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MACRAES PHASE III PROJECT

Tailings Static and Kinetic Geochemical Assessment

Submitted to:
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REPORT

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Executive Summary

Oceana Gold (New Zealand) Limited (OceanaGold) has engaged Golder Associates (New Zealand) Limited (Golder) to conduct a tailings geochemical assessment as part of the investigation into the proposed Macraes Phase III expansion of operations of the Macraes Gold Project on New Zealand's South Island. The primary focus of the assessment is to investigate the quality of potential drainage from the proposed Top Tipperary Tailings Storage Facility (TTTSF) using in-situ tailings, collected during the 2008 drilling program from the Mixed Tailings Impoundment (MTI) and the Southern Pit Tailings Impoundment (SP11) and recently deposited tailings.

Under separate scopes of work, Golder is assessing and using historic water quality data from the site to prepare a review of surface and groundwater that includes seepage and decant data from the MTI and the SP10 and SP11 tailings impoundments. These data are being used to develop surface and groundwater models. A secondary objective of this assessment was to evaluate the relevance of historic water quality data for use in predicting the quality of TTTSF seepage water.

The Macraes Gold Project consists of a series of open cast pits and waste rock stacks, an underground mine, ore processing plant, tailings storage impoundments, silt ponds and a water reservoir. Since 2007, the ore processing plant has also processed concentrate from OceanaGold's Reefton Gold Project. The proposed expansion, Macraes Phase III includes an expansion of the main Macraes open pits to encompass part of the current SP11 and the construction of the TTTSF.

Twelve samples were included in the tailings static geochemical assessment. Ten of the samples were collected during the 2008 drilling program of historic tailings from SP11 and the MTI. The remaining two samples were supplied from recently deposited tailings during a period when both the Macraes and Reefton ore was being treated.

No sulphide minerals were detected during the mineralogical investigation of the tailings samples. Calcite, siderite and gypsum were identified. Acid base accounting (ABA) and net acid generation (NAG) testing was conducted to determine the acid generation potential of the tailings samples. The static ABA and NAG results indicate that the tailings samples are unlikely to generate acid, and all 12 samples are classified as Non-Acid Forming, confirming previous investigation outcomes.

Multi-element concentrations were determined for all 12 samples. The Geochemical Abundance Index for the 12 samples showed that the samples were substantially enriched in arsenic compared with average crustal abundance.

Short-term leach testing was performed by four different methods to gain an indication of the leachability of the samples under different pH and ionic conditions. The results show that, for all test conditions, the samples leached arsenic at concentrations higher than those for most other parameters. The short-term leach testing results indicate that the new tailings in the TTTSF are likely to generate leachate of a similar quality to the historic tailings already present on site.

The deposited Macraes and Reefton tails are similar in terms of bulk geochemistry and seepage quality to historic tailings streams. However, the quality of the seepage that reports from the proposed TTTSF will be dependent on how the TTTSF is managed, in particular related to the tailings decant pond and its water quality.

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1.0 INTRODUCTION

1.1 Overview

The Oceana Gold (New Zealand) Limited (OceanaGold) Macraes Gold Project (MGP) is New Zealand's largest gold producing operation, with over three million ounces of gold produced since 1990 (OceanaGold, 2010). It is located in the historic Macraes Goldfield, approximately 80 km north of Dunedin and 30 km to the northwest of Palmerston in the Otago Region of the South Island, New Zealand. Since 2007, the project has also processed concentrate from OceanaGold's Reefton Gold Mine, within the West Coast Region of New Zealand's South Island.

As a result of recent reviews, OceanaGold have proposed an expansion of operations at the Macraes Gold Project known as the "Macraes Phase III Project". As part of the investigations for the environmental consenting for the Macraes Phase III, OceanaGold has engaged Golder Associates (NZ) Limited (Golder) to conduct a tailings geochemical assessment. The primary focus of the assessment is to investigate the quality of potential drainage from the proposed new tailings storage impoundment. This report provides a summary of the tailings geochemical assessment.[1]

Under separate scopes of work, Golder is assessing and using historic water quality data from the site to prepare a review of surface and groundwater that includes seepage and decant data from the Mixed Tailings Impoundment (MTI) and the SP10 and SP11 tailings impoundments. These data are also being used to develop surface and groundwater models. A secondary objective of this assessment was to evaluate the relevance of historic water quality data for use in predicting the quality of TTTSF seepage water.

1.2 Project Description

The current Macraes Gold Project consists of:

- A series of open cast pits, some of which have been partially or completely backfilled.
- An underground mine with a mine portal located in Frasers Pit.
- An ore processing plant.
- The Mixed Tailings Impoundment (MTI) and Southern Pit 11 (SP11) tailings impoundment.
- A series of waste rock stacks: Back Road, Deepdell, Northern Gully South, Northern Gully North, Golden Bar and Frasers West and Frasers East (under construction).
- Silt ponds (Deepdell North, Deepdell South, Battery Creek, Northern Gully, Maori Tommy Gully, Frasers West, Murphys Creek and Clydesdale Creek).
- Lone Pine water reservoir and water supply pipeline from Taieri River.

The proposed "Macraes Phase III project" involves:

- An expansion of the main Macraes open pits to encompass part of the current SP11 Tailings Impoundment and the former Round Hill open pit.
- Expansions of the Frasers underground mine.
- A new tailings impoundment: the Top Tipperary Tailings Storage Facility (TTTSF).
- New waste rock stacks.

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[1] This report is subject to the limitations in Appendix A.

- A new fresh water dam.
- Several new silt ponds.
- Road realignment and other infrastructure works.

The project area is situated on an elevated (approximately 490 m above sea level) plateau drained by north-westerly and north-easterly trending streams. Vegetation is comprised of a combination of improved pasture and tussock grassland. The predominant land use is stock grazing. The Macraes Gold Project area receives an average rainfall of about 630 mm per year with measured values ranging from 518 to 659 mm per year. Further detail about climate can be found in Golder Report No. 0978110562-R002 (Golder, 2010).

1.3 Ore Deposits

The large open cut mine was opened in 1990, although the area has been mined historically for gold since 1862 and scheelite since 1889 (OceanaGold, 2010). The Macraes gold deposits are located within the northwest – southeast trending, Hyde Macraes Shear Zone (HMSZ), within schist which forms the regional bedrock. The HMSZ consists of altered, deformed and mineralised schist up to 150 m thick. The thickest part of the shear zone consists of several mineralised zones stacked on metre-thick shears. The mineralised zones at Macraes are located along the surface trace of the HMSZ. All previous mining production and current resources are located along this zone.

The ore at Macraes is a combination of mineralised sheared graphitic schist and associated mineralised quartz veins. The gold generally occurs as small grains partially or wholly enclosed in pyrite [FeS_2] or arsenopyrite [FeAsS] grains. Minor fine-grained chalcopyrite [$CuFeS_2$], sphalerite [ZnS] and galena [PbS] are also present (OceanaGold, 2010).

The Reefton Mine was developed historically as underground tunnels. The modern mine, opened in 2007, is a large open cut operation. Like the gold at Macraes, the gold at Reefton is typically fine-grained particles encapsulated in sulfide (sulphide) minerals. The quartz veins at Reefton contain pyrite and arsenopyrite as well as stibnite [Sb_2S_3] on the vein margins (OceanaGold, 2010).

Both mines are classified as low sulphide gold (Au) quartz vein type deposits as per the geoenvironmental models developed by the U.S. Geological Survey (du Bray, 1995). According to this classification, the most common potential environmental considerations are as follows (du Bray, 1995):

1) Moderate amounts of acid mine drainage may be present where local, relatively high sulphide mineral concentrations are present in the ore, where broad zones of sulphidisation characterise wall rocks, and/or where much of the ore is hosted by greenstone that has relatively low acid-buffering capacity.
2) Oxidation of mine tailings that contain sulphide minerals, particularly arsenopyrite, or soil formed from unmined, yet sulphide-mineral-bearing rock can release arsenic.
3) Increased concentrations of arsenic, antimony, and other trace metals may be present downstream from these types of deposits.

1.4 Ore Processing

The processing of ore involves crushing and grinding to sand size particles. The sulphides are then separated by flotation and finely ground to produce a sulphide concentrate. This concentrate is then fed as slurry through an autoclave. The sulphides are oxidised to liberate the gold at 225 °C in a high-pressure oxygen atmosphere. The principal end products of this oxidation are arsenic bearing iron oxyhydroxides and sulfate (sulphate). The end products of the autoclave process are then passed through a cyanidation plant for gold extraction (Milham &Craw, 2009). The treatment of the finely ground sulphide concentrate in the autoclave was commissioned at Macraes in 1999.

The Macraes ore also contains a carbonaceous fraction. The carbonaceous material is typically recovered to the flotation concentrate. Limestone is introduced into the feed of the autoclave to assist with the treatment of the carbonaceous material. This limestone is also used to control acid generation in the pressure oxidation circuit (OceanaGold, 2010).

Ore from Reefton is processed on site to produce a sulphide-rich concentrate. The sulphide concentrate is dried before transport to Macraes. The sulphide concentrate from Reefton accounts for approximately 10% of the concentrate process stream. The concentrates from the two mines are passed separately through the autoclave but become mixed in the process stream prior to the cyanidation plant (Milham &Craw, 2009).

The two tailings types (concentrate and flotation) were initially stored in separate impoundments (concentrate and flotation Impoundments). Since 1993, the concentrate and flotation tailings have been mixed prior to discharge into the MTI or SP11 with a short period of separation in 1998/99 prior to implementation of pressure oxidation.

1.5 Assessment Objectives

The purpose of the geochemical assessment is to predict the likely drainage and seepage water quality associated with the proposed TTTSF. This information may be used as inputs into the surface and groundwater models developed to assess the potential for adverse environmental effects associated with the Macraes Phase III Project and to inform and optimise engineering designs for mine waste and water management. The changes in ore processing methods since 2006 present a potential for differences in impoundment geochemical conditions and associated drainage and seepage water. Therefore, the assessment is also intended to identify if the geochemistry of the TTTSF, which will contain tailings similar to those currently being produced at the Macraes and Reefton projects, is likely to be different or similar to the geochemistry of the MTI or SP11. This information will determine if use of the past twenty years of monitoring data from the MTI or SP11 is relevant for predicting future TTTSF discharge concentrations.

The specific objectives of the geochemical test program described in this document are to geochemically characterise the tailings material in the MTI and SP11, and recently deposited tailings derived from the Macraes and Reefton ore.

The focus of the geochemical test program is on determining the tailings' potential for generation of acid mine drainage (AMD) and metal leaching (ML). The AMD/ML potential is determined using static acid base accounting (ABA), net acid generation (NAG) testing, metal leaching analysis and mineralogical methods.

In terms of AMD potential, the tailings are classified into the following groups:

- Benign material types, i.e., Non Acid Forming (NAF) or Acid Consuming (AC) waste.
- Deleterious material types, i.e., Potentially Acid Forming (PAF) or Acid Forming (AF) waste.

In addition, the tailings are classified based on their potential to leach metals. Although metal leachability tends to increase with acidic conditions, in the case of arsenic, it should be noted that arsenic is mobile under neutral/alkaline conditions as well.

Golder is also assessing chemical data from kinetic columns that were commissioned in 2006 by OceanaGold. The columns were leached for three months in 2006 and were subsequently reinstated in 2010 to provide additional data for the geochemical program. The columns have been leached for a total of 5½ months and arsenic data have been obtained on three occasions in 2006 and seven occasions in 2010.

2.0 SAMPLE SELECTION, COLLECTION AND PREPARATION

Table 1 presents a list of the samples included in the tailings static geochemical assessment. The samples from SP11 and the MTI were collected during the 2008 drilling program. These samples were stored in unsealed bags rather than sealed and frozen. The initial static testing results indicated that, despite the potential for oxidation, the samples can be used for their intended purpose.

The samples from the SP11 were deposited between March 2006 and November 2007 and follow a depositional profile. The samples from the MTI represent various processing points as indicated in Table 1. The Macraes tails and the Reefton tails samples are from the current process stream.

Table 1: Sample numbers.

Sample number	Tailings impoundment	Depth	Sampling date	Comment
CL06309	SP11	514RL	12/09/2008	15 m below surface in 2008
CLO6324	SP11	499RL	12/09/2008	30 m below surface in 2008
CLO6340	SP11	484RL	12/09/2008	45 m below surface in 2008
CLO6355	SP11	469RL	12/09/2008	50 m below surface in 2008
CLO7065	MTI	528RL	25/09/2008	Q2 2008 (pressure-oxidation dropped)
CLO7069	MTI	524RL	25/09/2008	Q4 2005 (pressure-oxidation)
CLO7072	MTI	521RL	25/09/2008	Q4 2004 (pressure-oxidation)
CLO7080	MTI	513RL	25/09/2008	Q4 2001 (pressure-oxidation)
CLO7107	MTI	488RL	25/09/2008	Pre pressure oxidation mixed tailings
CLO7116	MTI	479RL	25/09/2008	Pre pressure oxidation mixed tailings
Macraes tails	Macraes MTD		15/09/2010	
Reefton tails	Macraes MTD		15/09/2010	

3.0 METHODS

3.1 Classification of AMD Potential

Results of the geochemical testing program are used to classify material into five categories with regard to AMD potential: Potentially Acid Forming (PAF), Potentially Acid Forming – Low Capacity (PAF-LC), Non-Acid Forming (NAF), Acid Consuming (AC) or Uncertain (UC) (Table 2).

Table 2: Classification scheme.

Category	Description
Potentially Acid Forming (PAF)	PAF material will generate considerable AMD if not managed properly. Lithological units with such potential acidity can release substantial amounts of acid, salts such as sulphate, and metals/metalloids. These materials should be handled with special care to avoid the occurrence of AMD.
Potentially Acid Forming – Low Capacity (PAF-LC)	PAF-LC samples have the potential to generate low levels of acid should complete oxidation occur. PAF-LC material should be considered in terms of its ability to generate leachate that may have elevated concentrations of acid, salts such as sulphate, and metals/metalloids. If the potential for PAF-LC waste rock to generate acid or to leach metals or salts is low then PAF-LC waste rock could be used as cover material. The material may generate moderate to low acidity or neutral mine drainage (NMD).
Non Acid Forming (NAF)	NAF materials can be considered as a potential resource for the management of AMD as long as the potential for these rock types to leach salts and metals is low. NAF material is generally good for use on outer waste rock dump faces whereas AC waste can be used to mix with, isolate or encapsulate AF waste. The material may generate moderate to low acidity or neutral mine drainage (NMD).
Acid Consuming (AC)	AC waste can be used to mix with, isolate or encapsulate AF waste. This material may generate alkaline leachate.
Uncertain (UC)	Material is given an UC classification when test results are inconclusive. Further testing is required to refine the classification of UC material.

A common approach is to measure the net acid producing potential (NAPP) of a sample using acid base accounting (ABA) (DITR, 2007). The NAPP value is defined as the difference between the maximum potential acidity (MPA) and total acid neutralising capacity (ANC) of a sample. Table 3 lists the various NAPP thresholds for mine waste classification. Ratios of ANC to MPA are routinely used to predict the potential of acid generation in mine waste. Ratios of 2:1 to 4:1 are typically used to assess whether a material will be PAF, NAF, or AC.

Another classification scheme, based on the results from net acid generation (NAG) testing (DITR, 2007), can be used in combination with NAPP values to categorise samples that have been analysed by both methods (Table 3). The DITR (2007) Managing Acid and Metalliferous Drainage Handbook states that “the risks of misclassifying Non-Acid Forming (NAF) material as Potentially Acid Forming (PAF) and PAF material as NAF are substantially reduced by conducting both NAPP and NAG tests.” This classification scheme was used to substantiate the conclusions drawn using the classification system described above. Both systems lead to similar conclusions.

Table 3: Geochemical classification criteria (DITR 2007).

Category	NAPP value	NAGpH
Potentially Acid Forming (PAF)	>10 kg H_2SO_4/tonne	<4.5
Potentially Acid Forming – Low Capacity (PAF-LC)	0 to 10 kg H_2SO_4/tonne	<4.5
Non Acid Forming (NAF)	<0 kg H_2SO_4/tonne	≥4.5
Acid Consuming (AC)	< -100 kg H_2SO_4/tonne	≥4.5
Uncertain	positive	≥4.5
	negative	<4.5

3.2 Static Testing Methods

Static tests involve short-term procedures that are used to determine the general geochemical characteristics of a sample and are typically the first step in the assessment and prediction of AMD/AML potential. All static testing was performed at ALS Laboratory Group located in Brisbane.

The following scope of work was undertaken:

- Stage 1 (all 12 samples):
  - pH and electrical conductivity (EC) (using a 1:5 solid water digest).
  - total sulphur (TS) to measure maximum potential acidity (MPA_{TS}) determined using a LECO CNS Analyser.
  - chromium reducible sulphur (CRS) to measure sulphide sulphur (MPA_{CRS}).
  - single addition peroxide oxidation net acid generation (NAG) method to measure acid generating potential and acid consuming potential of the waste, including pHOx, acidity to pH 4.5 and 7.
  - total acid neutralising capacity (ANC_{SOBEK}) using the modified SOBEK method - cold HCl acid digestion and back titration.
- Stage 2 - following the completion of the above analytical work, a subset of seven samples was analysed for:
  - whole rock analysis using a two acid Aqua Regia digest.
  - leachable metals by the US EPA Synthetic Precipitation Leachate Procedure (SPLP) at pH 3 and pH 5.
  - leachable metals by 0.5 M sodium bicarbonate extraction.

  - leachable metals by 1 M sodium hydroxide extraction.
- Stage 3 – mineralogical determination of all samples by quantitative powder X-ray diffraction (XRD) analysis.

A more detailed description of each method listed above is provided Appendix B.

3.3 Kinetic Column Leach Test Method

Two kinetic leach columns were set up on site by OceanaGold in 2006. Each column contained approximately 20 kg of tailings. The two samples included tailings from the autoclave at high oxidation (99%) and tailings from the autoclave run at low oxidation (92%). Water samples were collected from these columns between July and October in 2006. These columns were then stored and reinstated by OceanaGold in September 2010. Over this period of time, three water samples have been submitted for arsenic analysis. Field parameters, including pH and EC, have also been measured.

4.0 RESULTS

4.1 Introduction

The results of ABA, static leach testing, tailings composition and mineralogy and kinetic leach testing have been used to determine the AMD/ML potential of the tailings to assist in predicting probable water qualities for seepage from the proposed TTTSF. A description of the results of each testing scheme is provided in the following sections with emphasis on the similarity or differences between MTI and SPI tailings and also Macraes and Reefton tailings. Data summaries for all results are presented in Appendix C. The laboratory analysis results are presented in Appendix D.

4.2 Acid Base Accounting and Net Acid Generation

4.2.1 pH and electrical conductivity

All pH results fall within a relatively narrow range. The results are summarised as follows:

- The paste pH values for the 12 samples ranged from 7.6 to 8.7.
- The Macraes tails and the Reefton tails samples both recorded pH values of 7.6.
- The pH values for the samples from SP11 ranged from 7.8 to 8.2.
- The pH values for the samples from the MTI ranged from 7.8 to 8.7.

EC values ranged from 170 to 2450 μS/cm. Figure 1 shows that there is an inverse correlation between pH and EC.

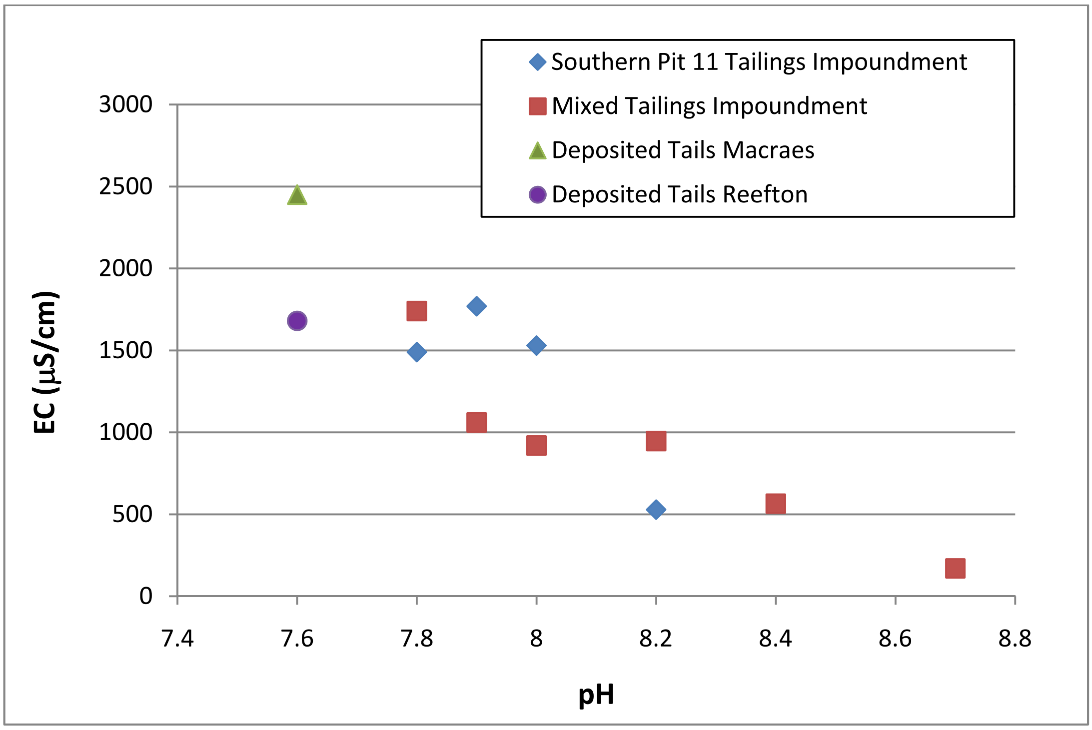

Figure 1: Tailings pH and EC values.

4.2.2 Total sulphur and chromium reducible sulphur

The total sulphur (TS) results are summarised as follows:

- The TS of the 12 samples ranged from 0.11 to 1.28 wt% sulphur.
- The four samples from SP11 all recorded <0.3 wt% sulphur.
- TS values for the MTI samples ranged from 0.19 to 0.68 wt% sulphur, with four of the six samples from the MTI recording TS values <0.3 wt%.
- The average TS value for the ten samples from SP11 and the MTI was 0.28 wt%.
- The Reefton tails recorded a TS value of 0.51 wt% and the Macraes tails recorded a TS value of 1.28 wt%.

The chromium reducible sulphur (CRS) results are summarised as follows:

- The CRS values for the 12 samples ranged from 0.03 to 0.47 wt%.
- CRS values for the four samples from SP11 ranged from 0.05 to 0.06 wt%.
- CRS for SP11 samples accounted for between 21 and 48% of the TS.
- CRS values for the six samples from the MTI ranged from 0.032 to 0.445 wt% with four of the samples recording CRS values of ≤0.07 wt%.
- CRS for the MTI samples accounted for between 16 and 66% of the TS.
- The average CRS value for the ten samples from SP11 and the MTI was 0.10 wt%.

- The Reefton tails recorded a CRS value of 0.05 wt% which was 9% of the TS value and the Macraes tails recorded a CRS value of 0.47 wt% which was 37% of the TS value.

The results demonstrate that the majority of sulphur measured in the TS analysis is present in the form of sulphate sulphur rather than sulphide sulphur. This is in good agreement with the mineralogical results, which indicated the presence of gypsum ($CaSO_4 \cdot 2H_2O$).

Figure 2 shows that, although the highest CRS values were recorded for the samples with the highest TS values, there is no definite correlation between CRS and TS.

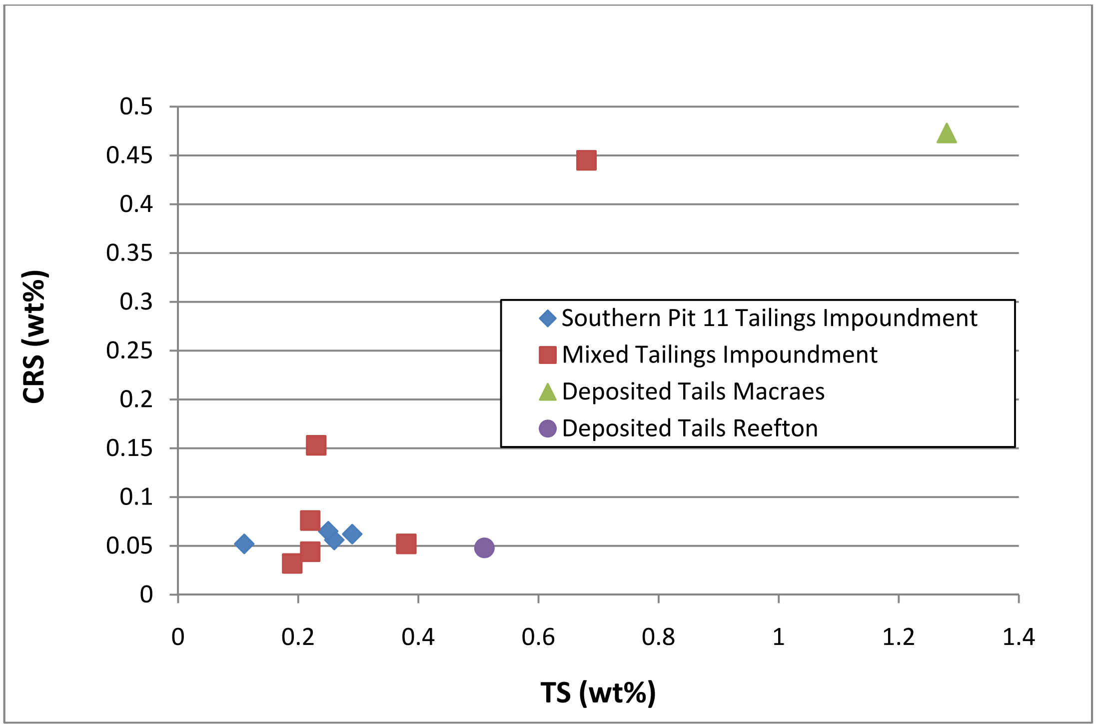

Figure 2: Tailings TS and CRS comparison.

4.2.3 Acid neutralising capacity

The acid neutralising capacity (ANC) for the 12 samples was 25.8 to 51.7 kg H_2SO_4/tonne. The results are summarised as follows:

- ANC values for the four samples from SP11 were 40.8 to 50 kg H_2SO_4/tonne.
- ANC values for the MTI were 25.8 to 51.7 kg H_2SO_4/tonne.
- The average ANC value for the ten samples from SP11 and the MTI was 41.57 kg H_2SO_4/tonne.
- The Macraes tails sample had an ANC value of 41.9 kg H_2SO_4/tonne and the Reefton tails sample had an ANC value of 40.8 kg H_2SO_4/tonne.

4.2.4 Net acid producing potential

The Net Acid Producing Potential (NAPP) values of the 12 samples were calculated from the Maximum Potential Acidity (MPA), calculated from CRS and ANC, according to the equation:

NAPP = MPA – ANC.

The NAPP results can be summarised as follows:

- The NAPP values for the 12 samples were -49.37 to -21.12 kg H_2SO_4/tonne.
- NAPP values for the four samples from SP11 were -48.41 to -38.49 kg H_2SO_4/tonne.
- NAPP values for the six samples from the MTI were -49.37 to -21.12 kg H_2SO_4/tonne.
- The average NAPP value for the ten samples from SP11 and the MTI was -38.40 kg H_2SO_4/tonne.
- The Macraes tails sample had a NAPP value of -27.43 kg H_2SO_4/tonne and the Reefton tails sample had a NAPP value of -39.33 kg H_2SO_4/tonne.

4.2.5 ANC MPA ratios

Figure 3 presents the ANC:MPA ratios, with MPA calculated from sulphide sulphur. The figure shows that 10 of the samples have ratios greater than 4:1, and one MTI and the Macraes tails sample have ratios of between 2:1 and 3:1.

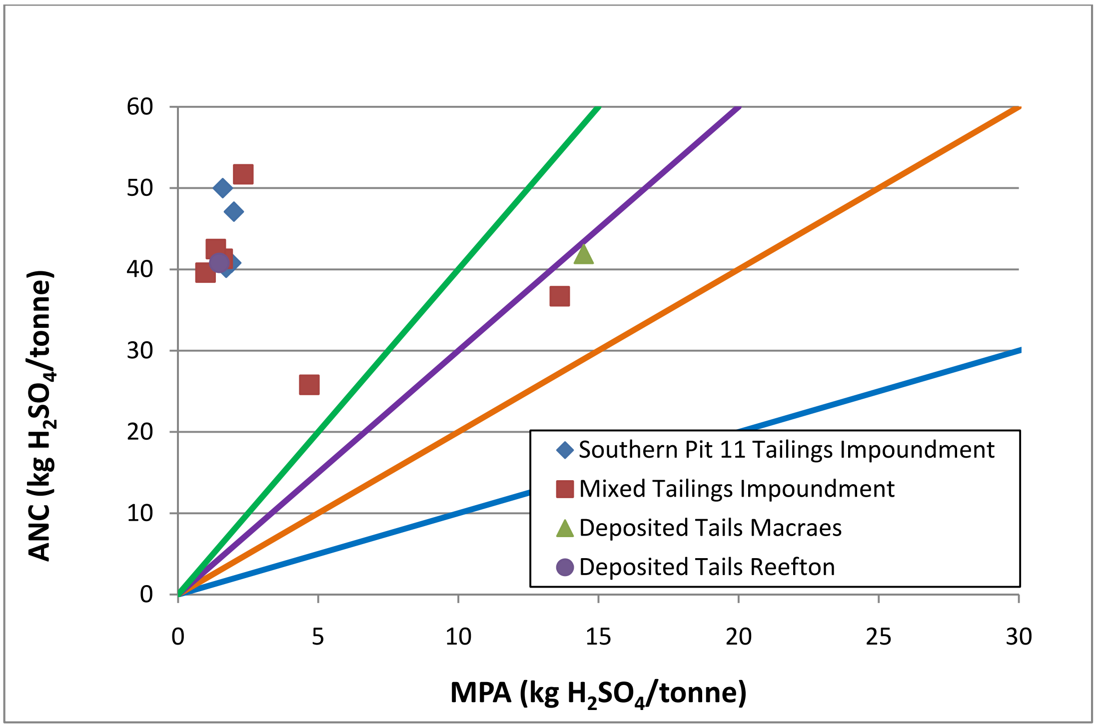

Figure 3: ANC MPA ratios.

4.2.6 NAGpH and NAG acidity

NAGpH values for the 12 samples were 8.2 to 8.8, with the Macraes tails sample recording a NAGpH value of 8.2 and the Reefton tails sample recording a NAGpH of 8.8. NAGpH values for SP11 samples were 8.6 to 8.7. NAGpH values for the MTI samples ranged from 8.5 to 8.8.

All samples recorded NAG Acidity values at both pH 4.5 and pH7 of <0.1 kg H_2SO_4/tonne.

4.3 Classification

Figure 4 presents the classification of the 12 samples based on the classification scheme presented in Table 3. The figure shows that all 12 samples are classified as Non-Acid Forming (NAF).

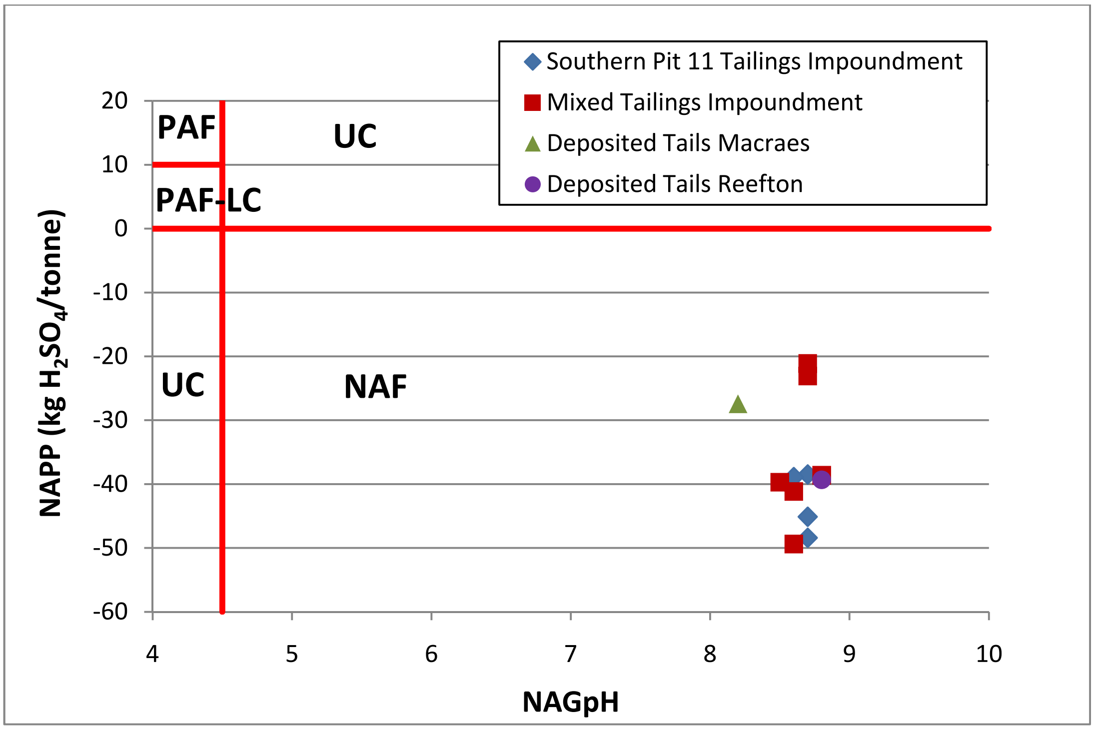

Figure 4: Tailings classification.

4.4 Multi-Element Chemical Composition

Multi-element concentrations were determined for all 12 samples of tailings. Table 4 presents a summary of the results. The results can be summarised as follows:

- The samples from the MTI contain a similar range of elemental concentrations as the samples from SP11 except for arsenic, which had a larger range of concentrations for the MTI samples compared with SP11 samples.
- The Reefton tails sample contained a slightly higher concentration of lead than SP11 and MTI samples.
- The Macraes tails sample contained higher concentrations of arsenic, cobalt, chromium, iron, lead, zinc sulphur and calcium than SP11 and MTI samples.

Table 4: Multi-element concentrations (mg/kg).

	SP11	MTI	Macraes tails	Reefton tails
Al	2,870 - 4,250	2,570 – 8,140	3,690	4,530
As	850 – 1,720	1,020 – 3,480	13,200	2,670
Co	9 - 10	7 - 13	21	10
Cr	15 - 18	13 - 26	62	16
Cu	23 - 34	25 -52	53	43
Fe	26,400 – 28,100	20,600 – 34,700	42,200	34,100
Mn	460 - 490	379 - 560	414	498
Ni	15 -18	13 -24	24	20
Pb	14 - 20	14 -42	143	77
Zn	55 - 65	45 - 86	133	67
S	0.11 - 0.28	0.19 - 0.67	1.28	0.46
Ca	12,500 – 15,500	8,200 – 16,700	17,500	15,200
Mg	5,530 – 5,790	3,760 -6,280	4,940	6,590
Na	100 - 270	80 - 190	290	190
K	1,420 – 1,620	990 – 1,620	1,580	1,400

The geochemical abundance index (GAI) has been used to assess the extent of element enrichment in the samples. The GAI quantifies an assay result for a particular element in terms of the estimated median crustal abundance (Smith & Huyck, 1999) for that element. The index, based on a log 2 scale, is expressed in 7 integer increments (0 through to 6, respectively) where a GAI of 0 indicates the element is present at a concentration similar to, or less than, median abundance and a GAI of 6 indicates approximately a 100-fold, or greater, enrichment above median abundance. As a general rule, a GAI of greater than 3 (implying 12-24 times the estimated median crustal abundance) indicates significant enrichment to a level that warrants further examination (DERM, 1995). Table 5 presents the GAI values for the 12 samples for the elements which were present at concentrations above detection level. The table shows that all samples recorded an arsenic GAI value of 6, indicating that arsenic is substantially enriched in the samples compared with the average crustal abundance. The remainder of the elements show no enrichment relative to crustal values, with the exception of lead in the Macraes and Reefton tails.

Table 5: Geochemical abundance index.

	Al	As	Co	Cr	Cu	Fe	Mn	Ni	Pb	Zn	S	Ca	Mg	Na	K
CLO6309	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO6324	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO6340	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO6355	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO7065	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO7069	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO7072	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO7080	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO7107	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
CLO7116	0	**6**	0	0	0	0	0	0	0	0	0	0	0	0	0
Macraes tails	0	**6**	0	0	0	0	0	0	2	0	0	0	0	0	0
Reefton tails	0	**6**	0	0	0	0	0	0	1	0	0	0	0	0	0

4.5 Short-Term Leach Testing

Short-term leach testing was performed by four different methods to gain an indication of the leachability of the samples under different pH and ionic concentrations. These tests were conducted on all samples to determine whether samples from the MTI and SP11, which were placed in the impoundments at different times using different processes and are currently under varying redox conditions, have substantially different concentrations of soluble or exchangeable major and trace element concentrations. Short-term leach testing results are presented in Appendix C.

Table 6 presents a summary of the short-term leach testing results for the SPLP test performed at pH 3. The results are summarised as follows:

- Leachate concentrations were similar for most elements for the MTI and SP11 samples.
- Exceptions were a larger range of arsenic and cobalt concentrations for the MTI samples compared with the SP11 Tailings Impoundment samples and a larger range of iron concentrations for SP11 samples compared with the MTI samples.
- The Macraes tails and Reefton tails samples leached slightly higher concentrations of sulphate and calcium than SP11 and the MTI.
- The Macraes tails sample leached a substantially higher concentration of cobalt than SP11, the MTI and Reefton tails samples.

Table 6: SPLP pH3 leachate summary.

	SP11	MTI	Macraes tails	Reefton tails
Al	0.05 - 0.3	0.05 - 0.18	0.05	0.03
As	0.699 - 0.803	0.25 - 1.12	0.484	0.704
Cd	<0.0001 - 0.0001	<0.0001 - 0.001	0.0002	0.0002
Co	0.005 - 0.008	0.002 - 0.023	0.139	0.006
Cr	<0.001 - 0.006	<0.001 - 0.003	<0.001	<0.001
Cu	0.016 - 0.031	0.007 - 0.029	0.01	0.002
Fe	<0.05 - 7.36	0.06 - 2.27	2.5	<0.05
Mn	0.183 - 0.309	0.071 - 0.508	0.459	0.339
Ni	0.007 - 0.013	0.002 - 0.011	0.008	0.001
Pb	<0.001 - 0.006	<0.001 - 0.009	0.002	<0.001
Zn	<0.005 - 0.023	<0.005 - 0.15	0.007	<0.005
SO_4^{2-}	278 – 1,230	86 – 1,450	1,620	1,580
Ca	119 - 471	54 - 608	656	659
Mg	15 - 40	7 - 25	36	25
Na	15 - 48	18 - 32	44	32
K	20 - 23	13 - 25	21	16

Note - All concentrations are in g/m^3.

Table 7 presents a summary of the short-term leach testing results for the SPLP test performed at pH 5. The results are summarised as follows:

- Leachate concentrations were similar for most elements for the MTI and SP11 samples.
- Exceptions were a larger range of cobalt and manganese concentrations for the MTI samples compared with SP11 samples.
- The Macraes tails sample leached slightly higher concentrations of iron, manganese, sulphate and calcium than SP11and the MTI.
- The Reefton tails sample also leached slightly higher concentrations of sulphate and calcium than the MTI and SP11 samples.
- The cobalt leached from the Macraes tails sample was substantially higher than the concentrations from the other samples.
- The majority of cobalt, manganese, nickel, zinc, sulphate, calcium, magnesium and potassium concentrations were higher for the SPLP pH3 leachates compared to the SPLP pH5 leachates for corresponding samples.
- The majority of arsenic concentrations were higher for the SPLP pH5 leachates compared with the SPLP pH3.

Table 7: SPLP pH 5 leachate summary.

	SP11	MTI	Macraes tails	Reefton tails
Al	0.04 - 0.18	0.07 - 0.16	0.09	0.09
As	0.587 - 1.01	0.36 - 1.34	0.643	0.754
Cd	<0.0001	<0.0001 - 0.0003	0.0001	<0.0001
Co	0.002 - 0.005	<0.001 - 0.021	0.14	0.004
Cr	<0.001 - 0.002	<0.001 - 0.003	0.001	<0.001
Cu	0.023 - 0.03	0.006 - 0.029	0.006	0.004
Fe	0.09 - 2.45	0.22 - 2.28	3.32	0.27
Mn	0.052 - 0.146	0.027 - 0.234	0.278	0.171
Ni	0.005 - 0.007	0.002 - 0.008	0.006	0.001
Pb	<0.001 - 0.002	<0.001 - 0.003	0.004	<0.001
Zn	<0.005 - 0.015	<0.005 - 0.01	0.006	0.006
SO_4^{2-}	261 – 1,220	72 – 1,330	1,660	1,600
Ca	90 - 441	26 - 548	662	672
Mg	13 - 38	4 - 23	34	21
Na	17 - 50	18 - 33	46	29
K	20 - 22	12 - 23	21	14

Note - All concentrations are in g/m^3.

Table 8 presents a summary of the 0.5 M $NaCO_3$ leach test results performed at pH 8.3. The results are summarised as follows:

- Leachate concentrations of most elements were similar for the SP11 and MTI samples.
- Arsenic, iron and manganese were present at wider ranges of concentrations in leachate from the MTI samples compared with SP11 samples.
- Leachate sulphate concentrations from the Macraes tails and Reefton tails samples were higher than those from SP11 and MTI samples.

Table 8: NaHCO$_3$ leachate summary.

	SP11	MTI	Macraes tails	Reefton tails
Al	<0.05 - 0.08	<0.05	<0.05	<0.05
As	3.21 - 8.23	5.86 - 20.4	10.7	6.64
Co	0.012 - 0.019	0.013 - 0.047	0.012	0.013
Cr	<0.005 - 0.031	0.012 - 0.027	0.024	0.016
Cu	0.032 - 0.052	0.024 -0.05	0.037	0.042
Fe	0.73 - 0.92	0.43 - 2.04	0.56	0.68
Mn	0.015 - 0.018	0.017 - 0.03	0.015	0.016
Ni	<0.005 - 0.006	<0.005 - 0.01	<0.005	<0.005
SO_4^{2-}	54 - 177	46 - 250	564	420
Ca	<2 - 4	3 - 4	3	4
Mg	4 - 7	<2 - 4	5	4
Na	10,900 – 11,000	10,900 – 11,200	11,000	11,400
K	7 - 8	5 - 8	7	6

Note - All concentrations are in g/m^3.

Table 9 presents a summary of the 1 M NaOH leach test results performed at pH 13. The results are summarised as follows:

- Leachate concentrations were similar for most elements for the MTI and SP11 samples, except for arsenic, chromium, lead and sulphate which were higher for the MTI samples.
- Leachate concentrations for the Reefton tails sample were similar to those of the MTI and SP11 samples.
- Leachate concentrations of cobalt, iron, lead and zinc were slightly higher for the Macraes tails sample compared with the MTI and SP11 samples.

Also,

- Leachate concentrations of cobalt, chromium, copper, iron, manganese and nickel were higher in the leachate from the sodium bicarbonate test than the sodium hydroxide test for the majority of samples.
- Leachate aluminium and sulphate concentrations were higher in the leachates from the sodium hydroxide test than the sodium bicarbonate test for the majority of samples.
- Leachate arsenic concentrations were higher in the leachates from the sodium hydroxide test than the sodium bicarbonate test for seven of the 12 samples.

Table 9: NaOH leachate summary.

	SP11	MTI	Macraes tails	Reefton tails
Al	1.66 - 4.46	1.79 - 2.65	0.29	1.12
As	6.32 - 7.86	7.72 - 73.9	4.18	10.5
Cd	<0.0001 - 0.0001	<0.0001 - 0.0006	<0.0001	<0.0001
Co	<0.001	<0.001 - 0.004	0.024	<0.001
Cr	0.005 - 0.006	0.006 - 0.019	0.003	0.004
Cu	0.009 - 0.014	0.008 - 0.025	0.001	0.003
Fe	0.14 - 0.34	0.08 - 0.42	0.96	0.05
Pb	0.002 - 0.004	0.003 - 0.01	0.053	0.01
Zn	0.007 - 0.01	0.007 - 0.015	0.022	0.01
SO_4^{2-}	216 - 341	249 – 2,080	637	432
Ca	2 - 5	2 - 9	2	2
Mg	<1	<1	<1	<1
Na	2,100 – 2,170	2,090 – 2,150	2,130	2,140
K	6 - 7	4 - 7	6	5

Note - All concentrations are in g/m^3.

4.6 Mineralogy

X-ray diffraction (XRD) results are presented in Table 10. The results show that the samples are dominated by quartz, muscovite and plagioclase. Two carbonate minerals, calcite and siderite, were detected in all 12 samples. Siderite was present at a higher concentration than calcite in most of the samples. The presence of siderite in the samples suggests that the ANC results as determined using the LECO method may over estimate the actual neutralising capacity of the samples. The LECO analysis accounts for all carbonate minerals; however, iron carbonates do not contribute to acid neutralisation under oxidising conditions due to the oxidation of the ferrous iron released, subsequent hydrolysis and precipitation of ferric hydroxide, and the consequent acid production (White et. al., 1999).

Although sulphide minerals are known to occur in the ore, in particular pyrite and arsenopyrite, no sulphide minerals were detected in the tailings samples, suggesting that if present, these minerals occur in minor concentrations. Gypsum was detected in 11 of the samples and this would account for the sulphate sulphur component of the total sulphur measured in the acid base accounting test work. Concentrations of most minerals were similar across the twelve samples; however, gypsum was detected in higher concentrations in the Macraes tails and the Reefton tails samples compared with SP11 and MTI samples, and calcite was detected in lower concentrations in the Macraes tails and Reefton tails samples compared with SP11 and MTI samples. The ANC values for the Macraes tails and Reefton tails samples are comparable with those of the other samples, which does not correspond to the lower calcite detected in these two samples. The combined concentration of calcite and siderite for the Macraes tails and Reefton tails samples is comparable with the other samples, supporting the likelihood that the measured ANC is a reflection of the presence of both calcite and siderite.

Table 10: Mineralogy data.

	CLO7072	**CLO7080**	**CLO7107**	**CLO7116**	**Deposited tails Macraes**	**Deposited tails Reefton**
	MTD 521RL	MTD 513RL	MTD 588RL	MTD 479RL		
Amorphous/unknown content	7	7	6	6	8	<5
Quartz	37.4	37.4	32	49.3	31.4	29.6
Plagioclase (albite)	23.2	23.1	19.6	14.6	17.1	19.1
K-feldspar (microcline)	1.4	1.2	1.4	1.3	2.7	1.8
Chlorite	1.2	4	6.8	6.1	1.8	2.1
Kaolinite	1.6	1.6	1.7	0.8	1.9	2.9
Muscovite	23.2	20.6	29.1	20.5	31.3	36.4
Calcite	1.4	2.1	1.4	1	0.9	0.6
Siderite	3.1	2.2	1.5	0.4	2.6	3.6
Gypsum	0.4	0.4	0.4	0	2.3	1.6
	CLO6309	**CLO6324**	**CLO6340**	**CLO6355**	**CLO7065**	**CLO7069**
	SP11 514RL	SP11 499RL	SP11 484RL	SP11 469RL	MTD 528RL	MTD 524RL
Amorphous/unknown content	<5	<5	<5	<5	6	9
Quartz	31.8	39.4	31.6	36.9	37.3	34.8
Plagioclase (albite)	20.1	22.7	20.1	18.6	19.4	16.8
K-feldspar (microcline)	1.5	1.5	1.4	0.5	0.5	0.5
Chlorite	2.9	2.1	1.7	1.3	1.9	1.7
Kaolinite	2.6	1.6	3.1	3.9	1.9	2
Muscovite	33.6	23.4	36.8	33.9	28	30.4
Calcite	1.6	1.7	1.1	1	1.4	0.8
Siderite	3	3.4	3.5	3.5	3.3	3.1
Gypsum	1.2	0.5	0.6	0.4	0.3	0.5

Note - All data in %.

4.7 Kinetic Leach Tests

OceanaGold initiated kinetic leach tests on tailings samples from site in 2006. The results are provided in Appendix E. The arsenic concentrations obtained between July and October in 2006 were:

- 0.008 and 0.989 g/m^3 for the 92% oxidation column
- 0.008 and 0.204 g/m^3 for the 99% oxidation column.

OceanaGold recommenced leaching of these columns in September 2010. Data for the first seven weeks of testing are provided in Tables 11 and 12. Total arsenic concentrations range between 0.095 and 0.175 g/m^3 for the 92% column and <0.01 and 0.013 g/m^3 for the 99% column.

Table 11: 2010 kinetic leach data (92% oxidation).

Period	Date	Water added	Water out	Eh	pH	Elec Cond	Dissolved As	Total As
		mL	mL	mv	pH	uS/cm	g/m^3	g/m^3
	1-Sep-10	600	995	170	7.97	1202	0.0097	0.095
WEEK 1	3-Sep-10	800	718	180	7.04			
	6-Sep-10	900	575	197	7.18			
	8-Sep-10	446	566.6	260	7.27	2220	0.131	0.112
WEEK 2	10-Sep-10	467.5	391.7	262	7.63			
	13-Sep-10	442	628.8	199	7.79			
	15-Sep-10	958	766.5	193	7.87	2750	0.176	0.175
WEEK 3	17-Sep-10	889	428	197	7.71			
	20-Sep-10	542	970	199	7.82			
	22-Sep-10	900	946.8	203	7.83	2900	0.16	0.152
WEEK 4	24-Sep-10	900	856	194	7.97			
	27-Sep-10	906	895.7	175	7.77			
	29-Sep-10	902	929.28	217	8.01	2840	0.159	0.149
WEEK 5	1-Oct-10	900	800	269	8.05			
	5-Oct-10	906	1,011.8	195	7.69	2560	0.141	0.157
WEEK 6	8-Oct-10	900	885.7	253	7.92			
	12-Oct-10	900	962.5	283	7.96	2780	0.141	0.164
WEEK 7	14-Oct-10	900	852.4	276	8.03			
	18-Oct-10	500						

Table 12: 2010 kinetic leach data (99% oxidation).

Period	Date	Water added	Water out	Eh	pH	Elec Cond	Dissolved As	Total As
		mLl	mL	mv	pH	uS/cm	g/m^3	g/m^3
	1-Sep-10	900	821	153	8.25	164	0.0089	<0.011
WEEK 1	3-Sep-10	800	883	151	7.56			
	6-Sep-10	900	975	178	7.50			
	8-Sep-10	902	954.2	251	7.99	1918	0.0102	<0.01
WEEK 2	10-Sep-10	909	826.7	246	8.15			
	13-Sep-10	910	799.5	192	8.04			
	15-Sep-10	903	858.3	191	7.90	3160	0.009	0.013
WEEK 3	17-Sep-10	889	752	195	7.94			
	20-Sep-10	542	1,010	209	7.63			
	22-Sep-10	1,400	931.8	209	7.76	3240	0.009	<0.011
WEEK 4	24-Sep-10	900	843	196	7.92			
	27-Sep-10	911	1,018	182	7.65			
	29-Sep-10	902	791.18	215	8.04	2960	0.009	0.011
WEEK 5	1-Oct-10	900	886.6	274	8.14			
	5-Oct-10	905	855.7	197	7.94	2510	0.008	0.012
WEEK 6	8-Oct-10	900	1,131.5	257	7.99			
	12-Oct-10	900	1,030	278	8.07	2190	0.0059	0.0073
WEEK 7	14-Oct-10	900	896.4	275	8.25		0.0089	
	18-Oct-10	1,400						

5.0 DISCUSSION AND CONCLUSIONS

5.1 Acid Generation Potential and Mineralogy

One objective of the current geochemical program was to determine the AMD/ML potential of the tailings to assist in predicting probable water qualities for seepage from the proposed TTTSF.

Static testing was initiated on all samples to assess acid generation and metal leaching potential. Ten of the samples tested were supplied from the tailings drilling program of 2008 and the other two samples were generated by the process circuit.

The dominant sulphide minerals associated with the ores from the Macraes Gold Project are pyrite and arsenopyrite. The ore from Reefton Gold Mine is also associated with pyrite and arsenopyrite as well as stibnite. The ore is passed through an autoclave where the sulphides are oxidised. Limestone is added to the feed to the autoclave to assist with the presence of carbonaceous material. The added limestone also neutralises acid that is generated in the oxidation of sulphides. The main end products of the oxidation are arsenic-bearing iron oxyhydroxides and sulphates.

No sulphide minerals were detected by XRD in any of the tailings samples. Calcite, siderite and gypsum were detected in all samples.

In conclusion, the ABA results indicate that up to 90% of the total sulphur measured is present as sulphate sulphur rather than sulphide sulphur. Based on the ABA and NAG results, all 12 samples are classified as Non-Acid Forming. The results suggest that both the tailings present on site in existing tailings impoundments and the new tailings streams are non acid generating. Therefore, the tailings to be stored in the TTTSF are likely to be non acid generating.

5.2 Metals Leaching Potential

The samples from the MTI and SP11 contained similar concentrations of the elements analysed. The Reefton tails sample contained a slightly higher concentration of lead and the Macraes tails sample contained higher concentrations of a number of elements including arsenic, lead and zinc than SP11 and MTI samples. All samples recorded an arsenic GAI value of 6, indicating that arsenic is substantially enriched in the samples compared with the average crustal abundance.

Short-term leach testing of the samples was conducted to evaluate metal leaching at pH 3, 5, 8.3, and 13 using solutions with varying ionic strengths. The results show that for all of the tests, the samples leached arsenic at concentrations higher than those for most of the other metals. For the low-pH leach tests, iron concentrations were also higher than those for other metals. Higher aluminium concentrations were recorded under alkaline conditions. Overall, similar concentrations of elements were leached from all of the samples. Cobalt concentrations from the Deposited Tails Macraes sample were higher than those from the other samples for three of the four tests, and may require further investigation.

In conclusion, the laboratory data show that the leachate of the placed tailings in the MTI and SP11, and of the tailings that are being generated by the current process, is similar in quality.

5.3 Predicting Seepage Quality at TTTSF

An indirect component of the geochemical program was to compare laboratory data with measured data from the site. Under another scope of work, Golder has done an extensive review of 20 years of surface and groundwater data that includes tailings seepage and decant water from the MTI and SP11 (Golder Report No. 0978110562-R012 (Golder, 2010).

The kinetic column and the SPLP pH 5 leach methods provide leachate data that are in good agreement with seepage reporting from the MTI and SP11 underdrains (Golder Report No. 0978110562-R012 (Golder, 2010). The sulphate data from both these methods are also in agreement with tailings impoundment decant and seepage data for early periods in the life of the mine (Golder Report No. 0978110562-R012 (Golder, 2010). Over time, the decant water quality has decreased, which is likely due to the ongoing recycling of the decant water, evaporation, dilution, and changes to the process and water management methods over the 20 years of mine operation.

Whereas there are some drains with water quality that is in good agreement with laboratory data, there are other drains reporting seepage from the MTI and the SP11 with substantially higher concentrations of parameters such as arsenic and sulphate (Golder Report No. 0978110562-R012 (Golder, 2010). This may be explained by the fact that the tailings above these drains are being leached with decant water with elevated concentrations of parameters such as arsenic and sulphate.

In conclusion, the seepage from the TTTSF will likely be within the range of water qualities that have been measured on site from the MTI and SP11. However, the seepage quality that will report from the TTTSF will be, in part, dependent on the tailings processing method as well as the sourcing and recycling of the process water throughout the operation.

6.0 RECOMMENDATIONS

The suggested mechanism for the higher seepage concentrations for arsenic and sulphate in some of the underdrains compared with laboratory data is the infiltration of decant water with high concentrations of arsenic and sulphate through the tailings.

It is recommended that the kinetic columns be leached with current decant water and that the leachate is then monitored and analysed for pH, EC, arsenic and sulphate for two to three months. The decant water could then be replaced with water from Lone Pine Reservoir and the resultant changes in water quality monitored for two to three months to determine whether the assumed mechanism is correct.

7.0 REFERENCES

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APPENDIX A

Report limitations.

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APPENDIX B

Methods.

Soil pH and electrical conductivity (EC)

A 1:5 solid to water solution is used to measure soil pH and electrical conductivity. These parameters provide an indication of soil acidity/alkalinity and soil salinity.

Total sulphur (TS)

Total sulphur (TS) is used to calculate Maximum Potential Acidity (MPA_{TS}). TS is measured by combustion in a LECO furnace at 1350ºC in the presence of strong oxidants/catalysts. This method determines the total concentration of sulphur in all the minerals containing sulphur: this will include sulphate minerals and organic sulphur in addition to unoxidised sulphide minerals, such as pyrite. The most environmentally conservative approach to calculate MPA is to make the assumption that all sulphur in a sample is potentially reactive and therefore capable of generating acid. However, this ignores the fact that not all sulphur will contribute to the generation of acidity (e.g., sulphur in gypsum, barite, galena, sphalerite or chalcocite). As a result, use of the TS analysis may result in an overestimate of the MPA, expressed in kg H_2SO_4/tonne.

By convention in ABA studies, one generally assumes that the sulphide sulphur is present entirely as pyrite (FeS_2). The stoichiometry of pyrite oxidation is used to calculate a theoretical amount of sulphuric acid that could be generated.

Sulphur speciation is recommended to determine whether the MPA_{TS} is providing a reasonable assessment of the sulphide acidity.

Chromium Reducible Sulphur (CRS)

The chromium reducible sulphur (CRS) method is a sulphur speciation method that determines the sulphide (inorganic sulphur) sulphur concentration as opposed to the MPA_{TS} method, which measures the TS. Use of the MPA based on the CRS determination (MPA_{CRS}) is recommended as the most reliable and direct measure of reduced inorganic sulphur, particularly at low sulphur levels (Ahern, et al. 2004).

Total Acid Neutralising Capacity (ANC)

The total acid neutralising capacity (ANC) can be measured by the modified Sobek method (ANC_{SOBEK}) that utilises digestion of a sample with 0.5 M HCl. The sample is then back titrated to measure the amount of acid consumed by reaction with the sample, which provides the total ANC, expressed in kg H_2SO_4/tonne.

Net Acid Generation (NAG)

The single addition peroxide oxidation net acid generating (NAG) method is used to measure NAG acidity, which is assumed to be the equivalent of NAPP derived from ABA data (Miller et al. 1997). It is often used in association with the NAPP and ANC:MPA ratio to classify the acid generating potential of a sample. The NAG method is a relatively inexpensive, straight forward method that may be used for operational waste rock management. The NAG method can also be used to measure ANC.

The NAG procedure uses a strong oxidant (hydrogen peroxide) to rapidly oxidise sulphide minerals in a crushed sample of rock. During the NAG test, acid generation and acid neutralisation reactions can occur simultaneously (AMIRA, 2002). If the sample has sufficient available acid neutralising capacity, the alkalinity of the whole rock will not be entirely depleted and the system will have the capacity to remain circum-neutral or alkaline. If there is inadequate available acid neutralising capacity, then the pH of the test solution (NAG pH) will fall below 4.5 and there will be net acidity rather than net alkalinity. In this case, a sample demonstrates a potential for acid generation.

Whole Rock Analysis

Total metal concentrations were assessed to determine the chemical composition of the samples and identify the presence of parameters of potential environmental concern.

Short-term leach tests

The short-term nature of static leach tests provides a snapshot in time of a material's environmental stability. Test results depend entirely on the present disposition of the sample (e.g., unoxidised versus oxidised, oxidation products absent versus present, etc.). For reactive rocks (i.e. material that contains oxidisable sulphur), the mechanisms that lead to changes in solution chemistry during water-rock interaction often develop over periods of time that are much greater than can be represented in a fixed-time extraction test. Therefore, short-term leach tests cannot be applied to predict long-term quality, but are instead used to get an initial indication of parameters of potential environmental concern. Long-term testing, such as kinetic testing, is generally required to evaluate environmental stability and weathering behaviour of mining wastes over time.

Synthetic Precipitation Leaching Procedure (SPLP)

Short-term metal leach testing was undertaken using the US Environmental Protection Agency's Synthetic Precipitation Leaching Procedure (SPLP) (USEPA Method 1312). SPLP testing was performed for 18 hours at pH 3 and pH 5 with a 1:5 solid to solution ratio. The solution consisted of a dilute sulphuric acid solution buffered with NaOH.

Sodium Bicarbonate Leach Test

A second short-term leach test was conducted using a 0.5 M $NaHCO_3$ solution. One gram of sample was combined with 30 mL of $NaHCO_3$ and tumbled for 16 hours. The sample was then centrifuged and filtered before analysis for dissolved metals and ions (Shiowatana et al. 2001). The test was undertaken to give an indication of the leachability of the material under slightly alkaline (pH 8.3) conditions.

Sodium Hydroxide Leach Test

A third short-term leach test was conducted using a 0.1M NaOH solution. One g of sample was combined with 30 mL of NaOH and tumbled for 16 hours. The sample was then centrifuged and filtered before analysis for dissolved metals and ions (Shiowatana et al., 2001). The test was undertaken to give an indication of the leachability of the material under alkaline (pH 13) conditions.

Mineralogy

Powder X-ray diffraction (XRD) is a non-destructive technique that can be used to investigate material properties such as structures, phases (composition), crystal orientations (textures), average grain size, strain, crystallinity and crystal defects. XRD analysis was conducted at the X-ray Analysis Facility at Queensland University of Technology to identify and quantify the main crystalline mineral phases of the samples.

Quantitative analysis was undertaken via a Rietveld analysis technique in which the crystal structures of the phases identified are used to model the diffraction pattern. The amorphous/unidentified fraction represents the non-diffracting and/or non-identified content of the sample.

APPENDIX C

Geochemical data.

Table 1: Static ABA and NAG data.

	Tailings impoundment	RL	pH	EC	$pH_{(ox)}$	$NAG_{pH4.5}$	NAG_{pH7}	ANC	TS	CRS	$MPA_{(CRS)}$	NAPP
		m		µS/cm		kg H_2SO_4/tonne			%	%	kg H_2SO_4/tonne	
CLO6309	SP11	514	7.8	1,490	8.7	<0.1	<0.1	40.2	0.26	0.056	1.71	-38.49
CLO6324	SP11	499	8.2	528	8.7	<0.1	<0.1	50	0.11	0.052	1.59	-48.41
CLO6340	SP11	484	8	1,530	8.7	<0.1	<0.1	47.1	0.25	0.065	1.99	-45.11
CLO6355	SP11	469	7.9	1,770	8.6	<0.1	<0.1	40.8	0.29	0.062	1.90	-38.90
CLO7065	MTI	528	8.2	947	8.6	<0.1	<0.1	51.7	0.22	0.076	2.33	-49.37
CLO7069	MTI	524	7.8	1740	8.5	<0.1	<0.1	41.3	0.38	0.052	1.59	-39.71
CLO7072	MTI	521	8	920	8.8	<0.1	<0.1	39.6	0.19	0.032	0.98	-38.62
CLO7080	MTI	513	7.9	1,060	8.6	<0.1	<0.1	42.5	0.22	0.044	1.35	-41.15
CLO7107	MTI	588	8.4	565	8.7	<0.1	<0.1	36.7	0.68	0.445	13.62	-23.08
CLO7116	MTI	479	8.7	170	8.7	<0.1	<0.1	25.8	0.23	0.153	4.68	-21.12
Deposited tails Macraes			7.6	2,450	8.2	<0.1	<0.1	41.9	1.28	0.473	14.47	-27.43
Deposited tails Reefton			7.6	1,680	8.8	<0.1	<0.1	40.8	0.51	0.048	1.47	-39.33

Table 2: Multi-element concentrations (mg/kg).

Sample no.	Tailings dam	RL (m)	Al	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn	S	Ca	Mg	Na	K
CLO6309	SP11	514	4,250	1,720	<1	9	18	29	27,100	<0.1	460	15	20	57	0.25	15,500	5,530	210	1,620
CLO6324	SP11	499	3,470	850	<1	9	17	23	26,400	<0.1	490	15	14	55	0.11	15,200	5,790	100	1,490
CLO6340	SP11	484	3,250	1,500	<1	10	16	30	28,100	<0.1	468	17	18	60	0.25	13,800	5,790	160	1,490
CLO6355	SP11	469	2,870	1,350	<1	10	15	34	28,100	<0.1	469	18	20	65	0.28	12,500	5,740	270	1,420
CLO7065	MTI	528	3,340	1,740	<1	10	16	28	30,200	<0.1	536	18	42	63	0.23	16,700	6,040	180	1,270
CLO7069	MTI	524	3,560	2,360	<1	9	22	33	29,600	<0.1	476	16	26	64	0.37	12,900	5,250	170	1,590
CLO7072	MTI	521	2,570	1,770	<1	9	19	25	28,400	<0.1	506	16	18	57	0.19	14,900	5,500	190	1,300
CLO7080	MTI	513	5,580	1,550	<1	9	16	36	27,700	<0.1	504	17	18	62	0.2	14,900	5,460	170	1,260
CLO7107	MTI	488	8,140	3,480	<1	13	26	52	34,700	<0.1	560	24	23	86	0.67	13,600	6,280	170	1,620
CLO7116	MTI	479	5,820	1020	<1	7	13	28	20,600	<0.1	379	13	14	45	0.23	8,200	3,760	80	990
Deposited tails Macraes			3,690	13,200	<1	21	62	53	42,200	0.2	414	24	143	133	1.28	17,500	4,940	290	1,580
Deposited tails Reefton			4,530	2,670	<1	10	16	43	34,100	<0.1	498	20	77	67	0.46	15,200	6,590	190	1,400

Table 3: SPLP at pH3 (g/m^3).

Sample no.	Tailings dam	RL (m)	Al	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn	SO_4^{2-}	Ca	Mg	Na	K
CLO6309	SP11	514	0.02	0.803	<0.0001	0.005	<0.001	0.016	<0.05	<0.0001	0.183	0.007	<0.001	<0.005	931	359	35	35	21
CLO6324	SP11	499	0.3	0.699	0.0001	0.005	0.006	0.031	7.36	<0.0001	0.303	0.013	0.006	0.023	278	119	15	15	23
CLO6340	SP11	484	0.05	0.779	<0.0001	0.005	<0.001	0.018	0.22	<0.0001	0.211	0.007	<0.001	0.011	1,020	405	35	28	22
CLO6355	SP11	469	0.05	0.76	<0.0001	0.008	<0.001	0.03	0.22	<0.0001	0.309	0.012	<0.001	0.008	1,230	471	40	48	20
CLO7065	MTI	528	0.09	0.25	0.001	0.023	0.001	0.024	0.54	<0.0001	0.225	0.011	0.009	0.15	590	233	22	30	19
CLO7069	MTI	524	0.05	1.12	<0.0001	0.009	<0.001	0.021	0.19	<0.0001	0.508	0.006	<0.001	0.011	1,450	608	25	26	25
CLO7072	MTI	521	0.18	0.928	<0.0001	0.008	0.003	0.021	2.27	<0.0001	0.215	0.009	0.003	0.018	550	213	23	30	18
CLO7080	MTI	513	0.08	0.667	<0.0001	0.008	0.002	0.029	0.45	<0.0001	0.357	0.006	<0.001	0.01	747	299	24	30	18
CLO7107	MTI	488	0.05	0.714	<0.0001	0.002	0.001	0.008	0.16	<0.0001	0.077	0.003	<0.001	0.008	281	102	17	32	21
CLO7116	MTI	479	0.08	0.407	0.0002	0.001	<0.001	0.007	0.06	<0.0001	0.071	0.002	<0.001	<0.005	86	54	7	18	13
Deposited tails Macraes			0.05	0.484	0.0002	0.139	<0.001	0.01	2.5	<0.0001	0.459	0.008	0.002	0.007	1,620	656	36	44	21
Deposited tails Reefton			0.03	0.704	0.0002	0.006	<0.001	0.002	<0.05	<0.0001	0.339	0.001	<0.001	<0.005	1,580	659	25	32	16

Table 4: SPLP at pH 5 (g/m^3).

Sample no.	Tailings dam	RL (m)	Al	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn	SO_4^{2-}	Ca	Mg	Na	K
CLO6309	SP11	514	0.04	0.874	<0.0001	0.004	<0.001	0.023	0.09	<0.0001	0.101	0.006	<0.001	<0.005	929	333	33	36	22
CLO6324	SP11	499	0.12	0.587	<0.0001	0.002	<0.001	0.026	0.34	<0.0001	0.052	0.005	<0.001	<0.005	261	90	13	17	21
CLO6340	SP11	484	0.18	1.01	<0.0001	0.005	0.002	0.024	2.45	<0.0001	0.146	0.007	0.002	0.015	935	347	31	29	21
CLO6355	SP11	469	0.05	0.842	<0.0001	0.005	0.001	0.03	0.12	<0.0001	0.141	0.007	<0.001	0.007	1,220	441	38	50	20
CLO7065	MTI	528	0.16	0.36	<0.0001	0.021	0.003	0.019	2.28	<0.0001	0.155	0.008	0.003	0.01	546	198	20	29	18
CLO7069	MTI	524	0.08	1.34	<0.0001	0.006	<0.001	0.023	0.22	<0.0001	0.234	0.004	<0.001	0.005	1,330	548	23	25	23
CLO7072	MTI	521	0.11	0.87	0.0002	0.004	<0.001	0.014	0.44	<0.0001	0.061	0.004	<0.001	<0.005	479	167	19	30	16
CLO7080	MTI	513	0.07	0.679	<0.0001	0.006	<0.001	0.029	0.25	<0.0001	0.161	0.004	<0.001	0.005	694	254	22	32	17
CLO7107	MTI	488	0.1	1.0	<0.0001	0.001	0.002	0.009	0.26	<0.0001	0.034	0.002	0.002	<0.005	268	76	14	33	20
CLO7116	MTI	479	0.16	0.803	0.0003	<0.001	<0.001	0.006	0.22	<0.0001	0.027	0.002	<0.001	<0.005	72	26	4	18	12
Deposited tails Macraes			0.09	0.643	0.0001	0.14	0.001	0.006	3.32	<0.0001	0.278	0.006	0.004	0.006	1,660	662	34	46	21
Deposited tails Reefton			0.09	0.754	<0.0001	0.004	<0.001	0.004	0.27	<0.0001	0.171	0.001	<0.001	0.006	1,600	672	21	29	14

Table 5: NaHCO3 at pH 8.3 (g/m^3)

Sample no.	Tailings dam	RL (m)	Al	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn	SO_4^{2-}	Ca	Mg	Na	K
CLO6309	SP11	514	0.2	3.21	<0.0005	0.012	<0.005	0.035	0.73	<0.0001	0.018	0.005	<0.005	<0.025	177	4	7	10,900	8
CLO6324	SP11	499	0.08	8.23	<0.0005	0.015	<0.005	0.036	0.88	<0.0001	0.016	<0.005	<0.005	<0.025	54	3	4	11,000	8
CLO6340	SP11	484	0.07	8.03	<0.0005	0.019	0.031	0.052	0.92	<0.0001	0.015	0.006	<0.005	<0.025	161	3	5	11,000	7
CLO6355	SP11	469	<0.05	4.88	<0.0005	0.016	0.014	0.032	0.82	<0.0001	0.018	0.005	<0.005	<0.025	233	<2	6	11,100	7
CLO7065	MTI	528	<0.05	9.2	<0.0005	0.013	0.027	0.038	0.61	<0.0001	0.028	<0.005	<0.005	<0.025	101	3	3	11,000	6
CLO7069	MTI	524	<0.05	6.31	<0.0005	0.013	0.023	0.033	0.43	<0.0001	0.018	0.005	<0.005	<0.025	250	3	4	10,900	8
CLO7072	MTI	521	<0.05	5.86	<0.0005	0.013	0.018	0.05	0.44	<0.0001	0.03	<0.005	<0.005	<0.025	114	3	4	11,200	6
CLO7080	MTI	513	<0.05	20.4	<0.0005	0.018	0.019	0.032	1.03	<0.0001	0.017	0.006	<0.005	<0.025	130	3	4	11,000	6
CLO7107	MTI	488	<0.05	7.19	<0.0005	0.013	0.013	0.028	0.59	<0.0001	0.018	0.007	<0.005	<0.025	84	4	4	10,900	8
CLO7116	MTI	479	<0.05	7.08	<0.0005	0.047	0.012	0.024	2.04	<0.0001	0.017	0.01	<0.005	<0.025	46	3	<2	11,200	5
Deposited tails Macraes			<0.05	10.7	<0.0005	0.012	0.024	0.037	0.56	<0.0001	0.015	<0.005	<0.005	<0.025	564	3	5	11,000	7
Deposited tails Reefton			<0.05	6.64	<0.0005	0.013	0.016	0.042	0.68	<0.0001	0.016	<0.005	<0.005	<0.025	420	4	4	11,400	6

Table 6: NaOH at pH 13 (g/m^3).

Sample no.	Tailings dam	RL (m)	Al	As	Cd	Co	Cr	Cu	Fe	Hg	Mn	Ni	Pb	Zn	SO_4^{2-}	Ca	Mg	Na	K
CLO6309	SP11	514	1.92	7.04	0.0001	<0.001	0.006	0.011	0.15	<0.0001	<0.001	<0.001	0.004	0.009	280	5	<1	2,160	7
CLO6324	SP11	499	4.46	7.86	<0.0001	<0.001	0.006	0.014	0.34	<0.0001	0.001	<0.001	0.003	0.01	216	4	<1	2,100	7
CLO6340	SP11	484	1.76	7.53	<0.0001	<0.001	0.005	0.009	0.18	<0.0001	<0.001	<0.001	0.002	0.007	289	4	<1	2,110	6
CLO6355	SP11	469	1.66	6.32	<0.0001	<0.001	0.006	0.014	0.14	<0.0001	<0.001	<0.001	0.003	0.009	341	2	<1	2,170	6
CLO7065	MTI	528	2.5	8.89	<0.0001	0.004	0.005	0.012	0.42	<0.0001	<0.001	<0.001	0.005	0.015	249	9	<1	2,150	6
CLO7069	MTI	524	1.88	7.72	<0.0001	<0.001	0.006	0.025	0.08	<0.0001	<0.001	<0.001	0.004	0.014	360	2	<1	2,120	7
CLO7072	MTI	521	2.16	10.8	<0.0001	<0.001	0.008	0.017	0.25	<0.0001	<0.001	<0.001	0.003	0.012	305	8	<1	2,090	6
CLO7080	MTI	513	1.79	8.32	<0.0001	0.001	0.006	0.02	0.2	<0.0001	<0.001	<0.001	0.004	0.007	391	7	<1	2,140	5
CLO7107	MTI	488	2.9	73.9	0.0006	<0.001	0.019	0.01	0.32	<0.0001	0.002	<0.001	0.007	0.012	2080	3	<1	2,140	7
CLO7116	MTI	479	2.65	16	0.0002	<0.001	0.008	0.008	0.26	<0.0001	0.001	<0.001	0.01	0.009	684	2	<1	2,110	4
Deposited tails Macraes			0.29	4.18	<0.0001	0.024	0.003	0.001	0.96	<0.0001	<0.001	<0.001	0.053	0.022	637	2	<1	2,130	6
Deposited tails Reefton			1.12	10.5	<0.0001	<0.001	0.004	0.003	0.05	<0.0001	<0.001	<0.001	0.01	0.01	432	2	<1	2,140	5

Table 7: XRD mineralogy data.

Sample no.	Tailings dam	RL	amorphous/ unknown	quartz	plagioclase (albite)	k-feldspar (microcline)	chlorite	kaolinite	muscovite	calcite	siderite	gypsum
CLO6309	SP11	514	<5	31.8	20.1	1.5	2.9	2.6	33.6	1.6	3	1.2
CLO6324	SP11	499	<5	39.4	22.7	1.5	2.1	1.6	23.4	1.7	3.4	0.5
CLO6340	SP11	484	<5	31.6	20.1	1.4	1.7	3.1	36.8	1.1	3.5	0.6
CLO6355	SP11	469	<5	36.9	18.6	0.5	1.3	3.9	33.9	1	3.5	0.4
CLO7065	MTI	528	6	37.3	19.4	0.5	1.9	1.9	28	1.4	3.3	0.3
CLO7069	MTI	524	9	34.8	16.8	0.5	1.7	2	30.4	0.8	3.1	0.5
CLO7072	MTI	521	7	37.4	23.2	1.4	1.2	1.6	23.2	1.4	3.1	0.4
CLO7080	MTI	513	7	37.4	23.1	1.2	4	1.6	20.6	2.1	2.2	0.4
CLO7107	MTI	588	6	32	19.6	1.4	6.8	1.7	29.1	1.4	1.5	0.4
CLO7116	MTI	479	6	49.3	14.6	1.3	6.1	0.8	20.5	1	0.4	0
Deposited tails Macraes			8	31.4	17.1	2.7	1.8	1.9	31.3	0.9	2.6	2.3
Deposited tails Reefton			<5	29.6	19.1	1.8	2.1	2.9	36.4	0.6	3.6	1.6

APPENDIX D

Raw laboratory data.

ALS Laboratory Group
ANALYTICAL CHEMISTRY & TESTING SERVICES

Environmental Division

CERTIFICATE OF ANALYSIS

Work Order : **EB1017676**

Client : **GOLDER ASSOCIATES**
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Project : 107631030
Order number : ----
C-O-C number : ----
Sampler : G Maddocks
Site : Macraes

Quote number : BN/587/10

Page : 1 of 15

Laboratory : Environmental Division Brisbane
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QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Date Samples Received : 01-OCT-2010
Issue Date : 14-OCT-2010

No. of samples received : 60
No. of samples analysed : 60

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

WORLD RECOGNISED
ACCREDITATION

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Inorganics
Stephen Hislop	Senior Inorganic Chemist	Inorganics
Stephen Hislop	Senior Inorganic Chemist	Stafford Minerals - AY

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ALS is not NATA accredited for the client specific leachates performed in this batch. All leachates were tumbled end over end for 16 hours. LORs have been raised in some circumstances due to the sample matrix.**
- **Results reported on samples 1-12 are from Nitric/Sulphuric leachates as per SPLP method at a pH of 3 and a 1:5 soil to liquid ratio..**
- **Results reported on samples 13-24 are from Nitric/Sulphuric leachates as per SPLP method at a pH of 5 and a 1:5 soil to liquid ratio..**
- **Results reported on samples 25-36 are from a 0.5M Sodium Bicarbonate 1:30 leachate method.**
- **Results reported on samples 37-48 are from a 1g:30 ml of 0.1M NaOH leachate.**

Analytical Results

Sub-Matrix: **PULP**			*Client sample ID*	**CLO6309**	**CLO6324**	**CLO6340**	**CLO6355**	**CLO7065**
			Client sampling date / time	03-SEP-2010 15:00	03-SEP-2010 15:00	03-SEP-2010 15:00	03-SEP-2010 15:00	03-SEP-2010 15:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-049**	**EB1017676-050**	**EB1017676-051**	**EB1017676-052**	**EB1017676-053**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.25**	**0.11**	**0.25**	**0.28**	**0.23**
ED093T: Total Major Cations								
Sodium	7440-23-5	10	mg/kg	**210**	**100**	**160**	**270**	**180**
Potassium	7440-09-7	10	mg/kg	**1620**	**1490**	**1490**	**1420**	**1270**
Calcium	7440-70-2	10	mg/kg	**15500**	**15200**	**13800**	**12500**	**16700**
Magnesium	7439-95-4	10	mg/kg	**5530**	**5790**	**5790**	**5740**	**6040**
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**4250**	**3470**	**3250**	**2870**	**3340**
Arsenic	7440-38-2	5	mg/kg	**1720**	**850**	**1500**	**1350**	**1740**
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**18**	**17**	**16**	**15**	**16**
Cobalt	7440-48-4	2	mg/kg	**9**	**9**	**10**	**10**	**10**
Copper	7440-50-8	5	mg/kg	**29**	**23**	**30**	**34**	**28**
Iron	7439-89-6	50	mg/kg	**27100**	**26400**	**28100**	**28100**	**30200**
Lead	7439-92-1	5	mg/kg	**20**	**14**	**18**	**20**	**42**
Manganese	7439-96-5	5	mg/kg	**460**	**490**	**468**	**469**	**536**
Nickel	7440-02-0	2	mg/kg	**15**	**15**	**17**	**18**	**18**
Zinc	7440-66-6	5	mg/kg	**57**	**55**	**60**	**65**	**63**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1

Analytical Results

Sub-Matrix: **PULP**			Client sample ID	**CLO7069**	**CLO7072**	**CLO7080**	**CLO7107**	**CLO7116**
			Client sampling date / time	03-SEP-2010 15:00	03-SEP-2010 15:00	03-SEP-2010 15:00	03-SEP-2010 15:00	03-SEP-2010 15:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-054**	**EB1017676-055**	**EB1017676-056**	**EB1017676-057**	**EB1017676-058**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.37**	**0.19**	**0.20**	**0.67**	**0.23**
ED093T: Total Major Cations								
Sodium	7440-23-5	10	mg/kg	**170**	**190**	**170**	**170**	**80**
Potassium	7440-09-7	10	mg/kg	**1590**	**1300**	**1260**	**1620**	**990**
Calcium	7440-70-2	10	mg/kg	**12900**	**14900**	**14900**	**13600**	**8200**
Magnesium	7439-95-4	10	mg/kg	**5250**	**5500**	**5460**	**6280**	**3760**
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**3560**	**2570**	**5580**	**8140**	**5820**
Arsenic	7440-38-2	5	mg/kg	**2360**	**1770**	**1550**	**3480**	**1020**
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	**22**	**19**	**16**	**26**	**13**
Cobalt	7440-48-4	2	mg/kg	**9**	**9**	**9**	**13**	**7**
Copper	7440-50-8	5	mg/kg	**33**	**25**	**36**	**52**	**28**
Iron	7439-89-6	50	mg/kg	**29600**	**28400**	**27700**	**34700**	**20600**
Lead	7439-92-1	5	mg/kg	**26**	**18**	**18**	**23**	**14**
Manganese	7439-96-5	5	mg/kg	**476**	**506**	**504**	**560**	**379**
Nickel	7440-02-0	2	mg/kg	**16**	**16**	**17**	**24**	**13**
Zinc	7440-66-6	5	mg/kg	**64**	**57**	**62**	**86**	**45**
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	**0.2**	<0.1

Analytical Results

Sub-Matrix: **PULP**			Client sample ID	**Deposited Tails Macraes MTD**	**Deposited Tails Reefton MTD**	----	----	----
			Client sampling date / time	03-SEP-2010 15:00	03-SEP-2010 15:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-059**	**EB1017676-060**	**----**	**----**	**----**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**1.28**	**0.46**	----	----	----
ED093T: Total Major Cations								
Sodium	7440-23-5	10	mg/kg	**290**	**190**	----	----	----
Potassium	7440-09-7	10	mg/kg	**1580**	**1400**	----	----	----
Calcium	7440-70-2	10	mg/kg	**17500**	**15200**	----	----	----
Magnesium	7439-95-4	10	mg/kg	**4940**	**6590**	----	----	----
EG005T: Total Metals by ICP-AES								
Aluminium	7429-90-5	50	mg/kg	**3690**	**4530**	----	----	----
Arsenic	7440-38-2	5	mg/kg	**13200**	**2670**	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg	**62**	**16**	----	----	----
Cobalt	7440-48-4	2	mg/kg	**21**	**10**	----	----	----
Copper	7440-50-8	5	mg/kg	**53**	**43**	----	----	----
Iron	7439-89-6	50	mg/kg	**42200**	**34100**	----	----	----
Lead	7439-92-1	5	mg/kg	**143**	**77**	----	----	----
Manganese	7439-96-5	5	mg/kg	**414**	**498**	----	----	----
Nickel	7440-02-0	2	mg/kg	**24**	**20**	----	----	----
Zinc	7440-66-6	5	mg/kg	**133**	**67**	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	**0.2**	<0.1	----	----	----

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**CLO6309** **SP11 514RL- pH 3**	**CLO6324** **SP11 499RL- pH 3**	**CLO6340** **SP11 484RL- pH 3**	**CLO6355** **SP11 469RL- pH 3**	**CLO7065** **MTD 528RL- pH 3**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-001**	**EB1017676-002**	**EB1017676-003**	**EB1017676-004**	**EB1017676-005**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**931**	**278**	**1020**	**1230**	**590**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**359**	**119**	**405**	**471**	**233**
Magnesium	7439-95-4	1	mg/L	**35**	**15**	**35**	**40**	**22**
Sodium	7440-23-5	1	mg/L	**35**	**15**	**28**	**48**	**30**
Potassium	7440-09-7	1	mg/L	**21**	**23**	**22**	**20**	**19**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.02**	**0.30**	**0.05**	**0.05**	**0.09**
Arsenic	7440-38-2	0.001	mg/L	**0.803**	**0.699**	**0.779**	**0.760**	**0.250**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	**0.0001**	<0.0001	<0.0001	**0.0010**
Cobalt	7440-48-4	0.001	mg/L	**0.005**	**0.005**	**0.005**	**0.008**	**0.023**
Chromium	7440-47-3	0.001	mg/L	<0.001	**0.006**	<0.001	<0.001	**0.001**
Copper	7440-50-8	0.001	mg/L	**0.016**	**0.031**	**0.018**	**0.030**	**0.024**
Manganese	7439-96-5	0.001	mg/L	**0.183**	**0.303**	**0.211**	**0.309**	**0.225**
Nickel	7440-02-0	0.001	mg/L	**0.007**	**0.013**	**0.007**	**0.012**	**0.011**
Lead	7439-92-1	0.001	mg/L	<0.001	**0.006**	<0.001	<0.001	**0.009**
Zinc	7440-66-6	0.005	mg/L	<0.005	**0.023**	**0.011**	**0.008**	**0.150**
Iron	7439-89-6	0.05	mg/L	<0.05	**7.36**	**0.22**	**0.22**	**0.54**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**CLO7069 MTD 524RL- pH 3**	**CLO7072 MTD 521RL- pH 3**	**CLO7080 MTD 513RL- pH 3**	**CLO7107 MTD 488RL- pH 3**	**CLO7116 MTD 479RL- pH 3**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-006**	**EB1017676-007**	**EB1017676-008**	**EB1017676-009**	**EB1017676-010**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**1450**	**550**	**747**	**281**	**86**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**608**	**213**	**299**	**102**	**54**
Magnesium	7439-95-4	1	mg/L	**25**	**23**	**24**	**17**	**7**
Sodium	7440-23-5	1	mg/L	**26**	**30**	**30**	**32**	**18**
Potassium	7440-09-7	1	mg/L	**25**	**18**	**18**	**21**	**13**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.05**	**0.18**	**0.08**	**0.05**	**0.08**
Arsenic	7440-38-2	0.001	mg/L	**1.12**	**0.928**	**0.667**	**0.714**	**0.407**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	**0.0002**
Cobalt	7440-48-4	0.001	mg/L	**0.009**	**0.008**	**0.008**	**0.002**	**0.001**
Chromium	7440-47-3	0.001	mg/L	<0.001	**0.003**	**0.002**	**0.001**	<0.001
Copper	7440-50-8	0.001	mg/L	**0.021**	**0.021**	**0.029**	**0.008**	**0.007**
Manganese	7439-96-5	0.001	mg/L	**0.508**	**0.215**	**0.357**	**0.077**	**0.071**
Nickel	7440-02-0	0.001	mg/L	**0.006**	**0.009**	**0.006**	**0.003**	**0.002**
Lead	7439-92-1	0.001	mg/L	<0.001	**0.003**	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.011**	**0.018**	**0.010**	**0.008**	<0.005
Iron	7439-89-6	0.05	mg/L	**0.19**	**2.27**	**0.45**	**0.16**	**0.06**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**Deposited Tails Macraes MTD Macraes MTD-pH 3**	**Deposited Tails Reefton MTD Macraes MTD-pH 3**	**CLO6309 SP11 514RL- pH 5**	**CLO6324 SP11 499RL- pH 5**	**CLO6340 SP11 484RL- pH 5**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-011**	**EB1017676-012**	**EB1017676-013**	**EB1017676-014**	**EB1017676-015**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**1620**	**1580**	**929**	**261**	**935**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**656**	**659**	**333**	**90**	**347**
Magnesium	7439-95-4	1	mg/L	**36**	**25**	**33**	**13**	**31**
Sodium	7440-23-5	1	mg/L	**44**	**32**	**36**	**17**	**29**
Potassium	7440-09-7	1	mg/L	**21**	**16**	**22**	**21**	**21**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.05**	**0.03**	**0.04**	**0.12**	**0.18**
Arsenic	7440-38-2	0.001	mg/L	**0.484**	**0.704**	**0.874**	**0.587**	**1.01**
Cadmium	7440-43-9	0.0001	mg/L	**0.0002**	**0.0002**	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	**0.139**	**0.006**	**0.004**	**0.002**	**0.005**
Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	**0.002**
Copper	7440-50-8	0.001	mg/L	**0.010**	**0.002**	**0.023**	**0.026**	**0.024**
Manganese	7439-96-5	0.001	mg/L	**0.459**	**0.339**	**0.101**	**0.052**	**0.146**
Nickel	7440-02-0	0.001	mg/L	**0.008**	**0.001**	**0.006**	**0.005**	**0.007**
Lead	7439-92-1	0.001	mg/L	**0.002**	<0.001	<0.001	<0.001	**0.002**
Zinc	7440-66-6	0.005	mg/L	**0.007**	<0.005	<0.005	<0.005	**0.015**
Iron	7439-89-6	0.05	mg/L	**2.50**	<0.05	**0.09**	**0.34**	**2.45**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**CLO6355 SP11 469RL- pH 5**	**CLO7065 MTD 528RL- pH 5**	**CLO7069 MTD 524RL- pH 5**	**CLO7072 MTD 521RL- pH 5**	**CLO7080 MTD 513RL- pH 5**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-016**	**EB1017676-017**	**EB1017676-018**	**EB1017676-019**	**EB1017676-020**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**1220**	**546**	**1330**	**479**	**694**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**441**	**198**	**548**	**167**	**254**
Magnesium	7439-95-4	1	mg/L	**38**	**20**	**23**	**19**	**22**
Sodium	7440-23-5	1	mg/L	**50**	**29**	**25**	**30**	**32**
Potassium	7440-09-7	1	mg/L	**20**	**18**	**23**	**16**	**17**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.05**	**0.16**	**0.08**	**0.11**	**0.07**
Arsenic	7440-38-2	0.001	mg/L	**0.842**	**0.360**	**1.34**	**0.870**	**0.679**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	**0.0002**	<0.0001
Cobalt	7440-48-4	0.001	mg/L	**0.005**	**0.021**	**0.006**	**0.004**	**0.006**
Chromium	7440-47-3	0.001	mg/L	**0.001**	**0.003**	<0.001	<0.001	<0.001
Copper	7440-50-8	0.001	mg/L	**0.030**	**0.019**	**0.023**	**0.014**	**0.029**
Manganese	7439-96-5	0.001	mg/L	**0.141**	**0.155**	**0.234**	**0.061**	**0.161**
Nickel	7440-02-0	0.001	mg/L	**0.007**	**0.008**	**0.004**	**0.004**	**0.004**
Lead	7439-92-1	0.001	mg/L	<0.001	**0.003**	<0.001	<0.001	<0.001
Zinc	7440-66-6	0.005	mg/L	**0.007**	**0.010**	**0.005**	<0.005	**0.005**
Iron	7439-89-6	0.05	mg/L	**0.12**	**2.28**	**0.22**	**0.44**	**0.25**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**CLO7107 MTD 488RL- pH 5**	**CLO7116 MTD 479RL- pH 5**	**Deposited Tails Macraes MTD Macraes MTD-pH 5**	**Deposited Tails Reefton MTD Macraes MTD-pH 5**	**CLO6309 SP11 514RL- NaHC03**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-021**	**EB1017676-022**	**EB1017676-023**	**EB1017676-024**	**EB1017676-025**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**268**	**72**	**1660**	**1600**	**177**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**76**	**26**	**662**	**672**	**4**
Magnesium	7439-95-4	1	mg/L	**14**	**4**	**34**	**21**	**7**
Sodium	7440-23-5	1	mg/L	**33**	**18**	**46**	**29**	**10900**
Potassium	7440-09-7	1	mg/L	**20**	**12**	**21**	**14**	**8**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.10**	**0.16**	**0.09**	**0.09**	**0.20**
Arsenic	7440-38-2	0.001	mg/L	**1.00**	**0.803**	**0.643**	**0.754**	**3.21**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	**0.0003**	**0.0001**	<0.0001	<0.0005
Cobalt	7440-48-4	0.001	mg/L	**0.001**	<0.001	**0.140**	**0.004**	**0.012**
Chromium	7440-47-3	0.001	mg/L	**0.002**	<0.001	**0.001**	<0.001	<0.005
Copper	7440-50-8	0.001	mg/L	**0.009**	**0.006**	**0.006**	**0.004**	**0.035**
Manganese	7439-96-5	0.001	mg/L	**0.034**	**0.027**	**0.278**	**0.171**	**0.018**
Nickel	7440-02-0	0.001	mg/L	**0.002**	**0.002**	**0.006**	**0.001**	**0.005**
Lead	7439-92-1	0.001	mg/L	**0.002**	<0.001	**0.004**	<0.001	<0.005
Zinc	7440-66-6	0.005	mg/L	<0.005	<0.005	**0.006**	**0.006**	<0.025
Iron	7439-89-6	0.05	mg/L	**0.26**	**0.22**	**3.32**	**0.27**	**0.73**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**CLO6324** **SP11 499RL- NaHC03**	**CLO6340** **SP11 484RL- NaHC03**	**CLO6355** **SP11 469RL- NaHC03**	**CLO7065** **MTD 528RL- NaHC03**	**CLO7069** **MTD 524RL- NaHC03**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-026**	**EB1017676-027**	**EB1017676-028**	**EB1017676-029**	**EB1017676-030**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**54**	**161**	**233**	**101**	**250**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**3**	**3**	<2	**3**	**3**
Magnesium	7439-95-4	1	mg/L	**4**	**5**	**6**	**3**	**4**
Sodium	7440-23-5	1	mg/L	**11000**	**11000**	**11100**	**11000**	**10900**
Potassium	7440-09-7	1	mg/L	**8**	**7**	**7**	**6**	**8**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**0.08**	**0.07**	<0.05	<0.05	<0.05
Arsenic	7440-38-2	0.001	mg/L	**8.23**	**8.03**	**4.88**	**9.20**	**6.31**
Cadmium	7440-43-9	0.0001	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	7440-48-4	0.001	mg/L	**0.015**	**0.019**	**0.016**	**0.013**	**0.013**
Chromium	7440-47-3	0.001	mg/L	<0.005	**0.031**	**0.014**	**0.027**	**0.023**
Copper	7440-50-8	0.001	mg/L	**0.036**	**0.052**	**0.032**	**0.038**	**0.033**
Manganese	7439-96-5	0.001	mg/L	**0.016**	**0.015**	**0.018**	**0.028**	**0.018**
Nickel	7440-02-0	0.001	mg/L	<0.005	**0.006**	**0.005**	<0.005	**0.005**
Lead	7439-92-1	0.001	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	7440-66-6	0.005	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025
Iron	7439-89-6	0.05	mg/L	**0.88**	**0.92**	**0.82**	**0.61**	**0.43**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**CLO7072 MTD 521RL- NaHC03**	**CLO7080 MTD 513RL- NaHC03**	**CLO7107 MTD 488RL- NaHC03**	**CLO7116 MTD 479RL- NaHC03**	**Deposited Tails Macraes MTD Macraes MTD-NaHC03**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-031**	**EB1017676-032**	**EB1017676-033**	**EB1017676-034**	**EB1017676-035**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**114**	**130**	**84**	**46**	**564**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**3**	**3**	**4**	**3**	**3**
Magnesium	7439-95-4	1	mg/L	**4**	**4**	**4**	<2	**5**
Sodium	7440-23-5	1	mg/L	**11200**	**11100**	**10900**	**11200**	**11000**
Potassium	7440-09-7	1	mg/L	**6**	**6**	**8**	**5**	**7**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Arsenic	7440-38-2	0.001	mg/L	**5.86**	**20.4**	**7.19**	**7.08**	**10.7**
Cadmium	7440-43-9	0.0001	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cobalt	7440-48-4	0.001	mg/L	**0.013**	**0.018**	**0.013**	**0.047**	**0.012**
Chromium	7440-47-3	0.001	mg/L	**0.018**	**0.019**	**0.013**	**0.012**	**0.024**
Copper	7440-50-8	0.001	mg/L	**0.050**	**0.032**	**0.028**	**0.024**	**0.037**
Manganese	7439-96-5	0.001	mg/L	**0.030**	**0.017**	**0.018**	**0.017**	**0.015**
Nickel	7440-02-0	0.001	mg/L	<0.005	**0.006**	**0.007**	**0.010**	<0.005
Lead	7439-92-1	0.001	mg/L	<0.005	<0.005	<0.005	<0.005	<0.005
Zinc	7440-66-6	0.005	mg/L	<0.025	<0.025	<0.025	<0.025	<0.025
Iron	7439-89-6	0.05	mg/L	**0.44**	**1.03**	**0.59**	**2.04**	**0.56**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**

			Client sample ID	**Deposited Tails Reefton MTD Macraes MTD-NaHC03**	**CLO6309 SP11 514RL- NaOH**	**CLO6324 SP11 499RL- NaOH**	**CLO6340 SP11 484RL- NaOH**	**CLO6355 SP11 469RL-NaOH**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-036**	**EB1017676-037**	**EB1017676-038**	**EB1017676-039**	**EB1017676-040**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**420**	**280**	**216**	**289**	**341**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**4**	**5**	**4**	**4**	**2**
Magnesium	7439-95-4	1	mg/L	**4**	<1	<1	<1	<1
Sodium	7440-23-5	1	mg/L	**11400**	**2160**	**2100**	**2110**	**2170**
Potassium	7440-09-7	1	mg/L	**6**	**7**	**7**	**6**	**6**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	<0.05	**1.92**	**4.46**	**1.76**	**1.66**
Arsenic	7440-38-2	0.001	mg/L	**6.64**	**7.04**	**7.86**	**7.53**	**6.32**
Cadmium	7440-43-9	0.0001	mg/L	<0.0005	**0.0001**	<0.0001	<0.0001	<0.0001
Cobalt	7440-48-4	0.001	mg/L	**0.013**	<0.001	<0.001	<0.001	<0.001
Chromium	7440-47-3	0.001	mg/L	**0.016**	**0.006**	**0.006**	**0.005**	**0.006**
Copper	7440-50-8	0.001	mg/L	**0.042**	**0.011**	**0.014**	**0.009**	**0.014**
Manganese	7439-96-5	0.001	mg/L	**0.016**	<0.001	**0.001**	<0.001	<0.001
Nickel	7440-02-0	0.001	mg/L	<0.005	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	<0.005	**0.004**	**0.003**	**0.002**	**0.003**
Zinc	7440-66-6	0.005	mg/L	<0.025	**0.009**	**0.010**	**0.007**	**0.009**
Iron	7439-89-6	0.05	mg/L	**0.68**	**0.15**	**0.34**	**0.18**	**0.14**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**CLO7065 MTD 528RL- NaOH**	**CLO7069 MTD 524RL- NaOH**	**CLO7072 MTD 521RL- NaOH**	**CLO7080 MTD 513RL- NaOH**	**CLO7107 MTD 488RL- NaOH**
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-041**	**EB1017676-042**	**EB1017676-043**	**EB1017676-044**	**EB1017676-045**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**249**	**360**	**305**	**291**	**2080**
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**9**	**2**	**8**	**7**	**3**
Magnesium	7439-95-4	1	mg/L	<1	<1	<1	<1	<1
Sodium	7440-23-5	1	mg/L	**2150**	**2120**	**2090**	**2140**	**2140**
Potassium	7440-09-7	1	mg/L	**6**	**7**	**6**	**5**	**7**
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**2.50**	**1.88**	**2.16**	**1.79**	**2.90**
Arsenic	7440-38-2	0.001	mg/L	**8.89**	**7.72**	**10.8**	**8.32**	**73.9**
Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	**0.0006**
Cobalt	7440-48-4	0.001	mg/L	**0.004**	<0.001	<0.001	**0.001**	<0.001
Chromium	7440-47-3	0.001	mg/L	**0.005**	**0.006**	**0.008**	**0.006**	**0.019**
Copper	7440-50-8	0.001	mg/L	**0.012**	**0.025**	**0.017**	**0.020**	**0.010**
Manganese	7439-96-5	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	**0.002**
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
Lead	7439-92-1	0.001	mg/L	**0.005**	**0.004**	**0.003**	**0.004**	**0.007**
Zinc	7440-66-6	0.005	mg/L	**0.015**	**0.014**	**0.012**	**0.007**	**0.012**
Iron	7439-89-6	0.05	mg/L	**0.42**	**0.08**	**0.25**	**0.20**	**0.32**
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001

Analytical Results

Sub-Matrix: **SPLP LEACHATE**			*Client sample ID*	**CLO7116 MTD 479RL- NaOH**	**Deposited Tails Macraes MTD Macraes MTD- NaOH**	**Deposited Tails Reefton MTD Macraes MTD- NaOH**	----	----
			Client sampling date / time	08-OCT-2010 12:00	08-OCT-2010 12:00	08-OCT-2010 12:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1017676-046**	**EB1017676-047**	**EB1017676-048**	**----**	**----**
ED040F: Dissolved Major Anions								
Sulfate as SO4 2-	14808-79-8	1	mg/L	**684**	**637**	**432**	----	----
ED093F: Dissolved Major Cations								
Calcium	7440-70-2	1	mg/L	**2**	**2**	**2**	----	----
Magnesium	7439-95-4	1	mg/L	<1	<1	<1	----	----
Sodium	7440-23-5	1	mg/L	**2110**	**2130**	**2140**	----	----
Potassium	7440-09-7	1	mg/L	**4**	**6**	**5**	----	----
EG020F: Dissolved Metals by ICP-MS								
Aluminium	7429-90-5	0.01	mg/L	**2.65**	**0.29**	**1.12**	----	----
Arsenic	7440-38-2	0.001	mg/L	**16.0**	**4.18**	**10.5**	----	----
Cadmium	7440-43-9	0.0001	mg/L	**0.0002**	<0.0001	<0.0001	----	----
Cobalt	7440-48-4	0.001	mg/L	<0.001	**0.024**	<0.001	----	----
Chromium	7440-47-3	0.001	mg/L	**0.008**	**0.003**	**0.004**	----	----
Copper	7440-50-8	0.001	mg/L	**0.008**	**0.001**	**0.003**	----	----
Manganese	7439-96-5	0.001	mg/L	**0.001**	<0.001	<0.001	----	----
Nickel	7440-02-0	0.001	mg/L	<0.001	<0.001	<0.001	----	----
Lead	7439-92-1	0.001	mg/L	**0.010**	**0.053**	**0.010**	----	----
Zinc	7440-66-6	0.005	mg/L	**0.009**	**0.022**	**0.010**	----	----
Iron	7439-89-6	0.05	mg/L	**0.26**	**0.96**	**0.05**	----	----
EG035F: Dissolved Mercury by FIMS								
Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	<0.0001	----	----

CERTIFICATE OF ANALYSIS

Work Order : **EB1016763**

Client : **GOLDER ASSOCIATES**
Contact : MS TUNDI NEWBERRY
Address : P O BOX 1734
MILTON QLD, AUSTRALIA 4064

E-mail : tnewberry@golder.com.au
Telephone : +61 07 37214815
Facsimile : +61 07 3721 5401

Project : 0978110562
Order number : ----
C-O-C number : ----
Sampler : D Carr
Site : Macraes

Quote number : EN/002/10

Page : 1 of 5

Laboratory : Environmental Division Brisbane
Contact : Milan Pavasovic
Address : 32 Shand Street Stafford QLD Australia 4053

E-mail : milan.pavasovic@alsglogal.com
Telephone : +61 7 3243 7129
Facsimile : +61 7 3243 7218

QC Level : NEPM 1999 Schedule B(3) and ALS QCS3 requirement

Date Samples Received : 20-SEP-2010
Issue Date : 28-SEP-2010

No. of samples received : 12
No. of samples analysed : 12

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. All pages of this report have been checked and approved for release.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

NATA Accredited Laboratory 825

This document is issued in accordance with NATA accreditation requirements.

Accredited for compliance with ISO/IEC 17025.

Signatories

This document has been electronically signed by the authorized signatories indicated below. Electronic signing has been carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Kim McCabe	Senior Inorganic Chemist	Bne Acid Sulphate Soils
Kim McCabe	Senior Inorganic Chemist	Inorganics
Kim McCabe	Senior Inorganic Chemist	Stafford Minerals - AY

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insuffient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting

- **ANC Fizz Rating: 0- None; 1- Slight; 2- Moderate; 3- Strong; 4- Very Strong.**

Analytical Results

Sub-Matrix: **SOIL**			*Client sample ID*	**CLO6309** **SP11 514RL**	**CLO6324** **SP11 499RL**	**CLO6340** **SP11 484RL**	**CLO6355** **SP11 469RL**	**CLO7065** **MTD 528RL**
			Client sampling date / time	12-SEP-2008 15:00	12-SEP-2008 15:00	12-SEP-2008 15:00	12-SEP-2008 15:00	25-SEP-2008 15:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1016763-001**	**EB1016763-002**	**EB1016763-003**	**EB1016763-004**	**EB1016763-005**
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.8**	**8.2**	**8.0**	**7.9**	**8.2**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1490**	**528**	**1530**	**1770**	**947**
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	**8.7**	**8.7**	**8.7**	**8.6**	**8.6**
NAG (pH 4.5)	----	0.1	kg H_2SO_4/t	<0.1	<0.1	<0.1	<0.1	<0.1
NAG (pH 7.0)	----	0.1	kg H_2SO_4/t	<0.1	<0.1	<0.1	<0.1	<0.1
EA013: Acid Neutralising Capacity								
ANC as H_2SO_4	----	0.5	kg H_2SO_4 equiv./t	**40.2**	**50.0**	**47.1**	**40.8**	**51.7**
^ ANC as $CaCO_3$	----	0.1	% $CaCO_3$	**4.1**	**5.1**	**4.8**	**4.2**	**5.3**
Fizz Rating	----	0	Fizz Unit	**2**	**2**	**2**	**2**	**2**
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	**0.056**	**0.052**	**0.065**	**0.062**	**0.076**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.26**	**0.11**	**0.25**	**0.29**	**0.22**

Analytical Results

Sub-Matrix: **SOIL**

Client sample ID				**CLO7069** **MTD 524RL**	**CLO7072** **MTD 521RL**	**CLO7080** **MTD 513RL**	**CLO7107** **MTD 588RL**	**CLO7116** **MTD 479RL**
Client sampling date / time				25-SEP-2008 15:00	25-SEP-2008 15:00	25-SEP-2008 15:00	25-SEP-2008 15:00	25-SEP-2008 15:00
Compound	*CAS Number*	*LOR*	*Unit*	**EB1016763-006**	**EB1016763-007**	**EB1016763-008**	**EB1016763-009**	**EB1016763-010**
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.8**	**8.0**	**7.9**	**8.4**	**8.7**
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**1740**	**920**	**1060**	**565**	**170**
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	**8.5**	**8.8**	**8.6**	**8.7**	**8.7**
NAG (pH 4.5)	----	0.1	kg H_2SO_4/t	<0.1	<0.1	<0.1	<0.1	<0.1
NAG (pH 7.0)	----	0.1	kg H_2SO_4/t	<0.1	<0.1	<0.1	<0.1	<0.1
EA013: Acid Neutralising Capacity								
ANC as H_2SO_4	----	0.5	kg H_2SO_4 equiv./t	**41.3**	**39.6**	**42.5**	**36.7**	**25.8**
^ ANC as $CaCO_3$	----	0.1	% $CaCO_3$	**4.2**	**4.0**	**4.3**	**3.7**	**2.6**
Fizz Rating	----	0	Fizz Unit	**2**	**2**	**2**	**2**	**2**
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	**0.052**	**0.032**	**0.044**	**0.445**	**0.153**
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**0.38**	**0.19**	**0.22**	**0.68**	**0.23**

Analytical Results

Sub-Matrix: **SOIL**			*Client sample ID*	**Deposited Tails Macraes Macraes MTD**	**Deposited Tails Reefton Macraes MTD**	----	----	----
			Client sampling date / time	15-SEP-2010 15:00	03-SEP-2010 15:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EB1016763-011**	**EB1016763-012**	**----**	**----**	**----**
EA002 : pH (Soils)								
pH Value	----	0.1	pH Unit	**7.6**	**7.6**	----	----	----
EA010: Conductivity								
Electrical Conductivity @ 25°C	----	1	µS/cm	**2450**	**1680**	----	----	----
EA011: Net Acid Generation								
pH (OX)	----	0.1	pH Unit	**8.2**	**8.8**	----	----	----
NAG (pH 4.5)	----	0.1	kg H_2SO_4/t	<0.1	<0.1	----	----	----
NAG (pH 7.0)	----	0.1	kg H_2SO_4/t	<0.1	<0.1	----	----	----
EA013: Acid Neutralising Capacity								
ANC as H_2SO_4	----	0.5	kg H_2SO_4 equiv./t	**41.9**	**40.8**	----	----	----
^ ANC as $CaCO_3$	----	0.1	% $CaCO_3$	**4.3**	**4.2**	----	----	----
Fizz Rating	----	0	Fizz Unit	**2**	**2**	----	----	----
EA026 : Chromium Reducible Sulfur								
Chromium Reducible Sulphur	----	0.005	%	**0.473**	**0.048**	----	----	----
ED042T: Total Sulfur by LECO								
Sulfur - Total as S (LECO)	----	0.01	%	**1.28**	**0.51**	----	----	----

POWDER X-RAY DIFFRACTION ANALYSIS OF SUBMITTED SAMPLES

QUT Reference :	XAF6485
Your Reference:	Golder 0978110562 : CLO6309, CLO6324, CLO6340 .. Deposited Tails Reefton
Date:	4 October 2010

INTRODUCTION

The twelve (12) samples were submitted by Mr. Greg Maddocks of Golder Associates (Brisbane) for powder x-ray diffraction analysis to determine the identity and concentrations of the compounds present in the samples. The samples were received by this facility on 30 September 2010.

PROCEDURE

A specimen was prepared using a McCrone micronising mill using agate beads with ethanol as a fluid. Sufficient internal standard (zinc oxide) was added to obtain 10 wt% in the analysed specimen. After preparation, the specimen was dried overnight at 55°C. A step-scanned diffraction pattern was collected for the specimen using a Panalytical X'Pert PRO vertical diffractometer, copper Ka radiation and the usual conditions. The powder x-ray diffraction data was analysed using Jade (V9.0, Materials Data Inc.) for phase identification and SiroQuant (V3.0, Sietronics Pty. Ltd.) for quantitative analysis. Quantitative analysis is undertaken via a Rietveld analysis technique in which the crystal structures of the phases identified are used to model the diffraction pattern. The quantitative results are absolute in that the known concentration of internal standard is used to find the concentration of all modelled phases. The sum of these is subtracted from 100wt% to obtain a residual that represents the amorphous/unidentified content. The error in the amorphous/unidentified content is the sum of errors of the modelled phases and for that reason it is not a reliable measure. Amorphous/unidentified represents the non-diffracting and/or non-identified content of the sample.

RESULTS

The samples are similar. The samples contained a series of crystalline phases whose concentrations are listed in the table below.

Tony Raftery

Tony Raftery
Senior Technologist

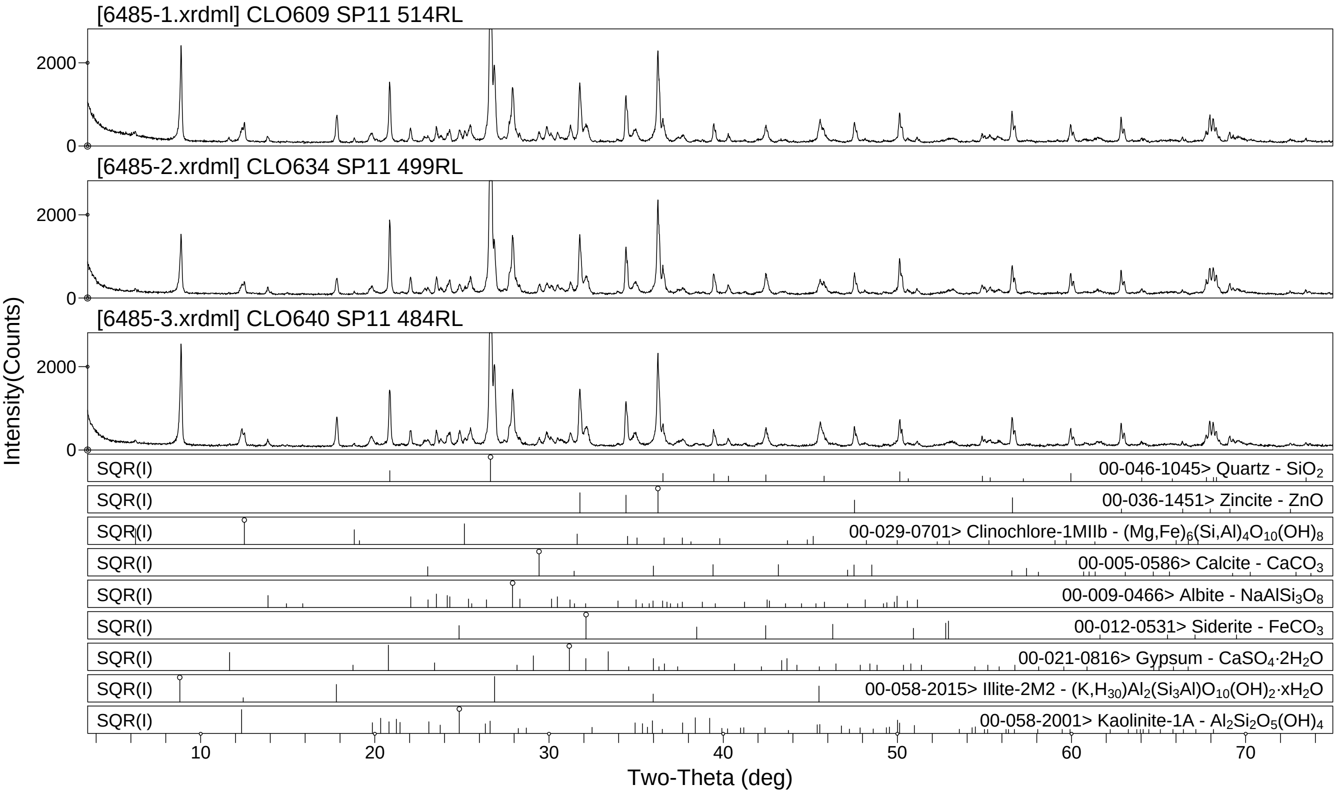
Nominal concentration (absolute) wt%

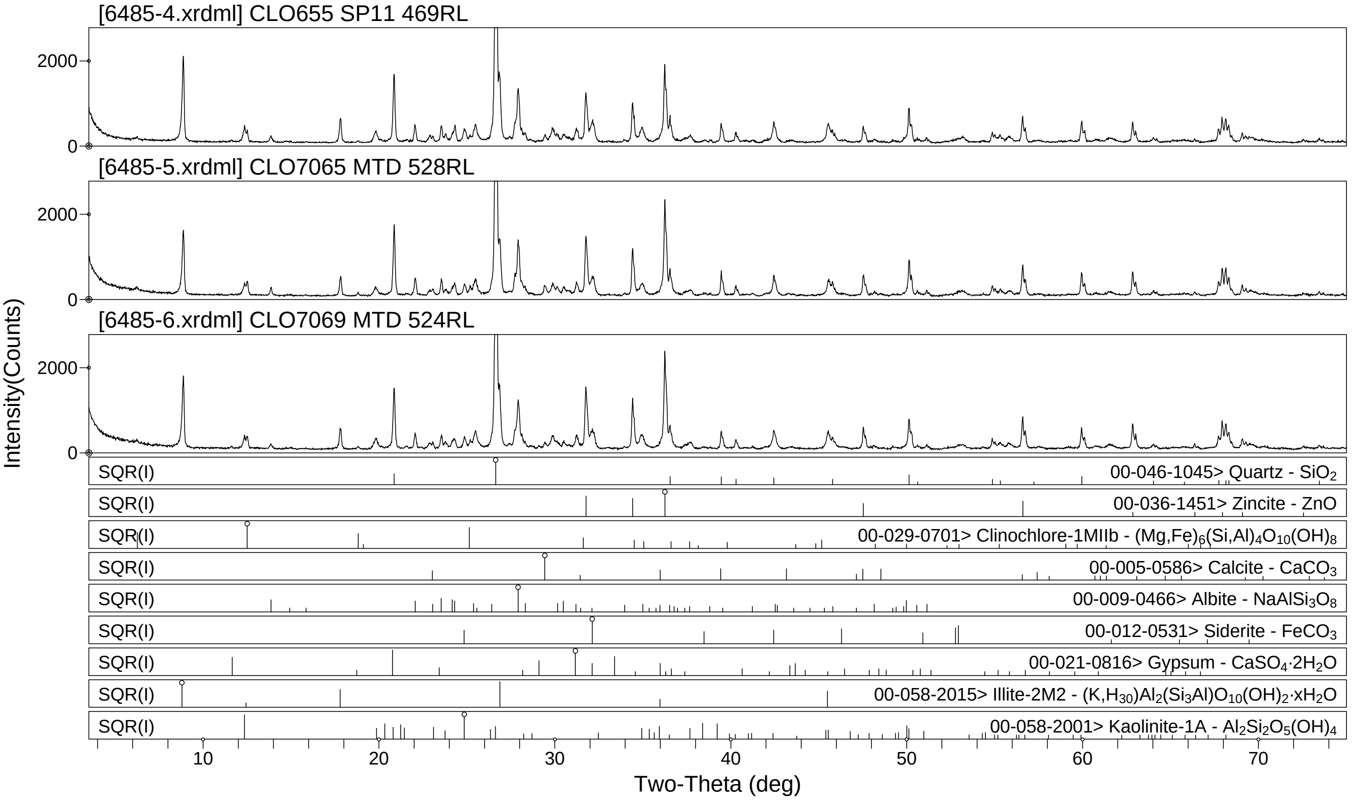
	CLO609 SP11 514RL	CLO634 SP11 499RL	CLO640 SP11 484RL	CLO655 SP11 469RL	CLO7065 MTD 528RL	CLO7069 MTD 524RL
Amorp./unknown Content	< 5	< 5	< 5	< 5	6	9
Quartz	31.8	39.4	31.6	36.9	37.3	34.8
Plagioclase(Albite)	20.1	22.7	20.1	18.6	19.4	16.8
K-feldspar(Microcline)	1.5	1.5	1.4	0.5	0.5	0.5
Chlorite	2.9	2.1	1.7	1.3	1.9	1.7
Kaolinite	2.6	1.6	3.1	3.9	1.9	2
Muscovite	33.6	23.4	36.8	33.9	28	30.4
Calcite	1.6	1.7	1.1	1	1.4	0.8
Siderite	3	3.4	3.5	3.5	3.3	3.1
Gypsum	1.2	0.5	0.6	0.4	0.3	0.5

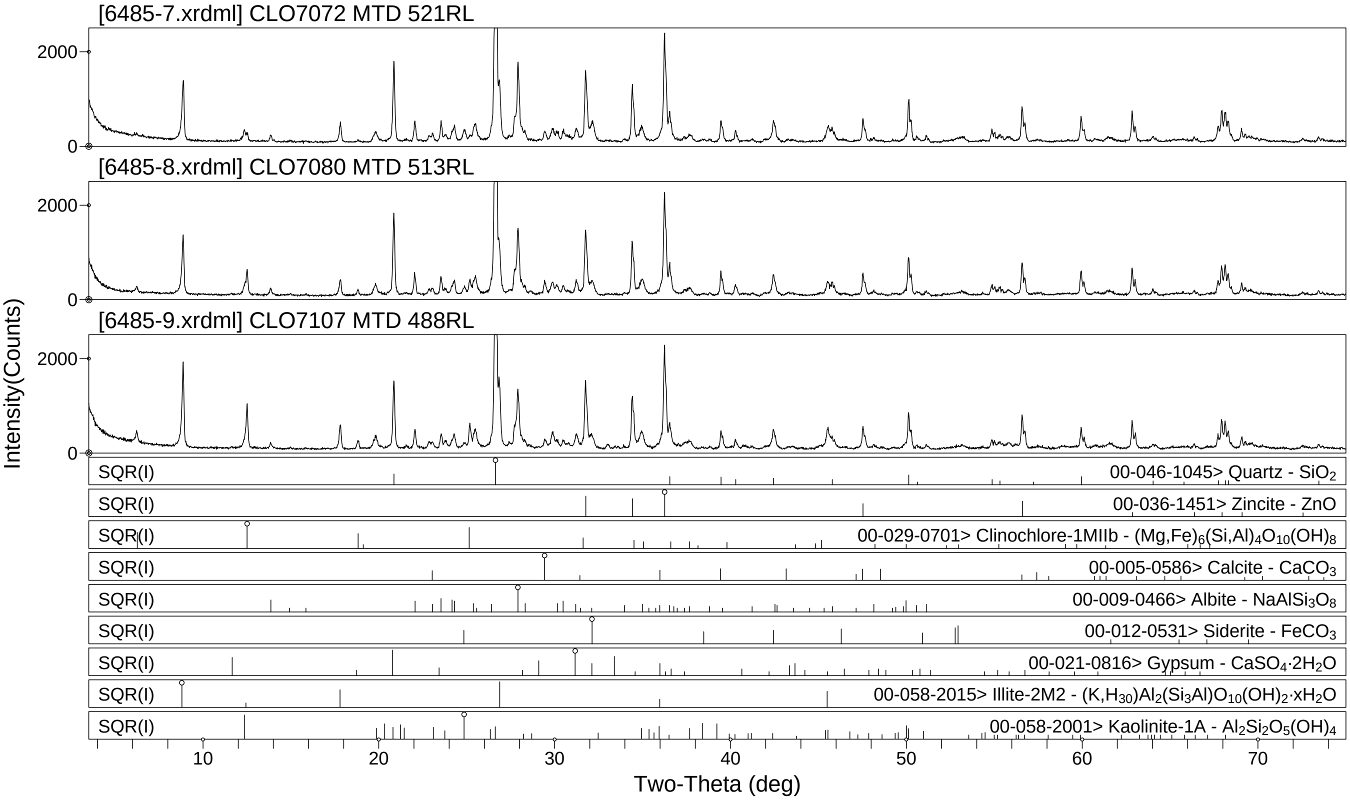
	CLO7072 MTD 521RL	CLO7080 MTD 513RL	CLO7107 MTD 488RL	CLO7116 MTD 479RL	Deposited Tails Macraes	Deposited Tails Reefton
Amorp./unknown Content	7	7	6	6	8	< 5
Quartz	37.4	37.4	32	49.3	31.4	29.6
plagioclase(Albite)	23.2	23.1	19.6	14.6	17.1	19.1
K-feldspar(Microcline)	1.4	1.2	1.4	1.3	2.7	1.8
Chlorite	1.2	4	6.8	6.1	1.8	2.1
Kaolinite	1.6	1.6	1.7	0.8	1.9	2.9
Muscovite	23.2	20.6	29.1	20.5	31.3	36.4
Calcite	1.4	2.1	1.4	1	0.9	0.6
Siderite	3.1	2.2	1.5	0.4	2.6	3.6
Gypsum	0.4	0.4	0.4	0	2.3	1.6

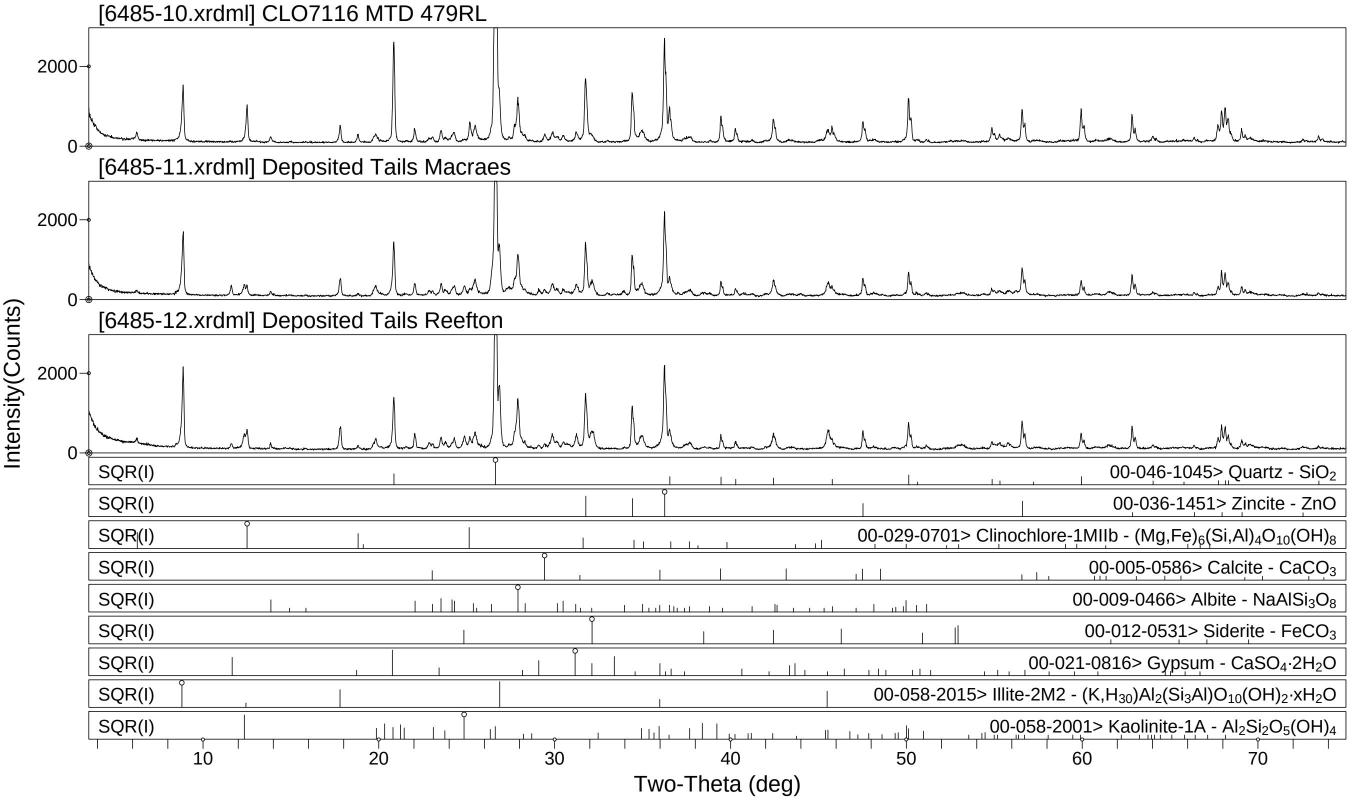
Some concentration values are close to the detection limits, nominally 0.2 to 0.5 wt% depending on the compound involved. Some values may not be significant.

Powder XRD Patterns






[6485-7.xrdml] CLO7072 MTD 521RL
[6485-8.xrdml] CLO7080 MTD 513RL
[6485-9.xrdml] CLO7107 MTD 488RL
2000
0
Intensity(Counts)
SQR(I)
00-046-1045> Quartz - SiO_2
00-036-1451> Zincite - ZnO
00-029-0701> Clinochlore-1MIIb - $(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$
00-005-0586> Calcite - $CaCO_3$
00-009-0466> Albite - $NaAlSi_3O_8$
00-012-0531> Siderite - $FeCO_3$
00-021-0816> Gypsum - $CaSO_4 \cdot 2H_2O$
00-058-2015> Illite-2M2 - $(K,H_{30})Al_2(Si_3Al)O_{10}(OH)_2 \cdot xH_2O$
00-058-2001> Kaolinite-1A - $Al_2Si_2O_5(OH)_4$
10
20
30
40
50
60
70
Two-Theta (deg)


[6485-10.xrdml] CLO7116 MTD 479RL
[6485-11.xrdml] Deposited Tails Macraes
[6485-12.xrdml] Deposited Tails Reefton
2000
0
Intensity(Counts)
SQR(I)
00-046-1045> Quartz - SiO_2
00-036-1451> Zincite - ZnO
00-029-0701> Clinochlore-1MIIb - $(Mg,Fe)_6(Si,Al)_4O_{10}(OH)_8$
00-005-0586> Calcite - $CaCO_3$
00-009-0466> Albite - $NaAlSi_3O_8$
00-012-0531> Siderite - $FeCO_3$
00-021-0816> Gypsum - $CaSO_4 \cdot 2H_2O$
00-058-2015> Illite-2M2 - $(K,H_{30})Al_2(Si_3Al)O_{10}(OH)_2 \cdot xH_2O$
00-058-2001> Kaolinite-1A - $Al_2Si_2O_5(OH)_4$
10
20
30
40
50
60
70
Two-Theta (deg)

APPENDIX E

Kinetic column leach test results.

Table 1: 2006 kinetic leach data.

Date	Total as 92% oxidation	Total as 99% oxidation
	g/m^3	g/m^3
4-Jul-06	0.02	0.008
7-Jul-06	0.005	0.008
17-Jul-06	0.008	0.008
21-Aug-06	0.016	0.011
18-Sep-06	0.989	0.011
16-Oct-06	0.177	0.056

Table 2: 2010 kinetic leach data (92% oxidation column).

Period	Date	Water added	Water out	Eh	pH	Elec Cond	Dissolved Arsenic	Total Arsenic
		mL	mL	mv	pH	uS/cm	g/m^3	g/m^3
	1-Sep-10	600	995	170	7.97	1,202	0.0097	0.095
WEEK 1	3-Sep-10	800	718	180	7.04			
	6-Sep-10	900	575	197	7.18			
	8-Sep-10	446	566.6	260	7.27	2,220	0.131	0.112
WEEK 2	10-Sep-10	467.5	391.7	262	7.63			
	13-Sep-10	442	628.8	199	7.79			
	15-Sep-10	958	766.5	193	7.87	2,750	0.176	0.175
WEEK 3	17-Sep-10	889	428	197	7.71			
	20-Sep-10	542	970	199	7.82			
	22-Sep-10	900	946.8	203	7.83	2,900	0.16	0.152
WEEK 4	24-Sep-10	900	856	194	7.97			
	27-Sep-10	906	895.7	175	7.77			
	29-Sep-10	902	929.28	217	8.01	2,840	0.159	0.149
WEEK 5	1-Oct-10	900	800	269	8.05			
	4-Oct-10							
	5-Oct-10	906	1,011.8	195	7.69	2,560	0.141	0.157
WEEK 6	8-Oct-10	900	885.7	253	7.92			
	11-Oct-10							
	12-Oct-10	900	962.5	283	7.96	2,780	0.141	0.164
WEEK 7	14-Oct-10	900	852.4	276	8.03			
	18-Oct-10	500						

Table 3: 2010 kinetic leach data (99% oxidation).

Period	Date	Water added	Water out	Eh	pH	Elec Cond	Dissolved Arsenic	Total Arsenic
		ml	ml	mv	pH	uS/cm	g/m3	g/m3
	1-Sep-10	900	821	153	8.25	164	0.0089	<0.011
WEEK 1	3-Sep-10	800	883	151	7.56			
	6-Sep-10	900	975	178	7.50			
	8-Sep-10	902	954.2	251	7.99	1,918	0.0102	<0.01
WEEK 2	10-Sep-10	909	826.7	246	8.15			
	13-Sep-10	910	799.5	192	8.04			
	15-Sep-10	903	858.3	191	7.90	3,160	0.009	0.013
WEEK 3	17-Sep-10	889	752	195	7.94			
	20-Sep-10	542	1,010	209	7.63			
	22-Sep-10	1400	931.8	209	7.76	3,240	0.009	<0.011
WEEK 4	24-Sep-10	900	843	196	7.92			
	27-Sep-10	911	1,018	182	7.65			
	29-Sep-10	902	791.18	215	8.04	2,960	0.009	0.011
WEEK 5	1-Oct-10	900	886.6	274	8.14			
	4-Oct-10							
	5-Oct-10	905	855.7	197	7.94	2,510	0.008	0.012
WEEK 6	8-Oct-10	900	1,131.5	257	7.99			
	11-Oct-10							
	12-Oct-10	900	1,030	278	8.07	2,190	0.0059	0.0073
WEEK 7	14-Oct-10	900	896.4	275	8.25		0.0089	
	18-Oct-10	1400						

APPENDIX E

Kinetic Column Leach Test Results

Figure 1: Example kinetic leach test column.

At Golder Associates we strive to be the most respected global company providing consulting, design, and construction services in earth, environment, and energy. Employee owned since our formation in 1960, we have created a unique culture with pride in ownership, resulting in long-term organisational stability. Golder professionals take the time to build an understanding of client needs and of the specific environments in which they operate. We continue to expand our technical capabilities and have experienced steady growth with employees who operate from offices located throughout Africa, Asia, Australasia, Europe, North America, and South America.

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