APPENDIX 10: CHARACTERISATION OF MINE WASTE – TRILOGY DEPOSIT - GRAEME CAMPBELL & ASSOCIATES (2010)

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SUBJECT:	Phillips River Project: Mine-Waste-Characterisation Study (Trilogy Deposit) - Implications for Mine-Waste Management

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The testwork results obtained in this study are presented in Tables 1-8, and shown on Figures 1-4.

Details of the sampling programme are presented in Attachment I, together with generic information on waste-zone geology for the proposed Trilogy Pit.

Details of the static-testwork methods employed are presented in Attachment II, and criteria for classifying the Acid-Formation Potential (AFP) of the waste-regolith and waste-bedrock samples are summarised in Attachment III. Copies of the laboratory reports are presented in Attachment IV.

The testwork outcomes obtained in this study are presented and discussed in the following, and implications for mine-waste management highlighted.

1.0 TESTWORK OUTCOMES FOR WASTE-REGOLITH SAMPLES

1.1 Acid-Forming Characteristics

1.1.1 Sulphur Occurrences

In all samples, but two, the Total-S occurred almost exclusively as SO_4-S (viz. Sulphide-S values less than 0.1 %) [Table 1].

In samples GCA8536 (High-Silica-[Pb/Cu]), and GCA8539 (Moderate-Silica), the majority of the Total-S values of 0.95 % and 0.74 %, respectively, occurred as SO_4-S. However, the Sulphide-S values for these samples were within the range 0.14-0.30 %, as inferred from the difference between the respective Total-S and SO_4-S values.[1] Samples GCA8536 and GCA8539 were tested for Cr(II)-Reducible-S by SGS (Cairns), and in fact had Sulphide-S values less than 0.01 %.

Although only a limited number of samples were tested, the indications are that, within the waste-regolith profile, Total-S values up to at least *c.* 0.2-0.3 % correspond, essentially, to SO_4-S only (i.e. negligible Sulphide-S). This interpretation should be confirmed (or refined) through testing additional samples.

1.1.2 Groundmass Acid-Consumption

The Acid-Neutralisation-Capacity (ANC) values ranged from -2 kg H_2SO_4/tonne, to 99 kg H_2SO_4/tonne (Table 1). The negative-ANC values reflect the acidic state of some samples. Samples GCA8534 and GCA8539 (both High-Silica-[Pb/Cu]) had CO_3-C values of 0.97 % and 0.59 %, respectively. However, the CO_3-C likely occurs almost exclusively as Fe-rich-carbonates (e.g. siderites), as indicated by the pH-buffering curves for these samples when subjected to autotitration (Figure 1).

In terms of circum-neutral-buffering capacity, the groundmass of the waste-regolith samples is aptly described as a "gutless-groundmass".

1.1.3 Acid-Formation Potential (AFP)

All samples, but two, are classified as Non-Acid Forming (NAF), and reflects the paucity of sulphide-minerals. However, the "NAF-samples" GCA8531 and GCA8533 (both High-Silica) are acidic.

1.2 Bio-geochemistry of Enriched Minor-Elements

1.2.1 Stability of Bound Forms: Release to Solution at Natural-pH

The total contents of a range of major/minor-elements pertinent to Trilogy mineralisation are presented in Table 2.

The results of the Water-Extraction testwork (Table 3) show that the samples of the High-Silica and Laminated-Graphitic-Siltstone (LG-Siltstone) units consistently had contents of Weakly-Bound-Zn forms within the multi-mg/kg range. In the Leaching-Column testwork these samples had Leachate-Zn concentrations ranging up to 80,000-90,000 µg/L in Leaching-Cycle-1 (Table 4).[2] A marked drop-off in Leachate-Zn concentrations occurred in subsequent leaching-cycles.

Consistent with the results from the Water-Extraction testwork, release of Mn to solution was second to Zn with Leachate-Mn concentrations ranging up to 40,000-50,000 µg/L in Leaching-Cycle-1 (viz. High-S variant of LG-Siltstone).

Combined, the Water-Extraction and Leaching-Column testwork indicate that the <u>High-Silica-[Pb/Cu] and Moderate-Silicate samples with Total-S values less than 0.3 %</u> had

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[1] The SO_4-S values of these samples were determined by both the Na_2CO_3-Extraction and HCl-Extraction Methods (see Attachment II).

[2] Each (Saturated)-Leaching-Column contained 2.00 kg of dry-solids, and in each leaching-cycle was flushed with 1.00 kg of deionised-water. Between leaching-cycles the sample-beds in the Leaching-Columns remained near-saturation. Four (4) leaching-cycles were completed, since by this stage of leaching, the Leachate-EC values were less than 200-300 µS/cm. [EC = Electrical-Conductivity].

the lowest contents of weakly-bound-minor-element forms (e.g. leachate-element concentrations were typically well within the sub-mg/L range).

1.2.1 Stability of Bound Forms: Potential Bio-Available "Pools"

Extraction at pH=6 with the Na_2-EDTA reagent provides only a broad approximation to the "pools" of minor-elements potentially available to biota. Nonetheless, the outcomes of this testing (Table 5) indicate that all samples have "pools" of Zn, Mn, Pb, and Cu ranging up to 'of-the-order' 100-1,000 mg/kg that may be available for uptake by biota via sequestration (e.g. chelation from exudation of complexing organic ligands by plant-roots).

The "pools" of potentially bio-available forms of Zn, Mn, Pb, and Cu in the above High-Silica-[Pb/Cu] and Moderate-Silicate samples with Total-S values less than 0.3 % were 'of-the-order' 10-100 mg/kg. The indicative magnitude of these "pools" therefore exceeds greatly that for water-extraction (i.e. typically less than 1 mg/kg).

2.0 TESTWORK OUTCOMES FOR WASTE-BEDROCK SAMPLES

2.1 Acid-Forming Characteristics

2.1.1 Sulphur Occurrences

The recorded Total-S values match the Target-Total-S groupings of 0.1-0.2 %, 0.2-0.4 %, and 0.4-0.6 % fairly closely (Table 6). Discrepancies between "observed" and "target" values reflect variations from sub-sampling – of both the drilling-intervals when the bulk samples (of several kgs) were collected, and the collection of sub-samples for testing herein.[3]

Samples GCA8543 and GCA8544 (Moderate-Silica), and GCA8546 (LG-Siltstone), contained negligible amounts of sulphide-minerals (viz. Sulphide-S values less than 0.1 %).

2.1.2 Groundmass Acid-Consumption

The ANC values ranged from -2 kg H_2SO_4/tonne, to 3 kg H_2SO_4/tonne (Table 6).

In terms of circum-neutral-buffering capacity, the groundmass of the waste-bedrock samples is aptly described as a "gutless-groundmass". This description also applies to the waste-regolith samples above.

2.1.3 Acid-Formation Potential

Samples GCA8543 (Moderate-Silica) and GCA8546 (LG-Siltstone), and GCA8544 (Moderate-Silica) are classified as NAF, due to negligible sulphide-minerals.

Samples GCA8547 and GCA8548 (both LG-Siltstone), and GCA8545 (Moderate-Silica), are classified as PAF.

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[3] In this study, the as-submitted chips of drillcore were spread-out in a tray for each sample, and after hand-mixing to homogenise, small sub-samples were randomly taken before combining into a 1 kg 'split' for assaying. A similar approach was adopted when packing the Weathering-Columns with 2.00 kgs of the rock-chips.

2.2 Major/Minor-Element Contents

The total contents of a range of major/minor-elements pertinent to Trilogy mineralisation are presented in Table 7.

Compared with the corresponding waste-regolith samples, enrichments in Pb and Cu, in particular, are appreciably less for the waste-bedrock samples. Since samples GCA8545 (Moderate-Silica) and GCA8548 (LG-Siltstone) had Sulphide-S values of *c.* 0.5 %, and since these samples have Zn, Pb and Cu contents each less than *c.* 0.05 %, base-metal-sulphides make-up a small proportion of the sulphide-mineral suite overall.

2.3 Sulphide-Mineral Reactivity and Weathering-Solubility Behaviour

2.3.1 Sulphide-Oxidation Rates (SORs)

The variation in the SORs for the PAF-waste-bedrock samples above (viz. GCA8547, GCA8548, and GCA8545) is shown on Figure 2.

The ranking of the SORs broadly confirms to the sulphide-mineral abundances (viz. slowest SOR recorded for sample GCA8547 with the lowest Sulphide-S value). A swift decrease in the SORs over the first few weathering-cycles is evident for all samples. Steady-SORs were seemingly established over the last few weathering-cycles. However, leachates generated in subsequent weathering-cycles would need to be analysed in order to confirm (or refine) this interpretation.

The Leachate-pH values for the PAF-waste-bedrock samples were *c.* 4-5 (Table 8). Given this weathering-pH regime, and given the Sulphide-S values of *c.* 0.3-0.6 %, the SORs of *c.* 20-40 mg SO_4/kg/week observed during the last few weathering-cycles indicate that the "trace-sulphides" are not atypically reactive (c.f. the hyper-reactivity shown by framboidal-pyrite even when present as only a trace component) [Campbell, unpublished results].

In terms of gauging the indicative spatial-scales over which sulphide-oxidation may occur, diffusion-based calculations indicate that, at steady-SORs that are *c.* 'of-the-order' 10 mg SO_4/kg/week, the O_2-diffusion-front (= "Oxidation-Front") may penetrate to a depth of *c.* 10 m. Although approximate, this places active sulphide-oxidation into a depth-perspective for exposed PAF-waste-bedrocks (with "trace-sulphides"), and a free-draining profile where the relative-saturation is well short of *c.* 80-85 %. Given the Mediterranean climate of the mine-site, the "Weathering-Window" for such sulphide-oxidation would be largely restricted to the winter/spring months when there is regular flushing of mineral-surfaces to multi-metre depths.

2.3.2 Minor-Element Solubility

In terms of minor-element solubility, Leachate-Cu, -Zn and -Mn concentrations were variously in excess of 10,000 µg/L for the PAF-waste-bedrock samples (Table 8).

The NAF-waste-bedrock samples (viz. GCA8543, GCA8544, and GCA8546) typically had Leachate-Cu, -Zn and -Mn concentrations less than a few hundred µg/L. However, equally, these samples had Sulphide-S values less than 0.1 % (Table 6).

3.0 MANAGEMENT IMPLICATIONS

As anticipated during the planning stage of this study, the geology of the country rocks (viz. dearth of carbonate-minerals in a highly-siliceous groundmass), and the nature of Trilogy mineralisation, mean that the Project will need to manage a range of waste-regolith and waste-bedrock streams which are "reactive" geochemically.

The reactive nature of specific mine-waste streams variously arises from:

(a) acidification of waste-bedrocks through sulphide-oxidation;

(b) leaching of soluble-metal forms (e.g. Zn and Mn) from waste-regoliths with a suppressed "natural-pH" (e.g. 4-5), due to alteration *in situ*; and,

(c) potential bio-availability of minor-elements (e.g. Cu and Pb) in waste-regoliths that are circum-neutral, and with a restricted water-solubility (i.e. modest leaching by rainfall alone).

Although the above geochemical model of the waste-zone for the Trilogy Pit is to be viewed as preliminary, it is clear that a sizeable proportion of the waste-regolith and waste-bedrock streams will need to reside "at-depth" within the waste-landform-profile at closure. It then remains to identify what lithotype(s) are preferable for placing in the Surface-Zone of the waste-landform, and to what thickness range.

Based on the findings of this study, the High-Silica-waste-regolith unit with a Total-S less than *c.* 0.2-0.3 % should be suitable for placement in the Surface-Zone. The Moderate-Silica- and LG-Siltstone-waste-bedrock units with Total-S values less than *c.* 0.1-0.2 % should also be suitable for Surface-Zone construction. In using these lithotypes in this way it is implicit that they possess "pools" of minor-elements (e.g. Zn and Mn) that are variously bio-available. The implications for constructing the Surface-Zone from the above lithotypes requires further thought and assessment in terms of quantities of the units, schedules, physical stability, form of revegetated ground-surface, and final land-use.[4]

This study has shown that my initial (June 2009) estimate of a Total-S value of 0.2 % to distinguish between reactive- and benign-lithotypes (see Attachment I) is invalid for the waste-regoliths, due to the potential bio-availability of minor-elements. In the case of the waste-bedrocks, the present results support a Total-S "cut-off" of 0.1 %.[5]

4.0 CLOSURE

I trust the above is useful to your current needs.

Regards,

Dr GD Campbell
Director

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[4] The LG-Siltstone-waste-bedrock is expected to be appreciably fissile, and so potentially prone to erosion, etc.

[5] The LG-Siltstone-waste-bedrock sample (GCA8547) with a Total-S value of 0.32 % (chiefly as Sulphide-S), was a strong source of Soluble-Zn and Soluble-Mn forms during the weathering-testwork (Table 8).

TABLES

Table 1: Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Waste-regolith Samples

GCA-SAMPLE NO.	SITE-SAMPLE NO.	LITHOTYPE	pH-(1:2)	EC-(1:2) [mS/cm]	TOTAL-S (%)	SO_4-S (%)	SULPHIDE-S (%)	TOTAL-C (%)	CO_3-C (%)	ANC	NAPP	NAG	NAG-pH	AFP CATEGORY
										kg H_2SO_4/tonne				
Target-Total-S = 0.1-0.2 %														
GCA8531	TTROX-12	High-Silica	6.9	0.13	0.05 (0.05)	0.06 (0.04)	0.01	0.14 (0.15)	0.02 (0.02)	-1 (-1)	nc	0.7	5.3	NAF
GCA8534	TTROX-9	High-Silica-[Pb/Cu]	7.1	0.70	0.14	0.14	<0.01	1.6	0.97	99	nc	<0.5	6.1	NAF
GCA8537	TTROX-4	Moderate-Silica	7.2	0.28	0.05	0.06	<0.01	0.14	0.01	<1	nc	0.7	6.6	NAF
GCA8540	TTROX-2	LG-Siltstone	4.8	1.7	0.11	0.11	<0.01	0.10	0.03	-1	nc	<0.5	5.8	NAF
Target-Total-S = 0.2-0.4 %														
GCA8532	TTROX-5	High-Silica	5.1	0.37	0.16	0.15	0.01	0.46	0.15	-2	nc	0.7	5.3	NAF
GCA8535	TTROX-8	High-Silica-[Pb/Cu]	6.9	1.6	0.29	0.22	0.07	0.62	0.28	5	nc	<0.5	6.2	NAF
GCA8538	TTROX-1	Moderate-Silica	6.6	1.3	0.15	0.11 (0.18)	<0.01 (0.04)	0.10	0.03	<1	nc	<0.5	6.4	NAF
GCA8541	TTROX-10	LG-Siltstone	5.2 (5.2)	1.1 (1.0)	0.21	0.20	0.01	0.12	0.06	-2	nc	0.7	5.7	NAF
Target-Total-S = 0.4-0.6 %														
GCA8533	TTROX-6	High-Silica	3.8	0.71	0.65	0.62	0.03	0.22	0.10	-2	nc	1.7	4.3	NAF
GCA8536	TTROX-7	High-Silica-[Pb/Cu]	7.1	0.88	0.95	0.60 (0.72)	0.23-0.30	1.1	0.59	27	-17	<0.5	6.2	**PAF**
GCA8539	TTROX-13	Moderate-Silica	6.0	1.6	0.74	0.56 (0.60)	0.14-0.18	0.12	0.05	-2	7.6	0.7	5.8	**PAF**
GCA8542	TTROX-3	LG-Siltstone	5.6	1.9	0.49	0.49	<0.01	0.07	0.02	-1	nc	<0.5	5.7	NAF

Notes:
ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; AFP = Acid-Formation Potential; NAF = Non-Acid Forming; PAF = Potentially-Acid Forming;
EC = Electrical-Conductivity; nc = not calculated.
pH-(1:2) and EC-(1:2) values correspond to pH and EC measured on sample slurries prepared with deionised-water, and a solid:solution ratio of *c.* 1:2 (w/w).
All results expressed on a dry-weight basis, except for pH-(1:2), EC-(1:2), and NAG-pH.
Values in parentheses represent duplicates.

Table 2: Results of Selected-Element-Analysis Suite for Waste-regolith Samples

GCA-SAMPLE NO.	SITE-SAMPLE NO.	LITHOTYPE	Zn (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Cu (mg/kg)	As (mg/kg)	Sb (mg/kg)	Se (mg/kg)	Fe (%)	Al (%)	Mn (mg/kg)
Target-Total-S = 0.1-0.2 %												
GCA8531	TTROX-12	High-Silica	68 (43)	<0.1 (<0.1)	160 (120)	46 (44)	19 (18)	7.0 (7.2)	<2 (<2)	0.34 (0.33)	1.8 (1.8)	15 (15)
GCA8534	TTROX-9	High-Silica-[Pb/Cu]	310	0.2	1,500	860	130	12	6	1.5	4.3	30
GCA8537	TTROX-4	Moderate-Silica	28	<0.1	380	49	16	3.5	<2	0.62	8.0	220
GCA8540	TTROX-2	LG-Siltstone	56	<0.1	41	31	22	2.1	<2	2.6	9.2	65
Target-Total-S = 0.2-0.4 %												
GCA8532	TTROX-5	High-Silica	24	<0.1	190	150	39	18	3	0.68	1.2	12
GCA8535	TTROX-8	High-Silica-[Pb/Cu]	210	<0.1	1,100	560	310	17	4	1.4	6.5	95
GCA8538	TTROX-1	Moderate-Silica	34	<0.1	470	150	69	2.4	<2	2.3	5.2	670
GCA8541	TTROX-10	LG-Siltstone	43	<0.1	530	230	99	31	6	1.1	2.1	9
Target-Total-S = 0.4-0.6 %												
GCA8533	TTROX-6	High-Silica	60	<0.1	940	1,200	540	72	22	5.8	1.5	5
GCA8536	TTROX-7	High-Silica-[Pb/Cu]	270	0.1	2,400	2,400	520	17	10	2.2	7.0	150
GCA8539	TTROX-13	Moderate-Silica	160	<0.1	1,600	180	380	16	<2	3.4	7.5	80
GCA8542	TTROX-3	LG-Siltstone	41	<0.1	51	110	22	2.9	<2	2.3	7.7	770

Table 3: Water-Extractable-Metal Results for Waste-regolith Samples

Results Expressed in Terms of Water-Extractable-Metal Contents (in mg/kg-solids basis)

GCA-SAMPLE NO.	SITE-SAMPLE NO.	LITHOTYPE	pH	Cl (mg/L)	SO_4 (mg/L)	Zn (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Cu (mg/kg)	As (mg/kg)	Sb (mg/kg)	Se (mg/kg)	Fe (mg/kg)	Al (mg/kg)	Mn (mg/kg)
Target-Total-S = 0.1-0.2 %															
GCA8531	TTROX-12	High-Silica	5.5	33	22	1.4	<0.01	<0.01	0.04	<0.01	<0.01	<0.01	<0.1	<0.1	0.34
GCA8534	TTROX-9	High-Silica-[Pb/Cu]	8.8	160	34	0.02	<0.01	<0.01	0.04	0.015	<0.01	0.012	<0.1	0.20	<0.1
GCA8537	TTROX-4	Moderate-Silica	6.0	110	38	0.08	<0.01	<0.01	<0.02	<0.01	<0.01	<0.01	<0.1	<0.1	0.20
GCA8540	TTROX-2	LG-Siltstone	4.6	740	130	15	<0.01	<0.01	0.06	<0.01	<0.01	0.015	<0.1	0.24	0.64
Target-Total-S = 0.2-0.4 %															
GCA8532	TTROX-5	High-Silica	4.6	170	29	5.9	<0.01	<0.01	0.14	<0.01	<0.01	<0.01	5.0	0.20	1.5
GCA8535	TTROX-8	High-Silica-[Pb/Cu]	7.8	460	76	0.10	<0.01	<0.01	0.08	0.012	<0.01	0.018	<0.1	<0.1	<0.1
GCA8538	TTROX-1	Moderate-Silica	7.1	790	83	<0.02	<0.01	<0.01	0.02	<0.01	<0.01	0.016	<0.1	<0.1	3.3
GCA8541	TTROX-10	LG-Siltstone	5.1	280	82	7.0	<0.01	0.015	0.04	<0.01	<0.01	0.024	0.14	<0.1	0.58
Target-Total-S = 0.4-0.6 %															
GCA8533	TTROX-6	High-Silica	3.8	340	61	13	<0.01	0.040	1.3	<0.01	<0.01	0.012	5.0	9.2	0.56
GCA8536	TTROX-7	High-Silica-[Pb/Cu]	8.3	390	110	<0.02	<0.01	<0.01	0.06	<0.01	<0.01	0.029	<0.1	0.22	<0.1
GCA8539	TTROX-13	Moderate-Silica	5.0	930	180	27	<0.01	0.014	0.04	<0.01	<0.01	0.020	0.66	0.14	0.66
GCA8542	TTROX-3	LG-Siltstone	5.8	520	93	6.3	<0.01	<0.01	0.10	<0.01	<0.01	<0.01	<0.1	<0.1	25

Note:
The Water-Extraction Testwork was performed on 'crushed-splits' (nominal -2mm) using slurries prepared from deionised-water and a solid:solution ratio of *c.* 1:2 (w/w). The slurries were bottled-rolled for *c.* 1 day before being left to "still-stand" followed by decanting-off the supernatants, vacuum-filtration (0.45µm-membrane), and preservation of the water-extracts, as appropriate, for specific analyses.

Table 4: Leachate-Analysis Results for Leaching-Column Testwork on Waste-regolith Samples

Target-Total-S = 0.1-0.2 %

High-Silica

PARAMETER	**Leaching-Cycles (GCA8531)**			
	1	**2**	**3**	**4**
pH	6.7	6.1	6.2	6.1
EC (µS/cm)	2,000	99	45	32
SO_4 (mg/L)	88	21	11	8
Cl (mg/L)	160	14	4	3
Zn (µg/L)	2,500	210	200	210
Cd (µg/L)	0.33	0.59	0.10	0.03
Pb (µg/L)	0.6	1.0	1.2	1.6
Cu (µg/L)	20	90	10	<10
As (µg/L)	2.5	1.6	1.1	1.2
Sb (µg/L)	0.47	0.35	0.30	0.26
Se (µg/L)	5.0	1.8	1.1	0.6
Fe (µg/L)	<10	<10	10	20
Al (µg/L)	<10	<10	10	30
Mn (µg/L)	520	60	30	30
Leachate Wt (kg)	0.69	0.87	0.97	0.96

Note: EC = Electrical-Conductivity.

High-Silica-[Pb/Cu]

PARAMETER	**Leaching-Cycles (GCA8534)**			
	1	**2**	**3**	**4**
pH	6.5	7.8	7.9	7.8
EC (µS/cm)	2,500	390	210	160
SO_4 (mg/L)	120	24	10	7
Cl (mg/L)	710	45	9	4
Zn (µg/L)	100	30	70	40
Cd (µg/L)	0.08	0.06	0.05	0.04
Pb (µg/L)	38	2.9	16	3.3
Cu (µg/L)	40	10	<10	<10
As (µg/L)	23	15	12	8.0
Sb (µg/L)	2.5	2.7	1.9	1.4
Se (µg/L)	16	3.2	2.1	0.9
Fe (µg/L)	<10	<10	<10	<10
Al (µg/L)	40	70	70	70
Mn (µg/L)	<10	<10	<10	<10
Leachate Wt (kg)	0.60	0.88	0.96	0.96

Moderate-Silica

PARAMETER	**Leaching-Cycles (GCA8537)**			
	1	**2**	**3**	**4**
pH	6.8	6.5	6.9	7.0
EC (µS/cm)	2,300	230	83	63
SO_4 (mg/L)	180	64	30	24
Cl (mg/L)	630	27	3	<1
Zn (µg/L)	1,300	40	80	30
Cd (µg/L)	2.2	0.03	0.03	<0.02
Pb (µg/L)	2.5	<0.5	<0.5	<0.5
Cu (µg/L)	30	<10	<10	<10
As (µg/L)	4.5	3.1	1.9	0.8
Sb (µg/L)	0.31	0.24	0.29	0.26
Se (µg/L)	5.2	0.9	0.5	<0.5
Fe (µg/L)	20	<10	<10	<10
Al (µg/L)	90	<10	20	20
Mn (µg/L)	3,500	30	<10	<10
Leachate Wt (kg)	0.50	0.90	0.99	0.96

Table 4 (Cont'd): Leachate-Analysis Results for Leaching-Column Testwork on Waste-regolith Samples

Target-Total-S = 0.1-0.2 % (Cont'd)

LG-Siltstone

PARAMETER	Leaching-Cycles (GCA8540)			
	1	2	3	4
pH	5.0	5.9	5.2	5.1
EC (µS/cm)	16,000	430	120	77
SO_4 (mg/L)	800	92	38	26
Cl (mg/L)	5,100	64	7	3
Zn (µg/L)	47,000	570	380	570
Cd (µg/L)	3.3	0.04	0.04	<0.02
Pb (µg/L)	43	0.6	0.7	1.3
Cu (µg/L)	130	<10	<10	<10
As (µg/L)	18	3.3	2.2	2.2
Sb (µg/L)	0.15	0.06	0.07	0.04
Se (µg/L)	45	1.0	0.7	0.5
Fe (µg/L)	<10	10	10	<10
Al (µg/L)	2,000	<10	20	10
Mn (µg/L)	1,800	20	20	30
Leachate Wt (kg)	0.43	0.90	0.95	0.97

Target-Total-S = 0.2-0.4 %

High-Silica

PARAMETER	Leaching-Cycles (GCA8532)			
	1	2	3	4
pH	5.6	4.9	4.7	4.9
EC (µS/cm)	2,500	180	98	63
SO_4 (mg/L)	110	38	25	18
Cl (mg/L)	740	31	10	5
Zn (µg/L)	13,000	2,100	1,300	960
Cd (µg/L)	0.76	0.18	0.12	0.08
Pb (µg/L)	5.4	1.3	1.7	1.4
Cu (µg/L)	180	80	80	50
As (µg/L)	5.4	4.2	3.9	1.5
Sb (µg/L)	0.36	0.39	0.33	0.29
Se (µg/L)	9.3	1.5	1.3	<0.5
Fe (µg/L)	1,400	80	10	<10
Al (µg/L)	300	50	60	60
Mn (µg/L)	2,300	470	320	260
Leachate Wt (kg)	0.69	0.91	0.96	0.96

High-Silica-[Pb/Cu]

PARAMETER	Leaching-Cycles (GCA8535)			
	1	2	3	4
pH	5.6	7.6	7.8	7.9
EC (µS/cm)	8,200	1,400	190	130
SO4 (mg/L)	330	86	10	5
Cl (mg/L)	2,100	350	14	4
Zn (µg/L)	70	40	50	50
Cd (µg/L)	0.17	0.04	0.02	<0.02
Pb (µg/L)	0.7	<0.5	<0.5	<0.5
Cu (µg/L)	90	40	20	<10
As (µg/L)	28	26	19	15
Sb (µg/L)	7.5	18	18	22
Se (µg/L)	41	8.2	1.6	0.8
Fe (µg/L)	<10	<10	<10	<10
Al (µg/L)	60	60	60	50
Mn (µg/L)	10	<10	<10	<10
Leachate Wt (kg)	0.45	0.91	0.99	0.98

Table 4 (Cont'd): Leachate-Analysis Results for Leaching-Column Testwork on Waste-regolith Samples

Target-Total-S = 0.2-0.4 % (Cont'd)

Moderate-Silica

PARAMETER	Leaching-Cycles (GCA8538)			
	1	2	3	4
pH	7.1	7.2	7.3	7.2
EC (µS/cm)	12,000	1,000	140	54
SO_4 (mg/L)	360	45	11	6
Cl (mg/L)	4,000	280	21	3
Zn (µg/L)	80	30	50	20
Cd (µg/L)	1.3	0.05	0.02	<0.02
Pb (µg/L)	0.7	<0.5	<0.5	<0.5
Cu (µg/L)	20	<10	<10	<10
As (µg/L)	31	14	11	7.5
Sb (µg/L)	0.30	0.35	0.54	0.48
Se (µg/L)	34	3.2	1.0	<0.5
Fe (µg/L)	<10	<10	<10	<10
Al (µg/L)	50	<10	30	20
Mn (µg/L)	5,800	180	10	<10
Leachate Wt (kg)	0.50	0.89	0.95	0.95

LG-Siltstone

PARAMETER	Leaching-Cycles (GCA8541)			
	1	2	3	4
pH	6.2	5.9	5.4	5.7
EC (µS/cm)	4,900	280	110	78
SO_4 (mg/L)	310	71	38	30
Cl (mg/L)	1,400	27	4	2
Zn (µg/L)	16,000	2,700	1,500	1,200
Cd (µg/L)	1.7	0.14	0.09	0.07
Pb (µg/L)	48	2.7	2.1	2.6
Cu (µg/L)	30	10	10	<10
As (µg/L)	6.3	1.6	2.2	1.3
Sb (µg/L)	0.33	0.16	0.13	0.12
Se (µg/L)	38	9.4	6.6	4.8
Fe (µg/L)	80	<10	<10	<10
Al (µg/L)	20	<10	10	<10
Mn (µg/L)	990	260	140	100
Leachate Wt (kg)	0.55	0.83	0.96	0.97

Target-Total-S = 0.4-0.6 %

High-Silica

PARAMETER	Leaching-Cycles (GCA8533)			
	1	2	3	4
pH	4.8	3.6	3.7	3.9
EC (µS/cm)	5,000	350	220	150
SO_4 (mg/L)	190	32	37	36
Cl (mg/L)	1,300	79	31	13
Zn (µg/L)	30,000	3,300	2,300	1,800
Cd (µg/L)	1.5	0.24	0.16	0.09
Pb (µg/L)	44	14	11	7.6
Cu (µg/L)	2,100	720	640	560
As (µg/L)	8.8	4.7	5.9	4.3
Sb (µg/L)	0.43	0.11	0.09	0.08
Se (µg/L)	21	1.9	1.6	0.7
Fe (µg/L)	9,700	2,200	1,300	1,200
Al (µg/L)	13,000	4,700	3,700	3,500
Mn (µg/L)	1,300	270	180	120
Leachate Wt (kg)	0.63	0.91	0.98	0.96

Table 4 (Cont'd): Leachate-Analysis Results for Leaching-Column Testwork on Waste-regolith Samples

Target-Total-S = 0.4-0.6 % (Cont'd)

High-Silica-[Pb/Cu]

PARAMETER	Leaching-Cycles (GCA8536)			
	1	2	3	4
pH	3.7	8.0	8.3	8.2
EC (µS/cm)	5,300	1,000	370	290
SO_4 (mg/L)	460	120	17	10
Cl (mg/L)	1,600	200	29	19
Zn (µg/L)	80	40	270	30
Cd (µg/L)	0.11	0.03	0.02	<0.02
Pb (µg/L)	2.1	<0.5	<0.5	<0.5
Cu (µg/L)	50	30	20	20
As (µg/L)	15	7.6	4.4	2.9
Sb (µg/L)	1.5	1.9	1.5	1.1
Se (µg/L)	65	13	2.3	0.8
Fe (µg/L)	<10	<10	<10	<10
Al (µg/L)	100	140	200	190
Mn (µg/L)	20	<10	<10	<10
Leachate Wt (kg)	0.49	0.89	0.97	0.97

Moderate-Silica

PARAMETER	Leaching-Cycles (GCA8539)			
	1	2	3	4
pH	6.2	6.1	5.8	5.8
EC (µS/cm)	17,000	770	200	110
SO_4 (mg/L)	920	140	58	40
Cl (mg/L)	5,300	150	19	7
Zn (µg/L)	86,000	2,700	1,200	1,500
Cd (µg/L)	3.7	0.07	0.07	0.04
Pb (µg/L)	270	0.7	1.1	1.0
Cu (µg/L)	80	10	<10	<10
As (µg/L)	21	9.3	5.9	2.9
Sb (µg/L)	0.82	0.30	0.20	0.13
Se (µg/L)	53	2.6	1.3	0.5
Fe (µg/L)	440	20	50	40
Al (µg/L)	560	<10	<10	30
Mn (µg/L)	1,700	70	30	40
Leachate Wt (kg)	0.47	0.89	0.98	0.98

LG-Siltstone

PARAMETER	Leaching-Cycles (GCA8542)			
	1	2	3	4
pH	6.6	6.1	6.1	5.7
EC (µS/cm)	9,100	920	130	68
SO_4 (mg/L)	360	110	36	23
Cl (mg/L)	3,200	230	12	3
Zn (µg/L)	17,000	1,500	400	540
Cd (µg/L)	2.0	0.07	0.03	0.02
Pb (µg/L)	5.6	1.2	<0.5	0.6
Cu (µg/L)	180	40	20	20
As (µg/L)	11	3.6	2.0	1.0
Sb (µg/L)	0.17	0.11	0.08	0.06
Se (µg/L)	22	2.6	0.6	<0.5
Fe (µg/L)	<10	<10	<10	<10
Al (µg/L)	70	<10	10	<10
Mn (µg/L)	46,000	3,500	670	1,100
Leachate Wt (kg)	0.47	0.89	0.95	0.97

Table 5: Na$_2$EDTA-Extractable-Metal Results for Waste-regolith Samples

Results Expressed in Terms of Extractable-Metal Contents (in mg/kg-solids basis)

GCA-SAMPLE NO.	SITE-SAMPLE NO.	LITHOTYPE	Zn (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Cu (mg/kg)	As (mg/kg)	Sb (mg/kg)	Se (mg/kg)	Mn (mg/kg)
Target-Total-S = 0.1-0.2 %										
GCA8531	TTROX-12	High-Silica	24	<0.01	3.3	3.2	0.042	0.063	<0.01	3.2
GCA8534	TTROX-9	High-Silica-[Pb/Cu]	140	0.16	300	210	0.10	0.040	0.044	5.8
GCA8537	TTROX-4	Moderate-Silica	6.2	<0.01	15	6.0	0.016	0.011	<0.01	150
GCA8540	TTROX-2	LG-Siltstone	30	<0.01	0.50	0.8	0.012	<0.01	0.024	1.4
Target-Total-S = 0.2-0.4 %										
GCA8532	TTROX-5	High-Silica	9.2	<0.01	3.3	3.6	0.022	0.071	0.014	1.8
GCA8535	TTROX-8	High-Silica-[Pb/Cu]	140	0.058	28	260	0.019	0.039	0.046	16
GCA8538	TTROX-1	Moderate-Silica	10	<0.01	200	83	0.11	<0.01	0.052	560
GCA8541	TTROX-10	LG-Siltstone	16	<0.01	8.4	3.0	0.026	0.047	0.052	0.8
Target-Total-S = 0.4-0.6 %										
GCA8533	TTROX-6	High-Silica	15	<0.01	2.7	9.4	0.022	0.036	0.038	0.6
GCA8536	TTROX-7	High-Silica-[Pb/Cu]	110	0.078	100	1,900	0.22	0.035	0.016	68
GCA8539	TTROX-13	Moderate-Silica	50	<0.01	16	2.0	0.066	0.012	0.024	1.4
GCA8542	TTROX-3	LG-Siltstone	25	<0.01	1.4	42	0.042	<0.01	0.026	660

Table 6: Acid-Base-Analysis, Salinity and Net-Acid-Generation Results for Waste-bedrock Samples

GCA-SAMPLE NO.	SITE-SAMPLE NO.	LITHOTYPE	pH-(1:2)	EC-(1:2) [mS/cm]	TOTAL-S (%)	SO$_4$-S (%)	SULPHIDE-S (%)	TOTAL-C (%)	CO$_3$-C (%)	ANC	NAPP	NAG	NAG-pH	AFP CATEGORY
										kg H_2SO_4/tonne				
Target-Total-S = 0.10-0.20 %														
GCA8543	TTRSU-15	Moderate-Silica	6.1	0.28	0.06 (0.06)	0.02 (0.02)	0.04	2.2 (2.2)	<0.01 (0.07)	<1 (1)	nc	3.6	3.9	NAF
GCA8546	TTRSU-14	LG-Siltstone	6.0	0.23	0.10	0.03	0.07	1.7	<0.01	<1	nc	3.3	3.8	NAF
Target-Total-S = 0.20-0.40 %														
GCA8544	TTRSU-16	Moderate-Silica	6.2	0.23	0.10	0.02	0.08	1.2	<0.01	3	nc	4.5	3.7	NAF
GCA8547	TTRSU-17	LG-Siltstone	6.0	0.28	0.32	0.04	0.28	1.0	<0.01	3	5.6	9.0	3.3	**PAF**
Target-Total-S = 0.40-0.60 %														
GCA8545	TTRSU-19	Moderate-Silica	5.7	0.29	0.65	0.05	0.60	1.6	<0.01	-2	21	18	2.8	**PAF**
GCA8548	TTRSU-18	LG-Siltstone	4.6 (4.6)	0.23 (0.22)	0.52	0.05	0.47	1.4	<0.01	1	14	11 (9.8)	3.2 (3.2)	**PAF**

Notes:
ANC = Acid-Neutralisation Capacity; NAPP = Net-Acid-Producing Potential; AFP = Acid-Formation Potential; NAF = Non-Acid Forming; PAF = Potentially-Acid Forming;
EC = Electrical-Conductivity; nc = not calculated.
pH-(1:2) and EC-(1:2) values correspond to pH and EC measured on sample slurries prepared with deionised-water, and a solid:solution ratio of *c.* 1:2 (w/w).
All results expressed on a dry-weight basis, except for pH-(1:2), EC-(1:2), and NAG-pH.
Values in parentheses represent duplicates.

Table 7: Results of Selected-Element-Analysis Suite for Waste-bedrock Samples

GCA-SAMPLE NO.	SITE-SAMPLE NO.	LITHOTYPE	Zn (mg/kg)	Cd (mg/kg)	Pb (mg/kg)	Cu (mg/kg)	As (mg/kg)	Sb (mg/kg)	Se (mg/kg)	Fe (%)	Al (%)	Mn (mg/kg)	Na (%)	K (%)	Mg (%)	Ca (%)	Si (%)
Target-Total-S = 0.1-0.2 %																	
GCA8543	TTRSU-15	Moderate-Silica LG-Siltstone	110 (110)	0.6 (0.6)	170 (160)	52 (56)	150 (150)	5.6 (5.9)	<2 (<2)	4.9 (5.1)	6.4 (6.3)	250 (260)	0.18 (0.18)	2.6 (2.6)	0.37 (0.39)	0.022 (0.017)	34.5 (34.3)
GCA8546	TTRSU-14		110	0.4	100	170	78	3.6	<2	2.6	6.6	110	0.19	3.1	0.27	0.0084	34.9
Target-Total-S = 0.2-0.4 %																	
GCA8544	TTRSU-16	Moderate-Silica LG-Siltstone	120	0.5	110	95	62	2.7	2	4.1	6.7	940	0.068	2.6	0.98	0.024	34.0
GCA8547	TTRSU-17		220	1.7	390	96	45	3.0	<2	3.7	7.0	1,300	0.075	2.7	0.82	0.029	34.8
Target-Total-S = 0.4-0.6 %																	
GCA8545	TTRSU-19	Moderate-Silica LG-Siltstone	21	0.4	190	150	59	6.2	<2	0.9	8.3	31	0.21	3.4	0.39	0.017	35.0
GCA8548	TTRSU-18		280	1.3	440	650	85	12	8	1.7	7.3	1,100	0.12	3.2	0.42	0.011	34.6

Table 8: Leachate-Analysis Results for Weathering-Column Testwork on Waste-bedrock Samples

Target-Total-S = 0.1-0.2 %

Moderate-Silica

PARAMETER	Weathering-Cycles (GCA8543)						
	0	1	2	3	4	5	6
pH	7.2	6.0	6.1	6.1	5.9	6.0	4.5
EC (µS/cm)	360	1,200	690	320	200	130	140
SO_4 (mg/L)	32	150	110	57	48	38	32
Cl (mg/L)	86	280	150	58	30	18	11
Na (mg/L)	59	230	120	70	35	26	19
K (mg/L)	6.5	22	13	6.2	4.7	4.0	3.6
Mg (mg/L)	1.8	9.3	4.6	1.5	1.1	0.89	0.69
Ca (mg/L)	0.66	2.8	1.3	0.49	0.30	0.27	0.23
Si (mg/L)	0.92	3.8	4.1	1.6	1.1	2.3	0.99
Zn (µg/L)	60	260	140	57	100	70	90
Cd (µg/L)	0.52	7.4	3.8	1.5	1.4	1.2	1.0
Pb (µg/L)	<0.5	0.6	0.7	1.1	0.9	0.9	1.0
Cu (µg/L)	<10	20	20	10	20	10	20
As (µg/L)	18	45	47	28	22	19	16
Sb (µg/L)	0.33	0.86	0.66	0.42	0.26	0.23	0.21
Se (µg/L)	6.9	30	20	9.5	6.5	4.9	3.8
Fe (µg/L)	<10	<10	<10	<10	<10	<10	<10
Al (µg/L)	<10	10	<10	20	20	<10	<10
Mn (µg/L)	60	380	210	70	50	50	40
Leachate Wt (kg)	0.60	0.62	0.68	0.71	0.72	0.72	0.72

LG-Siltstone

PARAMETER	Weathering-Cycles (GCA8546)						
	0	1	2	3	4	5	6
pH	6.7	5.8	6.0	5.7	6.1	6.1	5.7
EC (µS/cm)	340	1,500	580	430	140	150	160
SO_4 (mg/L)	32	170	82	71	26	36	35
Cl (mg/L)	83	370	130	89	23	23	18
Na (mg/L)	57	270	99	76	23	26	22
K (mg/L)	5.6	22	11	9.4	3.9	4.8	5.1
Mg (mg/L)	2.4	14	4.4	3.1	0.85	1.5	1.7
Ca (mg/L)	0.88	3.3	1.3	0.85	0.29	0.51	0.54
Si (mg/L)	0.79	3.0	3.1	1.7	0.75	1.9	0.58
Zn (µg/L)	70	410	140	150	90	90	80
Cd (µg/L)	0.10	1.4	0.34	0.25	0.09	0.17	0.19
Pb (µg/L)	<0.5	0.7	0.6	0.7	<0.5	<0.5	<0.5
Cu (µg/L)	20	350	230	320	130	280	430
As (µg/L)	30	89	84	64	38	30	26
Sb (µg/L)	0.52	1.7	1.4	1.4	0.49	0.47	0.49
Se (µg/L)	5.7	31	16	12	4.5	5.8	6.1
Fe (µg/L)	<10	<10	<10	<10	<10	<10	<10
Al (µg/L)	<10	20	<10	<10	<10	<10	10
Mn (µg/L)	70	530	180	130	40	70	70
Leachate Wt (kg)	0.54	0.53	0.68	0.62	0.69	0.69	0.69

Table 8 (Cont'd): **Leachate-Analysis Results for Weathering-Column Testwork on Waste-bedrock Samples**

Target-Total-S = 0.2-0.4 %

Moderate-Silica

PARAMETER	**Weathering-Cycles (GCA8544)**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
pH	7.1	6.2	6.2	6.1	6.3	6.3	4.9
EC (µS/cm)	340	910	530	200	110	76	80
SO_4 (mg/L)	35	140	100	41	28	23	21
Cl (mg/L)	76	200	100	32	11	5	3
Na (mg/L)	46	150	78	28	14	8.4	5.0
K (mg/L)	19	29	21	9.5	7.4	6.0	5.4
Mg (mg/L)	3.4	15	8.9	2.9	2.1	2.3	2.2
Ca (mg/L)	1.2	3.1	1.7	0.59	0.40	0.44	0.45
Si (mg/L)	0.94	3.2	6.1	2.7	2.5	3.7	2.8
Zn (µg/L)	50	250	100	80	80	60	80
Cd (µg/L)	0.19	1.6	0.65	0.97	0.26	0.30	0.33
Pb (µg/L)	0.9	0.7	4.6	0.8	1.4	0.5	0.5
Cu (µg/L)	<10	30	20	<10	<10	<10	<10
As (µg/L)	17	75	88	62	59	53	47
Sb (µg/L)	0.64	2.9	5.1	2.4	2.0	1.8	1.7
Se (µg/L)	13	51	36	14	9.4	7.1	6.2
Fe (µg/L)	10	<10	10	<10	<10	<10	<10
Al (µg/L)	<10	20	30	30	30	<10	<10
Mn (µg/L)	120	550	380	140	110	130	130
Leachate Wt (kg)	0.54	0.59	0.67	0.70	0.70	0.70	0.70

LG-Siltstone

PARAMETER	**Weathering-Cycles (GCA8547)**						
	0	**1**	**2**	**3**	**4**	**5**	**6**
pH	6.4	5.7	5.4	5.3	5.5	5.3	5.1
EC (µS/cm)	680	1,200	790	340	210	170	180
SO_4 (mg/L)	93	200	170	82	50	60	55
Cl (mg/L)	150	240	150	50	24	15	8
Na (mg/L)	94	170	95	39	19	14	8.1
K (mg/L)	20	33	25	13	8.8	7.7	7.3
Mg (mg/L)	12	27	21	8.9	6.2	6.7	6.1
Ca (mg/L)	3.0	5.2	4.2	2.0	1.3	1.4	1.4
Si (mg/L)	0.68	4.0	6.7	2.3	1.5	2.8	2.0
Zn (µg/L)	860	1,800	1,800	1,000	930	1,200	1,400
Cd (µg/L)	86	250	220	110	81	110	110
Pb (µg/L)	0.6	3.6	3.2	2.2	3.2	2.5	2.8
Cu (µg/L)	40	160	330	250	320	520	780
As (µg/L)	12	28	24	16	9.1	9.3	8.5
Sb (µg/L)	0.52	1.3	1.5	0.70	0.41	0.43	0.45
Se (µg/L)	36	89	63	30	17	19	17
Fe (µg/L)	<10	10	10	<10	<10	<10	<10
Al (µg/L)	<10	70	230	150	160	240	340
Mn (µg/L)	4,000	11,000	9,200	4,500	3,600	4,200	4,100
Leachate Wt (kg)	0.53	0.56	0.65	0.68	0.67	0.67	0.67

Table 8 (Cont'd): Leachate-Analysis Results for Weathering-Column Testwork on Waste-bedrock Samples

Target-Total-S = 0.4-0.6 %

Moderate-Silica

PARAMETER	Weathering-Cycles (GCA8545)						
	0	1	2	3	4	5	6
pH	5.3	4.5	4.2	4.4	4.5	4.4	4.1
EC (µS/cm)	370	1,100	700	340	200	200	250
SO_4 (mg/L)	98	340	240	120	75	91	90
Cl (mg/L)	44	130	63	21	6	4	2
Na (mg/L)	47	150	70	29	11	8.0	5.1
K (mg/L)	16	45	30	17	8.8	8.0	7.6
Mg (mg/L)	5.9	26	18	9.2	6.0	7.3	7.0
Ca (mg/L)	2.7	8.1	5.9	3.2	1.8	2.2	2.1
Si (mg/L)	1.1	4.4	5.6	1.8	0.78	2.2	0.92
Zn (µg/L)	660	3,400	2,600	1,500	990	1,200	1,200
Cd (µg/L)	5.5	30	18	7.8	4.9	5.2	5.3
Pb (µg/L)	2.2	14	12	2.8	1.4	1.4	6.0
Cu (µg/L)	1,100	9,800	9,800	6,500	5,700	8,500	11,300
As (µg/L)	40	150	110	61	36	33	31
Sb (µg/L)	2.4	7.1	5.7	3.8	1.9	1.9	1.9
Se (µg/L)	40	190	140	64	40	45	49
Fe (µg/L)	210	310	440	340	420	670	920
Al (µg/L)	410	3,100	2,900	1,700	1,500	2,100	2,800
Mn (µg/L)	490	2,400	1,700	840	580	680	650
Leachate Wt (kg)	0.57	0.60	0.70	0.71	0.72	0.72	0.72

LG-Siltstone

PARAMETER	Weathering-Cycles (GCA8548)						
	0	1	2	3	4	5	6
pH	4.9	4.2	4.3	4.3	4.5	4.3	4.3
EC (µS/cm)	240	1,100	770	430	300	260	290
SO_4 (mg/L)	72	400	310	190	120	130	110
Cl (mg/L)	20	92	55	21	9	5	4
Na (mg/L)	14	57	31	14	5.6	3.7	2.6
K (mg/L)	11	47	30	16	8.1	5.9	4.3
Mg (mg/L)	3.9	22	15	7.2	4.1	3.3	2.4
Ca (mg/L)	1.5	6.2	3.8	2.0	1.2	1.2	0.87
Si (mg/L)	0.98	3.7	6.2	2.0	1.1	2.4	1.9
Zn (µg/L)	5,200	36,000	29,000	16,000	11,000	8,600	7,200
Cd (µg/L)	59	430	340	170	110	90	73
Pb (µg/L)	150	120	75	31	19	18	19
Cu (µg/L)	7,200	75,000	70,000	46,000	37,000	38,000	37,000
As (µg/L)	25	65	36	23	16	16	16
Sb (µg/L)	0.98	3.0	2.9	1.9	1.2	1.3	1.1
Se (µg/L)	19	150	120	64	47	52	51
Fe (µg/L)	970	310	690	390	530	720	610
Al (µg/L)	560	2,700	2,000	1,300	1,100	1,300	1,300
Mn (µg/L)	5,200	36,000	28,000	16,000	12,000	11,000	8,900
Leachate Wt (kg)	0.54	0.53	0.65	0.67	0.69	0.69	0.69

FIGURES

Figure 1

pH-Buffering Curves for Waste-Regolith Samples

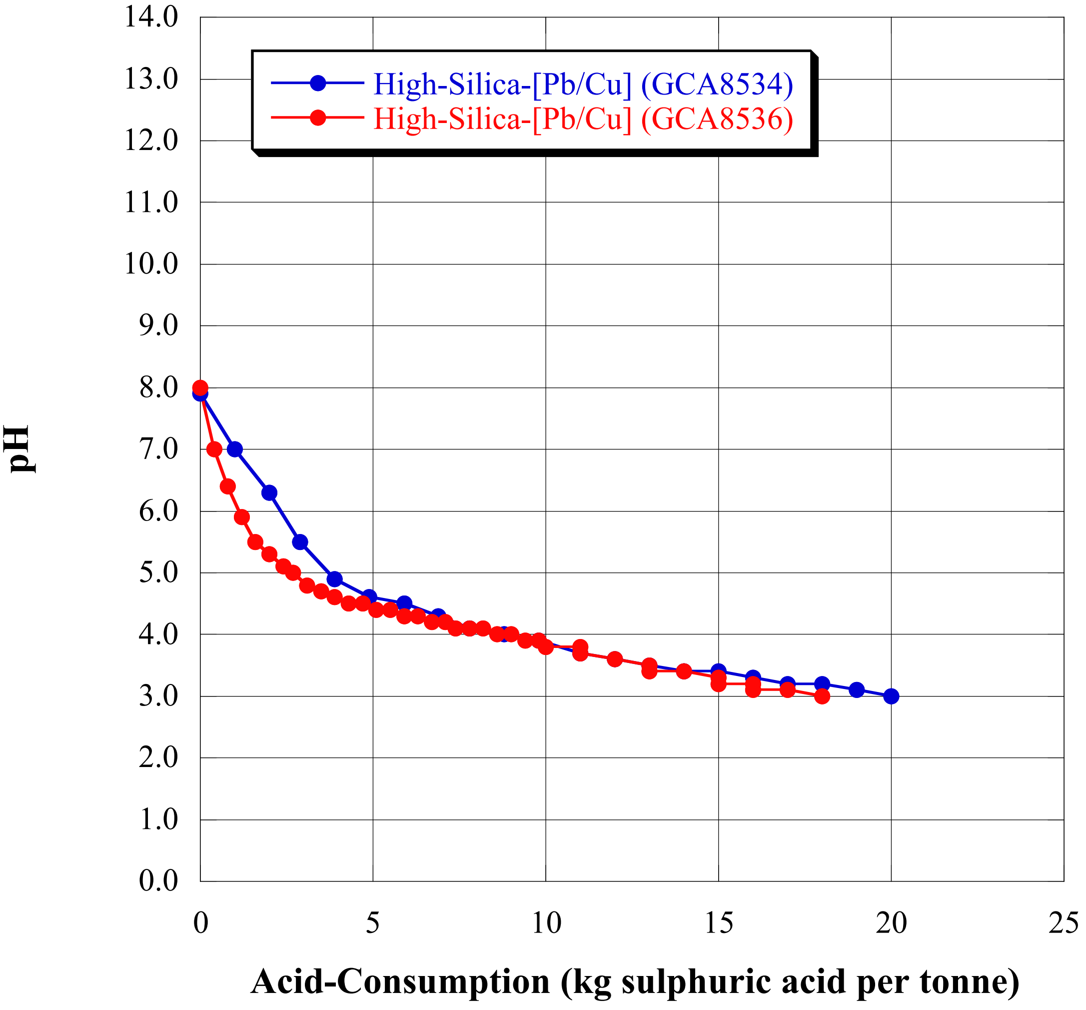


Figure 2

Variation in Sulphide-Oxidation Rates for Waste-bedrock Samples

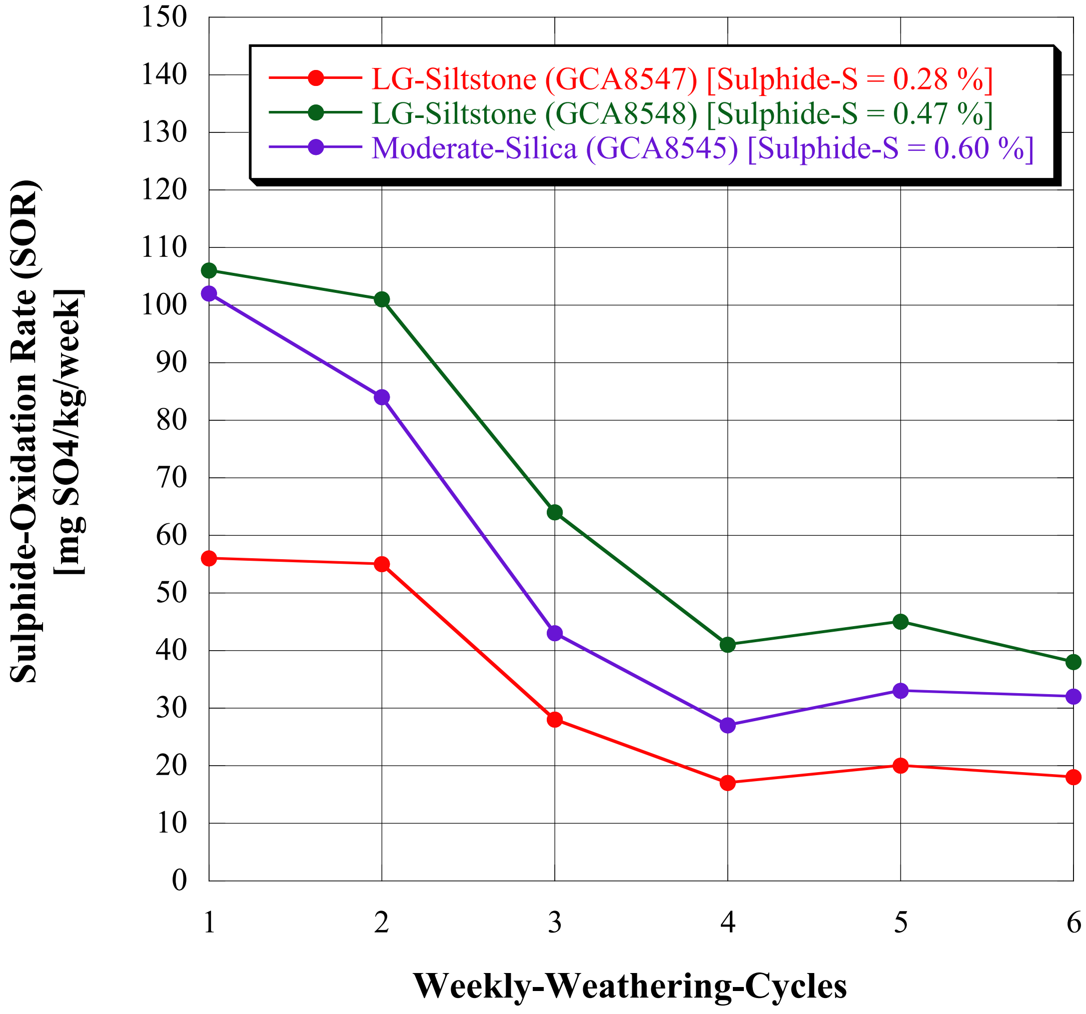


Figure 3

Leachate-Analysis Results for Selected Metals (LG-Siltstone-waste-bedrock Samples)

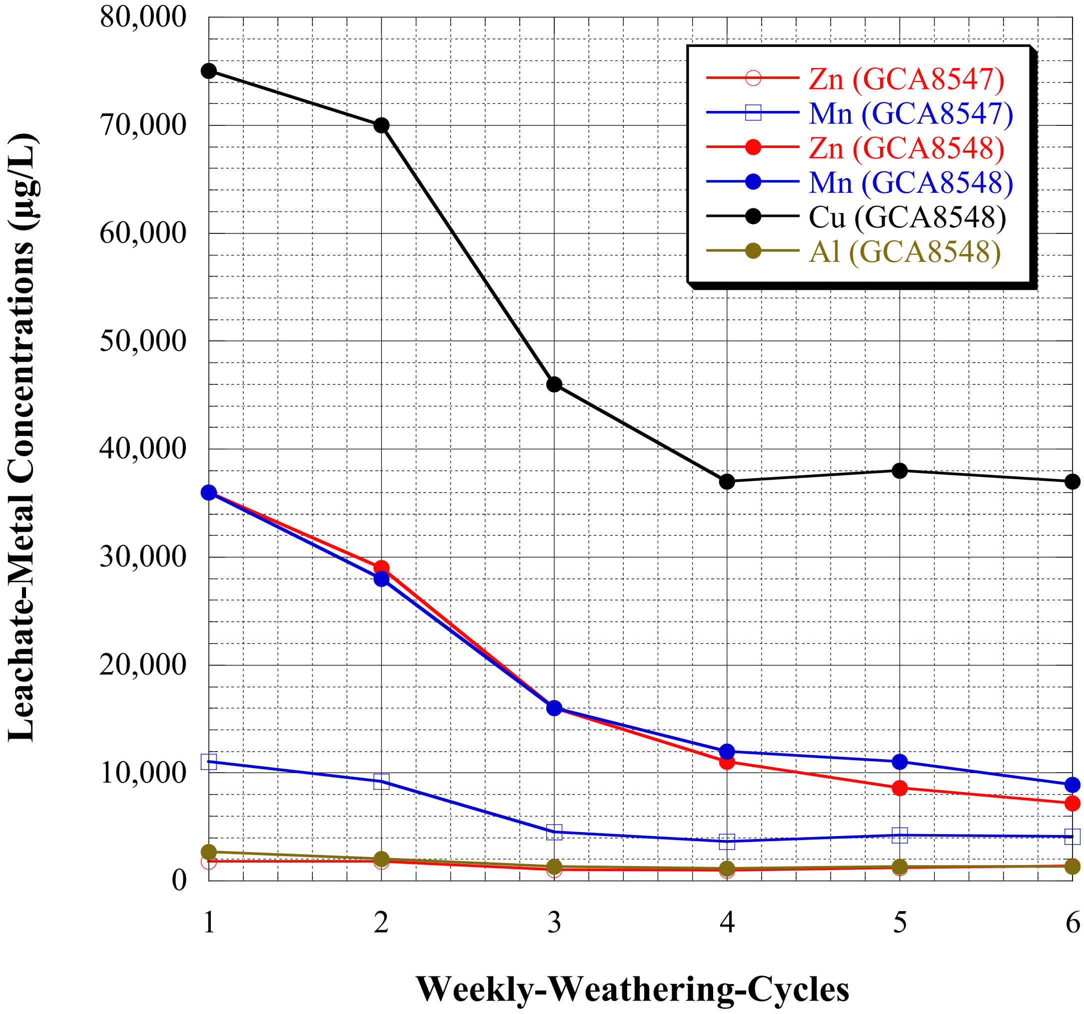
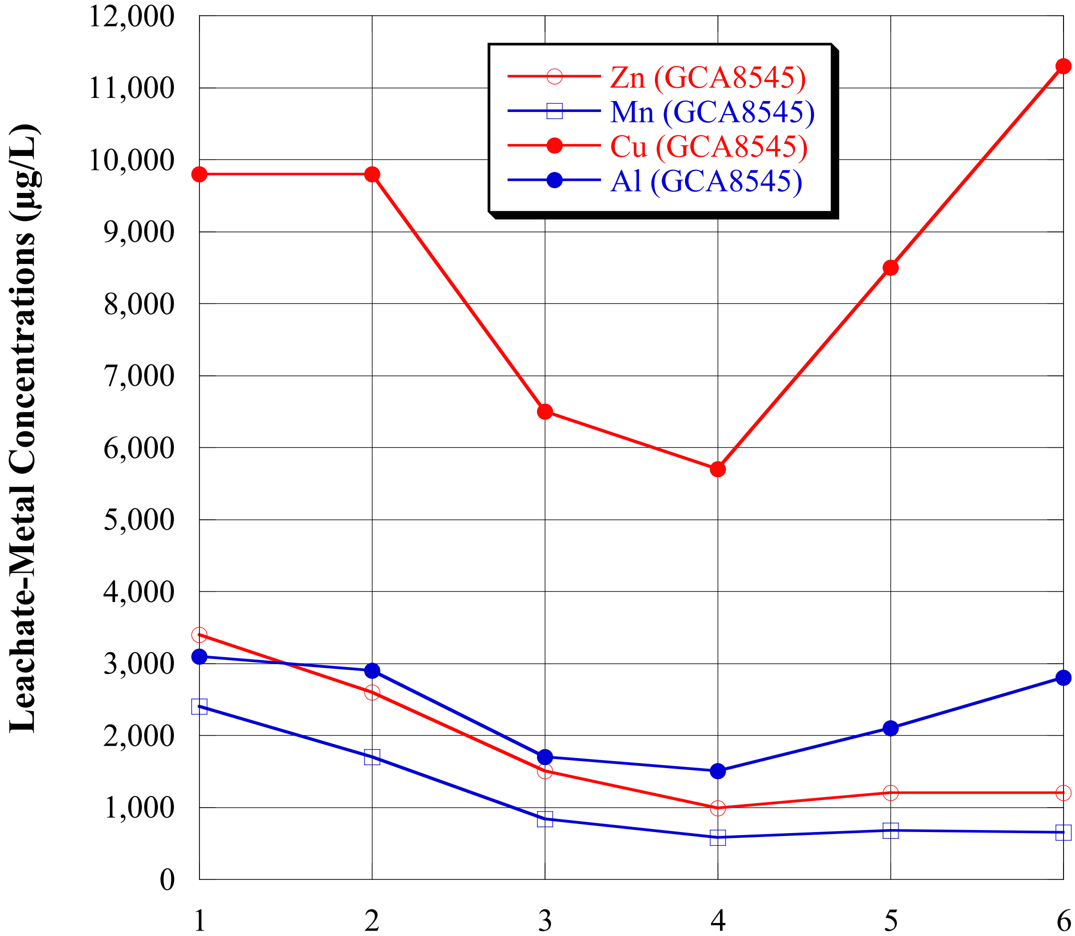


Figure 4

Leachate-Analysis Results for Selected Metals (Moderate-Silica-waste-bedrock Sample)



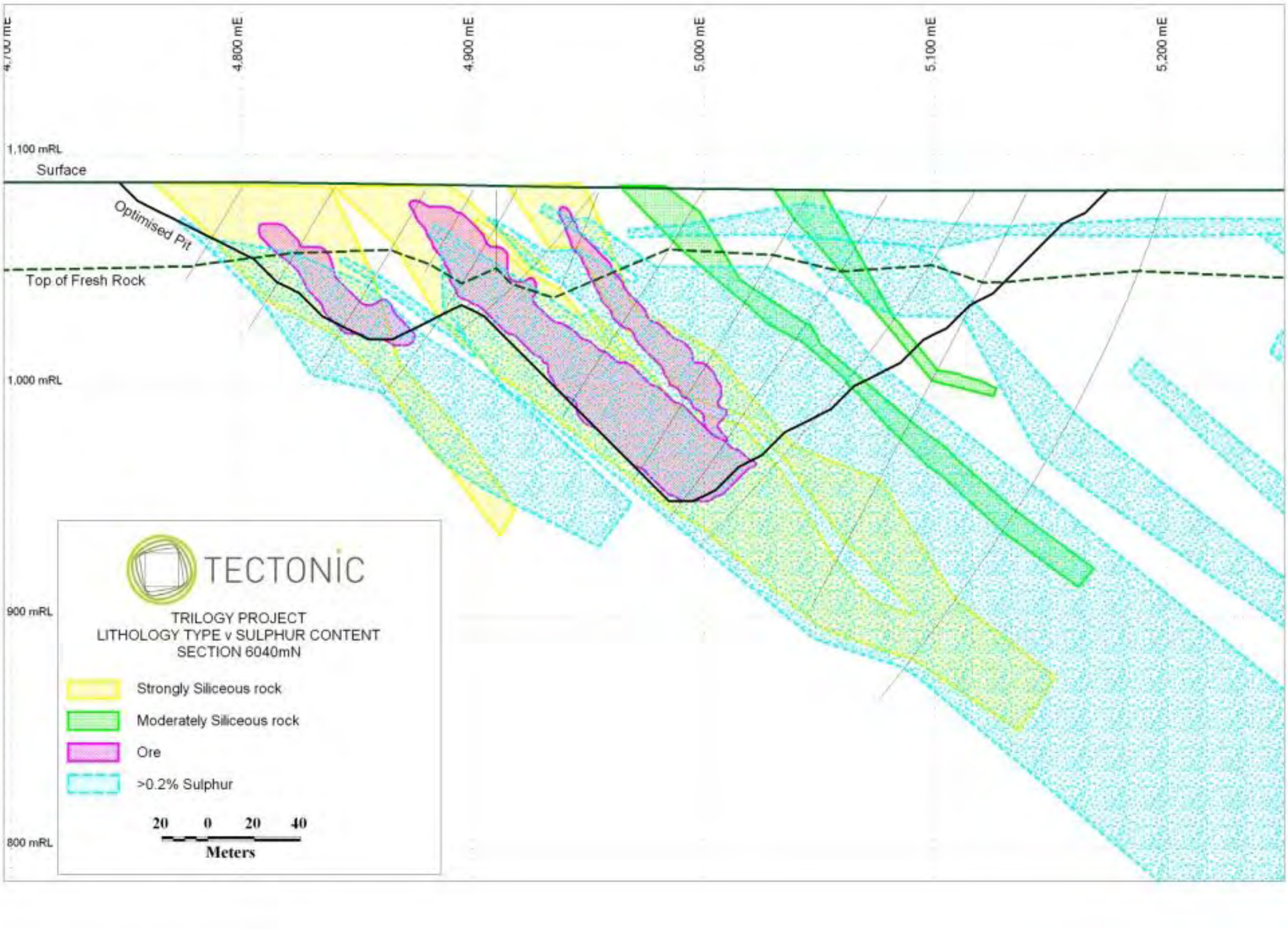
Weekly-Weathering-Cycles

ATTACHMENT I

DETAILS OF SAMPLING PROGRAMME AND INFORMATION ON WASTE-ZONE GEOLOGY

				Ag	Cu	Pb	Zn	S	Bi	Ca	Cd	Co	Se	Sb			
				ICP40Q	ICP40Q	ICP40Q	ICP40Q	ICP40Q	ICP40Q	ICP40Q	ICP40Q	ICP40Q	ICP40Q	ICP40Q			
				0.5	5	5	5	20	5	50	1	1	10	2			
				200	10000	5000	10000	50000	10000	400000	5000	10000	10000	5000			
Sample_id	Hole	from	to	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	PPM	LITHO	OXIDATION	S-RANGE
TTRSU-14	MYD190	98	103	0.3	175	121	114	1,508	3	100	0.5	8	5.0	4.2	LGZ	FRESH	0.1-0.2%
TTRSU-17	MYD190	128	134	0.3	99	451	200	3,070	3	310	1.6	20	5.0	2.8	LGZ	FRESH	0.2-0.4%
TTRSU-18	MYD190	164	177	1.1	727	513	348	4,578	6	116	1.4	15	7.3	8.7	LGZ	FRESH	0.4-0.6%
TTRSU-15	MYD190	108	120	0.3	67	213	103	1,352	3	133	0.7	11	5.0	5.8	Mod-Silica	FRESH	0.1-0.2%
TTRSU-16	MYD190	120	126	0.3	105	114	126	2,027	3	227	0.5	13	5.0	2.7	Mod-Silica	FRESH	0.2-0.4%
TTRSU-19	MYD190	141	144	0.8	165	243	22	5,245	8	175	0.5	14	5.0	6.5	Mod-Silica	FRESH	0.4-0.6%
TTROX-12	MYC235	16	24	0.3	56	151	40	1,430	8	65	0.5	3	5.0	6.5	High-Silica	Ox	0.1-0.2%
TTROX-5	MYC213	16	26	1.0	185	248	21	2,655	10	25	0.5	4	5.0	20.0	High-Silica	Ox	0.2-0.4%
TTROX-6	MYC213	27	28	1.0	1,100	985	65	6,740	25	25	0.5	5	20.0	74.0	High-Silica	Ox	0.4-0.6%
TTROX-9	MYC214	25	28	2.9	974	1,530	370	2,000	11	980	0.5	10	5.0	9.0	High-Silica/+1000ppm Cu,	Ox	0.1-0.2%
TTROX-8	MYC214	37	38	2.3	508	1,100	194	3,330	14	130	0.5	12	5.0	15.0	High-Silica/+1000ppm Cu,	Ox	0.2-0.4%
TTROX-7	MYC214	34	36	2.9	3,680	2,900	341	**14,800**	10	180	0.5	37	5.0	14.0	High-Silica/+1000ppm Cu,	Ox	0.4-0.6%
TTROX-2	MYD189	12	20	0.3	34	38	66	1,890	3	110	0.5	4	5.0	1.0	LGZ	Ox	0.1-0.2%
TTROX-10	MYD217	20	24	2.4	237	581	54	2,700	5	60	0.5	6	5.0	33.0	LGZ	Ox	0.2-0.4%
TTROX-3	MYD189	20	32	0.3	116	50	52	5,543	3	83	0.5	22	5.0	1.0	LGZ	Ox	0.4-0.6%
TTROX-4	MYC202	24	28	0.3	46	374	30	1,150	3	80	0.5	5	5.0	1.0	Mod-Silica	Ox	0.1-0.2%
TTR-OX1	MYD185	28	36	0.3	142	487	40	2,185	3	110	0.5	26	5.0	2.0	Mod-Silica	Ox	0.2-0.4%
TTROX-13	MYD218	4	12	0.3	206	1,430	139	6,260	6	200	0.5	5	5.0	12.0	Mod-Silica	Ox	0.4-0.6%

	0.1 to 0.2% S						0.2 to 0.4% S						0.4 to 0.6% S					
	Oxide			Fresh			Oxide			Fresh			Oxide			Fresh		
	Hole id	from	to	Hole id	from	to	Hole id	from	to	Hole id	from	to	Hole id	from	to	Hole id	from	to
High-SILICA	MYC235	16	24	no test			MYC213	16	26	no test			MYC213	27	28	no test		
High_SILICA + 1000ppm Pb/Cu	MYD214	25	28	no test			MYC214	37	38	no test			MYC214	34	36	no test		
Moderate-SILICA	MYC202	24	28	MYD190	108	120	MYD185	28	36	MYD190	120	126	MYD218	4	12	MYD190	141	144
Lamin.Graphitic Siltstone	MYD189	12	20	MYD190	98	103	MYD217	20	24	MYD190	128	134	MYD189	20	32	MYD190	164	177
Banded Sulphide	no test			no test			no test			no test			no test			no test		


4,700 mE
4,800 mE
4,900 mE
5,000 mE
5,100 mE
5,200 mE
1,100 mRL
Surface
Optimised Pit
Top of Fresh Rock
1,000 mRL
900 mRL
800 mRL
TECTONIC
TRILOGY PROJECT
LITHOLOGY TYPE v SULPHUR CONTENT
SECTION 6040mN
Strongly Siliceous rock
Moderately Siliceous rock
Ore
>0.2% Sulphur
20 0 20 40
Meters

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MEMORANDUM

To: GC, SN, AC
Date: 27th November 2009
From: Bruce Armstrong
Subject: Trilogy Waste Rock Characterisation

Summary

This report is intended as an introductory documentation of the likely proportions of waste rock types at Trilogy, and their elemental concentrations, for the purpose of waste dump design and management. These provisional figures can be used to guide further work of characterising and classifying the waste rock.

Trilogy deposit was 3D modelled on three parameters:

1. Economic mineralisation using 0.5% Cu Equivalent (based on Au+Ag+Cu+Pb+Zn) cut-off
2. Lithology modelling from logged rock type
3. NAF/PAF domains using a 0.2% S cut-off (as suggested by G. Campbell, June 2009)

The solids from these 3D interpretations have been used to determine the relative proportions NAF/PAF and lithology types of waste rock within the optimised pit shell. The average grade of these rock types have been reported based on weighted averages for economic minerals, and unweighted composite averages for non-economic minerals.

Relative proportions of the waste rock characterised by this methodology is

- **>0.2% Sulphur: 7.6Mt**
- **<0.2% Sulphur: 9.2Mt**

Further rock characterisation work is required to confirm the appropriate domaining. In addition,

Lithology Classification

Lithology has been modelled in 3D based on re-logging of the Trilogy drill core and RC chips during March 2009. For brevity the rock types were classified into:

- Banded Sulphides: determined by the texture of breccia clasts surrounded by banded galena, sphalerite, chalcopyrite, and pyrite. Hosts the Pb-Zn mineralised component of Trilogy deposit.
- Silica: dominantly siliceous material, as defined by scratch testing. No inferred genesis is given, with a mix of siliceous alteration and primary chemical sedimentation present. Dominant host of Cu-Au mineralisation below Top of Fresh Rock (TOFR).

- Low-Silica: moderate to weakly siliceous siltstones located in hanging wall. Hosts some weak mineralisation with accompanying sulphides. Usually sub-economic.
- Laminated Graphitic Siltstone: all graphitic siltstone which is not silica altered, nor with significant non-graphitic laminations contained within. Hosts some Cu-Au mineralisation via quartz-sulphide veining.

Sulphide Domain Classification

The Trilogy deposit was domained in 3D solids using the following dataset:

	element	count
1	BA	130
2	BI	10,552
3	CA	797
4	CD	10,517
5	CO	13,742
6	FE	6,940
7	HG	3,494
8	MG	853
9	MN	5,603
10	MO	627
11	S%	15,746
12	SB	10,061
13	SE	797

Table 1: Raw assay counts per element.

Assay data was composited into 1m intervals, with the following stats for all waste material.

Variable	**Number of samples**	**Minimum value**	**Maximum value**	**Mean**	**Median**
BA	111	24.0	1,000	274.59	214
BI	16,582	-	7,570	7.86	5
CA	1,005	0.0	11,100	255.03	30
CD	16,662	-	350	3.45	5
CO	21,337	0.0	4,120	18.51	11
FE	10,338	1,590.0	333,000	24,808.74	19,100
HG	2,422	-	120	3.00	1
MG	1,028	0.0	62,700	1,757.69	230
MN	5,763	5.0	19,700	159.24	76
MO	950	3.0	64	9.01	7
S	27,633	5.0	400,000	6,139.86	1,890
SB	17,505	-	530	8.10	5
SE	1,005	0.0	63	1.67	0

Table 2: Composited elemental statistics within waste rock and optimised pit.

0.2% Sulphur was used as sole determinant of 3D solids, which is about the modal peak (refer frequency histogram below). Hence roughly half the deposit and its host rock are below the 0.2% S cut-off.

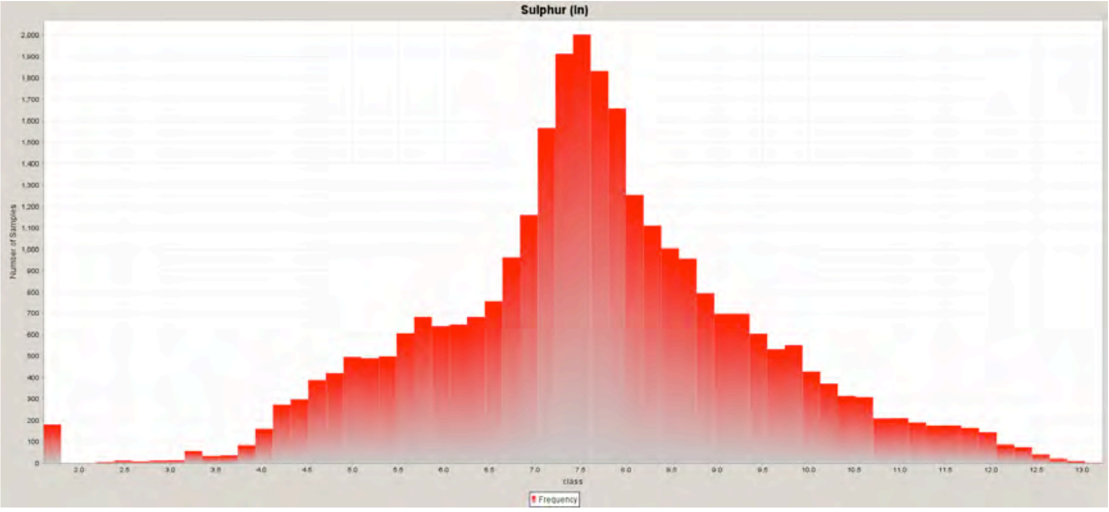

Figure 1: Log Normal histogram of composited S (ppm) distribution in unconstrained database.

Results

The deposit was domained on the basis of Ore/Waste, then by oxidation, lithology type, and S% domain.
The economic element grades were derived from block model queries, whilst non-economic elements were derived from straight averages inside/outside 3D models. Care must be given to elemental concentration results for those with low assay counts (Ba, Ca, Mg, Mo, Se) Results are displayed in Table 3 below.

In addition, the vertical distribution of the relative tonnage of waste rock type is graphed in Figure 2. This displays a surplus of <0.2% S waste rock near surface going to deficit at depth. **Classifying a component of the fresh siliceous material with >0.2% S as NAF material would alleviate this discrepancy at depth.**

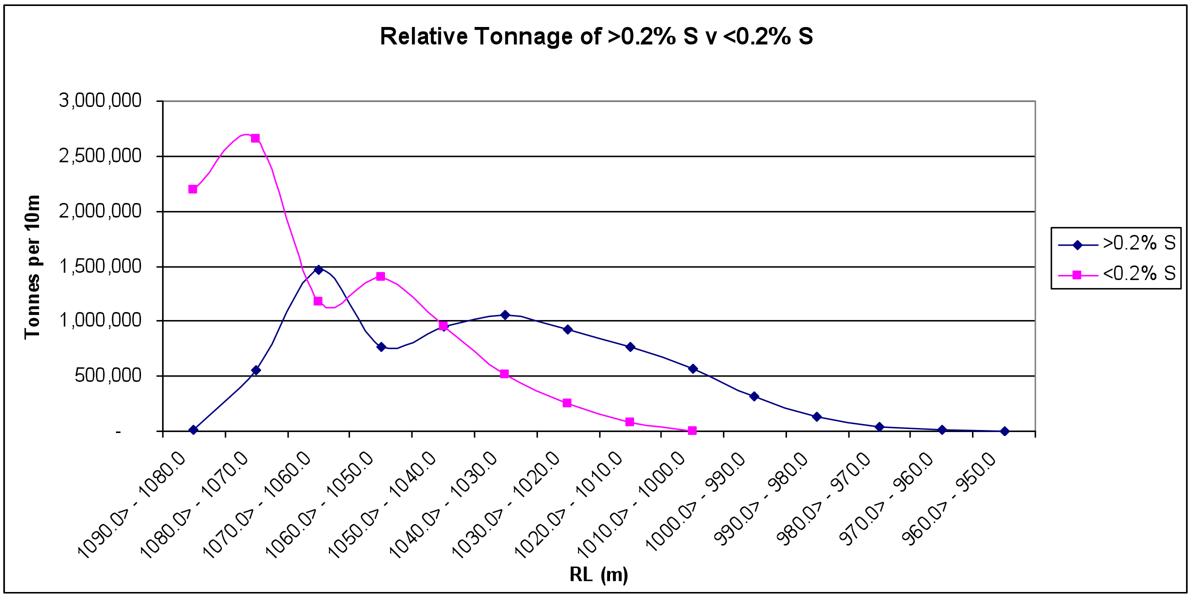

Figure 2: Relative proportions of Waste material type by depth.

TRILOGY RESOURCE: WASTE + ORE ROCK COMPOSITION: SELECTED BY 0.2% SULPHUR DOMAINS

Density weighted average, interpolated grades

average value, no interpolation (re: unweighted average)

	Ore/Waste	Ox	Lith	Volume	Tonnes	Au	Ag	Cu	Pb	Zn	As	Pbox	BA	BI	CA	CD	CO	FE	HG	MG	MN	MO	S	SB	SE
WASTE	>0.2% SULPHUR	OXIDE	SILICA	102,688	246,518	0.04	2.70	0.04	0.03	0.01	47		-	12.8	206.5	1.2	14.1	18,903	6.0	6,193	103.8	16.5	5,222	45.1	1.4
			LOW-SILICA	217,125	519,231	0.00	0.28	0.00	0.00	0.00	6		-	3.2	175.0	2.5	9.6	17,941	0.5	370	73.9	6.5	5,155	6.0	0.0
			LGZ	887,469	2,121,847	0.00	0.38	0.00	0.00	0.00	4		-	5.0	95.8	2.8	19.7	20,258	0.6	1,603	242.4	11.3	6,020	7.9	0.7
			BS	10,188	25,021	0.15	20.94	0.24	0.61	0.07	480		-	10.6	660.0	2.3	34.9	56,780	13.1	25,200	248.9	-	5,162	48.5	6.0
		Sub Total: Oxide		**1,217,470**	**2,912,617**																				
		FRESH	SILICA	320,500	859,248	0.06	8.47	0.14	0.14	0.05	140		315.2	21.1	104.0	10.4	44.3	24,777	7.6	626	92.9	24.2	22,946	50.8	2.3
			LOW-SILICA	236,500	630,933	0.03	2.52	0.04	0.01	0.00	61		384.0	16.9	35.3	2.8	40.7	19,847	1.5	937	92.7	8.0	14,355	13.5	3.2
			LGZ	1,128,156	3,015,389	0.02	2.90	0.04	0.04	0.02	43		327.5	9.5	29.6	2.5	20.6	20,460	3.4	303	129.9	6.3	10,717	15.6	2.5
			BS	65,031	178,418	0.17	49.36	0.44	0.94	0.35	502		-	67	504	35	106	41,986	16	648	112	33	52,004	123	6
		Sub Total: Fresh		**1,750,187**	**4,683,988**																				
	Sub Total: >0.2% Sulphur			**2,967,657**	**7,596,605**																				
	Ore/Waste	**Ox**	**Lith**	**Volume**	**Tonnes**	**Au**	**Ag**	**Cu**	**Pb**	**Zn**	**As**	**Pbox**	**BA**	**BI**	**CA**	**CD**	**CO**	**FE**	**HG**	**MG**	**MN**	**MO**	**S**	**SB**	**SE**
	<0.2% SULPHUR	OXIDE	SILICA	785,906	1,881,068	0.01	0.99	0.01	0.01	0.00	13.4		-	32.61	400.3	1.28	11.69	19,654	3.97	2,591	84	9.88	964	26.29	0.71
			LOW-SILICA	406,469	972,093	0.00	0.32	0.00	0.00	0.00	10.0		-	2.35	766.9	2.48	15.92	22,762	1.74	3,800	134	-	903	11.76	0.50
			LGZ	1,881,063	4,497,336	0.00	0.32	0.00	0.00	0.00	3.6		-	3.79	355.0	1.74	13.72	28,870	1.02	3,047	170	6.20	1,113	10.97	0.55
			BS	24,844	60,192	0.10	11.33	0.13	0.21	0.05	185.6		-	27.25	496.7	2.43	35.00	34,928	26.60	4,053	181	18.00	885	46.00	11.67
		Sub Total: Oxide		**3,098,282**	**7,410,689**																				
		FRESH	SILICA	115,156	306,365	0.01	1.47	0.02	0.01	0.00	17.5		-	15.69	77.5	2.30	9.46	11,322	0.51	5,730	83	6.33	893	6.11	0.00
			LOW-SILICA	87,469	233,453	0.01	0.55	0.01	0.00	0.00	17.4		-	0.00	98.8	0.91	44.53	26,170	4.69	1,458	313	-	932	16.00	3.63
			LGZ	473,125	1,263,076	0.00	0.17	0.00	0.00	0.00	3.1		-	0.98	120.5	1.02	5.32	21,468	0.83	1,724	110	10.00	973	5.08	2.74
			BS	844	2,368	0.29	35.66	0.51	2.35	0.41	841.8														
		Sub Total: Fresh		**676,594**	**1,805,262**																				
	Sub Total: <0.2% Sulphur			**3,774,876**	**9,215,951**																				
Sub Total: All WASTE				**6,742,533**	**16,812,556**																				

All tonnes confined to optimised pit shell, undiluted Resource Tonnes, density weighted average grades for Au, Ag, Cu, Pb, Zn, PbOx.
Simple average value of 1m composite intervals for Ba, Bi, Ca, Cd, Co, Fe, Hg, Mg, Mn, Mo, S, Sb, Se. No weighting for volume/density.
Ore v Waste defined on optimisation Oct 2009, USD$2.50/lb Cu, -10% productoin costs
Oxide is above Top of Fresh Rock
Lithology coded to solids interpreted Nov 2009
Sulphide >0.2% coded to solids generated using 0.2% S cut off.
Nov-09
All values in ppm, (apart from Cu, Pb, Zn, PbOx in %)

>0.2% Sulphur

	Ore/Waste	Ox	Lith	Volume	Tonnes	Au	Ag	Cu	Pb	Zn	As	Pbox
ORE	>0.2% SULPHUR	OXIDE	SILICA	36,094	89,921	1.45	73.17	0.66	0.63	0.07	1082	30.0
			LGZ	8,438	20,825	1.07	68.03	0.39	0.36	0.08	467	20.9
			BS	41,094	107,357	1.02	87.89	1.30	2.47	0.35	1485	47.1
		Sub Total: Oxide		**85,626**	**218,103**							
		FRESH	SILICA	323,813	920,438	1.01	35.41	1.33	1.22	0.71	1208	44.6
			LOW-SILICA	1,000	2,679	0.24	36.09	0.83	0.21	0.03	1060	
			LGZ	73,250	203,491	0.68	48.03	0.91	1.22	0.57	777	50.9
			BS	515,594	1,595,626	0.64	70.52	1.31	5.22	3.18	1919	39.7
		Sub Total: Fresh		**913,657**	**2,722,234**							
	Sub Total: >0.2% Sulphur			**999,283**	**2,940,337**							
							<0.2% Sulphur					
	Ore/Waste	**Ox**	**Lith**	**Volume**	**Tonnes**	**Au**	**Ag**	**Cu**	**Pb**	**Zn**	**As**	**Pbox**
	<0.2% SULPHUR	OXIDE	SILICA	152,156	372,311	1.74	66.20	0.24	0.25	0.04	690.8	25.4
			LGZ	38,688	95,205	1.12	74.62	0.22	0.28	0.06	464.4	26.6
			BS	70,875	177,327	1.04	98.71	0.46	0.97	0.15	704.9	28.8
		Sub Total: Oxide		**261,719**	**644,843**							
		FRESH	SILICA	13,906	37,961	1.32	44.49	1.04	0.39	0.05	750.2	26.3
			LOW-SILICA	375	976	0.21	34.28	0.73	0.28	0.04	1366.4	
			LGZ	3,031	8,276	0.63	69.95	0.83	0.38	0.06	650.3	46.3
			BS	5,875	16,499	0.66	59.79	1.02	2.00	0.29	1071.4	42.8
		Sub Total: Fresh		**23,187**	**63,712**							
	Sub Total: <0.2% Sulphur			**284,906**	**708,555**							
Sub Total: All ORE				**1,284,189**	**3,648,892**							
Grand Total				**8,026,722**	**20,461,448**							

ATTACHMENT II

TESTWORK METHODS

ATTACHMENT II

TESTWORK METHODS

The testwork methods outlined below are proven approaches to 'static-testing' within the Australian, and international mining-industries (e.g. Price 2009; Stewart *et al.* 2006; AMIRA 2002; Morin and Hutt 1997).[1] The MEND-document prepared by Price (2009), and *c.* 10-20 years in the making by an experienced practitioner, is an invaluable source of information on testing methods on mine-waste geochemistry. There is also the Global-Acid-Rock-Drainage-Guide (GARD Guide) which is an INAP initiative (go to: www.gardguide.com). However, in terms of comprehensiveness, structure, and clarity, the document by Price (2009) is recommended.

Part of the acid-base-account (ABA) testing, and all of the multi-element analyses, and clay-surface-chemical determinations, are carried out by Genalysis Laboratory Services Pty Ltd [GLS] (Maddington). Specialised ABA-testing is undertaken by GCA (Bridgetown), and characterisation of rock- and clay-mineralogy is carried out by Roger Townend & Associates (Malaga), and CSIRO (Bentley), respectively.

Samples are crushed to 2mm (nominal) in a jaw/rolls-crusher, and pulverised to 75µm (nominal), for specific tests, as required. These sample-splits are referred to herein as "crushings" and "pulps", respectively.

It should be noted that the testwork methods described below are routinely employed in work programmes undertaken by GCA. However, the testwork methods described are generic, and specific tests may not necessarily be undertaken in a given study.

1.0 ACID-BASE-CHEMISTRY AND SALINITY TESTWORK

Acid-base chemistry and salinity are assessed by determining:

- pH and Electrical-Conductivity (EC) on sample slurries;
- Total-Sulphur (Total-S), and Sulphate-Sulphur (SO_4-S);
- Acid-Neutralisation-Capacity (ANC), and CO_3-C;
- Net-Acid-Producing-Potential (NAPP); and,
- Net-Acid-Generation (NAG).

Relevant details of the testwork methods employed are discussed below. Further details are presented in the laboratory reports.

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[1] 'Static'-testing' corresponds to "whole-rock" analyses and tests.

1.1 pH-(1:2) and EC-(1:2) Tests

Measurements of pH and EC are performed on slurries prepared using deionised-water, and a solid:water ratio of *c.* 1:2 (w/w). The slurries are allowed to age for *c.* 24 hours, prior to measuring pH and EC.[2] These tests are performed on the crushings.

pH-(1:2) and EC-(1:2) values provide a measure of the inherent acidity/alkalinity and salinity.[3]

1.2 Total-S and SO_4-S

Total-S is determined by Leco combustion (@ 1300 °C) with detection of evolved $SO_{2(g)}$ by infra-red spectroscopy. SO_4-S is determined by the Na_2CO_3-Extraction Method (Berigari and Al-Any 1994; Lenahan and Murray-Smith 1986).[4] The difference between Total-S and SO_4-S indicates the Sulphide-S (strictly Non-Sulphate-S) value. The Total-S and SO_4-S tests are performed on pulps.

1.3 Acid-Consuming Properties

1.3.1 ANC

ANC is determined by a procedure based on that of Sobek *et al.* (1978) which is the "standard" ANC-testing method (AMIRA 2002; Morin and Hutt 1997).

Samples (as crushings) are reacted with dilute HCl for *c.* 2 hours at 80-90 °C, followed by back-titration with NaOH to a pH=7 end-point to determine the amount of acid consumed.[5] The simmering step for *c.* 2 hours differs from the Sobek *et al.* procedure wherein test-mixtures are heated to near boiling until reaction is deemed to be complete, followed by boiling for one minute. In terms of the dissolution of carbonate- and primary-silicate-minerals, this variation to the Sobek *et al.* method is inconsequential.

The Sobek *et al.* (1978) procedure subjects samples to both strongly-acidic conditions (e.g. pH of 1-2), and a near-boiling temperature. Provided excess acid is added, the dissolution of carbonate-minerals is near-quantitative, and traces of primary-silicates

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[2] The slurries are stirred at the beginning of the testwork, and once again immediately prior to measuring pH and EC.

[3] The pH-(1:2) values approximate the "Abrasion-pH" values for identifying minerals in the field (e.g. Stevens and Carron 1948).

[4] The Na_2CO_3-reagent extracts SO_4 which occurs as soluble sulphates, and calcium sulphates (e.g. gypsum and anhydrite). It also extracts SO_4 sorbed to the surfaces of sesquioxides, clays and primary-silicates. However, SO_4 present as barytes ($BaSO_4$) is not extracted, and SO_4 associated with jarositic-type and alunitic-type compounds is incompletely extracted.

[5] A few drops of 30 % (w/w) H_2O_2 are added to the test mixtures as the pH=7 end-point is approached, so that Fe(II) forms released by the acid-attack of ferroan-carbonates (and -silicates) are oxidised to Fe(III) forms (which then hydrolyse to "$Fe(OH)_3$"). This step ensures that the resulting ANC values are not unduly biased "on-the-high-side", due to the release of Fe(II) during the acid-digestion step (AMIRA 2002), provided that the ferroan-carbonate content is not excessive (e.g. siderite-C values less than 1.5 % [Stewart *et al.* 2006]).

also dissolve. However, at circum-neutral-pH (viz. pH 6-8) relevant to mine-waste and environmental management, the dissolution of primary-silicates is kinetically limiting (e.g. see review-monograph by White and Brantley [1995]).

In the absence of inhibiting alteration-rims, dissolution rates of mafic/felsic-silicates generally equate to H_2SO_4-consumption rates 'of-the-order' 10^{-11}-10^{-12} moles/m^2/s. Accordingly, for particle-sizes within the sub-mm range, circum-neutral-dissolution rates of primary-silicates correspond to Sulphide-Oxidation Rates (SORs) 'of-the-order' 1-10 mg SO_4/kg/week (= *c.* 0.1-1.0 kg H_2SO_4/tonne/year).[6] In practice, circum-neutral buffering through the surface-hydrolysis/dissolution of primary-silicates is therefore restricted to both particle-gradings akin to "rock-flour" (viz. sub-mm), and slow rates of sulphide-oxidation (e.g. as exhibited by "trace-sulphides" which are not atypically reactive).[7]

Despite aggressive-digestion conditions, the ANC values determined by the Sobek *et al.* (1978) method allow an informed "screening" of acid-consuming properties, especially when due regard is given to groundmass-mineralogy (Morin and Hutt 1997). Jambor *et al.* (2005, 2002, 2000) list 'Sobek-ANC' values for different types of primary-silicates which assists interpretation of ANC-testwork results.

That the ANC value is not an intrinsic property of a sample of geologic media, but rather the outcome of the particular ANC-testwork method employed, is shown by Morin and Hutt (2009).

1.3.2 CO_3-C

CO_3-C is the difference between the Total-C and Total-Organic-C (TOC). Total-C is measured by Leco combustion (@ 1300 °C) with detection of evolved $CO_{2(g)}$ by infra-red spectroscopy. TOC is determined by Leco combustion on a sub-sample which had been treated with strong HCl to decompose carbonate-minerals. Pulps are used for these determinations.

1.3.3 pH-Buffering Properties

pH-Buffering properties are determined via a Metrohm® 736 Titrino auto-titrator, and 0.05 M-H_2SO_4. Auto-titrations comprise regular addition of H_2SO_4 to decrease the pH values of the test-suspensions (prepared using pulps) to 3.0 typically over the course of

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[6] SORs of this magnitude (at circum-neutral-pH) would typically only be recorded for the oxidation of "trace-sulphides" (e.g. Sulphide-S contents less than *c.* 0.5 %) which are not hyper-reactive, and so excludes *inter alia* framboidal-pyrite, and marcasite.

[7] Primary-particle-sizes within the "rock-flour" range is a given for process-tailings-solids. In the case of mine-wastes, despite its usually small weight-based abundance, this size-fraction is invariably the main seat of geochemical-weathering reactions within waste-dumps, and thereby the main "source-term" for solute generation (e.g. Price and Kwong 1997). Such "rock-flour" occurs in two forms: that obtained via dry-sieving, and that associated with the surfaces of clasts of wide-ranging sizes, and which can only be obtained via wet-sieving.

c. 1 day.[8] Despite taking up to 1 day to complete, the H_2SO_4-addition rates employed in the auto-titrations are 'orders-of-magnitude' faster than the sulphide-oxidation rates typically observed under "ambient-weathering" conditions.

1.4 NAPP Calculations

NAPP values are calculated from Total-S, SO_4-S and ANC values, assuming that **all** of the Sulphide-S occurs in the form of pyrite, and/or pyrrhotite. NAPP values facilitate assessment of Acid-Formation Potential (AFP).

The complete-oxidation of pyrite (and/or marcasite) may be described by:

$$FeS_2 + 15/4\ O_2 + 7/2\ H_2O = 2H_2SO_4 + \text{"}Fe(OH)_3\text{"}$$

The complete-oxidation of pyrrhotite may be described by:

$$\text{"}FeS\text{"} + 9/2O_2 + 5/2H_2O = H_2SO_4 + \text{"}Fe(OH)_3\text{"}$$

Since pyrrhotite is non-stoichiometric, expressing it as "FeS" is approximate (Janzen *et al.* 2000). Elemental-S may also be produced during pyrrhotite weathering (Nicholson and Scharer 1994), especially at low-pH. However, Elemental-S is ultimately oxidised to H_2SO_4.

It may be shown that, if the Sulphide-S (in %S) occurs as pyrite/pyrrhotite, then the amount of acid (in kg H_2SO_4/tonne) produced through complete-oxidation is given by **30.6 x %S**. That is, the same conversion-factor of 30.6 applies for both pyrite-, and pyrrhotite-oxidation.

> Note: The above treatment of oxidation-reaction stoichiometry is restricted to oxidation by 'atmospheric-O_2' which is the dominant oxidant at circum-neutral-pH. A different oxidation-stoichiometry applies under acidic conditions (e.g. pH less than 3-4) where soluble-Fe(III) forms prevail, and then function as the chief oxidant (e.g. Rimstidt and Newcomb 1993).

Mechanistic aspects of pyrite- and pyrrhotite-oxidation were reviewed by Rimstidt and Vaughan (2003), and Belzile *et al.* (2004), respectively.

1.5 NAG Tests

The NAG Test is a direct measure of the potential for acid-production through sulphide-oxidation, and also provides an indication of the reactivity of the sulphide-minerals, and the availability of alkalinity-forms (AMIRA 2002; Miller *et al.* 1997, 1994). Since this test is performed on pulps, sulphide-grains are fully liberated, and available for reaction.

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[8] In titrating to a pH=3.0 end-point, any Fe(II) released through acid attack of ferroan-carbonates and -silicates is not quantitatively oxidised to Fe(III), and subsequently hydrolysed/precipitated to "$Fe(OH)_3$". The equivalent of *c.* 0.5 kg H_2SO_4/tonne is generally required to decrease the pH of the "solution-only" to pH=3.0. No correction is made for this "electrolyte-consumption" of H_2SO_4.

The sample is reacted with H_2O_2 to oxidise sulphide-minerals, and allow the produced acid to react with the acid-neutralising components (chiefly carbonate-minerals). The results from NAG testwork supplement the NAPP-based assessment of AFP (Stewart *et al.* 2006; Shaw 2005; Morin and Hutt 1997).

The NAG-testing methodology used by GCA is the 'Static-NAG Test' in its "single-addition" mode, with NaOH-titration to a pH=7 end-point (AMIRA 2002; Miller *et al.* 1994, 1997). The Start-pH of the 15 % (v/v) H_2O_2 solution (prepared from A.R.-grade H_2O_2) is adjusted to pH=4.5 using 0.1 M-NaOH. The boiling treatment to decompose residual, unreacted-H_2O_2 following overnight reaction is carried out in two stages (viz. boiling for *c.* 2 hours initially, cooling and addition of 1 mL of 0.02 M-$CuSO_4$, followed by boiling for a further *c.* 2 hours). The addition of Cu(II) catalyses the decomposition of unreacted-H_2O_2, and thereby prevents "positive-blank" values (McElnea and Ahern 2004; O'Shay *et al.* 1990).[9]

Prior to the boiling steps, the pH values of the test-suspensions are measured. Such pH values reflect buffering under ambient conditions without accelerated dissolution of groundmass-minerals through boiling. In the interpretation of NAG-testwork results, it is important to note the pH values prior to the boiling steps, especially for lithotypes characterised by "trace-sulphides" (e.g. Sulphide-S within the sub-% range), and ANC values less than *c.* 10-20 kg H_2SO_4/tonne (e.g. a groundmass devoid of carbonate-minerals). The rates of "peroxide-oxidation" are orders-of-magnitude faster than those of "ambient-oxidation" (viz. SORs recorded in kinetic-testing employing Weathering-Columns). If circum-neutral-pH is to prevail during NAG testwork, then the rate of acid-consumption must be proportionately faster than that for "ambient-oxidation", and is essentially restricted to buffering by reactive-carbonate-minerals (e.g. calcites, dolomites, and ankerites). This aspect must be borne in mind when interpreting NAG-testwork results, especially for samples that contain "trace-sulphides" in a carbonate-deficient groundmass.

2.0 MULTI-ELEMENT ANALYSES

The total content of a wide range of major- and minor-elements are determined through the use of various digestion and analytical techniques. The respective detection-limits are appropriate for environmental investigations.

Element enrichments are identified using the *Geochemical Abundance Index (GAI)*.[10] The GAI quantifies an assay result for a particular element in terms of the average-

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[9] Where samples contain sufficient Cu(II), then Cu(II) forms will be released to solution during reaction with H_2O_2, especially at low-pH.

[10] The GAI was developed by Förstner *et al* (1993), and is defined as:

$$GAI = \log_2 [C_n/(1.5 \times B_n)]$$

where:

C_n = measured content of n-th element in the sample.

B_n = "background" content of the n-th element in the sample.

crustal-abundance of that element.[11] The latter corresponds to the typical composition of soils, regoliths and bedrocks derived from unmineralised terrain.

The GAI (based on a log-2 scale) is expressed in 7 integer increments (viz. 0 to 6). A GAI of 0 indicates that the content of the element is less than, or similar to, the average-crustal-abundance; a GAI of 3 corresponds to a 12-fold enrichment above the average-crustal-abundance; and so forth, up to a GAI of 6 which corresponds to a 96-fold, or greater, enrichment above average-crustal-abundances.

3.0 MINERALOGY AND CLAY-SURFACE CHEMISTRY

The semi-quantitative mineralogy, and clay-surface chemistry (generally restricted to waste-regoliths, oxide-ores, and/or soils), are determined using methods routinely used in geology, and soil science.

Indicative abundances of mineral fall into one of the following broad classes, viz.

• dominant	greater than 50 %
• major	20-50 %
• minor	10-20 %
• accessory	2-10 %
• trace	less than 2 %

Randomly- and preferentially-oriented specimens are prepared, and variously treated with sodium-hexametaphosphate (dispersant), ethylene-glycol, and heating, to quantify non-expansive, and expansive (e.g. smectites), varieties of clay-minerals.

The Effective-Cation-Exchange Capacity (eCEC), and suite of Exchangeable-Cations, are determined by different methods for samples (as crushings) of non-calcareous and calcareous materials (Rengasamy and Churchman 1999). In both cases, soluble-salts are initially removed via pre-washing using a "mixed-organic-solvent" (viz. ethylene-glycol and ethanol). Method 15A2 in Rayment and Higginson (1992) is then employed for non-calcareous samples to determine eCEC, and Exchangeable-Sodium Percentage (ESP). In the case of calcareous samples, a method based on that described by Pierce and Morris (2004) is used, and prevents the dissolution of carbonate-minerals (e.g. calcites and dolomites).[12] After the initial pre-washing step above, extraction is carried out with 1 M-NH_4Cl buffered at pH=8.5 in an ethanolic-aqueous solution. Without such precautions to suppress dissolution of carbonate-minerals, the eCEC is biased "on-the-high-side", and ESP biased "on-the-low-side". Depending on the abundance and nature of the carbonate-minerals, the magnitude of this bias can be marked.

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[11] The average-crustal-abundances of the elements for the GAI calculations are based on the values listed in Bowen (1979).

[12] The procedure described by Pierce and Morris (2004) is closely related to that originally developed by Tucker (1974).

4.0 SOLUBILITY OF MAJOR/MINOR-ELEMENTS

4.1 Water-Extraction Testwork

Water-Extraction Testwork on the crushings is performed via the bottle-roll technique, and using deionised-water. The test-slurries have a solid:solution ratio of *c.* 1:2 (w/w), and are bottle-rolled for *c.* 1 day before being left to "still-stand" for *c.* 1 day to allow suspended mineral-fines to settle. The resulting supernatants are decanted, vacuum-filtered (0.45µm-membrane), and preserved, as appropriate, for specific analyses. Where required, centrifuging at *c.* 4,000 G for 30 minutes is undertaken to expedite solid-solution separation for vacuum-filtration. The Water-Extraction Testwork is performed in the GCA-Testing Laboratory.

4.2 Na_2EDTA-Extraction Testwork

Na_2EDTA-Extraction Testwork (at pH=6) is carried out on the crushings, based on the method described by Clayton and Tiller (1979). The test-slurries have a solid:solution ratio of *c.* 1:2 (w/w), and are bottle-rolled for *c.* 7 days. This testwork provides a measure of the "metal-pool" potentially available for uptake by biota (e.g. absorption by plant roots).

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ATTACHMENT III

ACID-FORMATION POTENTIAL (AFP):

CALCULATED PARAMETERS AND CLASSIFICATION CRITERIA

ATTACHMENT III

ACID-FORMATION POTENTIAL (AFP):

CALCULATED PARAMETERS AND CLASSIFICATION CRITERIA

Notes: The geochemically-based parameters, and AFP-classification criteria, indicated below apply equally to samples of mine-wastes (e.g. waste-regoliths and waste-bedrocks), low-grade-ores, and process-tailings-solids. The generic descriptor "test-sample" is employed below.

1.0 CALCULATED PARAMETERS

Maximum-Potential-Acidity (MPA) values (in kg H_2SO_4/tonne) of test-samples are typically calculated by multiplying the Sulphide-S values (in %) by 30.6. The multiplication-factor of 30.6 reflects both the reaction stoichiometry for the complete-oxidation of pyrite, by O_2 to "$Fe(OH)_3$" and H_2SO_4, and the different weight-based units of %, and kg H_2SO_4/tonne.

Net-Acid-Producing-Potential (NAPP) values (in kg H_2SO_4/tonne) are calculated from the corresponding MPA and Acid-Neutralisation-Capacity (ANC) values (i.e. NAPP = MPA - ANC).

2.0 CLASSIFICATION CRITERIA

In terms of AFP, test-samples may be classified into one of the following categories, viz.

- Non-Acid Forming (NAF)
- Potentially-Acid Forming (PAF)

There are **no** unifying, "standard" criteria for classifying the AFP of test-samples (e.g. Price 2009; AMIRA 2002), and reflects the diversity of sulphide- and gangue-mineral assemblages within (un)mineralised-lithotypes of varying weathering- and alteration-status. Rather, criteria for classifying AFP may need to be tailored to deposit-specific geochemistry, mineralogy, and site-specific climate.

The AFP-classification criteria often employed at mining-operations worldwide are:

- **NAF**: Sulphide-S < 0.3 %. For Sulphide-S ≥ 0.3 %, both a negative NAPP value, and an ANC/MPA ratio ≥ 2.0
- **PAF**: For Sulphide-S ≥ 0.3 %, any positive-NAPP value; negative-NAPP value with an ANC/MPA ratio < 2.0

In assessing AFP, lithotypes from hard-rock mines with Sulphide-S values less than 0.3 % are unlikely to acidify (e.g. pH less than 4-5) through sulphide-oxidation. This position holds especially where the groundmass hosting the "trace-sulphides" is not simply quartz, soil-clays, and/or sesquioxides (Price *et al.* 1997), and where the sulphide-minerals are not hyper-reactive varieties (e.g. framboidal-pyrite). A "cut-off" of 0.3 % for Sulphide-S also accords with the findings of kinetic-testing, since the late-1980s, by Dr. Graeme Campbell for test-samples of diverse mineralogy in terms of sulphide-weathering dynamics, and solubility behaviour.

The risk posed by PAF-lithotypes during the active-mine-life is governed primarily by the duration of the lag-phase (i.e. the period during which sulphide-oxidation occurs, but acidification does not develop, due to circum-neutral buffering by gangue-phases [chiefly reactive-carbonate-minerals]).[1] Although the duration of the lag-phase for mine-wastes at field-scale cannot be accurately predicted *a priori*, estimates may still be needed to identify threshold exposure-times for the safe handling of PAF-lithotypes. Lag-phase duration may be estimated via kinetic-testing (viz. Weathering-Columns), and consideration of the moisture/aeration/thermal-regimes of exposed (i.e. uncovered) mine-wastes under the site's climatic conditions. In the absence of results from kinetic-testing, experience permits "first-pass" estimates of sulphide-oxidation rates and lag-phase duration to be made from the results of static-testing, and thereby classify PAF-lithotypes into **PAF-[Short-Lag]** and **PAF-[Long-Lag]** sub-categories. Such "first-pass" estimations are necessarily provisional, and subject to revision, in the light of the outcomes of kinetic-testing, and field observations.

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[1] SO_4 is still produced by sulphide-oxidation during the lag-phase, and appreciable amounts of soluble-forms of certain minor-elements (e.g. Ni and As) may be released at circum-neutral-pH during lag-phase weathering. However, in the latter case, the mine-wastes would need to be sufficiently enriched in Total-Ni and Total-As to begin with.

ATTACHMENT IV

LABORATORY REPORTS

Dr G Campbell
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JOB INFORMATION

JOB CODE	**143/1002563**
No. of SAMPLES	12
CLIENT O/N	GCA1004
PROJECT	Phillips River
STATE	Waste regolith
DATE RECEIVED	9/03/2010
DATE COMPLETED	24/03/2010

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
\> = Value beyond Limit of Method

The samples were received as mine waste and required crushing, drying, mixing, splitting and fine pulverising in a zirconia bowl.

Results of analysis on:

Element		S	S-SO4	C	TOC+C	C-CO3
Method		Ind/IR	Na2CO3/GRAV	Ind/IR	HotAcidInd/IR	/CALC
Detection		0.005	0.01	0.01	0.01	0.01
Units		%	%	%	%	%
Sample Name						
Control Blank		X	X	0.01	X	X
GCA8531		0.044	0.06	0.15	0.13	0.02
GCA8531	check	0.044	0.04	0.14	0.12	0.02
GCA8532		0.159	0.15	0.46	0.31	0.15
GCA8533		0.641	0.62	0.22	0.12	0.1
GCA8534		0.139	0.14	1.54	0.57	0.97
GCA8535		0.281	0.22	0.62	0.34	0.28
GCA8536		0.949	0.71	1.06	0.47	0.59
GCA8537		0.05	0.06	0.14	0.13	0.01
GCA8538		0.15	0.11	0.1	0.07	0.03
GCA8539		0.733	0.56	0.12	0.07	0.05
GCA8540		0.101	0.11	0.1	0.07	0.03
GCA8541		0.207	0.2	0.12	0.06	0.06
GCA8542		0.481	0.49	0.07	0.05	0.02
MA-1b		1.27		2.43		
PD-1			4.24			
S_SO4_A			0.6			
S_SO4_B			1.29			
TOC-1					1.42	

Notes:
1. The C, S results were determined from the pulverised portion
2. The Carbon and Sulphur was determined according to Genalysis method number MPL_W043
3. S-SO4 was determined by precipitation of BaSO4 according to Genalysis method number ENV_W039
4. TOC+C (acid insoluble carbon compounds and elemental carbon) by a C&S analyser after removal of carbonates and soluble organic carbon according to Genalysis method number MPL_W046. This method is not covered by the NATA scope of accreditation

sample		Fizz	HCl	NaOH	Colour	ANC	pH	ANC
name		Rate	molarity	molarity	Change	soln pH	Drop	(kg H2SO4/tonne)
GCA8531		0	0.4930	0.2092	N	1.5		-1
GCA8531	check	0	0.4930	0.2092	N	1.4		-1
GCA8532		0	0.4930	0.2092	N	1.6		-2
GCA8533		0	0.4930	0.2092	N	1.6		-2
GCA8534		0	0.4930	0.2092	N	1.4		99
GCA8535		0	0.4930	0.2092	N	1.5		5
GCA8536		0	0.4930	0.2092	N	1.6		27
GCA8537		0	0.4930	0.2092	N	1.5		0
GCA8538		0	0.4930	0.2092	N	1.5		0
GCA8539		0	0.4930	0.2092	N	1.4		-2
GCA8540		0	0.4930	0.2092	N	1.5		-1
GCA8541		0	0.4930	0.2092	N	1.5		-2
GCA8542		0	0.4930	0.2092	N	1.5		-1

Acid Neutralisation Capacity (ANC)

Notes:
1. ANC was determined on 2g of the -2mm portion. Acid concentrations are as stated.
2. Colour change: Y indicates the appearance of a green colouration as the pH=7 endpoint was approached. N no change. Two drops of hydrogen peroxide are added to each sample as the endpoint is approached to oxidise any ferrous iron
3. pH drop : Result reported when the pH drops to a value below 4 on addition of peroxide
4. This procedure according to Genalysis method number ENV_W035

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Company Accreditation Number 3244
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NATA Signatory: Ann Evers

Date: 24/03/2010

This document is issued in accordance with NATA's accreditation requirements.

Dr G Campbell
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN WA 6255

JOB INFORMATION

JOB CODE	**143/1003657**
No. of SAMPLES	4
CLIENT O/N	GCA1004
PROJECT	Phillips River
STATE	Waste regolith
DATE RECEIVED	30/03/2010
DATE COMPLETED	16/04/2010

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
\> = Value beyond Limit of Method

The samples were originally received as mine waste and required crushing, drying, mixing, splitting and fine pulverising in a zirconia bowl.

Results of analysis on:

Element		S-SO4	S-SO4
Method		Na2CO3/GRAV	SO/OES
Detection		0.01	0.01
Units		%	%
Sample Name			
Control Blank		X	X
GCA8536		0.6	0.72
GCA8536	check	0.65	0.68
GCA8537		0.06	0.09
GCA8538		0.14	0.18
GCA8539		0.56	0.6
PD-1		4.36	4.15
S_SO4_A		0.59	
S_SO4_B		1.31	

Notes:
1. The S results were determined from the pulverised portion
2. S-SO4 was determined by precipitation of BaSO4 (Na2CO3/GRAV) according to Genalysis method number ENV_W039 and by digestion of the sample in hot hydrochloric acid followed by OES measurement of dissolved S (SO/OES) Genalysis method number MPL_W045. Analytical Finish: ICP_W004 (/OES)

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NATA Signatory: Ann Evers

Date: 16/04/2010

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Dr G Campbell
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BRIDGETOWN WA 6255

JOB INFORMATION

JOB CODE	**143/1002562**
No. of SAMPLES	6
CLIENT O/N	GCA1004
PROJECT	Phillips River Project
STATE	solid
DATE RECEIVED	9/03/2010
DATE COMPLETED	24/03/2010

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method

The samples were received as mine waste and required crushing, drying, mixing, splitting and fine pulverising in a zirconia bowl.

Results of analysis on:

Element		S	S-SO4	C	TOC+C	C-CO3
Method		Ind/IR	Na2CO3/GRAV	Ind/IR	HotAcidInd/IR	/CALC
Detection		0.005	0.01	0.01	0.01	0.01
Units		%	%	%	%	%
Sample Name						
GCA8543		0.059	0.02	2.16	2.21	X
GCA8543	check	0.06	0.02	2.19	2.12	0.07
GCA8544		0.092	0.02	1.19	1.31	X
GCA8545		0.643	0.05	1.53	1.62	X
GCA8546		0.097	0.03	1.71	1.8	X
GCA8547		0.313	0.04	0.96	1.14	X
GCA8548		0.512	0.05	1.35	1.42	X
MPL-3						
MA-1b		1.178		2.43		
PD-1			4.36			
S_SO4_A			0.59			
S_SO4_B			1.32			

Notes:
1. The C, S results were determined from the pulverised portion
2. The Carbon and Sulphur was determined according to Genalysis method number MPL_W043
3. S-SO4 was determined by precipitation of BaSO4 according to Genalysis method number ENV_W039

4. TOC+C (acid insoluble carbon compounds and elemental carbon) by a C&S analyser after removal of carbonates and soluble organic carbon according to Genalysis method number MPL_W046. This method is not covered by the NATA scope of accreditation

Acid Neutralisation Capacity (ANC)

sample name		Fizz Rate	HCl molarity	NaOH molarity	Colour Change	ANC soln pH	pH Drop	ANC (kg H2SO4/tonne)
GCA8543		0	0.4930	0.2092	N	1.5		0
GCA8543	check	0	0.4930	0.2092	N	1.5		1
GCA8544		0	0.4930	0.2092	N	1.5		3
GCA8545		0	0.4930	0.2092	N	1.5		-2
GCA8546		0	0.4930	0.2092	N	1.5		0
GCA8547		0	0.4930	0.2092	N	1.5		3
GCA8548		0	0.4930	0.2092	N	1.5		1

Notes:
1. ANC was determined on 2g of the -2mm portion. Acid concentrations are as stated.
2. Colour change: Y indicates the appearance of a green colouration as the pH=7 endpoint was approached. N no change. Two drops of hydrogen peroxide are added to each sample as the endpoint is approached to oxidise any ferrous iron
3. pH drop : Result reported when the pH drops to a value below 4 on addition of peroxide
4. This procedure according to Genalysis method number ENV_W035

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NATA Signatory: Ann Evers

Date: 24/03/2010

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ANALYTICAL REPORT

CLIENT DETAILS		LABORATORY DETAILS	
Contact	Graeme Campbell	Manager	Said Hirad
Client	Graeme Campbell & Associates Pty Ltd	Laboratory	SGS Newburn Environmental
Address	PO Box 247 BRIDGETOWN WA 6255	Address	10 Reid Rd Newburn WA 6104
Telephone	0897 612 829	Telephone	(08) 9373 3500
Facsimile	0897 612 830	Facsimile	(08) 9373 3556
Email	gca@wn.com.au	Email	au.environmental.perth@sgs.com
Project	**Mine-Waste-Pulp Samples**	SGS Reference	PE051543 R0
Order Number	**1004**	Report Number	0000004449
Samples	2	Date Reported	10 Aug 2010

COMMENTS

The document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance with ISO/IEC 17025. NATA accredited laboratory 2562(898).

COC received 03/08/2010.
Samples sub-contracted to SGS Minerals for Total Sulphur analysis 03/08/2010.

SIGNATORIES

Kurt Blackman	Said Hirad
Inorganic Team Leader - Soils	Laboratory Manager

		Sample Number	PE051543.001	PE051543.002
		Sample Matrix	Soil	Soil
		Sample Name	GCA8539	GCA8536
Parameter	Units	LOR		
Chromium Reducible Sulphur (CRS) Method: AN217				
Chromium Reducible Sulphur (Scr)	%	0.005	<0.005	<0.005
Chromium Reducible Sulphur (Scr)	moles H+/T	0.005	<0↓	0
Chromium Reducible Sulphur (Scr)	kg H2SO4/T	0.005	<0.005	<0.005
Total Carbon/Sulphur in soil by LECO Method: CSA06V				
Sulphur*	%	0.01	0.983	0.708

QC SUMMARY

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.

Parameter	QC Reference	Units	LOR

METHOD SUMMARY

METHOD	METHODOLOGY SUMMARY

FOOTNOTES

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
*	This analysis is not covered by the scope of accreditation.
^	Performed by outside laboratory.
LOR	Limit of Reporting
↑↓	Raised or Lowered Limit of Reporting

QFH	QC result is above the upper tolerance
QFL	QC result is below the lower tolerance
NA	The sample was not analysed for this analyte

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

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.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

Graeme Campbell & Associates Pty Ltd

Laboratory Report

pH-(1:2) & EC-(1:2) TESTWORK

SAMPLE NO.	SAMPLE WEIGHT (g)	SAMPLE + DEION.-W WEIGHT (g)	pH-(1:2)	EC-(1:2) (mS/cm)
GCA8531	30.0	60.0	6.9	0.13
GCA8532	30.0	60.0	5.1	0.37
GCA8533	30.0	60.0	3.8	0.71
GCA8534	30.0	60.0	7.1	0.70
GCA8535	30.0	60.0	6.9	1.6
GCA8536	30.0	60.0	7.1	0.88
GCA8537	30.0	60.0	7.2	0.28
GCA8538	30.0	60.0	6.6	1.3
GCA8539	30.0	60.0	6.0	1.6
GCA8540	30.0	60.0	4.8	1.7
GCA8541	30.0	60.0	5.2	1.1
GCA8541-1	30.0	60.0	5.2	1.0
GCA8542	30.0	60.0	5.6	1.9
GCA8543	30.0	60.0	6.1	0.28
GCA8544	30.0	60.0	6.2	0.23
GCA8545	30.0	60.0	5.7	0.29
GCA8546	30.0	60.0	6.0	0.23
GCA8547	30.0	60.0	6.0	0.28
GCA8548	30.0	60.0	4.6	0.23
GCA8548-1	30.0	60.0	4.6	0.22

Note: EC = Electrical-Conductivity.
Testwork performed on crushed (nominal -2 mm) samples.
pH-(1:2) and EC-(1:2) values correspond to pH and EC values of suspensions with a solid:solution ratio of *c.* 1:2 (w/w) prepared using deionised-water.
Drift in pH-glass-electrode less than 0.1 pH unit between commencement, and completion, of testwork.
Drift in EC-electrode less than 0.50 µS/cm between commencement, and completion, of testwork.
Testwork performed in a constant-temperature room (viz. 21 +/- 2-3 °C).

Dr GD Campbell
13th April 2010

NET-ACID-GENERATION (NAG) TESTWORK

Sample Number	Sample Weight (g)	Comments	pH of Test Mixture Before Boiling Step	Test Mixture After Boiling Step		Titre [0.1 M-NaOH] (mL)	NAG (kg H_2SO_4/ tonne)
				pH	EC (µS/cm)		
GCA8531	3.0	Reaction peaked overnight	5.3	5.3	120	0.40	0.7
GCA8532	3.0	Reaction peaked overnight	4.4	5.3	58	0.40	0.7
GCA8533	3.0	Reaction peaked overnight	4.0	4.3	96	1.00	1.7
GCA8534	3.0	Reaction peaked overnight	6.9	6.1	150	0.30	<0.5
GCA8535	3.0	Reaction peaked overnight	6.3	6.2	110	0.30	<0.5
GCA8536	3.0	Reaction peaked overnight	7.0	6.2	220	0.20	<0.5
GCA8537	3.0	Reaction peaked overnight	6.1	6.6	55	0.40	0.7
GCA8538	3.0	Reaction peaked within 4 hours	6.7	6.4	98	0.20	<0.5
GCA8539	3.0	Reaction peaked overnight	5.2	5.8	120	0.40	0.7
GCA8540	3.0	Reaction peaked overnight	5.4	5.8	99	0.30	<0.5
GCA8541	3.0	Reaction peaked overnight	5.2	5.7	65	0.40	0.7
GCA8542	3.0	Reaction peaked overnight	6.5	5.7	93	0.30	<0.5
GCA8543	3.0	Reaction peaked within 4 hours	4.0	3.9	130	2.20	3.6
GCA8544	3.0	Reaction peaked within 4 hours	3.8	3.7	160	2.70	4.5
GCA8545	3.0	Reaction peaked within 4 hours	2.7	2.8	870	11.00	18
GCA8546	3.0	Reaction peaked within 4 hours	3.9	3.8	140	2.00	3.3
GCA8547	3.0	Reaction peaked within 4 hours	3.3	3.3	310	5.50	9.0
GCA8548	3.0	Reaction peaked within 4 hours	3.1	3.2	390	6.30	11
GCA8548 (Repeat)	3.0	Reaction peaked within 4 hours	3.1	3.2	380	6.00	9.8
BLANK1	3.0	Reaction peaked overnight	6.2	6.8	73	-	<0.5

Notes: Test conditions based on those described by Miller *et al.* (1997). The pH of the 15 % (v/v) H_2O_2 solution was adjusted to 4.5 using 0.1 M-NaOH prior to commencing the NAG Tests. Test mixtures boiled for *c.* 2 hours to accelerate reaction with H_2O_2. Then, after allowing the test mixtures to cool, 1.0 mL of 0.016 M-$CuSO_4$ solution was added, and the test mixtures again boiled for *c.* 2 hours. The addition of Cu(II) catalyses the decomposition of any residual, unreacted H_2O_2 in the test mixtures (O'Shay *et al.* 1990). K-Feldspar was employed for the Blank.

Dr GD Campbell
10th April 2010

pH-BUFFERING TESTWORK (GCA8534)

Cumulative Volume of Acid Added (mL)	**Cumulative Acid Consumption (kg H_2SO_4/tonne)**	**pH**
0.00	0.0	7.9
0.40	1.0	7.0
0.80	2.0	6.3
1.20	2.9	5.5
1.60	3.9	4.9
2.00	4.9	4.6
2.40	5.9	4.5
2.80	6.9	4.3
3.20	7.8	4.1
3.60	8.8	4.0
4.00	9.8	3.9
4.40	11	3.7
4.80	12	3.6
5.20	13	3.5
5.60	14	3.4
6.00	15	3.4
6.40	16	3.3
6.80	17	3.2
7.20	18	3.2
7.60	19	3.1
8.00	20	3.0

Note: Titration performed using a Metrohm® 736 Titrino auto-titrator, and 0.05 M-H_2SO_4. Equilibration time between titrant additions was 15 minutes. 2.0 g of pulped sample initially dispersed in 150 mL of deionised-water. Test mixture in contact with air, at ambient temperature, and continuously stirred.
Calibration of pH-Glass Electrode:
Immediately prior to titration: asymmetry potential = 8 mV (pH=7.00); slope-point = 178 mV (pH=4.00); 95.7 % of Nernstian response for 25 °C.
Immediately following titration: pH=7.00 buffer read pH=7.02 and pH=4.00 buffer read pH=4.03. These discrepancies represent drift in pH-Glass electrode response during course of auto-titration.

Dr GD Campbell
13th April 2010

pH-BUFFERING TESTWORK (GCA8536)

Cumulative Volume of Acid Added (mL)	Cumulative Acid Consumption (kg H_2SO_4/tonne)	pH	Cumulative Volume of Acid Added (mL)	Cumulative Acid Consumption (kg H_2SO_4/tonne)	pH
0.00	0.0	8.0	16.80	16	3.1
0.40	0.4	7.0	17.20	17	3.1
0.80	0.8	6.4	17.60	17	3.1
1.20	1.2	5.9	18.00	18	3.0
1.60	1.6	5.5	18.40	18	3.0
2.00	2.0	5.3			
2.40	2.4	5.1			
2.80	2.7	5.0			
3.20	3.1	4.8			
3.60	3.5	4.7			
4.00	3.9	4.6			
4.40	4.3	4.5			
4.80	4.7	4.5			
5.20	5.1	4.4			
5.60	5.5	4.4			
6.00	5.9	4.3			
6.40	6.3	4.3			
6.80	6.7	4.2			
7.20	7.1	4.2			
7.60	7.4	4.1			
8.00	7.8	4.1			
8.40	8.2	4.1			
8.80	8.6	4.0			
9.20	9.0	4.0			
9.60	9.4	3.9			
10.00	9.8	3.9			
10.40	10	3.8			
10.80	11	3.8			
11.20	11	3.7			
11.60	11	3.7			
12.00	12	3.6			
12.40	12	3.6			
12.80	13	3.5			
13.20	13	3.5			
13.60	13	3.4			
14.00	14	3.4			
14.40	14	3.4			
14.80	15	3.3			
15.20	15	3.3			
15.60	15	3.2			
16.00	16	3.2			
16.40	16	3.2			

Note: Titration performed using a Metrohm® 736 Titrino auto-titrator, and 0.05 M-H_2SO_4. Equilibration time between titrant additions was 15 minutes. 5.0 g of pulped sample initially dispersed in 150 mL of deionised-water. Test mixture in contact with air, at ambient temperature, and continuously stirred.
Calibration of pH-Glass Electrode:
Immediately prior to titration: asymmetry potential = 8 mV (pH=7.00); slope-point = 178 mV (pH=4.00); 96.2 % of Nernstian response for 25 ^{o}C.
Immediately following titration: pH=7.00 buffer read pH=7.02 and pH=4.00 buffer read pH=4.03. These discrepancies represent drift in pH-Glass electrode response during course of auto-titration.

Dr GD Campbell
14th April 2010

Dr G Campbell
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PO Box 247
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JOB INFORMATION

JOB CODE	**143/1002562**
No. of SAMPLES	6
CLIENT O/N	GCA1004
PROJECT	Phillips River
STATE	Waste regolith
DATE RECEIVED	9/03/2010
DATE COMPLETED	24/03/2010

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method

The analysis results reported herein have been obtained using the following methods and conditions:

The 6 samples, as listed in the report, were received as being waste regolith which were been dried, crushed, mix and split and pulverised in a zirconia bowl

The results have been determined according to Genalysis methods codes :
Digestions : MPL_W001 (A/), MPL_W011 (D/),
Analytical Finishes: ICP_W004 (/OES), ICP_W003 (/MS).
The results included the assay of blanks and international reference standards
OREAS 45P Genalysis in-house standards MPL-3
The results are expressed as parts per million or percent by mass in the dried and prepared material..

Element		Al	As	Ca	Cd	Cu	Fe	K	Mg	Mn	Na
Method		A/OES	A/MS	A/OES	A/MS	A/OES	A/OES	A/OES	A/OES	A/OES	A/OES
Detection		50	2	50	0.1	1	0.01	20	20	1	20
Units		ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
Sample Name											
Control Blank		X	X	X	X	2	X	X	X	X	X
GCA8543		63835	143	219	0.6	52	4.88	25673	3677	244	1733
GCA8543	check	62789	150	165	0.6	56	5.01	25477	3826	251	1774
GCA8544		66530	62	231	0.5	95	4.1	25640	9766	937	675
GCA8545		82559	59	164	0.4	146	0.9	33620	3854	31	2083
GCA8546		65665	78	84	0.4	165	2.6	30163	2649	105	1869
GCA8547		69246	45	287	1.7	96	3.62	27042	8183	1234	746
GCA8548		72355	85	104	1.3	642	1.71	31832	4150	1099	1114
MPL-3		67113	698	6681	5.4	1929	4.02	37027	8353	1746	42242

Element		Pb	Sb	Se	Si	Zn
Method		A/MS	A/MS	A/MS	D/OES	A/OES
Detection		2	0.05	2	0.1	1
Units		ppm	ppm	ppm	%	ppm
Sample Name						
Control Blank		X	X	X	X	X
GCA8543		163	5.6	X	34.5	103
GCA8543	check	158	5.86	X	34.3	106
GCA8544		102	2.67	2	34	119
GCA8545		183	6.17	X	35	21
GCA8546		100	3.58	X	34.9	104
GCA8547		384	2.95	X	34.8	212
GCA8548		433	11.56	8	34.6	271
MPL-3		2049	209.51	34		1171
OREAS45P					20.3	

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NATA Signatory: Ann Evers

Date: 24/03/2010

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ANALYTICAL REPORT

31 March 2010

Client Details

Client : **Graeme Campbell & Associates Pty Ltd**
Contact : Graeme Campbell
Address : PO Box 247
BRIDGETOWN
PERTH WA 6255

Job Details

Client Reference : GCA Job No 1004
Report No : PE029476
Report Version : 00
Samples : Waters
Received : 26/03/2010

Comments:

This report cancels and supercedes any preliminary results provided

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For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Sample Receipt:	Cecilia Tadena	AU.Environmental.Perth@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA 8531 PE029476-1 Water	GCA 8532 PE029476-2 Water	GCA 8533 PE029476-3 Water	GCA 8534 PE029476-4 Water	GCA 8535 PE029476-5 Water
Date Extracted		30/03/2010	30/03/2010	30/03/2010	30/03/2010	30/03/2010
Date Analysed		30/03/2010	30/03/2010	30/03/2010	30/03/2010	30/03/2010
Chloride, Cl	mg/L	33	170	340	160	460
Sulphate, SO_4	mg/L	22	29	61	34	76

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA 8536 PE029476-6 Water	GCA 8537 PE029476-7 Water	GCA 8538 PE029476-8 Water	GCA 8539 PE029476-9 Water	GCA 8540 PE029476-10 Water
Date Extracted		30/03/2010	30/03/2010	30/03/2010	30/03/2010	30/03/2010
Date Analysed		30/03/2010	30/03/2010	30/03/2010	30/03/2010	30/03/2010
Chloride, Cl	mg/L	390	110	790	930	740
Sulphate, SO_4	mg/L	110	38	83	180	130

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA 8541 PE029476-11 Water	GCA 8542 PE029476-12 Water
Date Extracted		30/03/2010	30/03/2010
Date Analysed		30/03/2010	30/03/2010
Chloride, Cl	mg/L	280	520
Sulphate, SO_4	mg/L	82	93

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				30/3/10	[NT]	[NT]	CONTROL	30/3/10
Date Analysed				30/3/10	[NT]	[NT]	CONTROL	30/3/10
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	CONTROL	105%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	CONTROL	107%

Method ID	Methodology Summary
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

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Quality Control Key

Method Blank (MB): An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.
Duplicate (D): A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike (SS): An organic compound which is similar to the target analyte(s) in chemical composition and behaviour in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard (IS): Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard instrument retention time and /or response, which is invariant from run-to-run.
Laboratory Control Sample (LCS): A known matrix spiked with compound(s) representative of the target analytes. The LCS is used to document laboratory performance. When the results of the marix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.
Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.
Relative Percentage Difference (RPD): The difference between an original and a duplicate result divided by the average of the original and duplicate results, expressed as a percentage.

Quality Acceptance Criteria

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.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

Intertek

GENALYSIS
LABORATORY SERVICES

Dr G Campbell
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN WA 6255

JOB INFORMATION

JOB CODE	**143/1002563**
No. of SAMPLES	12
CLIENT O/N	GCA1004
PROJECT	Phillips River
STATE	Waste regolith
DATE RECEIVED	9/03/2010
DATE COMPLETED	9/04/2010

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
\> = Value beyond Limit of Method

The 12 samples, as listed in the report, were received as being waste regolith which were then dried, crushed, mixed and split and pulverised in a zirconia bowl

The results have been determined according to Genalysis method codes :

Digestions : MPL_W001 (A/),
Analytical Finishes: ICP_W004 (/OES), ICP_W003 (/MS).

The results included the assay of blanks and Genalysis in-house standards MPL-3

The results are expressed as parts per million or percent by mass in the dried and prepared material

Results of analysis on:

Element		As	Cd	Pb	Sb	Se	Al	Cu	Fe	Mn	Zn
Method		A/MS	A/MS	A/MS	A/MS	A/MS	A/OES	A/OES	A/OES	A/OES	A/OES
Detection		2	0.1	2	0.05	2	50	1	0.01	1	1
Units		ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm
Sample Name											
Control Blank		X	X	5	0.24	X	X	X	X	X	1
GCA8531		19	X	153	6.97	X	17414	46	0.34	15	68
GCA8531	check	18	X	116	7.16	X	17294	44	0.33	15	43
GCA8532		39	X	190	17.51	3	12047	150	0.68	12	24
GCA8533		533	X	933	71.89	22	14200	1124	5.72	5	60
GCA8534		124	0.2	1407	11.75	6	42130	853	1.48	30	307
GCA8535		310	X	1094	16.78	4	64083	553	1.37	95	206
GCA8536		513	0.1	2400	16.6	10	69064	2346	2.11	147	270
GCA8537		16	X	375	3.41	X	79104	49	0.62	214	28
GCA8538		69	X	462	2.35	X	51847	148	2.23	664	34
GCA8539		375	X	1508	15.12	X	74413	172	3.4	80	158
GCA8540		22	X	41	2.1	X	91406	31	2.52	65	56
GCA8541		99	X	524	30.42	6	20703	228	1.07	9	43
GCA8542		22	X	51	2.87	X	76757	106	2.22	768	41
MPL-3		699	5	1909	195.67	33	70633	1797	3.89	1681	1102

Water extraction testing
Reported as 143/1002610

200-300g of the crushed-splits of each sample was subjected to Water-Extraction 1:2 [w/w] ratio using deionised water and bottle-rolling for approx. 1 day

The raw-filtrates were measured for pH and EC. A portion was acidified with HNO3 and analysed.
The results are reported as mg/l or ug/l in solution
Analytical Finishes: ICP_W004 (/OES), ICP_W003 (/MS).

Element	Al	As	Cd	Cu	Fe	Mn	Pb	Sb	Se	Zn	EC	pH
Method	/OES	/MS	/MS	/OES	/OES	/OES	/MS	/MS	/MS	/OES	W/METER	W/METER
Detection	0.01	0.1	0.02	0.01	0.01	0.01	0.5	0.01	0.5	0.01	0.01	0.1
Units	mg/l	ug/l	ug/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	mg/l	mS/cm	NONE
Sample Name												
Control Blank	X	X	X	X	X	X	X	X	X	X	X	5.9
GCA8531	X	0.6	0.04	X	0.02	0.17	0.6	0.37	2	0.69	0.18	5.5
GCA8532	0.1	1	0.14	0.07	2.41	0.71	2.3	0.2	3.5	2.94	0.65	4.6
GCA8533	4.51	2	0.39	0.63	2.47	0.28	19.6	0.12	6	6.16	1.27	3.8
GCA8534	0.1	7.1	X	0.01	0.02	X	4	3.32	5.9	0.01	0.74	8.8
GCA8535	0.02	5.9	0.03	0.04	0.02	X	1.4	3.37	8.9	0.05	1.75	7.8
GCA8536	0.11	3.7	X	0.03	0.02	X	1.1	1.64	14.4	X	1.6	8.3
GCA8537	X	1	X	X	0.02	0.1	2.4	0.22	1.2	0.04	0.46	6
GCA8538	0.01	2.4	0.11	0.01	0.01	1.61	1.2	0.15	7.6	X	2.61	7.1
GCA8539	0.07	3.2	0.53	0.02	0.33	0.33	6.7	0.21	9.6	13.24	3.02	5
GCA8540	0.12	2.3	0.45	0.03	0.03	0.32	2.4	0.01	7.1	7.5	2.49	4.6
GCA8541	0.03	1.5	0.3	0.02	0.07	0.29	7.4	0.3	11.8	3.48	1.07	5.1
GCA8542	X	1.3	0.13	0.05	X	12.34	1.4	0.04	4.5	3.14	1.88	5.8
Alcoa9-OES	1.95			0.06	4.81	0.49				0.52		
Alcoa14-MS		24.8	5.35				6.1	5.23	26.2			

Na2EDTA-Extraction Testing

Reported as 143/1002611

200-300g of the crushed-splits of each sample was also subjected to a modified EDTA extraction(as outlined in Clayton and Tiller (1979)) using a 1:2 [w/w] ratio (solid to liquid) and bottle-rolling for 7 days
The Initial-Slurry-pH was determined, and reported
The final raw-filtrates were measured for pH. A portion was acidified with HNO3and analysed.
The results are reported as mg/l or ug/in solution
Analytical Finishes: ICP_W004 (/OES), ICP_W003 (/MS).

Element	As	Cd	Cu	Mn	Pb	Sb	Se	Zn	pH initial	pH final
Method	/MS	/MS	/OES	/OES	/MS	/MS	/MS	/OES		
Detection	0.001	0.2	0.1	0.1	0.005	0.1	0.005	0.1	0.1	0.1
Units	mg/l	ug/l	mg/l	mg/l	mg/l	ug/l	mg/l	mg/l		
Sample Name										
Control Blank	X	X	X	X	X	0.2	X	X	6	6
GCA8531	0.022	2.3	1.6	1.6	1.566	31.9	0.007	11.7	5.9	6
GCA8532	0.011	0.5	1.8	0.9	1.515	35.7	0.007	4.6	5.9	6
GCA8533	0.011	0.9	4.7	0.3	2.334	17.9	0.019	7.5	5.9	5.8
GCA8534	0.05	75.6	103.2	2.9	146.209	20	0.022	67.7	6	7
GCA8535	0.092	28.7	126.6	7.9	13.507	19.2	0.023	65.2	5.9	6.1
GCA8536	0.109	38.9	949.7	33.6	49.673	17.5	0.08	50.9	6	6.9
GCA8537	0.008	4.3	3	72.8	7.405	5.2	X	3.1	5.9	6
GCA8538	0.051	4.6	41.3	277.6	95.717	2.1	0.026	5	5.9	6
GCA8539	0.033	0.9	1	0.7	7.62	5.9	0.012	24.9	5.8	5.8
GCA8540	0.006	0.6	0.4	0.7	0.249	0.3	0.012	15	5.9	5.8
GCA8541	0.013	0.9	1.5	0.4	4.171	23.1	0.026	7.9	6	5.9
GCA8542	0.021	4.9	20.7	325.9	0.674	3.5	0.013	12.1	5.9	6
Alcoa9-OES			X	0.5				0.5		
Alcoa14-MS	0.025	5.1			0.007	5.5	0.027			
AlcoaHi2-OES			2.7	20.5						

The scope of accreditation does not cover this EDTA digest

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NATA Signatory: Ann Evers

Date: 9/04/2010

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Job No: 1004 **LEACHING-COLUMN WORKSHEET**

Project/Client: Phillips River, Tectonic

	GCA8531	**GCA8532**	**GCA8533**	**GCA8534**	**GCA8535**	**GCA8536**
Cycle No.	**1**	**1**	**1**	**1**	**1**	**1**
Date	1/3/10	1/3/10	1/3/10	1/3/10	1/3/10	1/3/10
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leach. + Beaker (kg)	0.95	0.95	0.89	0.86	0.71	0.75
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.69	0.69	0.63	0.60	0.45	0.49
pH	7.0	5.6	3.6	6.6	6.4	6.6
EC (µS/cm)	880	3,000	6,300	3,200	9,300	8,700

Cycle No.	**2**	**2**	**2**	**2**	**2**	**2**
Date	8/3/10	8/3/10	8/3/10	8/3/10	8/3/10	8/3/10
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leach. + Beaker (kg)	1.13	1.17	1.17	1.14	1.17	1.15
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.87	0.91	0.91	0.88	0.91	0.89
pH	7.3	5.2	3.3	7.1	6.9	7.5
EC (µS/cm)	120	230	460	510	1,800	1,300

Cycle No.	**3**	**3**	**3**	**3**	**3**	**3**
Date	15/3/10	15/3/10	15/3/10	15/3/10	15/3/10	15/3/10
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leach. + Beaker (kg)	1.23	1.22	1.24	1.22	1.25	1.23
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.97	0.96	0.98	0.96	0.99	0.97
pH	7.8	4.7	3.3	7.1	7.0	7.6
EC (µS/cm)	58	130	290	280	250	490

Cycle No.	**4**	**4**	**4**	**4**	**4**	**4**
Date	7/4/10	7/4/10	7/4/10	7/4/10	7/4/10	7/4/10
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leach. + Beaker (kg)	1.22	1.22	1.22	1.22	1.24	1.23
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.96	0.96	0.96	0.96	0.98	0.97
pH	7.7	4.7	3.6	5.8	6.3	7.8
EC (µS/cm)	43	84	210	220	180	390

Job No: 1004

LEACHING-COLUMN WORKSHEET

Project/Client: Phillips River, Tectonic

	GCA8537	**GCA8538**	**GCA8539**	**GCA8540**	**GCA8541**	**GCA8542**
Cycle No.	**1**	**1**	**1**	**1**	**1**	**1**
Date	1/3/10	1/3/10	1/3/10	1/3/10	1/3/10	1/3/10
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leach. + Beaker (kg)	0.76	0.76	0.73	0.69	0.81	0.73
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.50	0.50	0.47	0.43	0.55	0.47
pH	6.7	6.3	4.8	4.4	5.1	5.7
EC (µS/cm)	2,800	14,000	19,000	18,000	6,000	11,000

Cycle No.	**2**	**2**	**2**	**2**	**2**	**2**
Date	8/3/10	8/3/10	8/3/10	8/3/10	8/3/10	8/3/10
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leach. + Beaker (kg)	1.16	1.15	1.15	1.16	1.19	1.15
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.90	0.89	0.89	0.90	0.83	0.89
pH	7.7	7.2	6.7	6.9	6.7	6.5
EC (µS/cm)	290	1,300	950	540	320	1,200

Cycle No.	**3**	**3**	**3**	**3**	**3**	**3**
Date	15/3/10	15/3/10	15/3/10	15/3/10	15/3/10	15/3/10
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leach. + Beaker (kg)	1.25	1.21	1.24	1.21	1.22	1.21
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.99	0.95	0.98	0.95	0.96	0.95
pH	7.5	7.3	6.6	6.1	6.1	6.2
EC (µS/cm)	110	190	260	170	150	170

Cycle No.	**4**	**4**	**4**	**4**	**4**	**4**
Date	7/4/10	7/4/10	7/4/10	7/4/10	7/4/10	7/4/10
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leach. + Beaker (kg)	1.22	1.21	1.24	1.23	1.23	1.23
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.96	0.95	0.98	0.97	0.97	0.97
pH	7.7	7.6	6.6	5.8	6.1	6.3
EC (µS/cm)	84	74	160	110	100	91

ANALYTICAL REPORT

17 March 2010

Client Details

Client : **Graeme Campbell & Associates Pty Ltd**
Contact : Graeme Campbell
Address : PO Box 247
BRIDGETOWN
PERTH WA 6255

Job Details

Client Reference : GCA Job No 1004
Report No : PE029124-R2
Report Version : 00
Samples : Column Leachates
Received : 10/03/2010

Comments:

This report cancels and supersedes the report No. PE029124-R dated 16/03/2010 issued by SGS Environmental Services due to amendments to pH and Conductivity results.

This report cancels and supercedes any preliminary results provided

---

For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Sample Receipt:	Cecilia Tadena	AU.Environmental.Perth@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

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Miscellaneous Waters 1						
Client Reference	Units	GCA8531-1	GCA8532-1	GCA8533-1	GCA8534-1	GCA8535-1
Sample No		PE029124-R2-1	PE029124-R2-2	PE029124-R2-3	PE029124-R2-4	PE029124-R2-5
Type of Sample		Column Leachate	Column Leachate	Column Leachate	Column Leachate	Column Leachate
Date Extracted		10/03/2010	10/03/2010	10/03/2010	10/03/2010	10/03/2010
Date Analysed		10/03/2010	10/03/2010	10/03/2010	10/03/2010	10/03/2010
pH	pH Units	6.7	i.s.	4.8	6.5	5.6
Conductivity @25^{o}C	µS/cm	2,000	2,500	5,000	2,500	8,200
Chloride, Cl	mg/L	160	740	1,300	710	2,100
Sulphate, SO_4	mg/L	88	110	190	120	330

Miscellaneous Waters 1						
Client Reference	Units	GCA8536-1	GCA8537-1	GCA8538-1	GCA8539-1	GCA8540-1
Sample No		PE029124-R2-6	PE029124-R2-7	PE029124-R2-8	PE029124-R2-9	PE029124-R2-10
Type of Sample		Column Leachate	Column Leachate	Column Leachate	Column Leachate	Column Leachate
Date Extracted		10/03/2010	10/03/2010	10/03/2010	10/03/2010	10/03/2010
Date Analysed		10/03/2010	10/03/2010	10/03/2010	10/03/2010	10/03/2010
pH	pH Units	3.7	6.8	7.1	6.2	5.0
Conductivity @25^{o}C	µS/cm	5,300	2,300	12,000	17,000	16,000
Chloride, Cl	mg/L	1,600	630	4,000	5,300	5,100
Sulphate, SO_4	mg/L	460	180	360	920	800

Miscellaneous Waters 1			
Client Reference	Units	GCA8541-1	GCA8542-1
Sample No		PE029124-R2-11	PE029124-R2-12
Type of Sample		Column Leachate	Column Leachate
Date Extracted		10/03/2010	10/03/2010
Date Analysed		10/03/2010	10/03/2010
pH	pH Units	6.2	6.6
Conductivity @25^{o}C	µS/cm	4,900	9,100
Chloride, Cl	mg/L	1,400	3,200
Sulphate, SO_4	mg/L	310	360

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				10/3/10	[NT]	[NT]	Control	10/3/10
Date Analysed				10/3/10	[NT]	[NT]	Control	10/3/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	100%
Conductivity @25°C	µS/cm	2	AN106	<2	[NT]	[NT]	Control	107%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	105%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	104%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

Quality Control Key

Method Blank (MB): An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.

Duplicate (D): A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.

Surrogate Spike (SS): An organic compound which is similar to the target analyte(s) in chemical composition and behaviour in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.

Internal Standard (IS): Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard instrument retention time and /or response, which is invariant from run-to-run.

Laboratory Control Sample (LCS): A known matrix spiked with compound(s) representative of the target analytes. The LCS is used to document laboratory performance. When the results of the marix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.

Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.

Relative Percentage Difference (RPD): The difference between an original and a duplicate result divided by the average of the original and duplicate results, expressed as a percentage.

Quality Acceptance Criteria

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.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

ANALYTICAL REPORT

7 April 2010

Client Details

Client	:	**Graeme Campbell & Associates Pty Ltd**
Contact	:	Graeme Campbell
Address	:	PO Box 247 BRIDGETOWN PERTH WA 6255

Job Details

Client Reference	:	GCA Job No 1004
Report No	:	PE029348-R
Report Version	:	01
Samples	:	Water Extracts
Received	:	19/03/2010

Comments:

This report cancels and supersedes the report No. PE029348 dated 25/03/2010 issued by SGS Environmental Services, Conductivity and pH results have been added to the report.

This report cancels and supercedes any preliminary results provided

---

For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Sample Receipt:	Cecilia Tadena	AU.Environmental.Perth@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

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NATA accredited laboratory 2562(898)
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WORLD RECOGNISED ACCREDITATION

Miscellaneous Waters 1	Units					
Client Reference		GCA8531-2	GCA8532-2	GCA8533-2	GCA8534-2	GCA8535-2
Sample No		PE029348-R-1	PE029348-R-2	PE029348-R-3	PE029348-R-4	PE029348-R-5
Type of Sample		Water Extract	Water Extract	Water Extract	Water Extract	Water Extract
Date Extracted		24-31/03/2010	24-31/03/2010	24-31/03/2010	24-31/03/2010	24-31/03/2010
Date Analysed		24-31/03/2010	24-31/03/2010	24-31/03/2010	24-31/03/2010	24-31/03/2010
Sulphate, SO_4	mg/L	21	38	32	24	86
Chloride, Cl	mg/L	14	31	79	45	350
pH	pH Units	6.1	4.9	3.6	7.8	7.6
Conductivity @25^{o}C	µS/cm	99	180	350	390	1,400

Miscellaneous Waters 1	Units					
Client Reference		GCA8536-2	GCA8537-2	GCA8538-2	GCA8539-2	GCA8540-2
Sample No		PE029348-R-6	PE029348-R-7	PE029348-R-8	PE029348-R-9	PE029348-R-10
Type of Sample		Water Extract	Water Extract	Water Extract	Water Extract	Water Extract
Date Extracted		24-31/03/2010	24-31/03/2010	24-31/03/2010	24-31/03/2010	24-31/03/2010
Date Analysed		24-31/03/2010	24-31/03/2010	24-31/03/2010	24-31/03/2010	24-31/03/2010
Sulphate, SO_4	mg/L	120	64	45	140	92
Chloride, Cl	mg/L	200	27	280	150	64
pH	pH Units	8.0	6.5	7.2	6.1	5.9
Conductivity @25^{o}C	µS/cm	1,000	230	1,000	770	430

Miscellaneous Waters 1	Units		
Client Reference		GCA8541-2	GCA8542-2
Sample No		PE029348-R-11	PE029348-R-12
Type of Sample		Water Extract	Water Extract
Date Extracted		24-31/03/2010	24-31/03/2010
Date Analysed		24-31/03/2010	24-31/03/2010
Sulphate, SO_4	mg/L	71	110
Chloride, Cl	mg/L	27	230
pH	pH Units	5.9	6.1
Conductivity @25°C	µS/cm	280	920

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				24/3/10	[NT]	[NT]	CONTROL	24/3/10
Date Analysed				24/3/10	[NT]	[NT]	CONTROL	24/3/10
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	CONTROL	105%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	CONTROL	110%
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	CONTROL	100%
Conductivity @25^{o}C	µS/cm	2	AN106	<2	[NT]	[NT]	CONTROL	103%

Method ID	Methodology Summary
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

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Quality Control Key

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Relative Percentage Difference (RPD): The difference between an original and a duplicate result divided by the average of the original and duplicate results, expressed as a percentage.

Quality Acceptance Criteria

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.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

ANALYTICAL REPORT

26 March 2010

Client Details

Client : **Graeme Campbell & Associates Pty Ltd**
Contact : Graeme Campbell
Address : PO Box 247
BRIDGETOWN
PERTH WA 6255

Job Details

Client Reference : GCA Job No 1004
Report No : PE029397
Report Version : 00
Samples : Water
Received : 23/03/2010

Comments:

This report cancels and supercedes any preliminary results provided

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For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Sample Receipt:	Cecilia Tadena	AU.Environmental.Perth@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

Miscellaneous Waters 1						
Client Reference	Units	GCA8531-3	GCA8532-3	GCA8533-3	GCA8534-3	GCA8535-3
Sample No		PE029397-1	PE029397-2	PE029397-3	PE029397-4	PE029397-5
Type of Sample		Water	Water	Water	Water	Water
Date Extracted		24/03/2010	24/03/2010	24/03/2010	24/03/2010	24/03/2010
Date Analysed		24/03/2010	24/03/2010	24/03/2010	24/03/2010	24/03/2010
pH	pH Units	6.2	4.7	3.7	7.9	7.8
Conductivity @25°C	µS/cm	45	98	220	210	190
Chloride, Cl	mg/L	4	10	31	9	14
Sulphate, SO_4	mg/L	11	25	37	10	10

Miscellaneous Waters 1						
Client Reference	Units	GCA8536-3	GCA8537-3	GCA8538-3	GCA8539-3	GCA8540-3
Sample No		PE029397-6	PE029397-7	PE029397-8	PE029397-9	PE029397-10
Type of Sample		Water	Water	Water	Water	Water
Date Extracted		24/03/2010	24/03/2010	24/03/2010	24/03/2010	24/03/2010
Date Analysed		24/03/2010	24/03/2010	24/03/2010	24/03/2010	24/03/2010
pH	pH Units	8.3	6.9	7.3	5.8	5.2
Conductivity @25°C	µS/cm	370	83	140	200	120
Chloride, Cl	mg/L	29	3	21	19	7
Sulphate, SO_4	mg/L	17	30	11	58	38

Miscellaneous Waters 1	Units		
Client Reference		GCA8541-3	GCA8542-3
Sample No		PE029397-11	PE029397-12
Type of Sample		Water	Water
Date Extracted		24/03/2010	24/03/2010
Date Analysed		24/03/2010	24/03/2010
pH	pH Units	5.4	6.1
Conductivity @25°C	µS/cm	110	130
Chloride, Cl	mg/L	4	12
Sulphate, SO_4	mg/L	38	36

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				24/3/10	[NT]	[NT]	Control	24/3/10
Date Analysed				24/3/10	[NT]	[NT]	Control	24/3/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	100%
Conductivity @25°C	µS/cm	2	AN106	<2	[NT]	[NT]	Control	99%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	109%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	103%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS] : Insufficient Sample for this Test
[NR] : Not Required
[NT] : Not Tested
LOR : Limit of Reporting
[RPD] : Relative Percentage Difference
* : Not part of NATA Accreditation
[N/A] : Not Applicable
[ND] : Not Detected

Report Comments

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

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Quality Acceptance Criteria

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ANALYTICAL REPORT

20 April 2010

Client Details

Client : **Graeme Campbell & Associates Pty Ltd**
Contact : Graeme Campbell
Address : PO Box 247
BRIDGETOWN
PERTH WA 6255

Job Details

Client Reference : GCA Job No 1004
Report No : PE029879
Report Version : 00
Samples : Water
Received : 14/04/2010

Comments:

This report cancels and supercedes any preliminary results provided

For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Business Manager:	Trevor Pilbeam	Trevor.Pilbeam@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Michael McKay
Waste Waters Team Leader

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NATA accredited laboratory 2562(898)
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WORLD RECOGNISED ACCREDITATION

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8531-4 PE029879-1 Water	GCA8532-4 PE029879-2 Water	GCA8533-4 PE029879-3 Water	GCA8534-4 PE029879-4 Water	GCA8535-4 PE029879-5 Water
Date Extracted		15/04/2010	15/04/2010	15/04/2010	15/04/2010	15/04/2010
Date Analysed		15/04/2010	15/04/2010	15/04/2010	15/04/2010	15/04/2010
pH	pH Units	6.1	4.9	3.9	7.8	7.9
Conductivity @25°C	µS/cm	32	63	150	160	130
Chloride, Cl	mg/L	3	5	13	4	4
Sulphate, SO_4	mg/L	8	18	36	7	5

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8536-4 PE029879-6 Water	GCA8537-4 PE029879-7 Water	GCA8538-4 PE029879-8 Water	GCA8539-4 PE029879-9 Water	GCA8540-4 PE029879-10 Water
Date Extracted		15/04/2010	15/04/2010	15/04/2010	15/04/2010	15/04/2010
Date Analysed		15/04/2010	15/04/2010	15/04/2010	15/04/2010	15/04/2010
pH	pH Units	8.2	7.0	7.2	5.8	5.1
Conductivity @25°C	µS/cm	290	63	54	110	77
Chloride, Cl	mg/L	19	<1	3	7	3
Sulphate, SO_4	mg/L	10	24	6	40	26

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8541-4 PE029879-11 Water	GCA8542-4 PE029879-12 Water
Date Extracted		15/04/2010	15/04/2010
Date Analysed		15/04/2010	15/04/2010
pH	pH Units	5.7	5.7
Conductivity @25^{o}C	µS/cm	78	68
Chloride, Cl	mg/L	2	3
Sulphate, SO4	mg/L	30	23

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				15/4/10	[NT]	[NT]	Control	15/4/10
Date Analysed				15/4/10	[NT]	[NT]	Control	15/4/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	99%
Conductivity @25^{o}C	µS/cm	2	AN106	<2	[NT]	[NT]	Control	103%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	105%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	103%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

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Quality Acceptance Criteria

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ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1002539
No. of SAMPLES : 14
No. of ELEMENTS : 10
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachates (Waste-Regoliths)
STATE : Solutions
DATE RECEIVED : 09/03/2010
DATE COMPLETED : 17/03/2010
DATE PRINTED : 18/03/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
\> = Value beyond Limit of Method

MAIN OFFICE AND LABORATORY
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Email: genalysis@genalysis.com.au
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TOWNSVILLE LABORATORY
9-23 Kelli Street, Mt St John, Bohle, Queensland, Australia 4818
Tel: +61 7 4774 3655 Fax: +61 7 4774 4692

SAMPLE DETAILS

DISCLAIMER

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SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $3.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $75.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

*** NATA ENDORSED DOCUMENT ***

Company Accreditation Number 3244

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The analysis results reported herein have been obtained using the following methods and conditions:

The 14 samples, as listed in the report, were received as being 'Column-Leachates' which had been filtered and acidified.

The results have been determined according to Genalysis methods numbers ICP_W004 and ICP_W003.

The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP Chemist

Date: 17th March 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Cd	Cu	Fe-Sol	Mn	Pb	Sb	Se	Zn
UNITS	mg/l	ug/l	ug/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	mg/l
DETECTION LIMIT	0.01	0.1	0.02	0.01	0.01	0.01	0.5	0.01	0.5	0.01
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/MS	/OES	/OES	/OES	/MS	/MS	/MS	/OES
SAMPLE NUMBERS										
0001 GCA8531-1	X	2.5	0.33	0.02	X	0.52	0.6	0.47	5.0	2.41
0002 GCA8532-1	0.30	5.4	0.76	0.18	1.38	2.23	5.4	0.36	9.3	12.26
0003 GCA8533-1	12.10	8.8	1.43	2.07	9.66	1.21	43.9	0.43	20.3	29.26
0004 GCA8534-1	0.04	22.4	0.08	0.04	X	X	37.1	2.43	15.3	0.10
0005 GCA8535-1	0.06	27.9	0.17	0.09	X	0.01	0.7	7.47	40.8	0.07
0006 GCA8536-1	0.10	14.7	0.11	0.05	X	0.02	2.1	1.47	65.0	0.08
0007 GCA8537-1	0.09	4.5	2.15	0.03	0.02	3.41	2.5	0.31	5.2	1.22
0008 GCA8538-1	0.05	30.7	1.29	0.02	X	5.73	0.7	0.30	33.5	0.08
0009 GCA8539-1	0.56	20.9	3.66	0.08	0.44	1.67	262.8	0.82	52.5	85.75
0010 GCA8540-1	2.00	17.1	3.22	0.13	X	1.75	43.0	0.15	44.6	46.80
0011 GCA8541-1	0.02	6.3	1.64	0.03	0.08	0.99	47.5	0.33	37.4	15.97
0012 GCA8542-1	0.07	10.3	1.92	0.18	X	45.56	5.6	0.17	21.4	16.66
0013 BLANK-1-OX	0.05	0.7	0.04	0.01	0.03	X	43.7	0.04	1.0	0.06
0014 DW-1-OX	X	X	X	X	X	X	X	X	X	0.05
CHECKS										
0001 GCA8531-1	X	2.5	0.32	0.02	X	0.52	0.7	0.48	5.3	2.44
STANDARDS										
0001 Alcoa14-MS		27.6	5.34				6.6	5.41	28.1	
0002 Alcoa9-OES	1.92			0.06	4.79	0.51				0.51
BLANKS										
0001 Control Blank	X	X	X	X	X	X	X	X	X	X

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1003158
No. of SAMPLES : 14
No. of ELEMENTS : 10
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachates (Waste-Regoliths
STATE : Solutions
DATE RECEIVED : 18/03/2010
DATE COMPLETED : 30/03/2010
DATE PRINTED : 30/03/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
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SAMPLE DETAILS

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SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

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SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

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Company Accreditation Number 3244

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The analysis results reported herein have been obtained using the following methods and conditions:

The 14 samples, as listed in the report, were received as being 'Column-Leachates' which had been filtered and acidified.

The results have been determined according to Genalysis methods numbers ICP_W004 and ICP_W003.

The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed in micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP CHemist

Date: 30th March 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Cd	Cu	Fe-Sol	Mn	Pb	Sb	Se	Zn
UNITS	mg/l	ug/l	ug/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	mg/l
DETECTION LIMIT	0.01	0.1	0.02	0.01	0.01	0.01	0.5	0.01	0.5	0.01
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/MS	/OES	/OES	/OES	/MS	/MS	/MS	/OES
SAMPLE NUMBERS										
0001 GCA8531-2	X	1.6	0.59	0.09	X	0.06	1.0	0.35	1.8	0.21
0002 GCA8532-2	0.05	4.2	0.18	0.08	0.08	0.47	1.3	0.39	1.5	2.04
0003 GCA8533-2	4.67	4.7	0.24	0.72	2.12	0.27	13.4	0.11	1.9	3.30
0004 GCA8534-2	0.07	14.2	0.06	0.01	X	X	2.9	2.65	3.2	0.03
0005 GCA8535-2	0.06	26.0	0.04	0.04	X	X	X	17.78	8.2	0.04
0006 GCA8536-2	0.14	7.6	0.03	0.03	X	X	X	1.81	12.5	0.04
0007 GCA8537-2	X	3.1	0.03	X	X	0.03	X	0.24	0.9	0.04
0008 GCA8538-2	X	13.4	0.05	X	X	0.18	X	0.35	3.2	0.03
0009 GCA8539-2	X	9.3	0.07	0.01	0.02	0.07	0.7	0.30	2.6	2.61
0010 GCA8540-2	X	3.3	0.04	X	0.01	0.02	0.6	0.06	1.0	0.57
0011 GCA8541-2	X	1.6	0.14	0.01	X	0.26	2.7	0.16	9.4	2.65
0012 GCA8542-2	X	3.6	0.07	0.04	X	3.43	1.2	0.11	2.6	1.45
0013 BLANK-2-OX	X	0.3	0.06	0.01	X	X	X	0.02	0.6	0.05
0014 DW-2-OX	X	0.2	X	X	X	X	0.6	X	0.7	0.03
CHECKS										
0001 GCA8531-2	X	1.3	0.57	0.08	X	0.06	0.7	0.36	1.4	0.21
STANDARDS										
0001 Alcoa14-MS		26.1	5.15				6.2	5.45	26.9	
0002 AlcoaHi2-OES	48.81			2.64	102.29	19.89				20.92
BLANKS										
0001 Control Blank	X	X	X	X	X	X	X	X	X	X

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1003312
No. of SAMPLES : 14
No. of ELEMENTS : 10
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachates (Waste-Regoliths)
STATE : Solutions
DATE RECEIVED : 22/03/2010
DATE COMPLETED : 31/03/2010
DATE PRINTED : 31/03/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method

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GENERAL CONDITIONS

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The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP Chemist

Date: 31st March 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Cd	Cu	Fe-Sol	Mn	Pb	Sb	Se	Zn
UNITS	mg/l	ug/l	ug/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	mg/l
DETECTION LIMIT	0.01	0.1	0.02	0.01	0.01	0.01	0.5	0.01	0.5	0.01
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/MS	/OES	/OES	/OES	/MS	/MS	/MS	/OES
SAMPLE NUMBERS										
0001 GCA8531-3	0.01	1.1	0.10	0.01	0.01	0.03	1.2	0.30	1.1	0.20
0002 GCA8532-3	0.06	3.9	0.12	0.08	0.01	0.32	1.7	0.33	1.3	1.22
0003 GCA8533-3	3.65	5.9	0.16	0.64	1.21	0.18	10.7	0.09	1.6	2.27
0004 GCA8534-3	0.07	11.7	0.05	X	X	X	15.1	1.89	2.1	0.07
0005 GCA8535-3	0.06	18.6	0.02	0.02	X	X	X	17.92	1.6	0.05
0006 GCA8536-3	0.20	4.4	0.02	0.02	X	X	X	1.49	2.3	0.27
0007 GCA8537-3	0.02	1.9	0.03	X	X	X	X	0.29	0.5	0.08
0008 GCA8538-3	0.03	10.1	0.02	X	X	0.01	X	0.54	1.0	0.05
0009 GCA8539-3	X	5.9	0.07	X	0.05	0.03	1.1	0.20	1.3	1.20
0010 GCA8540-3	0.02	2.2	0.04	X	0.01	0.02	0.7	0.07	0.7	0.38
0011 GCA8541-3	0.01	2.2	0.09	0.01	X	0.14	2.1	0.13	6.6	1.47
0012 GCA8542-3	0.01	2.0	0.03	0.02	X	0.67	X	0.08	0.6	0.40
0013 BLANK-3-OX	X	X	0.07	0.02	X	X	X	0.02	0.8	0.05
0014 DW-3-OX	0.02	X	X	X	0.02	X	X	X	0.6	0.04
CHECKS										
0001 GCA8531-3	X	1.1	0.10	0.01	X	0.03	1.0	0.32	0.9	0.20
STANDARDS										
0001 Alcoa14-MS		27.3	5.32				6.5	5.49	27.8	
0002 Alcoa9-OES	1.87			0.06	4.81	0.50				0.50
BLANKS										
0001 Control Blank	X	X	X	X	X	X	X	X	X	0.01

METHOD CODE DESCRIPTION

/MS	Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES	Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1004149
No. of SAMPLES : 14
No. of ELEMENTS : 10
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachates(Waste-Regoliths)
STATE : Solutions
DATE RECEIVED : 12/04/2010
DATE COMPLETED : 27/04/2010
DATE PRINTED : 28/04/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method

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NATA Signatory: H Pham
ICP Chemist

Date: 27th April 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Cd	Cu	Fe-Sol	Mn	Pb	Sb	Se	Zn
UNITS	mg/l	ug/l	ug/l	mg/l	mg/l	mg/l	ug/l	ug/l	ug/l	mg/l
DETECTION LIMIT	0.01	0.1	0.02	0.01	0.01	0.01	0.5	0.01	0.5	0.01
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/MS	/OES	/OES	/OES	/MS	/MS	/MS	/OES
SAMPLE NUMBERS										
0001 GCA8531-4	0.03	1.2	0.03	X	0.02	0.03	1.6	0.26	0.6	0.21
0002 GCA8532-4	0.06	1.5	0.08	0.05	X	0.26	1.4	0.29	X	0.96
0003 GCA8533-4	3.43	4.3	0.09	0.56	1.16	0.12	7.6	0.08	0.7	1.77
0004 GCA8534-4	0.07	8.0	0.04	X	X	X	3.3	1.35	0.9	0.04
0005 GCA8535-4	0.05	14.7	X	X	X	X	X	21.70	0.8	0.05
0006 GCA8536-4	0.19	2.9	X	0.02	X	X	X	1.07	0.8	0.03
0007 GCA8537-4	0.02	0.8	X	X	X	X	X	0.26	X	0.03
0008 GCA8538-4	0.02	7.5	X	X	X	X	X	0.48	X	0.02
0009 GCA8539-4	0.03	2.9	0.04	X	0.04	0.04	1.0	0.13	0.5	1.43
0010 GCA8540-4	0.01	2.2	X	X	X	0.03	1.3	0.04	0.5	0.57
0011 GCA8541-4	X	1.3	0.07	X	X	0.10	2.6	0.12	4.8	1.11
0012 GCA8542-4	X	1.0	0.02	0.02	X	1.08	0.6	0.06	X	0.54
0013 BLANK-4-OX	X	1.7	0.10	0.03	0.01	X	7.5	0.04	X	0.05
0014 DW-4-OX	0.01	0.3	X	X	X	X	X	X	0.5	0.03
CHECKS										
0001 GCA8531-4	X	1.1	0.04	X	0.02	0.03	1.0	0.25	X	0.21
STANDARDS										
0001 Alcoa14-MS		26.4	5.10				6.3	5.35	26.6	
0002 Alcoa9-OES	1.94			0.06	4.68	0.50				0.51
BLANKS										
0001 Control Blank	X	X	X	X	X	X	X	X	X	X

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

Graeme Campbell & Associates Pty Ltd
Testing-Laboratory, Unit B, 15 Rose St. Bridgetown, WA 6255

KINETIC-TESTING WORKSHEET (WEATHERING-COLUMNS)

Job No: 1004

Client: TECTONIC, PHILLIPS RIVER PROJECT

	GCA8543	**GCA8544**	**GCA8545**	**GCA8546**	**GCA8547**	**GCA8548**
Column-Packing						
Wt Column-Only (kg)	0.32	0.32	0.32	0.32	0.32	0.32
Wt Column + Sample (kg)	2.32	2.32	2.32	2.32	2.32	2.32
Wt Sample (kg)	2.00	2.00	2.00	2.00	2.00	2.00
Sample-Bed-Height (cm) [+/- 0.5 cm]	6.0	6.0	6.0	6.0	6.0	6.0

Pre-Rinse Cycle (Cycle-0)	**0**	**0**	**0**	**0**	**0**	**0**
Wt DW Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
Wt Leachate + Beaker (kg)	0.86	0.80	0.83	0.80	0.79	0.80
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.60	0.54	0.57	0.54	0.53	0.54
Leachate-pH	**5.7**	**5.7**	**4.8**	**5.7**	**5.6**	**4.5**
Leachate-EC (µS/cm)	**380**	**370**	**420**	**370**	**740**	**260**
Wt "Drained-Column" (kg)	2.56	2.58	2.56	2.60	2.60	2.60
Wt Retained-Solution (kg)	0.24	0.26	0.24	0.28	0.28	0.28
Gravimetric-Water-Content (%, w/w)	**12.0**	**13.0**	**12.0**	**14.0**	**14.0**	**14.0**

	GCA8543	**GCA8544**	**GCA8545**	**GCA8546**	**GCA8547**	**GCA8548**
Weathering-Cycles						
Cycle No.	**1**	**1**	**1**	**1**	**1**	**1**
DAY-1 (i.e. Start-of-Day-1) [Monday]						
Lamps-On: Date	1/3/10	1/3/10	1/3/10	1/3/10	1/3/10	1/3/10
Lamps-On: Time	22.00	22.00	22.00	22.00	22.00	22.00
DAY-2						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.45	2.47	2.46	2.50	2.51	2.50
Gravimetric-Water-Content (%, w/w)	**6.5**	**7.5**	**7.0**	**9.0**	**9.5**	**9.0**
DAY-3						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.38	2.39	2.39	2.43	2.43	2.42
Gravimetric-Water-Content (%, w/w)	**3.0**	**3.5**	**3.5**	**5.5**	**5.5**	**5.0**
DAY-4						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.34	2.34	2.34	2.36	2.37	2.36
Gravimetric-Water-Content (%, w/w)	**1.0**	**1.0**	**1.0**	**2.0**	**2.5**	**2.0**
DAY-5						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.33	2.32	2.33	2.34	2.34	2.34
Gravimetric-Water-Content (%, w/w)	**0.5**	**0.0**	**0.5**	**1.0**	**1.0**	**1.0**
DAY-6 (Saturday)						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Dried-Out-Column (kg)	2.32	2.32	2.32	2.32	2.33	2.33
Gravimetric-Water-Content (%, w/w)	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
Wt Deionised-Water Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
(Lamps remain off)						
DAY-7 (i.e. End-of-Day-7)						
Wt Drained-Column(kg)	2.64	2.65	2.65	2.72	2.69	2.72
Gravimetric-Water-Content (%, w/w)	**16.0**	**16.5**	**16.5**	**20.0**	**18.5**	**20.0**
Wt Leachate + Beaker (kg)	0.88	0.85	0.86	0.79	0.82	0.79
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.62	0.59	0.60	0.53	0.56	0.53
Leachate-pH	**5.7**	**5.7**	**4.9**	**5.7**	**5.7**	**4.4**
Leachate-EC (µS/cm)	**1,500**	**1,200**	**1,400**	**1,800**	**1,400**	**1,300**

	GCA8543	**GCA8544**	**GCA8545**	**GCA8546**	**GCA8547**	**GCA8548**
Weathering-Cycles						
Cycle No.	**2**	**2**	**2**	**2**	**2**	**2**
DAY-1 (i.e. Start-of-Day-1) [Monday]						
Lamps-On: Date	8/03/10	8/03/10	8/03/10	8/03/10	8/03/10	8/03/10
Lamps-On: Time	22.00	22.00	22.00	22.00	22.00	22.00
DAY-2						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.54	2.56	2.57	2.63	2.61	2.63
Gravimetric-Water-Content (%, w/w)	**11.0**	**12.0**	**12.5**	**15.5**	**14.5**	**15.5**
DAY-3						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.45	2.47	2.49	2.55	2.52	2.54
Gravimetric-Water-Content (%, w/w)	**6.5**	**7.5**	**8.5**	**11.5**	**10.0**	**11.0**
DAY-4						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.37	2.38	2.40	2.47	2.43	2.44
Gravimetric-Water-Content (%, w/w)	**2.5**	**3.0**	**4.0**	**7.5**	**5.5**	**6.0**
DAY-5						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.33	2.33	2.34	2.37	2.35	2.35
Gravimetric-Water-Content (%, w/w)	**0.5**	**0.5**	**1.0**	**2.5**	**1.5**	**1.5**
DAY-6 (Saturday)						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Dried-Out-Column (kg)	2.32	2.32	2.32	2.33	2.33	2.33
Gravimetric-Water-Content (%, w/w)	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
Wt Deionised-Water Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
(Lamps remain off)						
DAY-7 (i.e. End-of-Day-7)						
Wt Drained-Column(kg)	2.59	2.59	2.57	2.59	2.62	2.61
Gravimetric-Water-Content (%, w/w)	**13.5**	**13.5**	**12.5**	**13.5**	**15.0**	**14.5**
Wt Leachate + Beaker (kg)	0.94	0.93	0.96	0.94	0.91	0.91
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.68	0.67	0.70	0.68	0.65	0.65
Leachate-pH	**5.6**	**5.6**	**4.3**	**5.4**	**5.3**	**4.3**
Leachate-EC (µS/cm)	**910**	**700**	**930**	**770**	**1,000**	**1,000**

	GCA8543	GCA8544	GCA8545	GCA8546	GCA8547	GCA8548
Weathering-Cycles						
Cycle No.	**3**	**3**	**3**	**3**	**3**	**3**
DAY-1 (i.e. Start-of-Day-1) [Monday]						
Lamps-On: Date	15/03/10	15/03/10	15/03/10	15/03/10	15/03/10	15/03/10
Lamps-On: Time	22.00	22.00	22.00	22.00	22.00	22.00
DAY-2						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.49	2.50	2.48	2.50	2.53	2.52
Gravimetric-Water-Content (%, w/w)	**8.5**	**9.0**	**8.0**	**9.0**	**10.5**	**10.0**
DAY-3						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.41	2.42	2.40	2.43	2.45	2.44
Gravimetric-Water-Content (%, w/w)	**4.5**	**5.0**	**4.0**	**5.5**	**6.5**	**6.0**
DAY-4						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.36	2.36	2.35	2.37	2.38	2.37
Gravimetric-Water-Content (%, w/w)	**2.0**	**2.0**	**1.5**	**2.5**	**3.0**	**2.5**
DAY-5						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.34	2.33	2.33	2.33	2.34	2.34
Gravimetric-Water-Content (%, w/w)	**1.0**	**0.5**	**0.5**	**0.5**	**1.0**	**1.0**
DAY-6 (Saturday)						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Dried-Out-Column (kg)	2.33	2.32	2.32	2.32	2.33	2.33
Gravimetric-Water-Content (%, w/w)	**0.5**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
Wt Deionised-Water Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
(Lamps remain off)						
DAY-7 (i.e. End-of-Day-7)						
Wt Drained-Column(kg)	2.58	2.57	2.57	2.65	2.59	2.60
Gravimetric-Water-Content (%, w/w)	**13.0**	**12.5**	**12.5**	**16.5**	**13.5**	**14.0**
Wt Leachate + Beaker (kg)	0.97	0.96	0.97	0.88	0.94	0.93
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.71	0.70	0.71	0.62	0.68	0.67
Leachate-pH	**5.2**	**5.3**	**4.2**	**5.2**	**5.2**	**4.3**
Leachate-EC (µS/cm)	**400**	**250**	**420**	**540**	**430**	**560**

	GCA8543	GCA8544	GCA8545	GCA8546	GCA8547	GCA8548
Weathering-Cycles						
Cycle No.	**4**	**4**	**4**	**4**	**4**	**4**
DAY-1 (i.e. Start-of-Day-1) [Monday]						
Lamps-On: Date	22/03/10	22/03/10	22/03/10	22/03/10	22/03/10	22/03/10
Lamps-On: Time	22.00	22.00	22.00	22.00	22.00	22.00
DAY-2						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.50	2.49	2.50	2.59	2.53	2.53
Gravimetric-Water-Content (%, w/w)	**9.0**	**8.5**	**9.0**	**13.5**	**10.5**	**10.5**
DAY-3						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.41	2.39	2.40	2.50	2.44	2.43
Gravimetric-Water-Content (%, w/w)	**4.5**	**3.5**	**4.0**	**9.0**	**6.0**	**5.5**
DAY-4						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.36	2.34	2.35	2.43	2.37	2.36
Gravimetric-Water-Content (%, w/w)	**2.0**	**1.0**	**1.5**	**5.5**	**2.5**	**2.0**
DAY-5						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.34	2.32	2.33	2.36	2.34	2.34
Gravimetric-Water-Content (%, w/w)	**1.0**	**0.0**	**0.5**	**2.0**	**1.0**	**1.0**
DAY-6 (Saturday)						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Dried-Out-Column (kg)	2.32	2.32	2.32	2.33	2.33	2.33
Gravimetric-Water-Content (%, w/w)	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**	**0.5**
Wt Deionised-Water Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
(Lamps remain off)						
DAY-7 (i.e. End-of-Day-7)						
Wt Drained-Column(kg)	2.57	2.57	2.56	2.60	2.60	2.58
Gravimetric-Water-Content (%, w/w)	**12.5**	**12.5**	**12.0**	**14.0**	**14.0**	**13.0**
Wt Leachate + Beaker (kg)	0.98	0.96	0.98	0.95	0.93	0.95
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.72	0.70	0.72	0.69	0.67	0.69
Leachate-pH	**5.4**	**5.7**	**4.3**	**5.8**	**5.4**	**4.3**
Leachate-EC (µS/cm)	**270**	**160**	**410**	**190**	**270**	**390**

	GCA8543	GCA8544	GCA8545	GCA8546	GCA8547	GCA8548
Weathering-Cycles						
Cycle No.	**5**	**5**	**5**	**5**	**5**	**5**
DAY-1 (i.e. Start-of-Day-1) [Monday]						
Lamps-On: Date	29/03/10	29/03/10	29/03/10	29/03/10	29/03/10	29/03/10
Lamps-On: Time	22.00	22.00	22.00	22.00	22.00	22.00
DAY-2						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.48	2.48	2.48	2.52	2.53	2.50
Gravimetric-Water-Content (%, w/w)	**8.0**	**8.0**	**8.0**	**10.0**	**10.5**	**9.0**
DAY-3						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.39	2.39	2.39	2.44	2.44	2.40
Gravimetric-Water-Content (%, w/w)	**3.5**	**3.5**	**3.5**	**6.0**	**6.0**	**4.0**
DAY-4						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.36	2.35	2.35	2.38	2.38	2.36
Gravimetric-Water-Content (%, w/w)	**2.0**	**1.5**	**1.5**	**3.0**	**3.0**	**2.0**
DAY-5						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.34	2.33	2.33	2.34	2.34	2.34
Gravimetric-Water-Content (%, w/w)	**1.0**	**0.5**	**0.5**	**1.0**	**1.0**	**1.0**
DAY-6 (Saturday)						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Dried-Out-Column (kg)	2.33	2.32	2.32	2.32	2.33	2.33
Gravimetric-Water-Content (%, w/w)	**0.0**	**0.0**	**0.0**	**0.0**	**0.5**	**0.5**
Wt Deionised-Water Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
(Lamps remain off)						
DAY-7 (i.e. End-of-Day-7)						
Wt Drained-Column(kg)	2.58	2.55	2.55	2.58	2.58	2.57
Gravimetric-Water-Content (%, w/w)	**13.0**	**11.5**	**11.5**	**13.0**	**13.0**	**12.5**
Wt Leachate + Beaker (kg)	0.97	0.98	0.99	0.96	0.95	0.96
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.72	0.70	0.72	0.69	0.67	0.69
Leachate-pH	**5.4**	**5.6**	**4.2**	**5.5**	**5.3**	**4.3**
Leachate-EC (µS/cm)	**190**	**110**	**270**	**210**	**230**	**360**

	GCA8543	GCA8544	GCA8545	GCA8546	GCA8547	GCA8548
Weathering-Cycles						
Cycle No.	**6**	**6**	**6**	**6**	**6**	**6**
DAY-1 (i.e. Start-of-Day-1) [Monday]						
Lamps-On: Date	5/04/10	5/04/10	5/04/10	5/04/10	5/04/10	5/04/10
Lamps-On: Time	22.00	22.00	22.00	22.00	22.00	22.00
DAY-2						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.50	2.48	2.48	2.52	2.52	2.50
Gravimetric-Water-Content (%, w/w)	**9.0**	**8.0**	**8.0**	**10.0**	**10.0**	**9.0**
DAY-3						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.43	2.41	2.41	2.46	2.45	2.43
Gravimetric-Water-Content (%, w/w)	**5.5**	**4.5**	**4.5**	**7.0**	**6.5**	**5.5**
DAY-4						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.37	2.35	2.36	2.39	2.38	2.37
Gravimetric-Water-Content (%, w/w)	**2.5**	**1.5**	**2.0**	**3.5**	**3.0**	**2.5**
DAY-5						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Drying-Column (kg)	2.34	2.33	2.34	2.35	2.35	2.34
Gravimetric-Water-Content (%, w/w)	**1.0**	**0.5**	**1.0**	**1.5**	**1.5**	**1.0**
DAY-6 (Saturday)						
Time	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30	9.00-9.30
Wt Dried-Out-Column (kg)	2.33	2.32	2.33	2.33	2.34	2.33
Gravimetric-Water-Content (%, w/w)	**0.5**	**0.0**	**0.5**	**0.5**	**1.0**	**0.5**
Wt Deionised-Water Added (kg)	1.00	1.00	1.00	1.00	1.00	1.00
(Lamps remain off)						
DAY-7 (i.e. End-of-Day-7)						
Wt Drained-Column(kg)	2.57	2.55	2.55	2.58	2.58	2.57
Gravimetric-Water-Content (%, w/w)	**12.5**	**11.5**	**11.5**	**13.0**	**13.0**	**12.5**
Wt Leachate + Beaker (kg)	0.99	0.99	1.00	0.97	0.97	0.97
Wt Beaker (kg)	0.26	0.26	0.26	0.26	0.26	0.26
Wt Leachate (kg)	0.72	0.70	0.72	0.69	0.67	0.69
Leachate-pH	**5.0**	**5.2**	**4.0**	**5.2**	**5.0**	**4.2**
Leachate-EC (µS/cm)	**130**	**71**	**250**	**160**	**180**	**280**

ANALYTICAL REPORT

15 March 2010

Client Details			**Job Details**		
Client	:	**Graeme Campbell & Associates Pty Ltd**	Client Reference	:	GCA Job No 1004
Contact	:	Graeme Campbell	Report No	:	PE029125
Address	:	PO Box 247	Report Version	:	00
		BRIDGETOWN	Samples	:	Column Leachates
		PERTH WA 6255	Received	:	10/03/2010

Comments:

This report cancels and supercedes any preliminary results provided

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For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Sample Receipt:	Cecilia Tadena	AU.Environmental.Perth@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8543-0 PE029125-1 Column Leachate	GCA8544-0 PE029125-2 Column Leachate	GCA8545-0 PE029125-3 Column Leachate	GCA8546-0 PE029125-4 Column Leachate	GCA8547-0 PE029125-5 Column Leachate
Date Extracted		10/03/2010	10/03/2010	10/03/2010	10/03/2010	10/03/2010
Date Analysed		10/03/2010	10/03/2010	10/03/2010	10/03/2010	10/03/2010
pH	pH Units	7.2	7.1	5.3	6.7	6.4
Conductivity @25°C	µS/cm	360	340	370	340	680
Chloride, Cl	mg/L	86	76	44	83	150
Sulphate, SO_4	mg/L	32	35	98	32	93

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8548-0 PE029125-6 Column Leachate
Date Extracted		10/03/2010
Date Analysed		10/03/2010
pH	pH Units	4.9
Conductivity @25°C	µS/cm	240
Chloride, Cl	mg/L	20
Sulphate, SO_4	mg/L	72

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				10/3/10	[NT]	[NT]	Control	10/3/10
Date Analysed				10/3/10	[NT]	[NT]	Control	10/3/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	100%
Conductivity @25^{o}C	µS/cm	2	AN106	<2	[NT]	[NT]	Control	107%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	105%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	104%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

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Quality Control Key

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Duplicate (D): A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike (SS): An organic compound which is similar to the target analyte(s) in chemical composition and behaviour in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard (IS): Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard instrument retention time and /or response, which is invariant from run-to-run.
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Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.
Relative Percentage Difference (RPD): The difference between an original and a duplicate result divided by the average of the original and duplicate results, expressed as a percentage.

Quality Acceptance Criteria

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.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

ANALYTICAL REPORT

25 March 2010

Client Details

Client : **Graeme Campbell & Associates Pty Ltd**
Contact : Graeme Campbell
Address : PO Box 247
BRIDGETOWN
PERTH WA 6255

Job Details

Client Reference : GCA Job No. 1004
Report No : PE029361
Report Version : 00
Samples : Leachates
Received : 19/03/2010

Comments:

This report cancels and supercedes any preliminary results provided

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For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Sample Receipt:	Cecilia Tadena	AU.Environmental.Perth@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

Miscellaneous Waters 1						
Client Reference	Units	GCA8543-1	GCA8544-1	GCA8545-1	GCA8546-1	GCA8547-1
Sample No		PE029361-1	PE029361-2	PE029361-3	PE029361-4	PE029361-5
Type of Sample		Water	Water	Water	Water	Water
Date Extracted		22/03/2010	22/03/2010	22/03/2010	22/03/2010	22/03/2010
Date Analysed		22/03/2010	22/03/2010	22/03/2010	22/03/2010	22/03/2010
pH	pH Units	6.0	6.2	4.5	5.8	5.7
Conductivity @25°C	µS/cm	1,200	910	1,100	1,500	1,200
Chloride, Cl	mg/L	280	200	130	370	240
Sulphate, SO_4	mg/L	150	140	340	170	200

Miscellaneous Waters 1		
Client Reference	Units	GCA8548-1
Sample No		PE029361-6
Type of Sample		Water
Date Extracted		22/03/2010
Date Analysed		22/03/2010
pH	pH Units	4.2
Conductivity @25°C	µS/cm	1,100
Chloride, Cl	mg/L	92
Sulphate, SO_4	mg/L	400

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				22/3/10	[NT]	[NT]	CONTROL	22/3/10
Date Analysed				22/3/10	[NT]	[NT]	CONTROL	22/3/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	CONTROL	100%
Conductivity @25°C	µS/cm	2	AN106	<2	[NT]	[NT]	CONTROL	100%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	CONTROL	110%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	CONTROL	105%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

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Quality Control Key

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Surrogate Spike (SS): An organic compound which is similar to the target analyte(s) in chemical composition and behaviour in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
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Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.
Relative Percentage Difference (RPD): The difference between an original and a duplicate result divided by the average of the original and duplicate results, expressed as a percentage.

Quality Acceptance Criteria

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ANALYTICAL REPORT

26 March 2010

Client Details

Client : **Graeme Campbell & Associates Pty Ltd**
Contact : Graeme Campbell
Address : PO Box 247
BRIDGETOWN
PERTH WA 6255

Job Details

Client Reference : GCA Job No 1004
Report No : PE029396
Report Version : 00
Samples : Water
Received : 23/03/2010

Comments:

This report cancels and supercedes any preliminary results provided

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For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Sample Receipt:	Cecilia Tadena	AU.Environmental.Perth@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

Miscellaneous Waters 1						
Client Reference	Units	GCA8543-2	GCA8544-2	GCA8545-2	GCA8546-2	GCA8547-2
Sample No		PE029396-1	PE029396-2	PE029396-3	PE029396-4	PE029396-5
Type of Sample		Water	Water	Water	Water	Water
Date Extracted		24/03/2010	24/03/2010	24/03/2010	24/03/2010	24/03/2010
Date Analysed		24/03/2010	24/03/2010	24/03/2010	24/03/2010	24/03/2010
pH	pH Units	6.1	6.2	4.2	6.0	5.4
Conductivity @25°C	µS/cm	690	530	700	580	790
Chloride, Cl	mg/L	150	100	63	130	150
Sulphate, SO_4	mg/L	110	100	240	82	170

Miscellaneous Waters 1		
Client Reference	Units	GCA8548-2
Sample No		PE029396-6
Type of Sample		Water
Date Extracted		24/03/2010
Date Analysed		24/03/2010
pH	pH Units	4.3
Conductivity @25°C	µS/cm	770
Chloride, Cl	mg/L	55
Sulphate, SO_4	mg/L	310

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				24/3/10	[NT]	[NT]	Control	24/3/10
Date Analysed				24/3/10	[NT]	[NT]	Control	24/3/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	100%
Conductivity @25^oC	µS/cm	2	AN106	<2	[NT]	[NT]	Control	99%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	109%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	103%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

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Quality Control Key

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Surrogate Spike (SS): An organic compound which is similar to the target analyte(s) in chemical composition and behaviour in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
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Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.
Relative Percentage Difference (RPD): The difference between an original and a duplicate result divided by the average of the original and duplicate results, expressed as a percentage.

Quality Acceptance Criteria

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ANALYTICAL REPORT

30 March 2010

Client Details

Client	:	**Graeme Campbell & Associates Pty Ltd**
Contact	:	Graeme Campbell
Address	:	PO Box 247 BRIDGETOWN PERTH WA 6255

Job Details

Client Reference	:	GCA Job No 1004
Report No	:	PE029456
Report Version	:	00
Samples	:	Water
Received	:	25/03/2010

Comments:

This report cancels and supercedes any preliminary results provided

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For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Sample Receipt:	Cecilia Tadena	AU.Environmental.Perth@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8543-3 PE029456-1 Water	GCA8544-3 PE029456-2 Water	GCA8545-3 PE029456-3 Water	GCA8546-3 PE029456-4 Water	GCA8547-3 PE029456-5 Water
Date Extracted		26/03/2010	26/03/2010	26/03/2010	26/03/2010	26/03/2010
Date Analysed		26/03/2010	26/03/2010	26/03/2010	26/03/2010	26/03/2010
pH	pH Units	6.1	6.1	4.4	5.7	5.3
Conductivity @25°C	µS/cm	320	200	340	430	340
Chloride, Cl	mg/L	58	32	21	89	50
Sulphate, SO_4	mg/L	57	41	120	71	82

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8548-3 PE029456-6 Water
Date Extracted		26/03/2010
Date Analysed		26/03/2010
pH	pH Units	4.3
Conductivity @25°C	µS/cm	430
Chloride, Cl	mg/L	21
Sulphate, SO_4	mg/L	190

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				26/3/10	[NT]	[NT]	Control	26/3/10
Date Analysed				26/3/10	[NT]	[NT]	Control	26/3/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	97%
Conductivity @25^{o}C	µS/cm	2	AN106	<2	[NT]	[NT]	Control	99%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	108%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	100%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
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AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

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Relative Percentage Difference (RPD): The difference between an original and a duplicate result divided by the average of the original and duplicate results, expressed as a percentage.

Quality Acceptance Criteria

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SGS

ANALYTICAL REPORT

14 April 2010

Client Details

Client : **Graeme Campbell & Associates Pty Ltd**
Contact : Graeme Campbell
Address : PO Box 247
BRIDGETOWN
PERTH WA 6255

Job Details

Client Reference : GCA Job No 1004
Report No : PE029706
Report Version : 00
Samples : Water
Received : 7/04/2010

Comments:

This report cancels and supercedes any preliminary results provided

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For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Business Manager:	Trevor Pilbeam	Trevor.Pilbeam@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8543-4 PE029706-1 Water	GCA8544-4 PE029706-2 Water	GCA8545-4 PE029706-3 Water	GCA8546-4 PE029706-4 Water	GCA8547-4 PE029706-5 Water
Date Extracted		8/04/2010	8/04/2010	8/04/2010	8/04/2010	8/04/2010
Date Analysed		8/04/2010	8/04/2010	8/04/2010	8/04/2010	8/04/2010
pH	pH Units	5.9	6.3	4.5	6.1	5.5
Conductivity @25°C	µS/cm	200	110	200	140	210
Chloride, Cl	mg/L	30	11	6	23	24
Sulphate, SO_4	mg/L	48	28	75	26	50

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8548-4 PE029706-6 Water
Date Extracted		8/04/2010
Date Analysed		8/04/2010
pH	pH Units	4.5
Conductivity @25°C	µS/cm	300
Chloride, Cl	mg/L	9
Sulphate, SO_4	mg/L	120

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				8/4/10	[NT]	[NT]	Control	8/4/10
Date Analysed				8/4/10	[NT]	[NT]	Control	8/4/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	100%
Conductivity @25^{o}C	µS/cm	2	AN106	<2	[NT]	[NT]	Control	102%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	103%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	102%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
AN274	Chloride reacts with mercuric thiocyanate forming a mercuric chloride complex. In the presence of ferric iron, highly coloured ferric thiocyanate is formed which is proportional to the chloride concentration. Reference APHA 4500Cl-
AN275	Sulphate is precipitated in an acidic medium with barium chloride. The resulting turbidity is measured photometrically at 405nm and compared with standard calibration solutions to determine the sulphate concentration in the sample. Reference APHA 4500-SO42-. Internal reference AN275.

Result Codes

[INS]	:	Insufficient Sample for this Test	[RPD]	:	Relative Percentage Difference
[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

Quality Control Key

Method Blank (MB): An analyte free matrix to which all reagents are added in the same volume or proportions as used in sample processing. The method blank should be carried through the complete sample preparation and analytical procedure. A method blank is prepared every 20 samples.
Duplicate (D): A separate portion of a sample being analysed that is treated the same as the other samples in the batch. One duplicate is processed at least every 10 samples.
Surrogate Spike (SS): An organic compound which is similar to the target analyte(s) in chemical composition and behaviour in the analytical process, but which is not normally found in environmental samples. Surrogates are added to samples before extraction to monitor extraction efficiency and percent recovery in each sample.
Internal Standard (IS): Added to all samples requiring analysis for organics (where relevant) or metals by ICP after the extraction/digestion process; the compounds/elements serve to give a standard instrument retention time and /or response, which is invariant from run-to-run.
Laboratory Control Sample (LCS): A known matrix spiked with compound(s) representative of the target analytes. The LCS is used to document laboratory performance. When the results of the marix spike analysis indicates a potential problem due to the sample matrix itself, the LCS results are used to verify that the laboratory can perform the analysis in a clean matrix.
Matrix Spike (MS): An aliquot of sample spiked with a known concentration of target analyte(s). The spiking occurs prior to sample preparation and analysis. A matrix spike is used to document the bias of a method in a given sample matrix.
Relative Percentage Difference (RPD): The difference between an original and a duplicate result divided by the average of the original and duplicate results, expressed as a percentage.

Quality Acceptance Criteria

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.au.sgs.com/sgs-mp-au-env-qu-022-qa-qc-plan-en-09.pdf

ANALYTICAL REPORT

19 April 2010

Client Details			**Job Details**		
Client	:	**Graeme Campbell & Associates Pty Ltd**	Client Reference	:	GCA Job No 1004
Contact	:	Graeme Campbell	Report No	:	PE029877
Address	:	PO Box 247	Report Version	:	00
		BRIDGETOWN	Samples	:	Water
		PERTH WA 6255	Received	:	14/04/2010

Comments:

This report cancels and supercedes any preliminary results provided

For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Business Manager:	Trevor Pilbeam	Trevor.Pilbeam@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Michael McKay
Waste Waters Team Leader

Miscellaneous Waters 1						
Client Reference	Units	GCA8543-5	GCA8544-5	GCA8545-5	GCA8546-5	GCA8547-5
Sample No		PE029877-1	PE029877-2	PE029877-3	PE029877-4	PE029877-5
Type of Sample		Water	Water	Water	Water	Water
Date Extracted		15/04/2010	15/04/2010	15/04/2010	15/04/2010	15/04/2010
Date Analysed		15/04/2010	15/04/2010	15/04/2010	15/04/2010	15/04/2010
pH	pH Units	6.0	6.3	4.4	6.1	5.3
Conductivity @25°C	µS/cm	130	76	200	150	170
Chloride, Cl	mg/L	18	5	4	23	15
Sulphate, SO_4	mg/L	38	23	91	36	60

Miscellaneous Waters 1		
Client Reference	Units	GCA8548-5
Sample No		PE029877-6
Type of Sample		Water
Date Extracted		15/04/2010
Date Analysed		15/04/2010
pH	pH Units	4.3
Conductivity @25°C	µS/cm	260
Chloride, Cl	mg/L	5
Sulphate, SO_4	mg/L	130

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				15/4/10	[NT]	[NT]	Control	15/4/10
Date Analysed				15/4/10	[NT]	[NT]	Control	15/4/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	99%
Conductivity @25°C	µS/cm	2	AN106	<2	[NT]	[NT]	Control	103%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	105%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	103%

Method ID	Methodology Summary
AN101	pH is measured electrometrically using a combination electrode (glass plus reference electrode) and is calibrated against 3 buffers purchased commercially. For soils, an extract with water is made at a ratio of 1:5 and the pH determined and reported on the extract. Reference APHA 4500-H+.
AN106	Conductivity is measured by meter with temperature compensation and is calibrated against a standard solution of potassium chloride. Conductivity is generally reported as µmhos/cm or µS/cm @ 25°C. For soils, an extract with water is made at a ratio of 1:5 and the EC determined and reported on the extract, or calculated back to the as-received sample. Salinity can be estimated from conductivity using a conversion factor, which for natural waters, is in the range 0.55 to 0.75. Reference APHA 2520 B.
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Result Codes

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[NR]	:	Not Required	*	:	Not part of NATA Accreditation
[NT]	:	Not Tested	[N/A]	:	Not Applicable
LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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

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Quality Acceptance Criteria

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ANALYTICAL REPORT

23 April 2010

Client Details			**Job Details**		
Client	:	**Graeme Campbell & Associates Pty Ltd**	Client Reference	:	GCA Job No 1004
Contact	:	Graeme Campbell	Report No	:	PE030030
Address	:	PO Box 247	Report Version	:	00
		BRIDGETOWN	Samples	:	Water
		PERTH WA 6255	Received	:	21/04/2010

Comments:

This report cancels and supercedes any preliminary results provided

For and on Behalf of SGS Environmental Services

Client Services Manager:	Matthew Deaves	Matthew.Deaves@sgs.com
Business Manager:	Trevor Pilbeam	Trevor.Pilbeam@sgs.com
Laboratory Manager:	Said Hirad	Said.Hirad@sgs.com

Results Approved and/or Authorised by:

Said Hirad

SAID HIRAD
NATA Signatory

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8543-6 PE030030-1 Water	GCA8544-6 PE030030-2 Water	GCA8545-6 PE030030-3 Water	GCA8546-6 PE030030-4 Water	GCA8547-6 PE030030-5 Water
Date Extracted		22/04/2010	22/04/2010	22/04/2010	22/04/2010	22/04/2010
Date Analysed		22/04/2010	22/04/2010	22/04/2010	22/04/2010	22/04/2010
pH	pH Units	4.5	4.9	4.1	5.7	5.1
Conductivity @25°C	µS/cm	140	80	250	160	180
Sulphate, SO_4	mg/L	32	21	90	35	55
Chloride, Cl	mg/L	11	3	2	18	8

Miscellaneous Waters 1 Client Reference Sample No Type of Sample	Units	GCA8548-6 PE030030-6 Water
Date Extracted		22/04/2010
Date Analysed		22/04/2010
pH	pH Units	4.3
Conductivity @25°C	µS/cm	290
Sulphate, SO_4	mg/L	110
Chloride, Cl	mg/L	4

QUALTY CONTROL Miscellaneous Waters 1	UNITS	LOR	METHOD	Blank	Duplicate	Sample || Dup || %RPD	Spike	Spike % Recovery
Date Extracted				22/4/10	[NT]	[NT]	Control	22/4/10
Date Analysed				22/4/10	[NT]	[NT]	Control	22/4/10
pH	pH Units	0.1	AN101	<0.1	[NT]	[NT]	Control	100%
Conductivity @25^{o}C	µS/cm	2	AN106	<2	[NT]	[NT]	Control	104%
Sulphate, SO_4	mg/L	1	AN275	<1	[NT]	[NT]	Control	106%
Chloride, Cl	mg/L	1	AN274	<1	[NT]	[NT]	Control	105%

Method ID	Methodology Summary
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LOR	:	Limit of Reporting	[ND]	:	Not Detected

Report Comments

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Solid samples expressed on a dry weight basis.

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Quality Acceptance Criteria

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ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1002540
No. of SAMPLES : 8
No. of ELEMENTS : 15
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachates (Waste-Bedrocks)
STATE : Solutions
DATE RECEIVED : 09/03/2010
DATE COMPLETED : 17/03/2010
DATE PRINTED : 18/03/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
\> = Value beyond Limit of Method

MAIN OFFICE AND LABORATORY
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Tel: +61 8 9251 8100 Fax: +61 8 9251 8110
Email: genalysis@genalysis.com.au
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ADELAIDE LABORATORY
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JOHANNESBURG LABORATORY
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TOWNSVILLE LABORATORY
9-23 Kelli Street, Mt St John, Bohle, Queensland, Australia 4818
Tel: +61 7 4774 3655 Fax: +61 7 4774 4692

SAMPLE DETAILS

DISCLAIMER

Genalysis Laboratory Services Pty Ltd wishes to make the following disclaimer pertaining to the accompanying analytical results.

Genalysis Laboratory Services Pty Ltd disclaims any liability, legal or otherwise, for any inferences implied from this report relating to either the origin of, or the sampling technique employed in the collection of, the submitted samples.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Genalysis Laboratory Services Pty Ltd accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $3.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $75.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

*** NATA ENDORSED DOCUMENT ***

Company Accreditation Number 3244

The contents of this report have been prepared in accordance with the terms of NATA accreditation and as such should only be reproduced in full.

The analysis results reported herein have been obtained using the following methods and conditions:

The 8 samples, as listed in the report, were received as being 'Column-Leachates' which had been filtered and acidified.

The results have been determined according to Genalysis methods numbers ICP_W004 and ICP_W003.

The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP Chemist

Date: 17th March 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Ca	Cd	Cu	Fe-Sol	K	Mg	Mn	Na
UNITS	mg/l	ug/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.01	0.1	0.01	0.02	0.01	0.01	0.1	0.01	0.01	0.1
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/OES	/MS	/OES	/OES	/OES	/OES	/OES	/OES
SAMPLE NUMBERS										
0001 GCA8543-0	X	17.7	0.66	0.52	X	X	6.5	1.74	0.06	58.4
0002 GCA8544-0	X	16.7	1.12	0.19	X	0.01	18.2	3.35	0.12	45.6
0003 GCA8545-0	0.41	39.9	2.64	5.50	1.07	0.21	15.4	5.86	0.49	46.2
0004 GCA8546-0	X	29.9	0.88	0.10	0.02	X	5.6	2.34	0.07	57.0
0005 GCA8547-0	X	11.9	2.97	85.84	0.04	X	19.3	11.76	3.99	93.1
0006 GCA8548-0	0.56	24.2	1.43	58.32	7.21	0.97	10.7	3.87	5.11	13.1
0007 BLANK-0-FR	0.03	X	0.09	0.02	X	X	0.2	0.16	0.02	2.0
0008 DW-0-FR	X	X	0.03	X	X	X	0.1	0.01	X	0.5

CHECKS										
0001 GCA8543-0	0.03	18.8	0.65	0.53	X	X	6.5	1.71	0.06	58.2

STANDARDS										
0001 Alcoa14-MS		26.2		5.25						
0002 Alcoa9-OES	1.99		48.20		0.06	4.74	3.6	60.01	0.50	246.6

BLANKS										
0001 Control Blank	X	X	X	X	X	X	X	0.01	X	X

ANALYSIS

ELEMENTS	Pb	Sb	Se	Si	Zn
UNITS	ug/l	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.5	0.01	0.5	0.05	0.01
DIGEST					
ANALYTICAL FINISH	/MS	/MS	/MS	/OES	/OES
SAMPLE NUMBERS					
0001 GCA8543-0	X	0.33	6.9	0.92	0.06
0002 GCA8544-0	0.9	0.64	12.2	0.94	0.05
0003 GCA8545-0	2.2	2.34	39.1	1.03	0.66
0004 GCA8546-0	X	0.52	5.7	0.79	0.07
0005 GCA8547-0	0.6	0.52	35.6	0.68	0.86
0006 GCA8548-0	146.6	0.98	18.4	0.98	5.19
0007 BLANK-0-FR	0.8	0.03	X	0.24	0.06
0008 DW-0-FR	X	X	X	0.21	0.05

CHECKS					
0001 GCA8543-0	0.5	0.34	7.0	0.91	0.05

STANDARDS					
0001 Alcoa14-MS	6.6	5.42	27.6		
0002 Alcoa9-OES				9.61	0.51

BLANKS					
0001 Control Blank	X	X	X	X	X

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1003159
No. of SAMPLES : 8
No. of ELEMENTS : 15
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachates (Waste-Bedrocks
STATE : Solutions
DATE RECEIVED : 18/03/2010
DATE COMPLETED : 31/03/2010
DATE PRINTED : 31/03/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
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( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
\> = Value beyond Limit of Method

MAIN OFFICE AND LABORATORY

15 Davison Street, Maddington 6109, Western Australia
PO Box 144, Gosnells 6990, Western Australia
Tel: +61 8 9251 8100 Fax: +61 8 9251 8110
Email: genalysis@genalysis.com.au
Web Page: www.genalysis.com.au

KALGOORLIE SAMPLE PREPARATION DIVISION

12 Keogh Way, Kalgoorlie 6430, Western Australia
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ADELAIDE LABORATORY

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TOWNSVILLE LABORATORY

9-23 Kelli Street, Mt St John, Bohle, Queensland, Australia 4818
Tel: +61 7 4774 3655 Fax: +61 7 4774 4692

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SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $3.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $75.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

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NOTES

*** NATA ENDORSED DOCUMENT ***

Company Accreditation Number 3244

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The 8 samples, as listed in the report, were received as being 'Column-Leachates' which had been filtered and acidified.

The results have been determined according to Genalysis methods numbers ICP_W004 and ICP_W003.

The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed in micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP Chemist

Date: 31th March 2010

This document is issued in accordance with NATA's accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Ca	Cd	Cu	Fe-Sol	K	Mg	Mn	Na
UNITS	mg/l	ug/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.01	0.1	0.01	0.02	0.01	0.01	0.1	0.01	0.01	0.1
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/OES	/MS	/OES	/OES	/OES	/OES	/OES	/OES
SAMPLE NUMBERS										
0001 GCA8543-1	0.01	44.8	2.71	7.32	0.02	X	21.6	9.24	0.38	221.0
0002 GCA8544-1	0.02	74.5	3.05	1.54	0.03	X	29.0	14.36	0.55	144.9
0003 GCA8545-1	3.07	146.6	8.09	29.29	9.72	0.31	44.6	25.51	2.34	140.7
0004 GCA8546-1	0.02	88.1	3.24	1.35	0.35	X	21.2	13.55	0.53	266.4
0005 GCA8547-1	0.07	27.3	5.17	243.89	0.16	0.01	32.5	26.74	10.82	165.4
0006 GCA8548-1	2.62	64.5	6.18	426.49	74.23	0.31	46.8	21.30	35.39	57.0
0007 BLANK-1-FR	X	0.9	0.34	0.04	0.07	0.01	0.2	0.08	0.03	1.3
0008 DW-1-FR	X	0.4	0.28	X	0.01	X	X	0.04	X	0.9
CHECKS										
0001 GCA8543-1	0.01	44.7	2.76	7.32	0.02	X	21.7	9.36	0.38	223.3
STANDARDS										
0001 Alcoa14-MS		27.7		5.14						
0002 Alcoa9-OES	1.93		48.41		0.06	4.87	3.8	60.83	0.49	259.6
BLANKS										
0001 Control Blank	X	X	X	X	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Pb	Sb	Se	Si	Zn
UNITS	ug/l	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.5	0.01	0.5	0.05	0.01
DIGEST					
ANALYTICAL FINISH	/MS	/MS	/MS	/OES	/OES
SAMPLE NUMBERS					
0001 GCA8543-1	0.6	0.86	29.6	3.71	0.26
0002 GCA8544-1	0.7	2.90	51.0	3.12	0.25
0003 GCA8545-1	13.5	7.10	184.2	4.38	3.39
0004 GCA8546-1	0.7	1.64	30.7	2.94	0.41
0005 GCA8547-1	3.6	1.25	88.4	3.96	1.78
0006 GCA8548-1	113.5	2.96	145.8	3.69	35.49
0007 BLANK-1-FR	0.9	0.05	0.7	1.11	0.09
0008 DW-1-FR	X	X	0.9	1.12	0.06
CHECKS					
0001 GCA8543-1	0.6	0.87	29.4	3.82	0.25
STANDARDS					
0001 Alcoa14-MS	6.4	5.56	27.7		
0002 Alcoa9-OES				9.91	0.52
BLANKS					
0001 Control Blank	X	X	X	X	0.01

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1003313
No. of SAMPLES : 8
No. of ELEMENTS : 15
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachates (Waste-Bedrocks
STATE : Solutions
DATE RECEIVED : 22/03/2010
DATE COMPLETED : 31/03/2010
DATE PRINTED : 31/03/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method

MAIN OFFICE AND LABORATORY

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Email: genalysis@genalysis.com.au
Web Page: www.genalysis.com.au

KALGOORLIE SAMPLE PREPARATION DIVISION

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ADELAIDE LABORATORY

11 Senna Road, Wingfield, 5013, South Australia
Tel: +61 8 8162 9714 Fax: +61 8 8349 7444

JOHANNESBURG LABORATORY

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Jet Park, Gauteng, South Africa 1459
Tel: +27 11 552 8149 Fax: +27 11 552 8248

TOWNSVILLE LABORATORY

9-23 Kelli Street, Mt St John, Bohle, Queensland, Australia 4818
Tel: +61 7 4774 3655 Fax: +61 7 4774 4692

SAMPLE DETAILS

DISCLAIMER

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Genalysis Laboratory Services Pty Ltd disclaims any liability, legal or otherwise, for any inferences implied from this report relating to either the origin of, or the sampling technique employed in the collection of, the submitted samples.

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SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

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SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

*** NATA ENDORSED DOCUMENT ***

Company Accreditation Number 3244

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The results have been determined according to Genalysis methods numbers ICP_W004 and ICP_W003.

The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed in micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP Chemist

Date: 31th March 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Ca	Cd	Cu	Fe-Sol	K	Mg	Mn	Na
UNITS	mg/l	ug/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.01	0.1	0.01	0.02	0.01	0.01	0.1	0.01	0.01	0.1
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/OES	/MS	/OES	/OES	/OES	/OES	/OES	/OES
SAMPLE NUMBERS										
0001 GCA8543-2	X	46.1	1.22	3.80	0.02	X	12.1	4.51	0.21	117.9
0002 GCA8544-2	0.03	87.8	1.66	0.65	0.02	0.01	20.1	8.86	0.38	77.8
0003 GCA8545-2	2.88	101.2	5.89	17.36	9.76	0.44	29.1	17.85	1.64	69.8
0004 GCA8546-2	X	83.3	1.22	0.34	0.23	X	10.5	4.33	0.18	98.6
0005 GCA8547-2	0.23	23.8	4.19	219.31	0.33	0.01	24.7	20.24	9.14	94.7
0006 GCA8548-2	1.94	35.2	3.75	335.19	69.10	0.69	29.2	14.60	27.34	30.8
0007 BLANK-2-FR	X	1.3	0.16	0.09	0.04	0.03	0.1	0.01	0.02	0.7
0008 DW-2-FR	X	0.1	0.02	X	0.01	0.02	X	X	0.01	0.6
CHECKS										
0001 GCA8543-2	0.02	45.2	1.20	3.92	0.02	X	11.8	4.46	0.20	116.0
STANDARDS										
0001 Alcoa14-MS		28.2		5.27						
0002 Alcoa9-OES	1.97		48.30		0.06	4.92	3.8	62.18	0.50	241.9
BLANKS										
0001 Control Blank	X	X	0.01	X	X	X	X	0.01	X	0.1

ANALYSIS

ELEMENTS	Pb	Sb	Se	Si	Zn
UNITS	ug/l	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.5	0.01	0.5	0.05	0.01
DIGEST					
ANALYTICAL FINISH	/MS	/MS	/MS	/OES	/OES
SAMPLE NUMBERS					
0001 GCA8543-2	0.7	0.66	19.7	4.09	0.14
0002 GCA8544-2	4.6	5.10	35.2	6.10	0.10
0003 GCA8545-2	12.0	5.69	131.4	5.60	2.53
0004 GCA8546-2	0.6	1.40	15.4	3.03	0.14
0005 GCA8547-2	3.2	1.41	62.6	6.63	1.77
0006 GCA8548-2	74.3	2.88	112.2	6.17	28.72
0007 BLANK-2-FR	10.3	0.07	0.6	1.11	0.06
0008 DW-2-FR	X	X	0.5	1.03	0.05
CHECKS					
0001 GCA8543-2	0.7	0.68	19.4	4.00	0.14
STANDARDS					
0001 Alcoa14-MS	6.3	5.51	27.5		
0002 Alcoa9-OES				9.84	0.52
BLANKS					
0001 Control Blank	X	X	X	X	X

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1003374
No. of SAMPLES : 8
No. of ELEMENTS : 15
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachates (Waste-Bedrocks
STATE : Solutions
DATE RECEIVED : 24/03/2010
DATE COMPLETED : 31/03/2010
DATE PRINTED : 31/03/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
\> = Value beyond Limit of Method

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GENERAL CONDITIONS

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NATA Signatory: H Pham
ICP Chemist

Date: 31th March 2010

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ANALYSIS

ELEMENTS	Al	As	Ca	Cd	Cu	Fe-Sol	K	Mg	Mn	Na
UNITS	mg/l	ug/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.01	0.1	0.01	0.02	0.01	0.01	0.1	0.01	0.01	0.1
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/OES	/MS	/OES	/OES	/OES	/OES	/OES	/OES
SAMPLE NUMBERS										
0001 GCA8543-3	0.02	27.7	0.49	1.46	0.01	X	6.2	1.49	0.07	56.4
0002 GCA8544-3	0.03	61.9	0.59	0.97	X	X	9.5	2.90	0.14	28.0
0003 GCA8545-3	1.70	60.3	3.16	7.77	6.41	0.34	16.1	9.16	0.84	28.5
0004 GCA8546-3	X	63.7	0.85	0.25	0.32	X	9.4	3.01	0.13	75.5
0005 GCA8547-3	0.15	15.6	1.98	101.49	0.25	X	12.8	8.84	4.49	38.7
0006 GCA8548-3	1.21	22.7	1.96	164.84	45.16	0.39	15.2	7.11	15.61	13.2
0007 BLANK-3-FR	X	1.3	0.24	0.11	0.04	X	0.5	0.02	X	0.9
0008 DW-3-FR	X	1.2	0.13	0.76	0.04	X	0.4	X	X	0.8
CHECKS										
0001 GCA8543-3	0.01	28.5	0.49	1.44	0.01	X	6.2	1.50	0.07	56.2
STANDARDS										
0001 Alcoa14-MS		25.8		5.28						
0002 Alcoa9-OES	1.93		46.40		0.06	4.78	3.8	60.36	0.49	247.3
BLANKS										
0001 Control Blank	X	X	X	X	X	X	0.1	X	X	X

ANALYSIS

ELEMENTS	Pb	Sb	Se	Si	Zn
UNITS	ug/l	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.5	0.01	0.5	0.05	0.01
DIGEST					
ANALYTICAL FINISH	/MS	/MS	/MS	/OES	/OES
SAMPLE NUMBERS					
0001 GCA8543-3	1.1	0.42	9.5	1.57	0.07
0002 GCA8544-3	0.8	2.34	13.5	2.65	0.08
0003 GCA8545-3	2.8	3.79	63.3	1.74	1.43
0004 GCA8546-3	0.7	1.35	11.8	1.61	0.15
0005 GCA8547-3	2.2	0.70	29.8	2.21	1.00
0006 GCA8548-3	30.3	1.90	63.2	1.99	15.71
0007 BLANK-3-FR	12.8	0.06	0.9	0.27	0.06
0008 DW-3-FR	10.4	0.05	0.9	0.29	0.05
CHECKS					
0001 GCA8543-3	1.1	0.43	9.8	1.58	0.09
STANDARDS					
0001 Alcoa14-MS	7.5	5.39	26.8		
0002 Alcoa9-OES				10.01	0.49
BLANKS					
0001 Control Blank	X	X	X	X	X

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1003844
No. of SAMPLES : 8
No. of ELEMENTS : 15
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column-Leachate (Waste-Bedrocks)
STATE : Solutions
DATE RECEIVED : 01/04/2010
DATE COMPLETED : 27/04/2010
DATE PRINTED : 27/04/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
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> = Value beyond Limit of Method

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GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

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The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed in micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP Chemist

Date: 27th April 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Ca	Cd	Cu	Fe-Sol	K	Mg	Mn	Na
UNITS	mg/l	ug/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.01	0.1	0.01	0.02	0.01	0.01	0.1	0.01	0.01	0.1
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/OES	/MS	/OES	/OES	/OES	/OES	/OES	/OES
SAMPLE NUMBERS										
0001 GCA8543-4	0.02	21.4	0.30	1.36	0.02	X	4.7	1.03	0.05	34.5
0002 GCA8544-4	0.03	58.7	0.40	0.26	X	X	7.4	2.07	0.11	13.9
0003 GCA8545-4	1.42	35.1	1.75	4.81	5.67	0.42	8.8	5.97	0.58	10.4
0004 GCA8546-4	X	37.5	0.29	0.09	0.13	X	3.9	0.85	0.04	22.7
0005 GCA8547-4	0.16	9.1	1.29	80.28	0.32	X	8.8	6.19	3.57	19.0
0006 GCA8548-4	1.06	15.9	1.15	104.13	36.92	0.53	8.1	4.05	11.15	5.6
0007 BLANK-4-FR	0.02	2.8	0.26	0.24	0.08	0.03	0.2	0.04	X	0.9
0008 DW-4-FR	X	0.5	0.02	X	X	X	0.2	X	X	0.8
CHECKS										
0001 GCA8543-4	0.02	21.5	0.30	1.33	0.02	X	4.6	1.01	0.05	34.6
STANDARDS										
0001 Alcoa14-MS		25.5		5.23						
0002 Alcoa9-OES	1.96		47.25		0.06	4.73	3.7	58.96	0.50	245.2
BLANKS										
0001 Control Blank	X	X	X	X	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Pb	Sb	Se	Si	Zn
UNITS	ug/l	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.5	0.01	0.5	0.05	0.01
DIGEST					
ANALYTICAL FINISH	/MS	/MS	/MS	/OES	/OES
SAMPLE NUMBERS					
0001 GCA8543-4	0.9	0.26	6.5	1.08	0.10
0002 GCA8544-4	1.4	1.96	9.4	2.43	0.08
0003 GCA8545-4	1.4	1.85	39.9	0.78	0.99
0004 GCA8546-4	X	0.49	4.5	0.75	0.09
0005 GCA8547-4	3.2	0.41	16.7	1.45	0.93
0006 GCA8548-4	19.0	1.18	46.5	1.04	10.18
0007 BLANK-4-FR	30.7	0.06	X	0.24	0.09
0008 DW-4-FR	X	X	X	0.25	0.05
CHECKS					
0001 GCA8543-4	1.1	0.26	6.3	1.08	0.10
STANDARDS					
0001 Alcoa14-MS	6.2	5.43	27.0		
0002 Alcoa9-OES				9.91	0.49
BLANKS					
0001 Control Blank	X	X	X	X	0.01

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE	:	143.0/1004148
No. of SAMPLES	:	8
No. of ELEMENTS	:	15
CLIENT O/N	:	GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No.	:	
PROJECT	:	Column-Leachates(Waste-Bedrocks)
STATE	:	Solutions
DATE RECEIVED	:	12/04/2010
DATE COMPLETED	:	27/04/2010
DATE PRINTED	:	27/04/2010
PRIMARY LABORATORY	:	Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method

MAIN OFFICE AND LABORATORY
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TOWNSVILLE LABORATORY
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SAMPLE DETAILS

DISCLAIMER

Genalysis Laboratory Services Pty Ltd wishes to make the following disclaimer pertaining to the accompanying analytical results.

Genalysis Laboratory Services Pty Ltd disclaims any liability, legal or otherwise, for any inferences implied from this report relating to either the origin of, or the sampling technique employed in the collection of, the submitted samples.

SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

Genalysis Laboratory Services Pty Ltd accepts no responsibility whatsoever for any interpretation by any party of any data where more than two or three significant figures have been reported.

SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $3.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $75.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

*** NATA ENDORSED DOCUMENT ***

Company Accreditation Number 3244

The contents of this report have been prepared in accordance with the terms of NATA accreditation and as such should only be reproduced in full.

The analysis results reported herein have been obtained using the following methods and conditions:

The 8 samples, as listed in the report, were received as being 'Column-Leachates' which had been filtered and acidified.

The results have been determined according to Genalysis methods numbers ICP_W004 and ICP_W003.

The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed in micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP Chemist

Date: 27th April 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Ca	Cd	Cu	Fe-Sol	K	Mg	Mn	Na
UNITS	mg/l	ug/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.01	0.1	0.01	0.02	0.01	0.01	0.1	0.01	0.01	0.1
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/OES	/MS	/OES	/OES	/OES	/OES	/OES	/OES
SAMPLE NUMBERS										
0001 GCA8543-5	X	18.6	0.27	1.17	0.01	X	4.0	0.89	0.05	25.6
0002 GCA8544-5	X	52.1	0.44	0.30	X	X	6.0	2.29	0.13	8.4
0003 GCA8545-5	2.07	32.2	2.16	5.19	8.50	0.67	8.0	7.21	0.68	8.0
0004 GCA8546-5	X	29.6	0.51	0.17	0.28	X	4.8	1.48	0.07	26.0
0005 GCA8547-5	0.24	9.3	1.38	100.50	0.52	X	7.7	6.64	4.11	13.6
0006 GCA8548-5	1.23	15.6	1.11	89.04	37.83	0.72	5.9	3.29	10.35	3.7
0007 BLANK-5-FR	X	0.5	0.30	0.13	0.04	0.02	0.2	0.07	X	1.1
0008 DW-5-FR	X	0.3	0.26	X	X	X	0.1	0.06	X	1.0
CHECKS										
0001 GCA8543-5	X	19.4	0.26	1.23	0.01	X	4.0	0.89	0.05	25.7
STANDARDS										
0001 Alcoa14-MS		27.3		5.30						
0002 Alcoa9-OES	1.95		47.47		0.06	4.73	3.7	59.97	0.50	256.7
BLANKS										
0001 Control Blank	X	0.1	X	X	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Pb	Sb	Se	Si	Zn
UNITS	ug/l	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.5	0.01	0.5	0.05	0.01
DIGEST					
ANALYTICAL FINISH	/MS	/MS	/MS	/OES	/OES
SAMPLE NUMBERS					
0001 GCA8543-5	0.9	0.23	4.9	2.24	0.07
0002 GCA8544-5	0.5	1.74	7.1	3.70	0.06
0003 GCA8545-5	1.4	1.86	45.0	2.15	1.11
0004 GCA8546-5	X	0.47	5.8	1.87	0.09
0005 GCA8547-5	2.5	0.43	18.8	2.78	1.13
0006 GCA8548-5	17.7	1.23	51.7	2.37	8.58
0007 BLANK-5-FR	14.1	0.02	X	1.57	0.07
0008 DW-5-FR	X	X	0.6	1.54	0.04
CHECKS					
0001 GCA8543-5	1.0	0.23	5.6	2.25	0.08
STANDARDS					
0001 Alcoa14-MS	6.0	5.31	27.4		
0002 Alcoa9-OES				9.68	0.50
BLANKS					
0001 Control Blank	X	X	X	X	X

METHOD CODE DESCRIPTION

/MS Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.

ANALYTICAL REPORT

Dr G. CAMPBELL
CAMPBELL, GRAEME and ASSOCIATES
PO Box 247
BRIDGETOWN, W.A. 6255
AUSTRALIA

JOB INFORMATION

JOB CODE : 143.0/1004341
No. of SAMPLES : 8
No. of ELEMENTS : 15
CLIENT O/N : GCA1004 (Job 1 of 1)
SAMPLE SUBMISSION No. :
PROJECT : Column Leachate (Waste-Bedrocks)
STATE : Solutions
DATE RECEIVED : 15/04/2010
DATE COMPLETED : 27/04/2010
DATE PRINTED : 28/04/2010
PRIMARY LABORATORY : Genalysis Main Laboratory

LEGEND

X = Less than Detection Limit
N/R = Sample Not Received
* = Result Checked
( ) = Result still to come
I/S = Insufficient Sample for Analysis
E6 = Result X 1,000,000
UA = Unable to Assay
> = Value beyond Limit of Method

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TOWNSVILLE LABORATORY
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SAMPLE DETAILS

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SIGNIFICANT FIGURES

It is common practice to report data derived from analytical instrumentation to a maximum of two or three significant figures. Some data reported herein may show more figures than this. The reporting of more than two or three figures in no way implies that the third, fourth and subsequent figures may be real or significant.

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SAMPLE STORAGE DETAILS

GENERAL CONDITIONS

SAMPLE STORAGE OF SOLIDS

Bulk Residues and Pulps will be stored for 60 DAYS without charge. After this time all Bulk Residues and Pulps will be stored at a rate of $3.00 per cubic metre per day until your written advice regarding collection or disposal is received. Expenses related to the return or disposal of samples will be charged to you at cost. Current disposal cost is charged at $75.00 per cubic metre.

SAMPLE STORAGE OF SOLUTIONS

Samples received as liquids, waters or solutions will be held for 60 DAYS free of charge then disposed of, unless written advice for return or collection is received.

NOTES

*** NATA ENDORSED DOCUMENT ***

Company Accreditation Number 3244

The contents of this report have been prepared in accordance with the terms of NATA accreditation and as such should only be reproduced in full.

The analysis results reported herein have been obtained using the following methods and conditions:

The 8 samples, as listed in the report, were received as being 'Column-Leachates' which had been filtered and acidified.

The results have been determined according to Genalysis methods numbers ICP_W004 and ICP_W003.

The analysis included the assay of blanks and Genalysis in-house reference standards. The results are expressed micrograms and milligrams per litre in the solution.

NATA Signatory: H Pham
ICP Chemist

Date: 27th April 2010

This document is issued in accordance with NATA’s accreditation requirements.

ANALYSIS

ELEMENTS	Al	As	Ca	Cd	Cu	Fe-Sol	K	Mg	Mn	Na
UNITS	mg/l	ug/l	mg/l	ug/l	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l
DETECTION LIMIT	0.01	0.1	0.01	0.02	0.01	0.01	0.1	0.01	0.01	0.1
DIGEST										
ANALYTICAL FINISH	/OES	/MS	/OES	/MS	/OES	/OES	/OES	/OES	/OES	/OES
SAMPLE NUMBERS										
0001 GCA8543-6	X	16.0	0.23	1.00	0.02	X	3.6	0.69	0.04	18.9
0002 GCA8544-6	X	46.7	0.45	0.33	X	X	5.4	2.14	0.13	5.0
0003 GCA8545-6	2.73	30.5	2.01	5.23	11.30	0.92	7.6	6.94	0.65	5.1
0004 GCA8546-6	0.01	25.6	0.54	0.19	0.43	X	5.1	1.66	0.07	21.8
0005 GCA8547-6	0.34	8.5	1.34	106.98	0.78	X	7.3	6.09	4.02	8.1
0006 GCA8548-6	1.24	15.3	0.87	72.94	36.47	0.61	4.3	2.32	8.82	2.6
0007 BLANK-6-FR	0.03	6.7	0.43	0.06	0.04	0.03	0.3	0.09	X	1.1
0008 DW-6-FR	X	0.4	0.27	0.22	0.01	X	0.2	0.07	X	1.0
CHECKS										
0001 GCA8543-6	0.02	16.7	0.22	0.95	0.02	X	3.7	0.69	0.04	18.8
STANDARDS										
0001 AlcoaHi2-OES	49.18		932.78		2.72	97.43	475.1	191.93	20.07	1879.0
0002 Alcoa-High3-MS		108.6		21.27						
BLANKS										
0001 Control Blank	X	X	X	X	X	X	X	X	X	X

ANALYSIS

ELEMENTS	Pb	Sb	Se	Si	Zn
UNITS	ug/l	ug/l	ug/l	mg/l	mg/l
DETECTION LIMIT	0.5	0.01	0.5	0.05	0.01
DIGEST					
ANALYTICAL FINISH	/MS	/MS	/MS	/OES	/OES
SAMPLE NUMBERS					
0001 GCA8543-6	1.0	0.21	3.8	0.99	0.09
0002 GCA8544-6	0.5	1.66	6.2	2.78	0.08
0003 GCA8545-6	6.0	1.87	48.5	0.92	1.16
0004 GCA8546-6	X	0.49	6.1	0.58	0.08
0005 GCA8547-6	2.8	0.45	16.2	1.94	1.32
0006 GCA8548-6	18.5	1.05	50.7	1.90	7.11
0007 BLANK-6-FR	13.7	0.08	1.1	1.52	0.05
0008 DW-6-FR	X	X	0.9	1.53	0.05
CHECKS					
0001 GCA8543-6	1.2	0.21	4.4	1.01	0.09
STANDARDS					
0001 AlcoaHi2-OES				101.88	20.65
0002 Alcoa-High3-MS	19.1	21.05	110.1		
BLANKS					
0001 Control Blank	X	X	X	X	X

METHOD CODE DESCRIPTION

/MS	Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Mass Spectrometry.

/OES	Genalysis Main Laboratory

No digestion or other pre-treatment undertaken. Analysed by Inductively Coupled Plasma Optical (Atomic) Emission Spectrometry.