

APPENDIX A

GEOTECHNICAL REPORT



November 5, 2012

File No. 12-0107-16

The City of Winnipeg
Planning, Property and Development
Municipal Accommodations Division
4th Floor – 185 King Street
Winnipeg, Manitoba
R3B 1J1

3rd Floor
865 Waverley Street
Winnipeg,
Manitoba
R3T 5P4
204.896.1209
fax: 204.896.0754
www.ksgroup.com

ATTENTION: Mr. Lou Chubenko

RE: Geotechnical Assessment for the
Sturgeon Heights Community Centre Inc. – Site Development Project

Dear Mr. Chubenko:

This letter outlines KGS Group's geotechnical site investigation and provides foundation recommendations for the proposed two (2) permanent outdoor hockey rinks, warming shack and outdoor lighting.

1.0 BACKGROUND

The Sturgeon Heights Community Centre was re-opened in April 2012 after a demolition of the existing facilities. The current site development project being jointly undertaken by the City of Winnipeg and the Sturgeon Heights Community Centre will consist of the construction of two (2) permanent outdoor hockey rinks and associated facilities. Due to on site constraints the positioning of the new rinks is limited; therefore the intent is to construct the new rinks at 85% of full size dimensions in order to maintain an adequate buffer between the rinks and the existing facilities.

2.0 TEST HOLE DRILLING AND LABORATORY TESTING PROGRAM

On October 10, 2012, KGS Group supervised the drilling of five (5) test holes (TH12-01 to TH12-05) at the site with two (2) test holes completed within the limits of each of the rinks and one (1) at the location of the proposed warming hut. The locations of the test holes are shown on KGS Group Drawing 12-0107-016_G01 attached to this report. The test holes were drilled with a truck mounted CT 250 drill rig contracted from Paddock Drilling Ltd. of Brandon, Manitoba under continuous KGS Group supervision. The drilling was advanced using 125 mm solid stem augers. Representative soil samples were collected directly off the auger flights at 1.5 m intervals or at changes in soil strata. All soil samples were classified according the modified Unified Soil Classification System (USCS) and all clay samples were field Torvane tested to estimate the undrained shear strength. Upon completion of the drilling, the test holes were examined for indications of squeezing and seepage and then backfilled with auger cuttings.

A laboratory testing program was performed on select soil samples to determine the relevant engineering properties of the subsurface soils. Testing included twenty (20) moisture content analyses. Detailed testhole logs incorporating all field observations and laboratory testing results are included in Appendix A.

3.0 SITE STRATIGRAPHY

In general the stratigraphy at the Sturgeon Heights Community Centre site has been interpreted by KGS Group to consist of clay fill, topsoil or asphalt overlying high plasticity silty clay and silt till.

Silty Clay Fill – Approximately 0.3 to 0.9 m of silty clay fill was encountered at ground surface in TH12-01, TH12-03 and immediately below a thin layer of asphalt in TH12-02. The silty clay fill was black in colour, damp, firm to stiff in consistency, of high plasticity and had a crumbly texture.

Topsoil – Approximately 0.6 m of topsoil was encountered at ground surface in TH12-05. The topsoil was black in colour, dry, crumbly and contained some clay nuggets, trace rootlets and trace fine grained gravel.

Silty Clay – below the fill and topsoil was silty clay of lacustrine origin, extending to a depth of 6.1 m. The clay was brown to mottled brown and grey in colour, damp to moist, stiff becoming soft with depth, of high plasticity and contained trace silt inclusions and trace fine grained gravel near the clay–till contact. Undrained shear strengths, as estimated by the filed Torvane ranged from 90 kPa near the top of the intact clay down to 9 kPa near the clay–till interface. The moisture content ranged between 17% and 54% and generally increased with increasing depth.

Silt Till – Underlying the silty clay at a depth of 6.1 m± at TH12-01 was a 3.0 m± thick deposit of silt till. The till was tan in colour, moist, loose to dense and contained some fine to coarse grained sand and trace fine grained gravel. Power auger refusal was encountered at a depth of 9.1 m± on dense till.

4.0 FOUNDATION OPTIONS

4.1 OUTDOOR HOCKEY RINK

The hockey rink base surface may consist of a granular pad complete with asphaltic concrete pavement. The following is recommended for the construction of the granular pad and asphalt pavement:

- Sub-excavate the surficial soils to the subgrade design elevation and perform proof-roll compaction of the native soil subgrade. Areas that exhibit unsuitable deflection or unsuitable soils such as organic matter, silts or soft clays should be sub-excavated an additional 600 mm and replaced with compacted granular sub-base. Alternatively the use of a light non-woven geotextile may be considered between unsuitable subgrade and compacted granular fill.
- A minimum 150 mm thick layer of granular base and 300 mm thick layer of sub-base should be placed immediately below the asphalt pavement structure.

- All granular should be placed in maximum 150 mm thick lifts and compacted to 98% Standard Proctor Dry Density (SPMDD). Granular base and sub-base materials shall be in accordance with standard City of Winnipeg Standard Construction Specifications.

The pavement structure to be constructed on top of the granular pad for the hockey rink base is recommended to consist of 75 mm of Type I asphaltic concrete pavement.

All asphaltic concrete pavement works shall be supplied and installed in accordance with the City of Winnipeg Standard Construction Specifications.

4.2 WARMING HUT

The base for the warming hut may consist of a granular pad similar to that recommended for the hockey rink base. The granular pad may consist of a minimum 150 mm thick layer of granular base and 300 mm thick layer of sub-base material. Asphalt pavement overlying the granular pad is optional.

4.3 LUMINAIRE POLE BASES

The City of Winnipeg, Planning, Property and Development – Municipal Accommodations Division's standard detail for luminaire poles (CS-6) requires that the bases be installed on minimum 20 inch diameter by 25 foot deep concrete friction piles. Based on the results of the testhole drilling the underlying till is at approximately 20 feet (6.1 m) below grade, therefore, cast-in-place end bearing concrete piles are suitable for use at this site to support the proposed lighting.

The end bearing piles (belled) may be designed on the basis of an allowable bearing capacity of 150 kPa (3 ksf). The base of the piles should be mechanically cleaned prior to placement of concrete, to obtain a sound bearing surface, and ensure that all deleterious material has been removed from the bearing surface. Sleeving of the pile shaft may be required to eliminate the possibility of sloughing and to minimize groundwater inflows. Groundwater within the pile shaft must be pumped out prior to the pouring of concrete and if pumping equipment can not pump the excavation dry, tremmie concrete pouring will be required. In addition, all concrete should utilize CSA Type 50 sulphate resistant cement.

5.0 SUMMARY

Based on the testhole drilling of five (5) test holes at the site, the stratigraphy is interpreted to consist of thin upper layer of topsoil or clay fill overlying a layer of high plastic silty clay and silt till.

It is recommended that the hockey rink base be constructed of a granular pad consisting of 75 mm of asphaltic pavement, a 150 mm thick layer of granular base and a 300 mm thick layer of sub-base. The pad for the warming hut should also be constructed similar to that of the hockey rink bases with the asphalt pavement being optional.

Silt till was encountered at a depth of 6.1 m± below grade therefore a suitable pile type to support the luminaire pole bases include cast in place concrete end bearing piles.

6.0 STATEMENT OF LIMITATIONS AND CONDITIONS

Third Party Use of Report

This report has been prepared for the City of Winnipeg Planning, Property and Development Department, Municipal Accommodations Division to whom this report has been addressed and any use a third party make 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 an third party as a result of decisions made or actions undertaken based on this report.

Geotechnical Investigation Statement of Limitations

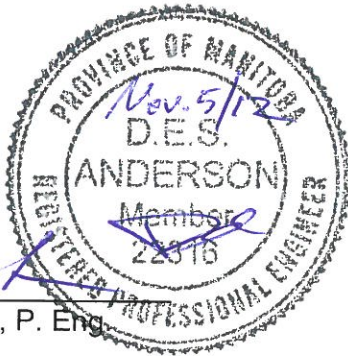
The geotechnical investigation findings and recommendations of this report were prepared in accordance with generally accepted professional engineering principles and practice. The findings and recommendations are based on the results of field and laboratory investigations, combined with an interpolation of soil and groundwater conditions found at and within the depth of the test holes drilled by KGS Group at this site. If conditions encountered during construction appear to be different from those shown by the test holes drilled by KGS Group 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.

If you have any questions regarding the enclosed information or require additional information, please call the undersigned at (204) 896-1209.

Prepared by:



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



Reviewed by:



Rob Kenyon, Ph. D., P. Eng.
Manager, Geotechnical Engineering

AMH/DEA/
Enclosure

DRAWING

APPENDIX A
TEST HOLE LOGS

CLIENT CITY OF WINNIPEG - PLANNING, PROPERTY AND DEVELOPMENT
PROJECT STURGEON HEIGHTS COMMUNITY CENTRE - SITE DEVELOPMENT
SITE 210 Rita Street
LOCATION West of Community Centre
DRILLING METHOD 125 mm ø Solid Stem Auger, CT 250 Truck Mounted Drill Rig

JOB NO. 12-0107-016
GROUND ELEV. 236.46 m
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 10/10/2012
UTM (m) N 5,526,335
 E 625,042

ELEVATION (m)	DEPTH (m) (ft)	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) ◆			
								20	40	60	80	20	40	60
236.2			FILL											
236			SILTY CLAY - Grey, damp, stiff, high plasticity, trace silt pockets.											
	1			S1										
	5		- Brown (mottled), firm, trace oxidation below 1.52 m.	S2										
	2													
	3		- Becoming softer below 2.74 m. - Moist below 3.05 m.	S3										
	4		- Soft below 3.96 m.	S4										
	5		- No mottling, increased silt pockets, no oxidation below 4.57 m.	S5										
	6		- Trace fine grained gravel below 5.64 m.	S6										
230.4	20		SILT TILL - Tan, moist, loose, low plasticity, some fine to coarse grained sand, trace fine grained gravel.											
229	25		- Damp, dense, some fine to coarse grained gravel below 7.62 m.	S7										
228	8													
227.3	30		POWER AUGER REFUSAL AT 9.14 m	S8										
227			Notes: 1. Test hole dry after drilling. 2. Backfilled test hole with bentonite chips at the top and bottom of hole and cuttings in the middle.											
226	10													

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. ARROWSMITH**

APPROVED

DEA

DATE 11/5/12

GEOTECHNICAL-SOIL LOG P:\PROJECTS\2012\12-0107-016\DESIGN\GEOLOGS\210 RITA STREET.GPJ

CLIENT CITY OF WINNIPEG - PLANNING, PROPERTY AND DEVELOPMENT
PROJECT STURGEON HEIGHTS COMMUNITY CENTRE - SITE DEVELOPMENT
SITE 210 Rita Street
LOCATION West of Community Centre
DRILLING METHOD 125 mm ø Solid Stem Auger, CT 250 Truck Mounted Drill Rig

JOB NO. 12-0107-016
GROUND ELEV. 236.52 m
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 10/10/2012
UTM (m) N 5,526,334
 E 625,074

ELEVATION (m)	DEPTH (m) (ft)	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) ◆
						20 40 60	20 40 60	PL	MC	LL	20 40 60 80
236.4			ASPHALT								
236			SILTY CLAY FILL - Black, damp, stiff, high plasticity.	S1							
235.6	1		SILTY CLAY - Brown, damp, firm, high plasticity, trace silt pockets.	S2							
235	5		- Mottled brown and grey below 1.83 m.								
234	2			S3							
233.5	3		END OF TEST HOLE AT 3.05 m								
233	4		Notes: 1. Backfilled test hole with auger cuttings and bentonite chips at the top.								
232	5										
231	6										
230	7										
229	8										
228	9										
227	10										

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. ARROWSMITH**

APPROVED

DATE 11/5/12

CLIENT CITY OF WINNIPEG - PLANNING, PROPERTY AND DEVELOPMENT
PROJECT STURGEON HEIGHTS COMMUNITY CENTRE - SITE DEVELOPMENT
SITE 210 Rita Street
LOCATION West of Community Centre
DRILLING METHOD 125 mm ø Solid Stem Auger, CT 250 Truck Mounted Drill Rig

JOB NO. 12-0107-016
GROUND ELEV. 236.50 m
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 10/10/2012
UTM (m) N 5,526,302
 E 625,039

ELEVATION (m)	DEPTH (m) (ft)	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) ◆	
							PL	MC LL
236			SILTY CLAY FILL - Black, damp, stiff, crumbly.					
235.7	1		SILTY CLAY - Dark brown, damp, stiff, high plasticity, trace silt pockets.	S1				
235	5		- Brown, moist, firm below 1.52 m.					
234	2			S2				
233.5	3		END OF TEST HOLE AT 3.05 m					
233	4		Notes: 1. Backfilled test hole with auger cuttings and bentonite chips at the top.					
232	5							
231	6							
230	7							
229	8							
228	9							
227	10							

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. ARROWSMITH**

APPROVED

DATE 11/5/12

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CLIENT CITY OF WINNIPEG - PLANNING, PROPERTY AND DEVELOPMENT
PROJECT STURGEON HEIGHTS COMMUNITY CENTRE - SITE DEVELOPMENT
SITE 210 Rita Street
LOCATION West of Community Centre
DRILLING METHOD 125 mm ø Solid Stem Auger, CT 250 Truck Mounted Drill Rig

JOB NO. 12-0107-016
GROUND ELEV. 236.42 m
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 10/10/2012
UTM (m) N 5,526,301
 E 625,070

ELEVATION (m)	DEPTH (m) (ft)	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) ◆	
								20	40	60	80
236	1		SILTY CLAY - Brown, damp, crumbly, high plasticity, trace organics. - Firm, trace silt pockets, no organics below 0.61 m.	S1							
235	5		- Mottled grey and brown, trace oxidation pockets below 1.52 m.	S2							
234	2			S3							
233.4	3		END OF TEST HOLE AT 3.05 m								
233			Notes: 1. Backfilled test hole with auger cuttings and bentonite chips at the top.								
232	4										
231	5										
230	6										
229	7										
228	8										
227	9										
226	10										

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SAMPLE TYPE Auger Grab
CONTRACTOR Paddock Drilling Ltd.
INSPECTOR J. ARROWSMITH
APPROVED
DATE 11/5/12

CLIENT CITY OF WINNIPEG - PLANNING, PROPERTY AND DEVELOPMENT
PROJECT STURGEON HEIGHTS COMMUNITY CENTRE - SITE DEVELOPMENT
SITE 210 Rita Street
LOCATION West of Community Centre
DRILLING METHOD 125 mm ø Solid Stem Auger, CT 250 Truck Mounted Drill Rig

JOB NO. 12-0107-016
GROUND ELEV. 236.55 m
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 10/10/2012
UTM (m) N 5,526,318
 E 625,057

ELEVATION (m)	DEPTH (m) (ft)	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) ◆	
							PL	MC LL
236.5	0		TOPSOIL - Black, dry, crumbly, non plastic, some clay nuggets, trace rootlets, trace fine grained gravel.	S1				
235.5	1		SILTY CLAY - Brown, damp, crumbly, high plasticity, trace silt pockets.	S2				
233.5	3		- Mottled grey and brown, moist, firm below 1.52 m.	S3				
END OF TEST HOLE AT 3.05 m								
Notes: 1. Backfilled test hole with auger cuttings and bentonite chips at the top.								

SAMPLE TYPE Auger Grab

CONTRACTOR **Paddock Drilling Ltd.**

INSPECTOR **J. ARROWSMITH**

APPROVED

DATE 11/5/12

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