

To: Matthew Skinner, P.Eng.

Date: April 8, 2022Project #: 60668984From: Ryan Harras, B.Sc., P.Eng.
Faris Alobaidy, M.Sc., P.Eng.

cc: Marv McDonald, C.E.T.

Memorandum

Subject: Branch I Aqueduct Drain Chamber and Associated Works - Geotechnical Investigation

1. Introduction

1.1 General

The City of Winnipeg (the City) has retained AECOM Canada Ltd. (AECOM) to provide geotechnical services in support of the design of a new drain chamber for the Branch I Aqueduct at the Tache Booster Pump Station (TBPS) site. This memorandum summarizes the results of the geotechnical investigation completed in January 2022, including test hole information, laboratory test results, and recommendations related to lateral earth pressures to aid in design of temporary shoring systems.

1.2 Scope of Work

The geotechnical scope of work included provision of the following services:

- **Geotechnical Investigation** – Drilling one (1) test hole near the proposed drain chamber at the TBPS site to a maximum depth of 10.7 m, and converting the test hole to a standpipe piezometer upon completion of the drilling.
- **Laboratory Testing** – Completion of laboratory testing on collected samples, including: moisture content, Atterberg Limits, gradation, unconfined compressive strength, and electrochemical tests.
- **Instrumentation Monitoring** – Completion of one (1) post-installation reading of the standpipe piezometer at least 3 weeks following installation.
- **Reporting** – Presentation of all geotechnical investigation results and lateral earth pressure recommendations in a geotechnical memo.

2. Geotechnical Investigation

2.1 General

On January 18, 2022, one (1) test hole (TH22-01) was drilled at the approximate location of the proposed drain chamber, as shown in the Contract Documents. A job hazard assessment was prepared prior to the field investigation, and utility clearance certificates were obtained by AECOM personnel from representatives of ClickBeforeYouDigMB and DigShaw.

Drilling was completed by Paddock Drilling Ltd. using a track-mounted Mobile B48 drill rig equipped with 125 mm Solid Stem Augers (SSA). Disturbed grab and split-spoon samples and relatively undisturbed Shelby Tube samples were retrieved from test holes at select intervals. Standard penetration tests (SPT's) were also completed at regular intervals within the test hole, and the blows required to advance the split-spoon sampler 300 mm were recorded (SPT 'N' values).

Subsurface conditions observed during drilling were documented by AECOM geotechnical personnel according to the Modified Unified Classification System for soils. Other pertinent information such as groundwater and drilling conditions were also recorded. Samples retrieved during the field investigation were tested in the AECOM and ALS Environmental materials testing laboratories located in Winnipeg, Manitoba.

A test hole log was prepared for the single test hole completed and is attached in **Appendix A**. The log include descriptions and depths of the soil units encountered, sample type, sample location, results of field and laboratory testing, instrumentation installed, and other pertinent information such as seepage and sloughing related to groundwater conditions.

2.2 In-situ and Laboratory Testing

In-situ and laboratory testing were completed at select depths and on select soil samples collected during the geotechnical investigation program. The soil testing program included the determination of index properties such as moisture content, grain size distribution (sieve analysis/hydrometer method), plasticity (Atterberg Limits), undrained shear strength ("Qu/2" unconfined compressive strength method), bulk unit weight, and electrochemical properties (chloride content, resistivity, sulphate content, and pH). The laboratory test results are presented in **Appendix B. Table 2-1** summarizes the number of each test completed.

Table 2-1: Summary of Laboratory Testing

Test	Number
Moisture Content	8
Atterberg Limits	2
Grain Size Distribution (Sieve Analysis/Hydrometer Method)	2
Undrained Shear Strength (Qu/2)	1
Bulk Unit Weight	1
Electrochemical (Chloride, Resistivity, Sulphate, pH)	2

2.3 Subsurface Conditions

The following sections describe the subsurface conditions encountered during the geotechnical drilling investigation completed by AECOM. The information provided in this section is a summary of the findings from the investigation and laboratory testing.

In descending order from grade, the general soil profile consisted of:

- Topsoil
- Clay Fill
- Sand Fill
- Sand
- Clay (CH)

Each of these units are described separately below.

Topsoil

A layer of topsoil 75 mm thick was encountered at ground surface. The topsoil was black and frozen at the time of drilling.

Clay Fill

A layer of clay fill of 0.6 m thick was encountered below the topsoil. The clay fill was silty, contained some sand and some gravel, and was dark brown, frozen at the time of the investigation, and of intermediate plasticity. A summary of the index properties of the clay fill layer is presented in **Table 2-2**.

Table 2-2: Summary of Index Properties of Clay Fill

Test	Minimum Value	Maximum Value	Number of Tests
Atterberg – Plastic Limit (%)	15		1
Atterberg – Liquid Limit (%)	33		1

Sand Fill

A layer of sand fill 1.1 m thick was encountered beneath the clay fill. The sand fill was gravelly, contained some silt and trace clay, and was dark brown, loose, and moist. A summary of the index properties of the sand fill layer is presented in **Table 2-3**.

Table 2-3: Summary of Index Properties of Sand Fill

Test	Minimum Value	Maximum Value	Number of Tests
Moisture Content (%)	12	22	2
Grain Size – Gravel (%)	24		1
Grain Size – Sand (%)	51		1
Grain Size – Silt (%)	18		1
Grain Size – Clay (%)	8		1

Sand

A layer of sand 1.3 m thick was encountered beneath the sand fill. The sand contained trace to some silt, trace to some clay, and was dark brown and moist. A summary of the index properties of the sand layer is presented in **Table 2-4**.

Table 2-4: Summary of Index Properties of Sand

Test	Minimum Value	Maximum Value	Number of Tests
Moisture Content (%)	13	20	2

Clay (CH)

A layer of clay was encountered beneath the sand and extended to the test hole termination depth at 10.7 m. The clay layer was silty, contained some sand, and was brown to grey, firm to stiff, moist, and of high plasticity. A summary of the index properties of the clay are presented in **Table 2-5**.

Table 2-5: Summary of Index Properties of Clay (CH)

Test	Minimum Value	Maximum Value	Number of Tests
Moisture Content (%)	32	43	4
SPT 'N' Blow Count (uncorrected)	5	9	3
Atterberg – Plastic Limit (%)	24		1
Atterberg – Liquid Limit (%)	54		1
Grain Size – Gravel (%)	0		1
Grain Size – Sand (%)	10		1
Grain Size – Silt (%)	57		1
Grain Size – Clay (%)	33		1
Undrained Shear Strength (Qu/2) (kPa)	60		1
Bulk Unit Weight	18.5		1

2.4 Seepage, Sloughing, and Heaving

Sloughing from the upper sand layers was encountered in test hole TH22-01 at drilling depths below 4.6 m. Seepage was not encountered during drilling. Detailed information about the nature and location of the sloughing and/or seepage are provided on the test hole log included in **Appendix A**.

One (1) standpipe piezometer was installed in test hole TH22-01 upon completion of the drilling. Short-term monitoring results of the groundwater level (GWL) are provided in **Table 2-6**.

Table 2-6: Piezometer Monitoring Data

Test Hole Number	TH22-01
Test Hole Elevation [m]	229.91
Tip Depth [m BGS]	10.36
Tip Elevation [m]	219.55
Tip Location	Clay
Dates	GWL Depth Below Ground Surface (Elevation) [m]
*January 18, 2022	Dry
March 7, 2022	5.86 (224.05)

* Measurement taken immediately following installation

It should be noted that groundwater levels, seepage, and sloughing levels in excavations may vary seasonally, annually, or as a result of construction activities.

2.5 Electrochemical Test Results

Electrochemical testing was completed on two (2) soil samples collected from test hole TH22-01 to determine water soluble sulphate in soil, pH of soil, water soluble chloride in soil, and soil resistivity. A summary of the test results is provided in **Table 2-7**.

Table 2-7: Summary of Electrochemical Test Results

Soil Unit	Sample ID / Depth (m)	Water Soluble Sulphate (mg/kg)	pH	Water Soluble Chloride (mg/kg)	Resistivity (ohm*cm)	Corrosivity
Clay Fill	G1A / 0.8	<20	7.58	<20	4950	Corrosive
Clay (CH)	S6 / 6.1	<20	7.62	<20	4240	Corrosive

The results of the water-soluble sulphate testing indicate that the clay fill and clay soils tested are classified as moderate (S-3) class of exposure to sulphate attack according to CAN/CSA A23.1-M94 (*Concrete Materials and Methods of Concrete Construction*). However, it is known that soils in the Winnipeg area commonly have a very severe (S-1) class of exposure to sulphate attack.

Based on the results of the resistivity testing, the clay fill and clay soils tested are classified as corrosive to buried metal.

3. Temporary Excavations

Temporary excavations will be required to facilitate the construction of the proposed drain chamber at the TPBS site. It is understood that the proposed drain chamber will consist of a 3048 mm diameter precast manhole founded at a depth of approximately 6.7 m below existing grade (Elev. 223.51 m above sea level) which is well below frost depth in Winnipeg area. For the proposed infrastructure it is understood that temporary shoring will be required during construction of the proposed drain chamber, and that the Contractor is responsible for design and construction of the temporary shoring system. All excavation work will be required to be performed in accordance with the most recent version of the Workplace Safety and Health Act and Part 26 of the Manitoba Workplace Safety and Health Regulation M.R. 217/2006.

Based on the results of the geotechnical investigation, lateral earth pressure design parameters have been recommended for use by the Contractor in completing the temporary shoring design. The lateral earth pressure distribution will be based on the selected configuration of the shoring system. **Table 3-1** provides a summary of lateral earth pressures for the different soil layers encountered.

Table 3-1: Lateral Earth Pressure Parameters

Soil Type	γ (kN/m ³)	Angle of internal friction, Φ (degrees)	Active Earth Pressure Coefficient, K_a	At-rest Earth Pressure Coefficient, K_o	Active Earth Pressure Coefficient, K_p
Clay Fill	19.0	20	0.49	0.66	2.0
Sand Fill	20.0	27	0.38	0.55	2.7
Sand	20.0	30	0.33	0.50	3.0
Clay	18.5	14	0.61	0.76	1.6

Temporary shoring systems are required to be designed for lateral earth pressure, lateral hydrostatic pressures below the groundwater level (when a sub-drainage system is not provided behind the wall), and surcharge loads of equipment adjacent to the shaft. Buoyant soil unit weight should be considered at depths below the groundwater level when a sub-drainage system is not provided behind the wall. A minimum surcharge of 16 kPa at ground surface is recommended to account for traffic acting adjacent to the wall; however, the actual surcharge of the selected construction equipment should be calculated and accounted for in the design of the shoring system (in case it's higher than 16 kPa). The temporary shoring design should be capable of controlling ground movement in accordance with the Contract Documents.

The passive earth pressure parameters provided in **Table 3-1** should be reduced by a factor of 1.5 to account for the partial mobilization of passive resistance that generally occurs with small wall displacements under the applied loads. Passive resistance from the soil located in the upper 0.5 m below the excavation level should be ignored.

To attain active earth pressure (K_a) conditions, the displacement at the top of the wall should be at least 0.01 times the height of the wall. In the case of an unyielding wall, the at-rest earth pressure (K_o) should be used in the design.

4. Closure

The findings of this memo were based on the results of field and laboratory investigations at a single test hole location. If conditions are encountered that appear to be different from those shown by the test holes at this site and described in this report, or if the assumptions stated herein are not in keeping with the design, this office should be notified in order that the report can be reviewed and adjusted, if necessary.

Soil conditions, by their nature, can be highly variable across a site. The placement of fill and prior construction activities on a site can contribute to the variability especially of near-surface soil conditions. A contingency should be included in the construction budget to allow for the possibility of variation in soil conditions. Such variations may require modifications to the design or construction procedures.

If you have any questions, please do not hesitate to contact the undersigned.

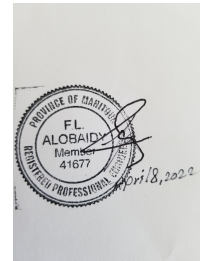
Sincerely,
AECOM Canada Ltd.

Prepared by:



For Ryan Harras, B.Sc. (Civil), P.Eng.
Geotechnical Engineer

Reviewed by:



Faris Alobaidy, M.Sc., P.Eng.
Senior Geotechnical Engineer

Appendix **A**

Test Hole Log

GENERAL STATEMENT

NORMAL VARIABILITY OF SUBSURFACE CONDITIONS

The scope of the investigation presented herein is limited to an investigation of the subsurface conditions as to suitability for the proposed project. This report has been prepared to aid in the evaluation of the site and to assist the engineer in the design of the facilities. Our description of the project represents our understanding of the significant aspects of the project relevant to the design and construction of earth work, foundations and similar. In the event of any changes in the basic design or location of the structures as outlined in this report or plan, we should be given the opportunity to review the changes and to modify or reaffirm in writing the conclusions and recommendations of this report.

The analysis and recommendations presented in this report are based on the data obtained from the borings and test pit excavations made at the locations indicated on the site plans and from other information discussed herein. This report is based on the assumption that the subsurface conditions everywhere are not significantly different from those disclosed by the borings and excavations. However, variations in soil conditions may exist between the excavations and, also, general groundwater levels and conditions may fluctuate from time to time. The nature and extent of the variations may not become evident until construction. If subsurface conditions differ from those encountered in the exploratory borings and excavations, are observed or encountered during construction, or appear to be present beneath or beyond excavations, we should be advised at once so that we can observe and review these conditions and reconsider our recommendations where necessary.

Since it is possible for conditions to vary from those assumed in the analysis and upon which our conclusions and recommendations are based, a contingency fund should be included in the construction budget to allow for the possibility of variations which may result in modification of the design and construction procedures.

In order to observe compliance with the design concepts, specifications or recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated, we recommend that all construction operations dealing with earth work and the foundations be observed by an experienced soils engineer. We can be retained to provide these services for you during construction. In addition, we can be retained to review the plans and specifications that have been prepared to check for substantial conformance with the conclusions and recommendations contained in our report.

EXPLANATION OF FIELD & LABORATORY TEST DATA

The field and laboratory test results, as shown for each hole, are described below.

1. NATURAL MOISTURE CONTENT

The relationship between the natural moisture content and depth is significant in determining the subsurface moisture conditions. The Atterberg Limits for a sample should be compared to its natural moisture content and plotted on the Plasticity Chart in order to determine the soil classification.

2. SOIL PROFILE AND DESCRIPTION

Each soil stratum is classified and described noting any special conditions. The Modified Unified Classification System (MUCS) is used. The soil profile refers to the existing ground level at the time the hole was done. Where available, the ground elevation is shown. The soil symbols used are shown in detail on the soil classification chart.

3. TESTS ON SOIL SAMPLES

Laboratory and field tests are identified by the following and are on the logs:

- N - Standard Penetration Test (SPT) Blow Count. The SPT is conducted in the field to assess the in-situ consistency of cohesive soils and the relative density of non-cohesive soils. The N value recorded is the number of blows from a 63.5 kg hammer dropped 760 mm which is required to drive a 51 mm split spoon sampler 300 mm into the soil.
- SO₄ - Water Soluble Sulphate Content. Expressed in percent. Conducted primarily to determine requirements for the use of sulphate resistant cement. Further details on the water-soluble sulphate content are given in Section 6.
- γ_D - Dry Unit Weight. Usually expressed in kN/m³.
- γ_T - Total Unit Weight. Usually expressed in kN/m³.
- Q_u - Unconfined Compressive Strength. Usually expressed in kPa and may be used in determining allowable bearing capacity of the soil.

- C_u - Undrained Shear Strength. Usually expressed in kPa. This value is determined by either a direct shear test or by an unconfined compression test and may also be used in determining the allowable bearing capacity of the soil.
- C_{PEN} - Pocket Penetrometer Reading. Usually expressed in kPa. Estimate of the undrained shear strength as determined by a pocket penetrometer.

The following tests may also be performed on selected soil samples and the results are given on separate sheets enclosed with the logs:

- Grain Size Analysis
- Standard or Modified Proctor Compaction Test
- California Bearing Ratio Test
- Direct Shear Test
- Permeability Test
- Consolidation Test
- Triaxial Test

4. SOIL DENSITY AND CONSISTENCY

The SPT test described above may be used to estimate the consistency of cohesive soils and the density of cohesionless soils. These approximate relationships are summarized in the following tables:

Table 1 Cohesive Soils

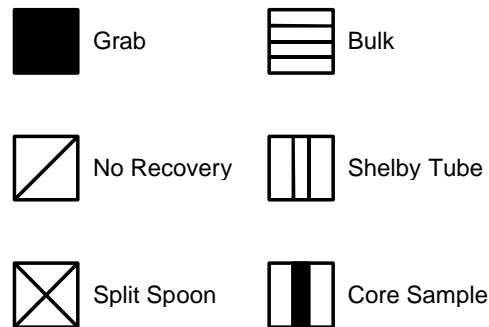
N	Consistency	C_u (kPa) approx.
0 - 1	Very Soft	<10
1 - 4	Soft	10 - 25
4 - 8	Firm	25 - 50
8 - 15	Stiff	50 - 100
15 - 30	Very Stiff	100 - 200
30 - 60	Hard	200 - 300
>60	Very Hard	>300

Table 2 Cohesionless Soils

N	Density
0 - 5	Very Loose
5 - 10	Loose
10 - 30	Compact
30 - 50	Dense
>50	Very Dense

5. SAMPLE CONDITION AND TYPE

The depth, type, and condition of samples are indicated on the logs by the following symbols:



6. WATER SOLUBLE SULPHATE CONCENTRATION

The following table, from CSA Standard A23.1-14, indicates the requirements for concrete subjected to sulphate attack based upon the percentage of water-soluble sulphate as presented on the logs. CSA Standard A23.1-14 should be read in conjunction with the table.

Table 3 Requirements for Concrete Subjected to Sulphate Attack*

Class of exposure	Degree of exposure	Water-soluble sulphate (SO ₄) [†] in soil sample, %	Sulphate (SO ₄) in groundwater samples, mg/L [‡]	Water soluble sulphate (SO ₄) in recycled aggregate sample, %	Cementing materials to be used ^{§††}	Performance requirements ^{§,§§}		
						Maximum expansion when tested using CSA A3004-C8 Procedure A at 23 °C, %		Maximum expansion when tested using CSA A3004-C8 Procedure B at 5 °C, % ^{†††}
						At 6 months	At 12 months ^{††}	At 18 months ^{‡‡}
S-1	Very severe	> 2.0	> 10 000	> 2.0	HS ^{**} , HSb, HSLb ^{***} or HSe	0.05	0.10	0.10
S-2	Severe	0.20–2.0	1500–10 000	0.60–2.0	HS ^{**} , HSb, HSLb ^{***} or HSe	0.05	0.10	0.10
S-3	Moderate (including seawater exposure*)	0.10–0.20	150–1500	0.20–0.60	MS, MSb, MSe, MSLb ^{***} , LH, LHb, HS ^{**} , HSb, HSLb ^{***} or HSe	0.10		0.10

*For sea water exposure, also see Clause 4.1.1.5.

[†]In accordance with CSA A23.2-3B.

[‡]In accordance with CSA A23.2-2B.

[§]Where combinations of supplementary cementing materials and portland or blended hydraulic cements are to be used in the concrete mix design instead of the cementing materials listed, and provided they meet the performance requirements demonstrating equivalent performance against sulphate exposure, they shall be designated as MS equivalent (MSe) or HS equivalent (HSe) in the relevant sulphate exposures (see Clauses 4.1.1.6.2, 4.2.1.1, and 4.2.1.3, and 4.2.1.4).

^{**}Type HS cement shall not be used in reinforced concrete exposed to both chlorides and sulphates, including seawater. See Clause 4.1.1.6.3.

††The requirement for testing at 5 °C does not apply to MS, HS, MSb, HSb, and MSe and HSe combinations made without portland limestone cement.

‡‡ If the increase in expansion between 12 and 18 months exceeds 0.03%, the sulphate expansion at 24 months shall not exceed 0.10% in order for the cement to be deemed to have passed the sulphate resistance requirement.

§§For demonstrating equivalent performance, use the testing frequency in Table 1 of CSA A3004-A1 and see the applicable notes to Table A3 in A3001 with regard to re-establishing compliance if the composition of the cementing materials used to establish compliance changes.

***Where MSLb or HSLb cements are proposed for use, or where MSe or HSe combinations include Portland-limestone cement, they must also contain a minimum of 25% Type F fly ash or 40% slag or 15% metakaolin (meeting Type N pozzolan requirements) or a combination of 5% Type SF silica fume with 25% slag or a combination of 5% Type SF silica fume with 20% Type F fly ash. For some proposed MSLb, HSLb, and MSe or HSe combinations that include Portland-limestone cement, higher SCM replacement levels may be required to meet the A3004-C8 Procedure B expansion limits. Due to the 18-month test period, SCM replacements higher than the identified minimum levels should also be tested. In addition, sulphate resistance testing shall be run on MSLb and HSLb cement and MSe or HSe combinations that include Portland-limestone cement at both 23 °C and 5 °C as specified in the table.

†††If the expansion is greater than 0.05% at 6 months but less than 0.10% at 1 year, the cementing materials combination under test shall be considered to have passed.

7. SOIL CORROSIVITY

The following table, from the Handbook of Corrosion Engineering (Roberge, 1999) indicates the corrosivity rating can be obtained from the soil resistivity, presented on the logs.

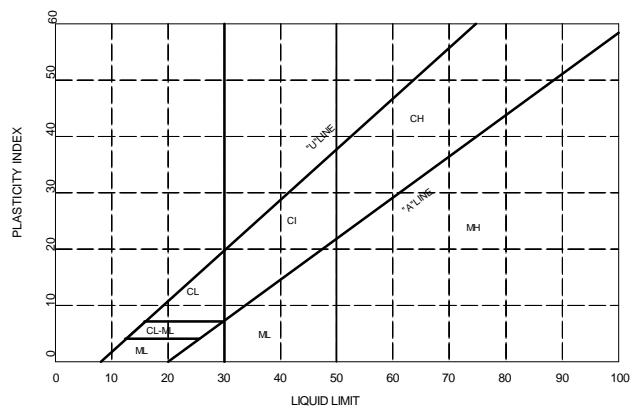
Table 4 Corrosivity Ratings Based on Soil Resistivity

Soil Resistivity (ohm-cm)	Corrosivity Rating
>20,000	Essentially non-corrosive
10,000 – 20,000	Mildly corrosive
5,000 – 10,000	Moderately corrosive
3,000 – 5,000	Corrosive
1,000 – 3,000	Highly corrosive
<1,000	Extremely corrosive

8. GROUNDWATER TABLE

The groundwater table is indicated by the equilibrium level of water in a standpipe installed in a testhole or test pit. This level is generally taken at least 24 hours after installation of the standpipe. The groundwater level is subject to seasonal variations and is usually highest in the spring. The symbol on the logs indicating the groundwater level is an inverted solid triangle (▼).

MAJOR DIVISION			LOG SYMBOLS	UCS	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA		
COARSE GRAINED SOILS	GRAVELS (MORE THAN HALF COARSE GRAINS LARGER THAN 4.75 mm)	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL GRADED GRAVELS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 4$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$		
				GP	POORLY GRADED GRAVELS AND GRAVEL-SAND MIXTURES, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS		
		GRAVELS WITH FINES		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE W_p LESS THAN 4	
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE W_p MORE THAN 7	
	SANDS (MORE THAN HALF COARSE GRAINS SMALLER THAN 4.75 mm)	CLEAN SANDS (LITTLE R NO FINES)		SW	WELL GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES	$C_u = \frac{D_{60}}{D_{10}} > 6$ $C_c = \frac{(D_{30})^2}{D_{10} \times D_{60}} = 1 \text{ to } 3$		
				SP	POORLY GRADED SANDS, LITTLE OR NO FINES	NOT MEETING ABOVE REQUIREMENTS		
		SANDS WITH FINES		SM	SILTY SANDS, SAND-SILT MIXTURES	CONTENT OF FINES EXCEEDS 12%	ATTERBERG LIMITS BELOW 'A' LINE W_p LESS THAN 4	
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES		ATTERBERG LIMITS ABOVE 'A' LINE W_p MORE THAN 7	
FINE GRAINED SOILS	SILTS (BELOW 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 50$		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY SANDS OF SLIGHT PLASTICITY	CLASSIFICATION IS BASED UPON PLASTICITY CHART (SEE BELOW)		
		$W_L > 50$		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SANDY OR SILTY SOILS			
	CLAYS (ABOVE 'A' LINE NEGLIGIBLE ORGANIC CONTENT)	$W_L < 30$		CL	INORGANIC CLAYS OF LOW PLASTICITY, GRAVELLY, SANDY, OR SILTY CLAYS, LEAN CLAYS	WHENEVER THE NATURE OF THE FINE CONTENT HAS NOT BEEN DETERMINED, IT IS DESIGNATED BY THE LETTER 'F'. E.G. SF IS A MIXTURE OF SAND WITH SILT OR CLAY		
		$30 < W_L < 50$		CI	INORGANIC CLAYS OF MEDIUM PLASTICITY, SILTY CLAYS			
		$W_L > 50$		CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS			
	ORGANIC SILTS & CLAYS (BELOW 'A' LINE)	$W_L < 50$		OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY			
		$W_L > 50$		OH	ORGANIC CLAYS OF HIGH PLASTICITY			
	HIGHLY ORGANIC SOILS				Pt	PEAT AND OTHER HIGHLY ORGANIC SOILS	STRONG COLOUR OR ODOUR, AND OFTEN FIBROUS TEXTURE	
BEDROCK				BR	SEE REPORT DESCRIPTION			
FILL				FILL	SEE REPORT DESCRIPTION			

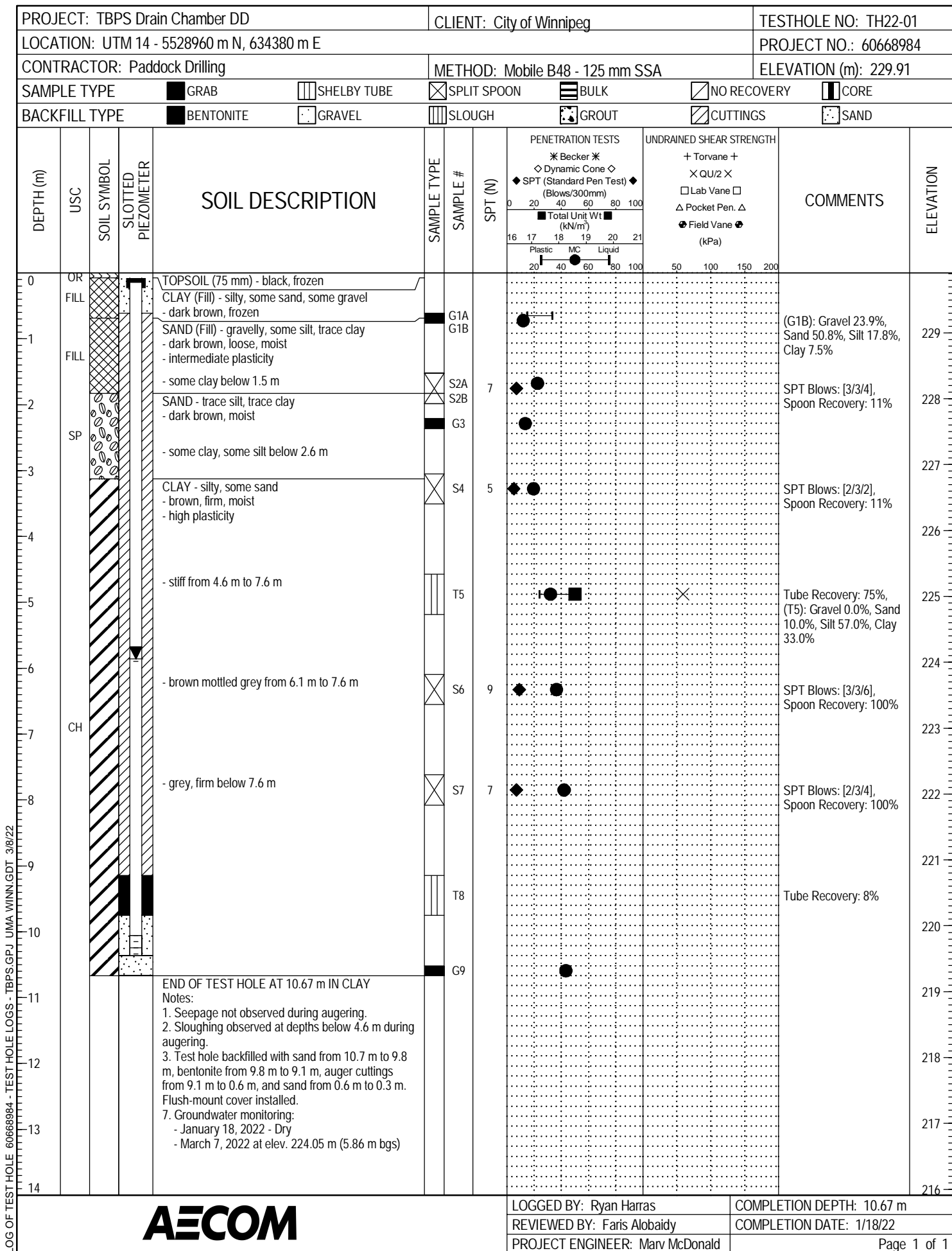


NOTE:
1. BOUNDARY CLASSIFICATION POSSESSING CHARACTERISTICS OF TWO GROUPS ARE GIVEN GROUP SYMBOLS, E.G. GW-GC IS A WELL GRADED GRAVEL MIXTURE WITH CLAY BINDER BETWEEN 5% AND 12%

SOIL COMPONENTS					
FRACTION		SIEVE SIZE (mm)		DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
		PASSING	RETAINED	PERCENT	IDENTIFIER
GRAVEL	COARSE	75	19	50 - 35	AND
	FINE	19	4.75		
SAND	COARSE	4.75	2.00	35 – 20	____Y
	MEDIUM	2.00	0.425		
		FINE	0.425	0.080	20 – 10
SILT (non-plastic) or CLAY (plastic)		0.080		10 - 1	TRACE
OVERSIZE MATERIALS					
ROUNDED OR SUB-ROUNDED COBBLES 75 mm TO 200 mm BOULDERS >200 mm			ANGULAR ROCK FRAGMENTS ROCKS > 0.75 m³ IN VOLUME		

MODIFIED UNIFIED SOIL CLASSIFICATION SYSTEM

August 2015



Appendix **B**

Laboratory Test Results

SOIL SAMPLES TEST SUMMARY

CLIENT:	AECOM Canada Ltd. 99 Commerce Drive Winnipeg MB R3P 0Y7	PROJECT No.:	112-2202
ATTENTION:	Ryan Harris	Date Sampled:	18-Jan-22
PROJECT:	TBPS Drain Chamber Job No. 60668984	Date Received:	21-Jan-22
		Sampled By:	Client
		Date Tested:	Jan 27 to Feb 11, 2022

Lab No.				Testing Required									Soil Description
Hole No.	Sample No.	Depth	Sampling Method	Moisture Content (%)	Particle Size Analysis				Atterberg Limits			Unconfined Compressive Strength Qu (kPa)	
					Gravel	Sand	Silt	Clay	Liquid Limit	Plastic Limit	Plastic Index		
TH22-01 11% rec.	G1	2.5	Auger	11.9	23.9	50.8	17.8	7.5	33	15	19		CLAY (FILL)
	S2	5	Split Spoon	22.4									SAND
11% rec.	G3	7.5	Auger	13.4									
	S4	10	Split Spoon	19.5									
	T5	15	Shelby Tube	32.0		10.0	57.0	33.0	54	24	30	118.9	
	S6	20	Split Spoon	36.4									
	S7	25	Split Spoon	42.0									
	T8	30	Shelby Tube										
8% rec.	G9	35	Auger	43.3									

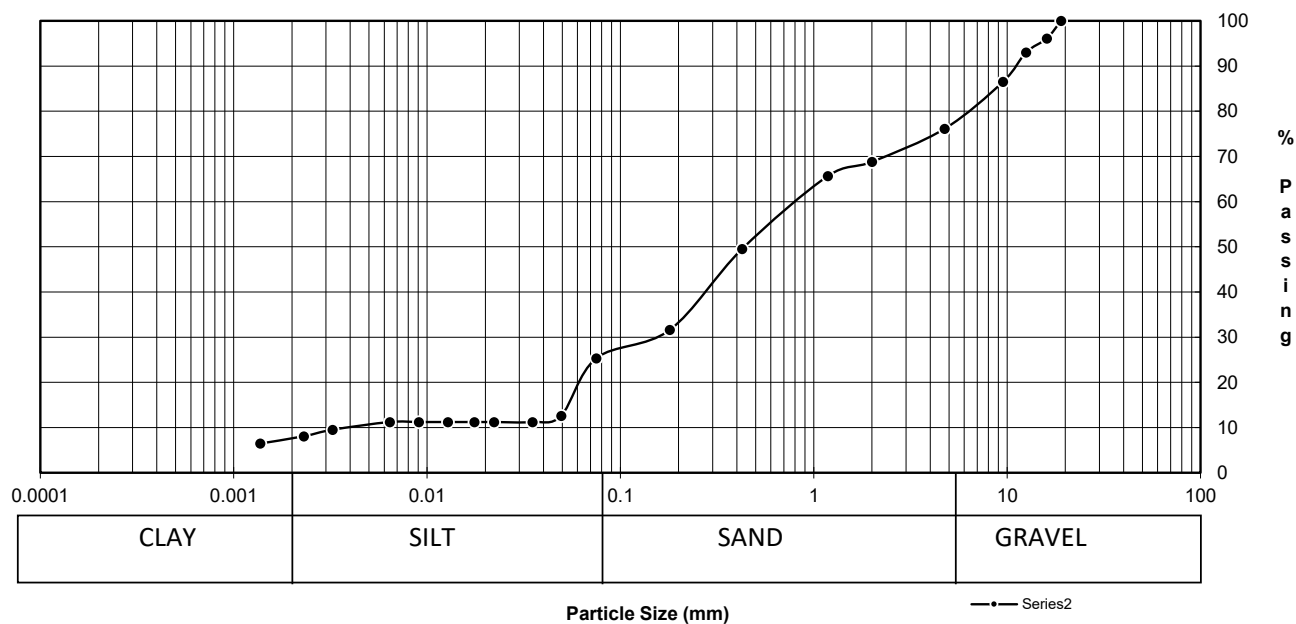
MOISTURE CONTENT OF SOIL (ASTM D2216)

CLIENT: AECOM	TEST NO:			PROJECT NO: 112-2202	
PROJECT: TBPS Drain Chamber	DATE SAMPLED: Jan. 18, 2022			SAMPLED BY: Client	
PROJECT CONTACT: R. Harras	DATE TESTED: Jan. 27, 2022			TESTED BY: E. Santiago	
Test Hole No. 22-01	G1	S2	G3	S4	S6
Depth	2.5'	5'	7.5'	10'	20'
Tare No.					
Wt Wet Sample + Tare	177.7	194.6	182.5	169.6	155
Wt Dry Sample + Tare	159.2	159.9	161.4	142.7	114.8
Wt Water	18.5	34.7	21.1	26.9	40.2
Wt Tare	4.3	4.7	4.3	4.6	4.3
Wt Dry Sample	154.9	155.2	157.1	138.1	110.5
Moisture Content (%)	11.9	22.4	13.4	19.5	36.4
Test Hole No. 22-01	S7	G9			
Depth	25'	35'			
Tare No.					
Wt Wet Sample + Tare	174.7	166.4			
Wt Dry Sample + Tare	124.3	117.4			
Wt Water	50.4	49.0			
Wt Tare	4.4	4.3			
Wt Dry Sample	119.9	113.1			
Moisture Content (%)	42.0	43.3			
Test Hole No.					
Depth					
Tare No.					
Wt Wet Sample + Tare					
Wt Dry Sample + Tare					
Wt Water					
Wt Tare					
Wt Dry Sample					
Moisture Content (%)					
Test Hole No.					
Depth					
Tare No.					
Wt Wet Sample + Tare					
Wt Dry Sample + Tare					
Wt Water					
Wt Tare					
Wt Dry Sample					
Moisture Content (%)					

PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

CLIENT:	AECOM Canada Ltd. 99 Commerce Drive Winnipeg MB R3P 0Y7		PROJECT No.: 112-2202			
ATTENTION:	Ryan Harras		PSA Test No.: 1			
PROJECT:	TBPS Drain Chamber Winnipeg, MB		LAB No.: HM 004A-1			
Date Sampled:	Jan. 18, 2022	Date Received:	21-Jan-22			
Sampled By:	Client	Date Tested:	01-Feb-22			
<div>Material Identification</div> <div>B.H./T.H. No. TH22-01-G1</div> <div>Depth 2.5 FT.</div> <div>Sample Source</div> <div>Specific Gravity of Material: 2.65</div>			Sieve Analysis		Hydrometer Analysis	
			Sieve (mm) % Passing		Diameter % Finer	
			50.00 100.0			
			37.50 100.0			
			25.00 100.0			
			19.00 100.0			
			16.00 96.1			
			12.50 93.0		0.0493	12.6
			9.50 86.5		0.0351	11.2
			4.75 76.1		0.0222	11.2
			2.00 68.8		0.0175	11.2
			1.18 65.6		0.0128	11.2
			0.425 49.5		0.0091	11.2
			0.180 31.6		0.0064	11.2
			0.075 25.3		0.0014	6.5

Grain Size Analysis



	% Composition		D10	0.00365
	23.9	Gravel	D30	0.15500
	50.8	Sand	D60	0.79500
	17.8	Silt	Cu	217.81
	7.5	Clay	Cc	8.28

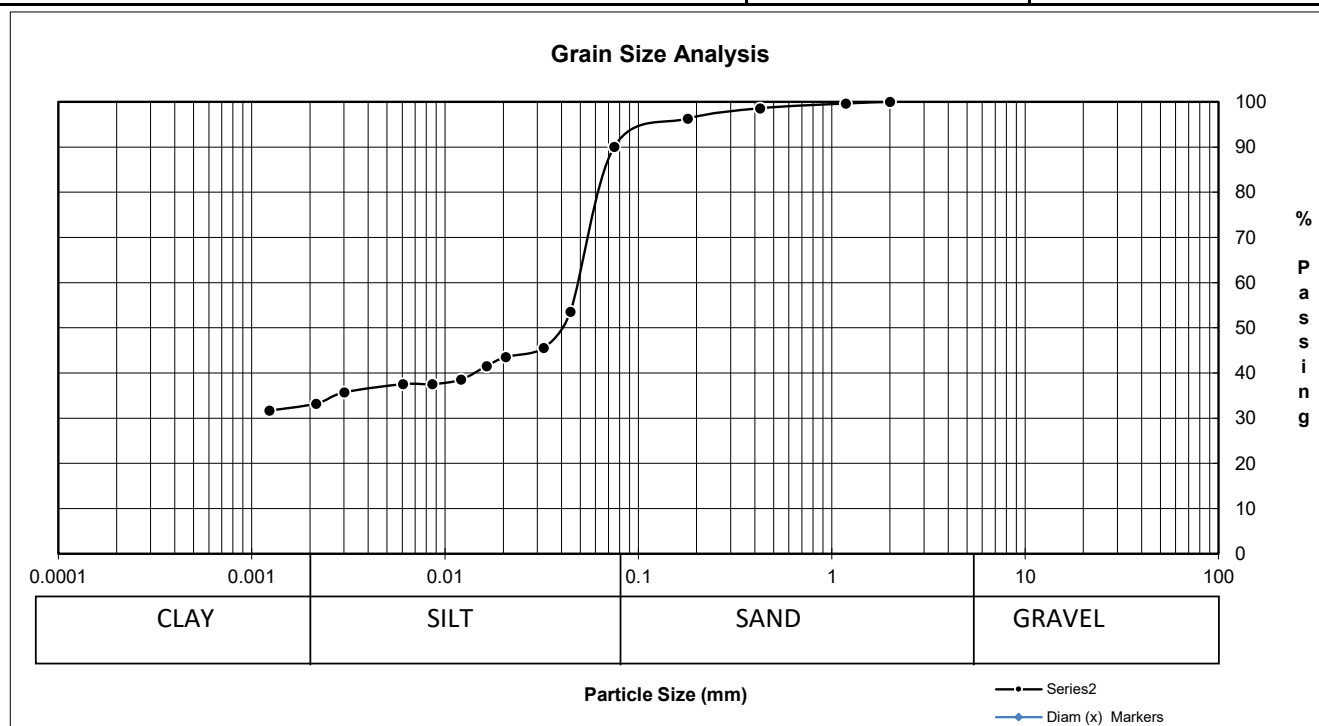
Remarks: Test Method: ASTM D7928, D2216, D4318

Technician: E. Santiago

Reviewed by: Paul Bevel

PARTICLE SIZE ANALYSIS OF SOILS TEST REPORT

CLIENT:	AECOM Canada Ltd. 99 Commerce Drive Winnipeg MB R3P 0Y7		PROJECT No.: 112-2202			
ATTENTION:	Ryan Harras		PSA Test No.: 2			
PROJECT:	TBPS Drain Chamber Winnipeg, MB		LAB No.: HM 004A-2			
Date Sampled:	Jan. 18, 2022	Date Received:	21-Jan-22			
Sampled By:	Client	Date Tested:	11-Feb-22			
<div>Material Identification</div> <div>B.H./T.H. No. TH22-01-T5</div> <div>Depth 15 FT.</div> <div>Sample Source</div> <div>Specific Gravity of Material: 2.65</div>			Sieve Analysis		Hydrometer Analysis	
			Sieve (mm) % Passing		Diameter % Finer	
			50.00 100.0			
			37.50 100.0			
			25.00 100.0			
			19.00 100.0			
			16.00 100.0			
			12.50 100.0		0.0444	53.5
			9.50 100.0		0.0323	45.5
			4.75 100.0		0.0206	43.5
			2.00 100.0		0.0164	41.5
			1.18 99.6		0.0121	38.5
			0.425 98.6		0.0086	37.5
			0.180 96.3		0.0061	37.5
			0.075 90.0		0.0012	31.7



	% Composition		D10	N/A
	9.96	Gravel	D30	N/A
	57.08	Sand	D60	0.05100
	32.96	Silt	Cu	
		Clay	Cc	

Remarks: Test Method: ASTM D7928, D2216, D4318

Technician: E. Santiago

Reviewed by: Paul Bevel

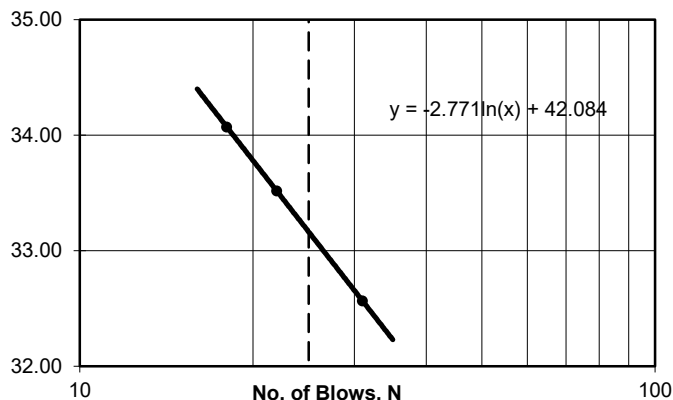
Atterberg Limits (ASTM D4318)

Client: AECOM Canada Ltd.
99 Commerce Drive
Winnipeg MB R3P 0Y7
Attention.: Ryan Harras
Project: TBPS Drain Chamber
Winnipeg, MB

PROJECT No.: 112-2202
PI Test No.: 1
LAB No.: HM 004B-1
Date Received: Jan., 21, 2022
Date Tested / By: 2022-1-30/G. Manalo

Liquid Limit Determination

Dish No.:	1	2	3		Liquid Limit 25 Blows
Wet Soil + Dish:	11.89	11.62	10.93		
Dry Soil + Dish:	10.05	9.81	9.24		
Moisture:	1.84	1.81	1.69		
Dish:	4.4	4.41	4.28		
Dry Soil:	5.65	5.4	4.96		
% Moisture:	32.57	33.52	34.07		
No. of Blows:	31	22	18		
Liquid Limit:					33

Liquid Limit**Material Identification:****TH 22-01**Depth: **G1 @ 2.5 ft.**

Liquid Limit, %: **33**
Plastic Limit, %: **15**
Plasticity Index: **19**
(LL-PL)

Plastic Limit Determination

Dish No.:	1	2	3		
Wet Soil + Dish:	10.35	10.55	11.09		
Dry Soil + Dish:	9.6	9.75	10.27		
Moisture:	0.75	0.80	0.82		
Dish:	4.28	4.27	4.81		
Dry Soil:	5.32	5.48	5.46		
% Moisture:	14.10	14.60	15.02		
Average:					15

Test Method : ASTM: D4318, D2216

P. Bevel

Reviewed by: Paul Bevel

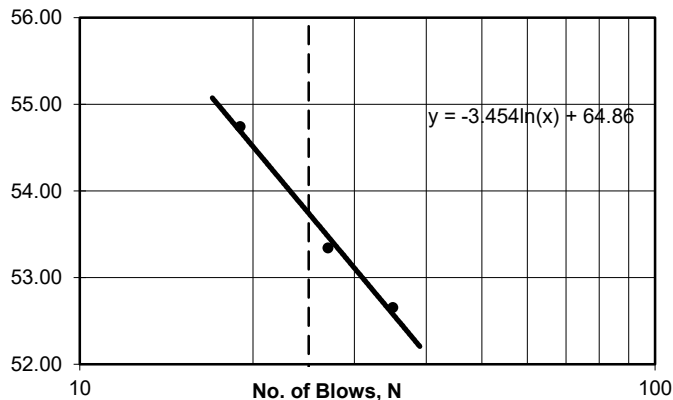
Atterberg Limits (ASTM D4318)

Client: AECOM Canada Ltd.
99 Commerce Drive
Winnipeg MB R3P 0Y7
Attention.: Ryan Harras
Project: TBPS Drain Chamber
Winnipeg, MB

PROJECT No.: 112-2202
PI Test No.: 2
LAB No.: HM 004B-2
Date Received: Jan., 21, 2022
Date Tested / By: 2022-2-11/G. Manalo

Liquid Limit Determination

Dish No.:	1	2	3		Liquid Limit 25 Blows
Wet Soil + Dish:	14.29	13.28	13.37		
Dry Soil + Dish:	10.82	10.17	10.14		
Moisture:	3.47	3.11	3.23		
Dish:	4.23	4.34	4.24		
Dry Soil:	6.59	5.83	5.9		
% Moisture:	52.66	53.34	54.75		
No. of Blows:	35	27	19		
Liquid Limit:					54

Liquid Limit**Material Identification:****TH 22-01**Depth: **T5 @ 15 ft.**

Liquid Limit, %: **54**
Plastic Limit, %: **24**
Plasticity Index: **30**
(LL-PL)

Plastic Limit Determination

Dish No.:	1	2	3		
Wet Soil + Dish:	10.08	10.15	10.68		
Dry Soil + Dish:	8.99	9	9.50		
Moisture:	1.09	1.15	1.18		
Dish:	4.27	4.22	4.61		
Dry Soil:	4.72	4.78	4.89		
% Moisture:	23.09	24.06	24.13		
Average:					24

Test Method : ASTM: D4318, D2216

P. Bevel

Reviewed by: Paul Bevel

UNCONFINED COMPRESSIVE STRENGTH TEST REPORT

CLIENT: AECOM PROJECT NO.: 112-2202
99 Commerce Drive Qu Test No.: 1
Winnipeg MB R3P 0Y7 Lab No.: HM 04
ATTENTION: Ryan Harris
PROJECT: TBPS Drain Chamber (60668984)

Date Sampled: 18-Jan-22 Date Received: 22-Jan-22
Sampled By: Client Date Tested: 07-Feb-22 Sample ID: TH 22-01 T5 (15')

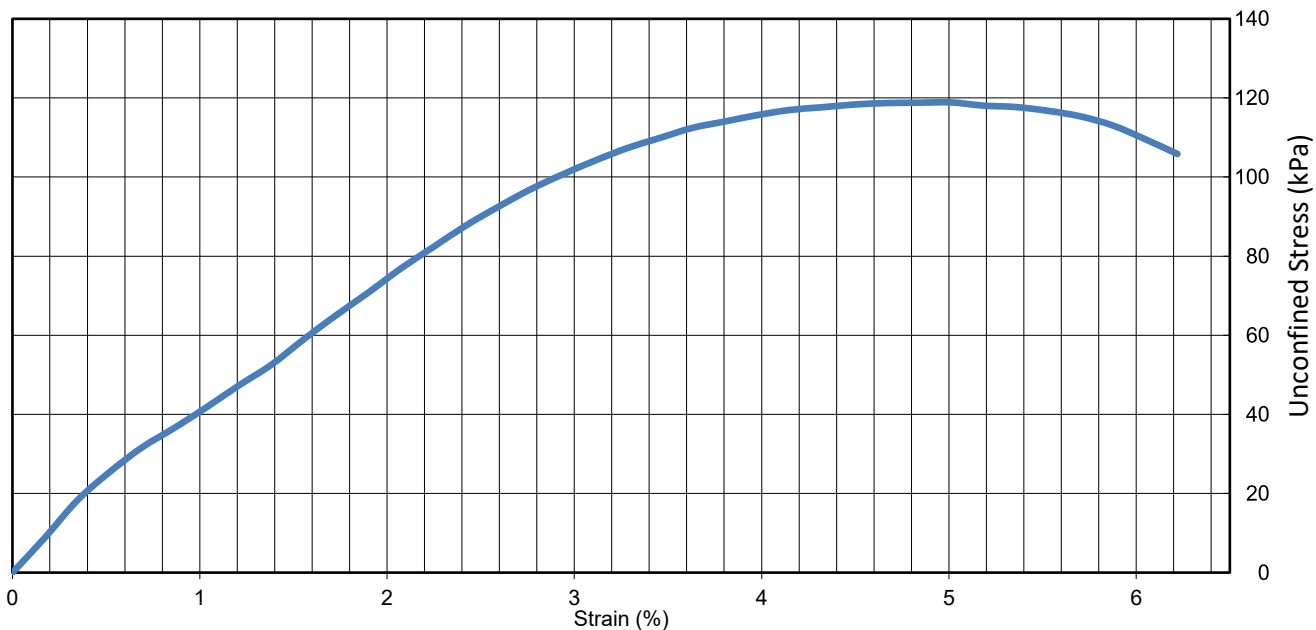
Test Result: Unconfined Compressive Strength 118.9 kPa

Test Sample Data

Sample Mass (g)	Average Height (m)	Average Diameter (m)	Moisture Content %	Wet Density (kg/m ³)	Dry Density (kg/m ³)	Strain rate (%/min)
1150.9	0.1470	0.0724	32.0	1885	1428	1.0

Test Sample Visual Description

CLAY, silty, trace gravel, dark brown, stiff, moist, trace silt pockets

Unconfined Stress (kPa) vs Strain (%)

Remarks: Test Method: ASTM D2166
Technician: PB

P. Bevel
Reviewed by: Paul Bevel



AECOM Canada Ltd.
ATTN: RYAN HARRAS
99 Commerce Drive
Winnipeg MB R3P 0Y7

Date Received: 24-JAN-22
Report Date: 02-FEB-22 13:21 (MT)
Version: FINAL

Client Phone: 204-477-5381

Certificate of Analysis

Lab Work Order #: L2680746
Project P.O. #: 60668984
Job Reference: WINNIPEG, MB
C of C Numbers:
Legal Site Desc:



Hua Wo
Chemistry Laboratory Manager

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ADDRESS: 1329 Niakwa Road East, Unit 12, Winnipeg, MB R2J 3T4 Canada | Phone: +1 204 255 9720 | Fax: +1 204 255 9721
ALS CANADA LTD Part of the ALS Group An ALS Limited Company

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L2680746-1 TH22-01-G1@2.5' Sampled By: CLIENT on 20-JAN-22 Matrix: SOIL Miscellaneous Parameters % Moisture Chloride Resistivity Sulphate Conductivity pH	 17.4 <20 4950 <20 0.202 7.58	 	 0.25 20 1.0 20 0.0040 0.10	 % mg/kg ohm*cm ug/g mS/cm pH units	 26-JAN-22 31-JAN-22 31-JAN-22 	 26-JAN-22 31-JAN-22 01-FEB-22 01-FEB-22 28-JAN-22 26-JAN-22	 R5709237 R5712341 R5712699 R5711483 R5708728
L2680746-2 TH22-01-S6@20' Sampled By: CLIENT on 20-JAN-22 Matrix: SOIL Miscellaneous Parameters % Moisture Chloride Resistivity Sulphate Conductivity pH	 24.4 33 4240 <20 0.236 7.62	 	 0.25 20 1.0 20 0.0040 0.10	 % mg/kg ohm*cm ug/g mS/cm pH units	 26-JAN-22 31-JAN-22 31-JAN-22 	 26-JAN-22 31-JAN-22 01-FEB-22 01-FEB-22 28-JAN-22 26-JAN-22	 R5709237 R5712341 R5712699 R5711483 R5708728

* Refer to Referenced Information for Qualifiers (if any) and Methodology.

Reference Information

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-WT	Soil	Chloride in Soil	EPA 300.0
5 grams of soil is mixed with 50 mL of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.			
EC-WT	Soil	Conductivity (EC)	MOEE E3138
A representative subsample is tumbled with de-ionized (DI) water. The ratio of water to soil is 2:1 v/w. After tumbling the sample is then analyzed by a conductivity meter.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
MOISTURE-WT	Soil	% Moisture	CCME PHC in Soil - Tier 1 (mod)
PH-WT	Soil	pH	MOEE E3137A
A minimum 10g portion of the sample is extracted with 20mL of 0.01M calcium chloride solution by shaking for at least 30 minutes. The aqueous layer is separated from the soil and then analyzed using a pH meter and electrode.			
Analysis conducted in accordance with the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act (July 1, 2011).			
RESISTIVITY-CALC-WT	Soil	Resistivity Calculation	APHA 2510 B
"Soil Resistivity (calculated)" is determined as the inverse of the conductivity of a 2:1 water:soil leachate (dry weight). This method is intended as a rapid approximation for Soil Resistivity. Where high accuracy results are required, direct measurement of Soil Resistivity by the Wenner Four-Electrode Method (ASTM G57) is recommended.			
SO4-WT	Soil	Sulphate	EPA 300.0
5 grams of soil is mixed with 50 mL of distilled water for a minimum of 30 minutes. The extract is filtered and analyzed by ion chromatography.			

** ALS test methods may incorporate modifications from specified reference methods to improve performance.

The last two letters of the above test code(s) indicate the laboratory that performed analytical analysis for that test. Refer to the list below:

Laboratory Definition Code	Laboratory Location
WT	ALS ENVIRONMENTAL - WATERLOO, ONTARIO, CANADA

Chain of Custody Numbers:

GLOSSARY OF REPORT TERMS

Surrogates are compounds that are similar in behaviour to target analyte(s), but that do not normally occur in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery. In reports that display the D.L. column, laboratory objectives for surrogates are listed there.

mg/kg - milligrams per kilogram based on dry weight of sample

mg/kg ww - milligrams per kilogram based on wet weight of sample

mg/kg lwt - milligrams per kilogram based on lipid-adjusted weight

mg/L - unit of concentration based on volume, parts per million.

< - Less than.

D.L. - The reporting limit.

N/A - Result not available. Refer to qualifier code and definition for explanation.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical results in unsigned test reports with the DRAFT watermark are subject to change, pending final QC review.

Quality Control Report

Workorder: L2680746

Report Date: 02-FEB-22

Page 1 of 2

Client: AECOM Canada Ltd.
99 Commerce Drive
Winnipeg MB R3P 0Y7

Contact: RYAN HARRAS

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-WT		Soil						
Batch	R5712341							
WG3690759-4	CRM	AN-CRM-WT						
Chloride			93.4		%		70-130	31-JAN-22
WG3690759-3	DUP	L2680746-1						
Chloride		<20	<20	RPD-NA	mg/kg	N/A	30	31-JAN-22
WG3690759-2	LCS							
Chloride			101.4		%		80-120	31-JAN-22
WG3690759-1	MB							
Chloride			<20		mg/kg		20	31-JAN-22
EC-WT		Soil						
Batch	R5711483							
WG3689972-2	IRM	WT SAR4						
Conductivity			106.4		%		70-130	28-JAN-22
WG3690327-1	LCS							
Conductivity			95.2		%		90-110	28-JAN-22
WG3689972-1	MB							
Conductivity			<0.0040		mS/cm		0.004	28-JAN-22
MOISTURE-WT		Soil						
Batch	R5709237							
WG3689411-2	LCS							
% Moisture			100.6		%		90-110	26-JAN-22
WG3689411-1	MB							
% Moisture			<0.25		%		0.25	26-JAN-22
PH-WT		Soil						
Batch	R5708728							
WG3688991-1	LCS							
pH			7.03		pH units		6.9-7.1	26-JAN-22
SO4-WT		Soil						
Batch	R5712699							
WG3690988-3	CRM	AN-CRM-WT						
Sulphate			114.2		%		60-140	01-FEB-22
WG3690988-2	LCS							
Sulphate			103.2		%		70-130	01-FEB-22
WG3690988-1	MB							
Sulphate			<20		ug/g		20	01-FEB-22

Quality Control Report

Workorder: L2680746

Report Date: 02-FEB-22

Page 2 of 2

Legend:

Limit	ALS Control Limit (Data Quality Objectives)
DUP	Duplicate
RPD	Relative Percent Difference
N/A	Not Available
LCS	Laboratory Control Sample
SRM	Standard Reference Material
MS	Matrix Spike
MSD	Matrix Spike Duplicate
ADE	Average Desorption Efficiency
MB	Method Blank
IRM	Internal Reference Material
CRM	Certified Reference Material
CCV	Continuing Calibration Verification
CVS	Calibration Verification Standard
LCSD	Laboratory Control Sample Duplicate

Sample Parameter Qualifier Definitions:

Qualifier	Description
RPD-NA	Relative Percent Difference Not Available due to result(s) being less than detection limit.

Hold Time Exceedances:

All test results reported with this submission were conducted within ALS recommended hold times.

ALS recommended hold times may vary by province. They are assigned to meet known provincial and/or federal government requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by the US EPA, APHA Standard Methods, or Environment Canada (where available). For more information, please contact ALS.

The ALS Quality Control Report is provided to ALS clients upon request. ALS includes comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against pre-determined data quality objectives to provide confidence in the accuracy of associated test results.

Please note that this report may contain QC results from anonymous Sample Duplicates and Matrix Spikes that do not originate from this Work Order.



12 - 1329 Niakwa Rd. E.
Winnipeg, Manitoba R2J 3T4
Tel: (204) 255-9720
Fax: (204) 255-9721
Toll Free: 1 800 607 7555



L2680746-COFC

of Custody / Analytical Request Form

WORK ORDER NO: _____

FOR LABORATORY USE ONLY (SHA)

Sample Condition Upon Receipt: ☐ ACCEPTABLE ☐ NON ACCEPTABLE
☐ Frozen ☐ Cold ☐ Ambient ☐ Broken ☐ Leakage ☐ Incorrect Sample Container
COMMENT: _____

LAB NO.: _____
DATE RECEIVED: 24/1/22
TIME RECEIVED: 9:25am
BY: O.A. TEMP: 7.4°C

Date Sampled: JAN 17 2022 Time: - : - : - A.M. ☐ P.M. ☐

Date Required: JAN 24, 2022

Location: WINNIPEG, MB
(Town, Community, City)

Submitter's Name Printed: RYAN HARRAS

Sample Submitted By: RYAN HARRAS

Community Code Number: _____

Rural Municipality/LGC/UV: _____

SAMPLE TYPE

DRINKING WATER

- ☐ Untreated Well
☐ Treated Well
☐ Treated Municipal
☐ Non-Treated Municipal
☐ Water-Surface-Raw
☐ Water-Surface-Treated

PURPOSE OF TEST

- ☐ Private ☐ Real Estate ☐ Water Main

PLEASE PRINT & PRESS FIRMLY

NON-DRINKING WATER

- ☐ Sewage/Waste Water
☐ Lake/River
☐ Swimming Pool
☐ Whirl Pool
☒ Other: SOIL

NOTES & CONDITIONS

1. Quote number **MUST BE** provided to insure proper pricing.
2. Failure to properly complete all portions of this form may delay analysis.
3. ALS's liability limited to cost of analysis.

SERVICE REQUESTED

- ☒ REGULAR ☐ PRIORITY
(50% SURCHARGE)

- ☐ EMERGENCY
(100% SURCHARGE)

- ☐ SAME DAY
(200% SURCHARGE)

LAB NUMBER	SAMPLE IDENTIFICATION	ALS CUSTOMER #:	QUOTE #:
	TH22-01-G1 @ 2.5'	REPORT TO BE SENT TO	
	TH22-01-#56 @ 20'	NAME: <u>RYAN HARRAS</u>	
		COMPANY: <u>AECOM</u>	
		ADDRESS: <u>99 COMMERCE DR</u>	
		CITY/TOWN: <u>WINNIPEG</u> / PROV.: <u>MB</u>	
		POSTAL CODE: <u>R3P 0Y7</u>	
		PHONE: <u>204-981-2796</u>	
		BY: MAIL <input checked="" type="checkbox"/> FAX <input type="checkbox"/>	
		(FAX NUMBER)	
		E-MAIL <input checked="" type="checkbox"/> <u>RYAN.HARRAS@AECOM.COM</u>	
		(EMAIL ADDRESS)	
		CC	
		NAME:	
		ADDRESS:	
		CITY/TOWN: _____ / PROV.: _____	
		POSTAL CODE: _____	
		PHONE: _____	
		BY: MAIL <input type="checkbox"/> FAX <input type="checkbox"/>	
		(FAX NUMBER)	
		E-MAIL <input type="checkbox"/>	
		(EMAIL ADDRESS)	

Analyses required SOIL RESISTIVITY/CONDUCTIVITY,

pH, SULPHATE CONTENT, CHLORIDE
CONTENT

BILLING ADDRESS

SAME AS REPORT TO ☒

NAME: _____
COMPANY: _____
ADDRESS: _____
CITY/TOWN: _____ / PROV.: _____
POSTAL CODE: _____

PAYMENT PARTICULARS (CASH NOT ACCEPTED)

- ☒ INVOICE NEEDED / CLIENT'S P.O. NO. 60668984
☐ INTERAC
☐ CHEQUE Subtotal \$ _____
☐ VISA G.S.T. \$ _____
☐ MASTERCARD Total \$ _____

* OUR POLICY IS NOT TO ACCEPT SAMPLES FROM THE PRIVATE CITIZEN WITHOUT PREPAYMENT

SAMPLING INSTRUCTIONS ON REVERSE SIDE ALS ENVIRONMENTAL

12 - 1329 Niakwa Rd. E., Winnipeg, MB Canada R2J 3T4
Phone: +1 204 255 9720 Fax: +1 204 255 9721 www.alsglobal.com
A Campbell Brothers Limited Company

SUBMITTER COPY

ENTERED IN LIMS BY: _____