

## **APPENDIX C – GEOTECHNICAL INVESTIGATION FOR CHARETTE ROAD AT BRADY ROAD LANDFILL (SEPTEMBER 4, 2014)**

# MEMORANDUM

**TO:** Roy Houston; Burton Mikolayenko  
**FROM:** Kelly Fordyce; Tony Ng  
**DATE:** September 4, 2014  
**FILE NO:** 14-0107-010  
**RE:** Geotechnical Investigation for Charette Road at Brady Landfill

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## 1.0 INTRODUCTION

The following memo presents the results and recommendation arising from KGS Group's recent geotechnical investigation of Charette Road at the City of Winnipeg Brady Landfill. Investigations included topographic survey, a soil survey drilling through the existing roadway and a laboratory testing program. The investigations form part of the design for reconstruction of this 950 m of roadway.

## 2.0 INVESTIGATION PROGRAM

The investigation program consisted of topographic site survey, soil survey drilling and laboratory testing program and described as below.

### 2.1 TOPOGRAPHIC SITE SURVEY

A topographic site survey was performed by KGS Group in June 2014 to determine the existing road geometry. The topographic survey was completed using GPS and the NAD83CSRS UTM Zone 14 horizontal projection and CGVD28 vertical datum.

### 2.2 SOIL SURVEY DRILLING

A drilling and sampling program was completed in June 2014 with drilling services provided by Paddock Drilling Ltd. of Brandon, Manitoba under continuous KGS Group supervision. Fourteen (14) test holes were completed within the 950 m construction limit right-of-way of Charette Road. Seven (7) test holes were evenly spaced on the south and north shoulders of the road respectively. Test holes on either side of the road were staggered to ensure no two test holes would represent the same cross section of road. Figure 01 shows the locations of the test holes.

The test holes were completed using a truck mounted Acker MP8 drill rig equipped with 125 mm solid stem augers. In general, disturbed soil samples were obtained directly from the auger to a designated depth of 4.57 m (15 feet) below grade. Soil samples were collected at 0.61 m intervals or whenever a change in stratigraphic conditions was observed. All samples were visually inspected for material type and classified according to the modified Unified Soil

Classification System (USCS). Field Torvane tests were performed to measure the undrained shear strength of clay samples from all test holes. Detailed test hole logs incorporating all field observations are included in Appendix A.

### 2.3 LABORATORY TESTING

A laboratory testing program was performed on select soil samples from the current drilling program to determine the relevant engineering properties of the subsurface soils relative to the stability assessment. Diagnostic testing included six (6) Atterberg Limits tests and sixty-four (64) moisture content analyses. Laboratory testing results are included on the test hole logs and provided in Appendix B.

## 3.0 INVESTIGATION RESULTS

### 3.1 SITE GEOMETRY

The topographic site survey data was used to develop a digital terrain model (DTM) of the site as well as the typical cross sections of the road. Figures 01 and 02 show the plan and the cross-sections respectively.

### 3.2 STRATIGRAPHY

In general, the soil stratigraphy of Charette Road located at the Brady Landfill Site has been interpreted by KGS Group to consist of a shallow top layer of granular fill (traffic gravel) underlain by clay fill, occasional silt pockets, and silty clay. The following sections highlight the stratigraphic units encountered during the drilling activities.

#### ***Granular Fill (Traffic Gravel)***

The depth of the granular fill ranged from 0.05 m to 0.30 m below existing grade. The fill was tan to brown; dry; compact; and consisted of fine to coarse grained sand, fine to coarse grained gravel. Granular fill contaminated or mixed with the underlying clay fill was observed.

#### ***Clay Fill***

Below the granular material was clay fill that extended to a maximum depth of approximately 1.5 m below existing grade. Within test holes TH14-09 and TH14-14 clay fill was encountered to a depth of 0.9 m and 1.2 m respectively. The fill was brown to black; damp; stiff in consistency; of low to high plasticity; and contained trace silt pockets, trace organics, trace oxidation, and occasional rootlets. Moisture content in the clay fill ranged from 20% to 66% with an overall average of 29%. Atterberg Limit testing of the fill measured a plastic limit,  $w_p$ , of 17% to 20%; a liquid limit,  $w_L$ , of 54% to 64%; and a Plasticity Index,  $I_p$ , of 37% to 44%.

#### ***Clay (CI)***

Intermediate plasticity silty clay (CI) was encountered in eight (8) of the test holes (TH14-01, TH14-02, TH14-03, TH14-08, TH14-09, TH14-11, TH14-14). The thickness of the silty clay (CI) layer ranged from 0.3 m to 2.3 m with an overall average of 0.9 m, while the depth of material extended below grade from 1.8 m to 3.4 m. The silty clay (CI) was brown; damp to moist; soft; of low to medium plasticity; and with high silt content. Samples obtained from test holes TH14-02, TH14-03, TH14-09, TH14-11, and TH14-14 were frozen at the time of drilling. The thickness of frozen material ranged from 0.3 m to 1.1 m. Moisture contents of the silty clay (CI) ranged from 23% to 41% with an overall average of 29%. Atterberg Limits of the silty clay (CI)

were a plastic limit,  $w_p$ , of 13% to 14%; a liquid limit,  $w_L$ , of 32% to 34%; and a Plasticity Index,  $I_p$ , of 18% to 21%, resulting in a classification of CI.

### **Clay (CH)**

The top of the high plasticity clay (CH) layer ranged from 1.5 m to 3.4 m below grade. This clay (CH) was brown to mottled grey and brown; damp to moist; firm to stiff in consistency; of high plasticity; and contained trace silt pockets, trace to some oxidation, occasional gypsum pockets, and trace fine grained sand. Samples obtained from test holes TH14-02, TH14-05, TH14-07, TH14-08, TH14-13, and TH14-14 were frozen at the time of drilling. The thickness of frozen material ranged from 0.3 m to 0.6 m. Moisture contents ranged from 29% to 51% with an overall average of 43%. Atterberg Limits of the silty clay (CH) were a plastic limit,  $w_p$ , of 23% to 24%; a liquid limit,  $w_L$ , of 92% to 95%; and a Plasticity Index,  $I_p$ , of 68% to 72%, resulting in a classification of CH. The undrained shear strengths of the clay, as estimated by the field Torvane ranged from 40 kPa to 90 kPa with an overall average of 65 kPa.

## **4.0 CONCLUSIONS AND RECOMMENDATIONS**

Based on our investigation and assessment the following conclusions and recommendations are made:

- The existing granular fill (traffic gravel) was contaminated with clay fill and should not be re-used for the new road construction.
- The existing clay fill of the embankment could be re-used for the new road construction. However, the top 0.6 m of the clay fill should be removed and not be re-used due to possible contamination with granular fill and other materials.
- Test holes TH14-03, TH14-06, and TH14-09 were observed to contain an extensive layer of silty clay (CI) with high silt content. Where encountered, these materials should be removed and should not be used for the new road construction.
- The underlying high plasticity clay material (CH) is intact and could be used for the construction of the new roads.
- Woven fabric in accordance with Section 2.5 of Specification CW 3130 should be placed underneath the granular fill (traffic gravel) as a sub-grade separator and reinforcement.
- Since the City owns the land of the Brady landfill and there is no right of way constrain for the reconstruction of Charette Road; therefore, it is feasible to reconstruct one lane at a time by utilizing existing embankment materials for the construction, by creating traffic control and an alternative lane outside of the construction boundaries to keep traffic moving in both directions.

## **5.0 PRELIMINARY CONSTRUCTION COST ESTIMATES**

The preliminary construction cost estimates for the reconstruction of Charette Road and its temporary road are about \$ 3,930,000 and the breakdown is presented in Table 1.

## 6.0 STATEMENT OF LIMITATIONS AND CONDITIONS

### 6.1 THIRD PARTY USE OF REPORT

This report has been prepared for City of Winnipeg to whom this report has been addressed and any use a third party makes of this report, or any reliance on or decisions made based on it, are the responsibility of such third parties. KGS Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions undertaken based on this report.

### 6.2 GEOTECHNICAL ENGINEERING STATEMENT OF LIMITATIONS

The conclusions and recommendations contained in this report were prepared in accordance with generally accepted professional engineering principles and practice. The conclusions and recommendations are based on the concept design drawings and engineering information that was made available to KGS Group by Parks Canada Agency, combined with information on soil and groundwater conditions described in existing soils report and those encountered at and within the depth of the test holes drilled by KGS at this site. If conditions encountered during construction appear to be different from those shown on the existing soil report or test holes drilled by KGS or if the assumptions stated herein are not in keeping with the design, this office should be notified in order that the recommendations can be reviewed and modified if necessary.

Prepared By:

Approved By:



Kelly Fordyce *for*  
Geotechnical Engineering Aide



Tony Ng, M.Sc., P.Eng.  
Senior Geotechnical Engineer

KF/TN/sa

**TABLE**

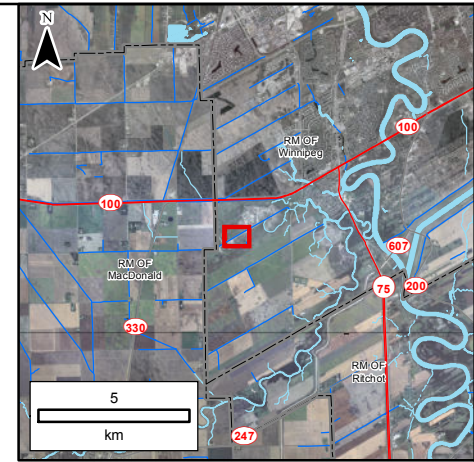
TABLE 1: PRELIMINARY CONSTRUCTION COST ESTIMATES  
 14-0107-010: Geotechnical Investigation for Charette Road at Brady Landfill

Items	Unit	Unit Price	Total
Mob & Demob	L.S.		\$50,000
Temporary Road			
Traffic Gravel	4,800 cu m	60	\$288,000
Geotextile	8,000 sq m	4	\$32,000
Road Embankment	45,000 cu m	12	\$540,000
Charette Road Reconstruction			
Traffic Gravel	9,600 cu m	60	\$576,000
Geotextile	15,000 sq m	4	\$60,000
Road Embankment	90,000 cu m	12	\$1,080,000
TOTAL:			\$2,626,000
Engineering Fees (15%)			\$393,900
Construction & Engineering Fees :			\$3,019,900
30% Contingency Fees			\$905,970
<b>GRANT TOTAL:</b>			<b>\$3,925,870</b>

**ROUND UP TOTAL = \$ 3,930,000**

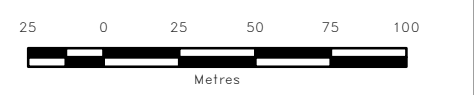
**FIGURE**





- LEGEND:**
- KGS Survey (June 3, 2014)
  - ⊕ Testhole Location
  - Section
  - 1m Index Contour
  - 0.25m Contour

**DRAFT**



SCALE: 1:2,500 METRIC 11"x17"

All units are metric and in metres unless otherwise specified.  
Transverse Mercator Projection, NAD 1983, Zone 14  
Elevations are in metres above sea level (MSL)

NO.	YY/MM/DD	DESCRIPTION	BY
A	14/09/04	ISSUED FOR INFORMATION	TNG

REVISIONS / ISSUE





**KGS**  
GROUP  
CONSULTING  
ENGINEERS

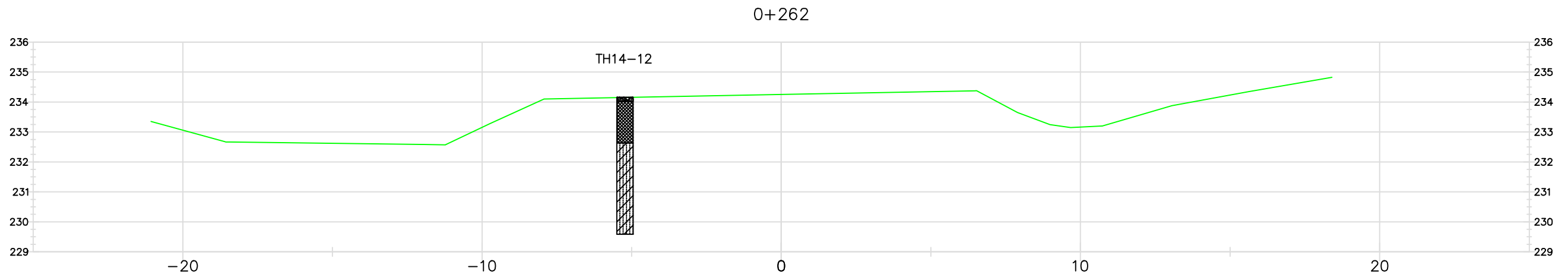
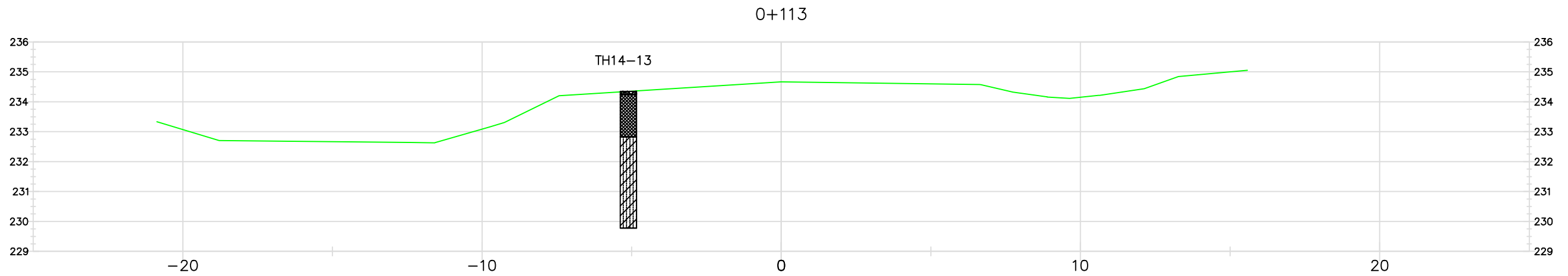
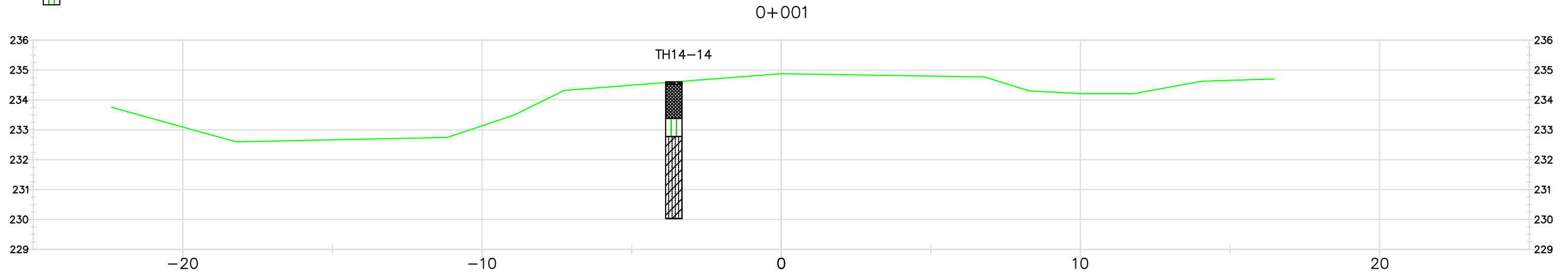
2014/15 GRANULAR ROADWAY  
RENEWAL PROGRAM  
CHARETTE ROAD AT BRADY LANDFILL  
GENERAL SITE PLAN AND  
TEST HOLE LOCATIONS

**PRELIMINARY**  
NOT TO BE USED FOR CONSTRUCTION







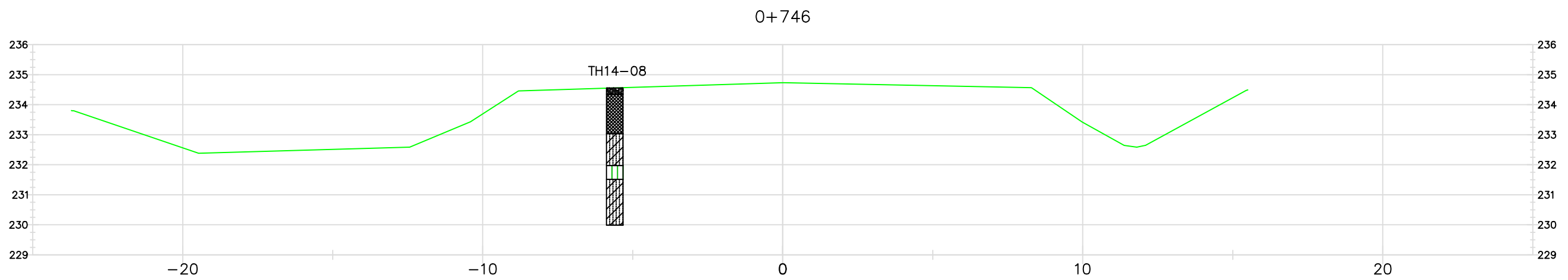
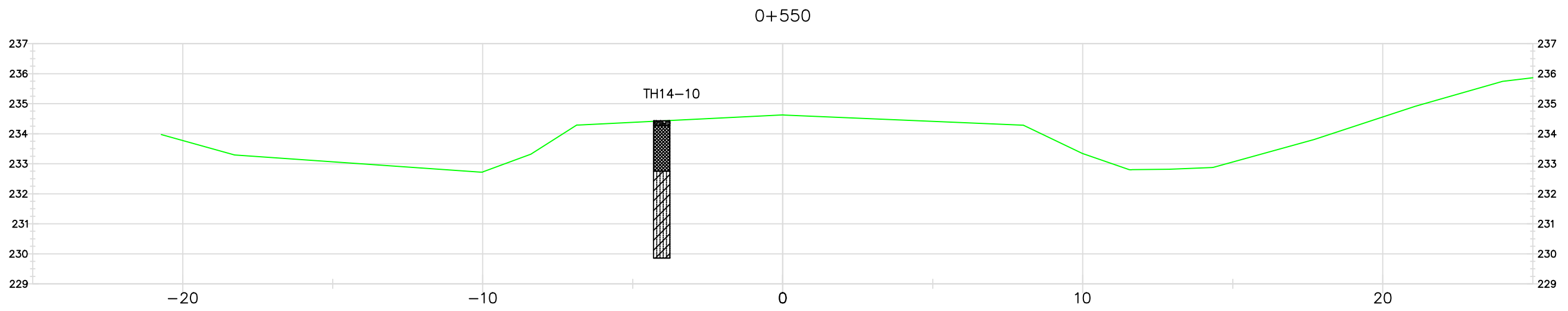
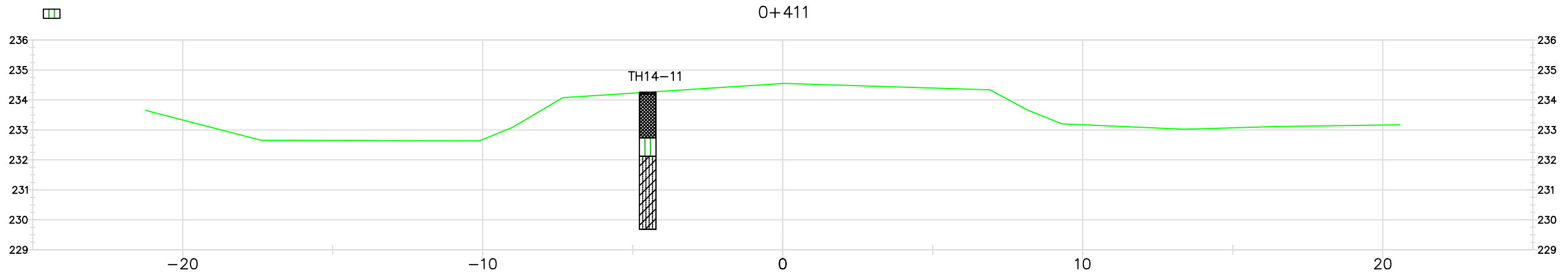
CHARETTE ROAD  
SEPT. 2, 2014  
1:150  
FIGURE 2  
PAGE 1 OF 3

- GRANULAR FILL 
- CLAY FILL (CL) 
- SILTY CLAY (CH) 
- SILTY CLAY (CI) 







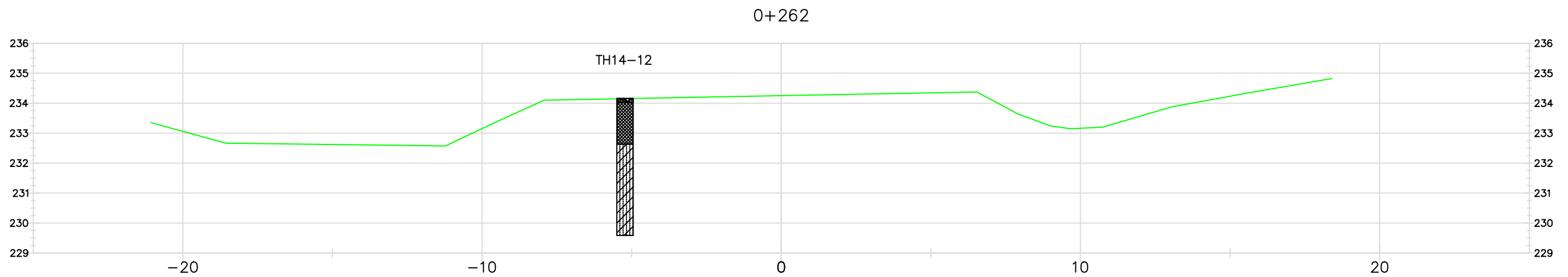
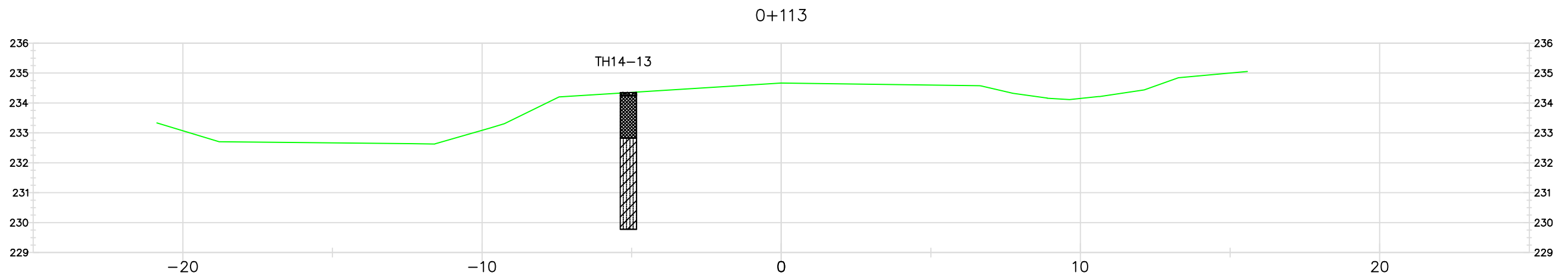
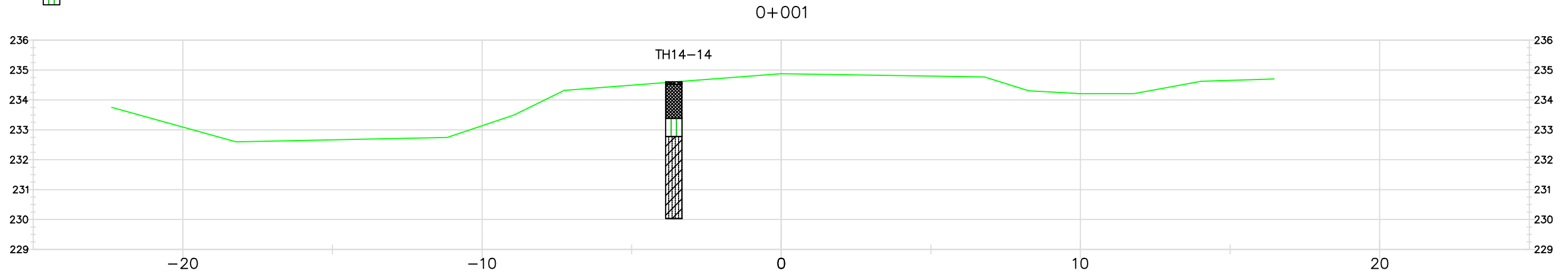
CHARETTE ROAD  
SEPT. 2, 2014  
1:150  
FIGURE 2  
PAGE 2 OF 3

- GRANULAR FILL 
- CLAY FILL (CL) 
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CHARETTE ROAD  
SEPT. 2, 2014  
1:150  
FIGURE 2  
PAGE 1 OF 3

- GRANULAR FILL 
- CLAY FILL (CL) 
- SILTY CLAY (CH) 
- SILTY CLAY (CI) 




**Appendix A**  
**KGS Group 2014 Test hole Logs**

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.91  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,512,934  
 E 628,950

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.6				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Tan, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill.	S1					
234	1			<b>CLAY FILL (CL)</b> - Black, damp, stiff, low plasticity, trace silt pockets, trace rootlets, trace organics, trace oxidation.	S2					
233.1	5				S3					
233					S4					
232.8	2			<b>SILTY CLAY (CI)</b> - Brown, damp to moist, soft, low plasticity, trace clay, trace oxidation, high silt content.	S5					
232	3			<b>SILTY CLAY (CH)</b> - Mottled grey and brown, damp to moist, stiff, high plasticity, trace silt pockets.	S6					
231	4				S7					
230.3	15			<b>END OF TEST HOLE at 4.57 m</b>						
230	5			Notes: 1. No groundwater encountered. 2. Backfilled TH14-01 with auger cuttings and bentonite chips to surface.						
229	6									
228	7									
227	8									
226	9									
225										

SAMPLE TYPE  Auger Grab

**CONTRACTOR**  
 Paddock Drilling Ltd.

**INSPECTOR**  
 J. WILCOX

**APPROVED**  
 TNG

**DATE**  
 9/3/14

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.69  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,512,977  
 E 629,024

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆			
	(m)	(ft)						PL	MC	LL	
234.4				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill.	S1						
234	1			<b>CLAY FILL (CL)</b> - Black, damp, stiff, low plasticity, some silt pockets, trace rootlets, trace organics.	S2						
233.2	5			<b>SILTY CLAY (CI)</b> - Brown, frozen, low plasticity, high silt content.	S3						
233.3				-frozen from 1.52 m to 2.13 m.	S4						
232.9	2			<b>SILTY CLAY (CH)</b> - Mottled grey and brown, frozen, trace silt pockets, trace oxidation. - Moist, stiff, high plasticity below 1.83 m.	S5						
232				- Trace to some oxidation below 3.65 m.	S6						
231	3	10			S7						
230.1	4	15									
230			<b>END OF TEST HOLE at 4.57 m</b>								
	5		Notes: 1. No ground water encountered. 2. Backfilled TH14-02 with auger cuttings and bentonite chips to surface.								
229	6	20									
228	7										
227	8	25									
226	9	30									
225											

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. WILCOX**

APPROVED **TNG**

DATE **9/3/14**

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.44  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,054  
 E 629,158

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆	
	(m)	(ft)						PL	MC
234.4				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Tan, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill.	S1				
234				<b>CLAY FILL (CH)</b> - Black, damp, stiff, low to high plasticity, trace silt pockets, trace rootlets, trace organics, trace oxidation.	S2				
233.9	1	3.3		<b>SILTY CLAY (CI)</b> - Brown, moist to wet, soft, low plasticity, high silt content. - Frozen from 1.82 m to 2.13 m.	S3				
232	2	6.6		S4					
231.1	3	9.9		S5					
231				<b>SILTY CLAY (CH)</b> - Mottled grey and brown, moist, firm to stiff, high plasticity, trace silt pockets, trace oxidation.	S6				
229.9	4	13.1		S7					
229	5	16.4	<b>END OF TEST HOLE at 4.57 m</b>						
228	6	19.7	Notes: 1. No groundwater encountered. 2. Backfilled TH14-03 with auger cuttings and bentonite chips to surface.						
227	7	23.0							
226	8	26.3							
225	9	29.6							

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. WILCOX**

APPROVED **TNG**


DATE **9/3/14**



**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.53  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,123  
 E 629,278

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.2				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, some fine grained gravel, mixed with clay fill.	S1					
234				<b>CLAY FILL (CL)</b> - Brown to Black, damp, stiff, low plasticity, trace silt pockets, trace organics.	S2					
233.0				<b>SILTY CLAY (CH)</b> - Brown, damp to moist, stiff, high plasticity, trace fine grained sand.	S3					
233					S4					
232					S5					
231				- Mottled grey and brown, moist, trace silt pockets, trace oxidation below 3.35 m.	S6					
230.0				<b>END OF TEST HOLE at 4.57 m</b>	S7					
229				Notes: 1. No groundwater encountered. 2. Backfilled TH14-04 with auger cuttings and bentonite chips to surface.						
228										
227										
226										
225										

 SAMPLE TYPE  Auger Grab

 CONTRACTOR **Paddock Drilling Ltd.**

 INSPECTOR **J. WILCOX**

 APPROVED **TNG**

 DATE **9/3/14**

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.76  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,197  
 E 629,406

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.5				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill.	S1					
234	1			<b>CLAY FILL (CL)</b> - Black to grey, damp, stiff, low plasticity, trace fine grained sand, trace oxidation.	S2					
233.2	5			<b>SILTY CLAY (CH)</b> - Brown, Frozen, trace silt pockets.  - Frozen from 1.52 m to 1.82 m. - Damp to moist, stiff, high plasticity below 1.82 m.	S3					
233	2			S4						
232	3	10		S5						
231	4			S6						
230.2	15			S7						
230	5			<b>END OF TEST HOLE at 4.57 m</b>						
229	6	20		Notes: 1. No groundwater encountered. 2. Backfilled TH14-05 with auger cuttings and bentonite chips to surface.						
228	7									
227	8	25								
226	9	30								
225										

SAMPLE TYPE Auger Grab

**CONTRACTOR**  
 Paddock Drilling Ltd.

**INSPECTOR**  
 J. WILCOX


**APPROVED**  
 TNG

**DATE**  
 9/3/14

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.55  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,267  
 E 629,528

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.3				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill.	S1					
234				<b>CLAY FILL (CL)</b> - Black, damp, stiff, low plasticity, trace silt pockets, trace rootlets, trace organics, trace oxidation.	S2					
233.0				<b>SILTY CLAY (CI)</b> - Brown, damp to moist, soft, low plasticity, trace clay, trace oxidation, high silt content.	S3					
233				<b>SILTY CLAY (CH)</b> - Mottled grey and brown, moist, stiff, high plasticity, trace silt pockets.	S4					
232.3				<b>SILTY CLAY (CH)</b> - Mottled grey and brown, moist, stiff, high plasticity, trace silt pockets.	S5					
232				- Trace oxidation below 3.65 m.	S6					
231					S7					
230.0				<b>END OF TEST HOLE at 4.57 m</b>						
229				Notes: 1. No groundwater encountered. 2. Backfilled TH14-06 with auger cuttings and bentonite chips to surface.						
228										
227										
226										
225										

SAMPLE TYPE  Auger Grab

**CONTRACTOR**  
 Paddock Drilling Ltd.

**INSPECTOR**  
 J. WILCOX

**APPROVED**  
 TNG

**DATE**  
 9/3/14

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.65  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,369  
 E 629,704

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.3				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill. <b>CLAY FILL (CL)</b> - Black, damp, stiff, low plasticity, trace silt pockets, trace organics.	S1					
234	1				S2					
233.1				<b>SILTY CLAY (CH)</b> - Brown to grey, damp, stiff, intermediate plasticity, trace silt pockets. - Frozen from 1.52 m to 1.83 m - Tan, block, increased silt content from 2.44 m to 3.05 m. - Mottled grey and brown, moist, high plasticity, trace silt pockets, trace oxidation below 3.05 m.	S3					
233	5			S4						
232	2			S5						
231	3	10		S6						
230.1	4			S7						
230	15		END OF TEST HOLE at 13.41 m							
			Notes: 1. No groundwater encountered. 2. Backfilled TH14-07 with auger cuttings and bentonite chips to surface.							
229	5									
228	6	20								
227	7									
226	8	25								
225	9	30								

SAMPLE TYPE Auger Grab

 CONTRACTOR **Paddock Drilling Ltd.**

 INSPECTOR **J. WILCOX**

 APPROVED **TNG**

 DATE **9/3/14**

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.62  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,339  
 E 629,636

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.4				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill. <b>CLAY FILL (CL)</b> - Black to brown, damp, stiff, low plasticity, trace silt pockets, trace rootlets, trace organics, trace oxidation.	S1					
234	1				S2					
233.1	5				S3					
233	2			<b>SILTY CLAY (CH)</b> - Mottled grey and brown, some silt pockets, trace fine grained gravel. - Frozen from 1.52 m to 2.13 m. - Damp to moist, stiff, high plasticity below 2.13 m.	S4					
232.0	3	10		<b>SILTY CLAY (CI)</b> - Brown, moist, soft, non plastic, some oxidation, high silt content.	S5					
231.6	4			<b>SILTY CLAY (CH)</b> - Mottled grey and brown, moist, firm to stiff, high plasticity. - Trace silt pockets below 3.65 m.	S6					
230.0	15			<b>END OF TEST HOLE at 4.57 m</b>	S7					
230	5		Notes: 1. No groundwater encountered. 2. Backfilled TH14-08 with auger cuttings and bentonite chips to surface.							
229	6	20								
228	7									
227	8	25								
226	9	30								
225										

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. WILCOX**

APPROVED **TNG**

DATE **9/3/14**

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.72  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,298  
 E 629,562

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.5				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, some fine grained gravel, mixed with clay fill.	S1					
234				<b>CLAY FILL (CL)</b> - Black, damp, stiff, low plasticity, trace silt pockets, trace rootlets, trace organics, trace oxidation.	S2					
233.8	1			<b>SILTY CLAY (CI)</b> - Brown, damp, soft, low plasticity, high silt content. -Frozen from 1.52 m to 2.13 m.	S3					
233	5			- Trace oxidation, trace coarse grained sand, trace fine grained gravel, trace clay below 1.82 m.	S4					
232	2			S5						
231.5	10			<b>SILTY CLAY (CH)</b> - Mottled grey and brown, moist, stiff, high plasticity, trace silt pockets.	S6					
231	4			- Trace oxidation below 4.26 m.	S7					
230.1	15			<b>END OF TEST HOLE at 4.57 m</b>						
230	5		Notes: 1. No groundwater encountered. 2. Backfilled TH14-09 with auger cuttings and bentonite chips to surface.							
229	6	20								
228	7									
227	8	25								
226	9	30								
225										

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. WILCOX**


APPROVED **TNG**

DATE **9/3/14**

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.50  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,242  
 E 629,466

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						20	40	60
234.4				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, some fine to coarse grained gravel, subangular to angular particles, mixed with clay fill.	S1					
234	1			<b>CLAY FILL (CL)</b> - Black, damp, stiff, low plasticity, trace silt pockets, trace rootlets, trace organics, trace fine to medium grained sand.	S2					
233		5			S3					
232.8				<b>SILTY CLAY (CH)</b> - Brown, damp, stiff, high plasticity.	S4					
232	2				S5					
				- Mottled grey and brown below 2.60 m.	S6					
	3	10		- Trace silt pockets below 3.04 m.	S7					
				- Trace oxidation below 3.65 m.						
	4			- Firm to stiff below below 4.26 m.						
229.0	15			<b>END OF TEST HOLE at 4.57 m</b>						
				Notes:						
	5			1. No groundwater encountered.						
				2. Backfilled TH14-10 with auger cuttings and bentonite chips to surface.						
	6	20								
	7									
	8	25								
	9	30								

 SAMPLE TYPE  Auger Grab

 CONTRACTOR **Paddock Drilling Ltd.**

 INSPECTOR **J. WILCOX**

 APPROVED **TNG**

 DATE **9/3/14**

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.34  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,171  
 E 629,343

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆	
	(m)	(ft)						PL	MC
234.3				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill.	S1				
234				<b>CLAY FILL (CL)</b> - Black, moist, stiff, low plasticity, trace silt pockets, trace rootlets, trace organics, trace silt.	S2				
233	1	3.3		<b>SILTY CLAY (CI)</b> - Brown, frozen, trace clay, trace oxidation, high silt content. - Frozen from 1.52 m to 2.13 m.	S3				
232.8				<b>SILTY CLAY (CH)</b> - Mottled grey and brown, damp, stiff, high plasticity, trace silt pockets. - Some oxidation pockets below 3.35 m.	S4				
232.2	2	6.6		<b>SILTY CLAY (CH)</b> - Mottled grey and brown, damp, stiff, high plasticity, trace silt pockets. - Firm to stiff below 4.26 m.	S5				
232					S6				
231	3	9.9			S7				
230	4	13.1							
229.8	5	16.4		<b>END OF TEST HOLE at 4.57 m</b>					
229	6	19.7		Notes: 1. No groundwater encountered. 2. Backfilled TH14-11 with auger cuttings and bentonite chips to surface.					
228	7	22.9							
227	8	26.2							
226	9	29.5							
225									

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. WILCOX**

APPROVED **TNG**


DATE **9/3/14**



**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.36  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,100  
 E 629,218

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.2				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill. <b>CLAY FILL (CL)</b> - Black, damp, stiff, low plasticity, trace to some silt pockets, trace rootlets, trace organics, trace to some silt, trace clay.	S1					
234					S2					
233.8				<b>SILTY CLAY (CH)</b> - Brown, damp, stiff, high plasticity, trace silt pockets, trace fine grained sand, fissured.  - Mottled grey and brown, trace oxidation, moist below 3.65 m.	S3					
232					S4					
231					S5					
230					S6					
229.8					S7					
				END OF TEST HOLE at 4.57 m						
				Notes:						
				1. No groundwater encountered.						
				2. Backfilled TH14-12 with auger cuttings and bentonite chips to surface.						

 SAMPLE TYPE  Auger Grab

 CONTRACTOR **Paddock Drilling Ltd.**

 INSPECTOR **J. WILCOX**


 APPROVED **TNG**

 DATE **9/3/14**

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm  $\varnothing$  Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.47  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,513,023  
 E 629,086

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆	
	(m)	(ft)						PL	MC
234.4				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, subangular to angular particles, mixed with clay fill.	S1				
234				<b>CLAY FILL (CL)</b> - Black to brown, damp, stiff, low plasticity, trace silt pockets, trace fine grained sand, trace rootlets.	S2				
233.9	1	3			S3				
232.9	5	16		<b>SILTY CLAY (CH)</b> - Brown, damp, stiff, high plasticity, trace silt pockets.  - Frozen from 1.52 m to 2.13 m. - Mottled grey and brown, damp, stiff, high plasticity below 2.13 m.	S4				
232	2	6			S5				
231	3	10		- Trace oxidation below 3.35 m.	S6				
229.9	4	13			S7				
229.9	15	49		<b>END OF TEST HOLE at 4.57 m</b>					
229	5	16		Notes: 1. No groundwater encountered. 2. Backfilled TH14-13 with auger cuttings and bentonite chips to surface.					
228	6	20							
227	7	23							
226	8	26							
225	9	30							

SAMPLE TYPE  Auger Grab

**CONTRACTOR**  
 Paddock Drilling Ltd.

**INSPECTOR**  
 J. WILCOX


**APPROVED**  
 TNG

**DATE**  
 9/3/14

**CLIENT** CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT  
**PROJECT** 2014/15 Granular Roadway Renewal Program  
**SITE** Brady Landfill  
**LOCATION** Charette Road  
**DRILLING METHOD** 125 mm ø Solid Stem Auger, Acker MP8

**JOB NO.** 14-0107-010  
**GROUND ELEV.** 234.66  
**TOP OF PVC ELEV.**  
**WATER ELEV.**  
**DATE DRILLED** 6/3/2014  
**UTM (m)** N 5,512,967  
 E 628,988

ELEVATION (m)	DEPTH		GRAPHICS	DESCRIPTION AND CLASSIFICATION	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	Cu POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆		
	(m)	(ft)						PL	MC	LL
234.6				<b>GRANULAR FILL (TRAFFIC GRAVEL)</b> - Brown, dry, compact, fine to coarse grained sand, fine to coarse grained gravel, angular particles, mixed with clay fill.	S1					
234				<b>CLAY FILL (CL)</b> - Black, damp, stiff, low plasticity, trace silt pockets, trace fine grained sand.	S2					
233.4	1			<b>SILTY CLAY (CI)</b> - Brown, trace clay, trace oxidation, high silt content.	S3					
233		5		- Frozen from 1.22 m to 2.29 m.						
232.8				<b>SILTY CLAY (CH)</b> - Brown, frozen, trace silt pockets.	S4					
232				- Moist, stiff, high plasticity below 2.28 m. - Mottled grey and brown below 2.43 m.	S5					
231				- Trace to some oxidation pockets below 3.04 m.	S6					
230.1		15		<b>END OF TEST HOLE at 4.57 m</b>	S7					
230				Notes: 1. No groundwater encountered. 2. Backfilled TH14-14 with auger cuttings and bentonite chips to surface.						
229										
228										
227										
226										
225										

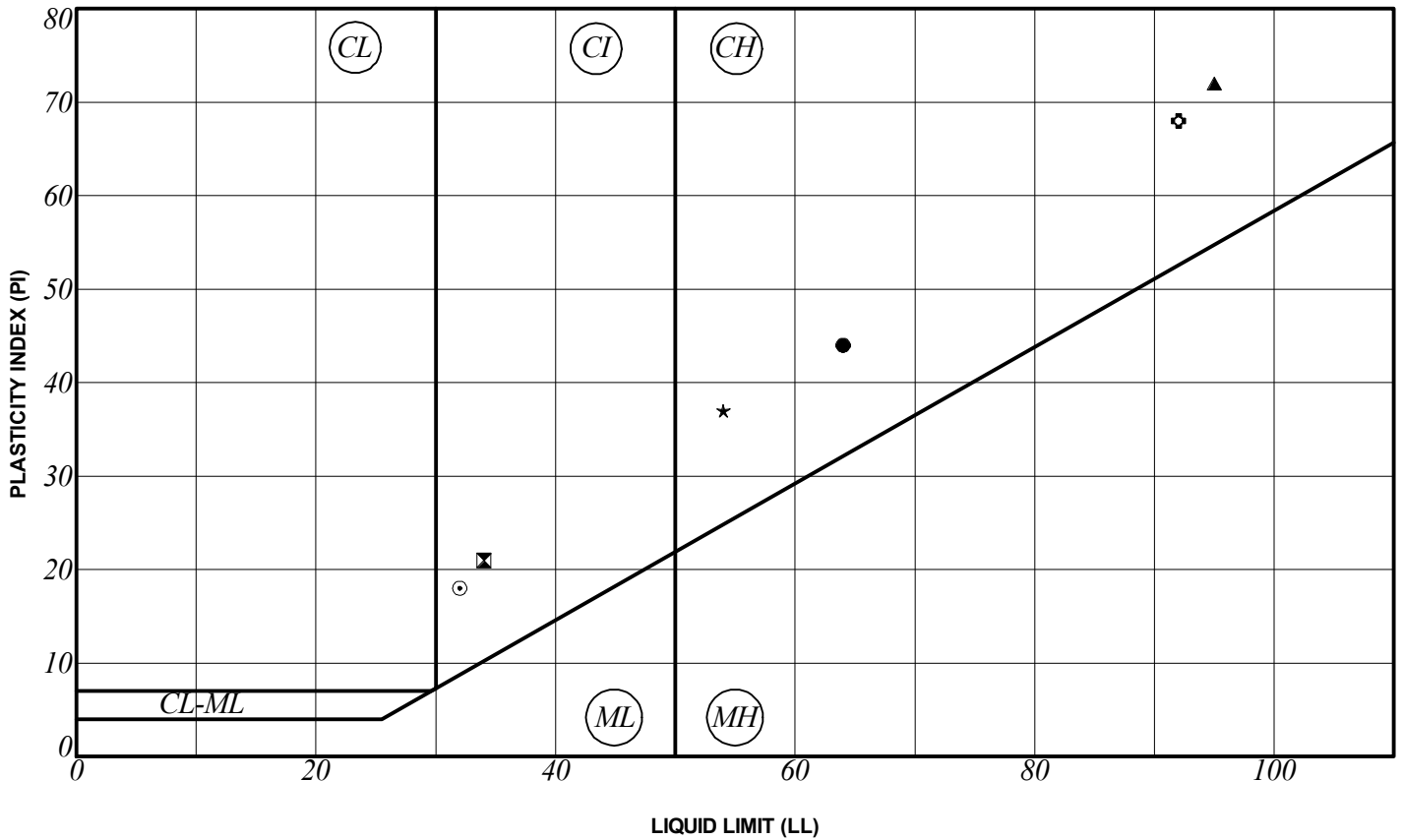
SAMPLE TYPE  Auger Grab

**CONTRACTOR**  
 Paddock Drilling Ltd.

**INSPECTOR**  
 J. WILCOX

**APPROVED**  
 TNG

**DATE**  
 9/3/14



SYMBOL	HOLE	DEPTH (m)	SAMPLE #	LL	PL	PI	% SAND	% SILT	% CLAY	% MC	CLASSIFICATION
●	TH14-03	1.2	S3	64	20	44				25.7	CH
⊠	TH14-03	1.8	S4	34	13	21				25.1	CI
▲	TH14-03	3.7	S6	95	23	72				46.8	CH
★	TH14-09	0.3	S2	54	17	37				25.4	CH
⊙	TH14-09	1.8	S4	32	14	18				23.5	CI
⊕	TH14-09	3.7	S6	92	24	68				41.0	CH

- Notes:**  
 ML - Low Plasticity Silt  
 MH - High Plasticity Silt  
 CL-ML - Silty Clay  
 CL - Low Plasticity Clay  
 CI - Intermediate Plasticity Clay  
 CH - High Plasticity Clay  
 LL - Liquid Limit  
 PL - Plastic Limit  
 PI - Plasticity Index  
 MC - Moisture Content  
 NP - Non-Plastic

<b>KGS GROUP</b>	<b>CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT</b>	
	2014/15 Granular Roadway Renewal Program	
<b>A-LINE PLOT</b>		
June 2014	Figure 1	Page 1 of 1

**Appendix B**  
**Laboratory Testing Results**



Stantec Consulting Ltd.  
199 Henlow Bay, Winnipeg MB R3Y 1G4

June 22, 2014  
File: 123311299

**Attention: Mr. Tony Ng**  
KGS Group Inc.  
3<sup>rd</sup> Floor – 865 Waverley  
Street Winnipeg, MB R3T 5P4

Dear Tony,

**Reference: 2014/2015 Granular Roadway Renewal Program (14-0107-010) – Winnipeg, MB**

Soil samples were submitted to our laboratory on June 16, 2014. The following tests were conducted on selected soil samples.

- Water content (ASTM D2216)
- Liquid limit (multi point), plastic limit, and plasticity index (ASTM D4318)

We appreciate the opportunity to assist you in this project. Please call if you have any questions regarding this report.

Regards,

**STANTEC CONSULTING LTD.**

A handwritten signature in black ink, appearing to read "J. Thompson".

Jason Thompson, C.E.T.  
Associate - Manager, Materials Testing Services  
Phone: (204) 928-4004  
Fax: (204) 488-6947  
Jason.Thompson@stantec.com

Attachment: Table 1 - Water Content Test Data  
Table 2 – Atterberg Limits Test Data  
6x - Atterberg Limits Test Results



Reference: 2014/2015 Granular Roadway Renewal Program (14-0107-010) – Winnipeg, MB

**TABLE 1**  
**WATER CONTENT TEST DATA**

Testhole ID	Sample ID	Sample Depth (m)	Water Content (%)	Testhole ID	Sample ID	Sample Depth (m)	Water Content (%)
TH14-01	S2	0.61-0.91	25.1	TH14-07	S3	1.22-1.52	26.4
TH14-01	S3	1.22-1.52	30.2	TH14-07	S5	2.44-2.74	35.9
TH14-01	S4	1.52-1.83	24.0	TH14-07	S7	4.27-4.57	44.3
TH14-01	S5	1.83-2.13	26.5	TH14-08	S2	0.61-0.91	25.0
TH14-01	S6	2.74-3.05	35.6	TH14-08	S3	1.22-1.52	27.9
TH14-02	S2	0.61-0.91	66.4	TH14-08	S4	2.13-2.44	28.8
TH14-02	S3	0.91-1.22	19.8	TH14-08	S5	2.74-3.05	41.0
TH14-02	S4	1.52-1.83	28.3	TH14-08	S6	3.66-3.96	48.9
TH14-02	S6	3.35-3.66	49.3	TH14-08	S7	4.27-4.57	48.4
TH14-03	S2	0.61-0.91	23.1	TH14-09	S2	0.30-0.61	25.4
TH14-03	S3	1.22-1.52	25.7	TH14-09	S3	0.91-1.22	23.3
TH14-03	S4	1.83-2.13	25.1	TH14-09	S4	1.83-2.13	23.5
TH14-03	S5	2.44-2.74	24.4	TH14-09	S5	2.44-2.74	29.0
TH14-03	S6	3.66-3.96	46.8	TH14-09	S6	3.66-3.96	41.0
TH14-03	S7	4.27-4.57	46.1	TH14-09	S7	4.27-4.57	49.5
TH14-04	S2	0.61-0.91	31.3	TH14-10	S2	0.61-0.91	29.5
TH14-04	S3	1.22-1.52	35.8	TH14-10	S3	1.22-1.52	33.1
TH14-04	S4	2.13-2.44	32.8	TH14-10	S5	2.74-3.05	41.2
TH14-04	S6	3.35-3.66	43.6	TH14-10	S7	4.27-4.57	44.2
TH14-05	S2	0.61-0.91	29.6	TH14-11	S2	0.61-0.91	27.0
TH14-05	S3	1.22-1.52	31.6	TH14-11	S3	1.22-1.52	26.3
TH14-05	S4	1.83-2.13	31.2	TH14-11	S4	1.52-1.83	23.5
TH14-05	S6	3.66-3.96	38.6	TH14-11	S6	3.35-3.66	49.3
TH14-06	S2	0.61-0.91	26.8	TH14-12	S2	0.30-0.61	27.5
TH14-06	S3	1.22-1.52	27.3	TH14-12	S3	1.22-1.52	26.0
TH14-06	S4	1.83-2.13	28.6	TH14-12	S5	2.74-3.05	38.1
TH14-06	S5	2.44-2.74	33.9	TH14-12	S7	3.96-4.27	51.3
TH14-06	S7	4.27-4.57	45.1	TH14-13	S2	0.30-0.61	27.0
TH14-07	S2	0.61-0.91	27.0	TH14-13	S3	1.22-1.52	28.9



Reference: 2014/2015 Granular Roadway Renewal Program (14-0107-010) – Winnipeg, MB

Testhole ID	Sample ID	Sample Depth (m)	Water Content (%)	Testhole ID	Sample ID	Sample Depth (m)	Water Content (%)
TH14-13	S5	2.74-3.05	43.1	TH14-14	S3	1.22-1.52	21.3
TH14-13	S7	4.27-4.57	48.5	TH14-14	S4	2.13-2.44	36.9
TH14-14	S2	0.30-0.61	26.7	TH14-14	S6	3.35-3.66	46.1

**TABLE 2  
ATTERBERG LIMITS TEST DATA**

Testhole ID	Sample ID	Sample Depth (m)	Atterberg Limits		
			Liquid Limit	Plastic Limit	Plasticity Index
TH14-03	S3	1.22-1.52	64	20	44
TH14-03	S4	1.83-2.13	34	13	21
TH14-03	S6	3.66-3.96	95	23	72
TH14-09	S2	0.30-0.61	54	17	37
TH14-09	S4	1.83-2.13	32	14	18
TH14-09	S6	3.66-3.96	92	24	68

**Notes:**

1. The soil samples were air-dried during sample preparation for Atterberg limits.





**Atterberg Limits**  
 ASTM D4318  
 Method A- Multi-Point

Client: KGS Group Inc.  
 Project Name: 2014/2015 Granular Roadway Renewal Program  
 Project No: 123311299  
 Date Received: June 16, 2014  
 Date Tested: June 18, 2014  
 Tested By: Nestor Abarca

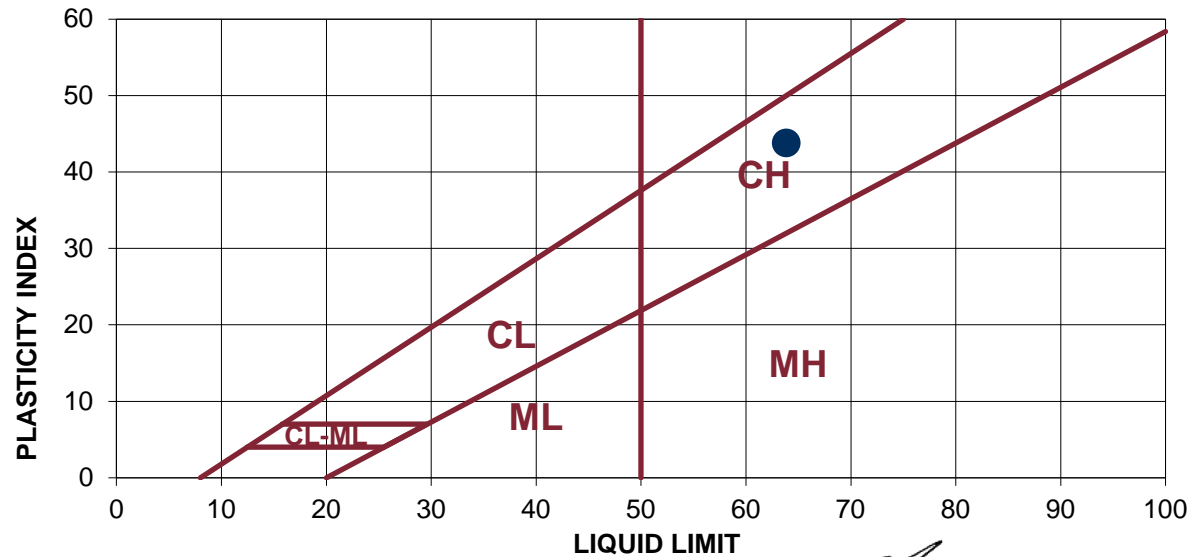
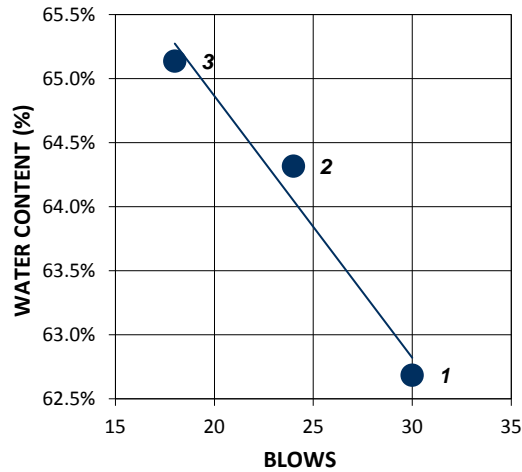
**LABORATORY**  
 199 Henlow Bay  
 Winnipeg, Manitoba  
 Canada R3Y 1G4

Tel: (204) 488-6999

Sample : TH14-03-S3 @ 1.22-1.52 m

LIQUID LIMIT				PLASTIC LIMIT		
Trial	1	2	3	Trial	1	2
No. of Blows	30	24	18	Tare No.	503	512
Tare No.	419	441	450	Wt. Sa. (wet+tare)(g)	38.41	37.79
Wt. Sa. (wet+tare)(g)	38	40	44	Wt. Sa. (dry+tare)(g)	36.88	36.21
Wt. Sa. (dry+tare)(g)	31	32	37	Wt. Tare (g)	29.26	28.32
Wt. Tare (g)	21	21	26	Wt. Dry Soil (g)	7.6	7.9
Wt. Dry Soil (g)	10.1	11.5	10.7	Wt. Water (g)	1.5	1.6
Wt. Water (g)	6.4	7.4	7.0	Water Content (%)	20.1%	20.0%
Water Content (%)	62.7%	64.3%	65.1%			

RESULTS	
LL	64
PL	20
PI	44



Reviewed By: Jason Thompson, C.E.T.

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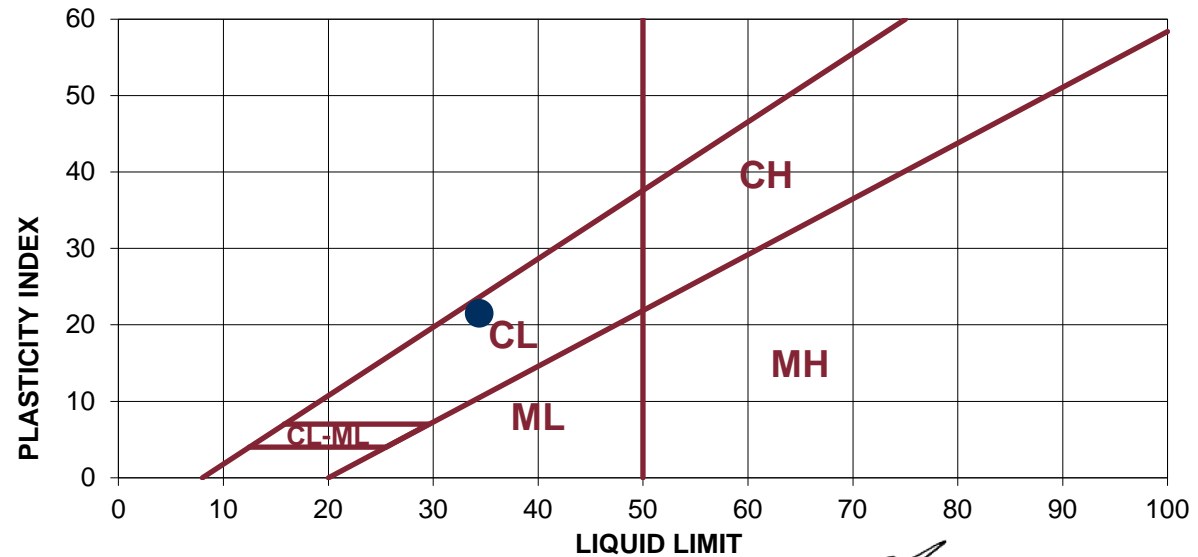
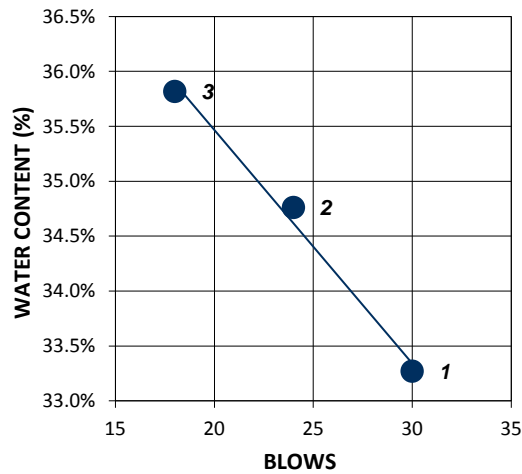
**LABORATORY**  
 199 Henlow Bay  
 Winnipeg, Manitoba  
 Canada R3Y 1G4

Tel: (204) 488-6999

Sample : TH14-03-S4 @ 1.83-2.13 m

LIQUID LIMIT				PLASTIC LIMIT		
Trial	1	2	3	Trial	1	2
No. of Blows	30	24	18	Tare No.	605	525
Tare No.	410	459	477	Wt. Sa. (wet+tare)(g)	35.30	35.53
Wt. Sa. (wet+tare)(g)	42	44	45	Wt. Sa. (dry+tare)(g)	34.09	34.27
Wt. Sa. (dry+tare)(g)	37	39	41	Wt. Tare (g)	24.62	24.66
Wt. Tare (g)	21	25	27	Wt. Dry Soil (g)	9.5	9.6
Wt. Dry Soil (g)	15.5	14.2	13.2	Wt. Water (g)	1.2	1.3
Wt. Water (g)	5.2	5.0	4.7	Water Content (%)	12.8%	13.1%
Water Content (%)	33.3%	34.8%	35.8%			

RESULTS	
LL	34
PL	13
PI	21



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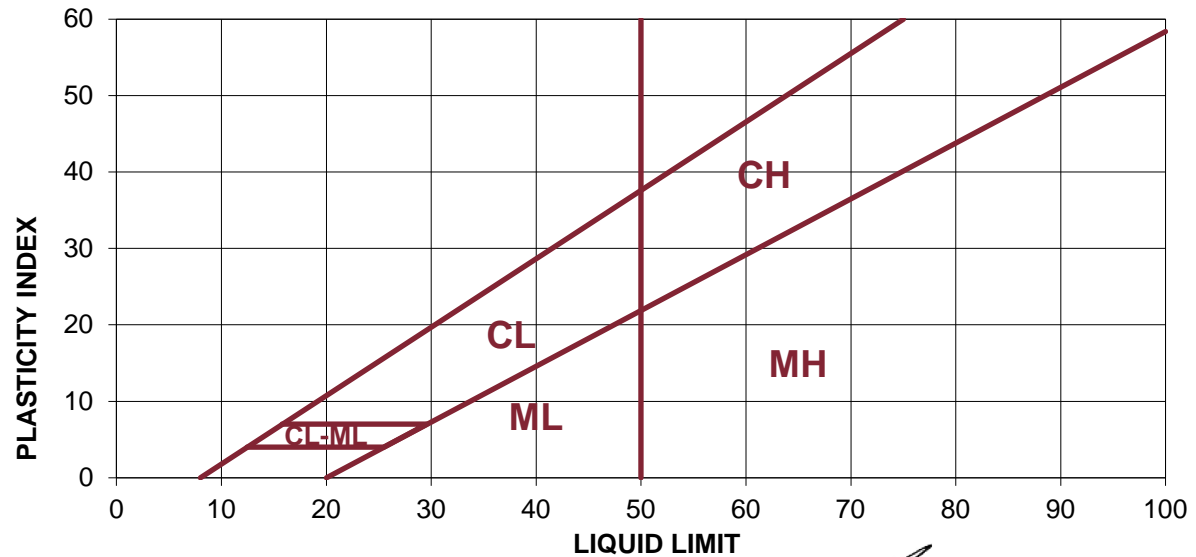
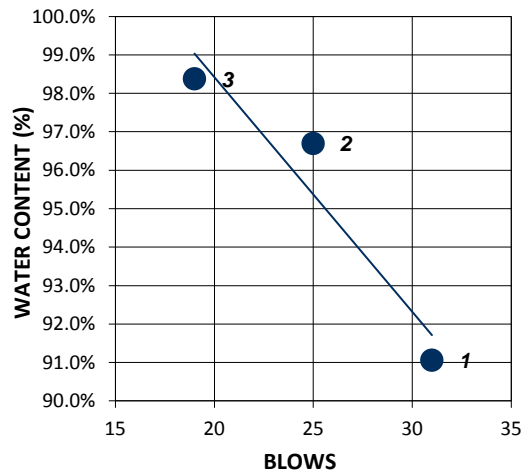
**LABORATORY**  
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 Canada R3Y 1G4

Tel: (204) 488-6999

Sample : TH14-03-S6 @ 3.66-3.96 m

LIQUID LIMIT				PLASTIC LIMIT		
Trial	1	2	3	Trial	1	2
No. of Blows	31	25	19	Tare No.	505	521
Tare No.	403	462	488	Wt. Sa. (wet+tare)(g)	31.27	31.31
Wt. Sa. (wet+tare)(g)	33	42	40	Wt. Sa. (dry+tare)(g)	30.11	30.36
Wt. Sa. (dry+tare)(g)	26	33	33	Wt. Tare (g)	25.15	26.28
Wt. Tare (g)	17	25	26	Wt. Dry Soil (g)	5.0	4.1
Wt. Dry Soil (g)	8.2	8.5	6.8	Wt. Water (g)	1.2	0.9
Wt. Water (g)	7.4	8.2	6.7	Water Content (%)	23.4%	23.3%
Water Content (%)	91.1%	96.7%	98.4%			

RESULTS	
LL	95
PL	23
PI	72



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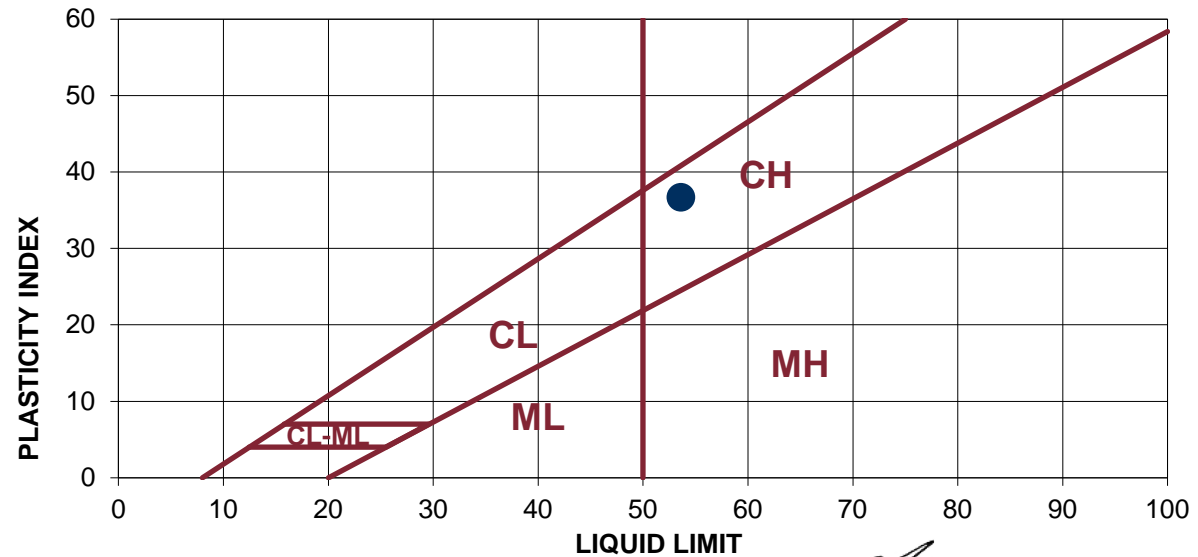
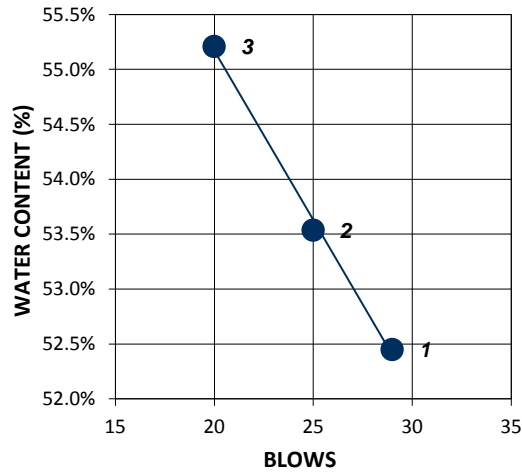
**LABORATORY**  
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 Canada R3Y 1G4

Tel: (204) 488-6999

Sample : TH14-09-S2 @ 0.30-0.61 m

LIQUID LIMIT				PLASTIC LIMIT		
Trial	1	2	3	Trial	1	2
No. of Blows	29	25	20	Tare No.	489	497
Tare No.	416	433	464	Wt. Sa. (wet+tare)(g)	40.14	38.35
Wt. Sa. (wet+tare)(g)	38	39	43	Wt. Sa. (dry+tare)(g)	38.16	36.43
Wt. Sa. (dry+tare)(g)	32	33	37	Wt. Tare (g)	26.68	24.94
Wt. Tare (g)	21	22	25	Wt. Dry Soil (g)	11.5	11.5
Wt. Dry Soil (g)	11.2	11.2	11.5	Wt. Water (g)	2.0	1.9
Wt. Water (g)	5.9	6.0	6.4	Water Content (%)	17.2%	16.7%
Water Content (%)	52.4%	53.5%	55.2%			

RESULTS	
LL	54
PL	17
PI	37



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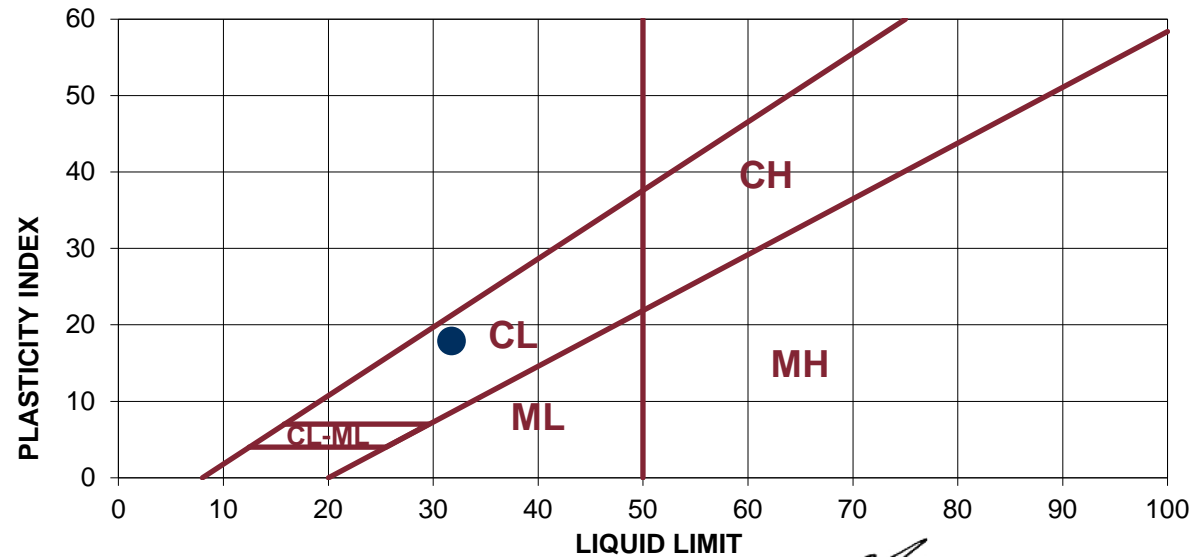
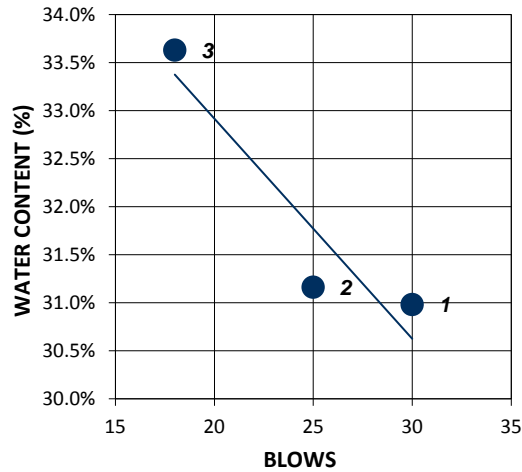
**LABORATORY**  
 199 Henlow Bay  
 Winnipeg, Manitoba  
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Sample : TH14-09-S4 @ 1.83-2.13 m

LIQUID LIMIT			PLASTIC LIMIT			
Trial	1	2	3	Trial	1	2
No. of Blows	30	25	18	Tare No.	406	480
Tare No.	452	468	425	Wt. Sa. (wet+tare)(g)	30.11	34.5
Wt. Sa. (wet+tare)(g)	44	49	46	Wt. Sa. (dry+tare)(g)	28.65	33.06
Wt. Sa. (dry+tare)(g)	40	44	42	Wt. Tare (g)	18.27	22.61
Wt. Tare (g)	26	28	27	Wt. Dry Soil (g)	10.4	10.5
Wt. Dry Soil (g)	14.0	16.3	14.8	Wt. Water (g)	1.5	1.4
Wt. Water (g)	4.4	5.1	5.0	Water Content (%)	14.1%	13.8%
Water Content (%)	31.0%	31.2%	33.6%			

RESULTS	
LL	32
PL	14
PI	18



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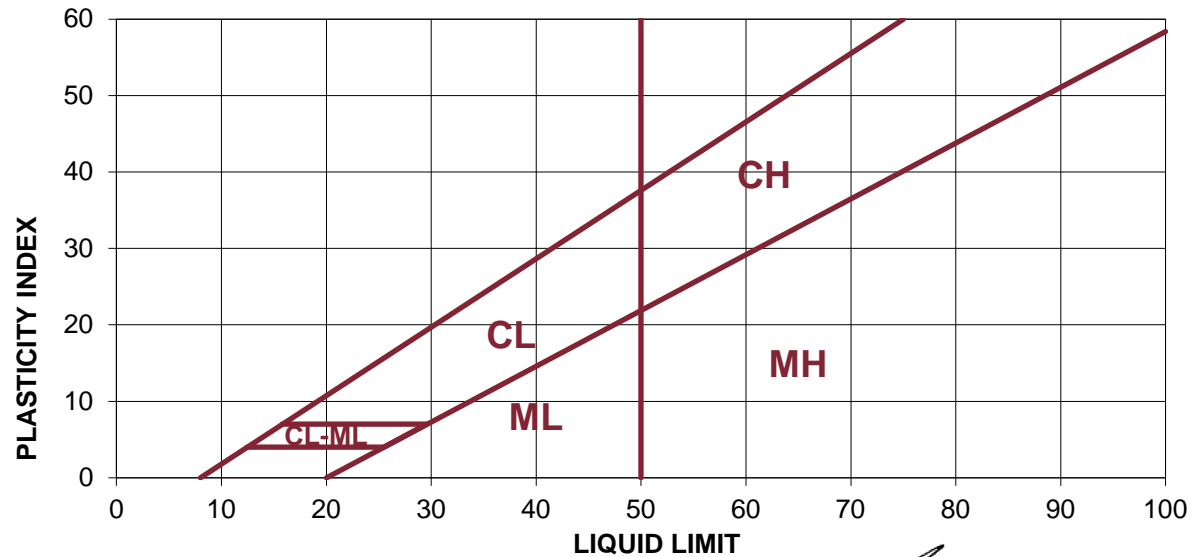
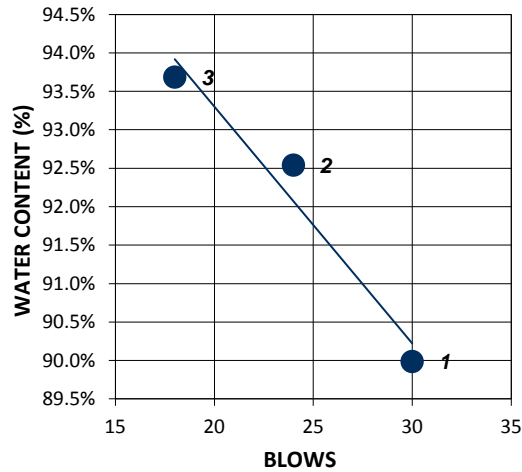
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Sample : TH14-09-S6 @ 3.66 - 3.96 m

LIQUID LIMIT				PLASTIC LIMIT		
Trial	1	2	3	Trial	1	2
No. of Blows	30	24	18	Tare No.	508	510
Tare No.	466	471	502	Wt. Sa. (wet+tare)(g)	34.88	32.8
Wt. Sa. (wet+tare)(g)	41	38	45	Wt. Sa. (dry+tare)(g)	33.47	31.37
Wt. Sa. (dry+tare)(g)	34	31	37	Wt. Tare (g)	27.64	25.53
Wt. Tare (g)	27	23	30	Wt. Dry Soil (g)	5.8	5.8
Wt. Dry Soil (g)	7.8	8.0	7.6	Wt. Water (g)	1.4	1.4
Wt. Water (g)	7.0	7.4	7.1	Water Content (%)	24.2%	24.5%
Water Content (%)	90.0%	92.5%	93.7%			

RESULTS	
LL	92
PL	24
PI	68



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