Appendix MM – Bus Rapid Transit Project Southwest Transitway Corridor Geotechnical Investigation – Technical Memorandum

Project No.

PRIVILEGED AND CONFIDENTIAL

16 December 2015

Insert name of Preferred Proponent

Insert name of Preferred Proponent

and the above Preferred Proponent's Lenders and Agent

and

The City of Winnipeg
185 King Street
Winnipeg MB R3B 1J1

Re: The City of Winnipeg Southwest Rapid Transitway (Stage 2) and Pembina Highway Underpass Project (the "Project") – Reliance on BUS RAPID TRANSIT PROJECT SOUTHWEST TRANSITWAY CORRIDOR GEOTECHNICAL INVESTIGATION. Technical Memorandum Report, December 16, 2015

Dear Sirs/Madames:

In consideration of the sum of $2.00, the receipt and sufficiency of which is hereby acknowledged by **Golder Associates Ltd.** (the "**Consultant**"), the Consultant has prepared this letter to allow the use of and reliance on the reports listed in Schedule "A" attached hereto (the "**Reports**") prepared in connection with the Project, by the Proponent who is ultimately successful under the RFP **[**[NTD: Insert Name of Preferred Proponent when Identified] **]** (the "**Preferred Proponent**") **[**and **]** **[**NTD: If required, insert the City if not included in underlying report **]**, **[**their/its **]** respective successors and permitted assigns, and the Preferred Proponent's lenders and/or lenders' agent as listed in the Preferred Proponent's submission documents for the RFP (the "**Preferred Proponent's Lenders and Agent**", as applicable), notwithstanding any limitation on reliance contained in the Reports, as if the Preferred Proponent, the Preferred Proponent's Lenders and Agent **[**and The City **]** were the original addressees.

Golder Associates Ltd.
140 Renfrew Drive, Suite 110, Markham, Ontario, Canada L3R 6B3
Tel: +1 (905) 475 5591 Fax: +1 (905) 475 5257 www.golder.com

We confirm that we are prepared to answer queries in respect of the Reports. Further, it should be noted that the use of and reliance on the Reports is governed by and limited to the terms and conditions as set out in the Reports and such other terms and conditions in Schedule “B” hereto. In addition, the use of and reliance on the Reports are governed by the following conditions:

1. The information in the Reports relates only to the property described in the Reports. The Consultant makes no representation or warranty whatsoever as to the sufficiency of the Consultant’s scope of work for the purposes of the Preferred Proponent, including in its capacity as Project Co (as this entity is defined in the Project Agreement for the Project between The City and Project Co).

2. The information and conclusions provided in the Reports apply only to the subject property as it existed at the time of the Consultant's site investigations. Should the site use or conditions change, the information and conclusions in the reports may no longer apply.

3. The Consultant makes no representations regarding the marketability of the subject property and none should be inferred based on the Reports.

4. The Reports are intended to be used in their entirety and no excerpts may be taken to be representative of the findings in the assessments.

5. Disclosure or distribution of the Reports to any third party, or any reproduction of such Reports (except as required by your accountants, regulators, and legal advisors, which shall include a copy of this reliance letter) without the prior written consent of the Consultant is prohibited.

6. This reliance letter is not assignable and does not confer any right or benefit upon any third party unless written agreement is made between the Consultant and the third party.

Subject to each and every of the foregoing conditions, you may rely on the Reports for the express purpose for which they were prepared, subject always to the qualifications and limitations contained in the Reports **[** and you have no greater rights than those of The City as contained in the Reports **]** **[** NTD: Insert only if the City is named as a party to the Reports **]**.

We trust that the foregoing is satisfactory. Should you have any further questions, please contact our office.

Yours truly,

Golder Associates Ltd.

If you have any questions, please do not hesitate to contact me at (306) 667-1186.

Yours truly,

Laurent Gareau, M.Sc.

GOLDER ASSOCIATES LTD.

Rod Ramage, M.Eng. P.Eng.
Senior Geotechnical Engineer

GOLDER ASSOCIATES LTD.

APEGM
Certificate of Authorization
Golder Associates Ltd.
No. 2997 Date: Dec 17, 2015

Attachments: Report / Memorandum dated December 16, 2015
Reliance Agreement Terms and Conditions

Golder Associates

SCHEDULE "A"

REPORTS

BUS RAPID TRANSIT PROJECT SOUTHWEST TRANSITWAY CORRIDOR GEOTECHNICAL INVESTIGATION. **Technical Memorandum Report, December 16, 2015**

TECHNICAL MEMORANDUM

DATE December 16, 2015 **PROJECT No.** 1537312

TO David Krahn
Dillon Consulting Ltd.

CC

FROM Crystal Rinas, M.Sc. **EMAIL** Crystal_Rinas@golder.com

BUS RAPID TRANSIT PROJECT SOUTHWEST TRANSITWAY CORRIDOR GEOTECHNICAL INVESTIGATION

Golder Associates Ltd. (Golder) is pleased to provide this memorandum detailing the geotechnical investigation along the alignment for the Southwest Transit Corridor for the Bus Rapid Transit Phase II project.

A geotechnical investigation was completed by Golder from October 13, 2015 to November 2, 2015. The investigation consisted of drilling thirteen test holes along the alignment of the Bus Rapid Transit expansion. Test hole TH15-03 was cancelled by Dillon Consulting Ltd. (Dillon) prior to the commencement of the field program. The boreholes were located in the field using a hand held GPS unit. Test holes TH15-05 to TH15-09 were moved from their originally planned locations to allow for a safe distance from overhead power lines. Test hole TH15-13 was moved to avoid underground infrastructure. The test hole locations are shown in Appendix A.

Prior to mobilization, requests were filed with Manitoba Click Before you Dig, Manitoba Hydro and DigShaw to locate underground utilities in the area of each test hole. In addition, a private utility locator was engaged to perform a secondary sweep of each location and locate private utilities. Work permits were obtained by Golder from Manitoba Hydro and CN Rail prior to drilling test holes which fell within their respective right-of-ways.

The test holes were advanced using a track mounted Acker SX drill rig supplied and operated by Paddock Drilling Ltd. of Brandon, Manitoba. The test holes were advanced using 150 millimetres (mm) solid stem, 200 mm hollow stem augers or casing advancer through the soil to the target termination depth of the test hole or to bedrock. In selected test holes up to 5 metres (m) of limestone (bedrock) core was retrieved using an HQ core barrel and casing advancer. Soil samples were obtained at approximately 1.5 m intervals using a 50 mm outside diameter split-spoon sampler driven by a drop hammer in accordance with the Standard Penetration Test procedure (ASTM D1586-08a Standard Test Method for Standard Penetration Test). Grab samples were obtained from the auger flights when using solid stem augers. Thin-walled Shelby tube samples were also taken within the cohesive materials at selected intervals (ASTM D1587-08 Standard Penetration for Thin-Walled Tube Sampling).

Samples recovered during the field investigation were returned to Golder's Saskatoon Laboratory for further testing and analysis. Table 1 summarizes the number and type of testing performed on the soil samples as part of this investigation. Shelby tube sample observations, including features such as desiccation, fractures and slickensides, were noted on the Record of Borehole sheets. The inclination of observed fractures and slickensides was measured relative to the axis of borehole penetration. Shelby tube sample photographs are included in Appendix D. A Record of Borehole sheet was completed for each borehole to record the description and relative position of the soil strata, the location of the borehole, and other drilling notes. Records of Borehole sheets are included in Appendix B. The results of all laboratory testing are included in Appendix C.

Table 1: Summary of Instrumentation Installed and Laboratory Testing Performed

Test Hole	TH15-01	TH15-02	TH15-04	TH15-05	TH15-06	TH15-07	TH15-08	TH15-09	TH15-10	TH15-11	TH15-12	TH15-13	TH15-14
Termination Depth	10.2 m	14.3 m	14.4 m	22.9 m	21.3 m	24.4 m	27.4 m	22.9 m	15.4 m	18.3 m	24.4 m	17.5 m	21.3 m
Moisture Content	15	17	15	19	13	24	25	15	21	15	16	22	24
Atterberg Limit	4	4	4	4	4	5	4	4	4	4	4	4	5
Unconfined Compression	4	3	4	4	4	4	4	4	4	2	3	3	4
Shelby Tube	4	3	4	4	4	4	4	4	4	3	4	4	4
Bulk Density (Unit Weight)	4	3	4	5	5	5	4	4	4	3	4	3	4
Standard Consolidation	0	1	0	0	2	0	0	2	0	0	0	0	4
Hydrometer	0	1	0	0	1	0	1	0	1	0	1	0	0
Uniaxial Compression (Rock Core)	0	0	0	1	1	0	0	1	0	1	1	0	1
Soil Chemistry and Sulphates	0	0	0	1	1	0	0	1	0	1	1	0	1
Standpipe	0	0	0	1 (bedrock)	0	0	1 (bedrock)	1 (bedrock)	0	1 (mid till)	0	0	1 (bedrock)
Piezometers	0	3 (mid and lower clay, mid till)	0	0	3 (mid and lower clay, mid till)	1 (mid till)	0	0	1 (mid clay)	0	2 (mid clay, mid till)	0	0

Standpipe piezometers were installed in test holes TH15-05, TH15-08, TH15-09, TH15-11 and TH15-14. The standpipe piezometers were constructed using 25 mm polyvinyl chloride pipes with a slotted section at selected depth intervals within the boreholes. The standpipe piezometer installation details are shown on the Record of Borehole sheets in Appendix B.

Vibrating wire piezometers were installed in selected test holes (Table 2). The vibrating wire piezometers were fully grouted in the boreholes using a Portland cement:water:bentonite (1:2.5:0.3) grout mix. The vibrating wire piezometer installation details are also shown on the Record of Borehole sheets in Appendix B. The vibrating wire calibration sheets are included in Appendix E.

Table 2: Vibrating Wire Piezometer Installation Details

Test hole	Vibrating Wire Piezometer Serial Number	Ground Surface Elevation (m)	Vibrating Wire Piezometer Depth (m)	Vibrating Wire Piezometer Tip Elevation (m)	Strata
TH15-02	VW34545	232.9	6.1	226.8	Mid clay
TH15-02	VW34544	232.9	10.7	222.2	Lower clay
TH15-02	VW34543	232.9	13.7	219.2	Till
TH15-06	VW34546	231.8	6.7	225.1	Mid clay
TH15-06	VW34547	231.8	11.0	220.8	Lower clay
TH15-06	VW34548	231.8	14.6	217.2	Till
TH15-07	VW34550	231.9	14.9	217.0	Till
TH15-10	VW34549	232.8	7.9	224.9	Mid clay
TH15-12	VW34551	232.9	7.9	225.0	Mid clay
TH15-12	VW34552	232.9	16.7	216.2	Till

The findings of this report were based on the results of field and laboratory investigations conducted for the proposed development. Conditions encountered at the surface or at depth during construction of the proposed structures may be different than those indicated in the report.

Closure

We trust that this report is sufficient for your present needs. Please contact the undersigned at your convenience if you have any questions, or if any point requires clarification.

GOLDER ASSOCIATES LTD.

Crystal Rinas, M.Sc.

Laurent Gareau, M.Sc.
Principal

PROVINCE OF MANITOBA
R. G. RAMAGE
Member
32203
REGISTERED PROFESSIONAL ENGINEER

Rod Ramage, M.Eng., P.Eng.
Senior Geotechnical Engineer

APEGM
Certificate of Authorization
Golder Associates Ltd.
No. 2997 Date: Dec 17, 2015

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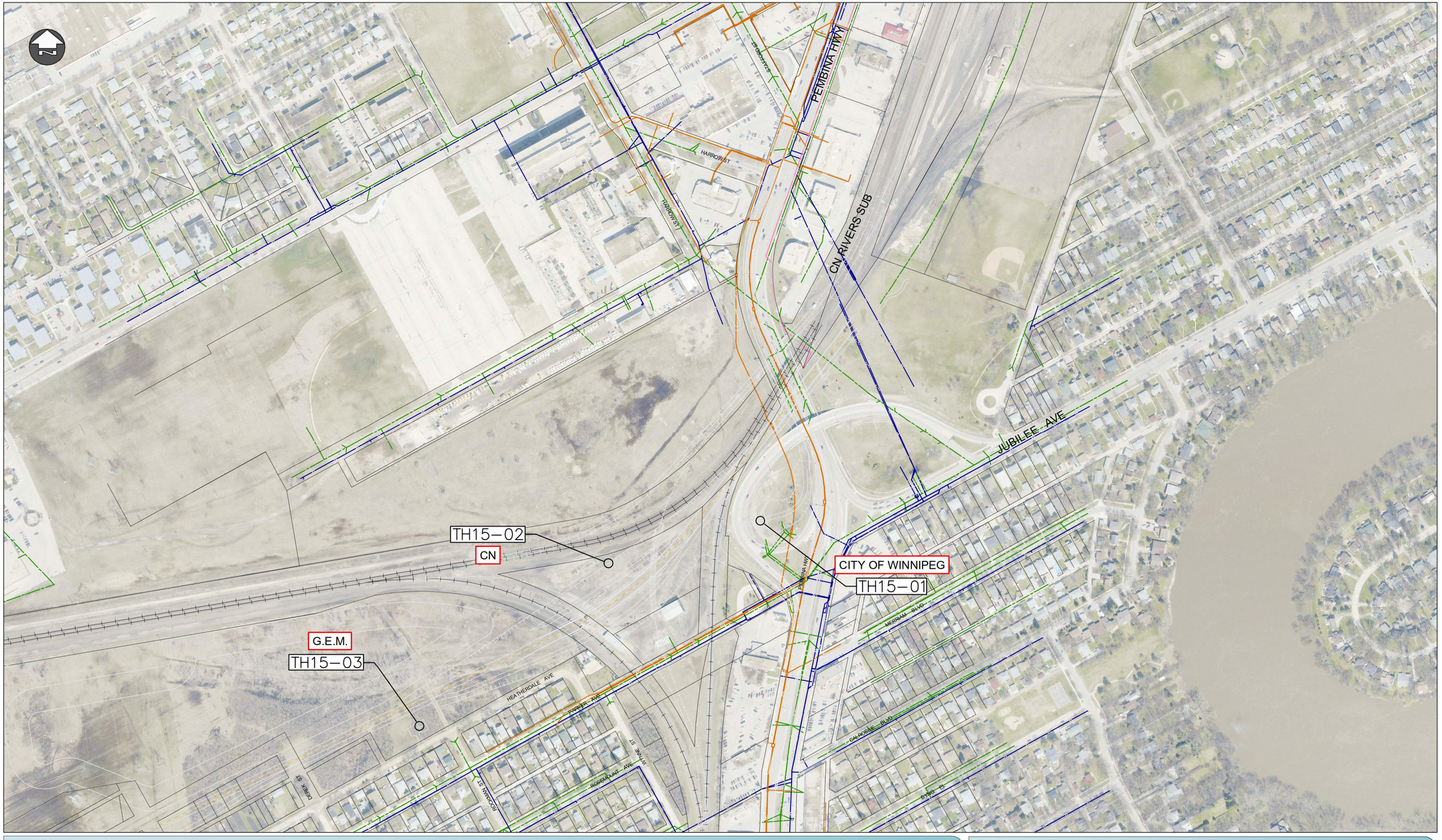
Golder Associates

APPENDIX A

Test Hole Locations



DILLON CONSULTING

0 40 80 120 160 200

MTS
WATER
SEWER

Winnipeg

CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

FIGURE 1
PROPOSED ADDITIONAL GEOTECHNICAL TESTING LOCATIONS

G:\CAD\138439_Reference-Internal\DWG\REF-178-Test-Locations-1.dwg

PROPOSED DOG PARK

HURST WAY EXTENSION

PUMP STATION FOR TRANSITWAY UNDERPASS

PARKER STATION

TRANSITWAY

AT PATH

TH15–04

CLOSED CITY ROAD

HURST WAY

GEORGINA ST

PARKER AVE

MERCURY BAY

EDDERTON AVE

PLANET ST

BEAUMONT ST

DANIEL ST

DEREK ST

ROCKMAN ST

WYNNE ST

HEATHERDALE AVE

ROSEMOUNT AVE

PEMBINA HWY

G:\CAD\138439_Reference-Internal\DWG\REF-178-Test-Locations-2.dwg

DILLON CONSULTING

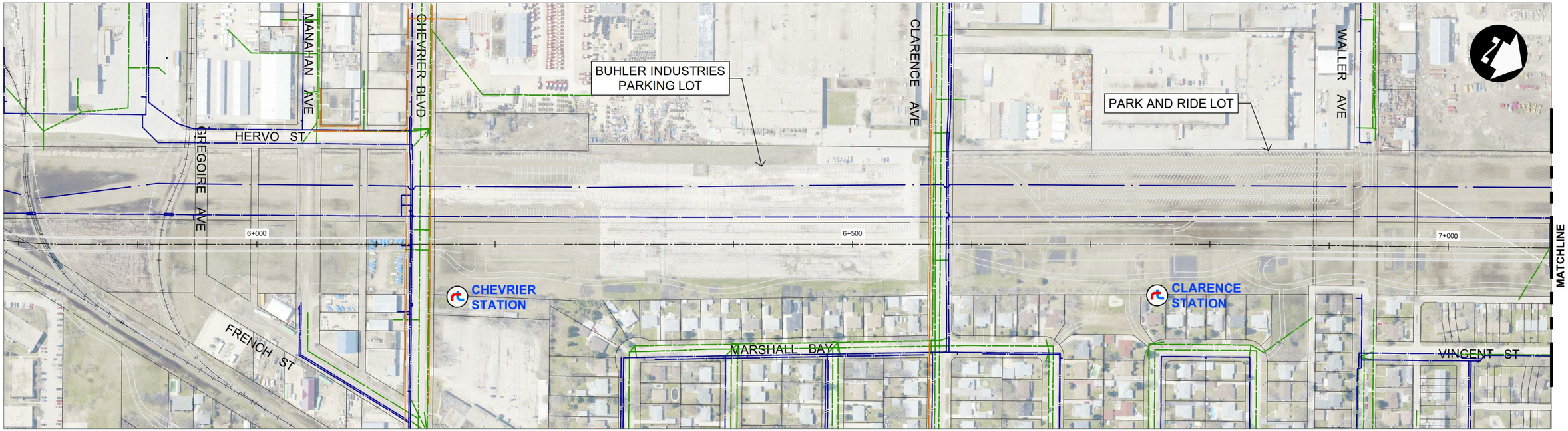
0 40 80 120 160 200

MTS
WATER
SEWER

Winnipeg

CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

FIGURE 2
PROPOSED ADDITIONAL GEOTECHNICAL TESTING LOCATIONS



G:\CAD\138439_Reference-Internal\DWG\REF-178-Test-Locations-3.dwg

DILLON CONSULTING

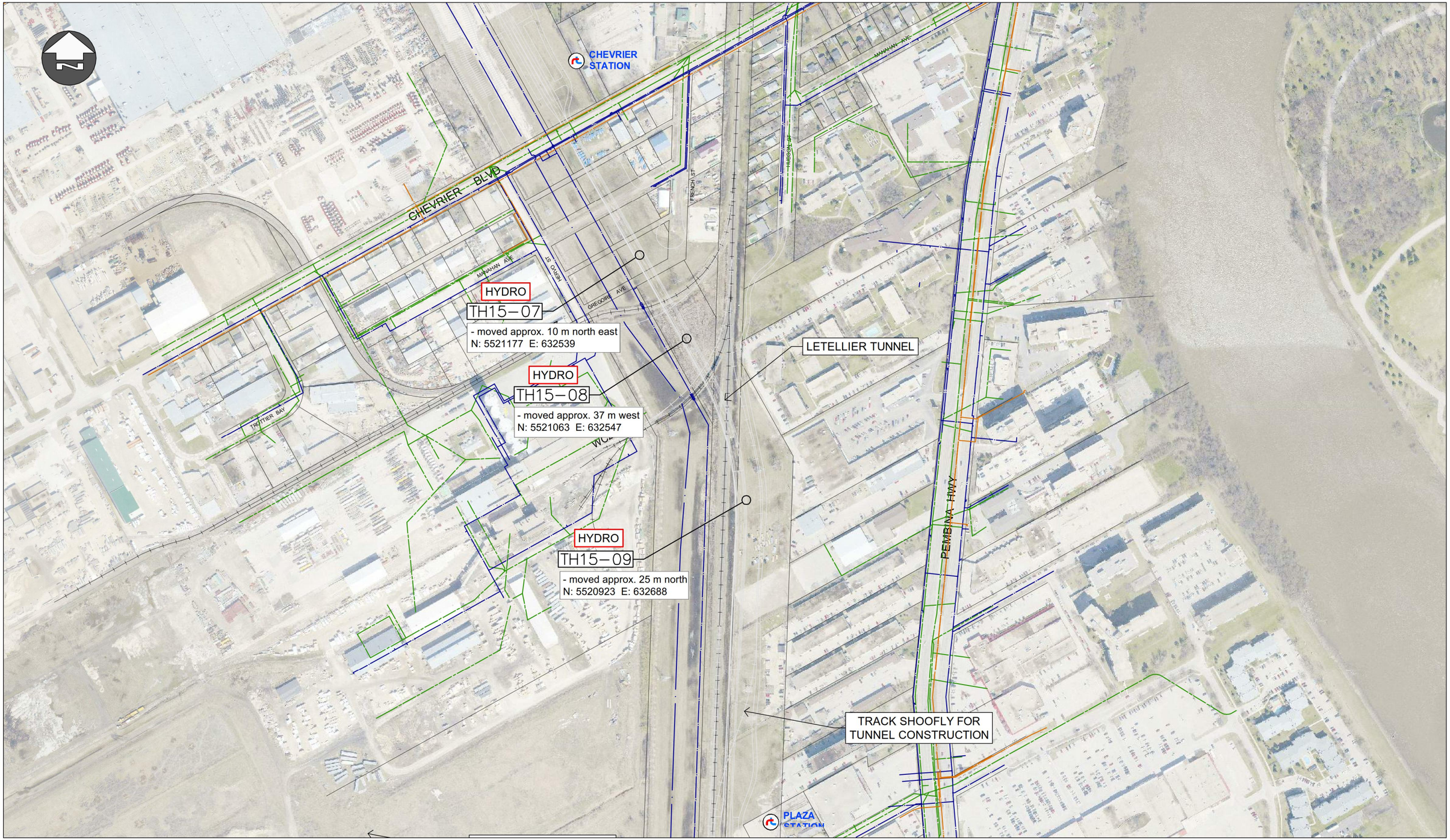
0 40 80 120 160 200

MTS
WATER
SEWER

Winnipeg

CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2 FUNCTIONAL DESIGN

FIGURE 3
PROPOSED ADDITIONAL GEOTECHNICAL TESTING LOCATIONS



DILLON CONSULTING

Winnipeg

CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

FIGURE 4
PROPOSED ADDITIONAL GEOTECHNICAL TESTING LOCATIONS

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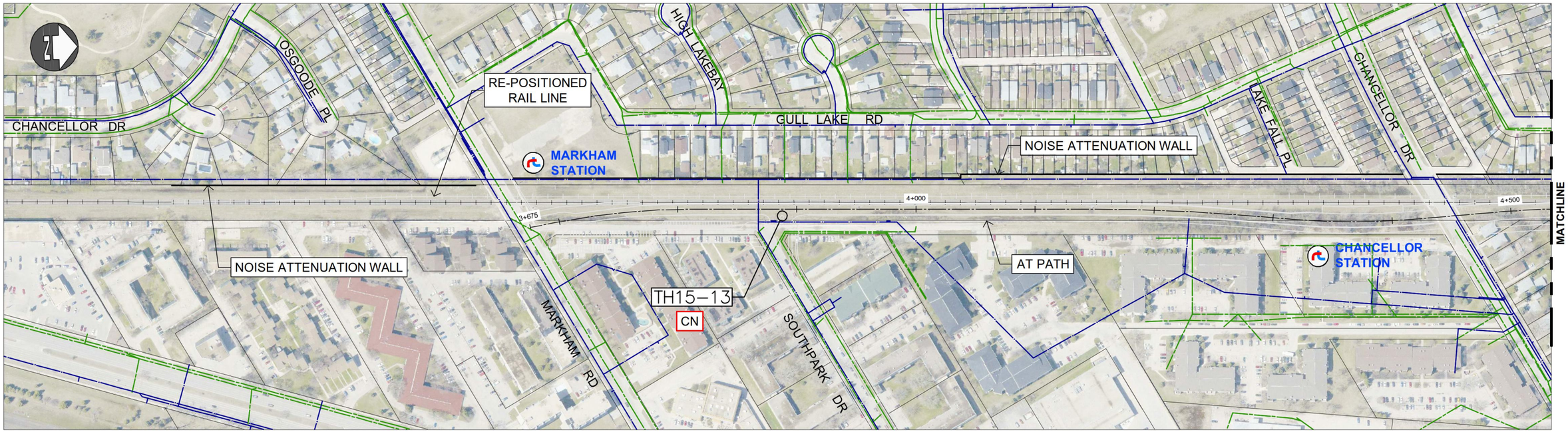

G:\CAD\138439_Reference-Internal\DWG\REF-178-Test-Locations-5.dwg

DILLON CONSULTING

0 40 80 120 160 200

MTS
WATER
SEWER

Winnipeg

CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

FIGURE 5
PROPOSED ADDITIONAL GEOTECHNICAL TESTING LOCATIONS

TRANSIT STOPS

SOUTHPARK DR

PEMBINA HWY

MARKHAM RD

DARTMOUTH DR

SNOW ST

MARKHAM RD

AT PATH

UNIVERSITY CRESCENT

IGF STATION

PRIVATE

TH15–14

- moved approx. 44 m north east
N: 5519050 E: 633499

INVESTORS GROUP FIELD

CHANCELLOR MATHESON

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DILLON CONSULTING

0 40 80 120 160 200

MTS
WATER
SEWER

Winnipeg

CITY OF WINNIPEG - SOUTHWEST TRANSITWAY - STAGE 2
FUNCTIONAL DESIGN

FIGURE 6
PROPOSED ADDITIONAL GEOTECHNICAL TESTING LOCATIONS

APPENDIX B

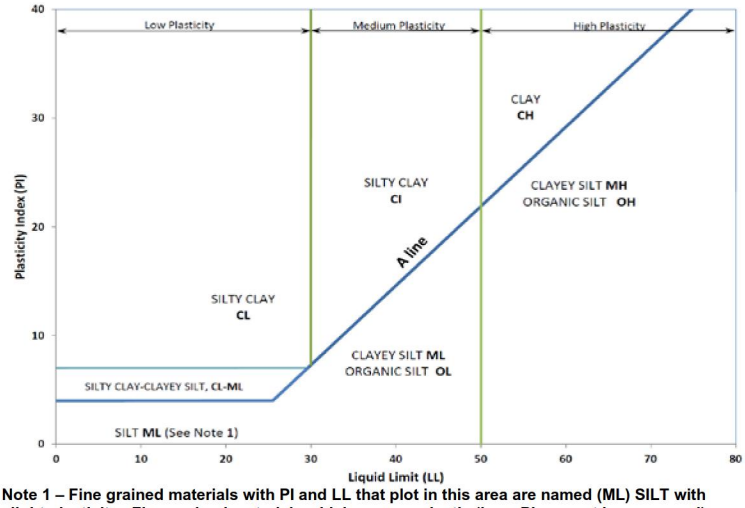
Record of Borehole Sheets

METHOD OF SOIL CLASSIFICATION

The Golder Associates Ltd. Soil Classification System is based on the Unified Soil Classification System (USCS)

Organic or Inorganic	Soil Group	Type of Soil		Gradation or Plasticity	$Cu = \frac{D_{60}}{D_{10}}$	$Cc = \frac{(D_{30})^2}{D_{10} x D_{60}}$	Organic Content	USCS Group Symbol	Group Name
INORGANIC (Organic Content ≤30% by mass)	COARSE-GRAINED SOILS (>50% by mass is larger than 0.075 mm)	GRAVELS (>50% by mass of coarse fraction is larger than 4.75 mm)	Gravels with ≤12% fines (by mass)	Poorly Graded	<4	≤1 or ≥3	≤30%	GP	GRAVEL
				Well Graded	≥4	1 to 3		GW	GRAVEL
			Gravels with >12% fines (by mass)	Below A Line	n/a			GM	SILTY GRAVEL
				Above A Line	n/a			GC	CLAYEY GRAVEL
		SANDS (≥50% by mass of coarse fraction is smaller than 4.75 mm)	Sands with ≤12% fines (by mass)	Poorly Graded	<6	≤1 or ≥3		SP	SAND
				Well Graded	≥6	1 to 3		SW	SAND
			Sands with >12% fines (by mass)	Below A Line	n/a			SM	SILTY SAND
				Above A Line	n/a			SC	CLAYEY SAND

Organic or Inorganic	Soil Group	Type of Soil		Laboratory Tests	Field Indicators					Organic Content	USCS Group Symbol	Primary Name
					Dilatancy	Dry Strength	Shine Test	Thread Diameter	Toughness (of 3 mm thread)			
INORGANIC (Organic Content ≤30% by mass)	FINE-GRAINED SOILS (≥50% by mass is smaller than 0.075 mm)	SILTS (Non-Plastic or PI and LL plot below A-Line on Plasticity Chart below)		Liquid Limit <50	Rapid	None	None	>6 mm	N/A (can't roll 3 mm thread)	<5%	ML	SILT
					Slow	None to Low	Dull	3mm to 6 mm	None to low	<5%	ML	CLAYEY SILT
					Slow to very slow	Low to medium	Dull to slight	3mm to 6 mm	Low	5% to 30%	OL	ORGANIC SILT
				Liquid Limit ≥50	Slow to very slow	Low to medium	Slight	3mm to 6 mm	Low to medium	<5%	MH	CLAYEY SILT
					None	Medium to high	Dull to slight	1 mm to 3 mm	Medium to high	5% to 30%	OH	ORGANIC SILT
		CLAYS (PI and LL plot above A-Line on Plasticity Chart below)		Liquid Limit <30	None	Low to medium	Slight to shiny	~ 3 mm	Low to medium	0% to 30% (see Note 2)	CL	SILTY CLAY
				Liquid Limit 30 to 50	None	Medium to high	Slight to shiny	1 mm to 3 mm	Medium		CI	SILTY CLAY
				Liquid Limit ≥50	None	High	Shiny	<1 mm	High		CH	CLAY
HIGHLY ORGANIC SOILS (Organic Content >30% by mass)		Peat and mineral soil mixtures								30% to 75%	PT	SILTY PEAT, SANDY PEAT
		Predominantly peat, may contain some mineral soil, fibrous or amorphous peat								75% to 100%		PEAT



Note 1 – Fine grained materials with PI and LL that plot in this area are named (ML) SILT with slight plasticity. Fine-grained materials which are non-plastic (i.e. a PL cannot be measured) are named SILT.
Note 2 – For soils with <5% organic content, include the descriptor "trace organics" for soils with between 5% and 30% organic content include the prefix "organic" before the Primary name.

Dual Symbol — A dual symbol is two symbols separated by a hyphen, for example, GP-GM, SW-SC and CL-ML.
For non-cohesive soils, the dual symbols must be used when the soil has between 5% and 12% fines (i.e. to identify transitional material between "clean" and "dirty" sand or gravel.
For cohesive soils, the dual symbol must be used when the liquid limit and plasticity index values plot in the CL-ML area of the plasticity chart (see Plasticity Chart at left).

Borderline Symbol — A borderline symbol is two symbols separated by a slash, for example, CL/CI, GM/SM, CL/ML.
A borderline symbol should be used to indicate that the soil has been identified as having properties that are on the transition between similar materials. In addition, a borderline symbol may be used to ~~or~~ indicates a range of similar soil types within a stratum.

ABBREVIATIONS AND TERMS USED ON RECORDS OF BOREHOLES AND TEST PITS

PARTICLE SIZES OF CONSTITUENTS

Soil Constituent	Particle Size Description	Millimetres	Inches (US Std. Sieve Size)
BOULDERS	Not Applicable	>300	>12
COBBLES	Not Applicable	75 to 300	3 to 12
GRAVEL	Coarse Fine	19 to 75 4.75 to 19	0.75 to 3 (4) to 0.75
SAND	Coarse Medium Fine	2.00 to 4.75 0.425 to 2.00 0.075 to 0.425	(10) to (4) (40) to (10) (200) to (40)
SILT/CLAY	Classified by plasticity	<0.075	< (200)

MODIFIERS FOR SECONDARY AND MINOR CONSTITUENTS

Percentage by Mass	Modifier
>35	Use 'and' to combine major constituents (*i.e.,* SAND and GRAVEL, SAND and CLAY)
> 12 to 35	Primary soil name prefixed with "gravelly, sandy, SILTY, CLAYEY" as applicable
> 5 to 12	some
≤ 5	trace

PENETRATION RESISTANCE

Standard Penetration Resistance (SPT), N:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) required to drive a 50 mm (2 in.) split-spoon sampler for a distance of 300 mm (12 in.).

Cone Penetration Test (CPT)

An electronic cone penetrometer with a 60° conical tip and a project end area of 10 cm^2 pushed through ground at a penetration rate of 2 cm/s. Measurements of tip resistance (q_t), porewater pressure (u) and sleeve frictions are recorded electronically at 25 mm penetration intervals.

Dynamic Cone Penetration Resistance (DCPT); N_d:

The number of blows by a 63.5 kg (140 lb) hammer dropped 760 mm (30 in.) to drive uncased a 50 mm (2 in.) diameter, 60° cone attached to "A" size drill rods for a distance of 300 mm (12 in.).

PH: Sampler advanced by hydraulic pressure
PM: Sampler advanced by manual pressure
WH: Sampler advanced by static weight of hammer
WR: Sampler advanced by weight of sampler and rod

SAMPLES

AS	Auger sample
BS	Block sample
CS	Chunk sample
DO or DP	Seamless open ended, driven or pushed tube sampler – note size
DS	Denison type sample
FS	Foil sample
RC	Rock core
SC	Soil core
SS	Split spoon sampler – note size
ST	Slotted tube
TO	Thin-walled, open – note size
TP	Thin-walled, piston – note size
WS	Wash sample

SOIL TESTS

w	water content
PL , w_p	plastic limit
LL , w_L	liquid limit
C	consolidation (oedometer) test
CHEM	chemical analysis (refer to text)
CID	consolidated isotropically drained triaxial test[1]
CIU	consolidated isotropically undrained triaxial test with porewater pressure measurement[1]
D_R	relative density (specific gravity, Gs)
DS	direct shear test
GS	specific gravity
M	sieve analysis for particle size
MH	combined sieve and hydrometer (H) analysis
MPC	Modified Proctor compaction test
SPC	Standard Proctor compaction test
OC	organic content test
SO_4	concentration of water-soluble sulphates
UC	unconfined compression test
UU	unconsolidated undrained triaxial test
V (FV)	field vane (LV-laboratory vane test)
γ	unit weight

1. Tests which are anisotropically consolidated prior to shear are shown as CAD, CAU.

NON-COHESIVE (COHESIONLESS) SOILS

Compactness[2]

Term	SPT 'N' (blows/0.3m)[1]
Very Loose	0 - 4
Loose	4 to 10
Compact	10 to 30
Dense	30 to 50
Very Dense	>50

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects.
2. Definition of compactness descriptions based on SPT 'N' ranges from Terzaghi and Peck (1967) and correspond to typical average N_{60} values.

Field Moisture Condition

Term	Description
Dry	Soil flows freely through fingers.
Moist	Soils are darker than in the dry condition and may feel cool.
Wet	As moist, but with free water forming on hands when handled.

COHESIVE SOILS

Consistency

Term	Undrained Shear Strength (kPa)	SPT 'N'[1] (blows/0.3m)
Very Soft	<12	0 to 2
Soft	12 to 25	2 to 4
Firm	25 to 50	4 to 8
Stiff	50 to 100	8 to 15
Very Stiff	100 to 200	15 to 30
Hard	>200	>30

1. SPT 'N' in accordance with ASTM D1586, uncorrected for overburden pressure effects; approximate only.

Water Content

Term	Description
w < PL	Material is estimated to be drier than the Plastic Limit.
w ~ PL	Material is estimated to be close to the Plastic Limit.
w > PL	Material is estimated to be wetter than the Plastic Limit.

LIST OF SYMBOLS

Unless otherwise stated, the symbols employed in the report are as follows:

I. GENERAL

π	3.1416
ln x	natural logarithm of x
$\log_{10}$	x or log x, logarithm of x to base 10
g	acceleration due to gravity
t	time

II. STRESS AND STRAIN

γ	shear strain
Δ	change in, e.g. in stress: $\Delta\sigma$
ε	linear strain
ε_v	volumetric strain
η	coefficient of viscosity
υ	Poisson's ratio
σ	total stress
σ'	effective stress ($\sigma' = \sigma - u$)
σ'_{vo}	initial effective overburden stress
σ_1, σ_2, σ_3	principal stress (major, intermediate, minor)
σ_{oct}	mean stress or octahedral stress $= (\sigma_1 + \sigma_2 + \sigma_3)/3$
τ	shear stress
u	porewater pressure
E	modulus of deformation
G	shear modulus of deformation
K	bulk modulus of compressibility

III. SOIL PROPERTIES

(a) Index Properties

$\rho(\gamma)$	bulk density (bulk unit weight)*
$\rho_d(\gamma_d)$	dry density (dry unit weight)
$\rho_w(\gamma_w)$	density (unit weight) of water
$\rho_s(\gamma_s)$	density (unit weight) of solid particles
γ'	unit weight of submerged soil ($\gamma' = \gamma - \gamma_w$)
D_R	relative density (specific gravity) of solid particles ($D_R = \rho_s / \rho_w$) (formerly G_s)
e	void ratio
n	porosity
S	degree of saturation

* Density symbol is ρ. Unit weight symbol is γ where $\gamma = \rho g$ (i.e. mass density multiplied by acceleration due to gravity)

(a) Index Properties (continued)

w	water content
w_l or LL	liquid limit
w_p or PL	plastic limit
I_p or PI	plasticity index = $(w_l - w_p)$
w_s	shrinkage limit
I_L	liquidity index = $(w - w_p) / I_p$
I_C	consistency index = $(w_l - w) / I_p$
e_{max}	void ratio in loosest state
e_{min}	void ratio in densest state
I_D	density index = $(e_{max} - e) / (e_{max} - e_{min})$ (formerly relative density)

(b) Hydraulic Properties

h	hydraulic head or potential
q	rate of flow
v	velocity of flow
i	hydraulic gradient
k	hydraulic conductivity (coefficient of permeability)
j	seepage force per unit volume

(c) Consolidation (one-dimensional)

C_c	compression index (normally consolidated range)
C_r	recompression index (over-consolidated range)
C_s	swelling index
C_α	secondary compression index
m_v	coefficient of volume change
c_v	coefficient of consolidation (vertical direction)
c_h	coefficient of consolidation (horizontal direction)
T_v	time factor (vertical direction)
U	degree of consolidation
σ'_p	pre-consolidation stress
OCR	over-consolidation ratio = σ'_p / σ'_{vo}

(d) Shear Strength

τ_p, τ_r	peak and residual shear strength
ϕ'	effective angle of internal friction
δ	angle of interface friction
μ	coefficient of friction = tan δ
c′	effective cohesion
c_u, s_u	undrained shear strength ($\phi = 0$ analysis)
p	mean total stress $(\sigma_1 + \sigma_3)/2$
p′	mean effective stress $(\sigma'_1 + \sigma'_3)/2$
q	$(\sigma_1 - \sigma_3)/2$ or $(\sigma'_1 - \sigma'_3)/2$
q_u	compressive strength $(\sigma_1 - \sigma_3)$
S_t	sensitivity

Notes: 1 $\tau = c' + \sigma' \tan \phi'$

2 shear strength = (compressive strength)/2

LITHOLOGICAL AND GEOTECHNICAL ROCK DESCRIPTION TERMINOLOGY

WEATHERINGS STATE

Fresh: no visible sign of weathering

Faintly weathered: weathering limited to the surface of major discontinuities.

Slightly weathered: penetrative weathering developed on open discontinuity surfaces but only slight weathering of rock material.

Moderately weathered: weathering extends throughout the rock mass but the rock material is not friable.

Highly weathered: weathering extends throughout rock mass and the rock material is partly friable.

Completely weathered: rock is wholly decomposed and in a friable condition but the rock and structure are preserved.

BEDDING THICKNESS

Description	Bedding Plane Spacing
Very thickly bedded	Greater than 2 m
Thickly bedded	0.6 m to 2 m
Medium bedded	0.2 m to 0.6 m
Thinly bedded	60 mm to 0.2 m
Very thinly bedded	20 mm to 60 mm
Laminated	6 mm to 20 mm
Thinly laminated	Less than 6 mm

JOINT OR FOLIATION SPACING

Description	Spacing
Very wide	Greater than 3 m
Wide	1 m to 3 m
Moderately close	0.3 m to 1 m
Close	50 mm to 300 mm
Very close	Less than 50 mm

GRAIN SIZE

Term	Size*
Very Coarse Grained	Greater than 60 mm
Coarse Grained	2 mm to 60 mm
Medium Grained	60 microns to 2 mm
Fine Grained	2 microns to 60 microns
Very Fine Grained	Less than 2 microns

Note: * Grains greater than 60 microns diameter are visible to the naked eye.

CORE CONDITION

Total Core Recovery (TCR)
The percentage of solid drill core recovered regardless of quality or length, measured relative to the length of the total core run.

Solid Core Recovery (SCR)
The percentage of solid drill core, regardless of length, recovered at full diameter, measured relative to the length of the total core run.

Rock Quality Designation (RQD)
The percentage of solid drill core, greater than 100 mm length, recovered at full diameter, measured relative to the length of the total core run. RQD varied from 0% for completely broken core to 100% for core in solid sticks.

DISCONTINUITY DATA

Fracture Index
A count of the number of discontinuities (physical separations) in the rock core, including both naturally occurring fractures and mechanically induced breaks caused by drilling.

Dip with Respect to Core Axis
The angle of the discontinuity relative to the axis (length) of the core. In a vertical borehole a discontinuity with a 90° angle is horizontal.

Description and Notes
An abbreviation description of the discontinuities, whether naturally occurring separations such as fractures, bedding planes and foliation planes or mechanically induced features caused by drilling such as ground or shattered core and mechanically separated bedding or foliation surfaces. Additional information concerning the nature of fracture surfaces and infillings are also noted.

Abbreviations

JN	Joint	PL	Planar
FLT	Fault	CU	Curved
SH	Shear	UN	Undulating
VN	Vein	IR	Irregular
FR	Fracture	K	Slickensided
SY	Stylolite	PO	Polished
BD	Bedding	SM	Smooth
FO	Foliation	SR	Slightly Rough
CO	Contact	RO	Rough
AXJ	Axial Joint	VR	Very Rough
KV	Karstic Void		
MB	Mechanical Break		

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-01

SHEET 1 OF 2

LOCATION: N 5523883.9 E 632775.9

BORING DATE: 10/17/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.92							
0		TOPSOIL		232.79							
		FILL - (CI) SILTY CLAY, trace organics, trace sand; grey; cohesive, firm to stiff		0.12							
1					001-01	AS					
				231.09	001-02	SS	7				
		(CH) CLAY, trace fine sand; brown; cohesive, w>PL, firm		1.83							
2					001-03	AS					
3					001-04	TO					
		- 90° slickenside joint observed in 001-04									
					001-05	SS	7				
4					001-06	AS					
					001-07	TO					
5	Solid Stem Auger	- oxidation stains at 4.7m - 90° slickenside joint observed in 001-07									
					001-08	SS	6				
					001-09	AS					
6				226.82							
		(CH) CLAY, high plasticity, trace fine sand; grey; cohesive, w>PL, firm to soft		6.10	001-10	SS	5				
7					001-11	AS					
8					001-12	TO					
					001-13	SS	4				
					001-14	AS					
9					001-15	TO					
					001-16	SS	2				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-01

SHEET 2 OF 2

LOCATION: N 5523883.9 E 632775.9

BORING DATE: 10/17/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
				222.71	001-16	SS	2				
		END OF BOREHOLE = 10.21m		10.21							
		Notes: 1. Upon completion of drilling, the borehole was backfilled with cuttings and sealed with bentonite to the ground surface.									
11											
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-02

SHEET 1 OF 2

LOCATION: N 5523835.2 E 632609.7

BORING DATE: 10/15/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (20 40 60 80) nat V. + Q - ● rem V. ⊕ U - ○	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.87							
0	Solid Stem Auger	FILL - gravel and wood chips		0.00	002-01	AS					
				232.10							
1		(CL) SILTY CLAY, trace fine to medium sand; grey to dark grey; cohesive, w>PL, soft		0.76	002-02	AS					
					002-03	SS	3				
2				230.73	002-04	AS					
		(CH) CLAY, high plasticity, trace fine sand; brown, oxidation stains; cohesive, w>PL, soft		2.13							
					002-05	AS					
3											
					002-06	TO				50.6	
4					002-07	AS				53.7 / 95	
					002-08	SS	4			50.8	
5											
					002-09	AS				50.6	
6											VW34545
					002-10	TO				51.4	
7					002-11	AS				50.3 / 77	
				225.25							
		(CH) CLAY, high plasticity, trace fine sand; grey; cohesive, w>PL, soft to firm		7.62	002-12	SS	4				
8											
					002-13	AS				74	
9											
	Hollow Stem Auger	- trace gravel at 9.1m			002-14	SS	5				
10											
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-02

SHEET 2 OF 2

LOCATION: N 5523835.2 E 632609.7

BORING DATE: 10/15/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10	Hollow Stem Auger	*CONTINUED FROM PREVIOUS PAGE* (CH) CLAY, high plasticity, trace fine sand; grey; cohesive, w>PL, soft to firm *(continued)*									
11					002-15	TO		○ +	51.2 ○		VW34544
12		- very soft at 12.2m			002-16	SS	2		54 ○		
13				219.76							
		(ML) sandy CLAYEY SILT, some gravel, fine to coarse sand; light grey/white, (TILL); cohesive, w>PL, very stiff		13.11							
14					002-17	SS	17		○		VW34543
				218.54							
		END OF BOREHOLE = 14.33m Notes: 1. Refusal at 14.3m		14.33	002-18	SS	18				
15											
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-04

SHEET 1 OF 2

LOCATION: N 5523420.1 E 631861.4

BORING DATE: 10/24/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		231.98							
0		TOPSOIL		0.00							
				231.77							
		(CI) SILTY CLAY, some sand; dark grey; cohesive, w~PL, stiff		0.21							
				231.37							
		(MH) CLAYEY SILT, some fine sand to sandy; light brown; cohesive, w>PL, soft		0.61	004-01	AS					
1				230.76							
		(CH) CLAY, high plasticity; mottled brown and grey; cohesive, w>PL, firm		1.22	004-02	AS			70		
					004-03	SS	5				
2											
					004-04	AS			64		
3											
		- 65° slickenside joint observed in 004-05			004-05	TO			54		
4	Solid Stem Auger										
					004-06	SS	5		59		
5											
					004-07	AS					
6											
		- grey below 6.1m									
		- 40° slickenside joint observed in 004-08			004-08	TO			56.5		
7											
					004-09	AS			78		
					004-10	SS	3		52.4		
8	Hollow Stem Auger										
9					004-11	TO					
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-04

SHEET 2 OF 2

LOCATION: N 5523420.1 E 631861.4

BORING DATE: 10/24/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10	Hollow Stem Auger	*CONTINUED FROM PREVIOUS PAGE* (CH) CLAY, high plasticity; mottled brown and grey; cohesive, w>PL, firm *(continued)*									
11					004-12	SS	2		59.4		
12					004-13	TO		+ ○	63.1		
13				218.57 13.41							
14		(CL-ML) SILTY CLAY to CLAYEY SILT, some fine to coarse sand, some gravel; light grey to brown, (TILL); non-cohesive, wet, dense			004-14	SS					
		SAND and GRAVEL		217.66	004-15a	SS					
		END OF BOREHOLE = 14.40m		14.40	004-15b	SS					
15		Notes: 1. Refusal at 14.4m. 2. Upon completion of drilling, the borehole was backfilled with cuttings and bentonite to the ground surface.									
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-05

SHEET 1 OF 3

LOCATION: N 5522211.9 E 631936.6

BORING DATE: 10/22/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.71							TOC=232.6m
0	Solid Stem Auger	(CI) SILTY CLAY, trace sand, trace to some organics; dark grey, black pockets; cohesive, w~PL, stiff		0.00							
					005-01	AS					
1											
				231.18							
		(ML) sandy SILT, fine sand, some clay; brown; cohesive, w>PL, soft		1.52							
					005-02	AS					
2				230.57							
		(CH) CLAY, high plasticity, trace fine sand; brown; cohesive, w>PL, firm		2.13							
					005-03	AS			82		
		- 15cm silt layer at 2.7m									
3											
		- 90° and 0° slickenside joints observed in 005-04			005-04	TO		103			
4					005-05	AS					
					005-06	SS	7				Bentonite Chips
5											
					005-07	AS			51.4		
6											
		- 60° slickenside joint observed in 005-08			005-08	TO		+	94		
7											
					005-09	AS					
					005-10	SS	8				
8											
		- becoming grey at 8.2m			005-11	AS			86		
9				223.56							
		(CH) CLAY, high plasticity; trace sand, grey; cohesive, w>PL, soft		9.14							
		- 65° slickenside joints observed in 005-12			005-12	TO		+	50.1		
10											
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-05

SHEET 2 OF 3

LOCATION: N 5522211.9 E 631936.6

BORING DATE: 10/22/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10	Solid Stem Auger	*CONTINUED FROM PREVIOUS PAGE* (CH) CLAY, high plasticity; trace sand, grey; cohesive, w>PL, soft *(continued)* - cobbles/boulders inferred from auger resistance at 10.1m			005-13	AS					
11					005-14	SS	4		56.5		
					005-15	AS			57.6 83		
12				220.21 12.50	005-16	TO			51.9		
13		(CL/ML) SILTY CLAY to CLAYEY SILT, some fine to coarse sand, some fine to coarse gravel; very light grey, (TILL); cohesive, soft to stiff									
14					005-17	SS	5				
15											Bentonite Chips
16	Drill Casing			216.70 16.00	005-18	SS	14				
		TILL and LIMESTONE, interlayers with limestone boulders/cobbles			005-19	RC					
17					005-20	SS					
					005-21	RC					
18				214.69 18.01							
		LIMESTONE; white, bedded with slight dolomitic alteration along bedding planes R=100% RQD=15%			005-22	RC					
19											Bentonite Pellets
		R=100% RQD=20%			005-23	RC					Sand
20					005-24	RC					Screen
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-05

SHEET 3 OF 3

LOCATION: N 5522211.9 E 631936.6

BORING DATE: 10/22/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
20	Drill Casing	*CONTINUED FROM PREVIOUS PAGE* LIMESTONE; white, bedded with slight dolomitic alteration along bedding planes *(continued)* R=100% RQD=27%			005-24	RC					
21											Screen
22		R & RQD not measured			005-25	RC					
				209.85							
23		END OF BOREHOLE = 22.86m		22.86							
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

Golder Associates

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-06

SHEET 1 OF 3

LOCATION: N 5522164.6 E 631962.4

BORING DATE: 10/23/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		231.83							
0		TOPSOIL		231.68							
		sandy SILT, fine to medium grained; brown; cohesive, w~PL, firm		0.15 231.22							
		(Cl) SILTY CLAY, trace fine sand; brown; cohesive, w~PL, stiff		0.61	006-01	AS					
1											
				230.01	006-02	SS	5				
		(MH) CLAYEY SILT, some fine sand; mottled light brown and light grey; cohesive, w>PL, soft		1.83 229.70							
2		(CH) CLAY, high plasticity; brown, oxidation stains; cohesive, w>PL, soft to firm		2.13	006-03	AS			51.1		
3											
		- 85° slickenside joint observed in 006-04			006-04	TO		○ +	58.4		
4					006-05	AS			57.5 95		
					006-06	SS	4				
5											
					006-07	AS			50.2		
6											
					006-08	TO		○ +	56.5		
7											VW34546
					006-09	AS			53.4		
				224.21							
		(CH) CLAY; grey, oxidation stains; cohesive, w>PL, soft		7.62					53.4		
8					006-10	SS	4		74		
					006-11	AS					
9											
					006-12	TO		○ +	○		
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-06

SHEET 2 OF 3

LOCATION: N 5522164.6 E 631962.4

BORING DATE: 10/23/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
		(CH) CLAY; grey, oxidation stains; cohesive, w>PL, soft *(continued)*			006-13	AS					
					006-14	SS	6				
11									60.4		VW34547
					006-15	AS					
12											
				219.34	006-16	TO			70.9		
		(CH) SILTY CLAY and SAND; mottled light grey/grey; cohesive, w>PL, soft		12.50 / 219.03							
		(CH) CLAY; grey; cohesive, w>PL, soft		12.80 / 218.73	006-17	AS			73		
13											
		(ML) sandy CLAYEY SILT, fine to coarse sand, trace to some gravel; very light grey, (TILL); cohesive, w<PL, firm to stiff		13.11	006-18	AS					
14					006-19	SS	8				
											VW34548
15											
					006-20	TO					
					006-21	SS					
16					006-22	RC					
					006-23	SS					
17				214.61							
		LIMESTONE; white, bedded with slight dolomite alteration along bedding planes		17.22							
		R=100% RQD=30%			006-24	RC					
18											
19		R=100% RQD=60%			006-25	RC					
20					006-26	RC					
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

Golder Associates

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-06

SHEET 3 OF 3

LOCATION: N 5522164.6 E 631962.4

BORING DATE: 10/23/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
20		*CONTINUED FROM PREVIOUS PAGE*									
		LIMESTONE; white, bedded with slight dolomite alteration along bedding planes *(continued)*									
		R=100% RQD=51%			006-26	RC					
21				210.50							
		END OF BOREHOLE = 21.34m		21.34							
22											
23											
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

Golder Associates

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-07

SHEET 1 OF 3

LOCATION: N 5521177.1 E 632538.9

BORING DATE: 10/27/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		231.91							
0		TOPSOIL		0.08							
		FILL - (Cl) SILTY CLAY, some gravel, some sand, some organics; mottled black and grey, w~PL, firm			007-01	AS					
		- dark grey to black at 0.6m		231.15							
1		FILL - (Cl-CH) SILTY CLAY, trace fine to coarse sand, organics nodules/pockets; mottled light and dark grey; cohesive, w~PL, firm		0.76	007-02	AS					
					007-03	SS	7				
2					007-04	AS					
				229.63							
		(CH) CLAY, trace fine sand; light brown, oxidation stains, light grey nodules; cohesive, w>PL, soft to firm		2.29	007-05	AS			64		
				229.32							
		(CH) CLAY; brown; cohesive, w>PL, firm		2.59	007-06	AS					
3											
		- 85° slickenside joint observed in 007-07			007-07	TO			54.3		
4					007-08	AS			53.6		
									54		
5					007-09	SS	5		97		
					007-10	AS			50.2		
6											
		- grey at 6.1m			007-11	TO					
7					007-12	AS					
					007-13	SS	5		79		
8											
					007-14	AS					
9											
					007-15	TO			53.3		
10											
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

Golder Associates

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-07

SHEET 2 OF 3

LOCATION: N 5521177.1 E 632538.9

BORING DATE: 10/27/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
		(CH) CLAY; brown; cohesive, w>PL, firm *(continued)*			007-16	AS					
		- soft at 10.4m									
					007-17	SS	3		53.2 / 77		
11											
					007-18	AS			55.2		
12											
		- very light grey interlayers at 12.5m			007-19	TO		+ ○	○		
13											
					007-20	AS			○		
				218.20							
		(CL) SILTY CLAY, some fine to coarse sand, trace gravel; very light grey, (TILL); non-cohesive, moist, compact to very dense		13.72	007-21	SS	12		⊢○		
14											
					007-22	AS			○		
15											VW34550
		- very dense below 15.2m			007-23	SS			○		
16											
					007-24	SS			○		
17											
				213.81							
18		LIMESTONE, white, bedded with slight dolomite alteration along bedding planes		18.11							
		R=96% RQD=66%			007-25	RC					
19											
					007-26	RC					
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

Golder Associates

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-07

SHEET 3 OF 3

LOCATION: N 5521177.1 E 632538.9

BORING DATE: 10/27/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
20		*CONTINUED FROM PREVIOUS PAGE*									
		LIMESTONE, white, bedded with slight dolomite alteration along bedding planes *(continued)*									
		R=100% RQD=37%			007-26	RC					
21											
22		R=100% RQD=43%			007-27	RC					
23											
		R=100% RQD=80%			007-28	RC					
24				207.53							
		END OF BOREHOLE = 24.38m		24.38							
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-08

SHEET 1 OF 3

LOCATION: N 5521063.8 E 632547.9

BORING DATE: 10/31/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.29							TOC=233.1m
0		TOPSOIL		232.14							
		FILL - (CI) SILTY CLAY, some sand; dark grey to grey, oxidation; cohesive, w~PL, firm		0.15							
					008-01	AS					
1											
					008-02	SS	7				
2					008-03	AS					
				230.00							
		(ML) CLAYEY SILT, trace sand; brown; cohesive, w>PL, soft		2.29	008-04	AS					
				229.70							
		(CH) CLAY; brown to grey; cohesive, w>PL, very soft to firm		2.59	008-05	AS			95		
3											
		- 90° slickenside joint observed in 008-06			008-06	TO			52		
4					008-07	AS			53		
					008-08	SS	2		56		
5											Bentonite Chips and Cuttings
					008-09	AS			54.9		
6											
					008-10	TO		106	54.7		
7					008-11	AS					
					008-12	SS	5		81		
8											
					008-13	AS					
9											
					008-14	TO					
10											
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

Golder Associates

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-08

SHEET 2 OF 3

LOCATION: N 5521063.8 E 632547.9

BORING DATE: 10/31/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
		(CH) CLAY; brown to grey; cohesive, w>PL, very soft to firm *(continued)*			008-15	AS			50.9		
					008-16	SS	2		59.2 / 96		
11											
					008-17	AS			55.9		
12											
					008-18	TO		○ +	62.2		
13											
					008-19	AS			53.2		
		- very light grey, TILL interlayers at 13.4m									
14					008-20	SS	5		57		
					008-21	AS			57.2		
				217.51							
		(ML) SILT, some fine to coarse sand, some gravel, limestone cobbles/boulders; very light grey, (TILL); non-plastic, w<PL, very stiff to hard		14.78	008-22	AS					Bentonite Chips and Cuttings
15					008-23	SS			○		
		- cobble/boulder inferred from auger resistance at 15.5m									
16											
					008-24	SS					
17											
		- cobble/boulder inferred from auger resistance at 17.1m									
					008-25	RC					
18											
					008-26	SS			○		
				213.70							
		(SP) SAND and GRAVEL, fine to coarse sand; very light grey; non-cohesive, wet, compact		18.59							
19					008-27	RC					
					008-28	SS	28		○		
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-08

SHEET 3 OF 3

LOCATION: N 5521063.8 E 632547.9

BORING DATE: 10/31/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
20		*CONTINUED FROM PREVIOUS PAGE*									
		(SP) SAND and GRAVEL, fine to coarse sand; very light grey; non-cohesive, wet, compact *(continued)*		211.56	008-29	RC					
		(SP) silty SAND, fine to coarse, some gravel; very light grey, (TILL); non-cohesive, wet, dense		20.73							Bentonite Chips and Cuttings
21											
					008-30	SS	46		W		
22											
					008-31	RC					
				209.73							
		LIMESTONE, white, bedded with slight dolomite alteration along bedding planes		22.56							Bentonite Pellets
23											
		R=98% RQD=51%			008-32	RC					
24											Sand
		R=100% RQD=73%			008-33	RC					
25											
											Screen
26											
		R=95% RQD=89%			008-34	RC					
27				204.86							
		END OF BOREHOLE = 27.43m		27.43							
28											
29											
30											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-09

SHEET 1 OF 3

LOCATION: N 5520924.0 E 632649.2

BORING DATE: 10/28/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.84							TOC=233.8m
0		TOPSOIL		232.68							
		FILL - (CI) SILTY CLAY, trace gravel, some medium to coarse sand, organic pockets; mottled brown and grey, oxidation stains; cohesive, w~PL, firm to stiff		0.15	009-01	AS					
1				231.62							
		FILL - (CI) SILTY CLAY, trace sand, some organics; dark grey; cohesive, w>PL, stiff		1.22 231.31	009-02	AS					
		FILL - (CI) SILTY CLAY, trace gravel, trace sand, trace organic fibres; mottled brown grey; cohesive, w>PL, firm		1.52	009-03	SS	5				
2					009-04	AS			94		
3					009-05	TO					
				229.18							
		(CH) CLAY; grey to brown; cohesive, w>PL, very soft to soft		3.66							
4					009-06	AS			53.6		
					009-07	SS	4				Bentonite Chips and Cuttings
5											
					009-08	AS			56.8		
6					009-09	TO			56.6		
7					009-10	AS			63.6		
					009-11	SS	3		52.2 79		
8											
					009-12	AS					
9					009-13	TO					
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-09

SHEET 2 OF 3

LOCATION: N 5520924.0 E 632649.2

BORING DATE: 10/28/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
		(CH) CLAY; grey to brown; cohesive, w>PL, very soft to soft *(continued)*			009-14	AS					
		- grey at 10.1m									
11					009-15	SS	3		90		
					009-16	AS					
12					009-17	TO		○ + ○			
					009-18	AS					
13											
		- very light grey TILL interlayers at 13.7m			009-19	SS	2		○		
14											Bentonite Chips and Cuttings
				218.05	009-20	AS					
		(ML) SILT, some fine to coarse sand, some fine to medium gravel, cobbles; very light grey, (TILL); cohesive, w<PL, compact to very dense		14.78							
15					009-21	SS	12		⊢○⊣		
					009-22	AS			○		
16											
17					009-23	RC					
18											
				214.40	009-24	SS			○		
		LIMESTONE, white, bedded with slight dolomite alteration along bedding planes		18.44							Bentonite Pellets
19					009-25	RC					Sand
					009-26	RC					Screen
20		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

Golder Associates

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-09

SHEET 3 OF 3

LOCATION: N 5520924.0 E 632649.2

BORING DATE: 10/28/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
20		*CONTINUED FROM PREVIOUS PAGE*									
		LIMESTONE, white, bedded with slight dolomite alteration along bedding planes *(continued)*									
		R=100% RQD=14%			009-26	RC					
21											Screen
		- coring resistance at 21.6m									
22		R=94% RQD=46%			009-27	RC					
				209.98							
23		END OF BOREHOLE = 22.86m		22.86							
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-10

SHEET 1 OF 2

LOCATION: N 5520191.4 E 632628.9

BORING DATE: 10/26/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.78							
0		TOPSOIL		232.60							
		FILL - (CI) SILTY CLAY, trace fine to coarse sand, trace gravel, trace to some organics, organic pockets; brown to grey; cohesive, w~PL, stiff		0.18	010-01	AS					
1											
		- 10cm light brown silt layer at 1.5m			010-02	SS	10				
2											
					010-03	AS					
3											
		- 90° slickenside joint observed in 010-04			010-04	TO				51.5	
				228.97							
4		(CH) CLAY, high plasticity; brown; cohesive, w>PL, soft to firm		3.81	010-05	AS				54.5 / 97	
5					010-06	SS	7			50.5	
					010-07	AS					
6											
					010-08	TO				53.7	
7											
					010-09	AS				84	
8					010-10	SS	3				VW34549
					010-11	AS				51	
9		- grey below 8.8m									Bentonite Chips
					010-12	TO				56.7	
10											
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

Golder Associates

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-10

SHEET 2 OF 2

LOCATION: N 5520191.4 E 632628.9

BORING DATE: 10/26/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
		(CH) CLAY, high plasticity; brown; cohesive, w>PL, soft to firm *(continued)*			010-13	AS			50.7, 84		
					010-14	SS	3		57.5		
11											
					010-15	AS			53.8		
12											
					010-16	TO		+ ○	57		Bentonite Chips
13											
					010-17	AS			52.6		
					010-18a	SS	2		62		
14				218.76							
		(ML) SILT, some fine to coarse sand, some fine to medium gravel; very light grey, (TILL); non-cohesive, moist, loose to dense		14.02	010-18b	SS					
		- dense at 14.6m			010-19	AS			H		
15											
				217.39	010-20	SS					
		END OF BOREHOLE = 15.39m		15.39							
16											
17											
18											
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-11

SHEET 1 OF 2

LOCATION: N 5520108.0 E 632587.4

BORING DATE: 10/25/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		226.92							TOC=226.7m
0		TOPSOIL		0.00							
				226.70							
		FILL - (CI-CH) SILTY CLAY, trace rounded fine gravel, trace organics, light grey/brown silt nodules; mottled grey and brown; cohesive, w~PL to w>PL, soft to firm		0.23	011-01	AS					
1											
					011-02	SS	3		68		
2					011-03	AS					
				224.79							
		(CH) CLAY; grey; cohesive, w>PL, soft		2.13							
					011-04	AS			50.5		
3											
					011-05	TO					
					011-06	AS			51.9 / 78		
4											Bentonite Chips and Cuttings
					011-07	SS	3				
5											
					011-08	AS			61.6		
6											
					011-09	TO			57.2		
7											
					011-10	AS			50.5 / 73		
					011-11	SS	3		59.7		
8											
					011-12	AS			58.3		
				218.24							Bentonite Pellets
		(ML) SILT, some fine to coarse sand, trace to some gravel; very light grey, (TILL); non-cohesive, dry, dense		8.69	011-13	AS					
9											
					011-14	TO					Sand
					011-15	SS					
10											Screen
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-11

SHEET 2 OF 2

LOCATION: N 5520108.0 E 632587.4

BORING DATE: 10/25/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
		(ML) SILT, some fine to coarse sand, trace to some gravel; very light grey, (TILL); non-cohesive, dry, dense *(continued)*									
		- cobble/boulder inferred from coring resistance at 10.3m									
11		- cobble/boulder inferred from coring resistance at 11.1m			011-16	RC					Screen
12		- cobble/boulder inferred from coring resistance at 11.9m			011-17	SS			W		
13					011-18	RC					
				213.21							
		LIMESTONE, white, bedded with slight dolomite alteration along bedding planes		13.72							Bentonite Pellets
14		R=100% RQD=46%			011-19	RC					
15											
16		R=97% RQD=28%			011-20	RC					Sand
17											
		R=100% RQD=45%			011-21	RC					
18				208.64							
		END OF BOREHOLE = 18.29m		18.29							
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-12

SHEET 1 OF 3

LOCATION: N 5520040.6 E 632581.4

BORING DATE: 11/01/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● / rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.87							
0		TOPSOIL		232.77							
		FILL - (CI) SILTY CLAY, trace sand, some organics; very dark grey; cohesive, w~PL, soft to firm - 10cm sand layer at 0.5m		0.10	012-01	AS					
1				231.35							
		(CL) SILTY CLAY, contains sand interlayers; light brown, oxidation stains; cohesive, w>PL, soft		1.52	012-02	SS	4		W		
2					012-03	AS					
				230.59							
		(CH) silty CLAY; brown; cohesive, w>PL, soft		2.29	012-04	AS					
3					012-05	SS	4			51.1	
					012-06	AS			93	50.1	
4											
5		- 40° slickenside joint observed in 012-07			012-07	TO				51.2	
6											
		- mottled brown and grey at 6.4m			012-08	SS	3				
7											
8					012-09	TO				51.4	VW34551
9											
					012-10	SS	2			61.5	
10		- grey below 9.8m									
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-12

SHEET 2 OF 3

LOCATION: N 5520040.6 E 632581.4

BORING DATE: 11/01/15

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DATUM: NAD83

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
		(CH) silty CLAY; brown; cohesive, w>PL, soft *(continued)*									
11					012-11	TO		+	69.4 ○		
12					012-12	SS	1		51.9 ○		
13											
14		- 60° slickenside joint observed in 012-13			012-13	TO		○ +	66.2 ○		
15		(SP-SW) silty SAND, fine to coarse, some gravel; very light grey, (TILL); non-cohesive, moist, very dense		217.94 / 14.94	012-14	SS			○		
16											
17					012-15	SS			○		VW34552
					012-16	RC					
18					012-17	SS			○		
19		R=90% RQD=20%			012-18	RC					Bentonite Pellets
		LIMESTONE, white, bedded with slight dolomite alteration along bedding planes		213.52 / 19.35							
20					012-19	RC					Sand
		CONTINUED NEXT PAGE									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-12

SHEET 3 OF 3

LOCATION: N 5520040.6 E 632581.4

BORING DATE: 11/01/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
20		*CONTINUED FROM PREVIOUS PAGE*									
		LIMESTONE, white, bedded with slight dolomite alteration along bedding planes *(continued)*									
		R=100% RQD=37%			012-19	RC					
21											
		R=100% RQD=27%			012-20	RC					Sand
23											
					012-21	RC					
24				208.49							
		END OF BOREHOLE = 24.38m		24.38							
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-13

SHEET 1 OF 2

LOCATION: N 5519104.4 E 632571.8

BORING DATE: 10/30/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.72							
0		TOPSOIL		232.57							
		FILL - (CI) SILTY CLAY, trace to some sand, trace organic fibres; very dark grey; cohesive, w~PL, soft		0.15							
				231.81	013-01	AS					
1		(MH) CLAYEY SILT, some sand; light brown; cohesive, w>PL, soft		0.91	013-02	AS					
				231.20							
		(CH) CLAY; brown; cohesive, w>PL, soft to firm		1.52	013-03	SS	8				
2					013-04	AS			90		
3					013-05	TO					
4					013-06	AS			52.3		
5					013-07	TO			56.2		
					013-08	AS			55.2		
6					013-09	TO			57.6		
		- 75° slickenside joint observed in 013-09									
7					013-10	AS			55.6		
8					013-12	SS	4		75		
					013-13	AS					
9		- grey below 9.1m									
					013-14	SS	3				
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-13

SHEET 2 OF 2

LOCATION: N 5519104.4 E 632571.8

BORING DATE: 10/30/15

DATUM: NAD83

DRILL RIG: Acker SX (track)

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10		*CONTINUED FROM PREVIOUS PAGE*									
		(CH) CLAY; brown; cohesive, w>PL, soft to firm *(continued)*			013-15	AS					
11		- 90°, 60°, 70° slickenside joints observed in 013-16			013-16	TO					
					013-17	AS			54.2 90		
12					013-18	SS	3		56.4		
13					013-19	AS			57.3		
14					013-20	SS	3		57.8		
					013-21	AS			58.6		
15											
16		- trace gravel at 15.8m			013-22	AS					
				216.11							
		(SP) silty SAND, fine to coarse, some gravel; very light grey, (TILL); non-cohesive, moist to wet, dense		16.61							
17					013-23	SS					
					013-24	AS					
				215.19							
		END OF BOREHOLE = 17.53m		17.53							
18		Notes: 1. Upon completion of drilling, the borehole was backfilled with cuttings and bentonite to the ground surface.									
19											
20											

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-14

SHEET 1 OF 3

LOCATION: N 5519050.3 E 633499.7

BORING DATE: 10/14/15

DATUM: NAD83

DRILL RIG: Truck mounted MP8

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	SAMPLES TYPE	SAMPLES BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (20 40 60 80) nat V. + Q - ● rem V. ⊕ U - ○	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT Wp W Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
		GROUND SURFACE		232.81							TOC=233.8m
0		TOPSOIL		232.65							
		(CI) SILTY CLAY, medium plasticity, trace sand; dark grey; cohesive, w>PL, firm to stiff		0.15	014-01	AS					
				232.04							
1		(CI) SILTY CLAY, medium to high plasticity; light grey; w>PL, firm		0.76	014-02	AS					
					014-03	SS	7				
2		- becoming (CH) at 2.0m			014-04	AS			96		
		- 2.5cm clayey silt seam at 2.4m			014-05	AS					
				230.06							
3		(CH) CLAY, high plasticity; brown; cohesive, w>PL, firm		2.74	014-06	TO			52.8		
4					014-07	AS			51.6 / 91		
5	Solid Stem Auger				014-08	SS	4		54.7		Bentonite Chips
					014-09	AS			52.8		
				227.01							
6		(CH) CLAY, high plasticity; oxidation stains; cohesive, w>PL, soft		5.79	014-10	AS			55.9		
		- 90° slickenside joint observed in 014-11			014-11	TO			55.7		
7					014-12	AS			58.7 / 80		
				225.03							
8		(CH) CLAY, high plasticity; oxidation stains; cohesive, w>PL, soft		7.77	014-13	SS	3				
					014-14	AS			80		
9											
		- 50° slickenside joint observed in 013-09			014-15	TO			56.2		
10		*CONTINUED NEXT PAGE*									

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-14

SHEET 2 OF 3

LOCATION: N 5519050.3 E 633499.7

BORING DATE: 10/14/15

DATUM: NAD83

DRILL RIG: Truck mounted MP8

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
10	Solid Stem Auger	*CONTINUED FROM PREVIOUS PAGE* (CH) CLAY, high plasticity; oxidation stains; cohesive, w>PL, soft *(continued)*			014-16	AS			59.1		
					014-17	SS	3		60.4		
11											
					014-18	AS			50.2		
12											
					014-19	SS	4				
13											Bentonite Chips
					014-20	AS			57 79		
14					014-21	TO		+	65.1		
					014-22	AS			60.9		
15		(SP) silty SAND, fine, trace gravel; light grey; non-cohesive, wet, compact		217.87 14.94	014-23	AS					
					014-24	SS	12				
16		LIMESTONE; white, bedded with slight dolomitic alteration along bedding planes		216.65 16.15							Bentonite Pellets
17											Sand
		R=100% RQD=22%			014-25	RC					
18											
		R=100% RQD=91%			014-26	RC					
19											Screen
		R=100% RQD=88%			014-27	RC					
20		*CONTINUED NEXT PAGE*			014-28	RC					

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

PROJECT: 1537312 BRT Phase II

RECORD OF BOREHOLE: TH15-14

SHEET 3 OF 3

LOCATION: N 5519050.3 E 633499.7

BORING DATE: 10/14/15

DATUM: NAD83

DRILL RIG: Truck mounted MP8

DRILLING CONTRACTOR: Paddock Drilling Ltd.

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	SAMPLES: TYPE	SAMPLES: BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕, Q - ●, U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-5} 10^{-4} 10^{-3}) / WATER CONTENT PERCENT (Wp, W, Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION AND GROUNDWATER OBSERVATIONS
20	Solid Stem Auger	*CONTINUED FROM PREVIOUS PAGE* LIMESTONE; white, bedded with slight dolomitic alteration along bedding planes *(continued)*			014-28	RC					
21		R=100% RQD=83%		211.47	014-29	RC					Screen
		END OF BOREHOLE = 21.34m		21.34							
22											
23											
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE

1 : 50

LOGGED: JB

CHECKED: CR

SK_SOIL 1537312 BOREHOLE LOGS.GPJ GAL-SASK.GDT 12/15/15

APPENDIX C

Laboratory Testing Results

Golder Associates

GENERAL TESTING RESULTS

Project #: 1537312 Phase : 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. / E.H. Date: November 30, 2015

Sample Identification				Laboratory Test Results										
Borehole #	Sample #	Depth (m)	Sample Type	Water Content (%)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing #200	SHT Group Index	ASTM Group Index	Specific Gravity	Dry Density (Kg/m^3)	Pocket Penetrometer (kPa)	Lab Vane (kPa)
TH-15-001	001-01	0.61-1.22	AS	39.7										
TH-15-001	001-02	1.52-1.98	SS	37.0	31	95	64							
TH-15-001	001-03	2.29-2.59	AS	44.5										
TH-15-001	001-04	3.05-3.66	TO	51.7								1142	48	85
TH-15-001	001-05	3.66-4.11	SS	53.3	22	87	65							
TH-15-001	001-06	4.11-4.42	AS	48.6										
TH-15-001	001-07	4.57-5.18	TO	51.5								1132	72	84
TH-15-001	001-08	5.18-5.64	SS											
TH-15-001	001-09	5.64-5.94	AS	48.8	23	84	61							
TH-15-001	001-10	6.10-6.55	SS	50.0										
TH-15-001	001-11	7.01-7.32	AS	48.1										
TH-15-001	001-12	7.62-8.23	TO	45.6								1198	36	74
TH-15-001	001-13	8.23-8.69	SS	47.5										
TH-15-001	001-14	8.69-8.99	AS	50.5	24	85	61							
TH-15-001	001-15	9.14-9.75	TO	50.6								1138	24	65
TH-15-001	001-16	9.75-10.21	SS	51.1										
TH-15-002	002-01	0.30-0.61	AS	40.3										
TH-15-002	002-02	0.91-1.22	AS	35.3										
TH-15-002	002-03	1.52-1.98	SS	23.8										
TH-15-002	002-04	2.04-2.13	AS	25.4	16	28	12							
TH-15-002	002-05	2.44-2.74	AS	42.0										
TH-15-002	002-06	3.05-3.66	TO	50.6								1146	48	85
TH-15-002	002-07	3.96-4.27	AS	53.7	27	95	68							
TH-15-002	002-08	4.57-5.03	SS	50.8										
TH-15-002	002-09	5.49-5.79	AS	50.6										
TH-15-002	002-10	6.10-6.71	TO	51.4								1135	36	76
TH-15-002	002-11	7.01-7.32	AS	50.3	22	77	55							
TH-15-002	002-12	7.62-8.08	SS	48.8										
TH-15-002	002-13	8.23-8.53	AS	46.6	18	74	56							
TH-15-002	002-14	9.14-9.60	SS	45.7										
TH-15-002	002-15	10.67-11.28	TO	51.2								1042	12	51
TH-15-002	002-16	12.19-12.65	SS	54.0										
TH-15-002	002-17	13.72-14.17	SS	11.5										
TH-15-002	002-18	14.33-14.40	SS											
TH-15-004	004-01	0.61-0.91	AS											
TH-15-004	004-02	1.22-1.52	AS	36.5	22	70	48							

1721 8th Street E.
Saskatoon, SK S7H 0T4

Reviewed by:_____

Golder Associates

GENERAL TESTING RESULTS

Project #: 1537312 Phase : 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. / E.H. Date: November 30, 2015

Sample Identification				Laboratory Test Results									
Borehole #	Sample #	Depth (m)	Sample Type	Water Content (%)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing #200	SHT Group Index	ASTM Group Index	Specific Gravity	Dry Density (Kg/m^3)	Pocket Penetrometer (kPa)	Lab Vane (kPa)
TH-15-004	004-03	1.52-1.98	SS	46.6										
TH-15-004	004-04	2.13-2.44	AS	38.6	21	64	43							
TH-15-004	004-05	3.05-3.66	TO	54.0								1110	36	84
TH-15-004	004-06	4.57-5.03	SS	59.0										
TH-15-004	004-07	5.18-5.49	AS	48.0										
TH-15-004	004-08	6.10-6.71	TO	56.5								1100	24	53
TH-15-004	004-09	7.01-7.32	AS	50.0	21	78	57							
TH-15-004	004-10	7.62-8.08	SS	52.4										
TH-15-004	004-11	9.14-9.75	TO	46.3								1212	24	55
TH-15-004	004-12	10.67-11.13	SS	59.4										
TH-15-004	004-13	12.19-12.80	TO	63.1								1090	12	38
TH-15-004	004-14	13.72-14.02	SS	11.1	12	17	5							
TH-15-004	004-15a	14.33-14.40	SS	11.0										
TH-15-004	004-15b	14.33-14.48	SS	20.9										
TH-15-005	005-01	0.61-0.91	AS	34.1										
TH-15-005	005-02	1.68-1.98	AS	20.8										
TH-15-005	005-03	2.44-2.74	AS	33.9	20	82	62							
TH-15-005	005-04	3.05-3.66	TO	49.8								1167	36	103
TH-15-005	005-05	3.96-4.27	AS	46.6										
TH-15-005	005-06	4.57-5.03	SS	47.4										
TH-15-005	005-07	5.49-5.79	AS	51.4										
TH-15-005	005-08	6.10-6.71	TO	46.8	25	94	69					1189	60	91
TH-15-005	005-09	7.01-7.32	AS	48.6										
TH-15-005	005-10	7.62-8.08	SS	42.3										
TH-15-005	005-11	8.23-8.53	AS	46.2	22	86	64							
TH-15-005	005-12	9.14-9.75	TO	50.1								1150	24	66
TH-15-005	005-13	10.06-10.36	AS	47.8										
TH-15-005	005-14	10.67-11.13	SS	56.5										
TH-15-005	005-15	11.28-11.58	AS	57.6	22	83	61							
TH-15-005	005-16	12.19-12.80	TO	51.9								1291	12	61
TH-15-005	005-17	13.72-14.17	SS	15.0										
TH-15-005	005-18	15.24-15.70	SS	9.1										
TH-15-005	005-20	16.76-17.22	SS	10.1										
TH-15-006	006-01	0.61-0.91	AS											
TH-15-006	006-02	1.52-1.98	SS											
TH-15-006	006-03	2.13-2.44	AS	51.1										

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GENERAL TESTING RESULTS

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Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. / E.H. Date: November 30, 2015

Sample Identification				Laboratory Test Results										
Borehole #	Sample #	Depth (m)	Sample Type	Water Content (%)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing #200	SHT Group Index	ASTM Group Index	Specific Gravity	Dry Density (Kg/m^3)	Pocket Penetrometer (kPa)	Lab Vane (kPa)
TH-15-006	006-04	3.05-3.66	TO	58.4								1059	24	70
TH-15-006	006-05	3.96-4.27	AS	57.5	25	95	70							
TH-15-006	006-06	4.57-5.03	SS											
TH-15-006	006-07	5.18-5.49	AS	50.2										
TH-15-006	006-08	6.10-6.71	TO	56.5								1128	36	87
TH-15-006	006-09	7.01-7.32	AS	53.4										
TH-15-006	006-10	7.62-8.08	SS	53.4	22	74	52							
TH-15-006	006-11	8.23-8.53	AS											
TH-15-006	006-12	9.14-9.75	TO	46.3								1229	12	61
TH-15-006	006-13	10.06-10.36	AS											
TH-15-006	006-14	10.67-11.13	SS	60.4										
TH-15-006	006-15	11.28-11.58	AS											
TH-15-006	006-16	12.19-12.80	TO	70.9								934	0	42
TH-15-006	006-17	12.80-13.11	AS	48.5	20	73	53							
TH-15-006	006-18	13.11-13.41	AS											
TH-15-006	006-19	13.72-14.17	SS	10.9										
TH-15-006	006-20	15.24-15.39	AS	8.9										
TH-15-006	006-21	15.39-15.54	SS		11	15	4							
TH-15-006	006-23	16.15-17.07	SS											
TH-15-007	007-01	0.30-0.30	AS	27.8										
TH-15-007	007-02	0.76-1.07	AS	29.5										
TH-15-007	007-03	1.52-1.98	SS	41.0										
TH-15-007	007-04	1.98-2.29	AS	39.6										
TH-15-007	007-05	2.29-2.59	AS	39.4	21	64	43							
TH-15-007	007-06	2.59-2.90	AS	46.7										
TH-15-007	007-07	3.05-3.66	TO	54.3								1099	24	76
TH-15-007	007-08	3.96-4.27	AS	53.6										
TH-15-007	007-09	4.57-5.03	SS	54.0	28	97	69							
TH-15-007	007-10	5.18-5.49	AS	50.2										
TH-15-007	007-11	6.10-6.71	TO	48.3								1182	48	84
TH-15-007	007-12	7.01-7.32	AS	46.6										
TH-15-007	007-13	7.62-8.08	SS	44.0	23	79	56							
TH-15-007	007-14	8.53-8.84	AS	36.0										
TH-15-007	007-15	9.14-9.75	TO	53.3								1109	36	91
TH-15-007	007-16	10.06-10.36	AS	49.8										
TH-15-007	007-17	10.67-11.13	SS	53.2	21	77	56							

1721 8th Street E.
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Borehole #	Sample #	Depth (m)	Sample Type	Water Content (%)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing #200	SHT Group Index	ASTM Group Index	Specific Gravity	Dry Density (Kg/m^3)	Pocket Penetrometer (kPa)	Lab Vane (kPa)
TH-15-007	007-18	11.58-11.89	AS	55.2										
TH-15-007	007-19	12.19-12.80	TO	41.9								1265	12	23
TH-15-007	007-20	13.11-13.41	AS	24.2										
TH-15-007	007-21	13.72-14.17	SS	21.3	12	19	7							
TH-15-007	007-22	14.33-14.63	AS	10.9										
TH-15-007	007-23	15.24-15.39	SS	39.4										
TH-15-007	007-24	16.76-16.92	SS	8.4										
TH-15-008	008-01	0.61-0.91	AS	28.7										
TH-15-008	008-02	1.52-1.98	SS	31.3										
TH-15-008	008-03	1.98-2.29	AS	41.1										
TH-15-008	008-04	2.29-2.59	AS	40.4										
TH-15-008	008-05	2.59-2.90	AS	43.5	24	95	71							
TH-15-008	008-06	3.05-3.66	TO	52.0								1121	24	80
TH-15-008	008-07	3.96-4.27	AS	53.0										
TH-15-008	008-08	4.57-5.03	SS	56.0										
TH-15-008	008-09	5.49-5.79	AS	54.9										
TH-15-008	008-10	6.10-6.71	TO	54.7								1118	48	106
TH-15-008	008-11	7.01-7.32	AS	48.9										
TH-15-008	008-12	7.62-8.08	AS	45.0	26	81	55							
TH-15-008	008-13	8.23-8.53	AS	46.6										
TH-15-008	008-14	9.14-9.75	TO	49.0								1169	12	61
TH-15-008	008-15	10.06-10.36	AS	50.9										
TH-15-008	008-16	10.67-11.13	SS	59.2	28	96	68							
TH-15-008	008-17	11.58-11.89	AS	55.9										
TH-15-008	008-18	12.19-12.80	TO	62.2								1019	12	57
TH-15-008	008-19	13.11-13.41	AS	53.2										
TH-15-008	008-20	13.72-14.17	SS	57.0										
TH-15-008	008-21	14.33-14.63	AS	57.2										
TH-15-008	008-22	14.78-15.09	AS											
TH-15-008	008-23	15.24-15.54	SS	13.6	Non-Plastic									
TH-15-008	008-24	16.76-16.79	SS											
TH-15-008	008-26	18.29-18.44	SS	8.8										
TH-15-008	008-28	19.81-19.96	SS	3.1										
TH-15-008	008-30	21.34-21.79	SS	12.6										
TH-15-009	009-01	0.61-0.91	AS											
TH-15-009	009-02	1.22-1.52	AS	39.8										

1721 8th Street E.
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GENERAL TESTING RESULTS

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Sample Identification				Laboratory Test Results										
Borehole #	Sample #	Depth (m)	Sample Type	Water Content (%)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing #200	SHT Group Index	ASTM Group Index	Specific Gravity	Dry Density (Kg/m^3)	Pocket Penetrometer (kPa)	Lab Vane (kPa)
TH-15-009	009-03	1.52-1.98	SS											
TH-15-009	009-04	2.13-2.44	AS	40.3	24	94	70							
TH-15-009	009-05	3.05-3.66	TO	49.6								1188	12	66
TH-15-009	009-06	3.96-4.27	AS	53.6										
TH-15-009	009-07	4.57-5.03	SS											
TH-15-009	009-08	5.49-5.79	AS	56.8										
TH-15-009	009-09	6.10-6.71	TO	56.6								1085	12	53
TH-15-009	009-10	7.01-7.32	AS	63.6										
TH-15-009	009-11	7.62-8.08	SS	52.2	25	79	54							
TH-15-009	009-12	8.53-8.84	AS											
TH-15-009	009-13	9.14-9.75	TO	46.2								1221	24	80
TH-15-009	009-14	10.06-10.36	AS											
TH-15-009	009-15	10.67-11.13	SS	49.5	22	90	68							
TH-15-009	009-16	11.58-11.89	AS											
TH-15-009	009-17	12.19-12.80	TO	35.6								1308	0	55
TH-15-009	009-18	13.11-13.41	AS											
TH-15-009	009-19	13.72-14.17	SS	42.7										
TH-15-009	009-20	14.63-14.94	AS											
TH-15-009	009-21	15.24-15.70	SS	10.1	11	13	2							
TH-15-009	009-22	15.70-15.85	AS	10.0										
TH-15-009	009-24	18.29-18.44	SS	8.4										
TH-15-010	010-01	0.61-0.91	AS	35.7										
TH-15-010	010-02	1.52-1.98	SS	29.9										
TH-15-010	010-03	2.44-2.74	AS	32.7										
TH-15-010	010-04	3.05-3.66	TO	51.5								1151	12	68
TH-15-010	010-05	3.96-4.27	AS	54.5	25	97	72							
TH-15-010	010-06	4.57-5.03	SS	50.5										
TH-15-010	010-07	5.18-5.49	AS	49.4										
TH-15-010	010-08	6.10-6.71	TO	53.7								1123	48	80
TH-15-010	010-09	7.01-7.32	AS	46.9	21	84	63							
TH-15-010	010-10	7.62-8.08	SS	49.3										
TH-15-010	010-11	8.23-8.53	AS	51.0										
TH-15-010	010-12	9.14-9.75	TO	56.7								1102	12	68
TH-15-010	010-13	10.06-10.36	AS	50.7	23	84	61							
TH-15-010	010-14	10.67-11.13	SS	57.5										
TH-15-010	010-15	11.58-11.89	AS	53.8										

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Borehole #	Sample #	Depth (m)	Sample Type	Water Content (%)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing #200	SHT Group Index	ASTM Group Index	Specific Gravity	Dry Density (Kg/m^3)	Pocket Penetrometer (kPa)	Lab Vane (kPa)
TH-15-010	010-16	12.19-12.80	TO	57.0								1075	12	46
TH-15-010	010-17	13.11-13.41	AS	52.6										
TH-15-010	010-18a	13.72-14.02	SS	62.0										
TH-15-010	010-18b	14.02-14.17	SS	48.3										
TH-15-010	010-19	14.63-14.94	AS	9.2	13	15	2							
TH-15-010	010-20	15.24-15.39	AS	12.5										
TH-15-011	011-01	0.61-0.91	AS	44.9										
TH-15-011	011-02	1.52-1.98	SS	48.8	24	68	44							
TH-15-011	011-03	1.98-2.13	AS	47.4										
TH-15-011	011-04	2.44-2.74	AS	50.5										
TH-15-011	011-05	3.05-3.66	TO	47.1								1176	12	61
TH-15-011	011-06	3.66-3.96	AS	51.9	25	78	53							
TH-15-011	011-07	4.57-5.03	SS	49.1										
TH-15-011	011-08	5.18-5.49	AS	61.6										
TH-15-011	011-09	6.10-6.71	TO	57.2								1120	0	49
TH-15-011	011-10	7.01-7.32	AS	50.5	20	73	53							
TH-15-011	011-11	7.62-8.08	SS	59.7										
TH-15-011	011-12	8.23-8.53	AS	58.3										
TH-15-011	011-13	8.69-8.99	AS	9.9	12	17	5							
TH-15-011	011-14	9.14-9.30	TO										84	61
TH-15-011	011-15	9.45-9.60	SS	5.7										
TH-15-011	011-17	12.19-12.34	SS	9.7										
TH-15-012	012-01	0.61-0.91	AS	37.7										
TH-15-012	012-02	1.52-1.98	SS	24.4	16	26	10							
TH-15-012	012-03	1.98-2.29	AS	29.6										
TH-15-012	012-04	2.44-2.74	AS	38.8										
TH-15-012	012-05	3.05-3.51	SS	51.1										
TH-15-012	012-06	3.66-3.96	AS	50.1	28	93	65							
TH-15-012	012-07	4.57-5.18	TO	51.2								1142	24	76
TH-15-012	012-08	6.10-6.55	SS	49.4										
TH-15-012	012-09	7.62-8.23	TO	51.4								1144	36	91
TH-15-012	012-10	9.14-9.60	SS	61.5	23	90	67							
TH-15-012	012-11	10.67-11.28	TO	69.4									12	49
TH-15-012	012-12	12.19-12.65	SS	51.9										
TH-15-012	012-13	13.72-14.33	TO	66.2								1026	12	57
TH-15-012	012-14	15.24-15.70	SS	8.1	Non-Plastic									

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Tested by: B.K. / E.H. Date: November 30, 2015

Sample Identification				Laboratory Test Results										
Borehole #	Sample #	Depth (m)	Sample Type	Water Content (%)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing #200	SHT Group Index	ASTM Group Index	Specific Gravity	Dry Density (Kg/m^3)	Pocket Penetrometer (kPa)	Lab Vane (kPa)
TH-15-012	012-15	16.76-16.92	SS	7.6										
TH-15-012	012-17	18.29-18.44	SS	7.2										
TH-15-013	013-01	0.61-0.91	AS	37.1										
TH-15-013	013-02	0.91-1.22	AS	26.0										
TH-15-013	013-03	1.52-1.98	SS	32.6										
TH-15-013	013-04	2.13-2.44	AS	42.6	27	90	63							
TH-15-013	013-05	3.05-3.66	TO	47.2								1165	24	76
TH-15-013	013-06	3.96-4.27	AS	52.3										
TH-15-013	013-07	4.57-5.18	TO	56.2								1092	24	95
TH-15-013	013-08	5.49-5.79	AS	55.2										
TH-15-013	013-09	6.10-6.71	TO	57.6								1097	60	91
TH-15-013	013-10	7.01-7.32	AS	55.6										
TH-15-013	013-12	7.62-8.08	SS	49.1	26	75	49							
TH-15-013	013-13	8.23-8.53	AS	47.7										
TH-15-013	013-14	9.14-9.60	SS	45.5										
TH-15-013	013-15	10.06-10.36	AS	44.9										
TH-15-013	013-16	10.67-11.28	TO											
TH-15-013	013-17	11.58-11.89	AS	54.2	25	90	65							
TH-15-013	013-18	12.19-12.65	SS	56.4										
TH-15-013	013-19	13.11-13.41	AS	57.3										
TH-15-013	013-20	13.72-14.17	SS	57.8										
TH-15-013	013-21	14.63-14.94	AS	58.6										
TH-15-013	013-22	15.85-16.15	AS	35.0	12	42	30							
TH-15-013	013-23	16.76-17.22	SS	11.8										
TH-15-013	013-24	17.22-17.53	AS	9.9										
TH-15-014	014-01	0.46-0.76	AS	38.5										
TH-15-014	014-02	1.07-1.37	AS	34.5										
TH-15-014	014-03	1.52-1.98	SS	40.2										
TH-15-014	014-04	1.98-2.29	AS	45.7	27	96	69							
TH-15-014	014-05	2.44-2.59	AS	39.1										
TH-15-014	014-06	3.05-3.66	TO	52.8								1127	48	99
TH-15-014	014-07	3.96-4.27	AS	51.6	27	91	64							
TH-15-014	014-08	4.57-5.03	SS	54.7										
TH-15-014	014-09	5.49-5.79	AS	52.8										
TH-15-014	014-10	5.94-6.25	AS	55.9										
TH-15-014	014-11	6.25-6.71	TO	55.7								1087	24	68

1721 8th Street E.
Saskatoon, SK S7H 0T4

Reviewed by:_____

Golder Associates

GENERAL TESTING RESULTS

Project #: 1537312 Phase : 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. / E.H. Date: November 30, 2015

Sample Identification				Laboratory Test Results										
Borehole #	Sample #	Depth (m)	Sample Type	Water Content (%)	Plastic Limit	Liquid Limit	Plasticity Index	% Passing #200	SHT Group Index	ASTM Group Index	Specific Gravity	Dry Density (Kg/m^3)	Pocket Penetrometer (kPa)	Lab Vane (kPa)
TH-15-014	014-12	6.86-7.16	AS	58.7	24	80	56							
TH-15-014	014-13	7.62-8.08	SS	47.1										
TH-15-014	014-14	8.08-8.38	AS	49.6	24	80	56							
TH-15-014	014-15	9.14-9.75	TO	56.2								1109	24	57
TH-15-014	014-16	10.21-10.52	AS	59.1										
TH-15-014	014-17	10.67-11.13	SS	60.4										
TH-15-014	014-18	11.43-11.73	AS	50.2										
TH-15-014	014-19	12.19-12.65	SS	45.9										
TH-15-014	014-20	13.11-13.41	AS	57.0	23	79	56							
TH-15-014	014-21	13.72-14.33	TO	65.1								1109	24	57
TH-15-014	014-22	14.63-14.94	AS	60.9										
TH-15-014	014-23	15.09-15.24	AS	23.3										
TH-15-014	014-24	15.24-15.70	AS	32.3										

1721 8th Street E.
Saskatoon, SK S7H 0T4

Reviewed by:_____

GRAIN SIZE ANALYSIS - ASTM D422

(Mechanical & Hydrometer)

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

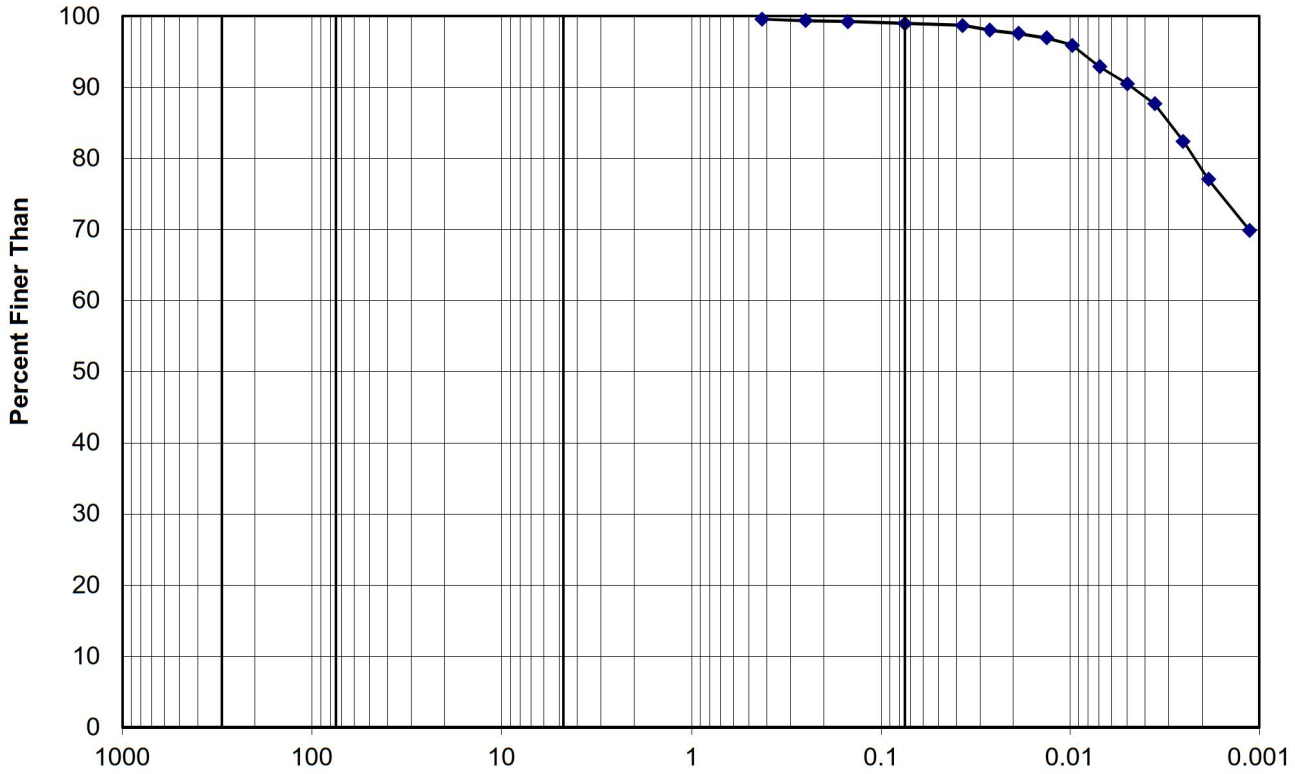
Tested by: T.B. Date: December 3, 2015

Borehole #: TH-15-002 Sample #: 002-09

Source:

Date Sample Received: November 5, 2015

Graphical Analysis



BOULDERS	COBBLES	GRAVEL		SAND			SILT / CLAY
		Coarse	Fine	Coarse	Medium	Fine	

Grain Size Analysis Results:

Opening (mm)	Percent Passing (%)
152	100
76	100
38	100
19	100
9.5	100
4.75	100
2.0	100
0.850	100
0.425	100
0.250	99
0.150	99
0.075	99
0.037	99
0.026	98
0.019	98
0.013	97
0.010	96
0.007	93
0.005	91
0.004	88
0.003	82
0.002	77
0.001	70

Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7N 0T4

Reviewed by:

GRAIN SIZE ANALYSIS - ASTM D422

(Mechanical & Hydrometer)

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

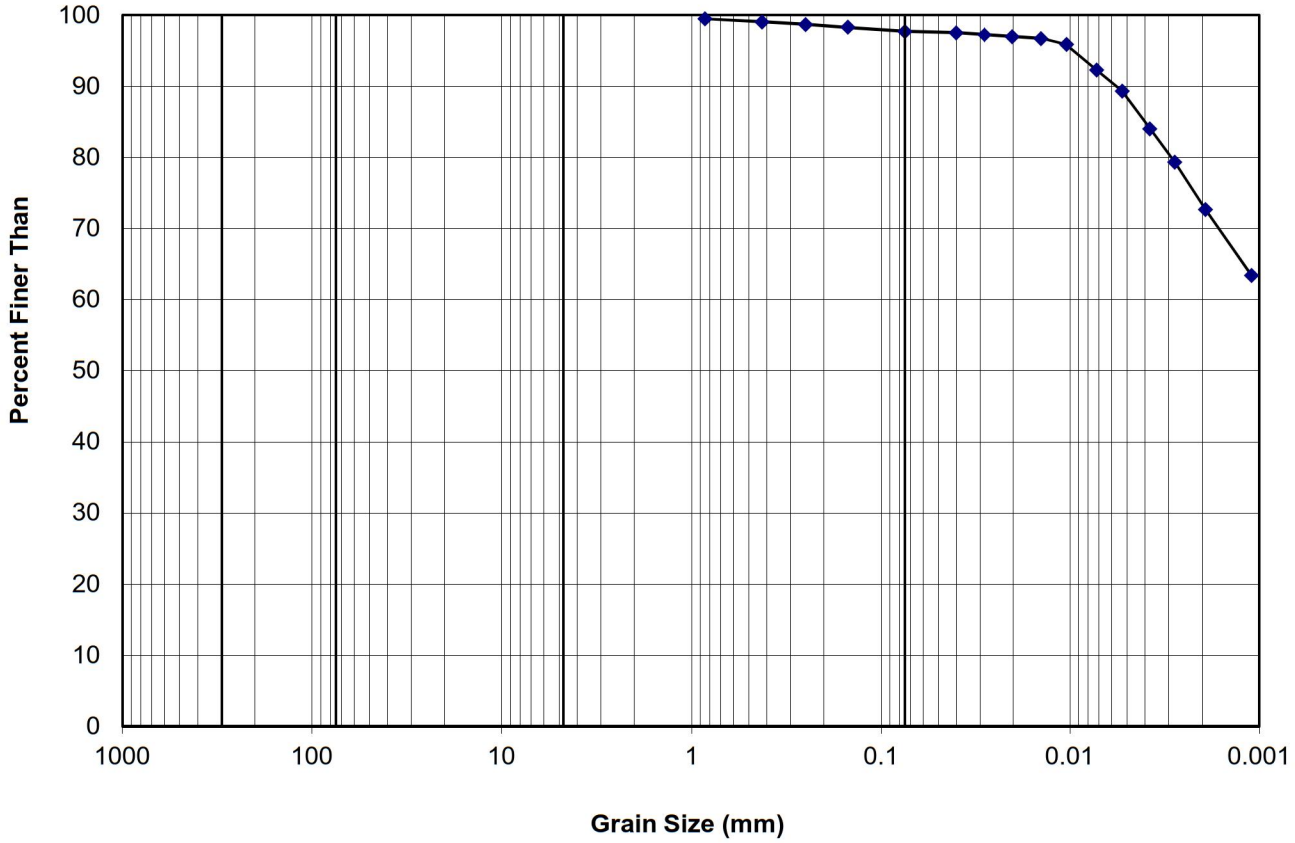
Tested by: J.H. Date: November 23, 2015

Borehole #: TH-15-006 Sample #: 006-09

Source:

Date Sample Received: November 5, 2015

Graphical Analysis



BOULDERS	COBBLES	GRAVEL		SAND			SILT / CLAY
		Coarse	Fine	Coarse	Medium	Fine	

Grain Size Analysis Results:

Opening (mm)	Percent Passing (%)
152	100
76	100
38	100
19	100
9.5	100
4.75	100
2.0	100
0.850	100
0.425	99
0.250	99
0.150	98
0.075	98
0.040	98
0.028	97
0.020	97
0.014	97
0.010	96
0.007	92
0.005	89
0.004	84
0.003	79
0.002	73
0.001	63

Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7N 0T4

Reviewed by:

GRAIN SIZE ANALYSIS - ASTM D422

(Mechanical & Hydrometer)

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

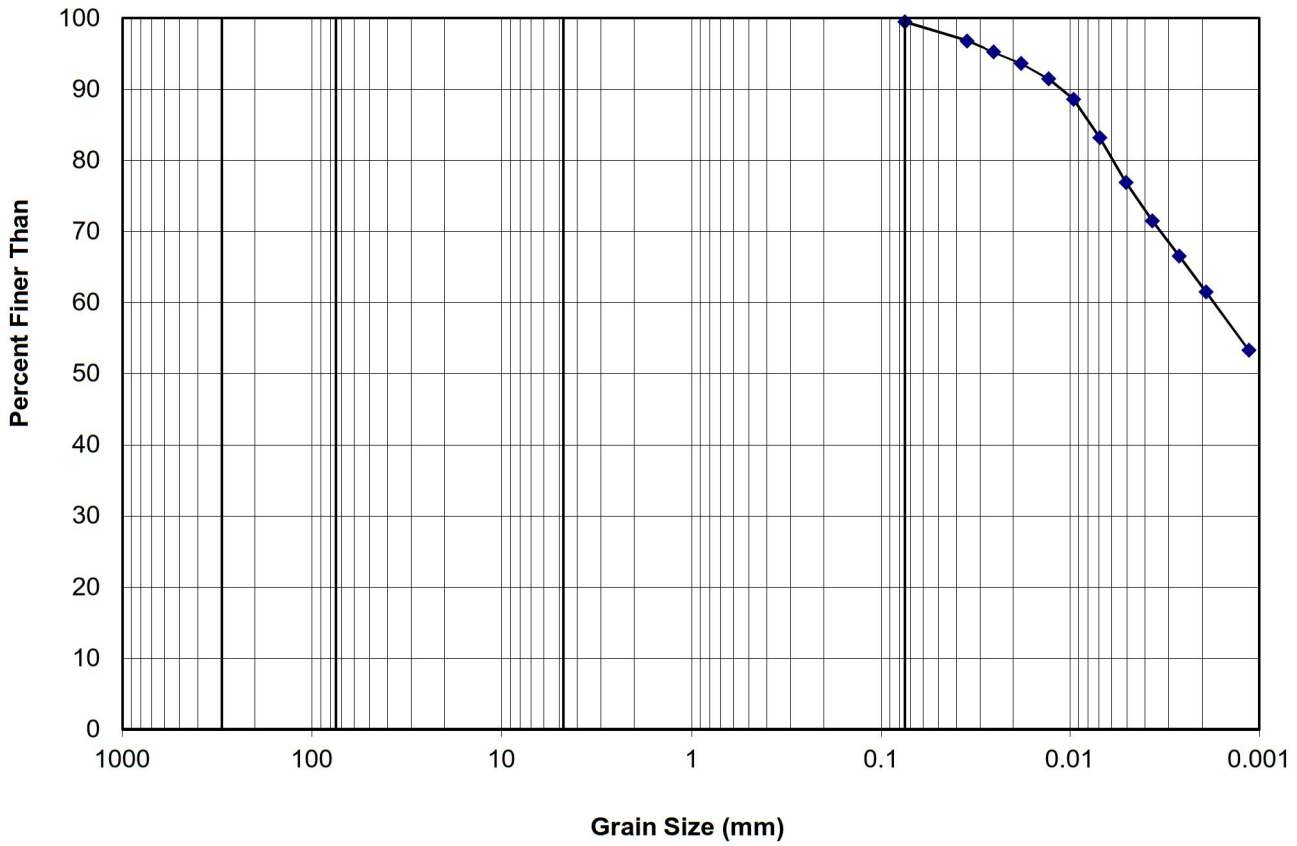
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-008 Sample #: 008-11

Source:

Date Sample Received: November 5, 2015

Graphical Analysis



BOULDERS	COBBLES	GRAVEL		SAND			SILT / CLAY
		Coarse	Fine	Coarse	Medium	Fine	

Grain Size Analysis Results:

Opening (mm)	Percent Passing (%)
152	100
76	100
38	100
19	100
9.5	100
4.75	100
2.0	100
0.850	100
0.425	100
0.250	100
0.150	100
0.075	100
0.035	97
0.025	95
0.018	94
0.013	91
0.010	89
0.007	83
0.005	77
0.004	72
0.003	67
0.002	62
0.001	53

Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7N 0T4

Reviewed by:

GRAIN SIZE ANALYSIS - ASTM D422

(Mechanical & Hydrometer)

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

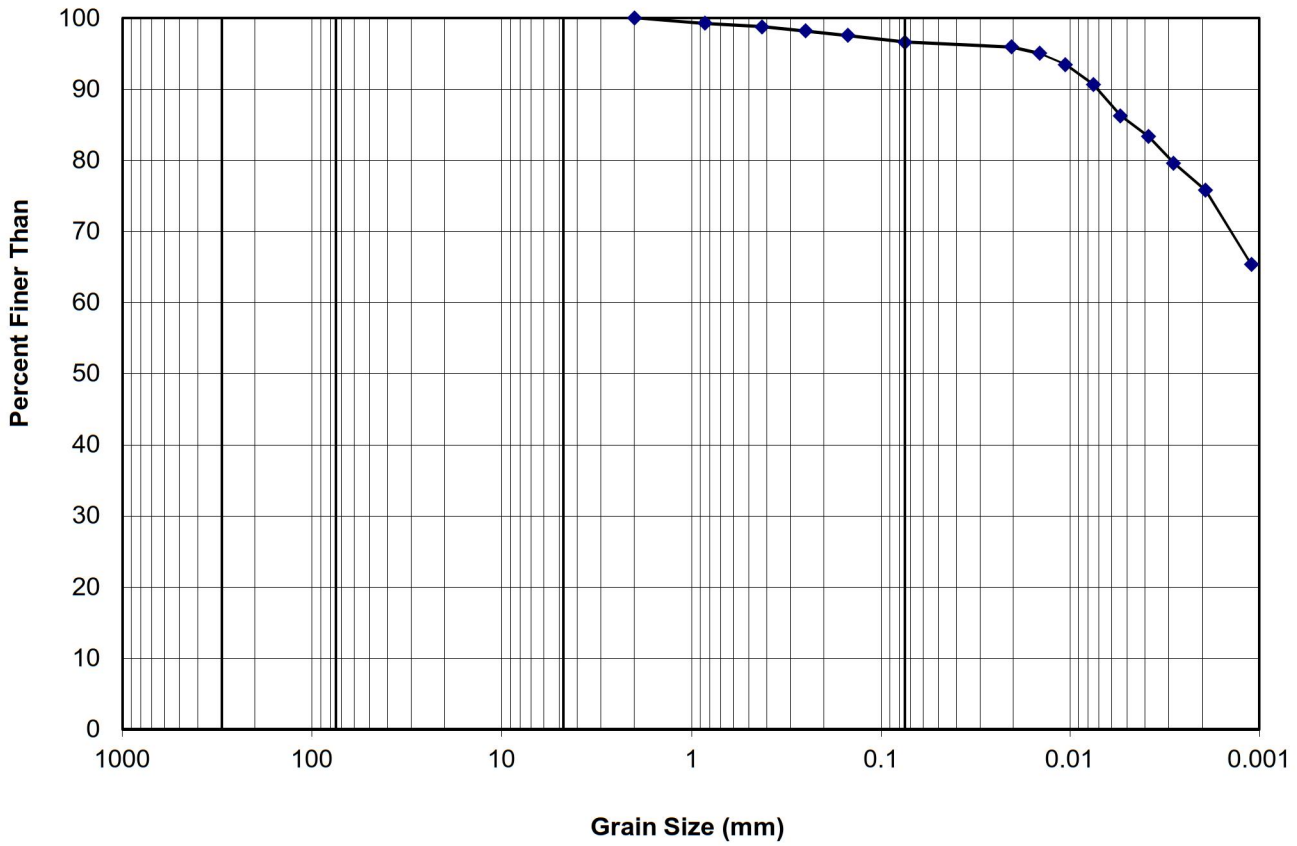
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-010 Sample #: 010-13

Source:

Date Sample Received: November 5, 2015

Graphical Analysis



BOULDERS	COBBLES	GRAVEL		SAND			SILT / CLAY
		Coarse	Fine	Coarse	Medium	Fine	

Grain Size Analysis Results:

Opening (mm)	Percent Passing (%)
152	100
76	100
38	100
19	100
9.5	100
4.75	100
2.0	100
0.850	99
0.425	99
0.250	98
0.150	98
0.075	97
0.020	96
0.014	95
0.011	94
0.008	91
0.005	86
0.004	83
0.003	80
0.002	76
0.001	65

Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7N 0T4

Reviewed by:

GRAIN SIZE ANALYSIS - ASTM D422

(Mechanical & Hydrometer)

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

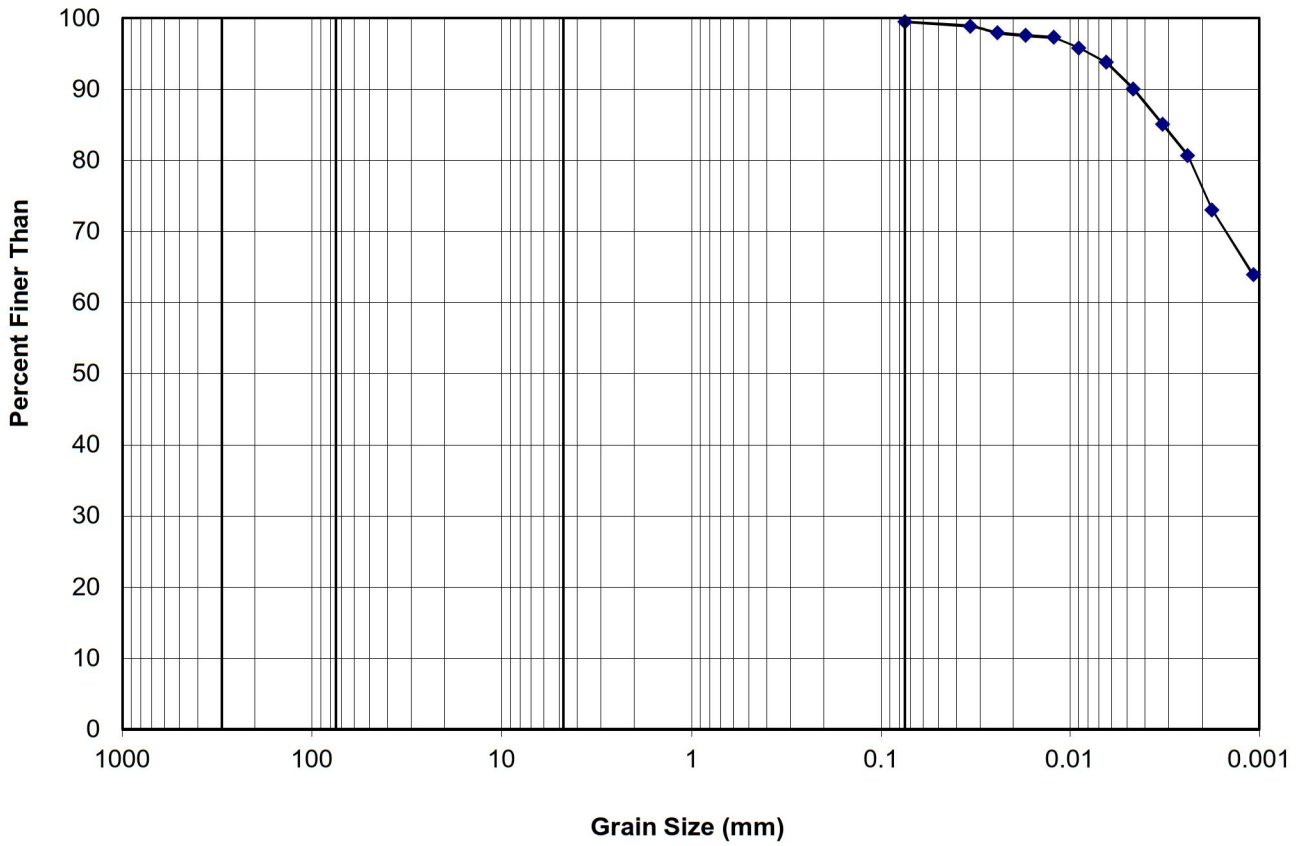
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-012 Sample #: 012-08

Source:

Date Sample Received: November 5, 2015

Graphical Analysis



BOULDERS	COBBLES	GRAVEL		SAND			SILT / CLAY
		Coarse	Fine	Coarse	Medium	Fine	

Grain Size Analysis Results:

Opening (mm)	Percent Passing (%)
152	100
76	100
38	100
19	100
9.5	100
4.75	100
2.0	100
0.850	100
0.425	100
0.250	100
0.150	100
0.075	100
0.034	99
0.024	98
0.017	98
0.012	97
0.009	96
0.006	94
0.005	90
0.003	85
0.002	81
0.002	73
0.001	64

Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7N 0T4

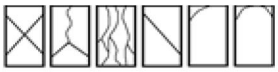
Reviewed by:

CORE COMPRESSIVE STRENGTH REPORT

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: J.H. / M.M. Date: November 27, 2015

Borehole #	Sample #	Depth (m)	CORE INFORMATION					Date Tested	Dry Density (Kg/m3)
			Core Diameter (mm)	Core Length (mm)	Correction Factor	Type of Fracture	Strength (Mpa)		
TH-15-005	005-23	19.20-19.81	-	-	-	-	-	-	2705
TH-15-005	005-24	19.81-21.34	63.40	126.30	1.00	1	36.5	26-Nov-15	-
TH-15-006	006-25	18.29-19.81	63.12	126.99	1.00	1	74.1	17-Nov-15	2354
TH-15-007	007-26	19.81-21.34	-	-	-	-	-	-	2259
TH-15-009	009-26	19.81-21.34	63.00	86.44	0.94	2	63.3	17-Nov-15	-
TH-15-011	011-20	15.24-16.76	63.40	114.90	0.98	3	41.5	26-Nov-15	2444
TH-15-012	012-19	19.81-21.34	63.22	109.26	0.98	2	61.0	17-Nov-15	2476
TH-15-014	014-27	19.35-19.81	63.10	110.90	0.98	3	61.1	2-Nov-15	2359

Type of Fracture codes:



REMARKS: Testing carried out in general accordance with CSA CAN3-A23.2-00
Correction factors for core strength are according to CSA A23.2-14C

SIGNED

1721 8th Street E.,
Saskatoon, Saskatchewan, S7H 0T4

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-001 Sample #: 001-04

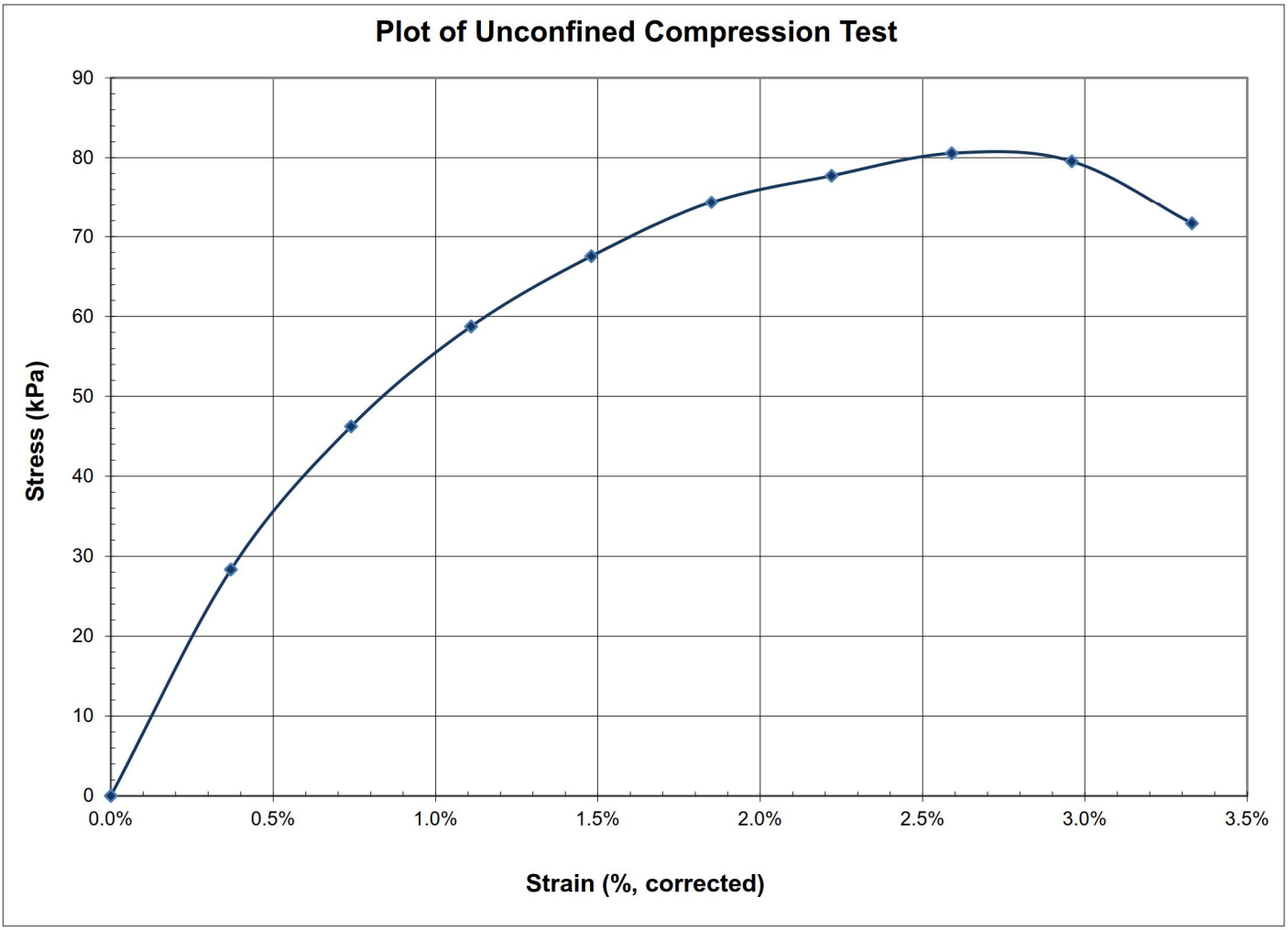
Source:

Visual Description of Sample: (CH) CLAY, trace white fine grained sand nodules, brown, cohesive w>PL, firm.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	80.5	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.6	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	40.3	Water Content (%):	N/A
Water Content (%):	49.7		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-001 Sample #: 001-07

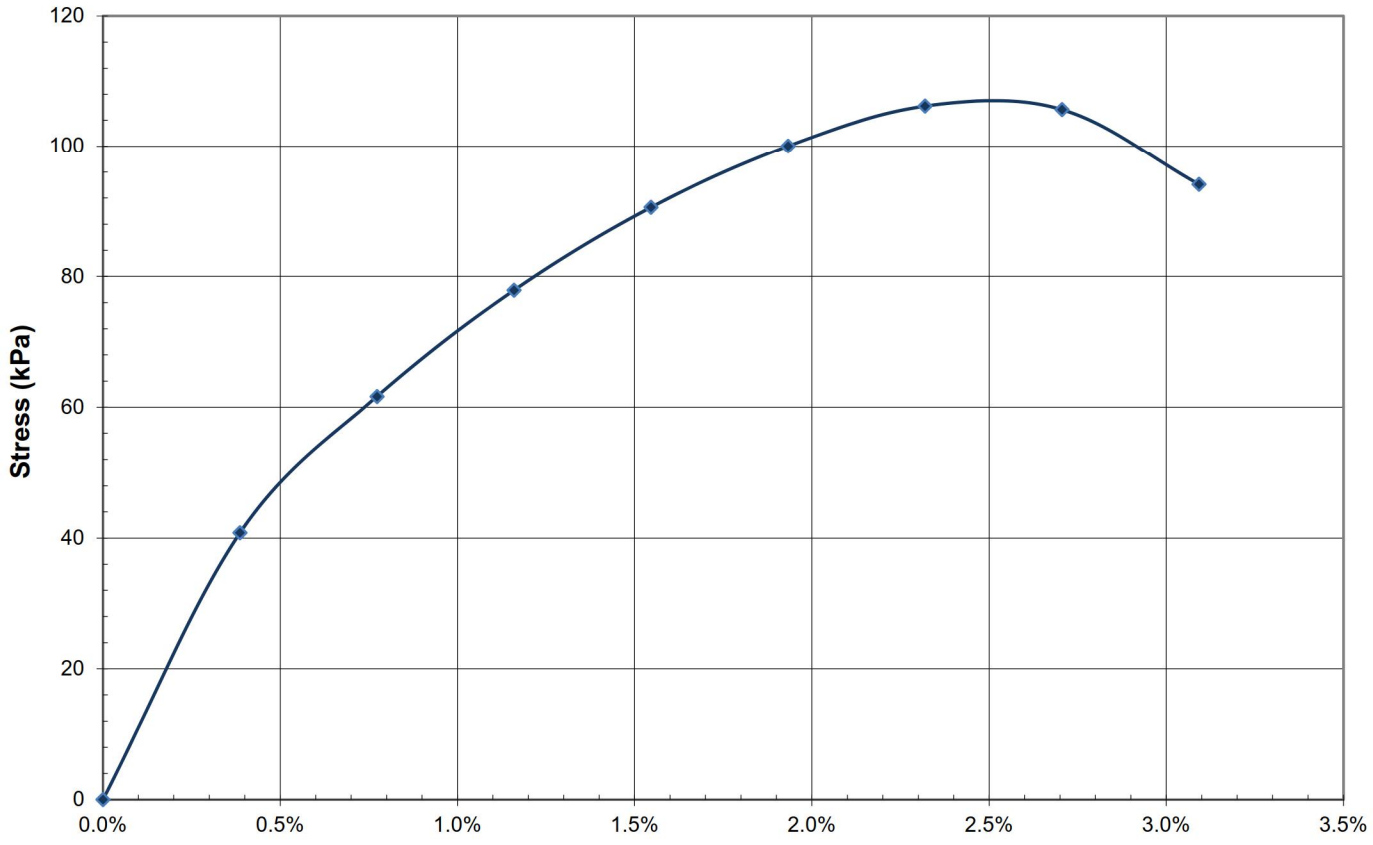
Source:

Visual Description of Sample: (CH) CLAY, trace white fine grained sand nodules, brown, cohesive w>PL, firm.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	106.2	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.3	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	53.1	Water Content (%):	N/A
Water Content (%):	52.8		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-001 Sample #: 001-12

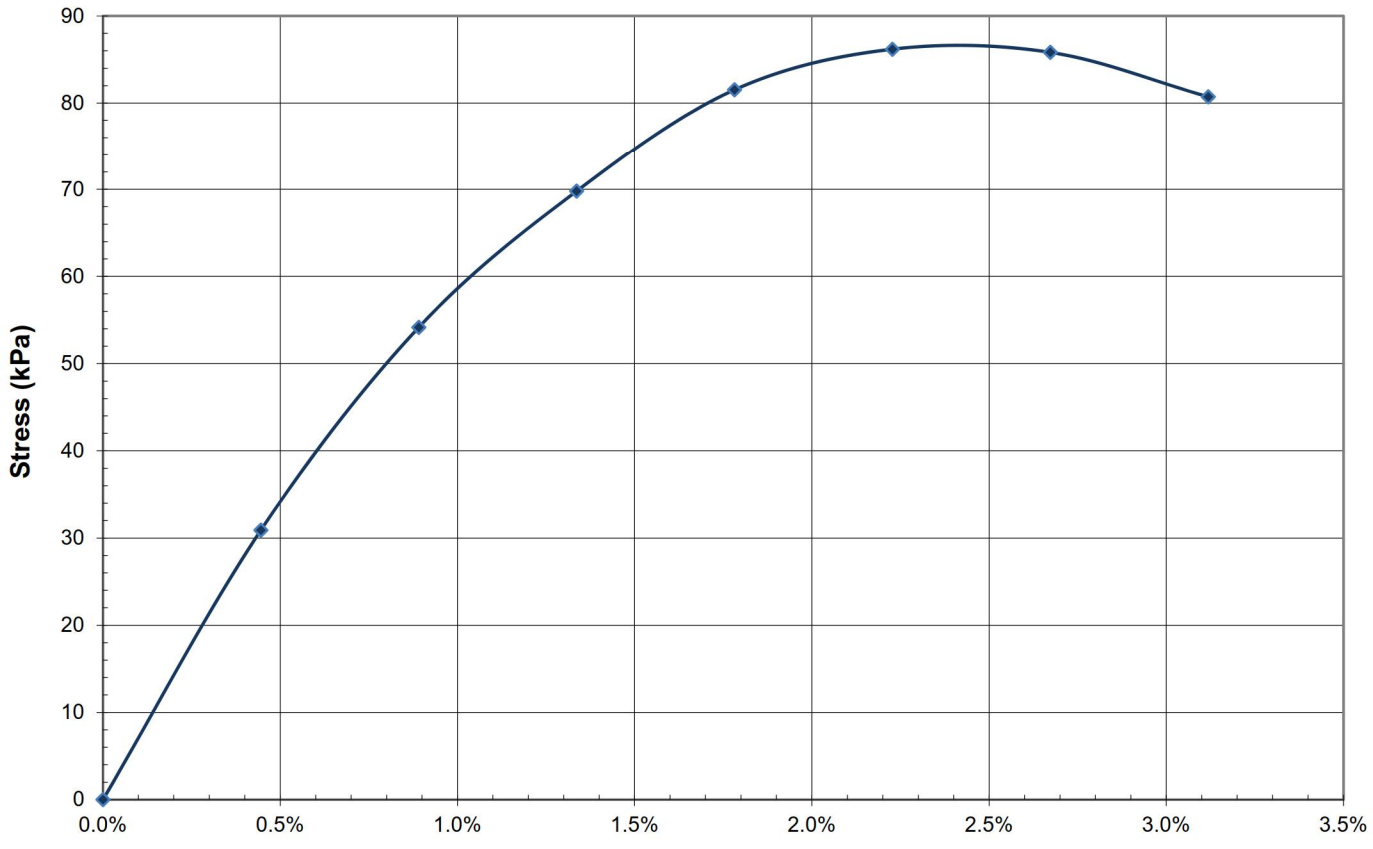
Source:

Visual Description of Sample: (CH) CLAY, white fine grained sand nodules, grey, cohesive, w>PL, firm to soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	86.2	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.2	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	43.1	Water Content (%):	N/A
Water Content (%):	51.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-001 Sample #: 001-15

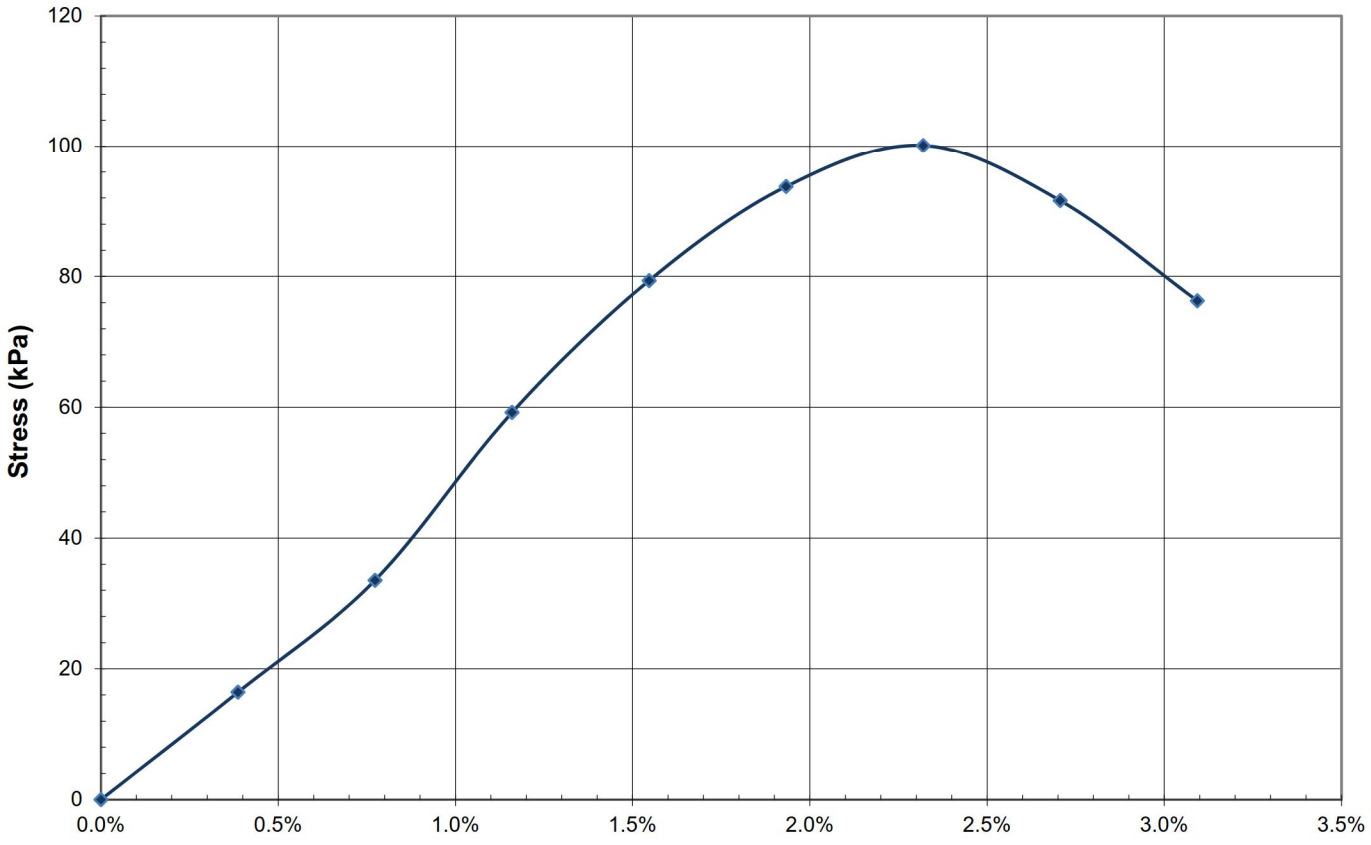
Source:

Visual Description of Sample: (CH) CLAY, white fine grained sand nodules, grey, cohesive, w>PL, soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	100.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.3	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	50.1	Water Content (%):	N/A
Water Content (%):	51.7		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-002 Sample #: 002-06

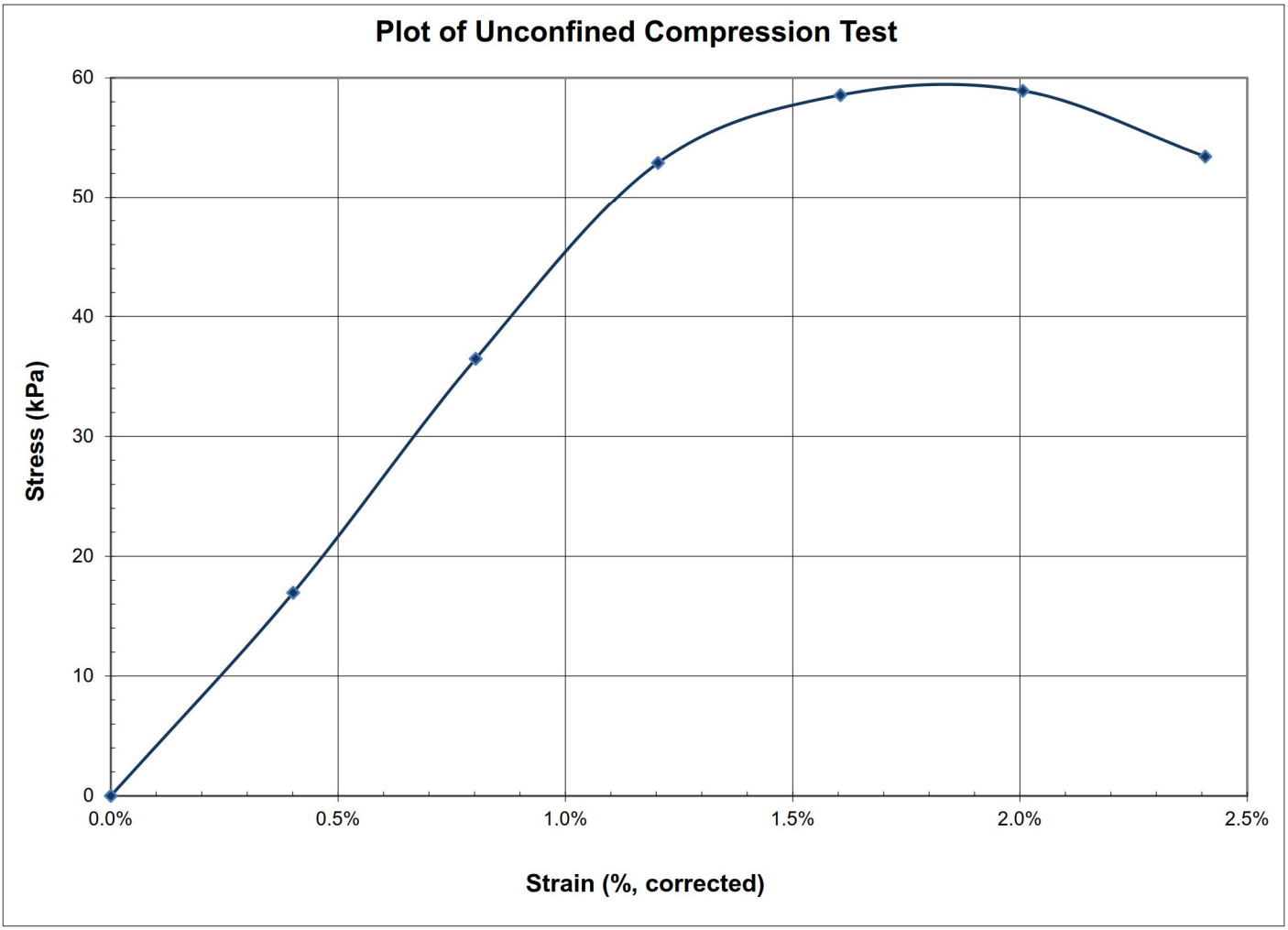
Source:

Visual Description of Sample: (CH) CLAY, white fine grained sand nodules, brown, cohesive, w>PL, soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	58.9	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.0	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	29.5	Water Content (%):	N/A
Water Content (%):	51.6		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-002 Sample #: 002-10

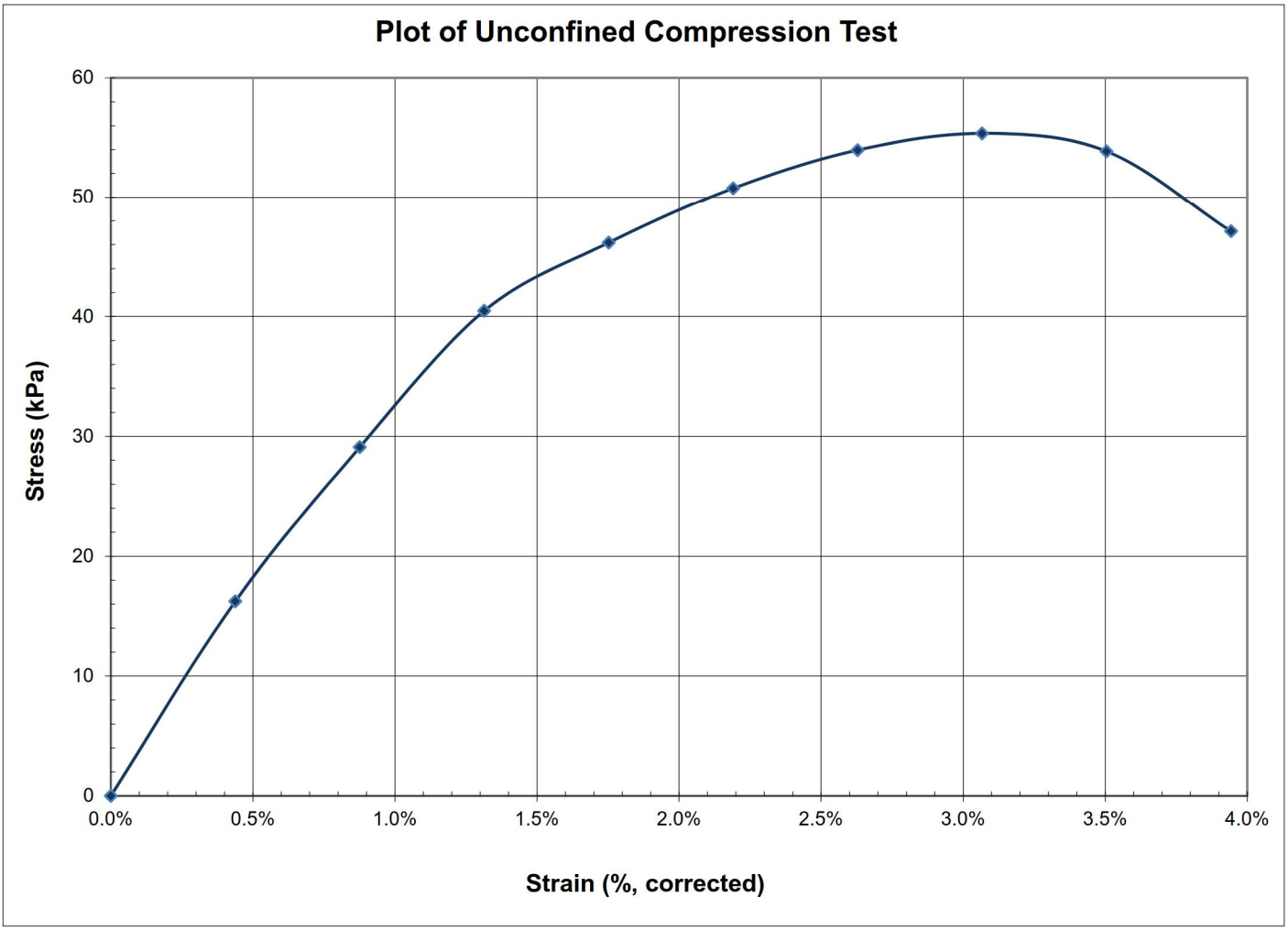
Source:

Visual Description of Sample: (CH) CLAY, white fine grained sand nodules, brown, cohesive, w>PL, soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	55.4	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.1	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	27.7	Water Content (%):	N/A
Water Content (%):	51.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-002 Sample #: 002-15

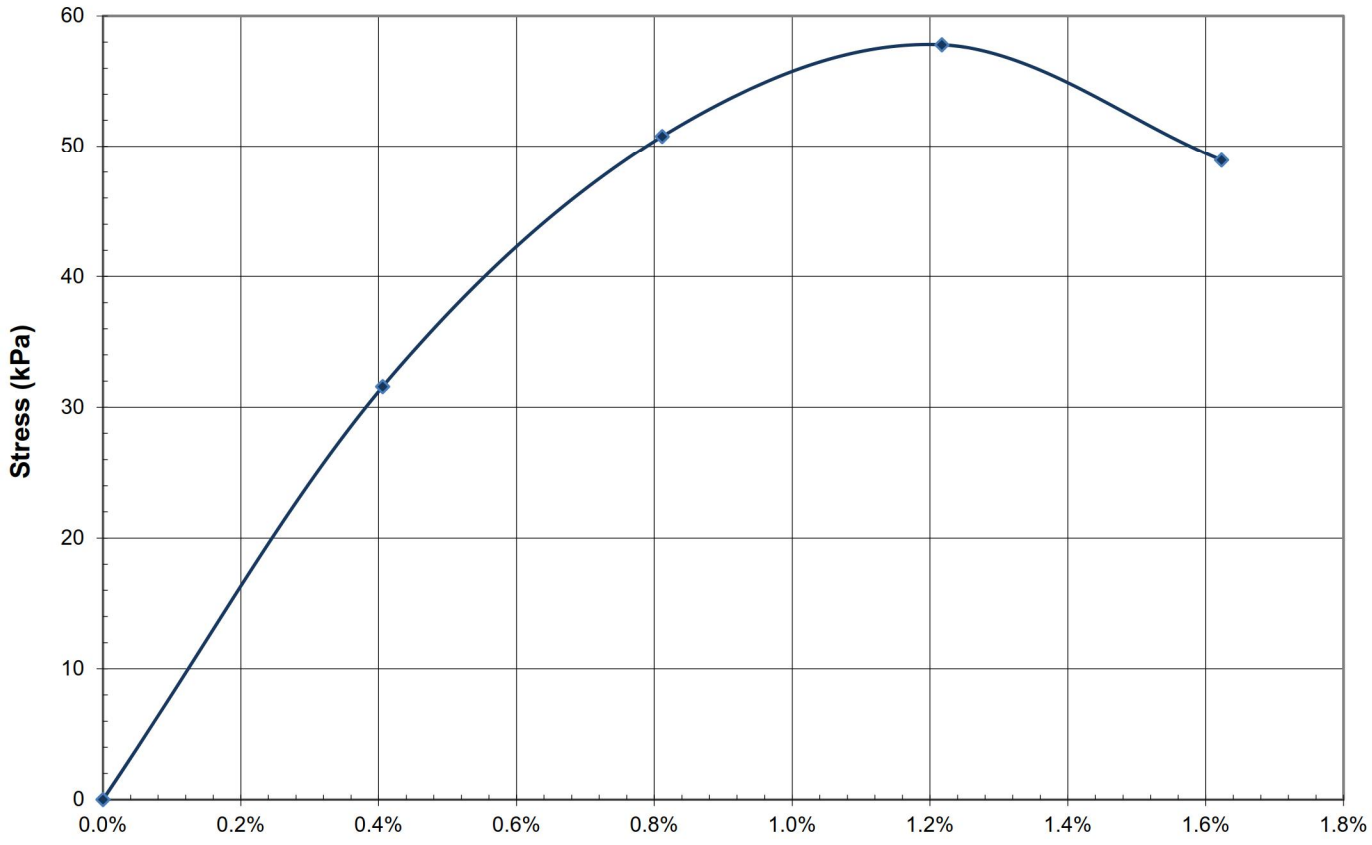
Source:

Visual Description of Sample: (CH) CLAY, white fine grained sand nodules, grey, cohesive, w>PL, soft to very soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	57.8	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.2	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	28.9	Water Content (%):	N/A
Water Content (%):	61.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-004 Sample #: 004-05

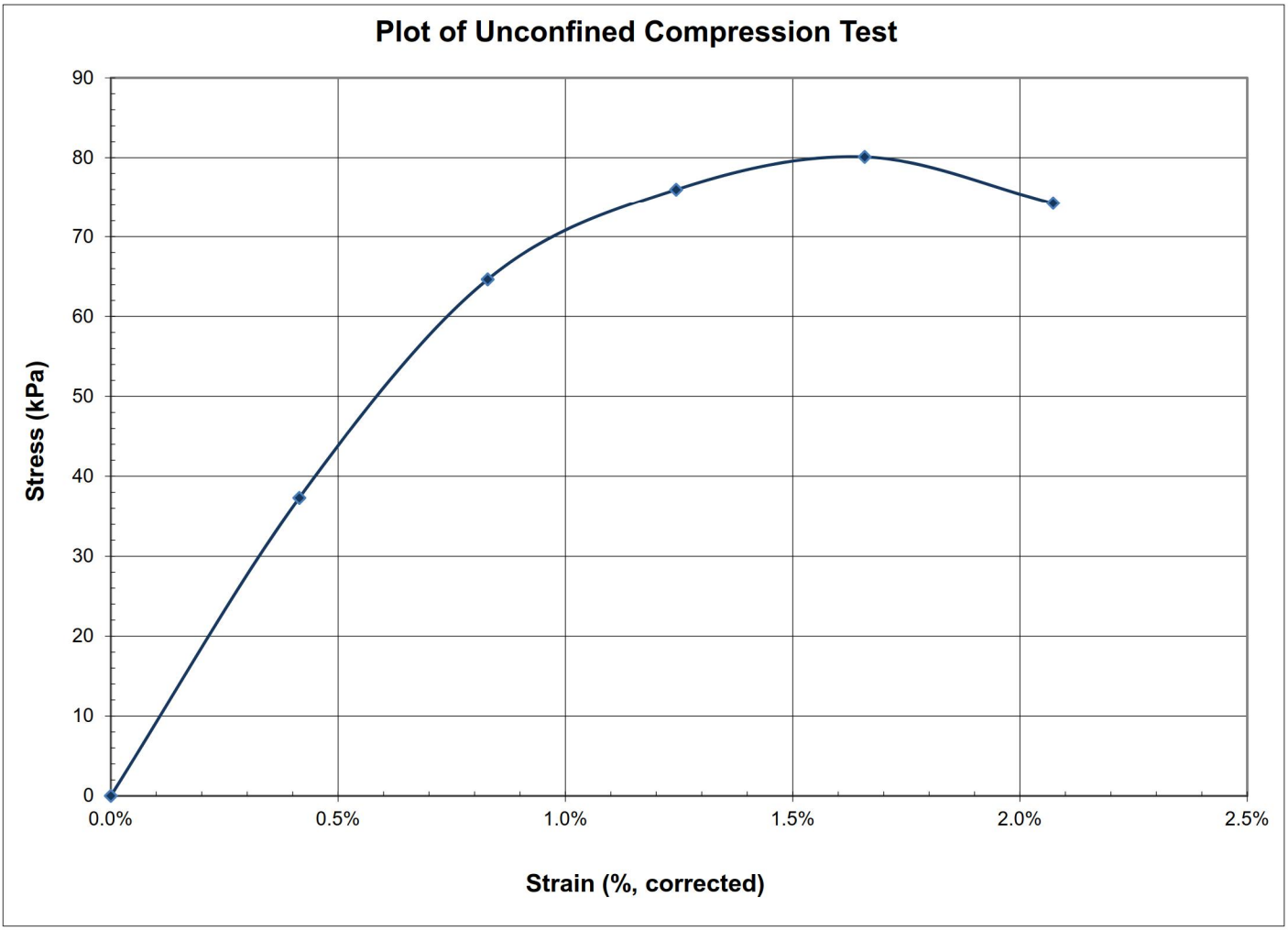
Source:

Visual Description of Sample: (CH) silty CLAY, motteled brown-grey, cohesive, w>PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	80.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.7	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	40.0	Water Content (%):	N/A
Water Content (%):	52.2		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by:

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-004 Sample #: 004-08

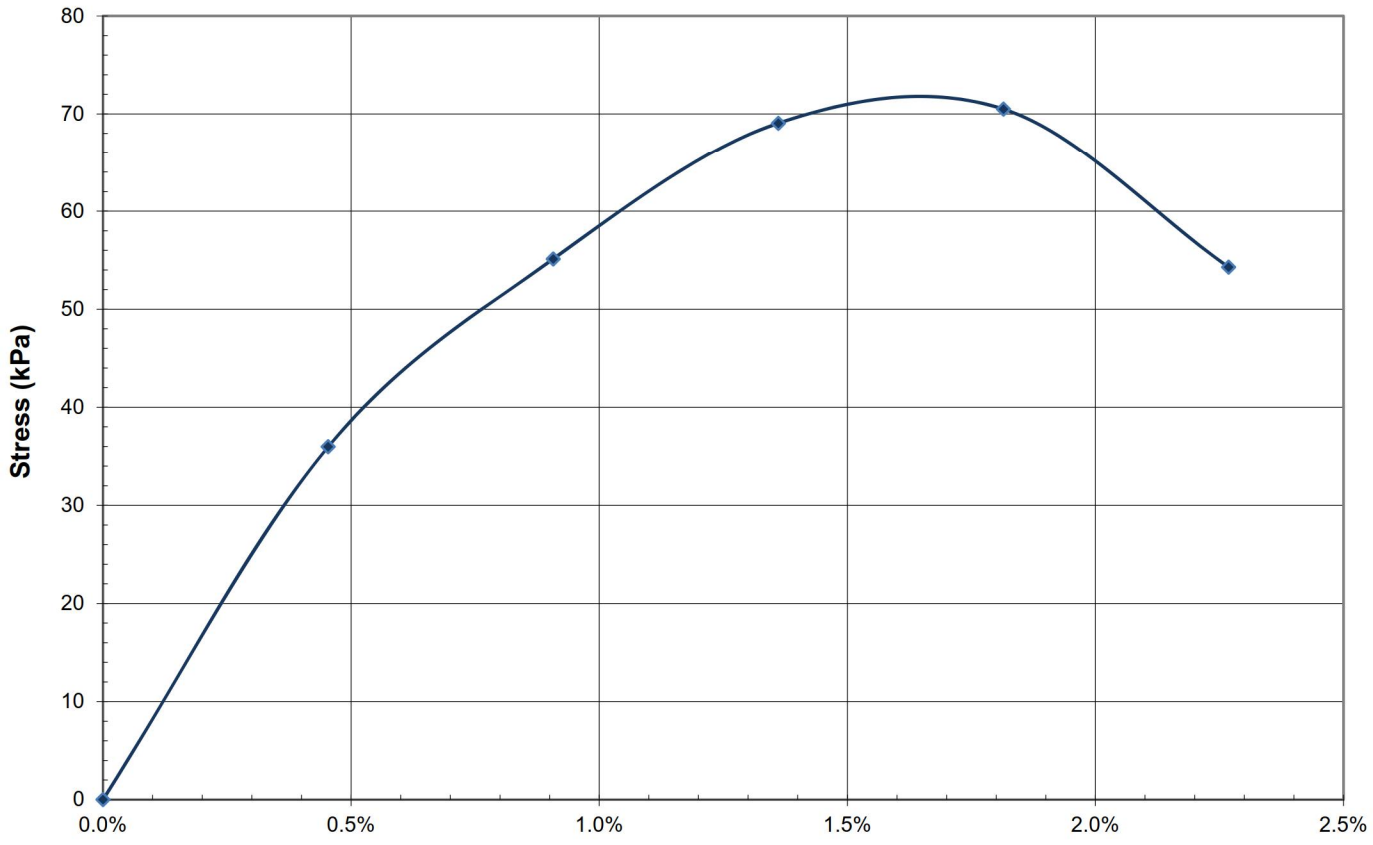
Source:

Visual Description of Sample: (CH) silty CLAY, grey, cohesive, w>PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	70.5	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.8	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	35.2	Water Content (%):	N/A
Water Content (%):	60.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

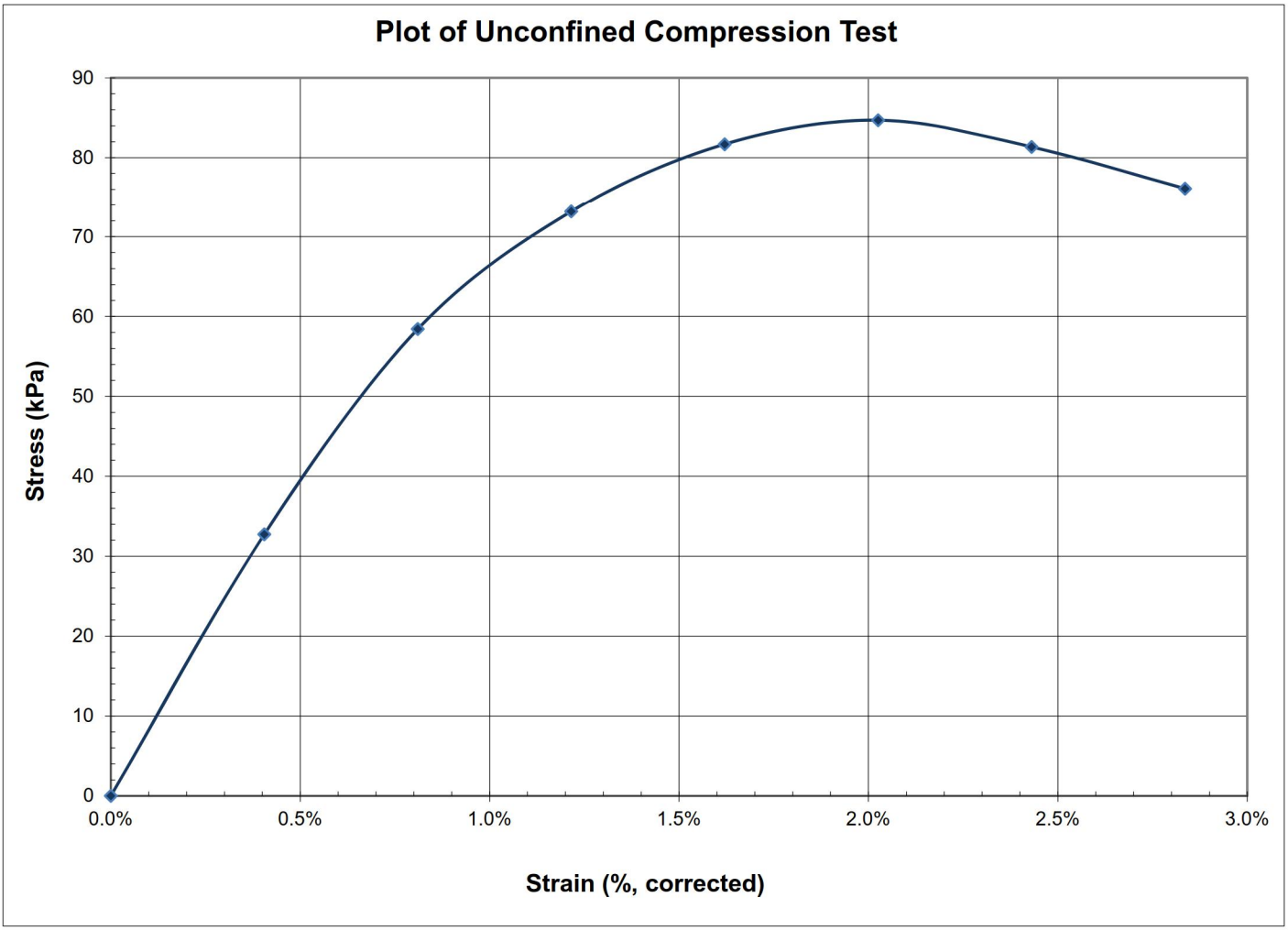
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-004 Sample #: 004-11
Source:
Visual Description of Sample: (CH) silty CLAY, grey, cohesive, w>PL, firm.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	84.7	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.0	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	42.3	Water Content (%):	N/A
Water Content (%):	61.4		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by:

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-004 Sample #: 004-13

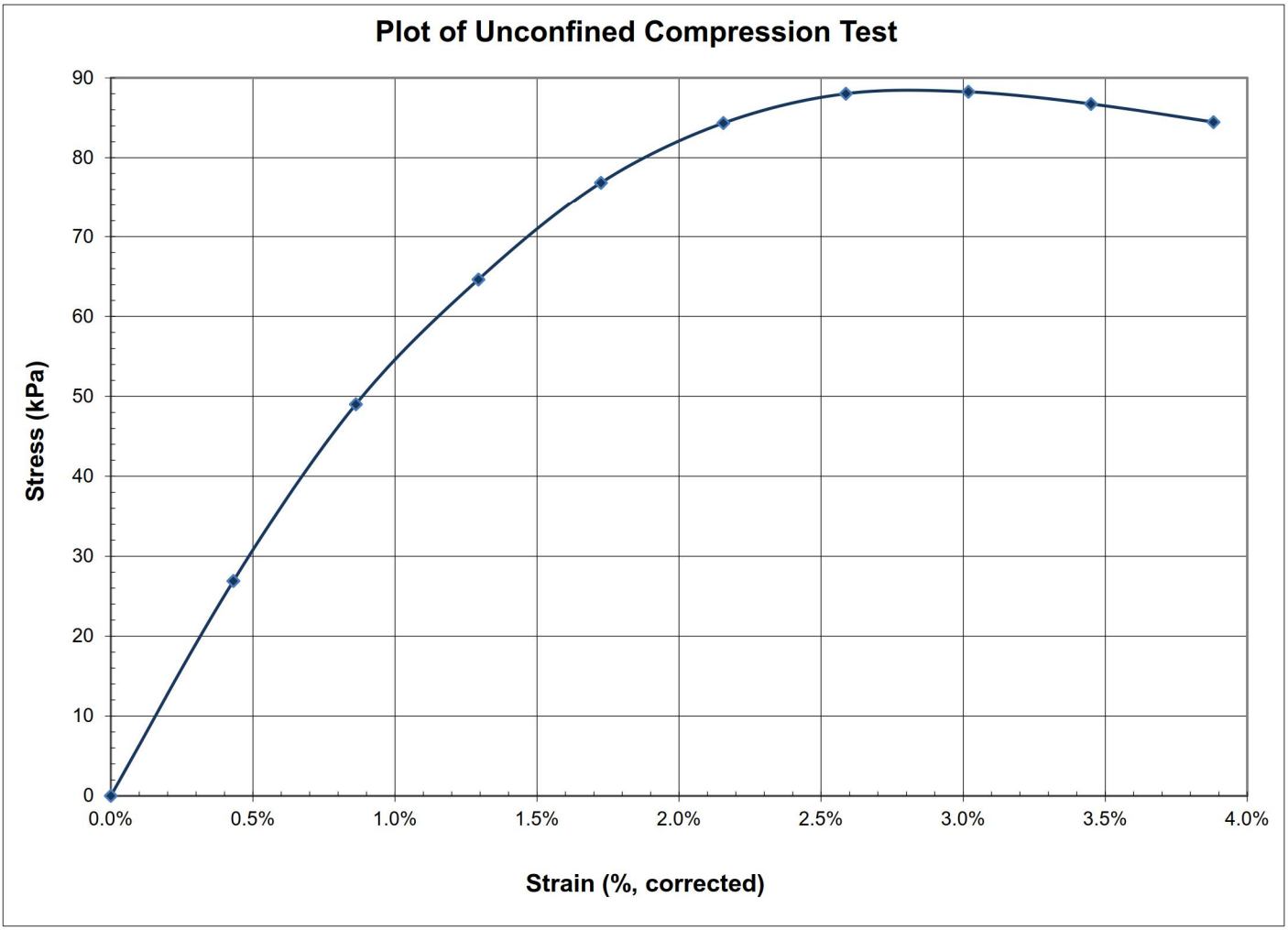
Source:

Visual Description of Sample: (CH) silty CLAY, mottled brown-grey, cohesive, w>PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	88.2	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.0	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	44.1	Water Content (%):	N/A
Water Content (%):	40.3		

Plot of Unconfined Compression Test



Comments:

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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-005 Sample #: 005-04

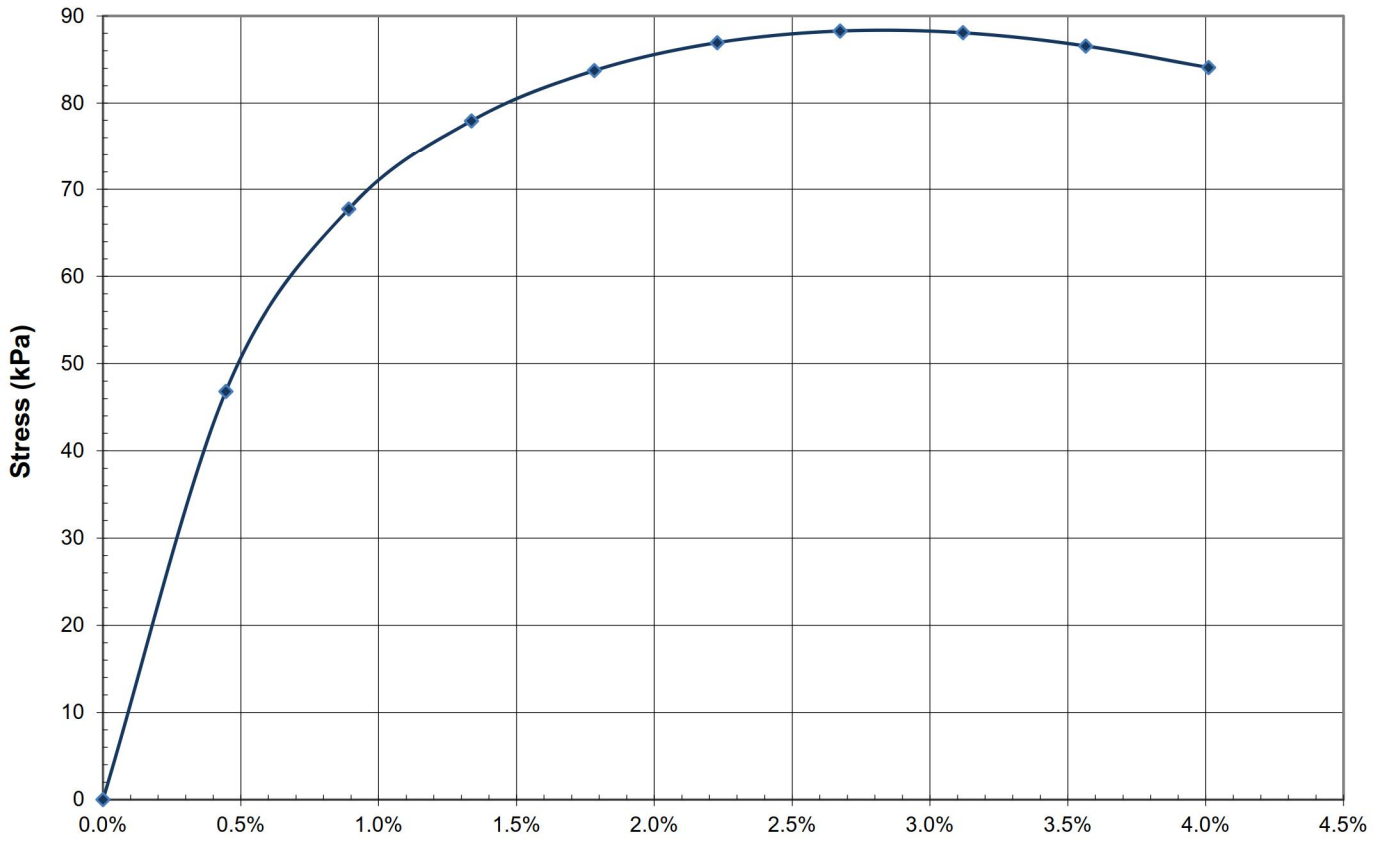
Source:

Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w>PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	88.3	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.7	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	44.1	Water Content (%):	N/A
Water Content (%):	45.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by: _____

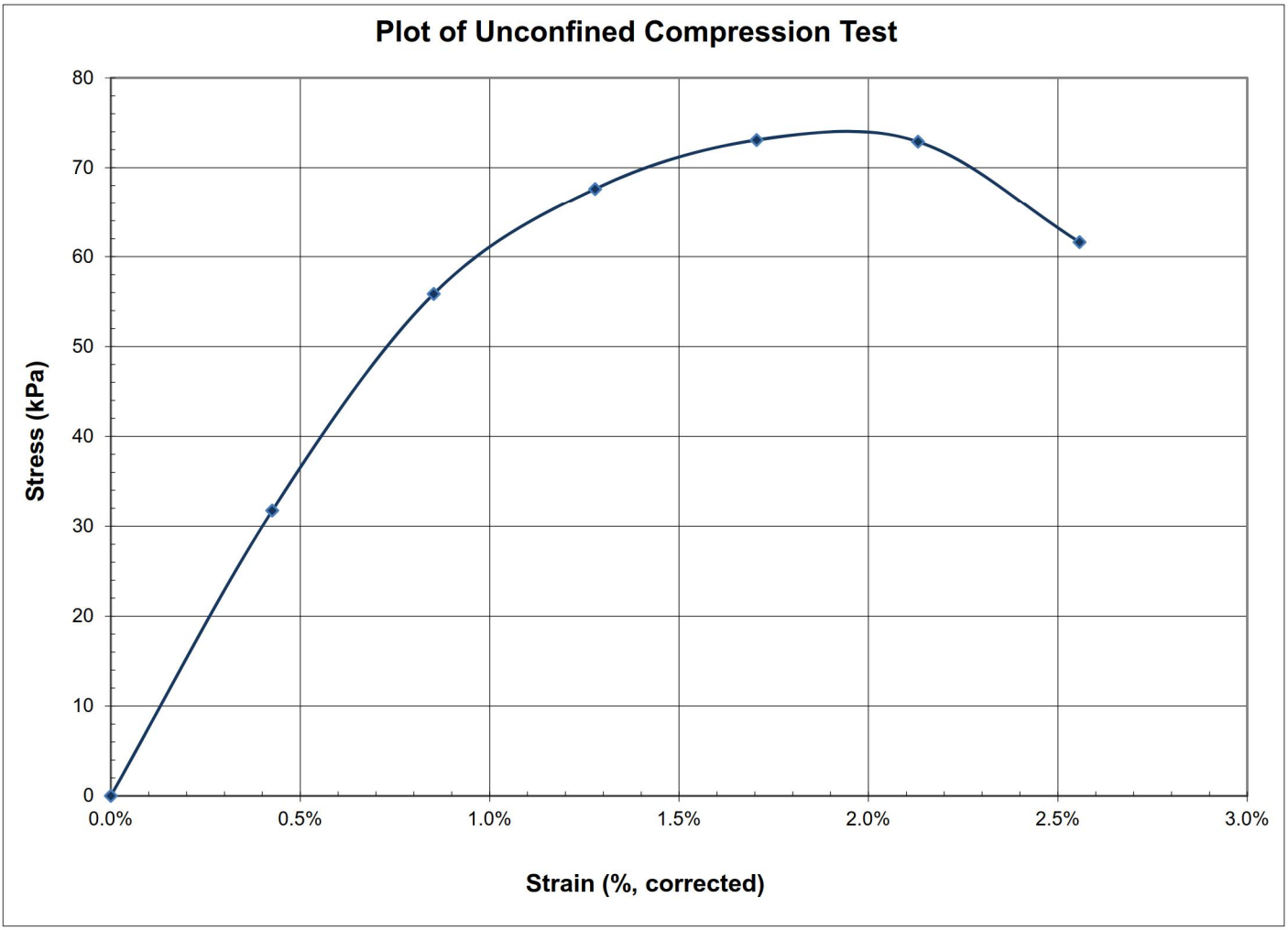
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-005 Sample #: 005-08
Source:
Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w>PL, firm.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	73.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.7	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	36.5	Water Content (%):	N/A
Water Content (%):	48.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-005 Sample #: 005-12

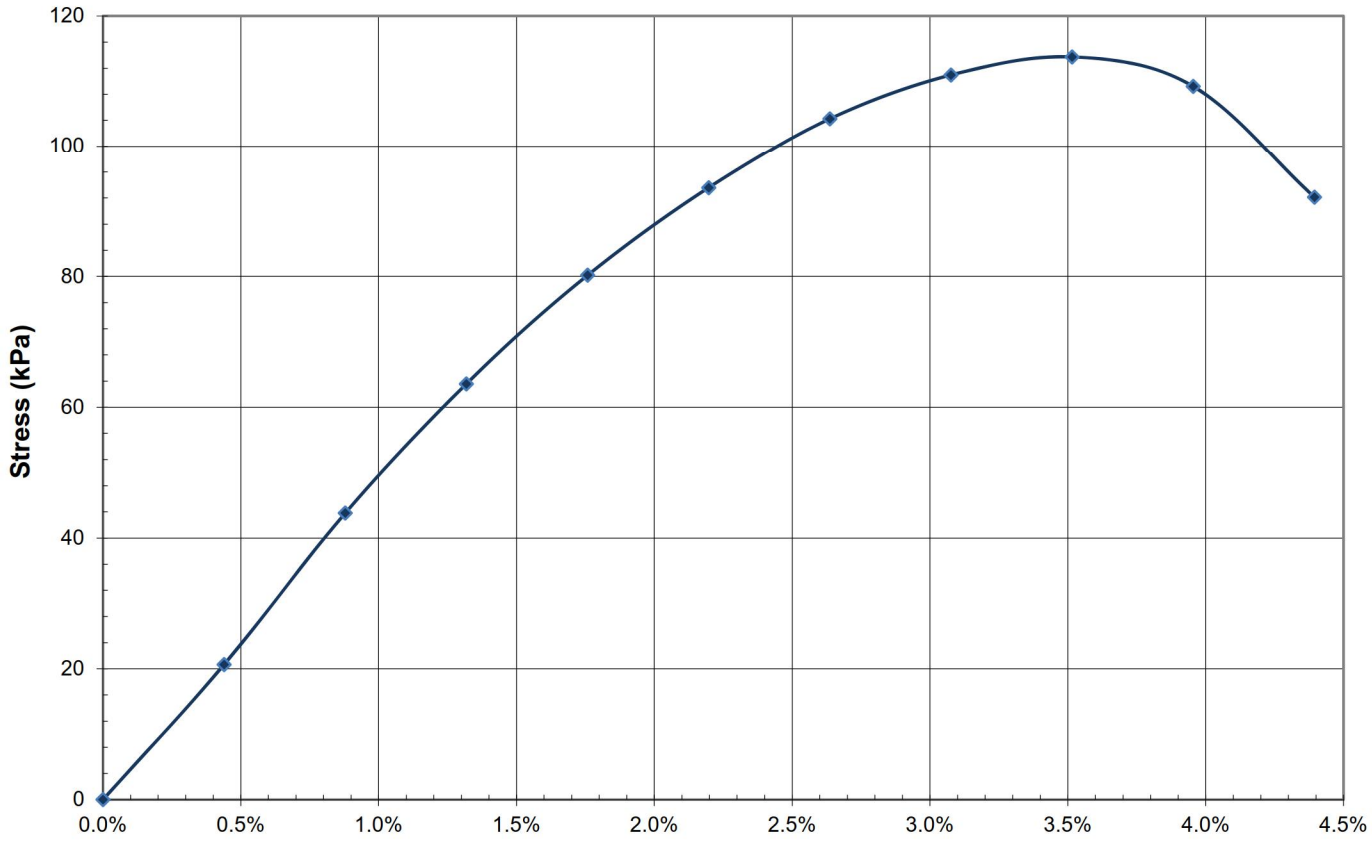
Source:

Visual Description of Sample: (CH) silty CLAY, grey, cohesive, w>PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	113.7	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.5	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	56.9	Water Content (%):	N/A
Water Content (%):	49.7		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-005 Sample #: 005-16

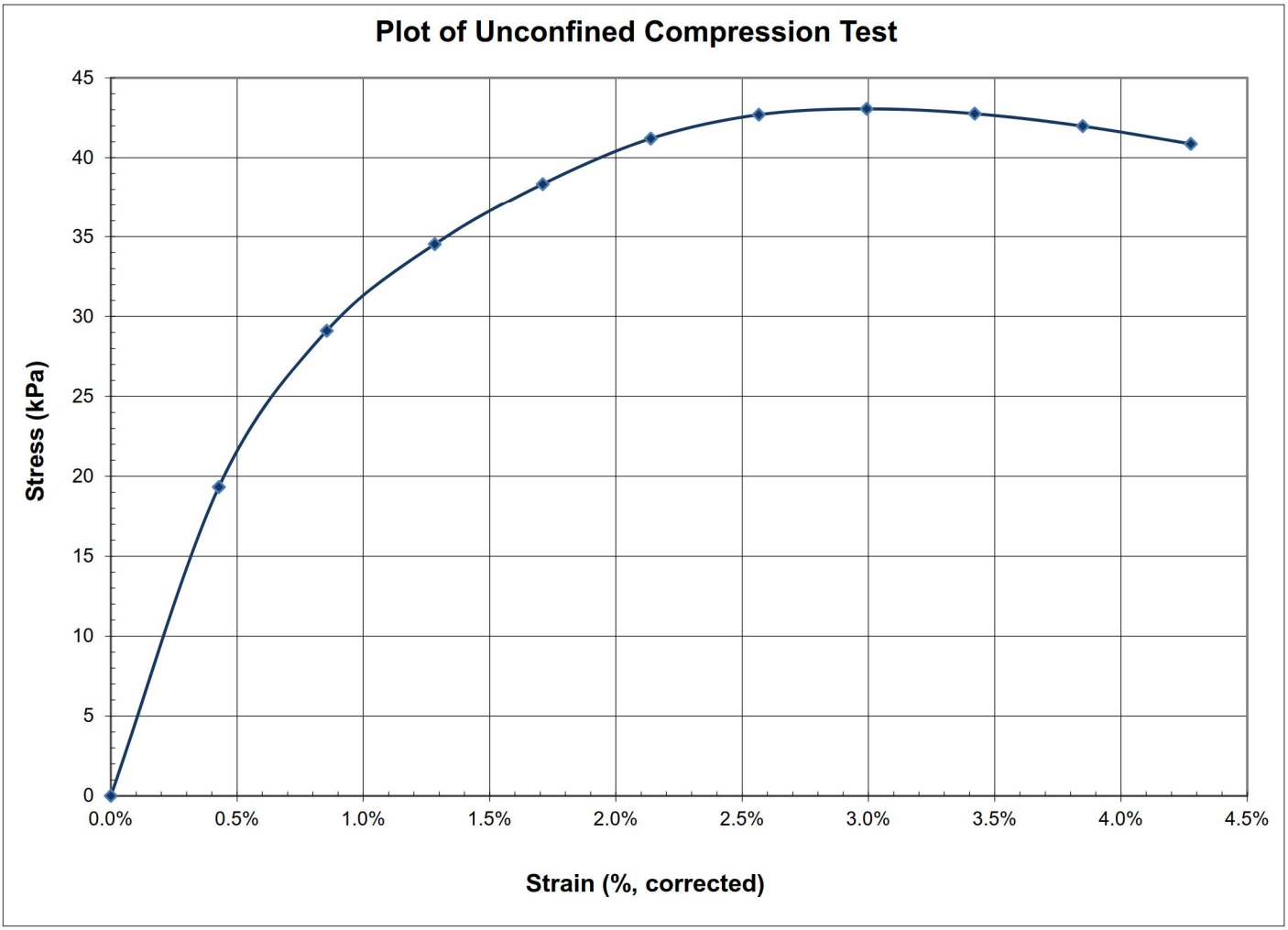
Source:

Visual Description of Sample: (CI) SILTY CLAY, some sand, trace gravel, very light grey, TILL, cohesive, w>PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	43.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.0	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	21.5	Water Content (%):	N/A
Water Content (%):	52.5		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-006 Sample #: 006-04

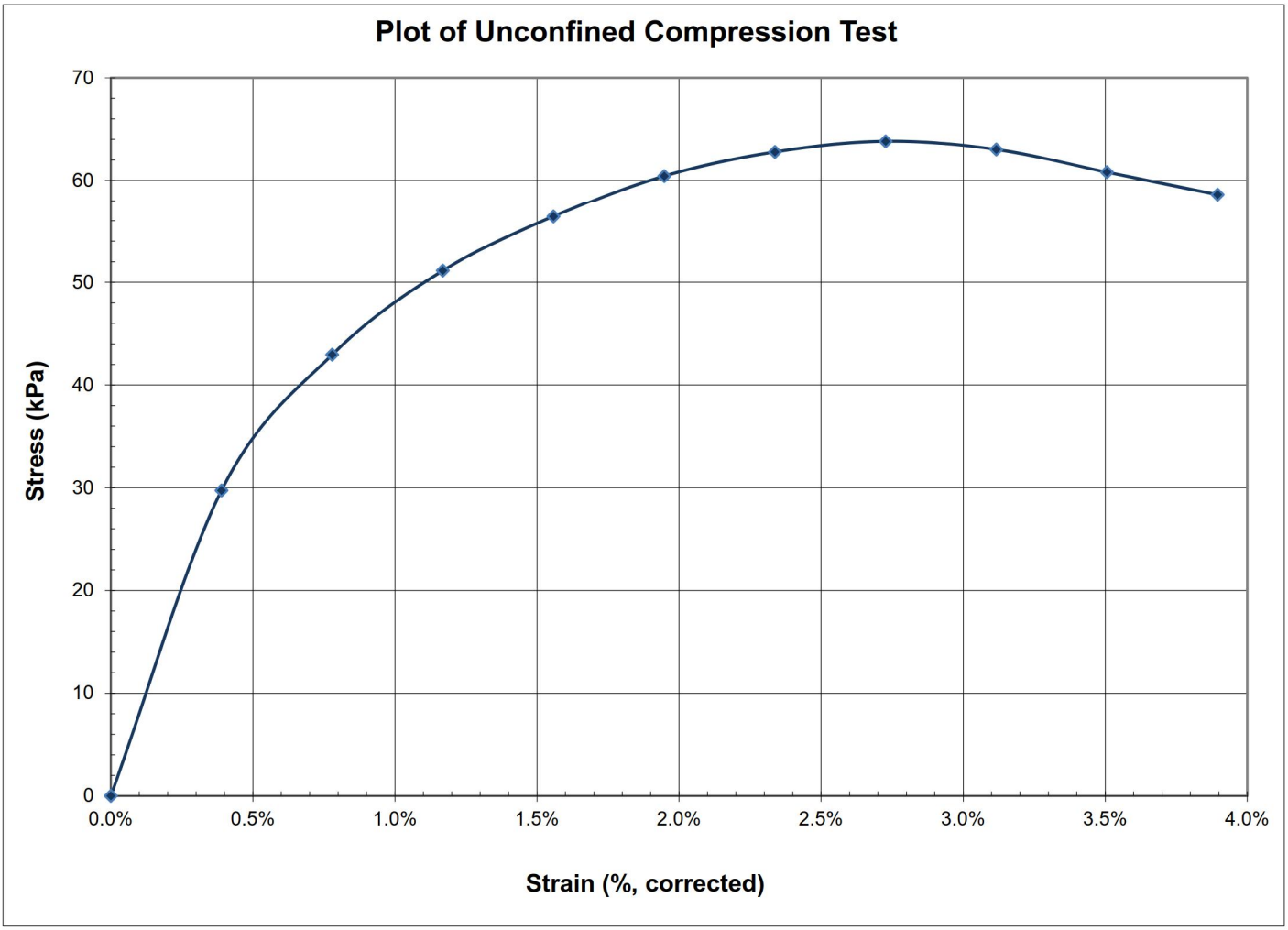
Source:

Visual Description of Sample: (CH) CLAY, trace silt nodules, brown, oxidation staining, cohesive, w>PL, firm to soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	63.8	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.7	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	31.9	Water Content (%):	N/A
Water Content (%):	55.8		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

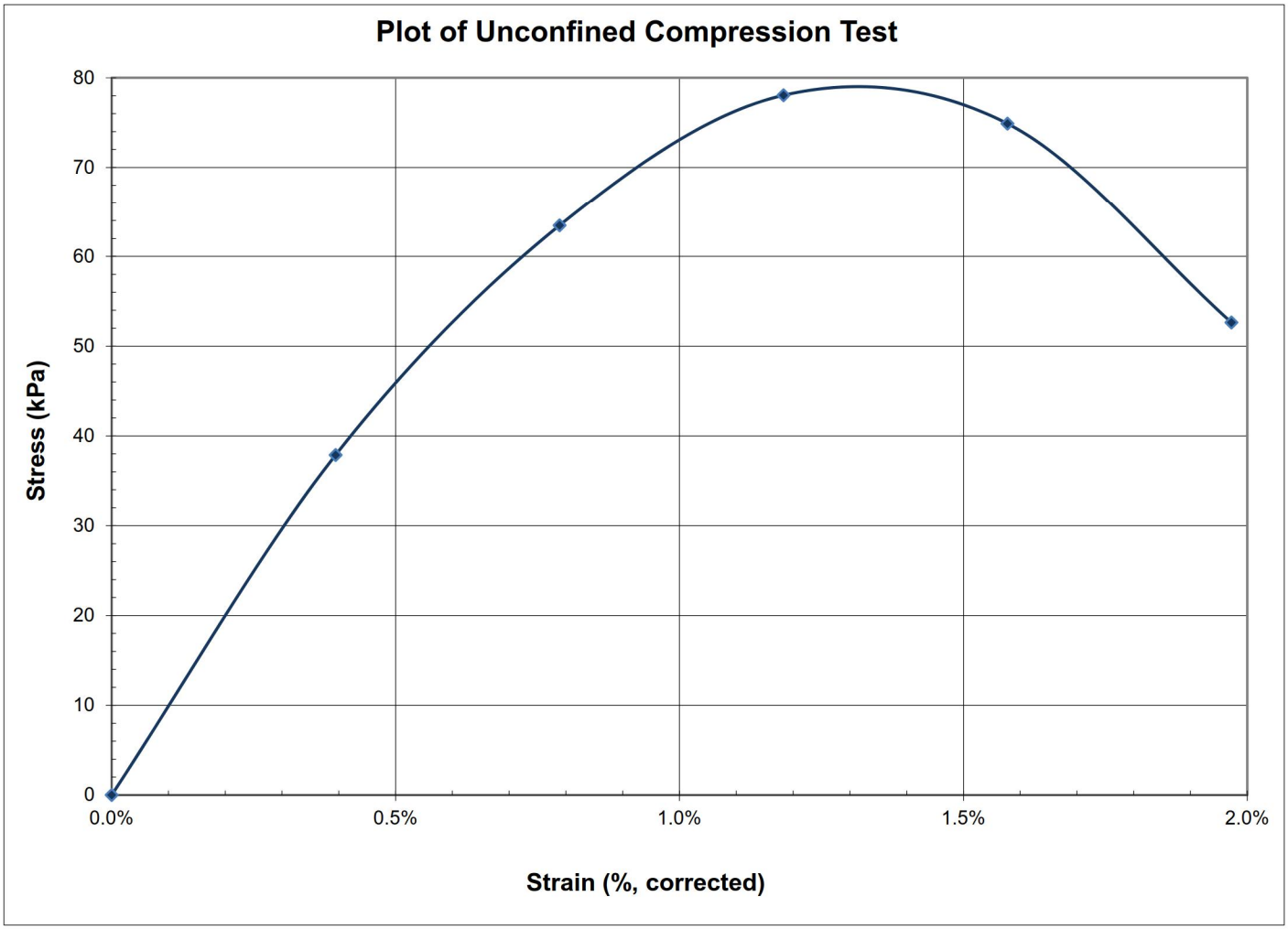
Borehole #: TH-15-006 Sample #: 006-08

Source:

Visual Description of Sample: (CH) CLAY, trace silt nodules, brown, oxidation staining, cohesive, w>PL, firm to soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	78.0	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.2	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	39.0	Water Content (%):	N/A
Water Content (%):	49.0		



Comments:

1721 8th Street E.,
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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-006 Sample #: 006-12

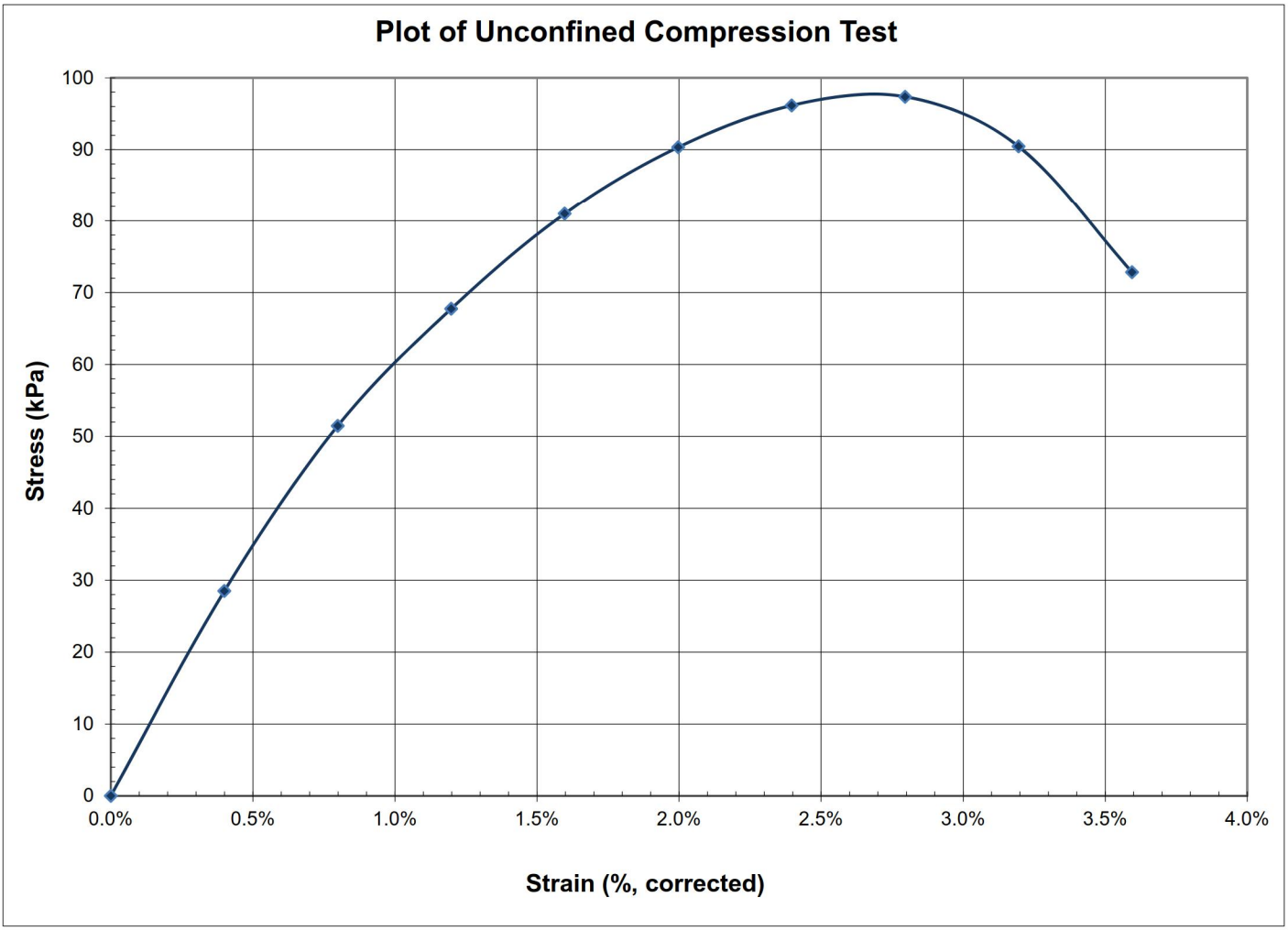
Source:

Visual Description of Sample: (CH) CLAY, some silt nodules, grey, oxidation staining, cohesive, w>PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	97.4	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.8	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	48.7	Water Content (%):	N/A
Water Content (%):	52.0		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-006 Sample #: 006-16

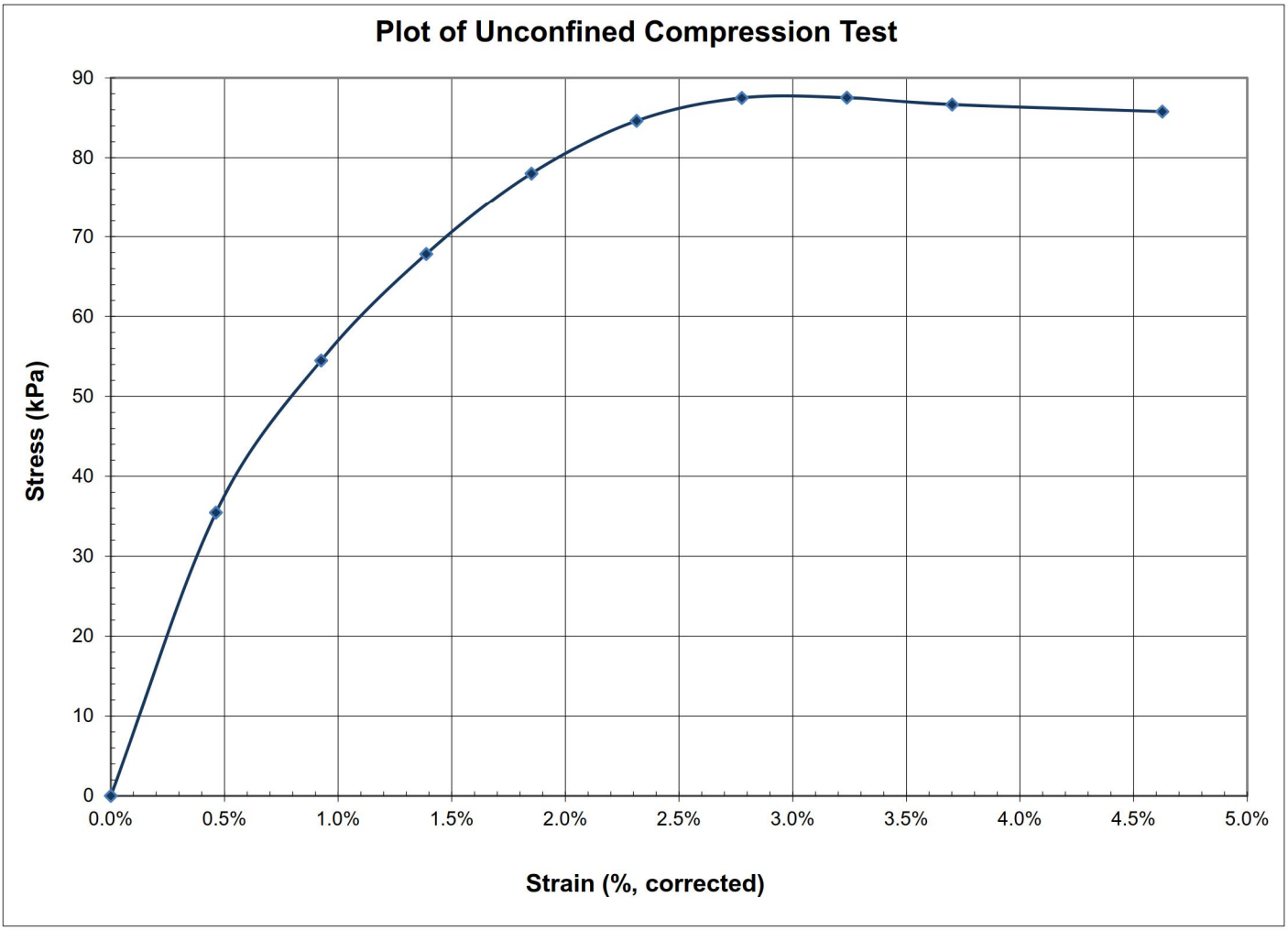
Source:

Visual Description of Sample: (CH) CLAY and sandy SILT, light grey, cohesive, w>PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	87.5	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.2	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	43.8	Water Content (%):	N/A
Water Content (%):	54.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-007 Sample #: 007-07

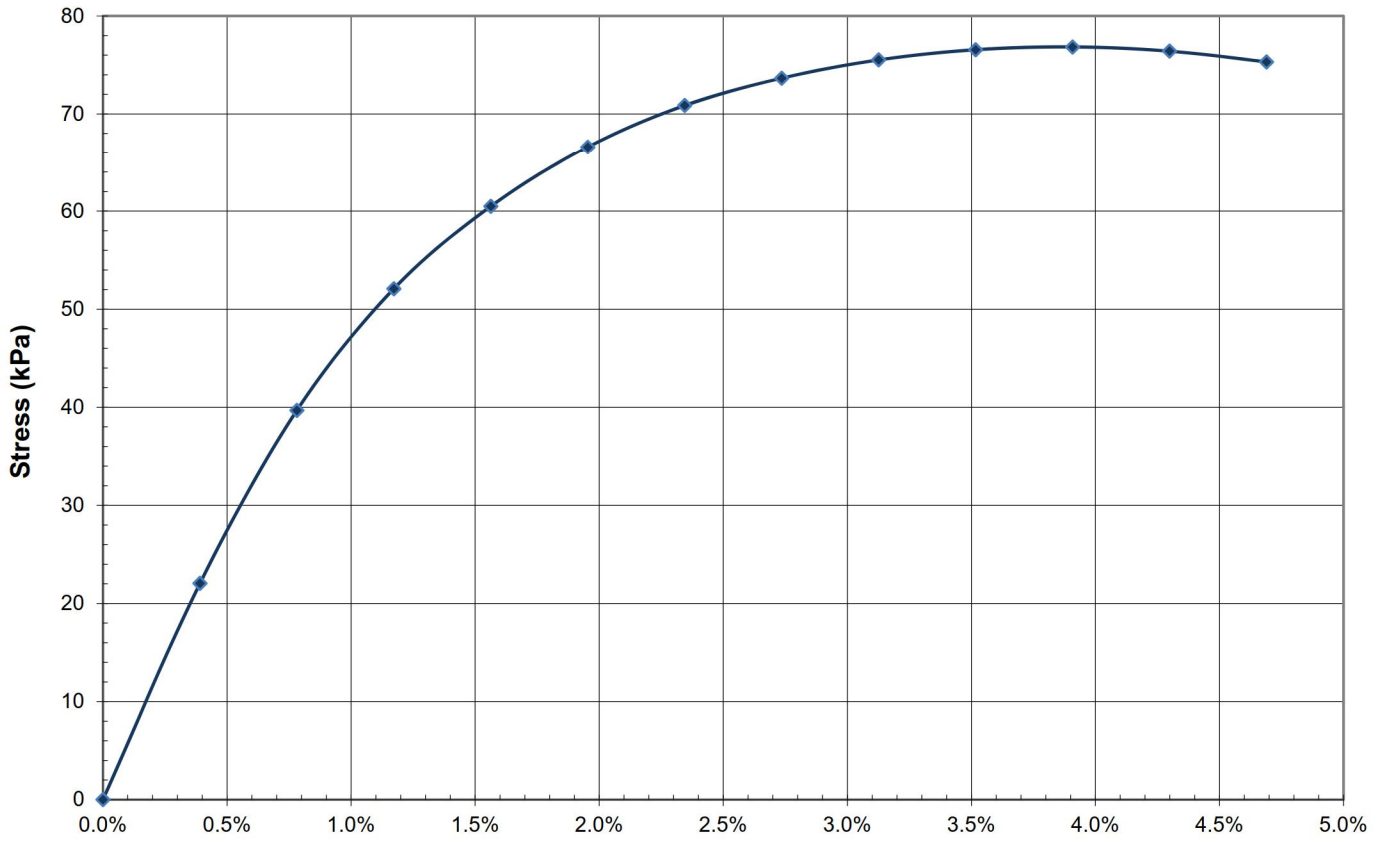
Source:

Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w~PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	76.8	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.9	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	38.4	Water Content (%):	N/A
Water Content (%):	54.7		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-007 Sample #: 007-11

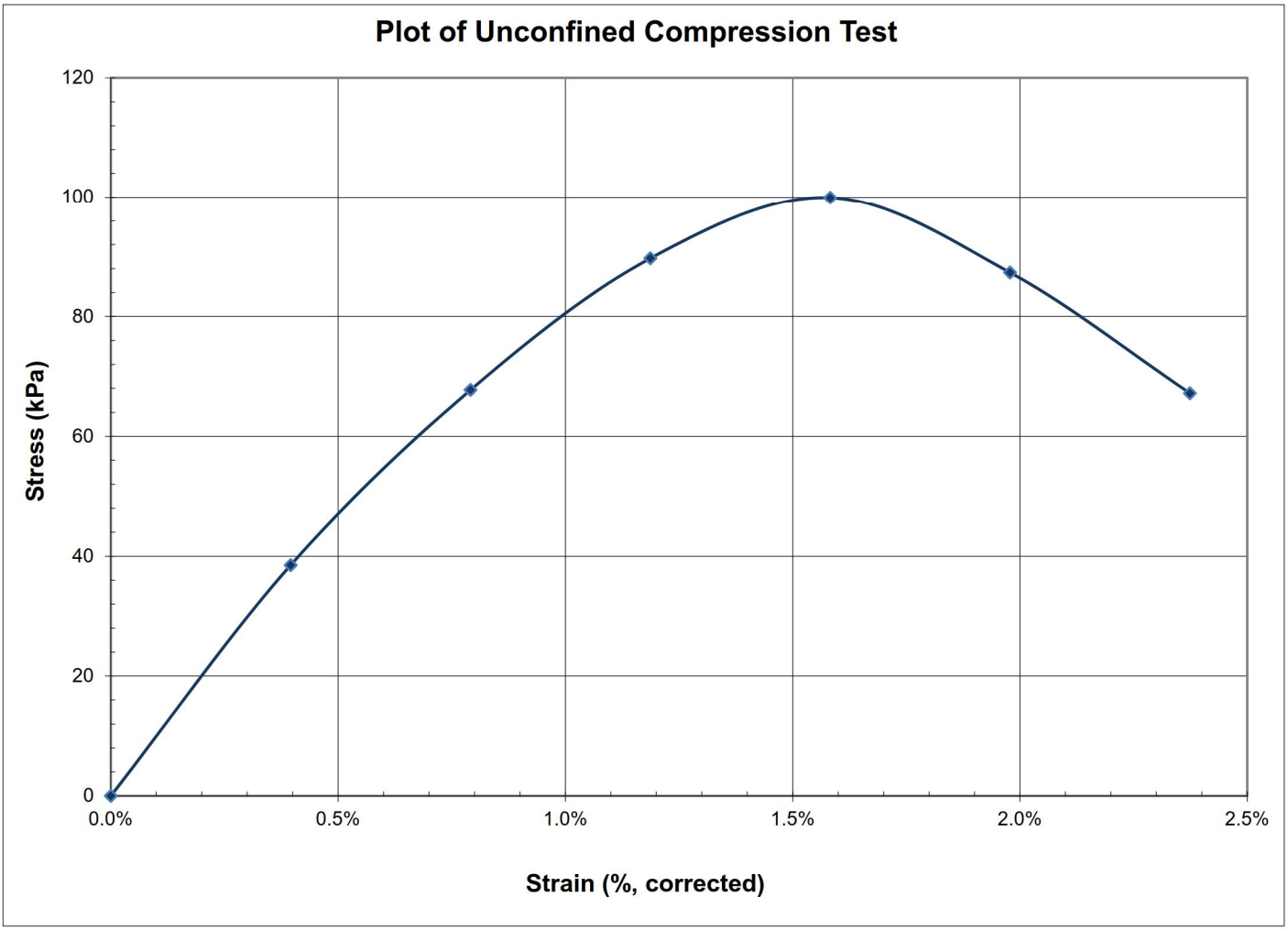
Source:

Visual Description of Sample: (CH) silty CLAY, grey, cohesive, w~PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	99.9	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.6	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	50.0	Water Content (%):	N/A
Water Content (%):	50.6		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-007 Sample #: 007-15

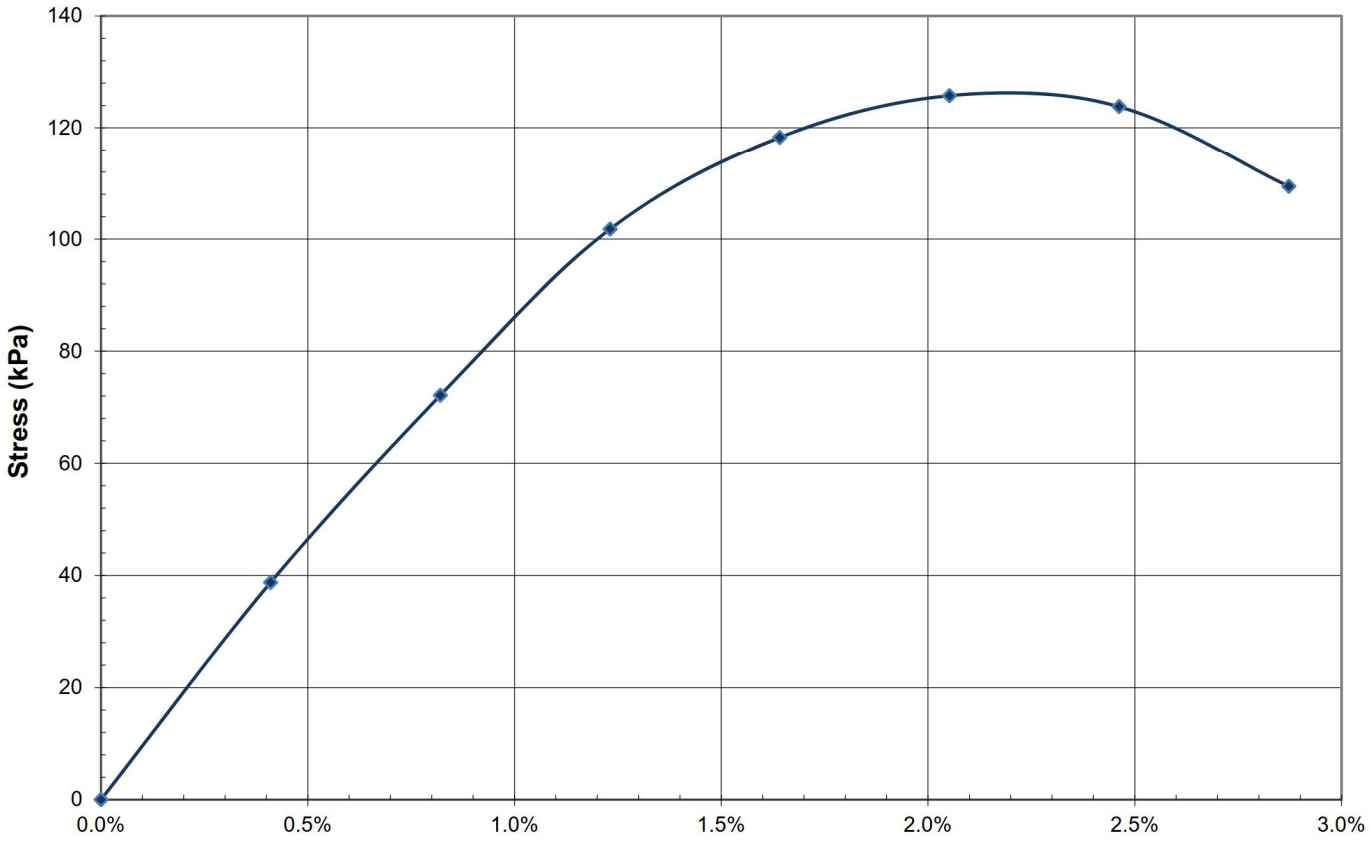
Source:

Visual Description of Sample: (CH) silty CLAY, grey, cohesive, w~PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	125.8	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.1	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	62.9	Water Content (%):	N/A
Water Content (%):	53.4		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

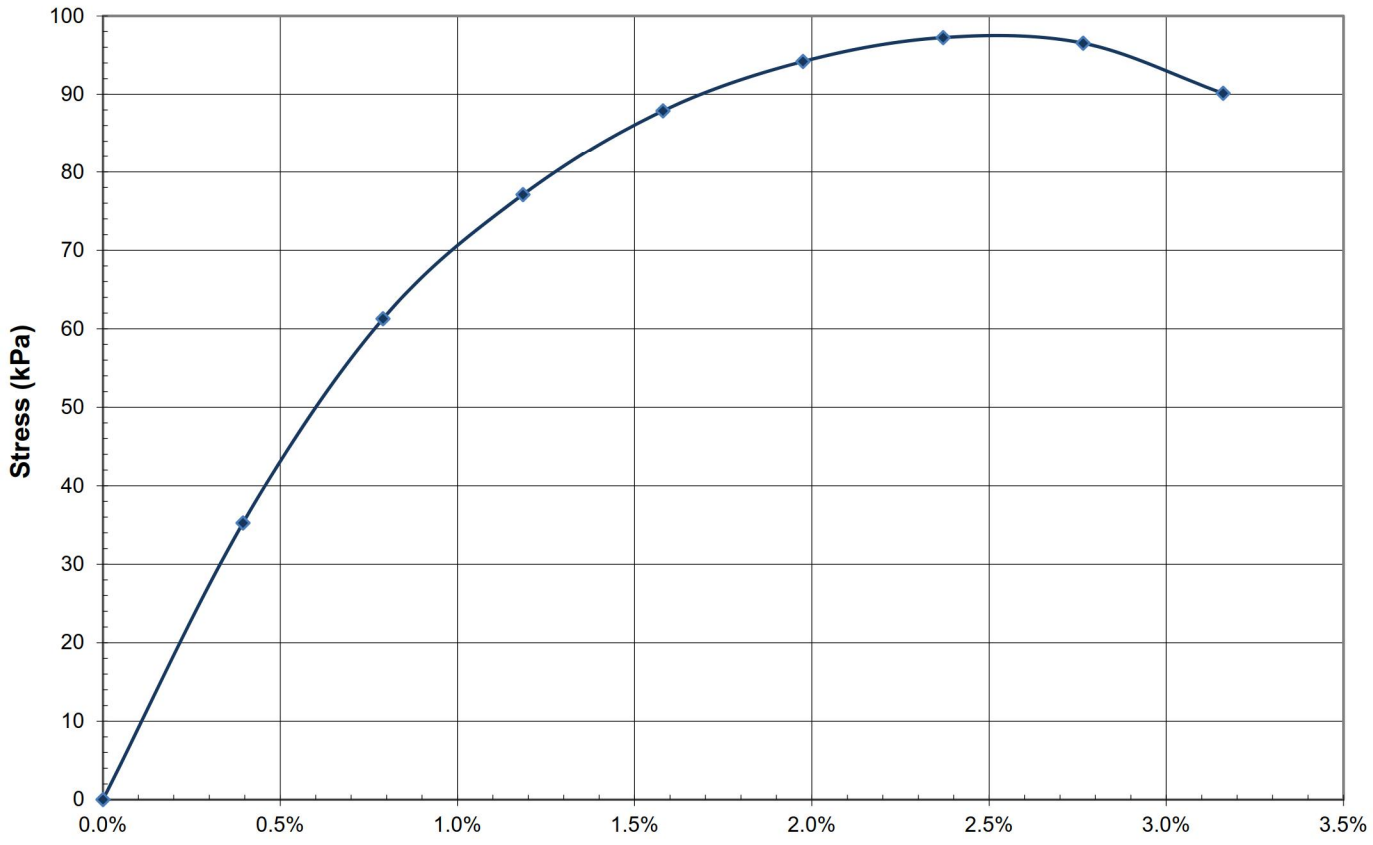
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-007 Sample #: 007-19
Source:
Visual Description of Sample: (CH) silty CLAY, grey, cohesive, w~PL, firm.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	97.2	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.4	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	48.6	Water Content (%):	N/A
Water Content (%):	35.9		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

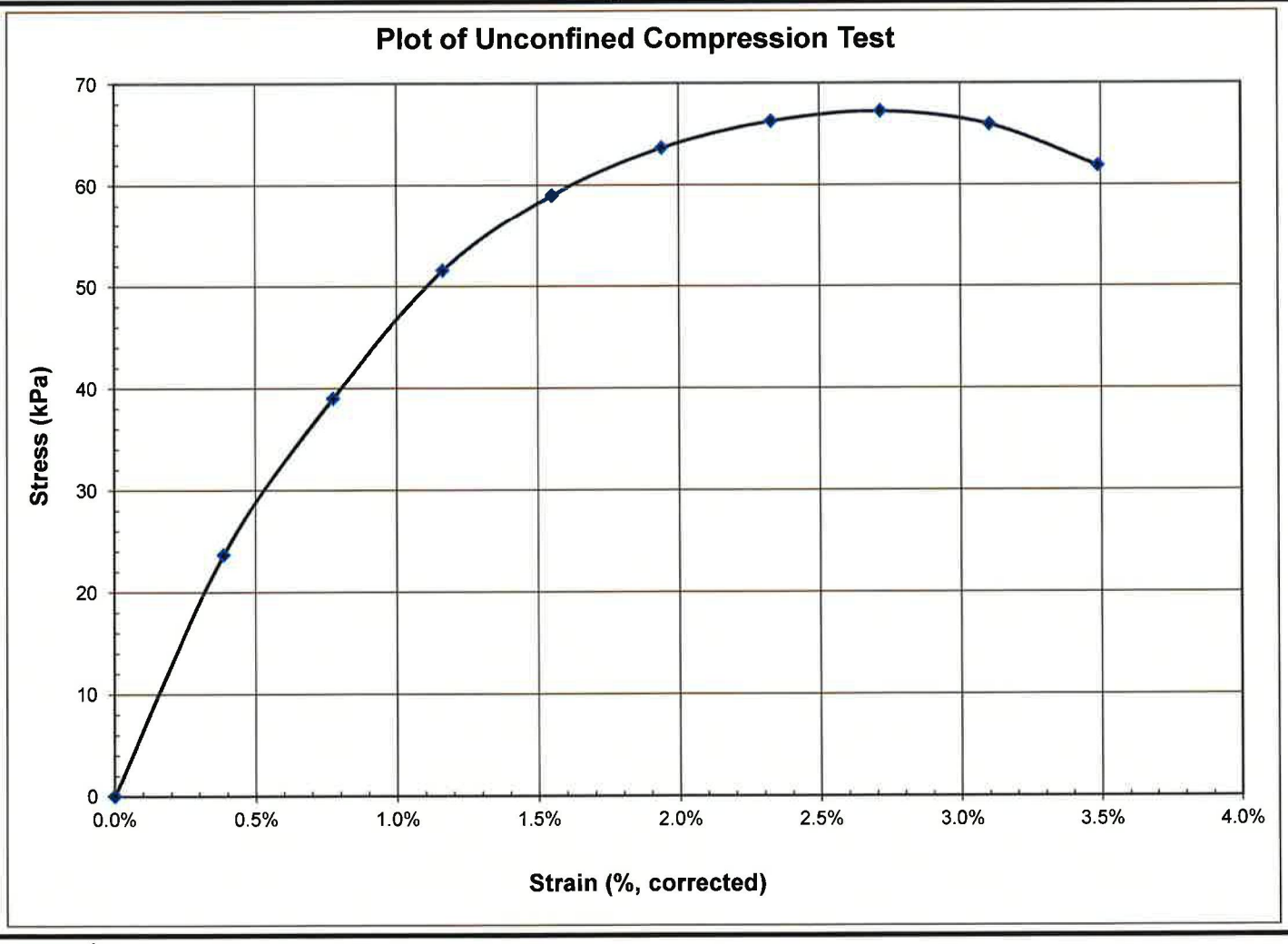
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-008 Sample #: 008-06
Source:
Visual Description of Sample: (CH) silty CLAY, brown-grey, cohesive, w~PL, firm.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	67.2	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.7	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	33.6	Water Content (%):	N/A
Water Content (%):	52.0		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-008 Sample #: 008-10

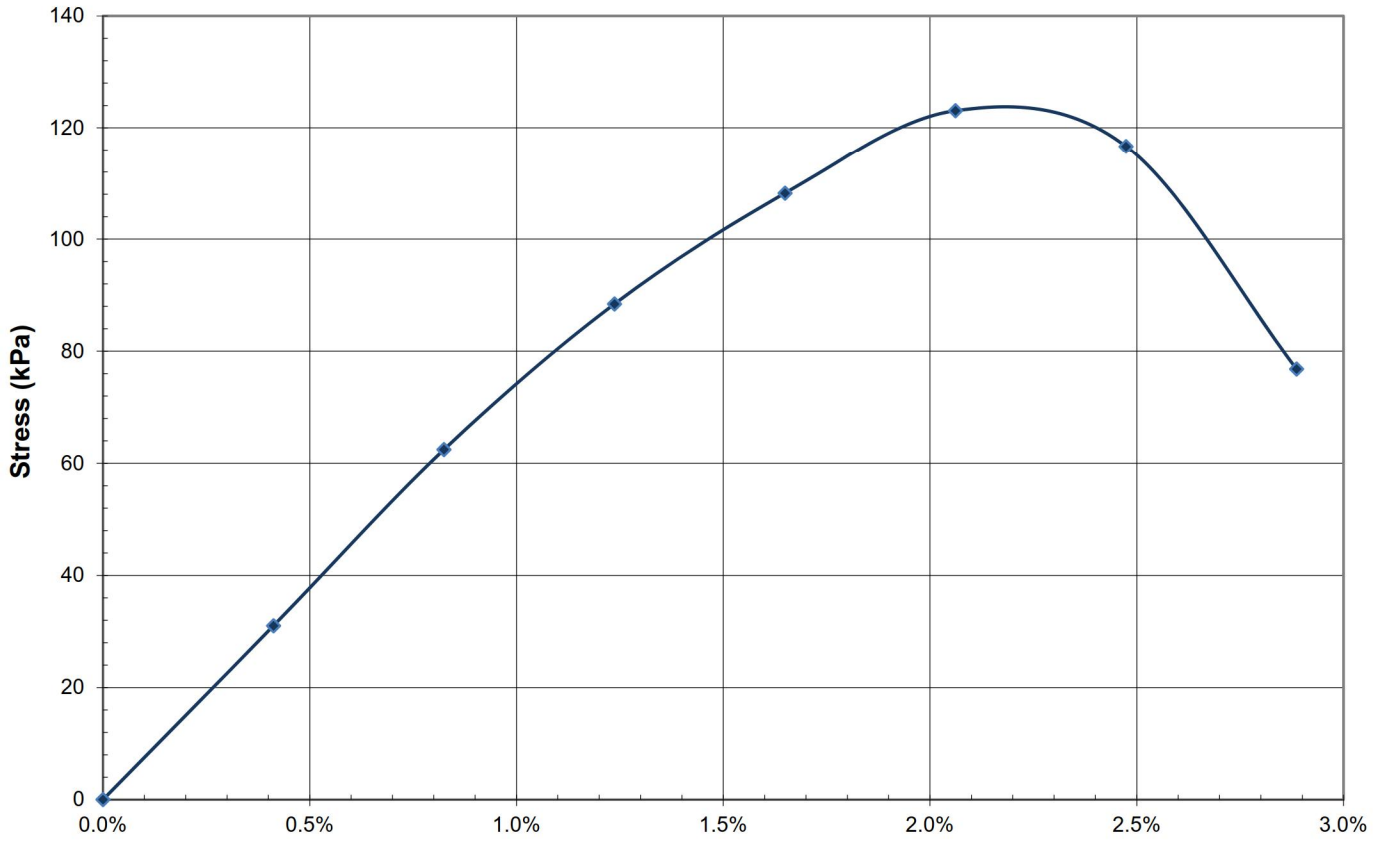
Source:

Visual Description of Sample: (CH) silty CLAY, brown-grey, cohesive, w~PL, very soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	123.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.1	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	61.5	Water Content (%):	N/A
Water Content (%):	48.2		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-008 Sample #: 008-14

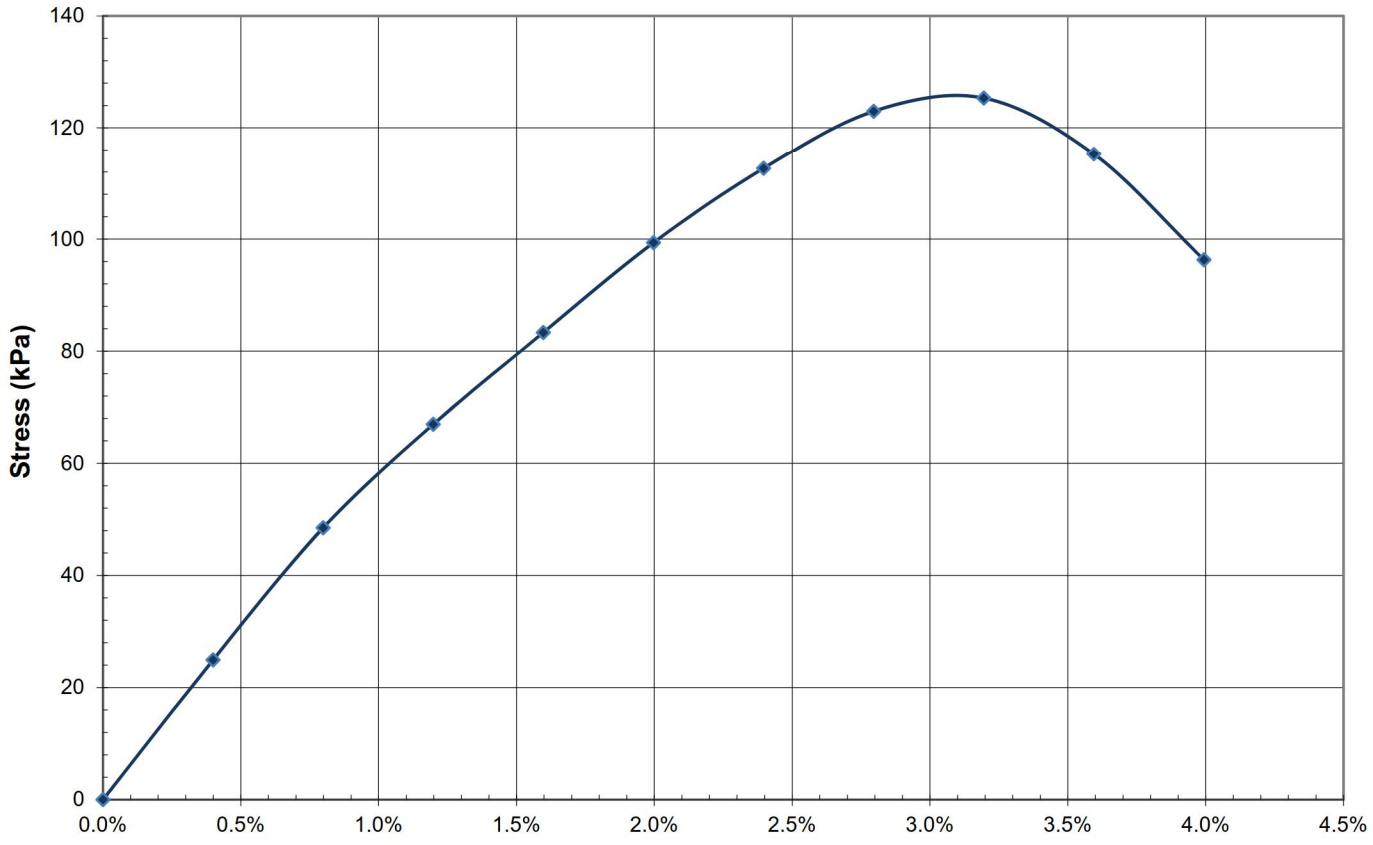
Source:

Visual Description of Sample: (CH) silty CLAY, brown-grey, cohesive, w~PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	125.3	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.2	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	62.7	Water Content (%):	N/A
Water Content (%):	46.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-008 Sample #: 008-18

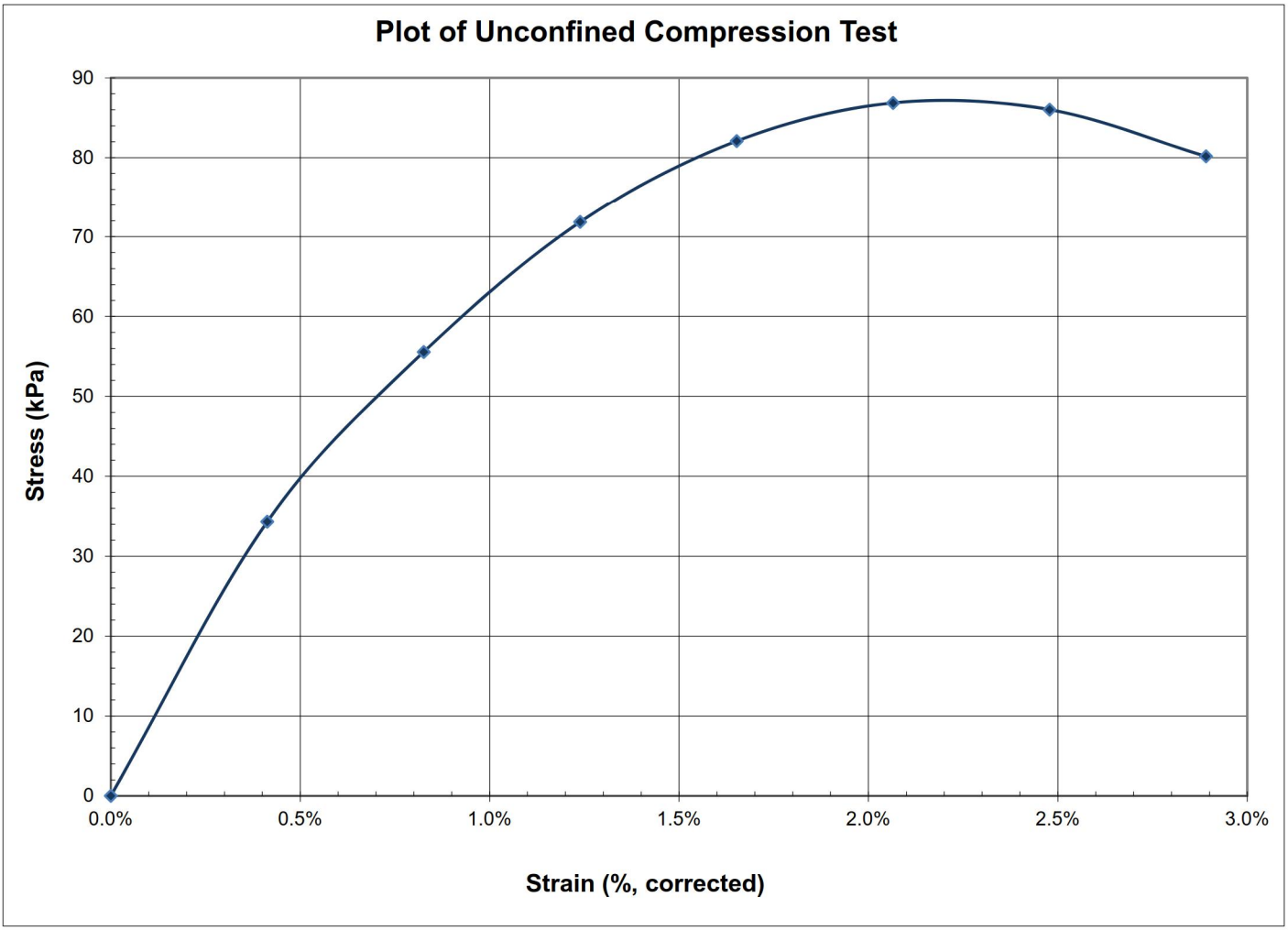
Source:

Visual Description of Sample: (CH) silty CLAY, brown-grey, cohesive, w~PL, very soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	86.9	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.1	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	43.4	Water Content (%):	N/A
Water Content (%):	45.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-009 Sample #: 009-05

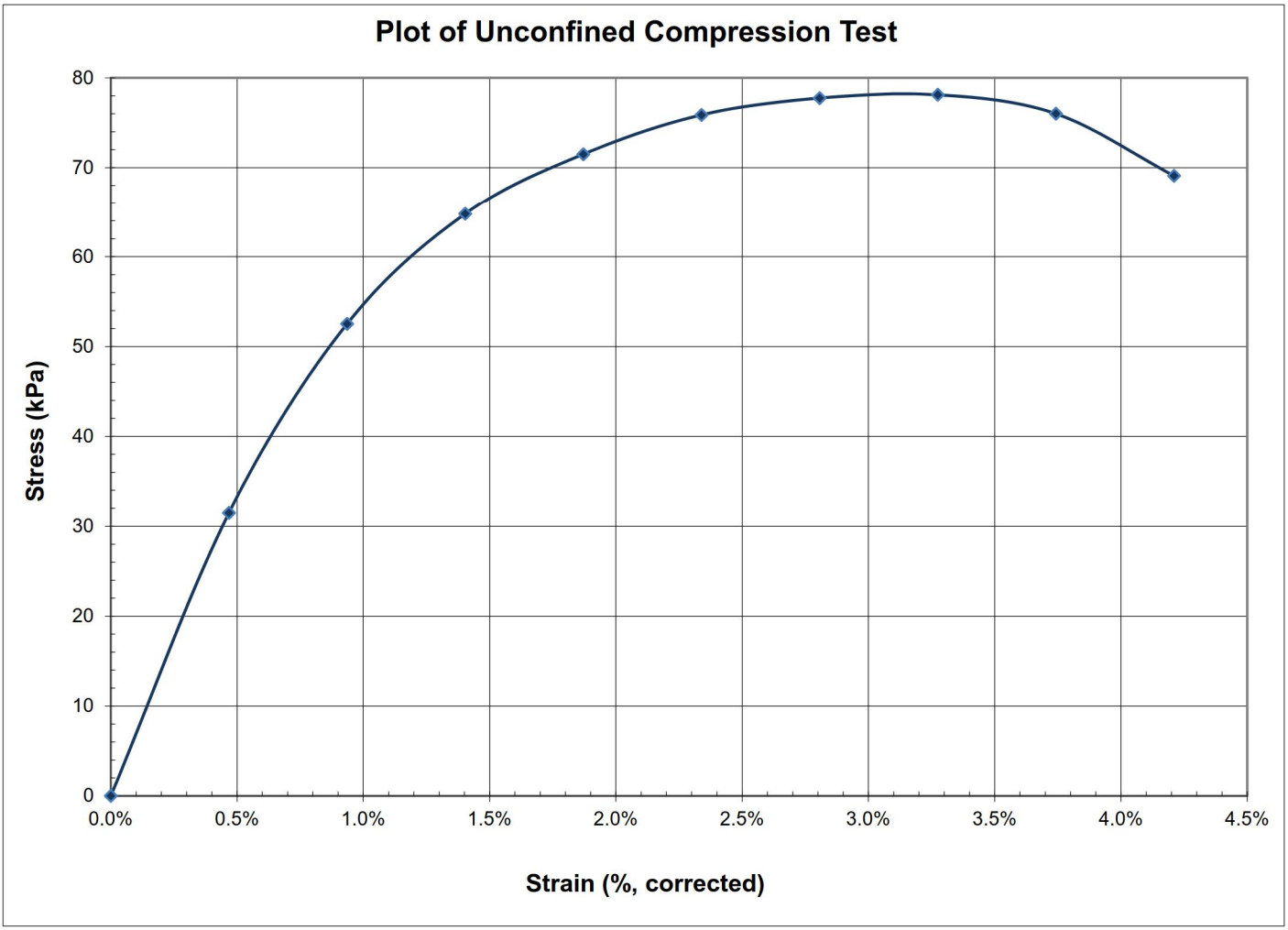
Source:

Visual Description of Sample: (CI) SILTY CLAY, trace sand and gravel, mottled brown-grey, FILL, cohesive, w~PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	78.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.3	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	39.1	Water Content (%):	N/A
Water Content (%):	44.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

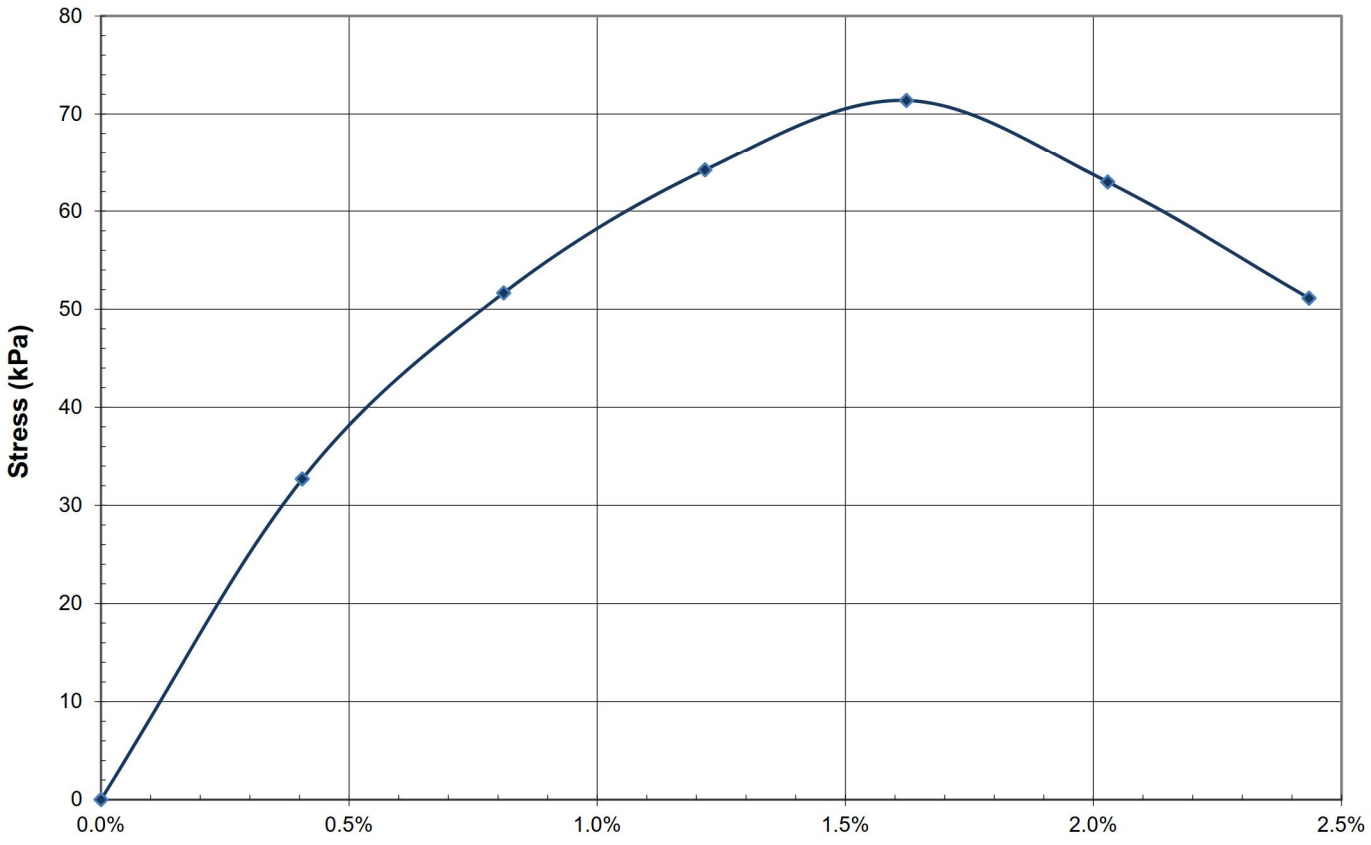
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-009 Sample #: 009-09
Source:
Visual Description of Sample: (CH) silty CLAY, grey-brown, cohesive, w~PL, soft.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	71.4	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.6	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	35.7	Water Content (%):	N/A
Water Content (%):	56.1		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
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Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-009 Sample #: 009-13

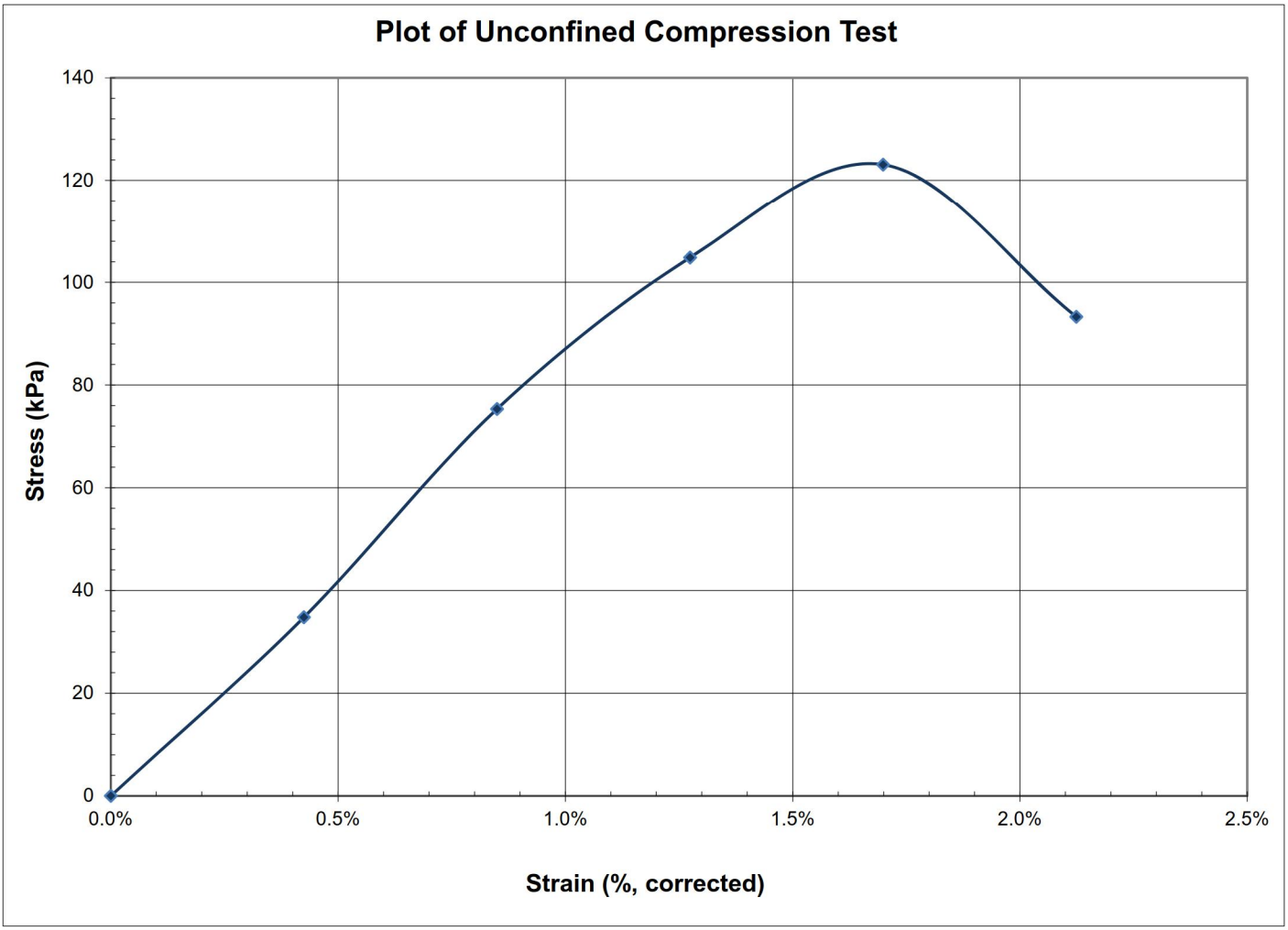
Source:

Visual Description of Sample: (CH) silty CLAY, grey-brown, cohesive, w~PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	123.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.7	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	61.5	Water Content (%):	N/A
Water Content (%):	48.6		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-009 Sample #: 009-17

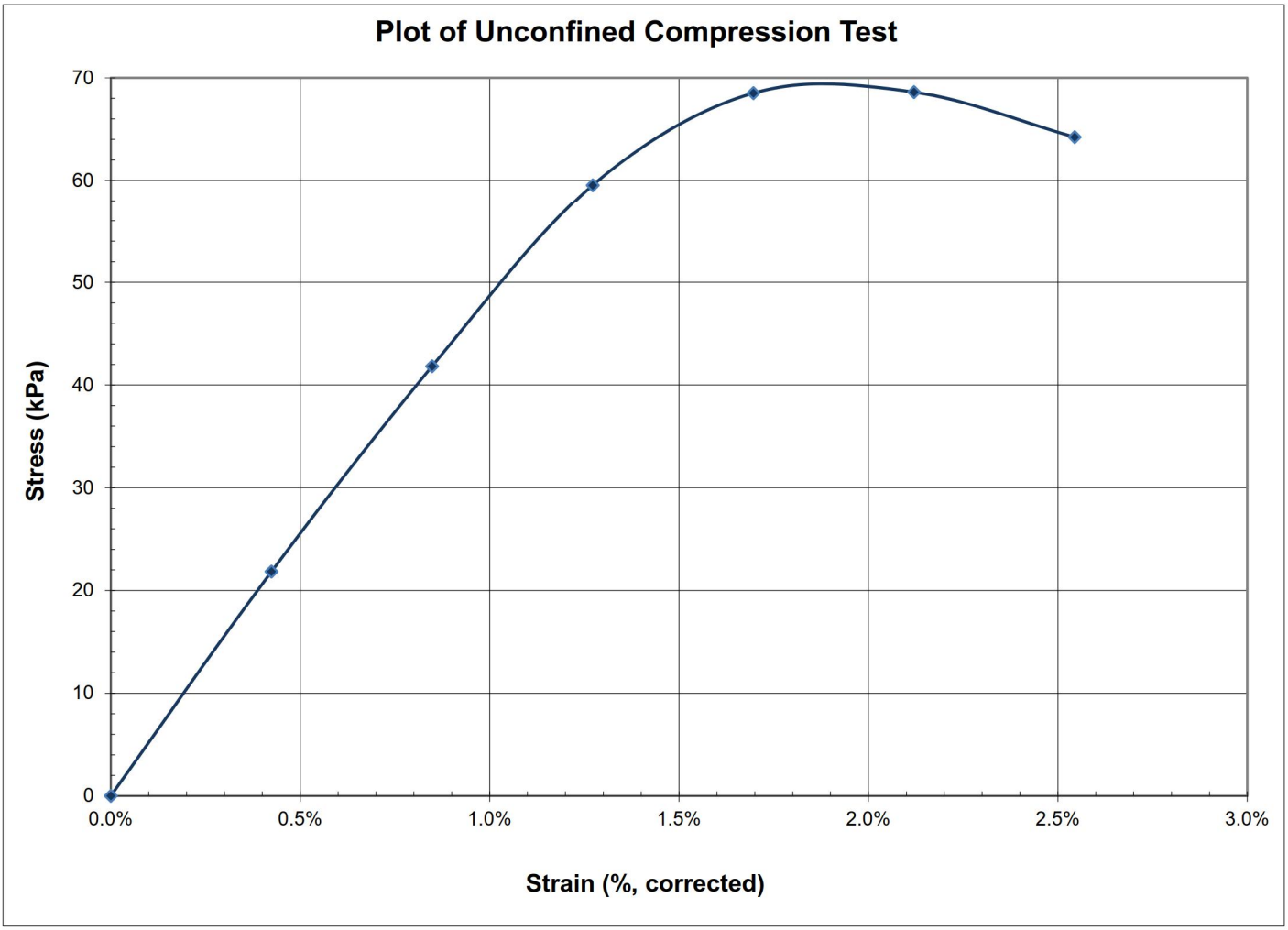
Source:

Visual Description of Sample: (CH) silty CLAY, grey, cohesive, w~PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	68.6	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.1	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	34.3	Water Content (%):	N/A
Water Content (%):	47.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by:

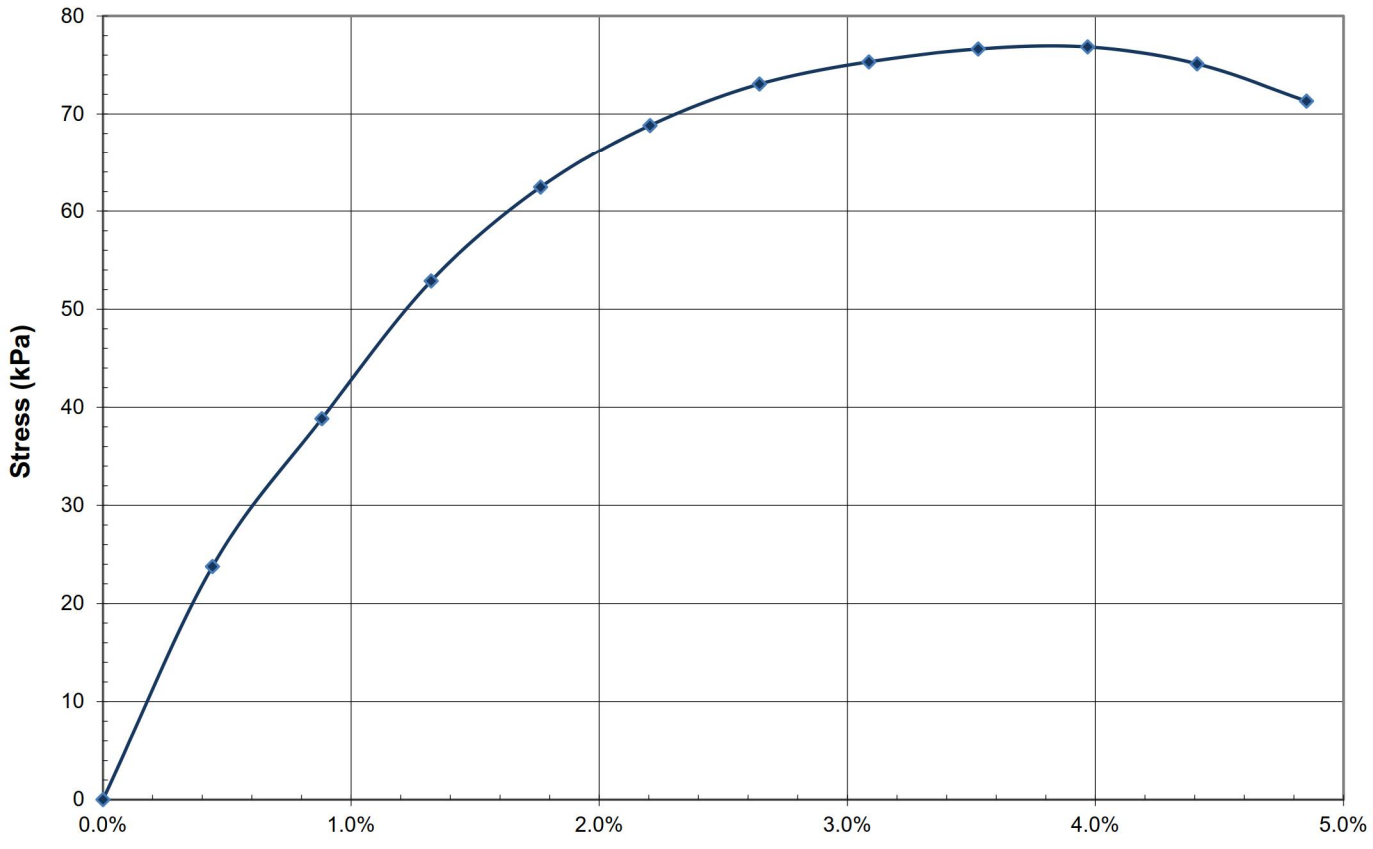
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-010 Sample #: 010-04
Source:
Visual Description of Sample:(CI) SILTY CLAY, some organics, trace sand and gravel, brown to grey, cohesive w~PL, stiff.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	76.8	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	4.0	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	38.4	Water Content (%):	N/A
Water Content (%):	53.0		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-010 Sample #: 010-08

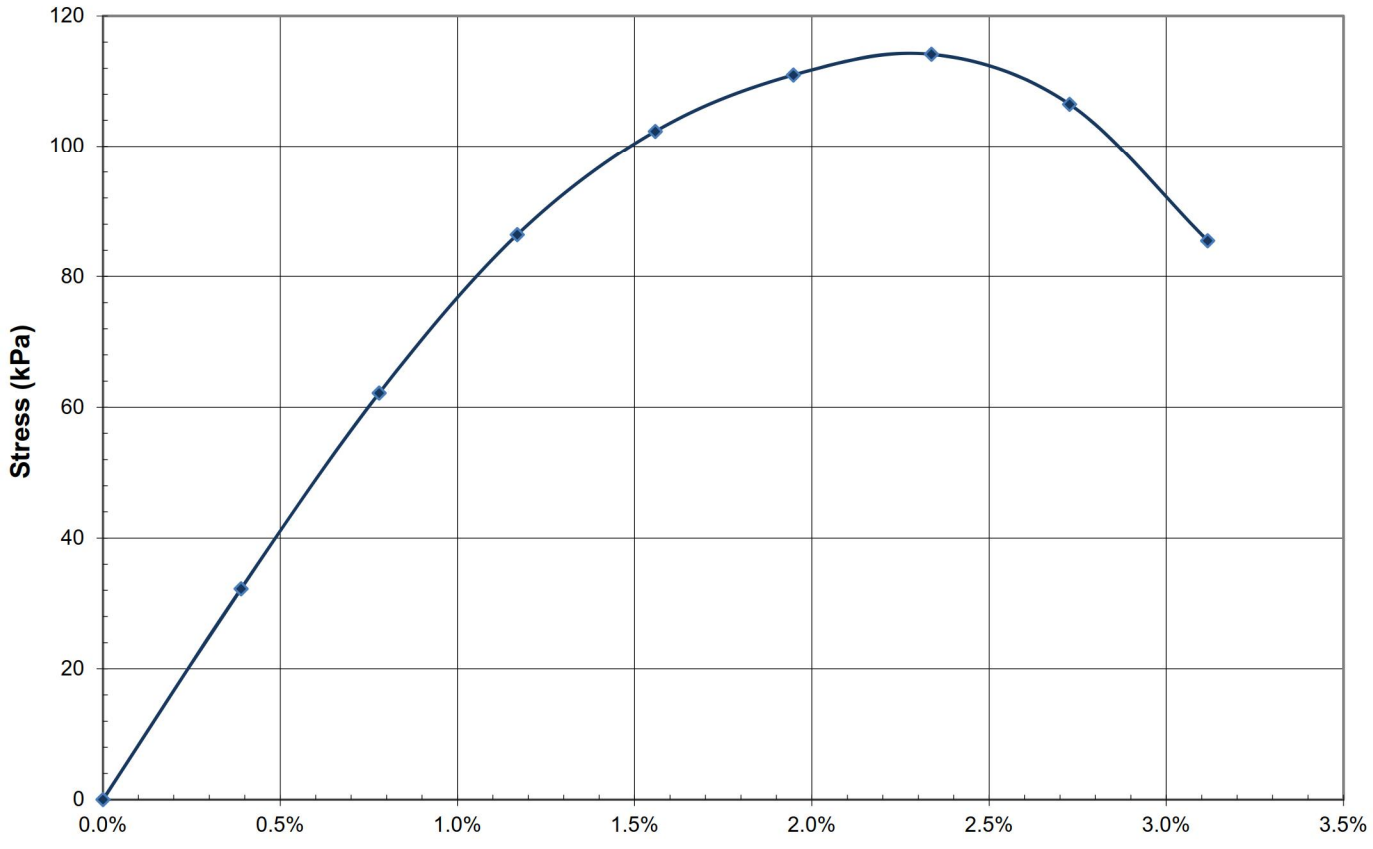
Source:

Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w~PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	114.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.3	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	57.1	Water Content (%):	N/A
Water Content (%):	53.8		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-010 Sample #: 010-12

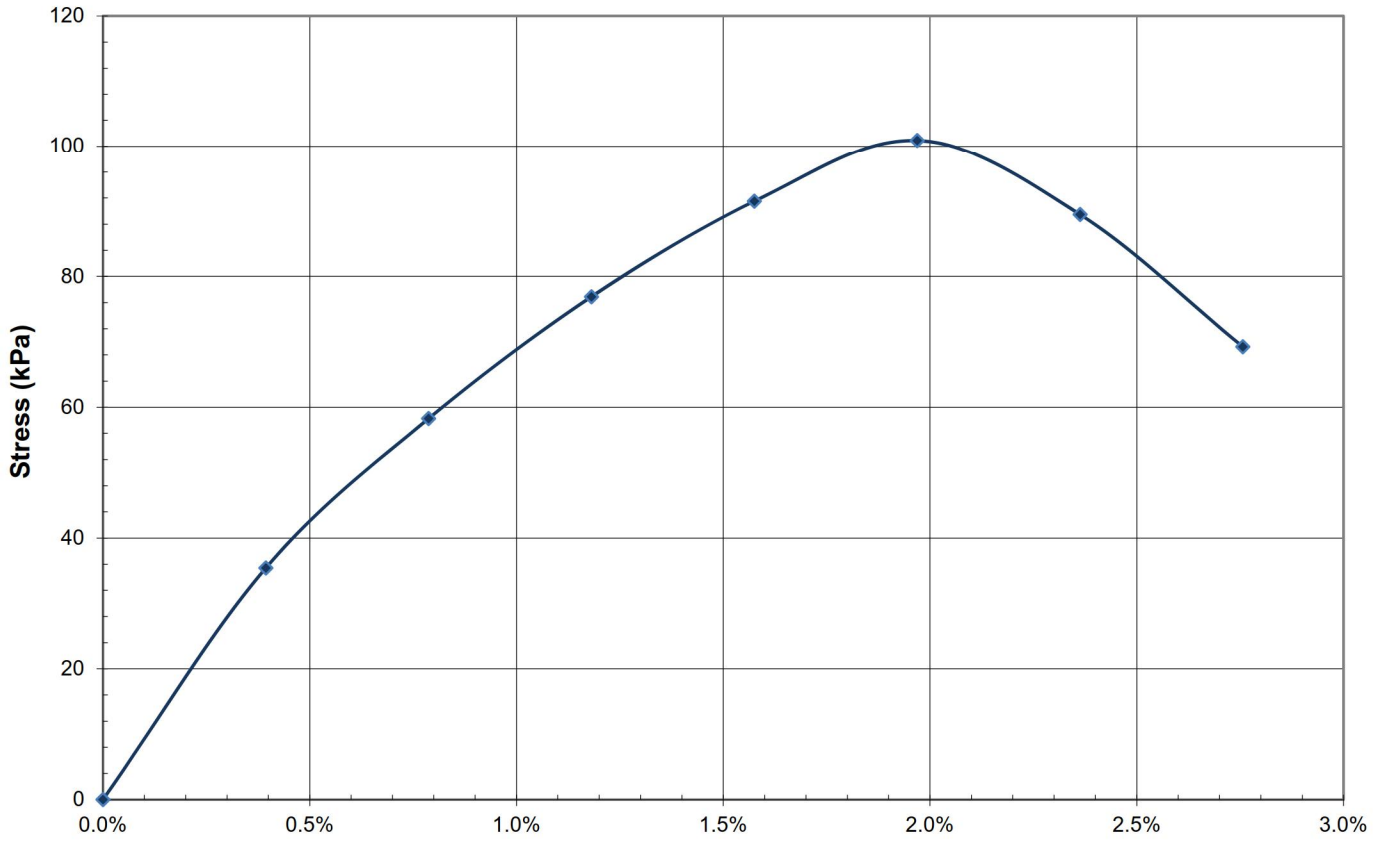
Source:

Visual Description of Sample: (CH) silty CLAY, grey, cohesive, w~PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	100.9	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.0	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	50.5	Water Content (%):	N/A
Water Content (%):	50.7		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-010 Sample #: 010-16

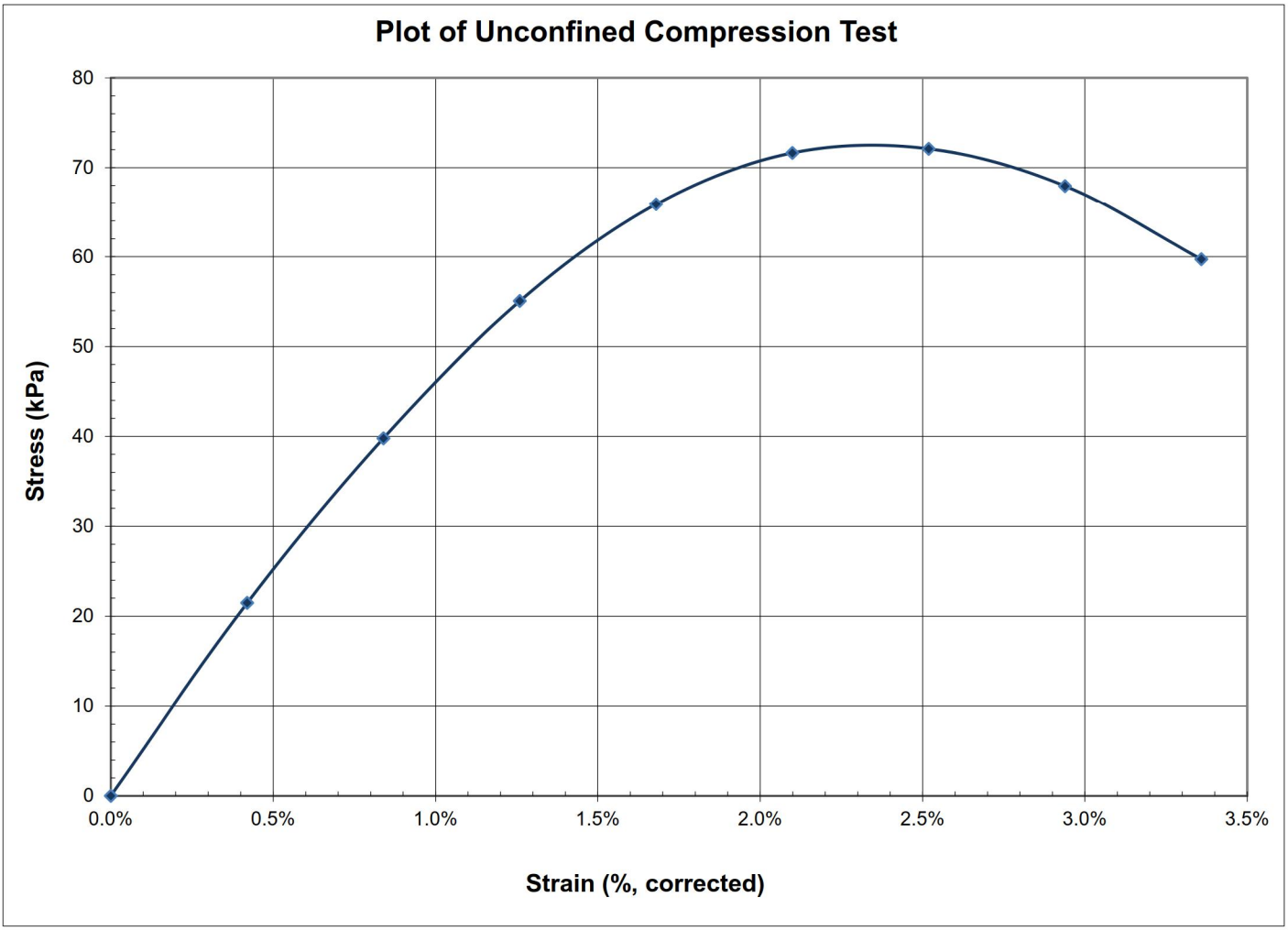
Source:

Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w~PL, firm.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	72.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.5	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	36.0	Water Content (%):	N/A
Water Content (%):	62.9		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-011 Sample #: 011-05

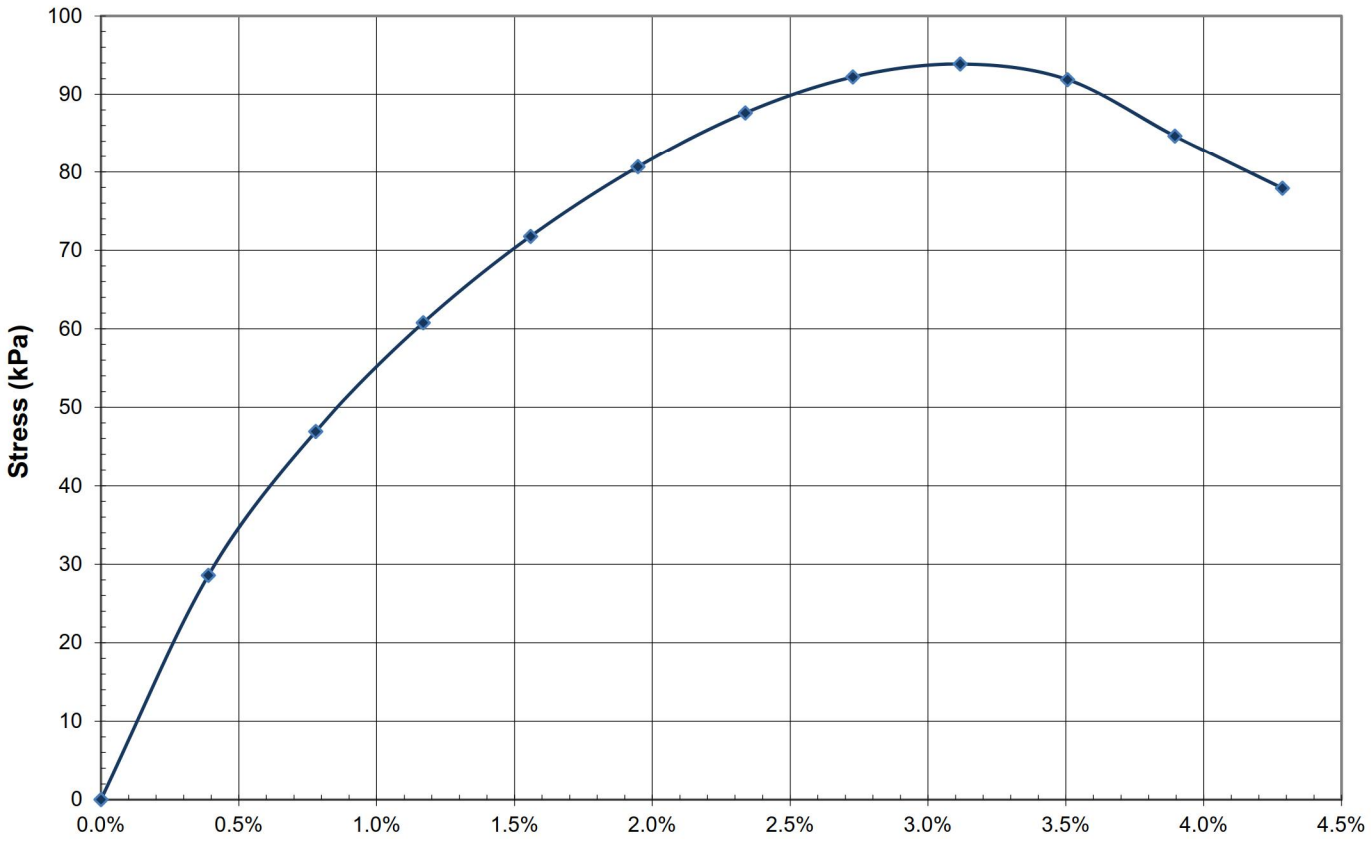
Source:

Visual Description of Sample: (CH) CLAY, some silt nodules, grey, cohesive, w>PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	93.9	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.1	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	46.9	Water Content (%):	N/A
Water Content (%):	52.0		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

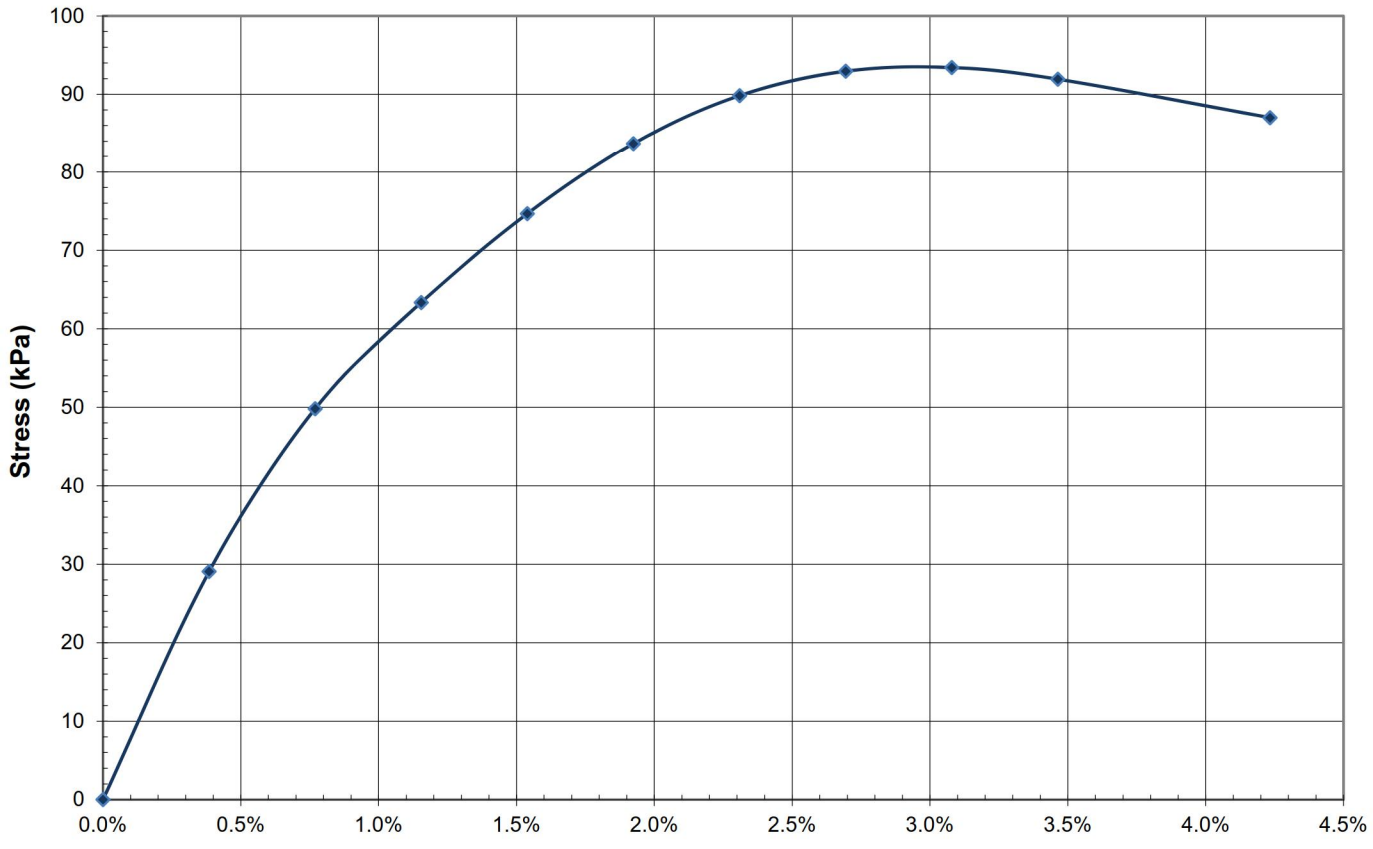
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-011 Sample #: 011-09
Source:
Visual Description of Sample: (CH) CLAY, some silt nodules, grey, cohesive w>PL, soft.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	93.4	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	3.1	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	46.7	Water Content (%):	N/A
Water Content (%):	58.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-012 Sample #: 012-07

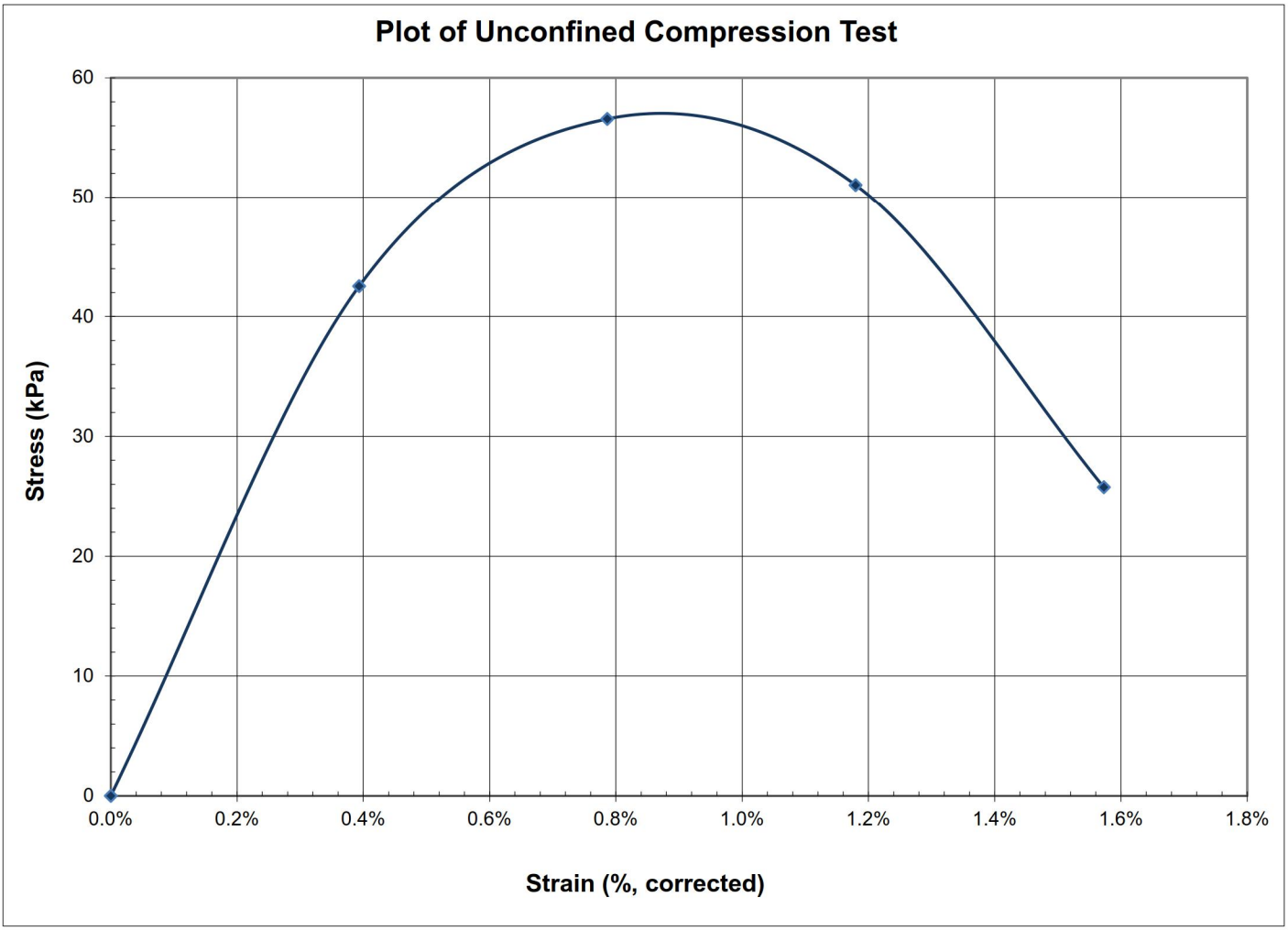
Source:

Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w~PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	56.6	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	0.8	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	28.3	Water Content (%):	N/A
Water Content (%):	49.6		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-012 Sample #: 012-09

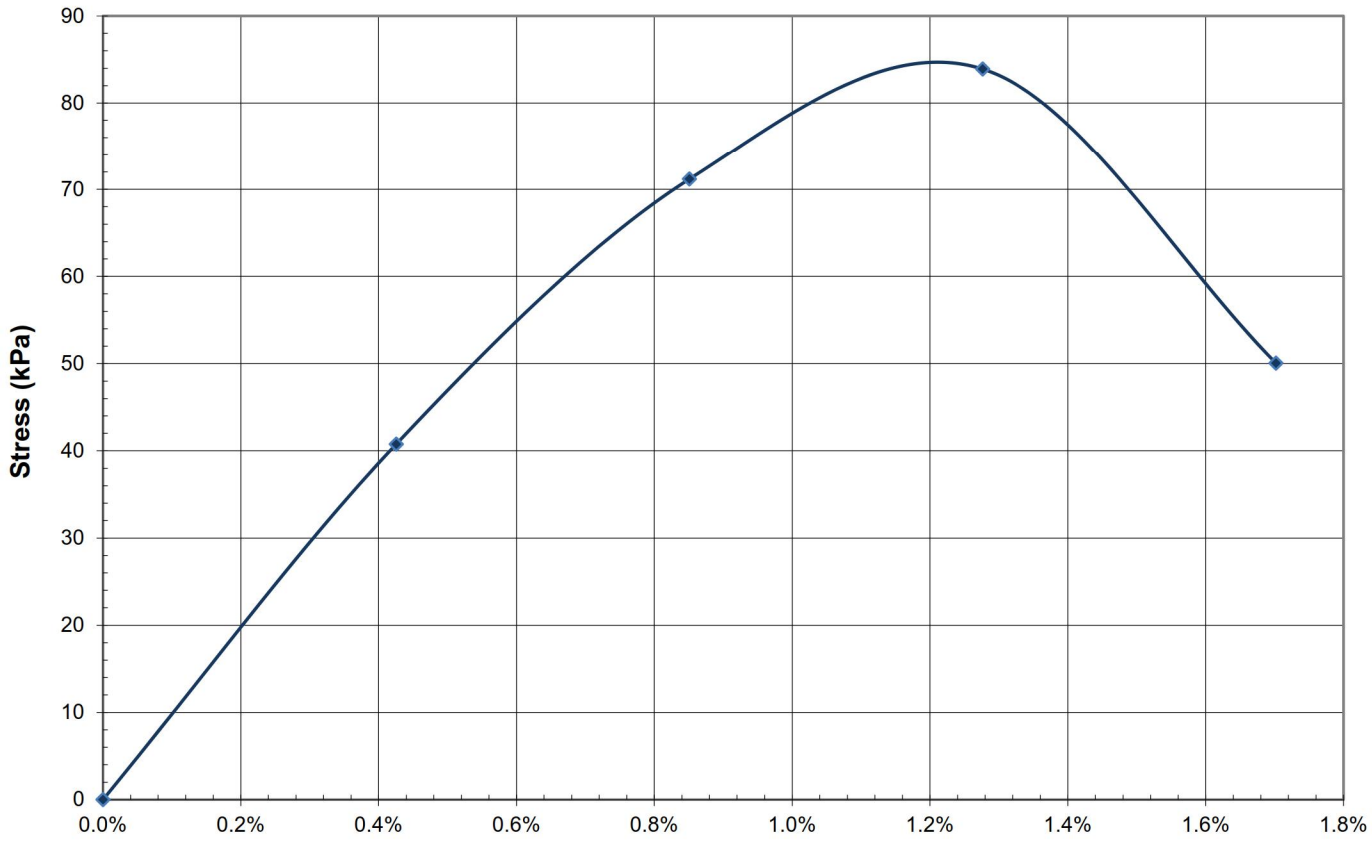
Source:

Visual Description of Sample: (CH) silty CLAY, mottled grey-brown, cohesive, w~PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	83.9	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.3	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	42.0	Water Content (%):	N/A
Water Content (%):	49.0		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

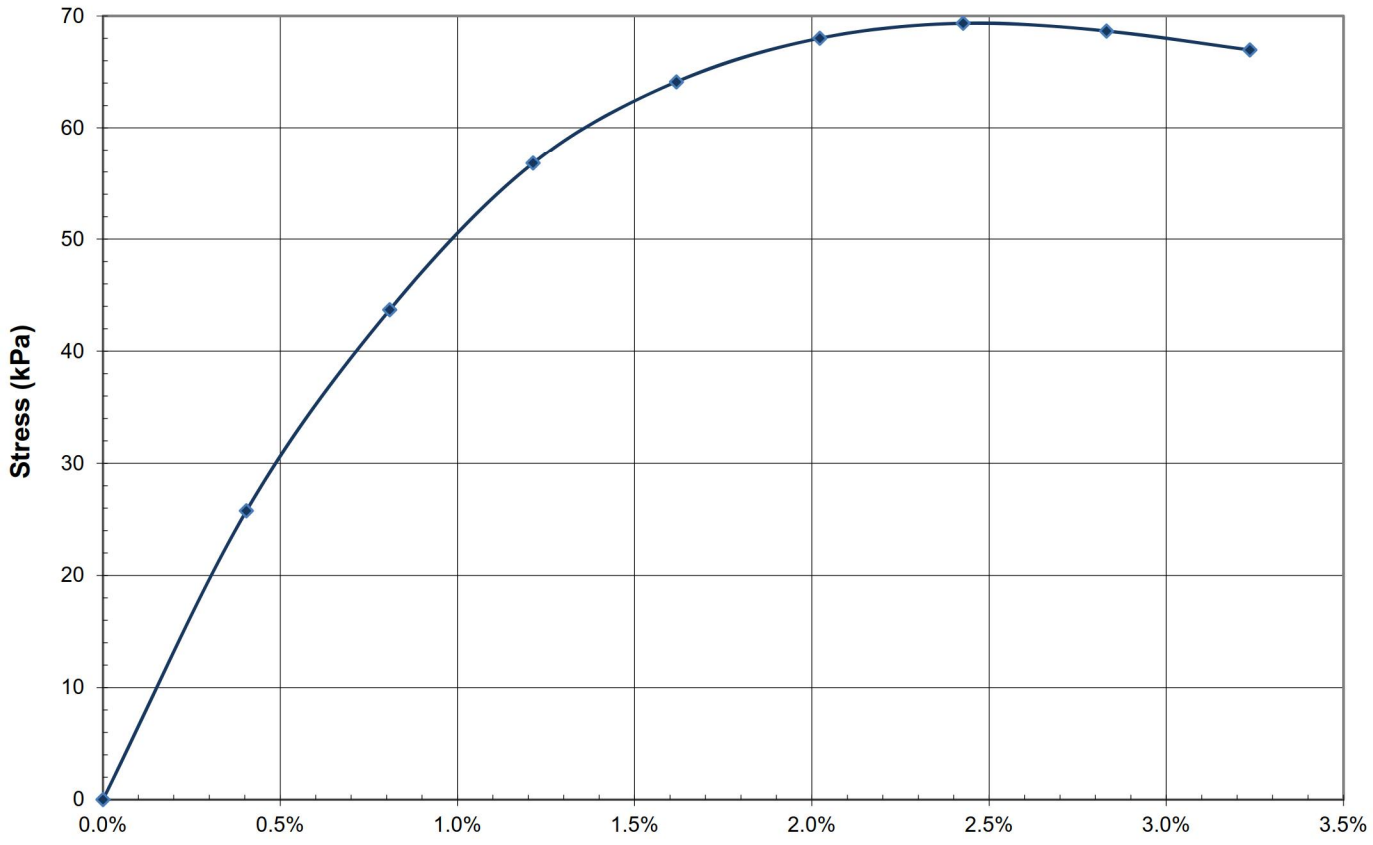
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-012 Sample #: 012-13
Source:
Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w~PL, soft.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	69.3	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.4	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	34.7	Water Content (%):	N/A
Water Content (%):	44.6		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-013 Sample #: 013-05

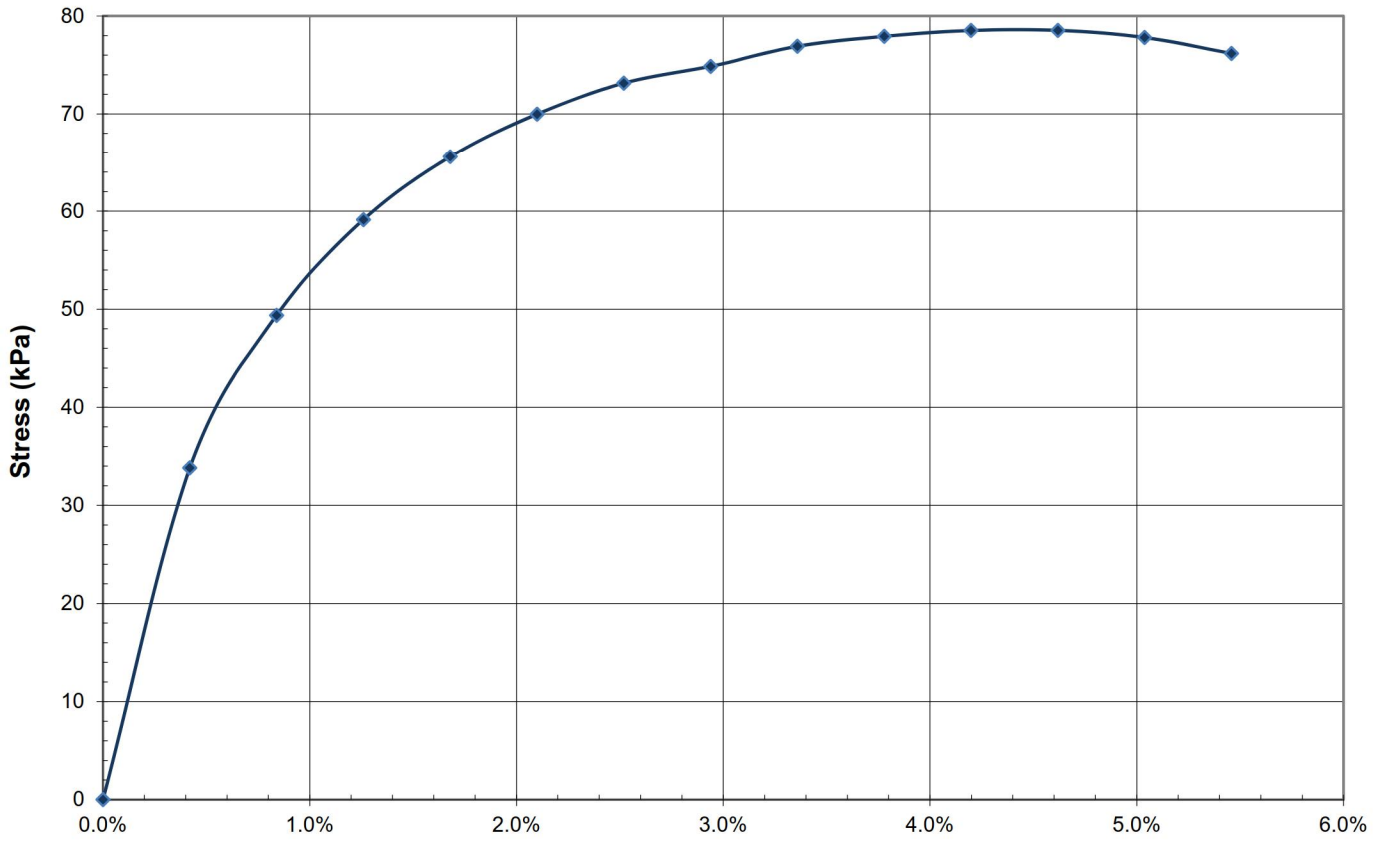
Source:

Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w~PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	78.5	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	4.6	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	39.3	Water Content (%):	N/A
Water Content (%):	58.7		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-013 Sample #: 013-07

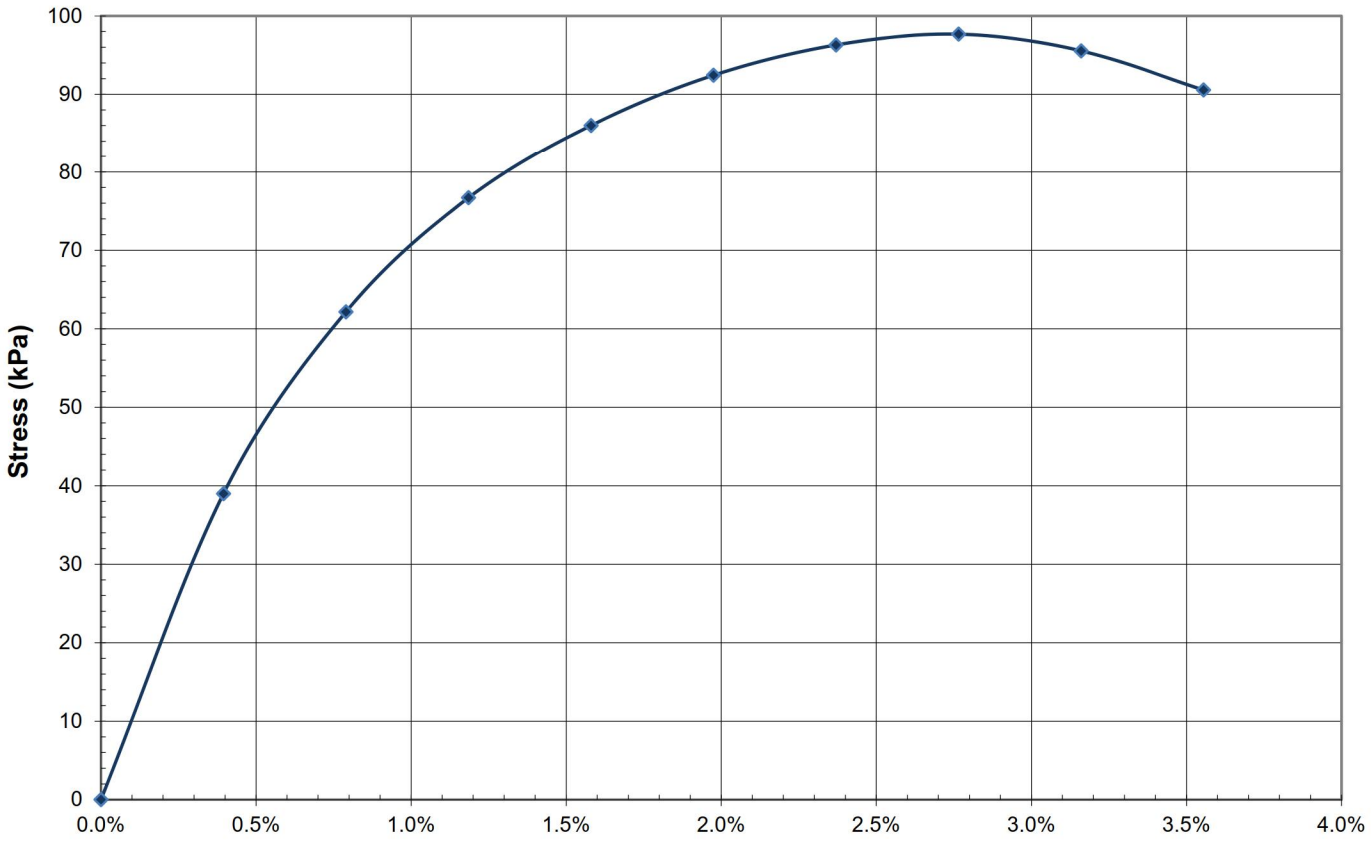
Source:

Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w~PL, soft.

Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	97.7	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.8	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	48.8	Water Content (%):	N/A
Water Content (%):	52.3		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

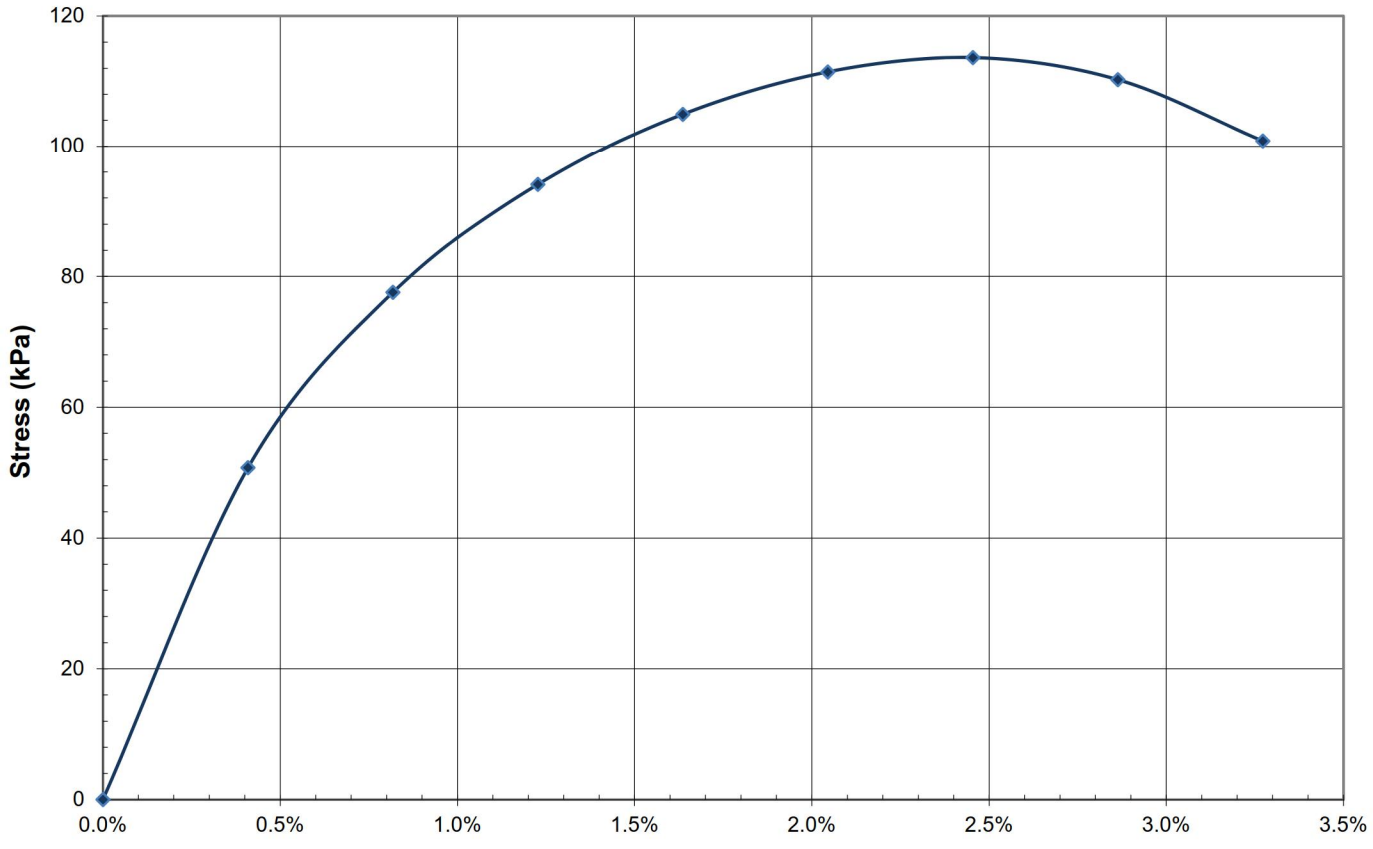
Unconfined Compression

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested by: B.K. Date: November 23, 2015

Borehole #: TH-15-013 Sample #: 013-09
Source:
Visual Description of Sample: (CH) silty CLAY, brown, cohesive, w~PL, soft.
Date Sample Received: November 5, 2015

Compressive Stress at Failure (kPa):	113.6	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.5	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	56.8	Water Content (%):	N/A
Water Content (%):	49.9		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-014 Sample #: 014-06

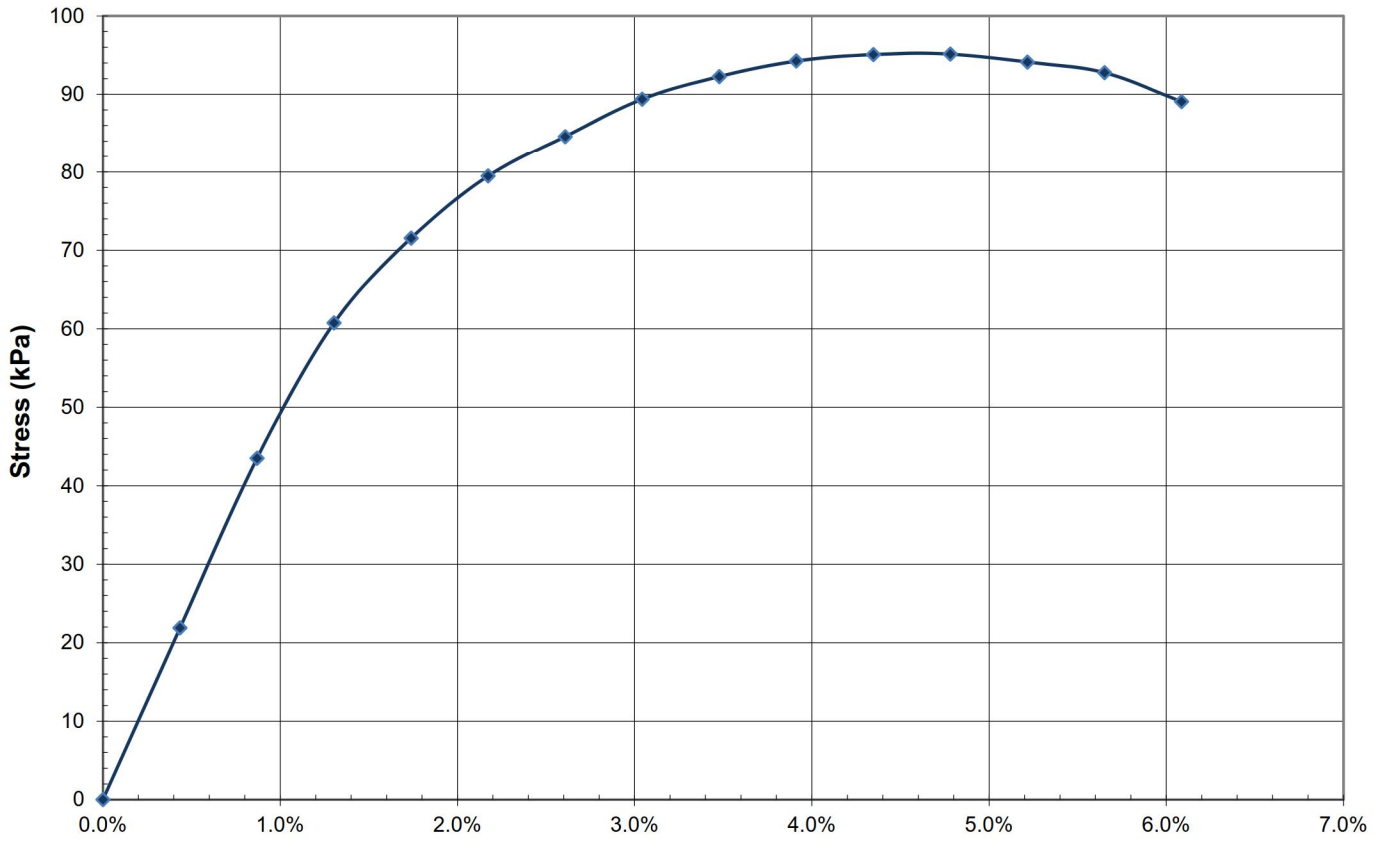
Source:

Visual Description of Sample: (CH) CLAY, high plastic, brown, cohesive, w>PL, firm to soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	95.1	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	4.8	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	47.6	Water Content (%):	N/A
Water Content (%):	51.1		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-014 Sample #: 014-11

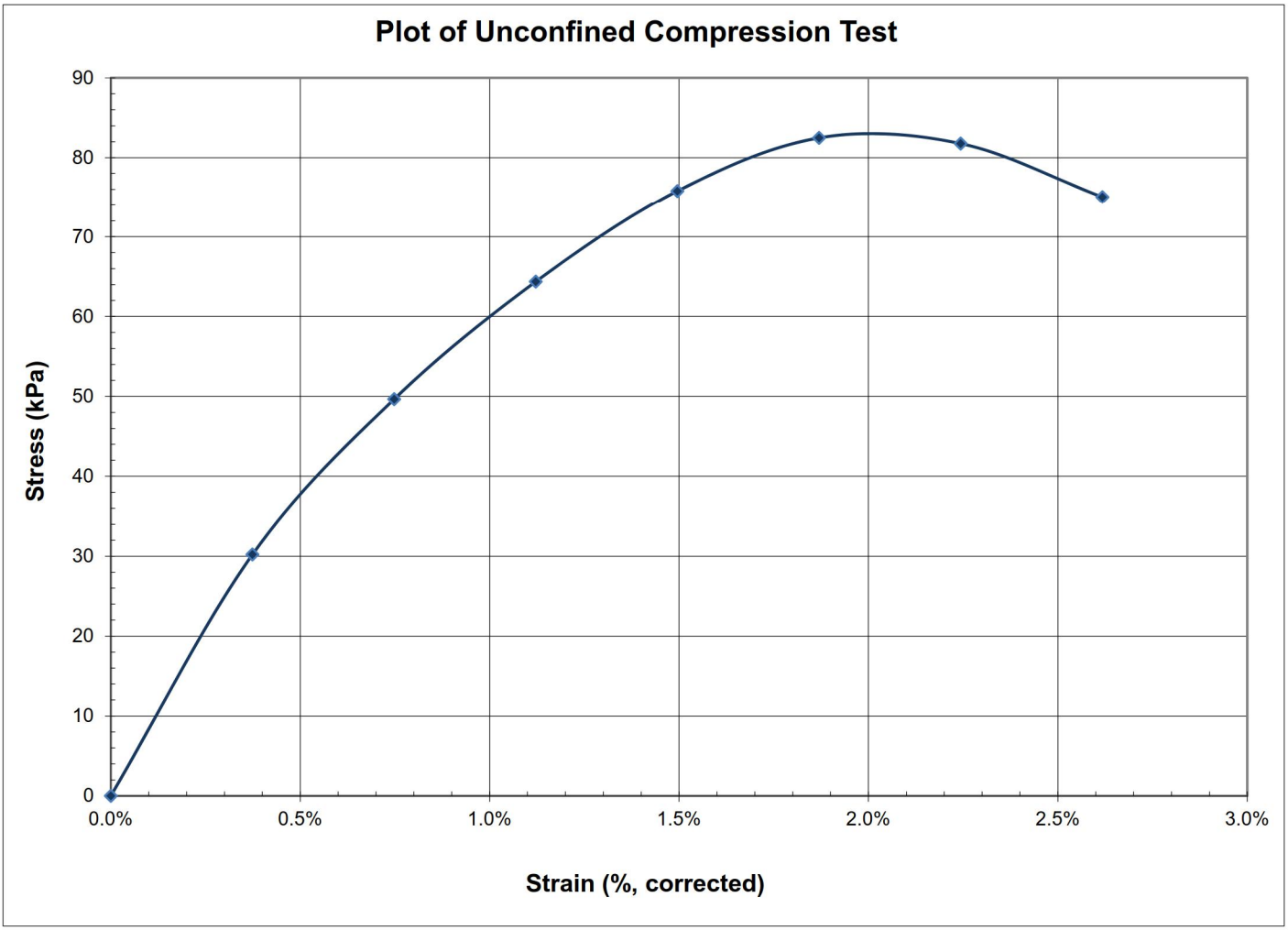
Source:

Visual Description of Sample: (CH) CLAY, high plastic, grey, white nodules, oxidation staining, cohesive, w>PL, soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	82.5	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	1.9	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	41.2	Water Content (%):	N/A
Water Content (%):	52.0		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-014 Sample #: 014-15

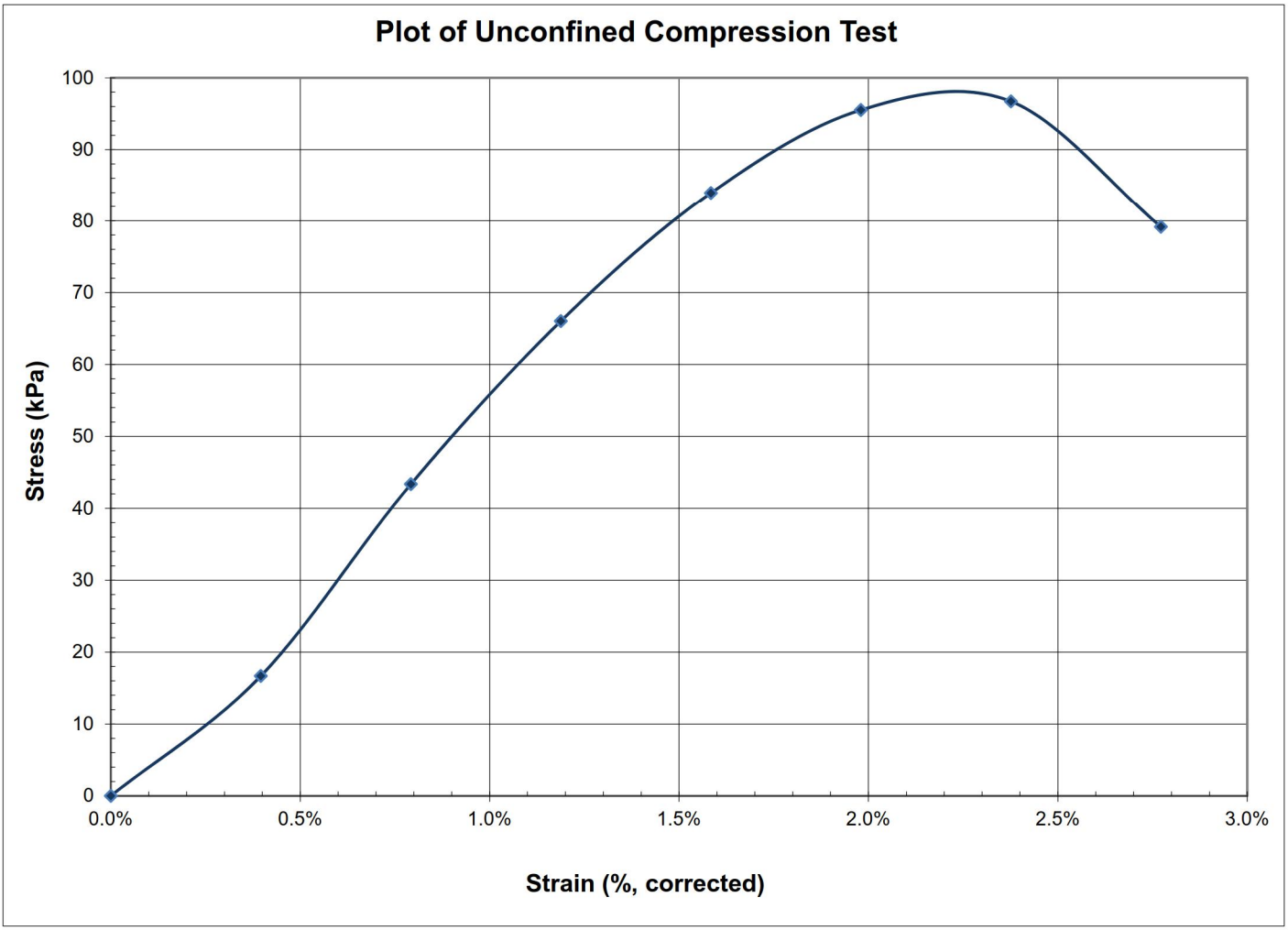
Source:

Visual Description of Sample: (CH) CLAY, high plastic, grey, white nodules, oxidation staining, cohesive, w>PL, soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	96.7	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.4	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	48.4	Water Content (%):	N/A
Water Content (%):	56.2		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

Unconfined Compression

Project #: 1537312 Phase: 2000

Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB

Tested by: S.H. Date: October 28, 2015

Borehole #: TH-15-014 Sample #: 014-21

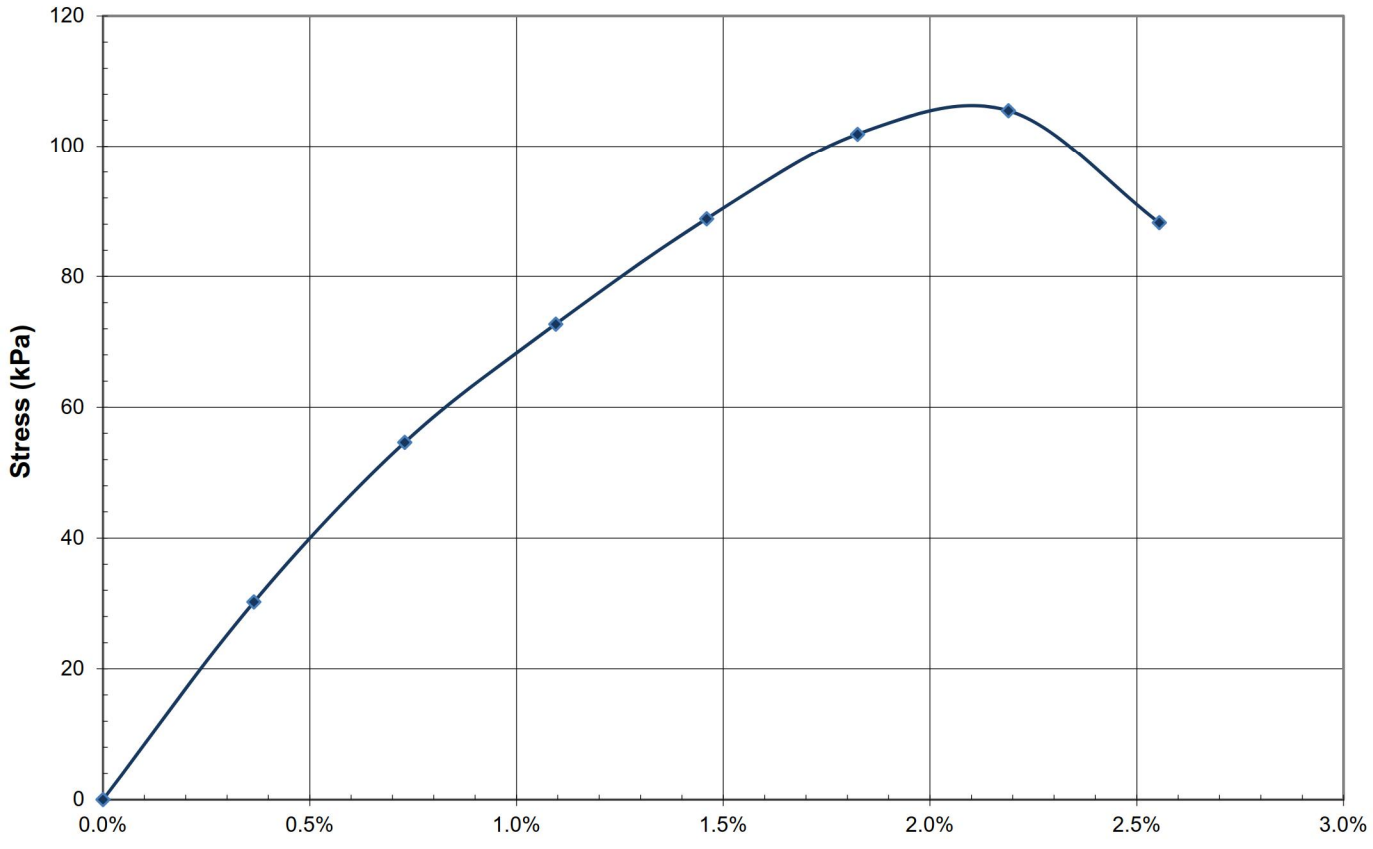
Source:

Visual Description of Sample: (CH) CLAY, high plastic, grey, white nodules, oxidation staining, cohesive, w>PL, soft.

Date Sample Received: October 25, 2015

Compressive Stress at Failure (kPa):	105.5	Compressive Stress at 15% Strain (kPa):	N/A
Strain at Failure (%):	2.2	Undrained Shear Strength (kPa):	N/A
Undrained Shear Strength (kPa):	52.7	Water Content (%):	N/A
Water Content (%):	60.2		

Plot of Unconfined Compression Test



Comments:

1721 8th Street E.,
Saskatoon, Saskatchewan S7H 0T4

Reviewed by: _____

ONE-DIMENSIONAL CONSOLIDATION TEST

Project #:	1537312	Phase:	2000
Short Title:	Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB		
Tested By:	B.Y.	Date:	December 14, 2015
Sample:	TH-15-002 002-06 3.05-3.66 m depth		

Test Results:

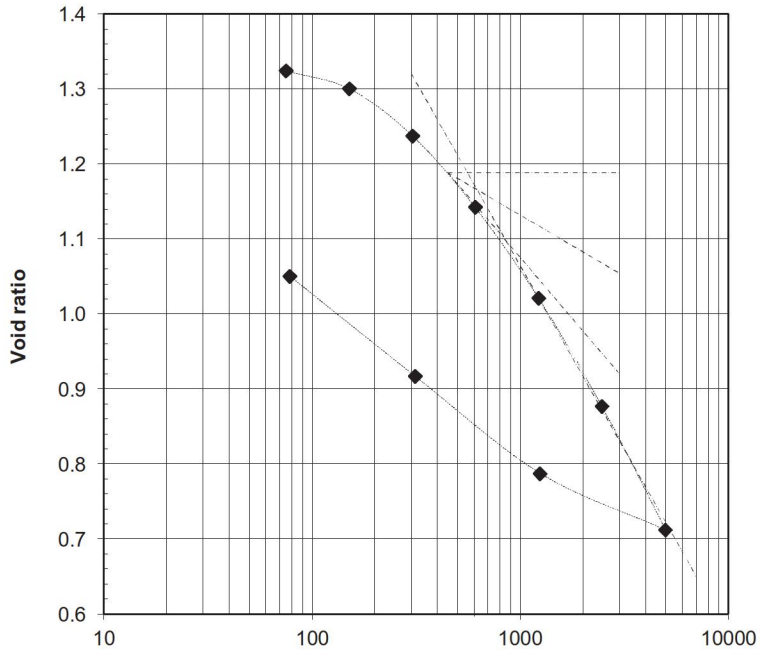
Void Ratio versus Stress		Coefficient of Consolidation	
Effective Stress (kPa)	Void Ratio	Average Void Ratio	c_v (cm^2/s)
75	1.32		
152	1.30	1.31	6.2E-04
304	1.24	1.27	2.8E-04
609	1.14	1.19	1.3E-04
1228	1.02	1.08	1.1E-04
2475	0.88	0.95	7.1E-05
5000	0.71	0.79	4.6E-05
1250	0.79		
313	0.92		
78	1.05		

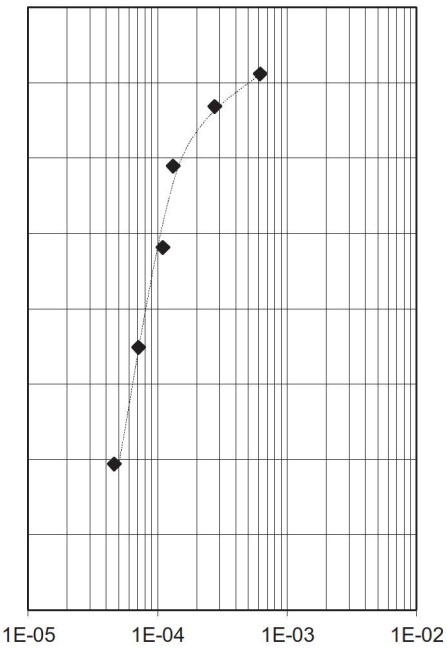
Sample Data:

Specific gravity:	2.75	(assumed)
Diameter:	63.7	mm
Initial height:	25.3	mm
Initial water content:	47.0	% (prior to saturation)
Initial dry density:	1183	kg/m^3 (prior to loading)
Initial void ratio:	1.32	(prior to loading)
Final water content:	42.1	%
Final dry density:	1344	kg/m^3

Estimated Preconsolidation Pressure: 600 kPa

Comments:





1721 8th Street E.,
Saskatoon, Saskatchewan, S7H 0T4

Reviewed by:

ONE-DIMENSIONAL CONSOLIDATION TEST

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT II Geotechnical Investigation / Winnipeg, MB
Tested By: D.B. Date: November 30, 2015
Sample: TH-15-006 006-08 6.10-6.71 m depth

Test Results:

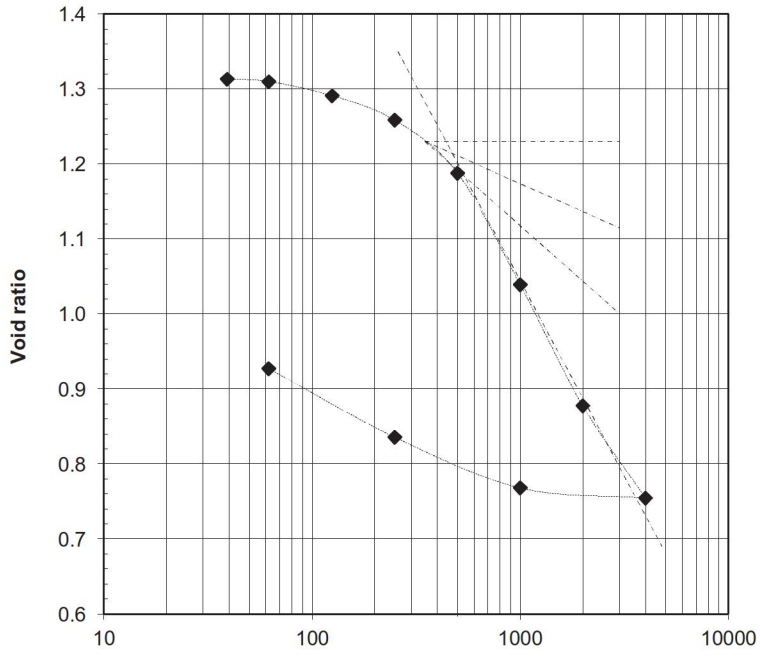
Void Ratio versus Stress		Coefficient of Consolidation	
Effective Stress (kPa)	Void Ratio	Average Void Ratio	c_v (cm^2/s)
39	1.31		
62	1.31	1.31	8.7E-03
125	1.29	1.30	3.6E-03
250	1.26	1.27	2.7E-03
500	1.19	1.22	9.2E-04
1000	1.04	1.11	4.3E-04
2000	0.88	0.96	3.5E-04
4000	0.75	0.82	2.3E-04
1000	0.77		
250	0.84		
62	0.93		

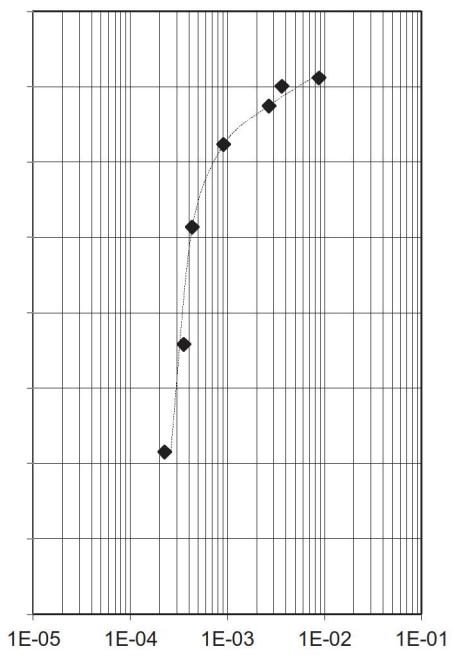
Sample Data:

Specific gravity:	2.75	(assumed)
Diameter:	64.2	mm
Initial height:	24.6	mm
Initial water content:	47.9	% (prior to saturation)
Initial dry density:	1189	kg/m^3 (prior to loading)
Initial void ratio:	1.31	(prior to loading)
Final water content:	35.7	%
Final dry density:	1428	kg/m^3

Estimated Preconsolidation Pressure: 500 kPa

Comments:





1721 8th Street E.,
Saskatoon, Saskatchewan, S7H 0T4

Reviewed by:

ONE-DIMENSIONAL CONSOLIDATION TEST

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT II Geotechnical Investigation / Winnipeg, MB
Tested By: B.Y. / D.B. Date: December 9, 2015
Sample: TH-15-006 006-16 12.19-12.80 m depth

Test Results:

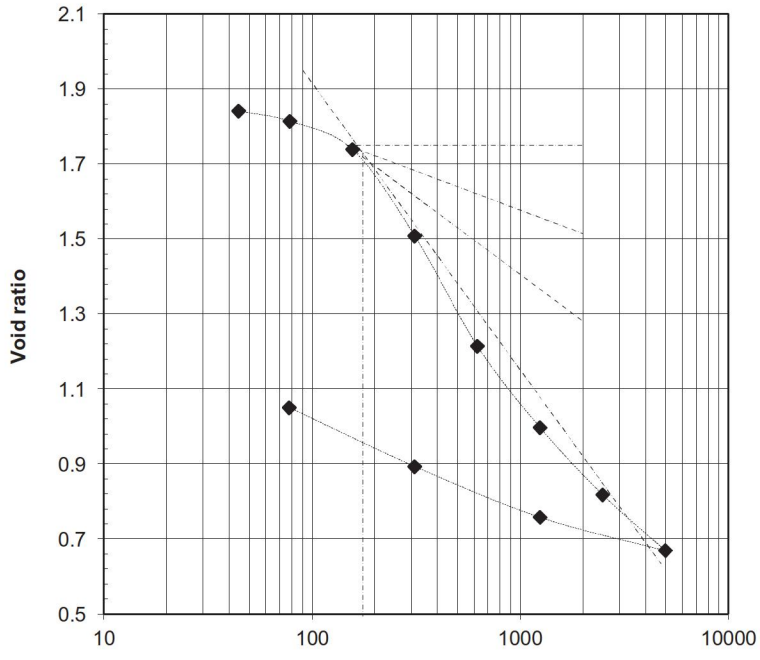
Void Ratio versus Stress		Coefficient of Consolidation	
Effective Stress (kPa)	Void Ratio	Average Void Ratio	c_v (cm^2/s)
45	1.84		
78	1.81	1.83	4.5E-04
156	1.74	1.78	3.0E-04
312	1.51	1.62	5.1E-05
624	1.21	1.36	3.2E-05
1249	1.00	1.10	3.1E-05
2500	0.82	0.91	2.5E-05
5000	0.67	0.74	2.4E-05
1250	0.76		
312	0.89		
78	1.05		

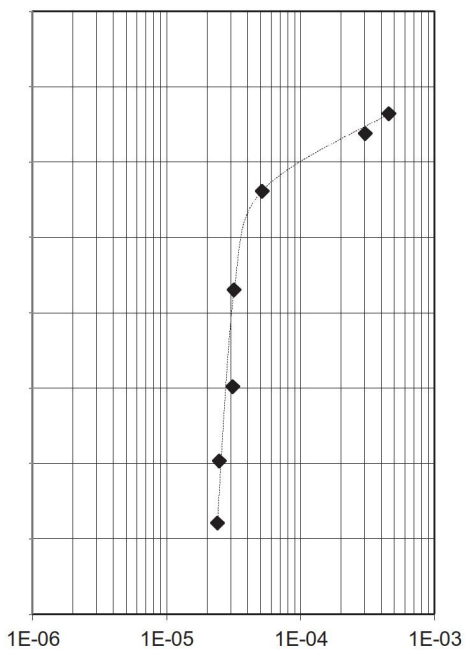
Sample Data:

Specific gravity:	2.75	(assumed)
Diameter:	63.9	mm
Initial height:	25.0	mm
Initial water content:	67.3	% (prior to saturation)
Initial dry density:	968	kg/m^3 (prior to loading)
Initial void ratio:	1.84	(prior to loading)
Final water content:	42.1	%
Final dry density:	1343	kg/m^3

Estimated Preconsolidation Pressure: 175 kPa

Comments:





1721 8th Street E.,
Saskatoon, Saskatchewan, S7H 0T4

Reviewed by:

ONE-DIMENSIONAL CONSOLIDATION TEST

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT II Geotechnical Investigation / Winnipeg, MB
Tested By: B.Y. / D.B. Date: November 26, 2015
Sample: TH-15-009 009-09 6.10-6.71 m depth

Test Results:

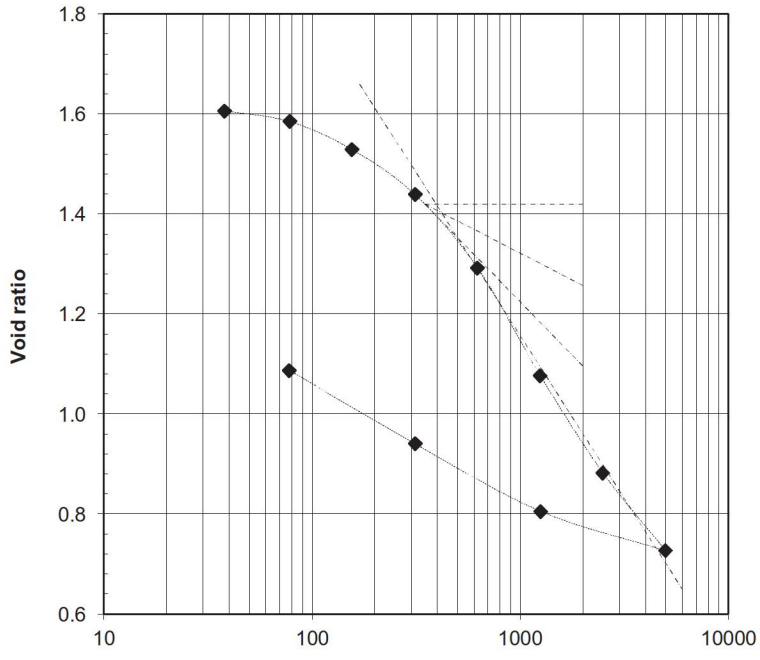
Void Ratio versus Stress		Coefficient of Consolidation	
Effective Stress (kPa)	Void Ratio	Average Void Ratio	c_v (cm^2/s)
38	1.61		
78	1.58		
156	1.53	1.56	4.9E-04
313	1.44	1.48	2.5E-04
624	1.29	1.37	1.8E-04
1249	1.08	1.18	9.4E-05
2500	0.88	0.98	8.1E-05
5000	0.73	0.80	6.7E-05
1251	0.81		
313	0.94		
78	1.09		

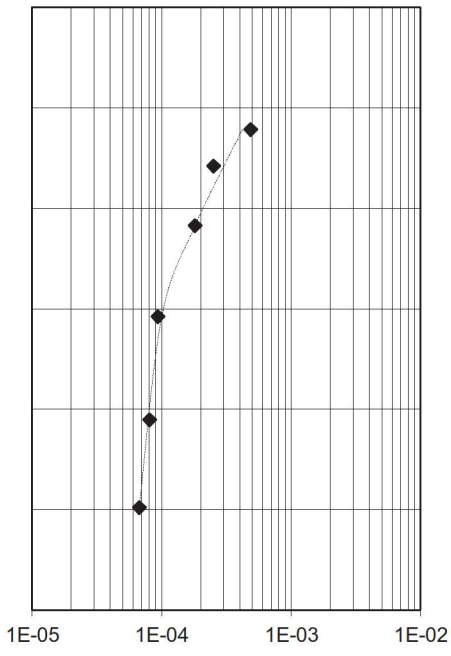
Sample Data:

Specific gravity:	2.75	(assumed)
Diameter:	64.1	mm
Initial height:	25.0	mm
Initial water content:	57.4	% (prior to saturation)
Initial dry density:	1055	kg/m^3 (prior to loading)
Initial void ratio:	1.61	(prior to loading)
Final water content:	41.0	%
Final dry density:	1314	kg/m^3

Estimated Preconsolidation Pressure: 400 kPa

Comments:





1721 8th Street E.,
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Reviewed by:

ONE-DIMENSIONAL CONSOLIDATION TEST

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested By: B.Y. Date: December 3, 2015
Sample: TH-15-009 009-17 12.19-12.80 m depth

Test Results:

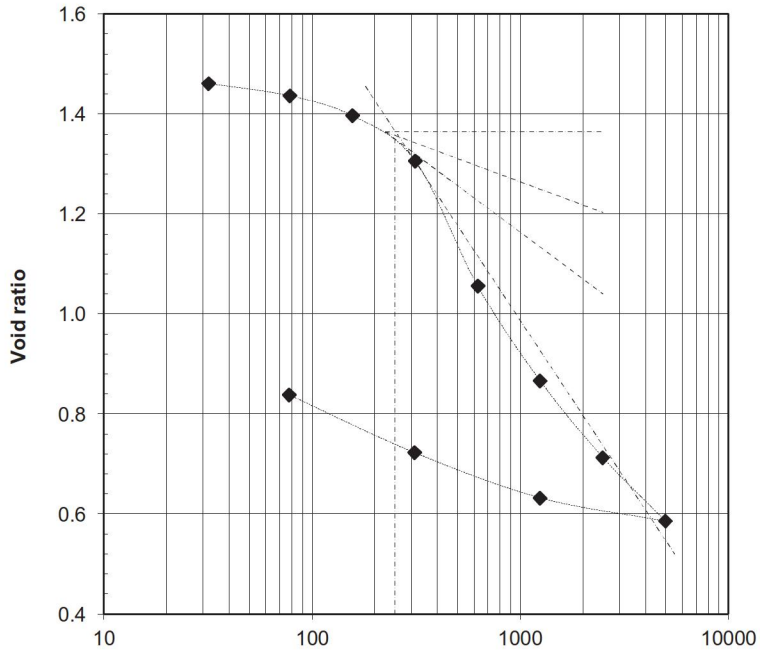
Void Ratio versus Stress		Coefficient of Consolidation	
Effective Stress (kPa)	Void Ratio	Average Void Ratio	c_v (cm^2/s)
32	1.46		
78	1.44	1.45	1.1E-03
156	1.40	1.42	6.6E-04
313	1.31	1.35	2.5E-04
626	1.06	1.18	7.2E-05
1250	0.87	0.96	7.7E-05
2498	0.71	0.79	6.9E-05
5001	0.59	0.65	5.8E-05
1250	0.63		
311	0.72		
78	0.84		

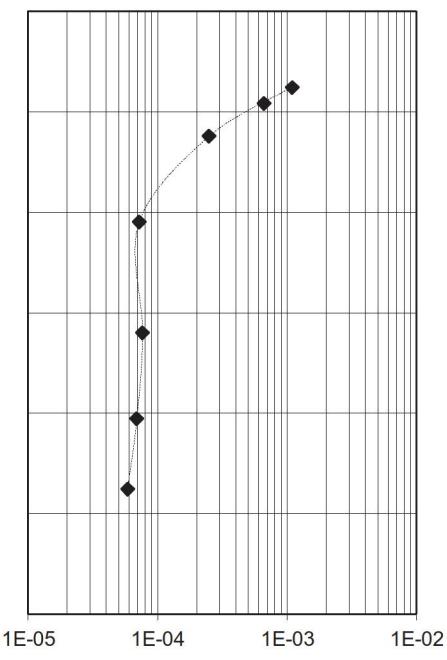
Sample Data:

Specific gravity:	2.75	(assumed)
Diameter:	63.9	mm
Initial height:	25.9	mm
Initial water content:	51.8	% (prior to saturation)
Initial dry density:	1117	kg/m^3 (prior to loading)
Initial void ratio:	1.46	(prior to loading)
Final water content:	32.1	%
Final dry density:	1498	kg/m^3

Estimated Preconsolidation Pressure: 250 kPa

Comments:





1721 8th Street E.,
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Reviewed by:

ONE-DIMENSIONAL CONSOLIDATION TEST

Project #: 1537312 Phase: 2000
Short Title: Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB
Tested By: B.Y. / D.B. Date: December 14, 2015
Sample: TH-15-014 014-15 9.14-9.75 m depth

Test Results:

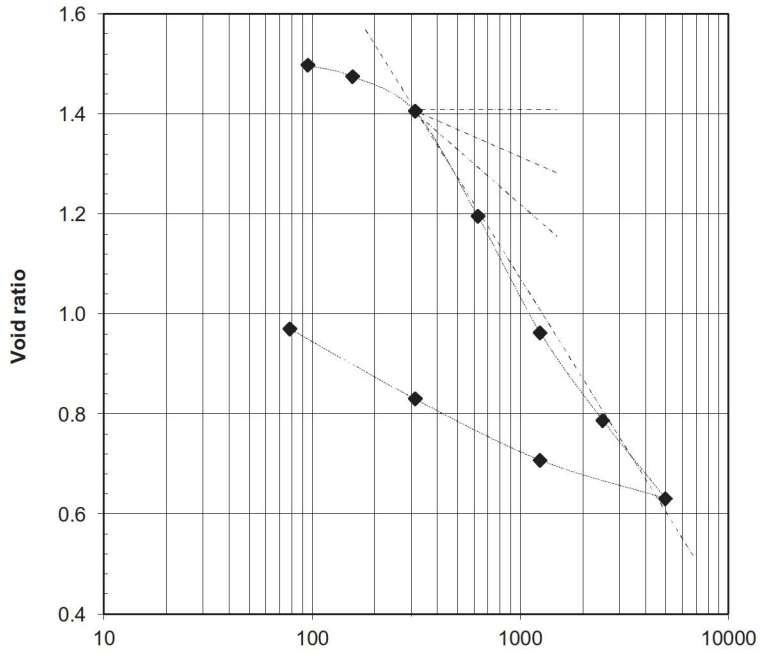
Void Ratio versus Stress		Coefficient of Consolidation	
Effective Stress (kPa)	Void Ratio	Average Void Ratio	c_v (cm^2/s)
95	1.50		
156	1.48	1.49	4.3E-04
313	1.41	1.44	3.1E-04
625	1.20	1.30	7.5E-05
1250	0.96	1.08	5.3E-05
2500	0.79	0.87	4.8E-05
5000	0.63	0.71	3.7E-05
1250	0.71		
312	0.83		
78	0.97		

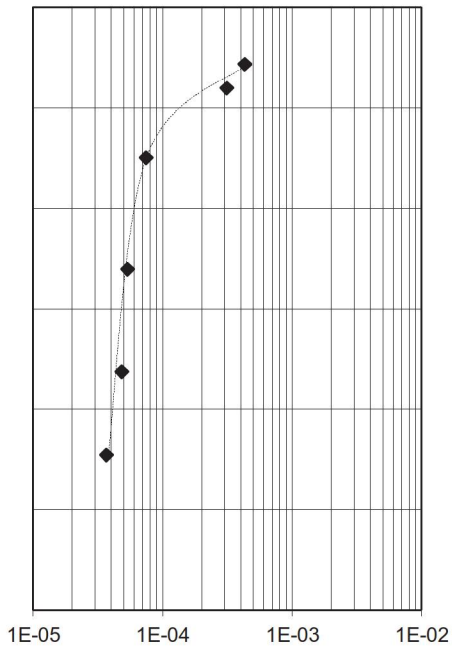
Sample Data:

Specific gravity:	2.75	(assumed)
Diameter:	63.8	mm
Initial height:	25.2	mm
Initial water content:	54.9	% (prior to saturation)
Initial dry density:	1101	kg/m^3 (prior to loading)
Initial void ratio:	1.50	(prior to loading)
Final water content:	38.2	%
Final dry density:	1398	kg/m^3

Estimated Preconsolidation Pressure: 300 kPa

Comments:





1721 8th Street E.,
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Reviewed by:

ONE-DIMENSIONAL CONSOLIDATION TEST

Project #:	1537312	Phase:	2000
Short Title:	Dillon / BRT Phase II Geotechnical Investigation / Winnipeg, MB		
Tested By:	B.Y.	Date:	December 14, 2015
Sample:	TH-15-014 014-011 6.25-6.71 m depth		

Test Results:

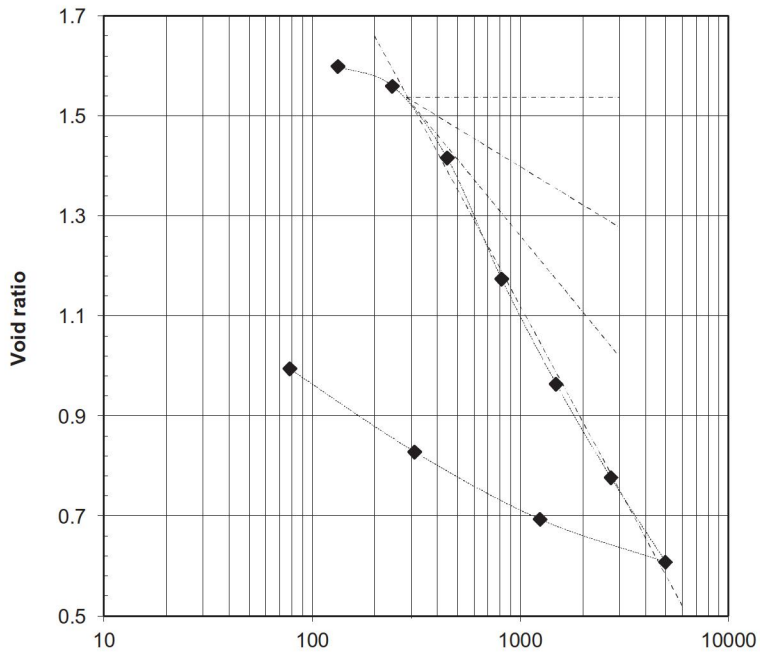
Void Ratio versus Stress		Coefficient of Consolidation	
Effective Stress (kPa)	Void Ratio	Average Void Ratio	c_v (cm^2/s)
133	1.60		
244	1.56	1.58	3.9E-04
445	1.42	1.49	1.1E-04
815	1.17	1.29	4.6E-05
1491	0.96	1.07	3.1E-05
2731	0.78	0.87	2.9E-05
5001	0.61	0.69	2.7E-05
1249	0.69		
312	0.83		
78	0.99		

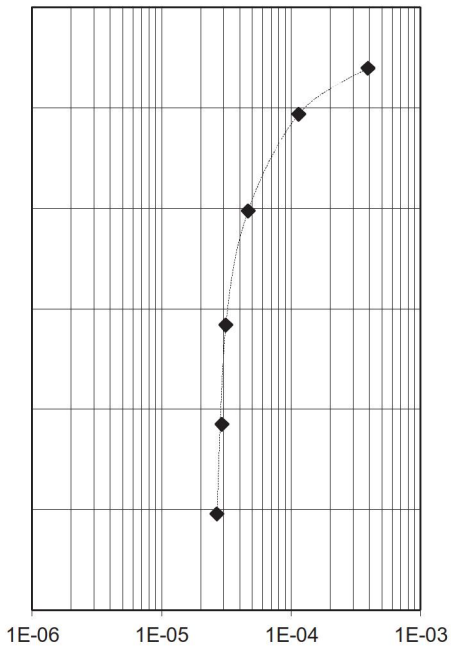
Sample Data:

Specific gravity:	2.75	(assumed)
Diameter:	63.9	mm
Initial height:	25.0	mm
Initial water content:	57.3	% (prior to saturation)
Initial dry density:	1058	kg/m^3 (prior to loading)
Initial void ratio:	1.60	(prior to loading)
Final water content:	41.9	%
Final dry density:	1382	kg/m^3

Estimated Preconsolidation Pressure: 300 kPa

Comments:





1721 8th Street E.,
Saskatoon, Saskatchewan, S7H 0T4

Reviewed by:

Golder Associates Ltd.
ATTN: Crystal Rinas
1721 8th Street East
Saskatoon SK S7H 0T4

Date Received: 10- NOV- 15
Report Date: 18- NOV- 15 14:53 (MT)
Version: FINAL

Client Phone: 306- 665- 7989

Certificate of Analysis

Lab Work Order #: L1700580
Project P.O. #: NOT SUBMITTED
Job Reference: 1537312
C of C Numbers:
Legal Site Desc:

Brian Morgan, B.Sc. Hons.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1700580-1 BH: TH-15-005 SA: 005-013							
Sampled By: CLIENT							
Matrix: SOIL							
Miscellaneous Parameters							
Water Soluble Sulfate	0.142		0.010	%	18-NOV-15	18-NOV-15	R3313242
Detailed Salinity							
Chloride (Cl) (Saturated Paste)							
Chloride (Cl)	298	DLDS	4.0	mg/L	17-NOV-15	17-NOV-15	R3312896
Detail Salinity in mg/kg							
Chloride (Cl)	336	DLDS	4.5	mg/kg		17-NOV-15	
Calcium (Ca)	338	DLDS	28	mg/kg		17-NOV-15	
Magnesium (Mg)	151	DLDS	28	mg/kg		17-NOV-15	
Potassium (K)	43	DLDS	28	mg/kg		17-NOV-15	
Sodium (Na)	292	DLDS	28	mg/kg		17-NOV-15	
Sulfur (as SO4)	1450	DLDS	28	mg/kg		17-NOV-15	
SAR, Cations and SO4 in saturated soil							
Calcium (Ca)	300	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Potassium (K)	38	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Magnesium (Mg)	134	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Sodium (Na)	259	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
SAR	3.13		0.10	SAR	17-NOV-15	17-NOV-15	R3312609
Sulfur (as SO4)	1280	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Theoretical Gypsum Requirement							
TGR(brine)	<0.10		0.10	t/ha		17-NOV-15	
TGR(sodic)	<0.10		0.10	t/ha		17-NOV-15	
pH and EC (Saturated Paste)							
% Saturation	113		1.0	%	16-NOV-15	17-NOV-15	R3312590
pH in Saturated Paste	7.53		0.10	pH	16-NOV-15	17-NOV-15	R3312590
Conductivity Sat. Paste	3.25		0.10	dS m-1	16-NOV-15	17-NOV-15	R3312590
L1700580-2 BH: TH-15-006 SA: 006-010							
Sampled By: CLIENT							
Matrix: SOIL							
Miscellaneous Parameters							
Water Soluble Sulfate	0.117		0.010	%	18-NOV-15	18-NOV-15	R3313242
Detailed Salinity							
Chloride (Cl) (Saturated Paste)							
Chloride (Cl)	241	DLDS	10	mg/L	17-NOV-15	17-NOV-15	R3312896
Detail Salinity in mg/kg							
Chloride (Cl)	287	DLDS	12	mg/kg		17-NOV-15	
Calcium (Ca)	294	DLDS	30	mg/kg		17-NOV-15	
Magnesium (Mg)	139	DLDS	30	mg/kg		17-NOV-15	
Potassium (K)	30	DLDS	30	mg/kg		17-NOV-15	
Sodium (Na)	283	DLDS	30	mg/kg		17-NOV-15	
Sulfur (as SO4)	1260	DLDS	30	mg/kg		17-NOV-15	
SAR, Cations and SO4 in saturated soil							
Calcium (Ca)	247	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Potassium (K)	25	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Magnesium (Mg)	117	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Sodium (Na)	238	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
SAR	3.12		0.10	SAR	17-NOV-15	17-NOV-15	R3312609
Sulfur (as SO4)	1050	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Theoretical Gypsum Requirement							
TGR(brine)	<0.10		0.10	t/ha		17-NOV-15	
TGR(sodic)	<0.10		0.10	t/ha		17-NOV-15	
pH and EC (Saturated Paste)							

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1700580-2 BH: TH-15-006 SA: 006-010							
Sampled By: CLIENT							
Matrix: SOIL							
pH and EC (Saturated Paste)							
% Saturation	119		1.0	%	16-NOV-15	17-NOV-15	R3312590
pH in Saturated Paste	7.68		0.10	pH	16-NOV-15	17-NOV-15	R3312590
Conductivity Sat. Paste	2.79		0.10	dS m-1	16-NOV-15	17-NOV-15	R3312590
L1700580-3 BH: TH-15-009 SA: 009-014							
Sampled By: CLIENT							
Matrix: SOIL							
Miscellaneous Parameters							
Water Soluble Sulfate	0.151		0.010	%	18-NOV-15	18-NOV-15	R3313242
Detailed Salinity							
Chloride (Cl) (Saturated Paste)							
Chloride (Cl)	618	DLDS	10	mg/L	17-NOV-15	17-NOV-15	R3312896
Detail Salinity in mg/kg							
Chloride (Cl)	676	DLDS	11	mg/kg		17-NOV-15	
Calcium (Ca)	422	DLDS	27	mg/kg		17-NOV-15	
Magnesium (Mg)	169	DLDS	27	mg/kg		17-NOV-15	
Potassium (K)	44	DLDS	27	mg/kg		17-NOV-15	
Sodium (Na)	394	DLDS	27	mg/kg		17-NOV-15	
Sulfur (as SO4)	1390	DLDS	27	mg/kg		17-NOV-15	
SAR, Cations and SO4 in saturated soil							
Calcium (Ca)	386	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Potassium (K)	40	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Magnesium (Mg)	154	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Sodium (Na)	360	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
SAR	3.92		0.10	SAR	17-NOV-15	17-NOV-15	R3312609
Sulfur (as SO4)	1270	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Theoretical Gypsum Requirement							
TGR(brine)	<0.10		0.10	t/ha		17-NOV-15	
TGR(sodic)	<0.10		0.10	t/ha		17-NOV-15	
pH and EC (Saturated Paste)							
% Saturation	109		1.0	%	16-NOV-15	17-NOV-15	R3312590
pH in Saturated Paste	7.50		0.10	pH	16-NOV-15	17-NOV-15	R3312590
Conductivity Sat. Paste	4.14		0.10	dS m-1	16-NOV-15	17-NOV-15	R3312590
L1700580-4 BH: TH-15-011 SA: 011-005							
Sampled By: CLIENT							
Matrix: SOIL							
Miscellaneous Parameters							
Water Soluble Sulfate	0.130		0.010	%	18-NOV-15	18-NOV-15	R3313242
Detailed Salinity							
Chloride (Cl) (Saturated Paste)							
Chloride (Cl)	973	DLDS	10	mg/L	17-NOV-15	17-NOV-15	R3312896
Detail Salinity in mg/kg							
Chloride (Cl)	1010	DLDS	10	mg/kg		17-NOV-15	
Calcium (Ca)	408	DLDS	26	mg/kg		17-NOV-15	
Magnesium (Mg)	157	DLDS	26	mg/kg		17-NOV-15	
Potassium (K)	38	DLDS	26	mg/kg		17-NOV-15	
Sodium (Na)	407	DLDS	26	mg/kg		17-NOV-15	
Sulfur (as SO4)	940	DLDS	26	mg/kg		17-NOV-15	
SAR, Cations and SO4 in saturated soil							
Calcium (Ca)	392	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Potassium (K)	37	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Magnesium (Mg)	151	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609

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

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1700580-4 BH: TH-15-011 SA: 011-005							
Sampled By: CLIENT							
Matrix: SOIL							
SAR, Cations and SO4 in saturated soil							
Sodium (Na)	391	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
SAR	4.26		0.10	SAR	17-NOV-15	17-NOV-15	R3312609
Sulfur (as SO4)	905	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Theoretical Gypsum Requirement							
TGR(brine)	<0.10		0.10	t/ha		17-NOV-15	
TGR(sodic)	<0.10		0.10	t/ha		17-NOV-15	
pH and EC (Saturated Paste)							
% Saturation	104		1.0	%	16-NOV-15	17-NOV-15	R3312590
pH in Saturated Paste	7.46		0.10	pH	16-NOV-15	17-NOV-15	R3312590
Conductivity Sat. Paste	4.50		0.10	dS m-1	16-NOV-15	17-NOV-15	R3312590
L1700580-5 BH: TH-15-012 SA: 012-008							
Sampled By: CLIENT							
Matrix: SOIL							
Miscellaneous Parameters							
Water Soluble Sulfate	0.265		0.010	%	18-NOV-15	18-NOV-15	R3313242
Detailed Salinity							
Chloride (Cl) (Saturated Paste)							
Chloride (Cl)	262	DLDS	10	mg/L	17-NOV-15	17-NOV-15	R3312896
Detail Salinity in mg/kg							
Chloride (Cl)	338	DLDS	13	mg/kg		17-NOV-15	
Calcium (Ca)	750	DLDS	32	mg/kg		17-NOV-15	
Magnesium (Mg)	273	DLDS	32	mg/kg		17-NOV-15	
Potassium (K)	40	DLDS	32	mg/kg		17-NOV-15	
Sodium (Na)	334	DLDS	32	mg/kg		17-NOV-15	
Sulfur (as SO4)	2950	DLDS	32	mg/kg		17-NOV-15	
SAR, Cations and SO4 in saturated soil							
Calcium (Ca)	582	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Potassium (K)	31	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Magnesium (Mg)	212	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Sodium (Na)	259	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
SAR	2.34		0.10	SAR	17-NOV-15	17-NOV-15	R3312609
Sulfur (as SO4)	2290	DLDS	25	mg/L	17-NOV-15	17-NOV-15	R3312609
Theoretical Gypsum Requirement							
TGR(brine)	<0.10		0.10	t/ha		17-NOV-15	
TGR(sodic)	<0.10		0.10	t/ha		17-NOV-15	
pH and EC (Saturated Paste)							
% Saturation	129		1.0	%	16-NOV-15	17-NOV-15	R3312590
pH in Saturated Paste	7.52		0.10	pH	16-NOV-15	17-NOV-15	R3312590
Conductivity Sat. Paste	4.32		0.10	dS m-1	16-NOV-15	17-NOV-15	R3312590

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

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-PASTE-COL-SK	Soil	Chloride (Cl) (Saturated Paste)	CSSS(1993) 18.2.2/APHA 4500-CL E
Chloride in a saturated soil extract is determined colorimetrically by auto-analyzer.			
SAL-MG/KG-CALC-SK	Soil	Detail Salinity in mg/kg	Manual Calculation
SALINITY-INTCHECK-SK	Soil		CSSS 18.4-Calculation
SAR-CALC-SO4-SK	Soil	SAR, Cations and SO4 in saturated soil	APHA 3120B
Ca, Mg, Na, K and SO4 in a saturated soil extract are determined by ICP-OES.			
SAT/PH/EC-SK	Soil	pH and EC (Saturated Paste)	CSSS 18.2.2/CSSC 3.14/CSSS 18.3.1
pH of a saturated soil paste is measured using a pH meter. After equilibration, an extract is obtained by vacuum filtration with conductivity of the extract measured by a conductivity meter.			
SO4-WATER-SOL-SK	Soil	Water Soluble Sulfate (6 hour 1:10)	CSA A23.2-3B (CONCRETE)
TGR2-CALC-SK	Soil	Theoretical Gypsum Requirement	J. Ashworth et al (1999)
Theoretical Gypsum Requirement is an estimate of the gypsum amendment required to remediate brine-contaminated or sodic soils, and is provided in units of tonnes per hectare (t/ha) for a treatment depth of 15cm. TGR(brine), intended for brine-contaminated soils, is calculated using Method A from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth (Cdn J. of Soil Science, 1999), available at www.alsglobal.com. TGR(sodic), intended for naturally sodic soils, uses the Oster and Frenkel method (Method B) from the same paper. Reported TGR values are capped at 50 t/ha, considered the maximum practical gypsum amendment. To convert TGR from t/ha to tons/acre, multiply by 0.446. To determine a TGR value for an alternate treatment depth, multiply by [desired treatment depth (cm) / 15 cm].			

** 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
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, 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 wwt - 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: L1700580 Report Date: 18-NOV-15

Client: Golder Associates Ltd.
1721 8th Street East
Saskatoon SK S7H 0T4
Contact: Crystal Rinas

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-PASTE-COL-SK	Soil							
Batch R3312896								
WG2213019-3 IRM		**SAL814**						
Chloride (Cl)			104.1		%		70-130	17-NOV-15
WG2213019-2 MB								
Chloride (Cl)			<5.0		mg/L		5	17-NOV-15
SAR-CALC-SO4-SK	Soil							
Batch R3312609								
WG2213019-3 IRM		**SAL814**						
Calcium (Ca)			110.4		%		70-130	17-NOV-15
Potassium (K)			110.9		%		70-130	17-NOV-15
Magnesium (Mg)			118.8		%		70-130	17-NOV-15
Sodium (Na)			106.6		%		70-130	17-NOV-15
Sulfur (as SO4)			113.6		%		70-130	17-NOV-15
WG2213019-2 MB								
Calcium (Ca)			<5.0		mg/L		5	17-NOV-15
Potassium (K)			<5.0		mg/L		5	17-NOV-15
Magnesium (Mg)			<5.0		mg/L		5	17-NOV-15
Sodium (Na)			<5.0		mg/L		5	17-NOV-15
Sulfur (as SO4)			<5.0		mg/L		5	17-NOV-15
SAT/PH/EC-SK	Soil							
Batch R3312590								
WG2213019-3 IRM		**SAL814**						
% Saturation			44.1		%		37.5-47.5	17-NOV-15
pH in Saturated Paste			7.73		pH		7.4-8	17-NOV-15
Conductivity Sat. Paste			112.7		%		80-120	17-NOV-15
WG2213019-2 MB								
Conductivity Sat. Paste			<0.10		dS m-1		0.1	17-NOV-15
SO4-WATER-SOL-SK	Soil							
Batch R3313242								
WG2213008-1 DUP		**L1700580-4**						
Water Soluble Sulfate		0.130	0.121		%	6.8	30	18-NOV-15
WG2213008-3 IRM		**NA2SO4 SOIL**						
Water Soluble Sulfate			111.7		%		70-130	18-NOV-15
WG2213008-2 MB								
Water Soluble Sulfate			<0.010		%		0.01	18-NOV-15

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
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.

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.

ALS Laboratc
ANALYTICAL CHEMISTRY & TESTIN
Environmental Divisio

L1700580-COFC

Chain of Custody / Analytical Request Form
Canada Toll Free: 1 800 668 9878
www.alsglobal.com

COC # _____

Page 1 of 1

Report To		Report Format / Distribution		Service Requested (Rush for routine analysis subject to availability)
Company:	Golder Associates	☑ Standard ☐ Other		◉ Regular (Default)
Contact:	Crystal Rinas	☑ PDF ☑ Excel ☑ Digital ☐ Fax		○ Priority (Specify Date Required → →) Surcharges apply
Address:	1721 8th St E	Email 1: Crystal_Rinas@golder.com		○ Emergency (1 Business Day) - 100% Surcharge
	Saskatoon SK S7H 0T4	Email 2:		○ For Emergency < 1 Day, ASAP or Weekend - Contact ALS
Phone:	306-665-7989 Fax: 306-665-3342			
Invoice To	Same as Report ? ☑ Yes ☐ No	Client / Project Information		Analysis Request
Company:		Job #: 1537312		Please indicate below Filtered, Preserved or both (F, P, F/P)
Contact:		PO / AFE:		
Address:		LSD:		
Phone:	Fax:	Quote #:		
Lab Work Order # (lab use only)		ALS Contact:	Sampler:	

Sample #	Sample Identification (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	Soil chemistry and sulfates	Number of Containers
	BH: TH-15-005 SA: 005-013			Soil	x	1
	BH: TH-15-006 SA: 006-010			Soil	x	1
	BH: TH-15-009 SA: 009-014			Soil	x	1
	BH: TH-15-011 SA: 011-005			Soil	x	1
	BH: TH-15-012 SA: 012-008			Soil	x	1

Special Instructions / Regulations / Hazardous Details

Golder requests report "STANDARDQC_ALS" and custom digital report "GOLDER_SK".

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY.
By the use of this form the user acknowledges and agrees with the Terms and Conditions as provided on a separate Excel tab.
Also provided on another Excel tab are the ALS location addresses, phone numbers and sample container / preservation / holding time table for common analyses.

SHIPMENT RELEASE (client use)			SHIPMENT RECEPTION (lab use only)				SHIPMENT VERIFICATION (lab use only)			
Released by:	Date (dd-mmm-yy)	Time (hh-mm)	Received by:	Date:	Time:	Temperature:	Verified by:	Date:	Time:	Observations: Yes / No ? If Yes add SIF
			OK	10/11/15	1:30	17 °C				

GENF 18.02 Front

Golder Associates Ltd.
ATTN: Crystal Rinas
1721 8th Street East
Saskatoon SK S7H 0T4

Date Received: 27- NOV- 15
Report Date: 28- NOV- 15 13:58 (MT)
Version: FINAL

Client Phone: 306- 665- 7989

Certificate of Analysis

Lab Work Order #: L1707563
Project P.O. #: NOT SUBMITTED
Job Reference: 1537312
C of C Numbers:
Legal Site Desc:

Brian Morgan, B.Sc. Hons.
Account Manager

ALS ENVIRONMENTAL ANALYTICAL REPORT

Sample Details/Parameters	Result	Qualifier*	D.L.	Units	Extracted	Analyzed	Batch
L1707563-1 TH15-014 SA014-08							
Sampled By: CLIENT							
Matrix: SOIL							
Miscellaneous Parameters							
Water Soluble Sulfate	0.113		0.010	%	28-NOV-15	28-NOV-15	R3320957
Detailed Salinity							
Chloride (Cl) (Saturated Paste)							
Chloride (Cl)	221	DLDS	10	mg/L	27-NOV-15	27-NOV-15	R3320728
Detail Salinity in mg/kg							
Chloride (Cl)	398	DLDS	18	mg/kg		27-NOV-15	
Calcium (Ca)	301	DLDS	18	mg/kg		27-NOV-15	
Magnesium (Mg)	194	DLDS	18	mg/kg		27-NOV-15	
Potassium (K)	<18	DLDS	18	mg/kg		27-NOV-15	
Sodium (Na)	347	DLDS	18	mg/kg		27-NOV-15	
Sulfur (as SO4)	1620	DLDS	18	mg/kg		27-NOV-15	
SAR, Cations and SO4 in saturated soil							
Calcium (Ca)	167	DLDS	10	mg/L	27-NOV-15	27-NOV-15	R3320751
Potassium (K)	<10	DLDS	10	mg/L	27-NOV-15	27-NOV-15	R3320751
Magnesium (Mg)	108	DLDS	10	mg/L	27-NOV-15	27-NOV-15	R3320751
Sodium (Na)	193	DLDS	10	mg/L	27-NOV-15	27-NOV-15	R3320751
SAR	2.86		0.10	SAR	27-NOV-15	27-NOV-15	R3320751
Sulfur (as SO4)	898	DLDS	10	mg/L	27-NOV-15	27-NOV-15	R3320751
Theoretical Gypsum Requirement							
TGR(brine)	<0.10		0.10	t/ha		27-NOV-15	
TGR(sodic)	<0.10		0.10	t/ha		27-NOV-15	
pH and EC (Saturated Paste)							
% Saturation	180		1.0	%	27-NOV-15	27-NOV-15	R3320632
pH in Saturated Paste	7.61		0.10	pH	27-NOV-15	27-NOV-15	R3320632
Conductivity Sat. Paste	2.22		0.10	dS m-1	27-NOV-15	27-NOV-15	R3320632

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

Reference Information

Sample Parameter Qualifier Key:

Qualifier	Description
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.

Test Method References:

ALS Test Code	Matrix	Test Description	Method Reference**
CL-PASTE-COL-SK	Soil	Chloride (Cl) (Saturated Paste)	CSSS(1993) 18.2.2/APHA 4500-CL E
Chloride in a saturated soil extract is determined colorimetrically by auto-analyzer.			
SAL-MG/KG-CALC-SK	Soil	Detail Salinity in mg/kg	Manual Calculation
SALINITY-INTCHECK-SK	Soil		CSSS 18.4-Calculation
SAR-CALC-SO4-SK	Soil	SAR, Cations and SO4 in saturated soil	APHA 3120B
Ca, Mg, Na, K and SO4 in a saturated soil extract are determined by ICP-OES.			
SAT/PH/EC-SK	Soil	pH and EC (Saturated Paste)	CSSS 18.2.2/CSSC 3.14/CSSS 18.3.1
pH of a saturated soil paste is measured using a pH meter. After equilibration, an extract is obtained by vacuum filtration with conductivity of the extract measured by a conductivity meter.			
SO4-WATER-SOL-SK	Soil	Water Soluble Sulfate (6 hour 1:10)	CSA A23.2-3B (CONCRETE)
TGR2-CALC-SK	Soil	Theoretical Gypsum Requirement	J. Ashworth et al (1999)
Theoretical Gypsum Requirement is an estimate of the gypsum amendment required to remediate brine-contaminated or sodic soils, and is provided in units of tonnes per hectare (t/ha) for a treatment depth of 15cm. TGR(brine), intended for brine-contaminated soils, is calculated using Method A from "A Comparison of Methods for Gypsum Requirement of Brine-Contaminated Soils", by J. Ashworth (Cdn J. of Soil Science, 1999), available at www.alsglobal.com. TGR(sodic), intended for naturally sodic soils, uses the Oster and Frenkel method (Method B) from the same paper. Reported TGR values are capped at 50 t/ha, considered the maximum practical gypsum amendment. To convert TGR from t/ha to tons/acre, multiply by 0.446. To determine a TGR value for an alternate treatment depth, multiply by [desired treatment depth (cm) / 15 cm].			

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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
SK	ALS ENVIRONMENTAL - SASKATOON, SASKATCHEWAN, 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.
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mg/kg wwt - 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.
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Quality Control Report

Workorder: L1707563 Report Date: 28-NOV-15

Client: Golder Associates Ltd.
1721 8th Street East
Saskatoon SK S7H 0T4
Contact: Crystal Rinas

Test	Matrix	Reference	Result	Qualifier	Units	RPD	Limit	Analyzed
CL-PASTE-COL-SK	Soil							
Batch R3320728								
WG2222331-2 IRM		**SAL814**						
Chloride (Cl)			115.3		%		70-130	27-NOV-15
WG2222331-1 MB								
Chloride (Cl)			<5.0		mg/L		5	27-NOV-15
SAR-CALC-SO4-SK	Soil							
Batch R3320751								
WG2222331-2 IRM		**SAL814**						
Calcium (Ca)			103.9		%		70-130	27-NOV-15
Potassium (K)			99.5		%		70-130	27-NOV-15
Magnesium (Mg)			112.0		%		70-130	27-NOV-15
Sodium (Na)			100.2		%		70-130	27-NOV-15
Sulfur (as SO4)			110.1		%		70-130	27-NOV-15
WG2222331-1 MB								
Calcium (Ca)			<5.0		mg/L		5	27-NOV-15
Potassium (K)			<5.0		mg/L		5	27-NOV-15
Magnesium (Mg)			<5.0		mg/L		5	27-NOV-15
Sodium (Na)			<5.0		mg/L		5	27-NOV-15
Sulfur (as SO4)			<5.0		mg/L		5	27-NOV-15
SAT/PH/EC-SK	Soil							
Batch R3320632								
WG2222331-2 IRM		**SAL814**						
% Saturation			43.0		%		37.5-47.5	27-NOV-15
pH in Saturated Paste			7.66		pH		7.4-8	27-NOV-15
Conductivity Sat. Paste			105.8		%		80-120	27-NOV-15
WG2222331-1 MB								
Conductivity Sat. Paste			<0.10		dS m-1		0.1	27-NOV-15
SO4-WATER-SOL-SK	Soil							
Batch R3320957								
WG2222335-1 DUP		**L1707563-1**						
Water Soluble Sulfate		0.113	0.133		%	16	30	28-NOV-15
WG2222335-3 IRM		**NA2SO4 SOIL**						
Water Soluble Sulfate			106.3		%		70-130	28-NOV-15
WG2222335-2 MB								
Water Soluble Sulfate			<0.010		%		0.01	28-NOV-15

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
DLDS	Detection Limit Raised: Dilution required due to high Dissolved Solids / Electrical Conductivity.

Hold Time Exceedances:

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

ALS

www.alsglobal.com

Chain of Custody (COC) / Analytical Request Form

Canada Toll Free: 1 800 668 9878

L1707563-COFC

COC Number: 14 - 418341

Page ____ of ____

Report To		Report Format / Distribution		Select Service Level Below (Rush Turnaround Time (TAT) is not available for all tests)	
Company:	Golder Associates	Select Report Format:	[✓] PDF [✓] EXCEL [✓] EDD (DIGITAL)	R [ ]	Regular (Standard TAT if received by 3pm)
Contact:	Crystal Rinas	Quality Control (QC) Report with Report	[ ] Yes [ ] No	P [ ]	Priority (2-4 business days if received by 3pm)
Address:	1721 8th St Saskatoon SK S7H 0T4	[ ] Criteria on Report - provide details below if box checked		E [✓]	Emergency (1-2 business days if received by 3pm)
		Select Distribution:	[ ] EMAIL [ ] MAIL [ ] FAX	E2 [ ]	Same day or weekend emergency if received by 10am – contact ALS for surcharge.
Phone:	306 665-7989	Email 1 or Fax		Specify Date Required for E2,E or P:	
		Email 2			

Invoice To		Invoice Distribution	
Same as Report To	[✓] Yes [ ] No	Select Invoice Distribution:	[ ] EMAIL [ ] MAIL [ ] FAX
Copy of Invoice with Report	[ ] Yes [ ] No	Email 1 or Fax	
Company:		Email 2	
Contact:			

Project Information		Oil and Gas Required Fields (client use)	
ALS Quote #:		Approver ID:	Cost Center:
Job #:	1537312	GL Account:	Routing Code:
PO / AFE:		Activity Code:	
LSD:		Location:	
ALS Lab Work Order # (lab use only)		ALS Contact:	Sampler:

Analysis Request — Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	soil chemistry and sulphate	Number of Containers
	TH15-014 SA ~~005~~ 014-08			soil	X	1

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report (client Use)
Are samples taken from a Regulated DW System? [ ] Yes [ ] No	
Are samples for human drinking water use? [ ] Yes [ ] No	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen [ ]		SIF Observations	Yes [ ] No [ ]
Ice packs	Yes [ ] No [ ]	Custody seal intact	Yes [ ] No [ ]
Cooling Initiated [ ]			
INITIAL COOLER TEMPERATURES °C	20	FINAL COOLER TEMPERATURES °C	

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: [signature]	Date: 27/NOV/15	Time:	Received by: [initials]	Date: 11/27	Time: 8:56	Received by:	Date:	Time:

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form

APPENDIX D

Shelby Tube Sample Photographs

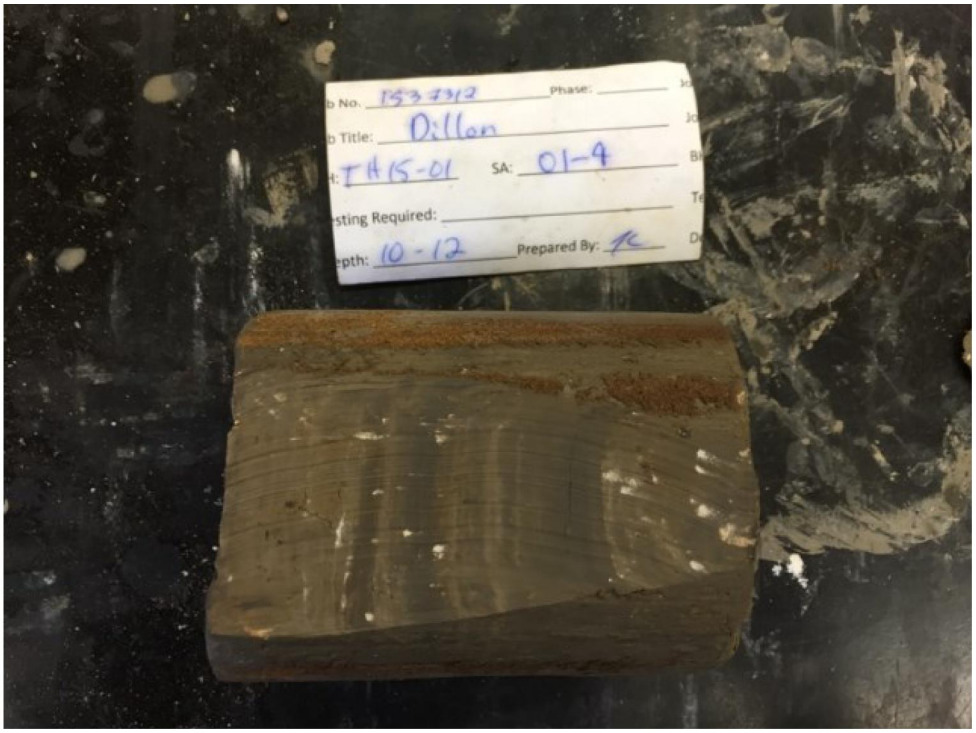

Photo 1: BH 15-01, SA 001-04

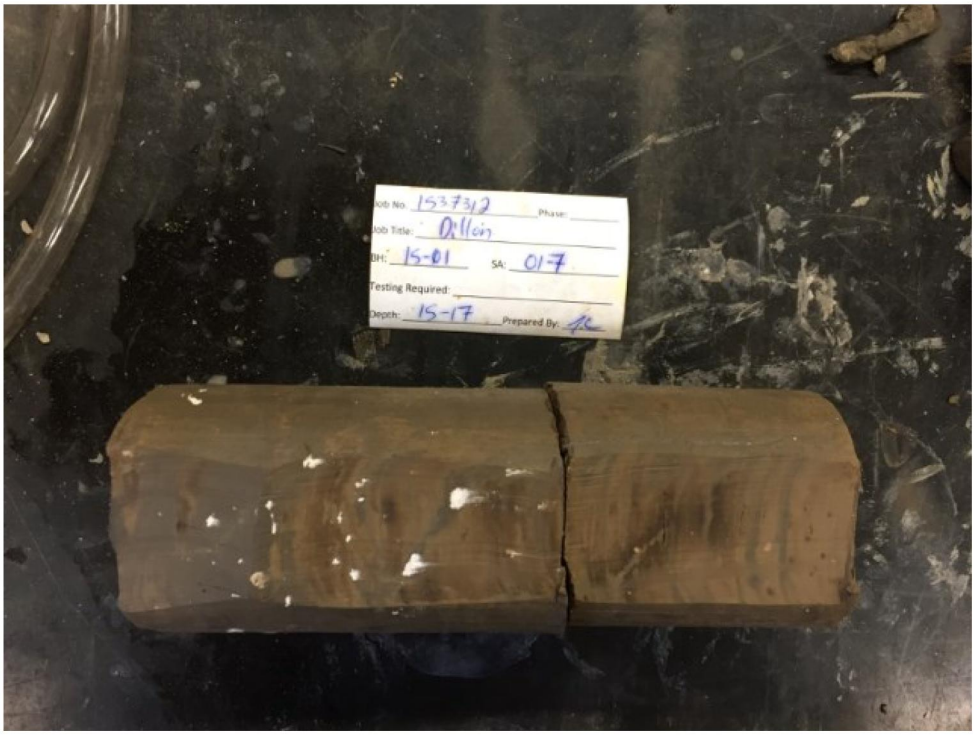

Photo 2: BH 15-01, SA 001-07

Photo 3: BH 15-01, SA 001-12

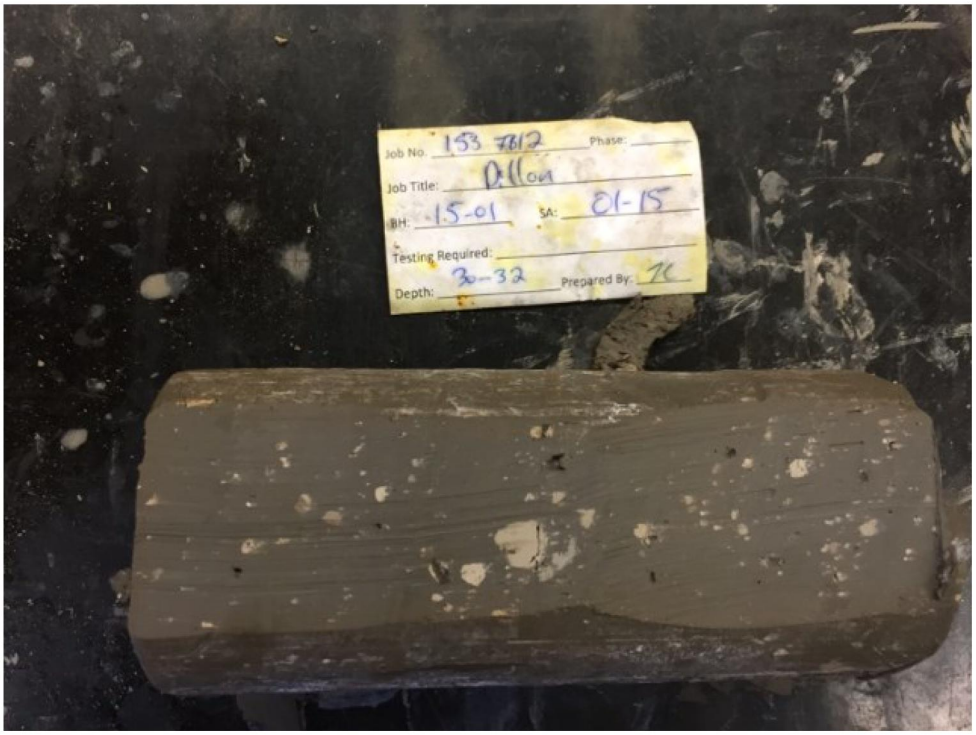

Photo 4: BH 15-01, SA 001-15

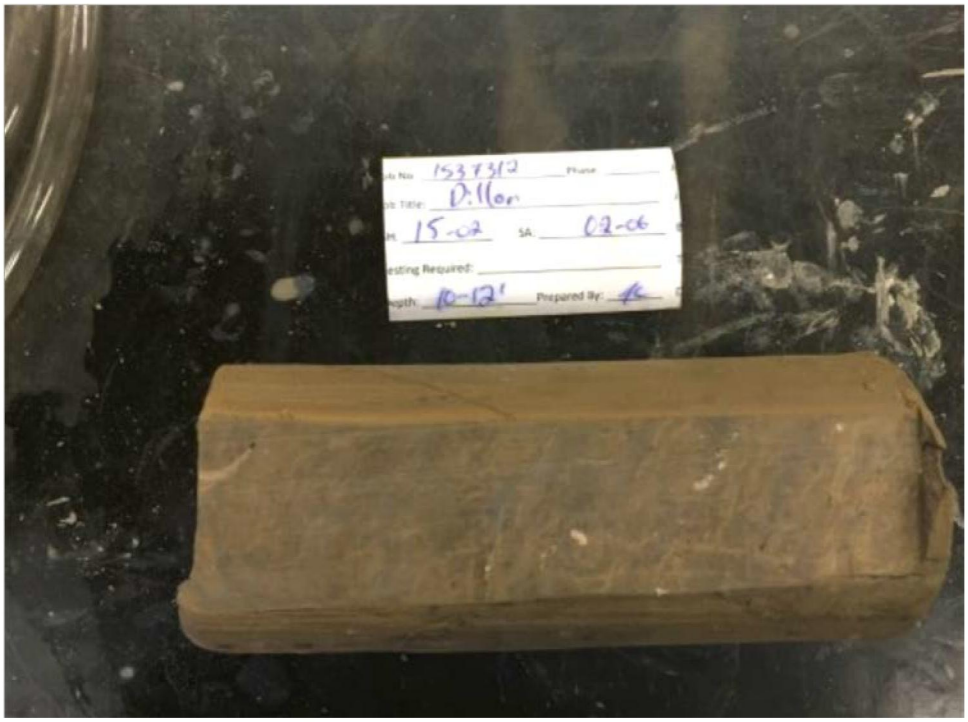

Photo 5: BH 15-02, SA 002-06

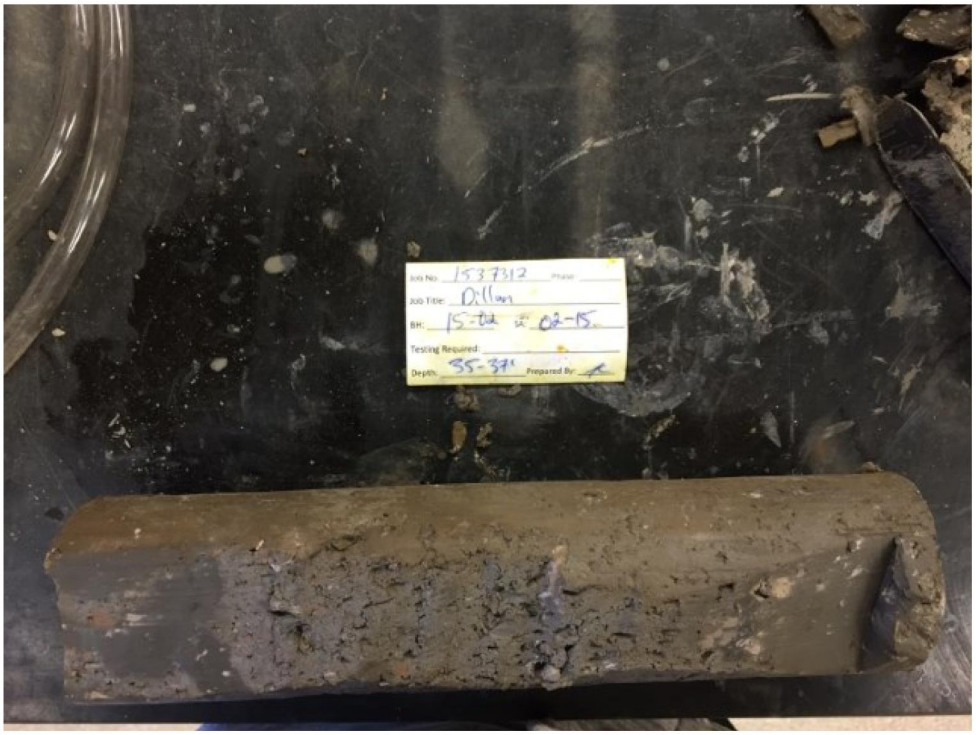

Photo 6: BH 15-02, SA 002-15

Photo 7: BH 15-04, SA 004-05

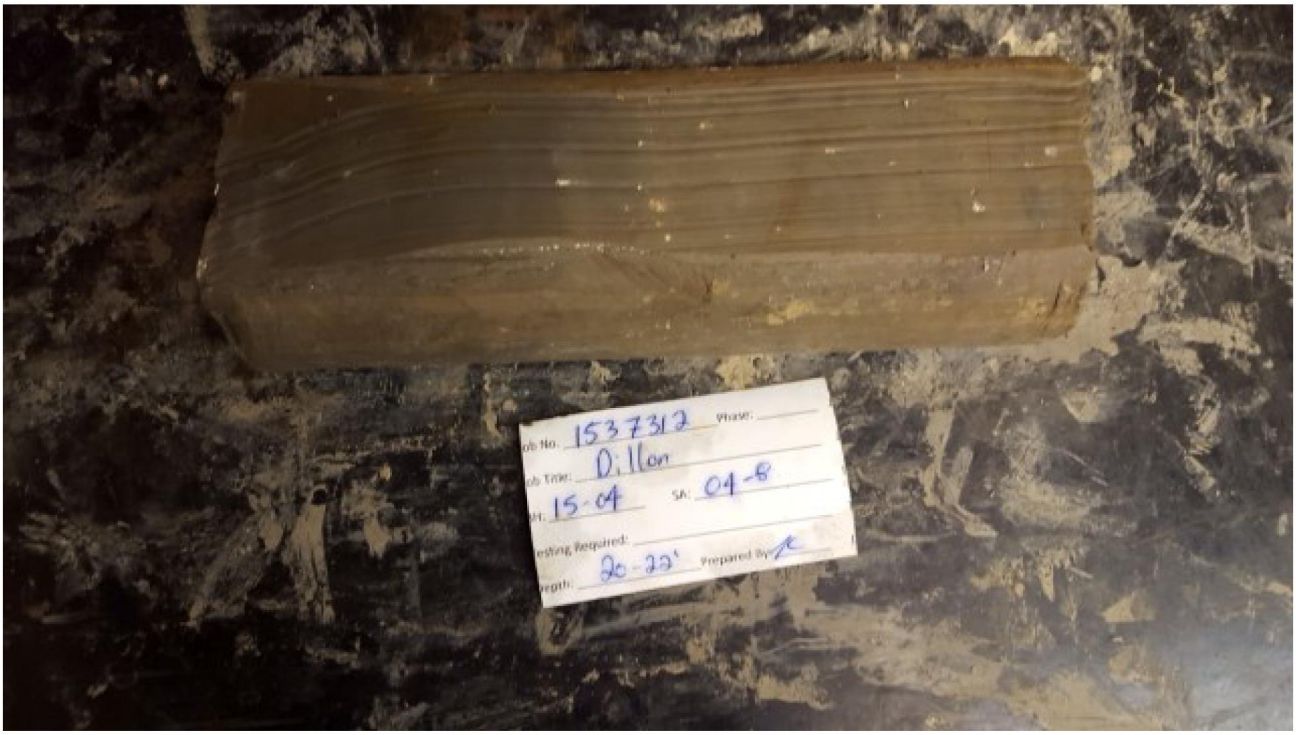

Photo 8: BH 15-04, SA 004-08

Photo 9: BH 15-04, SA 004-11

Photo 10: BH 15-04, SA 004-13

Photo 11: BH 15-05, SA 005-04

Photo 12: BH 15-05, SA 005-08

Photo 13: BH 15-05, SA 005-12

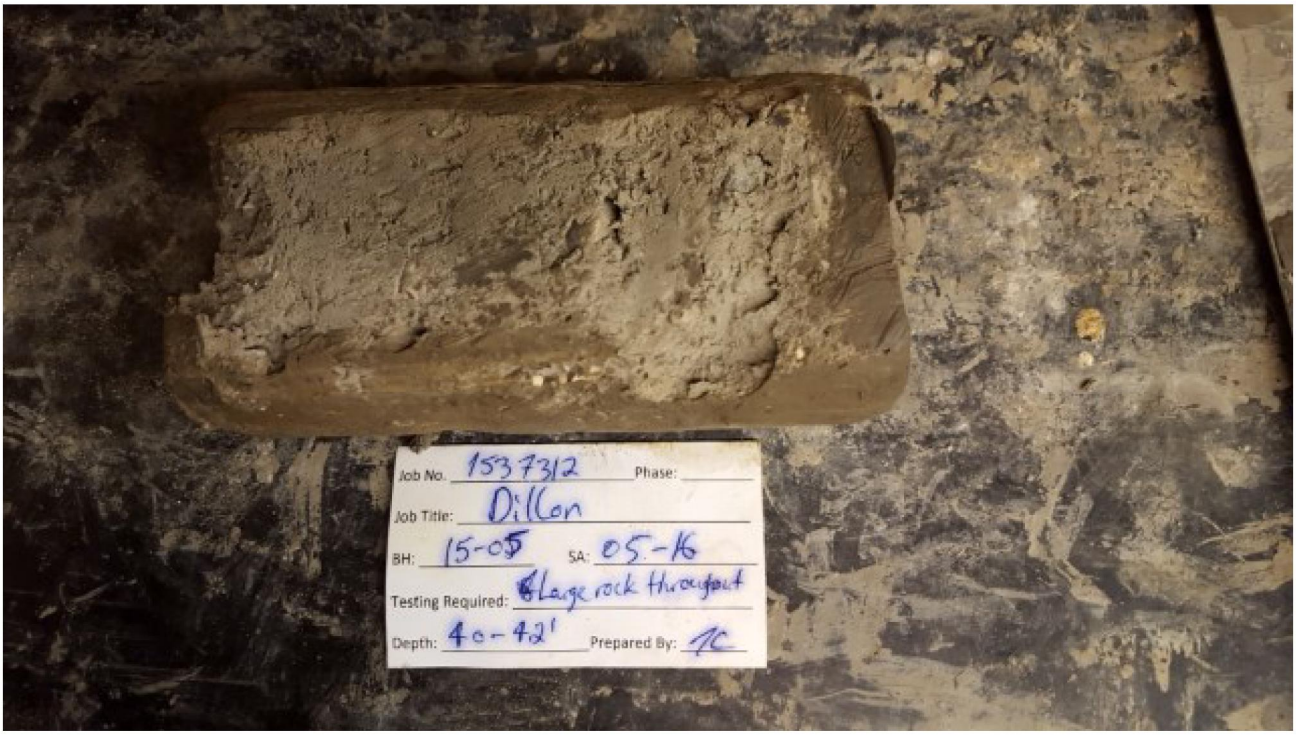

Photo 14: BH 15-05, SA 005-16

Photo 15: BH 15-06, SA 006-04

Photo 16: BH 15-06, SA 006-08

Photo 17: BH 15-06, SA 006-12

Photo 18: BH 15-06, SA 006-16

Photo 19: BH 15-07, SA 007-07

Photo 20: BH 15-07, SA 007-11

Photo 21: BH 15-07, SA 007-15

Photo 22: BH 15-07, SA 007-19

Photo 23: BH 15-08, SA 008-06

Photo 24: BH 15-08, SA 008-10

Photo 25: BH 15-08, SA 008-14

Photo 26: BH 15-08, SA 008-18

Photo 27: BH 15-09, SA 009-13

Photo 28: BH 15-09, SA 009-17

Photo 29: BH 15-09, SA 009-9

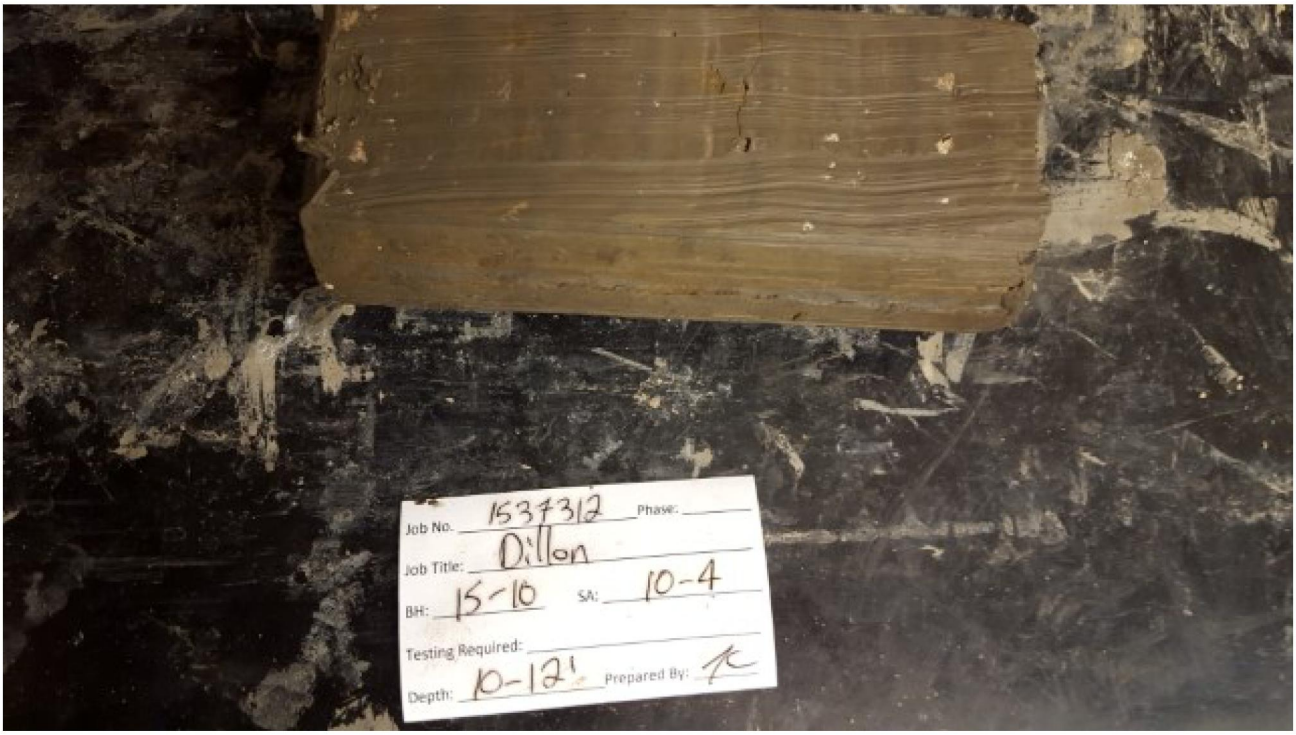

Photo 30: BH 15-10 , SA 010-04

Photo 31: BH 15-10, SA 010-08

Photo 32: BH 15-10, SA 010-12

Photo 33: BH 15-10, SA 010-16

Photo 34: BH 15-11, SA 011-05

Photo 35: BH 15-11, SA 011-09

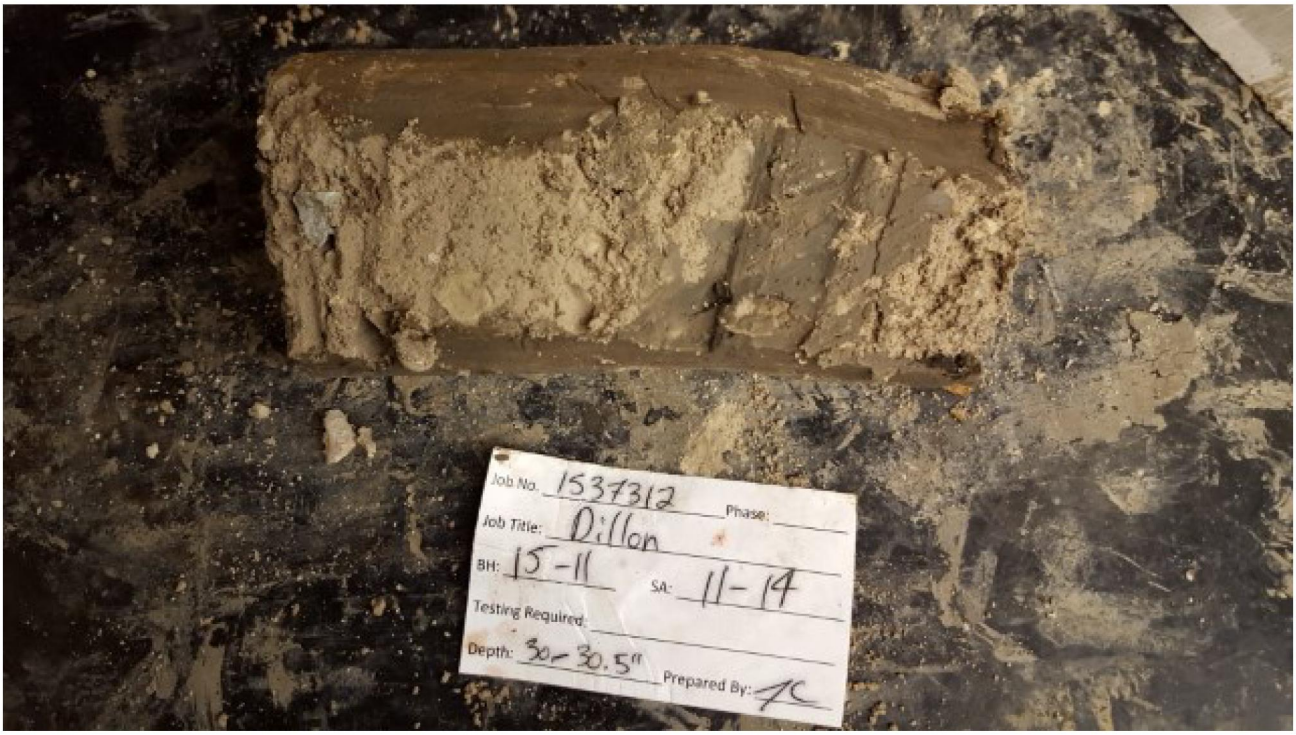

Photo 36: BH 15-11, SA 011-14

Photo 37: BH 15-12, SA 012-07

Photo 38: BH 15-12, SA 012-09

Photo 39: BH 15-12, SA 012-11

Photo 40: BH 15-12, SA 012-13

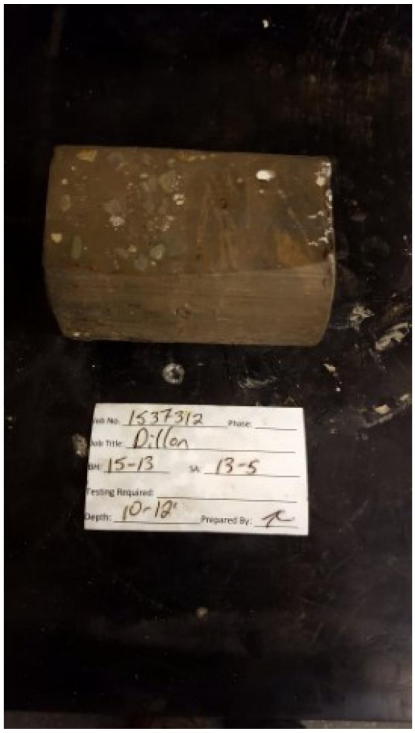

Photo 41: BH 15-13, SA 013-05

Photo 42: BH 15-13, SA 013-07

Photo 43: BH 15-13, SA 013-09

Photo 44: BH 15-14, SA 014-01

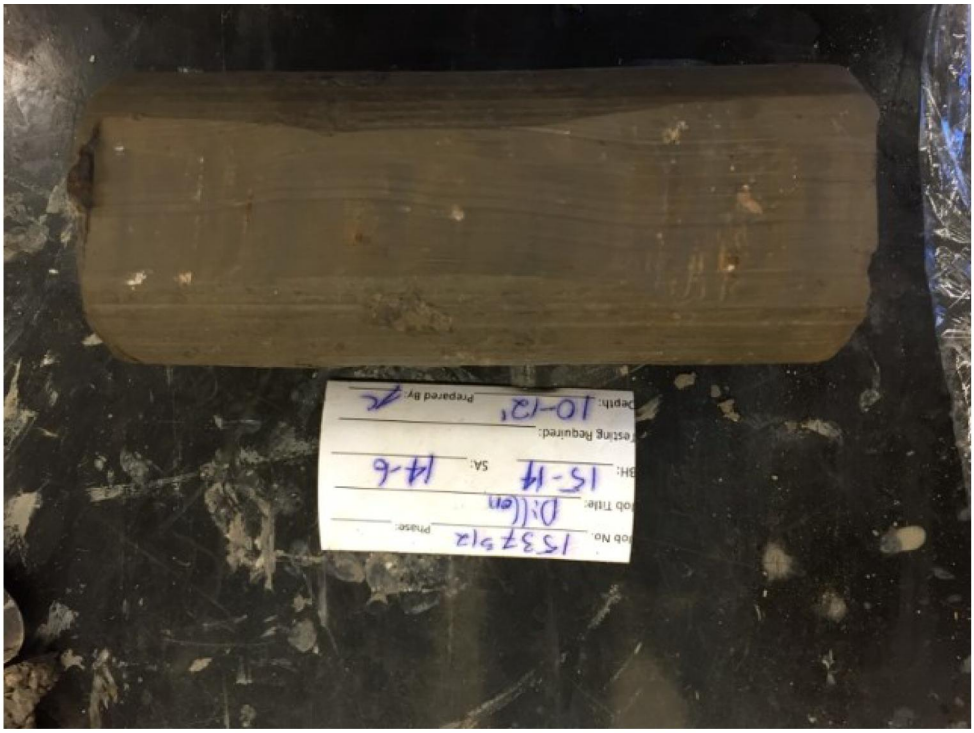

Photo 45: BH 15-14, SA 014-06

Photo 46: BH 15-14, SA 014-11

Photo 47: BH 15-14, SA 014-15

n:\active\2015\3 proj\1537312 dillon brtphase2geoinv winnipeg\report\appendix e - shelby tube sample photographs\photo log.docx

APPENDIX E

Vibrating Wire Calibration Sheets

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RST Instruments Ltd., 11545 Kingston St., Maple Ridge, British Columbia, Canada V2X 0Z5
Tel: 604 540 1100 • Fax: 604 540 1005 • Toll Free: 1 800 665 5599 (North America only)
e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Calibration Record

Vibrating Wire Piezometer

Customer:		Golder Associates Ltd.-Saskatoon	
Model:		VW2100-0.35	
Serial Number:		**VW34543**	
Mfg Number:		1530819	
Range:		350.0	kPa
Temperature:		22.6	°C
Barometric Pressure:		1005.4	millibars
Work Order Number:		208286	
Cable Length:		20	meters
Cable Markings:		1066823 m - 1066842 m	
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)	
Cable Type:		EL380004	
Thermistor Type:		3	kΩ

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8936	8937	8937	0.4	0.10	-0.05
70.0	8267	8268	8268	70.3	0.07	0.11
140.0	7605	7605	7605	139.5	-0.15	-0.02
210.0	6935	6936	6936	209.4	-0.16	-0.03
280.0	6262	6262	6262	279.8	-0.06	-0.02
350.0	5584	5584	5584	350.6	0.18	0.03
			Max. Error (%):		0.18	0.11

Linear Calibration Factor:	**C.F.=**	**0.10448 kPa/B unit**
Regression Zero:	**At Calibration =**	**8940.0 B unit**
Temperature Correction Factor:	**Tk =**	**-0.03256 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -3.6951E-07 **B:** -0.099118 **C:** 915.08

Pressure is calculated with the following equations:

Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$

Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8928	21.8	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon		
Model:	VW2100-0.35		
Serial Number:	**VW34544**		
Mfg Number:	1530898		
Range:	350.0 kPa		
Temperature:	22.7 °C		
Barometric Pressure:	1005.3 millibars		
Work Order Number:	208286		
Cable Length:	20 meters		
Cable Markings:	1017852 m - 1017870 m		
Cable Colour Code:	Red / Black (Coil)	Green / White	(Thermistor)
Cable Type:	EL380004		
Thermistor Type:	3 kΩ		

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8701	8702	8702	0.4	0.10	-0.01
70.0	8120	8120	8120	70.0	-0.01	0.01
140.0	7537	7537	7537	139.8	-0.07	0.02
210.0	6953	6954	6954	209.6	-0.11	-0.02
280.0	6367	6367	6367	279.8	-0.05	-0.02
350.0	5777	5777	5777	350.5	0.13	0.02
			Max. Error (%):		0.13	0.02

Linear Calibration Factor:	**C.F.=**	**0.11972 kPa/B unit**
Regression Zero:	**At Calibration =**	**8704.5 B unit**
Temperature Correction Factor:	**Tk =**	**-0.03725 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -3.5330E-07 **B:** -0.11460 **C:** 1023.9

Pressure is calculated with the following equations:

Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$

Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8694	21.9	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon		
Model:	VW2100-0.35		
Serial Number:	**VW34545**		
Mfg Number:	1530899		
Range:	350.0 kPa		
Temperature:	22.7 °C		
Barometric Pressure:	1005.3 millibars		
Work Order Number:	208286		
Cable Length:	20 meters		
Cable Markings:	1017952 m - 1017971 m		
Cable Colour Code:	Red / Black (Coil)	Green / White	(Thermistor)
Cable Type:	EL380004		
Thermistor Type:	3 kΩ		

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8793	8793	8793	0.1	0.03	-0.01
70.0	8153	8153	8153	70.0	0.01	0.02
140.0	7513	7513	7513	139.9	-0.02	0.02
210.0	6873	6873	6873	209.8	-0.04	-0.01
280.0	6232	6232	6232	279.9	-0.04	-0.03
350.0	5588	5588	5588	350.2	0.06	0.02
			Max. Error (%):		0.06	0.03

Linear Calibration Factor:	**C.F.=**	**0.10924 kPa/B unit**
Regression Zero:	**At Calibration =**	**8794.0 B unit**
Temperature Correction Factor:	**Tk =**	**-0.08707 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -1.1404E-07 **B:** -0.10760 **C:** 954.88

Pressure is calculated with the following equations:
Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$
Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8785	21.8	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = $Hz^2 / 1000$ ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon		
Model:	VW2100-0.35		
Serial Number:	**VW34546**		
Mfg Number:	1530900		
Range:	350.0	kPa	
Temperature:	22.7	°C	
Barometric Pressure:	1005.3	millibars	
Work Order Number:	208286		
Cable Length:	20	meters	
Cable Markings:	1017811 m - 1017830 m		
Cable Colour Code:	Red / Black (Coil)	Green / White	(Thermistor)
Cable Type:	EL380004		
Thermistor Type:	3	kΩ	

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8869	8870	8870	0.2	0.05	-0.01
70.0	8219	8220	8220	70.0	-0.01	0.00
140.0	7568	7568	7568	139.9	-0.03	0.02
210.0	6917	6917	6917	209.8	-0.06	-0.01
280.0	6264	6264	6264	279.9	-0.03	-0.01
350.0	5609	5609	5609	350.2	0.07	0.01
			Max. Error (%):		0.07	0.02

Linear Calibration Factor:	**C.F.=**	**0.10736 kPa/B unit**
Regression Zero:	**At Calibration =**	**8871.2 B unit**
Temperature Correction Factor:	**Tk =**	**-0.01603 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -1.3981E-07 **B:** -0.10534 **C:** 945.27

Pressure is calculated with the following equations:

Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$

Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8868	21.9	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon		
Model:	VW2100-0.35		
Serial Number:	**VW34547**		
Mfg Number:	1530901		
Range:	350.0 kPa		
Temperature:	22.7 °C		
Barometric Pressure:	1005.3 millibars		
Work Order Number:	208286		
Cable Length:	20 meters		
Cable Markings:	1017831 m - 1017850 m		
Cable Colour Code:	Red / Black (Coil)	Green / White	(Thermistor)
Cable Type:	EL380004		
Thermistor Type:	3 kΩ		

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8906	8906	8906	0.4	0.10	0.02
70.0	8300	8300	8300	69.9	-0.03	-0.01
140.0	7693	7693	7693	139.5	-0.13	-0.06
210.0	7079	7079	7079	210.0	0.00	0.06
280.0	6469	6469	6469	280.0	0.00	0.01
350.0	5857	5857	5857	350.2	0.06	-0.02
			Max. Error (%):		0.13	0.06

Linear Calibration Factor:	**C.F.=**	**0.11474 kPa/B unit**
Regression Zero:	**At Calibration =**	**8909.1 B unit**
Temperature Correction Factor:	**Tk =**	**-0.06677 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -2.3123E-07 **B:** -0.11133 **C:** 1009.9

Pressure is calculated with the following equations:
Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$
Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8906	21.8	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = $Hz^2 / 1000$ ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon
Model:	VW2100-0.35
Serial Number:	**VW34548**
Mfg Number:	1530902
Range:	350.0 kPa
Temperature:	22.7 °C
Barometric Pressure:	1005.3 millibars
Work Order Number:	208286
Cable Length:	20 meters
Cable Markings:	1017932 m - 1017951 m
Cable Colour Code:	Red / Black (Coil) Green / White (Thermistor)
Cable Type:	EL380004
Thermistor Type:	3 kΩ

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8733	8733	8733	0.3	0.09	0.00
70.0	8085	8085	8085	69.9	-0.02	0.00
140.0	7435	7435	7435	139.8	-0.06	0.01
210.0	6784	6784	6784	209.7	-0.08	0.00
280.0	6131	6131	6131	279.9	-0.03	-0.01
350.0	5475	5475	5475	350.4	0.10	0.01
			Max. Error (%):		0.10	0.01

Linear Calibration Factor:	**C.F.=**	**0.10744 kPa/B unit**
Regression Zero:	**At Calibration =**	**8736.0 B unit**
Temperature Correction Factor:	**Tk =**	**-0.08635 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -2.3505E-07 **B:** -0.10410 **C:** 927.03

Pressure is calculated with the following equations:

Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$

Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8727	22.1	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = $Hz^2 / 1000$ ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon		
Model:	VW2100-0.35		
Serial Number:	**VW34549**		
Mfg Number:	1530903		
Range:	350.0 kPa		
Temperature:	22.7 °C		
Barometric Pressure:	1005.3 millibars		
Work Order Number:	208286		
Cable Length:	20 meters		
Cable Markings:	1017912 m - 1017931 m		
Cable Colour Code:	Red / Black (Coil)	Green / White	(Thermistor)
Cable Type:	EL380004		
Thermistor Type:	3 kΩ		

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8879	8881	8880	0.4	0.12	0.02
70.0	8270	8271	8271	69.9	-0.04	-0.02
140.0	7659	7658	7659	139.6	-0.11	-0.03
210.0	7042	7043	7043	209.8	-0.05	0.03
280.0	6427	6427	6427	280.0	-0.01	0.01
350.0	5810	5810	5810	350.3	0.08	-0.01
			Max. Error (%):		0.12	0.03

Linear Calibration Factor:	**C.F.=**	**0.11397 kPa/B unit**
Regression Zero:	**At Calibration =**	**8883.5 B unit**
Temperature Correction Factor:	**Tk =**	**-0.06306 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -2.7785E-07 **B:** -0.10989 **C:** 997.79

Pressure is calculated with the following equations:

Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$

Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8872	21.8	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = $Hz^2 / 1000$ ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon		
Model:	VW2100-0.35		
Serial Number:	**VW34550**		
Mfg Number:	1530904		
Range:	350.0 kPa		
Temperature:	22.7 °C		
Barometric Pressure:	1005.3 millibars		
Work Order Number:	208286		
Cable Length:	20 meters		
Cable Markings:	1017972 m - 1017991 m		
Cable Colour Code:	Red / Black (Coil)	Green / White	(Thermistor)
Cable Type:	EL380004		
Thermistor Type:	3 kΩ		

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8695	8694	8695	0.3	0.08	-0.01
70.0	8045	8045	8045	70.0	-0.01	0.01
140.0	7394	7395	7395	139.8	-0.06	0.00
210.0	6742	6743	6743	209.8	-0.07	0.00
280.0	6089	6089	6089	279.9	-0.03	-0.01
350.0	5433	5433	5433	350.3	0.09	0.01
			Max. Error (%):		0.09	0.01

Linear Calibration Factor:	**C.F.=**	**0.10733 kPa/B unit**
Regression Zero:	**At Calibration =**	**8697.0 B unit**
Temperature Correction Factor:	**Tk =**	**-0.07024 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -2.0049E-07 **B:** -0.10449 **C:** 923.66

Pressure is calculated with the following equations:

Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$

Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8689	21.9	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = $Hz^2 / 1000$ ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon		
Model:	VW2100-0.35		
Serial Number:	**VW34551**		
Mfg Number:	1530905		
Range:	350.0 kPa		
Temperature:	22.7 °C		
Barometric Pressure:	1005.3 millibars		
Work Order Number:	208286		
Cable Length:	20 meters		
Cable Markings:	1017791 m - 1017810 m		
Cable Colour Code:	Red / Black (Coil)	Green / White	(Thermistor)
Cable Type:	EL380004		
Thermistor Type:	3 kΩ		

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8794	8794	8794	0.3	0.08	0.00
70.0	8170	8170	8170	69.9	-0.02	0.00
140.0	7544	7545	7545	139.8	-0.07	0.00
210.0	6917	6917	6917	209.8	-0.06	0.01
280.0	6289	6289	6289	279.9	-0.03	-0.01
350.0	5658	5658	5658	350.3	0.09	0.01
			Max. Error (%):		0.09	0.01

Linear Calibration Factor:	**C.F.=**	**0.11161 kPa/B unit**
Regression Zero:	**At Calibration =**	**8796.6 B unit**
Temperature Correction Factor:	**Tk =**	**-0.07486 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -2.2804E-07 **B:** -0.10832 **C:** 970.19

Pressure is calculated with the following equations:

Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$

Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8788	21.1	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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e-mail: info@rstinstruments.com • Website: www.rstinstruments.com

Calibration Record

Vibrating Wire Piezometer

Customer:	Golder Associates Ltd.-Saskatoon	
Model:	VW2100-0.35	
Serial Number:	**VW34552**	
Mfg Number:	1530906	
Range:	350.0 kPa	
Temperature:	22.7 °C	
Barometric Pressure:	1005.3 millibars	
Work Order Number:	208286	
Cable Length:	20 meters	
Cable Markings:	1017892 m - 1017910 m	
Cable Colour Code:	Red / Black (Coil)	Green / White (Thermistor)
Cable Type:	EL380004	
Thermistor Type:	3 kΩ	

Applied Pressure (kPa)	First Reading (B units)	Second Reading (B units)	Average Reading (B units)	Calculated Linear (kPa)	Linearity Error (% FS)	Polynomial Error (% FS)
0.0	8795	8796	8796	0.4	0.10	0.02
70.0	8209	8208	8209	69.8	-0.07	-0.05
140.0	7615	7616	7616	139.9	-0.04	0.03
210.0	7024	7024	7024	209.8	-0.06	0.01
280.0	6430	6431	6431	280.0	-0.01	0.01
350.0	5836	5836	5836	350.2	0.07	-0.01
			Max. Error (%):		0.10	0.05

Linear Calibration Factor:	**C.F.=**	**0.11823 kPa/B unit**
Regression Zero:	**At Calibration =**	**8798.5 B unit**
Temperature Correction Factor:	**Tk =**	**-0.02815 kPa/°C rise**

Polynomial Gage Factors (kPa) **A:** -2.3772E-07 **B:** -0.11475 **C:** 1027.7

Pressure is calculated with the following equations:
Linear: $P(kPa) = C.F.(Li-Lc) - [Tk(Ti-Tc)] + [0.10(Bi-Bc)]$
Polynomial: $P(kPa) = A(Lc)^2 + BLc + C + Tk(Tc-Ti) - [0.10(Bc-Bi)]$

	Date (dd/mm/yy)	VW Readout Pos. B (Li)	Temp °C (Ti)	Baro (Bi)
Shipped Zero Readings:	6-Oct-15	8794	21.8	1016.4

Li, Lc = initial (at installation) and current readings
Ti, Tc = initial (at installation) and current temperature, in °C
Bi, Bc = initial (at installation) and current barometric pressure readings, in millibars
B units = B scale output of VW 2102, VW 2104, VW 2106 and DT 2011 readouts
B units = Hz^2 / 1000 ie: 1700Hz = 2890 B units

Technician: B. Yu Date: 6-Oct-15

This instrument has been calibrated using standards traceable to the NIST in compliance with ANSI Z540-1

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SCHEDULE "B"

CONSULTANT'S STATEMENT OF LIMITATIONS

The scope and the period of Golder's investigations and services are as described in the Report, and are subject to restrictions and limitations. The Report has been based on instructions given to Golder by Client and communications between Golder and Client. Such instructions and communications have directed the extent and detail of explorations and testing, including the number, type, and geographic position of tests and their locations. Proposed Relying Party should review the level of investigation and reporting provided and make its own assessment and interpretation on the sufficiency of the Report and conduct any additional investigations or supplement as they deem appropriate.

Golder has prepared the Report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing in Manitoba subject to the time limits and financial, physical or any other constraints applicable to the services. No warranty, expressed or implied is made. Golder did not perform a complete assessment of all possible conditions or circumstances that may exist at the site referenced in the Report. Conditions may therefore exist which were undetectable given the limited nature of the inquiry Golder was retained to undertake with respect to the site. If a service is not expressly indicated, do not assume it has been provided. The Report is intended to be used in its entirety and no excerpts may be taken to be representative of the findings in the assessments.

The information provided in the Report applies only to the subject site as it existed at the time of Golder's site investigations. Should the site use or conditions change, the information in the Report may no longer apply. It is recognized that the passage of time affects the information provided in such Report. Not all sites may have been investigated due to various constraints (such as lack of permission to enter, limited access to site due to terrain, crops or dense vegetation cover). As such the subsurface models may not have had an inadequate number of data points and accordingly, should not be relied upon. Any interpretation of the data is at the sole risk of the interpreter and such interpretation must consider the variable nature of subsurface materials, the uncertainty associated with the exploration and testing methods, and the effects that these will have on design and construction. Golder assumes no responsibility and no liability for any interpretations of the data contained in the Report or the consequences thereof, including, but not limited to, proposed designs, the feasibility of development, construction techniques, cost, schedule, safety, and equipment capabilities. Golder makes no representations regarding the marketability of the subject property and none should be inferred based on the Report.

Classification and identification of geologic units have been based on commonly accepted methods employed in the practice of geotechnical engineering and related disciplines. Classification and identification of the type and condition of these materials or units involves judgment. Boundaries between different soil, rock, or geologic types or units are typically transitional rather than abrupt. Golder does not warrant or guarantee the exactness of the subsurface material descriptions or the boundary between different materials that is interpreted between sample locations. Soil and groundwater conditions shown in the Report are the observed conditions at the time and location of their determination or measurement. Soil and groundwater conditions

may vary between and beyond reported locations and can be affected by annual, seasonal and meteorological conditions. Fill of variable physical and chemical composition can be present over portions of the site or on adjacent properties. The Report includes only the geotechnical aspects of the subsurface conditions and no chemical information related to the native soil deposits and/or fill materials. The presence or implication(s) of possible surface and/or subsurface contamination resulting from previous activities or uses of the site and/or resulting from the introduction onto the site of materials from off-site sources are outside the terms of reference for the Report and have not been investigated or addressed in the Report. The condition of the soil, rock, and groundwater may be significantly altered by construction activities on the site or on adjacent sites. Excavation may expose the soils to changes due to wetting, drying, or freezing and the soil may require protection from these changes during construction.

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3. INDEMNITY - Relying Party shall indemnify, defend and hold harmless Golder and its subcontractors, consultants, agents, officers, directors and employees from and against all claims, damages, losses and expenses, including but not limited to legal fees, court and arbitration costs, arising out of or resulting from the acts, errors or omissions of Relying Party, inclusive of claims made by third parties.
4. LIMITATION – To the fullest extent permitted by law, the Relying Party agrees to limit the liability of Golder, its affiliates, and their respective employees, officers, directors, agents, consultants and subcontractors ("Golder Group") to Relying Party, for any and all causes of action asserted by Relying Party, to matters which arise directly from Golder's acts, errors or omissions, such that the total aggregate liability of Golder to Relying Party shall not exceed Fifty Thousand Dollars ($50,000). Relying Party hereby waives and releases: (i) all present and future claims against Golder Group other than those described in the preceding sentence, and (ii) any liability of Golder Group in excess of the limitation amount. Any liability of Golder shall expire one year after the date of the Report. Neither party shall be responsible to the other for and each party waives any right to recover from the other for lost revenues, lost profits, cost of capital, claims of customers, or other special, indirect, consequential or punitive damages. In consideration of the promises contained herein and for other separate, valuable consideration, the receipt and sufficiency of which is hereby acknowledged, Relying Party acknowledges and agrees that it has had the opportunity to negotiate the terms of this Section entitled Limitation as part of an "arms-length" transaction.
5. DISPUTES - In the event that one party makes a claim against the other, at law or otherwise, and then fails to prove such claim, then the prevailing party shall be entitled to all costs, including legal fees incurred in defending against the claim.