Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

HYDROGEOLOGICAL REPORT
TESTON ROAD IMPROVEMENTS
250 m WEST OF PINE VALLEY DRIVE TO
KLEINBURG SUMMIT WAY
CITY OF VAUGHAN, ONTARIO

Prepared for: HDR Corporation
100 York Boulevard, Suite 300
Richmond Hill, Ontario
L4B 1J8

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1.0 INTRODUCTION

Terraprobe has been retained by HDR Corporation (HDR), to provide hydrogeological engineering services in support of the Municipal Class Environmental Assessment Study and preliminary designs for improvements to Teston Road, from 250 m west of Pine Valley Drive to Kleinburg Summit Way, in the City of Vaughan, Ontario. A site location plan is provided as Figure 1.

The purpose of this study was to report the subsurface conditions at the site including soil and groundwater conditions through borehole drilling, laboratory testing on soil and groundwater samples and monitoring well installations to measure stabilized ground water elevations and to carry out in-situ hydraulic conductivity testing. The data obtained from this investigation was used to provide preliminary assessments of construction dewatering, groundwater discharge and treatment requirements, dewatering impacts and recommendations for monitoring, mitigation, and contingency planning.

2.0 SITE AND PROJECT DESCRIPTION

Teston Road is an east-west oriented collector road in the City of Vaughan. The west project limit is Sta. 1+000, and the east project limit is Sta. 3+175, with chainage increasing from west to east. Teston Road is a two-lane road with a rural cross section between Sta. 1+000 and Sta. 2+850 and an urban cross section between Sta. 2+850 and Sta. 3+175. Within the project limits, Teston Road intersects with Kleinburg Summit Way, Kipling Avenue and Ballantyne Boulevard. Culvert replacements were identified at Sta. 1+200, Sta. 1+740 and Sta. 2+175 and preliminary dewatering assessments were carried out at these sites.

The terrain is rolling to gently undulating consisting mainly of farmland and private residences. There are also multiple culvert crossings that convey watercourse flows below Teston Road within the project limits.

3.0 APPLICABLE LAND USE POLICIES

The following sections provide a review of land use policies for the project limits and surrounding lands.

3.1 City of Vaughan Official Plan

Based on a review of applicable schedules contained within the City of Vaughan Official Plan the following site classifications apply:

- Under Schedule 1 the project limits partially fall within the urban boundary with surrounding lands primarily consisting of natural areas and countryside;
- Under Schedule 3 there are no Environmentally Sensitive Areas (ESAs) or Areas of Natural and Scientific Interest (ANSIs) that fall within the project limits and surrounding vicinity (i.e., within 500 m of the project area);
- Under Schedule 4 the project limits fall within the Greenbelt Natural Heritage System;
- Under Schedule 6 the project limits are not identified as falling within a highly vulnerable aquifer (HVA);
- Under Schedule 7 the project limits are not identified as falling within a landform conservation area; and
- Under Schedule 8 the project limits are not identified within a special policy area.

3.2 Toronto and Region Conservation Authority

Most of the study area falls within TRCA regulated areas and is also within the East Humber Watershed and the Purpleville Creek sub-watershed. Three tributaries of Purpleville Creek cross Teston Road within project limits. As part of the hydrogeological investigation a dewatering impact assessment was completed for surrounding lands including private water supply wells and natural areas.

3.3 CTC Source Water Protection

The Credit Valley, Toronto and Region and Central Lake Ontario (CTC) Source Protection Plan was reviewed for information relating to source water protection areas within or in the vicinity of the project limits. The Plan establishes how water quality and quantity for municipal well supplies will be protected and this plan came into effect on December 31, 2015.

Kleinburg Well No. 2 falls west of the project limit and the wellhead protection zone associated with this municipal well does not fall within the project limits. The wellhead protection zone crosses Teston Road outside of the west project limit, approximately 100 m west of Kleinburg Summit Way. The intersection of Teston Road with Kleinburg Summit Way represents the western project limit (Sta 1+000). Impacts to Kleinburg Municipal Well No.2 because of the proposed works is not expected.

4.0 REGIONAL GEOLOGY AND HYDROGEOLOGY

The project limits fall within the physiographic region identified as the south slope. The south slope occupies lands south of the Oak Ridges Moraine, consisting of clay and silt till (Halton Till) and surficial deposits overlying relatively thin sand deposits of the Oak Ridges Moraine. The topography slopes from the north to the south towards the former shoreline of the glacial Lake Iroquois. The Oak Ridges Moraine deposits become thinner to the south, and typically do not form an extensive groundwater aquifer in the vicinity of the project limits.

The Oak Ridges Moraine deposits are underlain by clay and sand till (Newmarket Till) and sand deposits of the Thorncliffe Formation. The Thorncliffe Formation forms a regional aquifer, which is generally not utilized within the urban setting of the site. For municipal water supply, the City of Vaughan utilizes the surface water of Lake Ontario, situated approximately 27 km southeast of the project limits.

A review of the Ontario Well Record Database indicates that private wells within the project limits can be expected. It is expected that residential properties east of Kipling Avenue and west of Pine Valley Drive will be privately serviced. Table 1, attached to this report, provides a summary of well records located in the vicinity of the project limits (i.e., within a 250 m radius).

In summary, private ground water supply wells for domestic purposes are completed within overburden deposits between 10 m to 27 m in depth, and flow rates range from 15 L/min to 132 L/min (4 to 35 USG/min). Local ground water is considered an adequate private supply source with flow rates reported more than typical residential demands of 11 to 19 L/min (3 to 5 USG/min). Issues related to the private supply of ground water are not expected in the vicinity of the project area.

5.0 INVESTIGATION PROCEDURES

The subsurface and groundwater conditions were investigated with the results provided in the report titled *Geotechnical Report, Teston Road Improvements, 250 m West of Pine Valley Drive to Kleinburg Summit Way, City of Vaughan, Ontario,* completed by Terraprobe, dated February 08, 2022. Details of the field investigations are presented below:

- Drilling six foundation boreholes through the existing Teston Road pavement platform to depths ranging from 6.6 m to 9.6 m below ground surface;
- Drilling ten pavement boreholes through the existing Teston Road pavement each to a depth of 1.5 m below ground surface;
- Asphaltic concrete coring of the Teston Road main lanes at two locations; and
- Manually excavating fifteen shallow test pits to estimate topsoil thicknesses.

The boreholes were marked in the field by Terraprobe's staff in relation to existing features shown on the drawings provided by HDR. The foundation boreholes were surveyed for coordinates and geodetic elevation with a Trimble R10 Receiver connected to the Global Navigation Satellite System. The borehole data is summarized in the following table and the approximate borehole and test pit locations are shown on Figures 2 and 3.

Foundation Boreholes				
Borehole No.	Coordinates (UTM NAD 83, Zone 17)		Ground Surface Elevation (m)	Borehole Depth (m)
	Northing (m)	Easting (m)		
BH C1	4 856 363.8	611 181.3	205.5	8.1
BH C2	4 856 529.0	611 700.5	203.6	8.1
BH C3	4 856 659.2	612 108.4	202.6	9.6
BH RW1	4 856 597.8	611 908.3	205.2	6.6
BH RW2	4 856 805.5	612 585.3	220.1	6.6
BH 2+295	4 856 697.0	612 229.5	209.5	6.6

The boreholes were drilled with a truck-mounted drill rig supplied and operated by a specialist drilling contractor. Terraprobe's staff observed and recorded the drilling, sampling and in situ testing operations and logged the boreholes.

In the foundation boreholes, soil samples were obtained at intervals of 0.75 m and 1.5 m depth, using a 50 mm outer diameter (O.D.) split-spoon sampler in conjunction with the Standard Penetration Testing (SPT) procedures as specified in ASTM Method D 1586[1]. Samples of soil and granular material were also collected from auger cuttings retrieved from the 1.5 m deep boreholes drilled through the existing pavements.

Ground water conditions in the open boreholes were observed during the drilling operations and standpipe piezometers consisting of a 50 mm diameter PVC pipe with a slotted screen were installed in Boreholes C1, C2 and C3 to permit longer term ground water level monitoring.

The recovered soil samples were visually inspected in the field, placed in labelled plastic containers, and transferred to Terraprobe's Brampton laboratory for further examination and testing. The recovered soil samples were subjected to Visual Identification (VI) and select soil samples were subjected to a laboratory testing programme consisting of natural moisture content and grain size distribution analyses in accordance with MTO and/or ASTM Standards as appropriate. The results of the soil testing program are presented

1 ASTM D1586 – Standard Test Method for Standard Penetration Tests and Split Barrel Sampling of Soils.

on the Log of Borehole Sheets and Pavement Borehole Logs in Appendix A and on the figures in Appendix B.

6.0 SUBSURFACE CONDITIONS

6.1 General

Reference is made to the Pavement Borehole Logs and Log of Borehole Sheets in Appendix A. Details of the encountered soil stratigraphy are presented in this appendix. An overall description of the stratigraphy is given in the following paragraphs.

The stratigraphic boundaries shown on the Log of Borehole Sheets are inferred from non-continuous soil sampling and therefore represent transitions between soil types rather than exact planes of geological change. The subsurface conditions will vary between and beyond the borehole locations.

In summary topsoil, pavement, and fill material consisting of compact sandy gravel, firm to stiff silty clay, and loose silty sand were encountered at the site. The native overburden deposits consist of firm to hard silty clay to clayey silt till, loose to compact silt and sand to sand and silt, compact silt, and firm to stiff silty clay.

6.2 Pavement

A flexible pavement consisting of 75 mm to 175 mm thick asphaltic concrete, underlain by granular base/subbase material ranging in composition from sand and gravel to gravelly sand fill was encountered. The average pavement structure of Teston Road is summarized in the following table.

Road	Location	Average Thickness (mm)		
		HMA	Granular	Total
Teston Road	Sta. 1+000 to Sta. 2+720	130	470	600
	Sta. 2+720 to Sta. 3+175	165	475	640

The measured SPT N-values of Standard Penetration tests carried out in the base/subbase material range from 15 blows to 47 blows for 0.3 m of penetration, indicating a compact to dense relative density. The natural water content of nine samples of the granular base/subbase material varies from 1% to 14% by weight.

The grain size distribution curves of two samples of the granular base/subbase material are depicted on Figure B1, in Appendix B. The results are compared to the Ontario Provincial Standards (OPSS) gradation specifications for Granular A and Granular B Type II.

6.3 Fill – Sandy Gravel

Sandy gravel fill material was encountered at Borehole C1. The sandy gravel fill layer is approximately 0.8 m thick and extends to a depth of 1.4 m (elevation 204.1 m) below ground surface. A Standard Penetration test performed in the sandy gravel fill measured a SPT N-value of 23 blows for 0.3 m of penetration, indicating a compact relative density.

6.4 Fill – Silty Clay

Silty clay fill material was encountered in some of the boreholes. The locations, thicknesses, depths, and base elevations of the silty clay fill encountered in the foundation boreholes are summarized in the following table.

Borehole No.	Fill Thickness (m)	Fill Depth (m)	Fill Base Elevation (m)
BH C1	1.5	2.9	202.6
BH C2	0.6	1.2	202.4
BH C3	2.3	2.9	199.7
BH RW1	1.5	2.1	203.1
BH RW2	1.6	2.1	218.0
BH 2+295	0.7	1.4	208.1

Standard Penetration tests performed in the silty clay fill measured SPT N-values of 5 blows to 12 blows for 0.3 m of penetration, indicating a firm to stiff consistency. The natural water content of samples of the silty clay fill varies from 11% to 23% by weight.

A sample of the silty clay fill was subjected to a grain size distribution test and the grain size distribution curve is illustrated in Figure B3, in Appendix B. The test results show a grain size distribution consisting of 3% gravel, 25% sand, 52% silt and; 20% clay size particles.

6.5 Fill – Silty Sand

Silty sand fill material was encountered at Borehole RW1. The silty sand fill layer is approximately 1.6 m thick and extends to a depth of 3.7 m (elevation 201.5 m) below ground surface. Standard Penetration tests performed in the silty sand fill measured SPT N-values of 6 blows and 7 blows for 0.3 m of penetration, indicating a loose relative density. The natural water content of a sample of the silty sand fill is 17% by weight.

6.6 Silty Clay to Clayey Silt Till

Till deposits with a soil matrix composition that ranges from silty clay to clayey silt were encountered at this site. The locations, thicknesses, depths, and base elevations of the silty clay to clayey silt till encountered in the foundation boreholes are summarized in the following table.

Borehole No.	Thickness (m)	Depth (m)	Base Elevation (m)
BH C1	4.2	7.1	198.4
BH C2	5.2	8.1*	195.5
BH C3	2.7	5.6	197.0
BH RW1	2.2	6.6*	198.6
BH RW2	4.5	6.6*	213.5
BH 2+295	4.4	6.6*	202.9

*Borehole termination depth.

Standard Penetration tests performed in the silty clay to clayey silt till measured SPT N-values of 7 blows to 47 blows for 0.3 m of penetration, indicating a firm to hard consistency. The natural water content of samples of the silty clay to clayey silt till range from 10% to 21% by weight.

Four samples of the silty clay to clayey silt till deposit were subjected to grain size distribution tests and the grain size distribution curves are illustrated in Figure B4 in Appendix B. The test results show a grain size distribution consisting of 1% to 4% gravel, 7% to 21% sand, 54% to 70% silt and, 21% to 23% clay size particles. Till soils can also be expected to contain random cobble and boulder inclusions.

6.7 Silt and Sand to Sand and Silt

Deposits ranging in composition from silt and sand to sand and silt were encountered at this site and the locations, thicknesses, depths, and base elevations of these cohesionless deposits encountered in the foundation boreholes are summarized in the following table.

Borehole No.	Thickness (m)	Depth (m)	Base Elevation (m)
BH C1	1.0	8.1*	197.4
BH C3	4.0	9.6*	193.0
BH 2+295	0.8	2.2	207.3

* Borehole termination depth.

Standard Penetration tests performed in the silt and sand to sand and silt deposits measured SPT N-values of 7 blows to 20 blows for 0.3 m of penetration, indicating a loose to compact relative density. The natural water content of samples of the silt and sand to sand and silt deposits range from 15% to 28% by weight.

Two samples of the silt and sand to sand and silt deposits were subjected to grain size distribution tests and the grain size distribution curves are illustrated in Figure B5, in Appendix B. The test results show a grain size distribution consisting of 0% and 1% gravel, 39% and 50% sand, 45% and 50% silt and, 5% and 10% clay size particles.

6.8 Silt

A layer of silt was encountered at Borehole C2. The silt deposit is approximately 0.8 m thick and extends to a depth of 2.9 m (elevation 200.7 m) below ground surface. A Standard Penetration test carried out in the silt deposit measured a SPT N-value of 15 blows for 0.3 m of penetration, indicating a compact relative density. The natural water content of a sample of the silt deposit is 20% by weight.

A sample of the silt deposit was subjected to a grain size distribution test and the grain size distribution curve is illustrated in Figure B6, in Appendix B. The test results show a grain size distribution consisting of 0% gravel, 9% sand, 82% silt and, 9% clay size particles.

6.9 Silty Clay

Native silty clay deposits were encountered at this site. The locations, thicknesses, depths, and base elevations of the silty clay deposits encountered in the foundation boreholes are summarized in the following table.

Borehole No.	Thickness (m)	Depth (m)	Base Elevation (m)
BH C2	0.9	2.1	201.5
BH RW1	0.7	4.4	200.8

Standard Penetration tests performed in the silty clay deposits measured SPT N-values of 7 blows and 8 blows for 0.3 m of penetration, indicating a firm to stiff consistency.

6.10 Ground Water Conditions

Ground water conditions were observed in the boreholes during and upon completion of drilling. Boreholes C1, C2 and C3 were instrumented with a 50 mm diameter standpipe piezometer. Tabulated below are the ground water levels that were measured on separate visits after the completion of drilling.

Borehole Number	Date	Water Levels	
		Depth (m)	Elevation (m)
BH C1	January 06, 2022 January 31, 2022	5.7 5.8	199.8 199.7
BH C2	January 06, 2022 January 31, 2022	1.4 1.6	202.2 202.0
BH C3	January 06, 2022 January 31, 2022	2.1 2.3	200.5 200.3

Monitoring wells were equipped with pressure transducers to allow for the continuous monitoring of ground water levels and to capture the seasonal high ground water elevations within the project limits. Ground water levels obtained as part of the monitoring program will be provided as an addendum to the report following capture of seasonal high ground water conditions.

Ground water is expected to follow the topography along the alignment and the phreatic surface is expected to fall gradually from high ground to the watercourse crossings. Ground water is also expected to fluctuate seasonally and can be expected to rise during wet periods of the year and perched water can also be expected to occur where more permeable deposits overlie relatively impermeable deposits.

6.11 Hydraulic Conductivity

Rates of hydraulic conductivity through native soils were assessed from standard penetration test results the relative density and consistency of the soils. The results of laboratory grain size analysis were also used to assess rates of hydraulic conductivity by comparing the grain size distribution curves to the reference grain size analysis curves provided within the Supplementary Guidelines (SG-6) to the Ontario Building Code.

The following table provides a summary of the expected rates of hydraulic conductivity for native soils within the project limits:

Borehole No	Screened Stratum	Depth of Stratum (masl)	Relative Density	Hydraulic Conductivity (m/s)
RW1	Silty Sand Fill	201.5	Loose	$1 \times 10^{-5}\pm$
C1, C2, C3, RW1, RW2 BH2+295	Silty Clay	C1 – 198.4 C3 – 197.0 Remaining BHs Depth of Investigation	Firm to Hard (N = 7 – 47)	$1 \times 10^{-8}\pm$ (Disturbed $5 \times 10^{-8}\pm$)
C2	Silt	200.7	Compact (N = 15)	$1 \times 10^{-7}\pm$
C1, C3 BH2+295	Sand and Silt Silt and Sand	Top of Stratum 198.4 (C1) 197.0 (C3) 208.1 (2+295)	Loose to Compact (N = 7 - 20)	$1 \times 10^{-6}\pm$

6.12 Groundwater Quality

Ground water quality sampling was carried out as part of the site investigations on February 01, 2022. Monitoring wells installed at C1, C2 and C3 were purged and sampled. Ground water quality analysis was performed for general inorganics, metals and microbiology and compared to the Provincial Water Quality Objectives (PWQO).

Ground water quality samples were obtained using High Density Polyethylene (HDPE) tubing connected to a foot valve. High sediment loads were noted within collected samples from monitoring wells installed at C1 and C2 at concentrations of 14,100 mg/L and 2,100 mg/L respectively. Laboratory analysis was carried out on both filtered and unfiltered groundwater samples for metals, to determine the concentrations of total and dissolved parameters. All samples were stored in laboratory supplied bottles appropriate for the analysis and the samples were stored on ice for transport to SGS Laboratories in Lakefield, a CALA accredited laboratory.

Based on the ground water quality analysis completed, ground water quality will meet the requirements for discharge overland, provided sediment control measures are in place. Ground water quality exceedances with respect to limits for the PWQO were observed for total metals including copper, lead, iron, vanadium, and zinc in addition to total phosphorus. Concentrations within filtered samples (dissolved concentrations) were observed to meet with the PWQO.

7.0 LOCAL WATER RESOURCES

The area surrounding the site consists of a rural landscape with residential properties south and north of the site. Private ground water supply wells are expected within a 500 m radius from the site. Municipal well Kleinburg Well No. 2 is located west of the project limit and the wellhead protection zone associated with this municipal well does not intersect the project limits. Ground water uses in the vicinity of the site are expected to be primarily for residential purposes.

Based on a review of Source Water Protection Plans for Central Lake Ontario, Toronto and Region Conservation Authority and Credit Valley (CTC) Source Protection Regions; the site is not situated within a special policy area. The site is also not identified to be within a Significant Ground Water Recharge Area (SRGA), Highly Vulnerable Aquifer (HVA) or a Wellhead Protection Area (WHPA).

8.0 REQUIREMENTS FOR GROUND WATER CONTROL

Open cut excavations will be required to install new culverts at Sta. 1+200, Sta. 1+740 and Sta. 2+175. It is anticipated that retaining walls and earth cuts associated with road widening will be sufficiently shallow and will be carried out within relatively impermeable native silty clay till in which case significant dewatering operations will not be required. For relatively shallow excavations dewatering may be required to remove perched ground water within pervious fill deposits that overlie lower permeability till deposits. It is anticipated that localized dewatering to control perched ground water can be conducted at rates less than 50,000 L/day.

We understand that the culvert replacements will be installed in open cut excavations and the preliminary culvert design inverts indicate that the anticipated subsurface conditions at the trench bottom will consist of silty clay till deposits for the three proposed culvert replacements.

Based on the moisture content of the soil samples, the colour of the soil matrix and the ground water levels in standpipe piezometers, the estimated ground water elevations at the culvert locations are:

Culvert Location	Invert Elevation (m)	Borehole No	Estimated Design Groundwater Level Elevation (m)
1+200	203.6±	C1	199.7±
1+740	201.6±	C2	202.0±
2+175	198.6±	C3	200.3±

Given the above preliminary design ground water elevations, active dewatering is expected for culvert replacements at 1+740 and 2+175. It is anticipated that the culvert replacement at 1+200 will be completed above the shallow ground water elevation, based on ground water levels obtained on January 31, 2022. Perched water can also be expected in the relatively permeable fill soils overlying native soil deposits. The perched water yield into excavations will not be significant and will diminish with time. The estimated ground water seepages into excavations were calculated based on the hydraulic conductivity values estimated from grain size distribution curves and our experience and judgement. A two-year storm event equivalent to 32 mm of daily precipitation was also included in the analysis. The assumed width of the open excavation is 10 m and the excavation length for culvert replacement was assumed to be 6 m.

Based on the above parameters and construction geometry, it is expected that dewatering for culvert replacements would be on the order of 20,200 L/day for each location requiring dewatering. The dewatering radius of influence is expected to extend about 5± m beyond the crest of open excavations. It is expected that excavations will be completed within the silty clay till, which will preclude significant inflow of ground water to open excavations.

The total rate of discharge from the site for initial lowering of ground water is not to exceed permitting requirements with the Ministry of the Environment Conservation and Parks (MECP) (i.e., 50,000 L/day).

It is expected that average dewatering efforts would be required to maintain ground water levels at the above stated target drawdown (i.e., approximately 1.0± m below the base of excavations). It is envisaged that ground water flows into open excavations can be achieved by selecting suitably sized dewatering pumps and pumping from a series of filtered sumps.

9.0 IMPACT ASSESSMENT

The following impact assessment is based on the current preliminary design information for the Teston Road improvements provided in this report, and the results of the subsurface investigation. The purpose of the impact assessment is to determine the potential impacts from dewatering activities to surrounding natural features, land uses and ground water resources.

9.1 Radius of Influence

The potential radius of influence arising from ground water taking activities was calculated based on the anticipated drawdown and hydraulic conductivity determined for the site. The calculated radius of influence is estimated to extend a maximum distance of 5.0 ± m beyond the perimeter of the excavations. The radius of influence will be influenced by the hydraulic conductivity of soils, the total required drawdown, and the upward vertical hydraulic ground water gradients. The radius of influence for dewatering will be limited based on the low permeability of soils expected at the depth of excavation. Off-site structures are not situated within the expected radius of influence of dewatering works.

9.2 Geotechnical Impacts of Dewatering

The lowering of ground water levels has the potential to induce ground settlement within the radius of influence. The results of the geotechnical investigation indicate that the site is underlain by shallow fill deposits and silty clay till in areas where dewatering is expected. Given the expected limited radius of influence, significant subsidence due to construction dewatering is not anticipated.

Settlement can also occur in the event of loss of ground triggered by pumping fines and/or suspended materials through the dewatering system. Therefore, the dewatering system must be properly designed with an appropriate filtration system to ensure that there is no pumping of fines or suspended material.

9.3 Dewatering Impacts on Local Ground and Surface Water Resources

Private ground water supply wells and surface water features are not known to be located within the anticipated zone of influence of the dewatering work. Private wells are expected to be located within a 500 m radius of the project limits. However, given the limited radius of influence of dewatering works, impacts to ground water supply wells or surface water features are not expected.

9.4 Discharge of Water

Dewatering discharge from ground water control activities can be directed overland for subsequent infiltration into the ground. Sediment and erosion control measures must be in place at the dewatering discharge point to reduce sediment load within discharged ground water and to prevent erosion in the area of discharge. Measures can include, but are not limited to filter socks, hay bales, rock check dams and temporary sedimentation pools.

10.0 MONITORING AND CONTINGENCY PLAN

The results of the study and impact analysis indicate that significant impacts are not anticipated provided that appropriate ground water control activities are implemented. Nonetheless, it is important to maintain records to ensure that any unforeseen impacts are properly identified and if warranted, appropriate contingency measures can be implemented.

Record keeping shall be maintained over the duration of the ground water control activities and shall include the following:

- Daily records of the current location, depth and extent of all excavations on the site;
- Daily records of water taking including time and rate of pumping;
- Inspection of discharge from the ground water control system on an hourly basis for evidence of visible suspended solids or silt; and,
- Daily inspection of excavation activities for the potential presence of deleterious materials which may result in an impact to water quality.

If significant fines are noted in the ground water discharge, the pumping shall be stopped immediately, and proper control measures shall be implemented to prevent the movement of fines.

Dewatering volumes include pumping to remove accumulated precipitation runoff from open excavations for the daily maximum of 32 mm. If daily precipitation exceeds this amount, it is recommended to stop

construction work and pump excavations at the maximum allowed rate (i.e., 50,000 L/day) until which time that standing water within open excavations is removed.

11.0 RECOMMENDATIONS FOR DETAIL DESIGN

During detail design we recommend considering the following.

- Confirm and further refine the preliminary hydrogeological recommendations based on the selected design;
- Carry out additional detail level hydrogeological investigations for final design. Investigations should include confirmation of rates of hydraulic conductivity and ground water levels within areas proposed for culvert replacement and refinement of the predicted zone of influence of dewatering;
- Complete a private well survey to refine locations of private wells and to determine operational histories and construction details for private wells and to complete baseline ground water quality sampling and ground water level measurements;
- Refine recommendations for well monitoring and contingency plans for ground water control activities;
- Have consultation with the Region of York regarding Kleinberg Well No. 2 and the monitoring network in place to include these locations within the well monitoring plan for construction; and,
- Carry out additional ground water quality assessments to verify the level of ground water treatment that would be required to meet regulatory discharge criteria.

12.0 SUMMARY

Based on the results of the study, the following summary and conclusions are made:

- Open cut excavations will be required for culvert replacements located at chainage 1+200, 1+740 and 2+175 and it is envisioned that active dewatering will be required to enable construction.
- Excavations requiring dewatering are expected mostly within relatively impermeable silty clay till soils.
- Shallow ground water levels are expected at elevations ranging from 202.0± m near the central portions of the project falling to elevations of 199.7± m at the western extent and 200.3± m at the eastern extent of the project limits.
- It is anticipated that excavations will be completed within silty clay till deposits with an estimated hydraulic conductivity of 1.0×10^{-8} m/s.
- Based on the ground water quality analysis completed, ground water quality will meet the requirements for discharge overland, provided sediment control measures are in place. Ground water quality exceedances with respect to limits for the PWQO were observed for total metals including copper, lead, iron, vanadium, and zinc in addition to total phosphorus. Concentrations within filtered samples (dissolved concentrations) were observed to meet the PWQO limits.
- Land use in the vicinity of the site consists of rural residential properties. Private supply wells were identified within a 500 m radius of the subject site. Private ground water supply wells are completed within overburden deposits between 10 m to 27 m in depth, for domestic purposes with flow rates ranging between 15 L/min to 132 L/min (4 to 35 USG/min). Local ground water is considered an adequate private supply source with flow rates reported more than typical residential demand of 11

to 19 L/min (3 to 5 USG/min). Issues regarding private supply of ground water are not expected in the vicinity of the project area.

- Dewatering estimates were calculated given the observed site conditions and construction requirements and includes removal of precipitation (32 mm rainfall event) in excavated areas. Construction dewatering for culvert replacements is expected to average 20,200 L/day for locations at chainage 1+740 and 2+175. The culvert replacement at chainage 1+200 is expected to be completed above the ground water table.
- Dewatering for the purposes of construction dewatering is not expected to require permitting from the Ministry of the Environment and Climate Change (MECP) (i.e., dewatering less than 50,000 L/day). Discharge can be carried out overland to allow for infiltration into the underlying soils.
- The radius of influence associated with the ground water control activities is estimated at approximately 5± m. Significant structures are not expected to be situated within the predicted radius of influence for construction dewatering.
- A program of monitoring during construction is recommended. The monitoring should include frequent inspection of the excavation and discharge water. Detailed records should be maintained regarding excavation progress and pumping rates and volumes.
- Further investigation is recommended under detailed design to evaluate and refine preliminary conditions noted in this report. Further investigation includes but should not be limited completion of a private well survey, and additional ground water measurement and testing based on the selected final design.

Terraprobe

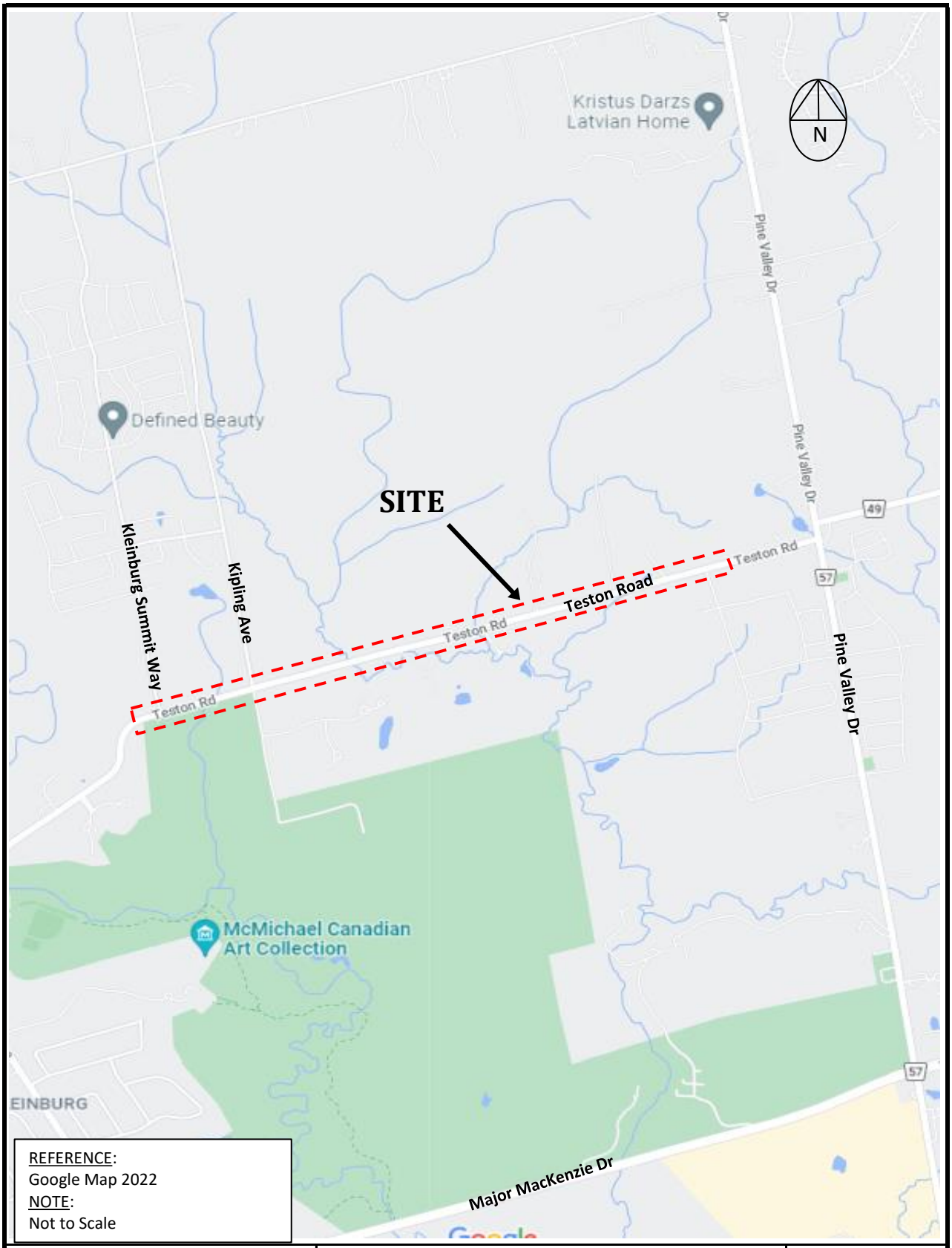
PROFESSIONAL GEOSCIENTIST
P. L. RAEPPLE
PRACTISING MEMBER
2242
ONTARIO

LICENSED PROFESSIONAL ENGINEER
R.A. ABDUL
May 16,2022
PROVINCE OF ONTARIO

Paul L. Raepple, P.Geo..
Hydrogeologist

Rehman Abdul, P.Eng.
Principal, Senior Geotechnical Engineer

FIGURES



REFERENCE:
Google Map 2022
NOTE:
Not to Scale

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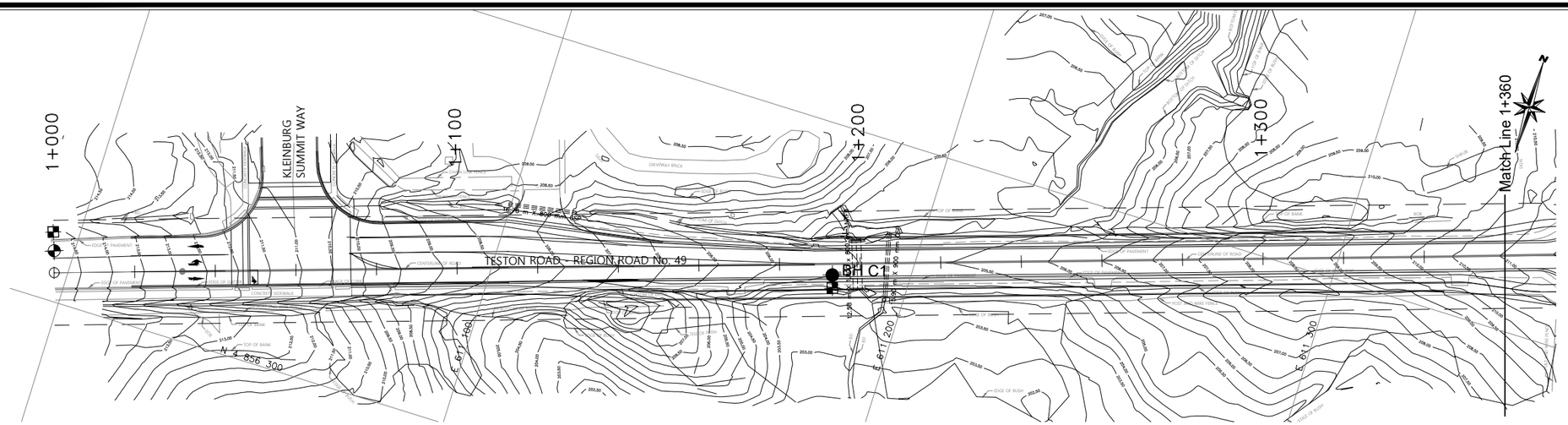
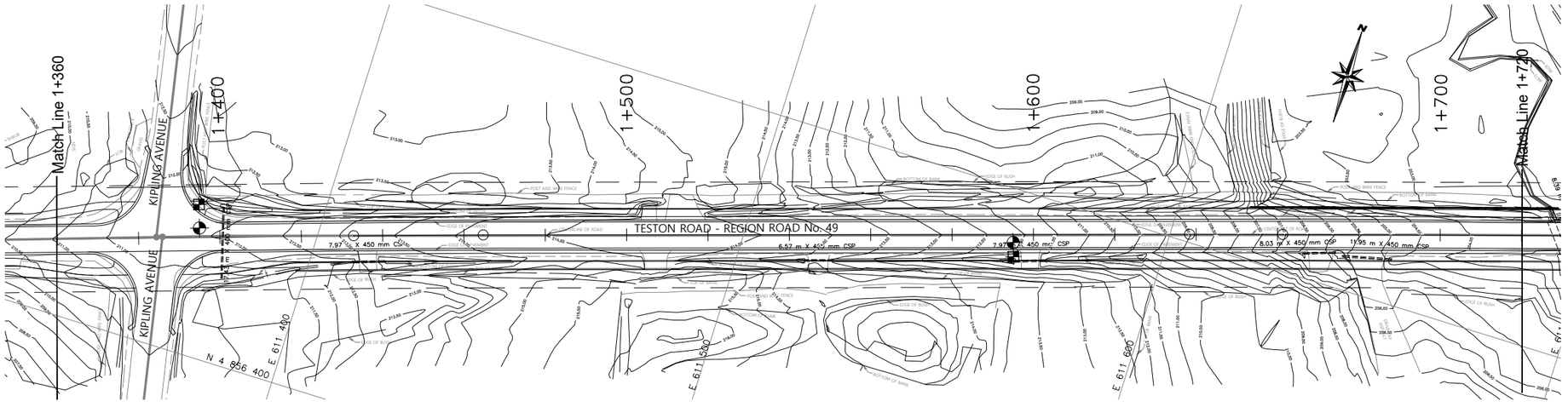
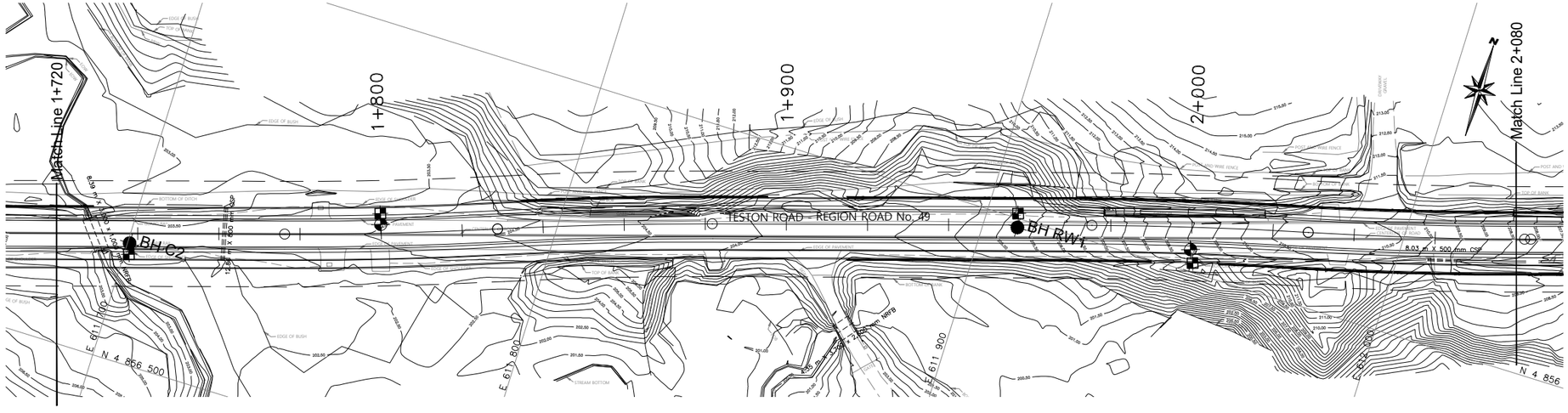
Title: **SITE LOCATION PLAN**

File No.: 1-20-0160

Figure: 1







TESTON ROAD (WEST OF PINE VALLEY DRIVE TO KLEINBURG SUMMIT WAY) THE CITY OF VAUGHAN, ONTARIO

BOREHOLE LOCATION PLAN

SHEET

METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN

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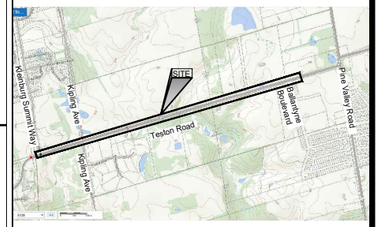


NOT TO SCALE

KEY PLAN

LEGEND

- Borehole
- Pavement Borehole
- Test Pit

BH No.	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE 17)	
		NORTHING (m)	EASTING (m)
C1	205.5	4 856 363.8	611 181.3
C2	203.6	4 856 529.0	611 700.5
RW1	205.2	4 856 597.8	611 908.3

SCALE

10 5 0 5 10 15 20m

NOTE

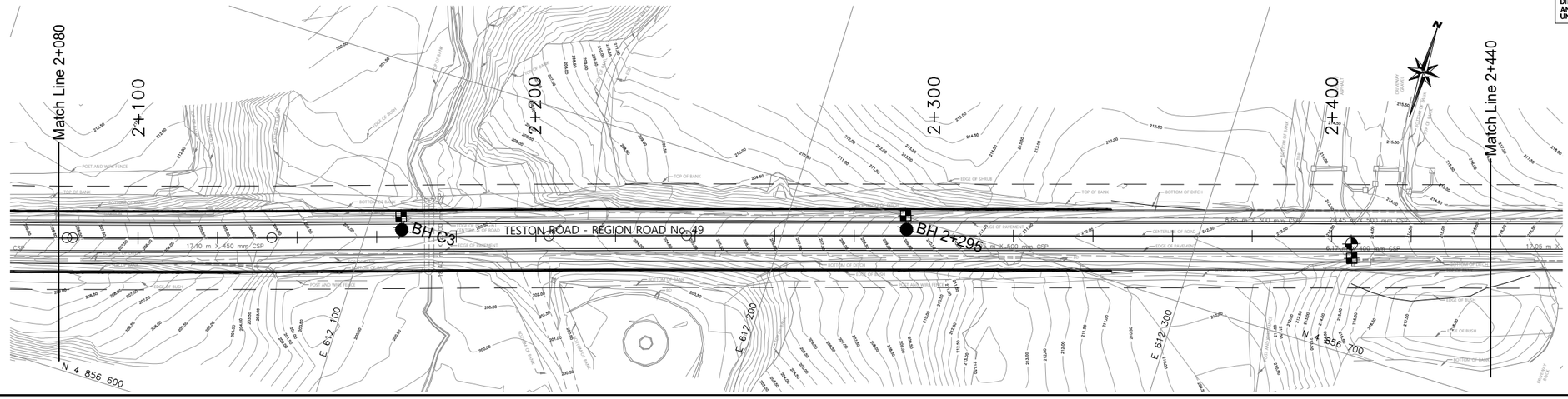
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

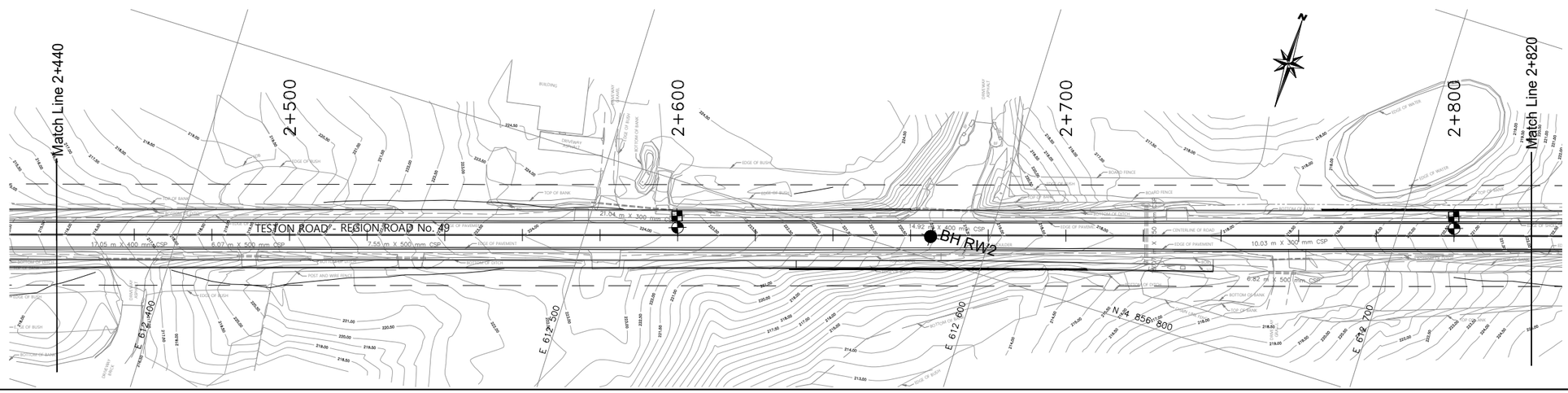
REFERENCE

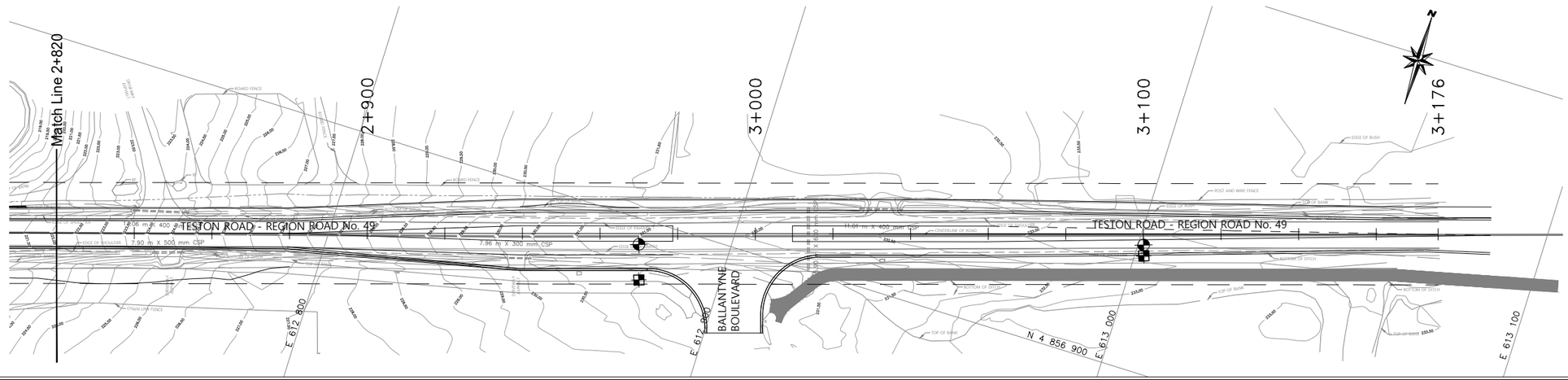
Drawings provided in digital format by HDR, received November 12, 2021.

REVISIONS	DATE	BY	DESCRIPTION

HWY. --	PROJECT No. 1-20-0160		DIST.
SUBM'D. SD	CHKD. RA	DATE: FEB. 2022	SITE: ----
DRAWN: KC	CHKD. RA	APPD: RA	DWG. 2







METRIC
DIMENSIONS ARE IN METRES AND/OR MILLIMETERS UNLESS OTHERWISE SHOWN

TESTON ROAD
(WEST OF PINE VALLEY DRIVE
TO KLEINBURG SUMMIT WAY)
THE CITY OF VAUGHAN, ONTARIO

BOREHOLE LOCATION PLAN

SHEET

HDR

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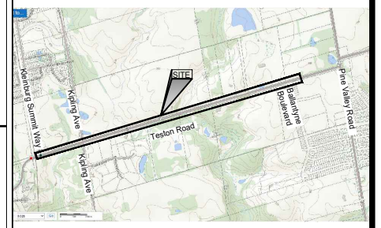


NOT TO SCALE

KEY PLAN

LEGEND

- Borehole
- Pavement Borehole
- Test Pit

BH No.	ELEV. (m)	COORDINATES (UTM, NAD83, ZONE 17) NORTHING (m)	EASTING (m)
C3	202.6	4 856 659.2	612 108.4
2+295	209.5	4 856 697.0	612 229.5
RW2	220.1	4 856 805.5	612 585.3

SCALE

10 5 0 5 10 15 20m

NOTE
This drawing is for subsurface information only. Surface details and features are for conceptual illustration. The subsurface conditions can be expected to vary between and beyond the borehole locations.

REFERENCE
Drawings provided in digital format by HDR, received November 12, 2021.

REVISIONS	DATE	BY	DESCRIPTION

HWY. --	PROJECT No. 1-20-0160			DIST.
SUBM'D. SD	CHKD. RA	DATE: FEB. 2022		SITE: ----
DRAWN: KC	CHKD. RA	APP'D: RA		DWG. 3

APPENDIX A
Log of Borehole Sheets

Terraprobe

ABBREVIATIONS AND TERMINOLOGY

SAMPLING METHODS

AS	Auger sample
GS	Grab sample
SS	Split spoon
ST	Shelby tube
WS	Wash sample
RC	Rock core
SC	Soil core

PENETRATION RESISTANCE

Standard Penetration Test (SPT) N-value (penetration resistance) is defined as the number of blows required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.) with a hammer weighing 63.5 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.).

Dynamic Cone Penetration Test (DCPT) resistance is defined as the number of blows required to advance a conical steel point 50 mm (2 in.) base diameter tapered 60° to the apex and attached to 'A' size drill rods for a distance of 0.3 m (12 in.), with a hammer weighing 63.5 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.).

COHESIONLESS SOILS

Relative Density	N-value Blows/0.3m
Very loose	< 5
Loose	5 – 10
Compact	10 – 30
Dense	30 – 50
Very dense	> 50

COHESIVE SOILS

Consistency	N-value Blows/0.3m	Undrained Shear Strength (kPa)
Very soft	< 2	< 12
Soft	2 – 4	12 – 25
Firm	4 – 8	25 – 50
Stiff	8 – 15	50 – 100
Very stiff	15 – 30	100 – 200
Hard	> 30	> 200

MINOR SOIL CONSTITUENTS

Modifier (e.g)	% by weight
trace (trace silt)	< 10
some (some silt)	10 – 20
(ey) or (y) (sandy)	20 – 35
and (sand and silt)	> 35

TESTS AND SYMBOLS

MH	combined sieve and hydrometer analysis
w,	water content
w_L,	liquid limit
w_P,	plastic limit
I_P,	plasticity index
k	coefficient of permeability
γ	soil unit weight, bulk
G_s	specific gravity
Φ'	effective angle of internal friction
c'	effective cohesion
c_u	undrained shear strength (Φ = 0 analysis)

▽	Unstabilized water level
▼	1st water level measurement
▼	2nd water level measurement
▼	Most recent water level measurement
3.0 +	Undrained shear strength from field vane (with sensitivity)
C_c	compression index (normally consolidated range)
C_r	recompression index (overconsolidated range)
c_v	coefficient of consolidation
m_v	coefficient of compressibility (volume change)
e	void ratio

FIELD MOISTURE DESCRIPTIONS

Dry	refers to a soil sample with a moisture content well below optimum ($w < w_{opt}$), absence of moisture, dusty, dry to the touch.
Moist	refers to a soil sample with a moisture content at or near optimum ($w \approx w_{opt}$), no visible pore water.
Wet	refers to a soil sample with a moisture content well above optimum ($w > w_{opt}$), has visible pore water.

LOG OF BOREHOLE C1

Terraprobe

Project No. : 1-20-0160	Client : HDR Corporation	Originated by : DH
Date started : December 8, 2021	Project : Teston Road, E.A. Study	Compiled by : LB
Sheet No. : 1 of 1	Location : City of Vaughan, Ontario	Checked by : SD

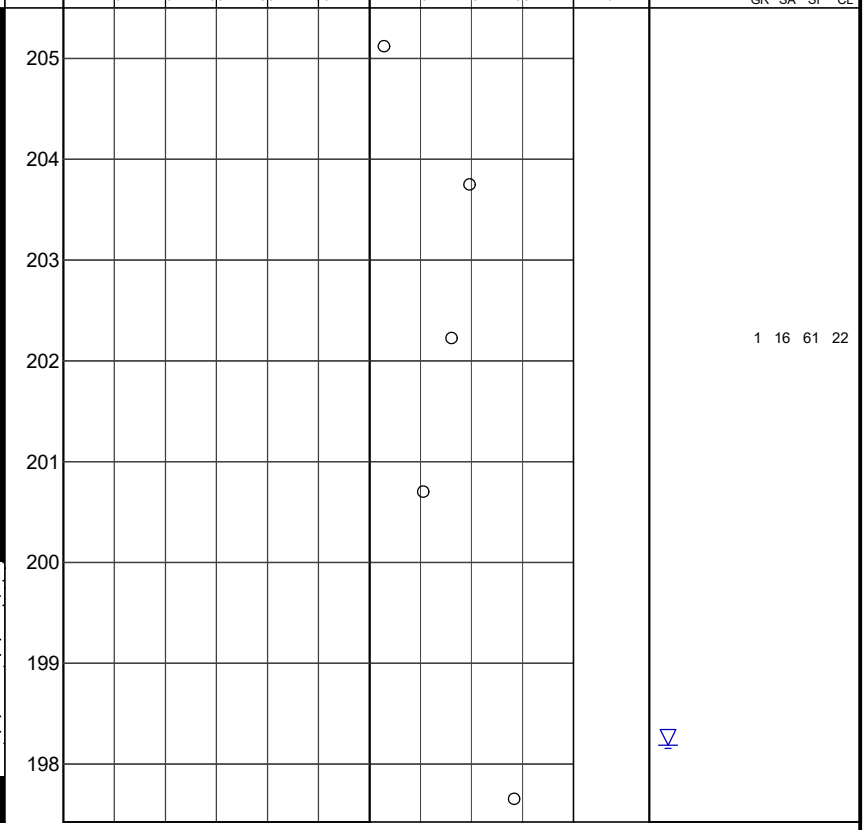
Position : E: 611181.3, N: 4856363.8 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

ELEV DEPTH (m)	DESCRIPTION	NUMBER	TYPE	SPT 'N' VALUE
205.5	**GROUND SURFACE**			
	75mm **ASPHALTIC CONCRETE**			
204.9 / 0.6	535mm **FILL**, sand and gravel to gravelly sand, some silt, dense, brown, dry	1	SS	43
	FILL, sandy gravel, trace to some silt, frequent crushed rock inclusions, compact, brown, dry	2	SS	23
204.1 / 1.4	**FILL**, silty clay, trace to some sand, trace gravel, firm, brown, moist to wet	3	SS	5
		4	SS	5
202.6 / 2.9	**SILTY CLAY**, trace sand to sandy, trcae gravel, stiff to hard, brown, moist to wet (GLACIAL TILL)	5	SS	19
		6	SS	23
		7	SS	31
		8	SS	33
198.4 / 7.1	**SAND AND SILT**, trace to some clay, compact, brown, wet	9	SS	15
197.4 / 8.1	**END OF BOREHOLE**			

Piezometer installation consists of a 50mm diameter PVC pipe with a 1.5m long slotted screen.

Unstabilized water level measured at 7.3 m below ground surface; borehole was open upon completion of drilling.



WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jan 6, 2022	5.7	199.8
Jan 31, 2022	5.8	199.7

+ 3, × 3 : Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

file: 1-20-0160 bh logs.gpj

LOG OF BOREHOLE C2

Terraprobe

Project No. : 1-20-0160	Client : HDR Corporation	Originated by : DH
Date started : December 8, 2021	Project : Teston Road, E.A. Study	Compiled by : LB
Sheet No. : 1 of 1	Location : City of Vaughan, Ontario	Checked by : SD

Position : E: 611700.5, N: 4856529.0 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE
203.6	**GROUND SURFACE**				
	130mm **ASPHALTIC CONCRETE**				
203.0	495mm **FILL**, sand and gravel to gravelly sand, some silt, compact, brown, dry		1	SS	29
0.6			2	SS	11
202.4	**FILL**, silty clay, some sand, trace gravel, stiff, brown, dry to moist				
1.2	**SILTY CLAY**, with sand seams, trace gravel, firm to stiff, brown, moist		3	SS	8
201.5					
2.1	**SILT**, trace clay, trace sand, compact, grey, wet		4	SS	15
200.7					
2.9	**SILTY CLAY to CLAYEY SILT**, some sand to sandy, very stiff, grey, dry to moist (GLACIAL TILL)		5	SS	17
			6	SS	23
			7	SS	22
			8	SS	22
			9	SS	19
195.5					
8.1	**END OF BOREHOLE**				

GROUND WATER CONDITIONS

ELEVATION SCALE: 203, 202, 201, 200, 199, 198, 197, 196

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

UNIT WEIGHT γ kN/m³

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
0	9	82	9

Piezometer installation consists of a 50mm diameter PVC pipe with a 3.0m long slotted screen.

Unstabilized water level measured at 5.5 m below ground surface; borehole was open upon completion of drilling.

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jan 6, 2022	1.4	202.2
Jan 31, 2022	1.6	202.0

+ 3, × 3 : Numbers refer to Sensitivity ○ 3% STRAIN AT FAILURE

file: 1-20-0160 bh logs.gpj

LOG OF BOREHOLE C3

Terraprobe

Project No. : 1-20-0160	Client : HDR Corporation	Originated by : DH
Date started : December 13, 2021	Project : Teston Road, E.A. Study	Compiled by : LB
Sheet No. : 1 of 1	Location : City of Vaughan, Ontario	Checked by : SD

Position : E: 612108.4, N: 4856659.2 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

ELEV DEPTH (m)	DESCRIPTION	NUMBER	TYPE	SPT 'N' VALUE	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
202.6	**GROUND SURFACE**				
	140mm **ASPHALTIC CONCRETE**	1	SS	32	
202.0	470mm **FILL**, sand and gravel to gravelly sand, trace silt, dense, brown, dry				
0.6	**FILL**, silty clay, trace to some sand, trace gravel, becoming sandy with some gravel below 2.6m, firm to stiff, brown, moist to wet	2	SS	9	
		3	SS	7	
199.7		4	SS	10	
2.9	**SILTY CLAY**, trace to some sand, firm to stiff, grey, wet (GLACIAL TILL)	5	SS	9	
		6	SS	10	1 7 70 22
197.0		7	SS	7	
5.6	**SAND AND SILT**, trace clay, loose to compact, grey, wet	8	SS	7	0 50 45 5
		9	SS	9	
193.0		10	SS	17	
9.6	**END OF BOREHOLE**				

Piezometer installation consists of a 50mm diameter PVC pipe with a 3.0m long slotted screen.

DYNAMIC CONE PENETRATION RESISTANCE PLOT (20 40 60 80 100)

SHEAR STRENGTH (kPa) (20 40 60 80 100)
○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%) (10 20 30)

UNIT WEIGHT γ kN/m^3

ELEVATION SCALE: 202 201 200 199 198 197 196 195 194 193

WATER LEVEL READINGS

Date	Water Depth (m)	Elevation (m)
Jan 6, 2022	2.1	200.5
Jan 31, 2022	2.3	200.3

+ ^{3}, × ^{3}: Numbers refer to Sensitivity ○ $^{3\%}$ STRAIN AT FAILURE

file: 1-20-0160 bh logs.gpj

LOG OF BOREHOLE RW1

Terraprobe

Project No. : 1-20-0160	Client : HDR Corporation	Originated by : DH
Date started : December 9, 2021	Project : Teston Road, E.A. Study	Compiled by : LB
Sheet No. : 1 of 1	Location : City of Vaughan, Ontario	Checked by : SD

Position : E: 611908.3, N: 4856597.8 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE	GROUND WATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
205.2	**GROUND SURFACE**						
	130mm **ASPHALTIC CONCRETE**		1	SS	15		
204.6	485mm **FILL**, sand and gravel to gravelly sand, trace silt, compact, brown, wet						
0.6			2	SS	12		3 25 52 20
	FILL, silty clay, some sand to sandy, trace gravel, firm to stiff, brown, dry						
203.1			3	SS	8		
2.1	**FILL**, silty sand, some clay, trace gravel, loose, brown, wet		4	SS	6		
201.5			5	SS	7		
3.7	**SILTY CLAY**, some sand, trace gravel, trace to some organics, firm, grey, moist		6	SS	7		
200.8							
4.4	**SILTY CLAY**, some sand to sandy, trace gravel, very stiff to hard, brown to 5.3m, grey below, moist to wet (GLACIAL TILL)		7	SS	22		▽
198.6			8	SS	36		
6.6	**END OF BOREHOLE**						

Unstabilized water level measured at 5.3 m below ground surface; borehole was open upon completion of drilling.

ELEVATION SCALE: 205, 204, 203, 202, 201, 200, 199

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

UNIT WEIGHT γ kN/m^3

+ ^{3}, × ^{3}: Numbers refer to Sensitivity ○ $^{3\%}$ STRAIN AT FAILURE

file: 1-20-0160 bh logs.gpj

LOG OF BOREHOLE RW2

Terraprobe

Project No. : 1-20-0160	Client : HDR Corporation	Originated by : DH
Date started : December 9, 2021	Project : Teston Road, E.A. Study	Compiled by : LB
Sheet No. : 1 of 1	Location : City of Vaughan, Ontario	Checked by : SD

Position : E: 612585.3, N: 4856805.5 (UTM 17T) Elevation Datum : Geodetic

Rig type : Truck-mounted Drilling Method : Solid stem augers

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	SAMPLES NUMBER	SAMPLES TYPE	SPT 'N' VALUE	GROUND WATER CONDITIONS
220.1	**GROUND SURFACE**					
	130mm **ASPHALTIC CONCRETE**		1	SS	47	
219.6	380mm **FILL**, sand and gravel to gravelly sand, trace silt, trace clay, dense, brown, dry					
0.5	**FILL**, silty clay, some sand to sandy, trace gravel, stiff, brown, moist		2	SS	10	
			3	SS	12	
218.0						
2.1	**SILTY CLAY**, some sand to sandy, trace gravel, very stiff to hard, brown, dry to moist (GLACIAL TILL)		4	SS	23	
			5	SS	31	
			6	SS	32	
			7	SS	29	
			8	SS	47	
213.5						
6.6	**END OF BOREHOLE**					

Borehole was dry and open upon completion of drilling.

ELEVATION SCALE: 220, 219, 218, 217, 216, 215, 214

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

UNIT WEIGHT γ kN/m^3

REMARKS & GRAIN SIZE DISTRIBUTION (%)

GR	SA	SI	CL
2	12	63	23

+ ^{3}, × ^{3}: Numbers refer to Sensitivity ○ $^{3\%}$ STRAIN AT FAILURE

file: 1-20-0160 bh logs.gpj

Terraprobe

LOG OF BOREHOLE 2+295

Project No. : 1-20-0160 | Client : HDR Corporation | Originated by : DH

Date started : December 13, 2021 | Project : Teston Road, E.A. Study | Compiled by : LB

Sheet No. : 1 of 1 | Location : City of Vaughan, Ontario | Checked by : SD

Position : E: 612229.5, N: 4856697.0 (UTM 17T) | Elevation Datum : Geodetic

Rig type : Truck-mounted | Drilling Method : Solid stem augers

ELEV DEPTH (m)	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	SPT 'N' VALUE	GROUND WATER CONDITIONS	REMARKS & GRAIN SIZE DISTRIBUTION (%) GR SA SI CL
209.5	**GROUND SURFACE**						
	140mm **ASPHALTIC CONCRETE**		1	SS	28		
208.8	510mm **FILL**, sand and gravel to gravelly sand, some silt, trace clay, compact, brown, dry						
0.7			2	SS	11		
208.1	**FILL**, silty clay, some sand to sandy, trace gravel, stiff, brown, dry						
1.4	**SILT AND SAND**, trace to some clay, trace gravel, compact, brown, wet		3	SS	20		1 39 50 10
207.3							
2.2	**SILTY CLAY**, some sand to sandy, stiff to very stiff, brown to 3.8m, grey below, dry to moist (GLACIAL TILL)		4	SS	22		
			5	SS	25		4 21 54 21
			6	SS	14		
			7	SS	18		
			8	SS	19		
202.9							
6.6	**END OF BOREHOLE**						

Borehole was dry and open upon completion of drilling.

ELEVATION SCALE: 209, 208, 207, 206, 205, 204, 203

DYNAMIC CONE PENETRATION RESISTANCE PLOT: 20 40 60 80 100

SHEAR STRENGTH (kPa): ○ UNCONFINED ● QUICK TRIAXIAL + FIELD VANE × LAB VANE; 20 40 60 80 100

PLASTIC LIMIT w_P | NATURAL MOISTURE CONTENT w | LIQUID LIMIT w_L

WATER CONTENT (%): 10 20 30

UNIT WEIGHT γ kN/m^3

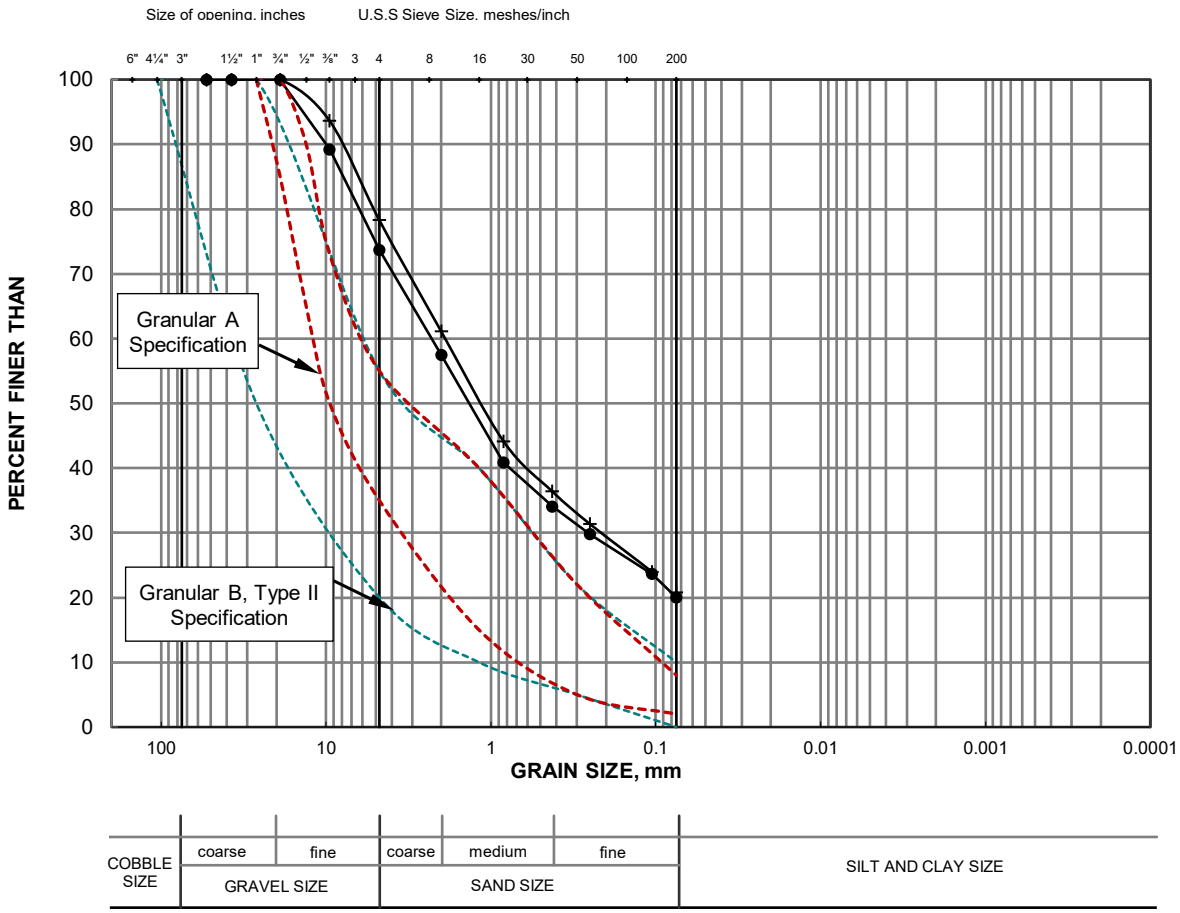
+^{3}, ×^{3}: Numbers refer to Sensitivity ○$^{3\%}$ STRAIN AT FAILURE

file: 1-20-0160 bh logs.gpj

APPENDIX B
Laboratory Test Results

GRAIN SIZE DISTRIBUTION	FIGURE B1

GRANULAR BASE/SUBBASE



LEGEND

SYMBOL	STATION	LOCATION	DEPTH (m)
●	1+600	EBL	0.13 - 0.65
+	2+800	WBL	0.16 - 0.66

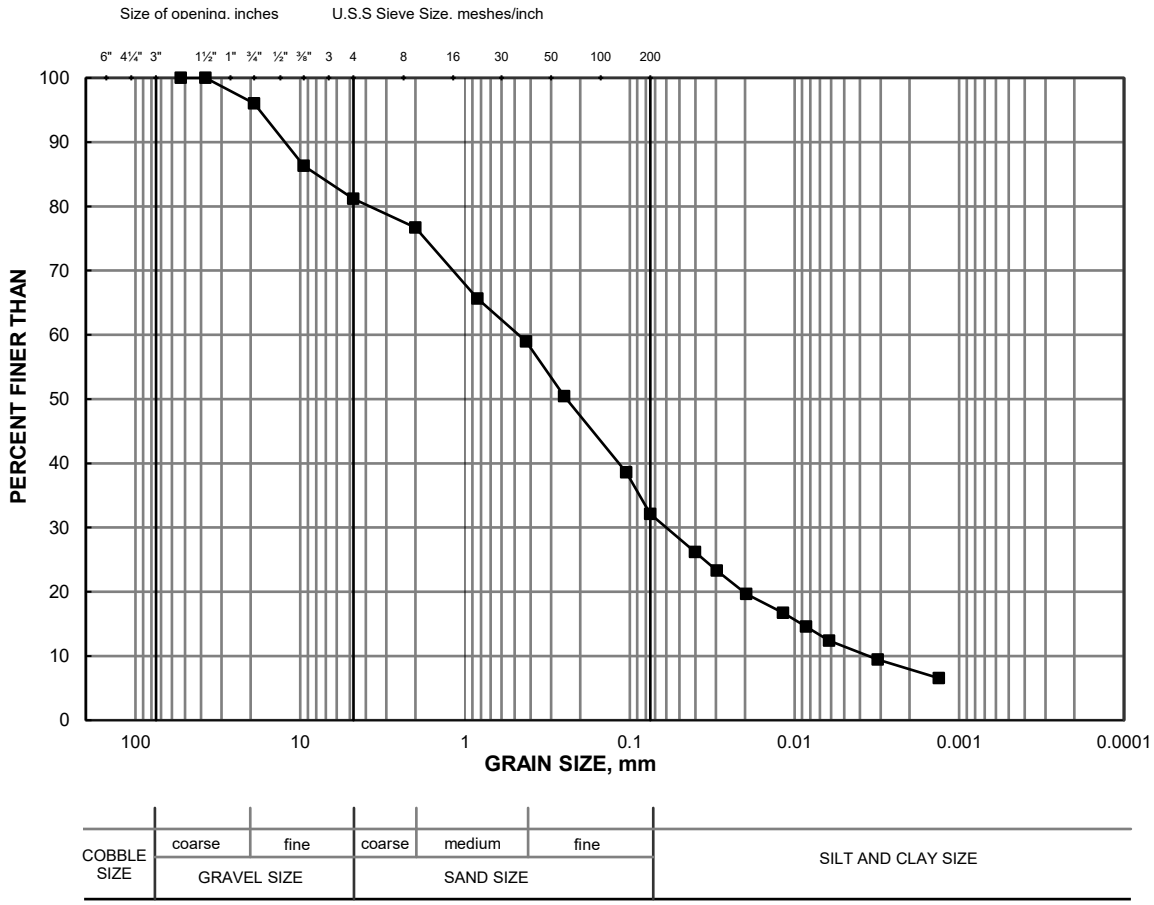
Project No: 1-20-0160
Date: Jan, 2022

Terraprobe

Prepared by : LB
Checked by : SD

GRAIN SIZE DISTRIBUTION	FIGURE B2

SUBGRADE (Silty Sand)



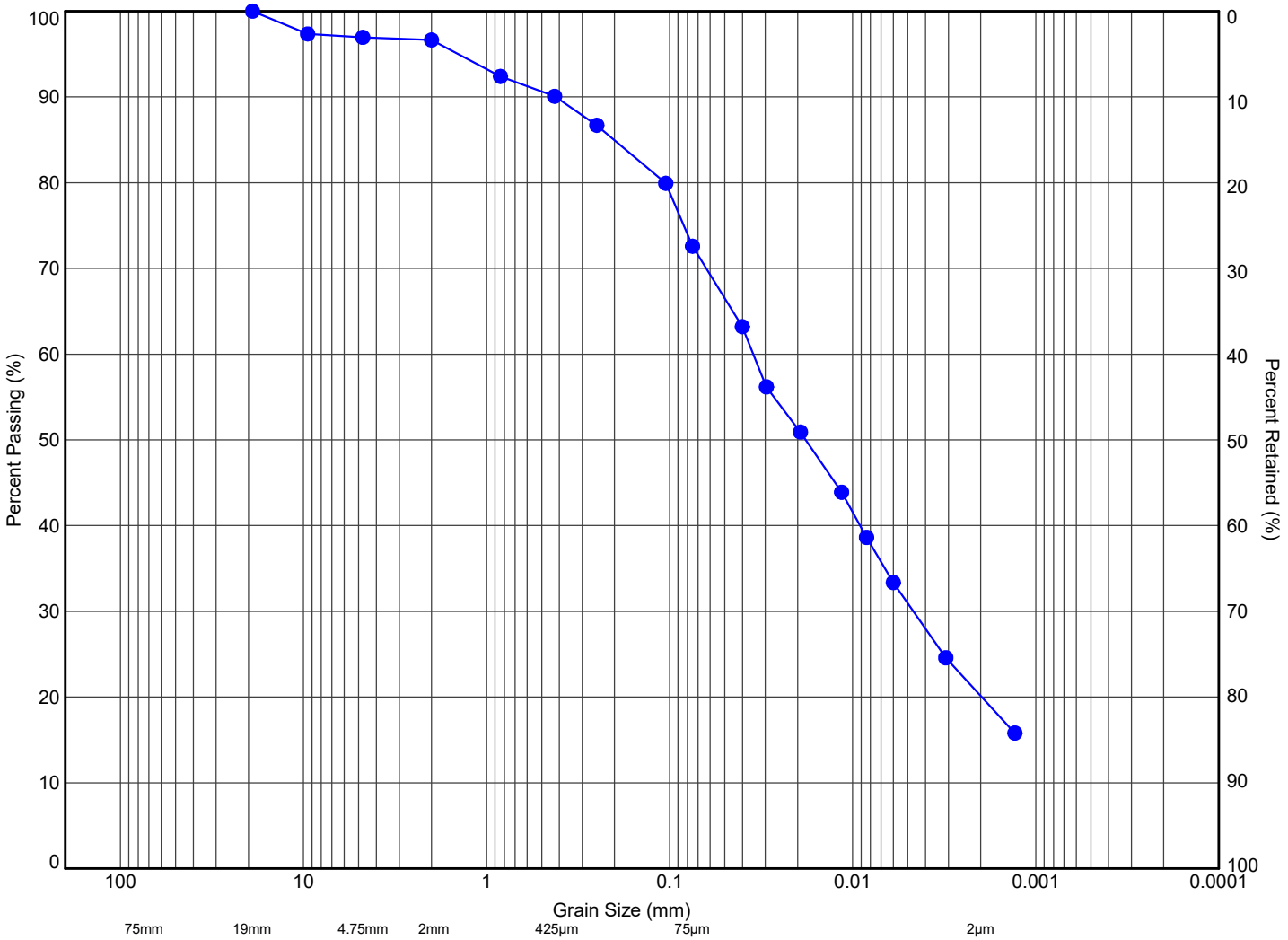
LEGEND

SYMBOL	STATION	LOCATION	DEPTH (m)
■	2+800	WBL	0.66 - 1.20

Project No: 1-20-0160
Date: Jan, 2022

Terraprobe

Prepared by : LB
Checked by : SD



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**RW1**	SS2	1.0	204.2	3	25	52	20	

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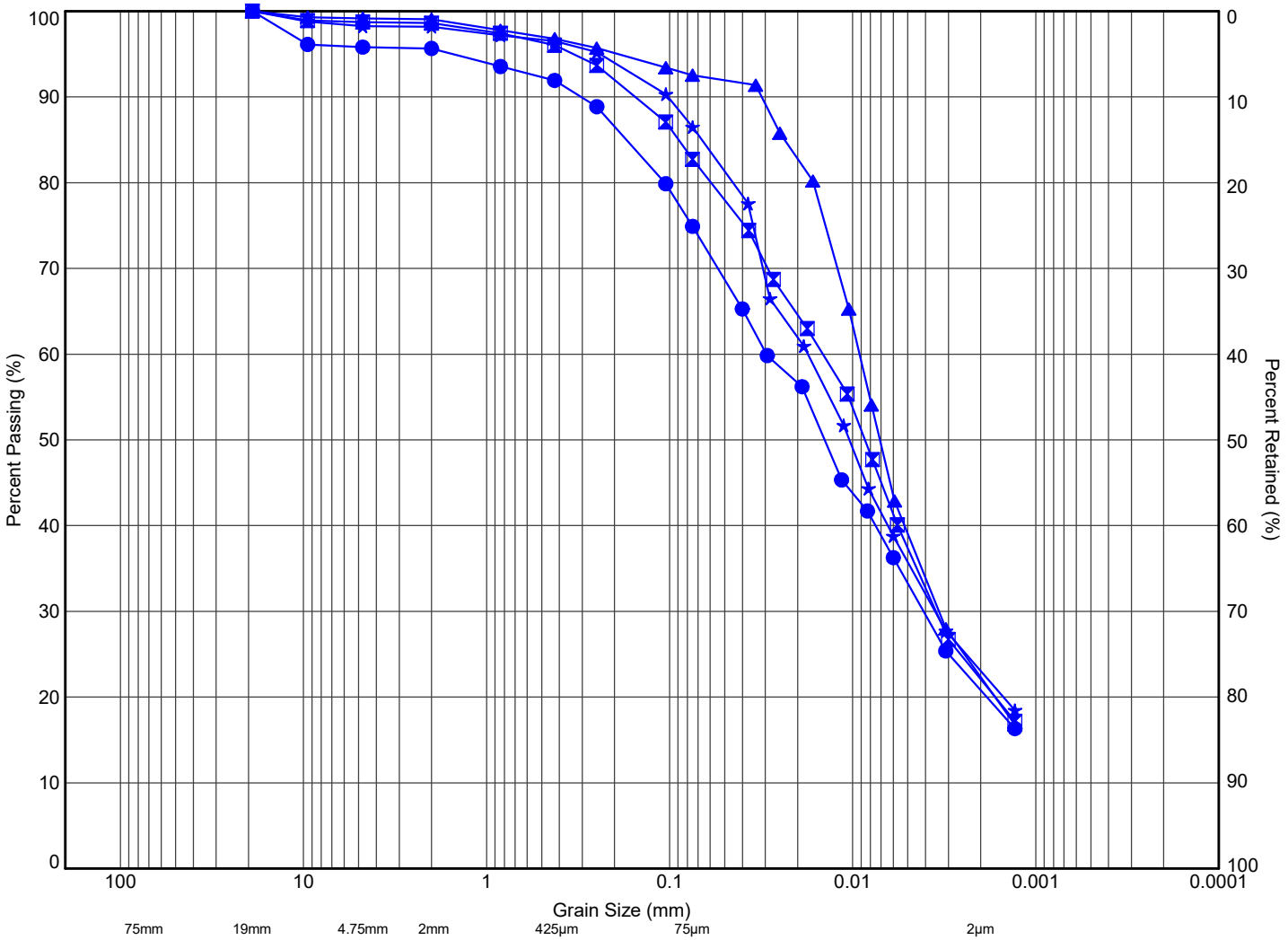
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
FIGURE B3 - FILL-SILTY CLAY

File No.: **1-20-0160**



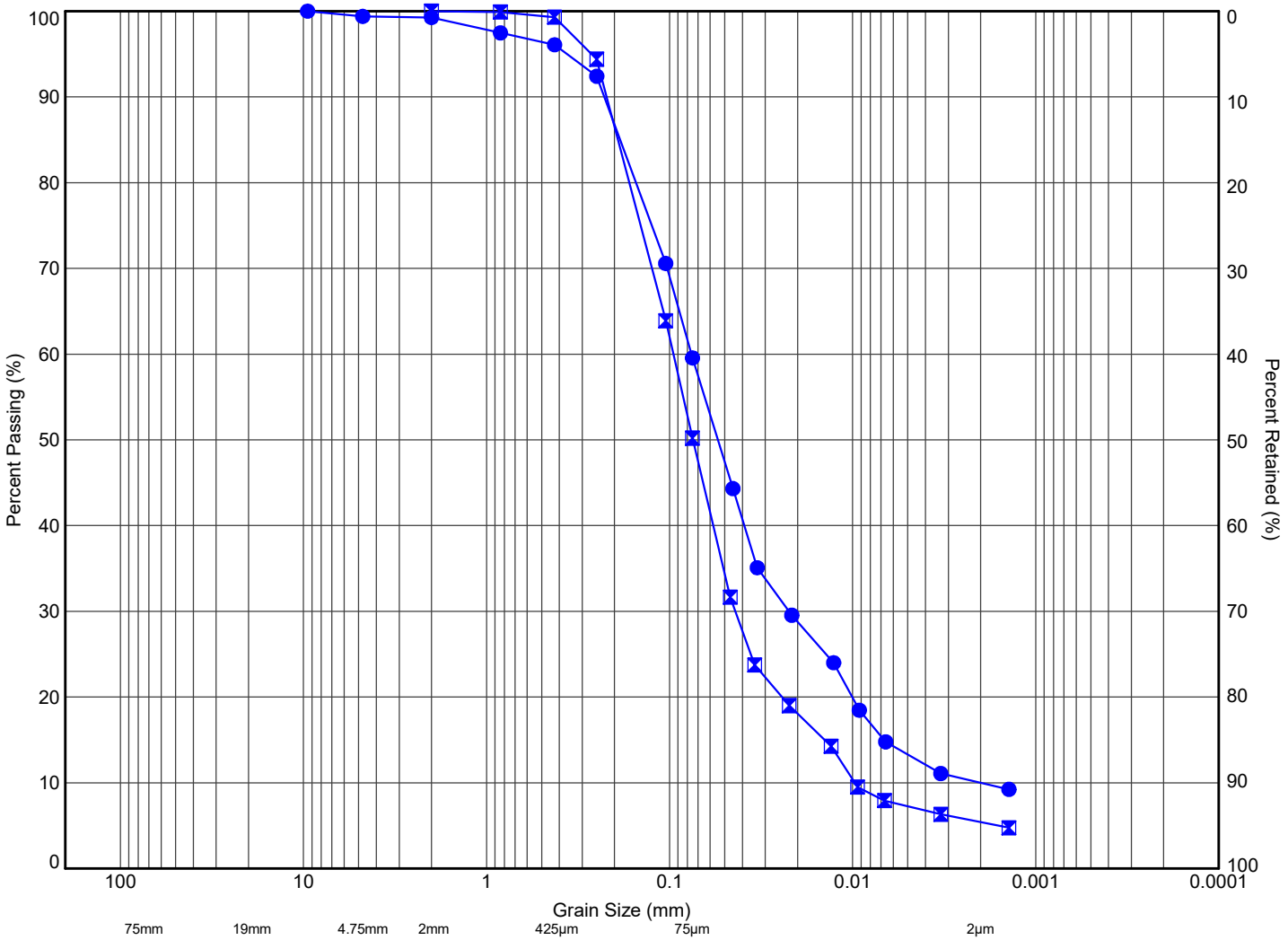
	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**2+295**	SS5	3.3	206.2	4	21	54	21	
⊠	**C1**	SS5	3.3	202.2	1	16	61	22	
▲	**C3**	SS6	4.0	198.6	1	7	70	22	
★	**RW2**	SS4	2.5	217.6	2	12	63	23	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
FIGURE B4 - SILTY CLAY (GLACIAL TILL)

File No.: **1-20-0160**



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**2+295**	SS3	1.8	207.7	1	39	50	10	
⊠	**C3**	SS8	6.3	196.3	0	50	45	5	

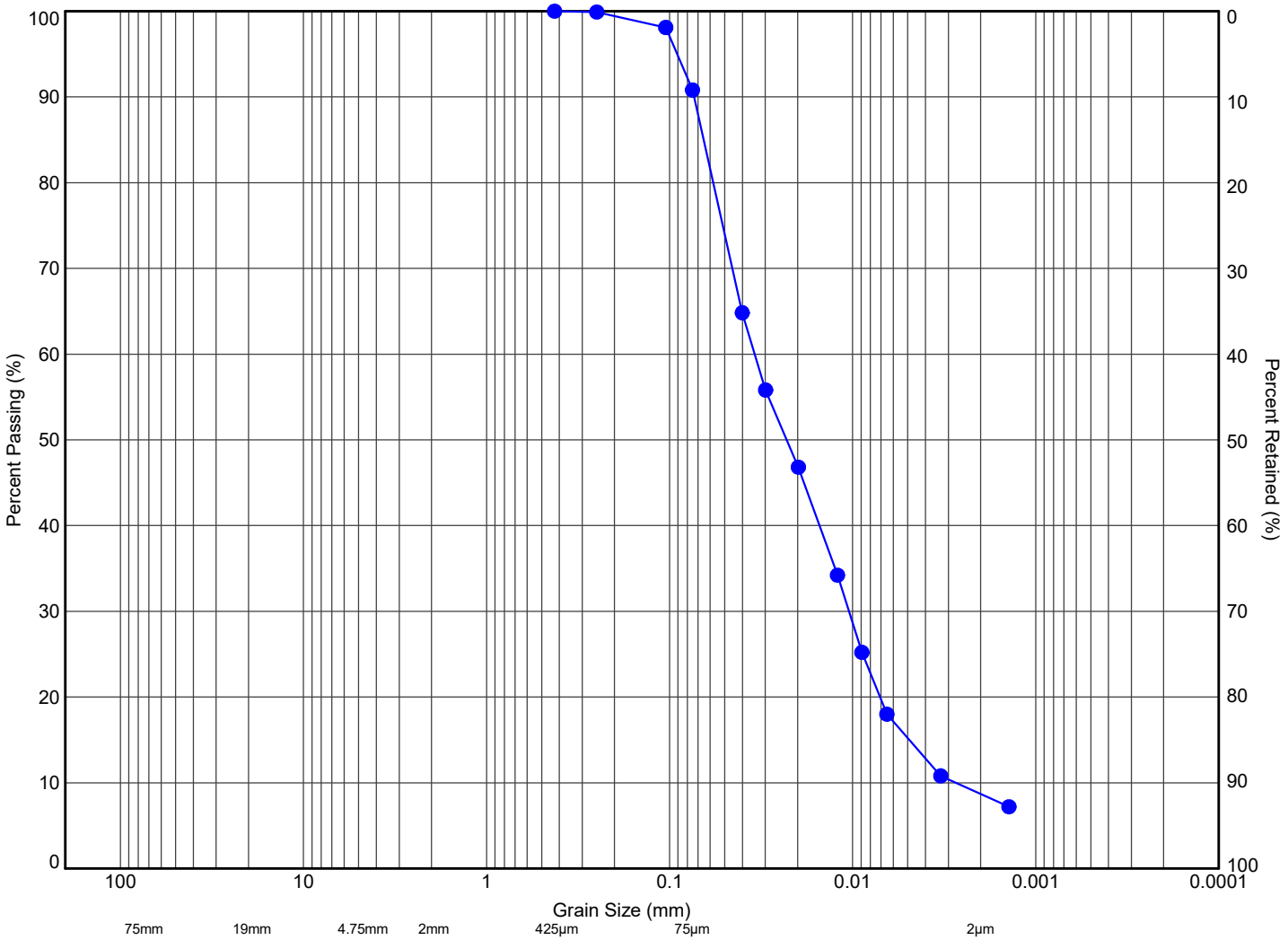
Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION

FIGURE B5 - SILT AND SAND TO SAND AND SILT

File No.: **1-20-0160**



	Hole ID	Sample	Depth (m)	Elev. (m)	Gravel (%)	Sand (%)	Silt (%)	Clay (%)	*(Fines, %)*
●	**C2**	SS4	2.5	201.1	0	9	82	9	

Terraprobe
11 Indell Lane, Brampton Ontario L6T 3Y3
(905) 796-2650

Title:

GRAIN SIZE DISTRIBUTION
FIGURE B6 - SILT

File No.: **1-20-0160**

APPENDIX C
Certificates of Analysis

FINAL REPORT

CA40010-FEB22 R1

1-20-0160, Teston Road

Prepared for

Terraprobe Inc

FINAL REPORT

First Page

CLIENT DETAILS		LABORATORY DETAILS	
Client	Terraprobe Inc	Project Specialist	Jill Campbell, B.Sc.,GISAS
		Laboratory	SGS Canada Inc.
Address	11 Indell Lane Brampton, ON L6T 3Y3. Canada	Address	185 Concession St., Lakefield ON, K0L 2H0
Contact	Leila Baninajarian	Telephone	2165
Telephone	(905) 796-2650	Facsimile	705-652-6365
Facsimile	(905) 796-2250	Email	jill.campbell@sgs.com
Email	lbaninajarian@terraprobe.ca	SGS Reference	CA40010-FEB22
Project	1-20-0160, Teston Road	Received	02/01/2022
Order Number		Approved	02/09/2022
Samples	Solution (6)	Report Number	CA40010-FEB22 R1
		Date Reported	02/09/2022

COMMENTS

MAC - Maximum Acceptable Concentration
AO/OG - Aesthetic Objective / Operational Guideline
NR - Not reportable under applicable Provincial drinking water regulations as per client.

Temperature of Sample upon Receipt: 8 degrees C
Cooling Agent Present: Yes
Custody Seal Present: Yes

Chain of Custody Number: 024260

NDOGEC - No Data: Overgrown with E.coli
NDOGTC - No Data: Overgrown with Total Coliform
NDOGHPC - No Data: Overgrown with HPC
Note: Elevated Ecoli results <100 cfu/100mL and <20 cfu/100mL. Unable to provide more accurate results due to sample matrix.

RL raised for tags 8 & 9 for sulphide due to sample matrix

Raise RL for NO2 on #9 due to matrix interference

SIGNATORIES

Jill Campbell, B.Sc.,GISAS

TABLE OF CONTENTS

Client: Terraprobe Inc
Project: 1-20-0160, Teston Road
Project Manager: Leila Baninajarian
Samplers: Leila-B

MATRIX: WATER

Sample Number				7	8	9	10	11	12	
Sample Name				BH-C1 Dissolved	BH-C1	BH-C2	BH-C2 Dissolved	BH-C3	BH-C3 Dissolved	
Sample Matrix				Solution	Solution	Solution	Solution	Solution	Solution	
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**	
General Chemistry										
UV Transmittance	%T			---	41.2	74.6	---	74.7	---	
Alkalinity	mg/L as CaCO3	2		---	572	335	---	339	---	
Bicarbonate	mg/L as CaCO3	2		---	572	335	---	339	---	
Carbonate	mg/L as CaCO3	2		---	< 2	< 2	---	< 2	---	
OH	mg/L as CaCO3	2		---	< 2	< 2	---	< 2	---	
Colour	TCU	3		---	7	3	---	< 3	---	
Conductivity	uS/cm	2		---	2330	3960	---	1060	---	
Total Suspended Solids	mg/L	2		---	14100	2100	---	116	---	
Turbidity	NTU	0.10		---	>4000	493	---	52.4	---	
Organic Nitrogen	mg/L	0.5		---	< 0.5	< 0.5	---	< 0.5	---	
Total Kjeldahl Nitrogen	as N mg/L	0.5		---	< 0.5	1.2	---	< 0.5	---	
Ammonia+Ammonium (N)	as N mg/L	0.1		---	< 0.1	0.9	---	0.2	---	
Dissolved Organic Carbon	mg/L	1		---	2	5	---	3	---	
Total Organic Carbon	mg/L	1		---	2	5	---	3	---	

Client: Terraprobe Inc
Project: 1-20-0160, Teston Road
Project Manager: Leila Baninajarian
Samplers: Leila-B

MATRIX: WATER

			Sample Number	7	8	9	10	11	12
			Sample Name	BH-C1 Dissolved	BH-C1	BH-C2	BH-C2 Dissolved	BH-C3	BH-C3 Dissolved
			Sample Matrix	Solution	Solution	Solution	Solution	Solution	Solution
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics									
Fluoride	mg/L	0.06		---	0.09	0.08	---	0.14	---
Bromide	mg/L	0.3		---	< 0.3	0.8	---	< 0.3	---
Nitrite (as N)	as N mg/L	0.03		---	< 0.03	< 0.3↑	---	< 0.03	---
Nitrate (as N)	as N mg/L	0.06		---	0.16	2.26	---	< 0.06	---
Sulphate	mg/L	0.2		---	63	39	---	96	---
Sulphide	mg/L	0.2		---	< 0.2	< 0.2	---	< 0.02↓	---
Aluminum (0.2µm)	mg/L	0.001		---	0.017	0.005	---	0.002	---
Hardness	mg/L as CaCO3	0.05		456	3490	3040	848	483	447
Aluminum (total)	mg/L	0.001		< 0.001	131	114	0.025	1.03	0.004
Arsenic (total)	mg/L	0.0002		< 0.0002	0.0297	0.0261	0.0008	0.0005	< 0.0002
Boron (total)	mg/L	0.002		0.034	0.179	0.183	0.057	0.035	0.030
Barium (total)	mg/L	0.00002		0.0711	0.848	1.57	0.797	0.169	0.128
Beryllium (total)	mg/L	0.000007		< 0.000007	0.00480	0.00377	< 0.000007	0.000050	< 0.000007
Bismuth (total)	mg/L	0.00001		< 0.00001	0.00157	0.00120	0.00009	0.00002	< 0.00001
Cobalt (total)	mg/L	0.000004		0.000256	0.0944	0.0656	0.000564	0.000916	0.000230
Calcium (total)	mg/L	0.01		152	1180	958	238	153	141
Cadmium (total)	mg/L	0.000003		0.000009	0.00103	0.00149	0.000017	0.000017	0.000005
Copper (total)	mg/L	0.0002		0.0009	0.672	0.267	0.0023	0.0048	0.0003
Chromium (total)	mg/L	0.00008		< 0.00008	0.177	0.160	0.00011	0.00251	< 0.00008
Iron (total)	mg/L	0.007		< 0.007	196	160	0.075	4.34	0.026
Potassium (total)	mg/L	0.009		2.64	38.4	52.6	7.50	3.00	2.80
Magnesium (total)	mg/L	0.001		18.5	135	156	61.4	24.7	23.4
Manganese (total)	mg/L	0.00001		0.251	6.94	4.84	0.375	0.483	0.422

Client: Terraprobe Inc
Project: 1-20-0160, Teston Road
Project Manager: Leila Baninajarian
Samplers: Leila-B

MATRIX: WATER

			Sample Number	7	8	9	10	11	12
			Sample Name	BH-C1 Dissolved	BH-C1	BH-C2	BH-C2 Dissolved	BH-C3	BH-C3 Dissolved
			Sample Matrix	Solution	Solution	Solution	Solution	Solution	Solution
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Metals and Inorganics (continued)									
Molybdenum (total)	mg/L	0.00004		0.00184	0.00826	0.00454	0.00230	0.00085	0.00079
Nickel (total)	mg/L	0.0001		0.0011	0.183	0.147	0.0036	0.0029	0.0011
Sodium (total)	mg/L	0.01		454	366	534	468	72.7	79.2
Phosphorus (total)	mg/L	0.003		< 0.003	6.94	5.29	0.009	0.150	0.003
Lead (total)	mg/L	0.00009		< 0.00009	0.172	0.102	0.00014	0.00155	< 0.00009
Silicon (total)	mg/L	0.02		7.34	297	239	9.75	11.9	9.26
Silver (total)	mg/L	0.00005		< 0.00005	0.00048	0.00049	< 0.00005	0.00006	< 0.00005
Strontium (total)	mg/L	0.00002		0.389	2.18	2.88	1.60	0.477	0.457
Thallium (total)	mg/L	0.000005		< 0.000005	0.00135	0.00127	< 0.000005	< 0.000005	< 0.000005
Tin (total)	mg/L	0.00006		0.00045	0.00624	0.0142	0.00171	0.00158	0.00107
Titanium (total)	mg/L	0.00005		0.00009	4.52	5.06	0.00089	0.0306	0.00025
Antimony (total)	mg/L	0.0009		< 0.0009	0.0020	0.0051	< 0.0009	< 0.0009	< 0.0009
Selenium (total)	mg/L	0.00004		0.00016	0.00176	0.00102	0.00008	< 0.00004	< 0.00004
Uranium (total)	mg/L	0.000002		0.00164	0.00754	0.00531	0.000409	0.000362	0.000294
Vanadium (total)	mg/L	0.00001		0.00026	0.268	0.229	0.00054	0.00231	0.00005
Zinc (total)	mg/L	0.002		< 0.002	0.964	0.526	0.018	0.025	0.021

Client: Terraprobe Inc
Project: 1-20-0160, Teston Road
Project Manager: Leila Baninajarian
Samplers: Leila-B

MATRIX: WATER

	Sample Number	7	8	9	10	11	12
	Sample Name	BH-C1 Dissolved	BH-C1	BH-C2	BH-C2 Dissolved	BH-C3	BH-C3 Dissolved
	Sample Matrix	Solution	Solution	Solution	Solution	Solution	Solution
Parameter	**Units**	**RL**		**Result**	**Result**	**Result**	**Result**	**Result**	**Result**
Microbiology									
Total Coliform	cfu/100mL	0		---	5200	12000	---	240	---
E. Coli	cfu/100mL	0		---	< 100↑	< 20↑	---	0	---
Heterotrophic Plate Count (HPC)	cfu/1mL	0		---	#NDOGHPC	#NDOGHPC	---	440000	---
Other (ORP)									
Chromium VI	µg/L	0.2		---	< 0.2	0.3	---	< 0.2	---
pH	No unit	0.05		---	7.48	7.69	---	7.44	---
Chloride	mg/L	0.2		---	600	1300	---	120	---
Mercury (total)	mg/L	0.00001		---	< 0.00001	< 0.00001	---	< 0.00001	---
Mercury (dissolved)	mg/L	0.00001		---	< 0.00001	< 0.00001	---	< 0.00001	---
Phenols									
4AAP-Phenolics	mg/L	0.002		---	0.003	0.004	---	0.003	---

QC SUMMARY

Alkalinity

Method: SM 2320 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Alkalinity	EWL0020-FEB22	mg/L as CaCO3	2	< 2	1	20	98	80	120	NA		

Ammonia by SFA

Method: SM 4500 I Internal ref.: ME-CA-IENVISFA-LAK-AN-007

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Ammonia+Ammonium (N)	SKA0016-FEB22	as N mg/L	0.1	<0.1	0	10	100	90	110	93	75	125
Ammonia+Ammonium (N)	SKA0029-FEB22	as N mg/L	0.1	<0.1	ND	10	100	90	110	90	75	125

QC SUMMARY

Anions by IC

Method: EPA300/MA300-Ions1.3 | Internal ref.: ME-CA-[ENV]IC-LAK-AN-001

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Bromide	DIO0043-FEB22	mg/L	0.3	<0.3	ND	20	98	90	110	93	75	125
Nitrite (as N)	DIO0043-FEB22	mg/L	0.03	<0.03	ND	20	102	90	110	97	75	125
Nitrate (as N)	DIO0043-FEB22	mg/L	0.06	<0.06	ND	20	102	90	110	99	75	125
Nitrite (as N)	DIO0068-FEB22	mg/L	0.03	<0.03	ND	20	98	90	110	97	75	125
Chloride	DIO0075-FEB22	mg/L	0.2	<0.2	2	20	94	90	110	123	75	125
Sulphate	DIO0075-FEB22	mg/L	0.2	<0.2	3	20	95	90	110	92	75	125

Carbon by SFA

Method: SM 5310 | Internal ref.: ME-CA-[ENV]SFA-LAK-AN-009

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Dissolved Organic Carbon	SKA0021-FEB22	mg/L	1	<1	0	20	96	90	110	76	75	125
Total Organic Carbon	SKA0021-FEB22	mg/L	1	<1	0	20	96	90	110	76	75	125

QC SUMMARY

Carbonate/Bicarbonate

Method: SM 2320 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Carbonate	EWL0020-FEB22	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		
Bicarbonate	EWL0020-FEB22	mg/L as CaCO3	2	< 2	1	10	NA	90	110	NA		
OH	EWL0020-FEB22	mg/L as CaCO3	2	< 2	ND	10	NA	90	110	NA		

Colour

Method: SM 2120 | Internal ref.: ME-CA-[ENV]EWL-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Colour	EWL0058-FEB22	TCU	3	< 3	ND	10	95	80	120	NA		

QC SUMMARY

Conductivity

Method: SM 2510 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Conductivity	EWL0020-FEB22	uS/cm	2	< 2	1	20	99	90	110	NA		

Fluoride by Specific Ion Electrode

Method: SM 4500 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-014

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Fluoride	EWL0021-FEB22	mg/L	0.06	<0.06	ND	10	105	90	110	NV	75	125

Hexavalent Chromium by SFA

Method: EPA218.6/EPA3060A I Internal ref.: ME-CA-IENVISKA-LAK-AN-012

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Chromium VI	SKA0034-FEB22	ug/L	0.2	<0.2	ND	20	103	80	120	97	75	125
Chromium VI	SKA0047-FEB22	ug/L	0.2	<0.2	ND	20	104	80	120	92	75	125

QC SUMMARY

Mercury by CVAAS

Method: EPA 7471A/SM 3112B | Internal ref.: ME-CA-[ENVISPE-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Mercury (total)	EHG0007-FEB22	mg/L	0.00001	< 0.00001	0	20	91	80	120	91	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Silver (total)	EMS0015-FEB22	mg/L	0.00005	<0.00005	ND	20	101	90	110	90	70	130
Aluminum (total)	EMS0015-FEB22	mg/L	0.001	<0.001	3	20	98	90	110	76	70	130
Aluminum (0.2µm)	EMS0015-FEB22	mg/L	0.001	<0.001	3	20	98	90	110	76	70	130
Arsenic (total)	EMS0015-FEB22	mg/L	0.0002	<0.0002	4	20	100	90	110	103	70	130
Barium (total)	EMS0015-FEB22	mg/L	0.00002	<0.00002	2	20	101	90	110	103	70	130
Beryllium (total)	EMS0015-FEB22	mg/L	0.000007	<0.000007	2	20	101	90	110	89	70	130
Boron (total)	EMS0015-FEB22	mg/L	0.002	<0.002	1	20	102	90	110	98	70	130
Bismuth (total)	EMS0015-FEB22	mg/L	0.00001	<0.00001	ND	20	94	90	110	86	70	130
Calcium (total)	EMS0015-FEB22	mg/L	0.01	<0.01	2	20	101	90	110	115	70	130
Cadmium (total)	EMS0015-FEB22	mg/L	0.000003	<0.000003	6	20	103	90	110	98	70	130
Cobalt (total)	EMS0015-FEB22	mg/L	0.000004	<0.000004	4	20	99	90	110	92	70	130
Chromium (total)	EMS0015-FEB22	mg/L	0.00008	<0.00008	ND	20	98	90	110	102	70	130
Copper (total)	EMS0015-FEB22	mg/L	0.0002	<0.0002	1	20	100	90	110	97	70	130
Iron (total)	EMS0015-FEB22	mg/L	0.007	<0.007	2	20	106	90	110	125	70	130
Potassium (total)	EMS0015-FEB22	mg/L	0.009	<0.009	2	20	108	90	110	94	70	130
Magnesium (total)	EMS0015-FEB22	mg/L	0.001	0.001	4	20	99	90	110	110	70	130
Manganese (total)	EMS0015-FEB22	mg/L	0.00001	<0.00001	4	20	99	90	110	108	70	130
Molybdenum (total)	EMS0015-FEB22	mg/L	0.00004	<0.00004	7	20	104	90	110	104	70	130
Sodium (total)	EMS0015-FEB22	mg/L	0.01	<0.01	2	20	100	90	110	113	70	130
Nickel (total)	EMS0015-FEB22	mg/L	0.0001	<0.0001	3	20	99	90	110	97	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Lead (total)	EMS0015-FEB22	mg/L	0.00009	<0.00001	1	20	102	90	110	98	70	130
Phosphorus (total)	EMS0015-FEB22	mg/L	0.003	0.003	ND	20	105	90	110	NV	70	130
Antimony (total)	EMS0015-FEB22	mg/L	0.0009	<0.0009	ND	20	104	90	110	89	70	130
Selenium (total)	EMS0015-FEB22	mg/L	0.00004	<0.00004	ND	20	105	90	110	99	70	130
Silicon (total)	EMS0015-FEB22	mg/L	0.02	<0.02	7	20	96	90	110	NV	70	130
Tin (total)	EMS0015-FEB22	mg/L	0.00006	<0.00006	ND	20	104	90	110	NV	70	130
Strontium (total)	EMS0015-FEB22	mg/L	0.00002	<0.00002	1	20	99	90	110	105	70	130
Titanium (total)	EMS0015-FEB22	mg/L	0.00005	<0.00005	5	20	104	90	110	NV	70	130
Thallium (total)	EMS0015-FEB22	mg/L	0.000005	<0.000005	ND	20	95	90	110	89	70	130
Uranium (total)	EMS0015-FEB22	mg/L	0.000002	<0.000002	4	20	93	90	110	91	70	130
Vanadium (total)	EMS0015-FEB22	mg/L	0.00001	<0.00001	3	20	99	90	110	101	70	130
Zinc (total)	EMS0015-FEB22	mg/L	0.002	<0.002	4	20	97	90	110	91	70	130
Silver (total)	EMS0039-FEB22	mg/L	0.00005	<0.00005	6	20	102	90	110	80	70	130
Aluminum (total)	EMS0039-FEB22	mg/L	0.001	<0.001	1	20	100	90	110	113	70	130
Arsenic (total)	EMS0039-FEB22	mg/L	0.0002	<0.0002	ND	20	101	90	110	110	70	130
Barium (total)	EMS0039-FEB22	mg/L	0.00002	<0.00002	1	20	105	90	110	109	70	130
Beryllium (total)	EMS0039-FEB22	mg/L	0.000007	<0.000007	0	20	97	90	110	109	70	130
Boron (total)	EMS0039-FEB22	mg/L	0.002	<0.002	2	20	107	90	110	118	70	130
Bismuth (total)	EMS0039-FEB22	mg/L	0.00001	<0.00001	ND	20	99	90	110	94	70	130
Calcium (total)	EMS0039-FEB22	mg/L	0.01	<0.01	1	20	98	90	110	113	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Cadmium (total)	EMS0039-FEB22	mg/L	0.000003	<0.000003	15	20	102	90	110	105	70	130
Cobalt (total)	EMS0039-FEB22	mg/L	0.000004	<0.000004	1	20	102	90	110	109	70	130
Chromium (total)	EMS0039-FEB22	mg/L	0.00008	<0.00008	5	20	100	90	110	105	70	130
Copper (total)	EMS0039-FEB22	mg/L	0.0002	<0.0002	1	20	103	90	110	121	70	130
Iron (total)	EMS0039-FEB22	mg/L	0.007	<0.007	0	20	100	90	110	125	70	130
Potassium (total)	EMS0039-FEB22	mg/L	0.009	<0.009	2	20	103	90	110	110	70	130
Magnesium (total)	EMS0039-FEB22	mg/L	0.001	<0.001	1	20	94	90	110	112	70	130
Manganese (total)	EMS0039-FEB22	mg/L	0.00001	<0.00001	0	20	103	90	110	118	70	130
Molybdenum (total)	EMS0039-FEB22	mg/L	0.00004	<0.00004	2	20	102	90	110	109	70	130
Sodium (total)	EMS0039-FEB22	mg/L	0.01	<0.01	2	20	93	90	110	122	70	130
Nickel (total)	EMS0039-FEB22	mg/L	0.0001	<0.0001	1	20	103	90	110	109	70	130
Lead (total)	EMS0039-FEB22	mg/L	0.00009	<0.00001	2	20	101	90	110	113	70	130
Phosphorus (total)	EMS0039-FEB22	mg/L	0.003	<0.003	6	20	94	90	110	NV	70	130
Antimony (total)	EMS0039-FEB22	mg/L	0.0009	<0.0009	ND	20	105	90	110	102	70	130
Selenium (total)	EMS0039-FEB22	mg/L	0.00004	<0.00004	1	20	103	90	110	115	70	130
Silicon (total)	EMS0039-FEB22	mg/L	0.02	<0.02	11	20	107	90	110	NV	70	130
Tin (total)	EMS0039-FEB22	mg/L	0.00006	<0.00006	11	20	100	90	110	NV	70	130
Strontium (total)	EMS0039-FEB22	mg/L	0.00002	<0.00002	1	20	100	90	110	111	70	130
Titanium (total)	EMS0039-FEB22	mg/L	0.00005	<0.00005	0	20	106	90	110	NV	70	130
Thallium (total)	EMS0039-FEB22	mg/L	0.000005	<0.000005	18	20	92	90	110	97	70	130

QC SUMMARY

Metals in aqueous samples - ICP-MS (continued)

Method: SM 3030/EPA 200.8 | Internal ref.: ME-CA-IENVISPE-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Uranium (total)	EMS0039-FEB22	mg/L	0.000002	<0.000002	3	20	91	90	110	99	70	130
Vanadium (total)	EMS0039-FEB22	mg/L	0.00001	<0.00001	1	20	102	90	110	114	70	130
Zinc (total)	EMS0039-FEB22	mg/L	0.002	<0.002	1	20	102	90	110	NV	70	130

Microbiology

Method: SM 9222D | Internal ref.: ME-CA-IENVIMIC-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
E. Coli	BAC9037-FEB22	cfu/100mL	-	ACCEPTED	ACCEPTED							
Heterotrophic Plate Count (HPC)	BAC9037-FEB22	cfu/1mL	-	ACCEPTED	ACCEPTED							
Total Coliform	BAC9037-FEB22	cfu/100mL	-	ACCEPTED	ACCEPTED							

QC SUMMARY

pH

Method: SM 4500 I Internal ref.: ME-CA-IENVIEWL-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
pH	EWL0020-FEB22	No unit	0.05	NA	0		100			NA		

Phenols by SFA

Method: SM 5530B-D I Internal ref.: ME-CA-IENVISFA-LAK-AN-006

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
4AAP-Phenolics	SKA0043-FEB22	mg/L	0.002	<0.002	7	10	96	80	120	100	75	125

Sulphide by SFA

Method: SM 4500 I Internal ref.: ME-CA-IENVISFA-LAK-AN-008

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Sulphide	SKA0026-FEB22	mg/L	0.2	<0.02	ND	20	100	80	120	NA	75	125

QC SUMMARY

Suspended Solids

Method: SM 2540D | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-004

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Suspended Solids	EWL0023-FEB22	mg/L	2	< 2	0	10	96	90	110	NA		

Total Nitrogen

Method: SM 4500-N C/4500-NO3- F | Internal ref.: ME-CA-[ENVISFA-LAK-AN-002

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Total Kjeldahl Nitrogen	SKA0024-FEB22	as N mg/L	0.5	<0.5	2	10	109	90	110	105	75	125

Turbidity

Method: SM 2130 | Internal ref.: ME-CA-[ENVIEWL-LAK-AN-003

Parameter	QC batch Reference	Units	RL	Method Blank	Duplicate		LCS/Spike Blank			Matrix Spike / Ref.		
					RPD	AC (%)	Spike Recovery (%)	Recovery Limits (%)		Spike Recovery (%)	Recovery Limits (%)	
								Low	High		Low	High
Turbidity	EWL0018-FEB22	NTU	0.10	< 0.10	6	10	100	90	110	NA		

QC SUMMARY

Method Blank: a blank matrix that is carried through the entire analytical procedure. Used to assess laboratory contamination.

Duplicate: Paired analysis of a separate portion of the same sample that is carried through the entire analytical procedure. Used to evaluate measurement precision.

LCS/Spike Blank: Laboratory control sample or spike blank refer to a blank matrix to which a known amount of analyte has been added. Used to evaluate analyte recovery and laboratory accuracy without sample matrix effects.

Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate laboratory accuracy with sample matrix effects.

Reference Material: a material or substance matrix matched to the samples that contains a known amount of the analyte of interest. A reference material may be used in place of a matrix spike.

RL: Reporting limit

RPD: Relative percent difference

AC: Acceptance criteria

Multielement Scan Qualifier: as the number of analytes in a scan increases, so does the chance of a limit exceedance by random chance as opposed to a real method problem. Thus, in multielement scans, for the LCS and matrix spike, up to 10% of the analytes may exceed the quoted limits by up to 10% absolute and the spike is considered acceptable.

Duplicate Qualifier: for duplicates as the measured result approaches the RL, the uncertainty associated with the value increases dramatically, thus duplicate acceptance limits apply only where the average of the two duplicates is greater than five times the RL.

Matrix Spike Qualifier: for matrix spikes, as the concentration of the native analyte increases, the uncertainty of the matrix spike recovery increases. Thus, the matrix spike acceptance limits apply only when the concentration of the matrix spike is greater than or equal to the concentration of the native analyte.

LEGEND

FOOTNOTES

NSS	Insufficient sample for analysis.
RL	Reporting Limit.
↑	Reporting limit raised.
↓	Reporting limit lowered.
NA	The sample was not analysed for this analyte
ND	Non Detect

Samples analysed as received. Solid samples expressed on a dry weight basis. “Temperature Upon Receipt” is representative of the whole shipment and may not reflect the temperature of individual samples.

Analysis conducted on samples submitted pursuant to or as part of Reg. 153/04, are in accordance to the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act” published by the Ministry and dated March 9, 2004 as amended.

-- End of Analytical Report --

SGS — Request for Laboratory Services and CHAIN OF CUSTODY

Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 024260 Page ____ of ____

Revised CoFC

Laboratory Information Section - Lab use only

Received By: Siobhan
Received Date: 02/01/2022 (mm/dd/yy)
Received Time: 09:45 (hr : min)
Received By (signature): Siobhan
Custody Seal Present: Yes ☑ No ☐
Custody Seal Intact: Yes ☑ No ☐
Cooling Agent Present: Yes ☐ No ☒ Type: Ice pack
Temperature Upon Receipt (°C): 8.6 & 3
LAB LIMS #: CA4001O-Feb22

REPORT INFORMATION	INVOICE INFORMATION
Company: Terraprobe Inc	☒ (same as Report Information)
Contact: Leila – B	Company:
Address: 11 Indell Lane Brampton	Contact:
Phone: 905 796 2650	Address:
Fax:	Phone:
Email: Ubaninagajanan@terraprobe.ca	Email:

Quotation #: Teston Road
Project #: 1-20-0160
P.O. #:
Site Location/ID: Teston Road

TURNAROUND TIME (TAT) REQUIRED

☒ Regular TAT (5-7days) — TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: ____

*NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table ____ Appx. ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations:
☐ Reg 347/558 (3 Day min TAT)
☒ PWQO ☐ MMER
☐ CCME ☐ Other: ____
☐ MISA
☐ ODWS Not Reportable *See note

Sewer By-Law:
☐ Sanitary
☐ Storm
Municipality: ____

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX	Field Filtered (Y/N)	Metals & Inorganics (incl CrVI, CN, Hg, pH, B(HWS), EC, SAR – each) (O. Reg water)	Full Metals Suite (ICP metals incl B(HWS), Mo (HWS), Hg, CrVI)	ICP Metals only (Sb, As, Ba, Be, B, Cd, Co, Cu, Pb, Mo, Ni, Se, Ag, Tl, V, Zn)	PAHs only	SVOCs (all incl PAHs, ABNs, CPs)	PCBs ☐ Aroclor ☐ Total	F1-F4 + BTEX	F1-F4 only (no BTEX)	VOCs (all incl BTEX)	BTEX only	Pesticides (Organochlorine or specify other)	Other (please specify): Dissolved metal	Sewer Use: (Specify pkg:)	Water Characterization Pkg ☒ General ☐ Extended	SPLP (Specify tests)	TCLP (Specify tests)	COMMENTS:
1	BH-C1	2022/1/31	10:00	1	GW	V																	
2	BH-C1	2022/1/31	"	16	GW	NO	X											X		X			
3																							
4	BH-C2	2022/1/31	13:00	17	GW	NO	X											X		X			please filter for dissolved metal (BH-C2 & BH-C3)
5	BH-C3	2022/1/31	14:00	17	GW	NO	X											X		X			
6																							
7																							
8																							
9																							
10																							
11																							
12																							

Observations/Comments/Special Instructions

Sampled By (NAME): Leila – B Signature: Leila
Relinquished by (NAME): Leila – B Signature: Leila
Date: 2022/2/1 (mm/dd/yy)
Date: 2022/2/1 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SC

Revision # 1.8 Date of Issue: 11 June 2021

Note: Submission of samples to SGS is acknowledgement that you have been provided direction on sample collection/handling and transportation of samples. (2) Submission of samples to SGS is considered authorization for completion of work. Signatures may appear on this form or be retained on file the contract, or in an alternative format (e.g. shipping documents). (3) Results may be sent by email to an unlimited number of addresses for no additional cost. Fax is available upon request. This document is issued by the Company under its General Conditions of Service accessible at http://www.sgs.com/terms_and_conditions.htm. (Printed copies are available upon request.) Attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Request for Laboratory Services and CHAIN OF CUSTODY

SGS Environment, Health & Safety - Lakefield: 185 Concession St., Lakefield, ON K0L 2H0 Phone: 705-652-2000 Fax: 705-652-6365 Web: www.sgs.com/environment
- London: 657 Consortium Court, London, ON, N6E 2S8 Phone: 519-672-4500 Toll Free: 877-848-8060 Fax: 519-672-0361

No: 019683 Page ____ of ____

Laboratory Information Section - Lab use only

Received By: Majeed Ahmadzadeh Received By (signature): Majeed Ahmadzadeh
Received Date: FEB 01 2022 (mm/dd/yy) Custody Seal Present: Yes ☑ No ☐ Cooling Agent Present: Yes ☑ No ☐ Type: Icepack
Received Time: 9:48 (hr : min) Custody Seal Intact: Yes ☑ No ☐ Temperature Upon Receipt (°C) 0.8 & 8.6 CA 40010 - Feb22
LAB LIMS #:

REPORT INFORMATION	INVOICE INFORMATION
Company: Terraprobe	☐ (same as Report Information)
Contact: Leila	Company:
Address:	Contact:
	Address:
Phone:	Phone:
Fax:	Email:
Email: Lbaninajarian@terraprobe.ca	

Quotation #: Project #: ~~2-07~~ 1-20-0160-Teston road P.O. #: Site Location/ID:

TURNAROUND TIME (TAT) REQUIRED

☑ Regular TAT (5-7days) TAT's are quoted in business days (exclude statutory holidays & weekends). Samples received after 6pm or on weekends: TAT begins next business day

RUSH TAT (Additional Charges May Apply): ☐ 1 Day ☐ 2 Days ☐ 3 Days ☐ 4 Days

PLEASE CONFIRM RUSH FEASIBILITY WITH SGS REPRESENTATIVE PRIOR TO SUBMISSION

Specify Due Date: *NOTE: DRINKING (POTABLE) WATER SAMPLES FOR HUMAN CONSUMPTION MUST BE SUBMITTED WITH SGS DRINKING WATER CHAIN OF CUSTODY

REGULATIONS

☐ O.Reg 153/04 ☐ O.Reg 406/19
☐ Table 1 ☐ Res/Park Soil Texture: ☐ Coarse
☐ Table 2 ☐ Ind/Com ☐ Medium/Fine
☐ Table 3 ☐ Agri/Other
☐ Table ____
Soil Volume ☐ <350m3 ☐ >350m3

Other Regulations: ☐ Reg 347/558 (3 Day min TAT) ☑ PWQO ☐ MMER ☐ CCME ☐ Other: ☐ MISA ☐ ODWS Not Reportable *See note

Sewer By-Law: ☐ Sanitary ☐ Storm Municipality:

RECORD OF SITE CONDITION (RSC) ☐ YES ☐ NO

ANALYSIS REQUESTED

	SAMPLE IDENTIFICATION	DATE SAMPLED	TIME SAMPLED	# OF BOTTLES	MATRIX
1	C1 - Extended water characterization	31/1/2022	10:00		
2					
3					
4					
5					
6	C2 - Extended water characterization	31/1/2022			
7					
8					
9					
10					
11	C3 - Extended water characterization	31/1/2022			
12					

M & I: Field Filtered (Y/N); Metals & Inorganics (incl CrVI, CN, Hg pH,(B(HWS),EC,SAR-soil) (Cl, Na-water); Full Metals Suite (ICP metals plus B(HWS-soil only) Hg, CrVI; iCP Metals only Sb,As,Ba,Be,B,Cd,Cr,Co,Cu,Pb,Mo,Ni,

SVOC: PAHs only; SVOCs all incl PAHs, ABNs, CPs

PCB: PCBs ☐ Total ☐ Arocolor

PHC: F1-F4 + BTEX; F1-F4 only no BTEX

VOC: VOCs all incl BTEX; BTEX only

Pest: ☐ Pesticides Organochlorine or specify other

Other (please specify): Appendix 2: 406/19 Leachate Screening Levels Table: ; Sewer Use: Specify pkg:; Water Characterization Pkg ☐ Extended ☐ General

TCLP: Specify TCLP tests ☐ M&I ☐ VOC ☐ PCB ☐ B(a)P ☐ ABN ☐ Ignit.

COMMENTS:

→ Dessolved metal bottle was filtered at the field.

→ Please filter for dessolved metal

→ Please filter for dessolved metals

Observations/Comments/Special Instructions

Sampled By (NAME): Leila - B Signature: Date: 31 / 1 / 2022 (mm/dd/yy)

Relinquished by (NAME): Leila - B Signature: Date: 31 / 1 / 2022 (mm/dd/yy)

Pink Copy - Client
Yellow & White Copy - SGS

Revision #: 1.4
Date of Issue: 22 May. 2020