DELOITTE & TOUCHE INC.

PHASE I GEOTECHNICAL INVESTIGATION PROGRAM ADJACENT TO THE FWS DAM

FARO MINE, YT

FINAL REPORT

PROJECT NO.: 0257-009-02
DATE: FEBRUARY 13, 2002

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Project No. 0257-009-02
Date: February 13, 2002

Ms. Shannon Glenn
Delotte and Touche Inc.
BCE Place
Suite 1400, 181 Bay Street
Toronto, Ontario
M5J 2V1

Re: Phase I Geotechnical Investigation Program Adjacent to the FWS Dam

Dear Ms. Glenn:

Please find attached three copies of our above referenced report dated February 13, 2002. This final report describes the drilling, laboratory testing and installation of piezometers downstream from the Fresh Water Supply (FWS) Dam. In addition to reporting on the drilling performed, we have provided recommendations for the piezometer monitoring program.

Should you have any questions or comments, please do not hesitate to contact me at the number listed above.

Yours truly,
BGC Engineering Inc.
per:

Gerry Ferris, M.Sc., P.Eng.(AB)
Geotechnical Engineer

GWF/sf

Attachment: Final Report

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LIMITATIONS OF REPORT

This report was prepared by BGC Engineering Inc. (BGC) for the account of Deloitte & Touche Inc (D&T). The material in it reflects the judgement of BGC staff in light of the information available to BGC at the time of report preparation. Any use which a Third Party makes of this report, or any reliance on decisions to be based on it are the responsibility of such Third Parties. BGC Engineering Inc. accepts no responsibility for damages, if any, suffered by any Third Party as a result of decisions made or actions based on this report.

As a mutual protection to our client, the public, and ourselves, all reports and drawings are submitted for the confidential information of our client for a specific project and authorization for use and / or publication of data, statements, conclusions or abstracts from or regarding our reports and drawings is reserved pending our written approval.

1.0 INTRODUCTION

1.1 Background

Based on potential risks identified in recent reports (BGC 2001a, BGC 2001b and Diving Dynamics 2001), along with concerns expressed by DIAND, a decision was made to lower the reservoir level retained by the Fresh Water Supply (FWS) Dam. In order to accomplish the lowering of the reservoir level, a new lower elevation spillway is required.

This report presents the results of a Phase I geotechnical investigation, conducted by BGC Engineering Inc. (BGC), of the area downstream of the FWS Dam.

The objective of the investigation was to collect geotechnical information regarding the soil and groundwater conditions downstream from the FWS dam for the purpose of evaluating proposed spillway options. This drilling investigation will be supplemented by future Phase II drilling program once the location of the proposed spillway is finalized.

1.2 Scope of Work and Authorization to Proceed

The specific scope of work for this investigation consisted of the following:

- Drill ten boreholes in the area downstream from the FWS Dam;
- Perform Standard Penetration Tests (SPT) at 1.5 m intervals, collect disturbed samples at 1.5 m intervals, between the SPT sample locations;
- Install standpipe piezometers (nested where possible);
- Perform laboratory testing of the soils;
- Determine, where possible, the depth to bedrock; and,
- Submit a summary factual report.

The drilling program was outlined verbally and the costs presented in a summary spreadsheet forwarded to Deloitte and Touche Inc. (D&T). Authorization to proceed was provided by Ms. Shannon Glenn of D&T.

2.0 SITE INVESTIGATION

2.1 Field Investigation

The site investigation program was performed between October 18 and 21, 2001 using a rubber tired CME 750 drill rig from Midnight Sun Drilling Co. Ltd. BGC's field representative during the drilling was Mr. Jonathan Kerr of Gartner Lee Limited from Whitehorse, YT. The borehole locations were laid out prior to commencement of the drilling program by Mr. Jim Cassie, P.Eng. of BGC. The following sampling and testing procedure was followed:

- Drill boreholes using hollow stem augers.
- Perform SPT's at depth intervals of 1.5 m in all boreholes. The soil collected in the penetrometer tube was bagged for later testing.
- Collect disturbed samples from the augers at 1.5 m intervals, between the SPT sample points.

- Visual examination and classification of the collected samples was performed in the field.
- Ground water conditions were noted during drilling. Installed standpipe piezometers in the boreholes that encountered water. The piezometers consisted of hand slotted 25mm diameter PVC pipe.
- Return the samples to a laboratory for selected soil testing (moisture content determination, grain size analysis and Atterberg Limit testing).

A total of ten boreholes (BGC01-03 through BGC01-13) were drilled to collect geotechnical information in this program. Note that boreholes BGC01-01 and BGC01-02 were part of a previous drilling program in which instruments were installed in the Canal Dyke; a report on the drilling for those boreholes is prepared under a separate cover. The co-ordinates (NAD 83) of the boreholes are given in Table 1 and the locations are shown on Figure 1. The locations of the boreholes were intitially determined through the use of a handheld GPS. A follow-up survey of the borehole locations, ground elevations and top of pipe elevations was performed by YES Surveying from Whitehorse, YT on December 14, 2001:

Table 1 Borehole Locations and Elevations (NAD83 co-ordinates)

Borehole	Northing	Easting	Ground Elevation (m. asl)	Top of Pipe Elevation (m. asl)
BGC01-03	6911492	585502	1087.2	
BGC01-04	6911358.37	585367.84	1077.157	
BGC01-05	6911375.99	585406.64	1079.119	Deep piezo = 1080.109 Shallow piezo = 1080.079
BGC01-06	6911349.46	585476.32	1080.183	
BGC01-07	6911397.03	585517.12	1084.298	1085.058
BGC01-08	6911442.45	585464.90	1084.963	
BGC01-09	6911472.50	585419.78	1084.380	
BGC01-10	6911505.11	585428.30	1085.412	
BGC01-11	6911527.41	585386.38	1081.505	
BGC01-12	6911507.54	585363.36	1078.804	1079.504
BGC01-13	6911401.41	585356.65	1077.036	1078.036

2.2 Laboratory Testing Program

Selected samples were submitted for moisture content, grain size analyses and Atterberg Limits testing. The results of the testing are shown on the borehole logs included in Appendix I, and separately on the laboratory summary sheets in Appendix II.

2.3 Ground Water Monitoring

As part of the investigation program, five piezometers were installed. A nested piezometer was installed in Borehole 01BGC-05 and single piezometers in Boreholes 01BGC-07, 01BGC-12 and 01BGC-13. The piezometers were constructed of 25 mm diameter Schedule 40 PVC pipe. Screens were constructed in the pipe by hand slotting. Details of the piezometer installations are included on the borehole logs included in Appendix I.

The “stick-up” for the five piezometers was determined as part of the YES survey. The stick-up was measured to be 0.99 m and 0.96 m respectively for the deep and shallow piezometers installed in Borehole 01BGC-05. The stick-up was 0.76 m, 0.70 m and 1.00 m for the piezometers installed in Boreholes 01BGC-07, 01BGC-12 and 01BGC-13.

3.0 RESULTS OF INVESTIGATION

3.1 Stratigraphy

The soil conditions encountered during the drilling program were relatively consistent, comprised of a silty sand-gravel (till) underlain by bedrock.

The silty sand-gravel (till) was described as a mixture of cobbles, gravel, sand and silt, with the gravel component being predominate (based on visual inspection). The gravel till ranged from brown to grey in colour and was dry to wet. Grain size analyzes were performed on five samples. The results of the grain size testing are included on the borehole logs and in the results of the laboratory analysis. One soil sample from Borehole 01BGC-07, a depth of 0.76 m, was tested to determine its Atterberg limits, and was determined to be non-plastic.

Bedrock was encountered in eight boreholes (01BGC-04, 01BGC-05, 01BGC-07, 01BGC-09, 01BGC-04, 01BGC-10, 01BGC-12 and 01BGC-13). This interpretation was made on the basis of auger refusal combined with visual inspection of samples or soil on the augers upon completion of the borehole. One grain size analysis was performed on the bedrock collected from 01BGC-07 following completion of an Atterberg limit test that indicated the sample was non-plastic, the results of that testing is included on the borehole log and within the summary of sampling section.

Ground ice, indicative of permafrost conditions, was encountered in Borehole 01BGC-12 only. This borehole is located within a vegetated area near the South Fork Rose Creek, as shown on Figure 1. The soil and ice, classified as V_c in accordance with NRC guidelines for permafrost classification, was encountered to a depth of about 5.3 m, below which the soil was saturated with free water. It should be noted that ground ice within the subsurface would generally be melted by the drilling method used.

The stratigraphy at Borehole 01BGC-10 was slightly different that typical, with 1.2 m of a gravel fill overlaying the gravel till. In addition, between the depths of 2.6 and 3.0 m, a uniform layer of fine sand was encountered.

It should be noted that when drilling below the water table, the soil cuttings came up on the augers as a “thick paste”. The material that was brought to the surface consisted mostly of the finer particles of the till matrix. Also, based on the performance during drilling, it is expected that cobbles are much more prevalent in the till matrix than indicated on the borehole logs. This is due to the small sampler size used in this program. In order to accurately determine the amounts of cobbles present, test pitting would be required.

Detailed descriptions of the soil encountered in the drilling program are provided in the borehole logs included in Appendix I.

4.0 SUMMARY AND RECOMMENDATIONS

Ten boreholes were drilled and five standpipe piezometers were installed downstream of the FWS Dam during this program. These boreholes were installed in order to assist in the definition of soil and groundwater conditions downstream of the dam.

The following recommendations are made:

- Monitor the piezometers on a monthly basis, when the piezometers are unfrozen.
- Well development should be undertaken prior to collection the initial readings of these piezometers. Well development should consist of a program of water level surging and pumping. The first reading from the piezometer should include depth to the bottom of the casing.

5.0 CLOSURE

This report summarizes the Phase I geotechnical investigation undertaken adjacent to the FWS Dam at Faro Mine, Yukon. The report summarizes and presents the results of the investigation that was undertaken.

Respectively submitted,
BGC Engineering Inc.
Per:

Reviewed by:

Gerry Ferris, M.Sc., P.Eng.(AB)
Geotechnical Engineer

James W. Cassie, M.Sc., P.Eng.
Specialist Geotechnical Engineer

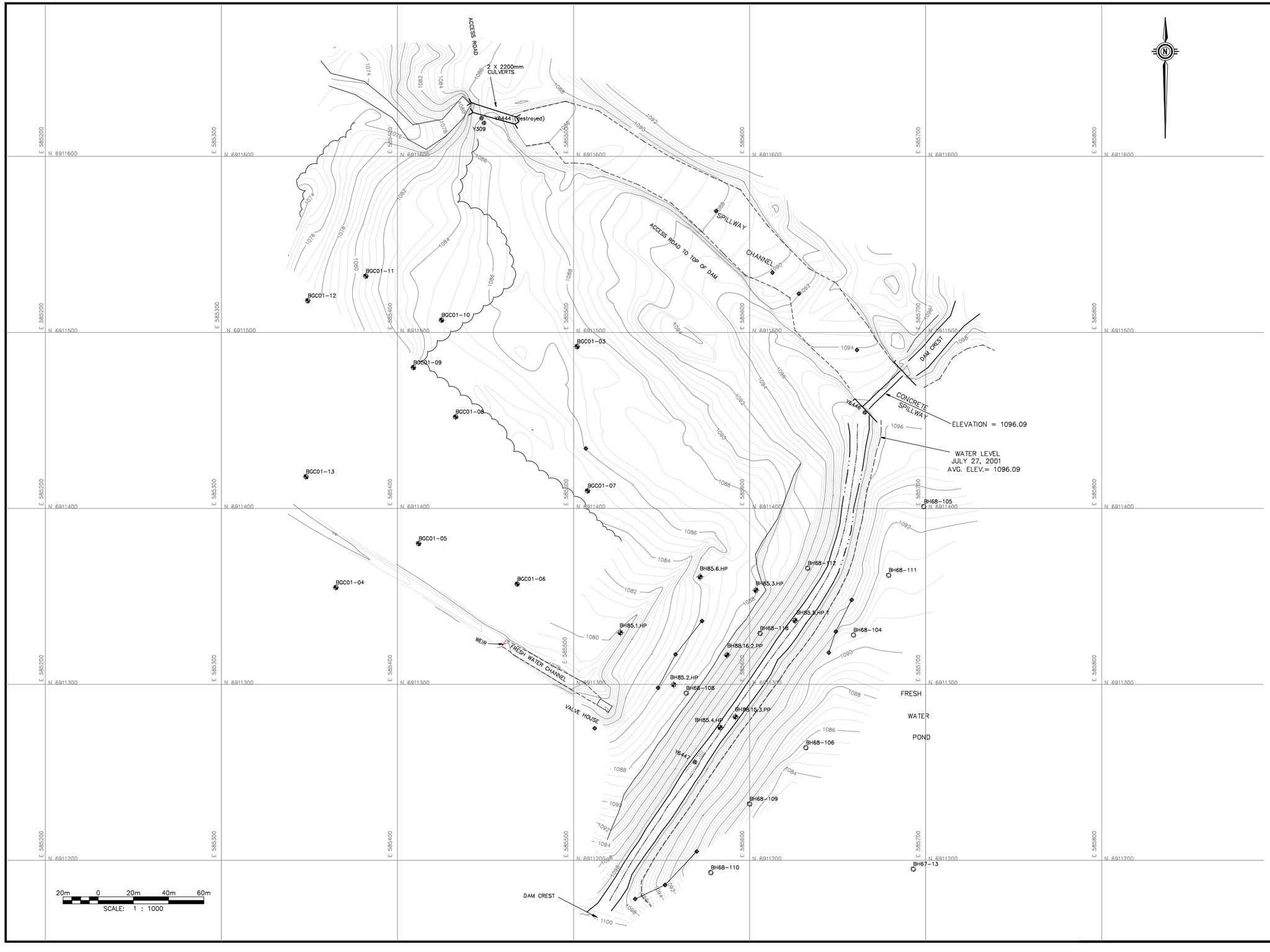
REFERENCES

BGC Engineering Inc. 2001a, “Physical Stability Assessment of the Fresh Water Supply Dam, Faro Mine, YT” Project number: 0257-006-03, report dated November 2001

BGC Engineering Inc. 2001b, “Qualitative Risk Assessment of Down Valley Tailing Area, Faro Mine, YT” Project number: 0257-004-01, report dated November 2001

Diving Dynamics 2001. Water Storage Dam, Internal Pipe Inspection, Anvil Range Mine, Yukon”, report dated September 2001

FIGURES
Figure I Site Plan



NOTES

CONTOUR INTERVAL = 0.5m

COORDINATES ARE UTM NAD 83 ZONE 8 DERIVED FROM 72Y237 LOCATED ALONG THE CAMPBELL HIGHWAY.

ELEVATIONS ARE GEODETIC.

COORDINATES AND ELEVATIONS

CP Y6447

NORTH 6911255.799
EAST 585568.951
ELEVATION 1099.286

CP Y6446

NORTH 6911454.513
EAST 585665.492
ELEVATION 1099.579

ALL SURVEY DATA PROVIDED BY YUKON ENGINEERING SERVICES.

LEGEND

- CENTRE OF DAM
- EDGE OF WATER
- SHOULDER OF DAM
- BORE HOLE
- BORE HOLE – LOCATION APPROXIMATE
- CONTROL POINT
- BEDROCK EXPOSURE
- BEDROCK EXPOSURE IN CUTOFF TRENCH

CLIENT:

Deloitte & Touche

REV.	DATE	REVISION NOTES	DRAWN	CHECKED	APPROVED

SCALE:	1:1000
DATE:	OCTOBER 2001
DRAWN:	GEJ
DESIGNED:	GWF
CHECKED:	
APPROVED:	

PROJECT: FARO MINE

TITLE: SITE PLAN AND BOREHOLE LOCATION

PROJECT No.	DWG. No.	REV.
0257-009-02	FIGURE 1	0

BGC Engineering Inc.
AN APPLIED EARTH SCIENCES COMPANY
Calgary, AB Phone: (403) 250 5185

APPENDIX I – Borehole Logs

DRILL HOLE # 01-BGC-03

Project No. 0257-009

Date Drilled: October 18, 2001
Location: See Figure 1
Reviewed by: GWF
Contractor & Rig: Midnight Sun, CME-750
Elevation: 1087.2
Notes:
Drill Method: Hollow Stem Augers
Co-ord: 6911492, 585502 NAD83
Hammer Type:
Logged by: JK

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300) / SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details	Depth (m)
0	Ground Surface 0 / 1087.2 ***Gravel*** (Till): Rounded / subrounded. Silty, sandy, some cobbles, dark brown.	1								0
1	@1m: Slight increase to gravel content.								Backfill with cuttings and bentonite	1
2	1.58 / 1085.6 @1.3m: Grey, very hard drilling due to cobbles ***End of Borehole*** Auger refusal at 1.58 m. Dry, no sloughing upon completion,	2								2
3										3
4										4
5										5
6										6
7										7
8										8
9										9
10	10 / 1077.2									10

CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-04

Project No. 0257-009

Date Drilled: October 18, 2001
Location: See Figure 1
Reviewed by: GWF
Contractor & Rig: Midnight Sun, CME-750
Elevation: 1077.157 m
Notes:
Drill Method: Hollow Stem Augers
Co-ord: 6911358, 585367 NAD83
Hammer Type:
Logged by: JK

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300) / SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details	Depth (m)
0	Ground Surface 0									0
	Gravel 1077.2									
	(Till): Trace silt, sandy, brown, compact. Upper 0.08 m frozen.									
	@0.6m: large boulder encountered	1							Backfilled with Bentonit and Cuttings	
1	@1.37m: Saturated.									1
		2				24				
2	@2.0m: Difficult drilling.									2
		3								
3	@3.0m: Trace silt, sandy, wet, del									3
		4				46				
	Below the water table material has a pasty texture, and sloughs into the hole.									
4										4
	@4.8m: Moist, compact.	5				22				
5										5
6										6
	@6.2m: loose.	6				11				
7										7
	@7.62m: Fine gravel, some sand trace silt.	7				R				
8	8.3									8
	Bedrock 1068.9									
	Auger refusal.									
9										9
10	10 1067.2									10

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Calgary, AB
Phone (403) 250-5185

CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-05

Project No. 0257-009

Date Drilled: October 19, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:

Location: See Figure 1
Elevation: 1079.119 m
Co-ord: 6911376, 585406 NAD83
Logged by: JK

Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer ◆ kPa ◆ (100 300); SPT (N) ■ Blows/ft ■ (10 20 30 40)	Installation / Backfill Details	Depth (m)
0	Ground Surface 0									0
	Gravel 1079.1									
	(Till): Rounded. Silty, sandy, some cobbles, brown, moist, compact. Upper 0.05 frozen.	1					×		Bentonite	
1	Dark brown, rootlets in upper 0.05m.									1
	@1.3m: And sand, grey. Trace decayed wood (black).	2				25	×	■		
2	@2.4m: Hard drilling due to cobble	3					×		Cuttings	2
3	@3.3m: And silt, sandy.	4				26	×	■		3
		5					×			
4									Bentonite	4
									Sand	
	@4.7m: Wet, suspected water tab Cobbles, dense.	6				36	×	■		
5		7					×		Bentonite	5
6	6.1								Sand	6
	Bedrock 1073									
	Auger refusal.									
7	Two piezometers installed using 25 mm diameter PVC. Hand slotted screens. Upper screened zone is from a depth of 4.59 m to 4.74 m. Lower screened zone if from a depth of 5.95 m to 6.1 m. Top of pipe elevation for deep piezometer is 1080.109 m. Top of pipe elevation for the shallow piezometer is 1080.079 m.									7
8										8
9										9
10	10 1069.1									10

BGC ENGINEERING INC.
AN APPLIED EARTH SCIENCES COMPANY
Calgary, AB
Phone (403) 250-5185

CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-06

Project No. 0257-009

Date Drilled: October 19, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:

Location: See Figure 1
Elevation: 1080.183 m
Co-ord: 6911349, 585476 NAD83
Logged by: JK

Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300) / SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details
0	Ground Surface 0 (1080.2)								
	Gravel (Till): Silty, sandy, some cobbles, dark brown, loose.								
	Upper 0.05 m was considered organic.								
1									
	@1.2m: dark grey, visible ice on clasts.	2				9			
2	2.4 (1077.8)								
	Auger refusal.								
	Dry hole, no sloughing upon completion.								
3									
4									
5									
6									
7									
8									
9									
10	10 (1070.2)								Backfilled w Bentonite / cuttings

CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-07

Project No. 0257-009

Date Drilled: October 20, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:

Location: See Figure 1
Elevation: 1084.298 m
Co-ord: 6911397, 585517 NAD83
Logged by: JK

Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300); SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details	Depth (m)
0	Ground Surface 0 / 1084.3									0
	Gravel (Till): Trace silt, and sand, trace cobbles, brown, compact. @0.76m: G - 54%, S - 32%, M - 10 %, C - 3.4 %	1			GM		×			
1									Bentonite	1
		2				18	×	■	Slough Bentonite	
2										2
		3					×			
3	@3.81m: G - 20%, S - 46% M - 29%, C - 5.3%								Sand	3
	3.5	4				R	×	■		
	Weathered Bedrock 1080.8 / 3.9	5			SM		×			
4	Light cream coloured fines (light yellow) and rock fragments in cuttings. 1080.4									4
	Bedrock Auger refusal.									
5	One piezometer installed using 25 mm diameter PVC. Hand slotted screen. Piezometer screened from a depth of 2.38 m to 3.9 m. Top of pipe elevation at 1085.058 m.									5
6										6
7										7
8										8
9										9
10	10 / 1074.3									10

CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-08

Project No. 0257-009

Date Drilled: October 20, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:

Location: See Figure 1
Elevation: 1084.963 m
Co-ord: 6911442, 585465 NAD83
Logged by: JK

Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300) / SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details	Depth (m)
0	Ground Surface 0									0
	Gravel 1085									
	(Till): Trace silt, sandy, trace cobbles, brown. 0.46 1084.5	1					×		Backfilled w Bentonite / cuttings	
1	Auger refusal.									1
	Dry hole, no slough upon completion									
2										2
3										3
4										4
5										5
6										6
7										7
8										8
9										9
10	10 1075									10

CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-09

Project No. 0257-009

Date Drilled: October 20, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:

Location: See Figure 1
Elevation: 1084.380 m
Co-ord: 6911472, 585419 NAD83
Logged by: JK

Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300) / SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details	Depth (m)
0	Ground Surface 0 1084.4 ***Sand*** (Till): Silty, and gravel, trace cobbles, orange/brown, compact. @0.76m: G - 39%, S - 44% M+C - 17%	1			SM		×			0
1	@1.2m: grey. @1.52m: Cobbles.								Backfilled w Bentonite / cuttings	1
2	@2m: Gravel, sandy, trace silt. @2.28m: G - 76%, S - 16% M+C - 7%	2				23	×	■		2
3		3			GM		×			3
4	@4.2m: G - 37%, S - 46% M+C - 17% 4.3 1080.1 ***Weathered Bedrock*** Rock fragments and creamy fines 1079.8	4				23	×	■		4
5	***Bedrock*** Auger refusal. Dry hole, no slough upon completion	5			SM		×			5
6										6
7										7
8										8
9										9
10	10 1074.4									10

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PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-10

Project No. 0257-009

Date Drilled: October 20, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:

Location: See Figure 1
Elevation: 1085.412 m
Co-ord: 6911505, 585428 NAD83
Logged by: JK

Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300) / SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details
0	Ground Surface 0 1085.4								
	Gravel (Fill): Angular. Silty, orange/brown.								
1	1.2 1084.2								
	Gravel (Till): Silty, sandy. trace cobble, brown, dense.	2				38			
2	2.6 1082.6								
	Sand Uniform, fine, trace gravel (rounded)	4				67			
3	3.05 1082.4								
	Gravel (Till): Fine. Trace silt, sandy, very dense. @4.6m: Angular clasts.	6				51			
4									
5	5.48 1079.9								
	Bedrock Auger refusal. Bedrock cuttings on end of auger. Dry hole. No sloughing upon completion.								
6									
7									
8									
9									
10	10 1075.4								Backfilled w Bentonite / cuttings

CLIENT: Deloitte & Touche Inc.

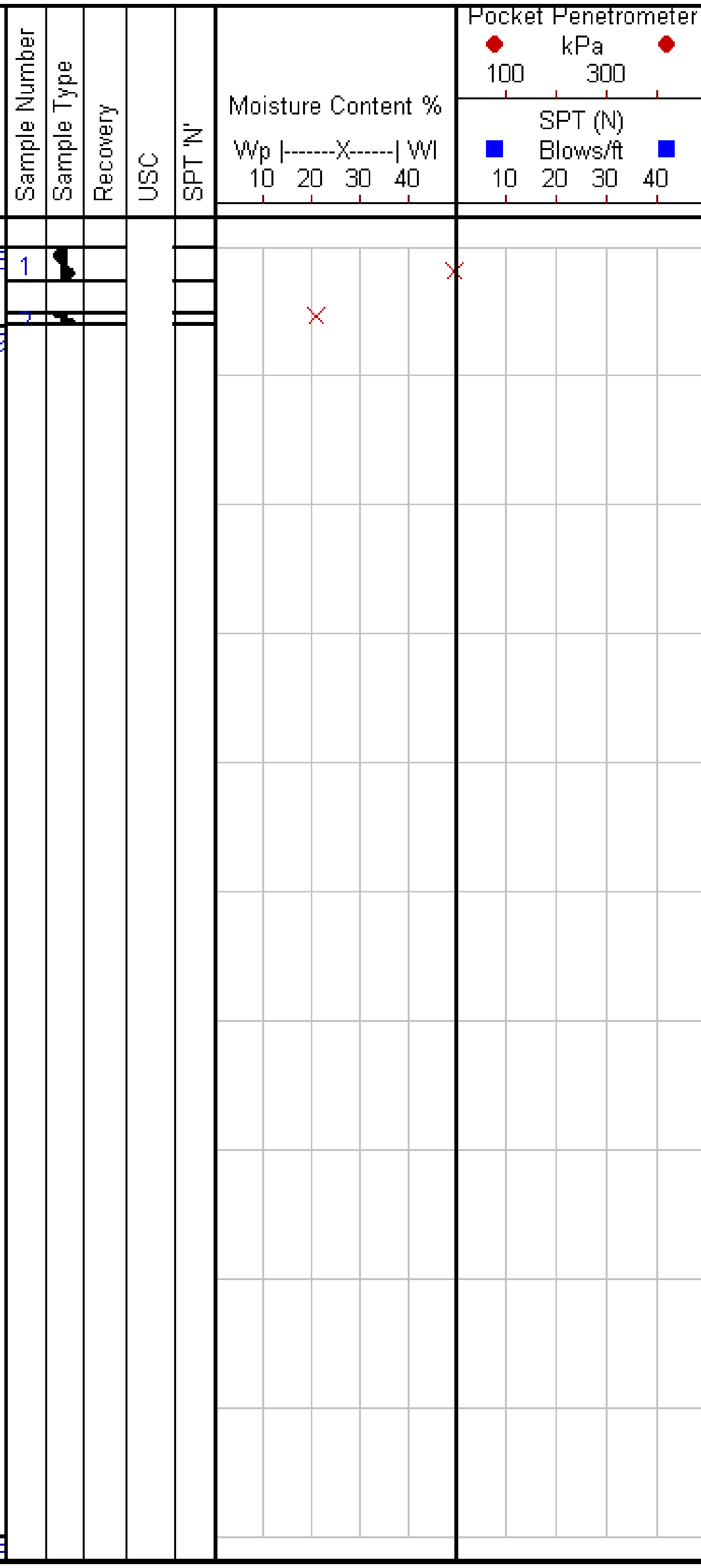
PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-11

Project No. 0257-009

Date Drilled: October 21, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:
Location: See Figure 1
Elevation: 1080.505 m
Co-ord: 6911527, 585386 NAD83
Logged by: JK
Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Depth / Elev.	Sample Number	Installation / Backfill Details
0	Ground Surface	0 / 1081.5	1	Backfilled w Bentonite / cuttings
	Sand Organic, rootlets, silty, dark brown.	0.61 / 1080.9	2	
	Sand Fine, white/grey.			
	Gravel (Till): Silty, sandy, trace cobble, brown.			
	Auger refusal.			
	Dry hole. No sloughing upon completion.			
10		10 / 1071.5		



CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-12

Project No. 0257-009

Date Drilled: October 21, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:

Location: See Figure 1
Elevation: 1078.804 m
Co-ord: 6911507, 585363 NAD83
Logged by: JK

Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300) / SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details	Depth (m)
0	Ground Surface 0									0
	1078.8									
	Gravel									
	(Till): Silty, sandy, trace cobble, brown.									
1	Upper 0.1 m was organic rich silt, with moss cover.								Bentonite	1
	@1.5m: Angular to subangular gravel, cold to touch. Trace ice coating on clasts (Vc).	2				R				
2	@2.25m: Ice visible on gravel (Vc).									2
		3				151			Cuttings	
3		4				81				3
4									Bentonite	4
	@4.7m: Fine gravel, some silt, sar	5				170				
5	@5.33m: Wet, no ice below this depth, compact.									5
		6				21				
6									Sand	6
		7				R				
	6.86									
7	1071.9 ***Bedrock***									7
	Auger refusal.									
8	Fragments of bedrock encountered on bottom auger.									8
9	One piezometer installed using 25 mm diameter PVC. Hand slotting for screen. Piezometer is screened between depths of 5.34 m and 6.86 m. Top of pipe elevation is 1079.504 m.									9
10	10									10
	1068.8									

CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

DRILL HOLE # 01-BGC-13

Project No. 0257-009

Date Drilled: October 21, 2001
Contractor & Rig: CME-750
Drill Method: Midnight Sun Drilling
Hammer Type:

Location: See Figure 1
Elevation: 1077.036 m
Co-ord: 6911401, 585356 NAD83
Logged by: JK

Reviewed by: GWF
Notes:

Depth (m)	SOIL DESCRIPTION	Sample Number	Sample Type	Recovery	USC	SPT 'N'	Moisture Content % (Wp |-------X------| Wl; 10 20 30 40)	Pocket Penetrometer kPa (100 300) / SPT (N) Blows/ft (10 20 30 40)	Installation / Backfill Details	Depth (m)
0	Ground Surface 0 / 1077 ***Gravel*** (Till): Silty, sandy, trace cobble, brown. @1.2m: Grey.								Bentonite Slough Bentonite Sand	0
1										1
2										2
3										3
4	4.6 / 1072.4 ***Bedrock*** Auger refusal. Visual inspection of cuttings on bottom auger. Fragments of bedrock. One piezometer installed using 25 mm diameter PVC. Hand slotting for screen. Piezometer is screened between depths of 4.2 m and 4.5 m. Top of pipe elevation is 1078.036 m.									4
5										5
6										6
7										7
8										8
9										9
10	10 / 1067									10

CLIENT: Deloitte & Touche Inc.

PROJECT: Phase I Geot. Investigation for FWS Dam

APPENDIX II – Laboratory Test Results

EBA Engineering Consultants Ltd.

FACSIMILE COVER SHEET

Calcite Business Centre, Unit 6
151 Industrial Road, Whitehorse, Yukon Y1A 2V3 CANADA
Telephone: (867) 668-3068 Facsimile: (867) 668-4349
Direct line: (867) 668-2071, ext. 27
Internet: mplaunt@eba.ca

Date: November 6, 2001 Time Sent: 8:31:13 AM

Attention: Mr. Gerry Ferris

Company: BGC Engineering Inc

Fax No.: (403) 250-5330 Telephone: (403) 250-5185

From: Myles Plaunt File No.: 0201-01-14969.031

Subject: Test Results – Faro Soil Samples

MESSAGE:

Gerry: Attached to this cover sheet are the results from the classification testing completed on the samples delivered to EBA on October 25, 2001.

All results are presented on the summary sheet attached to this fax cover sheet, with individual report forms for all grain size analysis tests. Please get back to me as soon as possible if you want us to make another attempt at liquid limits for the two samples from Testhole BCG-07

If you have any questions, call myself or Richard Trimble of this office for assistance.

Regards:

TOTAL NUMBER OF PAGES (including this page): 7
Please circle as appropriate

Original to follow	YES/NO
By Mail/other	YES/NO

eba

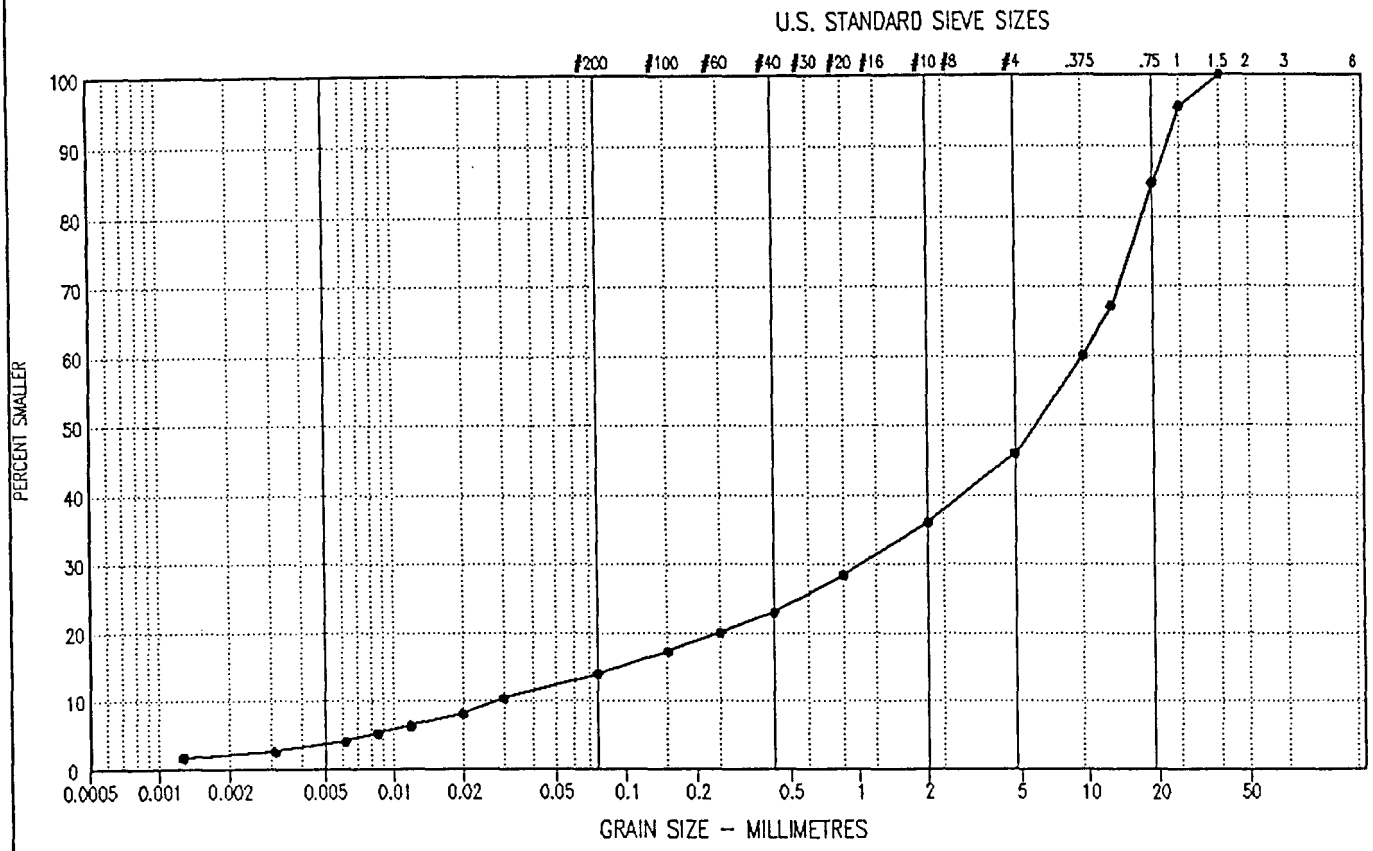
LABORATORY TEST RESULTS – FARO, YUKON

TESTHOLE	SAMPLE NUMBER	DEPTH (ft.)	MOISTURE CONTENT	GRAIN SIZE RESULTS GRAVEL	SAND	SILT	CLAY
BCG 03	S1A	2.5	5.3				
	S1B	2.5	5.1				
	S2A	5	0.7				
	S3A	5	2.7				
BCG 04	S1	2.5	4.9				
	S2	5.0 – 6.5	10.1				
	S3	7.5	15.4				
	S4	10.0 – 11.5	15.1				
	S5	15.0 – 16.5	11.1				
	S6	20.0 – 21.5	11.8				
	S7	25.0 – 26.5	14.7				
BCG 05	S1	2.5	7.5				
	S2	5.0 – 6.5	8.5				
	S3	7.5	18.2				
	S4	10.0 – 11.5	14.9				
	S5	12.5	13.7				
	S6	15.0 – 16.5	11.6				
	S7	17.5	26.3				
BCG 06	S1	2.5	6.4				
	S2	5.0 – 6.5	14.1				
	S3	7.5	9.4				
BCG 07	S1	2.5	4.0	54	32	10	3.4
	S2	5.0 – 6.5	9.2				
	S3	7.5	6.2				
	S4	10.0 – 11.5	14.1				
	S5	12.5	3.0	20	46	29	5.3
BCG 08	S1	1.5	13.2				
BCG 09	S1	2.5	6.3	39	44	17	
	S2	5.0 – 6.5	9.8				
	S3	7.5	3.8	76	16	7	
	S4	10.0 – 11.5	4.5				
	S5	13.0 – 14.0	2.6	37	46	17	
BCG 10	S1	2.5	5.1				
	S2	5.0 – 6.5	6.7				
	S3	7.5	3.2				
	S4	10.0 – 11.5	4.8				
	S5	8.0 – 10.0	5.7				
	S6	15.0 – 11.5	5.0				
	S7	17.5	2.9				
BCG 11	S1	GRAB	50.4				
	S2	GRAB	21.3				
BCG 12	S1	2.5	12.2				
	S2	5.0 – 6.5	14.7				
	S3	7.5 – 10.0	8.1				
	S4	10.0 – 11.5	8.5				
	S5	15.0 – 16.5	8.6				
	S6	17.5 – 19.0	8.5				
	S7	20.0 – 21.5	12.7				
BCG 13	S1	5.0	13.0				

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (ft)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●——●	BCG-07	2.50	3.4	10	32	54	–	4.5	GM

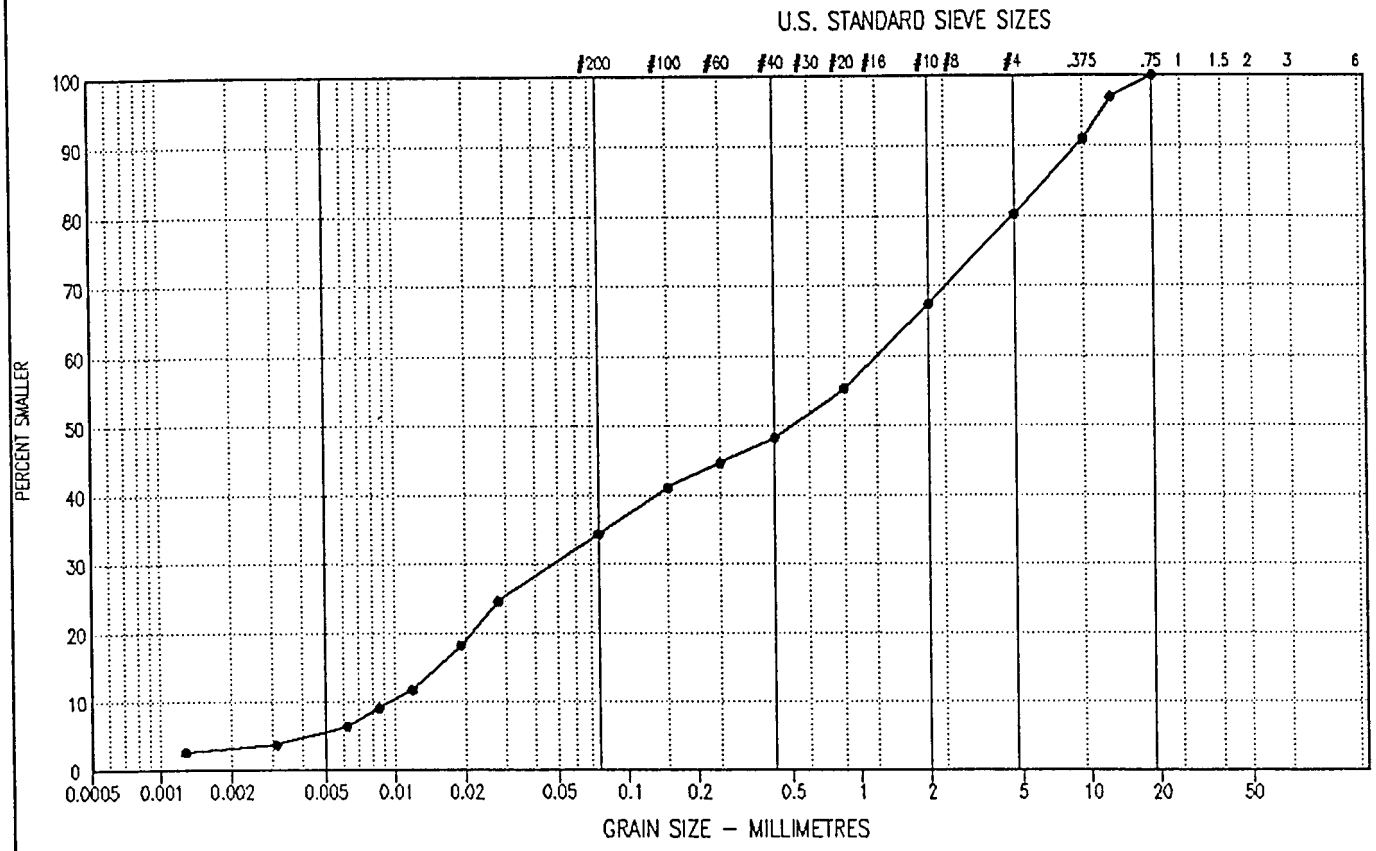
Project: 0201-0114969031 Date Tested: 01/11/01 BY: MCP

Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (ft)	DESCRIPTION				Cu	Cc	U.S.C
			CLAY %	SILT %	SAND %	GRAVEL %			
●	BCG-07	12.50	5.3	29	46	20	134.3	0.2	SM

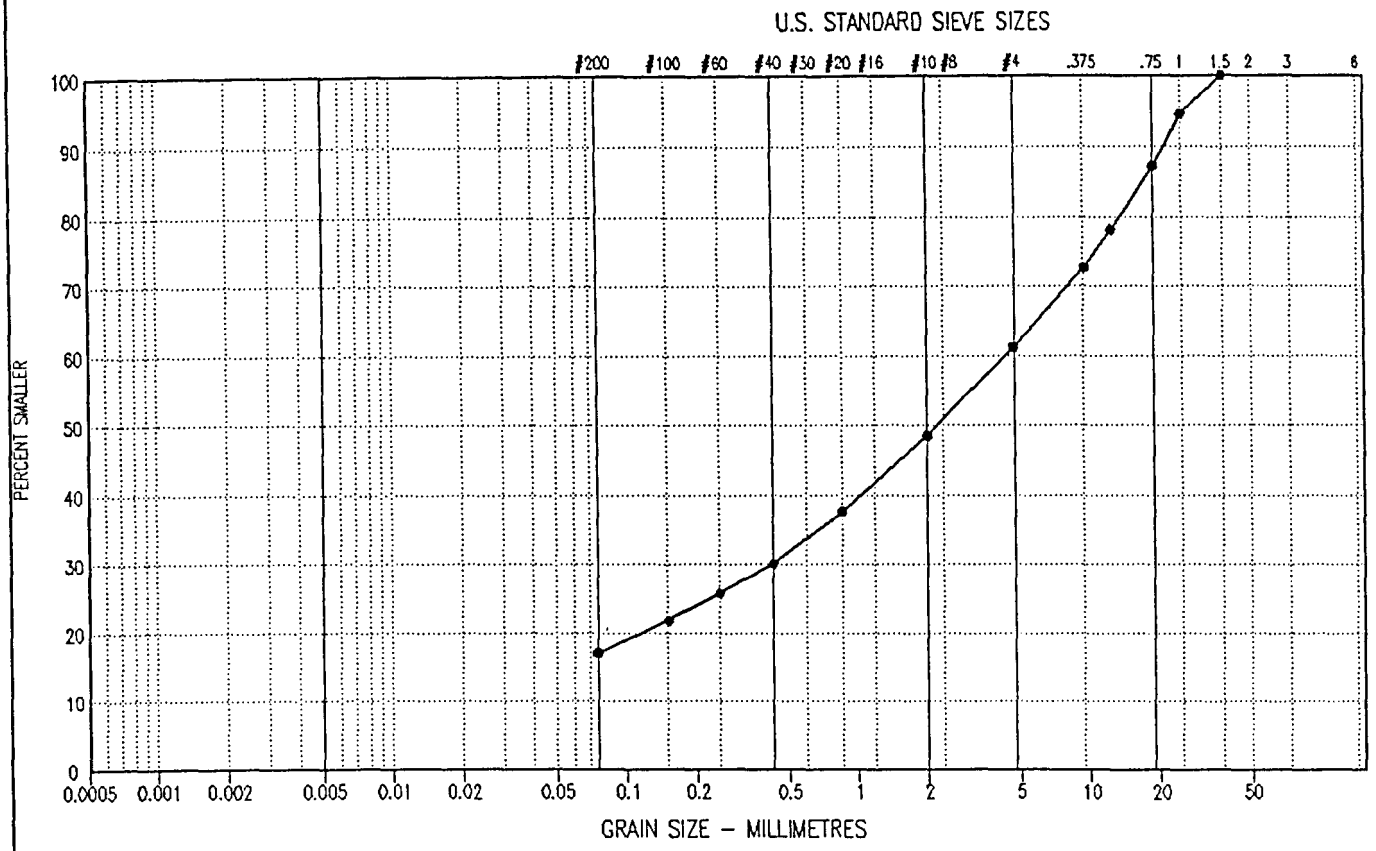
Project: 0201-0114969031 Date Tested: 01/11/01 BY: MCP

Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (ft)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●——●	BCG-09	2.50	17	44	39	–	–	

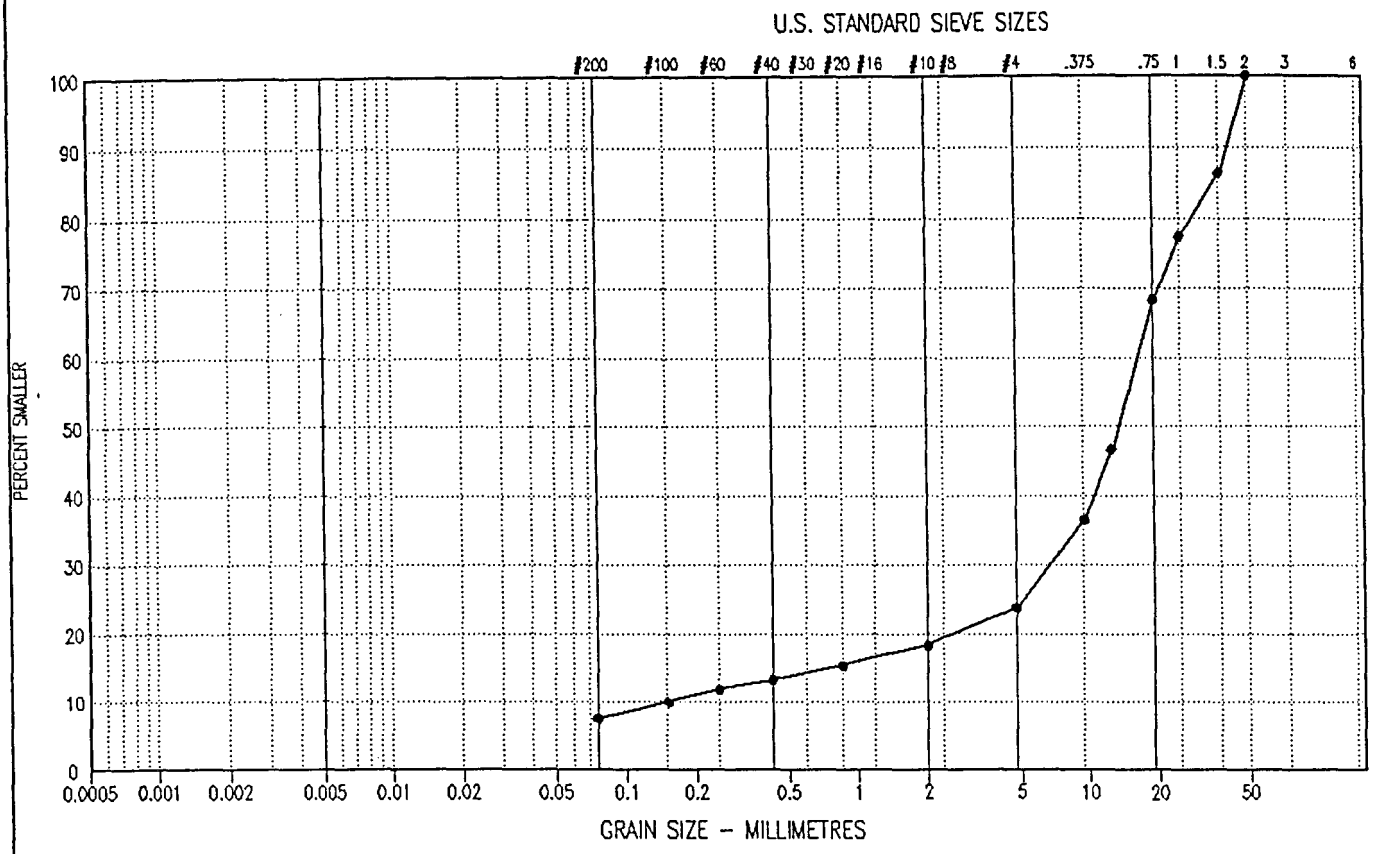
Project: 0201-0114969031 Date Tested: 31/10/01 BY: MCP

Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (ft)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●——●	BCG-09	7.50	7	16	76	104.7	19.3	GP-GM

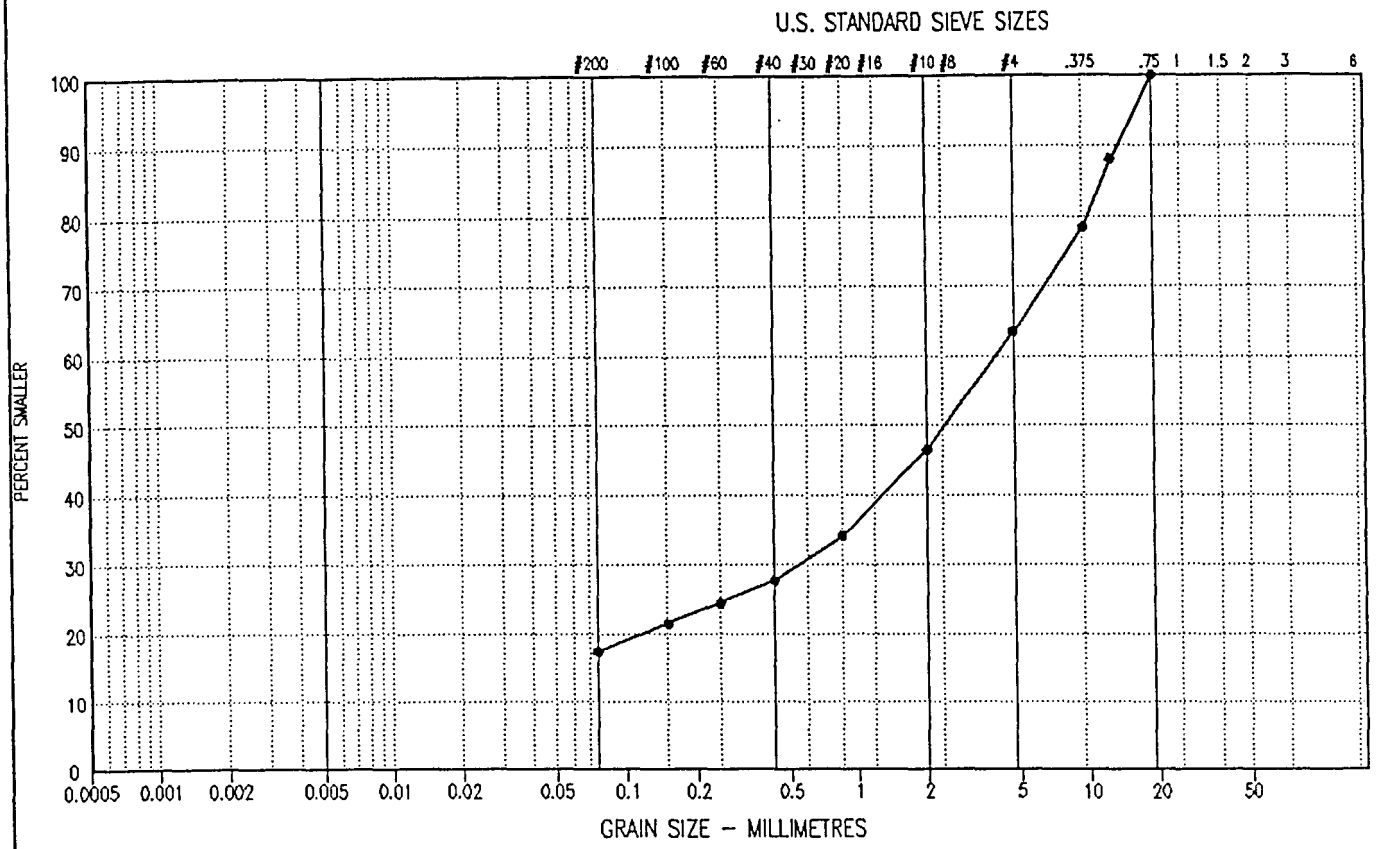
Project: 0201-0114969031 Date Tested: 02/11/01 BY: MCP

Tested in accordance with ASTM D422 unless otherwise noted.

EBA Engineering

PARTICLE SIZE – ANALYSIS OF SOILS

CLAY	SILT	SAND			GRAVEL	
		FINE	MEDIUM	COARSE	FINE	COARSE



SYMBOL	BOREHOLE NUMBER	DEPTH (ft)	DESCRIPTION			Cu	Cc	U.S.C
			CLAY & SILT %	SAND %	GRAVEL %			
●——●	BCG-09	13.00 – 14.00	17	46	37	–	–	

Project: 0201-0114969031 Date Tested: 01/11/01 BY: MCP

Tested in accordance with ASTM D422 unless otherwise noted.