

August 15, 2007

File No. 07-0107-10

City of Winnipeg
Water and Waste Department
110-1199 Pacific Avenue
Winnipeg, Manitoba
R3E 3S8

ATTENTION: Mr. Darcy Strandberg, C.E.T.
Project Manager

RE: Site Investigation – Dowker Avenue Outfall Gate Chamber
2007 Outfall Gate Chamber Upgrading Program

Dear Mr. Strandberg:

This letter report summarizes the results of KGS Group's geotechnical site investigation at the Dowker Avenue Outfall Gate Chamber including soil stratigraphy and groundwater monitoring. Information regarding lateral earth pressure coefficients, potential for blowout of the base of the excavation and suitable backfill soils are also included.

This information is submitted further to our letter of Proposal for Engineering Services dated June 21st, 2007.

1.0 BACKGROUND

It is our understanding that the new gate chamber at the Dowker Avenue Outfall will incorporate new flap gates, positive gates and pump chambers and will be constructed at a proposed depth of 6.5 m at this location south of the intersection of Dowker Avenue and South Drive.

2.0 SITE INVESTIGATION

On June 21st, 2006 KGS Group supervised the drilling of one test hole (TH06-02) at the site located approximately 3 m south of the existing gate chamber. The UTM coordinates of the test hole are noted on the test hole log, as measured by a handheld GPS unit. The test hole was drilled with the truck mounted Acker MP5-T drill rig contracted from Paddock Drilling Ltd. of Brandon, MB. The test hole was advanced using 125 mm solid stem augers to 19.2 m± below existing ground surface. Representative soil samples were collected directly off auger flights at 1.5 m intervals or at changes in soil stratigraphy. All samples were visually inspected for material type and classified according to the Unified Soil Classification System. Clay samples were tested with a field Torvane to estimate undrained shear strength. Upon completion of the

drilling, the test hole was examined for indications of squeezing and seepage. A Casagrande tip standpipe piezometer was installed in the glacial till to measure piezometric levels. Laboratory testing was performed on select soil samples and included moisture content analyses and Atterberg Limit testing.

A soil log incorporating all field observations and laboratory testing is attached to this letter.

3.0 STRATIGRAPHY

KGS Group's interpretation of the stratigraphy is based upon the test hole (TH06-02) drilled at the site. In general, the stratigraphy consists of topsoil over clay fill underlain by a clay of lacustrine origin over glacial till.

Topsoil

A thin layer of topsoil approximately 0.1 m± thick was found at the existing ground surface.

Clay Fill

Clay fill extended 0.75 m± below the topsoil. The fill was black in colour, moist, firm with a crumbly texture, and contained trace amounts of silt, sand and gravel.

Lacustrine Clay

Underlying the fill was clay of lacustrine origin, which extended to a depth of 12.5 m± below ground surface. The clay was mottled brown to light brown in colour to a depth of 7.0 m±, becoming massive in structure and grey in colour below. The clay was moist, of high plasticity, firm, with undrained shear strengths ranging from 65 kPa at the top to 20 kPa at the bottom of the stratum (overall average 39 kPa). The clay contained trace amounts of silt, gypsum precipitate and oxidation. Trace silt nodules and no oxidation were noted below the 7.0 m± depth. Till inclusions were encountered below 10.3 m± depth. Moisture contents ranged from 38% to 53% with an overall average of 48%. Atterberg Limit testing at 12.1 m measured a Liquid Limit of 81% and a Plasticity Index of 46% with the material being classified as CH based upon the results. Two layers of silt were encountered within the lacustrine clay stratum at 0.75 m± and 2.1 m± below ground surface, being 0.46 m± and 0.3 m± thick respectively. The silt layers were light brown in colour, moist, soft, fine grained and contained trace to no clay.

Clay Till and Silt Till

The lacustrine clay was underlain by clay till which extended to a depth of 16.2 m±. The clay till was grey to light grey in colour, moist, soft, of intermediate to high plasticity, and contained trace amounts of silt, sand and gravel.

Underlying the clay till was a 2.0 m or more thick deposit of silt till. The silt till was light grey, moist, dense, and contained trace amounts of clay, sand and gravel. Power auger refusal was encountered at 19.2 m.

Squeezing of the test hole was noted at a depth of 10.7 m± below ground surface. Upon completion of the test hole water infiltration was observed at the bottom of the test hole from within the underlying till material.

4.0 GROUNDWATER CONDITIONS

The groundwater level in the till was measured a total of four (4) times. The water level was first read immediately after the installation of the piezometer and the groundwater level was 18.77 m below ground surface. Subsequent groundwater readings of 8.14 m, 8.11 m and 7.17 m below ground surface were taken on July 13 and July 17, 2006 and August 2, 2007, respectively.

Groundwater levels vary seasonally and in response to precipitation such that future groundwater conditions at the site may vary from those reported herein.

5.0 CONSTRUCTION CONSIDERATIONS

5.1 Basal Heave and Blowout

Based upon a proposed excavation depth of 6.5 m for the proposed gate chamber and the measured groundwater conditions at this location, the estimated factor of safety against blowout of the base of the excavation is 1.8.

5.2 Lateral Earth Pressure Coefficients

Estimated lateral earth pressure coefficients of the soil are summarized in the table below for soils within the depth of the excavation of approximately 6.5 m.

Table 1 – Active, Passive and At-Rest Lateral Earth Pressure Coefficients

Soil Type	Estimated Friction Angle (Φ')	Ka	Kp	Ko
Clay Fill	18°	0.53	1.89	0.69
Clay	14°	0.61	1.64	0.76

Note : Ka = Active Earth Pressure
Kp = Passive Earth Pressure
Ko = Earth Pressure At-Rest

5.3 Backfill

Free draining granular backfill should be placed around the chamber walls for a minimum width of 0.6 m and covered with a low permeability clay cap at ground surface. All backfill should be placed in maximum 150 mm thick lifts and compacted to a minimum of 95% Standard Proctor maximum dry density (SPMDD).

6.0 SUMMARY

We have completed a geotechnical site investigation for the proposed gate chamber expansion at the Dowker Avenue Gate Chamber. The stratigraphy at the site generally consisted of

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Mr. Strandberg

topsoil over clay fill underlain by clay of lacustrine origin over glacial till. Construction Design considerations for basal heave and blowout, lateral earth pressure coefficients and backfill are included.

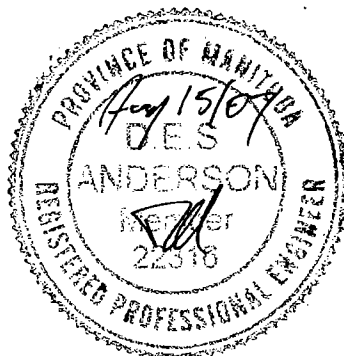
KGS Group thanks you for the opportunity to provide engineering services on this project. If you have any questions please contact the undersigned at 896-1209.

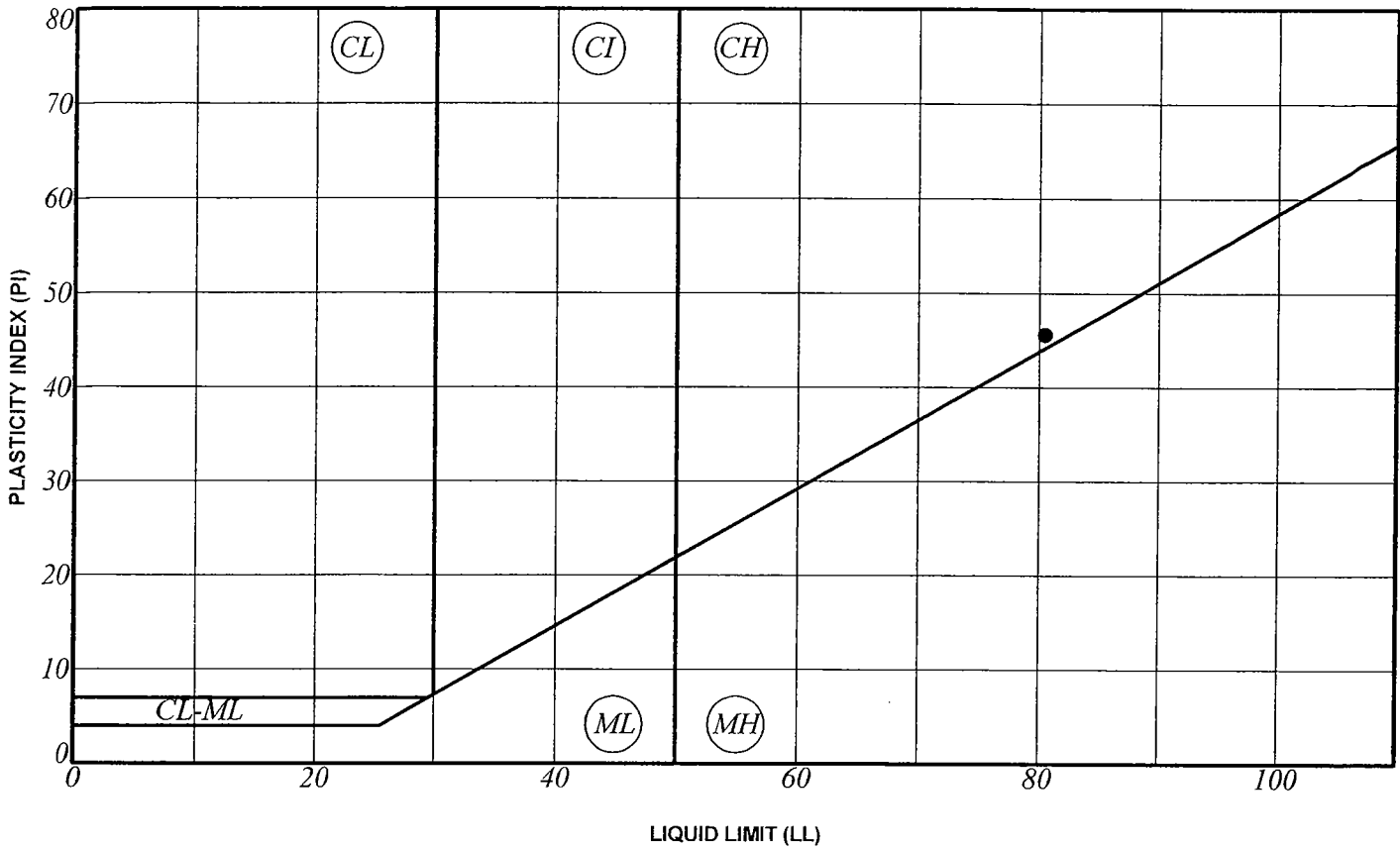
Yours truly,



David Anderson, M. Sc., P. Eng.
Geotechnical Engineer

RD/ja





SYMBOL	HOLE	DEPTH (m)	SAMPLE #	LL	PL	PI	% SAND	% SILT	% CLAY	% MC	CLASSIFICATION
●	TH06-02	12.0	S8	81	35	46	4.9	35.8	59.3	51.9	

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

KGS GROUP	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT	
	2007 GATE CHAMBER UPGRADES	
A-LINE PLOT		
Aug 2007	Figure 1	Page 1 of 1

A-LINE PLOT (MAY 2004) 07-107-10LOGS.GPJ GEN_FT_M.GDT 15/6/07

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT
PROJECT 2007 GATE CHAMBER UPGRADES
SITE Dowker Ave Gate Chambers
LOCATION 3 m South of Existing Gate Chamber
DRILLING METHOD 125 mm ø Solid Stem Auger

JOB NO. 07-107-10
GROUND ELEV.
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 21-Jun-06
UTM (m) N 5,522,644
 E 633,696



ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ DYNAMIC CONE (N) blows/ft △	POCKET PEN (kPa) ★ Cu TORVANE (kPa) ◆			
									PL	MC	LL	
			TOPSOIL (OL)									
			CLAY FILL (CL) - Black, moist, firm, low plasticity, trace silt, trace sand, trace gravel, crumbly.									
	1		SILT (ML) - Light brown, moist, soft, fine grained, trace to no clay.									
	5		CLAY (CH) - Mottled brown to light brown, moist, firm, high plasticity, trace silt, trace gypsum, trace oxidation.			S1						
	2		SILT (ML) - Brown, moist, soft, fine grained, trace clay, trace oxidation.									
	3		CLAY (CH) - Mottled brown to light brown, moist, firm, high plasticity, trace silt, trace gypsum, trace oxidation.			S2						
	10											
	4					S3						
	15											
	5					S4						
	6											
	20					S5						
	7											
	25					S6						
	8											
	9											
	30											
			- Grey, trace silt nodules, no oxidation below 7.01 m.									

SAMPLE TYPE Auger Grab Split Spoon

CONTRACTOR **Paddock Drilling Ltd.** INSPECTOR **D. ANDERSON** APPROVED _____ DATE **14/8/07**

SPT & TORVANE 2 P:\PROJECTS\2007\07-0107-10\GEOLOG\07-107-10.LOGS.GPJ

ELEVATION (m)	DEPTH (m) (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲	DYNAMIC CONE (N) blows/ft △	POCKET PEN (kPa) ★	Cu TORVANE (kPa) ◆
								40 80 120	20 40 60 80	20 40 60 80	20 40 60 80
35	11		- Trace till inclusions below 10.34 m.			S7					
40	12				12.5	S8					
45	13		CLAY TILL (CI-CH) - Grey, moist, soft, intermediate to high plasticity, trace silt, trace coarse grained sand, trace gravel.			S9					
50	14		- Light grey below 14.33 m.			S10					
55	15					S11	8	50			
60	16		SILT TILL (ML) - Light grey, moist, dense, trace clay, trace sand, trace gravel.								
65	17				18.9						
70	18				19.2	S12					
	19		AUGER REFUSAL AT 19.20 m								
	20		Note: 1. Water level at 18.77 m below ground after drilling. 2. Advanced SPT 75 cm in the second set after 50 blows. 3. Casagrande Tip Standpipe installed at 19.20 m, with an above ground casing and 0.91 m stickup. 4. Squeezing of the testhole below 10.67 m.								
	21										

SAMPLE TYPE  Auger Grab  Split Spoon

CONTRACTOR
Paddock Drilling Ltd.

INSPECTOR
D. ANDERSON

APPROVED _____ DATE **14/8/07**