

DYREGROV ROBINSON INC.

CONSULTING GEOTECHNICAL ENGINEERS

**WINDSOR PARK LIBRARY
GEOTECHNICAL INVESTIGATION
1201 ARCHIBALD STREET
WINNIPEG, MANITOBA**

Prepared for:

**City of Winnipeg
Winnipeg, Manitoba**

December 2015

File #153919

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DYREGROV ROBINSON INC.

Consulting Geotechnical Engineers

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December 30, 2015

File No. 153919

City of Winnipeg
Third Floor – 65 Gary Street
Winnipeg, MB
R3C 4K4

Attn: Iain Currie, Project Officer

Dear Mr. Currie:

**RE: Windsor Park Library
Geotechnical Investigation – 1201 Archibald Street**

Dyregrov Robinson Inc. is pleased to submit our final report for the geotechnical investigation completed at 1201 Archibald Street for the proposed Windsor Park Library project.

If we can be of further assistance, please contact the undersigned directly.

Sincerely,

DYREGROV ROBINSON INC.

A handwritten signature in blue ink that reads "Gil Robinson" with a long horizontal flourish extending to the right.

Gil Robinson, M.Sc., P.Eng
President / Senior Geotechnical Engineer

Distribution List

# of Hard Copies	PDF Required	Association / Company Name
3	Yes	City of Winnipeg

Dyregrov Robinson Inc.

Report Prepared By:

Gil Robinson

Gil Robinson, M.Sc., P.Eng.
President / Senior Geotechnical Engineer

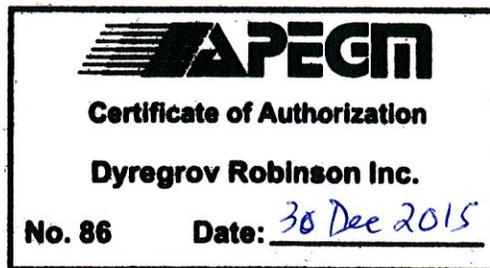


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FIGURE 1 – Test Hole Location Plan

APPENDIX A: Test Hole Logs

1.0 INTRODUCTION

As requested, Dyregrov Robinson Inc. has undertaken a geotechnical investigation for the proposed Windsor Park Library project at 1201 Archibald Street in Winnipeg, Manitoba. The purpose of the investigation was to evaluate the subsurface conditions in order to provide limit state design recommendations for foundations along with recommendations for other geotechnically related aspects of the development such as pavement design. Authorization to proceed with the investigation was provided by the City of Winnipeg (Purchase Order #408783).

2.0 PROPOSED DEVELOPMENT

We understand that development will include a single storey steel framed structure with a structural main floor over a void space with a perimeter grade beam. The maximum factored column loads are estimated to be 350 to 500 kN. Sidewalks and paved areas will be provided as part of the development. No basement or crawl space is planned. No other details of the development were provided.

3.0 SITE CONDITIONS

The project site is located on the west side of Archibald Street and was previously used by the City of Winnipeg Parks Department. Some buildings were located along the 'north' side of the property; the buildings have been demolished. We understand that some site remediation was completed in the east central area of the site to remove some contaminated soil. The property is triangular in shape and is bounded by trees on the 'north' and 'west' sides and by Archibald Street on the 'east' side. The open area has a gravel surface that is flat lying.

4.0 FIELD INVESTIGATION

Five test holes were drilled on October 23 and 26, 2015 at the locations illustrated on Figure 1. The test Holes were drilled by Subterranean Ltd. of Winnipeg, Manitoba using a truck mounted CME 75 drill rig equipped with 125 mm diameter solid stem augers.

The subsurface conditions were visually logged during drilling by Dyregrov Robinson Inc. Disturbed (auger cuttings) and undisturbed (Shelby tube) soil samples were recovered at regular depth intervals. The test holes were backfilled with auger cuttings and bentonite chips.

All samples were taken to our Soils Testing Laboratory for additional visual classification and testing. The testing included determining the moisture contents of all samples and measurement of bulk unit weights and undrained shear strengths on the Shelby tube samples. A copy of the test hole logs are attached in Appendix A. The test hole logs summarize the subsurface conditions encountered, results of the laboratory testing and notes on the observations made during drilling.

5.0 SUBSURFACE CONDITIONS

The general stratigraphy encountered in the test holes from grade includes sand and gravel, organic clay, silt, silty clay and glacial silt till.

5.1 Sand and Gravel

Sand and gravel was encountered at grade in all test holes except Test Hole 5. The sand and gravel ranges in thickness from 150 mm to 600 mm in Test Holes 1, 2 and 4. In Test Hole 3, which was drilled in the area of the site remediation work, the sand is 3.2 m thick and is very loose. Two Standard Penetration Tests were attempted in Test Hole 3 and in both cases the split barrel sampler penetrated under the weight of the slide hammer (63.5 kg mass). The thickness of the sand and gravel fill may vary from what was encountered in the test holes.

5.2 Organic Clay

A layer of organic clay was encountered below the sand and gravel in Test Holes 1, 4 and 5. It is black in color, moist with a stiff consistency and contains trace organics. The moisture content is around 32 percent and the layer ranges in thickness from 600 to 1100 mm.

5.3 Silt

A shallow silt layer (500 to 900 mm thick) was encountered in Test Holes 1, 4 and 5 at depths ranging from 0.6 to 1.3 m. The silt is brown in color, loose and moist with moisture contents around 25 percent.

5.4 Silty Clay

The usual thick deposit of Lake Agassiz lacustrine silty clay was encountered below the sand and gravel layer or the silt layer at depths ranging from 0.6 to 1.8 m below grade. In Test Hole 3, the clay was encountered at a depth of 3.2 m below grade. The clay is about 16 m thick, mottled brown and grey to a depth of about 6 m below which it is grey. It is moist with a stiff consistency and it is of high plasticity. The moisture contents of the clay range from about 45 to 60 percent with an average around 50 percent.

The undrained shear strength of the clay was measured using Torvane, penetrometer and unconfined compressive strength tests. The clay is stiff with undrained shear strengths ranging from about 55 to 85 kPa. The bulk unit weight of the clay is about 17 kN/m³.

5.5 Silt Till

Glacial silt till was encountered below the silty clay at a depth of 17.6 m in Test Hole 1. The glacial till deposit in the Winnipeg area is typically a heterogeneous mixture of sand, gravel, cobble and boulder size materials within a predominantly silt matrix that has a low but variable clay content.

The silt till encountered in Test Hole 1 contains traces of sand and gravel. No cobbles or boulders were confirmed with the small diameter augers used to drill the test hole. It is grey in color, moist and is compact. The moisture content of two samples were 12.4 and 14 percent. Auger refusal occurred at a depth of 19.8 m on suspected bedrock.

5.6 Test Hole Stability and Groundwater Conditions

No seepage or sloughing conditions were observed during drilling of Test Holes 2 and 5.

No seepage and sloughing was observed during drilling of Test Hole 1. Upon completion of drilling and removal of the augers from Test Hole 1, the water level was at 7.3 m below grade and the hole was open to 17.1 m below grade.

During drilling of Test Hole 3, seepage was observed from the sand and gravel below a depth of 0.7 m. Upon completion of drilling and removal of the augers, the hole was open to 0.9 m below grade.

No seepage and sloughing was observed during drilling of Test Hole 4. Upon completion of drilling and removal of the augers the hole was open to 2.5 m below grade.

Groundwater conditions should be expected to vary seasonally, from year to year and possibly as a result of construction activities.

6.0 DISCUSSION AND RECOMMENDATIONS

6.1 Foundations

The subsurface conditions at this site are suitable for two types of foundations including cast-in-place concrete friction piles and driven end bearing, precast prestressed concrete hexagonal (PPCH) piles. Based on the anticipated foundation loads, the preferred foundation type is cast-in-place concrete friction piles. Driven PPCH piles could be considered but are likely to be relatively expensive due to the length of piles required (i.e. on the order of 20 m). Since the property was previously developed there may be some former foundations remaining on the site that may be encountered during foundation installation. The thickness of the sand and gravel fill may vary from what was encountered in the test holes.

6.1.1 Cast-In-Place Concrete Friction Piles

Cast-in-place concrete friction piles can be designed in accordance to the current Manitoba Building Code (i.e. NBC 2010) using the service limit state (SLS) shaft adhesion values provided in Table 1 below. For the ultimate limit state (ULS) case, the piles can be designed with the factored shaft adhesion values and the factored end bearing pressure provided in Table 1. A resistance factor of 0.4 was used to calculate the factored ULS design values. Under the SLS loads, pile settlements are expected to be around 6 mm with differential settlements between piles around 3 to 6 mm.

Table 1: Design Parameters for CIP Concrete Friction Piles

Depth Below Existing Site Grade (m)	SLS Shaft Adhesion (kPa)	Factored ULS	
		Shaft Adhesion	End Bearing
		(kPa)	(kPa)
0 to 3 (see Note 1)	0	0	0
3 to 8	20.0	24.0	180
8 to 15	18.3	22.0	180

Note 1: When determining effective pile lengths, the upper 3 m of the pile shaft below existing site grade should be ignored to account for the presence of fill materials, silt layers and the potential for soil shrinkage away from the pile. The extent of the backfill conditions will not be known until the time of construction.

The pile length should be limited to 15 m below existing site grade to avoid drilling into the glacial till layer which is under high groundwater pressure.

Piles should have a minimum diameter of 400 mm and a minimum spacing of 3 pile diameters on centre. This spacing also applies to new piles installed near existing piles. Where this spacing cannot be achieved DRI should be contacted for additional input. Small pile groups (maximum of 3 piles) can be considered for moderately high column loads.

Concrete should be placed as soon as possible after each pile hole is completed. Temporary steel sleeves should be on site and used where sloughing/caving of the pile borings occur and/or if groundwater seepage is encountered. Some of the pile foundations may be located in or near the soil remediation area(s) which were backfilled with sand and gravel fill. The thickness of the sand and gravel fill may vary from what was encountered in the test holes.

Piles that are subjected to freezing conditions must be protected from potential frost heave effects by using minimum pile lengths of 7.6 m and installing full length reinforcement. The use of flat lying rigid insulation, such as Styrofoam HI, can also be used to minimize frost penetration into the soil around the piles if the minimum pile length cannot be achieved. A greased, polyethylene wrapped sonotube could also be placed around the upper 1.8 m of the pile shaft to act as a bond breaker and provide additional protection against frost heave.

6.1.2 Driven Precast Prestressed Concrete Hexagonal Piles

Driven end bearing precast prestressed concrete hexagonal (PPCH) piles driven to practical refusal into dense to very dense glacial silt till, or limestone bedrock if encountered, can be designed in accordance to the current Manitoba Building Code (i.e. NBC 2010) using the SLS and factored ULS pile capacities provided in Table 2. Under the SLS loads, pile settlements are expected to be around 6 mm with differential settlements between piles around 3 to 6 mm.

Table 2: PPCH Pile Capacities

PPCH Pile Size (mm)	Pile Capacities				
	SLS (kN)	Unfactored ULS (kN)	Factored ULS Capacities		
			$\phi = 0.4$ (kN)	$\phi = 0.5$ (kN)	$\phi = 0.6$ (kN)
300	445	1100	440	550	660
350	625	1560	624	780	936
400	800	2000	800	1000	1200

We recommend that a resistance factor of 0.6 be used for design provided that dynamic load testing with CAPWAP analysis is performed during foundation installation. If dynamic testing is not performed a resistance factor of 0.4 should be used. Dynamic load testing will provide data on the driving energy delivered to the pile and the driving stresses (tensile and compressive) in the piles. The CAPWAP analysis will utilize the data collected to provide a mobilized static pile resistance that can be compared to the unfactored and factored ULS pile capacities. The details of the dynamic load testing program can be finalized once the foundation layout has been established. Approximately 3 percent of the piles should be tested during pile installation under restrike conditions however; the number of piles to be tested will depend on the size of the building area and the number and sizes of piles to be installed. The piles to be tested will need at least 1.2 m of pile shaft above local grade around the pile to facilitate the testing.

The piles can be driven with diesel pile hammers having a rated energy of not less than 40 kilojoules. Hydraulic drop hammers can also be used provided they have a rated energy not less than 19.5 kilojoules. The rated energy for hydraulic drop hammers is less than for diesel hammers due to the high efficiency of this type of pile hammer. The driving stresses (compressive and tensile) in the piles should not exceed the limits specified by the pile manufacturer.

The pile driving criteria should be confirmed once the type of pile hammer proposed for use on this project is provided. Conventionally, practical refusal has been defined as final penetration resistance sets of 5, 8 and 12 blows per 25 mm (or less) for the 300, 350 and 400 mm diameter pile sizes, respectively. At least three consecutive sets should be obtained for each pile. If followers are used, the final

penetration resistance should be increased by 50 percent; that is, 8, 12 and 18 blows per 25 mm for 300, 350 and 400 mm diameter pile sizes, respectively.

Pile spacing for these piles should not be less than 2.5 pile diameters, centre to centre. No reduction in individual pile capacity is necessary for reasons related to group action provided that pile heave is monitored, measures are undertaken to minimize pile heave (i.e. preboring) and redriving is completed when pile heave greater than 6 mm is measured. Redriving of all piles in groups or clusters should be specified along with the requirement to monitor for pile heave.

Construction practice in Winnipeg normally includes preboring at driven PPCH pile locations. The prebore holes are usually drilled to diameters that are 50 mm larger than the pile size and to depths of about 3 m. Preboring is effective in reducing pile heave and contributes positively to pile verticality.

The depth to practical refusal will likely vary across the site and may be deeper than interpreted from the test hole logs. Some piles may be driven out of alignment and/or damaged during driving if boulders are present in the glacial till.

6.1.3 Foundation Inspection

Based on Sub-Sections 4.2.2.3 Field Review and 4.2.2.4 Altered Subsurface Condition (ref: NBC 2010 Section 4.2 Foundations) and as the Geotechnical Engineers of record for this project we recommend that the deep foundations be inspected on a full time basis by geotechnical personnel from our firm who are familiar with the subsurface conditions at this site, the foundation design considerations and the installation of major foundations.

If driven end bearing PPCH piles are to be installed, the dynamic testing and CAPWAP analysis should be performed by DRI.

6.2 Pile Caps and Grade Beams

A void separation of at least 150 mm should be provided under grade beams and pile caps.

6.3 Floor Slabs

We understand that a structural floor slab will be used for the project. Structural floor slabs will minimize the potential for movement of the floor slab due to heave or swelling of the underlying clay soils or settlement of fill materials encountered on the site. It is possible that the total amount of heave and swelling could be as much as 100 to 150 mm in the long term. A void separation between the structural floor slab and underlying soil should be at least 150 mm thick. A vapour barrier should be provided below the floor slab.

6.4 Pavements

Some vertical movements of the pavements are unavoidable and should be expected. The thick sand and gravel fill encountered in the soil remediation area of the site may need special consideration; additional discussion is provided at the end of this report section.

The following pavement sections can be placed on a prepared sub-grade consisting of high plastic silty clay soils:

- Standard duty asphalt pavements can be designed using 50 mm of asphalt placed on 300 mm of granular base material.
- Heavy duty asphalt pavements can be designed using 75 mm of asphalt placed on 150 mm of granular base material and 300 mm of granular sub-base material.
- For heavy duty traffic areas, such as refuse pick up areas, the pavement section should consist of 150 to 200 mm of reinforced concrete over 150 mm of granular base course and 200 mm of granular sub-base material. The reinforcing should be designed based on the anticipated loads.
- Sidewalk design and construction should meet the requirements of the City of Winnipeg's Standard Construction Specifications, CW3325-R5 for the Portland Cement Concrete Sidewalk. The concrete should be 100 mm thick with at least 50 mm of compacted granular base installed over a prepared sub-grade.

The material selection and construction requirements should meet the City of Winnipeg's Standard Construction Specifications. The granular base should be a 19 mm down crushed limestone material and the granular sub-base material should be a 50 mm down crushed limestone that is placed over a uniformly prepared subgrade. Where significantly more than 300 mm of sub-base material is required a 100 mm down crushed limestone can be considered.

Fill, topsoil and deleterious materials should be stripped from the sub-grade surface prior to preparation. The sub-grade should be graded smooth and scarified to a depth of about 150 mm and then uniformly re-compacted to 95 percent of the Standard Proctor maximum dry density before the granular sub-base material is placed. The subgrade should be proof rolled with a fully loaded tandem gravel truck to check for soft areas. Areas identified as being weak or soft during proof rolling should be stabilized by additional re-working and compaction or removal and replacement with suitable material. If encountered, silt can be over excavated and replaced with suitable material or bridged with a woven geotextile to provide separation and reinforcement. Woven geotextile should meet the requirements of the City of Winnipeg's Standard Construction Specifications, CW 3130 for the Supply and Installation of Geotextile Fabrics.

The very loose to loose sand and gravel fill encountered in the soil remediation area of the site may need to be over-excavated and replaced with compacted clay backfill. The sand and gravel is wet below a depth of 0.7 m and may be affected by frost action, which would result in some seasonal movements of the pavement and other surface features constructed over wet sand fill. If left in place, some settlement of the sand may occur over time due to its very loose to loose compactness condition. Compaction of the sand and gravel subgrade may be difficult and could require the use of a woven geotextile to provide some separation and reinforcement. Replacement of the sand and gravel fill with a high plastic clay

backfill should result in a more uniform performance of the pavement and surface works at the site. If the sand and gravel fill is removed and replaced with compacted clay backfill, the side slopes of the excavation should be cut back to an angle of 2H:1V and the clay compacted in lifts not exceeding 150 mm in thickness. The clay should be compacted to 95 percent of the Standard Proctor maximum dry density at a moisture content that is within 2 percent of the optimum moisture content.

6.5 Excavations

All excavation work should be completed by the Contractor in accordance with the current Manitoba Workplace Health and Safety Regulations to suit the planned and expected construction activities and schedule. The excavations should be designed so the surrounding properties are not impacted by the excavation(s).

6.6 Other

Positive drainage should be provided away from all structures at gradients of at least 2 percent.

The potential for sulphate attack in Winnipeg is considered to be severe (Exposure Class S-2). All concrete in contact with soil should be made with sulphate resistance cement (Type HS) in accordance with the Building Code and relevant CSA standards.

7.0 CLOSURE

This report and its findings were prepared based on the subsurface conditions encountered in the random representative sample of test holes drilled on the 23rd and 26th of October 2015 for the sole purpose of this geotechnical investigation and our understanding of the proposed development at the time of this report. Subsurface conditions are inherently variable and should be expected to vary across the site.

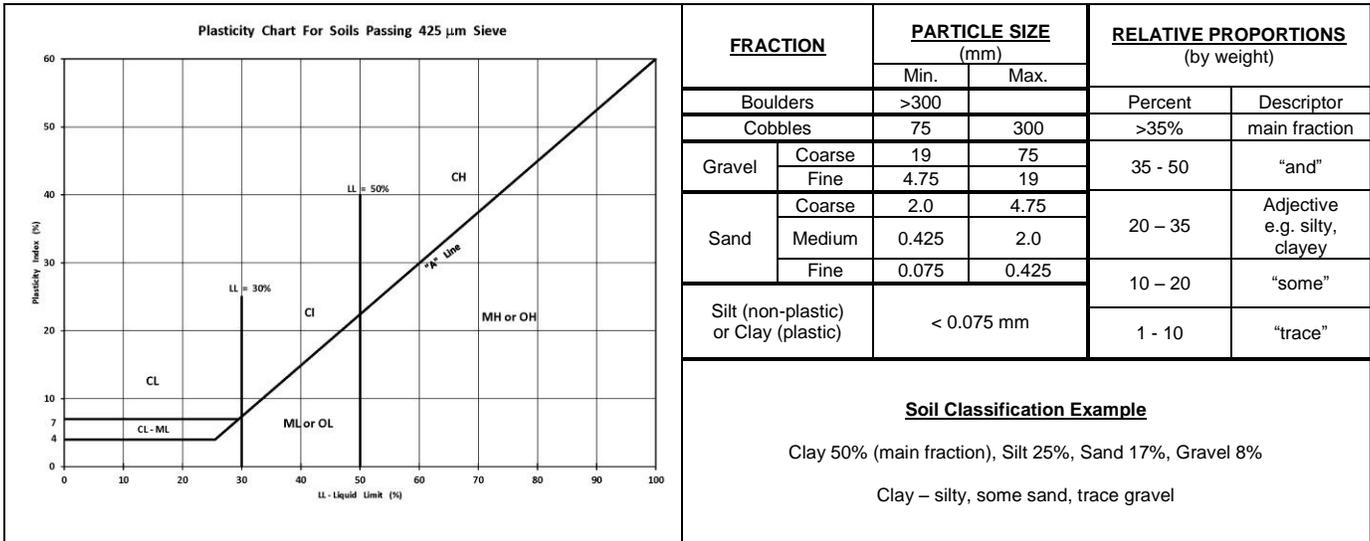
This report was prepared for the sole and exclusive use of the City of Winnipeg for the Windsor Park Library project located at 1201 Archibald Street in Winnipeg, MB. The information and recommendations contained in this report are for the benefit of the City of Winnipeg only and no other party or entity shall have any claim against the author nor may this report be used for any other projects, including but not limited to changes in this proposed development without the consent of the author. The findings and recommendations in this report have been prepared in accordance with generally accepted geotechnical engineering principles and practises. No other warranty, expressed or implied, is provided.

APPENDIX A

Test Hole Logs

EXPLANATION OF TERMS & SYMBOLS

Description			TH Log Symbols	USCS Classification	Laboratory Classification Criteria				
					Fines (%)	Grading	Plasticity	Notes	
COARSE GRAINED SOILS	GRAVELS (More than 50% of coarse fraction of gravel size)	CLEAN GRAVELS (Little or no fines)	Well graded gravels, sandy gravels, with little or no fines		GW	0-5	$C_u > 4$ $1 < C_c < 3$	Dual symbols if 5-12% fines. Dual symbols if above "A" line and $4 < W_p < 7$ $C_u = \frac{D_{60}}{D_{10}}$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}}$	
			Poorly graded gravels, sandy gravels, with little or no fines		GP	0-5	Not satisfying GW requirements		
		DIRTY GRAVELS (With some fines)	Silty gravels, silty sandy gravels		GM	> 12			Atterberg limits below "A" line or $W_p < 4$
			Clayey gravels, clayey sandy gravels		GC	> 12			Atterberg limits above "A" line or $W_p < 7$
	SANDS (More than 50% of coarse fraction of sand size)	CLEAN SANDS (Little or no fines)	Well graded sands, gravelly sands, with little or no fines		SW	0-5	$C_u > 6$ $1 < C_c < 3$		
			Poorly graded sands, gravelly sands, with little or no fines		SP	0-5	Not satisfying SW requirements		
		DIRTY SANDS (With some fines)	Silty sands, sand-silt mixtures		SM	> 12			Atterberg limits below "A" line or $W_p < 4$
			Clayey sands, sand-clay mixtures		SC	> 12			Atterberg limits above "A" line or $W_p < 7$
FINE GRAINED SOILS	SILTS (Below 'A' line negligible organic content)	$W_L < 50$	Inorganic silts, silty or clayey fine sands, with slight plasticity		ML		Classification is Based upon Plasticity Chart		
		$W_L > 50$	Inorganic silts of high plasticity		MH				
	CLAYS (Above 'A' line negligible organic content)	$W_L < 30$	Inorganic clays, silty clays, sandy clays of low plasticity, lean clays		CL				
		$30 < W_L < 50$	Inorganic clays and silty clays of medium plasticity		CI				
		$W_L > 50$	Inorganic clays of high plasticity, fat clays		CH				
	ORGANIC SILTS & CLAYS (Below 'A' line)	$W_L < 50$	Organic silts and organic silty clays of low plasticity		OL				
		$W_L > 50$	Organic clays of high plasticity		OH				
	HIGHLY ORGANIC SOILS			Peat and other highly organic soils		Pt		Von Post Classification Limit	Strong colour or odour, and often fibrous texture
	Asphalt		Glacial Till		Bedrock (Igneous)	DYREGROV ROBINSON INC. CONSULTING GEOTECHNICAL ENGINEERS			
	Concrete		Clay Shale		Bedrock (Limestone)				
	Fill				Bedrock (Undifferentiated)				



TERMS and SYMBOLS

Laboratory and field tests are identified as follows:

Unconfined Comp.: undrained shear strength (kPa or psf) derived from unconfined compression testing.

Torvane: undrained shear strength (kPa or psf) measured using a Torvane

Pocket Pen.: undrained shear strength (kPa or psf) measured using a pocket penetrometer.

Unit Weight bulk unit weight of soil or rock (kN/m³ or pcf).

SPT – N Standard Penetration Test: The number of blows (N) required to drive a 51 mm O.D. split barrel sampler 300 mm into the soil using a 63.5 kg hammer with a free fall drop height of 760 mm.

DCPT Dynamic Cone Penetration Test. The number of blows (N) required to drive a 50 mm diameter cone 300 mm into the soil using a 63.5 kg hammer with a free fall drop height of 760 mm.

M/C insitu soil moisture content in percent

PL Plastic limit, moisture content in percent

LL Liquid limit, moisture content in percent

The undrained shear strength (Su) of cohesive soil is related to its consistency as follows:

Su (kPa)	Su (psf)	CONSISTENCY
<12	250	very soft
12 – 25	250 – 525	soft
25 – 50	525 – 1050	firm
50 – 100	1050 – 2100	stiff
100 – 200	2100 – 4200	very stiff
200	4200	hard

The SPT - N of non-cohesive soil is related to compactness condition as follows:

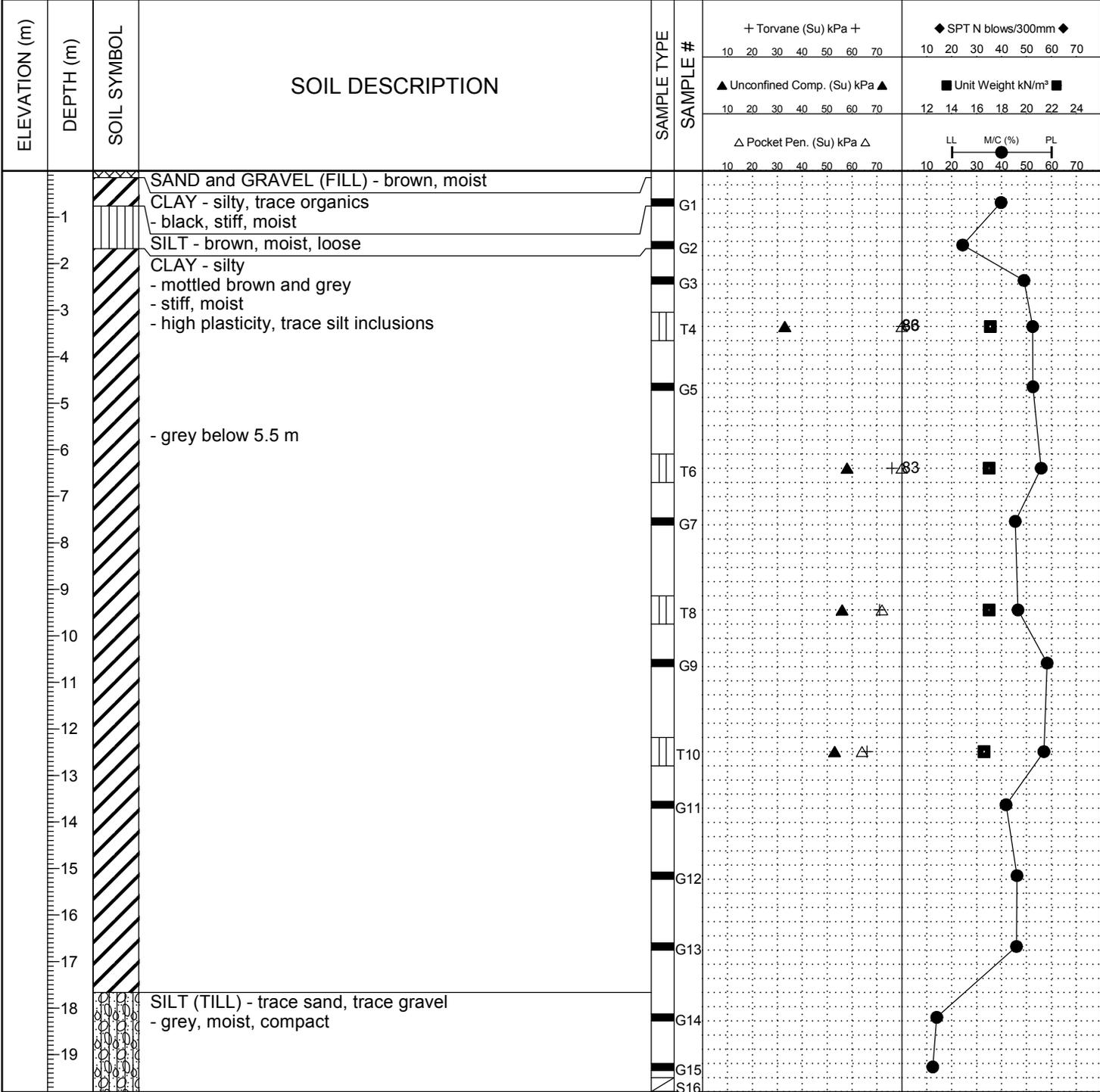
N – Blows / 300 mm	COMPACTNESS
0 - 4	very loose
4 - 10	loose
10 - 30	compact
30 - 50	dense
50 +	very dense

References:

ASTM D2487 – Classification of Soils For Engineering Purposes (Unified Soil Classification System)

Canadian Foundation Engineering Manual, 4th Edition, Canadian Geotechnical Society, 2006

PROJECT: Windsor Park Library		CLIENT: City of Winnipeg			TESTHOLE NO.: 1	
LOCATION: North west corner of proposed building					PROJECT NO.: 153919	
CONTRACTOR: Subterranean Ltd.		METHOD: CME 75 - 125mm SS augers			ELEVATION (m):	
SAMPLE TYPE	GRAB	SHELBY TUBE	SPLIT SPOON	BULK	NO RECOVERY	CORE
BACKFILL TYPE	BENTONITE	GRAVEL	SLOUGH	GROUT	CUTTINGS	SAND



END OF TEST HOLE AT 19.8 m IN SILT (TILL) (AUGER REFUSAL)

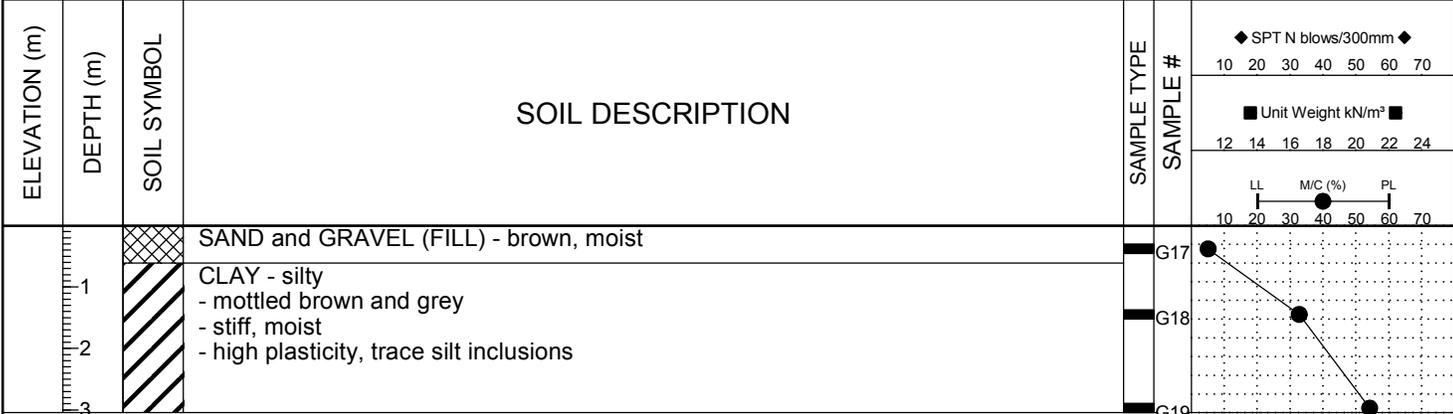
- Notes:
1. Water level 7.3 m below grade after drilling.
 2. Test hole open to 17.1 m below grade after drilling.
 3. Test hole backfilled with auger cuttings and bentonite chips.

BH GEOTECH PLOTS - NEW ALT.1 153919_COW WINDSOR PARK LIBRARY.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 10/12/15

DYREGROV ROBINSON INC.
Consulting Geotechnical Engineers

LOGGED BY: WG	COMPLETION DEPTH: 19.81 m
REVIEWED BY: GR	COMPLETION DATE: 23/10/15
PROJECT ENGINEER: Gil Robinson	

PROJECT: Windsor Park Library		CLIENT: City of Winnipeg		TESTHOLE NO: 2	
LOCATION: North corner area of property				PROJECT NO.: 153919	
CONTRACTOR: Subterranean Ltd.		METHOD: CME 75 - 125mm SS augers		ELEVATION (m):	
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> CUTTINGS
				<input type="checkbox"/> CORE	<input type="checkbox"/> SAND

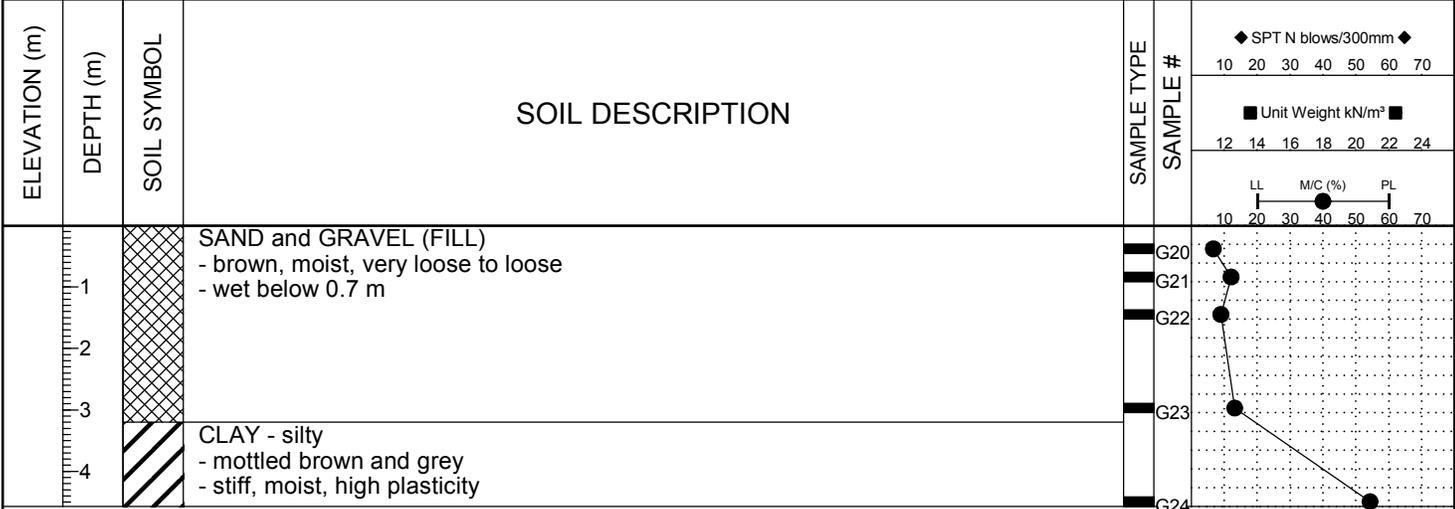


END OF TEST HOLE AT 3 m IN CLAY
Notes:
1. No sloughing or seepage observed.
2. Test hole backfilled with auger cuttings.

BH GEOTECH PLOTS -NEW ALT1 153919_COW WINDSOR PARK LIBRARY.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 10/12/15

DYREGROV ROBINSON INC. Consulting Geotechnical Engineers	LOGGED BY: WG	COMPLETION DEPTH: 3.05 m
	REVIEWED BY: GR	COMPLETION DATE: 26/10/15
	PROJECT ENGINEER: Gil Robinson	

PROJECT: Windsor Park Library		CLIENT: City of Winnipeg		TESTHOLE NO: 3	
LOCATION: East side of property in proposed parking area				PROJECT NO.: 153919	
CONTRACTOR: Subterranean Ltd.		METHOD: CME 75 - 125mm SS augers		ELEVATION (m):	
SAMPLE TYPE	<input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> SPLIT SPOON	<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY
BACKFILL TYPE	<input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH	<input type="checkbox"/> GROUT	<input type="checkbox"/> CUTTINGS
					<input type="checkbox"/> CORE
					<input type="checkbox"/> SAND



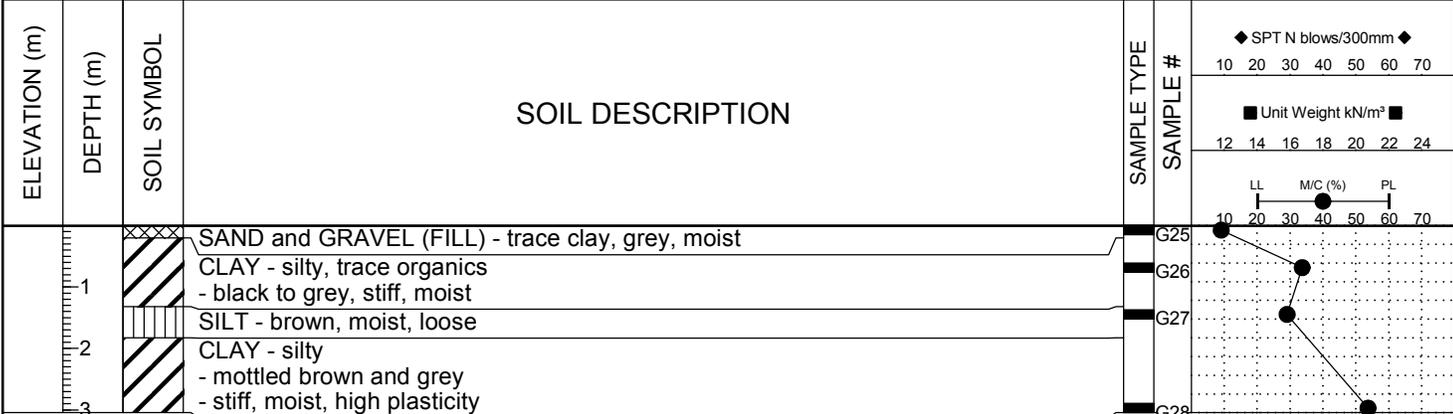
END OF TEST HOLE AT 4.6 m IN CLAY

- Notes:
1. Seepage observed from Fill below 0.7 m.
 2. Hole open to 0.9 m upon completion of drilling.
 3. Test hole backfilled with auger cuttings and bentonite chips.
 4. At 0.75 m and 1.5 m, split spoon penetrated under weight of slide hammer (SPT N = 0)

BH GEOTECH PLOTS - NEW ALT1 153919_COW WINDSOR PARK LIBRARY.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 10/12/15

DYREGROV ROBINSON INC. Consulting Geotechnical Engineers	LOGGED BY: WG	COMPLETION DEPTH: 4.57 m
	REVIEWED BY: GR	COMPLETION DATE: 26/10/15
	PROJECT ENGINEER: Gil Robinson	

PROJECT: Windsor Park Library	CLIENT: City of Winnipeg	TESTHOLE NO: 4
LOCATION: East side of property near proposed exit		PROJECT NO.: 153919
CONTRACTOR: Subterranean Ltd.	METHOD: CME 75 - 125mm SS augers	ELEVATION (m):
SAMPLE TYPE <input checked="" type="checkbox"/> GRAB	<input type="checkbox"/> SHELBY TUBE	<input type="checkbox"/> SPLIT SPOON
<input type="checkbox"/> BULK	<input type="checkbox"/> NO RECOVERY	<input type="checkbox"/> CORE
BACKFILL TYPE <input checked="" type="checkbox"/> BENTONITE	<input type="checkbox"/> GRAVEL	<input type="checkbox"/> SLOUGH
<input type="checkbox"/> GROUT	<input type="checkbox"/> CUTTINGS	<input type="checkbox"/> SAND



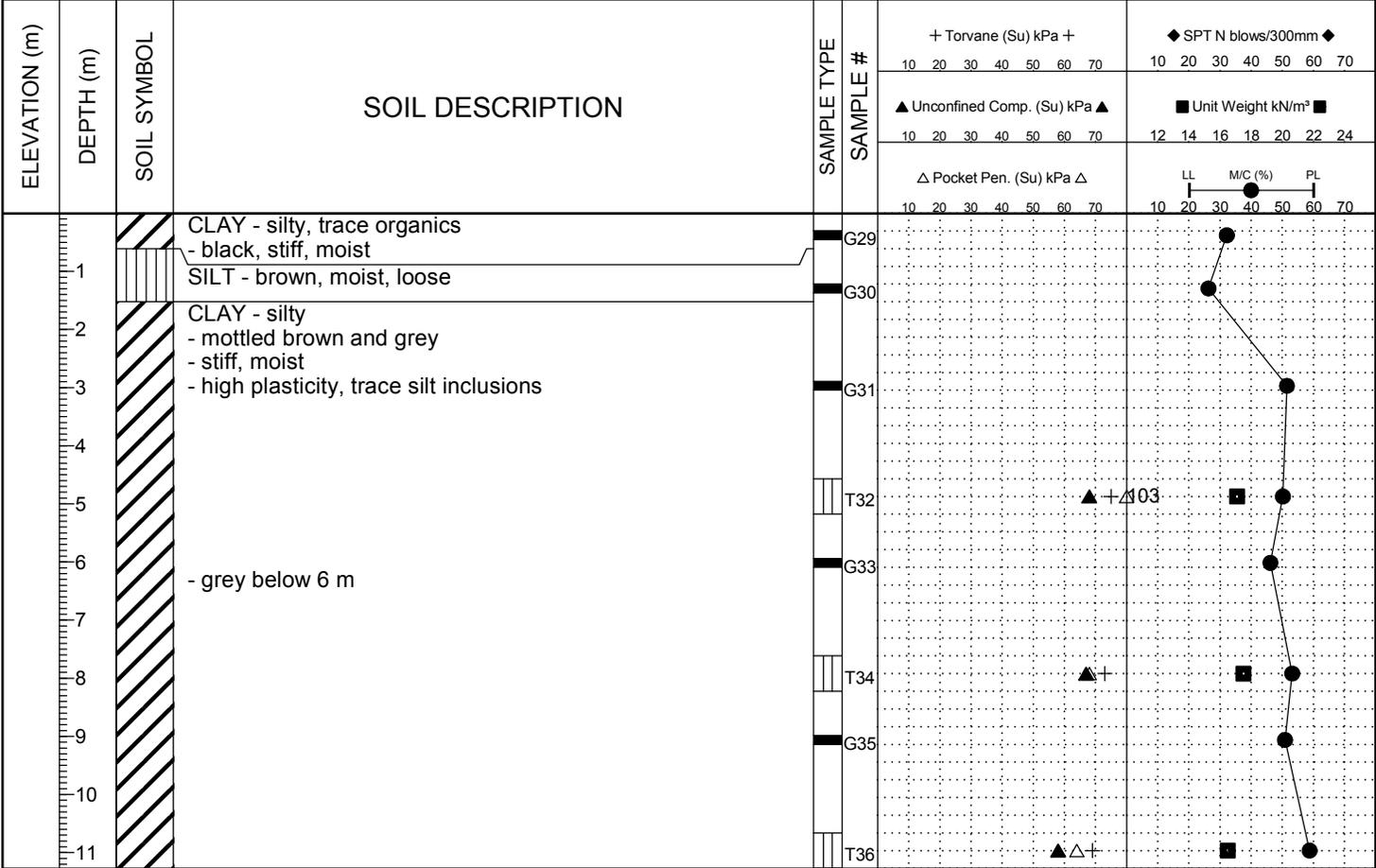
END OF TEST HOLE AT 3 m IN CLAY

- Notes:
1. No seepage observed.
 2. Test hole open to 2.5 m below grade upon completion of drilling.
 3. Test hole backfilled with auger cuttings and bentonite.

BH GEOTECH PLOTS -NEW ALT1 153919_COW WINDSOR PARK LIBRARY.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 10/12/15

DYREGROV ROBINSON INC. Consulting Geotechnical Engineers	LOGGED BY: WG	COMPLETION DEPTH: 3.05 m
	REVIEWED BY: GR	COMPLETION DATE: 26/10/15
	PROJECT ENGINEER: Gil Robinson	

PROJECT: Windsor Park Library	CLIENT: City of Winnipeg	TESTHOLE NO: 5
LOCATION: South corner of proposed building		PROJECT NO.: 153919
CONTRACTOR: Subterranean Ltd.	METHOD: CME 75 - 125mm SS augers	ELEVATION (m):
SAMPLE TYPE	<input type="checkbox"/> GRAB <input type="checkbox"/> SHELBY TUBE <input type="checkbox"/> SPLIT SPOON <input type="checkbox"/> BULK <input type="checkbox"/> NO RECOVERY <input type="checkbox"/> CORE	
BACKFILL TYPE	<input type="checkbox"/> BENTONITE <input type="checkbox"/> GRAVEL <input type="checkbox"/> SLOUGH <input type="checkbox"/> GROUT <input type="checkbox"/> CUTTINGS <input type="checkbox"/> SAND	



END OF TEST HOLE AT 11.3 m IN CLAY
Notes:
1. No sloughing or seepage observed.
2. Test hole backfilled with auger cuttings and bentonite.

BH GEOTECH PLOTS - NEW ALT.1 153919_COW WINDSOR PARK LIBRARY.GPJ DATA TEMPLATE - AUGUST 2, 2013.GDT 10/12/15

DYREGROV ROBINSON INC.
Consulting Geotechnical Engineers

LOGGED BY: WG	COMPLETION DEPTH: 11.28 m
REVIEWED BY: GR	COMPLETION DATE: 26/10/15
PROJECT ENGINEER: Gil Robinson	