KGS GROUP

MEMORANDUM

TO: **Darcy Strandberg, C.E.T.**

FROM: **Rob Kenyon, Ph.D., P.Eng. and Anne-Marie Hamilton, P.Eng.**

DATE: **September 26, 2008**

PROJECT NO: **08-107-07**

RE: **Supplemental Drilling at the Conway Gate Chamber**

Dear Mr. Strandberg:

This memorandum summarizes the results of KGS Group's supplemental drilling at the Conway Gate Chamber on September 22, 2008. The memorandum summarizes the results of the drilling program and includes a brief discussion regarding the potential issues for the use of conventional shoring at this site.

1.0 BACKGROUND

The City of Winnipeg Water and Waste Department is constructing a new gate chamber at the Conway Street Outfall located south of the intersection of Conway Street and Portage Avenue at the Assiniboine River. The new gate chamber will be constructed to a depth of 11.0 m and consists of a new chamber as shown on the attached drawing (City of Winnipeg Drawing LD-5066).

2.0 PREVIOUS SITE INVESTIGATIONS

In June, 2008 KGS Group supervised the drilling of one test hole (TH08-03) located approximately 4 m from the proposed gate chamber location. 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 auger refusal at 6.4 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 piezometeric levels. Laboratory testing was performed on select soil samples and included moisture content analyses and Atterberg Limit testing. A copy of TH08-03 is included with this memorandum.

3.0 SUPPLEMENTAL DRILLING INVESTIGATION

On September 22, 2008 an additional test hole was completed at the site to determine the condition of the underlying till material to the full depth of the new gate chamber. One test hole (TH08-04) was completed adjacent to the new gate chamber as shown on the attached drawing.

The test hole was completed using a truck mounted drill rig contracted from Subterranean

(Manitoba) Ltd. of Winnipeg, Manitoba. The test hole was advanced to auger refusal at 4.3 m± using 125 mm diameter solid stem augers. Below auger refusal rock coring methods utilizing an HQ (96 mm diameter) core barrel allowed for advancement of the test hole to 11.0 m±.

4.0 STRATIGRAPHY

KGS Group's interpretation of the stratigraphy is based upon the test hole (TH08-03) drilled at the site. In general, the stratigraphy consists of topsoil over silt underlain by silty clay over glacial till. A detailed description of the stratigraphic units encountered at TH08-03 are included in KGS Group's letter to the City of Winnipeg Water and Waste Department titled "Site Investigation – Conway Street Outfall Gate Chamber 2008 Outfall Gate Chamber Upgrading Program" dated June 13, 2008.

The stratigraphy at TH08-04 consists of topsoil overlying silt and silty clay to a depth of 3.8 m±. Till was encountered below 3.8 m± to a depth of 11.6 m±. Between 3.8 m± and 4.3 m± (auger refusal) the till was brown to grey in colour, moist, non to low plastic, loose to compact, and contained some medium to coarse grained gravel, some sand and trace clay.

Below 4.3 m±, where coring methods were utilized, the recovery of the fine grained components of the till was poor. In general, at those depths, where fine grained components were recovered, the till was buff to grey in colour, damp, dense, non to low plastic, and contained varying amounts of sand, gravel, cobbles and boulders as shown on Photo 1. Numerous large cobbles and boulders were encountered between depths of 4.3 m and 7.3 m±.

Below 7.3 m± the cobble and boulder content of the till decreased with recovered material consisting primarily of coarse grained gravel as shown on Photo 2. A significant loss of drilling fluid circulation occurred at a depth of 7.9 m±. The drilling Contractor also noted difficult drilling below 9.9 m± as the till material felt loose and gravelly with the drill bit experiencing difficulty cutting through the loose granular material.

Upon completion of the test hole at 11.6 m±, a 25 mm diameter standpipe piezometer was installed in the till. Test hole sloughing was observed at the top of the till upon removal of the casing. It is expected that the groundwater level in the standpipe piezometer will have stabilized by the week of September 29, 2008. KGs Group will monitor groundwater levels in both TH08-03 and TH08-04 during the week of September 29, 2008 and will forward results to the City of Winnipeg Water and Waste Department. In addition to this information an update including an assessment of any possible potential for basal heave will also be addressed.

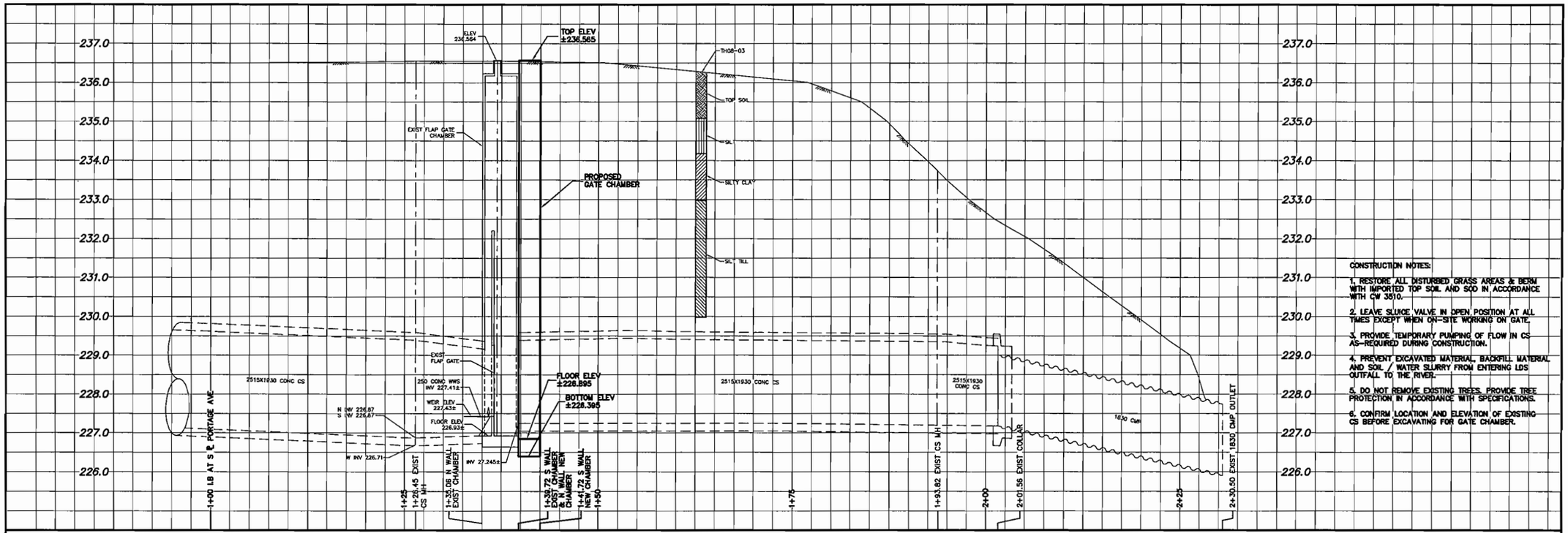
The conditions encountered in the coring of the till are consistent with the conditions KGS Group estimated would be encountered in its June 13, 2008 letter report. That is that "difficult conditions should be anticipated during excavation within the glacial till as boulders and cobbles are known to be present".

5.0 CONSTRUCTION CONSIDERATIONS

Based on the conditions, either reported in the June 13, 2008 letter report or confirmed herein, the Contractor should have anticipated difficult conditions during excavation including cobbles and boulders and potential groundwater inflow and should have anticipated very difficult to impractical conditions driving either sheet piles or steel piles for timber lagging.

Should you have any questions or comments regarding the enclosed information, please do not hesitate to contact Rob Kenyon, Ph.D., P.Eng., of our office.

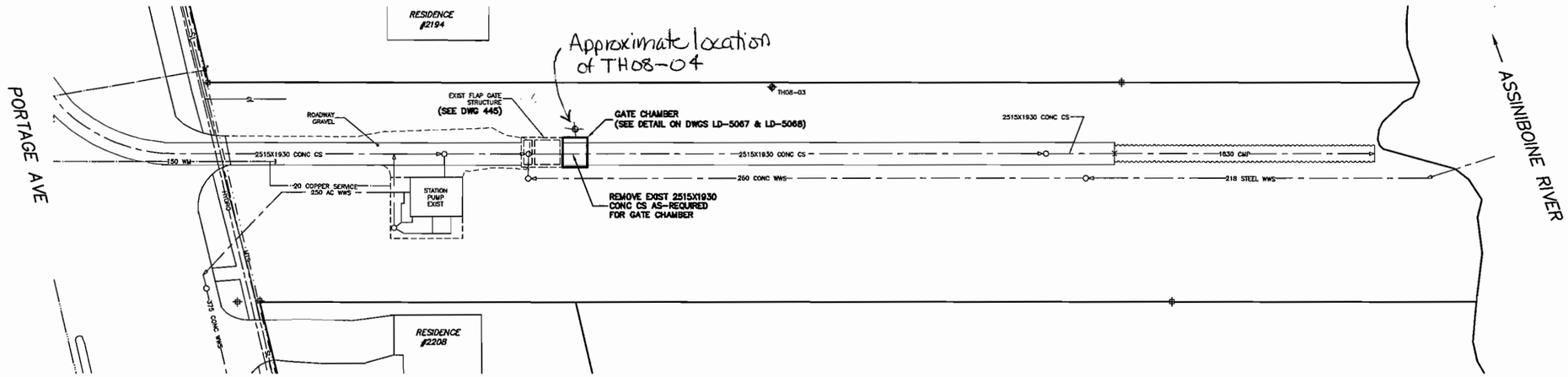
DRAWING



NOTE: CHAINAGES SHOWN ARE ALONG E. ℄ OF CONWAY ST

CONSTRUCTION NOTES:

1. RESTORE ALL DISTURBED GRASS AREAS & BERM WITH IMPORTED TOP SOIL AND SOD IN ACCORDANCE WITH CW 3510.
2. LEAVE SLUICE VALVE IN OPEN POSITION AT ALL TIMES EXCEPT WHEN ON-SITE WORKING ON GATE.
3. PROVIDE TEMPORARY PUMPING OF FLOW IN CS AS-REQUIRED DURING CONSTRUCTION.
4. PREVENT EXCAVATED MATERIAL, BACKFILL MATERIAL AND SOIL / WATER SLURRY FROM ENTERING LD'S OUTFALL TO THE RIVER.
5. DO NOT REMOVE EXISTING TREES. PROVIDE TREE PROTECTION IN ACCORDANCE WITH SPECIFICATIONS.
6. CONFIRM LOCATION AND ELEVATION OF EXISTING CS BEFORE EXCAVATING FOR GATE CHAMBER.



METRIC
WHOLE NUMBERS INDICATE MILLIMETRES
DECIMALIZED NUMBERS INDICATE METRES

0.0 5.0 10.0 15.0 20.0 25.0

WARNING

IF POWER EQUIPMENT OR EXPLOSIVES ARE TO BE USED FOR EXCAVATION ON THIS PROJECT THE CONTRACTOR MUST:
1) NOTIFY THE GAS COMPANY OF THE PROPOSED LOCATION OF EXCAVATION.
2) TAKE PRECAUTION TO AVOID DAMAGE TO GAS COMPANY INSTALLATIONS.

SEE PROVINCIAL REGULATION 210/72 FOR DETAILS

EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PLAN	PROPOSED	EXISTING	LEGEND-PROFILE	PROPOSED
200 WM	WATERMAIN	200 WM		SL , HYDRO		150 WM	WATERMAIN	150 WM
	HYDRANT			MTS			HYDRANT	
	VALVE			TRAFFIC SIGNALS			VALVE	
525 LDS	LAND DRAINAGE SEWER	525 LDS	50 GAS	GAS	50 GAS	300 LDS	LAND DRAINAGE SEWER	300 LDS
375 WWS	WASTEWATER SEWER	375 WWS		SURVEY BAR		250 WWS	WASTEWATER SEWER	250 WWS
	MANHOLE			FENCE			℄ PROFILE	
	CATCH BASIN			POLE - HYDRO, MTS			GROUND ABOVE PIPE	
	CURB INLET			CURB STOP			? DITCH (NORTH & WEST)	
	JUNCTIONS			GUY ANCHOR			? DITCH (SOUTH & EAST)	
	CULVERT			LIGHT STANDARD			GUTTER (NORTH & WEST)	
	ANODE			TREE			GUTTER (SOUTH & EAST)	

LOCATION APPROVED
UNDERGROUND STRUCTURES

SUPV. U/G STRUCTURES COMMITTEE — DATE

NOTE:
LOCATION OF UNDERGROUND STRUCTURES AS SHOWN ARE BASED ON THE BEST INFORMATION AVAILABLE BUT NO GUARANTEE IS GIVEN THAT ALL EXISTING UTILITIES ARE SHOWN OR THAT THE GIVEN LOCATIONS ARE EXACT. CONFIRMATION OF EXISTENCE AND EXACT LOCATION OF ALL SERVICES MUST BE OBTAINED FROM THE INDIVIDUAL UTILITIES BEFORE PROCEEDING WITH CONSTRUCTION.

B.M. ELEV. | FIELD BOOK #
POSTED TO LBIS

NO.	REVISIONS	DATE	BY

CITY OF WINNIPEG
WATER AND WASTE
ENGINEERING DIVISION

DESIGNED BY	DGS	CHECKED BY	SC
DRAWN BY	WKT/CJH	APPROVED BY	SC
HOR. SCALE	1:250	RELEASED FOR CONSTRUCTION	
VERTICAL	1:50		
DATE	2008 08 26	DATE	

ENGINEER'S SEAL

ORIGINAL SIGNED BY S.R.J. COURNOYER 08/08/26

BID OPPORTUNITY: 629-2008
FILENAME : LD-5066.dwg
PLOT DATE: 2008 08 25

Winnipeg

THE CITY OF WINNIPEG
WATER AND WASTE DEPARTMENT

2008 OUTFALL GATE CHAMBER CONSTRUCTION AND UPGRADES

CONWAY STREET

CS OUTFALL GATE CHAMBER SITE PLAN

SHEET 4 OF 11

CITY DRAWING NUMBER

LD-5066

TESTHOLE LOGS

KGS GROUP

SUMMARY LOG

HOLE NO. **TH08-03**

SHEET 1 of 1

CLIENT	CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT
PROJECT	2008 GATE CHAMBER INVESTIGATIONS
SITE	CONWAY GATE CHAMBER
LOCATION	CONWAY STREET AND PORTAGE AVENUE
DRILLING METHOD	150 mm ø Solid Stem Auger, Acker MP5-T

JOB NO. 08-107-07
GROUND ELEV.
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 5-Jun-08
UTM (m) N 5,526,308
E 626,392

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	SAMPLE TYPE	NUMBER	RECOVERY %	SPT (N) blows/0.15 m ▲ / DYNAMIC CONE (N) blows/ft △ (20 40 60)	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ (20 40 60 80) / PL MC LL / % (20 40 60 80)
	0	0		**TOPSOIL** - Black, damp, trace to some silt, trace organics, trace rootlets.							
	1	5		**SILT** - Light brown, dry to damp, trace rootlets.				S1			
								S2			
	2			**SILTY CLAY** - Dark brown, moist, firm, intermediate to high plasticity, increase in sand content with depth, trace sand.							
	3	10						S3			
								S4			
				SILT TILL - Orange-brown, moist, non-plastic to low plasticity, trace gravel, trace sand, trace clay.				S5			
	4	15									
	5					5.5					
				- Red-brown, increased moisture, increased angular gravel content, non-plastic, below 5.79 m.				S6			
	6	20						S7			
				AUGER REFUSAL AT 6.40 m.		6.4					
	7	25									
	8										
	9	30									

Notes:
1. Installed till standpipe with Casagrande tip at 6.4 m with stickup of 1.07 m.
2. No water observed in standpipe on June 5, 2008.

SAMPLE TYPE ⊠ Auger Grab

CONTRACTOR Paddock Drilling Ltd.

INSPECTOR D. ANDERSON

APPROVED DCL DATE 12/6/08

SPT & TORVANE 2 P:\PROJECTS\2008\08-0107-07\DESIGN\GEOLOGS\2008 GATE CHAMBER INVESTIGATIONS 5-JUN-08.GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TH08-04**

CLIENT CITY OF WINNIPEG - WATER AND WASTE DEPARTMENT
PROJECT 2008 GATE CHAMBER UPGRADE
SITE Conway Gate Chamber
LOCATION Adjacent to Proposed Gate Chamber Expansion
DRILLING METHOD 125 mm ø Solid Stem Auger, and HQ Core (3.79")

JOB NO. 08-107-07
GROUND ELEV.
TOP OF PVC ELEV.
WATER ELEV.
DATE DRILLED 22-Sep-08
UTM (m) N
E

ELEVATION (m)	DEPTH (m)	DEPTH (ft)	GRAPHICS	DESCRIPTION AND CLASSIFICATION	PIEZ. LOG	DEPTH (m)	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 / %
	0	0		**TOPSOIL** - Black, damp, trace to some silt, trace organics, trace rootlets.		0.0					
	1	5		**SILT** - Light brown, dry to damp, trace rootlets.							
	2			**CLAY** - Brown, moist, firm, intermediate to high plasticity, trace sand.							
	3	10				3.8					
	4	15		**SILT TILL** - Brown to grey, moist, loose to compact, non to low plasticity, trace to some medium to coarse grained gravel, some sand, trace clay. - Augered to a depth of 14'. - Auger refusal at 14' on boulder; switched over to coring method. - Run 1: 14' to 17.5' depth (total length of run 42"). - Several inches of till material recovered; grey wet, loose, sandy, fine to coarse grained sand, trace fine grained gravel. - Granitic boulder 6-9" in length. - Run 2: 17.5' to 21.0' depth (total length of run 42"). - Till material: buff, dry to damp, dense, trace to some fine to coarse grained sand, trace fine to medium grained gravel, limestone cobbles and boulders (up to 20" in length).				R1	100		
	5							R2	81		
	6	20		- Run 3: 21' to 24.0' depth (total length of run 36"). - Easier drilling below 21'. - No till material recovered. - Limestone and granitic boulders (up to 5" in length).				R3	64		
	7	25		- Run 4: 24' to 29' depth (total length of run 60"). - Till material recovered: buff, dry to damp, dense, some fine to coarse grained sand, some medium to coarse grained gravel, trace cobbles. - Loss of drilling fluid circulation at 26'.				R4	43		
	8	30		- Run 5; 29.0' to 32.5' (total length of run 42") - Mix of limestone and granitic boulders, subangular to subrounded, some coarse grained gravel. - No recovery of till material.				R5	38		
	9										

SAMPLE TYPE ▮ Core Barrel

CONTRACTOR Subterranean Ltd.
INSPECTOR A.M. HAMILTON
APPROVED _____ DATE 25/9/08

SPT & TORVANE 2 P:\PROJECTS\2008\08-0107-07\DESIGN\GEOLOGS\2008 GATE CHAMBERS UPGRADE 22-SEP-08.GPJ

KGS GROUP

SUMMARY LOG

HOLE NO. **TH08-04**

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 △	Cu POCKET PEN (kPa) ★ / Cu TORVANE (kPa) ◆ / PL MC LL %
	11	35		- Run 6: 32.5' to 38.0' (total length of run 60"). - Difficulty drilling below 32.5'; cobbles/ boulders loose drill having difficult time cutting through material. - No till recovered. - Coarse grained gravel and cobbles sized material recovered.		10.1		R6	12	20 40 60	20 40 60 80
						11.6					
	12	40		**END OF TEST HOLE IN SILT TILL AT 11.58 m.**							
	13			Notes: 1. Stratigraphy to 3.8 m depth based on testhole TH08-03 located approximately 4.6 m south of TH08-04. 2. 25 mm diameter standpipe installed in silt till at 11.6 m. 3. Testhole sloughing was observed at a depth of 3.8 m upon removal of casing.						
	14	45									
	15	50									
	16										
	17	55									
	18	60									
	19										
	20	65									
	21	70									

SAMPLE TYPE ▮ Core Barrel

CONTRACTOR **Subterranean Ltd.**

INSPECTOR **A.M. HAMILTON**

APPROVED _____ DATE 25/9/08

PHOTOS

SITE PHOTOGRAPHIC LOG – The City of Winnipeg
2008 Outfall Gate Chamber Geotechnical Investigations
Winnipeg, Manitoba

Photo 1 – Runs1, 2 and 3 (14 to 24 foot depth) at Conway Gate Chamber (September 22, 2008)