January 31, 2020

Geotechnical Investigation,
1381 Lakeshore Road East,
City of Mississauga

BROWN ASSOCIATES LIMITED PROJECT 17*4483
Consultants in the Environmental & Applied Earth Sciences

Contents

Appendix A:	Phase I Statement of Limitations
Figure 1-0:	Site Location Plan
Figure 2-0:	MW / Borehole Location Plan
Appendix B:	Borehole Logs, Key

Distribution: 2 copies and 1 pdf to Client, mmonass@cityparkhomes.ca
1 copy to file

Project 17*4483
January 31, 2020

City Park (1381 Lakeshore Road) Inc.
950 Nashville Road
Kleinburg, ON
L0J 1C0

Attn: Ms. Maria Monass

By email: mmonass@cityparkhomes.ca

Re: Geotechnical Report
1381 Lakeshore Road East, Mississauga

1.0 Summary

Brown Associates Limited completed a geotechnical investigation for proposed redevelopment of a single storey slab-on-grade multi-unit retail commercial building on the north side of Lakeshore Road East, and east of Dixie Road in the City of Mississauga. The scope of work included advancing two geotechnical boreholes to refusal on shale bedrock and coring two boreholes into shale to confirm rock quality for a sequence of about 3m. Boreholes were fitted with standpipe-piezometers and flushmount cover plates.

The subject lands comprise a rectangular property developed with single storey multi-unit retail commercial building constructed in two stages by 1989. Soil stratigraphy comprises 4 to 5 meters of uniform compact brown silt till with a minimal 200 to 400mm weathered transition zone to underlying competent Georgian Bay Formation shales. Water table ranges from 2.4m to 3.7m depth, generally perched above shales.

2.0 Introduction

2.1 Property Information

2.1.1 Municipal Address

The address for the phase one property is 1381 Lakeshore Road East, City of Mississauga. The lands can also be described as Parts of Lots 6, 7, 8, 9, 10, and part of Lane, Registered Plan A-20, more particularly described as Part 1 of Plan 43R-13617 (formerly Township of Toronto), City of Mississauga, Regional Municipality of Peel.

2.1.2 Contact Information for Property Owner

The Phase One Property is owned by:

City Park (1381 Lakeshore Road) Inc.,
950 Nashville Road
Kleinburg, ON L0J 1C0
Tel: 905-552-5200 (Ext. 221)

Attn: Maria Monass

2.1.3 Client Contact Information

Brown Associates was retained by Mr. Chris Zeppa of City Park Homes Inc. to complete a geotechnical evaluation for the property located at 1381 Lakeshore Road East in the City of Mississauga. There are also companion Phase 1 and Phase 2 environmental reports provided for this same property.

2.2 Terms of Reference

Brown Associates Limited completed a geotechnical evaluation for the property located at 1381 Lakeshore Road East. The purpose of this investigation was to provide soil and bedrock characterization for foundations, shoring and pavement design for the proposed redevelopment of the property with a multi-storey residential building. This report has also been prepared within the terms of reference set out in the Statement of Limitations, which is attached as **Appendix A**, which forms a part of this document.

2.3 General Description of the Phase One Property

The site is located within an established low-density predominantly residential area in the City of Mississauga, with municipal address of 1381 Lakeshore Road East. The property is located on the north side of Lakeshore Road East between Dixie Road to the west and Cherriebell Road to the east. The subject site is developed with a single storey multi-tenanted slab-on-grade retail plaza, the Dixie Lake Plaza, occupying the middle of the site, with paved parking and driveway surrounding the building except on the east side.

The site is bounded by a laneway and detached single family homes to the north, Cherriebell Road to the east followed by a vacant property, Dixie Road to the west, followed by the former Sheridan Mercury Sales Ltd. with Lakeshore Road frontage and with Lakeshore/Marie Curtis Park and the City of Mississauga community centre is to the southeast of Lakeshore Road.

A Site Location Plan is attached as Figure 1-0.

2.4 Previous Reporting

Two previous reports for the Phase One property are known. One of these reports was provided to Brown Associates. "*Preliminary Assessment of Soil and Ground Water at 1381 Lakeshore Road East in Mississauga*" was completed by WESA on March 29, 2012. WESA referred to initial soil and groundwater data findings by another consultant, which were provided to them, indicating three boreholes were previously advanced on the site and completed as monitoring wells. Reported findings from the earlier report found only conductivity and sodium absorption ratio impacts in soil from salt and minor impacts for these same parameters, but not resulting in exceedances of standards in groundwater. These reports dealt only with environmental issues and did not provide useful geotechnical information.

3.0 Field Investigations

Underground services were cleared by a private locator service, prior to mobilization with a drill rig. This service is a mandatory work item before drilling can take place.

The field investigation included geo-environmental drilling using a truck-mounted CME 75 continuous-flight hollow-stem power augurs, under the direction of our senior technologist on July 18 and 19, 2019. 1.5m length screens were set as low as possible in each borehole, with two screens spanning the shale interface and two others set between 6.5m to 8m and 8.1 and 9.6m depth respectively, both coring into sound shale with good rock quality indices. Development of all four wells for groundwater response with slug tests and drawdown testing was completed on July 31, 2019. This investigation has been carried out in accordance with the Statement of Limitations, which is attached in Appendix A, and forms a part of this report. Flushmount well cover plates were set into concrete.

3.1 Borehole Construction

On July 18 and 19, 2019 two boreholes were advanced to refusal into shale bedrock and two others were cored through sound shake to a maximum depth of 9.6m below grade. All four were instrumented and developed as monitoring wells. MW/Borehole locations are shown on the attached **Figure 2-0**.

Boreholes were advanced using a truck-mounted CME-75 with 200mm standard flight hollow-stem power augurs. Soil samples were obtained in intervals of 0.75m or 1.5m at greater depths using 50mm x 650mm standard split spoons. As the split spoon was advanced with Standard Force blows, penetration resistances, or "N" values, were recorded. Our senior technologist maintained field borehole logs. Borehole log summaries are attached in **Appendix B**.

Boreholes were advanced to contact shale bedrock found between 4 and 5.3m depths below grade and continued to augur through any weathered zone to refusal of augurs in sound rock at depths ranging from 4.4 to 6.3m depth below grade. Generally, 0.2 to 0.4m of highly weathered rock was reported and friable shales with thin bedding planes and partings were penetrated prior to complete refusal. In both boreholes 201 and 202, two 1.5m core barrels were advanced further into shales.

3.2 Groundwater Monitoring Well Installation

Monitoring wells were instrumented by Determination Drilling, using 50mm diameter x 1500mm 10-slot screen for piezometers with a 50mm cone tip in each. These were followed by a 50mm threaded solid standpipe up to 100mm from grade and capped with a 50mm J-plug. The screened interval was set to bracket the bedrock interface in two of the boreholes and to base of borehole in rock in the other two. Well screens were backfilled with well grade sand at depth and to 600mm above the top of 3m screens, followed by a bentonite seal from 600mm above screen to 460mm from grade where a standpipe with J-plug and flushmount protective cover was concreted into place.

When no longer required, because they will not extend deeper than proposed redevelopment, at least two of the wells may be decommissioned by removal during bulk excavation but must be preserved until that time. For two levels of parking, MWs-201-19 and 204-19 must still be properly decommissioned by a licensed well technician and a well record filed with the Ministry because they extend deeper than proposed redevelopment.

3.2.1 Well Development

Prior to chemical characterization of groundwater, wells were developed by removal of at least five well volumes during a hydrogeological assessment, using a four-stage 40mm diameter submersible 12 volt pump calibrated at 9 litres per minute flow. Drawdown for each well took less than one minute to void standpipes. Soil and groundwater quality are found in a separate Phase 2 environmental report prepared by Brown Associates.

3.3 Soil Stratigraphy

The reader is referred to the attached Borehole / Monitoring Well Logs found in Appendix B.

Parking stations and a private drive surrounds the existing slab-on-grade commercial building on three sides. This is finished with up to 100mm of asphaltic concrete which was generally in fair to good condition. Up to 500mm of granular bedding was found in each test location. Pavement was underlain by fill materials to depths ranging to 0.8m below grade in BH-202-19 and to 1.4m below grade in all others. Fill contained reworked till and in BH-203 only contained some topsoil and traces of red brick.

Compact to dense brown silt till extended through a colour change grading to uniform plastic, slightly cohesive mottled silt till by 2m depth and transitioned to uniform grey till by 2.5m depth below grade. Shale bedrock with very thin bedding planes is found beyond the transition of highly weathered shales between 4.6 and 5.3m depth below grade. A thin seam of soft to firm grey silt and clay-sized soil was found above bedrock in BH-202 only between 4.8 and 5.1m depth below grade. Shales were further excavated using the soil augurs to refusal, generally on a more massive limestone member. Shales belong to the Georgian Bay Formation, which is of Ordovician age.

Shale bedrock exhibits thin bedding planes with weathering and clayey seams at the soil interface. By approximately 1m below the soil interface, shales become sound with few weathered bedding plains and increasing hard, competent limestone content.

4.0 Geotechnical Recommendations

4.1 Proposed Redevelopment

The proposed redevelopment is to extend across the entire site. One level of underground parking would have the structure founding from 1 to nearly 2 meters above the shale bedrock interface, and with sumps and elevator pits set in overburden or at the rock interface. A second level of parking on any part of the site would found deeper into sound bedrock below any weathered zones.

4.2 Foundations in Overburden

Conventional foundations are possible in undisturbed soils. At depth of 3m below the base of fill, strip footings and column pads may be based on a safe allowable bearing capacity of 200 kPa SLS, (365 ULS) subject to a minimum pad dimension of 650mm to prevent punching and also subject to verification inspection by an experienced geotechnical engineer, based on Penetration Resistances measured between 15 and 25 blows per 300mm.

4.3 Foundations on Bedrock

Concrete perimeter footings and column pads founded at least 1m below the shale interface and weathered zone may be designed with bearing capacity of 4.5 mPa SLS (9.0 mPa ULS), subject to verification of rock soundness by an experienced geotechnical engineer. In general, rock may be cut to neat lines and walls foundations poured blind against rock faces. Below 6m depth safe allowable bearing capacities up to 6.0 kPa may be available, subject to inspection by an experienced geotechnical engineer.

4.4 Damp-Proofing Against Timber Lagging and Shales

A continuous waterproofing layer of drainage board with taped seams shall be provided, allowing tees through the bases at regular intervals to a collection drain inside the structure. This shall be attached to timber lagging, and concrete bases shall be cast directly against the waterproofing layer. Against shale faces, a second layer of drainage board is recommended to perform as a cushion to prevent tearing against sharp shale edges. In the alternative, gaps in the shale face can be filled with urethane foam or larger gaps bridged with plywood to maintain a flush face on excavation perimeters. This is especially important if there are any minor fault faces or joints at an angle, resulting in a sawtooth rock face where wedges of rock are removed as over-excavation on the face in the direction of joint system slopes.

Where shoring is not required, a vertical face in till up to 1.3m is permitted, above which an unsupported face shall slope at 1:1. All unsupported fill materials should slope at 1:1.

4.5 Drainage Beneath Building

Underdrains shall be spaced approximately 6m on centre in the granular bedding for the P3 concrete slab and may be common trench with other utilities such as building sanitary drains and solid drains to convey perimeter drainage. Precast serial sumps for perimeter drains and underdrains are required, with the first chamber acting as a sediment trap. Footings in till below 3m depth will encounter plastic and cohesive conditions which would lose strength if material is reworked when wetted. At such depths, a skin coat is recommended prior to placing foundations.

Elevator sumps above the rock interface may require a skin coat against soil, but deeper excavations into rock may be required to protect a proprietary waterproofing layer plus a minimal second skin coat above to protect the membrane while steel reinforcement is placed for shaft base, casting walls blind against the membrane. If elevator sumps are cast blind against shale, a second sacrificial layer of drainage board or other means to smooth the rock faces may be required to ensure integrity up to underside of slab elevation, since sharp edges on partings in shales can pierce many types of membrane.

4.6 Other Geotechnical Design Parameters

Lateral soil pressure for permanent structures against soil may be determined using the following equation:

$P = K (\gamma H+q)$ where,

P = lateral earth pressure kPa	kPa
K = lateral earth pressure coefficient	0.4
γ = unit weight of soil	22.4 kN/M^3
H = depth of wall below finished grade	m
q = surcharge loads adjacent to wall	kPa

This formula assumes free-draining conditions created by perimeter drainage systems to prevent any hydrostatic pressures from building behind perimeter walls. In addition, surfaces should be impervious or sloping away from the perimeter to prevent infiltration around the bases.

For temporary shoring, where there are building foundations of services behind temporary shoring within a distance of 0.5H, K= Ko = earth pressure coefficient at rest should be 4.0, and where there are services between 0.5H and H beyond the wall, minor amounts of movement for temporary shoring is acceptable, K= may be 0.33.

Where slight to moderate ground movement is acceptable for temporary shoring K = Ka = 0.25 active earth pressure coefficient.

For the perimeter shoring system, utilizing H piles set into shales and timber lagging to bedrock, a design factor of safety should not be less than 2 times. Depth of pile penetration may be at least 1m into sound shale where the shaft is augured or may be calculated from the following expression, which assumes free draining conditions are established behind the lagging:

$R = 9\ c_u\ D(L-1.5D)$ where,

R = ultimate load to be restrained (kN)
c_u = undrained shear strength of soil (kPa) *use 50 kPa for overburden on this site
D = diameter of concrete filled shaft (m)
L = embedment depth of soldier pile.

Where cold air may enter via a shaft to below grade, frost protection can be achieved by extending any wall or footing to 1.2m below the contact with outside air, or by use of equivalent insulation. As a rule of thumb, 50mm of continuous Styrofoam SM is equivalent to 300mm of soil or granular backfill, and any combination of depth of cover and continuous insulation may be incorporated into an air shaft design. Styrofoam may be used where shafts are founded directly on shale.

4.7 Earthquake Design

Earthquake factors for v and F, as applied in the Ontario Building Code, may be taken as 0.05 and 1.0 respectively for this site. All overburden is Class C for earthquake design purposes.

The 2010 National Building Code of Canada interpolated seismic hazard values are determined for a 2% in 50 year (0.000404 per annum) probability of exceedance. Values are for "*firm ground*" (NBCC soil Class C, such as this site) with average overburden shear wave velocities of 360 – 760 m.s^{-1}.) Median (50th percentile) values are given in units of g for spectral acceleration (Sa(T) where T is the period in seconds) and peak ground accelerations (PGA).

Only two significant figures are used. These values have been interpolated using Sheppard's Method from a 10 km spaced grid of points, based on site coordinates of 43.584492° North and -079.550862° West.

National Building Code Seismic Hazard values
2% in 50 years (0.000424 per annum) probability:

Sa(0.2)	**Sa(0.5)**	**Sa(1.0)**	**Sa(2.0)**	**PGA**
0.228	0.130	0.066	0.021	0.120g

4.8 Drainage Requirements

Perimeter drainage including Miradrain or equivalent and a drainage system beneath the floor slab will be required, since the established water table is close to underside of footings for a single level of below-grade structures, and a structure founded into bedrock will intercept groundwater at the shale bedrock interface, resulting in a permanent base flow to the perimeter and underdrain systems unless the structure is "*bathtubbed*". Where the bases are cast against H pile and timber lagging, products such as Miradrain should be stapled to the lagging and carefully taped, so that bases can be formed blind against the shoring.

The base of perimeter drainage systems should have tees constructed through the base or footing on about 6m on centre, discharging to an interior continuous perimeter sub-drain.

A system of drains should reflect the slopes of the basement floor, so that low points in the contact with clear stone bedding for slab can free-drain into the storm sewer discharge system. Separate sanitary drains are required for the basement floor drains because they may collect occasional oil and grease and the like from automobiles;

however, sanitary drains and perforate under-drains can be installed in common trench. A continuous under-drain system should extend around the inside of the perimeter footings and should also loop around the elevator sump, and around any other pump chambers or vaults set into the basement floor, regardless of whether one or two levels are provided below grade.

5.0 Water Discharge

During construction, dewatering to control precipitation is required; however continuous control of groundwater is not anticipated for limited depth excavations for a single parking structure founded in till.

A second underground level founded into shales will intercept the water table perched on the shale interface. Seepages from behind timber lagging are anticipated to dry quickly, after which pore water movement is expected to remain lower than rates of evaporation through an H pile and lagging face. Initial control of water is not anticipated to exceed 50 cubic meters per day. A Permit to Take Water is not anticipated as a requirement under O. Reg. 387-04 under the Ontario *Water Resources Act*, since discharges in excess of 50 cubic meters per day (about 35 litres per minute, sustained) are not anticipated. Excavations into shale are not likely to yield water discharges in excess of rates of evaporation on excavated faces after initial interstitial water in fractures free-drains.

5.1 Managing Water during Excavation

Snow melt or precipitation combined with groundwater during equipment operations could result in periodic discharges with high suspended solids. Precipitation and groundwater control measures at intermediate depths of excavation would require either a temporary standing water area for settlement or discharge through one or more settlement tanks in tandem, so that fines would have a quiescent opportunity to settle out to meet sewer by-law requirements. In shallow excavation, minor precipitation will likely be absorbed. Sediment control will be an issue especially with intermediate depth excavation through fine-grained soils and at the bedrock interface. Sumps and a ditch inlet are likely to be required for all intermediate depths above bedrock.

In the base of excavation, water discharge through properly engineered ditch inlets to barrel sumps should not have excessive suspended solids. A barrel sump in till is constructed by excavation and immediate placement of a layer of 270R geotextile against faces, standing a perforated 205 litre plastic or steel drum in the excavation and surrounding it immediately with clear 19mm limestone before enclosing the stone with the geotextile. Pumping from the barrel, as required, should not yield significant suspended solids.

For a parking garage floor founded into shale bedrock, a skin coat of 50mm of concrete should not be required, except where a proprietary waterproofing membrane may be required, such as surrounding an elevator sump in bedrock. 100mm UNX perforate drains shall follow grades to gravity discharge to sumps, for which at least

250mm of clear 19mm limestone bedding and cover is required. Care is required to prevent use of excessively dusty limestone, which can contribute pozzolitic fines which can cement and blind filter fabrics over time.

5.2 Pavement Design

Any driveways will likely require loads for truck traffic, whether for waste pick-up, or emergency vehicles, in which case a base of 240mm of OPPI Granular “B” will require compaction in minimal lifts to 95% of Standard Proctor Density, followed by a 160mm lift of OPPI Granular “A” also compacted to 95% of Standard Proctor Density. These may be substituted with a single 350mm lift of crusher-run limestone Granular “A”.

An 85mm lift of base course asphaltic concrete may be left exposed until work is completed and a final lift of 300mm of HL-3 provided to complete the pavement structure.

6.0 Record of Site Condition

Until perimeter shoring and a first lift of heterogeneous soils are removed, it is not possible to take verification samples and to certify that the remaining soils on the site meet residential standards. Because there is a change in land-use sensitivity, a submission of a Record of Site Condition (RSC) package is required to be reviewed by Ontario Ministry of the Environment, Conservation and Parks and an acknowledgment posted on the Environmental Registry. The City is not permitted to issue final building permits for more sensitive uses until the registration is complete.

7.0 Reliance

This report may be relied on by the City of Mississauga and Regional Municipality of Peel, in support of an application for redevelopment and by a mortgage lender providing mortgage financing, subject to the standard limitations statement contained herein. Any reliance letter to a third party shall also be subject to these standard limitations.

8.0 Qualification

Brown Associates Limited is a full-services geo-environmental consulting firm which has carried out more than 4,300 environmental evaluations over the past 48 years. Dr. Brown is a Professional Engineer and a Qualified Person recognized by the Ontario Ministry of the Environment, Conservation and Parks, and has a B.Sc. in Geology and Chemistry from Queen’s University (1968) and a Doctorate in Geochemistry from Oxford University (1970).

Brown Associates Limited carries $5 million in environmental liability insurance ($2 million per incident), $2 million in errors and omissions insurance, and enjoys a claims-free status.

9.0 Closure

We trust that this information is sufficient for your present requirements. Should any questions arise, please do not hesitate to call. Thank you for this opportunity to be of service.

Yours very truly,

BRUCE A. BROWN ASSOCIATES LIMITED

BABrown

Bruce A. Brown, Ph. D., RPP, P. Eng., QP(ESA)
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
B. A. BROWN
20/02/27
PROVINCE OF ONTARIO

Appendix A: Statement of Limitations for Geotechnical Evaluations

Bruce A. Brown Associates Limited

Geo-environmental Report
General Conditions and Limitations

Section 1: Use of the Report

1.1 The factual data, interpretations and recommendations contained in this report pertain to a specific project as described in the report and are not applicable to any other project or site location. If the project is modified in concept, location or elevation or if the project is not initiated within two years of the date of the report, Brown Associates should be given an opportunity to confirm that the recommendations are still valid.

1.2 Subsoils, groundwater, or other conditions which may affect design or implementation may differ between actual test locations and may not be appropriate for areas beyond those investigated.

1.3 The comments given in this report are intended only for the guidance of the design engineer. The number of test holes to determine all the relevant underground conditions which may affect construction costs, techniques and equipment choice, scheduling and sequence of operations, would be greater than has been carried out for design purposes. Contractors bidding on, or undertaking the work, should rely on their own investigations, as well as their own interpretations of the factual test hole data, as to how subsurface conditions may affect their work.

1.4 With the exception of instances where this firm is specifically retained to confirm field conditions, or to supervise construction or excavation, the responsibility of Bruce A. Brown Associates Limited shall be restricted to accurate interpretation of conditions at test location(s). No responsibility can be taken for the procedures or the sequence of effort carries out by any contractor, even when his final result would be to implement the recommended design, unless field supervision is requested form this firm.

Section 2: Follow Up

2.1 All details of the design and proposed construction may not be known at the time of submission of Brown Associates' report. It is recommended that Brown Associates be retained during the final design stage to review the design drawings and specifications related to foundations, earthworks, retaining systems and drainage, to determine that they are consistent with the intent of Brown Associates' report.

2.2 Retaining Brown Associates during construction is recommended to confirm and to document that the subsurface conditions throughout the site do not materially differ from those given in Brown Associates' report and to confirm and to document that construction activities did not adversely affect the design intent of Brown Associates' recommendations.

Section 3: Soil and Rock Conditions

3.1 Soils and rock descriptions in this report are based on commonly accepted methods of classification and identification employed in professional geotechnical practice. Classification and identification of soil and rock involves judgement and Brown Associates does not guarantee descriptions as exact, but implies accuracy only to the extent that is common in current geotechnical practice.

3.2 The soils and rock conditions described in this report are those observed at the time of study. Unless otherwise noted, those conditions form the basis of the recommendations in the report. The condition of the soil and rock may be significantly altered by construction activities (traffic, excavation, pile driving, blasting, etc.) on the site or on adjacent sites. Excavation may expose soils to changes due to wetting, drying or frost. Unless otherwise indicated the soil and rock must be protected from these changes or disturbances during and after construction.

Section 4: Logs of Test Holes and Subsurface Interpretations

4.1 Soil and rock formations are variable to a greater or lesser extent. The test hole logs indicate the approximate subsurface conditions only at the locations of the test holes. Boundaries between zones on the logs are often not distinct, but rather are transitional and have been interpreted. The precision with which subsurface conditions are indicated depends on the method of boring, the frequency of sampling and the uniformity of subsurface conditions. The spacing of test holes, frequency of sampling and type of boring also reflect budget and schedule considerations.

4.2 Subsurface conditions between test holes are inferred and may vary significantly from conditions encountered at the test holes.

4.3 Groundwater conditions described in this report refer only to those observed at the place and time of observation noted in the report. These conditions may vary seasonally or as a consequence of construction activities on the site or on adjacent sites.

Section 5: Changed Conditions

5.1 Where conditions encountered at the site differ significantly from those anticipated in this report, either due to a natural variability of subsurface conditions or due to construction activities, it is a condition of the use, or reliance by the client, of this report that Brown Associates be notified of the changes and provided with an opportunity to review the recommendations of this report. Recognition of changed soil and rock conditions requires experience and it is recommended that an experienced geotechnical engineer be employed to visit the site with sufficient frequency to detect if conditions have changed significantly.

Section 6: Drainage

6.1 Drainage of subsurface water is commonly required either for temporary or permanent installations for the project. Improper design or construction of drainage systems can have serious consequences. Brown Associates can assume no responsibility for the effects of drainage unless Brown Associates is specifically involved in the detailed design and follow-up site supervision and inspection during construction of the drainage system.

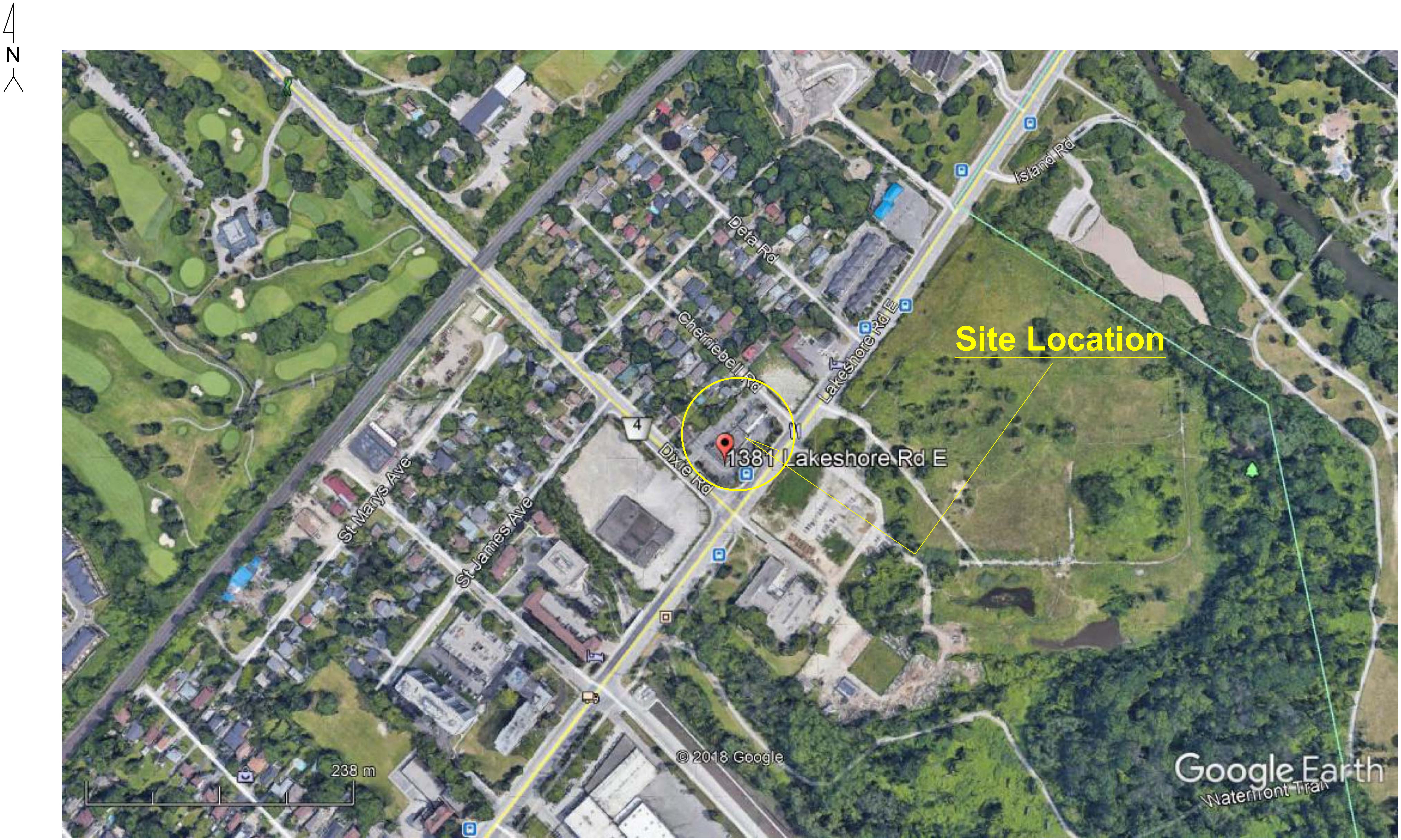
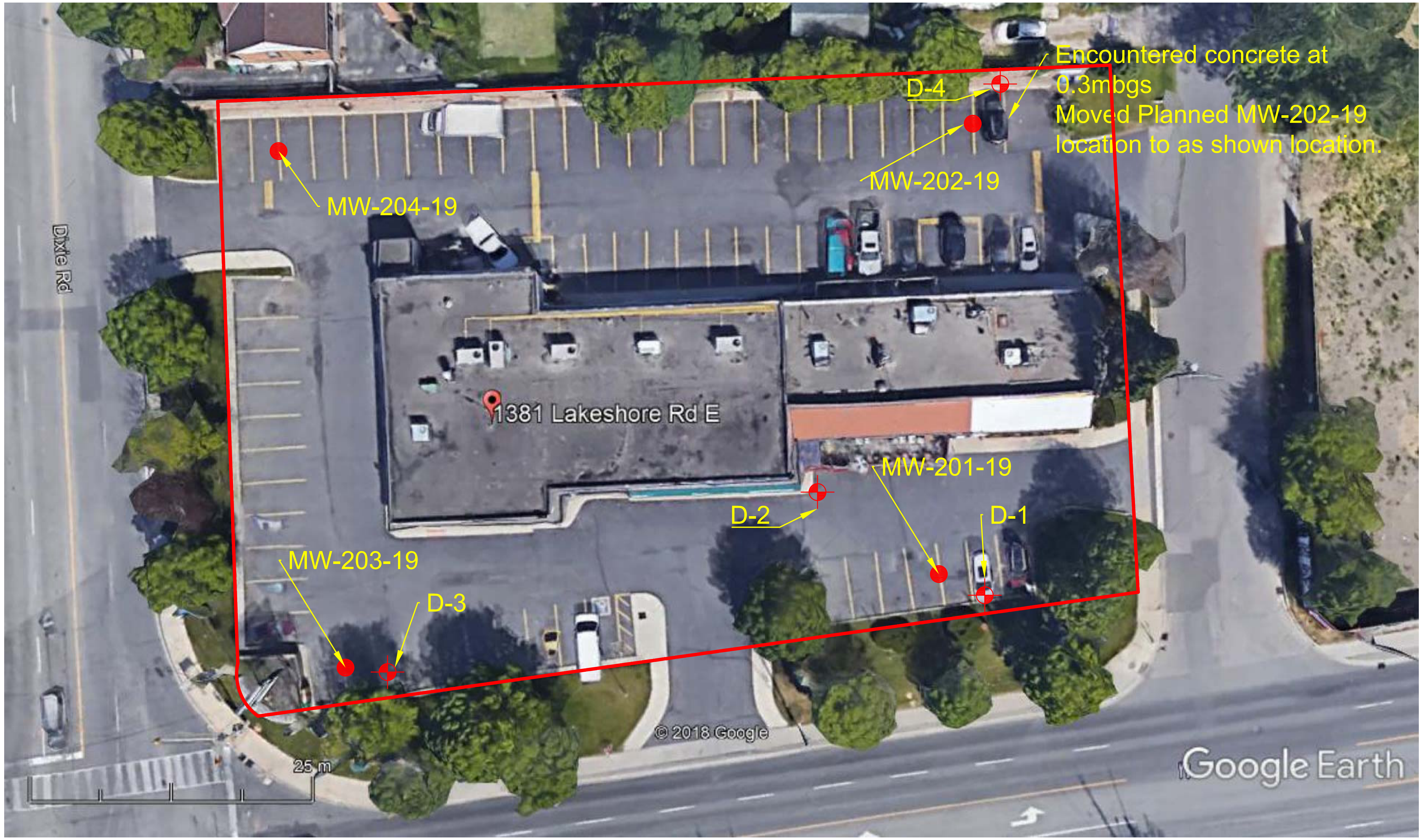


Figure:	Title:	Client:	Drawn By:	Date:	
1-0	**Site Location** 1381 Lakeshore Road East, City of Mississauga	CITY PARK (1381 Lakeshore Road) Inc. 950 Nashville Road Kleinburg, Ontario L0J 1C0	C. Colbourne, A.Sc.T.	September 1, 2019	BRUCE A. BROWN ASSOCIATES LIMITED Consultants in the Environmental and Applied Earth Sciences 101–102 Aerodrome Crescent Toronto, Ontario M4G 4J4 Tel [416] 424–3355
			Project No.: 17*4483	Drawing No.: 448319O901-001 Ver2	



● Monitoring Wells / Boreholes advanced by Bruce A. Brown Associates July 18 and 19, 2019.

⌖ Monitoring Wells by others placed prior to September 2017.

— Approximate Property Boundary.

Figure:	Title:	Client:	Drawn By:	Date:	
2-0	**Monitoring Well / Borehole Locations** 1381 Lakeshore Road East, City of Mississauga	CITY PARK (1381 Lakeshore Road) Inc. 950 Nashville Road Kleinburg, Ontario L0J 1C0	C. Colbourne, A.Sc.T.	September 1, 2019	BRUCE A. BROWN ASSOCIATES LIMITED Consultants in the Environmental and Applied Earth Sciences 101–102 Aerodrome Crescent Toronto, Ontario M4G 4J4 Tel [416] 424–3355
			Project No.:	Drawing No.:	
			17*4483	448319O901-002 Ver2	

Appendix B: Borehole Logs, Borehole Log Key & Soil Classification Key

BRUCE A. BROWN ASSOCIATES LIMITED
Consultants in the Environmental and Applied Earth Sciences

101-102 Aerodrome Crescent
Toronto, Ontario, Canada M4G 4J4
Tel: (416) 424-3355, Email bruce@brownassociates.ca

Project Location: 1381 Lakeshore East, City of Mississauga, Ontario

Client: City Park (1381 Lakeshore Road) Inc.
950 Nashville Road
Kleinburg, Ontario L0J 1C0

Project Number: 17*4483

Date of Borehole: July 18 to July 19, 2019

Technologist: C.W. Colbourne, A.Sc.T.

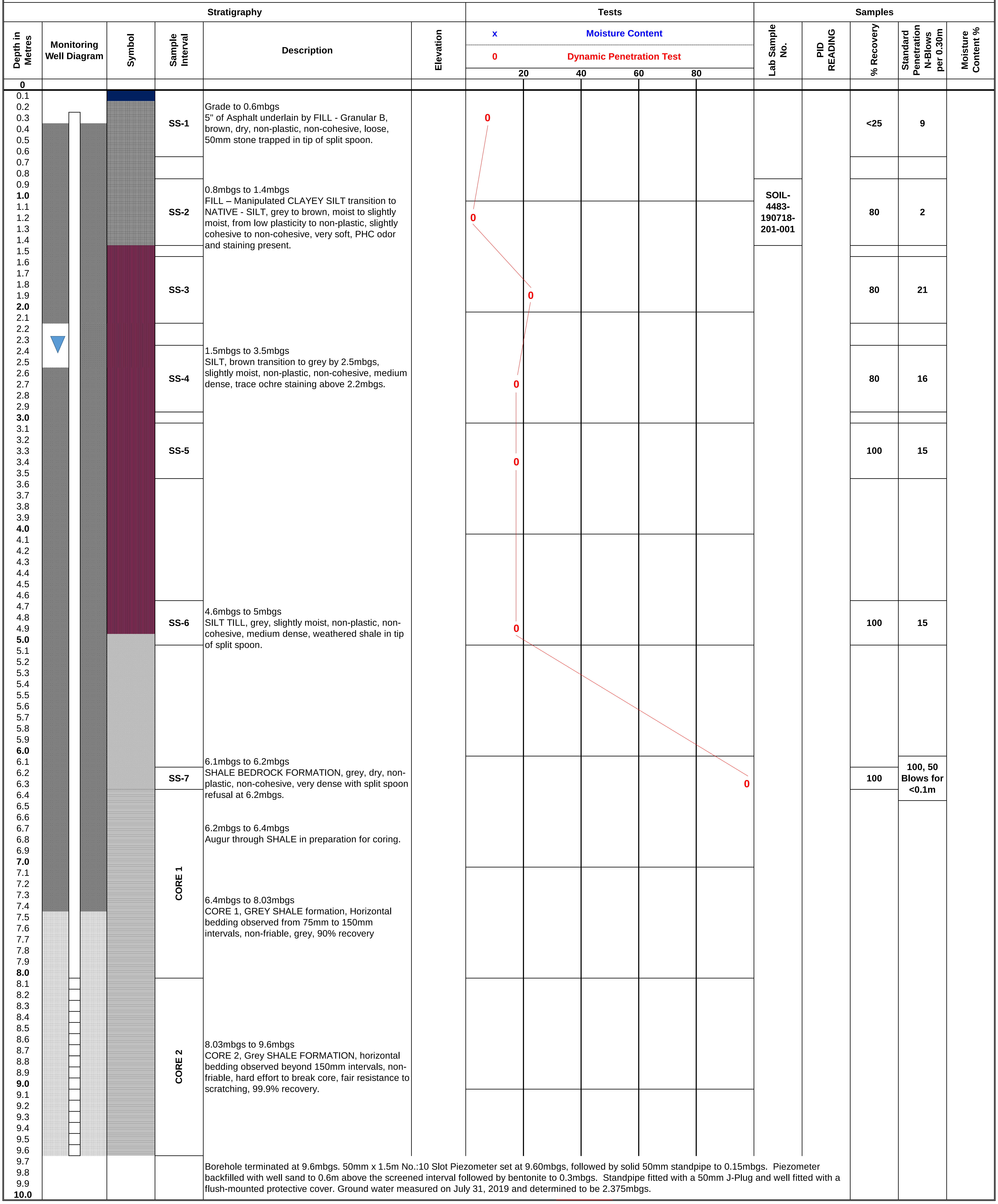
Drilling Contrator: Determination Drilling, Truck Mount CME 75 advancing 100mm solid stem flight augurs and 50mm x 0.6m split spoon sampler.

BH/MW Location: See site drawing

Bench Mark:

TOR Elevation:

BOREHOLE LOG No. MW-201-19



Sample Interval	Description	Lab Sample No.	PID READING	% Recovery	Standard Penetration N-Blows per 0.30m	Moisture Content %
SS-1	Grade to 0.6mbgs 5" of Asphalt underlain by FILL - Granular B, brown, dry, non-plastic, non-cohesive, loose, 50mm stone trapped in tip of split spoon.			<25	9	
SS-2	0.8mbgs to 1.4mbgs FILL – Manipulated CLAYEY SILT transition to NATIVE - SILT, grey to brown, moist to slightly moist, from low plasticity to non-plastic, slightly cohesive to non-cohesive, very soft, PHC odor and staining present.	SOIL-4483-190718-201-001		80	2	
SS-3				80	21	
SS-4	1.5mbgs to 3.5mbgs SILT, brown transition to grey by 2.5mbgs, slightly moist, non-plastic, non-cohesive, medium dense, trace ochre staining above 2.2mbgs.			80	16	
SS-5				100	15	
SS-6	4.6mbgs to 5mbgs SILT TILL, grey, slightly moist, non-plastic, non-cohesive, medium dense, weathered shale in tip of split spoon.			100	15	
SS-7	6.1mbgs to 6.2mbgs SHALE BEDROCK FORMATION, grey, dry, non-plastic, non-cohesive, very dense with split spoon refusal at 6.2mbgs.			100	100, 50 Blows for <0.1m	
	6.2mbgs to 6.4mbgs Augur through SHALE in preparation for coring.					
CORE 1	6.4mbgs to 8.03mbgs CORE 1, GREY SHALE formation, Horizontal bedding observed from 75mm to 150mm intervals, non-friable, grey, 90% recovery					
CORE 2	8.03mbgs to 9.6mbgs CORE 2, Grey SHALE FORMATION, horizontal bedding observed beyond 150mm intervals, non-friable, hard effort to break core, fair resistance to scratching, 99.9% recovery.					

Borehole terminated at 9.6mbgs. 50mm x 1.5m No.:10 Slot Piezometer set at 9.60mbgs, followed by solid 50mm standpipe to 0.15mbgs. Piezometer backfilled with well sand to 0.6m above the screened interval followed by bentonite to 0.3mbgs. Standpipe fitted with a 50mm J-Plug and well fitted with a flush-mounted protective cover. Ground water measured on July 31, 2019 and determined to be 2.375mbgs.

BRUCE A. BROWN ASSOCIATES LIMITED
Consultants in the Environmental and Applied Earth Sciences

101-102 Aerodrome Crescent
Toronto, Ontario, Canada M4G 4J4
Tel: (416) 424-3355, Email bruce@brownassociates.ca

Project Location: 1381 Lakeshore East, City of Mississauga, Ontario

Client: City Park (1381 Lakeshore Road) Inc.
950 Nashville Road
Kleinburg, Ontario L0J 1C0

Project Number: 17*4483

Date of Borehole: July 18 to July 19, 2019

Technologist: C.W. Colbourne, A.Sc.T.

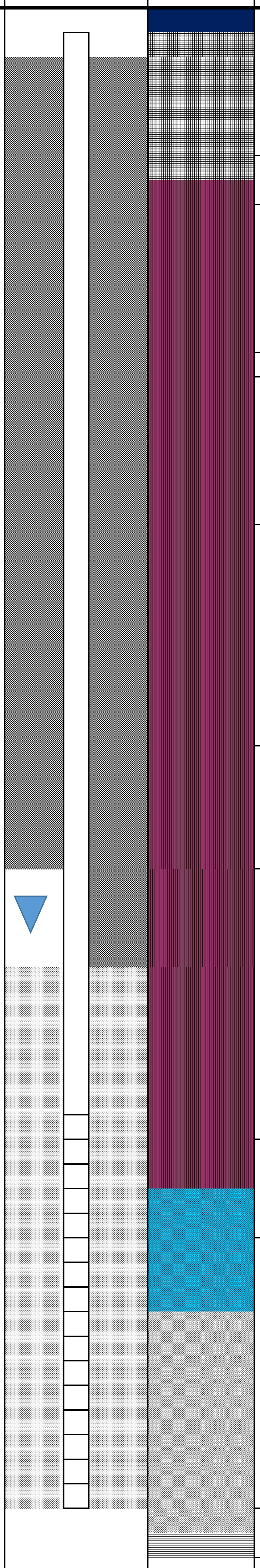
Drilling Contrator: Determination Drilling, Truck Mount CME 75 advancing 100mm solid stem flight augurs and 50mm x 0.6m split spoon sampler.

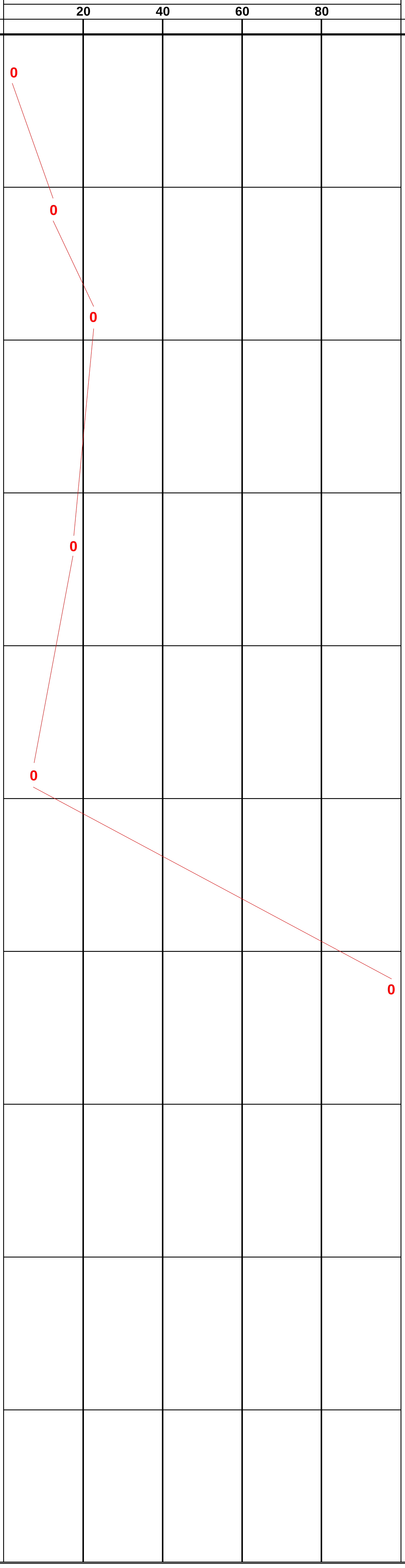
BH/MW Location: See site drawing

Bench Mark: Temp Bench Mark

TOR Elevation:

BOREHOLE LOG No. MW-202-19





Tests: x Moisture Content; 0 Dynamic Penetration Test

Depth in Metres	Monitoring Well Diagram	Symbol	Sample Interval	Description	Elevation	Tests	Lab Sample No.	PID READING	% Recovery	Standard Penetration N-Blows per 0.30m	Moisture Content %
0											
0.1											
0.2				Grade to 0.6mbgs FILL - 100mm of ASPHALT PAVEMENT, underlain by GRANULAR B, underlain by SANDY LOAM, underlain by FINE SAND, brown, dry, non-plastic, non-cohesive, very loose.							
0.3			SS-1						80	4	
0.4											
0.5											
0.6											
0.7											
0.8											
0.9											
1.0											
1.1			SS-2						75	11	
1.2											
1.3											
1.4											
1.5											
1.6											
1.7											
1.8			SS-3						75	22	
1.9											
2.0											
2.1											
2.2											
2.3											
2.4											
2.5											
2.6				0.8mbgs to 4.8mbngs NATIVE – SILT, brown to grey by 1.5mbgs, very wet becoming moist by 1.5mbgs, non-plastic, non-cohesive, medium dense, ochre staining with grey inclusions to 1.4mbgs with ochre staining to 2.1mbgs.							
2.7											
2.8											
2.9											
3.0											
3.1											
3.2											
3.3			SS-4						80	18	
3.4											
3.5											
3.6											
3.7											
3.8											
3.9											
4.0											
4.1											
4.2											
4.3											
4.4											
4.5											
4.6											
4.7											
4.8			SS-5						80	9	
4.9				4.8mbgs to 5mbgs SILTY CLAY, grey, moist, slightly plastic, cohesive, stiff.							
5.0											
5.1											
5.2											
5.3											
5.4											
5.5											
5.6											
5.7											
5.8											
5.9											
6.0											
6.1				6.1mbgs to 6.3mbgs WEATHERED SHALE and SHALE, grey, dry, non-plastic, non-cohesive, very dense, split spoon refusal at 6.3mbgs.						100, 50 Blows for <0.01m	
6.2			SS-6						100		
6.3											
6.4											
6.5											
6.6											
6.7											
6.8											
6.9				Borehole terminated at 6.3mbgs. 50mm x 1.5m No.:10 Slot Piezometer set at 6.1mbgs, followed by solid 50mm standpipe to 0.15mbgs. Piezometer backfilled with well sand to 0.6m above the screened interval followed by bentonite to 0.3mbgs. Standpipe fitted with a 50mm J-Plug and well fitted with a flush-mounted protective cover. Ground water measured on July 31, 2019 and determined to be 3.81mbgs.							
7.0											
7.1											
7.2											
7.3											
7.4											
7.5											
7.6											
7.7											
7.8											
7.9											
8.0											
8.1											
8.2											
8.3											
8.4											
8.5											
8.6											
8.7											
8.8											
8.9											
9.0											
9.1											
9.2											
9.3											
9.4											
9.5											
9.6											
9.7											
9.8											
9.9											
10.0											

BRUCE A. BROWN ASSOCIATES LIMITED
Consultants in the Environmental and Applied Earth Sciences

101-102 Aerodrome Crescent
Toronto, Ontario, Canada M4G 4J4
Tel: (416) 424-3355, Email bruce@brownassociates.ca

Project Location: 1381 Lakeshore East, City of Mississauga, Ontario

Project Number: 17*4483

Technologist: C.W. Colbourne, A.Sc.T.

Client: City Park (1381 Lakeshore Road) Inc.
950 Nashville Road
Kleinburg, Ontario L0J 1C0

Date of Borehole: July 18 to July 19, 2019

Drilling Contrator: Determination Drilling, Truck Mount CME 75 advancing 100mm solid stem flight augurs and 50mm x 0.6m split spoon sampler.

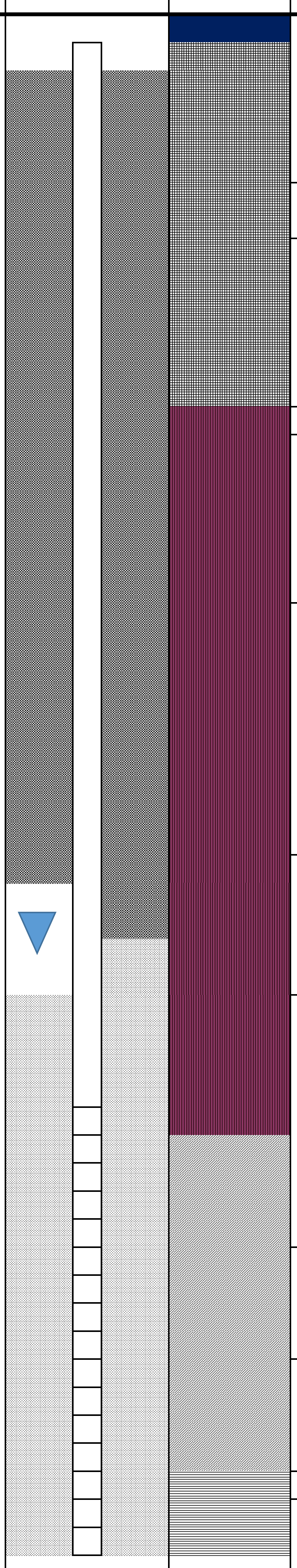
BH/MW Location: See site drawing

Bench Mark: Temp Bench Mark

TOR Elevation:

BOREHOLE LOG No. MW-203-19

Stratigraphy — Depth in Metres, Monitoring Well Diagram, Symbol



Sample Interval	Description	Lab Sample No.	% Recovery	Standard Penetration N-Blows per 0.30m
SS-1	Grade to 1.4mbgs FILL – 100mm of ASPHALT PAVEMENT underlain by 25mm CRUSHER RUN LIMESTONE, underlain by RE-MOLDED SILT / GRAVEL / TOPSOIL, RED BRICK FRAGMENTS, underlain by SILT, black to brown, dry to moist, non-plastic, non-cohesive, loose.		90	5
SS-2		SOIL-4833-190718-203-002	90	5
SS-3			90	24
SS-4	1.5mbgs to 3.5mbgs NATIVE – SILT, brown to grey by 3.3mbgs, moist to slightly moist, non-plastic, non-cohesive, medium dense, ochre staining with grey inclusion to 2.1mbgs.		100	15
SS-5	4.6mbgs to 4.8mbgs WEATHERED SHALE, grey, dry, non-plastic, non-cohesive, very dense, split spoon refusal at 4.8mbgs.		100	100, 50 Blows for <0.05m
SS-6	4.8mbgs to 5.3mbgs Augur Through WEATHERED SHALE FORMATION. At 5.3mbgs Confirmed SHALE, grey, dry, non-plastic, non-cohesive, very dense with split spoon refusal in less than 25mm.		100	100, 50 Blows for <0.025m

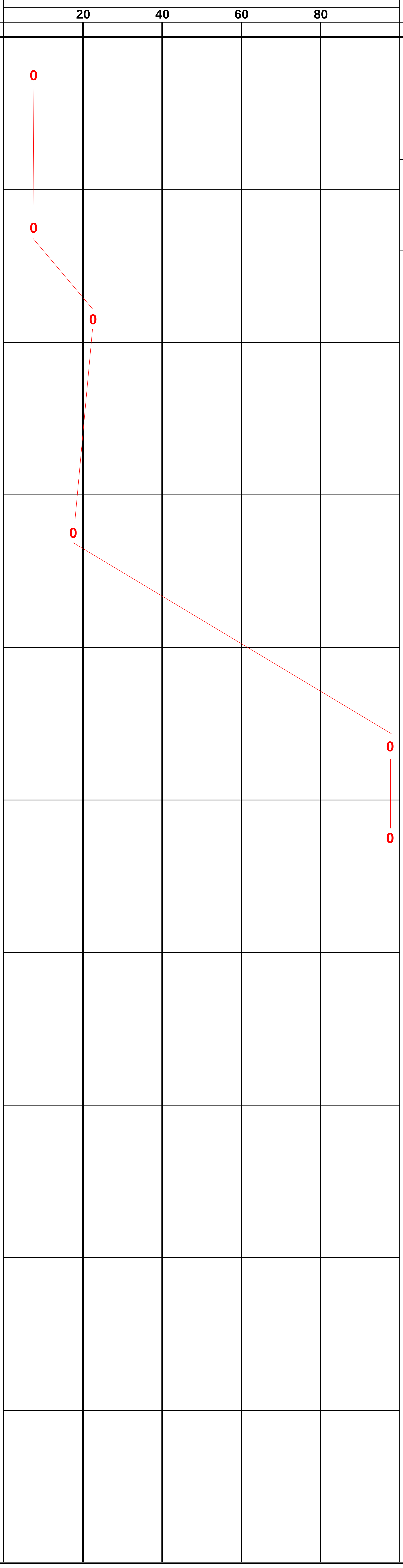
Borehole terminated at 5.3mbgs. 50mm x 1.5m No.:10 Slot Piezometer set at 5.5mbgs, followed by solid 50mm standpipe to 0.15mbgs. Piezometer backfilled with well sand to 0.6m above the screened interval followed by bentonite to 0.3mbgs. Standpipe fitted with a 50mm J-Plug and well fitted with a flush-mounted protective cover. Ground water measured on July 31, 2019 and determined to be 3.36mbgs.

Elevation

Tests

x Moisture Content

0 Dynamic Penetration Test



Samples — Lab Sample No., PID READING, % Recovery, Standard Penetration N-Blows per 0.30m, Moisture Content %

BRUCE A. BROWN ASSOCIATES LIMITED
Consultants in the Environmental and Applied Earth Sciences

101-102 Aerodrome Crescent
Toronto, Ontario, Canada M4G 4J4
Tel: (416) 424-3355, Email bruce@brownassociates.ca

Project Location: 1381 Lakeshore East, City of Mississauga, Ontario

Client: City Park (1381 Lakeshore Road) Inc.
950 Nashville Road
Kleinburg, Ontario L0J 1C0

Project Number: 17*4483

Date of Borehole: July 18 to July 19, 2019

Technologist: C.W. Colbourne, A.Sc.T.

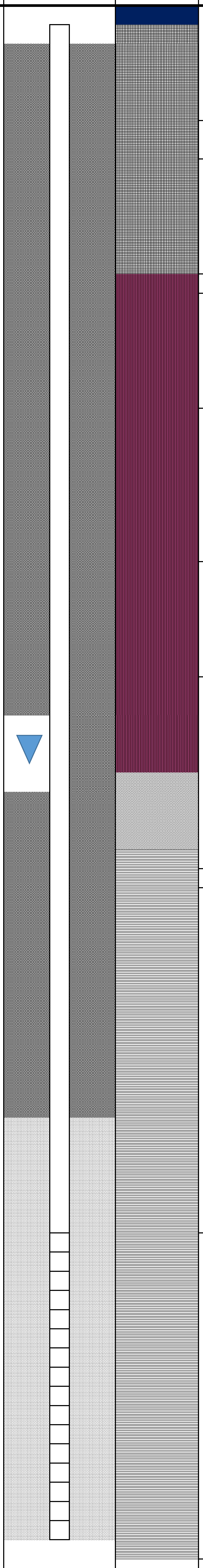
Drilling Contrator: Determination Drilling, Truck Mount CME 75 advancing 100mm solid stem flight augurs and 50mm x 0.6m split spoon sampler.

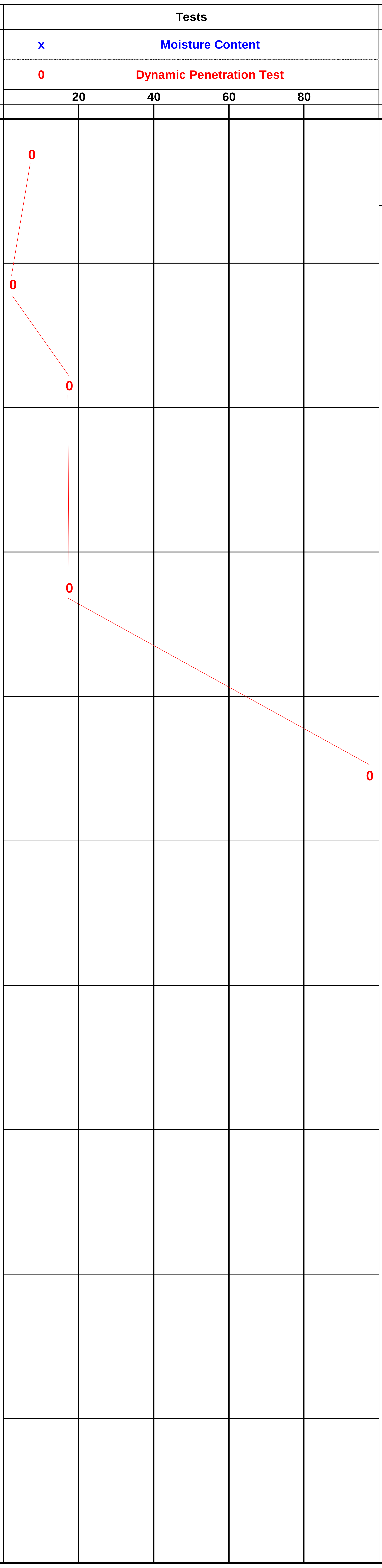
BH/MW Location: See site drawing

Bench Mark: Temp Bench Mark

TOR Elevation:

BOREHOLE LOG No. **MW-204-19**





Depth in Metres	Sample Interval	Description	Elevation	Lab Sample No.	PID READING	% Recovery	Standard Penetration N-Blows per 0.30m	Moisture Content %
0								
0.1								
0.2		Grade to 0.6mbgs FILL – 100mm of ASPHALT PAVEMENT underlain by GRAVEL / SILT / SAND / TOPSOIL, black, slightly moist, non-plastic, non-cohesive, non-plastic, non-cohesive, loose.		SOIL-4483-190718-204-003				
0.3	SS-1					75	6	
0.4								
0.5								
0.6								
0.7								
0.8								
0.9								
1.0		0.8mbgs to 1.4mbgs FILL – SILT and TOP SOIL, olive, moist, non-plastic, non-cohesive, loose.						
1.1								
1.2	SS-2					100	2	
1.3								
1.4								
1.5								
1.6								
1.7								
1.8								
1.9	SS-3					90	17	
2.0								
2.1								
2.2								
2.3								
2.4		1.5mbgs to 3.5mbgs NATIVE – SILT, brown to grey slightly moist, non-plastic, non-cohesive, medium dense, ochre staining present.						
2.5								
2.6								
2.7								
2.8								
2.9								
3.0								
3.1								
3.2								
3.3	SS-4					90	15	
3.4								
3.5								
3.6								
3.7								
3.8								
3.9								
4.0								
4.1								
4.2								
4.3								
4.4								
4.5								100, 50 Blows for <0.025m
4.6	SS-5					100	100	
4.7								
4.8		4.6mbgs to 4.7mbgs SHALE, grey, dry, non-plastic, non-cohesive, very dense with split spoon refusal at 4.7mbgs.						
4.9								
5.0								
5.1								
5.2		4.8 to 4.9mbgs Augured Through SHALE FORMATION						
5.3								
5.4								
5.5	CORE 1							
5.6								
5.7								
5.8		4.6mbgs to 6.4m CORE 1, GREY SHALE formation, Horizontal bedding observed from 75mm to 150mm intervals, non-friable, 90% recovery						
5.9								
6.0								
6.1								
6.2								
6.3								
6.4								
6.5								
6.6								
6.7								
6.8								
6.9								
7.0								
7.1		6.4mbgs to 8.1mbgs CORE 2, GREY SHALE FORMATION, horizontal bedding observed beyond 150mm intervals, non-friable, hard effort to break core, fair resistance to scratching, 95% recovery.						
7.2								
7.3	CORE 2							
7.4								
7.5								
7.6								
7.7								
7.8								
7.9								
8.0								
8.1								
8.2								
8.3								
8.4								
8.5		Borehole terminated at 8.1mbgs. 50mm x 1.5m No.:10 Slot Piezometer set at 8.0mbgs, followed by solid 50mm standpipe to 0.15mbgs. Piezometer backfilled with well sand to 0.6m above the screened interval followed by bentonite to 0.3mbgs. Standpipe fitted with a 50mm J-Plug and well fitted with a flush-mounted protective cover. Ground water measured on July 31, 2019 and determined to be 4.0mbgs.						
8.6								
8.7								
8.8								
8.9								
9.0								
9.1								
9.2								
9.3								
9.4								
9.5								
9.6								
9.7								
9.8								
9.9								
10.0								

Borehole Log Key and Soil Classification Key

Major Divisions			Colour / Symbol	Letter Symbol	Typical Description
Coarse Grained Soils, More than 50% of material is larger than No. 200 sieve size.	Gravel and Gravelly Soils, More than 50% of coarse fractions retained on No. 4 sieve	Clean Gravels (little or no fines)	🟪	GW	Well- graded gravels, gravel sand mixtures, little or no fines
			🟦	GP	Poorly grade gravels, gravel-sand mixtures, little or no fines
		Gravels With Fines (Appreciable amount of fines)	▥	GM	Silty gravels, gravel-sand-silt mixtures
			▨	GC	Clayey gravels, gravel-sand clay mixtures
	Sand and Sandy Soils, more than 50% of coarse fraction passing No. 4 sieve	Clean Sand (Little or no fines)	🟨	SW	Well-graded sands, gravelly sands, little or no fines
			🟧	SP	Poorly-graded sands, gravelly sands, little or no fines
		Sands with Fines (Appreciable amount of fines)	▥	SM	Silty-sands, sand-silt mixtures.
			▨	SC	Clayey sands, sand-clay mixtures
Fine Grained Soils, more than 50% of material is smaller than No. 200 sieve size	Silts and Clays,	Liquid limit less than 50	▥	ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands or clayey silts with slight plasticity
			🟦	CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
			▥	OL	Organic silts and organic silty clays of low plasticity
	Silts and Clays,	Liquid limit greater than 50	🟩	MH	Inorganic silts, micaceous or diatomaceous fine sand or silty soils
			🟨	CH	Inorganic clays of high plasticity, fat clays
			🟫	OH	Organic clays of medium to high plasticity, organic silts
Highly Organic Soils			▤	PT	Peat, humus, swamp soils with high organic contents

Bruce A. Brown Associates Limited.