



APPENDIX B2
Golder 2016 Grab Sampling



Figure 18: Photograph presenting material conditions at GS18 at 0 to 0.9 m depth



Figure 19: Photograph presenting material conditions at GS19 at 0 to 0.9 m depth



Figure 20: Photograph presenting material conditions at GS20 at 0 to 0.9 m depth



APPENDIX B2
Golder 2016 Grab Sampling



Figure 21: Photograph presenting material conditions at GS21 at 0 to 0.5 m depth

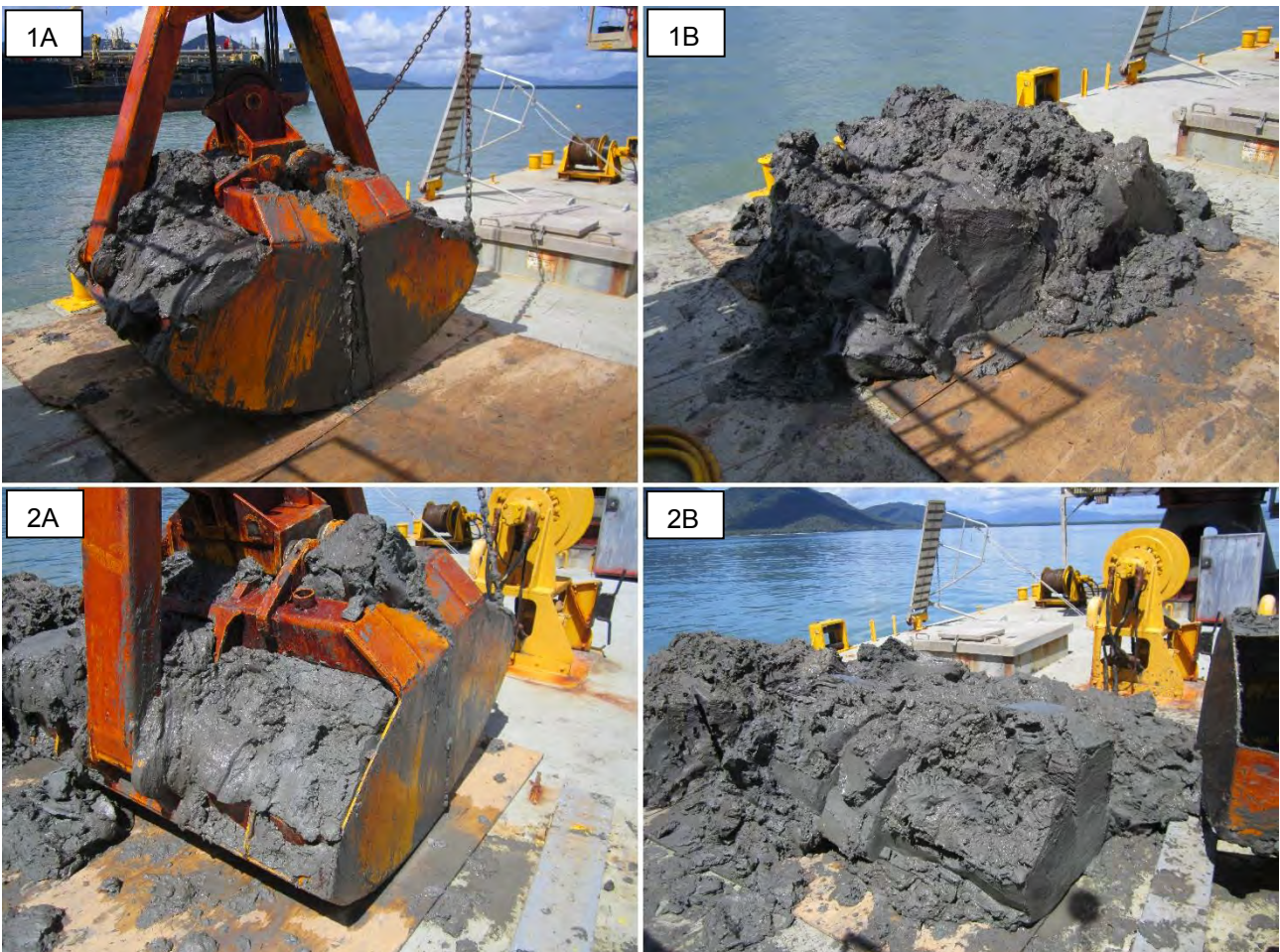


Figure 22: Photograph presenting material conditions at GS22: 1A-1B: 0 to 0.9 m and 2A-2B: 0.9 to 2 m.



APPENDIX B2
Golder 2016 Grab Sampling



Figure 23: Photograph presenting material conditions at GS22: 3A-3B: 2 to 3 m.

j:\geol\2015\1546223 - fcg - eis stage 1 - port development\corr out\stage 1b marine\appendix b2\1546223-csdp-appendix b2.docx



APPENDIX B2 Golder 2016 Grab Sampling - ASS



Figure 1: GS1: 0.00 to 0.90 m

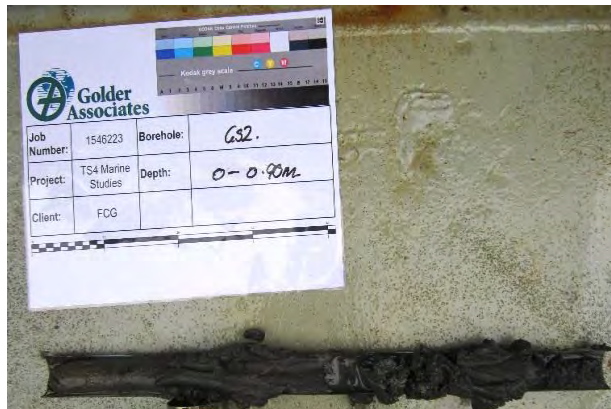


Figure 2: GS2: 0.00 to 0.90 m



Figure 3: GS3: 0.00 to 0.60 m



Figure 4: GS4: 0.00 to 0.50 m



Figure 5: GS-A2: 0.20 to 0.30 m



Figure 6: GS6: 0.00 to 0.50 m



APPENDIX B2

Golder 2016 Grab Sampling - ASS



Figure 7: GS7: 0.00 to 0.75 m



Figure 8: GS8: 0.00 to 0.90 m



Figure 9: GS9: 0.00 to 0.90 m



Figure 10: GS10-A1: 0.00 to 0.30 m

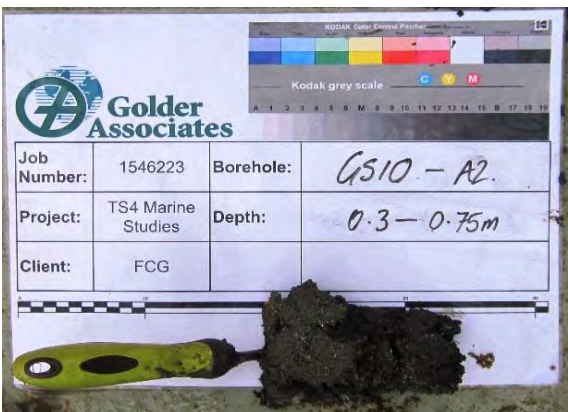


Figure 11: GS10-A2: 0.30 to 0.75 m

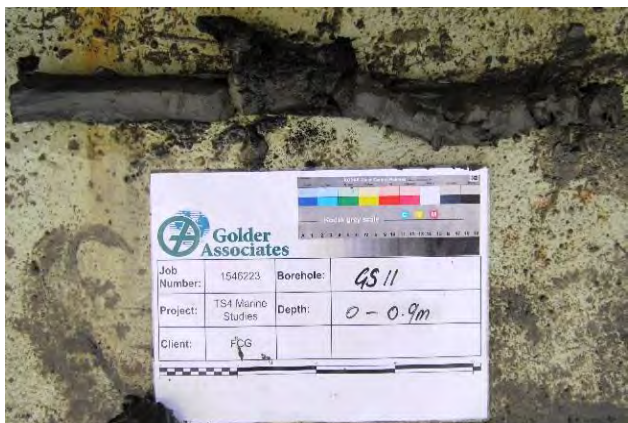


Figure 12: GS11: 0.00 to 0.90 m



APPENDIX B2

Golder 2016 Grab Sampling - ASS



Figure 13: GS12: 0.00 to 0.90 m



Figure 14: GS13: 0.00 to 0.90 m

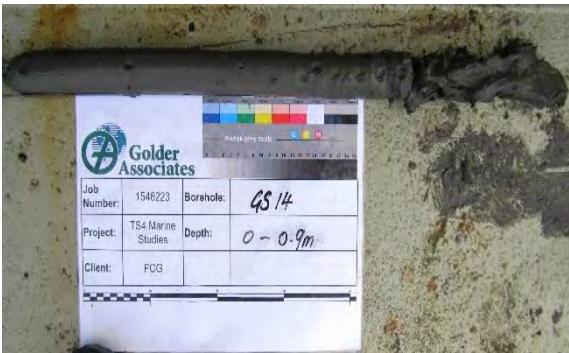


Figure 15: GS14: 0.00 to 0.90 m



Figure 16: GS15: 0.00 to 0.90 m



Figure 17: GS16: 0.00 – 0.90 m



Figure 18: GS17: 0.00 to 0.90 m



APPENDIX B2

Golder 2016 Grab Sampling - ASS



Figure 19: GS18: 0.00 to 0.90 m



Figure 20: GS19: 0.00 to 0.90 m



Figure 21: GS20: : 0.00 to 0.90 m



Figure 22: GS21: 0.00 to 0.50 m



Figure 23: GS22-1: 0.00 to 0.90 m



Figure 24: GS22-2: 0.90 to 2.0 m



Figure 25: GS22-3: 2.0 to 3.0 m



APPENDIX C

Appendix C1 – Geotechnical Laboratory Testing Results
Appendix C2 – ASS Laboratory Testing Results

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving) with hydrometer follow on

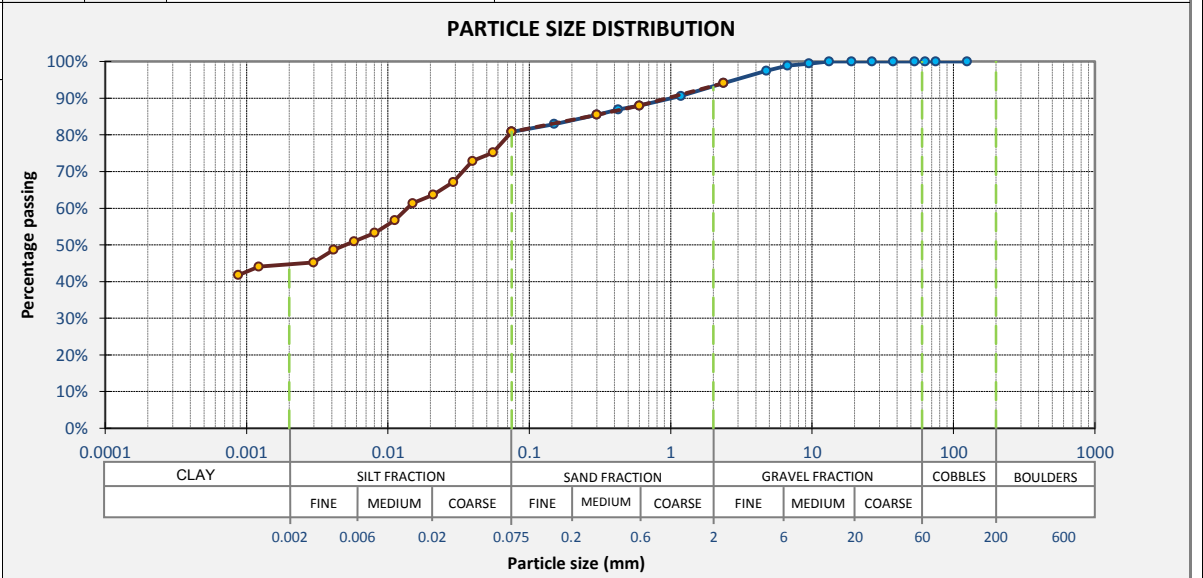
AS1289.3.6.1, 3.6.3, 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.5.1, & AS1726 Appendix A (Sec. A2)



Test request #: TRM16-0684	Lab sample ID: LMEL2016083054	Golder Associates Pty Ltd MELBOURNE GEOTECHNICAL LABORATORY Building 7, Botanicca Corporate Park 570 - 588 Swan Street Richmond, Victoria 3121
Client: FCG		
Client address:		
Project ID: 1546223	Lab report ref.: LMEL_16005647	
Project name: TS4 Marine Studies	Exploratory Hole: GS5	Sample depth (m): 0.20 - 0.30 Client sample ref: a
Location:	Project Reference: -	

Specimen description: (AS 1726 Appendix A, Section A2)				CH, CLAY trace of sand gravel, brown with grey staining				Sampling co-ordinates		Reduced Level	
PARTICLE SIZE DISTRIBUTION				AS 1289.3.6.1				Easting (m)	Northing (m)		
Sieve Size	Passing	LB S	UB S	Standard:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	n/a	
125 mm	100%			Test:	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking	Particle density (t/m³)
75 mm	100%										
63 mm	100%			LB S:						LSM length	
53 mm	100%			UB S:						254 mm	
37.5 mm	100%			Specimen history/notes:	Preparation of specimen and testing performed on sample supplied to the laboratory					PSD preparation method	
26.5 mm	100%			Hydrometer:	Loss on pre-treatment: 9%	Dispersant: Sodium Hexametaphosphate					
19 mm	100%			Definitions: LB S = Lower bound specification			n/a = Not applicable	NP = Non plastic			
13.2 mm	100%			LSM = Linear shrinkage mould			ND = Not determined	PSD = Particle size distribution			
9.5 mm	99%			UB S = Upper bound specification			NO = Not obtainable				
6.7 mm	99%			GRADING SUMMARY							
4.75 mm	97%			Clay* (<2 µm)	Silt* (>2 µm - <75 µm)	Fines (<75 µm)	Sand* (>75 µm - <2 mm)	Gravel* (>2 mm - <60 mm)	Cobbles* (>60 mm - <200 mm)		
2.36 mm	94%			44.6%	36.3%	80.9%	12.2%	7.0%	0.0%		
1.18 mm	91%			<i>Hydrometer type = ASTM</i>							<i>* Proportions based on linear interpolation between sieve/particle of nearest size and smaller</i>
600 µm	88%										
425 µm	87%										
300 µm	85%										
150 µm	83%										
75 µm	81%										

Hydrometer (AS1289.3.6.3)	
Size	% Finer
75.0 µm	81%
55.2 µm	75%
39.6 µm	73%
28.9 µm	67%
20.9 µm	64%
14.9 µm	61%
11.2 µm	57%
8.1 µm	53%
5.8 µm	51%
4.1 µm	49%
3.0 µm	45%
1.2 µm	44%
0.9 µm	42%



Testing performed by: SDB **Results reviewed by:** StephenAbbey **Date reported:** 14/09/2016

Cert. ref.: 1546223_GS5_TRM16-0684_CLSF_s16083054_Rep16005647	Approved signatory:
NATA accreditation number: 1961 - Site:1250 - Melbourne Accredited for compliance with ISO/IEC 17025	
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	Stephen Abbey - Laboratory Manager

Phone: +61 (03) 8862 3500 **Fax:** +61 (03) 8862 3501 **E-mail:** melbgeolab@golder.com.au **Web:** www.golder.com.au

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving) with hydrometer follow on

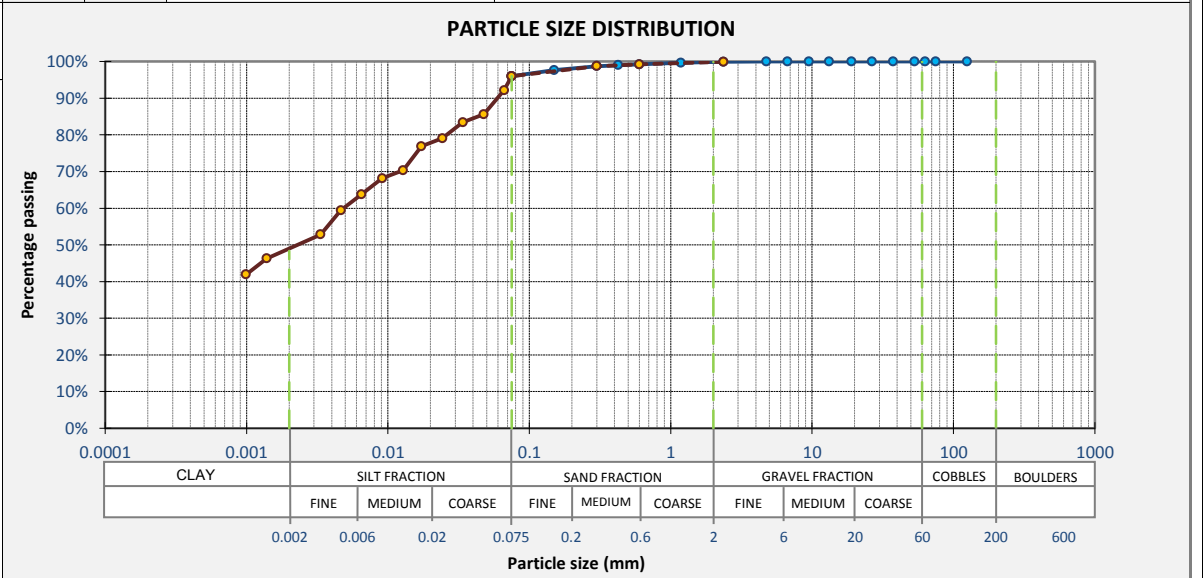
AS1289.3.6.1, 3.6.3, 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.5.1, & AS1726 Appendix A (Sec. A2)



Test request #: TRM16-0684	Lab sample ID: LMEL2016083055	Golder Associates Pty Ltd MELBOURNE GEOTECHNICAL LABORATORY Building 7, Botanicca Corporate Park 570 - 588 Swan Street Richmond, Victoria 3121
Client: FCG		
Client address:		
Project ID: 1546223	Lab report ref.: LMEL_16005648	
Project name: TS4 Marine Studies	Exploratory Hole: GS7	Sample depth (m): 0.00 - 0.75 Client sample ref: a
Location:	Project Reference: -	

Specimen description: (AS 1726 Appendix A, Section A2)				CH, CLAY trace of sand gravel, grey with brown staining				Sampling co-ordinates		Reduced Level	
PARTICLE SIZE DISTRIBUTION				AS 1289.3.6.1				Easting (m)	Northing (m)		
Sieve Size	Passing	LB S	UB S	Standard:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	n/a	
125 mm	100%			Test:	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking	Particle density (t/m³)
75 mm	100%										
63 mm	100%			LB S:						LSM length	
53 mm	100%			UB S:						254 mm	
37.5 mm	100%			Specimen history/notes:	Preparation of specimen and testing performed on sample supplied to the laboratory					PSD preparation method	
26.5 mm	100%			Hydrometer:	Loss on pre-treatment: 12%	Dispersant: Sodium Hexametaphosphate					
19 mm	100%			Definitions: LB S = Lower bound specification			n/a = Not applicable	NP = Non plastic			
13.2 mm	100%			LSM = Linear shrinkage mould			ND = Not determined	PSD = Particle size distribution			
9.5 mm	100%			UB S = Upper bound specification			NO = Not obtainable				
6.7 mm	100%			GRADING SUMMARY							
4.75 mm	100%			Clay* (<2 µm)	Silt* (>2 µm - <75 µm)	Fines (<75 µm)	Sand* (>75 µm - <2 mm)	Gravel* (>2 mm - <60 mm)	Cobbles* (>60 mm - <200 mm)		
2.36 mm	100%			48.4%	47.6%	96.0%	3.9%	0.2%	0.0%		
1.18 mm	100%			<i>Hydrometer type = ASTM</i>							<i>* Proportions based on linear interpolation between sieve/particle of nearest size and smaller</i>
600 µm	99%										
425 µm	99%										
300 µm	99%										
150 µm	98%										
75 µm	96%										

Hydrometer (AS1289.3.6.3)	
Size	% Finer
75.0 µm	96%
66.2 µm	92%
47.7 µm	86%
33.9 µm	83%
24.2 µm	79%
17.2 µm	77%
12.8 µm	70%
9.1 µm	68%
6.5 µm	64%
4.6 µm	59%
3.3 µm	53%
1.4 µm	46%
1.0 µm	42%



Testing performed by: SDB **Results reviewed by:** StephenAbbey **Date reported:** 14/09/2016

Cert. ref.: 1546223_GS7_TRM16-0684_CLSF_s16083055_Rep16005648	Approved signatory:
NATA accreditation number: 1961 - Site:1250 - Melbourne Accredited for compliance with ISO/IEC 17025	
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	Stephen Abbey - Laboratory Manager

Phone: +61 (03) 8862 3500 **Fax:** +61 (03) 8862 3501 **E-mail:** melbgeolab@golder.com.au **Web:** www.golder.com.au

These tests were carried out in accordance with the Australian standards identified in this certificate. Rep Combined PSD Hydro - RL10

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving) with hydrometer follow on

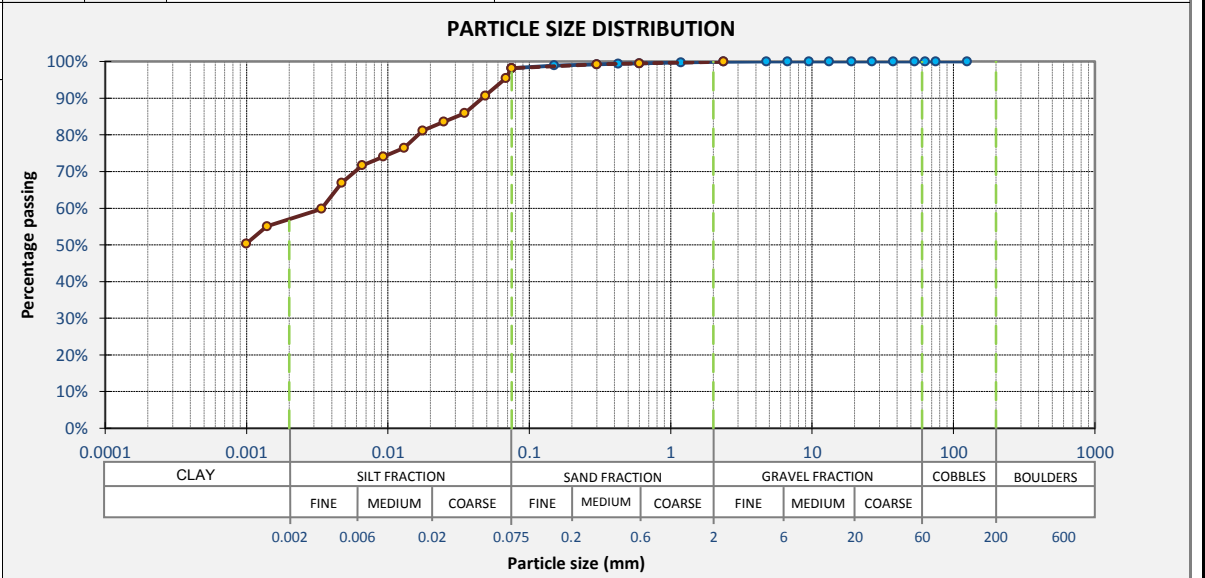
AS1289.3.6.1, 3.6.3, 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.5.1, & AS1726 Appendix A (Sec. A2)



Test request #: TRM16-0684	Lab sample ID: LMEL2016083059	Golder Associates Pty Ltd MELBOURNE GEOTECHNICAL LABORATORY Building 7, Botanicca Corporate Park 570 - 588 Swan Street Richmond, Victoria 3121
Client: FCG		
Client address:		
Project ID: 1546223	Lab report ref.: LMEL_16005649	
Project name: TS4 Marine Studies	Exploratory Hole: GS7+GS12	Sample depth (m): 0.00 - 0.80 Client sample ref: a
Location:	Project Reference: -	

Specimen description: (AS 1726 Appendix A, Section A2) CH, CLAY trace of sand gravel, grey with brown				Sampling co-ordinates		Reduced Level				
				Easting (m)	Northing (m)					
PARTICLE SIZE DISTRIBUTION		AS 1289.3.6.1								
Sieve Size	Passing	LB S	UB S	Standard: AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	n/a	
125 mm	100%			Test: Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking	Particle density (t/m³)
75 mm	100%									
63 mm	100%			LB S:					LSM length	
53 mm	100%			UB S:					250 mm	
37.5 mm	100%			Specimen history/notes:	Preparation of specimen and testing performed on sample supplied to the laboratory				PSD preparation method	Dry sieved
26.5 mm	100%			Hydrometer:	Loss on pre-treatment: 11%	Dispersant: Sodium Hexametaphosphate				
19 mm	100%			Definitions: LB S = Lower bound specification		n/a = Not applicable	NP = Non plastic			
13.2 mm	100%			LSM = Linear shrinkage mould		ND = Not determined	PSD = Particle size distribution			
9.5 mm	100%			UB S = Upper bound specification		NO = Not obtainable				
6.7 mm	100%			GRADING SUMMARY						
4.75 mm	100%			Clay* (<2 µm)	Silt* (>2 µm - <75 µm)	Fines (<75 µm)	Sand* (>75 µm - <2 mm)	Gravel* (>2 mm - <60 mm)	Cobbles* (>60 mm - <200 mm)	
2.36 mm	100%			56.5%	41.6%	98.2%	1.7%	0.1%	0.0%	
1.18 mm	100%			<i>Hydrometer type = ASTM</i>			* Proportions based on linear interpolation between sieve/particle of nearest size and smaller			
600 µm	99%									
425 µm	99%									
300 µm	99%									
150 µm	99%									
75 µm	98%									

Hydrometer (AS1289.3.6.3)	
Size	% Finer
75.0 µm	98%
68.1 µm	95%
48.7 µm	91%
34.8 µm	86%
24.8 µm	84%
17.6 µm	81%
13.0 µm	76%
9.2 µm	74%
6.6 µm	72%
4.7 µm	67%
3.4 µm	60%
1.4 µm	55%
1.0 µm	50%



Testing performed by: AA **Results reviewed by:** StephenAbbey **Date reported:** 14/09/2016

Cert. ref.: 1546223_GS7+GS12_TRM16-0684_CLSF_s16083059_Rep16005649	Approved signatory:
NATA accreditation number: 1961 - Site:1250 - Melbourne Accredited for compliance with ISO/IEC 17025	
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	Stephen Abbey - Laboratory Manager

Phone: +61 (03) 8862 3500 **Fax:** +61 (03) 8862 3501 **E-mail:** melbgeolab@golder.com.au **Web:** www.golder.com.au

These tests were carried out in accordance with the Australian standards identified in this certificate. Rep Combined PSD Hydro - RL10

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving) with hydrometer follow on

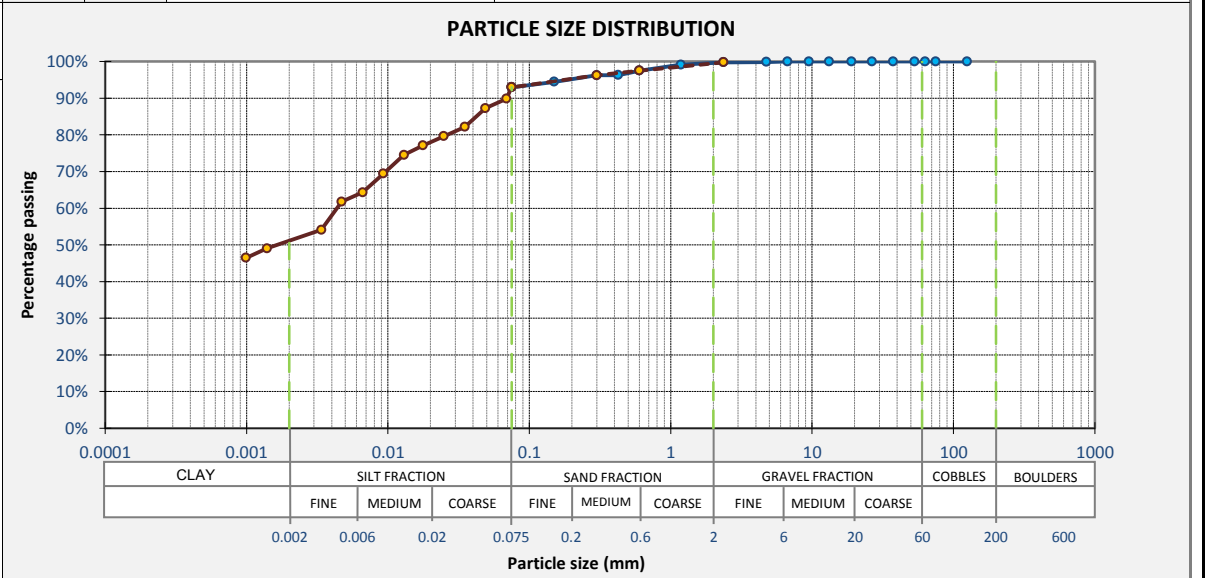
AS1289.3.6.1, 3.6.3, 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.5.1, & AS1726 Appendix A (Sec. A2)



Test request #: TRM16-0684	Lab sample ID: LMEL2016083056	Golder Associates Pty Ltd MELBOURNE GEOTECHNICAL LABORATORY Building 7, Botanicca Corporate Park 570 - 588 Swan Street Richmond, Victoria 3121
Client: FCG		
Client address:		
Project ID: 1546223	Lab report ref.: LMEL_16005650	
Project name: TS4 Marine Studies	Exploratory Hole: GS8	Sample depth (m): 0.00 - 0.80 Client sample ref: a
Location:	Project Reference: -	

Specimen description: (AS 1726 Appendix A, Section A2) CH, CLAY trace of sand gravel, grey				Sampling co-ordinates		Reduced Level					
				Easting (m)	Northing (m)						
PARTICLE SIZE DISTRIBUTION		AS 1289.3.6.1									
Sieve Size	Passing	LB S	UB S	Standard:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	n/a	
125 mm	100%			Test:	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking	Particle density (t/m³)
75 mm	100%										
63 mm	100%			LB S:						LSM length	
53 mm	100%			UB S:						250 mm	
37.5 mm	100%			Specimen history/notes:	Preparation of specimen and testing performed on sample supplied to the laboratory					PSD preparation method	Dry sieved
26.5 mm	100%			Hydrometer:	Loss on pre-treatment: 13%	Dispersant: Sodium Hexametaphosphate					
19 mm	100%			Definitions: LB S = Lower bound specification			n/a = Not applicable	NP = Non plastic			
13.2 mm	100%			LSM = Linear shrinkage mould			ND = Not determined	PSD = Particle size distribution			
9.5 mm	100%			UB S = Upper bound specification			NO = Not obtainable				
6.7 mm	100%			GRADING SUMMARY							
4.75 mm	100%			Clay* (<2 µm)	Silt* (>2 µm - <75 µm)	Fines (<75 µm)	Sand* (>75 µm - <2 mm)	Gravel* (>2 mm - <60 mm)	Cobbles* (>60 mm - <200 mm)		
2.36 mm	100%			50.6%	42.4%	93.0%	6.6%	0.4%	0.0%		
1.18 mm	99%			<i>Hydrometer type = ASTM</i>			* Proportions based on linear interpolation between sieve/particle of nearest size and smaller				
600 µm	98%										
425 µm	96%										
300 µm	96%										
150 µm	94%										
75 µm	93%										

Hydrometer (AS1289.3.6.3)	
Size	% Finer
75.0 µm	93%
68.7 µm	90%
48.8 µm	87%
34.9 µm	82%
24.8 µm	80%
17.7 µm	77%
13.0 µm	75%
9.3 µm	69%
6.6 µm	64%
4.7 µm	62%
3.4 µm	54%
1.4 µm	49%
1.0 µm	46%



Testing performed by: AA **Results reviewed by:** StephenAbbey **Date reported:** 14/09/2016

Cert. ref.: 1546223_GS8_TRM16-0684_CLSF_s16083056_Rep16005650	Approved signatory:
NATA accreditation number: 1961 - Site:1250 - Melbourne Accredited for compliance with ISO/IEC 17025	
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	Stephen Abbey - Laboratory Manager

Phone: +61 (03) 8862 3500 **Fax:** +61 (03) 8862 3501 **E-mail:** melbgeolab@golder.com.au **Web:** www.golder.com.au

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving) with hydrometer follow on

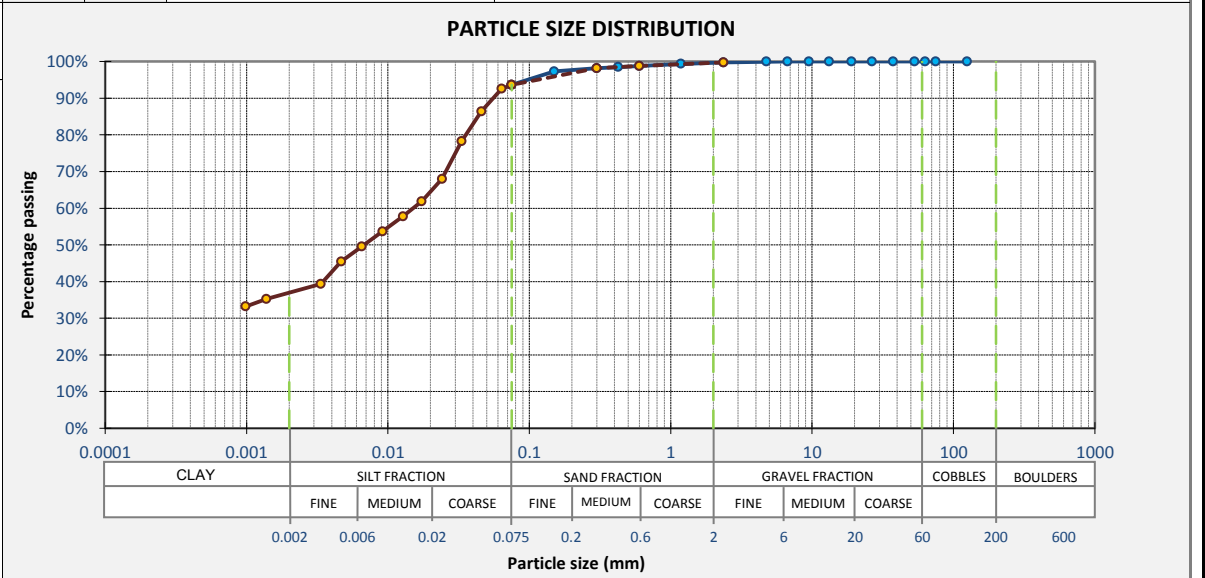
AS1289.3.6.1, 3.6.3, 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.5.1, & AS1726 Appendix A (Sec. A2)



Test request #: TRM16-0684	Lab sample ID: LMEL2016083060	Golder Associates Pty Ltd MELBOURNE GEOTECHNICAL LABORATORY Building 7, Botanicca Corporate Park 570 - 588 Swan Street Richmond, Victoria 3121
Client: FCG		
Client address:		
Project ID: 1546223	Lab report ref.: LMEL_16005651	
Project name: TS4 Marine Studies	Exploratory Hole: GS8+GS13	Sample depth (m): 0.00 - 0.80 Client sample ref: a
Location:	Project Reference: -	

Specimen description: (AS 1726 Appendix A, Section A2) CI, CLAY trace of sand gravel, grey				Sampling co-ordinates		Reduced Level				
				Easting (m)	Northing (m)					
PARTICLE SIZE DISTRIBUTION		AS 1289.3.6.1								
Sieve Size	Passing	LB S	UB S	Standard: AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	n/a	
125 mm	100%			Test: Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking	Particle density (t/m³)
75 mm	100%									
63 mm	100%			LB S:					LSM length	
53 mm	100%			UB S:					250 mm	
37.5 mm	100%			Specimen history/notes:	Preparation of specimen and testing performed on sample supplied to the laboratory				PSD preparation method	Dry sieved
26.5 mm	100%			Hydrometer:	Loss on pre-treatment: 12%	Dispersant: Sodium Hexametaphosphate				
19 mm	100%			Definitions: LB S = Lower bound specification		n/a = Not applicable	NP = Non plastic			
13.2 mm	100%			LSM = Linear shrinkage mould		ND = Not determined	PSD = Particle size distribution			
9.5 mm	100%			UB S = Upper bound specification		NO = Not obtainable				
6.7 mm	100%			GRADING SUMMARY						
4.75 mm	100%			Clay* (<2 µm)	Silt* (>2 µm - <75 µm)	Fines (<75 µm)	Sand* (>75 µm - <2 mm)	Gravel* (>2 mm - <60 mm)	Cobbles* (>60 mm - <200 mm)	
2.36 mm	100%			36.5%	57.1%	93.6%	6.0%	0.4%	0.0%	
1.18 mm	99%			<i>Hydrometer type = ASTM</i>			* Proportions based on linear interpolation between sieve/particle of nearest size and smaller			
600 µm	99%									
425 µm	99%									
300 µm	98%									
150 µm	97%									
75 µm	94%									

Hydrometer (AS1289.3.6.3)	
Size	% Finer
75.0 µm	94%
63.7 µm	93%
45.8 µm	86%
33.1 µm	78%
24.1 µm	68%
17.3 µm	62%
12.8 µm	58%
9.1 µm	54%
6.5 µm	50%
4.7 µm	45%
3.3 µm	39%
1.4 µm	35%
1.0 µm	33%



Testing performed by: AA **Results reviewed by:** StephenAbbey **Date reported:** 14/09/2016

Cert. ref.: 1546223_GS8+GS13_TRM16-0684_CLSF_s16083060_Rep16005651	Approved signatory:
NATA accreditation number: 1961 - Site:1250 - Melbourne Accredited for compliance with ISO/IEC 17025	
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	Stephen Abbey - Laboratory Manager

Phone: +61 (03) 8862 3500 **Fax:** +61 (03) 8862 3501 **E-mail:** melbgeolab@golder.com.au **Web:** www.golder.com.au

These tests were carried out in accordance with the Australian standards identified in this certificate. Rep Combined PSD Hydro - RL10

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving) with hydrometer follow on

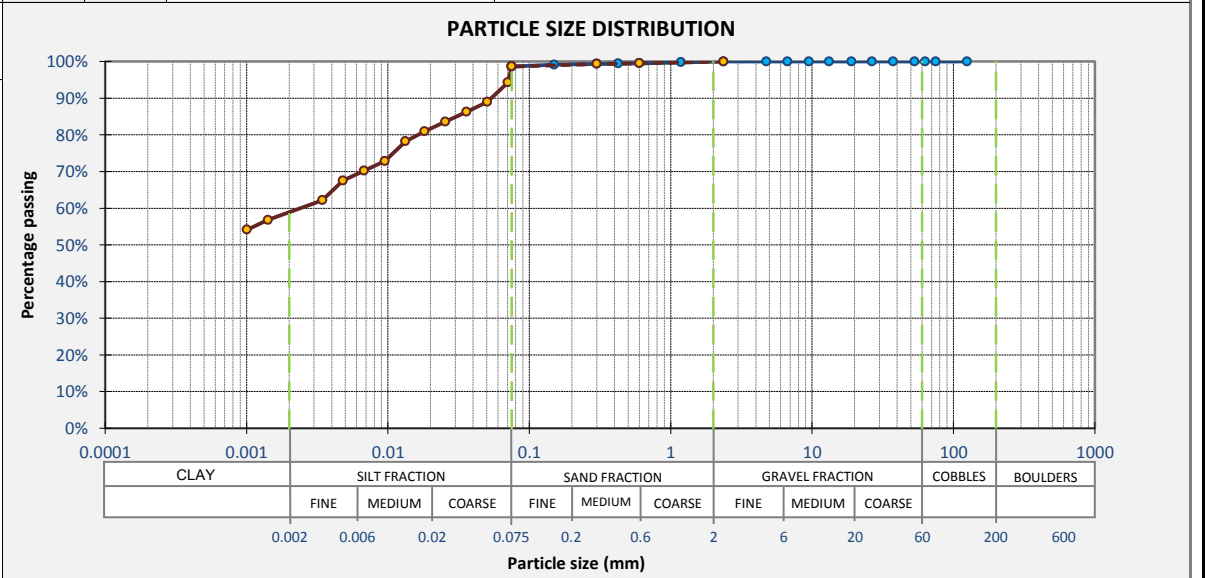
AS1289.3.6.1, 3.6.3, 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.5.1, & AS1726 Appendix A (Sec. A2)



Test request #: TRM16-0684	Lab sample ID: LMEL2016083057	Golder Associates Pty Ltd MELBOURNE GEOTECHNICAL LABORATORY Building 7, Botanicca Corporate Park 570 - 588 Swan Street Richmond, Victoria 3121
Client: FCG		
Client address:		
Project ID: 1546223	Lab report ref.: LMEL_16005645	
Project name: TS4 Marine Studies	Exploratory Hole: GS12	Sample depth (m): 0.00 - 0.80 Client sample ref: a
Location:	Project Reference: -	

Specimen description: (AS 1726 Appendix A, Section A2)				CH, CLAY trace of sand gravel, grey with brown staining				Sampling co-ordinates		Reduced Level	
PARTICLE SIZE DISTRIBUTION				AS 1289.3.6.1				Easting (m)	Northing (m)		
Sieve Size	Passing	LB S	UB S	Standard:	AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	n/a	
125 mm	100%			Test:	Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking	Particle density (t/m³)
75 mm	100%										
63 mm	100%			LB S:						LSM length	
53 mm	100%			UB S:						250 mm	
37.5 mm	100%			Specimen history/notes:	Preparation of specimen and testing performed on sample supplied to the laboratory					PSD preparation method	Dry sieved
26.5 mm	100%			Hydrometer:	Loss on pre-treatment: 16%	Dispersant: Sodium Hexametaphosphate					
19 mm	100%			Definitions:	LB S = Lower bound specification	n/a = Not applicable	NP = Non plastic				
13.2 mm	100%				LSM = Linear shrinkage mould	ND = Not determined	PSD = Particle size distribution				
9.5 mm	100%				UB S = Upper bound specification	NO = Not obtainable					
6.7 mm	100%			GRADING SUMMARY							
4.75 mm	100%			Clay* (<2 µm)	Silt* (>2 µm - <75 µm)	Fines (<75 µm)	Sand* (>75 µm - <2 mm)	Gravel* (>2 mm - <60 mm)	Cobbles* (>60 mm - <200 mm)		
2.36 mm	100%			58.4%	40.3%	98.7%	1.3%	0.1%	0.0%		
1.18 mm	100%			<i>Hydrometer type = ASTM</i>							<i>* Proportions based on linear interpolation between sieve/particle of nearest size and smaller</i>
600 µm	100%										
425 µm	99%										
300 µm	99%										
150 µm	99%										
75 µm	99%										

Hydrometer (AS1289.3.6.3)	
Size	% Finer
75.0 µm	99%
70.4 µm	94%
50.3 µm	89%
35.8 µm	86%
25.5 µm	84%
18.1 µm	81%
13.3 µm	78%
9.5 µm	73%
6.8 µm	70%
4.8 µm	68%
3.4 µm	62%
1.4 µm	57%
1.0 µm	54%



Testing performed by: SDB **Results reviewed by:** StephenAbbey **Date reported:** 14/09/2016

Cert. ref.: 1546223_GS12_TRM16-0684_CLSF_s16083057_Rep16005645	Approved signatory:
NATA accreditation number: 1961 - Site:1250 - Melbourne Accredited for compliance with ISO/IEC 17025	
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	Stephen Abbey - Laboratory Manager

Phone: +61 (03) 8862 3500 **Fax:** +61 (03) 8862 3501 **E-mail:** melbgeolab@golder.com.au **Web:** www.golder.com.au

Soils testing - Particle size distribution & consistency limits test report

Standard method (by sieving) with hydrometer follow on

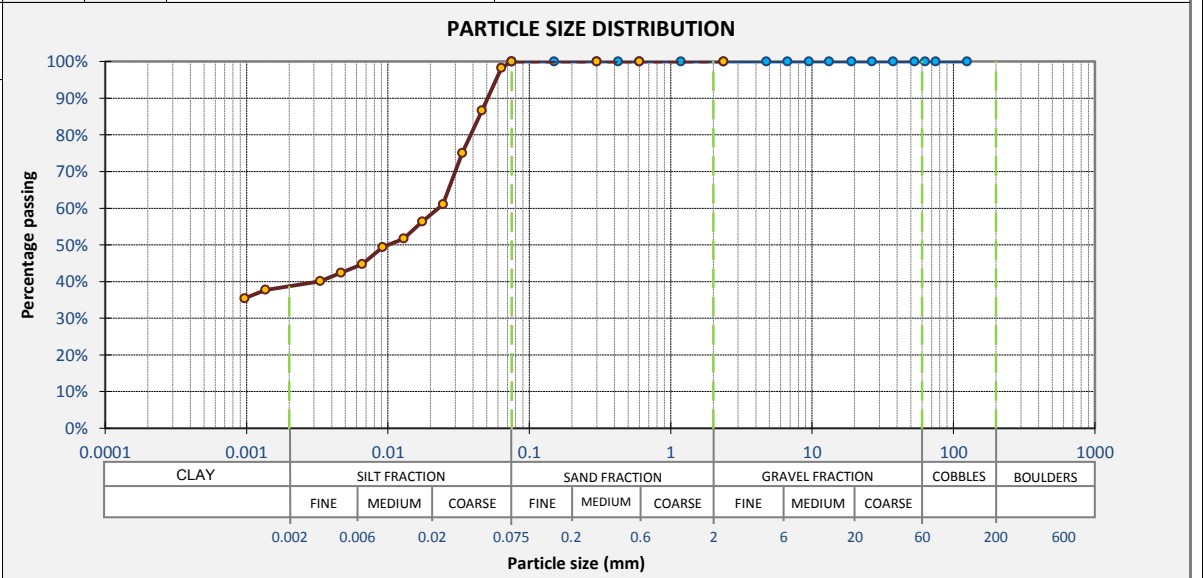
AS1289.3.6.1, 3.6.3, 2.1.1, 3.1.2, 3.2.1, 3.3.1, 3.4.1, 3.5.1, & AS1726 Appendix A (Sec. A2)



Test request #: TRM16-0684	Lab sample ID: LMEL2016083058	Golder Associates Pty Ltd MELBOURNE GEOTECHNICAL LABORATORY Building 7, Botanicca Corporate Park 570 - 588 Swan Street Richmond, Victoria 3121
Client: FCG		
Client address:		
Project ID: 1546223	Lab report ref.: LMEL_16005646	
Project name: TS4 Marine Studies	Exploratory Hole: GS13	Sample depth (m): 0.00 - 0.80 Client sample ref: a
Location:	Project Reference: -	

Specimen description: (AS 1726 Appendix A, Section A2) CI, CLAY, grey				Sampling co-ordinates		Reduced Level				
				Easting (m)	Northing (m)					
PARTICLE SIZE DISTRIBUTION		AS 1289.3.6.1								
Sieve Size	Passing	LB S	UB S	Standard: AS 1289.2.1.1	AS 1289.3.1.2	AS 1289.3.2.1	AS 1289.3.3.1	AS 1289.3.4.1	n/a	
125 mm	100%			Test: Moisture content	1 point Liquid limit	Plastic limit	Plasticity index	Linear shrinkage	Curling/ Crumbling/ Cracking	Particle density (t/m³)
75 mm	100%									
63 mm	100%			LB S:				LSM length		
53 mm	100%			UB S:				250 mm		
37.5 mm	100%			Specimen history/notes: Preparation of specimen and testing performed on sample supplied to the laboratory				PSD preparation method		
26.5 mm	100%							Dry sieved		
19 mm	100%			Hydrometer:		Loss on pre-treatment: 14%		Dispersant: Sodium Hexametaphosphate		
13.2 mm	100%									
9.5 mm	100%									
6.7 mm	100%									
4.75 mm	100%									
2.36 mm	100%									
1.18 mm	100%									
600 µm	100%									
425 µm	100%									
300 µm	100%									
150 µm	100%									
75 µm	100%									
				Definitions: LB S = Lower bound specification		n/a = Not applicable		NP = Non plastic		
				LSM = Linear shrinkage mould		ND = Not determined		PSD = Particle size distribution		
				UB S = Upper bound specification		NO = Not obtainable				
GRADING SUMMARY										
Clay* (<2 µm)		Silt* (>2 µm - <75 µm)		Fines (<75 µm)		Sand* (>75 µm - <2 mm)		Gravel* (>2 mm - <60 mm)		Cobbles* (>60 mm - <200 mm)
38.5%		61.5%		100.0%		0.0%		0.0%		0.0%
<i>Hydrometer type = ASTM</i>				<i>* Proportions based on linear interpolation between sieve/particle of nearest size and smaller</i>						

Hydrometer (AS1289.3.6.3)	
Size	% Finer
75.0 µm	100%
63.4 µm	98%
46.1 µm	87%
33.5 µm	75%
24.5 µm	61%
17.5 µm	56%
12.9 µm	52%
9.2 µm	49%
6.6 µm	45%
4.7 µm	42%
3.3 µm	40%
1.4 µm	38%
1.0 µm	35%



Testing performed by: SDB **Results reviewed by:** StephenAbbey **Date reported:** 14/09/2016

Cert. ref.: 1546223_GS13_TRM16-0684_CLSF_s16083058_Rep16005646	Approved signatory:
NATA accreditation number: 1961 - Site:1250 - Melbourne Accredited for compliance with ISO/IEC 17025	
THIS DOCUMENT SHALL ONLY BE REPRODUCED IN FULL	Stephen Abbey - Laboratory Manager

Phone: +61 (03) 8862 3500 **Fax:** +61 (03) 8862 3501 **E-mail:** melbgeolab@golder.com.au **Web:** www.golder.com.au

Test Location	Level Range (m below seabed)	Level Range (m - LAT)	Material Description	pH _{FIELD}	pH _{FOX}	Wider / Deeper	pH _{KCl}	TAA (kg H ₂ SO ₄ /tonne)	sTAA Converted to %S*	S _{NAS} (if pH less than 4.5)	Existing Acidity %S (sTAA + 0.75 x S _{NAS})	Chromium Reducible Sulfur (S _{CR}) %S	Acid Neutralising Capacity %CaCO ₃ (if pH more than 6.5)	Net Acidity %S (S _{CR} *Existing Acidity - ANC/FF)	Is This AASS	Is This PASS	Liming Rate for Net Acidity (Neutralises both AASS & PASS) (kg/m3)
BH2	1	1.25	-9.07	-9.32	8.05	6.36	Widening	8.8	< 0.5	< 0.010	0.000	0.710	4.4	0.240	No	YES	18.2
BH2	1.25	1.5	-9.32	-9.57	7.93	5.08	Widening	8.8	< 0.5	< 0.010	0.000	0.720	4.2	0.271	No	YES	20.5
BH5	0.5	0.75	-2.15	-2.40	8.24	6.31	Widening	9.2	< 0.5	< 0.010	0.000	0.400	11	-0.775	No	YES	No Additional Lime Required
BH5	1.5	1.75	-3.15	-3.40	8.67	6.42	Widening	9.2	< 0.5	< 0.010	0.000	0.400	12	-0.882	No	YES	No Additional Lime Required
BH5	2.5	2.75	-4.15	-4.40	8.41	6.23	Widening	9.2	< 0.5	< 0.010	0.000	0.400	12	-0.882	No	YES	No Additional Lime Required
BH5	3.5	3.75	-5.15	-5.40	8.16	6.33	Widening	9.2	< 0.5	< 0.010	0.000	0.480	12	-0.802	No	YES	No Additional Lime Required
BH5	4.5	4.75	-6.15	-6.40	8.41	6.23	Widening	9.2	< 0.5	< 0.010	0.000	0.520	11	-0.655	No	YES	No Additional Lime Required
BH5	5.5	5.75	-7.15	-7.40	8.32	6.25	Widening	9.2	< 0.5	< 0.010	0.000	0.610	10	-0.458	No	YES	No Additional Lime Required
BH5	6.5	6.75	-8.15	-8.40	8.32	6.25	Widening	8.9	< 0.5	< 0.010	0.000	0.860	4.9	0.337	No	YES	25.5
BH1	2.75	2.95	-9.12	-9.32	7.21	5.63	Widening	8.5	< 0.5	< 0.010	0.000	0.010	< 0.1	-0.001	No	No	NA
GS21	0.25	0.5	-3.29	-3.54	7.63	7.10	Deepening	9.6	< 0.25	< 0.008	0.000	0.082	11	-1.093	No	YES	No Additional Lime Required
GS22	0.5	0.75	-2.62	-2.87	8.03	6.14	Widening	9.2	< 0.25	< 0.008	0.000	0.510	11	-0.665	No	YES	No Additional Lime Required
GS22	1.4	1.65	-3.52	-3.77	8.12	5.56	Widening	9.3	< 0.25	< 0.008	0.000	0.380	11	-0.795	No	YES	No Additional Lime Required
GS22	2.5	2.75	-4.62	-4.87	8.12	5.56	Widening	9.2	< 0.25	< 0.008	0.000	0.410	12	-0.872	No	YES	No Additional Lime Required
GS1	0	0.25	-5.21	-5.46	7.45	6.13	Widening	9.0	< 0.25	< 0.008	0.000	0.280	6.6	-0.425	No	YES	No Additional Lime Required
GS1	0.75	0.9	-5.96	-6.11	7.15	5.93	Deepening	8.8	< 0.25	< 0.008	0.000	0.870	6.6	0.165	No	YES	12.5
GS3	0	0.25	-7.67	-7.92	7.01	2.42	Widening	8.7	< 0.25	< 0.008	0.000	0.770	7.4	-0.020	No	YES	No Additional Lime Required
GS3	0.5	0.6	-8.17	-8.27	7.31	7.74	Deepening	8.5	< 0.25	< 0.008	0.000	0.730	3.2	0.388	No	YES	29.4
GS6	0	0.25	-8.44	-8.69	6.87	1.61	Widening	7.0	< 0.25	< 0.008	0.000	1.300	1	1.193	No	YES	90.2
GS6	0.25	0.5	-8.69	-8.94	7.25	1.61	Widening	7.4	< 0.25	< 0.008	0.000	1.100	0.9	1.004	No	YES	75.9
GS9	0	0.25	-9.02	-9.27	7.04	6.13	Widening	8.9	< 0.25	< 0.008	0.000	0.410	11	-0.765	No	YES	No Additional Lime Required
GS9	0.5	0.75	-9.52	-9.77	6.69	6.12	Widening	9.4	< 0.25	< 0.008	0.000	0.190	11	-0.985	No	YES	No Additional Lime Required
GS4	0	0.4	-8.69	-9.09	7.55	5.92	Deepening	9.6	< 0.25	< 0.008	0.000	0.100	9.9	-0.957	No	YES	No Additional Lime Required
GS4	0.4	0.5	-9.09	-9.19	7.84	5.53	Widening	9.6	< 0.25	< 0.008	0.000	0.300	10	-0.768	No	YES	No Additional Lime Required
GS11	0	0.25	-9.19	-9.44	7.88	6.20	Widening	8.8	< 0.25	< 0.008	0.000	0.300	7.9	-0.544	No	YES	No Additional Lime Required
GS11	0.75	0.9	-9.94	-10.09	7.54	6.01	Widening	8.6	< 0.25	< 0.008	0.000	0.390	8.5	-0.518	No	YES	No Additional Lime Required
GS15	0	0.25	-9.14	-9.39	7.74	5.92	Deepening	8.8	< 0.25	< 0.008	0.000	0.260	9.9	-0.797	No	YES	No Additional Lime Required
GS15	0.75	0.9	-9.89	-10.04	7.48	7.63	Deepening	6.8	< 0.25	< 0.008	0.000	1.200	0.3	1.168	No	YES	88.3
GS14	0	0.25	-9.58	-9.83	7.54	6.01	Widening	8.8	< 0.25	< 0.008	0.000	0.260	9.5	-0.755	No	YES	No Additional Lime Required
GS14	0.75	0.9	-10.33	-10.48	7.42	5.84	Deepening	8.8	< 0.25	< 0.008	0.000	0.260	9.9	-0.797	No	YES	No Additional Lime Required
GS17	0	0.25	-9.30	-9.55	7.29	6.95	Deepening	8.9	< 0.25	< 0.008	0.000	0.210	11	-0.965	No	YES	No Additional Lime Required
GS17	0.75	0.9	-10.05	-10.20	7.94	6.30	Deepening	9.1	< 0.25	< 0.008	0.000	< 0.005	3.4	-0.363	No	No	NA
GS16	0	0.25	-9.14	-9.39	7.61	6.41	Deepening	8.9	< 0.25	< 0.008	0.000	0.270	10	-0.798	No	YES	No Additional Lime Required
GS16	0.75	0.9	-9.89	-10.04	7.91	6.18	Deepening	9.2	< 0.25	< 0.008	0.000	< 0.005	12	-1.282	No	No	NA
									< 0.5	< 0.016	0.000	< 0.005		0.000	No	No	NA

Note: * Equivalent oxidisable sulfur calculated as TAA/30.59

Liming rates assume a bulk density of 1.60 t/m³
 Fineness Factor = 3

TABLE C1
SUMMARY OF ACID SULFATE TEST RESULTS

Client: Fianagan Consulting Group
 Job Title: 1546223
 Location: Trinity Inlet, Cairns





pH FIELD TESTS

Method: As per the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client : Flanagan Consulting Group	Project Number : 1546223
Project : Cairns Shipping Development	Tested by : SD
Location : Cairns	Checked By / Date : PKS 28/08/16

Date pH Meter Calibrated : Daily 10/08/2016 to 23/08/2016

Hole No.	Depth (m)		Soil Source	pH	pH fox	reaction	Test Date	PASS Potential		
								high	medium	low
BH1	0	0.25	Widening	7.8	6.5	1	10/08/2016			low
BH1	2.7	2.95	Widening	7.2	5.6	1	10/08/2016			low
BH5	0	0.25	Widening	8.3	6.1	1	11/08/2016			low
BH5	0.25	0.5	Widening	8.2	6.1	1	11/08/2016			low
BH5	0.5	0.75	Widening	8.2	6.3	1	11/08/2016			low
BH5	0.75	1	Widening	8.3	6.4	1	11/08/2016			low
BH5	1	1.25	Widening	8.6	6.3	1	11/08/2016			low
BH5	1.25	1.5	Widening	8.5	6.3	1	11/08/2016			low
BH5	1.5	1.75	Widening	8.7	6.4	1	11/08/2016			low
BH5	1.75	2	Widening	8.7	6.3	1	11/08/2016			low
BH5	2	2.25	Widening	8.1	6.1	1	11/08/2016			low
BH5	2.25	2.5	Widening	8.4	6.4	1	11/08/2016			low
BH5	2.5	2.75	Widening	8.4	6.2	1	11/08/2016			low
BH5	2.75	3	Widening	8.4	6.5	1	11/08/2016			low
BH5	3	3.25	Widening	8.4	6.3	1	11/08/2016			low
BH5	3.25	3.5	Widening	8.5	6.2	1	11/08/2016			low
BH5	3.5	3.75	Widening	8.2	6.3	1	11/08/2016			low
BH5	3.75	4	Widening	8.4	6.4	1	11/08/2016			low
BH5	4	4.25	Widening	8.3	6.4	1	11/08/2016			low
BH5	4.25	4.5	Widening	8.1	6.3	1	11/08/2016			low
BH5	4.5	4.75	Widening	8.4	6.3	1	11/08/2016			low
BH5	4.75	5	Widening	8.2	6.3	1	11/08/2016			low
BH5	5	5.25	Widening	8.4	6.2	1	11/08/2016			low
BH5	5.25	5.5	Widening	8.4	6.2	1	11/08/2016			low
BH5	5.5	5.75	Widening	8.3	6.3	1	11/08/2016			low
BH5	5.75	6	Widening	8.5	6.0	1	11/08/2016			low
BH5	6	6.25	Widening	8.2	5.5	2	11/08/2016			low
BH5	6.25	6.5	Widening	8.3	5.8	2	11/08/2016			low
BH5	6.5	6.75	Widening	8.3	5.7	3	11/08/2016			low
BH5	6.75	7	Widening	8.1	4.6	2	11/08/2016			low
BH5	7	7.25	Widening	8.1	5.6	2	11/08/2016			low
BH7	0	0.25	Widening	8.0	6.2	1	15/08/2016			low
BH7	0.25	0.5	Widening	7.9	6.2	1	15/08/2016			low
BH7	0.5	0.75	Widening	8.2	6.1	1	15/08/2016			low
BH7	0.75	1	Widening	7.8	6.2	1	15/08/2016			low
BH7	1	1.25	Widening	8.1	6.2	1	15/08/2016			low
BH7	1.25	1.5	Widening	8.1	6.3	1	15/08/2016			low
BH7	1.5	1.75	Widening	8.2	6.2	1	15/08/2016			low
BH7	1.75	2	Widening	8.3	6.3	1	15/08/2016			low
BH7	2	2.25	Widening	8.2	6.3	1	15/08/2016			low
BH7	2.25	2.5	Widening	8.1	6.4	1	15/08/2016			low
BH7	2.5	2.75	Widening	8.3	6.3	1	15/08/2016			low
BH7	2.75	3	Widening	8.2	6.2	1	15/08/2016			low
BH7	3	3.25	Widening	8.2	6.1	1	15/08/2016			low
BH7	3.25	3.5	Widening	8.0	6.3	1	15/08/2016			low
BH7	3.5	3.75	Widening	7.9	6.3	1	15/08/2016			low
BH7	3.75	4	Widening	8.3	6.2	1	15/08/2016			low
BH7	4	4.25	Widening	8.1	6.2	1	15/08/2016			low
BH7	4.25	4.5	Widening	8.1	6.3	1	15/08/2016			low
BH7	4.5	4.75	Widening	8.1	6.4	1	15/08/2016			low
BH7	4.75	5	Widening	8.1	6.2	1	15/08/2016			low
BH7	5	5.25	Widening	8.1	5.3	1	15/08/2016			low
BH7	5.25	5.5	Widening	8.2	6.1	1	15/08/2016			low
BH7	5.5	5.75	Widening	8.1	6.3	1	15/08/2016			low
BH7	5.75	6	Widening	8.3	6.3	1	15/08/2016			low
BH7	6	6.25	Widening	8.1	6.2	1	15/08/2016			low
BH7	6.25	6.5	Widening	8.1	6.3	1	15/08/2016			low
BH7	6.5	6.75	Widening	8.3	6.0	1	15/08/2016			low
BH7	6.75	7	Widening	8.1	6.1	1	15/08/2016			low
BH7	7	7.25	Widening	8.2	6.1	1	15/08/2016			low
BH8	0	0.25	Widening	8.1	6.6	1	15/08/2016			low
BH8	0.25	0.5	Widening	8.3	6.7	1	15/08/2016			low
BH8	0.5	0.75	Widening	8.2	6.7	1	15/08/2016			low



pH FIELD TESTS

Method: As per the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client : Flanagan Consulting Group	Project Number : 1546223
Project : Cairns Shipping Development	Tested by : SD
Location : Cairns	Checked By / Date : PKS 28/08/16

Date pH Meter Calibrated : Daily 10/08/2016 to 23/08/2016

Hole No.	Depth (m)		Soil Source	pH	pH fox	reaction	Test Date	PASS Potential		
								high	medium	low
BH8	0.75	1	Widening	8.3	6.7	1	15/08/2016			low
BH8	1	1.25	Widening	8.3	6.6	1	15/08/2016			low
BH8	1.25	1.5	Widening	8.3	6.8	1	15/08/2016			low
BH8	1.5	1.75	Widening	8.2	6.7	1	15/08/2016			low
BH8	1.75	2	Widening	8.3	6.8	1	15/08/2016			low
BH8	2	2.25	Widening	8.4	6.9	1	15/08/2016			low
BH8	2.25	2.5	Widening	8.6	6.9	1	15/08/2016			low
BH8	2.5	2.75	Widening	8.4	6.8	1	15/08/2016			low
BH8	2.75	3	Widening	8.3	6.6	1	15/08/2016			low
BH8	3	3.25	Widening	8.5	6.5	1	15/08/2016			low
BH8	3.25	3.5	Widening	8.4	5.5	1	15/08/2016			low
BH8	3.5	3.75	Widening	8.3	6.2	1	15/08/2016			low
BH8	3.75	4	Widening	8.3	6.3	1	15/08/2016			low
BH8	4	4.25	Widening	8.41	6.32	1	15/08/2016			low
BH8	4.25	4.5	Widening	8.33	6.26	1	15/08/2016			low
BH8	4.5	4.75	Widening	8.41	6.32	1	15/08/2016			low
BH8	4.75	5	Widening	8.45	6.26	1	15/08/2016			low
BH8	5	5.25	Widening	8.33	6.31	1	15/08/2016			low
BH8	5.25	5.5	Widening	8.17	6.14	1	15/08/2016			low
BH8	5.5	5.75	Widening	8.18	6.03	1	15/08/2016			low
BH8	5.75	6	Widening	8.17	6.17	1	15/08/2016			low
BH8	6	6.25	Widening	8.28	6.33	1	15/08/2016			low
BH8	6.25	6.5	Widening	8.24	6.25	1	15/08/2016			low
BH8	9	9.25	Widening	8.1	2.42	4	15/08/2016			high
BH8	9.25	9.5	Widening	8.08	2.4	4	15/08/2016			high
BH2	0	0.25	Widening	7.88	6.2	1	15/08/2016			low
BH2	0.25	0.5	Widening	8	5.95	1	15/08/2016			low
BH2	0.5	0.75	Widening	8.12	5.75	1	15/08/2016			low
BH2	0.75	1	Widening	8.03	6.14	1	15/08/2016			low
BH2	1	1.25	Widening	8.05	8.28	4	15/08/2016			low
BH2	1.25	1.5	Widening	7.93	5.08	4	15/08/2016			low
BH2	1.5	1.75	Widening	8.06	6.57	1	15/08/2016			low
BH2	1.75	2	Widening	8.22	6.66	1	15/08/2016			low
BH2	2	2.25	Widening	8.14	6.13	1	15/08/2016			low
BH2	2.25	2.5	Widening	8.21	6.14	1	15/08/2016			low
BH3	0	0.25	Widening	7	6.45	1	16/08/2016			low
BH3	0.25	0.5	Widening	7.38	6.13	1	16/08/2016			low
BH3	0.5	0.75	Widening	7.52	6.05	2	16/08/2016			low
BH3	0.75	1	Widening	7.46	6.03	2	16/08/2016			low
BH3	1	1.25	Widening	7.54	6.01	2	16/08/2016			low
BH3	1.25	1.5	Widening	7.97	6.12	2	16/08/2016			low
BH3	1.5	1.75	Widening	8.09	6.83	2	16/08/2016			low
BH3	1.75	2	Widening	8.03	7.55	4	16/08/2016			low
BH3	2	2.25	Widening	8	2.24	2	16/08/2016			high
BH3	2.25	2.5	Widening	8.06	7.89	3	16/08/2016			low
BH3	2.5	2.75	Widening	8.05	7.51	3	16/08/2016			low
BH3	2.75	3	Widening	8.02	7.6	2	16/08/2016			low
BH3	3	3.25	Widening	8.14	4.91	2	16/08/2016			low
BH3	3.25	3.5	Widening	7.95	7.19	4	16/08/2016			low
BH3	3.5	3.75	Widening	8.22	7.23	3	16/08/2016			low
BH3	3.75	4	Widening	8.6	4.94	4	16/08/2016			low
BH3	4	4.25	Widening	8.53	5.46	1	16/08/2016			low
GS2	0	0.25	Widening	7.36	6	3	17/08/2016			low
GS2	0.25	0.5	Widening	7.37	6.1	3	17/08/2016			low
GS2	0.5	0.75	Widening	7.26	7.41	3	17/08/2016			low
GS18	0	0.25	Deepening	7.82	6.95	3	17/08/2016			low
GS18	0.25	0.5	Deepening	7.64	6.59	4	17/08/2016			low
GS18	0.5	0.75	Deepening	7.48	7.63	3	17/08/2016			low
GS18	0.75	1	Deepening	7.67	6.82	3	17/08/2016			low
GS20	0	0.25	Deepening	7.81	8.36	3	17/08/2016			low
GS20	0.25	0.5	Deepening	7.82	6.83	3	17/08/2016			low
GS20	0.5	0.75	Deepening	7.67	7.1	3	17/08/2016			low
GS20	0.75	1	Deepening	7.66	6.68	4	17/08/2016			low



pH FIELD TESTS

Method: As per the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client : Flanagan Consulting Group	Project Number : 1546223
Project : Cairns Shipping Development	Tested by : SD
Location : Cairns	Checked By / Date : PKS 28/08/16

Date pH Meter Calibrated : Daily 10/08/2016 to 23/08/2016

Hole No.	Depth (m)		Soil Source	pH	pH fox	reaction	Test Date	PASS Potential		
								high	medium	low
GS19	0	0.25	Deepening	7.75	6.8	3	17/08/2016			low
GS19	0.25	0.5	Deepening	7.31	7.74	3	17/08/2016			low
GS19	0.5	0.75	Deepening	7.3	7.21	3	17/08/2016			low
GS19	0.75	1	Deepening	7.23	7.39	3	17/08/2016			low
GS5	0	0.2	Widening	8.64	7.24	4	18/08/2016			low
GS5	0.2	0.3	Widening	8.65	6.38	2	18/08/2016			low
GS7	0	0.25	Deepening	8.31	5.83	2	18/08/2016			low
GS7	0.25	0.5	Deepening	8.08	5.83	2	18/08/2016			low
GS7	0.5	0.75	Deepening	7.97	8.27	4	18/08/2016			low
GS8	0	0.25	Widening	7.07	5.88	2	18/08/2016			low
GS8	0.25	0.5	Widening	7.93	5.82	2	18/08/2016			low
GS8	0.5	0.75	Widening	8.03	5.37	2	18/08/2016			low
GS8	0.75	0.9	Widening	8.04	5.86	2	18/08/2016			low
GS10	0	0.3	Widening	8.11	6.01	2	18/08/2016			low
GS10	0.3	0.75	Widening	8.34	5.94	2	18/08/2016			low
GS12	0	0.25	Deepening	7.78	5.86	2	18/08/2016			low
GS12	0.25	0.5	Deepening	7.15	5.93	4	18/08/2016			low
GS12	0.5	0.75	Deepening	7.48	5.88	2	18/08/2016			low
GS12	0.75	0.9	Deepening	7.77	6.59	2	18/08/2016			low
GS13	0	0.25	Widening	8.05	5.9	4	18/08/2016			low
GS13	0.25	0.5	Widening	8.12	6.14	2	18/08/2016			low
GS13	0.5	0.75	Widening	8.28	6.17	2	18/08/2016			low
GS13	0.75	0.9	Widening	8.14	6.09	2	18/08/2016			low
GS11	0	0.25	Deepening	7.88	7.41	4	19/08/2016			low
GS11	0.25	0.5	Deepening	7.63	7.1	4	19/08/2016			low
GS11	0.5	0.75	Deepening	7.76	5.59	2	19/08/2016			low
GS11	0.75	0.9	Deepening	7.54	5.72	2	19/08/2016			low
GS15	0	0.25	Deepening	7.74	5.92	3	19/08/2016			low
GS15	0.25	0.5	Deepening	7.7	7.08	3	19/08/2016			low
GS15	0.5	0.75	Deepening	7.65	1.88	4	19/08/2016			high
GS15	0.75	0.9	Deepening	7.48	1.44	2	19/08/2016			high
GS14	0	0.25	Deepening	7.54	5.96	3	19/08/2016			low
GS14	0.25	0.5	Deepening	7.51	3.36	2	19/08/2016			medium
GS14	0.5	0.75	Deepening	7.45	6.13	3	19/08/2016			low
GS14	0.75	0.9	Deepening	7.42	5.84	2	19/08/2016			low
GS17	0	0.25	Deepening	7.29	6.95	3	19/08/2016			low
GS17	0.25	0.5	Deepening	7.43	5.9	2	19/08/2016			low
GS17	0.5	0.75	Deepening	7.54	5.96	3	19/08/2016			low
GS17	0.75	0.9	Deepening	7.94	6.3	2	19/08/2016			low
GS16	0	0.25	Deepening	7.61	6.41	3	19/08/2016			low
GS16	0.25	0.5	Deepening	7.24	6.31	3	19/08/2016			low
GS16	0.5	0.75	Deepening	7.76	5.96	2	19/08/2016			low
GS16	0.75	0.9	Deepening	7.91	6.18	2	19/08/2016			low
GS1	0	0.25	Widening	7.45	5.32	1	22/08/2016			low
GS1	0.25	0.5	Widening	7.42	4.87	2	22/08/2016			low
GS1	0.5	0.75	Widening	7.21	5.52	3	22/08/2016			low
GS1	0.75	0.9	Widening	7.15	4.15	2	22/08/2016			low
GS3	0	0.25	Widening	7.01	2.42	4	22/08/2016			high
GS3	0.25	0.5	Widening	7.24	1.64	4	22/08/2016			high
GS3	0.5	0.6	Widening	7.31	1.64	4	22/08/2016			high
GS6	0	0.25	Widening	6.87	1.61	3	22/08/2016			high
GS6	0.25	0.5	Widening	7.25	1.61	4	22/08/2016			high
GS9	0	0.25	Deepening	7.04	6.13	2	22/08/2016			low
GS9	0.25	0.5	Deepening	7.26	4.95	2	22/08/2016			low
GS9	0.5	0.75	Deepening	6.69	6.12	2	22/08/2016			low
GS9	0.75	0.9	Deepening	6.97	5.74	2	22/08/2016			low
GS4	0	0.4	Widening	7.55	5.92	2	22/08/2016			low
GS4	0.4	0.5	Widening	7.84	5.53	2	22/08/2016			low
GS21	0	0.25	Widening	7.25	5.65	2	23/08/2016			low
GS21	0.25	0.5	Widening	7.63	5.42	2	23/08/2016			low
GS22	0	0.25	Widening	8.03	5.4	2	23/08/2016			low
GS22	0.25	0.5	Widening	7.96	5.4	2	23/08/2016			low
GS22	0.5	0.75	Widening	8.03	5.46	2	23/08/2016			low



pH FIELD TESTS

Method: As per the Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland 1998.

Client : Flanagan Consulting Group Project : Cairns Shipping Development Location : Cairns	Project Number : 1546223 Tested by : SD Checked By / Date : PKS 28/08/16
---	---

Date pH Meter Calibrated : Daily 10/08/2016 to 23/08/2016
--

Hole No.	Depth (m)		Soil Source	pH	pH fox	reaction	Test Date	PASS Potential		
								high	medium	low
GS22	0.75	0.9	Widening	8.17	5.5	2	23/08/2016		low	
GS22	0.9	1.15	Widening	8.1	5.68	2	23/08/2016		low	
GS22	1.15	1.4	Widening	7.97	5.69	2	23/08/2016		low	
GS22	1.4	1.65	Widening	8.12	5.51	2	23/08/2016		low	
GS22	1.65	2	Widening	7.97	5.64	2	23/08/2016		low	
GS22	2	2.25	Widening	7.93	5.6	2	23/08/2016		low	
GS22	2.25	2.5	Widening	7.77	5.58	2	23/08/2016		low	
GS22	2.5	2.75	Widening	8.12	5.64	2	23/08/2016		low	
GS22	2.75	3	Widening	7.58	5.66	2	23/08/2016		low	

CLIENT DETAILS

Contact Darcy Simpson
 Client GOLDER ASSOCIATES PTY LTD
 Address PO BOX 5823
 216 DRAPER ST
 CAIRNS QLD 4870

Telephone 07 4054 8200
 Facsimile 07 4054 8201
 Email dasimpson@golder.com.au

Project **1546223 Cairns**
 Order Number (Not specified)
 Samples 39

LABORATORY DETAILS

Manager Jon Dicker
 Laboratory SGS Cairns Environmental
 Address Unit 2, 58 Comport St
 Portsmith QLD 4870

Telephone +61 07 4035 5111
 Facsimile +61 07 4035 5122
 Email AU.Environmental.Cairns@sgs.com

SGS Reference **CE122558 R0**
 Date Received 17 Aug 2016
 Date Reported 23 Aug 2016

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(3146)

SIGNATORIES



Anthony Nilsson
 Operations Manager



Jon Dicker
 Manager Northern QLD

Parameter	Units	LOR	CE122558.001	CE122558.002	CE122558.003	CE122558.004
Sample Number			CE122558.001	CE122558.002	CE122558.003	CE122558.004
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			16 Aug 2016	16 Aug 2016	16 Aug 2016	16 Aug 2016
Sample Name			GS2_0-0.25	GS2_0.5-0.75	GS18_0-0.25	GS18_0.75-0.9

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122558.001	CE122558.002	CE122558.003	CE122558.004
% Moisture	%w/w	0.5	58	56	47	41

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

Parameter	Units	LOR	CE122558.001	CE122558.002	CE122558.003	CE122558.004
pH KCl	pH Units	-	8.7	8.8	9.1	9.1
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122558.001	CE122558.002	CE122558.003	CE122558.004
Chromium Reducible Sulphur (Scr)	%	0.005	0.34	0.32	0.19	0.26
Chromium Reducible Sulphur (Scr)	moles H+/T	5	210	197	117	164

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Parameter	Units	LOR	CE122558.001	CE122558.002	CE122558.003	CE122558.004
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	5.8	7.4	10	10
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	57	73	100	100
ANC as % CaCO ₃	% CaCO ₃	0.1	5.8	7.4	10	10
Lime Equivalence	% CaCO ₃	0.1	5.8	7.4	10	10

Parameter	Units	LOR	Sample Number	Sample Matrix	Sample Date	Sample Name
			CE122558.005	Soil	16 Aug 2016	GS20_0-0.25
			CE122558.006	Soil	16 Aug 2016	GS20_0.75-0.9
			CE122558.007	Soil	16 Aug 2016	GS19_0-0.25
			CE122558.008	Soil	16 Aug 2016	GS19_0.75-0.9

Moisture Content Method: AN002 Tested: 18/8/2016

% Moisture	%w/w	0.5	40	49	43	44

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

pH KCl	pH Units	-	9.3	9.0	9.1	9.1
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Chromium Reducible Sulphur (Scr)	%	0.005	0.11	0.30	0.21	0.26
Chromium Reducible Sulphur (Scr)	moles H+/T	5	71	185	130	163

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	12	12	10	10
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	120	120	100	98
ANC as % CaCO ₃	% CaCO ₃	0.1	12	12	10	10
Lime Equivalence	% CaCO ₃	0.1	12	12	10	10

	Sample Number	CE122558.009	CE122558.010	CE122558.011	CE122558.012
	Sample Matrix	Soil	Soil	Soil	Soil
	Sample Date	15 Aug 2016	15 Aug 2016	15 Aug 2016	15 Aug 2016
	Sample Name	BH3_1.75-2	BH3_2-2.25	BH3_3.25_3.5	BH3_3.75-4
Parameter	Units	LOR			

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122558.009	CE122558.010	CE122558.011	CE122558.012
% Moisture	%w/w	0.5	42	44	42	25

TAA (Titrateable Actual Acidity) Method: AN219 Tested: 22/8/2016

Parameter	Units	LOR	CE122558.009	CE122558.010	CE122558.011	CE122558.012
pH KCl	pH Units	-	8.8	8.8	8.6	8.2
Titrateable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titrateable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titrateable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122558.009	CE122558.010	CE122558.011	CE122558.012
Chromium Reducible Sulphur (Scr)	%	0.005	0.69	0.79	0.48	0.053
Chromium Reducible Sulphur (Scr)	moles H+/T	5	431	494	300	33

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Parameter	Units	LOR	CE122558.009	CE122558.010	CE122558.011	CE122558.012
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	4.2	3.8	3.0	0.6
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	41	37	30	6.2
ANC as % CaCO ₃	% CaCO ₃	0.1	4.2	3.8	3.0	0.6
Lime Equivalence	% CaCO ₃	0.1	4.2	3.8	3.0	0.6

Parameter	Units	LOR	CE122558.013	CE122558.014	CE122558.015	CE122558.016
Sample Number			CE122558.013	CE122558.014	CE122558.015	CE122558.016
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			11 Aug 2016	11 Aug 2016	11 Aug 2016	11 Aug 2016
Sample Name			BH7_0.5-0.75	BH7_1.5-1.75	BH7_2.5-2.75	BH7_3.5-3.75

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122558.013	CE122558.014	CE122558.015	CE122558.016
% Moisture	%w/w	0.5	33	33	43	33

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

Parameter	Units	LOR	CE122558.013	CE122558.014	CE122558.015	CE122558.016
pH KCl	pH Units	-	9.2	9.3	9.1	9.2
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122558.013	CE122558.014	CE122558.015	CE122558.016
Chromium Reducible Sulphur (Scr)	%	0.005	0.43	0.37	0.53	0.45
Chromium Reducible Sulphur (Scr)	moles H+/T	5	266	229	331	278

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Parameter	Units	LOR	CE122558.013	CE122558.014	CE122558.015	CE122558.016
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	11	12	11	12
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	100	110	110	110
ANC as % CaCO ₃	% CaCO ₃	0.1	11	12	11	12
Lime Equivalence	% CaCO ₃	0.1	11	12	11	12

Parameter	Units	LOR	CE122558.017	CE122558.018	CE122558.019	CE122558.020
Sample Number			CE122558.017	CE122558.018	CE122558.019	CE122558.020
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			11 Aug 2016	11 Aug 2016	11 Aug 2016	12 Aug 2016
Sample Name			BH7_4.5-4.75	BH7_5.5-5.75	BH7_6.5-6.75	BH8_0.5-0.75

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122558.017	CE122558.018	CE122558.019	CE122558.020
% Moisture	%w/w	0.5	34	32	35	32

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

Parameter	Units	LOR	CE122558.017	CE122558.018	CE122558.019	CE122558.020
pH KCl	pH Units	-	9.2	9.2	9.1	9.3
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122558.017	CE122558.018	CE122558.019	CE122558.020
Chromium Reducible Sulphur (Scr)	%	0.005	0.56	0.50	0.63	0.19
Chromium Reducible Sulphur (Scr)	moles H+/T	5	346	310	395	119

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Parameter	Units	LOR	CE122558.017	CE122558.018	CE122558.019	CE122558.020
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	11	9.2	6.9	11
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	110	90	68	110
ANC as % CaCO ₃	% CaCO ₃	0.1	11	9.2	6.9	11
Lime Equivalence	% CaCO ₃	0.1	11	9.2	6.9	11

Parameter	Units	LOR	Sample Number	Sample Matrix	Sample Date	Sample Name
			CE122558.021	Soil	12 Aug 2016	BH8_1.5-1.75
			CE122558.022	Soil	12 Aug 2016	BH8_2.5-2.75
			CE122558.023	Soil	12 Aug 2016	BH8_3.5-3.75
			CE122558.024	Soil	12 Aug 2016	BH8_4.5-4.75

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	Sample 1	Sample 2	Sample 3	Sample 4
% Moisture	%w/w	0.5	31	33	31	34

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

Parameter	Units	LOR	Sample 1	Sample 2	Sample 3	Sample 4
pH KCl	pH Units	-	9.3	9.2	9.3	9.2
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	Sample 1	Sample 2	Sample 3	Sample 4
Chromium Reducible Sulphur (Scr)	%	0.005	0.30	0.37	0.36	0.49
Chromium Reducible Sulphur (Scr)	moles H+/T	5	186	231	225	304

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Parameter	Units	LOR	Sample 1	Sample 2	Sample 3	Sample 4
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	12	11	12	11
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	120	110	110	100
ANC as % CaCO ₃	% CaCO ₃	0.1	12	11	12	11
Lime Equivalence	% CaCO ₃	0.1	12	11	12	11

Parameter	Units	LOR	CE122558.025	CE122558.026	CE122558.027	CE122558.028
Sample Number			CE122558.025	CE122558.026	CE122558.027	CE122558.028
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			12 Aug 2016	12 Aug 2016	12 Aug 2016	12 Aug 2016
Sample Name			BH8_5.5-5.75	BH8_9.0-9.25	BH2_1-1.25	BH2_1.25-1.5

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122558.025	CE122558.026	CE122558.027	CE122558.028
% Moisture	%w/w	0.5	32	36	41	40

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

Parameter	Units	LOR	CE122558.025	CE122558.026	CE122558.027	CE122558.028
pH KCl	pH Units	-	9.1	8.6	8.8	8.8
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122558.025	CE122558.026	CE122558.027	CE122558.028
Chromium Reducible Sulphur (Scr)	%	0.005	0.65	1.1	0.71	0.72
Chromium Reducible Sulphur (Scr)	moles H+/T	5	406	680	445	447

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Parameter	Units	LOR	CE122558.025	CE122558.026	CE122558.027	CE122558.028
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	8.1	3.7	4.4	4.2
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	79	36	43	41
ANC as % CaCO ₃	% CaCO ₃	0.1	8.1	3.7	4.4	4.2
Lime Equivalence	% CaCO ₃	0.1	8.1	3.7	4.4	4.2

Parameter	Units	LOR	CE122558.029	CE122558.030	CE122558.031	CE122558.032
Sample Number			CE122558.029	CE122558.030	CE122558.031	CE122558.032
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			10 Aug 2016	10 Aug 2016	10 Aug 2016	10 Aug 2016
Sample Name			BH5_0.5-0.75	BH5_1.5-1.75	BH5_2.5-2.75	BH5_3.5-3.75

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122558.029	CE122558.030	CE122558.031	CE122558.032
% Moisture	%w/w	0.5	34	38	35	37

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

Parameter	Units	LOR	CE122558.029	CE122558.030	CE122558.031	CE122558.032
pH KCl	pH Units	-	9.2	9.2	9.2	9.2
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122558.029	CE122558.030	CE122558.031	CE122558.032
Chromium Reducible Sulphur (Scr)	%	0.005	0.40	0.40	0.40	0.48
Chromium Reducible Sulphur (Scr)	moles H+/T	5	249	251	249	298

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Parameter	Units	LOR	CE122558.029	CE122558.030	CE122558.031	CE122558.032
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	11	12	12	12
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	110	120	120	110
ANC as % CaCO ₃	% CaCO ₃	0.1	11	12	12	12
Lime Equivalence	% CaCO ₃	0.1	11	12	12	12

Parameter	Units	LOR	CE122558.033	CE122558.034	CE122558.035	CE122558.036
Sample Number			CE122558.033	CE122558.034	CE122558.035	CE122558.036
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			10 Aug 2016	10 Aug 2016	10 Aug 2016	09 Aug 2016
Sample Name			BH5_4.5-4.75	BH5_5.5-5.75	BH5_6.5-6.75	BH1_2.7-2.95

Moisture Content Method: AN002 Tested: 18/8/2016

% Moisture	%w/w	0.5	36	35	30	21

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

pH KCl	pH Units	-	9.2	9.2	8.9	8.5
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Chromium Reducible Sulphur (Scr)	%	0.005	0.52	0.61	0.86	0.010
Chromium Reducible Sulphur (Scr)	moles H+/T	5	323	383	536	6

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	11	10	4.9	<0.1
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	110	99	48	<0.1
ANC as % CaCO ₃	% CaCO ₃	0.1	11	10	4.9	<0.1
Lime Equivalence	% CaCO ₃	0.1	11	10	4.9	<0.1



ANALYTICAL REPORT

CE122558 R0

Parameter	Units	LOR	CE122558.037	CE122558.038	CE122558.039
Sample Number			CE122558.037	CE122558.038	CE122558.039
Sample Matrix			Soil	Soil	Soil
Sample Date			12 Aug 2016	12 Aug 2016	12 Aug 2016
Sample Name			BH2_0.25-0.5	BH2_0.75-1	BH2_1.75-2

Moisture Content Method: AN002 Tested: 19/8/2016

Parameter	Units	LOR	CE122558.037	CE122558.038	CE122558.039
% Moisture	%w/w	0.5	39	38	43

TAA (Titratable Actual Acidity) Method: AN219 Tested: 22/8/2016

Parameter	Units	LOR	CE122558.037	CE122558.038	CE122558.039
pH KCl	pH Units	-	-	-	-
Titratable Actual Acidity	kg H2SO4/T	0.25	-	-	-
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	-	-	-
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	-	-	-
Sulphur (SKCl)	%w/w	0.005	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122558.037	CE122558.038	CE122558.039
Chromium Reducible Sulphur (Scr)	%	0.005	-	-	-
Chromium Reducible Sulphur (Scr)	moles H+/T	5	-	-	-

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 23/8/2016

Parameter	Units	LOR	CE122558.037	CE122558.038	CE122558.039
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	-	-	-
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	-	-	-
ANC as % CaCO ₃	% CaCO ₃	0.1	-	-	-
Lime Equivalence	% CaCO ₃	0.1	-	-	-

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acid Neutralising Capacity (ANC) Method: ME-(AU)-[ENV]AN214

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	LB038865	% CaCO ₃	0.1	<0.1	0 - 4%	100%
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	LB038865	kg H ₂ SO ₄ /T	0.1	<0.1	0 - 4%	NA
ANC as % CaCO ₃	LB038865	% CaCO ₃	0.1	<0.1	0 - 4%	NA
Lime Equivalence	LB038865	% CaCO ₃	0.1	<0.1		

Chromium Reducible Sulphur (CRS) Method: ME-(AU)-[ENV]AN217

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chromium Reducible Sulphur (Scr)	LB038784	%	0.005	<0.005	1 - 9%	89%
Chromium Reducible Sulphur (Scr)	LB038784	moles H+/T	5	<5		

TAA (Titratable Actual Acidity) Method: ME-(AU)-[ENV]AN219

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH KCl	LB038827	pH Units	-	5.8	0 - 1%	101%
Titratable Actual Acidity	LB038827	kg H ₂ SO ₄ /T	0.25	<0.25	0%	NA
Titratable Actual Acidity (TAA) moles H+/tonne	LB038827	moles H+/T	5	<5	0%	96%
Titratable Actual Acidity (TAA) S%w/w	LB038827	%w/w S	0.01	<0.01	0%	97%

METHOD

METHODOLOGY SUMMARY

AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN214	Acid Neutralising Capacity (ANC) or Neutralising Value (NV): The crushed or as received sample is reacted with excess normal acid (HCl) and then back titrated with standard sodium hydroxide to determine the acid consumed. The result is expressed as kg H ₂ SO ₄ /tonne or %CaCO ₃ . Based on AS4969-13.
AN217	Dried pulped sample is mixed with acid and chromium metal in a rapid distillation unit to produce hydrogen sulfide (H ₂ S) which is collected and titrated with iodine (I ₂ (aq)) to measure SCR.
AN219	Dried pulped sample is extracted for 4 hours in a 1 M KCl solution. The ratio of sample to solution is 1:40. The extract is titrated for acidity. Calcium, magnesium, and sulfur are determined by ICP-AES.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
		-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- a. 1 Bq is equivalent to 27 pCi
- b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at <http://www.sgs.com/en/terms-and-conditions>. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full.

CLIENT DETAILS

Contact Darcy Simpson
 Client GOLDER ASSOCIATES PTY LTD
 Address PO BOX 5823
 216 DRAPER ST
 CAIRNS QLD 4870

Telephone 07 4054 8200
 Facsimile 07 4054 8201
 Email dasimpson@golder.com.au

Project **1546223 Cairns**
 Order Number **PO Q003390**
 Samples 11

LABORATORY DETAILS

Manager Jon Dicker
 Laboratory SGS Cairns Environmental
 Address Unit 2, 58 Comport St
 Portsmith QLD 4870

Telephone +61 07 4035 5111
 Facsimile +61 07 4035 5122
 Email AU.Environmental.Cairns@sgs.com

SGS Reference **CE122571 R1**
 Date Received 18 Aug 2016
 Date Reported 24 Aug 2016

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(3146)

This report cancels and supersedes the report No.CE122571. dated 23 Aug 2016 issued by SGS Environment, Health and Safety due to amended Moisture result CE122571.004.

SIGNATORIES



Anthony Nilsson
 Operations Manager



Jon Dicker
 Manager Northern QLD

Parameter	Units	LOR	CE122571.001	CE122571.002	CE122571.003	CE122571.004
Sample Number			CE122571.001	CE122571.002	CE122571.003	CE122571.004
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			17 Aug 2016	17 Aug 2016	17 Aug 2016	17 Aug 2016
Sample Name			GS5_0-0.2	GS7_0-0.25	GS7_0.5-0.75	GS8_0-0.25

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122571.001	CE122571.002	CE122571.003	CE122571.004
% Moisture	%w/w	0.5	26	44	43	33

TAA (Titratable Actual Acidity) Method: AN219 Tested: 19/8/2016

Parameter	Units	LOR	CE122571.001	CE122571.002	CE122571.003	CE122571.004
pH KCl	pH Units	-	9.2	8.8	8.9	9.0
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122571.001	CE122571.002	CE122571.003	CE122571.004
Chromium Reducible Sulphur (Scr)	%	0.005	0.11	0.50	0.54	1.1
Chromium Reducible Sulphur (Scr)	moles H+/T	5	69	314	339	665

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 22/8/2016

Parameter	Units	LOR	CE122571.001	CE122571.002	CE122571.003	CE122571.004
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	12	8.6	4.3	8.1
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	120	84	42	79
ANC as % CaCO ₃	% CaCO ₃	0.1	12	8.6	4.3	8.1
Lime Equivalence	% CaCO ₃	0.1	12	8.6	4.3	8.1

Parameter	Units	LOR	CE122571.005	CE122571.006	CE122571.007	CE122571.008
Sample Number			CE122571.005	CE122571.006	CE122571.007	CE122571.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			17 Aug 2016	17 Aug 2016	17 Aug 2016	17 Aug 2016
Sample Name			GS8_0.75-0.9	GS10_0-0.3	GS10_0.3-0.75	GS12_0-0.25

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122571.005	CE122571.006	CE122571.007	CE122571.008
% Moisture	%w/w	0.5	35	42	24	58

TAA (Titratable Actual Acidity) Method: AN219 Tested: 19/8/2016

Parameter	Units	LOR	CE122571.005	CE122571.006	CE122571.007	CE122571.008
pH KCl	pH Units	-	8.8	9.9	9.6	8.9
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122571.005	CE122571.006	CE122571.007	CE122571.008
Chromium Reducible Sulphur (Scr)	%	0.005	0.91	0.009	0.069	0.57
Chromium Reducible Sulphur (Scr)	moles H+/T	5	567	6	43	356

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 22/8/2016

Parameter	Units	LOR	CE122571.005	CE122571.006	CE122571.007	CE122571.008
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	4.0	10	10	8.1
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	40	99	100	79
ANC as % CaCO ₃	% CaCO ₃	0.1	4.0	10	10	8.1
Lime Equivalence	% CaCO ₃	0.1	4.0	10	10	8.1

Parameter	Units	LOR	Sample Number	Sample Matrix	Sample Date	Sample Name
			CE122571.009	Soil	17 Aug 2016	GS12_0.75-0.9
			CE122571.010	Soil	17 Aug 2016	GS13_0-0.25
			CE122571.011	Soil	17 Aug 2016	GS13_0.75-0.9

Moisture Content Method: AN002 Tested: 18/8/2016

Parameter	Units	LOR	CE122571.009	CE122571.010	CE122571.011
% Moisture	%w/w	0.5	39	36	32

TAA (Titratable Actual Acidity) Method: AN219 Tested: 19/8/2016

Parameter	Units	LOR	CE122571.009	CE122571.010	CE122571.011
pH KCl	pH Units	-	9.0	9.2	9.3
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w	%w/w S	0.01	<0.01	<0.01	<0.01

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 19/8/2016

Parameter	Units	LOR	CE122571.009	CE122571.010	CE122571.011
Chromium Reducible Sulphur (Scr)	%	0.005	0.23	0.41	0.35
Chromium Reducible Sulphur (Scr)	moles H+/T	5	143	259	217

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 22/8/2016

Parameter	Units	LOR	CE122571.009	CE122571.010	CE122571.011
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	8.3	11	11
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	82	110	110
ANC as % CaCO ₃	% CaCO ₃	0.1	8.3	11	11
Lime Equivalence	% CaCO ₃	0.1	8.3	11	11

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acid Neutralising Capacity (ANC) Method: ME-(AU)-[ENV]AN214

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	LB038839	% CaCO ₃	0.1	<0.1	1%	100%
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	LB038839	kg H ₂ SO ₄ /T	0.1	<0.1	1%	NA
ANC as % CaCO ₃	LB038839	% CaCO ₃	0.1	<0.1	1%	NA
Lime Equivalence	LB038839	% CaCO ₃	0.1	<0.1		

Chromium Reducible Sulphur (CRS) Method: ME-(AU)-[ENV]AN217

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chromium Reducible Sulphur (Scr)	LB038785	%	0.005	<0.005	9 - 15%	88%
Chromium Reducible Sulphur (Scr)	LB038785	moles H+/T	5	<5		

TAA (Titratable Actual Acidity) Method: ME-(AU)-[ENV]AN219

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH KCl	LB038786	pH Units	-	5.9	0%	98%
Titratable Actual Acidity	LB038786	kg H ₂ SO ₄ /T	0.25	<0.25	0%	NA
Titratable Actual Acidity (TAA) moles H+/tonne	LB038786	moles H+/T	5	<5	0%	92%
Titratable Actual Acidity (TAA) S%w/w	LB038786	%w/w S	0.01	<0.01	0%	92%

METHOD

METHODOLOGY SUMMARY

AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN214	Acid Neutralising Capacity (ANC) or Neutralising Value (NV): The crushed or as received sample is reacted with excess normal acid (HCl) and then back titrated with standard sodium hydroxide to determine the acid consumed. The result is expressed as kg H ₂ SO ₄ /tonne or %CaCO ₃ . Based on AS4969-13.
AN217	Dried pulped sample is mixed with acid and chromium metal in a rapid distillation unit to produce hydrogen sulfide (H ₂ S) which is collected and titrated with iodine (I ₂ (aq)) to measure SCR.
AN219	Dried pulped sample is extracted for 4 hours in a 1 M KCl solution. The ratio of sample to solution is 1:40. The extract is titrated for acidity. Calcium, magnesium, and sulfur are determined by ICP-AES.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
		-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- a. 1 Bq is equivalent to 27 pCi
- b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at <http://www.sgs.com/en/terms-and-conditions>. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full.

CLIENT DETAILS

Contact Darcy Simpson
 Client GOLDER ASSOCIATES PTY LTD
 Address PO BOX 5823
 216 DRAPER ST
 CAIRNS QLD 4870

Telephone 07 4054 8200
 Facsimile 07 4054 8201
 Email dasimpson@golder.com.au

Project **1546223 Cairns**
 Order Number **Q003390**
 Samples 10

LABORATORY DETAILS

Manager Jon Dicker
 Laboratory SGS Cairns Environmental
 Address Unit 2, 58 Comport St
 Portsmith QLD 4870

Telephone +61 07 4035 5111
 Facsimile +61 07 4035 5122
 Email AU.Environmental.Cairns@sgs.com

SGS Reference **CE122589 R0**
 Date Received 19 Aug 2016
 Date Reported 25 Aug 2016

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(3146)

SIGNATORIES



Anthony Nilsson
 Operations Manager



Jon Dicker
 Manager Northern QLD

Parameter	Units	LOR	CE122589.001	CE122589.002	CE122589.003	CE122589.004
Sample Number			CE122589.001	CE122589.002	CE122589.003	CE122589.004
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			18 Aug 2016	18 Aug 2016	18 Aug 2016	18 Aug 2016
Sample Name			GS11_0-0.25	GS11_0.75-0.9	GS15_0-0.25	GS15_0.75-0.9

Moisture Content Method: AN002 Tested: 19/8/2016

% Moisture	%w/w	0.5	59	60	51	44

TAA (Titratable Actual Acidity) Method: AN219 Tested: 23/8/2016

pH KCl	pH Units	-	8.8	8.6	8.8	6.8
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 22/8/2016

Chromium Reducible Sulphur (Scr)	%	0.005	0.30	0.39	0.26	1.2
Chromium Reducible Sulphur (Scr)	moles H+/T	5	188	242	165	762

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 24/8/2016

Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	7.9	8.5	9.9	0.3
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	78	83	97	2.6
ANC as % CaCO ₃	% CaCO ₃	0.1	7.9	8.5	9.9	0.3
Lime Equivalence	% CaCO ₃	0.1	7.9	8.5	9.9	0.3

Parameter	Units	LOR	CE122589.005	CE122589.006	CE122589.007	CE122589.008
Sample Number			CE122589.005	CE122589.006	CE122589.007	CE122589.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			18 Aug 2016	18 Aug 2016	18 Aug 2016	18 Aug 2016
Sample Name			GS14_0-0.25	GS14_0.75-0.9	GS17_0-0.25	GS17_0.75-0.9

Moisture Content Method: AN002 Tested: 19/8/2016

% Moisture	%w/w	0.5	53	53	50	22

TAA (Titratable Actual Acidity) Method: AN219 Tested: 23/8/2016

pH KCl	pH Units	-	8.8	8.8	8.9	9.1
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 22/8/2016

Chromium Reducible Sulphur (Scr)	%	0.005	0.26	0.26	0.21	<0.005
Chromium Reducible Sulphur (Scr)	moles H+/T	5	160	163	133	<5

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 24/8/2016

Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	9.5	9.9	11	3.4
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	9.5	9.9	11	3.4
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	93	97	110	33
ANC as % CaCO ₃	% CaCO ₃	0.1	9.5	9.9	11	3.4
Lime Equivalence	% CaCO ₃	0.1	9.5	9.9	11	3.4

Sample Number	CE122589.009	CE122589.010
Sample Matrix	Soil	Soil
Sample Date	18 Aug 2016	18 Aug 2016
Sample Name	GS16_0-0.25	GS16_0.75-0.9

Parameter	Units	LOR		
Moisture Content Method: AN002 Tested: 19/8/2016				
% Moisture	%w/w	0.5	54	24

TAA (Titratable Actual Acidity) Method: AN219 Tested: 23/8/2016				
pH KCl	pH Units	-	8.9	9.2
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 22/8/2016				
Chromium Reducible Sulphur (Scr)	%	0.005	0.27	<0.005
Chromium Reducible Sulphur (Scr)	moles H+/T	5	170	<5

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 24/8/2016				
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	10	12
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	100	120
ANC as % CaCO ₃	% CaCO ₃	0.1	10	12
Lime Equivalence	% CaCO ₃	0.1	10	12

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acid Neutralising Capacity (ANC) Method: ME-(AU)-[ENV]AN214

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	LB038905	% CaCO ₃	0.1	<0.1	2%	99%
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	LB038905	kg H ₂ SO ₄ /T	0.1	<0.1	2%	NA
ANC as % CaCO ₃	LB038905	% CaCO ₃	0.1	<0.1	2%	NA
Lime Equivalence	LB038905	% CaCO ₃	0.1	<0.1		

Chromium Reducible Sulphur (CRS) Method: ME-(AU)-[ENV]AN217

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chromium Reducible Sulphur (Scr)	LB038856	%	0.005	<0.005	3%	87%
Chromium Reducible Sulphur (Scr)	LB038856	moles H+/T	5	<5		

TAA (Titratable Actual Acidity) Method: ME-(AU)-[ENV]AN219

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH KCl	LB038864	pH Units	-	5.8	0%	98%
Titratable Actual Acidity	LB038864	kg H ₂ SO ₄ /T	0.25	<0.25	0%	NA
Titratable Actual Acidity (TAA) moles H+/tonne	LB038864	moles H+/T	5	<5	0%	92%
Titratable Actual Acidity (TAA) S%w/w	LB038864	%w/w S	0.01	<0.01	0%	92%

METHOD

METHODOLOGY SUMMARY

AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN214	Acid Neutralising Capacity (ANC) or Neutralising Value (NV): The crushed or as received sample is reacted with excess normal acid (HCl) and then back titrated with standard sodium hydroxide to determine the acid consumed. The result is expressed as kg H ₂ SO ₄ /tonne or %CaCO ₃ . Based on AS4969-13.
AN217	Dried pulped sample is mixed with acid and chromium metal in a rapid distillation unit to produce hydrogen sulfide (H ₂ S) which is collected and titrated with iodine (I ₂ (aq)) to measure SCR.
AN219	Dried pulped sample is extracted for 4 hours in a 1 M KCl solution. The ratio of sample to solution is 1:40. The extract is titrated for acidity. Calcium, magnesium, and sulfur are determined by ICP-AES.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
		-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- a. 1 Bq is equivalent to 27 pCi
- b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at <http://www.sgs.com/en/terms-and-conditions>. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full.

CLIENT DETAILS

Contact Darcy Simpson
 Client GOLDER ASSOCIATES PTY LTD
 Address PO BOX 5823
 216 DRAPER ST
 CAIRNS QLD 4870

Telephone 07 4054 8200
 Facsimile 07 4054 8201
 Email dasimpson@golder.com.au

Project **1546223 Cairns**
 Order Number **Q003390**
 Samples 10

LABORATORY DETAILS

Manager Jon Dicker
 Laboratory SGS Cairns Environmental
 Address Unit 2, 58 Comport St
 Portsmith QLD 4870

Telephone +61 07 4035 5111
 Facsimile +61 07 4035 5122
 Email AU.Environmental.Cairns@sgs.com

SGS Reference **CE122602 R0**
 Date Received 22 Aug 2016
 Date Reported 25 Aug 2016

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(3146)

SIGNATORIES

Anthony Nilsson
 Operations Manager

Jon Dicker
 Manager Northern QLD

Parameter	Units	LOR	CE122602.001	CE122602.002	CE122602.003	CE122602.004
Sample Number			CE122602.001	CE122602.002	CE122602.003	CE122602.004
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			19 Aug 2016	19 Aug 2016	19 Aug 2016	19 Aug 2016
Sample Name			GS1_0-0.25	GS1_0.75-0.9	GS3_0-0.25	GS3_0.5-0.6

Moisture Content Method: AN002 Tested: 22/8/2016

Parameter	Units	LOR	CE122602.001	CE122602.002	CE122602.003	CE122602.004
% Moisture	%w/w	0.5	30	47	40	27

TAA (Titratable Actual Acidity) Method: AN219 Tested: 24/8/2016

Parameter	Units	LOR	CE122602.001	CE122602.002	CE122602.003	CE122602.004
pH KCl	pH Units	-	9.0	8.8	8.7	8.5
Titratable Actual Acidity	kg H ₂ SO ₄ /T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 24/8/2016

Parameter	Units	LOR	CE122602.001	CE122602.002	CE122602.003	CE122602.004
Chromium Reducible Sulphur (Scr)	%	0.005	0.28	0.87	0.77	0.73
Chromium Reducible Sulphur (Scr)	moles H+/T	5	180	540	480	450

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 24/8/2016

Parameter	Units	LOR	CE122602.001	CE122602.002	CE122602.003	CE122602.004
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	6.6	6.6	7.4	3.2
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	65	65	73	31
ANC as % CaCO ₃	% CaCO ₃	0.1	6.6	6.6	7.4	3.2
Lime Equivalence	% CaCO ₃	0.1	6.6	6.6	7.4	3.2

Parameter	Units	LOR	CE122602.005	CE122602.006	CE122602.007	CE122602.008
Sample Number			CE122602.005	CE122602.006	CE122602.007	CE122602.008
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			19 Aug 2016	19 Aug 2016	19 Aug 2016	19 Aug 2016
Sample Name			GS6_0-0.25	GS6_0.25-0.5	GS9_0-0.25	GS9_0.5-0.75

Moisture Content Method: AN002 Tested: 22/8/2016

% Moisture	%w/w	0.5	41	41	47	42

TAA (Titratable Actual Acidity) Method: AN219 Tested: 24/8/2016

pH KCl	pH Units	-	7.0	7.4	8.9	9.4
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 24/8/2016

Chromium Reducible Sulphur (Scr)	%	0.005	1.3	1.1	0.41	0.19
Chromium Reducible Sulphur (Scr)	moles H+/T	5	790	660	260	120

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 24/8/2016

Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	1.0	0.9	11	11
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	10	8.8	110	110
ANC as % CaCO ₃	% CaCO ₃	0.1	1.0	0.9	11	11
Lime Equivalence	% CaCO ₃	0.1	1.0	0.9	11	11

	Sample Number	CE122602.009	CE122602.010
	Sample Matrix	Soil	Soil
	Sample Date	19 Aug 2016	19 Aug 2016
	Sample Name	GS4_0-0.4	GS4_0.4-0.5
Parameter	Units	LOR	

Moisture Content Method: AN002 Tested: 22/8/2016

% Moisture	%w/w	0.5	14	16
------------	------	-----	-----------	-----------

TAA (Titratable Actual Acidity) Method: AN219 Tested: 24/8/2016

pH KCl	pH Units	-	9.6	9.6
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	<0.01	<0.01

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 24/8/2016

Chromium Reducible Sulphur (Scr)	%	0.005	0.10	0.30
Chromium Reducible Sulphur (Scr)	moles H+/T	5	62	190

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 24/8/2016

Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	9.9	10
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	98	100
ANC as % CaCO ₃	% CaCO ₃	0.1	9.9	10
Lime Equivalence	% CaCO ₃	0.1	9.9	10

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acid Neutralising Capacity (ANC) Method: ME-(AU)-[ENV]AN214

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	LB038913	% CaCO ₃	0.1	<0.1	1 - 2%	99%
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	LB038913	kg H ₂ SO ₄ /T	0.1	<0.1	1 - 2%	NA
ANC as % CaCO ₃	LB038913	% CaCO ₃	0.1	<0.1	1 - 2%	NA
Lime Equivalence	LB038913	% CaCO ₃	0.1	<0.1		

Chromium Reducible Sulphur (CRS) Method: ME-(AU)-[ENV]AN217

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chromium Reducible Sulphur (Scr)	LB038907	%	0.005	<0.005	3 - 7%	88%
Chromium Reducible Sulphur (Scr)	LB038907	moles H+/T	5	<5		

TAA (Titratable Actual Acidity) Method: ME-(AU)-[ENV]AN219

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH KCl	LB038906	pH Units	-	5.8	0 - 1%	101%
Titratable Actual Acidity	LB038906	kg H ₂ SO ₄ /T	0.25	<0.25	0%	NA
Titratable Actual Acidity (TAA) moles H+/tonne	LB038906	moles H+/T	5	<5	0%	92%
Titratable Actual Acidity (TAA) S%w/w	LB038906	%w/w S	0.01	<0.01	0%	92%

METHOD

METHODOLOGY SUMMARY

AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN214	Acid Neutralising Capacity (ANC) or Neutralising Value (NV): The crushed or as received sample is reacted with excess normal acid (HCl) and then back titrated with standard sodium hydroxide to determine the acid consumed. The result is expressed as kg H ₂ SO ₄ /tonne or %CaCO ₃ . Based on AS4969-13.
AN217	Dried pulped sample is mixed with acid and chromium metal in a rapid distillation unit to produce hydrogen sulfide (H ₂ S) which is collected and titrated with iodine (I ₂ (aq)) to measure SCR.
AN219	Dried pulped sample is extracted for 4 hours in a 1 M KCl solution. The ratio of sample to solution is 1:40. The extract is titrated for acidity. Calcium, magnesium, and sulfur are determined by ICP-AES.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
		-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- a. 1 Bq is equivalent to 27 pCi
- b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at <http://www.sgs.com/en/terms-and-conditions>. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full.

CLIENT DETAILS

Contact Darcy Simpson
 Client GOLDER ASSOCIATES PTY LTD
 Address PO BOX 5823
 216 DRAPER ST
 CAIRNS QLD 4870

Telephone 07 4054 8200
 Facsimile 07 4054 8201
 Email dasimpson@golder.com.au

Project **1546223 Cairns**
 Order Number **Q003390**
 Samples 4

LABORATORY DETAILS

Manager Jon Dicker
 Laboratory SGS Cairns Environmental
 Address Unit 2, 58 Comport St
 Portsmith QLD 4870

Telephone +61 07 4035 5111
 Facsimile +61 07 4035 5122
 Email AU.Environmental.Cairns@sgs.com

SGS Reference **CE122625 R0**
 Date Received 23 Aug 2016
 Date Reported 25 Aug 2016

COMMENTS

Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(3146)

SIGNATORIES

Anthony Nilsson
 Operations Manager

Jon Dicker
 Manager Northern QLD

Parameter	Units	LOR	CE122625.001	CE122625.002	CE122625.003	CE122625.004
Sample Number			CE122625.001	CE122625.002	CE122625.003	CE122625.004
Sample Matrix			Soil	Soil	Soil	Soil
Sample Date			22 Aug 2016	22 Aug 2016	22 Aug 2016	22 Aug 2016
Sample Name			GS21_0.25-0.5	GS22_0.5-0.75	GS22_1.4-1.65	GS22_2.5-2.75

Moisture Content Method: AN002 Tested: 23/8/2016

Parameter	Units	LOR	CE122625.001	CE122625.002	CE122625.003	CE122625.004
% Moisture	%w/w	0.5	26	36	35	38

TAA (Titratable Actual Acidity) Method: AN219 Tested: 24/8/2016

Parameter	Units	LOR	CE122625.001	CE122625.002	CE122625.003	CE122625.004
pH KCl	pH Units	-	9.6	9.2	9.3	9.2
Titratable Actual Acidity	kg H2SO4/T	0.25	<0.25	<0.25	<0.25	<0.25
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	<5	<5	<5	<5
Titratable Actual Acidity (TAA) S%/w	%w/w S	0.01	<0.01	<0.01	<0.01	<0.01
Sulphur (SKCl)	%w/w	0.005	-	-	-	-

Chromium Reducible Sulphur (CRS) Method: AN217 Tested: 24/8/2016

Parameter	Units	LOR	CE122625.001	CE122625.002	CE122625.003	CE122625.004
Chromium Reducible Sulphur (Scr)	%	0.005	0.082	0.51	0.38	0.41
Chromium Reducible Sulphur (Scr)	moles H+/T	5	51	320	230	260

Acid Neutralising Capacity (ANC) Method: AN214 Tested: 24/8/2016

Parameter	Units	LOR	CE122625.001	CE122625.002	CE122625.003	CE122625.004
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	% CaCO ₃	0.1	11	11	11	12
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	kg H ₂ SO ₄ /T	0.1	110	110	110	120
ANC as % CaCO ₃	% CaCO ₃	0.1	11	11	11	12
Lime Equivalence	% CaCO ₃	0.1	11	11	11	12

MB blank results are compared to the Limit of Reporting
 LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
 DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage*. Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

Acid Neutralising Capacity (ANC) Method: ME-(AU)-[ENV]AN214

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Acid Neutralisation Capacity (ANCBT) as % CaCO ₃	LB038913	% CaCO ₃	0.1	<0.1	1 - 2%	99%
Acid Neutralisation Capacity (ANCBT) as kg H ₂ SO ₄ /t	LB038913	kg H ₂ SO ₄ /T	0.1	<0.1	1 - 2%	NA
ANC as % CaCO ₃	LB038913	% CaCO ₃	0.1	<0.1	1 - 2%	NA
Lime Equivalence	LB038913	% CaCO ₃	0.1	<0.1		

Chromium Reducible Sulphur (CRS) Method: ME-(AU)-[ENV]AN217

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Chromium Reducible Sulphur (Scr)	LB038907	%	0.005	<0.005	3 - 7%	88%
Chromium Reducible Sulphur (Scr)	LB038907	moles H+/T	5	<5		

TAA (Titratable Actual Acidity) Method: ME-(AU)-[ENV]AN219

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH KCl	LB038906	pH Units	-	5.8	0 - 1%	101%
Titratable Actual Acidity	LB038906	kg H ₂ SO ₄ /T	0.25	<0.25	0%	NA
Titratable Actual Acidity (TAA) moles H+/tonne	LB038906	moles H+/T	5	<5	0%	92%
Titratable Actual Acidity (TAA) S%w/w	LB038906	%w/w S	0.01	<0.01	0%	92%

METHOD

METHODOLOGY SUMMARY

AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN214	Acid Neutralising Capacity (ANC) or Neutralising Value (NV): The crushed or as received sample is reacted with excess normal acid (HCl) and then back titrated with standard sodium hydroxide to determine the acid consumed. The result is expressed as kg H ₂ SO ₄ /tonne or %CaCO ₃ . Based on AS4969-13.
AN217	Dried pulped sample is mixed with acid and chromium metal in a rapid distillation unit to produce hydrogen sulfide (H ₂ S) which is collected and titrated with iodine (I ₂ (aq)) to measure SCR.
AN219	Dried pulped sample is extracted for 4 hours in a 1 M KCl solution. The ratio of sample to solution is 1:40. The extract is titrated for acidity. Calcium, magnesium, and sulfur are determined by ICP-AES.

FOOTNOTES

IS	Insufficient sample for analysis.	LOR	Limit of Reporting
LNR	Sample listed, but not received.	↑↓	Raised or Lowered Limit of Reporting
*	NATA accreditation does not cover the performance of this service.	QFH	QC result is above the upper tolerance
**	Indicative data, theoretical holding time exceeded.	QFL	QC result is below the lower tolerance
		-	The sample was not analysed for this analyte
		NVL	Not Validated

Samples analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the "Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.

Note that in terms of units of radioactivity:

- a. 1 Bq is equivalent to 27 pCi
- b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here : <http://www.sgs.com.au/~media/Local/Australia/Documents/Technical%20Documents/MP-AU-ENV-QU-022%20QA%20QC%20Plan.pdf>

This document is issued, on the Client's behalf, by the Company under its General Conditions of Service available on request and accessible at <http://www.sgs.com/en/terms-and-conditions>. The Client's attention is drawn to the limitation of liability, indemnification and jurisdiction issues defined therein.

Any other holder of this document is advised that information contained hereon reflects the Company's findings at the time of its intervention only and within the limits of Client's instructions, if any. The Company's sole responsibility is to its Client and this document does not exonerate parties to a transaction from exercising all their rights and obligations under the transaction documents.

This report must not be reproduced, except in full.



APPENDIX D

Important information relating to this report



IMPORTANT INFORMATION RELATING TO THIS REPORT

The document (“Report”) to which this page is attached and which this page forms a part of, has been issued by Golder Associates Pty Ltd (“Golder”) subject to the important limitations and other qualifications set out below.

This Report constitutes or is part of services (“Services”) provided by Golder to its client (“Client”) under and subject to a contract between Golder and its Client (“Contract”). The contents of this page are not intended to and do not alter Golder’s obligations (including any limits on those obligations) to its Client under the Contract.

This Report is provided for use solely by Golder’s Client and persons acting on the Client’s behalf, such as its professional advisers. Golder is responsible only to its Client for this Report. Golder has no responsibility to any other person who relies or makes decisions based upon this Report or who makes any other use of this Report. Golder accepts no responsibility for any loss or damage suffered by any person other than its Client as a result of any reliance upon any part of this Report, decisions made based upon this Report or any other use of it.

This Report has been prepared in the context of the circumstances and purposes referred to in, or derived from, the Contract and Golder accepts no responsibility for use of the Report, in whole or in part, in any other context or circumstance or for any other purpose.

The scope of Golder’s Services and the period of time they relate to are determined by the Contract and are subject to restrictions and limitations set out in the Contract. If a service or other work is not expressly referred to in this Report, do not assume that it has been provided or performed. If a matter is not addressed in this Report, do not assume that any determination has been made by Golder in regards to it.

At any location relevant to the Services conditions may exist which were not detected by Golder, in particular due to the specific scope of the investigation Golder has been engaged to undertake. Conditions can only be verified at the exact location of any tests undertaken. Variations in conditions may occur between tested locations and there may be conditions which have not been revealed by the investigation and which have not therefore been taken into account in this Report.

Golder accepts no responsibility for and makes no representation as to the accuracy or completeness of the information provided to it by or on behalf of the Client or sourced from any third party. Golder has assumed that such information is correct unless otherwise stated and no responsibility is accepted by Golder for incomplete or inaccurate data supplied by its Client or any other person for whom Golder is not responsible. Golder has not taken account of matters that may have existed when the Report was prepared but which were only later disclosed to Golder.

Having regard to the matters referred to in the previous paragraphs on this page in particular, carrying out the Services has allowed Golder to form no more than an opinion as to the actual conditions at any relevant location. That opinion is necessarily constrained by the extent of the information collected by Golder or otherwise made available to Golder. Further, the passage of time may affect the accuracy, applicability or usefulness of the opinions, assessments or other information in this Report. This Report is based upon the information and other circumstances that existed and were known to Golder when the Services were performed and this Report was prepared. Golder has not considered the effect of any possible future developments including physical changes to any relevant location or changes to any laws or regulations relevant to such location.

Where permitted by the Contract, Golder may have retained subconsultants affiliated with Golder to provide some or all of the Services. However, it is Golder which remains solely responsible for the Services and there is no legal recourse against any of Golder’s affiliated companies or the employees, officers or directors of any of them.

By date, or revision, the Report supersedes any prior report or other document issued by Golder dealing with any matter that is addressed in the Report.

Any uncertainty as to the extent to which this Report can be used or relied upon in any respect should be referred to Golder for clarification.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and related areas of energy. Employee owned since our formation in 1960, our focus, unique culture and operating environment offer opportunities and the freedom to excel, which attracts the leading specialists in our fields. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

Africa	+ 27 11 254 4800
Asia	+ 86 21 6258 5522
Australasia	+ 61 3 8862 3500
Europe	+ 356 21 42 30 20
North America	+ 1 800 275 3281
South America	+ 55 21 3095 9500

solutions@golder.com
www.golder.com

Golder Associates Pty Ltd
216 Draper Street
Cairns, Queensland 4870
Australia
T: +61 7 4054 8200

