial Volume: 1968 cm³	Operator: Agustin Sedran-Enrici	Serial number: 218A 2403 3078			

Appendix Two

Pressuremeter Data Interpretation

Interpretation of Pressuremeter Test Results

Prebored pressuremeter test results are expressed in terms of applied pressure versus radial strain. Both pressure and strain measurements must be corrected for pressure and volume losses using the corresponding probe and system calibration curves.

The typical pressure versus radial strain curve features up to four distinctive portions which characterize the stress-strain behaviour of the soil, namely:

- The linear pseudo-elastic stress-strain portion of the deformation curve;
- The departure from linear elastic conditions starting at the yield pressure p_y ;
- The unload-reload portion of the test (usually two cycles are performed); and
- The development of soil failure, which is represented by the net limit pressure p^*_L .

Based on these test features the following soil parameters are determined or estimated:

1. Contact Pressure p_o :

When using the prebored TEXAM unit, the initial contact pressure is taken as the pressure at the intersection of the two lines representing the pseudo elastic and the initial expansion portions of the pressure vs. $1/V$ plot, as shown in the PMT data sheets, in Appendix One.

2. Pressuremeter modulus E_{PMT} :

The pressuremeter modulus is represented by the slope of the pressure versus radial strain curve along its linear portion, and may be calculated as follows:

$$E_{PMT} = (1 + \nu)(p_2 - p_1) \frac{\left(1 + \left(\frac{\Delta R}{R_o}\right)_2\right)^2 + \left(1 + \left(\frac{\Delta R}{R_o}\right)_1\right)^2}{\left(1 + \left(\frac{\Delta R}{R_o}\right)_2\right)^2 - \left(1 + \left(\frac{\Delta R}{R_o}\right)_1\right)^2}$$

where the sub-indices 1 and 2 indicate the beginning and the end of the linear portion of the curve, respectively. These two points are shown in pressuremeter curves with two red oversized circles. For the self-boring probe, the linear portion of the stress-strain response occurs between the very first data point (zero volume increase) and the subsequent two or three data points.

In this determination a value of the Poisson's ratio, typically $\nu = 0.33$ for most soils, must be assumed. For saturated clays a value of $\nu = 0.45$ is suggested.

3. Yield Pressure p_y :

The yield pressure indicates the end of the linear pseudo-elastic deformations and the onset of plasticity. This yield pressure is useful in indicating beyond which pressure significant creep deformations may occur.

4. Unload-Reload Moduli E_{Unload} and E_{Reload}

The unload and reload moduli are represented by the slope of the unload-reload loop, and they may be used to determine elastic soil deformations upon unloading or reloading conditions such as those typically encountered during excavations.

5. Net Limit Pressure p_L^* :

The net limit pressure is a measure of the strength of the soil (either under undrained conditions for cohesive soils, or drained conditions for non-cohesive soils). This parameter is defined as the pressure reached when the soil cavity has been extended to twice its original soil cavity volume V_c (minus the initial total contact pressure p_0).

The limit pressure is not always attained during testing. In such cases, the value of p_L is inferred by plotting pressure versus $1/V$ for the plastic phase of the deformations. This method of inferring p_L , known as the “upside down curve” method, is described in “*The Pressuremeter and Foundation Engineering*” textbook, by F. Baguelin, J.F. Jezequel, and D.H. Shields, published in 1978 by Trans Tech Publications, Section: Methods of extrapolating pressuremeter curves to p_L . See also ASTM D4719-00, Section 10.6.

It should be noted that radial strains are calculated from the volume of fluid (typically tap water) injected into the probe. In this regard, the radial strains shown in the results are related to the probe expansion, not the cavity’s expansion. The cavity initial volume, V_c , is calculate by adding the probe initial volume, V_0 , to the volume of water injected into the probe at the initial contact pressure p_0 .

6. Some Additional PMT-based Parameters

In addition, two useful ratios, (E_{PMT}/p_L^*) and (p_L^*/p_y) , may be used as a general guideline for soil identification, as follows:

for sands $7 < E_{PMT}/p_L^* < 12$

for clays $12 < E_{PMT}/p_L^*$

Many PMT tests completed in the glacial tills present in the geology of the Golden Shoe area (Ontario) registered much higher values than those listed above. In many cases, values for E_{PMT}/p_L^* in excess of 30 have been recorded.

The E_{PMT} / p_L^* value is known as the *mechanical ratio*, and it indicates whether a soil mass behaves in a ductile (high value) or brittle (low value) manner after yield stresses have been reached. This ratio is the PMT equivalent of the soil mechanic's Rigidity Index, e.g., G/σ_{max} .

Inferred Soil Parameters

7. Young's Modulus E_Y

The Pressuremeter modulus E_{PMT} corresponds to large strains, namely for radial strains in the 2 to 5 % range, and it is therefore considered to be a relatively low value of the elastic modulus. In practice, the Young's modulus E can be inferred from Pressuremeter testing using the empirical Menard α factor:

$$E_Y = E_{PMT} / \alpha$$

Typical values of the Menard α factor are suggested in the following Table:

Soil type	Peat		Clay		Silt		Sand		Sand and gravel	
	E/p_L^*	α	E/p_L^*	α	E/p_L^*	α	E/p_L^*	α	E/p_L^*	α
Over consolidated		1	> 16	1	> 14	2/3	> 12	1/2	> 10	1/3
Normally consolidated	For all values	1	9-16	2/3	8-14	1/2	7-12	1/3	6-10	1/4
Weathered and/or remoulded		1	7-9	1/2		1/2		1/3		1/4
Rock	Extremely fractured				Other			Slightly fractured or extremely weathered		
	$\alpha = 1/3$				$\alpha = 1/2$			$\alpha = 2/3$		

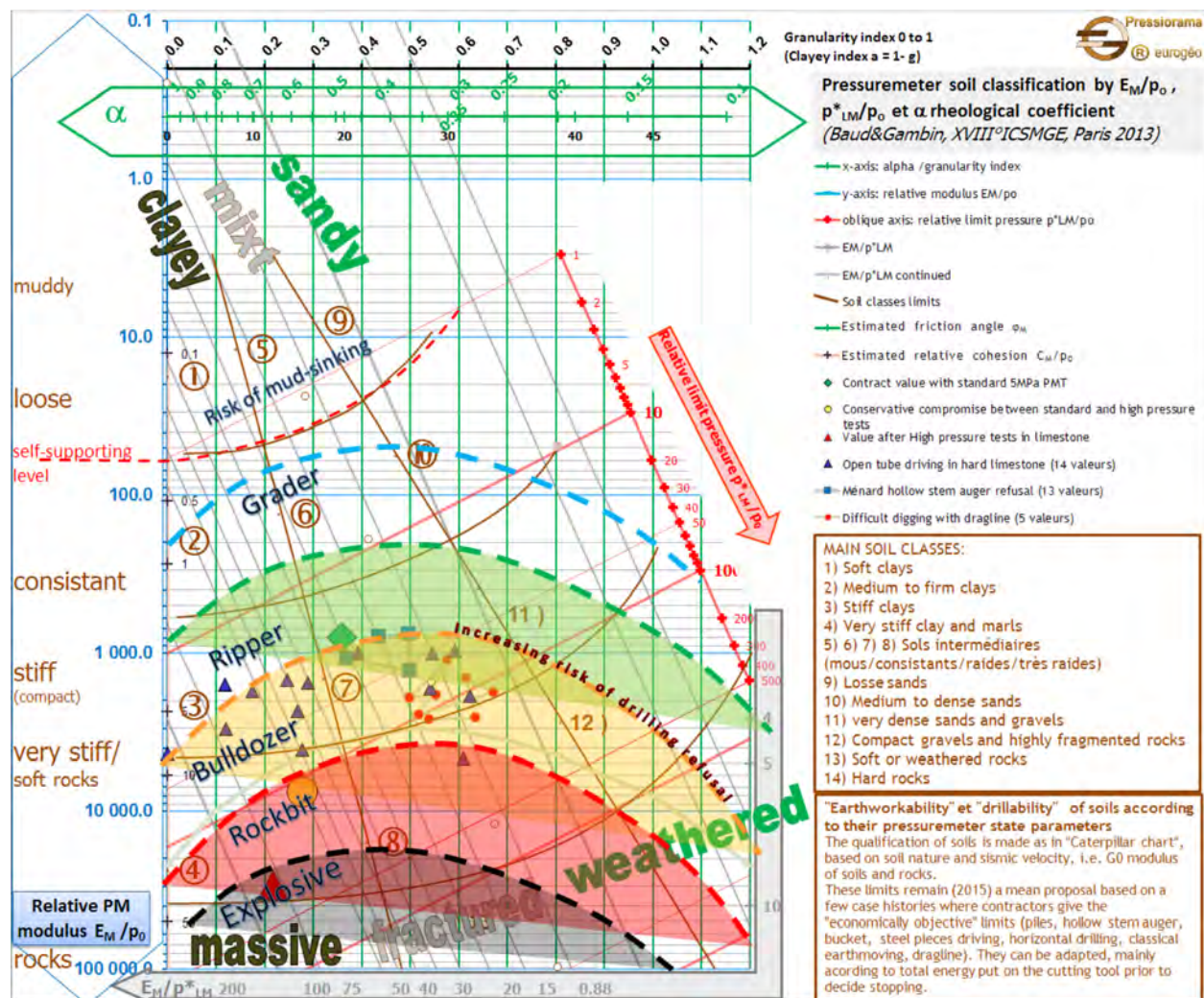
(from 'The Pressuremeter', J.L. Briaud. Balkema, 1992)

Alternatively, better-defined values of the Menard α parameter can be obtained using the following expression, as introduced by J.P. Baud

$$\alpha = \frac{\left(E_{PMT}/p_L^*\right)^{1/n}}{k_E \left(\frac{p_L^*}{p_0}\right)^{m/n}}$$

With $n = 2$; $m = 0.5$; and $k_E = 3.5$.

This expression is based on empirical correlations and may also be visualized in the Pressiorama Chart illustrated in the next page:



Baud J.P., and Gambin M. 2013. "Détermination du coefficient rhéologique α de Ménard dans le diagramme Pressiorama". Proceedings of the 18th International Conference on Soil Mechanics and Geotechnical Engineering, Paris, 2013, Parallel Session ISP 6, International Symposium on the Pressuremeter.

8. Undrained Shear Strength for Cohesive Soil Materials

The undrained shear strength of cohesive soils, c_u or S_u , may be estimated as:

$$c_u = \frac{P'_L}{\beta}$$

where P'_L is the net Limit Pressure; a value of $\beta = 6.5$ is used in this report, after J.L. Briaud ('The Pressuremeter', Balkema, 1992).

9. Drained Friction Angle for Cohesionless Soil Materials

The drained friction angle of cohesionless soils (for $c' = 0$) may be estimated using the empirical correlations illustrated in the graph shown below. This approach is outlined by Baguelin et.al., in “*The Pressuremeter and Foundation Engineering*” (F. Baguelin; J.F. Jézéquel; and D.H. Shields. TransTech Publications. 1978), and it requires some knowledge on the state or conditions of the cohesionless material. This approach only provides a likely range of friction angles for recorded values of the limit pressure.

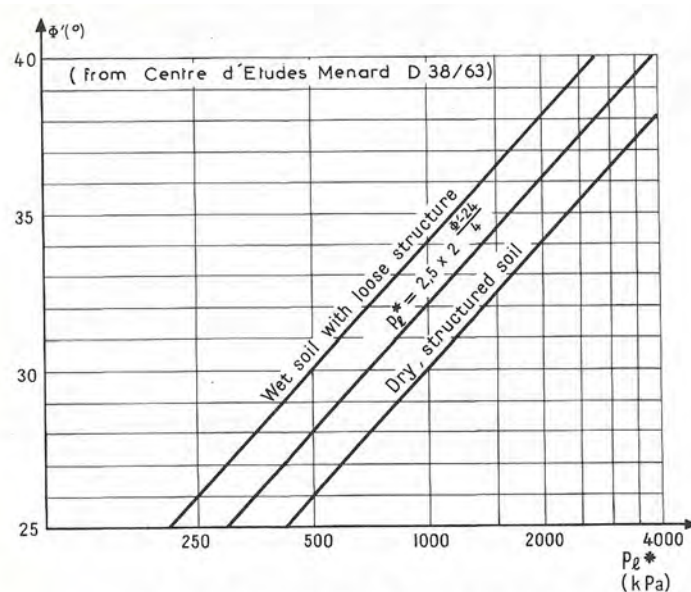


Fig. 6-86: MÉNARD's graph to determine Φ' from p_1^* .

Also alternatively, values of the drained friction angle ϕ' can be inferred using the modified Pressiorama Chart (*Pressiorama Cyclique*, in French) as introduced by Baud.

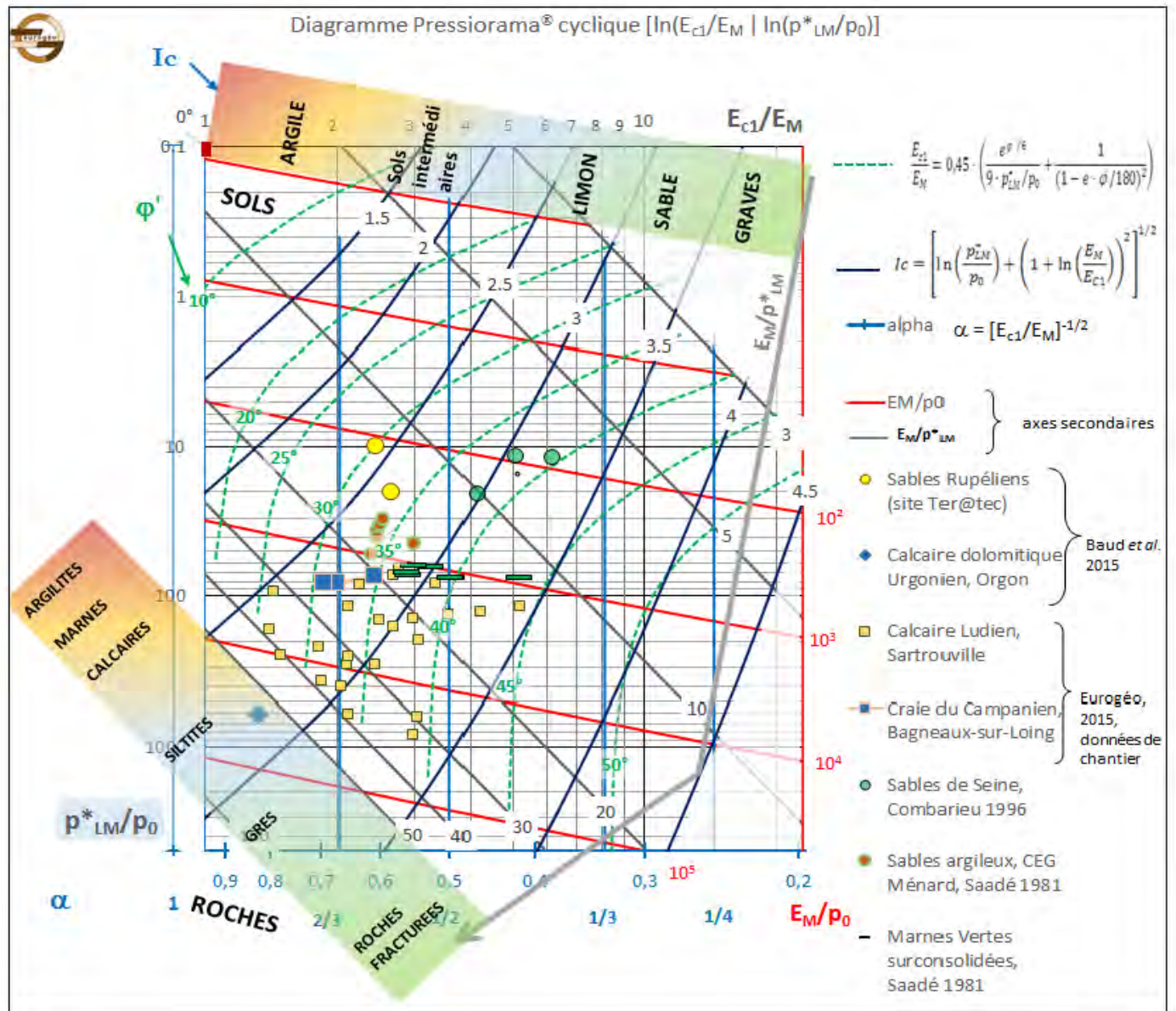


Figure 3. Diagramme Pressiorama® cyclique [$\ln(E_{c1}/E_M | \ln(p^*_{LM}/p_0)$].

The values of ϕ' plotted in the modified Pressiorama Chart are calculated with the following expression:

$$\phi' = 5.0 \ln \left(\frac{9}{\alpha^2} \frac{P_L^*}{p_0} \right)$$

with values of α calculated/inferred from the modified Pressiorama Chart.

Where this expression provides values of effective friction angle greater than a 45° , a maximum value of 45° should be assumed.

This expression was presented by J.P. Baud, in his publication “*Apport de L’Essai Cyclique a la Classification Pressiométrique des Sols et des Roches*”, Journées Nationales de Geotechnique et de Géologie de l’Ingénieur, Nancy, 2016.

Shear strength parameters suggested in Table No. 3, are based on the guidelines provided by the *Pressiorama* and *Cyclique Pressiorama* charts. It should be noted that these guidelines are subject to changes, or improvements, as the correlations between pressuremeter parameters E_M , p'_L , and p_0 are being adjusted by ever increasing amount of field data. As such, care should be used when using these suggested parameters.

10. Soil Classification Index

Based on PMT testing procedures, soil behavior may be characterized as cohesive or frictional (cohesionless). Using the modified Pressiorama Chart, a Soil Classification Index, namely I_c , can be inferred with the following expression:

$$I_c = \left[\left(1 + \log \left(P_L^* / p_0 \right) \right)^2 + (1 - \log(\alpha))^2 \right]^{1/2}$$

A minimum value of 1 would correspond to a cohesive soil, near its state of liquefaction. Whereas, a value of 4.5 would correspond to coarse gravel materials. A value of $I_c = 2.7$ would apply to a material which behaves mechanically as part frictional (drained for long-term loading conditions) and part cohesive (undrained for the short-term loading conditions). In general, Soil Type Behaviors corresponding to values of the Classification Index I_c are listed as:

1.0 to 1.5	Clays
1.5 to 2.5	Clay-Silt mixes
2.5 to 3.0	Silts
3.0 to 3.5	Sands
3.5 to 4.0	Gravels, and
4.0 to 4.5	Weathered Rocks

Appendix Three

Calibration Data

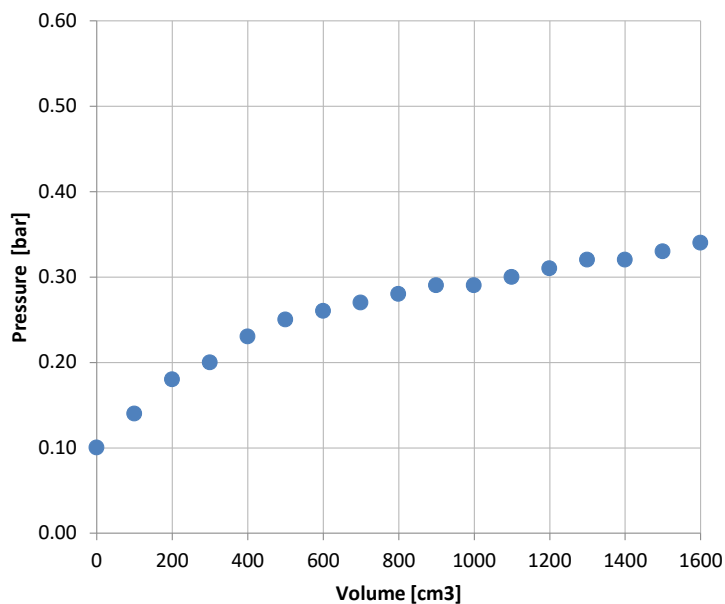
Calibration Date: August 7, 2025
 Probe Designation: B 540
 Calibration Record No.: II
 Length of Tubing: 120 feet
 Calibrated by: A.S.E.



Membrane stiffness calibration

Pressure [bar]	Volume cm ³
0.10	0
0.14	100
0.18	200
0.20	300
0.23	400
0.25	500
0.26	600
0.27	700
0.28	800
0.29	900
0.29	1000
0.30	1100
0.31	1200
0.32	1300
0.32	1400
0.33	1500
0.34	1600

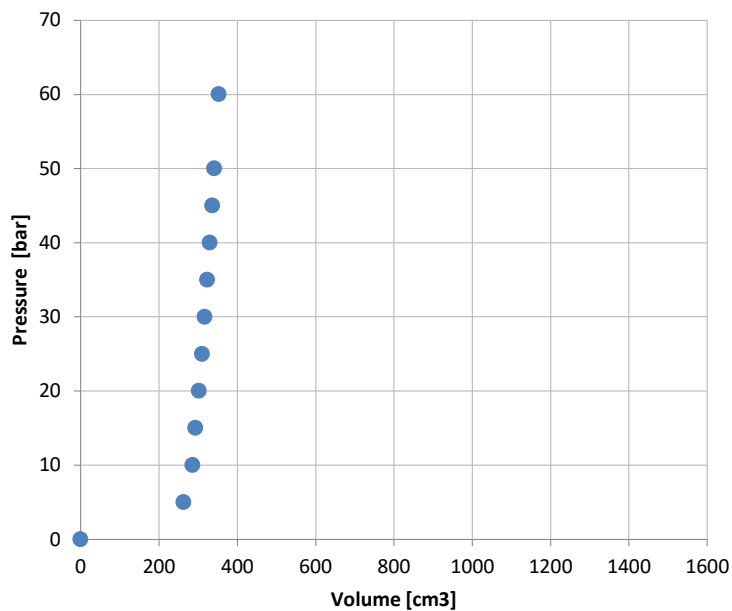
Membrane Stiffness (Air Calibration)



Volume calibration

Pressure [bar]	Volume cm ³
0	0.0
5	262.9
10	285.7
15	292.9
20	302.6
25	310.4
30	317.3
35	323.9
40	330.2
45	336.2
50	341.8
60	352.6
Reload Cal. Data	
25	324.5
50	342.2

System Stiffness (Compliance Calibration)



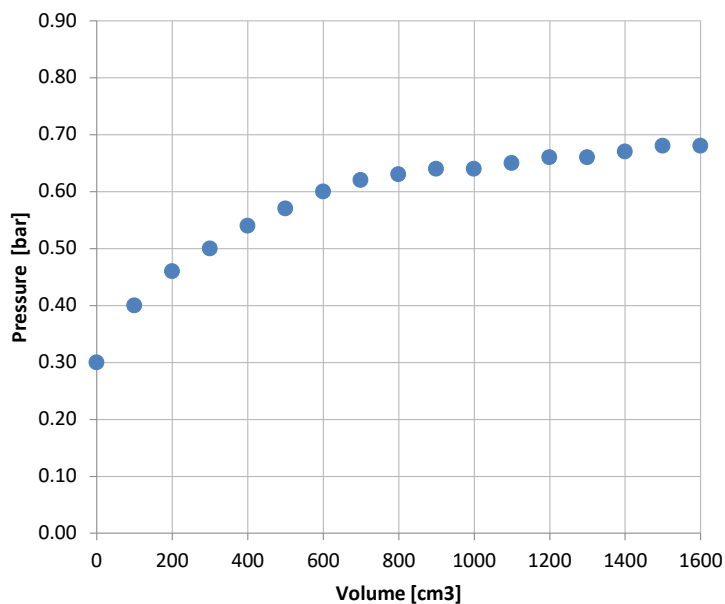
Calibration Date: July 14, 2025
 Probe Designation: A 541
 Calibration Record No.: I
 Length of Tubing: 180 feet
 Calibrated by: A.S.E.



Membrane stiffness calibration

Pressure [bar]	Volume cm ³
0.30	0
0.40	100
0.46	200
0.50	300
0.54	400
0.57	500
0.60	600
0.62	700
0.63	800
0.64	900
0.64	1000
0.65	1100
0.66	1200
0.66	1300
0.67	1400
0.68	1500
0.68	1600

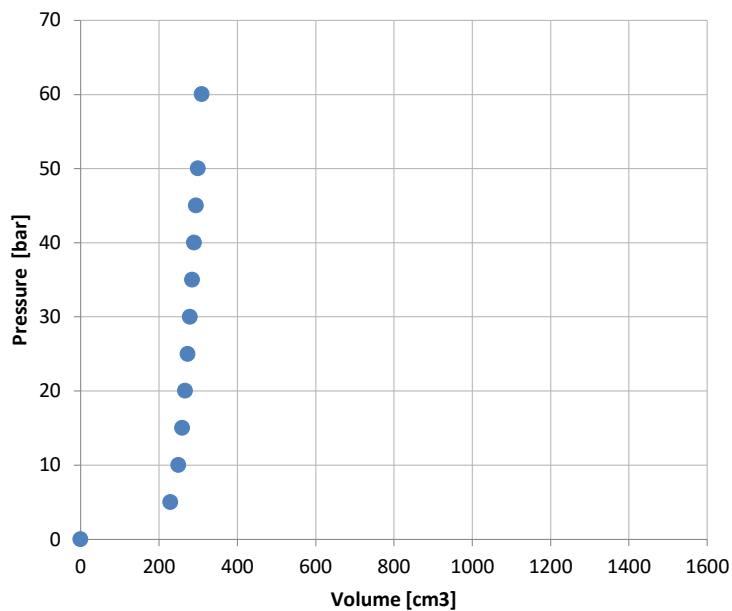
Membrane Stiffness (Air Calibration)



Volume calibration

Pressure [bar]	Volume cm ³
0	0.0
5	229.3
10	249.9
15	259.6
20	266.9
25	273.6
30	279.5
35	284.8
40	290.0
45	295.0
50	299.8
60	309.2
Reload Cal. Data	
25	277.8
50	300.1

System Stiffness (Compliance Calibration)



Appendix Four

Pressure Gauge Calibration Data

Digital Gauge No. 4 - ADT680-A – 2000 psi

Pages 1 to 4



Figure 1 - Digital Pressure Gauge – Front Face



Figure 2 – Digital Pressure Gauge Back Face - Label with Model and Serial No.



4

Certificate of Calibration



Model:	ADT680A-20-GP2K-PSI-N	Report Number:	N24121826
Description:	Digital Pressure Gauge	Calibration Date:	12/17/2024
Serial Number:	218A24033078	Due Date:	12/16/2025
Pressure Range:	(0 to 2000)psi	Temperature:	23.9°C
Accuracy(%FS):	0.2%FS	Humidity:	28% RH
Status:	New	Certificate Date:	12/18/2024
Procedure:	ADT680A;Lab3.4.0;ADT680AV4.0.02.14	Data Type:	As-Left
		Data Results:	In Tolerance
Customer:	Location of Calibration: Additel Corporation 2900 Saturn Street #B Brea CA 92821 United States		

Reference Standards used in this calibration are traceable to the SI Units through National Institute of Standards and Technology (NIST) or other recognized National Metrology Institutes (NMI's). This calibration is compliant to ISO/IEC 17025:2017 and ANSI/NCSL Z540-1:R2002.

By default, Additel reports the measurement result and its associated measurement uncertainty. When the measurement result is outside Additel's published specifications, it is indicated by a fail condition without taking the associated measurement uncertainty into consideration. Alternatively, if a compliance decision is desired taking the measurement uncertainty into account, Additel utilizes the ANSI Z540.3 Handbook Method 6 to make statements of conformity to specifications.

The results on this calibration report apply only to the item (s) calibrated or tested. Uncertainties of the measurements are based upon a coverage factor of $k=2$ providing an approximate 95% confidence level. The recommended calibration due date is included in the report only if it is specified by the customer.

This report shall not be used by the customer to claim product certification, approval, or endorsement by NVLAP, NIST, or any agency of the U.S. government. This report shall not be reproduced, except in full without written approval of Additel Corporation.

Standards Used

Model	Description	Serial Number	Cal Date	Due Date
ADT151-01RD-CP3.6KM	Additel Digital Pressure Module	DPSE0230260065	9/18/2024	1/20/2025

Comments:

Performed By: 
Kyle Bague

Approved By: 
Eric Chavier

Report Number: N24121826

Test Results

TestPoint	Reference	DUT	Difference	Specification	Uncertainty	Condition
psi	psi	psi	psi	psi	psi	
0.0	0.00	0.0	0.0	±4.0	1.2E-01	pass
500.0	500.00	500.0	0.0	±4.0	1.2E-01	pass
1000.0	1000.00	999.9	-0.1	±4.0	1.2E-01	pass
1500.0	1500.00	1499.9	-0.1	±4.0	1.6E-01	pass
2000.0	2000.00	1999.9	-0.1	±4.0	2.1E-01	pass
1500.0	1500.00	1500.0	0.0	±4.0	1.6E-01	pass
1000.0	1000.00	1000.0	0.0	±4.0	1.2E-01	pass
500.0	500.00	500.0	0.0	±4.0	1.2E-01	pass
0.0	0.00	0.0	0.0	±4.0	1.2E-01	pass

ENCLOSURES



Soil Abbreviations and Terms Used on Record of Borehole Sheets

TERMINOLOGY DESCRIBING COMMON SOIL TYPES:

Topsoil	-	mixture of soil and humus capable of supporting vegetation
Peat	-	mixture of visible and invisible fragments of decayed organic matter
Till	-	unstratified glacial deposit which may range from clay to boulders
Fill	-	soil materials identified as being placed anthropologically

CLASSIFICATION (UNIFIED SYSTEM)

Clay	<0.002mm
Silt	0.002 to .075mm
Sand	0.075 to 4.75mm
	Fine 0.075 to 0.425 mm
	Medium 0.425 to 2.0 mm
	Coarse 2.0 to 4.75 mm
Gravel	4.75 to 75mm
	Fine 4.75 to 19 mm
	Coarse 19 to 75 mm
Cobbles	75 to 300mm
Boulders	>300mm

TERMINOLOGY

Soil Composition	% by Weight
"traces"	<10%
"some"(eg. some silt)	10-20%
Adjective (eg. sandy)	20-35%
"and"(eg. sand and gravel)	35-50%

Standard Penetration Resistance (SPT): Standard Penetration Resistance ('N' Values) refers to the number of blows required to advance a standard (ASTM D1586) 51 mm Ø (2 inch) split-spoon sampler by the use of a free falling, 63.5 Kg (140lbs) hammer. The number of blows from the drop weight is recorded for every 15 cm (6 inches). The hammer is dropped from a distance of 0.76m (30 inches) providing 474.5 Joules per blow. When the sampler is driven a total of 45 cm (18 inches) into the soil, the standard penetration index ('N' Value) is the total number of blows for the last 30 cm (12 inches).

Dynamic Cone Penetration Resistance (DCPT): Dynamic Cone Penetration Resistance is similar to a SPT with the 474.5 Joule/blow impulse provided by the free falling hammer where the split-spoon sampler is replaced by a 51 mm Ø, 60° conical point and the number of blows is recorded continuously for every 30 cm (12 inches).

COHESIVE SOILS CONSISTENCY

	(kPa)	(P.S.F.)	Nominal 'N' Value
Very Soft	<12	<250	0-2
Soft	12-25	250-500	2-4
Firm	25-50	500-1000	4-8
Stiff	50-100	1000-2000	8-15
Very Stiff	100-200	2000-4000	15-30
Hard	>200	>4000	>30

RELATIVE DENSITY OF COHESIONLESS SOIL

	'N' Value
Very Loose	0-4
Loose	4-10
Compact	10-30
Dense	30-50
Very Dense	>50

MOISTURE CONDITIONS:

Cohesive Soil
DTPL- Drier than plastic limit
APL- About plastic limit
WTPL- Wetter than plastic limit
MWTPL- Much wetter than plastic limit

Cohesionless Soil
Damp
Moist
Wet
Saturated

SAMPLE TYPES AND ADDITIONAL FIELD TESTS

SS	Split Spoon Sample (obtained from SPT)	GS	Grab Sample	PP	Pocket Penetrometer
AS	Auger Sample	BS	Bulk Sample	VANE	Peak & Remolded shear
		TW	Thin Wall Sample or Shelby Tube	DMT	Flat Plate Dilatometer

LABORATORY TESTS

SG	Specific Gravity	S	Sieve Analysis	W	Water Content
H	Hydrometer	P	Field Permeability	K	Lab Permeability
W_p	Plastic Limit	W_L	Liquid Limit	I_p	Plasticity Index
GSA	Grain Size Analysis	C	Consolidation	UNC	Unconfined compression



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Enclosure A

FILE No: 1161

BOREHOLE No. 1



Client: 14688210 Canada Inc.

Project: Proposed 33-Storey Mixed-Use Building

Location: 87 - 95 Seagram Drive, Waterloo, Ontario

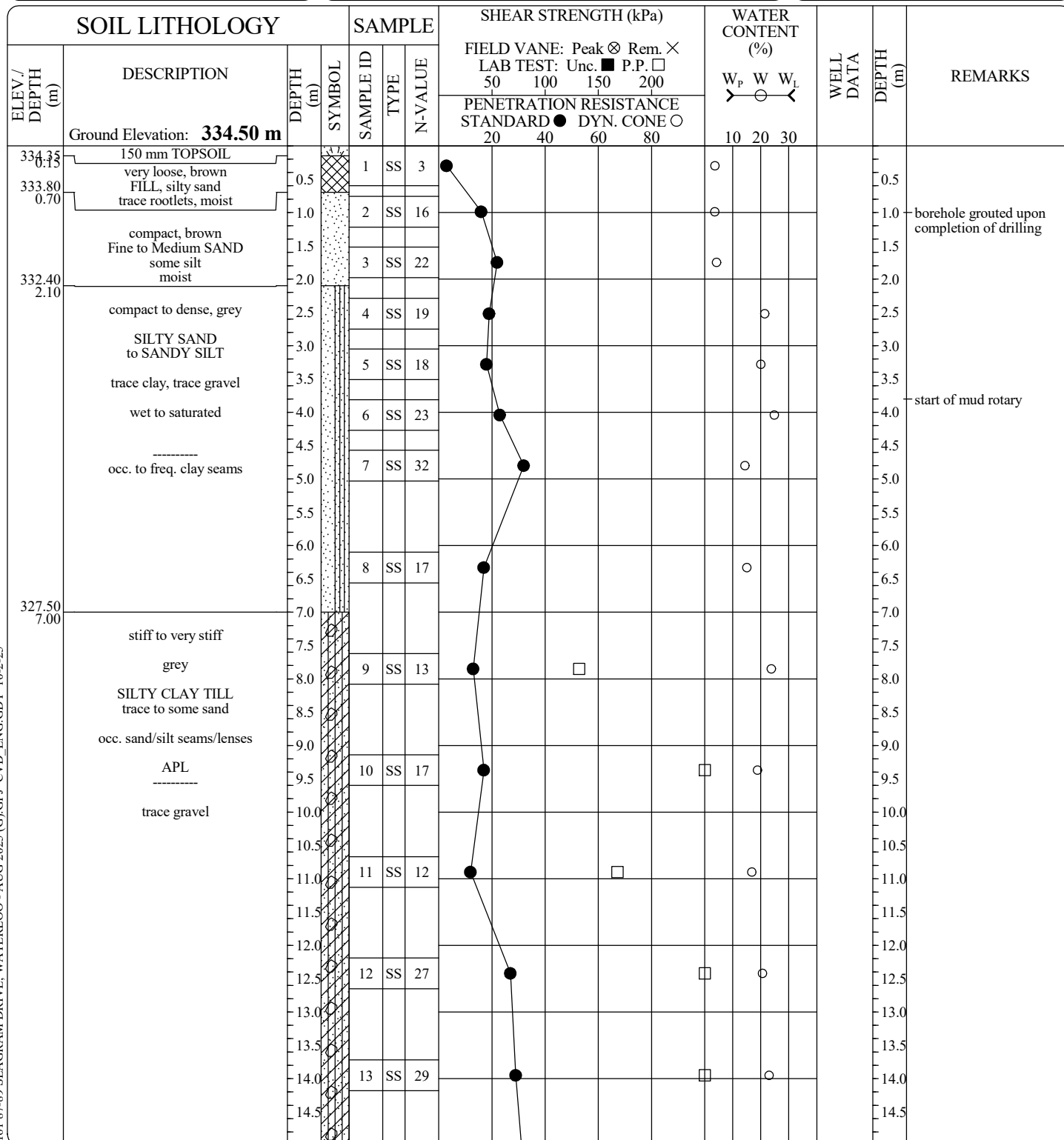
EQUIPMENT DATA

Machine: CME-55

Method: HSA / Mud Rotary

Size: 108 mm I.D.

Date: Jun 20 - 23 TO Jun 20 - 23



PROJECT MANAGER: NZ

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ENGINEERING LTD.

311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 1161

BOREHOLE No. 1



Client: **14688210 Canada Inc.**

Project: **Proposed 33-Storey Mixed-Use Building**

Location: **87 - 95 Seagram Drive, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME-55**

Method: **HSA / Mud Rotary**

Size: **108 mm I.D.**

Date: **Jun 20 - 23 TO Jun 20 - 23**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				WATER CONTENT (%) W _p W W _L						
							PENETRATION RESISTANCE STANDARD ● DYN. CONE ○				10 20 30						
318.65 15.85	----- sandy	15.5		14	SS	32											
	very dense grey SAND and SILT TILL trace gravel, trace clay occ. sand/gravel seams occ. cobbles moist	16.0															
		16.5															
		17.0		15	SS	50/ 140 mm											
		17.5															
		18.0															
		18.5		16	SS	50/ 140 mm											
		19.0															
		19.5															
		20.0															
		20.5															
		21.0															
		21.5		17	SS	50/ 50 mm											
	22.0																
	22.5																
	23.0																
	23.5																
	24.0																
309.90 24.60	End of Borehole	24.5		18	SS	50/ 75 mm											
		25.0															
		25.5															
		26.0															
		26.5															
		27.0															
		27.5															
		28.0															
		28.5															
		29.0															
		29.5															

PROJECT MANAGER: **NZ**

**CHUNG & VANDER DOELEN
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FILE No: 1161**BOREHOLE No. 2**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **HSA / Mud Rotary**Size: **108 mm I.D.**Date: **Jun 20 - 23 TO Jun 21 - 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				W _p W W _L					
							PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80				10 20 30					
Ground Elevation: 335.13 m																
335.00	100 mm TOPSOIL															
	very loose to loose brown	0.5		1	SS	3	●						○			
	FILL, sandy silt	1.0		2	SS	5	●						○		borehole grouted upon completion of drilling	
	trace gravel, trace rootlets	1.5		3	SS	5	●						○			
	occ. clay seams	2.0														
333.03	contains brick fragments															
2.10	moist															
	compact, brown	2.5		4	SS	16	●					○				
	Fine to Medium SAND, some silt	3.0														
	occ silt/clay seams/lenses	3.5		5	SS	16	●						○			
331.48	moist to saturated															
3.65	compact, grey	4.0		6	SS	16	●						○		start of mud rotary	
	SAND AND SILT to SILTY SAND	4.5														
	trace clay	5.0		7	SS	10	●					○				
	occ. clay seams	5.5														
	saturated	6.0														
		6.5		8	SS	13	●			□			○			
328.73	stiff to very stiff															
6.40	grey	7.0														
	SILTY CLAY TILL	7.5														
	trace to some sand, trace gravel	8.0		9	SS	19	●			□			○			
	occ. sand/silt seams/lenses	8.5														
	APL	9.0														
	interbedded saturated sand and silt layer	9.5		10	SS	20	●						○			
		10.0														
		10.5														
		11.0		11	SS	29	●					□	○			
		11.5														
		12.0														
		12.5		12	SS	20	●					□	○			
		13.0														
		13.5														
		14.0		13	SS	20	●			□			○			
		14.5														

borehole grouted upon completion of drilling

start of mud rotary

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Kitchener, Ontario N2H 5E1
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FILE No: 1161

BOREHOLE No. 2



Client: 14688210 Canada Inc.

Project: Proposed 33-Storey Mixed-Use Building

Location: 87 - 95 Seagram Drive, Waterloo, Ontario

EQUIPMENT DATA

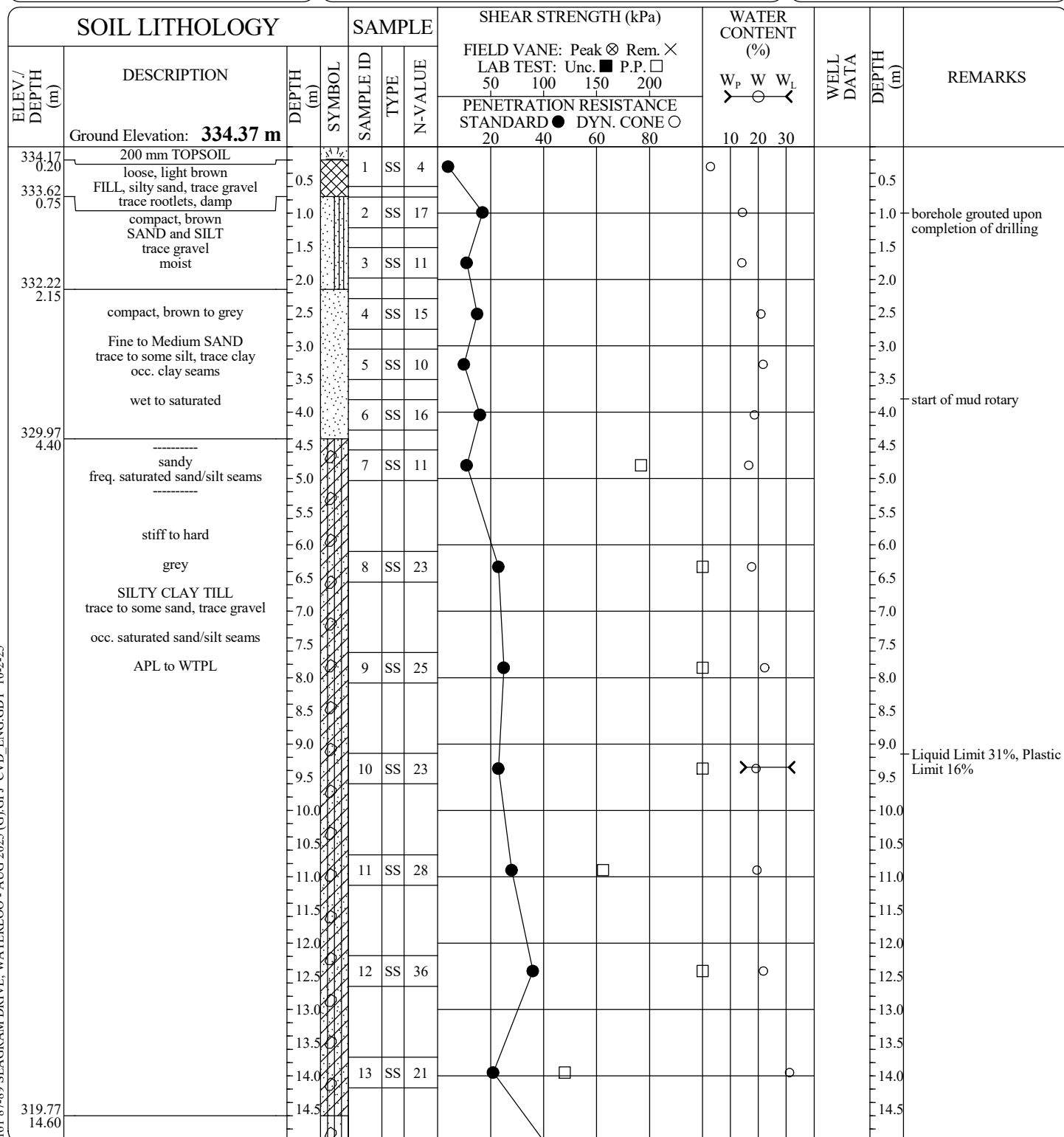
Machine: CME-55
Method: HSA / Mud Rotary
Size: 108 mm I.D.
Date: Jun 20 - 23 TO Jun 21 - 23

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS		
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				W _p W W _L ↗ ○ ↖							
(continued)							PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80				10 20 30							
318.68 16.45	very dense grey SAND and SILT TILL trace gravel, trace clay occ. sand/gravel seams occ. cobbles moist	15.5		14	SS	21												
		16.0																
		16.5																
		17.0			15	SS	50/ 140 mm											
		17.5																
		18.0																
		18.5				16	SS	50/ 100 mm										
		19.0																
		19.5																
		20.0																
		20.5																
		21.0																
		21.5				17	SS	50/ 125 mm										
		22.0																
310.58 24.55	End of Borehole	22.5																
		23.0																
		23.5																
		24.0																
		24.5				18	SS	50/ 150 mm										
		25.0																
		25.5																
		26.0																
		26.5																
		27.0																
		27.5																
		28.0																
		28.5																
		29.0																
29.5																		

PROJECT MANAGER: NZ

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FILE No: 1161**BOREHOLE No. 3**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **HSA / Mud Rotary**Size: **108 mm I.D.**Date: **Jun 16 - 23 TO Jun 16 - 23**

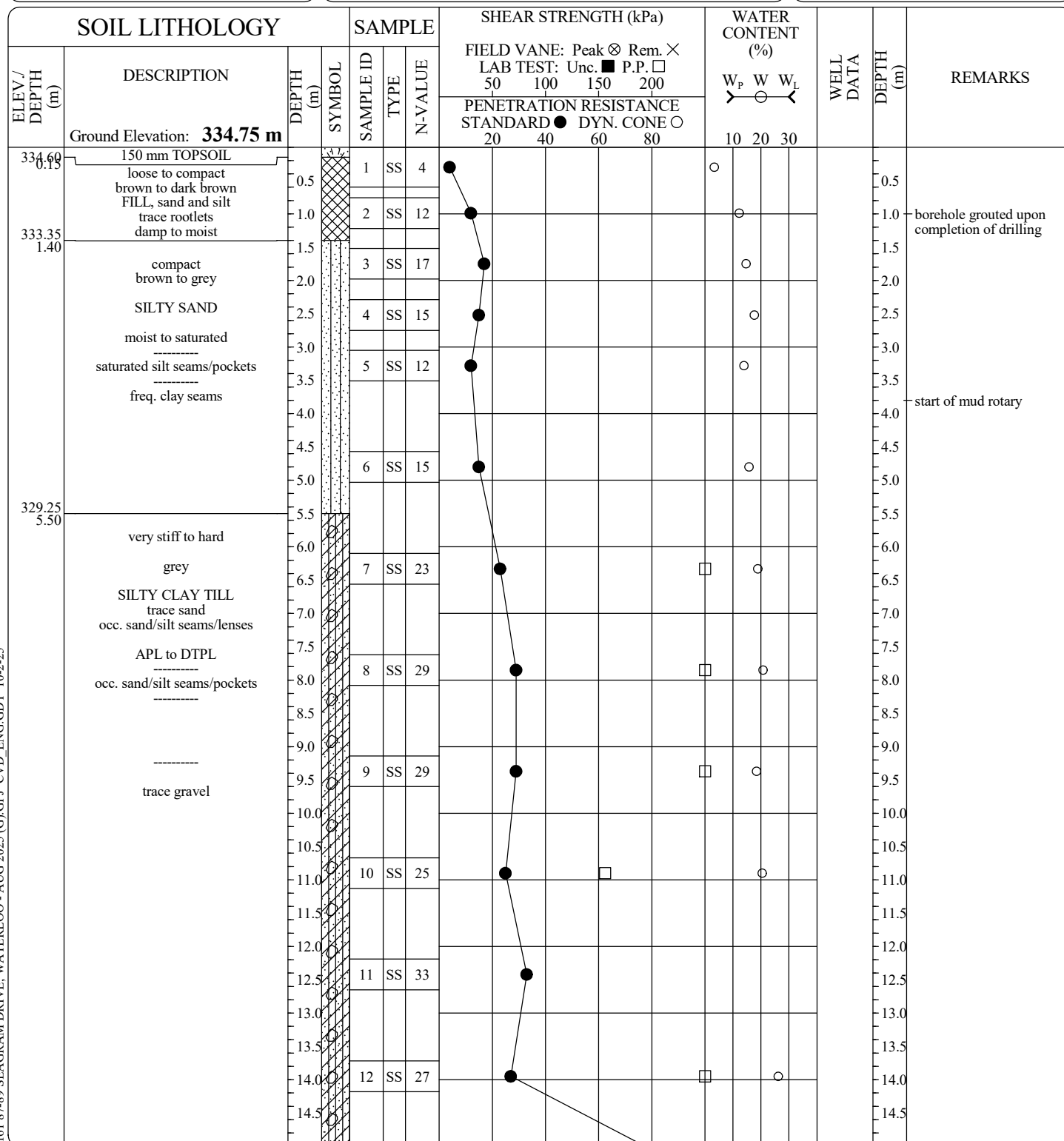
CVD BOREHOLE (2017) 1161 87-89 SEAGRAM DRIVE, WATERLOO - AUG 2025 (G).GPJ CVD_ENG.GDT 10-2-25

PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
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FILE No: 1161**BOREHOLE No. 3**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **HSA / Mud Rotary**Size: **108 mm I.D.**Date: **Jun 16 - 23 TO Jun 16 - 23**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □				W _p W W _L					
							PENETRATION RESISTANCE				↗ — ○ ↖					
							STANDARD ● DYN. CONE ○				10 20 30					
	(continued)						20	40	60	80						
309.77 24.60	very dense	15.5	○	14	SS	49										15.5
	grey	16.0	○													16.0
	SAND and SILT TILL	16.5	○													16.5
	trace gravel, trace clay	17.0	○	15	SS	50/ 140 mm										17.0
	occ. sand/gravel seams	17.5	○													17.5
	occ. cobbles	18.0	○													18.0
	moist	18.5	○	16	SS	50/ 140 mm										18.5
		19.0	○													19.0
		19.5	○													19.5
		20.0	○													20.0
		20.5	○													20.5
		21.0	○													21.0
		21.5	○	17	SS	50/ 140 mm										21.5
		22.0	○													22.0
		22.5	○													22.5
		23.0	○													23.0
		23.5	○													23.5
		24.0	○													24.0
	24.5	○	18	SS	50/ 75 mm										24.5	
	25.0														25.0	
	25.5														25.5	
	26.0														26.0	
	26.5														26.5	
	27.0														27.0	
	27.5														27.5	
	28.0														28.0	
	28.5														28.5	
	29.0														29.0	
	29.5														29.5	

PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
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Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 1161**BOREHOLE No. 4**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **HSA / Mud Rotary**Size: **108 mm I.D.**Date: **Jun 19 - 23 TO Jun 19 - 23**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 1161

BOREHOLE No. 4



Client: **14688210 Canada Inc.**

Project: **Proposed 33-Storey Mixed-Use Building**

Location: **87 - 95 Seagram Drive, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME-55**

Method: **HSA / Mud Rotary**

Size: **108 mm I.D.**

Date: **Jun 19 - 23 TO Jun 19 - 23**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS		
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				WATER CONTENT (%) W _p W W _L							
							PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80											
											10 20 30							
318.90 15.85	very dense grey SAND and SILT TILL trace gravel, trace clay occ. sand/gravel seams occ. cobbles moist	15.5		13	SS	50/ 150 mm										15.5		
		16.0															16.0	
		16.5															16.5	
		17.0		14	SS	50/ 125 mm											17.0	
		17.5															17.5	
		18.0															18.0	
		18.5		15	SS	50/ 100 mm											18.5	
		19.0															19.0	
		19.5															19.5	
		20.0															20.0	
		20.5															20.5	
		21.0															21.0	
		21.5		16	SS	50/ 25 mm											21.5	
		22.0															22.0	
		22.5															22.5	
		23.0															23.0	
		23.5															23.5	
24.0															24.0			
310.30 24.45	End of Borehole	24.5		17	SS	50/ 75 mm									24.5			
		25.0													25.0			
		25.5													25.5			
		26.0													26.0			
		26.5													26.5			
		27.0													27.0			
		27.5													27.5			
		28.0													28.0			
		28.5													28.5			
		29.0													29.0			
		29.5													29.5			

PROJECT MANAGER: **NZ**

**CHUNG & VANDER DOELEN
ENGINEERING LTD.**

311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 1161**BOREHOLE No. 5**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Jun 22 - 23 TO Jun 22 - 23**

SOIL LITHOLOGY			SAMPLE		SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200	PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80	W _p	W	W _L			
334.06	Ground Elevation: 334.16 m													
	100 mm TOPSOIL	0.5		1	SS	4								
	very loose to loose brown	1.0		2	SS	6								
	FILL, sand and silt	1.5												
	trace gravel, trace rootlets	2.0		3	SS	2								
	occ. clay seams	2.5												
	contains pottery fragments	3.0												
	moist	3.5												
332.06	compact	4.0												
2.10	brown to grey	4.5		4	SS	14								
	Fine to Medium SAND	5.0												
	some silt to silty	5.5		5	SS	11								
	occ. clay seams	6.0												
	wet to saturated	6.5		6	SS	11								
		7.0												
		7.5												
		8.0		7	SS	16								
		8.5												
		9.0												
		9.5												
		10.0												
		10.5												
		11.0												
		11.5												
		12.0												
		12.5												
		13.0												
		13.5												
		14.0												
		14.5												
325.96	stiff to very stiff, grey	8.5												
8.20	SILTY CLAY TILL	9.0		8	SS	14								
	trace sand, trace gravel	9.5												
	occ. to freq. saturated sand/silt	10.0												
	seams/lenses	10.5												
	APL	11.0												
324.56	End of Borehole	11.5		9	SS									
9.60		12.0												
		12.5												
		13.0												
		13.5												
		14.0												
		14.5												

water level at a depth of 2.3 m bgs upon withdrawal of drilling augers

borehole cave-in at a depth of 6 m bgs upon withdrawal of drilling augers

low 'N'-value due to disturbance by hydrostatic pressure

PROJECT MANAGER: **NZ**

**CHUNG & VANDER DOELEN
ENGINEERING LTD.**

311 Victoria Street North
Kitchener, Ontario N2H 5E1
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FILE No: 1161**BOREHOLE No. 6**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Jun 22 - 23 TO Jun 22 - 23**

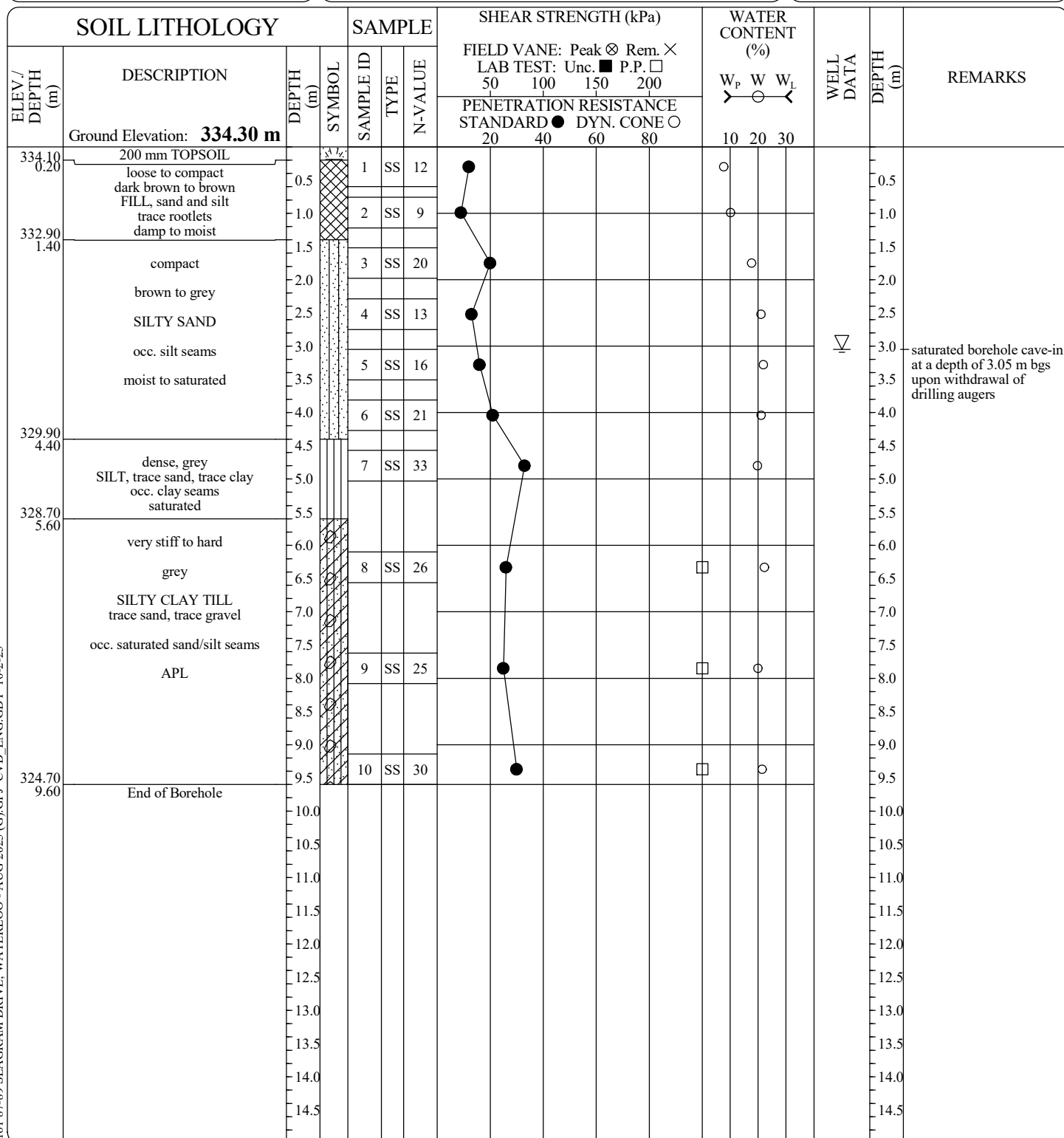
SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				W _p W W _L ↗ — ○ ↖					
							PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80									
Ground Elevation: 335.03 m																
334.78 0.25	250 mm TOPSOIL			1	SS	3	●						○			at grade flushmount casing set in concrete
	very loose to loose brown FILL, sand and silt trace rootlets moist	0.5		2	SS	7	●						○			
		1.0														
		1.5		3	SS	3	●						○			bentonite seal/50 mm I.D. PVC riser
333.18 1.85	compact, light brown Fine to Medium SAND trace silt moist	2.0														
		2.5		4	SS	17	●						○			
332.13 2.90	compact grey to brown SAND and SILT trace clay freq. clay seams moist to saturated	3.0														
		3.5		5	SS	16	●						⊗	×		water level in monitoring well measured to 3.15 m bgs on August 19, 2025 Liquid Limit 15%, Plastic Limit 11%
		4.0		6	SS	15	●						○			
		4.5														
		5.0		7	SS	18	●						○			3.0 m long, 50 mm I.D. PVC screen with sandpack
		5.5														
329.08 5.95	very stiff to hard grey SILTY CLAY TILL trace sand occ. sand/silt lenses APL	6.0		8	SS	17	●						□		○	
		6.5														
		7.0														
		7.5														
		8.0		9	SS	23	●						□		○	bentonite seal
		8.5														
		9.0														
325.43 9.60	End of Borehole	9.5		10	SS	32	●						□		○	
		10.0														
		10.5														
		11.0														
		11.5														
		12.0														
		12.5														
		13.0														
		13.5														
		14.0														
		14.5														

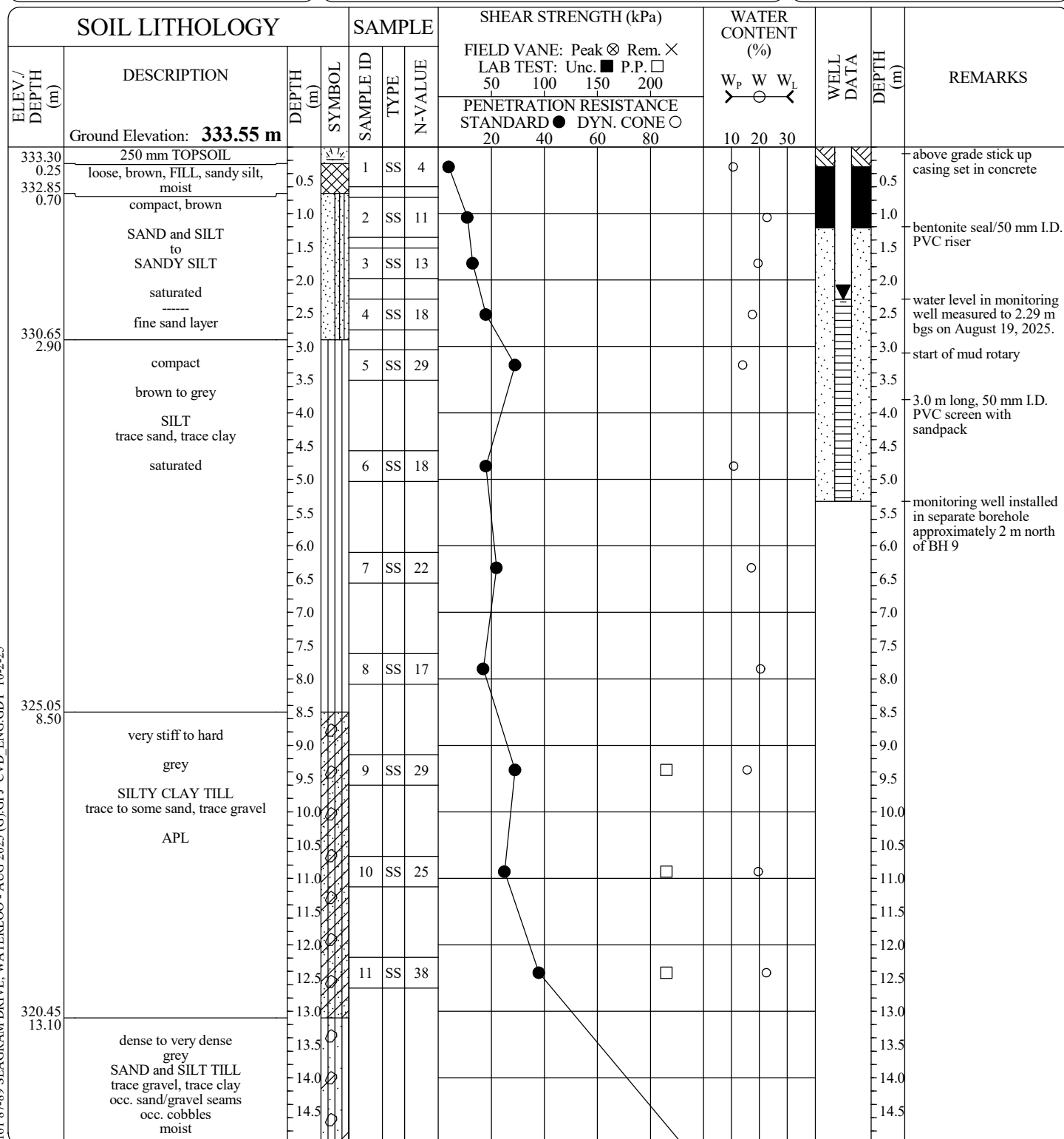
PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
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FILE No: 1161**BOREHOLE No. 7**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Jun 15 - 23 TO Jun 15 - 23**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS	
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○					
Ground Elevation: 334.22 m							20	40	60	80	W _p	W	W _L			
334.05 0.18	175 mm TOPSOIL			1	SS	3	●							○		above grade stick up casing set in concrete
	very loose to loose, dark brown FILL, sandy silt trace rootlets, trace organics damp to moist	0.5														
333.02 1.20	compact, brown SAND and SILT, trace clay occ. clay seams moist	1.0		2	SS	6	●							○		bentonite seal/50 mm I.D. PVC riser
		1.5														
332.12 2.10	stiff, grey SANDY CLAYEY SILT occ. sand lenses APL	2.0		3	SS	16	●							○		
		2.5														
331.32 2.90		2.5		4	SS	9	●			□				○		
		3.0														
	loose, brown SILTY SAND, trace gravel occ. clay seams saturated	3.5		5	SS	7	●							○		water level in monitoring well measured to 2.95 m bgs on August 19, 2025
		4.0														
329.82 4.40		4.0		6	SS	7	●							○		3.0 m long, 50 mm I.D. PVC screen with sandpack
		4.5														
	very stiff	4.5		7	SS	8	●							○		
	grey	5.0														
	SILTY CLAY TILL some sand to sandy	5.5														
	occ. sand pockets/seams/lenses	6.0														
	WTPL to APL	6.5		8	SS	23	●			□				○		monitoring well installed in separate borehole approximately 3 m north of BH 7
		7.0														
		7.5														
		8.0		9	SS	16	●							○		
		8.5														
	freq. sand/silt seams	9.0														
324.62 9.60	End of Borehole	9.5		10	SS	30	●									
		10.0														
		10.5														
		11.0														
		11.5														
		12.0														
		12.5														
		13.0														
		13.5														
		14.0														
		14.5														

PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
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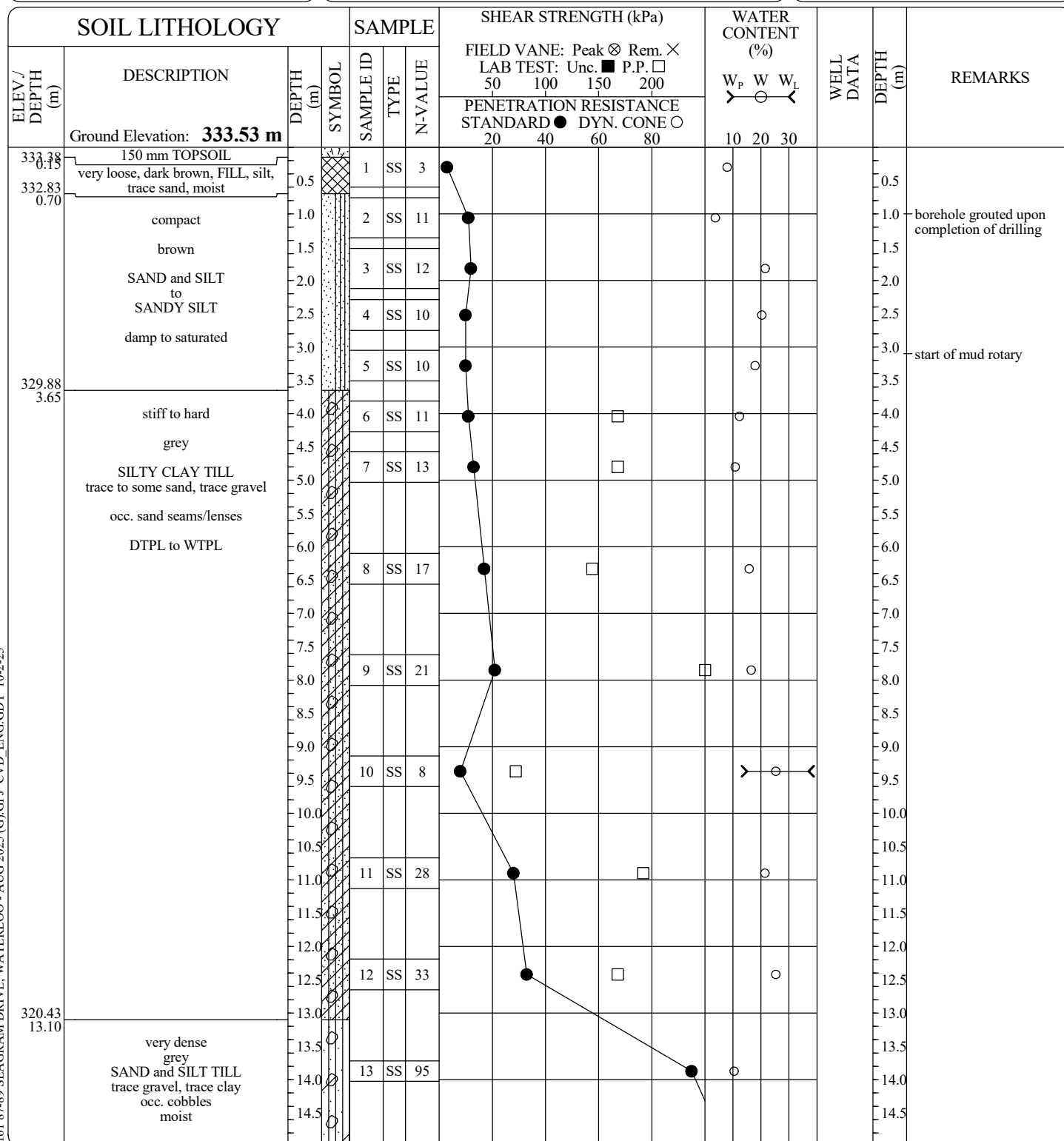
FILE No: 1161**BOREHOLE No. 8**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Jun 15 - 23 TO Jun 15 - 23**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
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FILE No: 1161**BOREHOLE No. 9**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Aug 05 - 25 TO Aug 05 - 25**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
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FILE No: 1161**BOREHOLE No. 9**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Aug 05 - 25 TO Aug 05 - 25**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS			
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80						W _p W W _L 10 20 30		
							(continued)												
308.90 24.65	dense to very dense grey SAND and SILT TILL trace gravel, trace clay occ. sand/gravel seams occ. cobbles moist	15.5	○	12	SS	50/ 125 mm								●	○		15.5		
		16.0	○															16.0	
		16.5	○															16.5	
		17.0	○															17.0	
		17.5	○															17.5	
		18.0	○															18.0	
		18.5	○	13	SS	42									●		○	18.5	
		19.0	○															19.0	
		19.5	○															19.5	
		20.0	○															20.0	
		20.5	○															20.5	
		21.0	○															21.0	
	21.5	○	14	SS	50/ 25 mm									●		○	21.5		
	22.0	○															22.0		
	22.5	○															22.5		
	23.0	○															23.0		
	23.5	○															23.5		
	24.0	○															24.0		
	24.5	○	15	SS	50/ 100 mm										●		○	24.5	
	End of Borehole																		

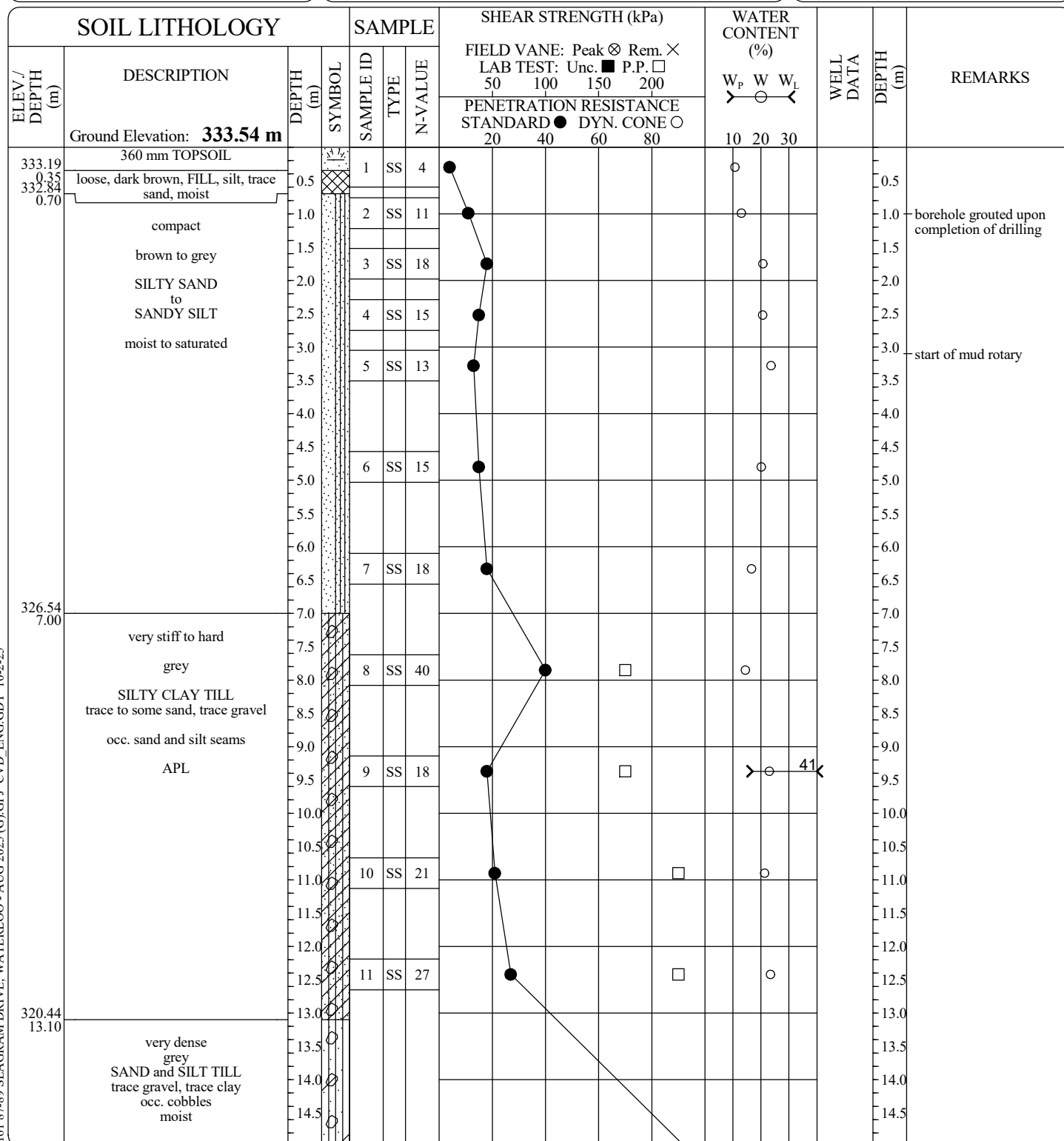
PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
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FILE No: 1161**BOREHOLE No. 10**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Aug 11 - 25 TO Aug 11 - 25**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
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FILE No: 1161**BOREHOLE No. 10**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Aug 11 - 25 TO Aug 11 - 25**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS		
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				W _p W W _L ↗ ○ ↖ 10 20 30							
							PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80											
309.03 24.50	(continued)	15.5	○	14	SS	113						113	●	○		15.5		
		16.0	○														16.0	
		16.5	○														16.5	
		17.0	○	15	SS	50/ 50 mm								●	○		17.0	
		17.5	○														17.5	
		18.0	○														18.0	
		18.5	○	16	SS	50/ 125 mm								●	○		18.5	
		19.0	○														19.0	
		19.5	○														19.5	
		20.0	○														20.0	
		20.5	○														20.5	
		21.0	○														21.0	
		21.5	○	17	SS	50/ 125 mm								●	○		21.5	
		22.0	○														22.0	
		22.5	○														22.5	
		23.0	○														23.0	
		23.5	○														23.5	
		24.0	○														24.0	
	24.5	○	18	SS	50/ 100 mm								●	○		24.5		
	25.0															25.0		
	25.5															25.5		
	26.0															26.0		
	26.5															26.5		
	27.0															27.0		
27.5															27.5			
28.0															28.0			
28.5															28.5			
29.0															29.0			
29.5															29.5			

PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
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FILE No: 1161**BOREHOLE No. 11**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Aug 06 - 25 TO Aug 06 - 25**PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
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FILE No: 1161

BOREHOLE No. 11



Client: **14688210 Canada Inc.**

Project: **Proposed 33-Storey Mixed-Use Building**

Location: **87 - 95 Seagram Drive, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME-55**
Method: **Hollow Stem Auger**
Size: **83 mm I.D.**
Date: **Aug 06 - 25 TO Aug 06 - 25**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS			
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80					W _p W W _L 10 20 30		
	(continued)																	
309.04 24.50	very dense grey SAND and SILT TILL trace gravel, trace clay occ. cobbles moist	15.5	○	12	SS	50/ 125 mm							●	○		15.5		
		16.0	○														16.0	
		16.5	○														16.5	
		17.0	○														17.0	
		17.5	○														17.5	
		18.0	○														18.0	
		18.5	○	13	SS	50/ 25 mm								●	○		18.5	
		19.0	○														19.0	
		19.5	○														19.5	
		20.0	○														20.0	
		20.5	○														20.5	
		21.0	○														21.0	
	21.5	○	14	SS	50/ 75 mm								●			21.5		
	22.0	○														22.0		
	22.5	○														22.5		
	23.0	○														23.0		
	23.5	○														23.5		
	24.0	○														24.0		
	24.5	○	15	SS	50/ 125 mm									●	○		24.5	
	25.0															25.0		
	25.5															25.5		
	26.0															26.0		
	26.5															26.5		
	27.0															27.0		
27.5															27.5			
28.0															28.0			
28.5															28.5			
29.0															29.0			
29.5															29.5			

PROJECT MANAGER: **NZ**

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FILE No: 1161**BOREHOLE No. PMT-1**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Aug 07 - 25 TO Aug 08 - 25**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				W _p W W _L					
							PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80									
Ground Elevation: 333.74 m																
333.44 0.30	300 mm TOPSOIL			1	SS	4	●						○			
332.39 1.35	loose, dark brown FILL, silt some sand damp to moist	0.5		2	SS	4	●							○		borehole grouted upon completion of drilling
	compact, brown SAND AND SILT moist to saturated	1.0														
330.84 2.90		1.5		3	SS	13	●							○		for PMT results refer to In-situ Pressuremeter Test Report
		2.0														
329.34 4.40		2.5		4	SS	10	●							○		start of mud rotary
		3.0														
	loose, brown Fine SAND trace silt saturated	3.5		5	SS	8	●							○		
		4.0			1	PMT										
320.64 13.10	very stiff to hard grey SILTY CLAY TILL trace to some sand, trace gravel occ. sand/silt seams/lenses APL to DTPL	4.5		6	SS	11	●			□			○			
		5.0														
		5.5														
		6.0														
		6.5		2	PMT											
		7.0														
		7.5														
		8.0		7	SS	39	●				□		○			
		8.5														
		9.0														
9.5	3	PMT														
10.0																
10.5																
11.0				8	SS	33	●				□		○			
11.5																
12.0																
12.5				4	PMT											
13.0																
	very dense, grey SAND and SILT TILL trace gravel, trace clay occ. sand/gravel seams occ. cobbles moist	13.5														
		14.0		9	SS	50/50 mm	●				□		○			
		14.5														

borehole grouted upon completion of drilling
for PMT results refer to In-situ Pressuremeter Test Report

start of mud rotary

PROJECT MANAGER: **NZ**

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FILE No: 1161**BOREHOLE No. PMT-1**Client: **14688210 Canada Inc.**Project: **Proposed 33-Storey Mixed-Use Building**Location: **87 - 95 Seagram Drive, Waterloo, Ontario****EQUIPMENT DATA**Machine: **CME-55**Method: **Hollow Stem Auger**Size: **83 mm I.D.**Date: **Aug 07 - 25 TO Aug 08 - 25**

SOIL LITHOLOGY			SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)			WELL DATA	DEPTH (m)	REMARKS		
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □ 50 100 150 200				W _p W W _L ↗ ○ ↖						
							PENETRATION RESISTANCE STANDARD ● DYN. CONE ○ 20 40 60 80				10 20 30						
	(continued)																
305.39 28.35	very dense grey SAND and SILT TILL trace gravel, trace clay occ. sand/gravel seams occ. cobbles moist	15.5	○	5	PMT										15.5		
		16.0	○													16.0	
		16.5	○													16.5	
		17.0	○	10	SS	50/50 mm							●	○		17.0	
		17.5	○													17.5	
		18.0	○													18.0	
		18.5	○	6	PMT											18.5	
		19.0	○													19.0	
		19.5	○													19.5	
		20.0	○	11	SS	50/75 mm							●	○		20.0	
		20.5	○													20.5	
		21.0	○													21.0	
		21.5	○	7	PMT											21.5	
		22.0	○													22.0	
		22.5	○													22.5	
		23.0	○													23.0	
		23.5	○	8	PMT											23.5	
		24.0	○													24.0	
		24.5	○	12	SS	50/125 mm								●	○	24.5	
	25.0	○													25.0		
25.5	○													25.5			
26.0	○	9	PMT											26.0			
26.5	○													26.5			
27.0	○													27.0			
27.5	○	13	SS	75/50 mm								●	○	27.5			
28.0	○													28.0			
	very dense brown Fine SAND trace silt saturated	28.5	○											28.5			
29.0			10	PMT										29.0			
29.5														29.5			

PROJECT MANAGER: **NZ****CHUNG & VANDER DOELEN
ENGINEERING LTD.**311 Victoria Street North
Kitchener, Ontario N2H 5E1
ph. (519) 742-8979, fx. (519) 742-7739

FILE No: 1161

BOREHOLE No. PMT-1

Enclosure No.: 12

Sheet 3 of 3



Client: **14688210 Canada Inc.**

Project: **Proposed 33-Storey Mixed-Use Building**

Location: **87 - 95 Seagram Drive, Waterloo, Ontario**

EQUIPMENT DATA

Machine: **CME-55**

Method: **Hollow Stem Auger**

Size: **83 mm I.D.**

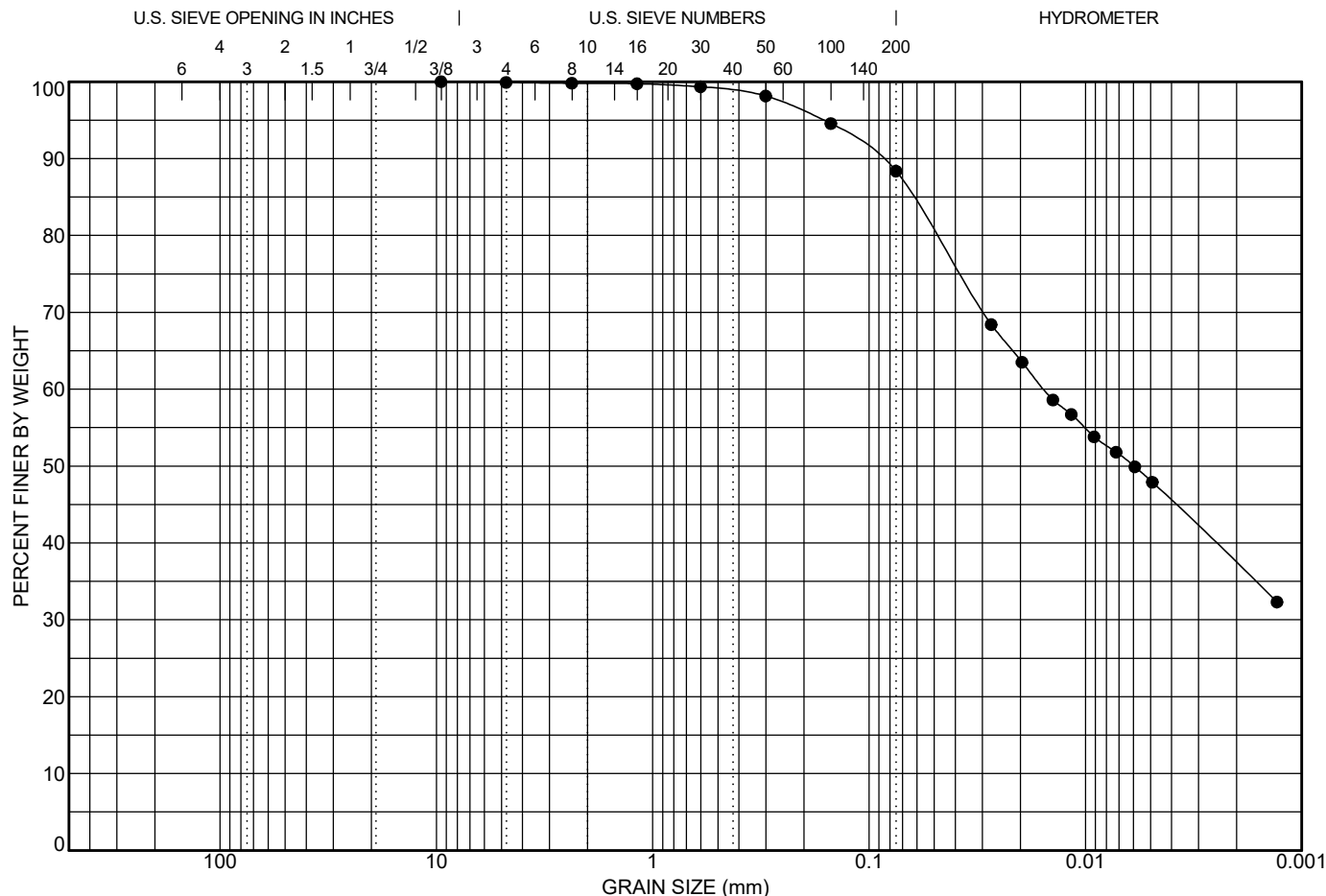
Date: **Aug 07 - 25 TO Aug 08 - 25**

SOIL LITHOLOGY				SAMPLE			SHEAR STRENGTH (kPa)				WATER CONTENT (%)				WELL DATA	DEPTH (m)	REMARKS
ELEV./ DEPTH (m)	DESCRIPTION	DEPTH (m)	SYMBOL	SAMPLE ID	TYPE	N-VALUE	FIELD VANE: Peak ⊗ Rem. × LAB TEST: Unc. ■ P.P. □				W _p W W _L						
							50	100	150	200	PENETRATION RESISTANCE						
							STANDARD ● DYN. CONE ○										
	(continued)						20	40	60	80		10	20	30			
302.99 30.75		30.5		14	SS	50/						●	○			30.5	
	End of Borehole	31.0				100 mm										31.0	
		31.5														31.5	
		32.0														32.0	
		32.5														32.5	
		33.0														33.0	
		33.5														33.5	
		34.0														34.0	
		34.5														34.5	
		35.0														35.0	
		35.5														35.5	
		36.0														36.0	
		36.5														36.5	
		37.0														37.0	
		37.5														37.5	
		38.0														38.0	
		38.5														38.5	
		39.0														39.0	
		39.5														39.5	
		40.0														40.0	
		40.5														40.5	
		41.0														41.0	
		41.5														41.5	
		42.0														42.0	
		42.5														42.5	
		43.0														43.0	
		43.5														43.5	
	44.0														44.0		
	44.5														44.5		

PROJECT MANAGER: **NZ**

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COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

LL	PL	PI	Cc	Cu	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
31	15.6				9.5	0.015			0.1	11.5	88.4	

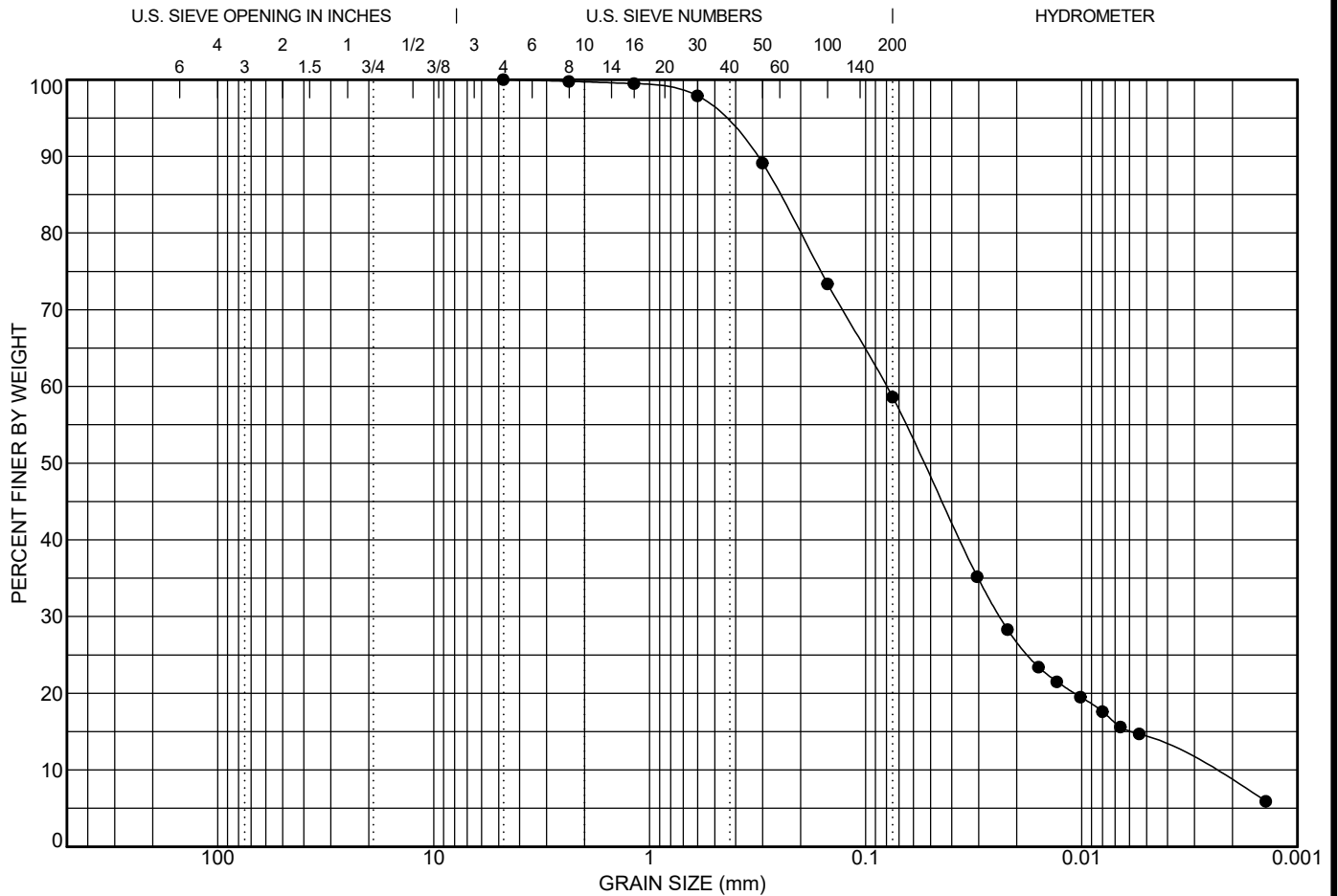
Date: Jul. 06 - 2023 Client: 14688210 Canada Inc. Contractor: Source: Sampled From: BH 3 - SA 10, 9.15 to 9.60 m Sample No.: 3-10 Date Sampled: Jun. 16 - 2023 Sampled By: MP Lab No.: 0810 Date Tested: Jun. 27 - 2023 Type of Material: Silty Clay Till, some sand								Sieve Size (mm)	Percent Passing	No Specifications

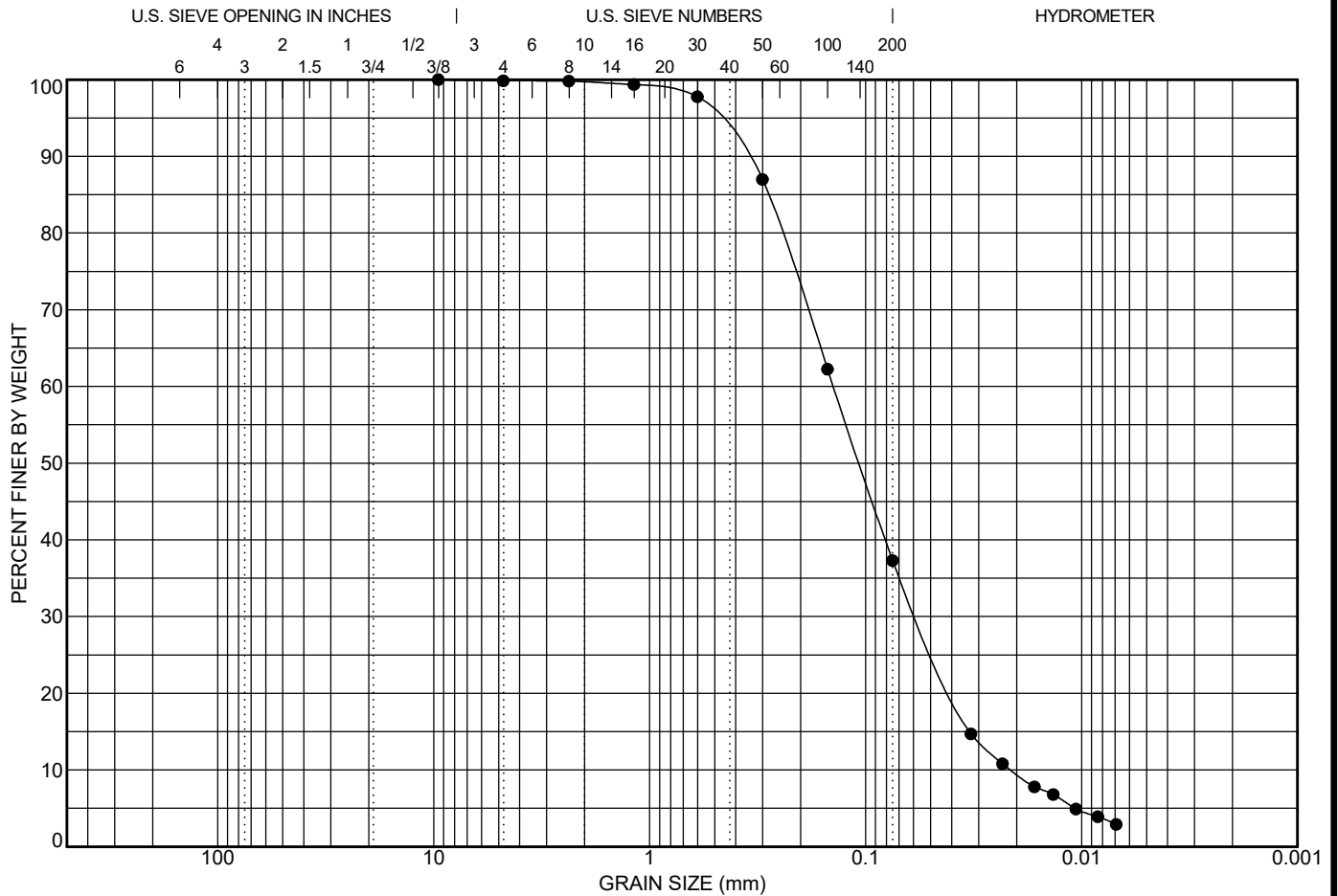


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 e-mail: info@cvdengineering.com

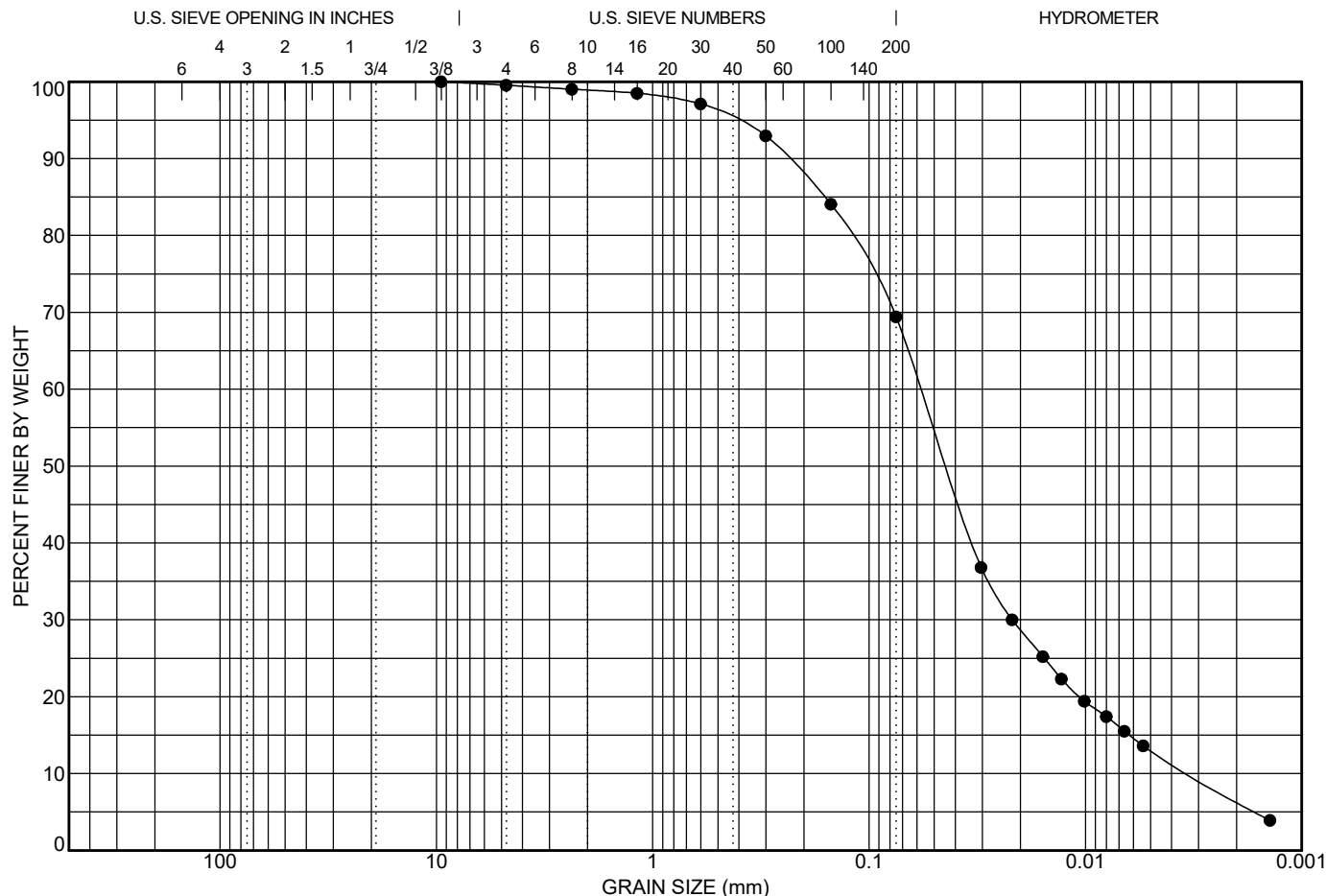
GRAIN SIZE DISTRIBUTION

Project: Proposed 33-Storey Mixed-Use Building
Location: 87 - 95 Seagram Drive, Waterloo, Ontario
File No.: 1161
Enclosure No.: 13

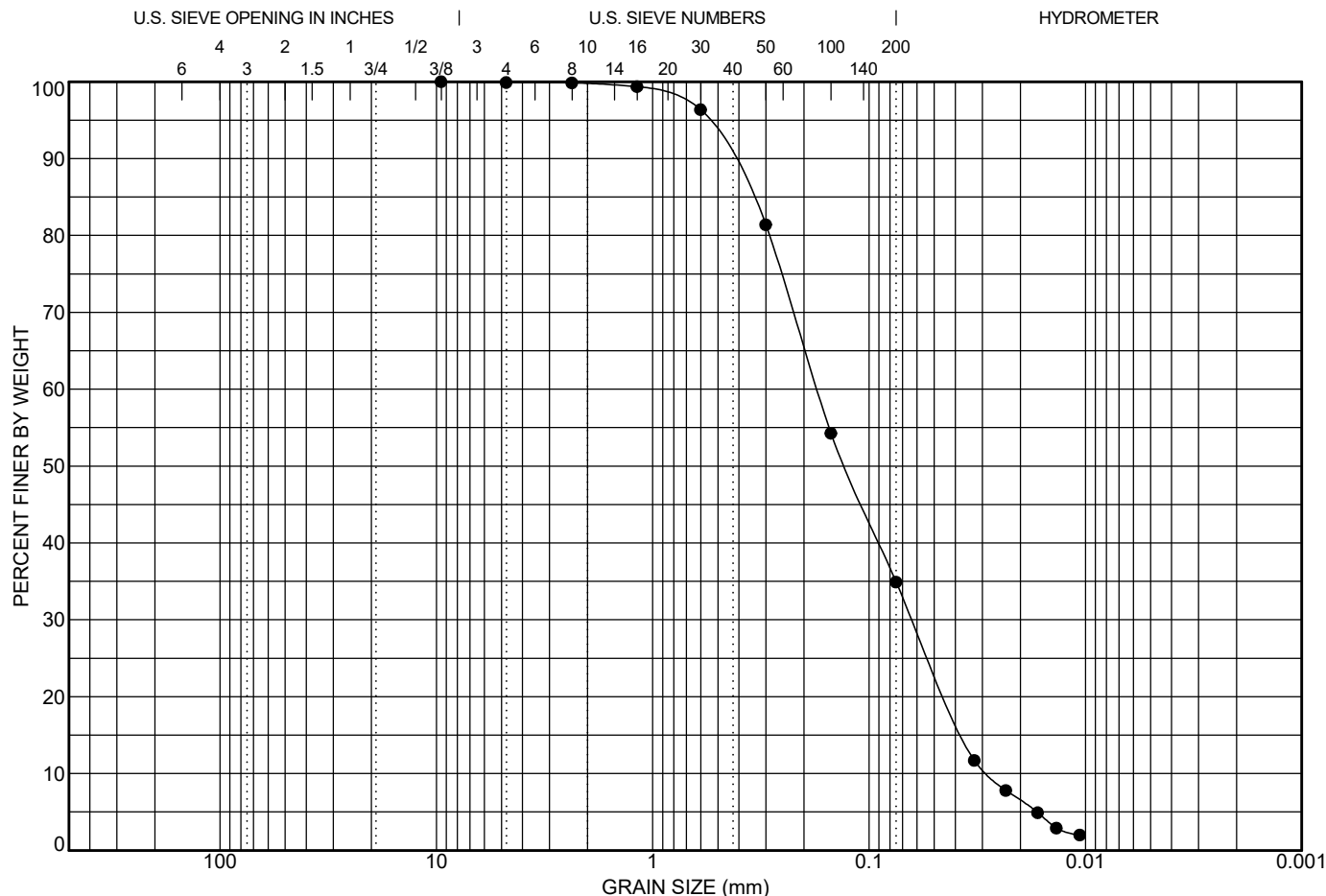


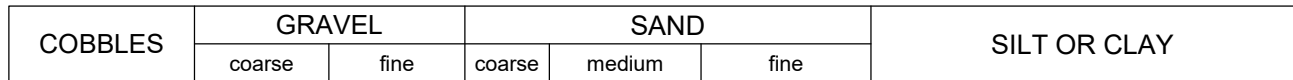


DM - NO SPECIFICATIONS 1161 87-89 SEAGRAM DRIVE, WATERLOO - AUG 2025 (G).GPJ LAW LNDN.GDT 10-2-25



DM - NO SPECIFICATIONS 1161 87-89 SEAGRAM DRIVE, WATERLOO - AUG 2025 (G).GPJ LAW LNDN.GDT 10-2-25





Date: Sep. 26 - 2025 Client: 14688210 Canada Inc. Contractor: Source: Sampled From: BH 10 - SA 10, 9.15 to 9.60 m Sample No.: 10-10 Date Sampled: Aug. 11 - 2025 Sampled By: DS Lab No.: 1002 Date Tested: Sep. 24 - 2025 Type of Material: Silty Clay Till, trace sand	Sieve Size (mm)	Percent Passing	No Specifications
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GRAIN SIZE DISTRIBUTION

Project: Proposed 33-Storey Mixed-Use Building

Location: 87 - 95 Seagram Drive, Waterloo, Ontario

File No.: 1161

Enclosure No.: 18

DM - NO SPECIFICATIONS 1161 87-89 SEAGRAM DRIVE, WATERLOO - AUG 2025 (G).GPJ LAW LNDN.GDT 10-2-25

