B-4

C□□-□□□ W□□□ M□ M □□□□□□ M

Foth

Memorandum

Foth Infrastructure & Environment, LLC

2121 Innovation Court, Suite 300
P.O. Box 5126 • De Pere, WI 54115-5126
(920) 497-2500 • Fax: (920) 497-8516
www.foth.com

August 24, 2017

TO: Andrew Boushy, Aquila Resources Inc.

CC: Steve Donohue, Foth Infrastructure & Environment, LLC
Master File

FR: Kris Baran, Foth Infrastructure & Environment, LLC
John Starke, Foth Infrastructure & Environment, LLC
Raymond Wong, Foth Canada Corporation

RE: Back Forty Project Design of Cut-off Wall/River Road Realignment/East Access Power Corridor - Revised

Introduction

Aquila Resources Inc. (Aquila) is preparing a Mining Permit Application (MPA) for the Back Forty Project, which is located in western Menominee County, about 15 miles northwest of Stephenson, Michigan. The project consists of mining a volcanogenic massive sulfide deposit of zinc and copper as an open pit. The planned open pit is bounded to the west by the Menominee River. A cut-off wall is proposed to restrict seepage from the Menominee River to the open pit and improve the stability of the pit slope. Figure 1 shows the general location of the open pit, proposed cut-off wall alignment, and proposed River Road termination.

This memorandum presents the Permit Level design for the Menominee River cut-off wall based on the finalized open pit configuration by Aquila. The work is based on preliminary geotechnical investigation and cut-off wall alternative evaluation completed by Golder Associates Inc. in 2011 (Golder, 2011). From the preliminary concept description prepared by Golder, as well as the updated pit shell included with the Preliminary Economic Analysis (PEA) (Tetra Tech, 2014), Foth has prepared the cut-off wall design to support the MPA including:

- Layout the cut-off wall alignment based on the finalized open pit configuration (Pit 32).
- Finalize the construction method and cut-off wall mix design.
- Update seepage estimates based on the realigned length and depth of the cut-off wall.

EPA-R5-2018-009055_0000272_0002

Design of the cut-off wall containment structure.

Determine optimum overburden slope configuration.

Previous Geotechnical Investigation and Study

In 2011 Golder was retained by Aquila to provide technical support on a cut-off wall design to minimize seepage from the adjacent Menominee River into the planned open pit. A geotechnical investigation for the cut-off wall design was carried out in 2011. The scope of work covered by Golder's evaluation includes the following:

Evaluating preliminary seepage analyses and determining the need for a cut-off wall structure.

Comparing concept alternative cut-off wall construction methods with respect to constructability, performance (efficiency), environmental impact/footprint, order of magnitude construction cost, and potential requirement for bedrock grouting based upon previous mine description.

Recommend technically feasibility cut-off descriptions for the project.

Cut-off Wall Design

Design Basis

The cut-off wall is designed and constructed as a low permeability barrier through the overburden soils to impede seepage from the Menominee River into the proposed open pit and at the same time to reduce the hydraulic gradient in the overburden soil to improve slope stability. The selection of the type of cut-off wall construction technique shall be based on the ability of such method to excavate the on-site soils and rock in an efficient manner and provide the best performance as a low permeability barrier.

The pertinent design criteria of the Back Forty project cut-off wall are presented in Table 1.

Table 1

Cut-off Wall Design Criteria

Description	Design Value
Maximum hydraulic conductivity	1×10^{-8} m/s
Minimum unconfined compression strength	500 kPa (5 tons/feet^2)
Minimum embedment depth in weathered rock	2 m (6 feet)
Design maximum flood level of the Menominee River for a 100-year, 24-hour storm (Foth, 2015)	212 m
Minimum set-back distance	30.5 m (100 feet) to the maximum flood level, i.e., 212 m

m/s = meter per second
feet^2 = square feet
m = meter

Prepared by: RXW
Checked by: MJV2

EPA-R5-2018-009055_0000272_0003

Cut-off Wall Types
Four (4) cut-off wall construction alternatives were considered for the Back Forty Project including:

Conventional Excavation (long-reach excavator).
Clamshell Excavation.
Cutter Soil Mixing (CSM).
Trench Cutter (TC).

Of these, it is concluded that the CSM and the TC methods are best suited for constructing the cut-off wall in the soil and bedrock conditions present at the Project site. The Conventional Excavation and Clamshell Excavation methods were rejected due to limitations as outlined below:

Difficult to control verticality.
Not suitable for dense/stiff soils, cobbles and boulders.
Cannot excavate bedrock.
Cleaning if bottom of wall difficult.
Difficult to ensure backfill quality to meet QA/QC.

The CSM and TC construction methods are capable of cutting through the bedrock to provide the necessary key-in in a single step. The CSM and TC construction methods are very similar, both employing cutting wheels rotating about a horizontal axis. The main difference between TC and the CSM is the manner the cut-off is formed. With the TC method, there is no injection of slurry at the point of cutting. Instead, cutting takes place under a head of bentonite slurry with the cut soils being removed from the trench by pumping to the surface in a suspension of a bentonite slurry. The TC method is usually used where very deep penetration (up to 120 m) in dense or bedrock formation is required. The CSM mixes the in-situ soils with cement-bentonite (SCB) slurry that is injected directly into the soil at the point of cutting. However, the capability of the CSM to penetrate the weathered zone is highly dependent on the strength of the bedrock encountered during construction of the cut-off wall. In the event that the CSM cannot penetrate the weathered zone to construct the cut-off wall key-in, the bottom 2 m (6 feet) of the cut-off wall shall be pressure grouted.

The CSM and TC method also provides a better assurance of quality and performance and has many advantages over the conventional and clamshell method. Based on the soil conditions and depth of the overburden, the CSM method is best suitable at the Project site.

Cut-off Wall Alignment and Location
The general plan arrangement and profiles of the cut-off wall are shown on Figure 2. Typical cross sections through the cut-off wall alignment are provided on Figure 3. The depth of the cut-off wall varies from about 12 m to 20 m below the existing ground surface. The cut-off wall will have a setback distance of 30.5 m (100 feet) from the 100-year, 24-hour flood level, i.e., 212 m. Other environmental features such as cultural resources that could be affected by the pit cut-off wall are also shown on Figure 2.

EPA-R5-2018-009055_0000272_0004

Cut-off Wall Construction

Figure 4 shows typical construction details of the cut-off wall. The CSM equipment shall be provided with a level platform during excavation of the cut-off trench to ensure verticality. A reinforced concrete guide wall is usually construed first to ensure that the CSM will properly be aligned. The guide wall also provides support of the near surface soil and footings for personnel and equipment. The cut-off wall is constructed in alternative panels. Two primary panels are constructed first. When the soil, cement, and bentonite (SCB) have set, the secondary panel is installed by overlapping into the primary panels, thus providing a continuous wall structure. The CSM is capable of excavating rock. However, in the event that it cannot penetrate unexpected hard formation, the cut-off wall will terminate at the rock surface and that a grout curtain shall be installed in the rock from the bottom of the cut-off wall. The depth of the grout curtain is the same as the embedment depth of the cut-off wall into weathered rock.

Cut-off Wall Mix Design

The cut-off wall will be constructed of soil, cement, and bentonite mix (SCB). Typical bentonite mix content is 6% to 7% of cement by weight and the water/cement ratio shall be between 2 and 3. The final design mix should be determined by suitability tests prior to construction to ascertain that the SCB mix will meet the minimum hydraulic conductivity and a shear strength requirement to meet the final design criteria.

Groundwater Seepage Estimate

Preliminary seepage analyses, based on the proposed cut-off wall profile, approximately 400 m in length indicated the seepage through the cut-off wall ranges from 123 to 4,756 cubic meters per day (32,500 to 125,500 gallons per day [gpd]) during Life of Mine. Further detailed seepage analyses will be carried out in the ongoing project hydrogeological evaluation. Groundwater infiltration and surface water runoff will be collected in sumps located at the lowest operating pit level. Pumps installed in the sumps will pump water to the clarifier ponds located near the Contact Water Basin (CWB). Pump design capacity will be determined with the Project final design upon completion of detailed water seepage analysis.

Overburden Slope Stability

The overburden at the proposed cut-off wall location consists of loose to very dense silty sand to sand and gravel. Pockets of cobles were also encountered at some of the borehole locations. The thickness of the overburden varied from 11 to 21 m. The measured 'N' values from the Standard Penetration Test (SPT) of the overburden varied from 3 to more than 100 blows per 0.3 m of penetration. Copies of the boring logs from Golder (Golder, 2011) are provided in Attachment 1.

Based on SPT 'N' values and experience of the types of overburden, the geotechnical parameters adopted for slope stability analysis are presented in Table 2.

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Table 2

Geotechnical Parameters Used for Slope Stability Analysis

Description of Stratum	Unit Weight (kN/m^3)	Cohesion, c' (kPa)	Internal Friction, '(degrees)
Overburden 20	0	30	
Cut-off Wall 20	500	30	
Rock Fill Berm 20	0	36	

Prepared by: RXW
Checked by: MJV2

The proposed overburden slope above the bedrock surface is 2H:1V and the toe is located a minimum of 15 m from the crest of the open pit slope. This provides a safe distance from the edge of the pit due to potential development of tension crack on the pit slope. To take into consideration of construction and normal road traffic, a surcharge load of 40 kPa is applied to the top of the slope.

Slope stability analyses were carried out using SLOPE/W software developed by Geo-Slope (Geo-Slope, 2012). The analyses were carried out for the following scenarios:

> Static short-term condition when the slope is being formed and prior to the construction of the cut-off wall and the phreatic surface is based on the normal water level of the Menominee River.
>
> Phreatic surface developed from a steady state flow condition during the 100-year, 24-hour storm with the cut-off wall in place. The raised water level of the Menominee River during the 100-year, 24-hour storm is assumed to be 212 m. For added stability and prevention of sloughing of the overburden slope face, a 3 m wide rock fill toe berm is provided downstream of the overburden slope. The rock fill berm toe is placed directly on bedrock and extended to elevation 210 m. Details of the overburden slope are shown on cross sections presented on Figure 3.

The minimum required factors of safety (FS) for slope stability are as follow:

> FS during construction of the cut-off wall is 1.25; and
> Long-term FS during a 100-year, 24-hour storm event is 1.5.

The results of slope stability analysis are provided in Attachment 2. All FS satisfy the minimum required and are summarized as below in Table 3.

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Table 3

Summary of Overburden Slope Stability Analysis

Description	FS
Static Short-Term Condition during Construction	27
Static Steady State with a 100-year, 24-hour storm event	1.62

Prepared by: RXW
Checked by: MJV2

Final Design and Construction Considerations

The cut-off alignment will be placed to meet local zoning requirements as well as the project site development needs. The construction of the cut-off wall by the CSM method is often carried out by a specialty contractor. A common design build approach can accept this method based on performance criteria set out by the geotechnical engineer. Additional boreholes will be required at the southern-most portion of the cut-off wall to provide the level of confidence required for final design and tender prior to construction.

Proposed River Road Termination

River Road is proposed to be terminated on the north and south sides of the mine pit during operations as shown on Figure 1. This proposal is currently being evaluated by the Menominee County Road Commission. If the proposed route is approved, all permitting will be handled by the Menominee County Road Commission as a separate project.

References

Foth Infrastructure & Environment, LLC, 2015. *Environmental Impact Assessment, Back Forty Project*. October 2015.

Geo-Slope International, 2012. Calgary, Alberta, Canada.

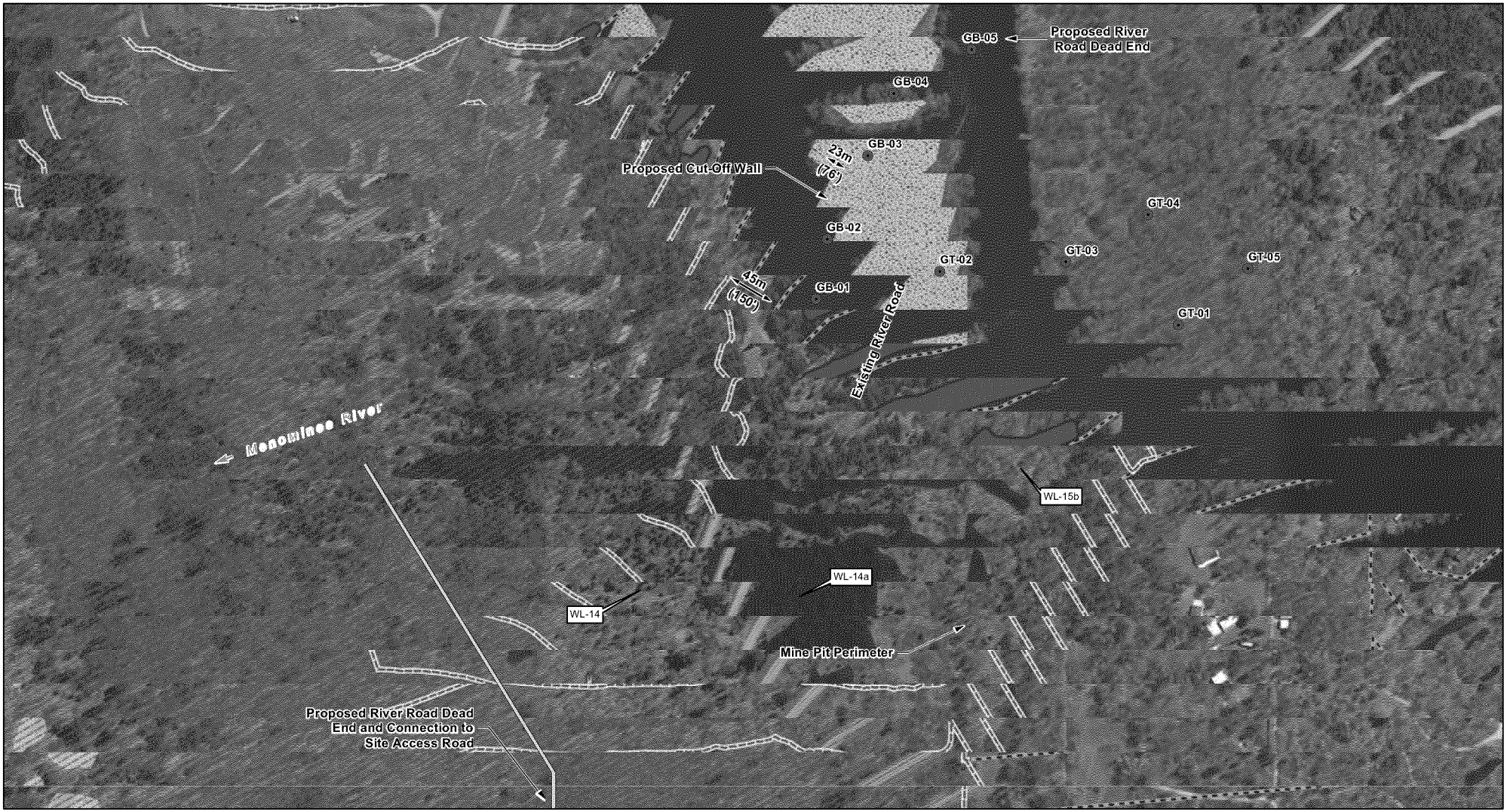
Golder Associates Inc., 2011. *Cut-off Wall Geotechnical Investigation Factual Report, Back Forty Project*. October 2011.

Tetra Tech, 2014. *Preliminary Economic Assessment of the Back Forty Project, Michigan, USA*. July 23, 2014.

Attachments:

Figure 1 – Cut-off Wall Alignment along Menominee River
Figure 2 – Cross Section Locations and Longitudinal Cross Section
Figure 3 – Transverse Cross Sections
Figure 4 – Typical Cut-off Wall Section Detail
Attachment 1 – Boring Logs
Attachment 2 – Slope Stability Analysis Results

Figures



NOTES

1. Topographic and planimetric data provided by Aero-Metric, Inc., Sheboygan, WI. Date of Acquisition: LiDAR-October 31, 2007 and Imagery-May 14, 2008.
2. Horizontal datum based on NAD 1983. Horizontal coordinates based on UTM Zone 16 Nor th. Topographic contours in meters.
3. Wetlands created from June 2017 field surveys supplied by King and MacGregor.
4. Updated facility features and pit design supplie d by Lycopodium in August 2017.
5. Cultural resources findings supplied by CCRG in October 2011.

LEGEND

- Drillholes: GT - Open Pit Series (Golder 2011); GB - Cut-Off Wall Series (Golder 2011)
- Proposed Cut-Off Wall
- Treated Water Discharge Pipeline
- Potential Disturbance Areas
- Cultural Resource Locations
- Regulated Wetland
- Non-Regulated Wetland
- NWI Wetland
- Mineral Property Boundary
- Project Boundary

Aquila Resources Inc.

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Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION
PREPARED BY:	MJV2	DATE:	SEP. '17
REVIEWED BY:	MAN	DATE:	SEP. '17
APPROVED BY:	KKB	DATE:	SEP. '17

BACK FORTY PROJECT

FIGURE 1

CUTOFF WALL ALIGNMENT
ALONG MENOMINEE RIVER
STEPHENSON, MICHIGAN

Scale: 0 150 300 Feet

Date: SEPTEMBER 2017

Drafted by: DAT

Project No: 17A021

Path: X:\GB\IE\2014\14A021-00\GIS\mxd\WPA Aug 2017\Appendix B4\Figure 1 Cut-Off Wall Alignment.mxd Date: 9/26/2017

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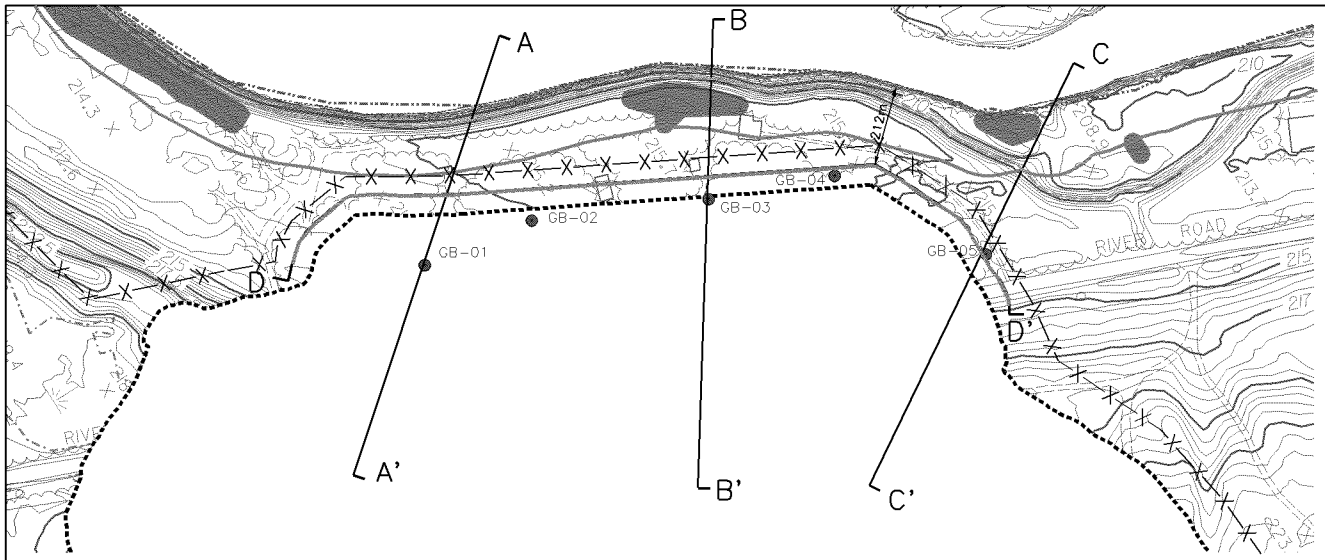
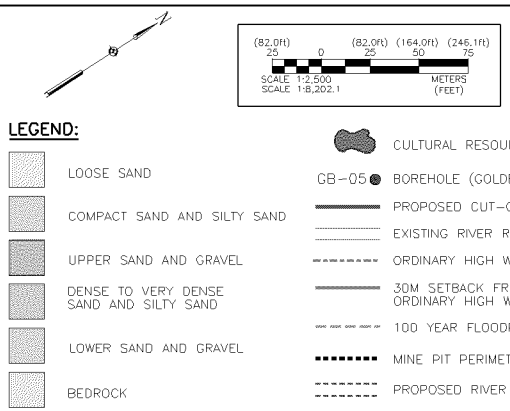
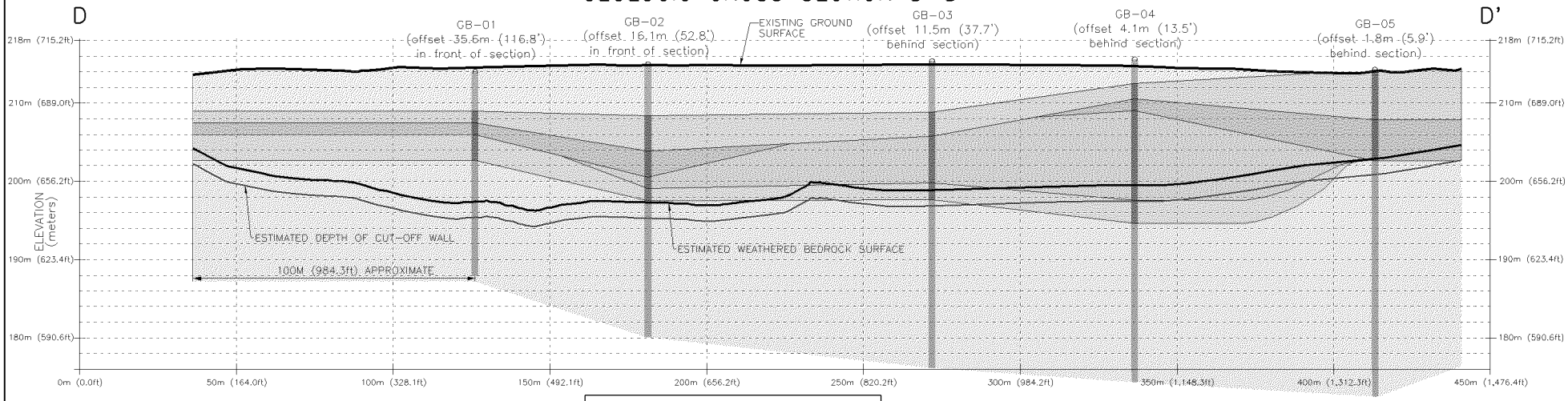


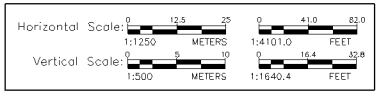


GEOLOGIC CROSS SECTION D–D'



NOTES:

1. HORIZONTAL DATUM BASED ON NAD 1983.
   HORIZONTAL COORDINATES BASED ON UTM ZONE 16 NORTH.
   VERTICAL DATUM IS NAVD 1988.
2. UPDATED FACILITY FEATURES AND PIT DESIGN SUPPLIED BY LYCOPODIUM IN AUGUST 2017.
3. CULTURAL RESOURCE SITES SUPPLIED BY ERM IN OCT. 2011.
4. 100 FT. RIVER SETBACK FROM THE ORDINARY HIGH WATER MARK AS REQUIRED BY LAKE TOWNSHIP ZONING ORDINANCE.
5. INTERPRETED 100-YEAR FLOODPLAIN IS AT ELEVATION 212m (695.5ft)
   BASED ON FOTH, 2017 – 100 YEAR FLOODPLAIN DELINEATION MEMO.



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Foth Infrastructure & Environment, LLC			
REVISED	DATE	BY	DESCRIPTION

PREPARED BY:	MJV2	DATE:	SEP.'17
REVIEWED BY:	DRD	DATE:	SEP.'17
APPROVED BY:	KKB	DATE:	SEP.'17

BACK FORTY PROJECT

FIGURE 2
CROSS SECTION LOCATIONS AND LONGITUDINAL CROSS SECTION
STEPHENSON, MICHIGAN

Scale:	AS SHOWN	Date:	SEPTEMBER 2017
Drafted By:	MRS	Project No.	17A021

X:\GB\IE\2014\14A021-00\CAD\WPA Aug 2017\Appendix B4\Figure 2 Cut-Off Wall General Arrangement.dgn
9/27/2017 jow

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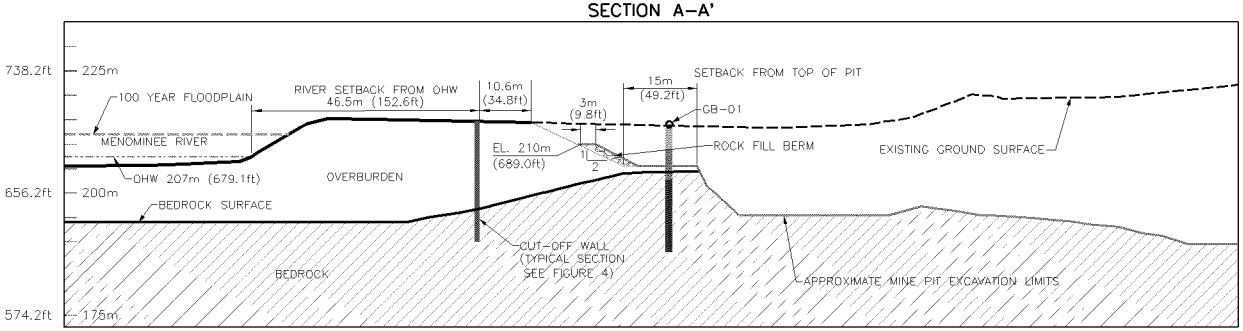
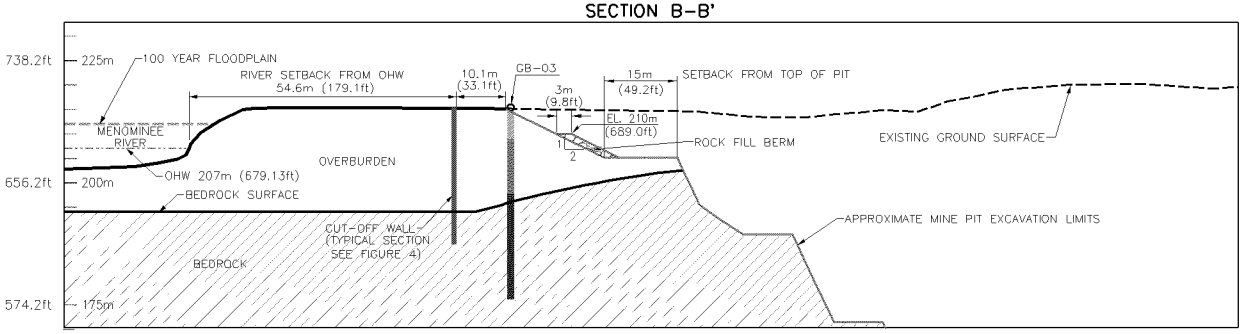
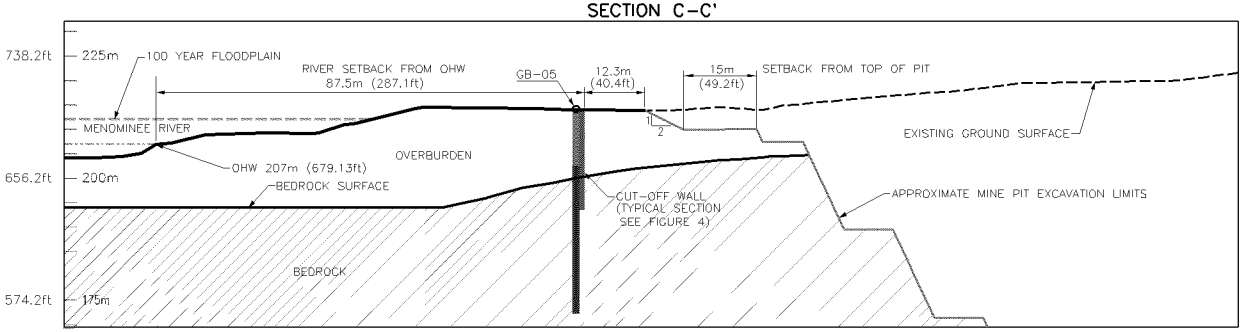
SECTION A–A'



SECTION B–B'



SECTION C–C'



NOTES:

1. HORIZONTAL DATUM BASED ON NAD 1983. HORIZONTAL COORDINATES BASED ON UTM ZONE 16 NORTH. VERTICAL DATUM IS NAVD 1988.
2. UPDATED FACILITY FEATURES AND PIT DESIGN SUPPLIED BY LYCOPODIUM IN AUGUST 2017.
3. CULTURAL RESOURCE SITES SUPPLIED BY ERM IN OCT. 2011.
4. 100ft. RIVER SETBACK FROM THE ORDINARY HIGH WATER LEVEL AS REQUIRED BY LAKE TOWNSHIP ZONING ORDINANCE.
5. ORDINARY HIGH WATER MARK REPRESENTS THE SEASONALLY HIGH WATER MARK AND CAN GENERALLY BE TAKEN AS THE TYPICAL SHORELINE.
6. CROSS SECTION LOCATIONS SHOWN ON FIGURE 2.
7. INTERPRETED 100-YEAR FLOODPLAIN IS AT ELEVATION 212m (695.5ft) BASED ON FOTH, 2017 – 100 YEAR FLOODPLAIN DELINEATION MEMO.

Aquila Resources Inc.

Foth

Foth Infrastructure & Environment, LLC					
REVISED	DATE	BY	DESCRIPTION		
PREPARED BY:		MJV2		DATE:	SEP.'17
REVIEWED BY:		DRD		DATE:	SEP.'17
APPROVED BY:		KKB		DATE:	SEP.'17

BACK FORTY PROJECT

FIGURE 3

TRANSVERSE CROSS SECTIONS
STEPHENSON, MICHIGAN

Scale:	AS SHOWN	Date:	SEPTEMBER 2017
Drafted By:	MRS	Project No.	17A021

X:\GB\IE\2014\14A021-00\CAD\WPA Aug 2017\Appendix B4\Figure 3 Cut-Off Wall Sections.dgn
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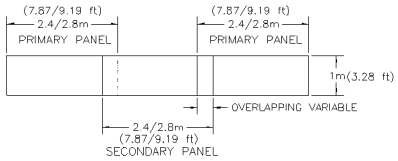
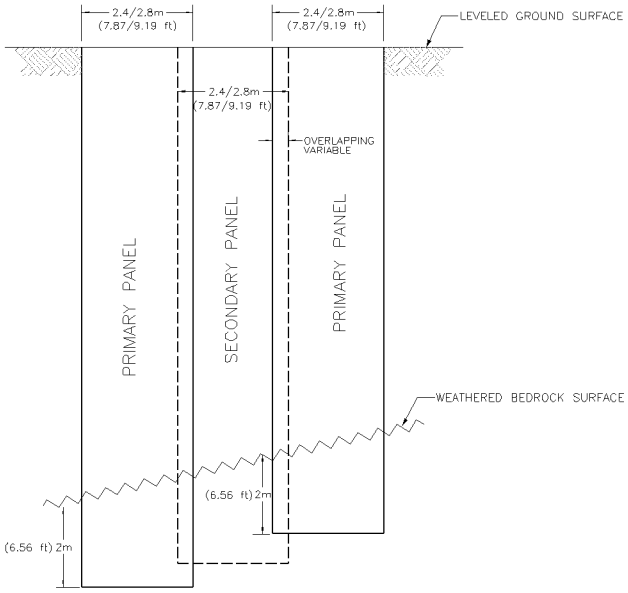


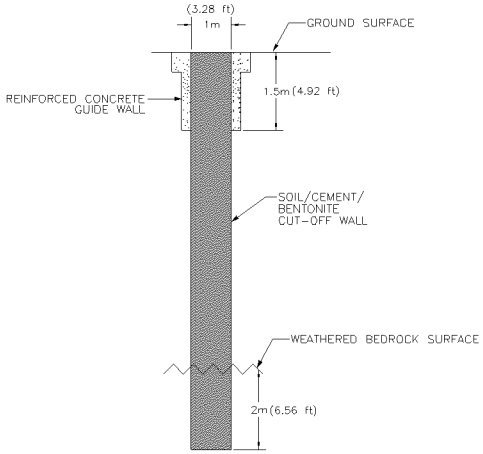
CUT-OFF WALL CONSTRUCTION SEQUENCE – PLAN VIEW

(NOT TO SCALE)



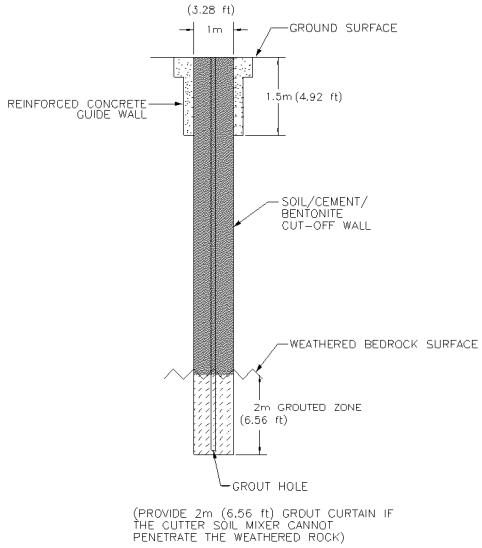
CUT-OFF WALL CONSTRUCTION SEQUENCE – SECTION VIEW

(NOT TO SCALE)



TYPICAL CUT-OFF WALL SECTIONS

(NOT TO SCALE)



ALTERNATIVE CUT-OFF WALL SECTION

(NOT TO SCALE)

NOTES:

1. CONSTRUCTION METHOD ASSUMED TO BE CUTTER SOIL MIXER (CSM).
2. A LEVEL PLATFORM SHALL BE PROVIDED FOR THE CSM TO ENSURE VERTICALITY.
3. THE FINAL DESIGN MIX SHOULD BE DETERMINED BY SUITABILITY TESTS PRIOR TO CONSTRUCTION TO ENSURE THE CSM MIX WILL MEET THE MAXIMUM HYDRAULIC CONDUCTIVITY AND MINIMUM SHEAR STRENGTH REQUIREMENTS.
4. THE CONSTRUCTION OF THE CUT-OFF WALL SHALL BE SUPERVISED BY A QUALIFIED GEOTECHNICAL ENGINEER.

Aquila Resources Inc.

Foth

Foth Infrastructure & Environment, LLC					
REVISED	DATE	BY	DESCRIPTION		
PREPARED BY:	MJV2		DATE:	SEP.'17	
REVIEWED BY:	DRD		DATE:	SEP.'17	
APPROVED BY:	KKB		DATE:	SEP.'17	

BACK FORTY PROJECT

FIGURE 4
TYPICAL CUT-OFF WALL SECTION DETAIL
STEPHENSON, MICHIGAN

Scale:	AS SHOWN	Date:	SEPTEMBER 2017
Drafted By:	JOW	Project No.	17A021

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9/27/2017 jow

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Attachment 1

Boring Logs

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-01

SHEET 1 OF 2

LOCATION: N 5033376.66 ;E 434794.09

BORING DATE: AUG 3-4, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-4} 10^{-3} 10^{-2}); WATER CONTENT PERCENT Wp ⊢—○ $\overline{w}$ —⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		214.02							
0	152 mm POWER AUGER; 108 mm I.D. HOLLOW STEM 02/08/2011	Loose, brown, SAND, trace gravel, trace silt		0.00							
1											
					1	DO	6				
2											
3					2	DO	6				
4											
					3	DO	5			M	
5		Compact, reddish brown, Silty SAND, some gravel, some clay		209.06 / 5.00							
6					4	DO	11			MH	
		Compact, blackish-brown, angular, GRAVEL and COBBLES		207.43 / 6.59							
7											02/08/2011
					5	DO	14				
8		Very dense, reddish-brown, SAND and GRAVEL, some silt, trace to some clay		205.98 / 8.08							
9					6	DO	>100			MH	
10											

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-01

SHEET 2 OF 2

LOCATION: N 5033376.66 ;E 434794.09

BORING DATE: AUG 3-4, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-4} 10^{-3} 10^{-2}) / WATER CONTENT PERCENT (Wp ⊖W W) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	152 mm POWER AUGER	Very dense, reddish-brown, SAND and GRAVEL, some silt, trace to some clay		202.73							
11		END OF HOLE		11.30							
12											
13											
14											
15											
16											
17											
18											
19											
20											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-RHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-02

SHEET 1 OF 2

LOCATION: N 5033435.02 ;E 434804.80

BORING DATE: AUG 6-8, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. +, rem V. ⊕; Q ●, U ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-4} 10^{-3} 10^{-2}) / WATER CONTENT PERCENT (Wp ⊖W Wl; 10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		214.88							
0	152 mm POWER AUGER; 108 mm I.D. HOLLOW STEM 06/08/2011	Loose, brown, SAND		0.00							
1											
					1	DO	7				
2											
					2	DO	6				
3											
4											
					3	DO	7				
5											
6											
					4	DO	6				
				208.42							
		Compact, brown, SAND, some gravel, trace to some silt to SAND and GRAVEL, trace silt		6.55							
7											
					5	DO	11			M	
8											
											06/08/2011
9											
					6	DO	10			M	
10											
		CONTINUED NEXT PAGE									

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-02

SHEET 2 OF 2

LOCATION: N 5033435.02 ;E 434804.80

BORING DATE: AUG 6-8, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-4} 10^{-3} 10^{-2})	WATER CONTENT PERCENT (Wp ⊢—○W—⊣ Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		— CONTINUED FROM PREVIOUS PAGE —											
10	152 mm POWER AUGER	Compact, brown, SAND, some gravel, trace to some silt to SAND and GRAVEL, trace silt											
					7	DO	17						
11				203.85 / 11.13									
		Very dense, brown, SAND and GRAVEL, some cobbles											
12					8	DO	67						
13													
	ROTARY DRILL	76 mm CASING ADVANCED 06/08/2011											
					9	DO	>100						
14				200.50 / 14.48									
		Very dense, light brown, SAND with SILT, trace to some clay											
15					10	DO	64					MH	
				199.13 / 15.85									
		Very dense, brown, SAND and GRAVEL, some cobbles											
16					11	DO	>100						
17				197.51 / 17.47									
		END OF HOLE											
18													
19													
20													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-03

SHEET 1 OF 2

LOCATION: N 5033516.78 ;E 434844.79

BORING DATE: AUG 11-12, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80); SHEAR STRENGTH Cu, kPa nat V. + Q - ● rem V. ⊕ U - ○ (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-4} 10^{-3} 10^{-2}); WATER CONTENT PERCENT Wp ⊢—⊙W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		215.37							
0	152 mm POWER AUGER; 108 mm I.D. HOLLOW STEM 09/08/2011	Loose, brown, SAND, some gravel		0.00							
1											
					1	DO	7				
2											
3											
					2	DO	9				
4											
					3	DO	4				
5											
6											
					4	DO	6				
		Compact to loose, brown, GRAVEL and SAND, trace to some silt		208.82 6.55							
7											
					5	DO	26			M	
8											09/08/2011
9	ROTARY DRILL										
					6	DO	5				
		Dense to very dense, brown, SAND, trace to some silt		206.77 9.60							
10											

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-03

SHEET 2 OF 2

LOCATION: N 5033516.78 ;E 434844.79

BORING DATE: AUG 11-12, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ● rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-4} 10^{-3} 10^{-2}) / WATER CONTENT PERCENT (Wp ⊖W Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		-- CONTINUED FROM PREVIOUS PAGE --									
10	ROTARY DRILL, 102 mm CASING ADVANCED 08/08/2011	Dense to very dense, brown, SAND, trace to some silt									
11					7	DO	31			M	
					8	DO	40				
12											
13											
14	ROTARY DRILL, 79 mm CASING ADVANCED 08/08/2011				9	DO	83				
		Very dense, light brown, SAND, some silt, trace to some clay		201.20 / 14.17							
15					10	DO	>100			MI	
		GRAVEL and COBBLES		199.83 / 15.54							
16											
17				197.66 / 17.71							
		END OF HOLE									
18											
19											
20											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-04

SHEET 1 OF 3

LOCATION: N 5033577.28 ;E 434869.92

BORING DATE: AUG 15-17, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-4} 10^{-3} 10^{-2}) / WATER CONTENT PERCENT (Wp ⊢—O W—⊣ Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		215.59							
0	152 mm POWER AUGER, 108 mm I.D. HOLLOW STEM 13/08/2011	Loose, brown, SAND, some gravel		0.00							
1											
2					1	DO	4				
3				212.54							
		Very loose to compact, brown, SAND, trace gravel, trace to some silt		3.06	2	DO	3			M	
4											
					3	DO	22				
5		Very dense, brown, SAND and GRAVEL, trace to some silt		210.56 5.03							
6					4	DO	61			M	
		Dense to loose, brown, Silty SAND, trace to some clay to SAND, trace to some gravel, trace to some silt, trace to some clay		209.04 6.55							
7											
8					5	DO	37			MH	
9					6	DO	41			MH	
10											

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-04

SHEET 2 OF 3

LOCATION: N 5033577.28 ;E 434869.92

BORING DATE: AUG 15-17, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-6} 10^{-4} 10^{-2} 10^{2}) / WATER CONTENT PERCENT (Wp ⊢—⊙W—⊣ Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		--- CONTINUED FROM PREVIOUS PAGE ---									
10	ROTARY DRILL, 102 mm CASING ADVANCE 13/08/2011	Dense to loose, brown, Silty SAND, trace to some clay to SAND, trace to some gravel, trace to some silt, trace to some clay									
11				204.46	7	DO	8				
		Very dense, brown, Silty SAND, trace gravel, trace to some clay									
12					8	DO	60			MH	
13											
14	ROTARY DRILL, NQ CORE 13/08/2011				9	DO	91				
15					10	DO	71			M	
16											
17					11	DO	63				
18		Very dense, brown, SAND and GRAVEL, trace to some silt, trace to some clay		197.61 / 17.98	12	DO	>100			M	
19											
20		CONTINUED NEXT PAGE									

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-04

SHEET 3 OF 3

LOCATION: N 5033577.28 ;E 434869.92

BORING DATE: AUG 15-17, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (nat V. + Q - ●, rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-4} 10^{-3} 10^{-2}) / WATER CONTENT PERCENT (Wp ⊢—○W—⊣ Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		— CONTINUED FROM PREVIOUS PAGE —									
20	ROTARY DRILL NQ CORE 13/08/2011	Very dense, brown, SAND and GRAVEL, trace to some silt, trace to some clay		194.69							
21		END OF HOLE		20.90							
22											
23											
24											
25											
26											
27											
28											
29											
30											

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-05

SHEET 1 OF 2

LOCATION: N 5033620.44 ;E 434845.71

BORING DATE: AUG 19-20, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80) / SHEAR STRENGTH Cu, kPa (20 40 60 80) nat V. + Q - ● rem V. ⊕ U - ○	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-5} 10^{-4} 10^{-3} 10^{-2}) / WATER CONTENT PERCENT Wp ⊢—○W—⊣ Wl (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		GROUND SURFACE		214.27							
0	152 mm POWER AUGER; 108 mm I.D. HOLLOW STEM 18/08/2011	Compact, brown, Silty SAND, some gravel, trace clay		0.00							
1					1	DO	28				
2				211.84							
		Compact, brown, SAND, some gravel, trace to some clay		2.44							
3					2	DO	29				
4											
6					3	DO	12				
6				207.87	4	DO	60			M	18/08/2011
		Very dense, SAND and GRAVEL, trace to some silt, trace to some clay		6.40							
7											
8					5	DO	68				
9											
10	ROTARY DRILL				6	DO	53				

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Borehole: GB-05

SHEET 2 OF 2

LOCATION: N 5033620.44 ;E 434945.71

BORING DATE: AUG 19-20, 2011

DATUM:

SAMPLER HAMMER, 64kg; DROP, 760mm

PENETRATION TEST HAMMER, 64kg; DROP, 760mm

DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE: DESCRIPTION	STRATA PLOT	ELEV. / DEPTH (m)	SAMPLES: NUMBER	TYPE	BLOWS/0.3m	DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m (20 40 60 80)	SHEAR STRENGTH Cu, kPa (nat V. + Q - ●; rem V. ⊕ U - ○) (20 40 60 80)	HYDRAULIC CONDUCTIVITY, k, cm/s (10^{-4} 10^{-4} 10^{-4} 10^{-2})	WATER CONTENT PERCENT (Wp ⊢—⊖W—⊣ Wl) (10 20 30 40)	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		— CONTINUED FROM PREVIOUS PAGE —											
10	ROTARY DRILL 102 mm CASING ADVANCE 18/08/2011	Very dense, SAND and GRAVEL, trace to some silt, trace to some clay			7	DO	90						
11				202.82									
		END OF HOLE		11.68									
12													
13													
14													
15													
16													
17													
18													
19													
20													

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-BHS 001 10-1193-0003.GPJ GAL-MIS.GDT 10/18/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-01

SHEET 1 OF 2

LOCATION: N 5033376.7 ;E 434794.1

DRILLING DATE: AUG 3-4, 2011

DATUM:

INCLINATION: -90° AZIMUTH: —

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate, BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage, PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular, PO- Polished, K - Slickensided, SM- Smooth, RO - Rough, MB- Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP W.R.T. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		Continued from Record of Borehole GB-01		202.73												
	NQ-3 Bit / NQ Rods; Triple Tube Sampling	11.30 - 26.03 m Moderately weathered, foliated, dark bluish grey and dark reddish brown, fine grained, weak to medium strong, sheared RHYOLITE CRYSTAL TUFF (RCTF), containing fine to medium grained quartz eyes -Moderate silicification to 15.74 m, weak to moderate sericite/chlorite alteration -Strong oxidation throughout interval		202.26	3							FO,PL,RO,CT,OX/M FO,PL,RO,CT,OX/M JN,PL,RO,CT,OX/M				Bc
12					4							JN,PL,SM,CT,OX/CB SH,PL,SM,SA,OX JN,ST,RO,ST,OX				
13					5							JN,PL,RO,ST,CH SH,PL,SM,ST,OX JN,CU,RO,CT,OX JN,PL,RO,ST,OX JN,PL,RO,CT,OX JN,PL,VR,CT,OX FR,IR,VR,ST,OX JN,PL JN,IR,RO,CT,OX/M JN,PL,SM,ST,OX JN,PL,SM,ST,OX JN,IR,RO,ST,OX JN,PL,RO,CT,OX JN,PL,RO,ST,OX JN,PL,RO,CT,OX JN,PL,RO,CT,OX				Bc
14												JN,PL,RO,CT,OX JN,IR,VR,CT,CH JN,IR,VR,ST,OX FO,PL,SM,CT,OX/M JN,PL,RO,CT,OX/M JN,IR,VR,CT,OX/M JN,PL,VR,CT,OX/M				
15					6							JN,IR,RO,CT,OX/M JN,PL,VR,ST,OX JN,PL,RO JN,PL,VR,ST,CH JN,PL,RO,SA,OX/CH JN,PL,VR,CT,OX JN,PL,VR,CT,OX				
16												JN,PL,RO,CT,OX JN,PL,RO				
16					7							JN,PL,RO,CT,OX JN,PL,VR,ST,OX JN,PL,RO,CT,OX JN,, SH,PL,K ,ST,OX JN,PL,VR,SA,OX JN,IR,VR,CT,OX/M JN,PL,VR,CT,OX/M				
17																
		17.50 - 20.5 m Very fine grained, disseminated iron-oxide in pitted/vuggy areas			8							SH,PL,RO FR,PL,VR JN,PL,RO				Bc
18																
19					9							SH,IR,VR,IN,OX/M ,2 mm SH,IR,VR,CT,OX/M JN,IR,VR,IN,OX/M ,2 mm JN,ST,VR,CT,OX/M JN,IR,VR,IN,OX,1 mm				Cl/Go
20		19.84 - 20.08 m Lapilli tuff			10							JN,PL,RO,SA,OX/CB FR,, JN,PL,VR JN,PL,VR JN,PL,VR JN,PL,RO,SA,CH SH,PL,RO FR,PL,VRO				
21																
		CONTINUED NEXT PAGE														

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-ROK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-01

SHEET 2 OF 2

LOCATION: N 5033376.7 ;E 434794.1

DRILLING DATE: AUG 3-4, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, PLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate; BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage; PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular; PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA DIP W.R.T. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	Jn	Jw	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		--- CONTINUED FROM PREVIOUS PAGE ---																
	NQ-3 Bit / NQ Rods; Triple Tube Sampling	11.30 - 26.03 m Moderately weathered, foliated, dark bluish grey and dark reddish brown, fine grained, weak to medium strong, sheared RHYOLITE CRYSTAL TUFF (RCTF), containing fine to medium grained quartz eyes -Moderate silicification to 15.74 m, weak to moderate sericite/chlorite alteration -Strong oxidation throughout interval 21.46 - 22.95 m Dark grey, chlorite filled veinlets present 22.60 - 22.80 m Shear zone, dipping 35o to core axis			10							PLT,PL,RO,IN,GO,3 mm	1.5	1				
												JN,PL,VR,SA,CH	1.5	2				
												JN,PL,VR,SA,OX/CH	1.5	2				
												JN,PL,VR,SA,CH	1.5	2				
												JN,PL,VR,SA,CH	1.5	2				
												FO,PL,RO,ST,OX	1.5	1				
												JN,PL,VR						
22					11							SH,PL,VR,SA,CH/OX	1.5	2				
												SH,PL,SM,ST,OX	1	2				
23																		
					12							FO,PL,RO,SA,OX/CH	1.5	2				
24												FO,PL,RO,ST,OX	1.5	1				
												FO,PL,RO,ST,OX	1.5	1				
												SH,CU,RO,ST,OX	1	1				
25												FO,PL,RO,ST,OX	1.5	1				
					13							JN,IR,VR,CT,OX	1	5				
												JN,PL,RO	1					
												JN,PL,VR,SA,CH/OX	1.5	5				
												FO,PL,RO,ST,OX	1.5	1				
26		END OF DRILLHOLE		156.00 26.03														
27																		
28																		
29																		
30																		
31																		

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-02

SHEET 1 OF 2

LOCATION: N 5033435.0 ;E 434804.8

DRILLING DATE: AUG 6-8, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate, BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage, PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular, PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP W.R.T. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		Continued from Record of Borehole GB-02		197.51												
18	NQ-3 Bit / NQ Rods; Triple Tube Sampling	17.47 - 25.55 m Slightly weathered, massive to moderately foliated, very light to medium light grey and yellowish grey, fine to medium grained, non to faintly porous, weak to medium strong RHYOLITE CRYSTAL TUFF (RCTF), abundant quartz eyes, generally lacking iron oxidation -Moderate silicification, weak to moderate sericite alteration -Trace disseminated very fine grained pyrite throughout interval		17.47	1							FR, JN,PL,RO JN,PL,SM				Lo
19					2							JN,PL,RO JN,PL,RO JN,PL,VR JN,PL,VR JN,PL,RO JN,PL,SM,CT,OX JN,PL,VR JN,PL,SM,IN,OX,2 mm				
20					3							JN,PL,RO JN,PL,RO,SA,CH JN,PL,RO JN,PL,RO,IN,OX,2 mm				
					4							JN,PL,VR,CT,OX/CH JN,PL,SM JN,PL,SM JN,PL,SM,SA,SR				
21												JN,PL,SM,SA,SR FLT,PL,RO JN,PL,SM JN,PL,VR				
22					5							JN,PL,RO,ST,OX JN, JN,PL,RO,SA,SR JN,PL,RO JN,PL,SM,ST,OX JN,PL,RO,SA,OX/CH				
23												JN,PL,SM JN,PL,SM,SA,CH JN,PL,SM,SA,OX/CH				
					6							JN,PL,SM				
24												JN,PL,SM JN,PL,SM JN,PL,VR SH,PL,PO				
												SH,PL,K				
26					7							SH,PL,RO SH,PL,RO,SA,CH JN,PL,RO JN,PL,RO				
		25.55 - 27.67 m Slightly weathered, massive to foliated, light bluish grey to pinkish grey, fine to medium grained, highly porous with pitted texture, weak to medium strong RHYOLITE CRYSTAL TUFF (RCTF)		189.43 25.65								JN,PL,RO				
28					8							JN,PL,RO				
27												JN,PL,RO				
					9											

CONTINUED NEXT PAGE

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/28/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-02

LOCATION: N 6033436.0 ;E 434804.8

DRILLING DATE: AUG 6-8, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		--- CONTINUED FROM PREVIOUS PAGE ---														
28		27.67 - 31.02 m Slightly weathered to fresh, massive, very light grey to dark grey, fine to coarse grained, faintly porous, medium strong RHYOLITE CRYSTAL TUFF (RCTF)		27.67	9							JN,PL,VR SH,PL,VR JN,PL,RO JN,PL,RO				
29					10							JN,PL,RO JN,PL,RO,SA JN,PL,SM JN,PL,SM JN,IR,VR,ST SH,PL,SM JN,PL,RO JN,PL,SM,OX,ST FO,PL,SM FO,PL,RO				
30	NQ-3 Bit / NQ Rods Triple Tube Sampling															
31		31.02 - 33.55 m Fresh, bedded, light bluish grey to medium grey, fine to medium grained, non-porous, medium strong TUFFACEOUS SEDIMENTS (TFSD) -Moderate silicification -Some pale yellow irregular siliceous veinlets		183.96 31.02	11							FO,PL,RO FO,PL,RO CO,PL,VR SH,PL,RO VN,CU,RO FR,PL,VR VN,PL,VR FR,PL,RO				
32					12							VN,PL,RO VN,PL,SM				
33												BD,PL,RO VN,PL,SM,SA,OZ				
34		33.55 - 34.87 m Fresh, foliated, greyish black and moderate olive brown, fine to medium grained, faintly to moderately porous, medium strong, MASSIVE SULPHIDE (MASU), containing sub-hedral, fine grained pyrite with sphalerite in slightly dipping, undulating bands -Slightly brecciated texture and randomly oriented micro-defects		181.43 33.55	13							FO,PL,VR FO,PL,VR VN,PL,VR JN,PL,VR				
35		END OF DRILLHOLE		180.11 34.87												
36																
37																

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-03

SHEET 1 OF 3

LOCATION: N 5033516.8 ;E 434844.8

DRILLING DATE: AUG 11-12, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP WRT CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	HYDRAULIC CONDUCTIVITY, K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		Continued from Record of Borehole GB-03		197.66														
18		17.71 - 39.20 m Slightly to moderately weathered, massive to foliated, medium dark grey to dark reddish brown, aphanitic to medium grained, non-porous, medium strong to strong, RHYOLITE CRYSTAL TUFF (RCTF) -Moderately silicified, medium to coarse grained quartz eyes and oxidation throughout -15% disseminated very fine grained pyrite zone from 18.17 - 18.38 m		17.71	1							CO,PL,RO,ST,OX	1	1				
												CO,IR,VR,CT,CL,1 mm	3	1				
												JN,PL,SM,SA,CH	1.5	1				
												JN,PL,VR,CT,CL,1 mm	3	1				
												JN,PL,SM,CT,CL,1 mm	3	6				
19					2							JN,PL,SM,CT,OX/CL,1 mm	3	1				
												JN,PL,RO,CT,OX/CL	2	1				
												JN,PL,VR,CT,OX,1 mm	1.5	1				
												JN,PL,RO,CT,OX,1 mm	4	1				
												JN,PL,RO,CT,OX	3	1				
												JN,PL,RO,CT,OX	3	2				
												SH,PL,SM,CT,OX	1.5	1				
												SH,PL,SM,CT,OX	2	1				
20					3							SH,PL,SM,CT,OX	2	2				
												JN,PL,RO,ST,OX	1	1				
												HJN,PL,	2	1				
												JN,PL,RO,CT,OX	3	1				
												JN,PL,SM,CT,OX	1.5	1				
												JN,PL,SM,CT,OX	1.5	1				
												JN,PL,SM,CT,OX	0.5	1				
21												JN,PL,RO,CT,OX	2	2				
												JN,PL,VR,ST,OX	0.5	1				
												JN,PL,SM,CT,OX	2	1				
												JN,PL,SM,ST,OX	1	3				
												JN,PL,SM,CT,OX	0.5	1				
												JN,PL,SM,CT,OX/CH	3	1				Lc
												FLT,PL,SM,IN,OX/CH,2 mm	3	1				
												JN,PL,VR,ST,OX	2	1				
					4							JN,PL,RO,ST,OX	3	2				
												JN,PL,RO,ST,OX						
22												SH,PL,VR,OX,ST	2	1				Go
												SH,PL,SM,CT,OX	1	1				
												FO,PL,RO,ST,OX	1	1				
												SH,PL,RO,CT,CL	2	1				
												JN,PL,SM,CT,OX/CL	2	1				
23												JN,FL,RO,ST,OX	2	1				
					5							JN,PL,RO,ST,OX	2	1				
												JN,PL,RO,CT,OX	2	1				
												JN,PL,RO,ST,OX	1.5	1				
												JN,PL,RO,ST,OX	3	1				
												JN,PL,SM,CT,OX						
												JN,PL,VR,CT,OX	3	1				
												SH,PL,VR,CT,OX	0.5	1				Go Bc
24												JN,PL,RO,SA,OX	0.5	1				
												JN,PL,RO,SA,CH	1.5	1				
					6							JN,PL,RO,SA,OX/CH	1.5	1				
												JN,IR,VR,SA,OX/CH	0.5	1				
25																		Bc
												JN,PL,RO,SA,OX/CH	1	4				
												JN,PL,RO,CT,OX/CH	1.5	1				
												JN,PL,SM,CT,OX/M	1.5	1				
												JN,PL,VR,ST,OX	1	1				
												JN,PL,RO,SA,OX/CA	3	1				
26					7							FR,PL,VR,SA,OX/CH	1	5				
27												JN,PL,SM,CT,OX/SA,1 mm	3	1				
					8							JN,PL,RO,IN,OX/SA,1 mm	3	1				
												JN,PL,RO,CT,OX						

NQ-3 Bit / NQ Rods

Triple Tube Sampling

CONTINUED NEXT PAGE

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-03

SHEET 2 OF 3

LOCATION: N 5033516.8 ;E 434844.8

DRILLING DATE: AUG 11-12, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock

NOTES: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP to the CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		--- CONTINUED FROM PREVIOUS PAGE ---														
28		17.71 - 39.20 m Slightly to moderately weathered, massive to foliated, medium dark grey to dark reddish brown, aphanitic to medium grained, non-porous, medium strong to strong, RHYOLITE CRYSTAL TUFF (RCTF) -Moderately silicified, medium to coarse grained quartz eyes and oxidation throughout -15% disseminated very fine grained pyrite zone from 18.17 - 18.38 m			8							JN,PL,RO,CT,OX/SA FLN,PL,VR,CT,OX/SA,3 mm JN,PL,SM,CT,OX/CH JN,PL,SM,CT,OX/CH				
29					9							JN,PL,RO,CT,OX/CH JN,PL,VR,CT,OX/CH,1 mm JN,PL,RO,CT,OX/CH JN,PL,RO,ST,OX FR,PL,RO,CT,OX JN,PL,VR,SA,OX/CA				
30					10							JN,PL,RO,CT,OX JN,PL,RO,CT,OX FR,PL,VR,CT,OX JN,PL,VR,ST,OX/M SH,PL,RO,CT,OX/M				
31	NQ-3 Bit / NQ Rods Triple Tube Sampling											JN,PL,SM,ST,OX JN,PL,VR,CT,OX JN,PL,SM,CT,OX JN,PL,SM,ST,OX JN,PL,RO,SA,OX/CA JN,PL,SM,CT,OX/CA,1 mm				
32					11							JN,PL,RO,CT,OX JN,PL,VR,CT,OX JN,PL,SM,CT,OX JN,PL,VR,CT,OX JN,PL,VR,SA,OX/CH JN,PL,VR,CT,OX,1 mm JN,PL,SM,SA,OX/CH				
33												JN,PL,RO,SA,OX FO,PL,VR,ST,OX/CH			Bc	
34					12							JN,PL,VR,SA,OX/CA SH,PL,RO,CT,OX JN,PL,VR,CT,OX JN,PL,RO,IN,OX,2 mm JN,PL,VR,SA,OX/CA JN,PL,SM,ST,OX			Gc	
35					13							JN,PL,VR,SA,OX/CH JN,PL,VR,SA,OX/CH JN,PL,SM,SA,CH SH,PL,SM,CT,OX/CL SH,PL,RO,CT,OX/CL				
36												JN,PL,RO,ST,OX/CH JN,PL,SM,CT,OX/M JN,PL,RO,SA,OX/CA FR,CU,VR,ST,OX/CH JN,IR,VR,CT,OX/M FR,PL,VR,IN,OX/SA,2 mm SH,PL,SM,SA,OX/CH JN,PL,VR,SA,OX/CH JN,PL,RO,SA,OX/CH JN,PL,RO,CT,OX/M				
37					14							JN,PL,VR,ST,OX FR,UN,VR,SA,CA/OX FR,PL,VR,SA,CA/SA JN,PL,VR,ST,OX JN,PL,RO,ST,OX/M JN,PL,SM,SA,OX/CH JN,PL,SM,CT,OX/CH/M			Bc	
		CONTINUED NEXT PAGE														

DEPTH SCALE

1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-03

SHEET 3 OF 3

LOCATION: N 5033516.8 ;E 434844.8

DRILLING DATE: AUG 11-12, 2011

DATUM:

INCLINATION: -90° AZIMUTH: --

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	DISCONTINUITY DATA Ja	DISCONTINUITY DATA Jw	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		--- CONTINUED FROM PREVIOUS PAGE ---																
38	NQ-3 BIT / NQ Rods; Triple Tube Sampling	17.71 - 39.20 m Slightly to moderately weathered, massive to foliated, medium dark grey to dark reddish brown, aphanitic to medium grained, non-porous, medium strong to strong, RHYOLITE CRYSTAL TUFF (RCTF) -Moderately silicified, medium to coarse grained quartz eyes and oxidation throughout -15% disseminated very fine grained pyrite zone from 18.17 - 18.38 m			15							JN,PL,SM,CT,OX/CR JN,PL,RO,ST,OX	3	1				
												JN,PL,VR,IN,OX/SA,2 mm	1	6				
39					16							JN,PL,SM,SA,OX/CR JN,PL,RO,IN,OX/SA,1 mm JN,PL,RO,CT,OX/SA	7 1 3	1 4 1			Bc	
				176.17														
		END OF DRILLHOLE		39.20														
40																		
41																		
42																		
43																		
44																		
45																		
46																		
47																		

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-04

LOCATION: N 5033577.3 ;E 434869.9

DRILLING DATE: AUG 15-17, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate; BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage; PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular; PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break; BR - Broken Rock. NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		Continued from Record of Borehole GB-04		194.08														
21		20.90 - 21.85 m Highly weathered, massive, white chalky, fine grained, highly porous, very weak to weak RHYOLITE CRYSTAL TUFF (RCTF)		189.80	2							JN,PL,VR,ST,OX	2	4				
												JN,PL,RO,ST,OX	1	3			Bc	
																	Lc	
				193.74 / 21.85														
22		21.85 - 24.50 m Moderately weathered, foliated, pinkish grey to dark reddish brown, aphanitic to medium grained, faintly porous, occasional vugs, weak to medium strong RHYOLITE CRYSTAL TUFF (RCTF) -Moderately silicified and highly oxidized on almost all joint surfaces			3							SH,PL,PO	2	1				
												JN,PL,RO,IN,SA/M	1	1				
												JN,PL,RO,SA,OX/CA	1	1				
												JN,PL,VR,SA,OX/CA	2	1				
												JN,PL,VR,SA,OX/CA	2	2				
23																	Lc	
												JN,PL,RO,ST,OX	2	1				
					4							JN,PL,VR,SA,OX/CA	2	1				
												JN,PL,SM,SA,OX	1	1				
																	Bc	
24												JN,PL,SM,ST,OX	1	1				
												JN,PL,RO,CT,CL/M	1	1				
												JN,PL,RO,ST,CL	2	1				
												JN,PL,RO,ST,OX	2	1				
				191.08 / 24.50								JN,PL,SM	2	4				
		24.50 - 26.87 m Moderately weathered, foliated, medium dark grey, fine to medium grained, non-porous, strong, RHYOLITE CRYSTAL TUFF (RCTF) -Darker grey, harder, strongly silicified zone between 25.00 - 26.00 m -Trace fine grained pyrite throughout										JN,PL,SM,CT,CL	2	4				
												JN,PL,SM,SA,OX/CA	2	4				
												JN,PL,SM,SA,OX/CA	2	4				
25												JN,PL,RO	1	1				
	NQ-3 Bit / NQ Rods Thin Tube Sampling				5													
26												JN,PL,RO,ST,OX	1	4				
												JN,PL,SM,SA,OX/CA	2	1				
												JN,PL,RO,IN,CL	3	1				
												JN,PL,RO,ST,OX	2	1				
				189.72 / 26.87	6													
27		26.87 - 30.42 m Moderately weathered, foliated, pinkish grey to dark reddish brown, aphanitic to medium grained, faintly porous, weak to medium strong, RHYOLITE CRYSTAL TUFF (RCTF) -Slight silificiation and sericite alteration										JN,PL,SM,SA,CU/CA	2	1				
												JN,PL,RO,ST,OX	2	1				
												JN,PL,SM,ST,OX	1	4				
												JN,PL,RO,SA,CA/SA	1	1				
												JN,PL,RO,SA,CA	1	1				
28												SH,PL,PO,ST,OX/CL	1	1				
					7							JN,PL,RO,ST,OX	2	1				
												JN,PL,SM,CT,OX	1	4				
												SH,PL,K,ST,OX	1	5				
												FR,PL,VR	1	5			Bc	
												SH,PL,K,SA,OX/CH	2	1				
29												FR,IR,VR,CT,OX/SA	1	1				
												JN,PL,VR,ST,OX	1	1				
					8							JN,IR,VR,CT,OX/SA,1 mm	1	2				
												JN,PL,RO,CT,OX/M	1	1				
												SH,PL,SM,CT,OX/M	1	1				
30												SH,PL,VR,IN,CL,1 mm	1	1				
												SH,PL,VR,IN,CL,1 mm	1	1				
												JN,PL,RO,ST,OX	1	1				
												SH,PL,RO,CT,OX/M	1	1				
				185.17 / 30.42								JN,PL,RO,ST,OX	1	1			Lc	
					8							FO,PL,VR,CT,SA/M	0.5	1				
												FO,PL,VR,ST,OX/M	0.5	1				
												FO,CU,RO,ST,OX/M	1	1				
												FO,CU,VR,CT,OX/M	1	1				

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-ROK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-04

SHEET 2 OF 3

LOCATION: N 5033577.3 ;E 434869.9

DRILLING DATE: AUG 15-17, 2011

DATUM:

INCLINATION: -90° AZIMUTH: —

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate, BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage, PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular, PO- Polished, K - Slickensided, SM- Smooth, RO - Rough, MB- Mechanical Break, BR - Broken Rock. NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		--- CONTINUED FROM PREVIOUS PAGE ---														
31		30.42 - 32.30 m Slightly weathered, highly foliated, medium dark grey and dark red, fine to medium grained, non-porous, medium strong to strong, RHYOLITE CRYSTAL TUFF (RCTF) -Highly silicified, slight sericite/chlorite alteration -Trace disseminated very fine grained pyrite from 30.50 - 32.30 m			9							FO,PL,VR,CT,OX/SA FO,CU,RO,SA,CA/CH FO,PL,RO,CT,M FO,PL,VR,CT,OX/M FO,PL,VR,CT,OX/M FO,PL,VR FO,CU,VR,CT,OX/M				
32				183.29 32.30	10							FO,PL,RO,CT,OX/M FO,PL,RO,CT,OX/M FO,PL,RO,IN,OX/M ,5 mm FO,PL,RO,CT,OX/SA FO,PL,VR,IN,OX/M ,5 mm FO,CU,VR,CT,OX/SA FO,PL,VR,CT,OX/SA FO,PL,VR,CT,OX/SA FO,CU,RO,CT,OX/SA FR,PL,VR,CT,OX JN,PL,RO,ST,OX FO,PL,VR,CT,OX/M JN,PL,RO,CT,OX/M ,5 mm				
33		32.30 - 41.24 m Slightly weathered, weakly foliated, light grey with dark green grains, fine to coarse grained, non-porous, medium strong to strong, RHYOLITE CRYSTAL TUFF (RCTF) -Moderately silicified, slight sericite/chlorite alteration -Trace disseminated very fine grained pyrite														Bc
34	NO-3 Bit / NQ Rods Triple Tube Sampling				11							FR,IR,VR,CT,OX/SA JN,PL,RO,CT,OX/M ,1 mm JN,PL,VR,CT,OX/M ,2 mm FO,PL,VR,CT,OX/SA SH,PL,VR,CT,SA/M SH,PL,VR,CT,OX/M JN,CU,RO,ST,OX/SA JN,PL,SM,CT,CH/SA SH,PL,VR,CT,OX/SA,2 mm SH,PL,RO,CR,SA/M SH,PL,VR,CT,SA FO,PL,VR,CT,OX,3 mm JN,PL,RO,IN,SA,3 mm				
35					12							JN,PL,VR,CT,OX/SA				
36					13							JN,PL,RO,SA,OX/CH JN,PL,VR,CT,CH,1 mm JN,PL,VR,CT,OX				
37					14							JN,PL,SM,SA,CH/PY JN,PL,RO,SA,CH JN,PL,VR,SA,CH/CA FO,PL,SM,CT,CL				
38					15							JN,PL,VR,SA,CH JN,PL,RO,SA,CH				
39																
40																
		CONTINUED NEXT PAGE														

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-04

SHEET 3 OF 3

LOCATION: N 5033577.3 ;E 434869.9

DRILLING DATE: AUG 15-17, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock. NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY TOTAL CORE %	RECOVERY SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA DIP w.r.t. CORE AXIS	DISCONTINUITY DATA TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATH-ERING INDEX	FEATURES	NOTES
		--- CONTINUED FROM PREVIOUS PAGE ---														
41				174.35	15							FO,PL,VR,SA,CH/SA				
		END OF DRILLHOLE		41.24												
42																
43																
44																
45																
46																
47																
48																
49																
50																

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-05

LOCATION: N 5033620.4 ;E 434945.7

DRILLING DATE: AUG 19-20, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR- Shear, VN - Vein, CJ - Conjugate, BD- Bedding, FO- Foliation, CO- Contact, OR- Orthogonal, CL - Cleavage, PL - Planar, CU- Curved, UN- Undulating, ST - Stepped, IR - Irregular, PO- Polished, K - Slickensided, SM- Smooth, Ro - Rough, MB- Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP WRT CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		Continued from Record of Borehole GB-05		202.62												
12	NQ-3 Bit / NQ Rods; Triple Tube Sampling	11.65 - 26.70 m Moderately weathered, foliated, dark grey to dark reddish brwon, fine grained, non-porous, weak to medium strong, RHYOLITE CRYSTAL TUFF (RCTF) -Strong silicification, slight sericite/chlorite alteration, pervasive oxidation -Moderate water loss between 11.89 - 12.22 m (Broken/Lost core zone) -Numerous iron-rich veins between 1 - 40 mm thick		11.65	1							JN,PL,VR,CT,OX/SA JN,PL,VR,CT,OX/CH FO,PL,VR,CT,OX/SA FO,PL,RO,CT,OX/CH FO,PL,RO,CT,OX/CH FO,PL,VR,CT,OX/CH FR,PL,VR,CT,OX				Bc	
13					2							FO,PL,K ,CT,OX/CH JN,PL,RO,CT,OX/CH JN,PL,VR,CT,OX FO,PL,VR,CT,OX FO,PL,K ,CT,OX/CH FR,PL,VR,IN,CL,1 mm				Bc	
14												FR,PL,VR,CT,OX JN,PL,RO,CT,OX JN,PL,VR,CT,OX					
15					3							JN,PL,VR,ST,OX JN,CU,VR,CT,OX JN,PL,RO,ST,OX JN,PL,VR,IN,OX/SA,7 mm JN,PL,VR,IN,OX/SA,10 mm JN,PL,VR,IN,OX/SA,10 mm JN,PL,VR,CT,OX/CH JN,IR,VR,ST,OX JN,PL,VR,ST,OX JN,PL,VR,IN,OX/SA,5 mm JN,PL,VR,IN,OX/CL,2 mm					
16					4							JN,PL,RO,ST,OX FR,IR,VR,IN,OX/SA,1 mm FR,IR,VR,CT,OX JN,PL,VR,IN,OX/SA,10 mm FR,IR,VR,ST,OX JN,PL,VR,IN,OX/CH,1 mm					
17												,PL,VR,CT,OX/CH FO,PL,K ,CT,OX/CH FO,PL,K ,CT,OX/CH					
18		18.40 - 18.55 m Very strongly silicified zone containing 3 cm diameter, globular pyrite			5							JN,PL,SM,ST,OX JN,PL,RO,CT,OX/CH FO,PL,VR,CT,OX/CL JN,PL,VR,CT,OX/CL JN,PL,VR,IN,OX/SA,2 mm				Bc	
19					6							JN,PL,VR,IN,OX/SA FR,PL,VR,IN,OX/SA JN,IR,VR,CT,OX/CH JN,PL,VR,IN,OX/CL,3 mm JN,PL,VR,IN,OX/CL,4 mm JN,PL,VR,CT,OX/CH JN,CU,VR,CT,OX/CH JN,PL,RO,IN,OX/CL,1 mm JN,PL,RO,IN,OX/CL,2 mm JN,PL,VR,IN,OX/CL,2 mm JN,PL,VR,ST,OX JN,PL,RO,ST,OX JN,PL,VR,CT,CL JN,PL,RO,SA,OX/CH FR,IR,VR,CT,OX JN,PL,RO,CT,OX					
20																
21					7							JN,PL,VR,CT,OX JN,PL,VR,CT,OX JN,ST,VR,ST,OX JN,PL,VR,SA,OX/CH					

CONTINUED NEXT PAGE

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES
CHECKED:

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-05

LOCATION: N 5033620.4 ;E 434945.7

DRILLING DATE: AUG 19-20, 2011

DATUM:

INCLINATION: -90° AZIMUTH: ---

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CO - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DEPTH ALONG CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		--- CONTINUED FROM PREVIOUS PAGE ---														
22		11.85 - 26.70 m Moderately weathered, foliated, dark grey to dark reddish brwon, fine grained, non-porous, weak to medium strong, RHYOLITE CRYSTAL TUFF (RCTF) -Strong silicification, slight sericite/chlorite alteration, pervasive oxidation -Moderate water loss between 11.89 - 12.22 m (Broken/Lost core zone) -Numerous iron-rich veins between 1 - 40 mm thick			7							JN,PL,RO,CT,OX/CH JN,PL,SM,CT,OX					
23					8							JN,PL,RO,SA,OX/CH JN,PL,RO,SA,OX/CH					
24					9							FO,PL,VR,CT,M FO,PL,RO,ST,OX FO,PL,VR,ST,OX FO,PL,RO,ST,OX FO,PL,VR,IN,OX,1 mm					
25		24.99 - 26.70 m Dark green propylitic alteration zone										FR,IR,VR,IN,OX/CL,1 mm FO,PL,VR,CT,OX/CL FO,PL,VR,ST,OX FO,PL,VR,ST,OX FO,PL,VR,CT,OX					
26					10							JN,PL,RO,CT,OX/M JN,PL,SM,CT,OX/M JN,PL,SM,CT,OX/M JN,PL,RO,CT,OX/SA				Bc	
27		26.70 - 29.70 m Slightly to moderately weathered, massive, greenish black to very dark reddish brown, fine grained, semi-porous, weak to medium strong MAFIC DYKE (MFDK) -Highly chlorite altered, pervasive oxidation -White, randomly oriented veinlets		187.57 26.70	11							SH,PL,K ,ST,OX FR,IR,VR,CT,OX/M FR,IR,VR,CT,OX/M FR,IR,VR,CT,OX/M JN,PL,RO,ST,OX JN,PL,RO,ST,OX JN,PL,RO,CT,OX/CL,1 mm JN,PL,RO,CT,OX/CL JN,PL,RO,ST,OX JN,PL,VR,CT,OX/CL,1 mm					
28												SH,PL,K ,CT,OX SH,PL,RO,IN,OX/CL,2 mm JN,PL,RO,IN,OX/CL,2 mm JN,PL,SM,CT,OX					
29					12							JN,PL,RO,CT,OX/CL JN,PL,RO,IN,OX/CL,1 mm JN,ST,RO,CT,OX/CH FR,IR,VR,CT,OX					
30		29.70 - 41.76 m Slightly weathered, highly foliated, dark grey to dark reddish brown, fine grained, non-porous, weak to medium strong, RHYOLITE CRYSTAL TUFF (RCTF) -Strong to moderate silicification, slight sericite/chlorite alteration, pervasive oxidation -More iron-rich veins to 38.00 m		184.57 29.70	13							JN,PL,RO,CT,OX/M JN,PL,SM,CT,OX/CL SH,PL,K ,SA,CH SH,PL,K ,SA,OX/CH SH,PL,K ,CT,CH SH,PL,K ,CT,CH SH,PL,K ,CT,CH JN,PL,SM,CT,OX/CH JN,PL,RO,CT,OX/CH					
31					14											
		CONTINUED NEXT PAGE														

DEPTH SCALE
1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-05

LOCATION: N 5033620.4 ;E 434945.7

DRILLING DATE: AUG 19-20, 2011

DATUM:

INCLINATION: -90° AZIMUTH: —

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint; FLT - Fault; SHR- Shear; VN - Vein; CJ - Conjugate; BD- Bedding; FO- Foliation; CO- Contact; OR- Orthogonal; CL- Cleavage; PL - Planar; CU- Curved; UN- Undulating; ST - Stepped; IR - Irregular; PO- Polished; K - Slickensided; SM- Smooth; RO- Rough; MB- Mechanical Break; BR - Broken Rock

NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP W.R.T. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		-- CONTINUED FROM PREVIOUS PAGE --														
32		29.70 - 41.76 m Slightly weathered, highly foliated, dark grey to dark reddish brown, fine grained, non-porous, weak to medium strong, RHYOLITE CRYSTAL TUFF (RCTF) -Strong to moderate silicification, slight sericite/chlorite alteration, pervasive oxidation -More iron-rich veins to 36.00 m			14							JN,PL,RO,CT,OX/CL FR,IR,VR,CT,OX FR,CU,VR,CT,OX/CL FR,PL,VR,CT,OX FR,IR,VR,OX,CT JN,PL,SM,CT,OX/CH FR,IR,RO,CT,OX FR,IR,VR,CT,OX FR,IR,VR,CT,OX/CH HFR,IR,VR,IN,CL,1 mm				
33					15							JN,PL,RO,CT,OX JN,PL,SM,IN,CL,2 mm JN,PL,RO,ST,OX JN,ST,RO,IN,CH/CL,2 mm JN,PL,SM,CT,OX/CH JN,PL,RO,CT,OX JN,PL,VR,CT,OX/CL JN,PL,SM,CT,OX/CH FR,PL,VR,CT,M SH,PL,K,CT,CL JN,PL,RO,IN,SA/FE,2 mm				
34												JN,PL,SM,CT,OX/CH JN,PL,SM,CT,OX/CH JN,PL,SM,ST,OX/CH JN,PL,VR,CT,OX/CH HJN,PL,VR,IN,SA/M,15 mm JN,PL,VR,IN,OX/SA,1 mm				
35					16							JN,PL,SM,CT,OX/SA JN,PL,SM,CT,CH/CL JN,PL,SM,CT,OX FR,IR,VR,CT,OX/M FO,PL,SM,CT,OX/CH JN,PL,RO,CT,OX/CH JN,PL,RO,CT,OX/CH JN,PL,SM,CT,OX/CL JN,PL,VR,IN,OX/SA,2 mm JN,PL,VR,IN,OX/CL,3 mm				
36					17							JN,PL,VR,CT,OX/M JN,PL,VR,CT,CH/M JN,PL,SM,SA,OX JN,PL,VR,SA,OX/CH JN,PL,VR,CT,OX/CH JN,PL,SM,CT,OX/CH JN,PL,SM,CT,OX/SA FR,PL,VR,ST,OX JN,PL,SM,CT,OX				Bc
37												JN,PL,VR,CT,OX JN,PL,VR,IN,OX/CL,2 mm FR,IR,VT,CT,OX/CH JN,PL,VR,CT,OX/CL				
38					18							JN,PL,VR,IN,OX/CL,3 mm JN,PL,RO,IN,OX/CL,3 mm JN,PL,VR,CT,OX JN,PL,RO,CT,OX/CH JN,PL,VR,CT,OX JN,PL,SM,CT,OX/CL JN,PL,VR,CT,OX/CH JN,PL,VR,IN,CL,3 mm JN,PL,RO,CT,OX/M JN,PL,SM,CT,OX/M JN,PL,RO,CT,OX/CH FR,PL,VR,CT,OX				Bc
39					19							JN,PL,SM,SA,OX/CH JN,PL,SM,CT,OX/SA JN,PL,RO,SA,OX/CH JN,PL,RO,CT,OX/CH				
40					20							JN,PL,SM,CT,OX/CH JN,PL,RO,CT,OX/CH JN,PL,RO,CT,OX/CH JN,PL,SM,CT,OX/CH JN,PL,RO,CT,OX/CH JN,PL,RO,CT,OX/CH JN,PL,RO,CT,OX/CH				
41												JN,PL,SM,CT,OX/CH JN,PL,SM,CT,OX/CH JN,PL,SM,CT,CH JN,PL,SM,CT,OX/CH JN,PL,RO,CT,CH JN,PL,RO,CT,CH/CL JN,PL,VR,CT,OX/CH				
		CONTINUED NEXT PAGE														

DEPTH SCALE 1 : 50

Golder Associates

LOGGED: ES

CHECKED:

GTA-ROK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

PROJECT: 10-1193-0003

RECORD OF Drillhole: GB-05

LOCATION: N 5033620.4 ;E 434945.7

DRILLING DATE: AUG 19-20, 2011

DATUM:

INCLINATION: -90° AZIMUTH: —

DRILL RIG: D-120

DRILLING CONTRACTOR: Coleman Engineering Co.

JN - Joint, FLT - Fault, SHR - Shear, VN - Vein, CJ - Conjugate, BD - Bedding, FO - Foliation, CC - Contact, OR - Orthogonal, CL - Cleavage, PL - Planar, CU - Curved, UN - Undulating, ST - Stepped, IR - Irregular, PO - Polished, K - Slickensided, SM - Smooth, Ro - Rough, MB - Mechanical Break, BR - Broken Rock. NOTE: For additional abbreviations refer to list of abbreviations & symbols.

DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. / DEPTH (m)	RUN No.	FLUSH RETURN	RECOVERY: TOTAL CORE %	RECOVERY: SOLID CORE %	R.Q.D. %	FRACT. INDEX PER Meter	DISCONTINUITY DATA: DIP w.r.t. CORE AXIS	DISCONTINUITY DATA: TYPE AND SURFACE DESCRIPTION	Jr	Ja	HYDRAULIC CONDUCTIVITY K, cm/sec	WEATHERING INDEX	FEATURES	NOTES
		— CONTINUED FROM PREVIOUS PAGE —																
	1	END OF DRILLHOLE		172.51 / 41.76	20													
42																		
43																		
44																		
45																		
46																		
47																		
48																		
49																		
50																		
51																		

DEPTH SCALE
1 : 50

Golder Associates

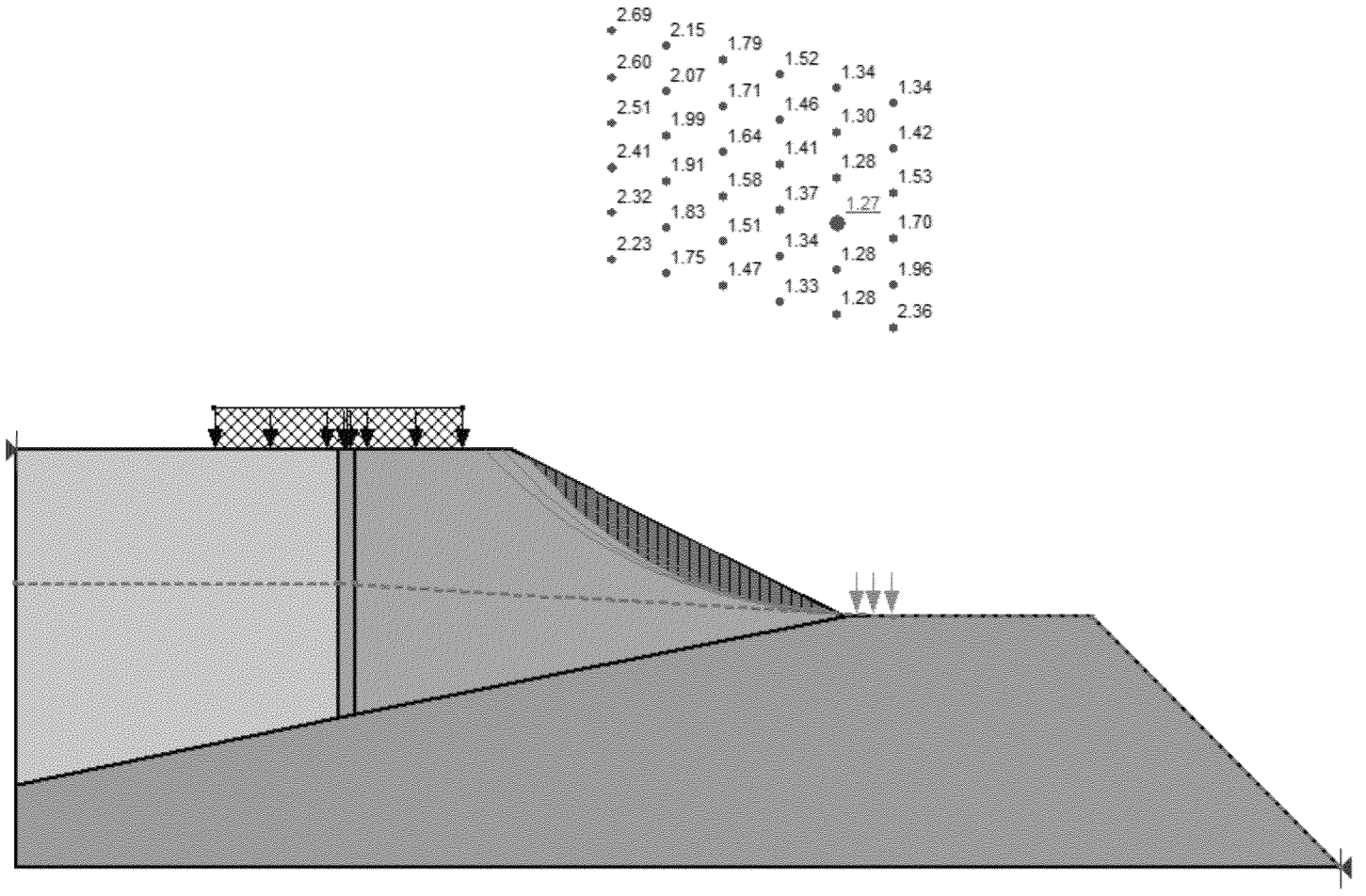
LOGGED: ES
CHECKED:

GTA-RCK 030 10-1193-0003.GPJ GAL-MISS.GDT 9/29/11 ET

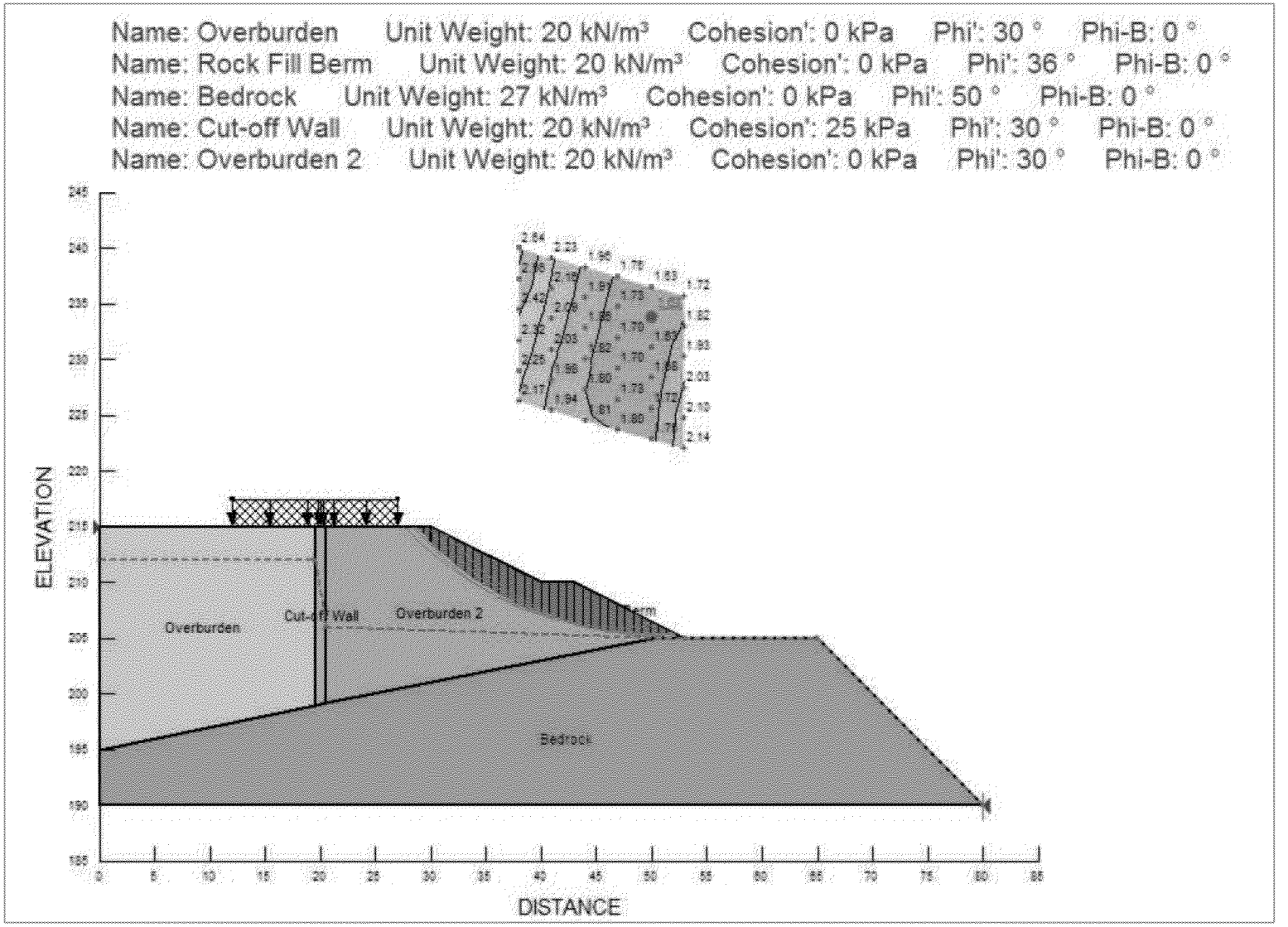
Attachment 2

Slope Stability Analysis Results

Name: Overburden Unit Weight: 20 kN/m³ Cohesion': 0 kPa Phi': 30 ° Phi-B: 0 °
Name: Bedrock Unit Weight: 27 kN/m³ Cohesion': 0 kPa Phi': 50 ° Phi-B: 0 °
Name: Cut-off Wall Unit Weight: 20 kN/m³ Cohesion': 0 kPa Phi': 30 ° Phi-B: 0 °
Name: Overburden 2 Unit Weight: 20 kN/m³ Cohesion': 0 kPa Phi': 30 ° Phi-B: 0 °

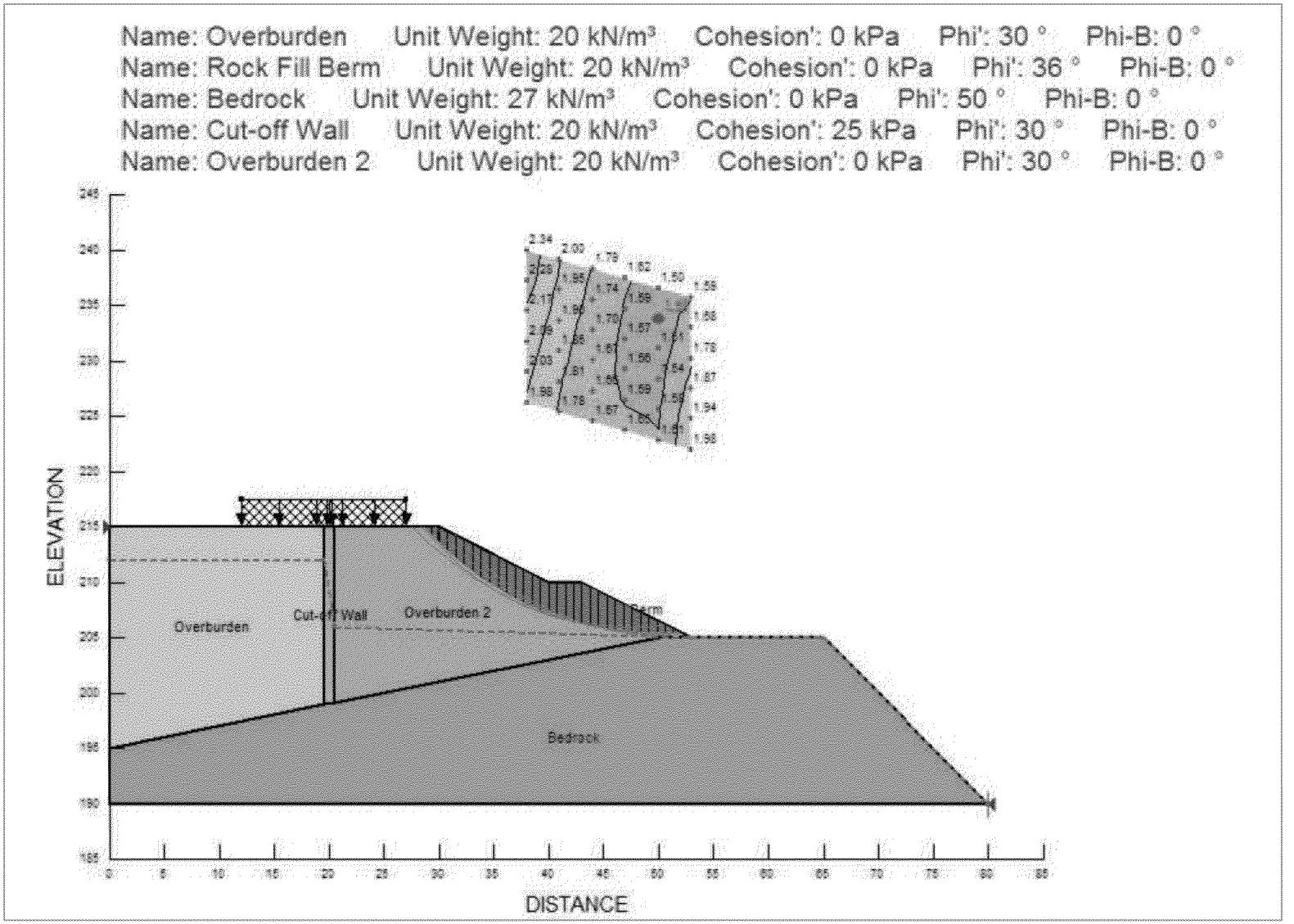


Slope Stability Analysis Result - Static Short Term Condition during Construction



Slope Stability Analysis Result - Static Steady Statewith a 100-year, 24-hour storm event

EPA-R5-2018-009055_0000272_0041



Slope Stability Analysis Result - Pseudo-Static Long Term Condition with PGA = 0.03 g.