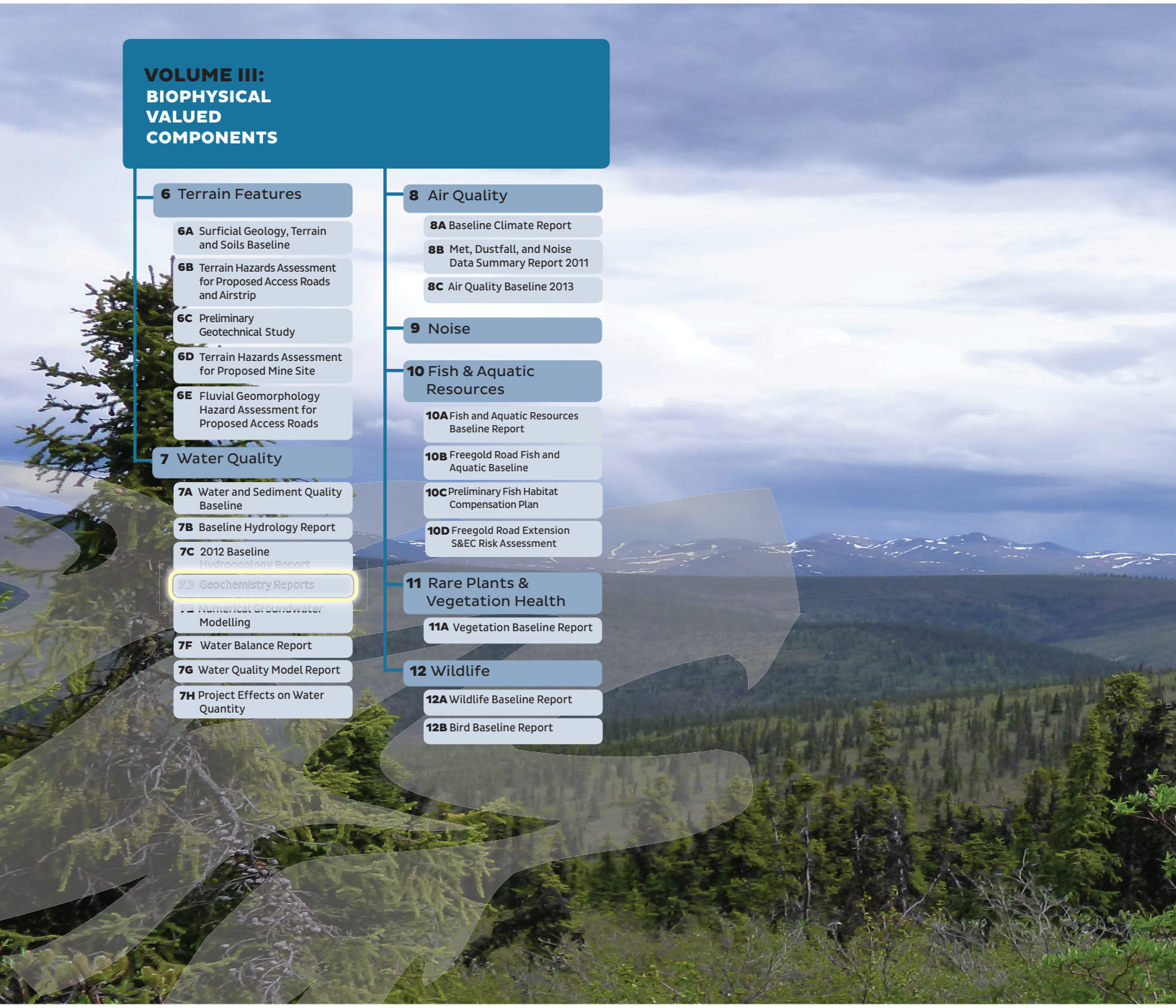
APPENDIX 7D: GEOCHEMISTRY REPORTS



CASINO
COPPER AND GOLD

Site Access Road ML/ARD Risk Assessment – Update



Project No. J862-5

5 November 2013

LORAX ENVIRONMENTAL

2289 Burrard Street
Vancouver, BC, V6J 3H9
Canada
1-604-688-7173

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CASINO
COPPER AND GOLD

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1. Introduction

CASINO
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1. Introduction

This report provides recommendations to minimize the risk of potential metal leaching and acid rock drainage (ML/ARD) associated with the construction of the proposed site access road. These recommendations are required in support of Casino Mining Corporation's application to the Yukon Environmental and Socioeconomic Assessment Board (YESAB). Based on the additional information available, this report will provide an update to the 2012 Lorax report titled "Casino Road: Preliminary Risk Assessment Metal Leaching and Acid Rock Drainage".

Site access to the Casino mineral deposit is via the Klondike Highway along the Freegold Road Upgrade and the Freegold Road Extension (M3 Engineering, 2011; Figure 1-1). The total length of the proposed road is approximately 203 km and it can be divided into two main sections:

- The Freegold Road Upgrade ("the FGR Upgrade") – 0+000 to 84+000; and
- The Freegold Road Extension ("the Extension") – 84+000 to 203+000.

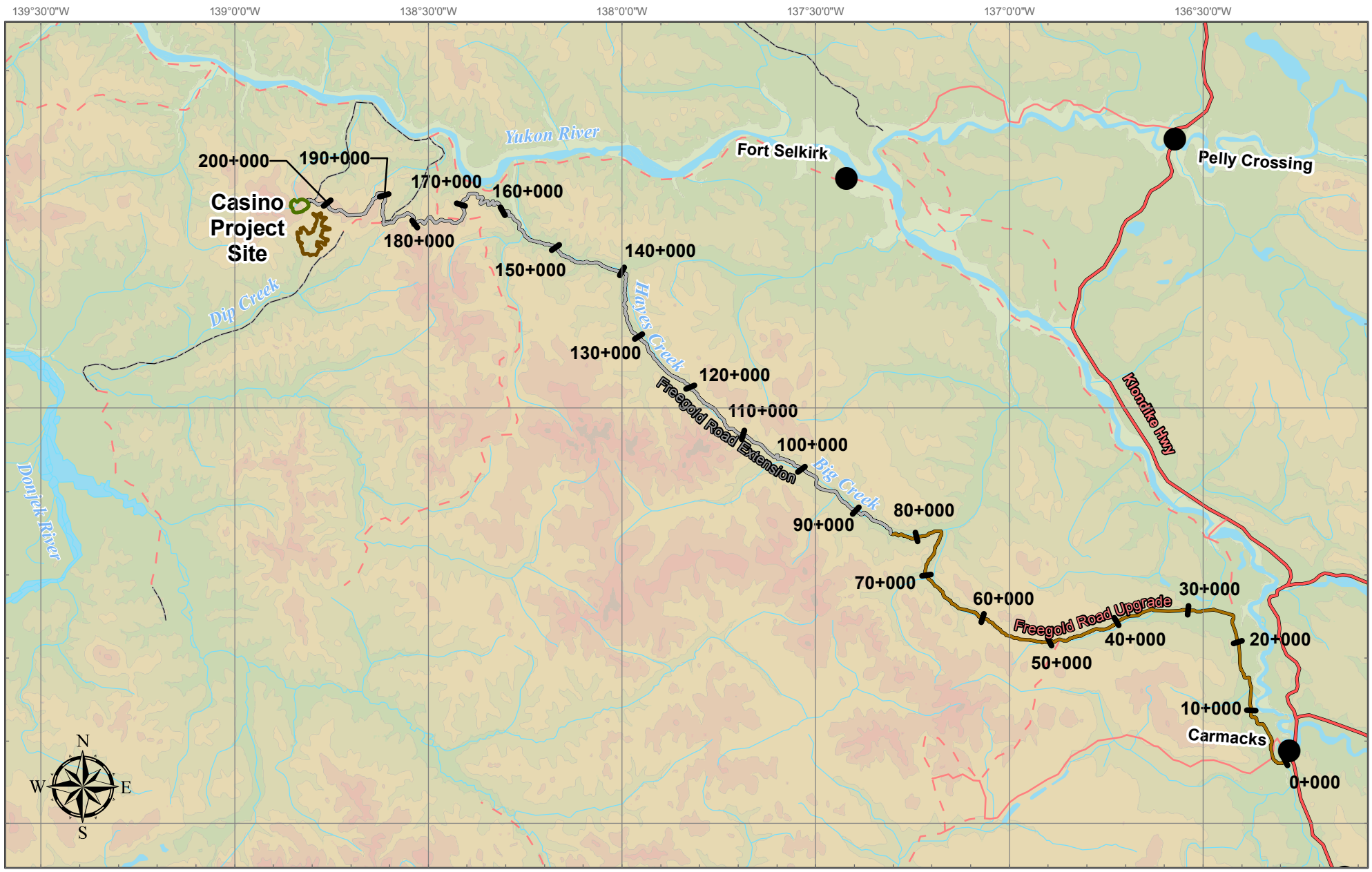
The FGR Upgrade begins with the Carmacks Bypass, a short section of road that will extend from the Klondike Highway south of Carmacks, and connect with the Freegold Road. From here, the road continues to the north for approximately 24 km and then travels to the west for approximately 60 km, for a total length of approximately 84 km. This section covers the existing Freegold Road and, in certain areas, will require upgrades and possible rerouting to accommodate large trucks and a higher volume of traffic.

The Extension will require the construction of a new road, connecting the end of the existing Freegold Road with the Casino property to the northwest. The total length of the Extension is approximately 119 km. In addition to the update to the ML/ARD assessment of the Extension first evaluated in the 2012 Lorax report, this report will provide a preliminary assessment of the ML/ARD potential associated with the FGR Upgrade.

1.1 Objectives

The specific objectives of this report are to:

- Provide a general indication of the level of risk associated with ML/ARD along the FGR Upgrade;
- Provide an update to the ML/ARD risk assessment completed for the Extension; and
- Provide recommendations for more detailed investigations, where warranted.



Legend

- Cities/Communities
- Open Pit
- Tailings Storage Facility
- Freegold Road Extension
- Freegold Road
- Existing Road
- Resource Road/Trail
- Historical Road
- Highway

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VERSION:	4

Coordinate System: World Mercator
Projection: Mercator
Datum: WGS 1984
Units: Meter

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CLIENT: CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT:

Casino Project
Phase II Road Assessment

TITLE: Proposed Casino Access Road Location

PROJECT #: J862-5

FIGURE: 1-1

P:\J862 (Casino)\Road\Drafting\MXDs\LocationMap of Proposed Road_20131105.mxd

1.2 Summary of Previous Work

The previous work on the ML/ARD potential along the site access road covered only the final 14 km of the FGR Upgrade and all of the Extension. A detailed description of the risk assessment methodology used for this section of the road is included in the previous Lorax report (2012), while a brief summary is provided here. For the preliminary assessment, the general risk assessment framework using a stressor (ML/ARD), a pathway (surface water drainage) and a receptor (aquatic ecosystems) was adopted. The road was divided into 81 discrete sections, where the stressor, the pathway and the receptor were generally consistent. For each of these sections, these terms were assigned a numerical risk rating, which were then multiplied together in a risk matrix to calculate the overall risk. Table 1-1 provides the overall risk rating system used in the assessment. This method was used to highlight sections of higher risk where further investigation was recommended.

Table 1-1:
Risk Rating and Corresponding Risk Category

Overall Risk Rating	Risk Category
0-49	Very low risk
50-99	Low risk
100-149	Moderate-low risk
150-199	Moderate risk
>200	Moderate-high risk

The risk assessment highlighted 16 sections along the road alignment with moderate-low risk or greater, representing a total road length of approximately 38 km. The majority of the higher risk sections were located along the ridge within 50 km to the east of the Casino property, from 156+940 to 168+740 and 178+470 to 194+870. Additional areas with moderate-low risk or higher were from 71+730 to 76+400, from 83+860 to 88+840, and from 148+860 to 149+450. These results were taken into account when additional sampling was completed in 2013. Note that these road chainages reflect the updated 2013 road chainage, rather than the chainage used at the time of the 2012 report.

In support of this assessment, 60 rock and sediment samples were collected from surface outcrops. The geochemical results from these samples indicate that there is a low risk for ML/ARD based on low sulfur values. However, since these samples were collected from the surface of outcrops and would, therefore, have been exposed to more weathering relative to samples at a greater depth, a review of the published geology was also taken into consideration as part of the stressor term. Rock cuts made during road construction may expose fresher material which has not been weathered, and which possibly has greater ML/ARD potential.

2. Freegold Road Upgrade Preliminary ML/ARD Assessment

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2. Freegold Road Upgrade Preliminary ML/ARD Assessment

The following section assesses the ML/ARD potential of road construction along the first 84 km of the site access road along the FGR Upgrade (Figure 2-1). The ML/ARD risk will only be discussed at a preliminary level and a full risk assessment will not be conducted at this time, as all the information required is not currently available.

2.1 Available Information

The relevant information available for the preliminary ML/ARD assessment of the FGR Upgrade includes:

- Yukon Geological Survey Bedrock Geology base map (Gordey and Makepeace, 1999);
- Geological Descriptions of units along the proposed road alignment (Carlson, 1987; Payne *et al.*, 1987); and
- Geochemical results from sampling completed by Lorax personnel along the proposed road route.

In total, 28 samples were collected from the FGR Upgrade: 22 samples in 2013 from the first 70 km of this section and 6 samples in 2011 from the last 14 km of this section (Figure 2-1). The samples collected from this section of road consisted of 15 rock samples, 5 colluvium samples, 5 Quaternary deposit samples (till and glaciofluvial material) and 3 waste rock samples. Rock samples were collected from the majority of outcrops along the FGR Upgrade; surficial material samples (colluvium, till, glaciofluvial and waste rock) were collected in areas identified as potential borrow sites or areas with significant road cuts. The waste rock samples were collected from piles of rock that were processed as part of past mining operations along the corridor. These waste rock piles have the potential to be used as fill for the road upgrade.

137°20'0"W 137°0'0"W 136°40'0"W 136°20'0"W

62°20'0"N

62°10'0"N

LX-C-42 CR-13-02 LX-C-39 LX-C-38 LX-C-40 LX-C-43 CR-13-01 LX-C-34 LX-C-37 LX-C-36 LX-C-35 LX-C-33 FGR-13-01 FGR-13-02 FGR-13-03 FGR-13-05 FGR-13-07 FGR-13-04 FGR-13-09 FGR-13-06 FGR-13-08 FGR-13-10 FGR-13-11 FGR-13-12 FGR-13-13 FGR-13-14 FGR-13-15 FGR-13-16 FGR-13-17 FGR-13-18 FGR-13-19 FGR-13-20 FGR-13-21

90+000 80+000 70+000 60+000 50+000 40+000 30+000 20+000 10+000 0+000

Freegold Road Extension

Freegold Road Upgrade

Klondike Highway

Yukon River

DMN3 LKfP EJyL DMgPW EJgA Q uTrP IJN uTrAK2 uJKT JL PPa

Fort Selkirk Pelly Crossing Carmacks

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N

Geologic Units Crossed by the site access road

Quaternary Deposits

- Q — Unconsolidated glacial, glaciofluvial and glaciolacustrine deposits

Prospector Mountain Suite

- LKfP — Quartz-feldspar porphyry
- LKqP — Quartz monzonite, biotite quartz-rich granite; porphyritic alaskite; biotite and hornblende quartz monzodiorite, granite and leucocratic granodiorite

Carmacks

- uKC1 — Augite olivine basalt and breccia; hornblende feldspar porphyry andesite and dacite flows

Mount Nansen

- mKN — Andesite to dacite flows, breccia and tuff

Whitehorse Suite

- mKdW — Hornblende diorite, biotite-hornblende quartz diorite and mesocratic, often strongly magnetic, hypersthene-hornblende diorite, quartz diorite and gabbro
- mKgW — Biotite-hornblende granodiorite, hornblende quartz diorite and hornblende diorite
- mKqW — Biotite quartz-monzonite, biotite granite and leucogranite, granophyric quartz monzonite

Tantalus

- uJKT — Massive to thickly bedded chert pebble conglomerate and quartz-chert-feldspar sandstone

Long Lake Suite

- EJgA — Medium- to coarse- grained, foliated biotite-hornblende granodiorite and hornblende diorite to monzodiorite
- EJyL — Coarse to very coarse grained mesocratic hornblende syenite

Nasina

- DMN3 — Quartzite, micaceous quartzite, quartz muscovite schist and minor metaconglomerate and metagrit
- DMN5 — Dark grey to black strongly graphitic quartzite with lesser grey micaceous quartzite and quartz mica schist

Pelly Gneiss Suite

- DMgPW — Biotite granite gneiss to biotite or hornblende granodiorite gneiss

LEGEND

Sample Locations

- 2013 Rock
- 2013 Waste Rock
- 2013 Sediment
- 2011 Sediment
- 2011 Rock

KM Markers

- 10 Km Markers
- 1 Km Markers
- Freegold Road Extension
- Freegold Road Upgrade

- Existing Road
- Resource Road/Trail
- Historical Road
- Highway
- PIT
- TAILINGS
- Waterbodies
- Cities/Communities

Bedrock Geology

Gordey, S.P. and Makepeace, A.J. (comp.) 1999: Yukon bedrock geology in Yukon digital geology, S.P. Gordey and A.J. Makepeace (comp.); Geological Survey of Canada Open File D3826 and Exploration and Geological Services Division, Yukon, Indian and Northern Affairs Canada, Open File 1999-1(D)

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REVIEWED:	JO
VERSION:	1

Coordinate System: *World Mercator*
Projection: *Mercator*
Datum: *North American 1983*
Units: *Metres*

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0 5 10 Km

CLIENT: CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT:

Casino Project
Phase II Road Assessment

TITLE: Freegold Road Upgrade Sample Locations With Bedrock Geology

PROJECT #: J862-5 FIGURE: 2-1

P:\J862 (Casino)\Road\Drafting\MXDs\Bedrock Geology with 2011 and 2013 Sample Locations_Freegold Road Upgrade_20131105_GM.mxd

2.2 Geochemical Results

Both the 2011 and 2013 samples were sent to SGS Canada in Burnaby, BC for static testing. The samples were analyzed for rinse and paste pH, Acid-Base Accounting (ABA) tests and Metals by Aqua Regia Digestion with ICP-MS Finish. The 2013 ABA results are provided in Appendix A and the Metals by Aqua Regia Digestion results are presented in Appendix C. In general, the results indicate that the samples are non-acid generating (NAG), indicated by Net Potential Ratios (NPRs) greater than 2. Lower NPR values indicate potentially acid generating (PAG) material, due to a higher degree of acid generating potential relative to neutralization potential (NP). In addition, the majority of samples have low sulfur values (0.02% total sulfur or less), indicating a low risk for ML/ARD. In general, the concentrations of metals found in the samples are less than three times the average continental crustal abundance (Appendix C). One exception to this is waste rock sample "FGR-13-08", which has several parameters which are greater than three times the average continental crustal abundance (Ag, As, Bi, Cd, Mo, Sb and Th). Although elevated concentrations of a parameter in the solid-phase may identify potential parameters of concern, it does not necessarily indicate that the parameter will be a source of metal leaching. If this waste rock is disturbed during road upgrades, further testing would be recommended to assess the potential for metal leaching.

2.3 Discussion of ML/ARD Potential

Since the cut volumes have not yet been determined for the majority of the FGR Upgrade, sufficient information is presently not available to complete a full risk assessment. At this stage, the discussion on ML/ARD potential along this section of road should be considered preliminary, with additional work expected prior to construction. Based on the geochemical results from the samples collected along the FGR Upgrade, as well as the results from samples collected along the Extension in the same geologic units, the ML/ARD risk is considered moderate to low. The ML/ARD risk is discussed below for each of the units crossed by the FGR Upgrade:

- *Tantalus Unit (uJKT):* The initial 700 m of the road crosses through this unit. No samples were collected from uJKT, therefore if significant cut or quarrying is expected in this unit, samples should be collected and submitted for static testing.
- *Quaternary Deposits (Q):* The FGR Upgrade crosses this unit from 0+700 to 8+500 and from 22+000 to 29+700. This unit includes till and glaciofluvial deposits. These deposits are expected to be low risk due to the high degree of physical and chemical weathering of the material.
- *Carmacks Unit (uKC1):* The FGR Upgrade crosses this unit from 8+500 to 22+000. This unit was reported as low risk in Lorax (2012) based on the

occurrence of carbonate and the ability of the mafic silicate minerals in basalt to buffer low levels of acid production. However, the sample collected along the FGR Upgrade contains some sulfur (total sulfur = 0.04%) and has an NPR of 0.7, indicating that the unit in this area is potentially acid generating (PAG). If rock cut or quarries are proposed along this section of road, additional samples should be collected prior to construction to further characterize the ML/ARD risk of this unit.

- *Long Lake Suite*
    - *EJgA:* The FGR Upgrade crosses this unit from 29+700 to 54+400. All samples collected from outcrops in this unit along the existing Freegold Road indicate that this unit is non-acid generating (NAG). This unit is considered low risk.
    - *EJyL:* The FGR Upgrade crosses this unit from 55+400 to 61+000, 61+600 to 64+000, and 65+900 to 66+100. No samples were collected in this unit, although in the 2012 risk assessment this unit was considered to be low risk, based on the presence of mafic silicate minerals which provide buffering capacity for low levels of acidity and sericitic alteration which may include carbonate minerals.
- *Pelly Gneiss Suite (DMgPW):* The FGR Upgrade crosses this unit from 54+400 to 55+400 and 71+690 to 82+260. This unit is considered to have moderate ML/ARD risk, based on the 2012 assessment. The one sample collected in this unit along the FGR Upgrade is NAG, indicating, therefore, that if further sampling is completed prior to construction, the risk for the unit may be reduced.
- *Whitehorse Suite*
    - *mKgW:* This unit occurs from 61+000 to 61+600, 64+000 to 65+900, and 66+100 to 71+650. This unit is considered to have moderate ML/ARD risk, based on the static test results. In some areas, there are moderate sulfur values with low NP values, in which case this unit is PAG. However, since the results are variable, further static testing is recommended prior to construction in areas where rock cuts or quarries are proposed in this unit.

- *mKqW:* The FGR Upgrade crosses this unit from 71+650 to 71+690 and 82+260 to 83+640. This unit is considered to have a low ML/ARD risk, based on the static test results.

In addition to the units discussed above, colluvium and waste rock may be used as fill material along the FGR extension. Colluvium is considered to have a moderate risk, although the risk is variable based on the parent bedrock type. The risk will need to be assessed for each site where significant cut or quarries are proposed. The waste rock from previous mining operations will likely also need to be evaluated on a site-by-site basis, considering that the three samples collected in 2013 have variable results. The two samples collected near 63+500 are NAG, while the sample collected near 62+000 is PAG.

3. Update to Freegold Road Extension ML/ARD Assessment

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3. Update to Freegold Road Extension ML/ARD Assessment

3.1 New Information

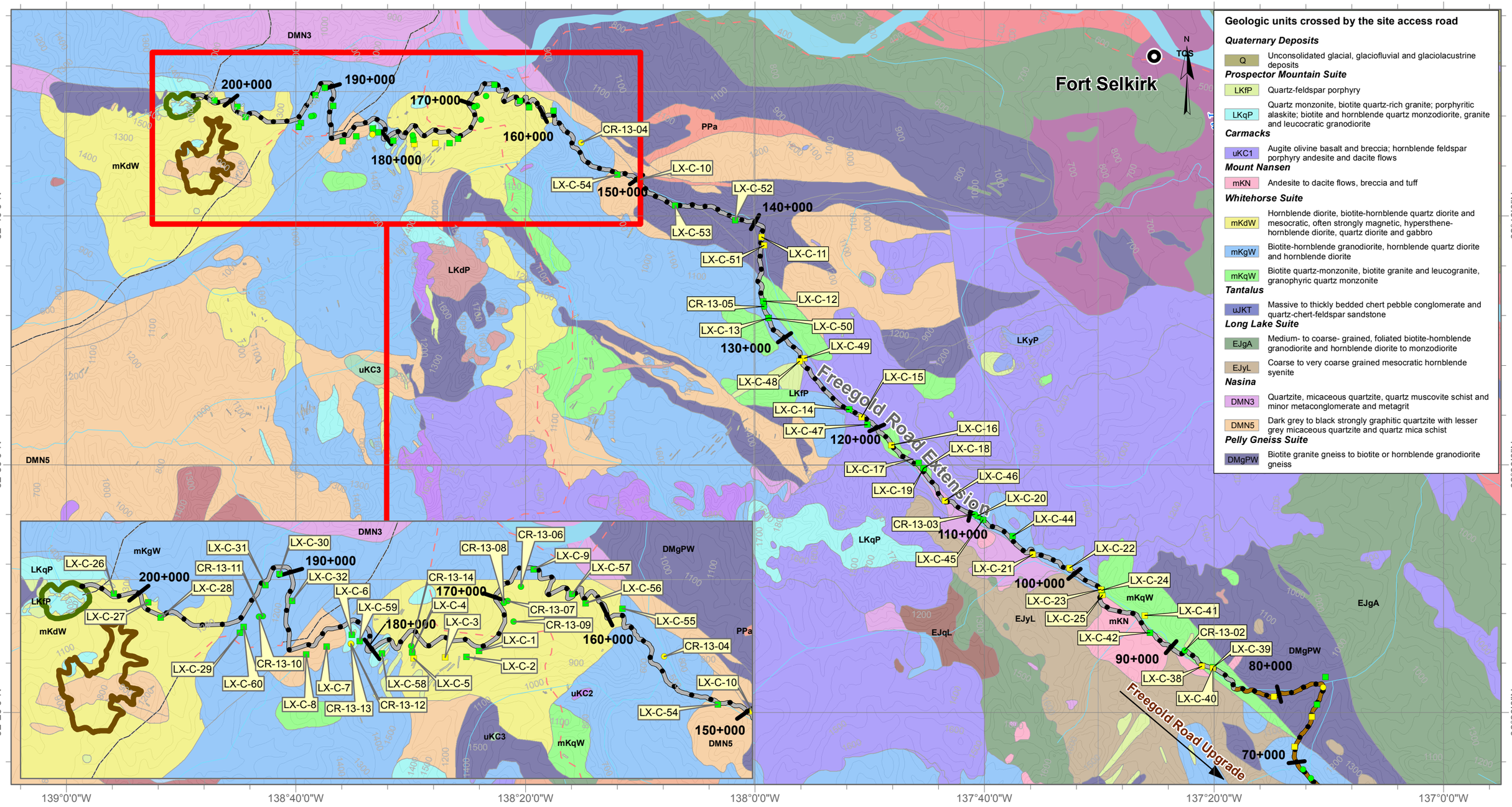
Since the Lorax 2012 assessment, a second round of sampling was completed in June 2013 and additional information concerning fish presence along the road alignment provided new information for the Extension. This information is used to update the risk matrix prepared for the initial risk assessment (Lorax, 2012). Cut volumes and upgradient drainage areas were not modified as part of this update.

3.1.1 Additional Samples

As part of the June 2013 field work, 13 additional samples were collected along the Extension: 10 rock samples, 2 colluvium samples and 1 fluvial sample (Figure 3-1). Sampling was focused on the area along the ridge within 50 km from the Casino property (9 of the 13 samples), which was indicated to be a higher risk area in the initial assessment. Samples were also collected at 4 other sites along the rest of the road which were identified as potential borrow areas or areas of bedrock disturbance. These 13 samples are added to the existing 54 samples which were collected along the Extension in 2011.

3.1.1.1 Update to Geochemical Results

The samples were sent to SGS Canada in Burnaby, BC for ABA and Aqua Regia Metals analysis. In general, the additional results support the ML/ARD risk rating system adopted in Lorax (2012). The 2013 ABA results are provided in Appendix B, while the Metals by Aqua Regia Digestion results are provided in Appendix C. Based on these additional results, modifications to the rating system were made and these changes are discussed below.



Geologic units crossed by the site access road

Quaternary Deposits

- Q — Unconsolidated glacial, glaciofluvial and glaciolacustrine deposits

Prospector Mountain Suite

- LKfP — Quartz-feldspar porphyry
- LKqP — Quartz monzonite, biotite quartz-rich granite; porphyritic alaskite; biotite and hornblende quartz monzodiorite, granite and leucocratic granodiorite

Carmacks

- uKC1 — Augite olivine basalt and breccia; hornblende feldspar porphyry andesite and dacite flows

Mount Nansen

- mKN — Andesite to dacite flows, breccia and tuff

Whitehorse Suite

- mKdW — Hornblende diorite, biotite-hornblende quartz diorite and mesocratic, often strongly magnetic, hypersthene-hornblende diorite, quartz diorite and gabbro
- mKgW — Biotite-hornblende granodiorite, hornblende quartz diorite and hornblende diorite
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LEGEND

Sample Locations

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VERSION:	1

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Datum: *North American 1983*
Units: *Metres*

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CLIENT:

CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT:

Casino Project
Phase II Road Assessment

TITLE: Freegold Road Extension Sample Locations With Bedrock Geology

PROJECT #: J862-5 *FIGURE:* 3-1

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A review of the static test results for samples in the Whitehorse Suite was completed, with the addition of the new 2013 results. The samples were grouped into the sub-units of the Whitehorse Suite: mKdW (diorite), mKgW (granodiorite) and mKqW (quartz monzonite and granite). The full ABA results for the Whitehorse Suite samples, divided by sub-unit, are provided in Appendix D, while a summary is provided in Table 3-1.

Relative to mKqW, which has <0.01% total sulfur in all samples collected from this sub-unit, the mKdW and mKgW sub-units were observed to have slightly higher sulfur (Table 3-1). In addition, the mKdW and mKgW sub-units are found in the vicinity of the mineralized deposit at the Casino property and would, therefore, be expected to have a higher ML/ARD risk. Based on this information, the risk rating for these units was revised by increasing the risk for mKdW and decreasing the risk for mKqW (Table 3-2). The risk rating for mKgW remains the same.

Table 3-1:
Summary of the Static Test Results for the Whitehorse Suite

Sub-Unit		Rinse pH	C(T) %	TIC (%)	S(T) %	S(S^{-2}) %	TAP	SAP	CaNP	NPR (CaNP/TAP)	NPR (CaNP/SAP)
	min	5.71	0.02	0.01	0.01	0.01	0.31	0.31	0.83	0.89	2.67
mKdW	median	7.20	0.08	0.01	0.02	0.01	0.63	0.31	0.83	2.67	2.67
	max	8.83	0.31	0.08	0.05	0.05	1.56	1.56	6.67	10.7	6.22
	min	5.99	0.01	0.01	0.01	0.01	0.31	0.31	0.83	0.18	2.67
mKgW	median	7.81	0.06	0.01	0.01	0.01	0.31	0.31	0.83	2.67	2.67
	max	8.92	0.54	0.52	0.15	0.02	4.69	0.63	43.33	69.3	139
	min	6.65	0.02	0.01	0.01	0.01	0.31	0.31	0.83	2.67	2.67
mKqW	median	7.27	0.03	0.01	0.01	0.01	0.31	0.31	0.83	2.67	2.67
	max	9.21	0.16	0.11	0.01	0.01	0.31	0.31	9.17	29.3	29.3

Note: C(T): Total Carbon; TIC: Total Inorganic Carbon; S(T): Total Sulfur ; S(S^{-2}): Sulfide Sulfur ; TAP: Total Acid Potential; SAP: Sulfide Acid Potential; CaNP: Carbonate Neutralization Potential; NPR: Net Potential Ratio.

An additional change was made to the Prospector Mountain Suite (unit LKP) ML/ARD risk rating. The colluvial samples collected in 2013 from this unit (near 182+500) are PAG (Appendix B). In addition, these samples have several metals which are elevated more than three times the average continental crustal abundance; these metals are: Ag, As, Bi, Cd, Mo, Pb, S, Sb, Th and Zn (Appendix C). If this material was disturbed during road construction, these parameters would potentially be of concern for metal leaching. Based on the results, the risk rating for bedrock in this unit was increased, since colluvium derived from this unit is potentially a concern for ML/ARD (Table 3-2).

Table 3-2:
Revised Rock Type Risk Ratings

Unit	Previous Risk Rating (Lorax, 2012)	Change	Revised Risk Rating
mKdW	2	↑	3
mKgW	3	-	3
mKqW	4	↓	2
LKP	3	↑	4

3.1.2 Additional Fisheries Information

An additional assessment on fish habitat and the likely presence or absence of fish at road crossings was completed by Palmer Environmental Consulting Group (Cleveland, Pers. Comm., 2013). Limited information is also included herein on stream flow for certain crossings. Information from this work was used to modify uncertain receptor risk ratings in the risk matrix, particularly in the section of road on the ridge close to the Casino property. For the previous assessment, only limited work on the aquatic habitat had been completed in this area and a conservatively high receptor risk rating had been assigned. The additional information decreases the receptor risk rating, as the majority of the streams in this area are not fish bearing.

3.2 Risk Matrix

The risk matrix has been updated with the revised geology risk rating for the Whitehorse Suite (mKdW, mKgW and mKqW) and the Prospector Mountain Suite (LKP), as well as the receptor ratings corresponding to the additional fisheries information (Appendix E). Although there were minor changes in the road alignment following the 2012 assessment, it was not deemed necessary to update the drainage areas for these road sections at this time as the changes to the alignment were minor and were in low risk areas. Table 3-3 shows the risk matrix for the area along the ridge to the Casino Property, which was the primary focus of the 2013 sampling program. There are now 13 sections with a moderate-low or higher risk ranking, representing 24.6 km, or 20.6% of the Extension (Table 3-4). The majority of the overall risk ratings have either been reduced in the update or remain the same. Due to the increase in the risk rating for mKdW, there are, however, three sections of road where the risk rating has increased from low risk to moderate-low risk.

Table 3-3:
Risk Matrix for the Ridge Area near the Casino Property

Chainage		Overall Risk	Stressors						Stressor	Pathway		Pathway	Receptor		Receptor
From	To		Rock Code	Rock Type Rating	Colluvium (c), alluvium (a) or bedrock (r)	Overall Geology Rating	Total Rock Cut (em^3)	Cut Rating	Rating	Drainage Area (hectares)	Pathway Ratio	Rating	Species Sensitivity	Habitat Resiliency	Rating
Hayes Creek (rock cut area)															
156+560	156+940	60	mKgW	3	r	3	2,663	2	**6**	34.9	76	**2**	2	3	**5**
156+940	158+190	135	mKgW	3	r	3	46,159	3	**9**	136.5	338	**3**	2	3	**5**
158+190	158+340	180	mKdW	3	r	3	11,090	3	**9**	2.05	5,409	**4**	2	3	**5**
158+340	158+480	48	mKgW	3	r	3	4,390	2	**6**	73.2	60	**2**	1	3	**4**
158+480	158+720	144	mKdW	3	r	3	13,616	3	**9**	10.5	1,293	**4**	1	3	**4**
158+720	159+160	144	mKgW	3	r	3	7,435	3	**9**	6.43	1,156	**4**	1	3	**4**
159+160	165+90	144	mKdW	3	r	3	360,110	4	**12**	1,162	310	**3**	1	3	**4**
165+90	166+090	144	mKgW	3	r	3	21,110	3	**9**	3.53	5,973	**4**	1	3	**4**
Mascot Creek															
166+090	168+740	81	mKgW	3	r	3	23,394	3	**9**	120	195	**3**	1	2	**3**
168+740	177+110	54	mKdW	3	r	3	34,819	3	**9**	631	55	**2**	1	2	**3**
Idaho/Isaac/Sunshine Creek															
177+110	178+470	72	mKdW	3	r	3	16,677	3	**9**	270	62	**2**	1	3	**4**
178+470	178+850	108	mKgW	3	r	3	12,156	3	**9**	64.0	190	**3**	1	3	**4**
178+850	178+930	96	LKqP	4	r	4	914	2	**8**	1.17	781	**3**	1	3	**4**
178+930	178+980	32	LKfP	4	r	4	72	1	**4**	0.849	85	**2**	1	3	**4**
178+980	179+820	256	LKqP	4	r	4	51,831	4	**16**	30.1	1,721	**4**	1	3	**4**
179+820	182+900	90	mKgW	3	r	3	41,383	3	**9**	873	47	**2**	2	3	**5**
182+900	186+080	180	DMN	4	r	4	37,436	3	**12**	275	136	**3**	2	3	**5**
186+080	194+870	180	mKgW	3	r	3	86,893	4	**12**	551	158	**3**	2	3	**5**
Casino Creek															
194+870	196+500	60	mKdW	3	r	3	3,369	2	**6**	43.1	78	**2**	2	3	**5**
196+500	197+360	0	mKdW	3	r	3	0	0	**0**	12.4	0	**0**	2	3	**5**
197+360	198+100	15	mKgW	3	r	3	18	1	**3**	17.4	1	**1**	2	3	**5**
198+100	199+740	135	mKdW	3	r	3	15,573	3	**9**	78.6	198	**3**	2	3	**5**
199+740	200+280	30	mKgW	3	r	3	266	1	**3**	5.74	46	**2**	2	3	**5**
200+280	202+850	90	mKdW	3	r	3	10,605	3	**9**	112	94	**2**	2	3	**5**
202+850	203+050	120	LKfP	4	r	4	2,824	2	**8**	20.2	140	**3**	2	3	**5**

Overall Risk Rating

<49 - Very low risk
50-99 - Low risk
100-149 - Moderate-low risk
150-199 - Moderate risk
>200 - Moderate-high risk

Rating is uncertain, conservative

Rock Codes

DMN	Nasina - quartzite and quartz-mica schist
mKdW	Whitehorse suite - diorite
mKgW	Whitehorse suite - granodiorite
LKP	Prospector Mountain suite - quartz-rich monzonite stock (LKqP) with latite dykes (LKfP)

Table 3-4:
Road Sections with Moderate-Low or Higher Risk in the Revised Risk Matrix

From	To	Overall Risk (Revised)	Overall Risk (Lorax, 2012)
148+860	149+450	135	135
156+940	158+190	135	162
158+190	158+340	180	144
158+480	158+720	144	144
158+720	159+160	144	216
159+160	165+90	144	144
165+90	166+090	144	216
178+470	178+850	108	162
178+980	179+820	256	288
182+900	186+080	180	216
186+080	194+870	180	180
198+100	199+740	135	90
202+850	203+050	120	90

Note:
50-99: Low risk
100-149: Moderate-low risk
150-199: Moderate risk
>200: Moderate-high risk

3.3 Discussion of ML/ARD Potential

3.3.1 Moderate-High Risk Section (1)

In the revised matrix, one section has an overall risk rating greater than 200. The section runs from 178+980 to 179+820 (0.84 km). This section is through the Prospector Mountain Suite (LKqP), which has a geology risk rating of 4. There is also a relatively large cut volume and small drainage area for this section. This moderate-high risk section is close to the colluvium samples with the high sulfur values (CR-13-12 and CR-13-13), indicating that rock cut should be minimized from this area.

3.3.2 Moderate Risk Sections (3)

There are 3 moderate risk sections along the Extension. All of these sections are along the ridge to the east of the Casino Property. Two of the sections cut through the Whitehorse Suite. The first section is from 158+190 to 158+340 (0.15 km) and cuts through the mKdW sub-unit. The second section is from 186+080 to 194+870 (8.79 km) and cuts through the mKgW sub-unit. The third section is from 182+900 to 186+080 (3.18 km)

and cuts through the Nasina unit (DMN). These three sections all have moderate to high stressor (9-12), pathway (3-4) and receptor (5) ratings. Some uncertainty remains in the receptor rating, so the risk may be reduced once further habitat assessments are completed in these areas.

3.3.3 Moderate-Low Risk Sections (9)

There are 9 moderate-low risk sections. The majority are located in the high area along the ridge to the Casino property. The only section that is not in this area occurs from 148+860 to 149+450 (0.59 km). The risk for this section is elevated due to a high geology rating, a relatively high cut volume and a relatively low drainage area. The remaining 8 sections are along the ridge to the east of the Casino Property. Four of the 8 sections are through mKgW, 3 sections are through mKdW and 1 section is through LKfP. In order to determine if there will be ML/ARD issues during or following road construction, further work is recommended for these sections.

3.3.4 Low Risk Sections

The low risk sections have an overall risk of less than 100 and cover 94.8 km (79.4 %) of the proposed road alignment. In general, these sections are in the first 73 km of the Extension where it is predicted to be all soil (and no rock) cut. Additionally, there are a few short sections in the rock cut area with low risk (Appendix E). No further work is recommended for these sections, as the overall risk is low enough to determine that ML/ARD will not be an issue during or following construction.

4. Recommendations

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4. Recommendations

In general, the ML/ARD risk along the site access road is considered to be low to moderate, although there are areas along both the FGR Upgrade and the Extension where more test work is required to confirm this. Below, general recommendations are provided which apply to the full length of the site access road. These general recommendations are subsequently followed with recommendations specific to the FGR Upgrade and to the Extension.

4.1 Recommendations for the Entire Site Access Road

General recommendations for the entire road are:

1) Sampling at quarry locations, once they are finalized. The number of samples to be collected should consider the geology risk rating system, as well as the MEND (2009) and the MOT (2004) guidelines. This will ensure that the quarried material to be used as fill will have a low ML/ARD risk.

2) ML/ARD monitoring during the construction phase for any areas which are determined to be potentially acid generating. This should include sampling and static testing of geotechnical drill core or blasted rock from these sections of road. Prior to receiving the static test results, any material which may have acid generating potential should be placed in a location away from streams, to minimize impact to aquatic ecosystems. The results of this secondary testing will determine how the material must ultimately be handled. Ideally, PAG material should be avoided during road construction. However, in cases where this is not possible, the two main options are: (1) mixing potentially acid generating material with acid consuming material, and (2) placing the material away from important aquatic ecosystems. Both of these options would minimize the impact on the aquatic ecosystem.

4.2 Recommendations for the Freegold Road Upgrade

Recommendations specific to the FGR Upgrade are:

1) Sampling in the Tantalus unit (uJKT) is recommended if there will be significant rock cut or quarrying in this unit, as there have not been any samples collected from this unit. This unit is only found along the initial 700 m of the road.

2) Additional sampling in the Carmacks unit (uKC1), which occurs along 13.5 km of the FGR Upgrade, is recommended if there is to be significant rock cut or

quarrying in this unit, since the one sample collected in this area was PAG. Ideally, samples would be collected from drill core, in order to sample the unweathered rock. If there is no rock cut or quarrying in this unit, no further work is required.

3) Additional sampling in the Whitehorse Suite (sub-unit mKgW; 8 km of the FGR Upgrade) is recommended in areas where significant rock cuts or quarries are located as the results are variable for the acid generating potential of this unit.

4) Any waste rock piles from previous mining activities along the FGR Upgrade should be sampled and submitted for static testing prior to being used as fill. The results from the initial three waste rock samples indicate that the acid generating potential of the waste rock is variable. Some waste rock appears to be suitable as fill, whereas some is PAG.

5) Due to a high cut volume, the section from 71+730 to 76+400 was considered moderate-low risk, as opposed to low risk, in the 2012 ML/ARD risk assessment. Additional sampling is recommended to confirm that the colluvial and alluvial materials in this area are in fact low risk.

6) A full risk assessment may be completed for the FGR Upgrade once the cut volumes are estimated. However, because the geologic units in this area typically have a moderate to low ML/ARD risk and the majority of the cut will likely be through surficial material, a full risk assessment is not considered necessary at this time.

4.3 Recommendations for the Freegold Road Extension

The recommendations presented in this memorandum supersede the recommendations from the Lorax 2012 report. The updated recommendations for the Extension are:

1) Minimize rock cut where the road crosses geologic units with high risk ratings (*e.g*. LKP and DMN, which both have a risk rating of 4). Rock cut is expected in the Prospector Mountain suite (LKP) from 178+930 to 179+820 (0.89 km) and from 202+850 to 203+050 (0.2 km), and in the Nasina unit (DMN) from 182+900 to 186+080 (3.18 km). Where rock cut or quarries are unavoidable through these sections, further sampling should be completed, preferably from drill core, to better characterize the ML/ARD risk associated with the unweathered rock.

2) Additional sampling in areas of moderate-low risk or higher should be completed prior to construction, if the rock cut volumes remain the same. In

order to collect unweathered rock samples, these samples would ideally be from drill core.

3) Additional sampling of the colluvium from 148+860 to 149+450, which was the single moderate-low risk section of the Extension outside of the high area along the ridge. Additional sampling may indicate that the material is NAG and will not be an issue during or following road construction in this area.

4) No further work is recommended for the low risk road sections.

References

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Appendices

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Appendix A
2013 ABA Results - Freegold Road Upgrade

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Sample ID	Rinse pH	Paste pH	TIC %	C(T) %	S(T) %	$S(SO_4)$ %	$S(S^{-2})$ %	Insoluble S %	SAP	TAP	Net NP	CaNP	NPR (CaNP/SAP)	NPR (CaNP/TAP)	Fizz Test
Rock Samples															
Pelly Gneiss Suite (DMgPW)															
FRG-13-10	8.73	8.81	0.12	0.13	0.02	<0.01	<0.01	0.02	0.3	0.6	15.1	10.0	32.0	16.0	Slight
Long Lake Suite (EJgA)															
FRG-13-12	8.08	8.86	<0.01	0.03	<0.01	<0.01	<0.01	<0.01	0.3	0.3	6.7	0.8	2.7	2.7	None
FRG-13-13	8.69	8.77	0.1	0.11	0.01	<0.01	<0.01	0.01	0.3	0.3	12.8	8.3	26.7	26.7	None
FRG-13-14	8.96	8.85	0.69	0.7	0.01	<0.01	<0.01	0.01	0.3	0.3	60.0	57.5	184.0	184.0	Slight
FRG-13-15	8.49	9.34	0.01	0.03	<0.01	<0.01	<0.01	<0.01	0.3	0.3	5.1	0.8	2.7	2.7	None
FRG-13-16	8.99	9.05	0.1	0.12	0.02	<0.01	<0.01	0.02	0.3	0.6	16.6	8.3	26.7	13.3	Slight
FRG-13-17	8.64	9.20	0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.3	4.3	0.8	2.7	2.7	None
Whitehorse Suite (mKgW)															
FRG-13-01	8.58	8.98	<0.01	0.01	0.02	<0.01	<0.01	0.02	0.3	0.6	20.1	0.8	2.7	***1.3***	None
FRG-13-02	8.36	8.84	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.3	6.0	0.8	2.7	2.7	None
FRG-13-04	8.92	9.08	0.52	0.54	0.02	<0.01	<0.01	0.02	0.3	0.6	25.3	43.3	138.7	69.3	Slight
FRG-13-05	8.67	9.58	0.03	0.05	0.02	<0.01	0.01	0.01	0.3	0.6	4.7	2.5	8.0	4.0	None
Mount Nansen (mKN)															
FRG-13-09	9.04	9.03	0.16	0.19	0.02	<0.01	<0.01	0.02	0.3	0.6	17.9	13.3	42.7	21.3	Slight
Carmacks (uKC)															
FRG-13-21	8.59	7.64	0.01	0.02	0.04	<0.01	<0.01	0.04	0.3	1.3	4.2	0.8	2.7	***0.7***	None
Colluvium Samples															
FRG-13-03	5.57	7.46	<0.01	0.04	0.02	<0.01	<0.01	0.02	0.3	0.6	1.9	0.8	2.7	***1.3***	None
Quarternary Deposits															
FRG-13-11	7.90	8.33	0.04	0.13	0.02	<0.01	<0.01	0.02	0.3	0.6	9.3	3.3	10.7	5.3	None
FRG-13-18	8.37	8.25	0.25	0.44	0.04	<0.01	<0.01	0.04	0.3	1.3	25.4	20.8	66.7	16.7	Slight
CR-13-01	8.55	8.39	0.26	0.32	0.02	<0.01	<0.01	0.02	0.3	0.6	24.8	21.7	69.3	34.7	Slight
FRG-13-19	7.75	8.13	<0.01	0.15	0.03	<0.01	<0.01	0.03	0.3	0.9	6.0	0.8	2.7	***0.9***	None
FRG-13-20	8.52	8.53	0.51	0.74	0.04	<0.01	0.01	0.03	0.3	1.3	49.0	42.5	136.0	34.0	Slight
Waste Rock Samples															
FRG-13-06	9.13	9.16	0.78	0.78	0.03	<0.01	<0.01	0.03	0.3	0.9	69.4	65.0	208.0	69.3	Slight
FRG-13-07	9.14	9.10	0.49	0.5	0.02	<0.01	<0.01	0.02	0.3	0.6	41.5	40.8	130.7	65.3	Slight
FRG-13-08	7.42	7.67	<0.01	0.13	0.05	0.03	<0.01	0.02	0.3	1.6	5.0	0.8	2.7	***0.5***	None

Note:

AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from sulfide sulfur content.

NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. Acid addition based on TIC content.

Net NP = Modified NP-AP

Carbonate NP is calculated from TIC originating from carbonates and is expressed in kg $CaCO_3$/tonne

Sulfate Sulfur determined by 25% HCl Leach with S by ICP Finish

Sulfide Sulfur determined by Sobek 1:7 Nitric Acid with S by ICP-MS Finish

Insoluble S is acid insoluble S (Total S - (Sulfate S + Sulfide S)).

Bold red italics indicate PAG (NPR < 2)

Appendix B
2013 ABA Results - Freegold Road Extension

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Sample ID Rock Samples	Rinse pH	Paste pH	TIC %	S(T) %	$S(SO_4)$ %	$S(S^{-2})$ %	Insoluble S %	SAP	TAP	NP	Net NP	CaNP	NPR (CaNP/SAP)	NPR (CaNP/TAP)	Fizz Test
Nasina (DMN)															
CR-13-03	8.42	8.71	0.02	<0.01	<0.01	<0.01	<0.01	0.3	0.3	0.9	0.9	1.7	5.3	5.3	None
Whitehorse Suite (mKgW)															
CR-13-05	8.72	9.14	0.12	0.01	<0.01	<0.01	0.01	0.3	0.3	12.5	12.5	10.0	32.0	32.0	Slight
CR-13-10	6.52	7.93	<0.01	0.02	<0.01	<0.01	0.02	0.3	0.6	7.1	7.1	0.8	2.7	***1.3***	None
CR-13-11	7.46	8.32	<0.01	0.15	<0.01	<0.01	0.15	0.3	4.7	3.8	3.8	0.8	2.7	***0.2***	None
Whitehorse Suite (mKdW)															
CR-13-06	6.91	8.13	<0.01	0.01	<0.01	<0.01	0.01	0.3	0.3	5.7	5.7	0.8	2.7	2.7	None
CR-13-07	6.62	8.05	<0.01	0.02	<0.01	<0.01	0.02	0.3	0.6	6.7	6.7	0.8	2.7	***1.3***	None
CR-13-08	7.61	8.60	<0.01	0.02	<0.01	<0.01	0.02	0.3	0.6	6.5	6.5	0.8	2.7	***1.3***	None
CR-13-09	6.85	8.11	<0.01	0.01	<0.01	<0.01	0.01	0.3	0.3	5.1	5.1	0.8	2.7	2.7	None
CR-13-14	7.49	8.60	0.04	0.01	<0.01	0.04	<0.01	1.3	0.3	7.9	6.7	3.3	2.7	10.7	None
Mount Nansen (mKN)															
CR-13-02	8.94	8.59	0.34	0.03	<0.01	<0.01	0.03	0.3	0.9	40.9	40.9	28.3	90.7	30.2	Slight
Colluvium Samples															
CR-13-12	6.57	7.45	<0.01	0.53	0.01	<0.01	0.52	0.3	16.6	1.5	1.5	0.8	2.7	***0.1***	None
CR-13-13	7.92	8.00	0.02	0.11	0.04	0.04	0.03	1.3	3.4	2.9	1.7	1.7	***1.3***	***0.5***	None
Fluvial Samples															
CR-13-04	5.57	6.53	<0.01	0.02	<0.01	<0.01	0.02	0.3	0.6	2.0	2.0	0.8	2.7	***1.3***	None

Note:

AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from sulfide sulfur content.

NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. Acid addition based on TIC content.

Net NP = Modified NP-AP

Carbonate NP is calculated from TIC originating from carbonates and is expressed in kg $CaCO_3$/tonne

Sulfate Sulfur determined by 25% HCl Leach with S by ICP Finish

Sulfide Sulfur determined by Sobek 1:7 Nitric Acid with S by ICP-MS Finish

Insoluble S is acid insoluble S (Total S - (Sulfate S + Sulfide S)).

Bold red italics indicate PAG (NPR < 2)

Appendix C
2013 Aqua Regia Metals Results

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Sample ID	Ag ppm	Al %	As ppm	Au ppb	B ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Fe %	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	K %	La ppm	Li ppm	Lu ppm	Mg %
Freegold Road Upgrade																										
Rock Samples																										
Pelly Gneiss Suite (DMgPW)																										
FRG-13-10	<0.01	1.51	***4***	-	50	245	0.3	<0.02	1	0.05	19.2	8.5	***143***	1.53	2.1	3.01	6.5	0.2	0.11	<0.01	0.02	0.11	10.6	13	0.14	1.17
Long Lake Suite (EJgA)																										
FRG-13-12	0.03	1.1	***3***	-	50	63	0.4	***0.03***	0.86	0.05	34.4	7.6	***166***	0.44	4.9	2.28	5.5	0.2	0.13	<0.01	<0.02	0.17	18.5	12	0.1	0.94
FRG-13-13	0.01	1.15	***2***	-	60	66	0.3	<0.02	0.92	0.01	29.8	6	***156***	1.04	2.4	2.55	5.7	0.1	0.09	<0.01	<0.02	0.09	16.8	14	0.08	0.75
FRG-13-14	0.01	0.61	***4***	-	40	78	0.4	<0.02	2.48	0.03	25.2	5.4	***128***	1.66	2.3	1.73	2.8	0.2	0.12	<0.01	<0.02	0.15	12.8	5	0.13	0.28
FRG-13-15	<0.01	0.41	***2***	-	60	87	0.2	<0.02	0.67	0.05	16.3	3.8	***157***	<0.05	2.3	2.22	2.7	0.2	0.13	<0.01	0.02	0.07	7.5	<1	0.13	0.24
FRG-13-16	0.02	1.94	***3***	-	40	107	0.5	<0.02	2.64	0.05	23	16.5	***115***	0.05	2.2	5.4	10.7	0.4	0.28	<0.01	0.06	0.23	11.2	6	0.22	1.74
FRG-13-17	<0.01	0.67	***2***	-	50	104	0.1	<0.02	0.3	<0.01	12.1	3.7	***175***	0.16	3.3	1.57	2.9	0.2	0.05	<0.01	<0.02	0.27	6.1	6	0.06	0.42
Whitehorse Suite (mKgW)																										
FRG-13-01	0.07	1.2	***3***	-	40	155	0.3	***0.07***	0.7	0.06	36.6	19.6	***287***	3.58	***60.4***	2.7	4.4	0.2	0.16	<0.01	<0.02	0.96	18.3	13	0.09	1.7
FRG-13-02	0.03	0.72	***7***	-	60	168	0.4	***0.07***	0.5	0.03	32.3	6.3	***174***	1.26	10.9	2.36	3.9	0.2	0.23	<0.01	<0.02	0.27	18.6	13	0.14	0.57
FRG-13-04	0.01	1.75	***3***	-	50	117	0.5	***0.07***	2.04	***0.15***	33.6	14	***139***	2.34	7	3.68	6.4	0.2	0.05	<0.01	0.02	0.16	18.9	21	0.17	1.69
FRG-13-05	0.02	0.56	***9***	-	50	51	0.1	***0.19***	0.27	0.03	36.5	3.3	***224***	0.6	14	1.14	3.4	0.2	0.42	<0.01	<0.02	0.08	22.1	5	0.08	0.33
Mount Nansen (mKN)																										
FRG-13-09	0.03	1.45	***5***	-	40	205	0.4	***0.11***	1.06	0.05	36.8	13.7	***138***	1.43	17	3.39	6.5	0.2	0.19	0.03	0.02	0.11	19.5	23	0.18	1.25
Carmacks (uKC)																										
FRG-13-21	0.02	1.8	***2***	-	40	56	0.3	<0.02	0.9	0.06	24.1	9	54	0.37	18.7	2.49	4.5	0.1	0.31	<0.01	0.04	0.11	10.9	<1	0.12	0.3
Colluvium Samples																										
FRG-13-03	***0.1***	0.73	***5***	-	30	357	0.4	***0.28***	0.09	0.06	46.1	3	***152***	1.56	9.7	1.18	1.5	0.1	0.23	<0.01	<0.02	0.2	26.5	6	0.08	0.24
Quarternary Deposits																										
FRG-13-11	0.04	1.15	***5***	-	40	158	0.4	***0.07***	0.7	0.08	27.1	6.8	***125***	0.61	18.6	2.13	3.5	0.1	0.26	0.02	<0.02	0.11	14.2	7	0.11	0.59
FRG-13-18	0.06	1.27	***11***	-	50	207	0.4	***0.08***	1.42	0.12	26.2	10.6	***112***	0.72	28	2.73	4.4	0.2	0.28	0.04	0.02	0.13	13.1	7	0.15	0.64
FRG-13-19	0.03	1.3	***7***	-	50	166	0.3	***0.08***	0.68	0.05	22.3	11.5	***152***	0.6	22.5	2.77	4.4	0.1	0.3	0.02	0.02	0.11	9.5	8	0.09	0.71
FRG-13-20	0.06	1.36	***6***	-	40	145	0.4	***0.06***	2.45	***0.19***	25.2	13.1	***119***	0.54	46.6	3.23	4.7	0.2	0.32	0.02	0.02	0.13	12.5	9	0.14	0.93
CR-13-01	0.04	0.94	***18***	-	40	266	0.5	***0.1***	1.01	0.1	30.5	10.5	***134***	1.41	15.9	2.65	3.2	0.1	0.27	0.06	<0.02	0.14	15.2	6	0.11	0.72
Waste Rock Samples																										
FRG-13-06	0.04	1.69	***5***	-	40	239	0.4	***0.1***	2.86	***0.18***	38	14.7	***168***	1.35	18.1	3.58	6.9	0.2	0.11	0.02	0.03	0.19	19.6	20	0.15	1.47
FRG-13-07	0.02	0.9	***2***	-	30	***585***	0.3	***0.03***	1.82	0.08	24.4	5.3	***140***	1.88	14.6	1.82	4.7	0.2	<0.05	***0.09***	<0.02	0.16	12.7	8	0.09	0.63
FRG-13-08	***0.72***	1.25	***273***	-	30	***457***	0.7	***2.61***	0.3	***1.32***	35.5	6.4	***128***	2.72	30.3	2.46	3.1	0.1	0.09	<0.01	0.03	0.21	19.3	12	0.13	0.48
Freegold Road Extension																										
Rock Samples																										
Nasina (DMN)																										
CR-13-03	***0.08***	0.2	***15***	-	60	62	0.3	***0.12***	0.05	***0.17***	40.5	4.3	***182***	0.68	11.9	0.55	0.5	0.1	0.11	<0.01	<0.02	0.07	15.9	<1	0.12	0.01
Whitehorse Suite (mKgW)																										
CR-13-05	<0.01	0.86	<1	-	40	80	0.3	***0.03***	0.52	0.02	60	5.1	***181***	0.94	3.2	2.1	3.8	0.2	0.1	0.01	0.02	0.15	32	17	0.31	0.63
CR-13-10	0.05	2.06	<1	-	50	***1390***	0.2	***0.07***	0.94	0.06	28.9	11.4	***273***	2.31	23.6	3.31	5.3	0.3	0.14	<0.01	<0.02	0.93	15.4	17	0.13	1.05
CR-13-11	0.02	1.58	***2***	-	50	***638***	0.2	***0.02***	0.67	0.05	24.2	8.6	***186***	2.36	5	2.54	4.6	0.2	0.12	<0.01	<0.02	0.73	13.3	14	0.11	0.78
Whitehorse Suite (mKdW)																										
CR-13-06	0.02	2.08	1	-	50	***1250***	0.2	***0.04***	0.7	0.04	19.4	12.9	***141***	2.63	6.2	3.8	6.1	0.2	0.11	<0.01	<0.02	1.11	9.3	15	0.12	1.18
CR-13-07	0.06	2.32	1	-	30	***1040***	0.2	***0.07***	0.96	0.05	19.8	15.7	***134***	2.62	34.1	3.69	6.6	0.2	0.14	<0.01	<0.02	1.1	10.3	15	0.11	1.27
CR-13-08	0.01	2.12	***2***	-	30	***1230***	0.2	***0.06***	0.9	0.04	18	12.7	***150***	3.28	12.9	3.49	6.1	0.2	0.12	<0.01	<0.02	1.02	10.2	18	0.09	1.26
CR-13-09	0.04	1.36	***3***	-	40	***550***	0.3	***0.08***	0.62	0.05	21	10.3	***157***	2.2	19.9	3.29	6.1	0.3	0.18	<0.01	0.03	0.56	9.9	17	0.22	0.97
CR-13-14	***0.09***	1.78	<1	-	50	***772***	0.2	***0.1***	0.79	0.08	38	9	***170***	2.51	19.2	2.99	6	0.2	0.6	<0.01	0.03	0.61	21	17	0.15	0.89
Mount Nansen (mKN)																										
CR-13-02	0.07	1.91	***24***	-	30	242	1.7	***0.23***	1.44	***0.71***	42.9	***28.6***	***299***	9.79	***68.3***	3.97	7.2	0.3	0.53	0.02	0.02	0.32	21.5	28	0.19	2.24
Colluvium Samples																										
CR-13-12	***4.24***	0.35	***577***	-	40	154	0.5	***0.14***	0.08	***10.1***	31.8	2.6	***166***	2.56	19.9	1.62	0.7	<0.1	0.2	0.04	0.08	0.21	17.3	<1	0.2	0.03
CR-13-13	***3.33***	0.29	***537***	-	40	279	0.4	***0.09***	0.14	***8.23***	33.3	2.9	***181***	2.01	17	1.36	0.5	0.1	0.13	0.04	<0.02	0.21	19.4	<1	0.14	0.02
Fluvial Samples																										
CR-13-04	0.01	1.15	***5***	-	40	132	0.2	***0.08***	0.19	0.08	23.7	10.9	***166***	1.97	6.2	2.55	4.9	0.2	<0.05	<0.01	0.03	0.26	11.1	18	0.1	0.59
Average Crustal Abundance	0.075	8.23	1.8		-	425	-	0.0085	4.15	0.15	-	25.0	102	-	60.00	5.63	19	-	-	0.085	-	2.085	39	-	-	2.33

Sample ID	Mn ppm	Mo ppm	Na %	Nb ppm	Ni ppm	P %	Pb ppm	Rb ppm	S %	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Yb ppm	Zn ppm	Zr ppm
Freegold Road Upgrade																											
Rock Samples																											
Pelly Gneiss Suite (DMgPW)																											
FRG-13-10	557	***3.83***	0.06	0.35	7.3	970	2.5	4.3	<0.01	***0.41***	8.5	<1	0.5	42.5	<0.05	0.29	<0.05	***2***	0.15	0.03	0.17	75	<0.1	9.15	0.9	69	2.2
Long Lake Suite (EJgA)																											
FRG-13-12	426	***4.37***	0.09	0.58	11.3	***1100***	2.9	10.9	<0.01	0.08	4.9	<1	0.4	39.7	<0.05	0.21	<0.05	***5.5***	0.17	0.05	0.71	52	<0.1	6.03	0.6	48	2.2
FRG-13-13	464	***4.24***	0.05	0.41	5.1	900	2	6.1	<0.01	0.05	5.5	<1	0.5	38.7	<0.05	0.22	<0.05	***3.9***	0.1	0.03	0.55	48	<0.1	6.3	0.5	56	1.6
FRG-13-14	436	***3.74***	0.03	<0.05	5.8	590	3.2	7.9	<0.01	<0.05	3.4	<1	<0.3	86.2	<0.05	0.28	<0.05	***3.3***	<0.01	0.04	0.88	24	<0.1	9	0.8	37	4.4
FRG-13-15	438	***4.48***	0.09	1.49	3.5	950	1.3	1.1	<0.01	<0.05	4.2	<1	0.6	27.1	<0.05	0.23	<0.05	1.1	0.09	<0.02	0.24	49	<0.1	8.27	0.8	22	3.4
FRG-13-16	***1080***	***3.48***	0.27	0.52	7.9	***1880***	1.4	2.7	<0.01	<0.05	17.3	<1	1.2	50.8	<0.05	0.48	<0.05	***2.2***	0.32	<0.02	0.18	***156***	<0.1	16.3	1.4	***87***	6.3
FRG-13-17	327	***5.35***	0.07	0.75	3.7	440	0.9	16.8	<0.01	<0.05	2.7	<1	<0.3	22.4	<0.05	0.12	<0.05	***1.5***	0.08	0.07	0.24	33	<0.1	3.91	0.4	29	1.3
Whitehorse Suite (mKgW)																											
FRG-13-01	213	***3.68***	0.1	0.79	***111***	***2060***	3.2	86.3	<0.01	0.07	3.2	<1	0.8	35.4	<0.05	0.34	<0.05	***6.7***	0.31	0.31	1.85	100	0.6	8.6	0.6	37	5.3
FRG-13-02	288	***5.25***	0.06	1.61	7.1	1040	6.4	23.9	<0.01	***0.73***	2.9	<1	0.8	24.2	<0.05	0.3	<0.05	***19.3***	0.18	0.18	1.85	63	0.5	9.1	0.9	26	3.6
FRG-13-04	768	***3.63***	0.05	0.12	12.9	840	6.2	11.7	<0.01	***0.61***	7.2	<1	0.4	47.1	<0.05	0.33	<0.05	***10.7***	0.03	0.07	2.01	79	0.5	9.79	1	59	1.4
FRG-13-05	252	***6.63***	0.05	0.66	5	290	6.6	5.1	0.02	***0.39***	1.6	<1	0.5	17.5	<0.05	0.22	<0.05	***13***	0.03	0.04	2.57	12	0.3	5.68	0.5	17	11.7
Mount Nansen (mKN)																											
FRG-13-09	560	***4.73***	0.06	0.51	11.5	850	4.1	10.2	<0.01	***1.86***	7.7	<1	0.6	68.8	<0.05	0.4	<0.05	***11.8***	0.15	0.08	1.75	90	0.2	12.7	1.2	54	6.7
Carmacks (uKC)																											
FRG-13-21	466	1.11	0.2	<0.05	7.8	***1120***	1.7	11.8	<0.01	<0.05	11.9	<1	0.4	120	<0.05	0.41	<0.05	***1.7***	0.02	0.02	0.28	72	<0.1	12	0.8	36	11.7
Colluvium Samples																											
FRG-13-03	263	***4.86***	0.03	0.13	4.1	360	***16.9***	12.1	<0.01	***0.5***	0.9	<1	<0.3	11	<0.05	0.22	<0.05	***13.6***	<0.01	0.11	1.62	11	0.2	4.41	0.5	22	8.9
Quarternary Deposits																											
FRG-13-11	357	***3.2***	0.06	0.43	17.4	690	4.8	8	<0.01	***0.2***	5.3	<1	0.4	48.2	<0.05	0.31	<0.05	***4.1***	0.08	0.07	0.76	48	0.1	7.9	0.7	38	8.9
FRG-13-18	494	***2.8***	0.05	0.29	27.1	760	6	12.9	<0.01	***0.25***	7	<1	0.4	82.7	<0.05	0.37	<0.05	***4***	0.06	0.11	0.78	61	<0.1	10.8	0.9	50	12.3
FRG-13-19	474	***4.37***	0.06	0.37	23.4	790	5.3	11.7	<0.01	0.18	5.8	<1	0.4	51.1	<0.05	0.26	<0.05	***3.6***	0.1	0.07	0.71	66	<0.1	6.97	0.6	39	10.9
FRG-13-20	470	***3.47***	0.09	0.5	34.9	***1220***	4.9	9.1	0.03	***0.2***	7.6	<1	0.5	122	<0.05	0.37	<0.05	***3.6***	0.13	0.09	0.9	95	<0.1	10.9	0.9	59	16.8
CR-13-01	410	***3.46***	0.05	0.25	38.4	1030	6.2	10.8	<0.01	***1.14***	6.3	<1	0.5	49.2	<0.05	0.36	<0.05	***5***	0.05	0.08	0.92	59	0.1	9.24	0.7	47	9.4
Waste Rock Samples																											
FRG-13-06	785	***5.44***	0.04	<0.05	11.2	***1070***	7.9	13.1	<0.01	***0.28***	8.2	<1	0.4	108	<0.05	0.43	<0.05	***12.2***	<0.01	0.08	***3.33***	72	<0.1	12.8	0.9	50	4.5
FRG-13-07	401	***4.27***	0.04	<0.05	5.1	510	6.4	8.7	0.01	***0.66***	2.7	<1	<0.3	76.2	<0.05	0.26	<0.05	***5.1***	<0.01	0.05	1.13	33	0.1	7.02	0.6	44	0.5
FRG-13-08	545	***5.89***	0.02	0.25	9.3	710	***35.1***	14.7	0.03	***3.09***	3.8	<1	<0.3	24.3	<0.05	0.31	<0.05	***13.1***	0.02	0.17	***3.26***	30	0.2	8.13	0.8	***175***	4.5
Freegold Road Extension																											
Rock Samples																											
Nasina (DMN)																											
CR-13-03	153	***5.58***	0.03	0.1	6.2	<50	4.4	4.2	<0.01	***1.21***	6.6	<1	<0.3	7	<0.05	0.31	<0.05	***46.7***	<0.01	0.09	***3.31***	15	0.1	8.7	0.8	23	3.1
Whitehorse Suite (mKgW)																											
CR-13-05	720	***5.6***	0.04	0.16	4.1	410	3.7	15.7	<0.01	0.18	5.6	<1	0.6	19	<0.05	0.75	<0.05	***18.9***	0.02	0.1	1.9	31	<0.1	19.6	1.8	53	2.8
CR-13-10	468	***8.03***	0.24	1.44	8.4	790	3.4	70.6	0.01	0.16	6.9	<1	0.8	62	<0.05	0.25	<0.05	***10.5***	0.3	0.61	***3.33***	105	0.3	7.18	0.8	50	2.8
CR-13-11	341	***5.38***	0.2	0.96	5.6	600	3	66.2	<0.01	0.09	4.5	<1	0.7	47.1	<0.05	0.21	<0.05	***13***	0.23	0.51	2.14	81	0.1	6.47	0.7	34	2.5
Whitehorse Suite (mKdW)																											
CR-13-06	491	***4.11***	0.19	0.74	5.5	930	1.7	65.1	<0.01	0.06	8.4	<1	0.7	44.1	<0.05	0.24	<0.05	***7.1***	0.31	0.44	1.06	***122***	0.2	7.65	0.7	56	2.7
CR-13-07	499	***3.86***	0.22	0.58	6.7	1040	2.1	68.6	0.01	***0.2***	7.9	<1	0.5	62.2	<0.05	0.23	<0.05	***7.3***	0.31	0.52	1.83	118	0.2	7.24	0.7	53	3.2
CR-13-08	510	***5.66***	0.21	0.52	6	950	3.1	70	<0.01	0.16	7.4	<1	0.6	57.2	<0.05	0.17	<0.05	***10***	0.31	0.56	2.26	115	0.2	5.38	0.5	51	3
CR-13-09	615	***4.88***	0.1	1.06	5.2	910	3.5	50.4	<0.01	0.1	10.2	<1	1.1	19.2	<0.05	0.39	<0.05	***7.5***	0.21	0.41	***5.07***	86	0.2	14.4	1.4	53	2.9
CR-13-14	560	***5.12***	0.18	0.73	6.8	760	5.2	51.7	<0.01	0.07	6.4	<1	0.9	63.5	<0.05	0.3	<0.05	***14.4***	0.17	0.4	2.61	70	***1.5***	9.14	0.9	54	18
Mount Nansen (mKN)																											
CR-13-02	***1050***	***3.51***	0.04	0.17	***180***	***2160***	12.3	29.1	<0.01	***1.67***	8.7	<1	0.4	62.8	<0.05	0.61	0.08	***8.2***	0.11	0.13	***3.46***	100	0.3	16.6	1.2	***242***	23.5
Colluvium Samples																											
CR-13-12	686	***6.4***	0.02	0.13	4.6	180	***648***	13.8	***0.62***	***6.87***	1.1	<1	0.4	7.7	<0.05	0.32	<0.05	***22.2***	<0.01	0.2	***5.58***	5	0.5	10	1.2	***743***	7.2
CR-13-13	***1100***	***6.54***	0.01	<0.05	4.1	170	***773***	13.6	***0.11***	***4.29***	0.7	<1	<0.3	11.1	<0.05	0.25	<0.05	***19.9***	<0.01	0.21	***6.87***	3	0.1	8.15	0.9	***814***	5.1
Fluvial Samples																											
CR-13-04	699	***5.37***	0.04	1.51	9.6	470	4.8	47.9	<0.01	0.14	5.7	<1	0.9	12.4	<0.05	0.2	<0.05	***6.6***	0.11	0.25	0.67	54	0.1	6.01	0.6	58	2.2
Average Crustal Abundance	950.0	1.2	2.355	-	84.0	1050	14.0	-	0.035	0.20	22	0.050	-	370	-	-	-	1.2	0.565	0.85	2.7	120	1.3	-	-	70.0	-

Appendix D
Combined ABA Results - Whitehorse Suite

CASINO
COPPER AND GOLD

Sample ID	Rinse pH	Paste pH	TIC %	CaCO3 NP	C(T) %	S(T) %	$S(SO_4)$ %	$S(S^{-2})$ %	Insoluble S %	SAP	TAP	Net NP	CaNP	NPR (CaNP/SAP)	NPR (CaNP/TAP)	Fizz Test
Rock Samples																
mKdW																
LX-C-56	7.68	8.50	0.01	0.8	0.04	0.02	<0.01	0.01	0.02	0.3	0.6	6.1	0.8	2.7	***1.3***	None
LX-C-57	8.83	8.99	0.08	6.7	0.08	0.05	<0.01	0.05	<0.01	1.6	1.6	9.6	6.7	4.3	4.3	None
LX-C-1	7.20	8.20	<0.01	<0.8	0.05	<0.01	<0.01	<0.01	<0.01	0.3	0.3	6.1	0.8	2.7	2.7	None
LX-C-2	7.25	8.77	<0.01	<0.8	0.03	0.02	<0.01	<0.01	0.02	0.3	0.6	5.8	0.8	2.7	***1.3***	None
LX-C-4	6.50	8.15	<0.01	<0.8	0.31	0.03	<0.01	<0.01	0.03	0.3	0.9	6.6	0.8	2.7	***0.9***	None
LX-C-28	6.65	8.33	0.01	0.8	0.05	<0.01	<0.01	<0.01	<0.01	0.3	0.3	9.1	0.8	2.7	2.7	None
LX-C-27	8.00	8.91	0.07	5.8	0.08	0.05	<0.01	0.03	0.02	0.9	1.6	16.2	5.8	6.2	3.7	None
LX-C-26	5.71	8.27	<0.01	<0.8	0.02	0.02	<0.01	<0.01	0.02	0.3	0.6	5.6	0.8	2.7	***1.3***	None
CR-13-06	6.91	8.13	<0.01	<0.8	0.11	0.01	<0.01	<0.01	0.01	0.3	0.3	5.7	0.8	2.7	2.7	None
CR-13-07	6.62	8.05	<0.01	<0.8	0.17	0.02	<0.01	<0.01	0.02	0.3	0.6	6.7	0.8	2.7	***1.3***	None
CR-13-08	7.61	8.60	<0.01	<0.8	0.07	0.02	<0.01	<0.01	0.02	0.3	0.6	6.5	0.8	2.7	***1.3***	None
CR-13-09	6.85	8.11	<0.01	<0.8	0.13	0.01	<0.01	<0.01	0.01	0.3	0.3	5.1	0.8	2.7	2.7	None
CR-13-14	7.49	8.60	0.04	3.3	0.16	0.01	<0.01	0.04	<0.01	1.3	0.3	6.7	3.3	2.7	10.7	None
min	5.71	8.05	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.31	0.31	5.10	0.83	2.67	0.89	-
10th percentile	6.52	8.11	0.01	0.03	0.03	0.01	0.01	0.01	0.01	0.31	0.31	5.62	0.83	2.67	1.33	-
25th percentile	6.65	8.15	0.01	0.05	0.05	0.01	0.01	0.01	0.01	0.31	0.31	5.80	0.83	2.67	1.33	-
median	7.20	8.33	0.01	0.08	0.08	0.02	0.01	0.01	0.02	0.31	0.63	6.50	0.83	2.67	2.67	-
75th percentile	7.61	8.60	0.01	0.13	0.13	0.02	0.01	0.01	0.02	0.31	0.63	6.70	0.83	2.67	2.67	-
90th percentile	7.94	8.88	0.06	0.17	0.17	0.05	0.01	0.04	0.02	1.19	1.44	9.53	5.33	3.95	4.16	-
max	8.83	8.99	0.08	0.31	0.31	0.05	0.01	0.05	0.03	1.56	1.56	16.16	6.67	6.22	10.67	-
mKqW																
LX-C-45	6.59	7.64	<0.01	<0.8	0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.3	0.6	0.8	2.7	2.7	None
LX-C-44	6.97	7.45	<0.01	<0.8	0.03	<0.01	<0.01	<0.01	<0.01	0.3	0.3	3.4	0.8	2.7	2.7	None
LX-C-20	8.77	9.36	<0.01	<0.8	<0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.3	1.5	0.8	2.7	2.7	None
LX-C-13	7.25	8.97	0.02	1.7	0.05	<0.01	<0.01	<0.01	<0.01	0.3	0.3	5.4	1.7	5.3	5.3	None
LX-C-50	8.43	8.92	0.02	1.7	0.04	<0.01	<0.01	<0.01	<0.01	0.3	0.3	4.5	1.7	5.3	5.3	None
LX-C-9	6.05	8.07	<0.01	<0.8	0.06	<0.01	<0.01	<0.01	<0.01	0.3	0.3	5.6	0.8	2.7	2.7	None
LX-C-58	6.57	7.73	<0.01	<0.8	0.06	<0.01	<0.01	<0.01	<0.01	0.3	0.3	1.1	0.8	2.7	2.7	None
LX-C-59	8.58	9.13	0.05	4.2	0.09	<0.01	<0.01	<0.01	<0.01	0.3	0.3	6.5	4.2	13.3	13.3	None
LX-C-6	8.16	8.84	0.05	4.2	0.14	0.02	<0.01	0.02	<0.01	0.6	0.6	8.2	4.2	6.7	6.7	None
LX-C-7	8.33	8.44	0.04	3.3	0.18	0.03	<0.01	0.02	0.01	0.6	0.9	7.4	3.3	5.3	3.6	None
LX-C-32	8.41	8.83	0.01	0.8	0.07	0.02	<0.01	<0.01	0.02	0.3	0.6	6.1	0.8	2.7	***1.3***	None
LX-C-30	5.99	7.91	<0.01	<0.8	0.07	<0.01	<0.01	<0.01	<0.01	0.3	0.3	6.0	0.8	2.7	2.7	None
LX-C-31	6.60	8.46	0.01	0.8	0.06	0.01	<0.01	<0.01	0.01	0.3	0.3	5.8	0.8	2.7	2.7	None
LX-C-29	6.16	8.04	<0.01	<0.8	0.06	0.02	<0.01	<0.01	0.02	0.3	0.6	6.4	0.8	2.7	***1.3***	None
LX-C-60	7.31	8.32	0.01	0.8	0.04	0.01	<0.01	<0.01	0.01	0.3	0.3	5.1	0.8	2.7	2.7	None
FRG-13-01	8.58	8.98	<0.01	<0.8	0.01	0.02	<0.01	<0.01	0.02	0.3	0.6	20.1	0.8	2.7	***1.3***	None
FRG-13-02	8.36	8.84	<0.01	<0.8	0.01	<0.01	<0.01	<0.01	<0.01	0.3	0.3	6.0	0.8	2.7	2.7	None
FRG-13-04	8.92	9.08	0.52	43.3	0.54	0.02	<0.01	<0.01	0.02	0.3	0.6	25.3	43.3	138.7	69.3	Slight
FRG-13-05	8.67	9.58	0.03	2.5	0.05	0.02	<0.01	0.01	0.01	0.3	0.6	4.7	2.5	8.0	4.0	None
CR-13-05	8.72	9.14	0.12	10.0	0.15	0.01	<0.01	<0.01	0.01	0.3	0.3	12.5	10.0	32.0	32.0	Slight
CR-13-10	6.52	7.93	<0.01	<0.8	0.43	0.02	<0.01	<0.01	0.02	0.3	0.6	7.1	0.8	2.7	***1.3***	None
CR-13-11	7.46	8.32	<0.01	<0.8	0.08	0.15	<0.01	<0.01	0.15	0.3	4.7	3.8	0.8	2.7	***0.2***	None
min	5.99	7.45	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.31	0.31	0.60	0.83	2.67	0.18	-
10th percentile	6.20	7.75	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.31	0.31	1.69	0.83	2.67	1.33	-
25th percentile	6.59	8.05	0.01	0.04	0.04	0.01	0.01	0.01	0.01	0.31	0.31	4.55	0.83	2.67	2.67	-
median	7.81	8.65	0.01	0.06	0.06	0.01	0.01	0.01	0.01	0.31	0.31	5.90	0.83	2.67	2.67	-
75th percentile	8.54	8.98	0.03	0.09	0.09	0.02	0.01	0.01	0.02	0.31	0.63	6.95	2.29	5.33	5.00	-
90th percentile	8.72	9.14	0.05	0.18	0.18	0.02	0.01	0.01	0.02	0.31	0.63	12.07	4.17	12.80	12.67	-
max	8.92	9.58	0.52	0.54	0.54	0.15	0.01	0.02	0.15	0.63	4.69	25.30	43.33	138.66	69.33	-
mKqW																
LX-C-39	9.21	9.59	0.11	9.2	0.11	<0.01	<0.01	<0.01	<0.01	0.3	0.3	8.9	9.2	29.3	29.3	Slight
LX-C-24	7.27	8.67	0.01	0.8	0.02	<0.01	<0.01	<0.01	<0.01	0.3	0.3	3.9	0.8	2.7	2.7	None
LX-C-19	7.16	8.41	<0.01	<0.8	0.03	<0.01	<0.01	<0.01	<0.01	0.3	0.3	3.9	0.8	2.7	2.7	None
LX-C-17	6.65	8.47	<0.01	<0.8	0.02	<0.01	<0.01	<0.01	<0.01	0.3	0.3	2.8	0.8	2.7	2.7	None
LX-C-12	8.38	9.03	0.05	4.2	0.16	<0.01	<0.01	<0.01	<0.01	0.3	0.3	6.6	4.2	13.3	13.3	None
min	6.65	8.41	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.31	0.31	2.80	0.83	2.67	2.67	-
10th percentile	6.85	8.43	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.31	0.31	3.24	0.83	2.67	2.67	-
25th percentile	7.16	8.47	0.01	0.02	0.02	0.01	0.01	0.01	0.01	0.31	0.31	3.90	0.83	2.67	2.67	-
median	7.27	8.67	0.01	0.03	0.03	0.01	0.01	0.01	0.01	0.31	0.31	3.90	0.83	2.67	2.67	-
75th percentile	8.38	9.03	0.05	0.11	0.11	0.01	0.01	0.01	0.01	0.31	0.31	6.60	4.17	13.33	13.33	-
90th percentile	8.88	9.37	0.09	0.14	0.14	0.01	0.01	0.01	0.01	0.31	0.31	7.98	7.17	22.93	22.93	-
max	9.21	9.59	0.11	0.16	0.16	0.01	0.01	0.01	0.01	0.31	0.31	8.90	9.17	29.33	29.33	-

Note:
AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. AP is determined from sulfide sulfur content.
NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. Acid addition based on TIC content.
Net NP = Modified NP-AP
Carbonate NP is calculated from TIC originating from carbonates and is expressed in kg $CaCO_3$/tonne
Sulfate Sulfur determined by 25% HCl Leach with S by ICP Finish
Sulfide Sulfur determined by Sobek 1:7 Nitric Acid with S by ICP-MS Finish
Insoluble S is acid insoluble S (Total S - (Sulfate S + Sulfide S)).
Bold red italics indicate PAG (NPR < 2)

Appendix E
Revised Risk Matrix - Freegold Road Extension

CASINO
COPPER AND GOLD

Chainage		Overall Risk	Stressors						**Stressor**	Pathway		**Pathway**	Receptor		**Receptor**
From	To		Rock Code	Rock Type Rating	Colluvium (c), alluvium (a) or bedrock (r)	Overall Geology Rating	Total cut (Soil or Rock) (em^3)	Cut Rating	**Rating**	Drainage Area (hectares)	Pathway Ratio	**Rating**	Species Sensitivity	Habitat Resiliency	**Rating**
Soil Cut															
Big Creek (main stem)															
82+960	83+860	6	mKqW	2	a	1	363	1	**1**	1,603	0.2	**1**	3	3	**6**
83+860	88+840	72	mKqW	2	a/c/r	2	42,061	3	**6**	1,730	24	**2**	3	3	**6**
88+840	89+010	0	mKqW	2	a/c	1	0	0	**0**	83.2	0	**0**	3	3	**6**
89+010	89+620	6	mKN	2	a	1	161	1	**1**	4,068	0.04	**1**	3	3	**6**
89+620	90+450	12	EJyL	2	a/c	1	2,344	2	**2**	142	17	**2**	1	2	**3**
90+450	93+040	36	mKN	2	a/c	1	22,086	3	**3**	1,126	20	**2**	3	3	**6**
93+040	94+330	3	mKqW	2	a/c	1	279	1	**1**	3,424	0.08	**1**	1	2	**3**
94+330	97+220	36	mKN	2	a/c	1	11,742	3	**3**	811	14	**2**	3	3	**6**
97+220	97+280	0	mKN	2	c	1	0	0	**0**	14.4	0	**0**	3	3	**6**
97+280	97+320	0	mKqW	2	a/c	1	0	0	**0**	21.0	0	**0**	2	3	**5**
97+320	97+940	15	mKqW	2	a/c	1	10,368	3	**3**	1,962	5	**1**	2	3	**5**
97+940	103+690	60	mKgW	3	a/c	2	25,257	3	**6**	1,907	13	**2**	2	3	**5**
Big Creek headwaters															
103+690	104+680	30	mKgW	3	a/c	2	8,414	3	**6**	1,116	8	**1**	2	3	**5**
104+680	105+080	30	DMN/mKgW	4	c	3	234	1	**3**	7.91	30	**2**	2	3	**5**
105+080	107+720	40	mKgW	3	c	2	6,095	2	**4**	189	32	**2**	2	3	**5**
107+720	107+800	0	uKC1	2	c	1	0	0	**0**	95.7	0	**0**	2	3	**5**
107+800	110+540	8	mKgW	3	a/c	2	7,416	2	**4**	987	8	**1**	1	1	**2**
110+540	110+740	0	uKC1	2	c	1	0	0	**0**	34.2	0	**0**	1	1	**2**
110+740	113+260	12	DMN	4	c	3	880	2	**6**	508	2	**1**	1	1	**2**
Hayes Creek headwaters															
113+260	114+190	0	DMN	4	c	3	0	0	**0**	268	0	**0**	1	1	**2**
114+190	119+680	12	mKqW	2	a/c	1	36,759	3	**3**	1,841	20	**2**	1	1	**2**
119+680	121+640	8	uKC1	2	a/c	1	6,633	2	**2**	925	7	**1**	1	3	**4**
121+640	123+720	24	uKC1	2	a/c	1	20,518	3	**3**	744	28	**2**	1	3	**4**
123+720	124+340	12	mKgW	3	a/c	2	1,796	2	**4**	273	7	**1**	1	2	**3**
124+340	127+010	36	uKC1	2	a/c	1	27,549	3	**3**	139	198	**3**	1	3	**4**
127+010	127+360	0	uKC1	2	c	1	0	0	**0**	14,314	0	**0**	2	3	**5**
127+360	127+780	0	LKfP	4	a/c	3	0	0	**0**	102	0	**0**	2	3	**5**
127+780	127+920	0	mKgW	3	a	1	0	0	**0**	446	0	**0**	2	3	**5**
Hayes Creek (valley bottom)															
127+920	132+700	30	mKgW	3	a/c	2	18,292	3	**6**	2,770	7	**1**	2	3	**5**
132+700	133+090	20	mKgW	3	a	1	2,033	2	**2**	95.1	21	**2**	2	3	**5**
133+090	134+440	30	mKgW	3	a/c	2	19,790	3	**6**	4,406	4	**1**	2	3	**5**
134+440	134+740	30	mKqW	2	a/c	1	6,610	2	**2**	18.9	350	**3**	2	3	**5**
134+740	135+180	0	mKgW	3	a/c	2	0	0	**0**	43.9	0	**0**	2	3	**5**
135+180	135+370	0	mKgw	3	a/c	2	0	0	**0**	3.49	0	**0**	2	3	**5**
135+370	135+540	0	DMgPW	3	a/c	2	0	0	**0**	26.7	0	**0**	2	3	**5**
135+540	135+700	0	mKqW	2	a/c	1	0	0	**0**	18.8	0	**0**	2	3	**5**
135+700	136+650	10	DMgPW	3	a/c	2	60	1	**2**	1,951	0.03	**1**	2	3	**5**
136+650	136+760	0	DMgPW	3	a	1	0	0	**0**	5.63	0	**0**	2	3	**5**
136+760	138+220	0	DMgPW	3	a	1	0	0	**0**	101	0	**0**	2	3	**5**
138+220	138+940	5	DMgPW	3	a	1	91	1	**1**	104	1	**1**	2	3	**5**
138+940	139+820	20	DMgPW	3	a	1	976	2	**2**	85.7	11	**2**	2	3	**5**
139+820	148+860	60	DMgPW	3	a/c	2	65,716	3	**6**	6,232	11	**2**	2	3	**5**
148+860	149+450	135	DMN	4	a/c	3	8,023	3	**9**	16.4	489	**3**	2	3	**5**
149+450	149+840	0	DMN	4	a	1	0	0	**0**	12.3	0	**0**	3	3	**6**
149+840	152+180	0	DMN	4	a/c	3	0	0	**0**	272	0	**0**	3	3	**6**
152+180	155+190	60	mKgW	3	a/c	2	17,603	3	**6**	984	18	**2**	2	3	**5**
155+190	156+560	20	mKgW	3	a/c	2	1,403	2	**4**	39,613	0.04	**1**	2	3	**5**

Chainage		Overall Risk	Stressors						**Stressor**	Pathway		**Pathway**	Receptor		**Receptor**
From	To		Rock Code	Rock Type Rating	Colluvium (c), alluvium (a) or bedrock (r)	Overall Geology Rating	Total cut (Soil or Rock) (em^3)	Cut Rating	**Rating**	Drainage Area (hectares)	Pathway Ratio	**Rating**	Species Sensitivity	Habitat Resiliency	**Rating**
Rock Cut															
Hayes Creek (rock cut area)															
156+560	156+940	60	mKgW	3	r	3	2,663	2	**6**	34.9	76	**2**	2	3	**5**
156+940	158+190	135	mKgW	3	r	3	46,159	3	**9**	136.5	338	**3**	2	3	**5**
158+190	158+340	180	mKdW	3	r	3	11,090	3	**9**	2.05	5,409	**4**	2	3	**5**
158+340	158+480	48	mKgW	3	r	3	4,390	2	**6**	73.2	60	**2**	1	3	**4**
158+480	158+720	144	mKdW	3	r	3	13,616	3	**9**	10.5	1,293	**4**	1	3	**4**
158+720	159+160	144	mKgW	3	r	3	7,435	3	**9**	6.43	1,156	**4**	1	3	**4**
159+160	165+90	144	mKdW	3	r	3	360,110	4	**12**	1,162	310	**3**	1	3	**4**
165+90	166+090	144	mKgW	3	r	3	21,110	3	**9**	3.53	5,973	**4**	1	3	**4**
Mascot Creek															
166+090	168+740	81	mKgW	3	r	3	23,394	3	**9**	120	195	**3**	1	2	**3**
168+740	177+110	54	mKdW	3	r	3	34,819	3	**9**	631	55	**2**	1	2	**3**
Idaho/Isaac/Sunshine Creek															
177+110	178+470	72	mKdW	3	r	3	16,677	3	**9**	270	62	**2**	1	3	**4**
178+470	178+850	108	mKgW	3	r	3	12,156	3	**9**	64.0	190	**3**	1	3	**4**
178+850	178+930	96	LKqP	4	r	4	914	2	**8**	1.17	781	**3**	1	3	**4**
178+930	178+980	32	LKfP	4	r	4	72	1	**4**	0.849	85	**2**	1	3	**4**
178+980	179+820	256	LKqP	4	r	4	51,831	4	**16**	30.1	1,721	**4**	1	3	**4**
179+820	182+900	90	mKgW	3	r	3	41,383	3	**9**	873	47	**2**	2	3	**5**
182+900	186+080	180	DMN	4	r	4	37,436	3	**12**	275	136	**3**	2	3	**5**
186+080	194+870	180	mKgW	3	r	3	86,893	4	**12**	551	158	**3**	2	3	**5**
Casino Creek															
194+870	196+500	60	mKdW	3	r	3	3,369	2	**6**	43.1	78	**2**	2	3	**5**
196+500	197+360	0	mKdW	3	r	3	0	0	**0**	12.4	0	**0**	2	3	**5**
197+360	198+100	15	mKgW	3	r	3	18	1	**3**	17.4	1	**1**	2	3	**5**
198+100	199+740	135	mKdW	3	r	3	15,573	3	**9**	78.6	198	**3**	2	3	**5**
199+740	200+280	30	mKgW	3	r	3	266	1	**3**	5.74	46	**2**	2	3	**5**
200+280	202+850	90	mKdW	3	r	3	10,605	3	**9**	112	94	**2**	2	3	**5**
202+850	203+050	120	LKfP	4	r	4	2,824	2	**8**	20.2	140	**3**	2	3	**5**

Overall Risk Rating

<49 - Very low risk
50-99 - Low risk
100-149 - Moderate-low risk
150-199 - Moderate risk
>200 - Moderate-high risk

Rating is uncertain, conservative

Rock Codes

DMN	Nasina - quartzite and quartz-mica schist
DMgPW	Pelly Gneiss suite - schist and gneiss
EJyL	Long Lake suite - syenitic granitc rocks
mKdW	Whitehorse suite - diorite
mKgW	Whitehorse suite - granodiorite
mKqW	Whitehorse suite - granodiorite to quartz monzonite
mKN	Mount Nansen - volcanic flows and subvolcanic intrusions
uKC1	Carmacks - volcanic sequence
LKP	Prospector Mountain suite - quartz-rich monzonite stock (LKqP) with latite dykes (LKfP)

CASINO
COPPER AND GOLD

Casino Waste Rock and Ore Geochemical Static Test Assessment



Project No. J862-5
3 December 2013

LORAX ENVIRONMENTAL

2289 Burrard Street
Vancouver, BC, V6J 3H9
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1-604-688-7173

Executive Summary

CASINO
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Executive Summary

The Casino deposit is a large gold-copper-molybdenum (Au-Cu-Mo) porphyry deposit that occurs in the Yukon Crystalline Terrane. The mineralization of the Casino deposit occurs as a leached oxide gold cap (CAP) that overlies a copper enriched supergene (SUP) zone and a lower copper-gold hypogene (HYP) zone. The majority of the waste lies in the CAP (32%) and HYP (37%) mineralization zones. Four generalized lithological groups are defined in the Casino deposit:

- WR – Dawson Range batholith (granodiorite) and earlier metamorphic rocks,
- PP – Patton Porphyry (dacite to rhyodacite),
- IX – Intrusion breccia (PP matrix with WR clasts), and
- MX – Post-mineral explosion breccia (latite with microbreccia fragments).

Geochemical sampling from 2008 through 2012 was conducted in four phases that collected a total of 1,444 drill core samples and 33 test pit samples. The majority of samples (n = 675) were taken from the HYP zone that comprises the majority of the waste rock. In addition, overburden (n = 3), CAP (n = 494), SOX (n = 82), SUS (n = 186) and unknown (n = 4) samples were also obtained.

The static test data indicate that the major geologic control on the deposit's ARD characteristics are the four major mineralization zones and the primary lithology only has limited influence particularly in the most highly weathered and altered zones of CAP, SOX and SUS. XRD quantitative phase analyses determined that CAP rock is typically devoid of carbonate and sulphur is primarily in the form of the sulphate mineral jarosite. SOX and SUS rock have variable mineral compositions and the boundary between these two units is not always well defined. SOX has a similar composition as CAP (carbonate absent and jarosite present) but may also contain pyrite and/or secondary sulphide minerals. SUS rock tends to have sulphur in the form of gypsum, secondary sulphides and pyrite. Carbonate is absent more often than not but can be present in sufficient quantities to buffer acidity. HYP rock typically contains carbonate and sulphur in the form of gypsum, pyrite and chalcopyrite.

Acid-Base accounting (ABA) data indicate that the majority of the rock in the deposit is potentially acid generating (PAG). Based on the proportion of non-acid generating (NAG) samples from each mineralized zone it is estimated that 27.4 Mt of NAG waste rock is present in the deposit.

Zone	% of NAG Samples	Quantity of NAG Waste Rock (t x 1000)
CAP	5%	10,501
SOX	0%	-
SUS	0%	-
HYP	7%	16,931
Total	5%	27,432

CAP lacks neutralization potential (NP) and has median paste pH of 4.7. The CAP waste rock contains sulphate (median = 0.41 %S) in the form of jarosite that has acid generating potential. Due to these characteristics the majority of CAP rock is expected to be capable of producing ARD almost immediately following exposure. However, drainage is expected to be maintained between pH 4.0 and 5.0 due to the lack of sulphide mineralization.

SOX and SUS waste rock have a greater acid generating potential than the CAP, these zones have a greater sulphur content (median = 2.2 %S and 3.1 %S, respectively) than the CAP and a portion of this sulphur is in the form of pyrite. Although carbonate can be present in the SUS zone, the majority of the supergene waste rock is expected to become acidic shortly after exposure.

The majority of HYP waste rock is also PAG, however, there is sufficient carbonate in this zone to maintain neutral pH for several years to decades following exposure. Available carbonate NP (10^{th} percentile = 3 $kgCaCO_3/t$) and paste pH (10^{th} percentile = 6.45) indicates that the majority of HYP waste rock will initially be neutral. Acid potential is primarily in the form of pyritic sulphur (median sulphide S = 1.8 %S), however, sulphate can also be present in the form of gypsum.

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1. Introduction

CASINO
COPPER AND GOLD

1. Introduction

1.1 Project Background

Lorax Environmental Services Ltd. (Lorax) was retained to complete a geochemical characterization of the waste rock that will be produced during operations of Casino Mining Corporation's (CMC) proposed Casino Project. The Casino Project is a gold-copper-molybdenum porphyry deposit that consists of an oxide gold leach cap overlying copper enriched supergene and hypogene zones. The site is located in the Yukon Territory at latitude 62° 44'N and longitude 138° 50'W, 300 km northwest of Whitehorse (Figure 1-1) (M3 Engineering, 2013). The deposit is situated on a small divide in the north-westerly trending Dawson Range. Drainage from the northern part of the property flows to Canadian Creek and eventually into the Yukon River while drainage from the southern part of the property flows southward via Casino Creek and eventually northward to the Yukon River. The village of Pelly Crossing is the nearest community, approximately 115 km to the east.

Mining at Casino will be carried out by open pit using conventional truck and shovel methods. Casino Mining Corporation is planning to use two ore extraction processes based on the style of mineralization of the Casino deposit. Gold and copper from the leached oxide cap ore will be extracted in a heap leach, whereas ore from the supergene and hypogene zones will be processed in a mill through a flotation circuit. As such, three waste streams will be produced during operations, including waste rock, flotation tailings from milled ore and residual heap leach residue.

Several consulting firms are involved with completing the baseline studies for the Project to support future permitting activities as required under the Yukon Environmental and Socio-economic Assessment Act (YESAA). Lorax is conducting the geochemical characterization studies and contributing to the development of waste rock and tailings management plans in support of the environmental assessment.

The primary objective of this report is to depict the geochemical characteristics of waste rock, ore and pit walls that will be exposed during mining of the Casino Deposit. The geochemical data is meant to be used to delineate expected tonnages of potentially acid generating (PAG) waste versus non-acid generating (NAG) waste whereas elevated metal concentrations in the waste materials can be used to identify metals that are potentially of concern at the site. The geochemical assessment also allows identification of materials that can be used in the construction of mine site components and in the development of waste management strategies and waste handling protocols that are protective of the environment during construction, operations and post-closure activities of the mine.

Hence, characterizing the geochemistry of excavated or exposed mine rock at a mine site is an essential part of a successful metal leaching and acid rock drainage (ML/ARD) program that is required to obtain mining permits.



Figure 1-1: Map showing location of the Casino Deposit (M3 Engineering, 2008)

1.2 ML/ARD Background

The objective of the geochemical assessment is to evaluate the potential for ML/ARD associated with the weathering of geological materials produced during mining activities at the Casino site. This was achieved through several phases of static and kinetic geochemical testwork. Static testwork involves acid-base-accounting (ABA) techniques and solid-phase metal analysis. ABA compares the acid potential and neutralization potential of a sample to provide an overall theoretical acid generation potential for the sample. Solid-phase metals data are used to identify which metals are enriched in waste materials and could potentially leach from the waste rock stockpiles. Results of static testing are used to support laboratory and field-based kinetic testing. This report summarizes all static testwork for waste rock, ore and overburden conducted in support of the Casino geochemical assessment. The tailings static testing and kinetic testwork for both mine rock and tailings is presented under separate cover Lorax (2013).

Four phases of static testing have been completed for the Casino waste rock and ore. In January of 2009, Lorax issued the Casino Phase I Geochemical Assessment Report. The report provided an initial evaluation of the general geochemical characteristics of waste rock, tailings and ore based on static tests which were used to direct the second phase of the static test program, constrain the field kinetic test program, and assess the requirement for additional geochemical characterization of tailings samples. In January of 2010, Lorax issued the Phase II Geochemical Assessment Report, which focused on the waste rock and ore of the Casino deposit and was used to develop the waste rock laboratory kinetic test program.

In 2010, inconsistencies in drill core logs for the Casino deposit were recognized by CMC. Drill core was re-logged which resulted in a revised rock categorization system that included revision of the mineralization zone and lithologic unit designations in the logs. This report provides the complete results for all available samples, which includes a revision of the Phase I and Phase II data according to the 2010 re-logging, incorporates supplemental static testwork completed for Phase III (2009 sampling) and Phase IV (2011 sampling); and presents the results for overburden samples collected from test pits at the Casino site.

1.3 Report Structure

Following this introduction, Chapter 2 outlines the regional and deposit geology of the Casino deposit. The sample selection rationale, field methods and analytical techniques are discussed in Chapter 3. Chapters 4 and 5 discuss the results of the mineralogical investigations and static testing, respectively. Chapter 6 provides a summary of the most salient conclusions and discusses the implication of the results.

2. Geology

CASINO
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2. Geology

2.1 Regional Geology

The Casino deposit is a large gold-copper-molybdenum (Au-Cu-Mo) porphyry deposit that occurs in the Yukon Crystalline Terrane near the overlapping zone with the Yukon Cataclastic Terrane to the north (Figure 2-1) (M3 Engineering, 2013). An elongate band of ultramafic rocks 1 km north of the Casino deposit occurs along what may be a major tectonic suture, which separates the two terranes. Another major tectonic feature near the deposit is the Dip Creek Fault which lies to the east and south of the deposit.

The Yukon Cataclastic Terrane is dominated by rocks of the Yukon Metamorphic Complex with scattered intrusions of the Coffee Creek Suite. The Yukon Crystalline Terrane consists of the Dawson Range Batholith with scattered remnants (roof-pendants and blocks) of the Yukon Metamorphic Complex. The Casino Intrusion Complex is composed of stocks up to 5 km across that intrude the Dawson Range Batholith. The major fault in the deposit is the Casino Fault.

2.2 Local Geology of the Casino Deposit

A re-logging program was undertaken in 2010 in order to provide updated geological data for modeling purposes (M3 Engineering, 2013). Four generalized lithological groups were defined:

- WR – Dawson Range batholith and earlier metamorphic rocks,
- PP – Patton Porphyry,
- IX – Intrusion breccia, and
- MX – Post-mineral explosion breccia.

The Casino deposit is centered on a tonalite porphyry stock which intrudes the Dawson Range Batholith and the Yukon Metamorphic Complex. This intrusion caused brecciation at the margins, which has been observed along the northern, southern and eastern contacts. Younger intrusions, similar in composition to the tonalite stock, intrude both the tonalite and the country rock. A typical east –west cross section through the central portion of the Casino open pit is presented in Figure 2-2.

Unit 1 – Dawson Range Batholith and Earlier Metamorphic Rocks (WR)

The Dawson Range Batholith is the main country rock to the Casino deposit. It is dominantly granodiorite and diorite in composition with less abundant occurrences of quartz monzonite (Figure 2-2). The two main phases of granodiorite are (1) a hornblende-

bearing phase, mainly to the west, south, and eastern regions of the deposit, and (2) a biotite-hornblende-bearing phase to the north. The granodiorite is brecciated on the southern margin of the deposit, and in places, the cataclastic breccia grades into the microbreccia core of the deposit.

The earlier metamorphic rocks include the Yukon Metamorphic Complex. These occur mainly as fragments in intrusion breccia in the northern and north-eastern parts of the Casino deposit and locally as roof pendants in the Dawson Range Batholith (Figure 2-2). The most common rock type of this complex is mafic gneiss, dominated by plagioclase, biotite, and quartz. Less abundant types include metadiorite / amphibolite, quartz-rich and intermediate gneiss, and quartzite.

Unit 2 – Patton Porphyry (PP)

The Patton Porphyry represents two or more episodes of high-level intrusion of porphyritic rhyodacite. The main body is a few hundred meters across. Abundant PP fragments occur in the adjacent intrusion breccia. Elsewhere, PP forms many discontinuous dikes ranging from a few cm to 20 m wide. The contacts between PP and the breccia are variable and range from sharply intrusive to gradational.

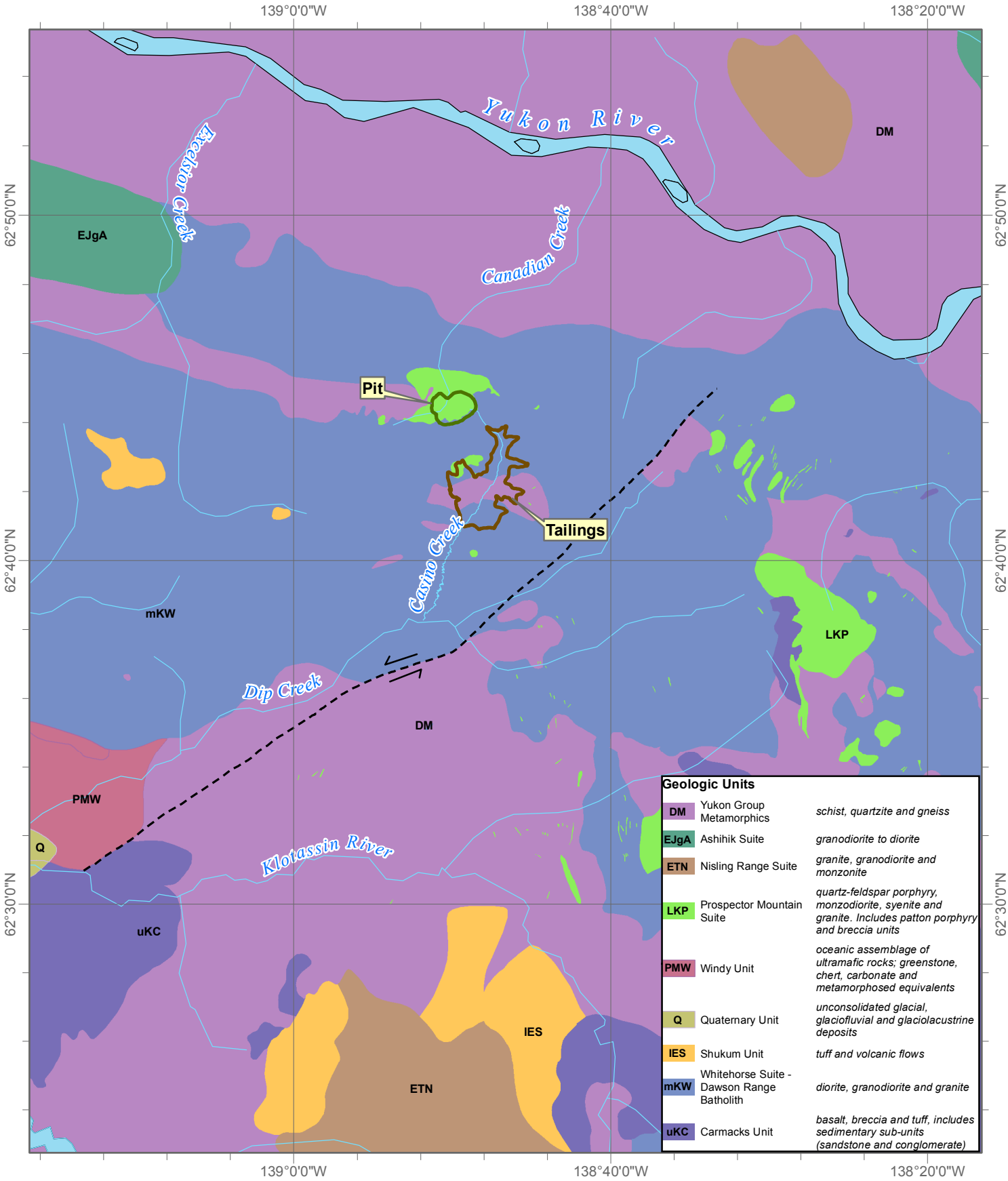
Most types of PP are porphyritic with plagioclase and biotite phenocrysts set in an aphanitic, medium to dark green latitic to rhyodacitic groundmass. Some chloritic aggregates may be altered hornblende grains. Much of PP is strongly potassically altered and poorly mineralized. One PP intrusion observed in the southeastern part of the core is well mineralized and may be closely associated with the hydrothermal fluids.

Unit 3 –Intrusion Breccia (IX)

This unit is a contact breccia formed at the intrusive contact between the Patton Porphyry and the Dawson Range batholith. It is heterolithic with a Patton Porphyry/potassic matrix. Clasts are generally sub-rounded and are generally from the country rock (Dawson Range Batholith and earlier Metamorphic rocks). The occurrence of this unit generally outlines the extent of the deposit.

Unit 4 – Post-Mineral Explosion Breccia (MX)

The explosion-breccia is an irregular, vertical pipe up to 100 m across near the southeast margin of the central microbreccia body. It contains sub-angular fragments, mainly of altered microbreccia, and less commonly of late, quartz-phyric dikes and WR in a latite groundmass. The breccia grades into a large latite dike. The late dikes, sills and breccias contain only minor base- and precious- metal mineralization, most of which is contained in mineralized and altered clasts of microbreccia.



LEGEND

- Dip Creek Fault
- Proposed Pit
- Proposed Tailings
- Watercourses
- Waterbodies

DATE SAVED:	Nov 25, 2013
DRAWN BY:	GM
REVIEWED:	BM
VERSION:	1

Coordinate System: World Mercator
Projection: Mercator
Datum: North American 1983
Units: Meter

1:600,000

0 5 10 Km

CLIENT: CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT: **Casino Waste Rock and Ore Geochemical Static Test Assessment**

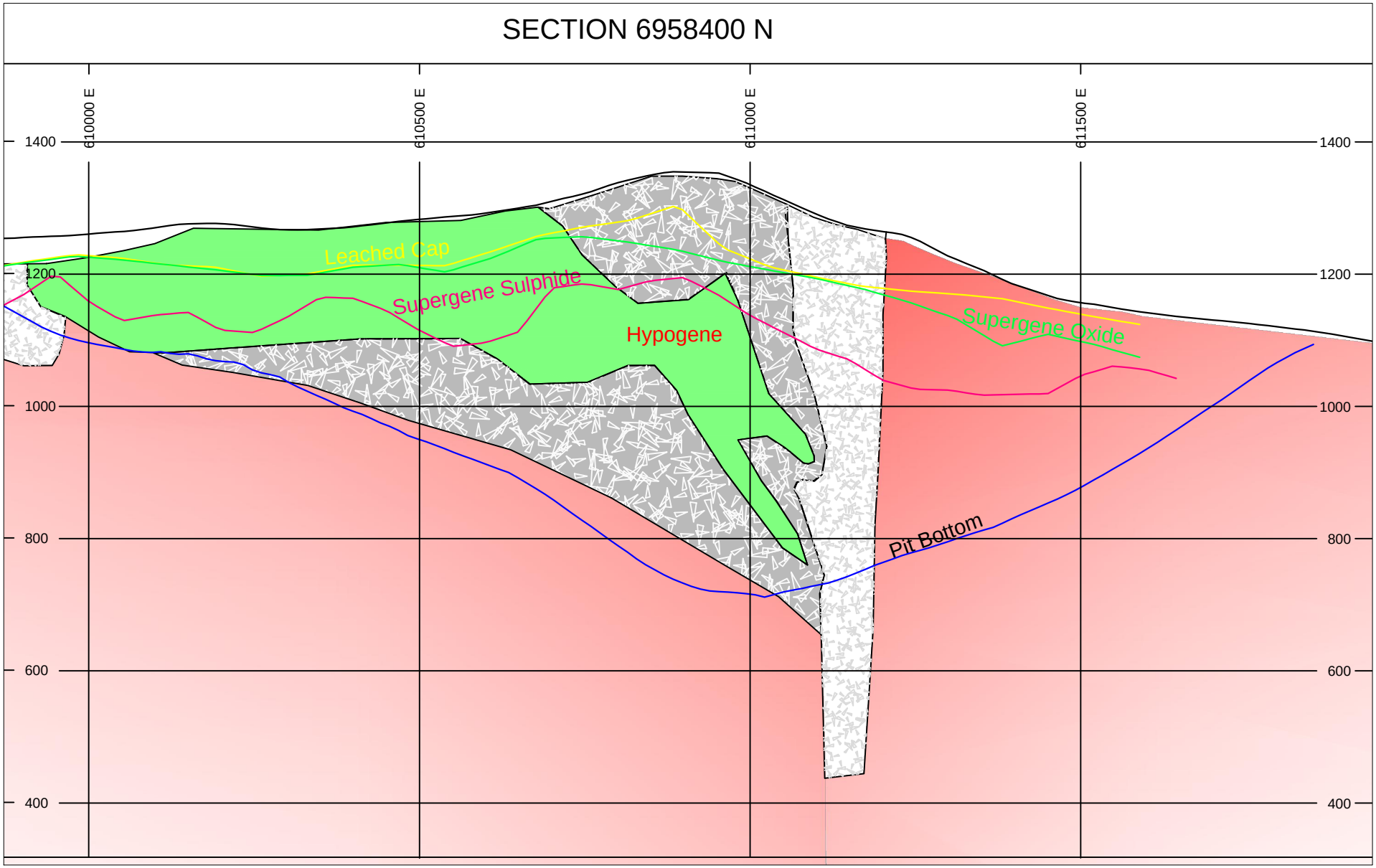
TITLE: Regional Geology Map of the Casino Project Area

PROJECT #: J862-5

FIGURE: 2-1

P:\J862 (Casino)\Road\Drafting\MXDs\Regional Geology Map of the Casino Project Area_20131122v2_GM.mxd

SECTION 6958400 N



LEGEND

Late Cretaceous - Prospector Mountain Suite
- Explosion Breccia
- Intrusion Breccia
- Patton Porphyry Hypabysal Intrusion

Mid Cretaceous - Dawson Range Intrusion
- Diorite - Granodiorite

- Supergene Oxide
- Pit Bottom
- Leached Cap
- Supergene Sulphide
- Topographic Surface

Notes: Original drawing provided by Casino Mining Corporation

DATE SAVED:	Nov 25, 2013
DRAWN BY:	GM
REVIEWED:	BM
VERSION:	1

0 125 250 M

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LORAX ENVIRONMENTAL

PROJECT: **Casino Waste Rock and Ore Geochemical Static Test Assessment**

TITLE: Geological Cross Section of the Casino Intrusive Complex (Section 6958400 N)

PROJECT #: J862-5

FIGURE: 2-2

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2.2.1 Mineralization Zones of the Casino Intrusive Complex

The mineralization of the Casino deposit occurs as a leached oxide gold cap (CAP) that overlies a copper enriched supergene (SUP) zone and a lower copper-gold hypogene (HYP) zone. An illustration showing the relationship of these mineralized zones and the primary stratigraphic units in an E-W vertical cross section through the central portion of the open pit is provided in Figure 2-2.

Leached Cap (Oxide Gold) Zone (CAP)

The Casino deposit is weathered to a depth of up to 300 m producing a well-defined leached cap (CAP). The CAP averages 70 m thick and is characterized by boxwork textures partly filled by earthy limonite, jarosite, goethite and hematite. Gold is enriched in the CAP relative to the SUP and HYP zones.

Supergene Oxide and Sulphide Zones (SOX and SUS)

Supergene alteration at Casino consists of a poorly defined upper copper oxide zone that overlies a more defined copper sulphide zone. The poorly defined supergene oxide zone (SOX) averages 10 m in thickness and separates the CAP from the supergene sulphide zone (SUS). The SOX also forms perched bodies in the CAP. Copper-bearing minerals in the SOX include chalcanthite, malachite and brochantite and minor azurite, tenorite, cuprite, and neotocite.

Thickness and grade of the SUS varies widely depending on the distribution of pyrite, fracture density, and the erosion surface at the time of leaching. The SUS averages 60 m in thickness and is characterized by a high pyrite content of the phyllic and/or outer potassic zone, which promotes leaching. Secondary enrichment zones are thickest near the contact of potassic and phyllic alteration. The SUS has an overall copper enrichment that can be up to double the grade of the hypogene zone. The highest grades are in the fractured and highly pyritic zones (M3 Engineering, 2013).

Hypogene Zone (HYP)

The bulk of the sulphide ore mineralization occurs in and adjacent to the intrusion breccias and microbreccia. Molybdenite is concentrated moderately as discrete flakes and selvages in quartz veins in the core of the deposit. Chalcopyrite is concentrated moderately towards the periphery, just inside the potassic/phyllic alteration contact. Chalcopyrite occurs in veins, disseminations, and irregular patches. On the west side of the Casino Fault disseminated chalcopyrite is more abundant. On the east side of the Casino Fault, the dominant style of mineralization consists of fracture controlled, open

space fillings and chalcopyrite with carbonate and gypsum as breccia matrix. The pyrite/chalcopyrite ratio ranges from <2:1 in the potassic zone to >20:1 in the phyllic.

Native gold occurs as free grains (50-70 μm) in quartz and inclusions (1-15 μm) in fractures in pyrite and chalcopyrite grains. Within the HYP, commonly vuggy, polymetallic base metal veins were introduced into fractures. The veins vary in mineralogy, containing sphalerite, galena, and calcite/ankerite, with minor quartz, tetrahedrite, and chalcopyrite. Some veins are dominated by chalcopyrite and/or pyrite, typically geo-chemically anomalous in Ag, As, Au, Bi, Cu, Cd, Mn, Pb, Sb, and Zn.

2.2.2 Alteration of the Casino Intrusion Complex

The 2010 re-logging program defines four alteration types at the Casino deposit:

- Potassic (POT),
- Phyllic (PHY),
- Argillic (ARG), and
- Propylitic (PRO).

The dominant type of alteration varies by mineralization zone. Phyllic and potassic alteration are the dominant alteration types in the SUS and HYP zones, while argillic alteration is dominant in the CAP and SOX zones. Propylitic alteration is relatively uncommon within the deposit.

The potassic alteration suite is nearest to the core of the deposit and comprises K-feldspar, biotite, magnetite, anhydrite, gypsum, pyrite, chalcopyrite, molybdenite, gold and trace concentrations of sphalerite and bornite. Potassic alteration is most prominent in the groundmass of the microbreccia and bordering granodiorite. A sericite-chlorite-clay suite forms irregular patches along the border of, and within, this potassic alteration zone. Ankeritic carbonate-gypsum alteration overprints potassic alteration in the vicinity and to the east of the Casino Fault. Total sulphides are <5% (Halle Geological, 2010b).

The phyllic suite (to the south and southeast) contains sericitized, quartz-sericite and silicified rocks. Other common minerals associated with phyllic alteration include pyrite, tourmaline and clays. The gold, copper, molybdenum and tungsten associated with this type of alteration are concentrated as disseminations and veins of pyrite, chalcopyrite and molybdenite along the pyrite halo. Phyllic alteration is strongly fracture controlled. Sporadically developed in both alteration zones are clay-rich assemblages (kaolinite, sericite, and/or montmorillonite). A pyrite halo, within the phyllic zone, follows the contact with the potassic zone. It is discontinuous around the main breccia body and has

the highest copper values (M3 Engineering, 2013). Pyrite is generally between 5-10% (Halle Geological, 2010b).

Argillic alteration is secondary weathering where kaolinite replaces both mafic and felsic minerals (Halle Geological, 2010). Argillic alteration overprints the other alteration types (Halle Geological, 2010b). Advanced argillic alteration has been eroded away at the top of the Casino deposit.

Propylitic alteration forms a shell around the deposit and contains chlorite, epidote and pyrite (Halle Geological, 2010). It is generally high in sulphides (pyrite >5%).

3. Methodology

CASiNO
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3. Methodology

3.1 Sample Collection

The main objectives of the waste rock and ore sampling program for the Casino Project were to 1) produce a dataset representative of all types of materials, including mineralization zones, ore/waste designation, lithologies and alteration type; and 2) obtain an adequate number of samples to produce a scientifically defensible dataset. Mineralization zones, lithologies and alteration types of the Casino deposit were described in Chapter 2. The delineation of waste rock from ore in the Casino deposit is based on the cut off grade determined by copper (Cu), gold (Au), molybdenum (Mo) and silver (Ag) concentrations. For the present study, the distinction between ore and waste rock is based on the following copper equivalent (CuEQ) formula, provided by Casino Mining Corporation, from the 2013 Pre-Feasibility report and a cut-off of 0.25% (M3 Engineering, 2013). The equation is based on the following CuEQ metal prices: US$2.00/lb copper, US$875/oz gold, US$11.25/lb molybdenum and US$11.25/oz silver. The CuEQ for each sample was calculated using the drill assay results.

$$CuEQ = [Cu\% + \left(Au\ g/t * \frac{28.13}{44.1}\right) + \left(Mo\% * \frac{248.06}{44.1}\right) + \left(Ag\ g/t * \frac{0.36}{44.1}\right)]$$

Estimated tonnages and relative proportions of waste rock that have been defined for the major lithological units in each mineralized zone of the Casino deposit are provided in Table 3-1. According to Price and Errington (1998), the recommended number of samples required to characterize the geochemical properties of the Casino waste rock is in excess of 6,000 samples. Given the number of geochemical tests involved, a phased approach was implemented which involved an initial reconnaissance study (Phase I) in 2008 followed by three stages of further sampling (Phases II, III and IV). Overburden samples were collected in 2011 and 2012.

Table 3-1 demonstrates that the majority of the waste lies in the CAP and HYP (approximately 32% from CAP and 37% from HYP). Prior to collecting material for geochemical characterization, drill core sample intervals were selected after reviewing the geological cross sections and the drill core database provided by Casino Mining Corporation. The sample intervals were selected to be contained within a single lithologic unit. Sample locations were selected and distributed spatially within the pit limits as allowed by the distribution of existing drilling and to include both ore and waste from the major lithologic units.

Table 3-1:
Estimated waste rock tonnages (tonnes x 1,000) and relative proportions of waste rock (%) for the Casino Project.

Zone	Estimated Tonnages (tonnes x 1000)	Relative Proportion
Overburden	17,504	2.7%
CAP	210,022	31.9%
SOX	49,213	7.5%
SUS	137,991	21.0%
HYP	241,873	36.8%
Waste - Unclassified	1,264	0.2%
Total Waste	*657,867*	*100%*

Note that most of the drill core sampled for Phase I and Phase II was produced by Pacific Sentinel Gold Corporation, which acquired the Casino property in 1992 and carried out a major drilling program until 1995. As such, drill core samples used in this assessment were stored at the Casino site and exposed to natural weathering conditions for more than 15 years. The incorporation of partially weathered mine rock for the static tests provides an advanced indication of waste rock and ore drainage chemistry which provides more certainty to long term drainage chemistry predictions. Phase III and Phase IV static test samples were collected from drill core produced during the more recent Casino Mining Corporation drilling program (2008-present).

3.1.1 Static Test Programs - Four Sampling Phases

Four phases of ML/ARD sampling have been completed to date by Lorax. Phase I and Phase II sampling events took place in two phases in 2008 by Lorax personnel, the results of which have been previously presented in Lorax (2009) and Lorax (2010). All samples were collected by hand from core racks stored at the Casino site. All samples collected during Phase I (129 samples) and Phase II (296 samples) were submitted for ABA and metal determination. In addition, 104 of the samples were selected for Shake Flask Extraction (SFE) testwork.

Phase III sampling was completed in 2009. Thirty-nine samples were collected at this time and submitted for ABA. These samples were collected from the more recent Casino Mining Corporation drilling program which began in 2008. They were collected in areas where there had previously been limited drilling.

The fourth phase of sampling was completed in 2011 and included 980 samples. Sampling focussed on the CAP and HYP, with fewer samples collected from the SUP. CAP samples are from drill core, while SUP and HYP samples are a combination of drill core samples and pulp samples. Sample locations were selected by Lorax personnel; however, collection of drill core was completed by a combination of on-site Casino Mining Corporation personnel and Lorax personnel. Pulp samples had been stored at West Coast Mineral Storage and the selected samples were sent directly to the analytical laboratory. Reduced analysis was conducted on the Phase IV samples. The CAP samples were submitted for rinse pH only and the SUP and HYP samples for total sulphur and total carbon. These parameters have been identified as critical parameters for acid generating potential for each of these zones, based on the results of the Phase I and Phase II sampling. A further discussion for these parameter choices is provided in Section 5.1.

A description of the samples is provided in Appendix A.1 including the cross section number, drill hole, sample interval, waste/ore designation, lithology, mineralization zone and alteration. Sample intervals typically range from 0.3 to 3 m within a single lithologic unit. The location of the drill holes sampled as part of the Phase I, II, III and IV studies are illustrated on a plan map in Figure 3-1. A series of east-west trending cross sections through the proposed open pit also illustrate the location of the static test samples (Appendix A.2). In addition to the sample locations, extensive geologic and mine planning information is presented in the cross sections along with select ABA results.

The samples collected were selected in rough proportion to the volume of material associated with each mineralization zone and lithologic unit within the ultimate pit. The distribution of samples collected for drill core static test programs are provided in Table 3-2.

Table 3-3 provides a description of the lithologic unit codes for the Casino deposit. Table 3-4 highlights the number of samples included in the geochemical assessment and the relative proportion of the lithologies in the Casino pit. The exception is the two samples located outside and to the east of the pit boundary were collected in order to obtain sufficient samples from the Yukon Metamorphic Group (now combined with the Dawson Range Batholith). This unit was encountered infrequently in the drill holes available for ARD sample selection, making it necessary to collect the samples outside of the pit boundary.

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Section 6959450N
Section 6959000N
Section 6958500N
Section 6958000N
Section 6957750N

Canadian Creek
Casino Creek

1340 1320 1300 1280 1260 1200 1220 1140 1100 1040 1160 1120 1080 1180 1240 1300 1320 1380 1360 1400 1420 1340

N

LEGEND

- Sampled By Lorax
- Not Sampled By Lorax
- Sections (500m interval)
- Sections (50m interval)
- Pit Outline
- Watercourses
- Topographic Contours (20m)

Notes: Original drawn by Casino Mining Corporation

Coordinate System: *NAD 1983 UTM Zone 7N*
Projection: *Transverse Mercator*
Datum: *North American 1983*
Units: *Meter*

1:9,000

0 200 400 Meters

DATE SAVED:	Nov 25, 2013
DRAWN BY:	GM
REVIEWED:	BM
VERSION:	1

CLIENT: CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT:

Casino Waste Rock and Ore Geochemical Static Test Assessment

TITLE: Phase I, II, III and IV Static Test Sample Drill Holes

PROJECT #: J862-5 *FIGURE:* 3-1

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Table 3-2:
Distribution of Samples Collected for the Casino ML/ARD Phase I, Phase II, Phase III and Phase IV Geochemical Assessments

Lithology	Overburden			Leach Cap			Supergene Oxide			Supergene Sulphide			Hypogene			Total
	ore	waste	unk	ore	waste	unk	ore	waste	unk	ore	waste	unk	ore	waste	unk	
Phase I Samples																
PP	-	-	-	-	11	-	-	1	-	-	3	-	-	9	-	24
IX	-	-	-	2	3	-	-	-	-	-	2	-	-	5	-	12
WR	-	-	-	5	28	-	-	4	-	-	10	-	-	33	-	80
MX	-	-	-	-	7	-	-	1	-	-	-	-	-	2	-	10
UNK	-	-	1	-	-	-	-	-	-	-	-	-	-	-	-	1
Total	**0**	**0**	**1**	**7**	**49**	**0**	**0**	**6**	**0**	**0**	**15**	**0**	**0**	**49**	**0**	**127**
Phase II Samples																
PP	-	-	-	-	10	-	2	-	-	4	9	-	5	17	-	47
IX	-	-	-	7	5	-	2	3	-	2	-	-	9	4	-	32
WR	-	1	-	16	27	-	10	10	-	12	13	-	37	69	-	195
MX	-	-	-	-	8	-	-	1	-	-	1	-	-	9	-	19
FZ	-	-	-	-	1	-	2	-	-	-	-	-	-	-	-	3
Total	**0**	**1**	**0**	**23**	**51**	**0**	**16**	**14**	**0**	**18**	**23**	**0**	**51**	**99**	**0**	**296**
Phase III Samples																
PP	-	-	-	2	-	-	2	-	-	2	1	-	2	4	-	13
IX	-	-	-	-	-	-	1	-	-	2	-	-	2	-	-	5
WR	-	-	-	-	2	-	-	-	-	5	1	-	3	7	-	18
MX	-	-	-	-	-	-	-	-	-	-	-	-	-	2	-	2
Total	**0**	**0**	**0**	**2**	**2**	**0**	**3**	**0**	**0**	**9**	**2**	**0**	**7**	**13**	**0**	**38**
Phase IV Samples																
PP	-	-	-	16	52	-	-	3	-	6	9	-	11	45	-	142
IX	-	-	-	12	10	-	-	-	-	4	-	-	19	9	1	55
WR	-	1	-	49	195	2	19	14	-	37	57	-	120	182	29	705
MX	-	-	-	-	16	8	-	4	3	1	4	1	2	27	12	78
Total	**0**	**1**	**0**	**77**	**273**	**10**	**19**	**21**	**3**	**48**	**70**	**1**	**152**	**263**	**42**	**980**
Total	**0**	**2**	**1**	**109**	**375**	**10**	**38**	**41**	**3**	**75**	**110**	**1**	**210**	**424**	**42**	**1441**

Notes:
unk: unknown
There are 4 samples for which the zone is unknown (2 from Phase I, 1 from Phase III and 1 from Phase IV)
The overburden samples from the test pits are not included in this table

Table 3-3:
Description of Lithology Codes for the Casino Deposit

Code	Description	Dominant Lithology
PP	Patton Porphyry	Dacite to rhyodacite
IX	Intrusion Breccia	PP matrix with WR clasts
WR	Dawson Range Batholith and earlier metamorphic rocks	Granodiorite and diorite
MX	Post-mineral explosion breccia	Latite groundmass with altered microbreccia fragments

Table 3-4:
Percentage of ARD Samples Collected According to Lithologic Unit and Relative Proportion of each Lithologic Unit in the Casino Pit

Lithologic Unit	Samples Collected		Relative Proportion in Pit (%)
	No.	%	
PP	222	15.4	10
IX	105	7.3	4
WR	1003	69.5	66
MX	108	7.5	5
Undefined/Overburden	6	0.4	15
Total	**1444**	**100**	**100**

Note: The test pit samples are not included

3.1.2 Overburden Sampling

Thirty three test pit samples were collected as part of the 2011 and 2012 Geotechnical site investigation completed by Knight Piésold. The 2011 and 2012 samples were selected for geochemical analysis from the available test pit samples by Lorax personnel. The available 2011 samples included samples from the Tailings Management Facility, the Heap Leach Facility, the Plant Site and the Potential NAG Storage Facility (Figure 3-2). In 2012 additional test pits were completed in the Open Pit area. The sample descriptions indicate that the overburden is predominately sand and silt in the footprints of most facilities with the exception of the heap leach area where gravel is more commonly observed. A full description of the most recent samples is provided in Appendix A.3. In addition, a number of ABA samples were collected in 1994 and the results are included in Appendix A.3. Although the location of most of the samples is available, the depth of the sample was not recorded, therefore due to the uncertainty of the geologic origins of these samples, the results are included in the appendices but not carried through into the analysis.

610,000 612,000 614,000

6,958,000 6,956,000 6,954,000 6,952,000

N

39-1
TP-PIT-04
TP-PIT-06
38-3
38-4
TP-PIT-05
TP-PIT-01
Open Pit

Gold Ore Stockpile

TP11-04

Low Grade Stockpile

TP11-NAG-02
TP11-NAG-08
TP11-NAG-07
TP11-NAG-06

Low Grade Stockpile

TP11-11
TP11-20
TP11-10
TP11-18
TP11-06
Plant Site

Low Grade Stockpile

TP11-HLF-01
TP11-HLF-05
TP11-HLF-21
TP11-HLF-16
TP11-HLF-13
TP11-HLF-41

Low Grade Stockpile

Tailings Management Facility (TMF)

TP11-TMF-99
TP11-TMF-94
TP11-TMF-05
TP11-TMF-01
TP11-TMF-09
TP11-TMF-10
TP11-TMF-34
TP11-TMF-12
TP11-TMF-100
TP11-TMF-13

TMF Embankment Toe

610,000 612,000 614,000

LEGEND

Test Pit Samples

- Open Pit
- Low Grade Stockpiles - includes Heap Leach Facility and Potential NAG Storage
- Plant Area
- Tailings Management Facility
- Site Facility Maximum Footprint
- 10m Elevation Contour

DATE SAVED:	Nov 25, 2013
DRAWN BY:	GM
REVIEWED:	JO
VERSION:	1

Coordinate System: *NAD 1983 UTM Zone 7N*
Projection: *Transverse Mercator*
Datum: *North American 1983*
Units: *Meter*

1:25,000

0 0.5 1 Km

CLIENT:

CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT:

Casino Project

TITLE:

Test Pit
Sample Locations

PROJECT #: J862-5

FIGURE: 3-2

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3.2 Analytical Methods

3.2.1 Mineralogical Identification

Quantitative X-ray analyses were conducted at the University of British Columbia (UBC) Earth & Ocean Sciences Department. Samples were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°. The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 using Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 3 (Bruker AXS).

3.2.2 Acid-Base Accounting and Solid-Phase Metals

ABA involves a suite of static tests to determine the acid potential (AP) and neutralizing potential (NP) of a sample. The AP of a sample is based on the sulphur content of a sample and the NP is typically composed of carbonates and, to a lesser extent silicate minerals. An accounting technique is used to compare the AP and NP with standard criteria thereby indicating the theoretical acid generation potential of a sample. Solid-phase metals data are used to identify which metals are enriched in waste materials and could potentially leach from the waste rock stockpiles. This information can be used in combination with ABA to establish the geochemical properties of the waste that will be generated at the project site.

Acid base accounting (ABA) was conducted by SGS in Burnaby, B.C. according to the modification of Sobek *et al.* (1978) *Field and Laboratory Methods Applicable to Overburdens and Minesoils* (Report EPA-600/2-78-054) (*i.e.,* Modification of Conventional EPA Neutralization Potential Determination by Addition of Hydrogen Peroxide). The procedure is outlined in MEND *Project 1.16.1c* (1991). The fizz test was conducted in accordance with the procedure.

Total sulphur (S) and carbon (C) were determined using a Leco furnace. Total inorganic carbon (TIC) was determined by placing a sample in a glass test tube and acidified with 25% hydrochloric acid (HCl). The sample was boiled to evolve CO_2 which was measured by coulometric titration with the Carbon Dioxide Analyzer. Sulphate-S was

determined by the procedure outlined in ASTM D2492-02, *Standard Test Method for Forms of Sulphur in Coal*. In this procedure sulphate-S is dissolved with HCl and measured gravimetrically after precipitation of barium chloride ($BaCl_2$).

Sulphide-S was determined by leaching residue from the sulphate-S in a 1:7 nitric acid (HNO_3) to water ratio, according to the procedure by Sobek *et al.* (1978). The oxidized sulphide was then determined gravimetrically after precipitation with $BaCl_2$.

Solid phase metals were conducted on pulverized samples by digesting 0.500 g in aqua regia at 95ºC for one hour. The extract was then diluted to 10.0 mL and analyzed for metals by ICP-MS. For a complete description of the analytical techniques, refer to Appendix B.

3.2.3 Shake Flask Extractions

Shake flask extractions (SFE) were conducted on several of the CAP samples (79 samples, using revised re-logging codes) and a subset of the overburden (2 samples), supergene (11 samples) and hypogene (12 samples) samples from the Phase I and Phase II static test programs to evaluate the water soluble metal release from these materials.

Shake flask extractions (SFE) are used to determine the amount of water soluble constituents in a geologic material. SFE were conducted as described by Price (1997) in *Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia*, using a 24 hour NanoPure water leach extraction test at a 3:1 liquid to solid ratio. The leachate was filtered and submitted for analysis including pH, conductivity, anions, nutrients, thiosalts, thiocyanate, total cyanide, weak acid dissociable (WAD) cyanide and total and dissolved metals.

4. Mineralogical Identification

CASINO
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4. Mineralogical Identification

The mineralogical analysis is used to determine the forms of sulphur and neutralization potential. Minerals containing sulphur will provide an indication of the acid potential. Several types of minerals contribute neutralization potential, including carbonates (calcite, dolomite and ankerite), aluminosilicates (plagioclase, clinochlore and biotite) and clay minerals (kaolinite and montmorillonite).

In sulphide-bearing rock undergoing weathering ARD will result only if there is insufficient production of neutralizing alkalinity to buffer the generated acidity. The generation of acid is predominantly associated with the oxidation of sulphide minerals or dissolution of iron-bearing sulphate minerals; therefore, the amount and form of sulphur-bearing mineralization needs to be determined. The neutralizing potential of weathering materials is dependent on the content of minerals that dissolve when exposed to acidic conditions and act to buffer acidity.

The traditional sulphide oxidation ARD reaction is typically described by the pyrite oxidation reaction.

$$2FeS_2 + 7.5O_2 + 7H_2O = 4SO_4^{2-} + 2(OH)_3 + 8H^+$$

However, the dissolution of (K, Na)-jarosite can also release acidity as described by the following reaction.

$$(K,Na)Fe_3^{3+}(SO_4)_2(OH)_6 + 3H_2O = (K,Na)^+ + 2SO_4^{2-} + 3Fe(OH)_3 + 3H^+$$

Conversely, the dissolution of the sulphate minerals gypsum ($CaSO_4.2H_2O$) and anhydrite ($CaSO_4$) do not release acidity.

While many mineral dissolution reactions can be thought of as acid buffering, the minerals most typically responsible for acid neutralization are fast dissolving carbonates. However, it should be noted that not all carbonate minerals neutralize acid as effectively as others. For example, Fe-bearing carbonate minerals, such as ankerite which contains Fe^{2+}, are much less effective at neutralizing acid compared to calcite. This is due to the fact that the Fe^{2+} liberated is oxidized to Fe^{3+}, which then precipitates as $Fe(OH)_3$ producing acidity in the process. Therefore, although Fe-bearing carbonate minerals contribute to the neutralizing potential of a sample, the net capacity of a sample to neutralize acid decreases as the amount of Fe-bearing carbonate increases (Jambor *et al.*, 2003). As a result, not only is it important to quantify the carbonate fraction in a sample, but it is also important to determine the types of carbonate minerals present.

Aluminosilicate minerals may also contribute to the total neutralizing capacity of a sample; however, rates of silicate dissolution are much slower and thus the ability of these minerals to buffer mine waters in the field are still not well defined. Jambor *et al*. (2002) investigated the NP of silicates and concluded that the sodic and potassic members of the feldspar group yield little NP and the calcic-bearing members give little NP until compositions are well into the field of anorthite ($CaAl_2Si_2O_8$). Similarly, the NP of the chlorite and mica group samples indicated low to negligible NP values.

4.1 Sample Description

As part of Phase II of the static test program, eight drill core samples were sent for quantitative phase analysis using the Reitveld Method and x-ray powder diffraction data. These samples were selected based on ABA results and primarily from the WR within the HYP (waste and ore) since this represents the dominant material which will be extracted from the proposed pit. The samples were selected according to elevated concentrations of total and sulphide sulphur concentrations, elevated insoluble sulphur concentrations and elevated and median concentrations of NP (carbonate and siderite corrected).

Additional samples were selected following Phase II from the HYP and SUP waste rock samples in order to further characterize the waste rock from the hypogene zone. Several of these samples were used for additional kinetic tests. All samples that have been used in the kinetic tests have also submitted for XRD analysis. This includes the column samples, the humidity cell samples and the field bin samples. These results can be used to indicate the mineralogy of the different mineralogical zones, as the kinetic test samples include samples from all zones. The results for the kinetic test samples are discussed further in the kinetic test report (Lorax, 2013).

The following sections associate the mineral composition of the samples with the ABA data. This association allows the ML/ARD potential of the larger ABA dataset to be better understood from a mineral composition perspective. Several of the samples that have XRD data are composite samples that contain a mixture of rock from different mineralized zones. Although the results for these samples are presented in the data tables, these results are not helpful in clearly defining the typical mineralogic composition of each mineralized zone.

A description of the samples selected for XRD testing is provided in Appendix A.4. Table 4-1 presents ABA results of the samples that also have XRD quantitative phase tests associated with the CAP, SUP and HYP zones. The XRD quantitative phase analyses are presented for the CAP (Table 4-2), SUP (Table 4-3) and HYP (Table 4-4). The full details of the XRD analyses are provided in Appendix C.1.

Table 4-1:
Summary of Key ABA Data for Samples Selected for Mineralogical Investigation

a) CAP Samples

Sample Description		CAP	CAP	95% CAP 5% SUS	95% CAP 5% SUS	80% CAP 20% SOX	81% CAP 13% SUS 6.3% OVB	CAP	CAP	CAP	CAP
Kinetic Test		**Sat Col 9** (lower)	**Col 1**	**Sat Col 2 & Col 2A**	**Col 2B**	**Col 3**	**Col 4a**	**FB1**	**FB2**	**FB3**	**FB4**
Parameter	**Unit**										
Paste pH	s.u.	4.2	4.4	5.3	5.3	3.9	6.45	6.1	6.0	5.8	5.3
TIC	%	<0.01	<0.01	<0.01	<0.01	0.01	0.02	<0.01	<0.01	<0.01	<0.01
Total C	%	0.03	0.07	0.03	0.03	0.04	0.05	*ND*	*ND*	*ND*	*ND*
Total S	%	0.49	0.19	0.32	0.31	1.23	0.16	0.41	0.30	0.2	1.55
Sulphate S	%	0.2	0.15	0.31	0.31	0.77	0.1	0.43	0.18	0.19	1.39
Sulphide S	%	0.02	0.05	0.02	0.01	0.45	0.05	0.02	0.12	0.02	0.11
Insoluble S	%	0.27	<0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	0.05
Non-Sulphate S	%	0.29	0.04	0.01	<0.01	0.46	0.06	0.02	0.12	0.01	0.16
AP	$kgCaCO_3/t$	14	4.8	7.6	7.6	32	4.2	11	8.0	4.8	38
CaNP	$kgCaCO_3/t$	<0.8	<0.8	<0.8	<0.8	0.8	1.7	<0.8	<0.8	<0.8	<0.8
ScNP	$kgCaCO_3/t$	3.3	5.8	6.3	5.2	0.6	11.9	0.15	4.57	2.74	-0.37
CaNPR	CaNP/AP	0.058	0.17	0.11	0.11	0.025	0.40	0.075	0.10	0.17	0.021
ScNPR	ScNP/AP	0.24	1.2	0.83	0.69	0.019	2.8	0.014	0.57	0.57	-0.010

Notes: ND = no data
TIC = total inorganic carbon, originating from carbonates;
Non-Sulphate S is calculated by subtracting Sulphate S from the Total S value;
AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated as (Sulphate Sx23.44) + (Non-Sulphate Sx31.25);
CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC;
ScNP = Siderite corrected neutralization potential; and
NPR = net potential ratio.

b) SUP Samples

Sample Description		90% SUP 5% CAP 5% HYP	50% SUS 50% CAP	SUP (acidic)	SUP (neutral)	SUP	81.7% SUP, 18.3% HYP	SUP (WR)	SUP (WR)	56% SUP 44% SUP
Kinetic Test		**Sat Col 5**	**Sat Col 6**	**Sat Col 12 & 14** (lower)	**Sat Col 13** (lower) **& Sat Col 15** (full)	**08-270**	**HC2**	**HC11**	**HC12**	**FB5**
Parameter	**Unit**									
Paste pH	s.u.	6.3	3.8	3.99	7.68	5.54	5.4	8.2	5.4	8
TIC	%	0.09	<0.01	<0.01	0.08	<0.01	0.08	0.22	<0.01	0.03
Total C	%	0.11	0.03	0.02	0.1	0.01	0.11	0.23	<0.01	*ND*
Total S	%	2.36	1.62	1.42	1	3.73	1.23	2.27	3.11	1.52
Sulphate S	%	0.1	0.48	0.35	0.02	0.04	0.04	0.03	0.04	0.13
Sulphide S	%	2.3	1.19	0.83	0.88	1.84	0.99	1.95	2.94	1.36
Insoluble S	%	<0.01	<0.01	0.24	0.1	1.85	0.2	0.29	0.13	0.05
Non-Sulphate S	%	2.26	1.14	1.07	0.98	3.69	1.19	2.24	3.07	1.39
AP	$kgCaCO_3/t$	71	36	33	31	115	37.2	70	96	43.5
CaNP	$kgCaCO_3/t$	7.5	<0.8	<0.8	6.7	<0.8	6.7	18.3	<0.8	2.29
ScNP	$kgCaCO_3/t$	10.7	-4.1	3.8	16.5	9	10	33	3.7	12.5
CaNPR	CaNP/AP	0.073	0.003	0.003	0.142	0.001	0.117	0.228	0.001	0.002
ScNPR	ScNP/AP	0.15	-0.12	0.11	0.54	0.08	0.27	0.47	0.039	0.29
Net NP	ratio	-61.2	-41.3	-22.1	-11	-111.6	-27.2	-27.9	-88.2	-30.3

Notes: ND = no data
TIC = total inorganic carbon, originating from carbonates;
Non-Sulphate S is calculated by subtracting Sulphate S from the Total S value;
AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from non-sulphate S;
CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC and modified by removing the unavailable CaNP (2.36 kg $CaCO_3/t$);
ScNP = Siderite corrected neutralization potential; and
NPR = net potential ratio.

c) HYP Samples

Sample Description		HYP	HYP	HYP	89% HYP 11% SUS	HYP	HYP	HYP	HYP	HYP	HYP	HYP	HYP	HYP (ore)	HYP (PP)	HYP (WR)	HYP (PP)	HYP (WR)	HYP (IX)	HYP (MX)	HYP (MX)	HYP (PP)	HYP (WR)	HYP (WR)	92% HYP 8% SUP	HYP	HYP
		Sat Col 3	**Sat Col 4**	**Sat Col 7**	**Sat Col 9** (upper)	**Sat Col 12, 13 & 14** (upper)	**08-218**	**08-234**	**08-285**	**08-296**	**08-302**	**08-407**	**08-416**	**HC1**	**HC3**	**HC4**	**HC5**	**HC6**	**HC7**		**HC8**	**HC9**	**HC10**		**FB6**	**FB7**	**FB8**
Parameter	**Unit**																										
Paste pH	s.u.	7.6	7.5	7.6	8	8.15	8.26	7.88	8.1	8.5	8.07	8.54	8.91	7.9	8.4	8.3	8.1	8.1	7.9	6.3	5.1	7.9	4.7	5.4	8.4	8.5	8.4
TIC	%	0.33	0.28	0.34	0.5	0.77	0.74	0.65	1.5	0.43	0.51	0.43	0.28	0.32	0.27	0.69	0.21	0.19	0.48	0.1	<0.01	<0.01	<0.01	<0.01	0.24	0.45	0.34
Total C	%	0.38	0.33	0.39	0.54	0.78	0.75	0.65	1.65	0.43	0.54	0.44	0.28	0.34	0.28	0.72	0.21	0.2	0.51	0.1	0.01	0.01	0.01	0.02	*ND*	*ND*	*ND*
Total S	%	3.08	4.33	3.04	2.22	2.65	1.42	4.2	1.44	3.58	1.34	0.54	0.62	1.53	4.23	4.29	2.21	1.81	2.89	3.62	4.28	0.92	1.99	5.12	1.63	2.88	1.84
Sulphate S	%	0.24	0.27	0.24	0.41	0.03	0.02	0.04	0.03	0.03	0.04	0.03	0.02	0.25	0.03	0.03	0.07	0.02	0.12	0.03	0.03	0.02	0.06	0.03	0.19	0.06	0.11
Sulphide S	%	2.9	4.18	2.81	1.86	2.49	1.32	4.15	0.65	0.51	1.28	0.44	0.48	1.09	2.04	4.22	1.07	1.65	2.73	3.58	4.13	0.86	1.69	4.24	1.38	2.81	1.72
Insoluble S	%	<0.01	<0.01	<0.01	<0.01	0.13	0.08	0.01	0.76	0.06	0.02	0.07	0.12	0.19	2.16	0.04	1.07	0.14	0.04	0.01	0.12	0.04	0.24	0.85	0.06	0.02	0.01
Non-Sulphate S	%	2.84	4.06	2.8	1.81	2.62	1.4	4.16	1.41	3.55	1.3	0.51	0.6	1.28	4.2	4.26	2.14	1.79	2.77	3.59	4.25	0.9	1.93	5.09	1.44	2.82	1.73
AP	$kgCaCO_3/t$	89	127	88	57	82	44	130	44.1	111	41	16	19	40	131	133	67	56	87	112	133	28	60	159	44.9	88.1	54.1
CaNP	$kgCaCO_3/t$	27.5	23.3	28.3	41.7	64.2	61.7	54.2	125	35.8	42.5	35.8	23	26.7	22.5	57.5	17.5	15.8	40	8.3	<0.8	<0.8	<0.8	<0.8	20.2	37.3	28.6
ScNP	$kgCaCO_3/t$	24.5	21.1	23.4	39.8	61.5	60.8	54.5	150.7	39.5	60.1	37.5	31.1	35	32.1	67.7	26.6	26.9	48.1	9.2	3.2	14.2	4.1	1.5	26.1	39.3	34.1
CaNPR	CaNP/AP	0.27	0.15	0.28	0.67	0.74	1.33	0.39	2.75	0.29	0.95	2.01	1.03	0.57	0.14	0.40	0.21	0.22	0.42	0.04	0.001	0.004	0.002	0.001	0.37	0.38	0.46
ScNPR	ScNP/AP	0.28	0.17	0.27	0.7	0.75	1.39	0.42	3.4	0.36	1.5	2.4	1.7	0.88	0.24	0.51	0.4	0.48	0.56	0.082	0.024	0.5	0.068	0.0094	0.58	0.45	0.63
Net NP		-66.1	-109.5	-64.4	-18.3	-16.3	19.5	-75.2	107.3	-69.5	20.1	23.7	16.1	-5	-31.7	-64.2	-6.8	-24.7	-37.2	-102.7	-125.9	-12.6	-48.7	-131	-16.9	-47.2	-20.4

Notes: ND = no data
TIC = total inorganic carbon, originating from carbonates;
Non-Sulphate S is calculated by subtracting Sulphate S from the Total S value;
AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from non-sulphate S;
CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC and modified by removing the unavailable CaNP (3.72 kg $CaCO_3/t$);
ScNP = Siderite corrected neutralization potential; and
NPR = net potential ratio

4.2 Oxide Leach Cap

4.2.1 Forms of Sulphur

Based on the mineralogical results for CAP samples (Table 4-2), the dominant form of sulphur is the sulphate mineral jarosite. This is supported by the ABA results, as sulphate sulphur is the dominant form of sulphur in the CAP samples. Jarosite is found in all of the samples analyzed from the oxide leach cap (from 0.5 % to 11%). Sulphide minerals can be present in trace amounts in the CAP as shown by the ABA data indicating median sulphide S content in CAP samples is 0.02%S (Table 5-1). XRD data indicate that pyrite is likely the major form of sulphide in the CAP as documented by the three CAP samples (FB2, FB3 and FB4, with 0.6%, 0.3% and 0.2% pyrite, respectively). It should be noted that these three CAP samples have sulphide S content (Table 4-1) well above typical amounts observed through the deposit (Table 5-1). Col 3 is 80% CAP and 20% SOX; therefore, the pyrite is likely the portion from the SUP zone.

4.3 Forms of Neutralization Potential

The XRD data confirm that carbonates are absent in the CAP. The most abundant minerals in the CAP with some neutralizing potential are the aluminosilicates. The majority of samples contain K-feldspar (all samples), plagioclase (8 of 10 samples) and muscovite (all samples). Clinochlore and biotite are also found occasionally, in 5 samples and 3 samples, respectively. The only clay mineral identified by XRD in this zone is kaolinite (9 of 10 samples, 1.4% to 5.9%). The CaNP is either low or below the detection limit for all 10 samples, supporting the mineralogical results indicating that carbonate minerals are rare or absent.

4.4 Supergene Zone

4.4.1 Forms of Sulphur

Pyrite is the dominant sulphide mineral in the supergene zone, with all supergene samples containing pyrite up to 8.4% (Table 4-3). The ABA results also show that sulphide sulphur is the dominant form of sulphur for the supergene zone (49% to 97% of the total sulphur). The sulphate mineral jarosite is found in only 1 one sample containing exclusively SUP, Sat Col 12 & 14 (lower) (1.5%). This sample was selected as an acidic SUP sample. In addition to jarosite, this sample contains gypsum (0.7%).

4.4.2 Forms of Neutralization Potential

Calcite is found in four of the samples at low to moderate levels (0.2% to 2.7%). This is generally supported by higher CaNP values for these samples (*e.g*. HC11 (sample 08-068) has 2.7 % calcite and a higher CaNP of 18.3 kg $CaCO_3$/t). Aluminosilicates are the dominant minerals with some limited neutralization potential. The most common aluminosilicate is muscovite, which is found in all samples. The clay mineral, kaolinite was found in 7 samples (2.3% to 7.3%). However, as carbonate minerals are rare, the NPR values for these supergene samples are low and indicate that the material is potentially acid generating.

4.5 Hypogene Zone

4.5.1 Forms of Sulphur

The dominant sulphide mineral in the hypogene zone is pyrite (Table 4-4). Pyrite is found in all of the samples (from 1% to 8.8%) and sulphide is the dominant form of sulphur based on the ABA results, making up an average (median) of 93% of total sulphur for the 26 HYP samples. Trace molybdenite was found in three samples (0.1% to 0.2%). Sulphur also occurs as sulphate in the mineral gypsum (6 samples, 0.6% to 1.5%). Jarosite is not found in the HYP samples.

4.5.2 Forms of Neutralization Potential

Several of the samples from the hypogene zone contain carbonate minerals. Calcite is found in 21 of 24 samples (0.3% to 10.2%), and lower quantities of dolomite-ankerite in 10 samples (0.5% to 6.6%). The higher carbonate percentages correspond with higher CaNP values. In addition to the carbonates, aluminosilicates and clay minerals are also found in several samples; however, these minerals are not expected to contribute significant neutralization potential, relative to the carbonate minerals. The plagioclase found in these samples is suggested to be predominantly albite (*i.e.,* sodic-rich end-member, $NaAlSi_3O_8$) and possibly calcic-albite (pers. comm. Mati Raudsepp), which is documented to be the least reactive and neutralizing of the plagioclase group (Jambor *et al.,* 2007).

Table 4-2:
Results of the Quantitative Phase Analysis for CAP Samples Selected for Mineralogical Investigation

		Sample Description	CAP	CAP	95% CAP 5% SUS	95% CAP 5% SUS	80% CAP 20% SOX	81% CAP 13% SUS 6.3% OVB	CAP	CAP	CAP	CAP
		Kinetic Test	**Sat Col 9** (lower)	**Col 1**	**Sat Col 2 & Col 2A**	**Col 2B**	**Col 3**	**Col 4a**	**FB1**	**FB2**	**FB3**	**FB4**
Mineral		**Ideal formula**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**
Sulphides	Pyrite	FeS_2					1			0.6	0.3	0.2
Secondary	Hematite	α-Fe_2O_3										0.4
	Jarosite	$K_2Fe^{3+}{}_6(SO_4)_4(OH)_{12}$	3.3	0.7	2.6	2.6	5.1	0.5	3.7	1.2	1.8	11
Major Rock Forming	Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$						0.8				
	Anatase	TiO_2								0.6		
	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$		6.3				1.6		4.1		
	Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$		10.3	1.5	1.8		5.4		9		
	Kaolinite	$Al_2Si_2O_5(OH)_4$	3	3.8	1.6	1.4	4.2	5.9	2		4.1	4.3
	K-feldspar	$KAlSi_3O_8$	6.3	9.2	9.2	8.5	11.3	15.4	2.9	10.4	19.5	15.8
	Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	32.6	25.5	28.8	29.8	31.4	16.3	42.9	30.5	20.8	23.7
	Plagioclase	$NaAlSi_3O_8 - CaAl_2Si_2O_8$	4.4	11.9	12	10.7	3.1	19.9		8.6	4	
	Quartz	SiO_2	48.3	32.3	44.4	45.2	43.8	34.1	48.5	35	49.5	44.6
	Tobermorite	$Ca_5Si_6(O,OH)_{18}\ 5H_2O$	2.1									
		Total	*100.0*	*100.0*	*100.1*	*100.0*	*98.9*	*99.9*	*100.0*	*99.4*	*99.7*	*99.8*

Table 4-3:
Results of the Quantitative Phase Analysis for SUP Samples Selected for Mineralogical Investigation

		Sample Description	90% SUP 5% CAP 5% HYP	50% SUP 50% CAP	SUP (acidic)	SUP (neutral)	SUP	81.7% SUP, 18.3% HYP	SUP (08-068)	SUP (08-058)	56% SUP 44% CAP
		Kinetic Test	**Sat Col 5**	**Sat Col 6**	**Sat Col 12 & 14** (lower)	**Sat Col 13** (lower) **& Sat Col 15** (full)	**08-270**	**HC2**	**HC11**	**HC12**	**FB5**
Mineral		**Ideal formula**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt. %**	**wt.%**	**wt.%**	**wt.%**	**wt.%**
Sulphides	Pyrite	FeS_2	4.7	2.2	1.8	1.7	8.4	2	5.29	4.28	3.2
	Molybdenite	MoS_2						tr			
Carbonates	Calcite	$CaCO_3$				0.2	0.3	0.8	2.65		
Secondary	Gypsum	$CaSO_4 \cdot 2H_2O$			0.7						
	Jarosite	$K_2Fe^{3+}{}_6(SO_4)_4(OH)_{12}$		2.9	1.5						1.5
Major Rock Forming	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$				1.8			5.66		
	Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	1.2		1.4	3.9	9.3	1.8	8.77		3.9
	Kaolinite	$Al_2Si_2O_5(OH)_4$	3.3	2.4	3.1			5.2	2.27	7.32	4.3
	K-feldspar	$KAlSi_3O_8$	9.8	6.3	26.5	20	24.1	33.7	7.47		12.4
	Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	30.9	34.8	17.5	11	16.8	11.5	7.19	41.01	22.7
	Plagioclase (calcian Albite-low)	$NaAlSi_3O_8 - CaAl_2Si_2O_8$	7		4.2	30.7	9.9	8	32.37		19.7
	Plagioclase (Albite-low)										
	Quartz	SiO_2	43.1	51.3	43.3	30.7	31.1	36.9	28.34	47.39	32.3
		Total	*100*	*99.9*	*100*	*100*	*99.9*	*99.9*	*100*	*100*	*100*

Table 4-4:
Results of the Quantitative Phase Analysis for HYP Samples Selected for Mineralogical Investigation

Sample Description			HYP	HYP	HYP	89% HYP 11% SUP	HYP	HYP	HYP	HYP	HYP	HYP	HYP	HYP	HYP (ore)	HYP (08-276)	HYP (08-294)	HYP (08-277)	HYP (08-028)	HYP (08-043/08-225)	HYP (08-143)	HYP (08-260)	HYP (08-059/08-178)	92% HYP 8% SUP	HYP	HYP
Kinetic Test			**Sat Col 3**	**Sat Col 4**	**Sat Col 7**	**Sat Col 9** (upper)	**Sat Col 12, 13 & 14 (**upper**)**	**08-218**	**08-234**	**08-285**	**08-296**	**08-302**	**08-407**	**08-416**	**HC1**	**HC3**	**HC4**	**HC5**	**HC6**	**HC7**	**HC8**	**HC9**	**HC10**	**FB6**	**FB7**	**FB8**
Mineral		**Ideal formula**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**
Sulphides	Pyrite	FeS_2	5.4	7.8	5.7	3.6	4.8	2.4	8.4	3.6	7.3	2.6	1.3	1	2.3	8.29	6.82	5.31	3.95	5.7	8.82	1.78	6.9	2.9	6.1	4.2
	Molybdenite	MoS_2						0.2							0.1			0.05								
Carbonates	Calcite	$CaCO_3$	1	1	1.4	2.9	2.7	1.5		10.2	2.5	5.3	0.6	3.6	1.4	2.64	5.32	1.62	1.87	2.71			0.3	2.3	2.4	1.8
	Dolomite-Ankerite	$Ca(Mg,Fe)CO_3$		0.5		0.8	3.4	6.6	6.6		1.2		3.8			0.77				0.54					1.8	1.1
Secondary	Gypsum	$CaSO_4 \cdot 2H_2O$	1.5	1.4	1.4	1.1									1.4			0.61						1		0.7
	Rutile?	TiO_2						1.3																		
Major Rock Forming	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$				2.8	1.8			11.9		1.8			2.7	2.09	4.9	4.65	3.46			3.64				
	Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	3.2	1.2	2.3	3.8	2				7.5			4.1	2.1	5.63	7.42	5.84	2.72	3.98		3.7		3.9		6
	Kaolinite	$Al_2Si_2O_5(OH)_4$	4	3.2	4.7	4.1	2.5	9.2	6	7.5		3	2.1		3.2	1.08	4.37	1.79	1.14	2.46	3.3		2.23		4.6	2.1
	Montmorillonite	$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot nH_2O$								27.2		19.3	13.2													
	K-feldspar	$KAlSi_3O_8$	13	8.4	13.2	12.1	20.1	18.2	1.9	4.3	14.1	11.2	30.1	13.1	27.1	5.29	9.12	9.79	23.57	6.91		19.78	8.77	12.1	18.2	12.5
	Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	23.4	25.7	25	14.1	18.3	18	28.4	7	14.6	12.2	5.6	15.2	12.5	25.14	16.01	15.45	19.11	32.47	40.39		23.13	18.9	20.4	14.2
	Plagioclase (calcian Albite)	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	7.7	7.3	6.8	14.2	10.5			7.1	31.3	15.1	2	49	17	9.13	18.41	14.4				44.88		28.8	2.4	28.3
	Plagioclase (Albite-low)															6.64		5.38	9.82	3.7						
	Quartz	SiO_2	40.9	43.6	39.5	38.4	33.9	42.6	48.6	21.1	21.5	29.4	41.2	14	30.2	33.3	27.65	35.1	34.36	41.53	47.48	26.21	51.29	30.1	44.1	29.1
	Tourmaline (Dravite)	$NaMg_3Al_6(BO_3)_3Si_6O_{18}(OH)_4$																					7.38			
		Total	100.1	100.1	100	97.9	100	100	99.9	99.9	100	99.9	99.9	100	100	100	100	100	100	100	100	100	100	100	100	100

5. Static Test Results

CASINO
COPPER AND GOLD

5. Static Test Results

The following sections discuss the ABA and solid phase metal results of samples collected in support of the Phase I, Phase II, Phase III, Phase IV and overburden geochemical assessment for the Casino Project. The complete Phase I through Phase IV static test data sets were assessed according to mineralization zone, lithology, alteration type and ore/waste potential; however, only the most relevant and significant results are presented and discussed in this chapter. The static test data for the overburden samples is discussed in a separate section at the end of the chapter. A complete listing of the static test data is presented in Appendix D (drill core samples) and Appendix E (overburden samples).

5.1 Acid-Base-Accounting Assessment

Table 5-1 presents the 90th and 10th percentile values and median values (shaded) of ABA results for each mineralization zone according to the ore/waste designation. The 90th and 10th percentile values are used in the summary table and in discussions rather than maximum and minimum values in order to more appropriately represent the variation in the large data sets and avoid highlighting outliers. Note that values reported to be below detection were set at half the analytical limit for statistical calculations and plotting purposes.

Distinctions are evident between each mineralization zone of the Casino deposit. Distinctions are also apparent between median values for waste and ore designated material within the SOX. Material designated as waste within the CAP, SUS and HYP have similar median values as their respective ore designated material. Below is a review of the distinctions between each mineralization zone of the Casino deposit. The ore designation, lithologies and alteration types within each mineralization zone are assessed afterward in more detail.

Table 5-1:
90th and 10th Percentile and Median Values for Waste and Ore Samples According to Mineralization Zones of the Casino Deposit

Mineralization Zones	Combined Rinse and Paste pH	S(T) %	$S(SO_4)$ %	$S(S^{-2})$ %	S(insol) %	S(non-SO_4) %	AP $kgCaCO_3/t$	C(T) %	TIC %	CaNP $kgCaCO_3/t$	ScNP $kgCaCO_3/t$	NPR CaNP/AP
	Oxide Leach Cap											
Ore												
90th percentile	6.41	2.5	1.2	0.79	0.058	0.79	58	0.049	0.0050	0.4	8.8	0.38
Median	4.70	0.29	0.25	0.020	0.0050	0.0063	7.6	0.020	0.0050	0.4	3.5	0.053
10th percentile	3.73	0.042	0.041	0.0050	0.0050	0.0025	1.7	0.010	0.0050	0.4	-0.34	0.0069
n	109	32	32	32	32	32	32	32	32	32	32	32
Waste												
90th percentile	6.59	2.2	1.3	1.6	0.049	1.7	66	0.040	0.0050	0.75	12	0.32
Median	4.70	0.69	0.41	0.020	0.0050	0.020	17	0.010	0.0050	0.4	2.5	0.028
10th percentile	3.69	0.062	0.040	0.0050	0.0050	0.0025	2.0	0.005	0.0050	0.4	-0.69	0.0075
n	374	103	102	102	102	102	103	103	102	103	102	103
	Supergene Oxide Zone											
Ore												
90th percentile	8.11	6.5	0.21	5.7	0.72	6.5	202	0.20	0.056	16	19	1.1
Median	5.54	0.80	0.050	0.12	0.010	0.13	25	0.030	0.0050	1.6	5.4	0.015
10th percentile	4.52	0.070	0.020	0.0050	0.0050	0.0025	2.0	0.010	0.0050	0.4	2.3	0.001
n	26	31	19	19	19	19	31	31	19	31	19	31
Waste												
90th percentile	7.83	5.1	0.68	4.9	0.19	5.0	160	0.24	0.27	19	28	0.33
Median	5.73	2.2	0.040	1.7	0.045	1.7	69	0.020	0.0050	0.4	7.8	0.003
10th percentile	3.32	0.29	0.010	0.0095	0.0050	0.0093	7.7	0.0090	0.0050	0.4	0.89	0.0006
n	32	29	20	20	20	20	29	29	20	29	20	29

Mineralization Zones	**Combined Rinse and Paste pH**	**S(T)**	**$S(SO_4)$**	**$S(S^{-2})$**	**S(insol)**	**$S(non\text{-}SO_4)$**	**AP**	**C(T)**	**TIC**	**CaNP**	**ScNP**	**NPR**
		%	**%**	**%**	**%**	**%**	**$kgCaCO_3/t$**	**%**	**%**	**$kgCaCO_3/t$**	**$kgCaCO_3/t$**	**CaNP/AP**
	Supergene Sulphide Zone											
Ore												
90th percentile	8.15	5.2	0.15	3.4	0.49	3.9	161	0.35	0.29	27	25	0.80
Median	6.25	1.9	0.030	1.6	0.16	1.9	59	0.040	0.010	3.1	8.1	0.009
10th percentile	4.45	0.54	0.016	0.44	0.0050	0.53	17	0.010	0.0050	0.4	2.6	0.001
n	33	69	27	27	27	27	69	69	27	69	27	69
Waste												
90th percentile	8.16	5.8	0.085	4.0	0.20	3.8	182	0.44	0.32	34	27	0.39
Median	6.99	3.1	0.030	1.5	0.060	1.6	97	0.035	0.025	2.8	12	0.013
10th percentile	4.47	0.73	0.019	0.55	0.0050	0.59	23	0.0050	0.0050	0.4	2.5	0.0006
n	42	108	40	40	40	40	108	108	40	108	40	108
	Hypogene Zone											
Ore												
90th percentile	8.51	3.3	0.41	3.6	0.39	4.3	100	0.83	0.74	65	60	2.3
Median	8.14	1.1	0.030	1.0	0.15	1.2	35	0.35	0.23	27	27	0.66
10th percentile	6.04	0.45	0.010	0.27	0.037	0.46	14	0.090	0.010	7.0	6.5	0.05
n	58	210	58	58	58	58	210	210	58	210	58	210
Waste												
90th percentile	8.51	5.5	0.56	5.0	0.32	5.2	171	0.83	0.82	65	67	1.7
Median	8.12	2.5	0.030	1.8	0.070	1.9	75	0.34	0.32	27	31	0.37
10th percentile	6.45	0.57	0.010	0.41	0.010	0.49	16	0.040	0.030	3.1	7.5	0.004
n	161	424	161	161	161	161	424	424	161	424	161	424

Notes:

n = number of samples used in calculations
Sulphate Sulphur determined by 25% HCL with Gravimetric Finish; Sulphide Sulphur determined by Sobek 1:7 Nitric Acid with Gravimetric Finish;
Non-Sulphate Sulphur is calculated by subtracting sulphate sulphur from the total sulphur value;
If SO_4-S is ≥ total S then non-SO_4 S was set to a quarter of the analytical detection limit, if SO_4-S was <DL, non-SO_4 S was set equal to total S;
For CAP and SOX samples (Phase I, II and III), AP is the sulphate sulphur AP + the non-sulphate sulphur AP, and total S AP for Phase IV samples
For SUS and HYP samples (Phase I, II and III), AP is the non-sulphate sulphur AP, and total S AP for Phase IV samples
CaNP = Neutralization potential, calculated from TIC for Phase I, II and III samples, calculated from total carbon with correction factor (0.9348) for Phase IV samples;
For the SUP and HYP samples, the available CaNP is calculated for the NPR calculation by subtracting the unavailable CaNP from the CaNP. The unavailable CaNP is 2.36 kgCaCO3/t for the SUP and 3.72 kgCaCO3/t for the HYP.
ScNP = siderite corrected neutralization potential

5.1.1 Paste pH and Rinse pH

Paste and rinse pH values are useful in that they provide information on the amount and availability of neutralizing potential by indicating whether or not a sample was actively producing net acidity prior to sampling. Paste and rinse pH values for the Casino samples have been combined in this section. As mentioned previously, paste pH was completed on the Phase I, II and III samples and rinse pH on the CAP samples from Phase IV. Rinse pH was measured for the Phase IV CAP samples as pH was identified as a critical parameter in distinguishing PAG and NAG in the oxide cap, which does not typically have measurable carbonate NP. A comparison of the paste and rinse pH measurements is provided in Table 5-2. In general, rinse pH values tend to be slightly lower, relative to paste pH values.

Table 5-2:
Comparison of Paste pH and Rinse pH statistics for the oxide CAP

	Paste pH	Rinse pH	Combined
Oxide Leach Cap (CAP) - Ore			
90th percentile	5.69	6.46	6.41
Median	4.99	4.63	4.70
10th percentile	3.95	3.64	3.73
n	32	77	109
Oxide Leach Cap (CAP) - Waste			
90th percentile	7.25	6.39	6.59
Median	4.89	4.56	4.70
10th percentile	3.79	3.65	3.69
n	102	272	374
Oxide Leach Cap (CAP) - Undefined			
90th percentile		5.88	5.88
Median		4.67	4.67
10th percentile		4.03	4.03
n		10	10

The samples from the Casino deposit have paste and rinse pH values typically ranging from 10th percentile of 3.3 in the SOX (waste) to 90th percentile of 8.5 in the HYP (ore and waste) (Table 5-1, Figure 5-1). The CAP ore and waste designated samples comprise the overall lowest pH values, with median values of 4.7. The low median value of 4.7 indicates that the majority of the CAP samples would be capable of generating acid immediately following disturbance by mining activity.

The HYP ore and waste designated samples comprise the overall highest pH values (typical range from 6.0 to 8.5) with median values of 8.1 for the ore and waste designated samples (Table 5-1). The median values indicate that the HYP samples, as a group, are slightly alkaline. Paste and rinse pH values for the SOX and SUS cover the full range of values indicated for the CAP and HYP (Table 5-1, Figure 5-1), ranging from 3.3 up to 8.2. The samples designated as waste for the SOX have a median pH of 5.7, while the ore designated samples have a median pH of 5.5. The ore designated samples for the SUS have a median pH of 6.3, while the waste designated samples for the SUS have a median pH of 7.0. This variability of pH values indicates a range of acidic conditions are present in the SUP, likely due to variable intensity of secondary mineralization and formation of secondary carbonate minerals

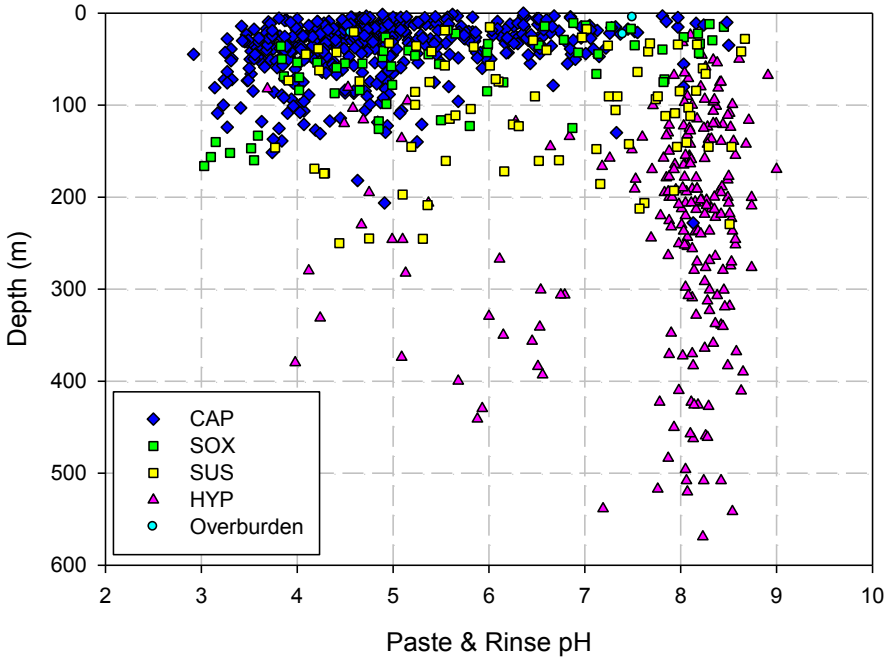


Figure 5-1: Paste & rinse pH versus depth for mineralization zones of the Casino deposit

5.1.2 Sulphur Species

Total sulphur values for the Casino waste samples typically range from 0.06 wt. %S (10th percentile in the CAP) up to 5.8 wt. %S (90th percentile in the SUS). Values up to 14 wt. %S (maximum) are reported for the HYP (waste) (Appendix D.1).Table 5-1 indicates that samples from the CAP (ore and waste) and SOX (ore) comprise the overall lowest median total sulphur values (0.29 and 0.69 wt. %S in the CAP and 0.80 wt. %S in the SOX) and samples from the SOX (waste), SUS and HYP comprise the overall highest median concentrations of total sulphur (2.2 wt. %S in the SOX, 1.9 and 3.1 wt. %S in the SUS and 1.1 and 2.5 wt. %S in the HYP). In general, total sulphur concentrations are

higher for the waste designated samples of each mineralization zone relative to the respective ore designated samples.

The estimation of total AP, as determined by the total sulphur in a sample, assumes that all sulphur measured is in the form of pyrite and will oxidize completely, forming sulphate and iron hydroxide. However, when a significant portion of a sample's total sulphur is present as non-acid generating forms of sulphur (gypsum and organic sulphur) total sulphur values may unrealistically overestimate AP.

Figure 5-2 plots total sulphur versus sulphide sulphur for the Phase I, II and III samples with the diagonal line indicating the locus of points along which a sample would plot if all the sulphur were present as sulphide mineralization. The majority of the HYP, SUS and SOX samples plot on or relatively close to the line indicating that sulphide minerals make up the bulk of the sulphur budget for those samples. Conversely, the majority of the CAP samples plot well below the line, indicating that sulphide minerals make up only a small fraction of the total sulphur budget (Table 5-1, Figure 5-2).

Nearly all waste and ore designated samples for each mineralization zone contain measurable sulphate sulphur (Table 5-1). The CAP and SOX samples, in particular, contain a significant amount of sulphate sulphur, thereby making up a large portion of the sulphur budget for these zones. Based on the XRD results this sulphur is expected to be primarily in the form of jarosite. Thus, the acid potential (AP) of CAP and SOX samples from Phase I, II and III is calculated assuming all non-sulphate S is in the form of pyrite and all sulphate is in the form of jarosite.

$$AP = (\text{non-sulphate S} \times 31.25) + (\text{sulphate S} \times 23.44)$$

Notable concentrations of insoluble sulphur are present from the HYP ore and SUS ore suggesting that there is a sulphur mineral associated with the ore zone that does not fully respond to the sulphate-S and sulphide-S analytical methods. The XRD analyses did not conclusively establish what the insoluble forms of sulphur may be. However, knowledge of the deposit geology suggests that it may be either minor amounts of barite or a copper sulphide, the former which is non-acid generating and the latter which is potentially acid generating.

The larger static test dataset analyzed during Phase IV were analyzed for total sulphur only, as the total sulphur values for Phase I, II and III samples were identified to provide a reasonable estimate of non-sulphate sulphur values. This is demonstrated in Figure 5-3, which plots total sulphur and non-sulphate sulphur values for the Phase I, II and III samples. The non-sulphate sulphur value is calculated by subtracting the measured sulphate sulphur value from the measured total sulphur value. The majority of the samples plot on the 1:1 line; however, several HYP samples plot below the line, indicating the presence of sulphate minerals. This is supported by XRD results in Table 4-4, which identified up to 1.5% gypsum in the HYP samples.

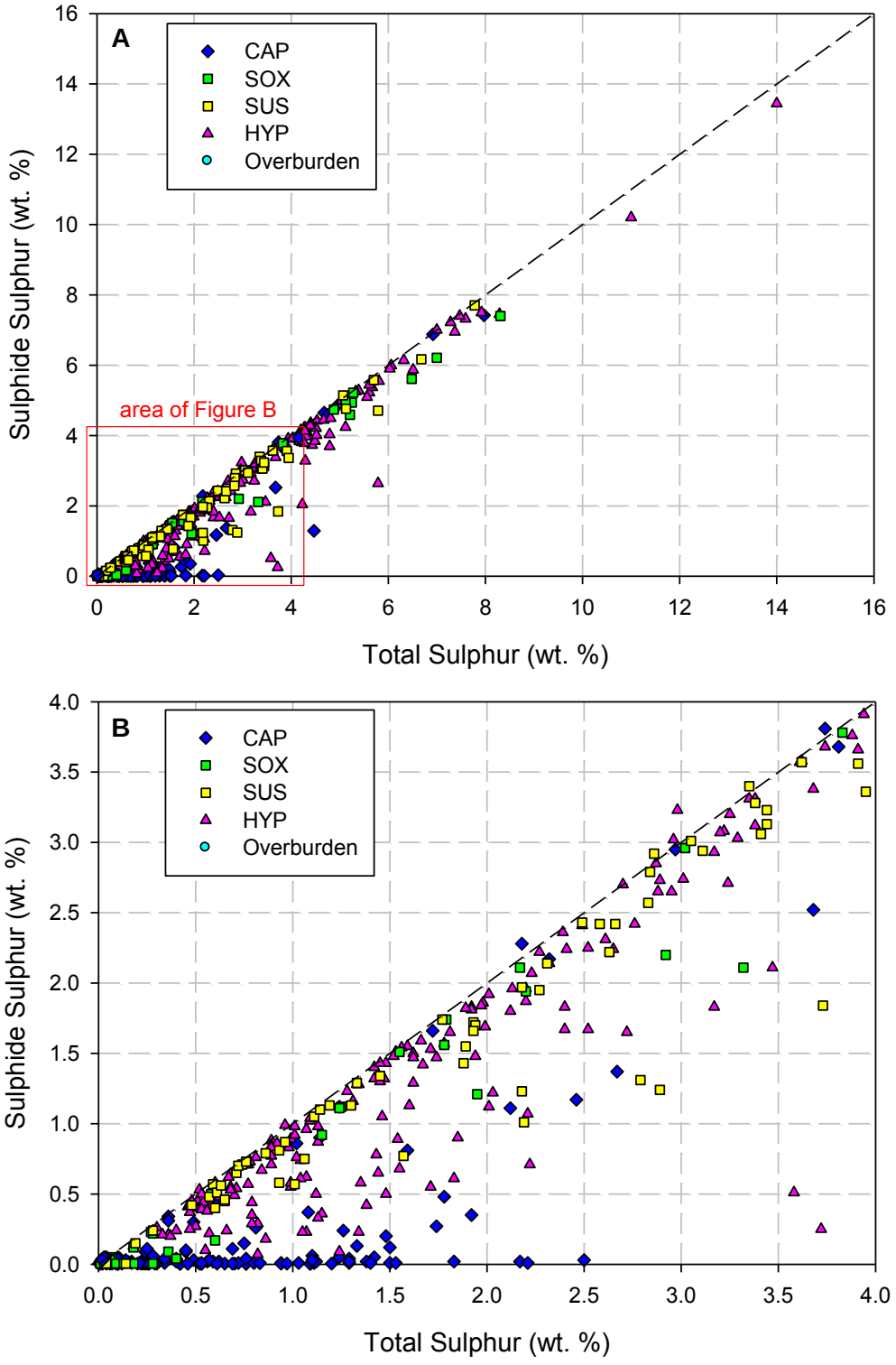


Figure 5-2: Total sulphur versus sulphide sulphur values for Phase I, Phase II and Phase III static test samples for all mineralized zones of the Casino Deposit

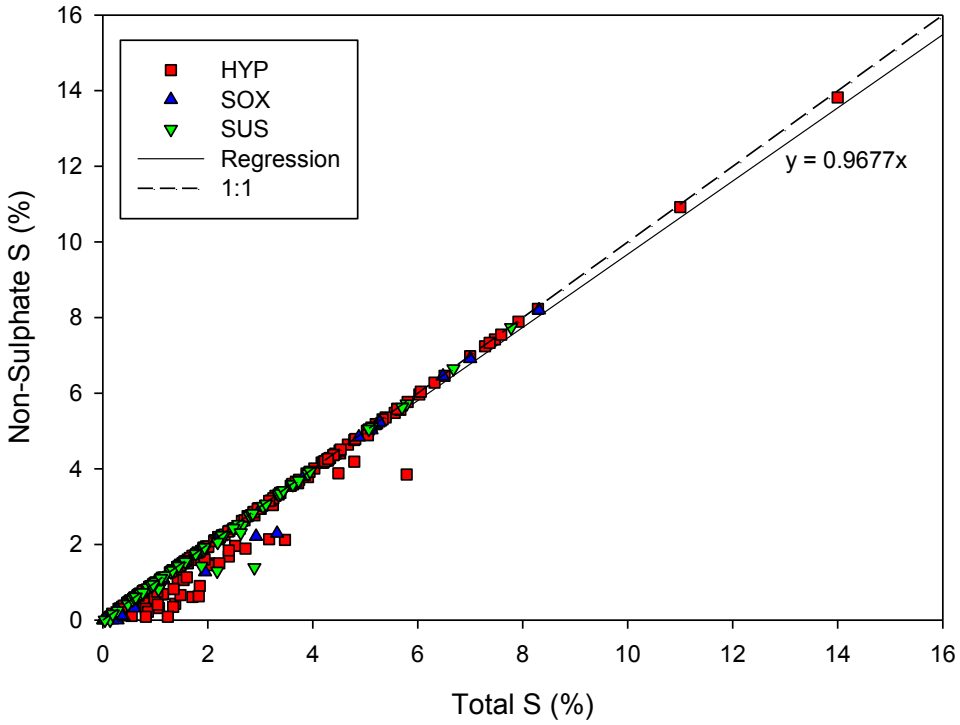


Figure 5-3: Total sulphur versus non-sulphate sulphur for Phase I, II and III static test samples

To conservatively estimate the true acid generating potential of the Casino HYP and SUS samples, a non-sulphate sulphur value is used to assess the ARD potential of the Phase I, II and III samples (Table 5-1). Note that (1) where sulphate is measured to be equal to or greater than total sulphur, the non-sulphate sulphur value was set at a quarter of the analytical detection limit (0.0025 wt. %S) and (2) where sulphate is below the analytical limit, the non-sulphate sulphur value is set equal to total sulphur. Total sulphur is also used to calculate AP values for the Phase IV samples, which provides an even more conservative estimate of acid potential for these samples.

5.1.3 Neutralization Potential

Both Siderite corrected NP (ScNP) and carbonate NP (CaNP) values were determined for the Phase I, II and III samples. Siderite corrected NP is obtained by titration using the method of Sobek *et al.* (1978) modified with the addition of hydrogen peroxide in an effort to oxidize Fe(II) liberated from Fe-carbonates prior to back-titration, which does not occur with the standard Sobek NP determination. Carbonate NP, on the other hand, is obtained by converting the total inorganic carbon (TIC) content of a sample to an equivalent amount of $CaCO_3$ per tonne of rock. This calculation assumes that all the

inorganic carbon is present as calcite. Carbonate NP was also calculated from total carbon (TC) for the Phase IV samples.

It is important to note that ScNP values provide information on the bulk NP of a sample and are not mineral specific, whereas CaNP values provide information on the specific contribution of carbonate minerals to the neutralization potential of a sample. Therefore, if the ScNP method yields considerably greater values in comparison to the CaNP method, it is important to determine the identity and amount of the non-carbonate minerals contributing to a higher bulk NP, as well as their dissolution kinetics if they are to be included as a source of NP for an ARD assessment.

5.1.3.1 Siderite corrected NP

Table 5-1 indicates that samples from the Casino deposit contain low to moderate ScNP values. Frequency analysis within each mineralization zone shows 10^{th} and 90^{th} percentile values range from -0.69 kg $CaCO_3$/t in the CAP (waste) to 66.7 kg $CaCO_3$/t in the HYP (waste). Concentrations of ScNP are particularly low in samples from the CAP, SOX and SUS, which all have median values < 13 kg $CaCO_3$/t. The highest median ScNP values are associated with the waste samples from the HYP with 31.4 kg $CaCO_3$/t. Note that negative ScNP values are identified within the ore and waste designated samples of CAP and SOX and in the waste designated samples of the SUS. Negative NP values indicate that these particular samples were acidic when they were analyzed. ScNP values of up to 169 kg $CaCO_3$/t (maximum) were measured in the HYP (ore).

The XRD analyses indicated that the CAP samples do not contain significant quantities of non-carbonate minerals capable of buffering pH above 7.0. HYP and SUP samples contained minor amounts (< 10 %) of biotite and clinoclore that may be responsible for ScNP values elevated above the CaNP values. However, although the minerals may dissolve and contribute to the measured ScNP, the plot supports the original premise that they are not capable of buffering pH above 6.0 (Figure 5-4). To maintain a conservative approach for ARD prediction of the Casino materials, the ScNP measurement is not used to calculate net potential ratio to assign PAG and NAG designation for waste rock and tailings.

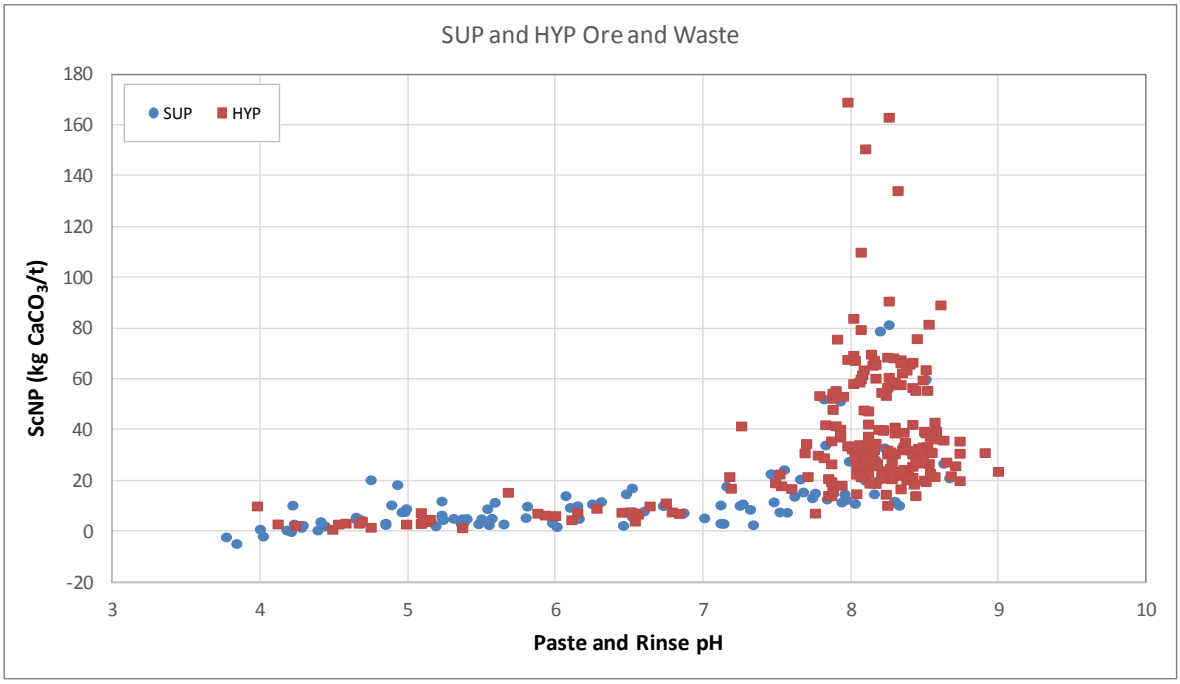


Figure 5-4: ScNP versus paste and rinse pH for the SUP and HYP samples

5.1.3.2 Carbonate NP

The following discussion uses the statistics for the CaNP calculated from the TIC for Phase I, II and III samples and from the total carbon with the correction factor for the Phase IV samples.

To calculate the CaNP for the Phase IV samples using the total carbon results, a correlation was developed using the relationship between the NP calculated using total carbon and the NP calculated using TIC for the Phase I, II and III samples (Figure 5-5). An equation of y=0.9348x was determined for the best fit line for the dataset and a factor of 0.9348 is applied to NP values calculated based on total carbon for the Phase IV samples.

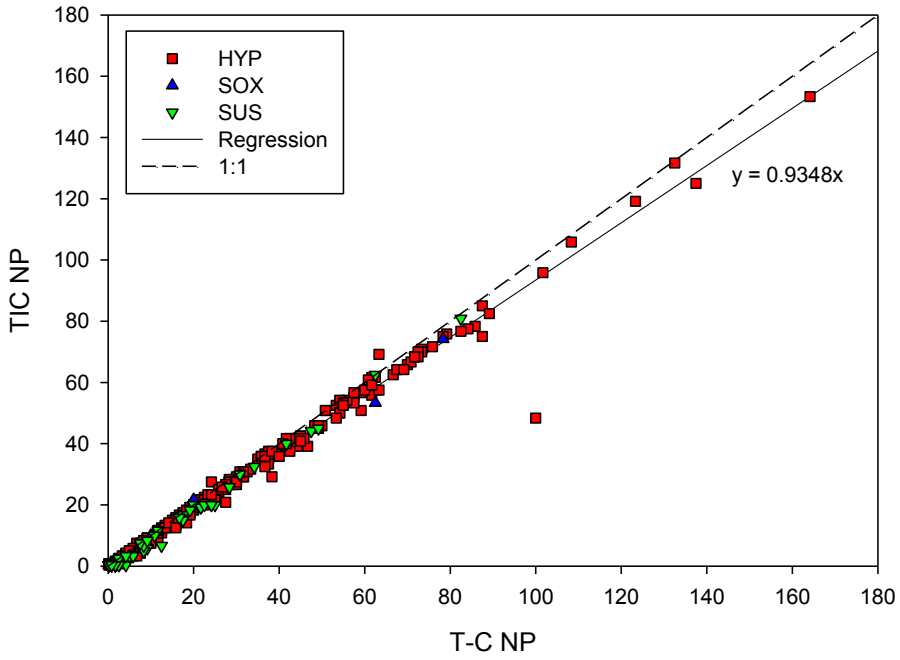


Figure 5-5: TIC NP versus Total Carbon NP for Phase I, II and III HYP and SUP samples

Table 5-1 indicates that samples from the Casino deposit contain low concentrations of CaNP with values ranging from below the analytical detection (< 0.8 kg CaCO3/t) in the oxide cap and the supergene, up to a 90th percentile of 64.7 kg CaCO3/t in the hypogene (ore). Similar to the ScNP values, the CAP, SOX and SUS have particularly low CaNP concentrations with median values of < 3.2 kg CaCO3/t. The highest median CaNP values are indicated for both the ore and waste samples from the HYP with 27.3 kg $CaCO_3$/t. The NP data for the Casino samples is consistent with paste and rinse pH results

Table 5-1 where the low-NP CAP samples were indicated to be actively generating acid (median pH of 4.7) and the HYP samples containing carbonate were slightly alkaline (median pH of 8.1). Figure 5-6 plots ScNP versus CaNP for the Phase I, II and III samples, as ScNP was not determined for the Phase IV samples. The dashed line represents the points along which samples would plot if all the measured ScNP were a result of calcite ($CaCO_3$) dissolution. Points plotting above this line indicate that these samples may contain Fe-bearing carbonate minerals (*e.g.*, ankerite). Points plotting below this line indicate that the measured NP has a non-carbonate component, since the measured bulk NP of a sample is higher than the CaNP value.

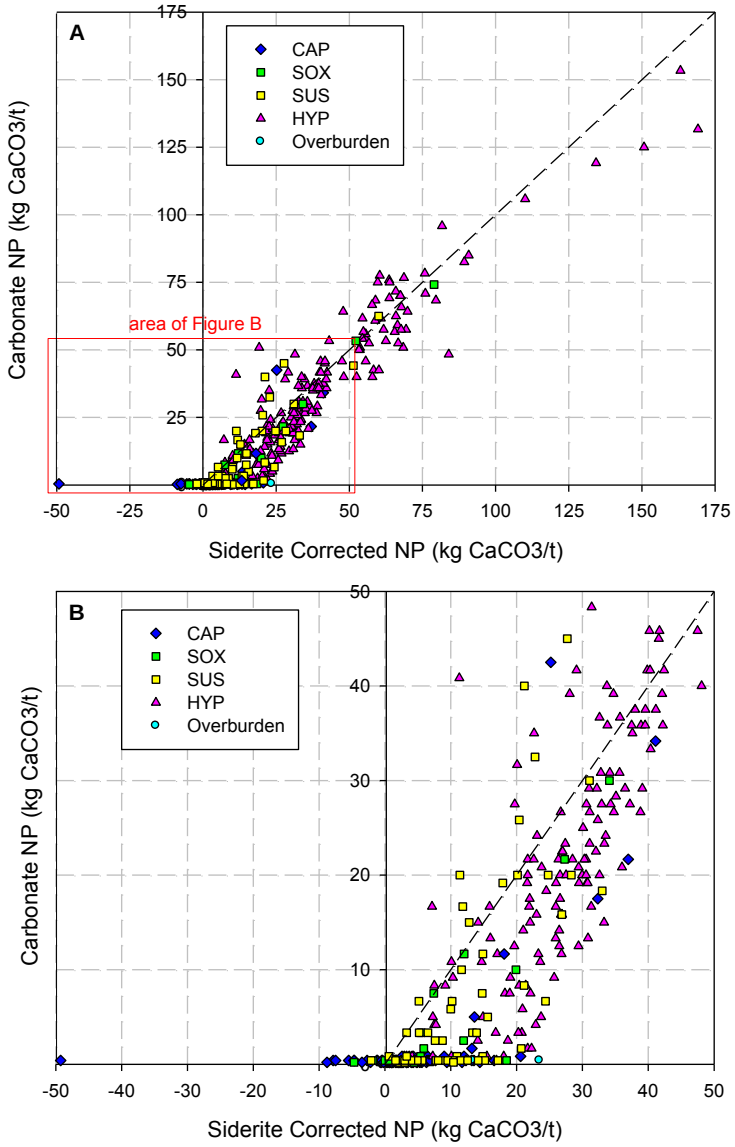


Figure 5-6: Carbonate NP versus siderite corrected NP for Phase I, II and III static test samples for the mineralized zones of the Casino deposit

A small group of samples from the SUS and HYP zones plot above this line, indicating that Fe-carbonate minerals are part of the carbonate mineral assemblage of these mineralization zones; a result supported by mineralogical investigations which indicated the presence of ankerite in the HYP waste (Table 4-4). However, the majority of samples plot below the dashed line, indicating that the rocks of the Casino deposit generally have higher ScNP than CaNP (Figure 5-6, Table 5-1) and that a portion of their measured NP is due to the dissolution of non-carbonate minerals.

As previously indicated, it is known from field observations, and has also been quantified in laboratory studies, that silicate minerals may contribute to the total neutralizing capacity of a sample; however, the reaction rates are typically slow relative to the rate of sulphide oxidation and the rate of carbonate dissolution (Jambor *et al*., 2007). Thus, in situations such as the Casino deposit, where NP values are generally low, the contribution by non-carbonate minerals to the laboratory-determined bulk NP may lead to an overestimation of "available NP", thereby resulting in an incorrect interpretation as to whether a rock will be acid generating. In addition, a portion of the total CaNP may be unavailable due to the exclusion of carbonate minerals being locked in a silicate matrix. Unavailable NP represents the measured NP that is ineffective at buffering the pH to a neutral value. The amount of NP that is unavailable for acid buffering was determined by comparing the paste pH and total CaNP in the Casino ABA dataset (Figure 5-7, Figure 5-8). The measured CaNP in samples with a paste pH less than the pH of the deionized water used in the pH determination (pH=5.1) is considered unavailable. An exponential trend line evaluating the pH – NP relationship is presented for SUP (Figure 5-7) and HYP (Figure 5-8). Based on the trend observed in the existing ABA database and interpolated to a conservative pH of 6.0, 3.7 kg$CaCO_3$/tonne and 2.4 kg$CaCO_3$/tonne of the total CaNP is unavailable in the HYP and SUP mineralization zones, respectively. This correction factor is carried forward to calculate net potential ratio using CaNP.

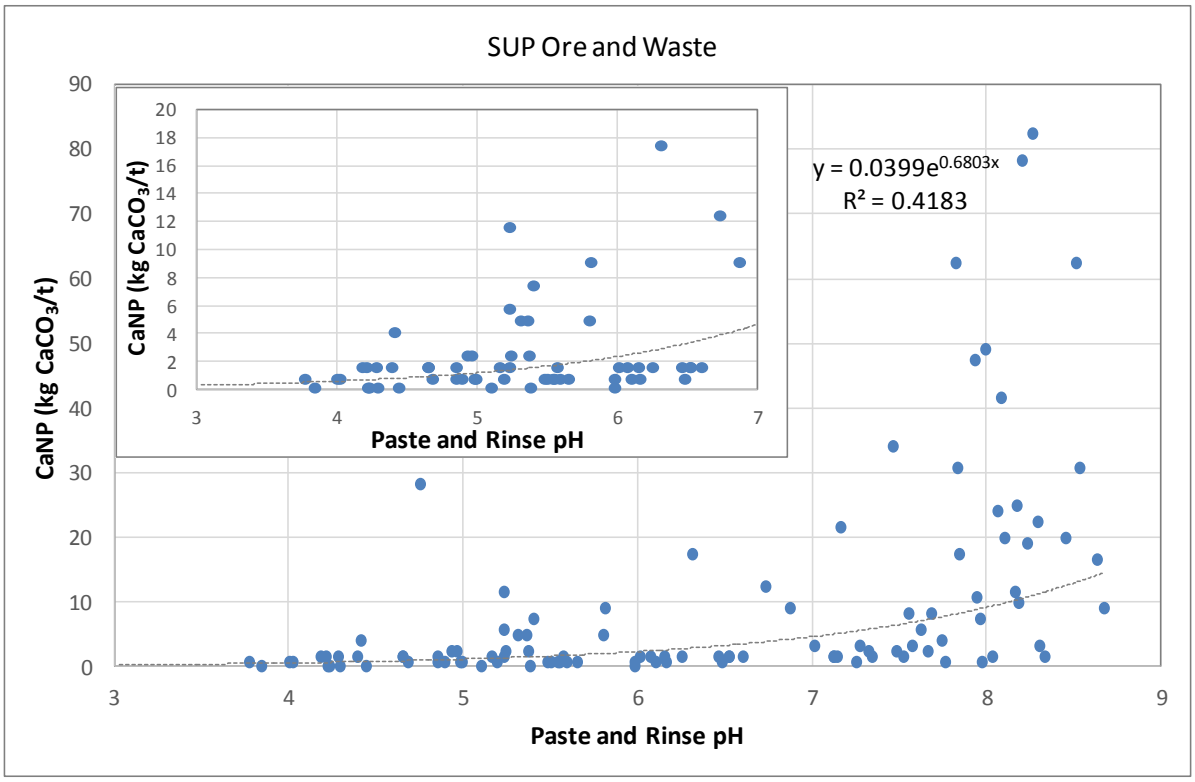


Figure 5-7: CaNP versus Paste and Rinse pH for SUP samples

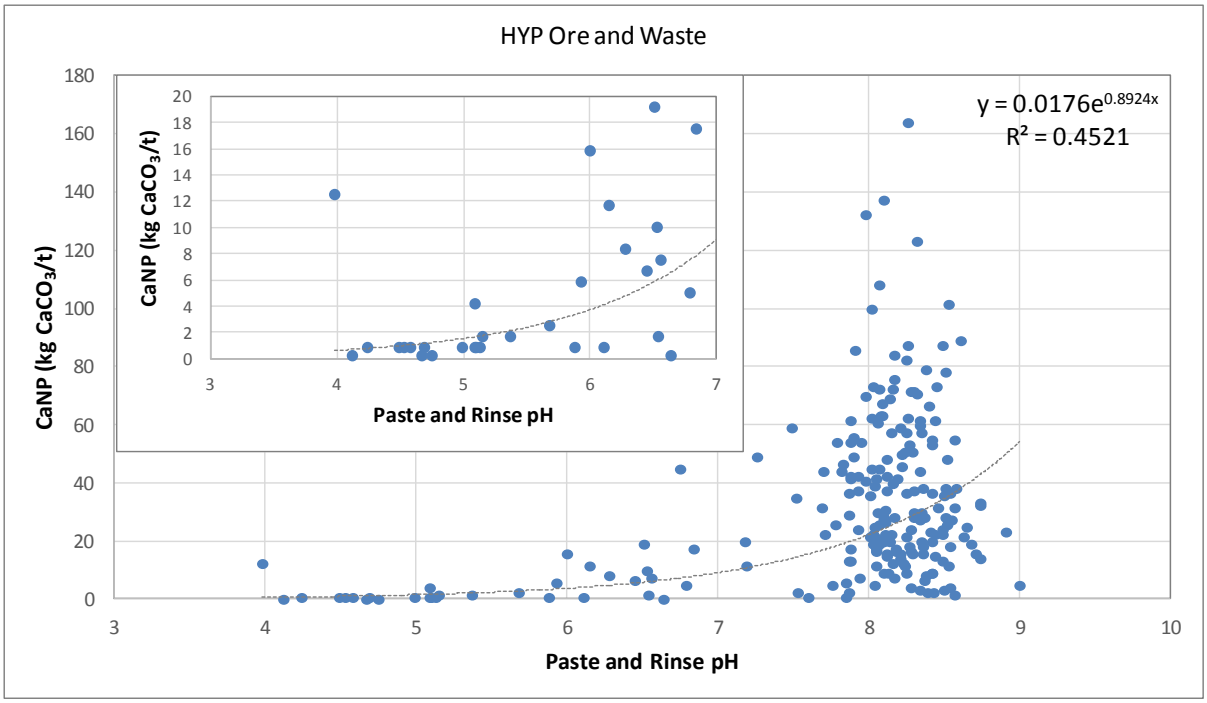


Figure 5-8: CaNP versus Paste and Rinse pH for HYP samples

The net potential ratio (NPR), which is calculated by dividing the NP of a sample by its AP, is often used to assess the likelihood of a sample to generate acidic drainage. The Gard Guide (INAP, 2009) uses the following general criteria:

- Samples with NPR<1 are considered PAG;
- Samples with 1≤NPR≤2 have uncertain ARD generating potential;
- Samples with NPR>2 are considered Non-PAG.

As stated previously, NPR for the Casino geochemical characterization study is calculated from the ration of CaNP to AP. Table 5-3 summarizes the formulas used to calculate the NP and the AP for the different mineralized zones. The different calculations for the different sample sets and mineralization zones reflect the analytical techniques and distinct mineralogy of each zone.

Table 5-3:
Methodology used to determine the CaNP and AP

	CaNP	AP (CAP & SOX)	AP (SUS & HYP)
Phase I, II and III	(TIC x 83.33) - Unavailable CaNP	(Sulphide S x 31.25) + (non-Sulphate S x 23.44)	Non-sulphate S x 31.25
Phase IV	(TC x correction factor of 0.9348 x 83.33) - Unavailable CaNP	TS x 31.25	TS x 31.25

Table 5-1 indicates that 10th and 90th percentile NPR values (CaNP/AP) for the Casino samples range from 0.00057 in the SUS (waste) up to 2.3 in the HYP (ore). Median NPR values for all mineralization zones are < 1 and median NPR values for the CAP, SOX and SUS (ore and waste) are < 0.1. Figure 5-9 provides a plot of NPR versus total sulphur for the Casino samples. A red dashed line separates the samples with NPR values > 2 from those with NPR values < 2 and indicates that the bulk of the samples from the Casino deposit plot below this line and are PAG.

A more detailed assessment of the acid generating potential of each mineralization zone of the Casino deposit is discussed in subsequent sections following a review of the solid phase metal results. In addition to ore and waste designation, the different lithologies and alteration types within each mineralization zone are investigated. The majority of the samples from the Casino deposit are indicated to have NPR values of < 2; therefore, identifying the common element among the samples with NPR values > 2 is important in order to identify which materials may be used for construction purposes at the Casino Project site.

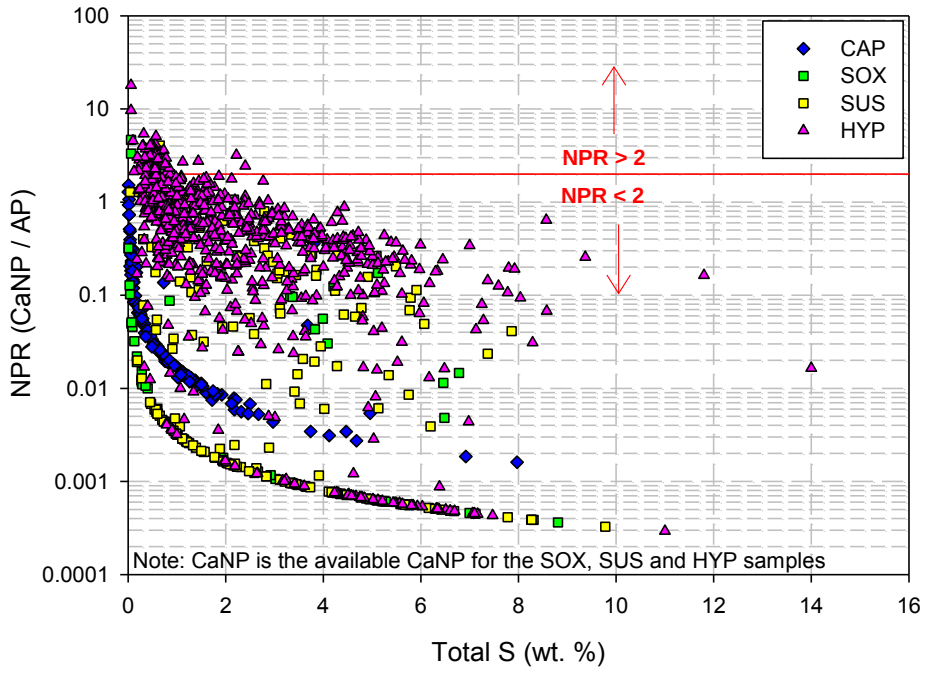


Figure 5-9: NPR versus total sulphur for static test samples for the Casino Project.

5.2 Solid Phase Metals

Solid-phase metals data are used to identify which metals are enriched in the various waste materials. This information can be used in combination with ABA to establish the geochemical properties of the mine rock of the Casino deposit. Table 5-4 presents a summary of the median metal abundances obtained from aqua-regia digestion of the Casino samples (Phase I, II and III). The degree of enrichment of an element over crustal abundance can be used as a general indicator of the metals that could be of potential concern, and which should be scrutinized in field kinetic leaching tests prior to further development of the deposit. However, solid-phase metal concentrations well above crustal abundance do not conclusively indicate that the metal will be leached at a high rate from the material. Rather, the rate of metal leaching is related to the metal's mineralogical association and the aqueous geochemistry of the infiltrating waters.

An indicator of significant solid-phase enrichment is assigned arbitrarily herein to be values greater than or equal to three times the crustal abundance. These values are indicated as shaded cells (light grey) in Table 5-4. Values indicated to be greater than or equal to ten times the crustal abundance are shaded in dark grey. Values for elements that were indicated to be present in concentrations below detection were set at half the analytical limit in order to maintain a conservative analysis. For a complete listing of the Casino samples solid-phase metals data, refer to Appendix D.2.

Table 5-4 indicates that silver (Ag), gold (Au), bismuth (Bi), molybdenum (Mo), sulphur (S), selenium (Se), and tellurium (Tl) are present in elevated concentrations in ore and waste designated samples within each mineralization zone of the Casino samples. Additionally, arsenic (As) is elevated in all except the median values for the SUS waste designated samples, and copper (Cu) is elevated in all except the CAP waste rock. Cadmium (Cd) and antimony (Sb) are generally not elevated except in the SUP ore designated samples, with Cd elevated in the SOX samples and Sb elevated in the SOX and SUS samples. All of the mentioned metals are being assessed further using kinetic testing to determine whether these metals may be of environmental concern in drainage from stockpiled waste rock from the proposed pit excavation.

Table 5-4:
Median Metal Concentrations for Waste and Ore Samples from Mineralization Zones of the Casino Deposit (Phase I, II and III)

Metal	Units	CAP		SOX		SUS		HYP		Average Continental Crust
		ore (n=32)	waste (n=102)	ore (n=19)	waste (n=20)	ore (n=27)	waste (n=40)	ore (n=58)	waste (n=161)	
Ag	ppm	1.0	0.80	1.4	0.50	1.1	0.50	1.1	0.50	0.075
Al	%	0.59	0.38	0.89	0.67	1.4	1.2	0.92	0.57	8.23
As	ppm	13	10	13	7.2	14	5.3	6.9	5.8	1.8
Au	ppb	153	77.4	139	51.9	120	51	110	54	**4**
Ba	ppm	200	172	109	63	102	92	99	90	425
Bi	ppm	1.1	1.8	1.7	0.80	1.6	0.85	1.0	0.90	**0.17**
Ca	%	0.020	0.020	0.080	0.12	0.16	0.25	1.0	1.2	4.15
Cd	ppm	0.10	0.050	0.50	0.10	0.25	0.25	0.20	0.10	0.15
Co	ppm	1.9	1.8	7.2	12	13	14	12	12	25
Cr	ppm	67	68	53	92	49	67	57	65	105
Cu	ppm	251	126	1290	640	1280	819	1443	507	60
Fe	%	3.5	2.8	2.0	3.2	3.1	3.4	2.3	3.1	5.63
Hg	ppm	0.0050	0.0050	0.0050	0.0050	0.0075	0.0050	0.010	0.0050	**0.08**
K	%	0.46	0.45	0.23	0.22	0.42	0.28	0.33	0.24	2.09
La	ppm	21	14	23	11	20	15	20	15	39
Mg	%	0.075	0.040	0.39	0.41	0.35	0.62	0.55	0.47	2.3
Mn	ppm	32	18	74	92	113	156	164	165	950
Mo	ppm	255	35	120	31	91	25	159	25	**1.5**
Na	%	0.018	0.022	0.033	0.017	0.025	0.029	0.024	0.022	2.36
Ni	ppm	3.3	2.7	5.5	6.4	4	7.5	5.4	5.8	84
P	%	0.052	0.034	0.045	0.048	0.053	0.065	0.049	0.055	0.105
Pb	ppm	11	12	15	5.1	7.8	5.0	8.3	6.9	**12.5**
S	%	0.32	0.67	0.24	1.8	1.7	1.8	1.4	1.9	0.035
Sb	ppm	0.50	0.50	0.80	0.40	2.5	0.25	0.40	0.40	**0.2**
Sc	ppm	2.3	1.2	2.2	1.6	3.7	2.7	4.1	1.8	22
Se	ppm	1.9	1.7	1.4	1.9	1.3	1.4	1.5	1.6	**0.05**
Sr	ppm	21	19	19	12	16	18	31	34	**375**
Th	ppm	10	7.7	10	12	10	7.9	11	11	**9.6**
Ti	%	0.015	0.0060	0.0090	0.0030	0.023	0.010	0.021	0.0030	0.565
Tl	ppm	0.30	0.20	0.20	0.20	0.20	0.20	0.20	0.20	**0.001**
U	ppm	3.4	1.3	2.8	3.5	5.0	4.0	4.9	4.4	**2.7**
V	ppm	22	8.5	20	11	27	22	31	15	120
Zn	ppm	17	9.0	72	29	25	32	24	21	70

Notes:
1. Values greater than or equal to 3 times the crustal concentration are shaded in light grey. Values greater than or equal to 10 times the crustal concentration are shaded in dark grey.
2. Average continental crustal abundances according to Price (1997). Bold values are from CCR (1985).

5.3 Mineralization Zones

5.3.1 Oxide Leach Cap

The total sulphur content of the CAP samples ranges from the detection limit (0.01 %S) through to the 90th percentile of 2.47 wt. %S for ore and 2.2 wt. %S for waste, the majority of which occurs as sulphate sulphur (Table 5-1). SFE testing was conducted on a subset of 78 CAP samples. SFE data are used to evaluate the quantity of water soluble sulphate minerals that could contribute to acid generation in comparison to the acid soluble sulphate sulphur data from ABA analysis. The CAP samples exhibited acid soluble sulphate values that were often two orders of magnitude greater than water soluble sulphate (Figure 5-10). The two sulphate measurements in the CAP samples support the presence of highly soluble sulphate minerals as well as the predominance of sparingly soluble sulphate minerals, such as jarosite. Based on the moderately acidic SFE rinse pH values and longer term laboratory column leachate pH (Lorax, 2013), both types of minerals may contain stored acidity.

Consistent with the genesis of the oxide leach cap mineralization zone, the ABA data demonstrate that carbonate has been "leached" out of the CAP. Approximately 90% of the CAP samples have CaNP values below the analytical detection limit (< 0.8 kg $CaCO_3$/t) (Figure 5-11). As a result of the extremely low or absent CaNP, the NPR values are extremely sensitive to the sulphur content used to calculate the AP of the sample. Using the methodology for calculating NPR established in Section 5.1, all of the CAP samples (ore and waste) have NPR values of < 2 (Table 5-1). However, CAP samples that have paste pH > 7.1 also typically have total sulphur content < 0.1 %S, which indicate they have a low acid generating potential. These samples are illustrated by orange symbols on Figure 5-11. However, there are 4 samples with a pH > 7.1 that have a sulphur content > 0.1, which suggests that these samples may not have been fully leached and are distinct from the rest of the CAP samples (Figure 5-11). This trend indicates that a combined paste pH and total S measurement is the most conclusive indication of the CAP rock's acid generating potential.

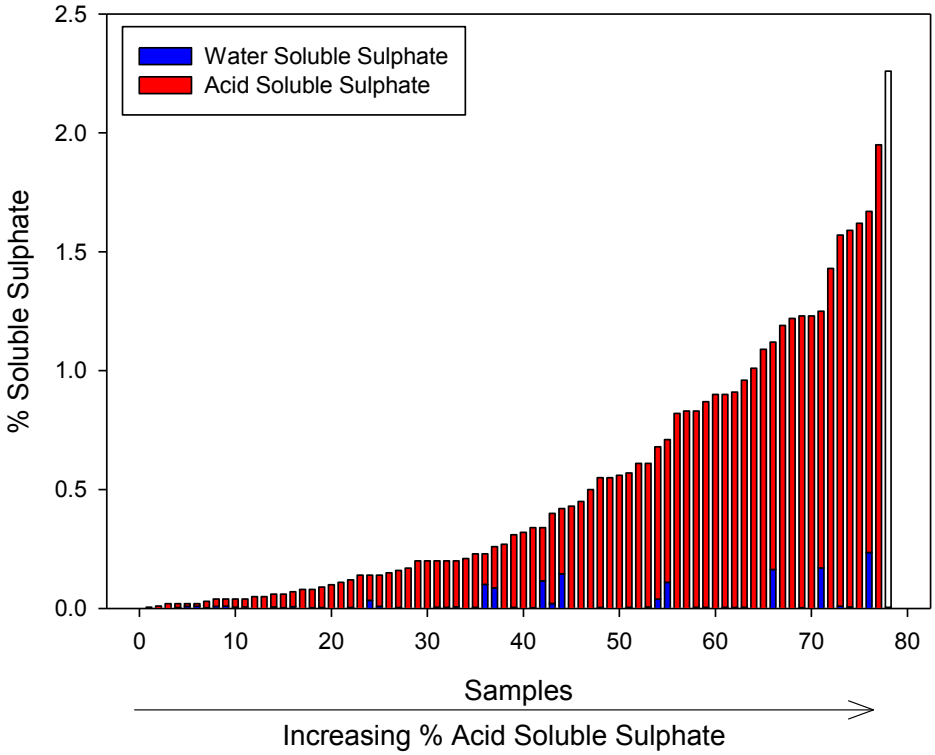


Figure 5-10: Acid soluble and water soluble sulphate content in CAP samples

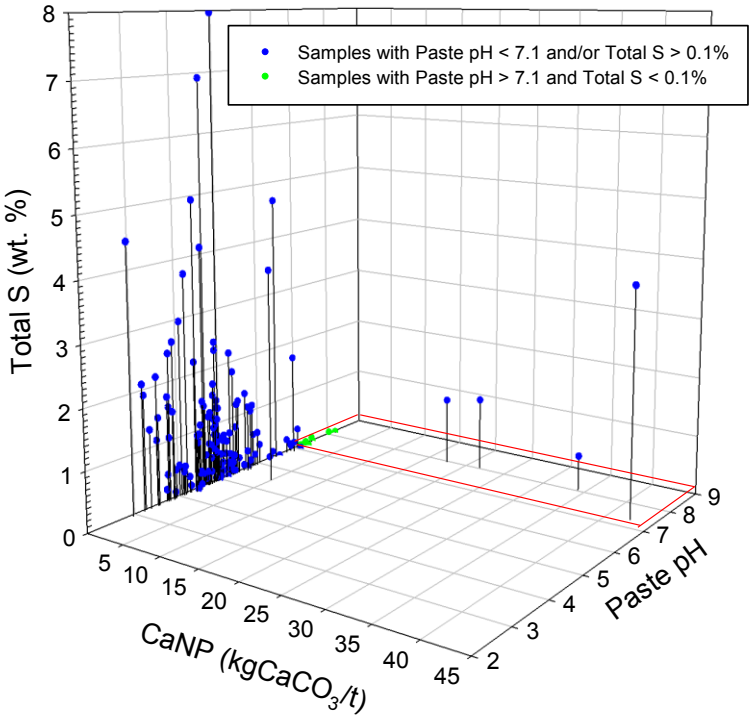


Figure 5-11: Total Sulphur versus Carbonate NP versus paste pH values for Phase I, II and III Oxide CAP samples

5.3.2 Metal Leaching Potential

A relationship between pH and metal leaching potential was first outlined in the Phase I Geochemical Assessment (Lorax, 2009). This initial study identified that a paste pH of 6.0 could delineate samples in the CAP with a high ML/ARD potential based on SFE and ABA results of the Phase I CAP samples. As would be expected paste pH and SFE rinse pH have a positive correlation but do not correspond exactly (Figure 5-12).

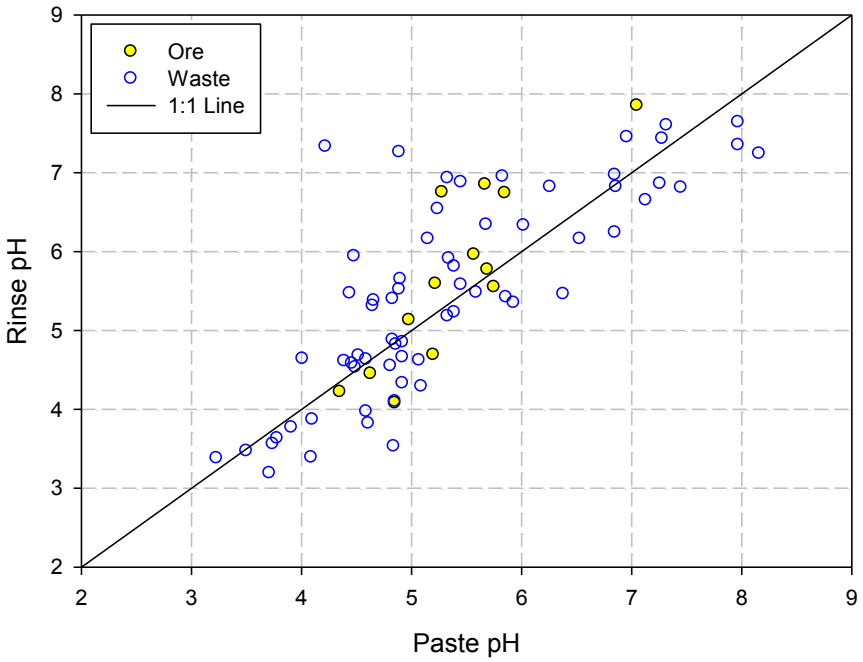


Figure 5-12: SFE Rinse pH versus paste pH values for Oxide CAP samples

Further analysis of metal release relative to pH indicates that higher rates of metal release are observed in the SFE for low pH samples. The data show that the levels of metals, including Al, Cu, Fe, Mn and Zn, in solution decrease significantly as pH increases (Figure 5-13) while the levels of metalloids such as As, Mo and Se do not consistently correlate with pH within the range of 4 to 8 (Figure 5-14).

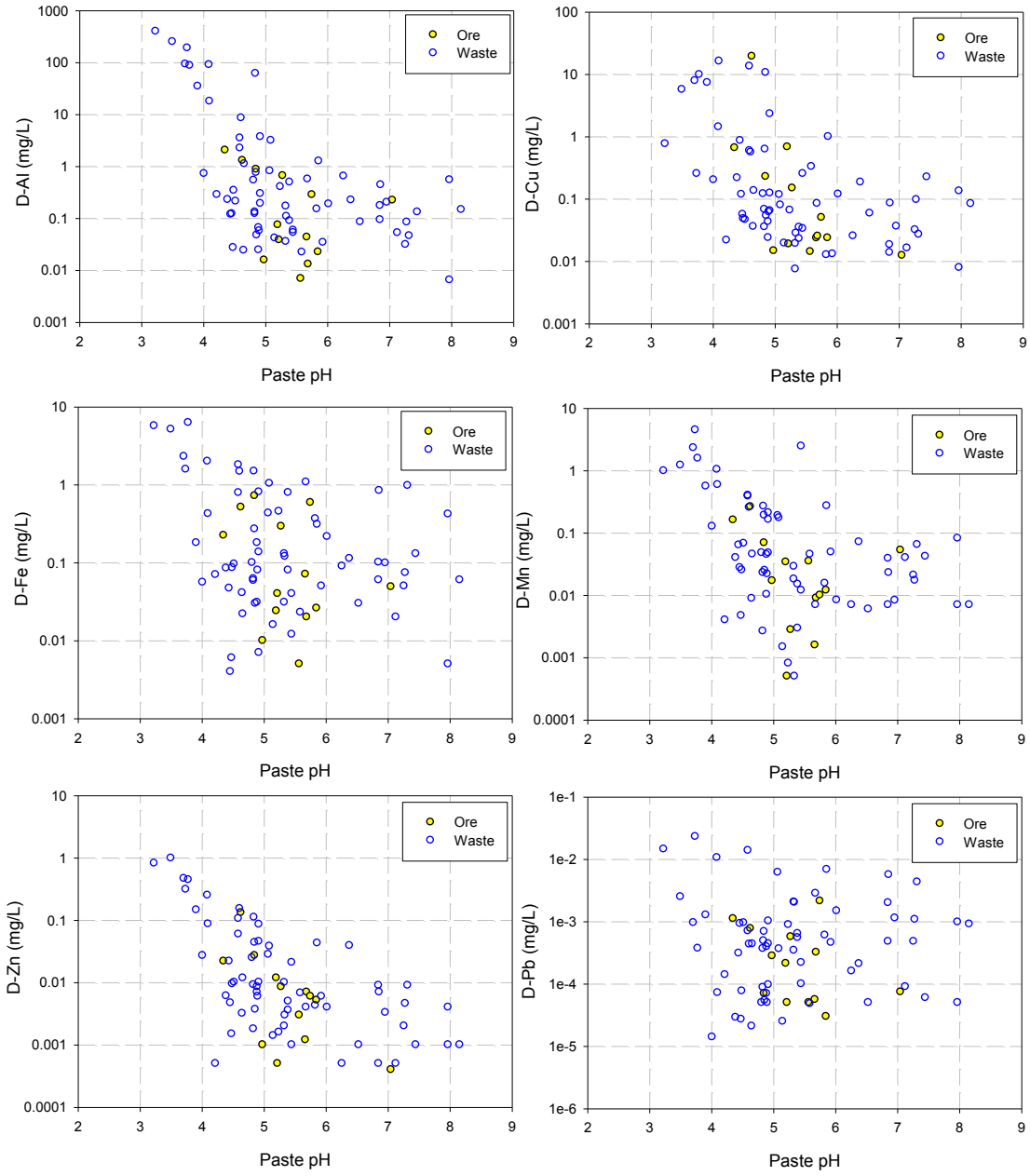


Figure 5-13: Paste pH versus SFE Al, Cu, Fe, Mn, Pb and Zn concentrations for Oxide CAP samples

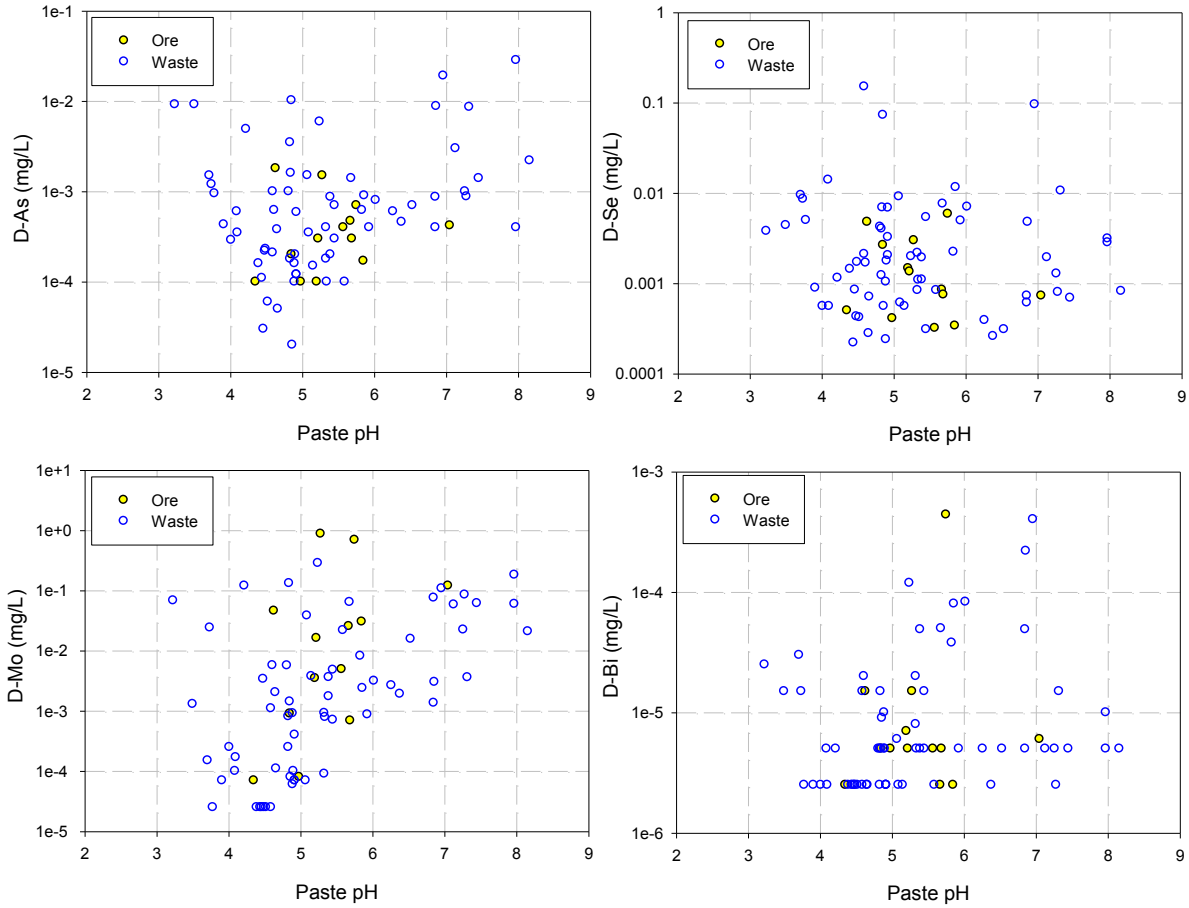


Figure 5-14: Paste pH versus SFE As, Mo, Bi and Se concentration for Oxide CAP samples.

Overall the data indicate that the release rates of most metals are low from the majority CAP samples regardless of pH. Although SFE do not provide a direct measure of drainage chemistry, SFE concentrations were compared to CCME guidelines as a reference in Table 5-5. The range of metal concentrations for the SFE from CAP (Table 5-5) shows that Al, Cd, Cr, Cu and Se release from the CAP has the greatest potential to impinge upon freshwater aquatic life. In particular, Cu and Al have the greatest metal leaching potential, which increases at lower pH. This indicates that Al and Cu are the parameters of greatest concern for the CAP material.

Table 5-5:
CAP Shake Flask Extraction Statistics

Parameter	Units	CCME (max)[2]	MMER[3]	CAP (paste pH < 6) (n=61)				
				Minimum	10th percentile	Median	90th percentile	Maximum
Rinse pH				3.19	3.63	5.13	6.75	7.33
Sulphate	mg/L	100		10	14	41	***865***	***2355***
D-Al	mg/L	0.005[a]		***0.0069***	***0.0246***	***0.284***	***61.3***	***397***
D-Sb	mg/L	0.02[b]		0.00001	0.00001	0.00017	0.0021	***0.0275***
D-As	mg/L	0.005	0.5	0.00002	0.0001	0.00035	0.0018	***0.0102***
D-Cd	mg/L	0.000004[c]		0.0000015	***0.000013***	***0.000115***	***0.00132***	***0.00479***
D-Cr	mg/L	0.001[d]		0.00005	0.0001	***0.0011***	***0.0141***	***0.092***
D-Co	mg/L	0.11		0.000001	0.00013	0.00212	***0.111***	***0.472***
D-Cu	mg/L	0.002[c]	0.5	***0.00747***	***0.0192***	***0.0845***	***7.33***	***19.3***
D-Fe	mg/L	0.3		0.004	0.016	0.1	***1.58***	***6.26***
D-Pb	mg/L	0.001[c]	0.2	0.000014	0.000048	0.000393	***0.00283***	***0.0231***
D-Mn	mg/L	0.2[e]		0.0005	0.0028	0.045	***0.989***	***4.48***
D-Hg	ug/L	0.026		0.005	0.005	0.02	***0.05***	***0.18***
D-Mo	mg/L	0.73		0.000025	0.000025	0.00091	0.0641	***0.872***
D-Ni	mg/L	0.25[c]		0.0002	0.0003	0.00167	0.0426	0.24
D-Se	mg/L	0.001	0.5	0.0002	0.0004	***0.0017***	***0.0086***	***0.151***
D-Ag	mg/L	0.0001		0.0000025	0.000005	0.00002	***0.00018***	***0.0036***
D-Zn	mg/L	0.03	0.5	0.0005	0.0015	0.0095	***0.153***	***0.988***
Parameter	**Units**	**CCME (max)[2]**	**MMER[3]**	**CAP (paste pH > 6) (n=17)**				
				Minimum	**10th percentile**	**Median**	**90th percentile**	**Maximum**
Rinse pH				4.61	5.95	6.84	7.612	7.85
Sulphate	mg/L	100		6	13	30	97.5	***1013***
D-Al	mg/L	0.005[a]		***0.0065***	***0.0416***	***0.161***	***0.579***	***1.74***
D-Sb	mg/L	0.02[b]		0.0001	0.0001	0.00067	0.00442	***0.0453***
D-As	mg/L	0.005	0.5	0.0004	0.000414	0.00089	***0.01189***	***0.0284***
D-Cd	mg/L	0.000004[c]		0.0000015	0.0000015	***0.000063***	***0.000342***	***0.00091***
D-Cr	mg/L	0.001[d]		0.0002	0.000285	0.001	***0.0035***	***0.152***
D-Co	mg/L	0.11		0.00005	0.00018	0.00052	0.00237	0.0205
D-Cu	mg/L	0.002[c]	0.3	***0.0079***	***0.0134***	***0.0476***	***0.1977***	***20.1***
D-Fe	mg/L	0.3		0.005	0.027	0.0945	***0.830***	***0.974***
D-Pb	mg/L	0.001[c]	0.2	0.00005	0.000057	0.000695	***0.00269***	***0.00563***
D-Mn	mg/L	0.2[e]		0.006	0.007	0.022	0.0746	***0.189***
D-Hg	ug/L	0.026		0.005	0.005	0.015	***0.046***	***0.06***
D-Mo	mg/L	0.73		0.00136	0.00243	0.0403	0.1116	0.182
D-Ni	mg/L	0.25[c]	0.5	0.0002	0.0003	0.0009	0.0070	0.012
D-Se	mg/L	0.001		0.00026	0.000366	0.0010	***0.00812***	***0.0957***
D-Ag	mg/L	0.0001		0.000005	0.000005	0.00003	***0.00047***	***0.00090***
D-Zn	mg/L	0.03	0.5	0.0004	0.0005	0.0026	0.0180	***0.0828***

Notes:
1. Metals are dissolved concentrations. Values shaded in grey represent values which exceed the CCME guidelines
2. Canadian Council of Minister's of the Environment Maximum Water Quality Guidelines for the Protection of Freshwater Aquatic Life
3. Metal Mining Effluent Regulations, Schedule 4, Maximum Authorized Monthly Mean Concentration
   a) criteria based on pH of <6.5
   b) criteria based on proposed Ontario guideline for the protection of freshwater aquatic life
   c) criteria based on hardness of 7.5 mg $CaCO_3$/L for hardness dependent metals
   d) criteria is for Cr (VI)
   e) irrigation guideline

5.3.3 NAG CAP Segregation Criteria

SFE data from 79 CAP samples were used to establish a relationship between pH and Cu concentration using a regression analysis (Figure 5-15). Copper was chosen for the regression as it is the element with the greatest leaching potential. The pH cutoff where Cu would meet the Metal Mining Effluent Regulations (MMER) Maximum Authorized Monthly Mean (MMM) of 0.3 mg/L was determined for the 75% and 90% confidence intervals. For 75% confidence, the pH cutoff is 6.4 and for 90% confidence the pH cutoff is 7.1. Samples with a paste or rinse pH above 7.1 are considered NAG, while samples with a pH of less than 6.4 are considered PAG. Paste and rinse pH values between 6.4 and 7.1 are considered to have an uncertain acid generation potential. These pH cutoffs were used along with Casino Mining Corporation's block model to estimate the volume of NAG material within the CAP. This resulted in an estimated range of volumes for neutral CAP material, from 1 Mm^3 to 1.5 Mm^3. Paste and rinse pH were also plotted with %Ca and %Ca/%S results from aqua regia and assay data (Appendix F.1). However, the correlation was not strong enough to use this relationship to designate neutral material.

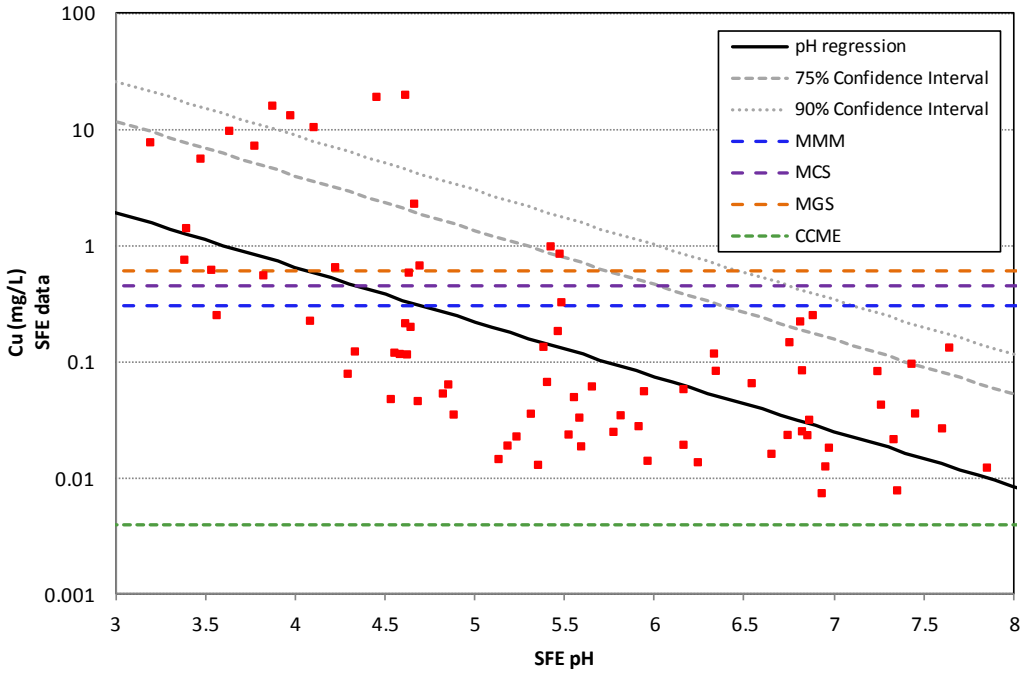


Figure 5-15: SFE pH versus SFE copper concentration for Oxide CAP samples. MMM - Maximum Authorized Monthly Mean, MCS - MMER Maximum Authorized Concentration in a Composite Sample, MGS - MMER Maximum Authorized Monthly Mean Concentration, MMER - Metal Mining Effluent Regulations , CCME - Council of Canadian Ministers of the Environment

Using pH values of 6.4 and 7.1 as ARD criteria, approximately 88% of the CAP samples would be considered to have a high ML/ARD risk and a further 8% have uncertain ML/ARD risk (Table 5-6). The remaining 4% are considered NAG (1% of ore designated samples and 5% of waste designated samples).

The spatial distribution within the Casino pit of CAP samples was used to evaluate areas of the pit where there is a greater proportion of CAP rock that has paste pH > 7.1. Plan sections between the 1140 m and 1215 m elevation indicate that a cluster of samples with rinse pH > 7.1 occurs in the northeast portion of the pit (Appendix F.2). A volume of approximately 1.5 Mm^3 of NAG waste rock is in this area as demarcated by green polygons on the plan sections that was determined using the CMC geologic block model.

Table 5-6:
Percentage of Samples from the CAP with ML/ARD Potential using the pH criteria of 6.4 and 7.1

Mineralization Zones		No. of Samples	Paste & Rinse pH		
		n	<6.4	6.4-7.1	>7.1
CAP	Ore	109	88%	11%	1%
	Waste	374	87%	8%	5%
	No Designation	10	100%	0%	0%
	Total	**493**	**88%**	**8%**	**4%**

The magnitude of acid generation from the dissolution of the water soluble sulphate minerals is lower relative to materials with an equivalent amount of pyrite. However, the relative duration of the acidic contribution from sulphate minerals of the CAP waste rock and ore continues to be investigated in field and laboratory kinetic tests (Lorax, 2013).

Given the low NP values of the CAP samples and variable mineral phases contributing to the measured sulphur content, paste or rinse pH is a more appropriate parameter to assess the acid generating potential of the samples in context with the sulphate sulphur content. Determination of the pH and sulphur content are determined to be appropriate indices for assessing the ARD potential of the CAP waste rock and ore due to the following characteristics of the CAP:

- sulphate minerals are the major available source of acidity in CAP samples, sulphate-S in the form of jarosite is the primary source of acidity rather than sulphide minerals;
- CAP samples typically lack carbonate minerals to buffer at neutral or alkaline pH; and
- pH neutral samples designated as CAP that have high sulphur content are likely misidentified and are likely SUP or HYP samples with significant sulphide content.

Based on these characteristics CAP rock with a low ML/ARD potential are designated as those with a rinse pH > 7.1 and total sulphur content < 0.1 %S. The extent of the samples is illustrated in Appendix F.2.

5.3.4 Supergene Zone

The majority of the SOX and SUS samples (97% of SOX, 99% of SUS) have been identified as having NPR values of < 2 (Table 5-7), which implies that under advanced weathering conditions oxidized waste rock and ore from this mineralization zone within the Casino deposit is predicted to produce acidic pH. Table 5-7 also presents the percentage of ore and waste designated samples from the SOX and SUS with ML/ARD potential using the paste pH criteria of 5.1.

Table 5-7:
NPR Values for Ore and Waste Designated Samples from the SOX and SUS

Mineralization Zones		No. of samples		NPR (CaNP/AP)		Paste & Rinse pH	
		NPR	Paste & Rinse pH	NPR>2	NPR<2	≥5.1	<5.1
		n	n				
SOX	Ore	31	26	6%	94%	62%	38%
	Waste	29	32	0%	100%	56%	44%
	Unknown designation	0	3	-	-	0%	100%
	Total	**60**	**61**	**3%**	**97%**	**56%**	**44%**
SUS	Ore	69	33	3%	97%	82%	18%
	Waste	108	42	0%	100%	83%	17%
	Unknown designation	0	1	-	-	0%	100%
	Total	**177**	**76**	**1%**	**99%**	**82%**	**18%**

Supergene samples have variable paste and rinse pH and CaNP values ranging from alkaline to acidic. Although the majority of the SUP samples are potentially acid generating (NPR < 2) the majority of the samples have paste or rinse pH values ≥ 5.1. Of the two samples from the SOX that have NPR values > 2, one has a paste pH>5.1 and the other was not analyzed for paste pH. Similarly, the two samples from the SUS with NPR values > 2 have a paste pH >5.1. Given the elevated potential for acid drainage (Table 5-7) and metal release from the SOX and SUS identified by the static test program, it is expected that there is little potential for waste material from these zones not to have acid generating and metal leaching potential.

The SFE data indicate that samples from the SUP generally exhibited the highest concentrations of the dissolved constituents (Appendix G). Although SFE do not provide

a direct measure of drainage chemistry, the values were compared to CCME guidelines as a reference and showed that median SFE concentrations of Al, Cd, Cr, Cu and Se in the SUP zone were all elevated with respect to CCME guidelines for the protection of freshwater aquatic life (Table 5-8). The high concentrations observed from the SUP zone are likely due to the presence of both secondary sulphides and oxidation products. Secondary sulphides tend to have poor crystal structure relative to primary sulphides, rendering them unstable and therefore more reactive.

Table 5-8:
Shake Flask Extraction Statistics for the Supergene Zone Samples

Parameter	Units	CCME (max)[2]	MMER[3]	Minimum	10th percentile	Median	90th percentile	Maximum
pH				3.3	3.9	7.1	7.8	7.9
Sulphate	mg/L	100		18	20	52	***521***	***2248***
Aluminum Al	mg/L	0.005[a]		***0.0106***	***0.0109***	***0.23***	***30.6***	***71.4***
Antimony Sb	mg/L	0.02[b]		0.00005	0.00009	0.00086	0.0114	***0.0325***
Arsenic As	mg/L	0.005	0.5	0.00006	0.00015	0.0013	0.0033	***0.00779***
Cadmium Cd	mg/L	0.000004[c]		0.000003	***0.000013***	***0.000499***	***0.00803***	***0.0235***
Chromium Cr	mg/L	0.001[d]		0.00005	0.00005	***0.0016***	***0.0033***	***0.0259***
Cobalt Co	mg/L	0.11		0.000173	0.000398	0.00334	0.0752	***0.33***
Copper Cu	mg/L	0.002[c]	0.3	***0.00288***	***0.00633***	***0.117***	***47.6***	***87.1***
Iron Fe	mg/L	0.3		0.0005	0.002	0.15	***3.05***	***7.55***
Lead Pb	mg/L	0.001[c]	0.2	0.000016	0.000018	0.000193	0.00056	0.000822
Manganese Mn	mg/L	0.2[e]		0.0005	0.004	0.0942	***0.667***	***7.68***
Mercury Hg	ug/L	0.026		0.005	0.005	0.020	***0.090***	***0.11***
Molybdenum Mo	mg/L	0.73		0.00015	0.00043	0.0101	0.325	***0.969***
Nickel Ni	mg/L	0.25[c]	0.5	0.00042	0.00058	0.001	0.0739	0.186
Selenium Se	mg/L	0.001		0.00027	0.00042	***0.0021***	***0.0068***	***0.00854***
Silver Ag	mg/L	0.0001		0.0000025	0.0000025	0.000031	***0.00014***	***0.00014***
Zinc Zn	mg/L	0.03	0.5	0.0005	0.001	0.004	***0.459***	***0.831***

Notes
1. Metals are dissolved concentrations. Values shaded in grey represent values which exceed the CCME guidelines
2. Canadian Council of Minister's of the Environment Maximum Water Quality Guidelines for the Protection of Freshwater Aquatic Life
3. Metal Mining Effluent Regulations, Schedule 4, Maximum Authorized Monthly Mean Concentration
   a) criteria based on pH of <6.5
   b) criteria based on proposed Ontario guideline for the protection of freshwater aquatic life
   c) criteria based on hardness of 7.5 mg $CaCO_3$/L for hardness dependent metals
   d) criteria is for Cr (VI)
   e) irrigation guideline

5.3.5 Hypogene Zone

The majority of the HYP samples (92% overall) have been identified as having NPR values of < 2 (Table 5-9), which implies that under advanced weathering conditions oxidized waste rock and ore from this mineralization zone within the Casino deposit is predicted to produce acidic pH conditions.

Table 5-9:
NPR Values for the Phase I, II, III and IV HYP Samples (waste and ore) of the Casino deposit

		No. of Samples	NPR (CaNP/AP)		NPR (CaNP/AP)	
			NPR > 2	NPR < 2	NPR > 2	NPR < 2
		n	n	n	%	%
HYP	Ore	210	24	186	11	89
	Waste	424	28	396	7	93
	Undefined	40	2	38	5	95
	Total	**674**	**54**	**620**	**8**	**92**

Note: CaNP is calculated using TIC for Phase I, II and III samples and total C with a correction factor for Phase IV samples. CaNP represents the available CaNP. AP is calculated using non-sulphate S for Phase I, II and III samples and total S for Phase IV samples.

Evaluation of the SFE data supports the premise that metal leaching from the Casino HYP rock is greater under acidic conditions. The one HYP sample with SFE pH < 5 has higher concentrations of dissolved Al, Cd, Cu, Fe and Zn in SFE relative to concentrations measured in SFE from the 11 HYP samples with pH > 5 (Table 5-10). However, paste pH data for Phase I and II samples indicate that the majority of samples have pH values > 7 even after 15 years of exposure (*i.e.*, length of time core has been exposed in the core racks); thereby indicating that for the majority of the HYP samples there is sufficient CaNP present to buffer generated acidity for > 10 years.

Because a large proportion of the rock and, in particular, the waste material to be extracted from the Casino deposit will be from the HYP, it is important to evaluate potential geologic controls on acid generation potential. However, similar to the samples from the CAP, SOX and SUS, no consistent correlation exists between acid generating potential of the HYP samples with regards to ore / waste designation, lithologic unit or alteration type. A few observations between ML/ARD characteristics and the lithology and alteration types are noted and presented below.

Table 5-10:
SFE Data for HYP samples

Parameter	Units	CCME (max)[2]	MMER[3]	HYP (pH < 5) (n=1)	HYP (pH > 5) (n=11)				
					Minimum	10th percentile	Median	90th percentile	Maximum
pH				4.47	5.92	7.54	7.8	8.08	8.19
Sulphate	mg/L	100		50	13	21	37	***207***	***1760***
Aluminum Al	mg/L	0.005[a]		***2.78***	***0.0144***	***0.0192***	***0.037***	***0.0754***	***0.209***
Antimony Sb	mg/L	0.02[b]		0.0005	0.00047	0.00047	0.0012	0.0101	0.0141
Arsenic As	mg/L	0.005	0.5	0.0007	0.00024	0.0009	0.00143	***0.00861***	***0.02***
Cadmium Cd	mg/L	0.000004[c]		***0.00041***	***0.000005***	***0.000008***	***0.000036***	***0.000103***	***0.000273***
Chromium Cr	mg/L	0.001[d]		0.0007	0.00005	0.00005	0.0002	0.0005	0.0009
Cobalt Co	mg/L	0.11		0.0123	0.000013	0.00003	0.00047	0.00125	0.00198
Copper Cu	mg/L	0.002[c]	0.3	***12.6***	***0.00217***	***0.00241***	***0.0102***	***0.0166***	***1.51***
Iron Fe	mg/L	0.3		***0.745***	0.001	0.003	0.008	0.027	0.125
Lead Pb	mg/L	0.001[c]	0.2	0.00042	0.000024	0.000027	0.00014	0.000293	0.00071
Manganese Mn	mg/L	0.2[e]		0.0951	0.00191	0.00475	0.0193	0.0552	0.1
Mercury Hg	µg/L	0.026		0.025	0.005	0.005	0.005	0.02	0.025
Molybdenum Mo	mg/L	0.73		0.0012	0.003	0.00312	0.00682	0.0355	0.0937
Nickel Ni	mg/L	0.25[c]	0.5	0.0298	0.0002	0.00022	0.00116	0.00589	0.0102
Selenium Se	mg/L	0.001		0.0008	0.00054	0.00065	***0.00118***	***0.00263***	***0.00417***
Silver Ag	mg/L	0.0001		0.00004	0.0000025	0.0000025	0.000008	0.000034	***0.000107***
Zinc Zn	mg/L	0.03	0.5	***0.0844***	0.0002	0.0004	0.001	0.0027	0.0089

Notes
1. Metals are dissolved concentrations. Values shaded in grey represent values which exceed the CCME guidelines
2. Canadian Council of Minister's of the Environment Maximum Water Quality Guidelines for the Protection of Freshwater Aquatic Life
3. Metal Mining Effluent Regulations, Schedule 4, Maximum Authorized Monthly Mean Concentration
   a) criteria based on pH of <6.5
   b) criteria based on proposed Ontario guideline for the protection of freshwater aquatic life
   c) criteria based on hardness of 7.5 mg CaCO3/L for hardness dependent metals
   d) criteria is for Cr (VI)
   e) irrigation guideline

5.3.5.1 Lithologic Units

Figure 5-16 plots the total sulphur values versus depth for HYP samples from Phase I through Phase IV, for the different lithological units. Sulphate sulphur is also plotted for Phase I through Phase II samples. There is no obvious division for sulphur content between the different lithologies. However, there does appear to be a greater prevalence of sulphate S between 150 m to 350 m depth.

Figure 5-17 plots CaNP values versus paste pH for ore and waste designated samples of the HYP according to lithology. The plot indicates that there is not a clear separation of paste pH and CaNP by lithology within the HYP. The results indicate that all intrusion breccia (IX) samples have paste pH values > 7 and CaNP values > 11 kg $CaCO_3$/t, while

both ore and waste designated samples from the Dawson Range (WR) and waste designated samples from the Patton Porphyry (PP) and explosion breccia (MX) make up the group of HYP samples with paste pH values < 7 and CaNP values near or at the analytical detection limit. A consistent trend between all rock types is that samples with paste pH < 6.0 also have CaNP < 10, regardless of lithology.

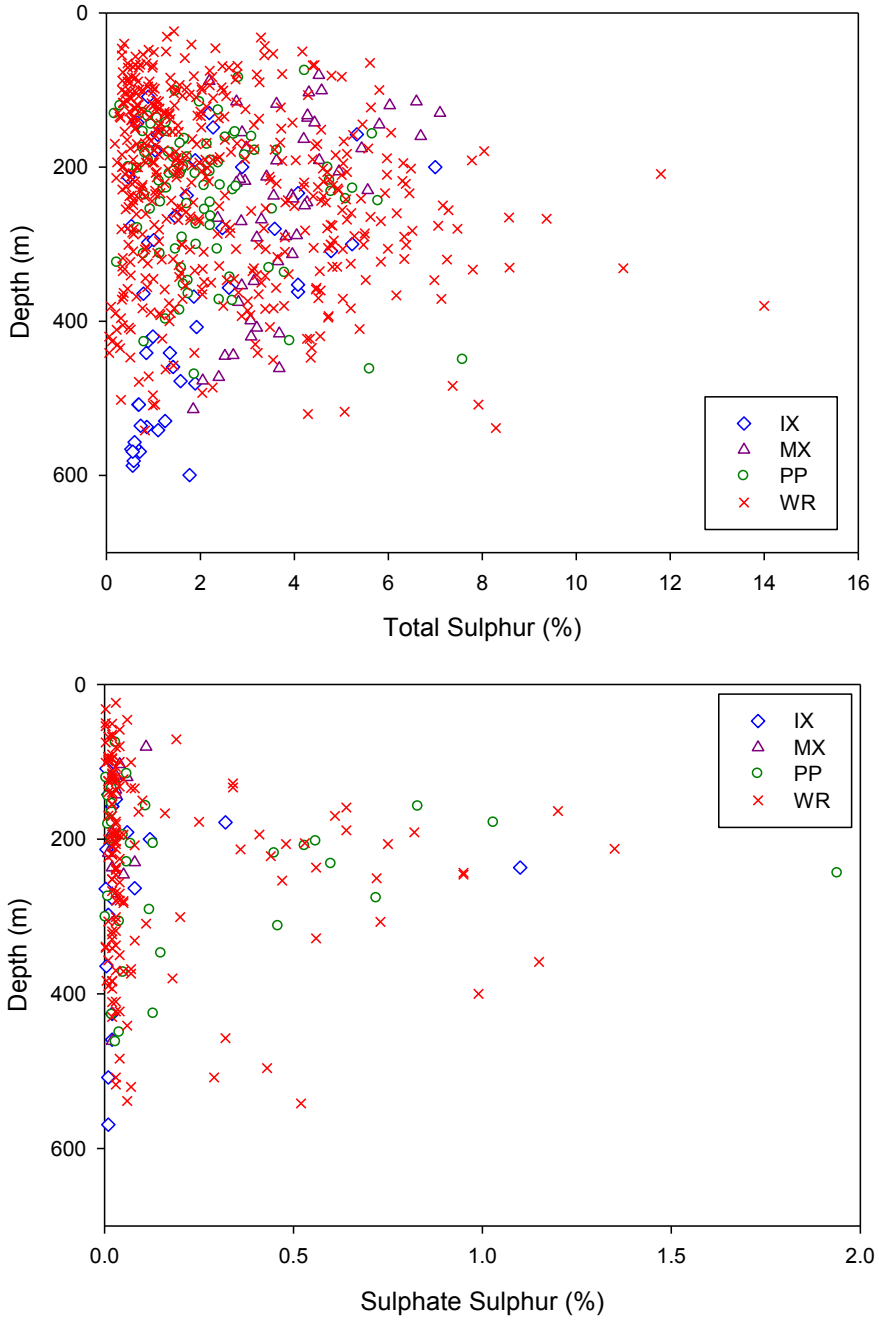


Figure 5-16: Total sulphur and Sulphate sulphur versus depth for HYP samples, according to lithologic unit.

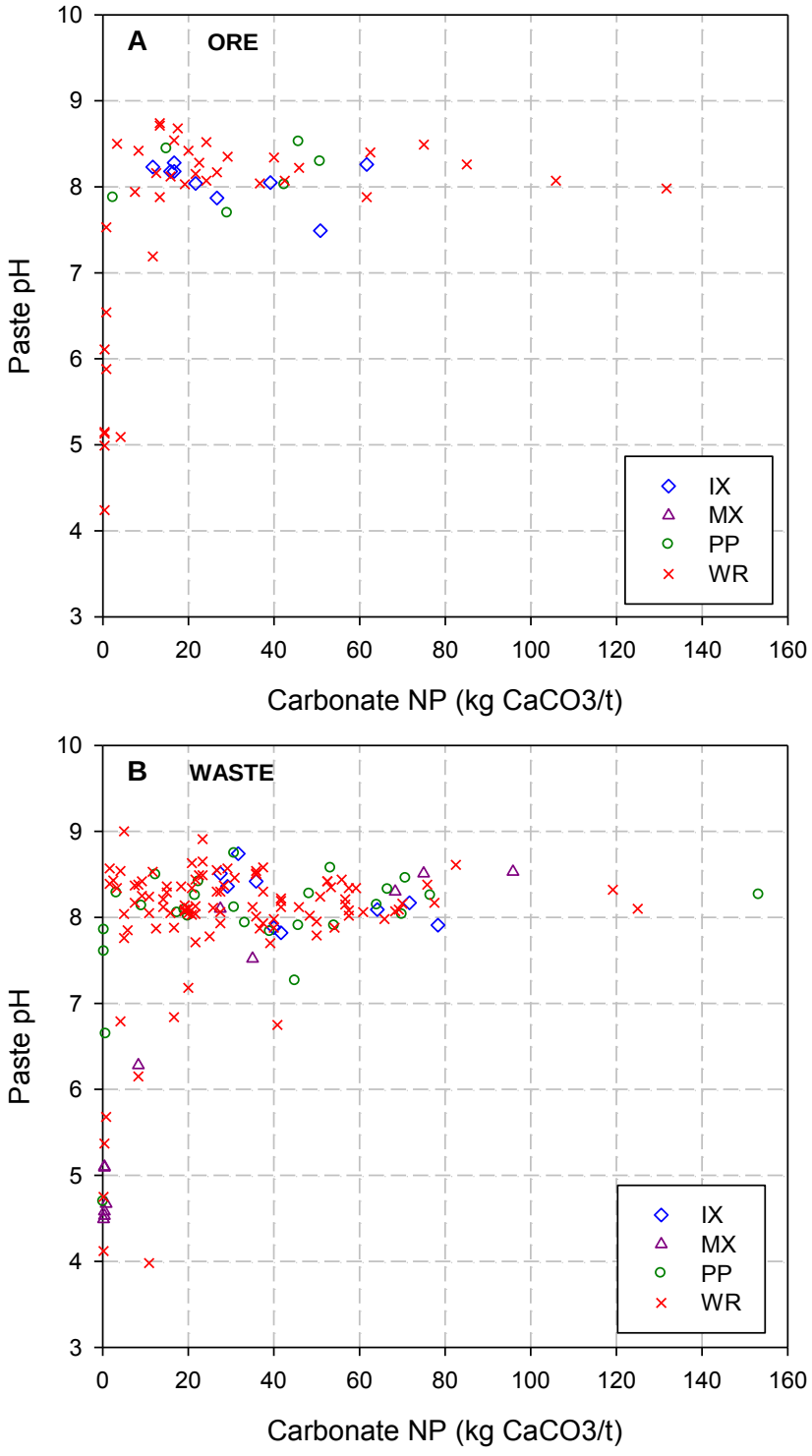


Figure 5-17: CaNP versus paste pH for HYP samples according to lithologic unit for A) ore and B) waste samples

Figure 5-18 compares the distribution of CaNP with ScNP values for lithologies of the HYP (ore and waste) to evaluate the availability of non-carbonate NP in these units. The box plots indicate that the CaNP and ScNP are comparable for the lithologic units of the HYP, indicating limited potential for non-carbonate NP. However, the median ScNP value for the explosion breccia (MX) is considerably lower than the median CaNP value. This indicates iron carbonates may be associated with this unit.

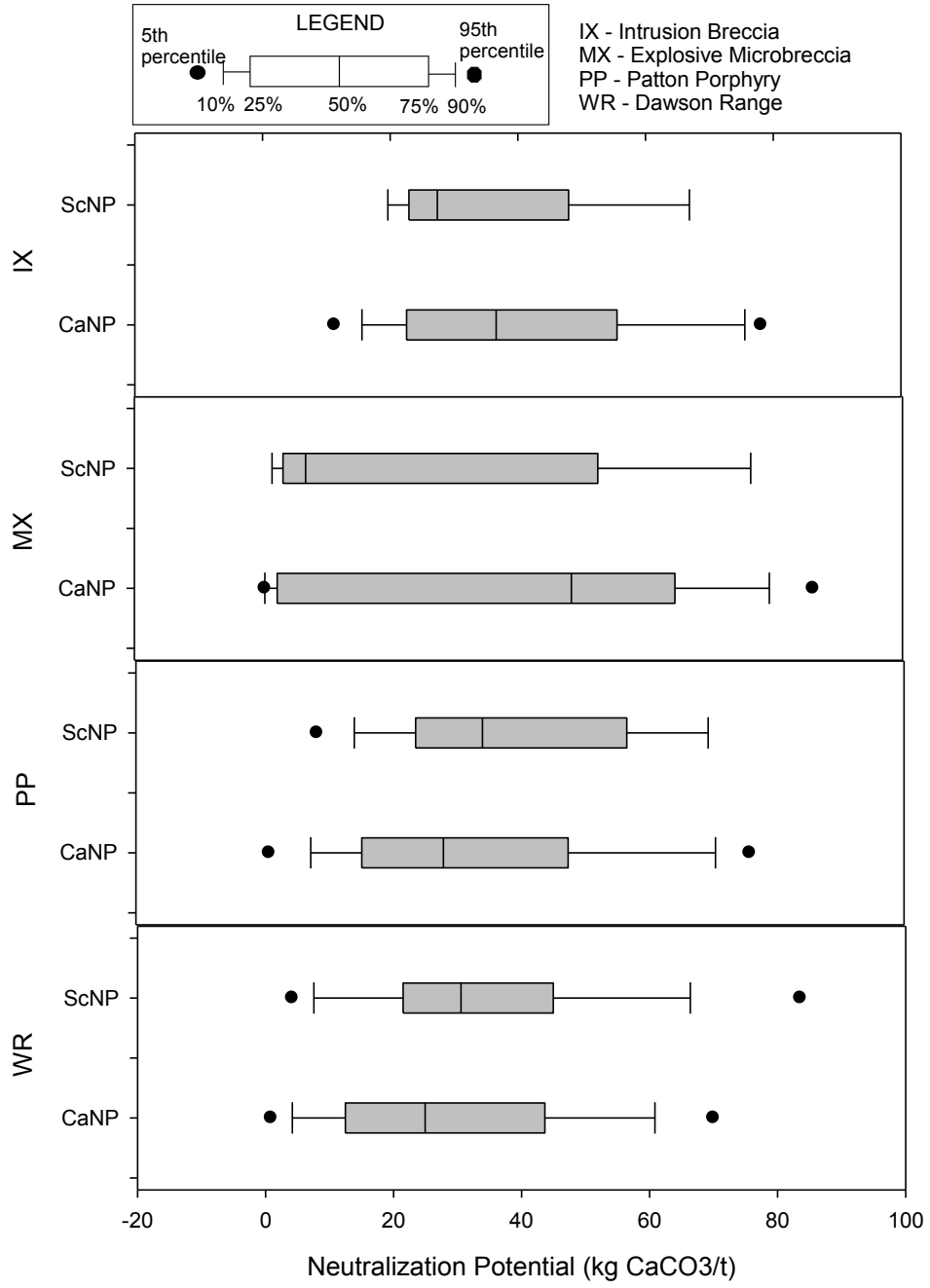


Figure 5-18: Distribution of CaNP and ScNP values for the lithologies of the HYP

In order to assess alternate methods to estimate NP using standard assay data within the HYP, the NP was calculated using the %Ca from assay data and compared with the total carbon results from ABA analysis. These two parameters were plotted together to develop a correlation between them for the different lithological units in the HYP zone. However, the correlations between were not strong enough to establish a Ca proxy for NP within the HYP (Appendix F.3).

Figure 5-19 shows the distribution of NPR values for the waste designated samples from the HYP according to lithologic units. The plots show that over 90% of samples from each lithologic unit have NPR values < 2. Figure 5-20 plots NPR vs. total sulphur. The general trend is increasing total sulphur and decreasing NPR. Of the HYP waste samples, 25 samples from the WR, 2 samples from the PP and 1 sample from the IX are indicated to have NPR values > 2. Note that no samples from the MX have NPR values > 2.

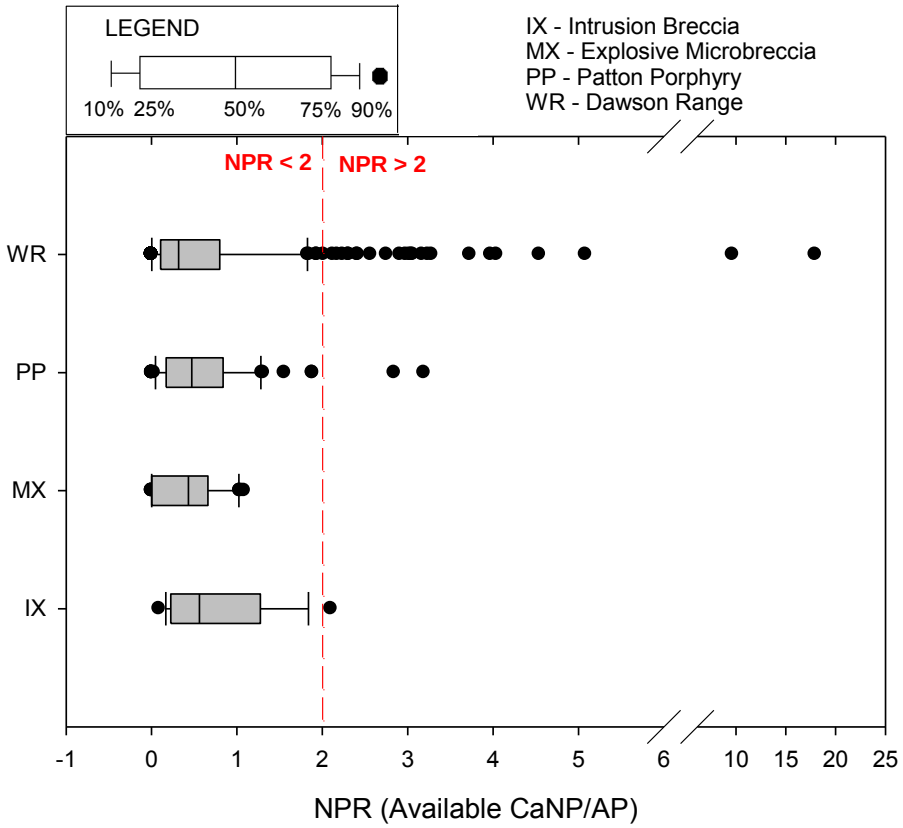


Figure 5-19: Distribution of NPR values for HYP waste samples according to lithologic units.

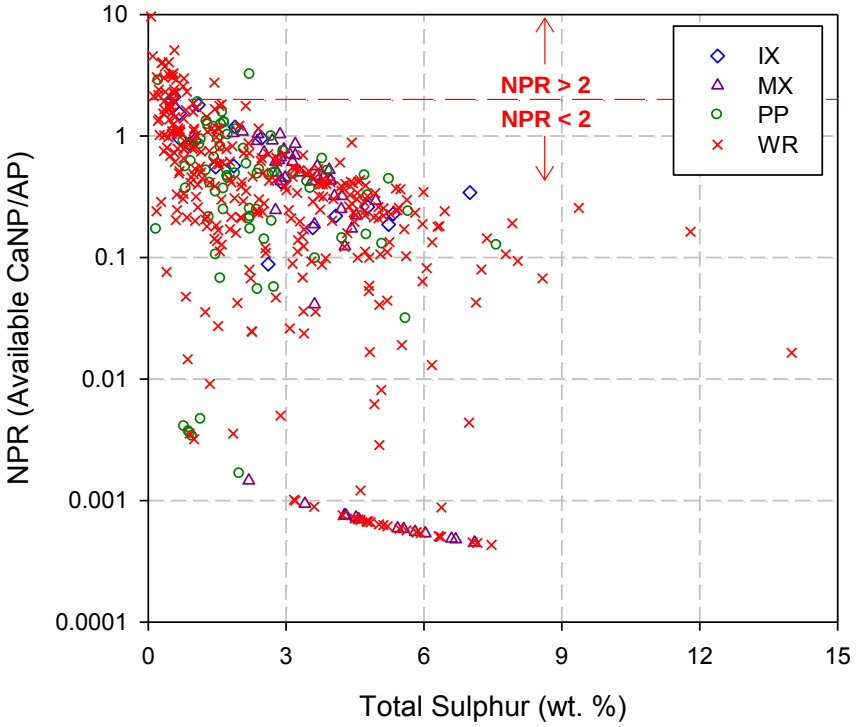


Figure 5-20: Total sulphur versus NPR (Available CaNP/AP) for the HYP waste samples according to lithologic unit

5.3.5.2 Alteration Types

Figure 5-21 plots total sulphur values versus paste pH for ore and waste samples of the HYP according to alteration type. Samples comprising dominantly argillic alteration in the ore designated samples and phyllic alteration in the waste samples make up the HYP samples with paste pH values of < 7.

Figure 5-22 shows the distribution of NPR values for the waste designated samples according to alteration type. The box plots show that at least 75% of samples from all alteration types have NPR values < 2. Phyllic alteration has the lowest NPR values, with the majority (> 90%) having values < 2. Phyllic alteration samples also have the lowest paste pH (Figure 5-22).

Figure 5-23 highlights the waste designated samples of the HYP which have NPR values > 2. Twelve samples with potassic alteration, 3 with phyllic alteration, 1 with argillic alteration and 1 with propylitic alteration have NPR values > 2.

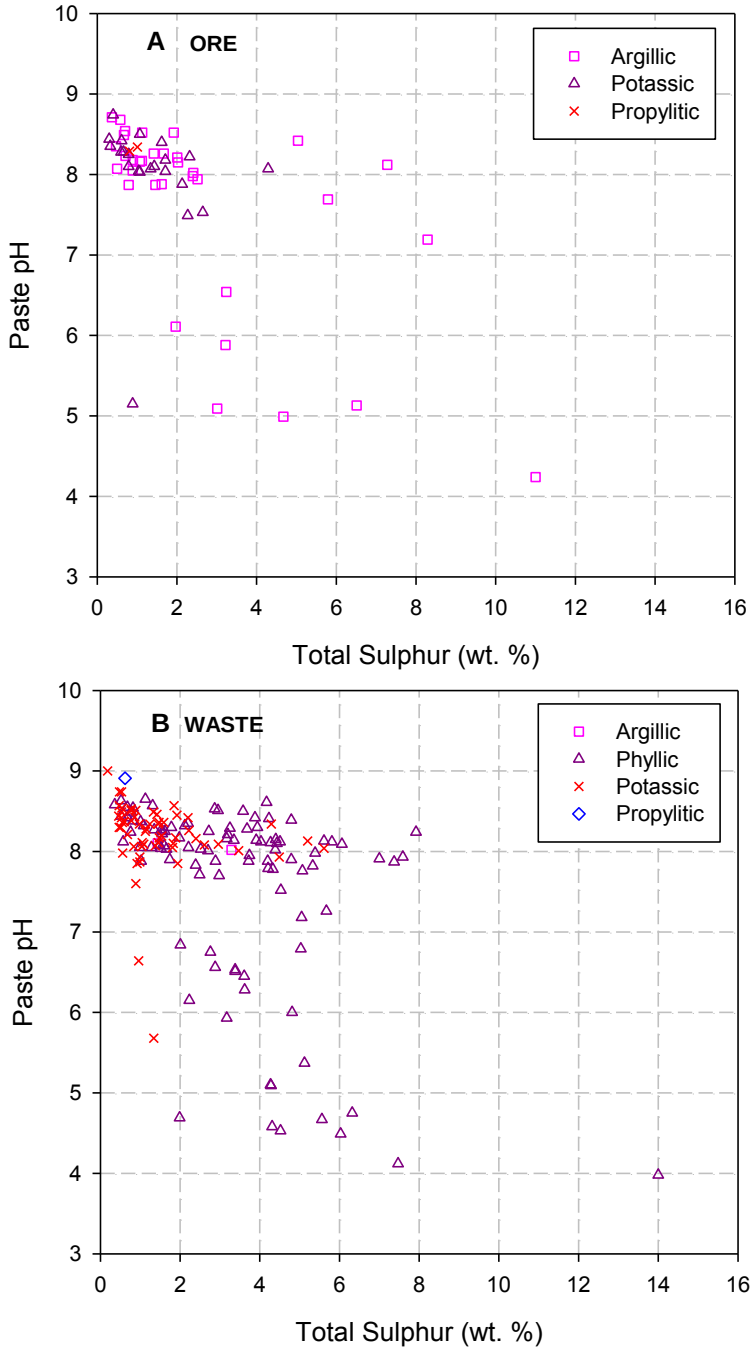


Figure 5-21: Total sulphur versus paste pH for HYP samples according to alteration type for A) ore and B) waste classification

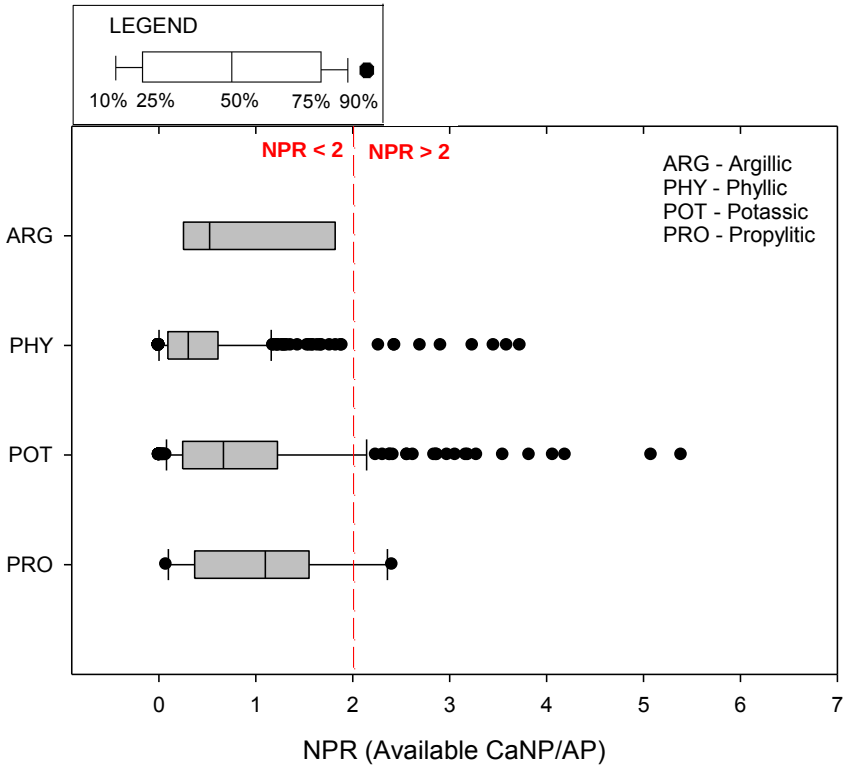


Figure 5-22: Distribution of NPR values for HYP waste samples according to alteration

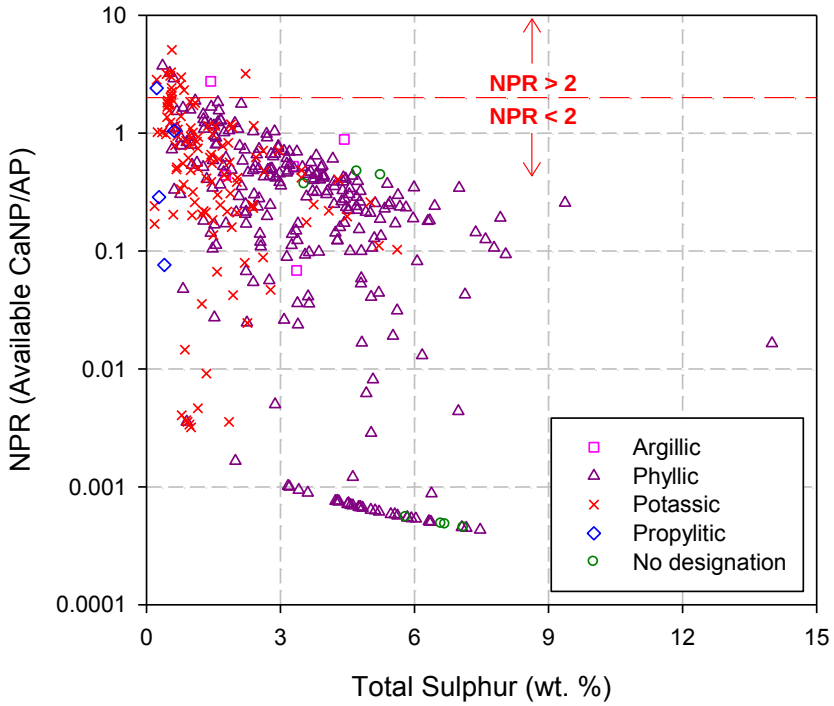


Figure 5-23: Total sulphur versus NPR (Available CaNP/AP) for HYP waste samples according to alteration type

5.4 Overburden Samples

Overburden samples were obtained from test pits excavated within the footprints of five following proposed facilities: the tailings management facility, the heap leach facility, the plant site, the potential NAG storage area and the open pit. The location of the samples was presented in Figure 3-2. The full analytical dataset is provided in Appendix E.

Overall, the overburden samples generally have a low paste pH (median = 5.3) indicating that the overburden is currently slightly acidic (Table 5-11). However, the low pH is believed to be associated with the organic carbon content and not related to ML/ARD due to low or absent sulphide sulphur content in the samples (Figure 5-24). Sulphide sulphur is either at or below the analytical detection limit for all samples (maximum = 0.01%, 90th percentile is less than the detection limit), indicating that these samples have a low acid potential. Figure 5-24 illustrates that the low pH for the overburden samples is the result of a low CaNP and that only 3 overburden samples obtained from the footprint of the open pit have total sulphur content > 0.1 %S. Thus, it is possible that portions of the overburden defined from the footprint of the open pit may contain jarosite and have ML/ARD characteristics similar to the CAP material.

Table 5-11:
Statistical Summary of ABA Results for Test Pit Samples

Sample ID	Paste pH	C(T) %	TIC %	$CaCO_3$ NP	S(T) %	$S(SO_4)$ %	$S(S^{-2})$ %	Insoluble S %	SAP	ScNP	Net NP
Maximum	6.73	3.17	0.17	14.17	1.04	1.13	0.010	0.020	0.31	38.80	38.80
90th Percentile	6.18	2.06	0.020	1.67	0.10	0.11	***0.005***	0.010	***0.15***	21.58	21.58
75th Percentile	5.67	0.98	0.010	0.83	0.050	0.050	***0.005***	0.010	***0.15***	17.10	17.10
Mean	5.27	0.75	0.014	1.18	0.062	0.063	***0.005***	0.007	0.16	15.82	15.79
Median	5.30	0.47	***0.005***	***0.40***	0.020	0.010	***0.005***	***0.005***	***0.15***	14.80	14.80
25th Percentile	4.89	0.18	***0.005***	***0.40***	***0.005***	***0.005***	***0.005***	***0.005***	***0.15***	12.80	12.80
10th Percentile	4.39	0.08	***0.005***	***0.40***	***0.005***	***0.005***	***0.005***	***0.005***	***0.15***	11.28	11.28
Minimum	3.71	0.04	***0.005***	***0.40***	***0.005***	***0.005***	***0.005***	***0.005***	***0.15***	4.80	4.80

Notes:
Bold italic indicates that the value is equal to half the detection limit
Values <DL are set at 0.5*DL for calculations
SAP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.
AP is determined from the measured sulphide sulphur content.
NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.
NET NP = NP - AP
Carbonate NP is calculated from TIC originating from carbonates and is expressed in kg $CaCO_3$/tonne.
Sulphate Sulphur determined by 25% HCL with Gravimetric Finish
Sulphide Sulphur determined by Sobek 1:7 Nitric Acid with S by ICP-MS Finish
Insoluble S is acid insoluble S (Total S - (Sulphate S + Sulphide S)).

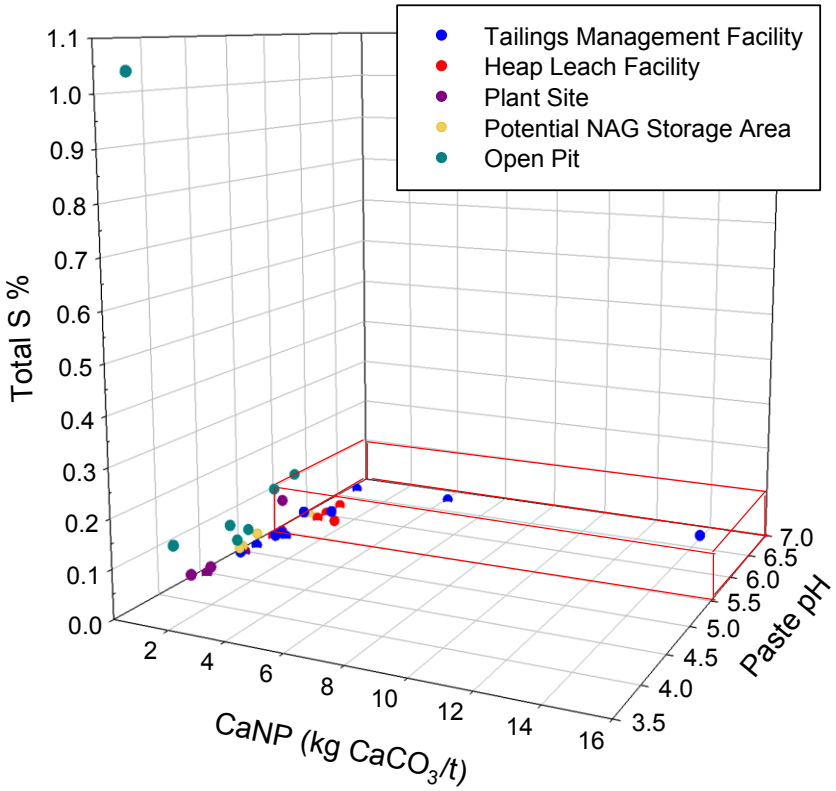


Figure 5-24: Overburden Sulphur versus CaNP versus Paste pH

There are several elements with median values greater than three times the average continental crustal abundance (Table 5-12). The median concentrations for As, Sb, Se, Tl and P exceed at least three times the average continental crustal abundance for all five of the areas where samples were collected. In addition to these parameters, Ag, Bi, Cd, Pb and Zn exceed at least three times the average continental crustal abundance for two or more areas. The open pit area has significantly higher Cu and Mo concentrations, as both have median concentrations of over ten times the average continental crustal abundance. The samples collected from the other facility footprints generally have concentrations below the average continental crustal abundance for these two parameters.

Table 5-12:
Median Metal Concentrations for Test Pit Samples

Parameter	Units	Tailings Management Facility (n=10)	Heap Leach Facility (n=6)	Plant Site (n=6)	Potential NAG Storage Area (n=4)	Open Pit (n=7)	Average Continental Crustal Abundance
Ag	**ppm**	0.085	0.45	0.375	1.28	0.73	0.075
Al	**%**	1.79	0.86	1.79	1.725	1.36	8.23
As	**ppm**	10	17.5	24	20.5	18	1.8
Ba	**ppm**	165	332	233.5	286	353	425
Bi	**ppm**	0.185	0.525	0.225	1.19	1.48	0.17
Ca	**%**	0.45	0.26	0.38	0.42	0.23	4.15
Cd	**ppm**	0.105	2.26	0.66	1.59	0.22	0.15
Co	**ppm**	10.6	8.4	10.6	11.5	7.9	25
Cr	**ppm**	96	115.5	110.5	124	66	105
Cu	**ppm**	28.85	14.25	20.6	39	1010	60
Fe	**%**	2.985	2.585	3.49	3.61	3.65	5.63
Hg	**ppm**	0.02	0.045	0.03	0.02	0.005	0.08
K	**%**	0.225	0.2	0.155	0.16	0.32	2.09
Mg	**%**	0.575	0.255	0.515	0.56	0.41	2.3
Mn	**ppm**	513.5	1685	895.5	1635	275	950
Mo	**ppm**	1.27	3.22	1.055	1.185	50.8	1.5
Na	**%**	0.055	0.03	0.035	0.045	0.06	2.36
Ni	**ppm**	15	8.75	16.5	15.85	7.2	84
P	**ppm**	390	425	570	620	500	0.105
Pb	**ppm**	8.3	87.25	56.15	132.5	20	12.5
S	**%**	0.005	0.005	0.005	0.005	0.1	0.035
Sb	**ppm**	0.605	1.88	0.825	1.53	1.81	0.2
Se	**ppm**	0.5	0.5	0.5	0.5	1	0.05
Sr	**ppm**	27.55	16.3	24.7	24.15	35.5	375
Th	**ppm**	8.9	15.35	9.45	10	10.1	9.6
Ti	**%**	0.125	0.0375	0.105	0.11	0.07	0.565
Tl	**ppm**	0.205	0.36	0.28	0.28	0.25	0.001
U	**ppm**	1.78	4.125	3.01	3.555	3.12	2.7
V	**ppm**	72.5	36	75.5	76	45	120
Zn	**ppm**	64	269.5	147.5	249	60	70

Notes
Light grey shading indicates that the element is greater than 3 x the average continental crustal abundance
Dark grey shading indicates that the element is greater than 10 x the average continental crustal abundance.

6. Summary

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6. Summary

6.1 Summary of Results

The objective of this study was to combine the results for all the static test work which has been completed to data for the Casino deposit and to assess the potential for ML/ARD from geological materials associated with the deposit. The results of the static testing provide insight regarding the suitability of using the deposit materials in the construction of mine facilities and the development of mine waste management strategies.

The results demonstrate the similarity of ML/ARD characteristics between ore and waste designated materials and lithologic units within each mineralization zone of the Casino deposit. However, distinct differences were observed for the sample sets between the mineralization zones. The geochemical characteristics of the CAP, SOX, SUS and HYP and the implications of the geochemical assessment for waste management are outlined below.

The results indicate that roughly 95% of the waste rock is expected to be PAG (Table 6-1).

Table 6-1:
Quantity of PAG and NAG waste rock in the Casino Deposit

	Waste Rock (tonnes x 1000)	%	% PAG Samples	PAG Waste Rock (Mt)	NAG Waste Rock (Mt)	% NAG Waste Rock
CAP	210,022	32	95	199,521	10,501	5
SOX	49,213	8	100	49,213	0	0
SUS	137,991	21	100	137,991	0	0
HYP	241,873	37	93	224,942	16,931	7
OVB	17,504	3	71	12,428	5,076	29
Total	*656,603*	-	-	*624,095*	*32,508*	-

Oxide Leach CAP Zone

- The CAP samples (ore and waste) have acidic median paste pH values of <5.0, indicating that the majority of the CAP waste rock will be immediately acid generating when excavated.
- Secondary water soluble sulphate and oxide minerals, rather than sulphide minerals, are the major source of acidity and metal leaching from CAP samples.

Supergene (SUP) Zone (Oxide (SOX) and Sulphide (SUS))

- The majority of the SUP samples have a neutralization potential ratio (NPR) < 2.0 (97% SOX and 99% SUS), which implies that waste rock and ore from this mineralization zone is PAG.
- Unlike the CAP sample set, some SUP samples still contain carbonate minerals capable of buffering pH; however, the samples also contain sulphide minerals that will oxidize, acidify and deplete the buffering capacity over time and will be a source of metal leaching.
- Similar to the CAP sample set, SUP samples contain oxide minerals as a source of acidity and metal leaching.

Hypogene (HYP) Zone

- The majority of the HYP samples (89% ore and 93% waste rock) have been identified as having a NPR < 2, which implies that under advanced weathering conditions waste rock and ore from the HYP zone will produce acidic drainage.
- Ore and waste rock samples from the HYP zone have the highest median carbonate neutralization potential (27 kg $CaCO_3$/t), and highest median paste pH (8.1) for the Casino deposit. However, the HYP samples also contain sulphide content typically < 1.0 %S.

Overburden

- Overburden samples do not contain sulphide mineralization. However, there is indication that portions of the overburden material within the open pit may contain jarosite similar to the CAP waste rock.

7. Report Limitations

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7. Report Limitations

This report was prepared for the exclusive use of Casino Mining Corporation and its consultants in accordance with the rationale and study objectives described in Chapter 1 of this report. The Yukon Environmental and Socio-economic Assessment Board and other government agencies involved with reviewing the application may also rely upon this report; any other use or reliance on this report by any third party is at that party's sole risk. The authors accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Respectfully submitted,

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Appendices

CASINO
COPPER AND GOLD

Appendix A
Sample Description and Location

CASiNO
COPPER AND GOLD

Appendix A1: Drill Hole Samples

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase I	08-001	93-195	20.4	20.7	WR	WASTE	CAP	ARG	PHY
Phase I	08-002	93-195	28.0	28.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-003	93-195	174.0	174.3	WR	WASTE	SUS	PHY	ARG
Phase I	08-004	93-195	197.2	197.5	WR	WASTE	SUS	PHY	ARG
Phase I	08-005	93-195	250.0	250.3	WR	WASTE	SUS	PHY	ARG
Phase I	08-006	94-320	50.0	50.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-007	94-320	140.0	140.3	WR	WASTE	CAP	PHY	ARG
Phase I	08-008	94-320	280.0	280.3	WR	WASTE	HYP	PHY	ARG
Phase I	08-009	94-304	10.0	10.3	MX	WASTE	CAP		
Phase I	08-010	94-304	50.0	50.3	MX	WASTE	SOX	ARG	PHY
Phase I	08-011	94-304	120.0	120.3	MX	WASTE	HYP	PHY	
Phase I	08-012	93-179	27.0	27.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-013	93-179	100.0	100.3	WR	WASTE	CAP	PHY	ARG
Phase I	08-014	93-179	182.0	182.3	WR	ORE	CAP	PHY	ARG
Phase I	08-015	94-313	60.0	60.3	PP	WASTE	CAP	ARG	PHY
Phase I	08-016	94-313	130.0	130.3	PP	WASTE	CAP	PHY	ARG
Phase I	08-017	93-178	57.0	57.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-018	93-178	82.6	82.9	WR	WASTE	CAP	ARG	PHY
Phase I	08-019	93-165	4.0	4.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-020	93-165	350.0	350.3	WR	WASTE	HYP	PHY	
Phase I	08-021	94-300	20.0	20.3	PP	WASTE	CAP	ARG	PHY
Phase I	08-022	93-177	106.0	106.3	MX	WASTE	CAP	ARG	PHY
Phase I	08-023	93-177	127.1	127.4	MX	WASTE	CAP	PHY	ARG
Phase I	08-024	93-177	195.0	195.3	WR	WASTE	HYP	PHY	
Phase I	08-025	93-177	230.0	230.3	MX	WASTE	HYP	PHY	
Phase I	08-026	93-175	4.6	4.9	PP	WASTE	CAP	ARG	PHY
Phase I	08-027	93-153	30.0	30.3	PP	WASTE	CAP	ARG	
Phase I	08-028	93-153	220.1	220.4	WR	WASTE	HYP	POT	
Phase I	08-029	93-168	72.0	72.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-030	93-168	245.0	245.3	WR	WASTE	SUS	PHY	POT
Phase I	08-031	93-168	380.0	380.3	WR	WASTE	HYP	PHY	POT
Phase I	08-032	94-307	38.7	39.0	IX	WASTE	SUS	ARG	POT
Phase I	08-033	94-307	62.2	62.5	IX	WASTE	SUS	ARG	POT
Phase I	08-034	94-312	14.0	14.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-035	94-312	30.0	30.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-036	94-312	52.0	52.3	WR	WASTE	CAP	PHY	ARG
Phase I	08-037	93-191	15.6	15.9	PP	WASTE	CAP	ARG	
Phase I	08-038	93-191	181.4	181.7	PP	WASTE	HYP	POT	PHY
Phase I	08-039	93-191	264.3	264.6	IX	WASTE	HYP	POT	
Phase I	08-040	93-191	383.1	383.4	WR	WASTE	HYP	POT	PHY
Phase I	08-041	93-171	15.0	15.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-042	93-171	85.0	85.3	WR	WASTE	CAP	PHY	ARG
Phase I	08-043	93-171	200.0	200.3	IX	WASTE	HYP	PHY	
Phase I	08-044	93-171	339.0	339.3	WR	WASTE	HYP	PHY	
Phase I	08-045	93-171	410.0	410.3	WR	WASTE	HYP	PHY	
Phase I	08-046	94-341	30.0	30.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-047	94-330	5.0	5.3	MX	WASTE	CAP	ARG	PHY
Phase I	08-048	94-330	30.0	30.3	MX	WASTE	CAP	ARG	PHY
Phase I	08-049	94-330	75.0	75.3	MX	WASTE	CAP	PHY	
Phase I	08-050	93-229	30.0	30.3	PP	WASTE	CAP	ARG	PHY
Phase I	08-051	93-229	72.0	72.3	PP	WASTE	SOX	ARG	PHY
Phase I	08-052	93-229	230.0	230.3	PP	WASTE	HYP	PHY	
Phase I	08-053	94-289	15.0	15.3	MX	WASTE	CAP	ARG	PHY
Phase I	08-054	93-224	25.0	25.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-055	93-224	85.0	85.3	WR	WASTE	SOX	PHY	ARG
Phase I	08-056	93-224	170.0	170.3	WR	WASTE	HYP	PHY	ARG
Phase I	08-057	93-226	15.0	15.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-058	93-226	75.0	75.3	WR	WASTE	SUS	PHY	ARG
Phase I	08-059	93-226	116.0	116.3	PP	WASTE	HYP	PHY	ARG
Phase I	08-060	93-226	220.0	220.3	WR	WASTE	HYP	PHY	
Phase I	08-061	94-338	10.0	10.3	WR	WASTE	CAP	PHY	ARG
Phase I	08-062	94-338	75.0	75.3	WR	WASTE	SOX	PHY	
Phase I	08-063	93-206	80.0	80.3	PP	WASTE	CAP	PHY	
Phase I	08-064	93-206	193.0	193.3	PP	WASTE	SUS	PHY	
Phase I	08-065	93-206	301.0	301.3	PP	WASTE	HYP	POT	PHY
Phase I	08-066	93-185	20.0	20.3	IX	WASTE	CAP	ARG	PHY
Phase I	08-067	93-186	14.3	14.6	WR	WASTE	CAP	ARG	PHY
Phase I	08-068	93-186	60.0	60.3	WR	WASTE	SUS	POT	
Phase I	08-069	93-221	33.0	33.3	WR	WASTE	SUS	PHY	POT
Phase I	08-070	93-221	80.0	80.3	WR	WASTE	HYP	PHY	POT
Phase I	08-071	93-221	94.0	94.3	WR	WASTE	HYP	PHY	POT
Phase I	08-072	93-221	318.5	318.8	WR	WASTE	HYP	POT	PHY
Phase I	08-073	93-221	390.0	390.3	WR	WASTE	HYP	PHY	POT
Phase I	08-074	94-261	35.0	35.3	WR	WASTE	SOX	ARG	PHY
Phase I	08-075	94-261	65.0	65.3	WR	WASTE	HYP	POT	PHY

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase I	08-076	94-261	100.0	100.3	WR	WASTE	HYP	PHY	
Phase I	08-077	93-231	30.5	30.8	WR	ORE	CAP	ARG	PHY
Phase I	08-078	93-250	3.1	3.4	IX	ORE	CAP	ARG	POT
Phase I	08-079	93-228	45.0	45.3	PP	WASTE	CAP	ARG	PHY
Phase I	08-080	93-228	145.0	145.3	PP	WASTE	HYP	POT	
Phase I	08-081	93-245	32.6	32.9	IX	WASTE	CAP	ARG	POT
Phase I	08-082	93-240	10.0	10.3	PP	WASTE	CAP	ARG	PHY
Phase I	08-083	93-233	157.6	157.9	PP	WASTE	HYP	PHY	PRO
Phase I	08-086	93-217	32.0	32.3	WR	WASTE	HYP	ARG	
Phase I	08-087	93-217	54.0	54.3	WR	WASTE	HYP	POT	
Phase I	08-088	93-217	340.5	340.8	WR	WASTE	HYP	PHY	POT
Phase I	08-089	94-259	50.0	50.3	WR	WASTE	HYP	PHY	
Phase I	08-090	94-259	120.0	120.3	WR	WASTE	HYP	POT	
Phase I	08-091	94-259	190.0	190.3	WR	WASTE	HYP	PHY	
Phase I	08-092	93-249	154.5	154.8	WR	WASTE	HYP	PHY	ARG
Phase I	08-093	93-230	30.5	30.8	WR	WASTE	CAP	ARG	
Phase I	08-094	93-230	192.0	192.3	WR	WASTE	HYP	PHY	
Phase I	08-095	93-241	10.0	10.3	WR	ORE	CAP		
Phase I	08-096	93-241	195.1	195.4	PP	WASTE	HYP	PHY	POT
Phase I	08-097	93-148	29.6	29.9	WR	ORE	CAP	ARG	PHY
Phase I	08-098	93-232	32.6	32.9	PP	WASTE	CAP	PHY	ARG
Phase I	08-099	93-162	10.0	10.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-100	93-162	165.0	165.3	PP	WASTE	HYP	PHY	
Phase I	08-101	93-225	157.6	157.9	IX	WASTE	HYP	PHY	
Phase I	08-102	93-225	200.0	200.3	IX	WASTE	HYP	PHY	
Phase I	08-103	94-276	17.4	17.7	IX	WASTE	CAP	ARG	POT
Phase I	08-104	93-205	15.8	16.1	WR	WASTE	CAP	ARG	POT
Phase I	08-105	93-205	34.1	34.4	WR	WASTE	SUS	POT	PHY
Phase I	08-106	93-205	67.7	68.0	WR	WASTE	HYP	POT	PHY
Phase I	08-107	93-205	101.2	101.5	WR	WASTE	HYP	POT	PHY
Phase I	08-108	93-205	243.5	243.8	WR	WASTE	HYP	POT	
Phase I	08-109	93-205	323.2	323.5	WR	WASTE	HYP	POT	
Phase I	08-110	94-262	15.0	15.3	WR	WASTE	SOX	ARG	POT
Phase I	08-111	94-262	75.0	75.3	WR	WASTE	HYP	POT	
Phase I	08-112	94-262	125.0	125.3	WR	WASTE	HYP	POT	
Phase I	08-113	94-262	170.0	170.3	WR	WASTE	HYP	POT	
Phase I	08-114	93-247	13.4	13.7	WR	ORE	CAP	ARG	PHY
Phase I									
Phase I	08-115	93-243	35.0	35.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-116	93-243	160.0	160.3	WR	WASTE	SUS	PHY	ARG
Phase I	08-117	93-238	10.0	10.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-118	93-238	48.0	48.3	WR	WASTE	CAP	ARG	PHY
Phase I	08-119	93-238	85.0	85.3	PP	WASTE	SUS	PHY	
Phase I	08-120	93-238	111.9	112.2	PP	WASTE	SUS	PHY	
Phase I	08-121	93-238	137.0	137.3	PP	WASTE	HYP	PHY	
Phase I	08-122	93-227	5.0	5.3	WR	WASTE	CAP	ARG	POT
Phase I	08-123	93-227	158.0	158.3	IX	WASTE	HYP	POT	
Phase I	08-124	94-256	5.0	5.3			OVB	ARG	
Phase I	08-125	94-256	20.0	20.3	WR	WASTE	CAP	POT	ARG
Phase I	08-126	94-256	71.0	71.3	WR	WASTE	HYP	POT	PHY
Phase I	08-127	94-256	125.0	125.3	WR	WASTE	HYP	PHY	POT
Phase I	08-128	94-274	39.9	40.2	IX	ORE	CAP	ARG	
Phase I	08-129	93-186	41.8	42.1	WR	WASTE	SUS	PHY	
Phase I	08-130	94-346	10.0	10.3		WASTE			
Phase I	08-131	94-347	35.0	35.3		WASTE			
Phase II	08-132	93-189	25.0	27.0	WR	WASTE	CAP	ARG	PHY
Phase II	08-134	93-189	306.3	308.3	WR	WASTE	HYP	PHY	
Phase II	08-135	93-187	34.1	36.1	WR	WASTE	CAP	ARG	PHY
Phase II	08-136	93-187	85.7	87.7	WR	WASTE	SUS	PHY	ARG
Phase II	08-137	93-187	191.1	193.1	WR	WASTE	HYP	PHY	
Phase II	08-138	94-304	26.5	28.5	MX	WASTE	CAP	ARG	
Phase II	08-139	94-304	35.4	37.4	MX	WASTE	CAP	ARG	
Phase II	08-140	94-304	46.3	48.3	MX	WASTE	SOX	ARG	PHY
Phase II	08-141	94-304	80.8	82.8	MX	WASTE	HYP	PHY	
Phase II	08-142	94-304	103.3	105.3	MX	WASTE	HYP	PHY	
Phase II	08-143	94-304	136.3	138.3	MX	WASTE	HYP	PHY	
Phase II	08-144	93-169	26.5	28.5	WR	ORE	CAP	ARG	PHY
Phase II	08-145	93-169	75.3	77.3	WR	ORE	CAP	ARG	PHY
Phase II	08-146	93-169	246.0	248.0	WR	ORE	HYP	PHY	
Phase II	08-147	93-158	28.0	30.0	WR	ORE	CAP	ARG	
Phase II	08-148	93-188	32.6	34.6	WR	WASTE	CAP	ARG	PHY
Phase II	08-149	93-188	160.6	162.6	WR	ORE	SUS	PHY	ARG
Phase II	08-150	93-188	267.3	269.3	WR	ORE	HYP	PHY	ARG
Phase II	08-151	93-188	425.8	427.8	PP	WASTE	HYP	PHY	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase II	08-152	93-157	122.5	124.5	WR	ORE	CAP	ARG	PHY
Phase II	08-153	93-179	44.8	46.8	WR	WASTE	CAP	ARG	PHY
Phase II	08-154	93-179	72.2	74.2	WR	WASTE	CAP	PHY	ARG
Phase II	08-155	93-179	206.4	208.4	WR	ORE	CAP	PHY	ARG
Phase II	08-156	93-179	282.5	284.5	WR	ORE	HYP	PHY	ARG
Phase II	08-157	93-179	331.3	333.3	WR	ORE	HYP	PHY	ARG
Phase II	08-158	93-179	374.0	376.0	WR	ORE	HYP	PHY	ARG
Phase II	08-159	93-179	441.0	443.0	WR	ORE	HYP	PHY	ARG
Phase II	08-160	93-179	538.6	540.6	WR	ORE	HYP	PHY	POT
Phase II	08-161	94-313	108.8	110.8	PP	WASTE	CAP	PHY	ARG
Phase II	08-162	94-313	212.4	214.4	IX	ORE	SUS	PHY	
Phase II	08-163	93-178	121.0	123.0	WR	ORE	SUS	PHY	ARG
Phase II	08-164	93-165	44.8	46.8	WR	WASTE	CAP	ARG	PHY
Phase II	08-165	93-165	370.0	372.0	WR	WASTE	HYP	PHY	
Phase II	08-166	93-165	422.8	424.8	WR	WASTE	HYP	PHY	
Phase II	08-167	94-339	12.8	14.8	WR	WASTE	CAP	ARG	
Phase II	08-169	94-300	50.3	52.3	FZ	WASTE	CAP	ARG	PHY
Phase II	08-170	94-300	73.5	75.5	IX	ORE	CAP	ARG	PHY
Phase II	08-171	94-300	85.9	87.9	IX	ORE	CAP	ARG	PHY
Phase II	08-172	94-300	89.0	91.0	PP	WASTE	CAP	ARG	PHY
Phase II	08-173	94-300	117.7	119.7	PP	ORE	SOX	PHY	ARG
Phase II	08-174	94-300	125.9	127.9	PP	ORE	SOX	PHY	ARG
Phase II	08-175	93-177	121.0	123.0	MX	WASTE	CAP	PHY	ARG
Phase II	08-176	93-177	145.4	147.4	MX	WASTE	SUS	PHY	ARG
Phase II	08-177	93-177	171.9	173.9	WR	WASTE	SUS	PHY	
Phase II	08-178	93-177	206.4	208.4	WR	WASTE	HYP	PHY	
Phase II	08-179	93-177	246.0	248.0	MX	WASTE	HYP	PHY	
Phase II	08-181	93-175	300.8	302.8	WR	ORE	HYP	PHY	
Phase II	08-182	93-175	370.9	372.9	WR	ORE	HYP	PHY	
Phase II	08-183	93-153	15.1	17.1	PP	WASTE	CAP	ARG	
Phase II	08-184	93-153	55.5	57.5	PP	WASTE	CAP	ARG	POT
Phase II	08-185	93-153	180.4	182.4	WR	ORE	HYP	POT	
Phase II	08-186	93-153	223.1	225.1	WR	WASTE	HYP	POT	
Phase II	08-187	93-153	263.5	265.5	IX	ORE	HYP	PHY	
Phase II	08-188	93-173	194.2	196.2	WR	ORE	HYP	POT	PHY
Phase II	08-189	93-173	297.8	299.8	IX	ORE	HYP	PHY	POT
Phase II	08-190	93-173	425.8	427.8	IX	ORE	HYP	PHY	POT
Phase II	08-191	93-173	569.1	571.1	IX	ORE	HYP	PHY	POT
Phase II	08-192	94-308	26.5	28.5	WR	WASTE	CAP	ARG	
Phase II	08-193	94-308	96.0	98.0	IX	WASTE	CAP	ARG	PHY
Phase II	08-194	93-168	19.5	21.5	WR	WASTE	CAP	ARG	PHY
Phase II	08-195	93-168	60.0	62.0	WR	WASTE	CAP	ARG	PHY
Phase II	08-196	93-168	142.3	144.3	WR	WASTE	SUS	ARG	PHY
Phase II	08-197	93-168	270.4	272.4	WR	WASTE	HYP	PHY	POT
Phase II	08-198	93-168	422.8	424.8	WR	WASTE	HYP	PHY	POT
Phase II	08-199	93-168	450.2	452.2	PP	WASTE	HYP	PHY	
Phase II	08-200	93-168	462.4	464.4	PP	WASTE	HYP	PHY	
Phase II	08-201	93-168	483.7	485.7	WR	WASTE	HYP	PHY	
Phase II	08-202	93-168	508.1	510.1	WR	WASTE	HYP	PHY	
Phase II	08-203	93-168	517.3	519.3	WR	WASTE	HYP	PHY	
Phase II	08-204	93-229	12.8	14.8	PP	WASTE	CAP	ARG	PHY
Phase II	08-205	93-229	50.9	52.9	PP	WASTE	CAP	ARG	PHY
Phase II	08-206	93-229	90.5	92.5	PP	WASTE	SUS	ARG	PHY
Phase II	08-207	93-229	114.9	116.9	PP	WASTE	SUS	ARG	PHY
Phase II	08-208	93-229	160.6	162.6	PP	WASTE	SUS	ARG	PHY
Phase II	08-209	93-229	206.4	208.4	PP	ORE	SUS	PHY	
Phase II	08-210	93-150	35.7	37.7	IX	ORE	CAP	ARG	POT
Phase II	08-211	93-150	108.8	110.8	IX	ORE	CAP	POT	
Phase II	08-212	93-150	229.3	231.3	PP	ORE	SUS	PHY	POT
Phase II	08-213	93-150	274.6	276.6	PP	ORE	HYP	PHY	POT
Phase II	08-215	93-150	347.8	349.8	PP	WASTE	HYP	PHY	POT
Phase II	08-216	93-150	372.5	374.5	PP	ORE	HYP	PHY	POT
Phase II	08-217	93-150	427.3	429.3	PP	ORE	HYP	PRO	POT
Phase II	08-218	93-150	459.3	461.3	IX	ORE	HYP	PHY	
Phase II	08-219	93-150	508.1	510.1	IX	WASTE	HYP	PHY	
Phase II	08-220	94-289	35.0	37.0	MX	WASTE	CAP	ARG	PHY
Phase II	08-221	94-289	47.2	49.2	MX	WASTE	CAP	ARG	PHY
Phase II	08-222	94-289	86.9	88.9	MX	WASTE	CAP	ARG	PHY
Phase II	08-223	93-163	11.3	13.3	MX	WASTE	CAP	ARG	PHY
Phase II	08-224	93-163	54.0	56.0	MX	WASTE	CAP	ARG	PHY
Phase II	08-225	93-163	118.0	120.0	MX	WASTE	HYP	PHY	ARG
Phase II	08-226	93-163	142.3	144.3	MX	WASTE	HYP	PHY	ARG
Phase II	08-227	93-163	191.1	193.1	MX	WASTE	HYP	PHY	
Phase II	08-228	93-163	236.8	238.8	MX	WASTE	HYP	PHY	
Phase II	08-229	93-163	270.4	272.4	MX	WASTE	HYP	PHY	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase II	08-230	93-224	12.2	14.2	WR	WASTE	CAP	ARG	PHY
Phase II	08-231	93-224	54.9	56.9	WR	WASTE	CAP	PHY	ARG
Phase II	08-232	93-224	125.0	127.0	WR	WASTE	SOX	PHY	ARG
Phase II	08-233	93-224	155.4	157.4	WR	WASTE	HYP	PHY	ARG
Phase II	08-234	93-224	225.6	227.6	WR	WASTE	HYP	PHY	
Phase II	08-235	93-226	42.7	44.7	WR	WASTE	SOX	PHY	ARG
Phase II	08-236	93-226	64.0	66.0	WR	WASTE	SUS	PHY	ARG
Phase II	08-237	93-226	100.6	102.6	WR	WASTE	HYP	PHY	ARG
Phase II	08-238	93-226	134.1	136.1	WR	WASTE	HYP	PHY	ARG
Phase II	08-239	93-226	166.6	168.6	WR	WASTE	HYP	PHY	ARG
Phase II	08-240	93-226	237.7	239.7	WR	WASTE	HYP	PHY	
Phase II	08-241	94-338	21.8	23.8	WR	WASTE	CAP	PHY	ARG
Phase II	08-242	94-338	55.5	57.5	WR	WASTE	SOX	PHY	
Phase II	08-243	93-246	14.6	16.6	WR	WASTE	CAP	POT	PHY
Phase II	08-244	93-246	33.5	35.5	WR	ORE	CAP	POT	ARG
Phase II	08-245	93-246	42.7	44.7	WR	ORE	SUS	POT	ARG
Phase II	08-246	93-246	121.6	123.6	WR	ORE	HYP	POT	PHY
Phase II	08-247	93-246	164.6	166.6	WR	ORE	HYP	PHY	POT
Phase II	08-248	93-246	213.4	215.4	WR	ORE	HYP	PHY	POT
Phase II	08-249	93-231	39.6	41.6	WR	ORE	CAP	ARG	PHY
Phase II	08-250	93-231	137.2	139.2	WR	WASTE	HYP	PHY	POT
Phase II	08-251	93-231	195.1	197.1	WR	ORE	HYP	PHY	POT
Phase II	08-252	93-231	256.0	258.0	WR	ORE	HYP	PHY	POT
Phase II	08-253	93-250	17.1	19.1	IX	ORE	CAP	ARG	POT
Phase II	08-254	93-250	38.7	40.7	IX	ORE	CAP	ARG	POT
Phase II	08-255	93-250	148.4	150.4	IX	ORE	HYP	POT	
Phase II	08-256	93-250	178.3	180.3	IX	ORE	HYP	POT	
Phase II	08-257	93-250	206.2	208.2	PP	WASTE	HYP	POT	PHY
Phase II	08-258	93-228	108.8	110.8	PP	WASTE	SUS	POT	
Phase II	08-259	93-228	134.7	136.7	PP	WASTE	HYP	POT	
Phase II	08-260	93-228	178.9	180.9	PP	WASTE	HYP	POT	
Phase II	08-261	93-228	236.8	238.8	IX	ORE	HYP	POT	
Phase II	08-262	93-228	291.7	293.7	PP	WASTE	HYP	PHY	POT
Phase II	08-263	93-245	11.3	13.3	IX	WASTE	CAP	ARG	POT
Phase II	08-264	93-245	42.4	44.4	IX	WASTE	CAP	ARG	POT
Phase II	08-265	93-245	145.4	147.4	PP	WASTE	SUS	POT	PHY
Phase II	08-266	93-245	200.3	202.3	PP	WASTE	HYP	POT	PHY
Phase II	08-267	93-240	5.2	7.2	PP	WASTE	CAP	ARG	PHY
Phase II	08-268	93-240	26.5	28.5	PP	WASTE	CAP	ARG	PHY
Phase II	08-269	93-240	35.7	37.7	PP	WASTE	CAP	PHY	ARG
Phase II	08-270	93-240	57.0	59.0	PP	WASTE	SUS	PHY	ARG
Phase II	08-271	93-240	74.4	76.4	PP	ORE	SUS	PHY	ARG
Phase II	08-272	93-240	130.1	132.1	PP	ORE	HYP	PHY	POT
Phase II	08-273	93-240	218.5	220.5	PP	WASTE	HYP	POT	
Phase II	08-274	93-240	276.5	278.5	PP	WASTE	HYP	POT	
Phase II	08-275	93-233	11.3	13.3	PP	WASTE	CAP	ARG	PHY
Phase II	08-276	93-233	75.3	77.3	PP	WASTE	HYP	PHY	
Phase II	08-277	93-233	206.4	208.4	PP	WASTE	HYP	PHY	PRO
Phase II	08-278	93-211	90.5	92.5	PP	WASTE	SUS	POT	PHY
Phase II	08-279	93-211	145.4	147.4	PP	ORE	SUS	POT	PHY
Phase II	08-280	93-211	312.7	314.7	PP	WASTE	HYP	POT	PHY
Phase II	08-281	94-278	78.0	80.0	IX	WASTE	SOX	ARG	POT
Phase II	08-282	94-281	48.0	50.0	IX	ORE	SOX	ARG	POT
Phase II	08-283	94-281	142.3	144.3	IX	ORE	HYP	POT	ARG
Phase II	08-284	94-279	3.3	5.3	IX	WASTE	CAP	ARG	PHY
Phase II	08-285	93-217	23.8	25.8	WR	WASTE	HYP	ARG	
Phase II	08-286	93-217	114.9	116.9	WR	ORE	HYP	PHY	
Phase II	08-287	93-217	203.3	205.3	WR	WASTE	HYP	PHY	
Phase II	08-288	93-217	309.4	311.4	WR	WASTE	HYP	PHY	POT
Phase II	08-289	93-217	383.1	385.1	WR	WASTE	HYP	PHY	POT
Phase II	08-290	93-217	410.6	412.6	WR	WASTE	HYP	PHY	POT
Phase II	08-291	93-217	495.9	497.9	WR	WASTE	HYP	PHY	POT
Phase II	08-292	93-217	541.6	543.6	WR	WASTE	HYP	PHY	POT
Phase II	08-293	94-259	81.4	83.4	WR	WASTE	HYP	PHY	
Phase II	08-294	94-259	106.5	108.5	WR	WASTE	HYP	POT	
Phase II	08-295	94-259	150.0	152.0	WR	WASTE	HYP	PHY	POT
Phase II	08-296	94-259	177.4	179.4	WR	WASTE	HYP	PHY	POT
Phase II	08-297	93-248	14.3	16.3	WR	ORE	CAP	ARG	
Phase II	08-298	93-248	20.4	22.4	WR	ORE	CAP	ARG	
Phase II	08-299	93-248	40.5	44.8	WR	ORE	SOX	POT	ARG
Phase II	08-300	93-248	44.8	47.0	WR	ORE	SOX	POT	ARG
Phase II	08-301	93-248	95.4	97.4	WR	ORE	HYP	POT	ARG
Phase II	08-302	93-248	132.1	134.1	WR	ORE	HYP	POT	
Phase II	08-303	93-248	191.1	193.1	WR	WASTE	HYP	POT	
Phase II	08-304	93-248	246.0	248.0	WR	WASTE	HYP	POT	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase II	08-307	93-237	120.1	122.1	WR	WASTE	HYP	PHY	POT
Phase II	08-310	93-247	71.8	73.8	WR	WASTE	SUS	PHY	POT
Phase II	08-311	93-247	177.7	179.7	WR	WASTE	HYP	PHY	POT
Phase II	08-312	93-247	205.1	207.1	WR	ORE	HYP	PHY	POT
Phase II	08-313	93-247	236.8	238.8	WR	WASTE	HYP	PHY	POT
Phase II	08-314	93-239	14.3	16.3	WR	ORE	CAP	ARG	
Phase II	08-315	93-239	32.6	34.6	WR	ORE	CAP	ARG	
Phase II	08-316	93-239	74.1	76.1	WR	ORE	SUS	POT	
Phase II	08-317	93-239	99.7	101.7	WR	WASTE	SUS	POT	
Phase II	08-318	93-239	194.2	196.2	WR	WASTE	HYP	POT	PHY
Phase II	08-319	93-239	206.4	208.4	WR	WASTE	HYP	POT	PHY
Phase II	08-320	93-239	328.3	330.3	WR	WASTE	HYP	POT	PHY
Phase II	08-321	93-243	20.4	22.4	WR	ORE	CAP	ARG	POT
Phase II	08-322	93-243	26.5	28.5	WR	WASTE	CAP	ARG	PHY
Phase II	08-323	93-243	54.9	56.9	WR	WASTE	SOX	PHY	ARG
Phase II	08-324	93-243	57.9	59.9	WR	WASTE	SOX	PHY	ARG
Phase II	08-325	93-243	105.5	107.5	WR	WASTE	SUS	PHY	ARG
Phase II	08-326	93-243	145.4	147.4	WR	WASTE	SUS	PHY	ARG
Phase II	08-327	93-243	252.1	254.1	WR	WASTE	HYP	PHY	POT
Phase II	08-328	93-238	22.4	24.4	WR	WASTE	CAP	ARG	PHY
Phase II	08-329	93-238	32.5	34.5	WR	WASTE	CAP	ARG	PHY
Phase II	08-330	93-238	75.3	77.3	WR	WASTE	SOX	PHY	ARG
Phase II	08-331	93-238	102.7	104.7	PP	WASTE	SUS	PHY	
Phase II	08-332	93-238	154.5	156.5	PP	WASTE	HYP	PHY	
Phase II	08-333	93-238	203.3	205.3	PP	WASTE	HYP	PHY	
Phase II	08-334	93-238	306.9	308.9	PP	WASTE	HYP	PHY	
Phase II	08-335	93-227	38.4	40.4	IX	WASTE	CAP	ARG	POT
Phase II	08-336	93-227	53.6	55.6	IX	WASTE	SOX	ARG	POT
Phase II	08-337	93-227	66.1	68.1	IX	WASTE	SOX	ARG	POT
Phase II	08-338	93-227	93.6	95.6	PP	WASTE	SUS	POT	
Phase II	08-339	93-227	108.8	110.8	IX	WASTE	HYP	POT	ARG
Phase II	08-340	93-227	121.0	123.0	PP	ORE	HYP	POT	
Phase II	08-341	93-227	191.1	193.1	IX	WASTE	HYP	POT	
Phase II	08-342	93-227	276.5	278.5	IX	WASTE	HYP	POT	
Phase II	08-343	93-203	41.8	43.8	IX	ORE	CAP	ARG	POT
Phase II	08-344	93-203	122.8	124.8	WR	ORE	SUS	PHY	POT
Phase II	08-346	93-203	200.3	202.3	WR	ORE	HYP	PHY	POT
Phase II	08-347	93-203	279.5	281.5	WR	WASTE	HYP	PHY	POT
Phase II	08-348	93-203	337.4	339.4	WR	WASTE	HYP	POT	
Phase II	08-349	94-284	11.9	13.9	WR	ORE	SOX	ARG	POT
Phase II	08-350	94-284	44.5	46.5	WR	ORE	SOX	ARG	POT
Phase II	08-351	94-284	87.2	89.2	FZ	ORE	SOX	POT	
Phase II	08-352	94-284	98.8	100.8	FZ	ORE	SOX	POT	
Phase II	08-353	94-284	116.4	118.4	WR	ORE	SOX	POT	
Phase II	08-354	94-275	18.3	20.3	IX	ORE	SOX	ARG	POT
Phase II	08-355	93-235	43.9	45.9	WR	WASTE	CAP	ARG	POT
Phase II	08-356	93-235	199.9	201.9	WR	ORE	HYP	POT	PHY
Phase II	08-357	93-236	29.3	31.3	WR	ORE	CAP	ARG	
Phase II	08-358	93-236	32.3	34.3	WR	ORE	CAP	ARG	
Phase II	08-359	93-236	90.5	92.5	WR	ORE	HYP	PHY	POT
Phase II	08-360	93-236	122.5	124.5	WR	ORE	HYP	POT	PHY
Phase II	08-361	93-236	206.4	208.4	WR	ORE	HYP	POT	PHY
Phase II	08-362	93-236	251.8	253.8	WR	WASTE	HYP	POT	PHY
Phase II	08-363	93-236	300.8	302.8	WR	WASTE	HYP	POT	
Phase II	08-364	93-236	319.1	321.1	WR	WASTE	HYP	POT	PHY
Phase II	08-365	93-209	50.9	52.9	WR	ORE	HYP	PRO	POT
Phase II	08-366	93-209	96.6	98.6	WR	WASTE	HYP	POT	PHY
Phase II	08-367	93-209	123.8	125.8	WR	ORE	HYP	POT	PHY
Phase II	08-368	93-209	188.7	190.7	WR	WASTE	HYP	POT	PRO
Phase II	08-369	93-209	221.9	223.9	WR	WASTE	HYP	POT	PRO
Phase II	08-370	93-209	250.6	252.6	WR	ORE	HYP	PHY	POT
Phase II	08-371	93-209	253.6	255.6	WR	WASTE	HYP	PHY	POT
Phase II	08-372	93-209	268.8	270.8	WR	WASTE	HYP	PHY	POT
Phase II	08-373	93-209	399.9	401.9	WR	WASTE	HYP	POT	
Phase II	08-374	94-256	17.4	19.4	WR	WASTE	CAP	ARG	
Phase II	08-375	94-256	93.6	95.6	WR	WASTE	HYP	PHY	POT
Phase II	08-376	94-256	139.3	141.3	WR	WASTE	HYP	PHY	POT
Phase II	08-377	94-256	163.7	165.7	WR	WASTE	HYP	POT	
Phase II	08-378	94-256	194.2	196.2	WR	WASTE	HYP	POT	
Phase II	08-379	93-242	32.6	34.6	WR	WASTE	SUS	PHY	POT
Phase II	08-380	93-242	133.2	135.2	WR	WASTE	HYP	POT	
Phase II	08-381	93-242	218.5	220.5	WR	ORE	HYP	POT	PHY
Phase II	08-382	93-242	239.9	241.9	WR	WASTE	HYP	POT	PHY
Phase II	08-383	94-260	13.4	15.4	WR	ORE	SOX	ARG	PHY
Phase II	08-384	94-260	22.3	24.3	WR	ORE	SOX	ARG	PHY

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase II	08-385	94-260	29.6	31.6	WR	WASTE	SOX	ARG	PHY
Phase II	08-386	94-260	35.0	37.0	WR	WASTE	SOX	ARG	PHY
Phase II	08-387	94-260	54.0	56.0	WR	WASTE	SOX	ARG	PHY
Phase II	08-388	94-260	111.9	113.9	WR	ORE	SUS	PHY	ARG
Phase II	08-389	93-213	29.6	31.6	WR	ORE	SUS	ARG	POT
Phase II	08-390	93-213	35.7	37.7	WR	ORE	SUS	ARG	POT
Phase II	08-391	93-213	41.8	43.8	WR	ORE	SUS	ARG	POT
Phase II	08-392	93-213	57.0	59.0	WR	WASTE	SUS	ARG	POT
Phase II	08-393	93-213	90.5	92.5	WR	WASTE	SUS	POT	
Phase II	08-394	93-213	139.3	141.3	WR	WASTE	HYP	POT	
Phase II	08-395	93-213	212.4	214.4	WR	WASTE	HYP	POT	
Phase II	08-396	93-213	279.5	281.5	WR	WASTE	HYP	POT	
Phase II	08-397	93-213	358.8	360.8	WR	WASTE	HYP	POT	
Phase II	08-398	93-213	508.1	510.1	WR	WASTE	HYP	POT	
Phase II	08-399	93-213	520.3	522.3	WR	ORE	HYP	POT	
Phase II	08-400	93-219	23.5	25.5	WR	WASTE	OVB	ARG	POT
Phase II	08-401	93-219	84.4	86.4	WR	ORE	SUS	PHY	POT
Phase II	08-402	93-219	99.4	101.4	WR	ORE	HYP	PHY	POT
Phase II	08-403	93-219	124.1	126.1	WR	ORE	HYP	PHY	POT
Phase II	08-404	93-219	142.3	144.3	WR	ORE	HYP	PHY	POT
Phase II	08-405	93-219	169.8	171.8	WR	WASTE	HYP	POT	
Phase II	08-406	93-219	212.4	214.4	WR	WASTE	HYP	PHY	POT
Phase II	08-407	93-219	236.8	238.8	WR	WASTE	HYP	POT	PHY
Phase II	08-408	93-219	306.9	308.9	WR	WASTE	HYP	PHY	POT
Phase II	08-409	93-219	367.9	369.9	WR	WASTE	HYP	PHY	POT
Phase II	08-410	94-257	45.7	47.7	WR	ORE	HYP	POT	PHY
Phase II	08-411	94-251	22.0	24.0	WR	WASTE	CAP	ARG	
Phase II	08-412	94-251	58.5	60.5	WR	ORE	HYP	PHY	PRO
Phase II	08-413	94-251	116.4	118.4	WR	ORE	HYP	PHY	PRO
Phase II	08-414	94-253	14.6	16.6	WR	ORE	SOX	PHY	PRO
Phase II	08-415	94-253	28.0	30.0	WR	WASTE	SUS	PHY	PRO
Phase II	08-416	94-253	67.7	69.7	WR	WASTE	HYP	PRO	PHY
Phase II	08-417	94-253	209.4	211.4	WR	ORE	HYP	POT	PRO
Phase II	08-418	94-254	4.9	6.9	WR	WASTE	CAP	ARG	POT
Phase II	08-419	94-254	26.2	28.2	WR	ORE	SOX	POT	PHY
Phase II	08-420	94-254	110.9	112.9	WR	WASTE	HYP	POT	PHY
Phase II	08-421	94-254	159.1	161.1	WR	WASTE	HYP	POT	PHY
Phase II	08-422	94-254	207.9	209.9	WR	WASTE	HYP	POT	PHY
Phase II	08-423	94-336	11.1	13.1	WR	WASTE	CAP	ARG	
Phase II	08-424	94-336	17.1	19.1	WR	WASTE	SOX	ARG	
Phase II	08-425	94-336	33.2	35.2	WR	ORE	SOX	ARG	PHY
Phase II	08-426	94-336	41.8	43.8	WR	WASTE	SUS	PHY	POT
Phase II	08-427	94-335	9.8	11.8	WR	WASTE	CAP	ARG	
Phase II	08-428	94-335	18.9	20.9	WR	WASTE	CAP	ARG	
Phase II	08-429	94-335	22.0	24.0	WR	WASTE	CAP	ARG	
Phase II	08-430	94-335	34.1	36.1	WR	ORE	SUS	POT	ARG
Phase II	08-431	94-335	40.2	42.2	WR	ORE	SUS	POT	ARG
Phase II	08-432	93-188	21.6	23.6	WR	WASTE	CAP	ARG	PHY
Phase II	08-433	93-248	26.5	28.5	WR	ORE	CAP	ARG	
Phase II	08-434	93-234	14.4	16.4	WR	WASTE	CAP	ARG	
Phase II	08-435	93-234	23.5	25.5	WR	ORE	CAP	ARG	
Phase II	08-436	93-203	90.5	92.5	IX	ORE	SUS	POT	PHY
Phase III	09-01	CAS-024	33.00	36.00	PP	ORE	CAP	ARG	
Phase III	09-02	CAS-024	54.42	57.42	PP	ORE	CAP	ARG	
Phase III	09-03	CAS-024	83.75	86.75	PP	ORE	SOX	PHY	
Phase III	09-04	CAS-024	122.75	125.75	PP	ORE	SOX	PHY	
Phase III	09-05	CAS-024	185.75	188.75	PP	ORE	SUS	PHY	
Phase III	09-06	CAS-024	232.25	235.25	PP	WASTE	HYP	PHY	
Phase III	09-07	CAS-024	244.25	246	PP	ORE	HYP	PHY	
Phase III	09-08	CAS-026	104.3	107.3	PP	ORE	SUS	PHY	
Phase III	09-09	CAS-026	140.4	143.4	PP	WASTE	SUS	PHY	
Phase III	09-10	CAS-026	157.9	160.9	PP	WASTE	HYP	PHY	
Phase III	09-11	CAS-026	178.9	181.9	PP	WASTE	HYP	PHY	
Phase III	09-12	CAS-028	203	206	PP	ORE	HYP	PHY	
Phase III	09-13	CAS-028	209	212	PP	WASTE	HYP	PHY	
Phase III	09-14	CAS-003	429.77	432.82	WR	WASTE	HYP	PHY	
Phase III	09-15	CAS-003	393.2	396.2	WR	WASTE	HYP	PHY	
Phase III	09-16	CAS-003	384.1	387.1	WR	WASTE	HYP	PHY	
Phase III	09-17	CAS-003	356.6	359.7	WR	WASTE	HYP	PHY	
Phase III	09-18	CAS-003	341.2	344.4	WR	WASTE	HYP	PHY	
Phase III	09-19	CAS-003	329.5	332.2	WR	WASTE	HYP	PHY	
Phase III	09-20	CAS-003	306.32	309.37	WR	WASTE	HYP	PHY	
Phase III	09-21	CAS-003	169.16	172.21	WR	ORE	SUS	PHY	ARG
Phase III	09-22	CAS-003	174.31	176.78	WR	ORE	SUS	PHY	ARG
Phase III	09-23	CAS-003	208.79	211.84	WR	ORE	SUS	PHY	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase III	09-24	CAS-003	245.36	247.48	WR	ORE	SUS	PHY	
Phase III	09-25	CAS-003	146.3	149.35	WR	WASTE	SUS	PHY	ARG
Phase III	09-26	CAS-003	137.16	140.21	WR	WASTE	CAP	PHY	ARG
Phase III	09-27	CAS-002	83.82	86.87	IX	ORE	SOX	ARG	PHY
Phase III	09-28	CAS-002	111.25	114.3	IX	ORE	SUS	ARG	PHY
Phase III	09-29	CAS-002	147.83	150.88	IX	ORE	SUS	ARG	PHY
Phase III	09-30	CAS-002	213.36	214.96	IX	ORE	HYP	PHY	
Phase III	09-31	CAS-002	457.2	460.25	WR	ORE	HYP	POT	
Phase III	09-32	CAS-002	364.24	367.28	IX	ORE	HYP	POT	
Phase III	09-33	CAS-007	461.0	464.0	MX	WASTE	HYP	PHY	
Phase III	09-34	CAS-011	217.93	220.93	MX	WASTE	HYP	PHY	
Phase III	09-35	CAS-005	39.00	42.00	WR	WASTE	CAP	ARG	
Phase III	09-36	CAS-017	228	331	WR	WASTE		PHY	
Phase III	09-37	CAS-008	66.00	69.00	WR	ORE	SUS	PHY	
Phase III	09-38	CAS-005	97.00	100.0	WR	ORE	HYP	POT	PHY
Phase III	09-39	CAS-012	127.9	130.9	WR	ORE	HYP	POT	
Phase IV	LX-11-001	CAS-066	23.6	26.6	WR	ORE	CAP	ARG	
Phase IV	LX-11-002	CAS-066	29.6	32.6	WR	ORE	CAP	ARG	
Phase IV	LX-11-003	CAS-066	35.6	38.6	WR	ORE	CAP	ARG	
Phase IV	LX-11-004	CAS-066	41.6	44.6	WR	ORE	CAP	ARG	
Phase IV	LX-11-005	CAS-066	47.6	50.6	WR	WASTE	CAP	ARG	
Phase IV	LX-11-006	CAS-060	22.7	24.7	WR	WASTE	CAP	ARG	
Phase IV	LX-11-007	CAS-060	26.95	29.95	WR	WASTE	CAP	ARG	
Phase IV	LX-11-008	CAS-060	32.95	35.95	WR	WASTE	CAP	ARG	
Phase IV	LX-11-009	CAS-060	38.95	41.95	WR	WASTE	CAP	ARG	
Phase IV	LX-11-010	CAS-076	18.29	22	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-011	CAS-076	27.43	30.43	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-012	CAS-076	33.43	36.43	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-013	CAS-076	43	46	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-014	CAS-057	39.1	41.15	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-015	CAS-057	44.15	47.15	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-016	CAS-057	47.15	50.15	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-017	CAS-057	50.15	53.15	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-018	CAS-057	55	58	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-019	CAS-062	11.9	14.9	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-020	CAS-062	14.9	17.9	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-021	CAS-062	17.9	20.9	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-022	CAS-062	20.9	23.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-023	CAS-062	23.9	26.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-024	CAS-062	26.9	29.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-025	CAS-062	29.9	32.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-026	CAS-062	32.9	35.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-027	CAS-062	35.9	38.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-028	CAS-062	38.9	41.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-029	CAS-062	41.9	44.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-030	CAS-062	44.9	47.9	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-031	CAS-062	47.9	50.9	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-032	CAS-062	50.9	52.8	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-033	CAS-062	52.8	55.8	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-034	CAS-062	55.8	58.8	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-035	CAS-062	58.8	61.8	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-036	CAS-062	61.8	64.3	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-037	CAS-062	64.3	66.6	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-038	CAS-062	66.6	69.6	WR	WASTE	CAP	PHY	
Phase IV	LX-11-039	CAS-061	27	30	WR	WASTE	CAP	ARG	
Phase IV	LX-11-040	CAS-061	33	36	WR	ORE	CAP	ARG	
Phase IV	LX-11-041	CAS-061	39	42	WR	WASTE	CAP	ARG	
Phase IV	LX-11-042	CAS-054	22.86	25.86	WR	WASTE	CAP	ARG	
Phase IV	LX-11-043	CAS-054	45.5	45.72	WR	ORE	CAP	ARG	
Phase IV	LX-11-044	CAS-054	54	55.75	WR	WASTE	CAP	ARG	
Phase IV	LX-11-045	CAS-034	7.6	10.6	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-046	CAS-034	16.6	19.6	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-047	CAS-034	25.5	27.5	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-048	CAS-034	33.5	36.5	MX	WASTE	SOX	ARG	PHY
Phase IV	LX-11-049	CAS-034	39.5	41.5	MX	WASTE	SOX	ARG	PHY
Phase IV	LX-11-050	CAS-034	43.5	46.5	MX	WASTE	SOX	ARG	PHY
Phase IV	LX-11-051	CAS-065	8	11	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-052	CAS-065	17	20	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-053	CAS-065	23	26	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-054	CAS-065	32.4	35.4	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-055	CAS-065	41.4	44.4	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-056	CAS-065	50.4	53.4	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-057	CAS-065	59.4	62.4	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-058	CAS-065	71.4	74.4	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-059	CAS-032	12	15	WR	ORE	CAP	ARG	PHY

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-060	CAS-032	21	23	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-061	CAS-032	30.4	32.3	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-062	CAS-032	37.3	40.3	WR	WASTE	CAP	ARG	
Phase IV	LX-11-063	CAS-032	46.3	49.3	PP	WASTE	CAP	ARG	
Phase IV	LX-11-064	CAS-032	53.35	56.35	PP	WASTE	CAP	ARG	
Phase IV	LX-11-065	CAS-053	14.5	17.5	WR	WASTE	CAP	ARG	
Phase IV	LX-11-066	CAS-053	20.5	23.75	WR	WASTE	CAP	ARG	
Phase IV	LX-11-067	CAS-053	29.75	32	WR	WASTE	CAP	ARG	
Phase IV	LX-11-068	CAS-029	7.9	10.9	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-069	CAS-029	12.88	15.12	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-070	CAS-029	18	21	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-071	CAS-029	27	30	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-072	CAS-029	33	36	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-073	CAS-029	39	42	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-074	CAS-064	4.52	7.52	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-075	CAS-064	13.52	16.52	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-076	CAS-064	19.52	22.52	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-077	CAS-064	25.52	28.52	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-078	CAS-064	34.52	37.52	PP	WASTE	CAP	PHY	ARG
Phase IV	LX-11-079	CAS-064	43.52	46.52	PP	WASTE	CAP	PHY	ARG
Phase IV	LX-11-080	CAS-064	49.52	52.52	PP	WASTE	CAP	PHY	ARG
Phase IV	LX-11-082	CAS-056	22.86	25	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-083	CAS-056	35.4	38.4	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-084	CAS-056	41.95	44.95	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-085	CAS-056	47.55	50	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-086	CAS-055	26.5	29.5	WR	WASTE	CAP	ARG	
Phase IV	LX-11-087	CAS-055	32.5	34.5	WR	WASTE	CAP	ARG	
Phase IV	LX-11-088	93-195	38.1	41.15	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-089	93-195	59.44	61.57	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-090	93-195	69.19	72.24	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-091	93-195	78.63	81.38	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-092	93-195	88.39	91.14	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-093	93-195	97.23	99.06	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-094	93-195	105.77	108.97	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-095	93-195	121.01	122.84	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-096	CAS-070	6.05	9.05	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-097	CAS-070	18.05	21.05	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-098	CAS-070	27.1	30.1	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-099	CAS-070	39.1	42.1	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-100	CAS-067	5.45	8.45	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-101	CAS-067	11.45	14.45	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-102	CAS-067	17.45	20.45	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-103	CAS-067	23.45	26.45	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-104	CAS-067	29.45	32.35	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-105	CAS-069	6.4	9.4	PP	WASTE	CAP	ARG	
Phase IV	LX-11-106	CAS-069	15.4	18.4	PP	WASTE	CAP	ARG	
Phase IV	LX-11-107	CAS-069	21.4	24.4	PP	WASTE	CAP	ARG	
Phase IV	LX-11-108	CAS-069	27.4	29.4	PP	ORE	CAP	ARG	
Phase IV	LX-11-109	CAS-049	12.8	15.8	WR	ORE	CAP	ARG	
Phase IV	LX-11-110	CAS-049	21.8	24.8	WR	ORE	CAP	ARG	
Phase IV	LX-11-111	CAS-049	30.8	33.8	WR	ORE	CAP	ARG	
Phase IV	LX-11-112	CAS-073	4.77	6.77	IX	ORE	CAP	ARG	PHY
Phase IV	LX-11-113	CAS-073	14.4	17.4	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-114	CAS-073	29.4	32.4	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-115	CAS-073	43.84	45.84	IX	ORE	CAP	ARG	PHY
Phase IV	LX-11-116	CAS-073	53.32	56.32	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-117	CAS-073	65.32	68.32	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-118	CAS-073	74.5	77.5	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-119	CAS-073	84.68	87.68	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-120	CAS-073	90.4	93.4	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-121	CAS-073	99.4	102.4	IX	ORE	CAP	ARG	PHY
Phase IV	LX-11-122	CAS-028	7.52	10.52	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-123	CAS-028	16.52	19.52	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-124	CAS-028	28.52	31.52	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-125	CAS-028	39.8	42.8	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-126	CAS-028	48.8	51	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-127	CAS-028	59.44	62.44	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-128	CAS-050	16.15	19.15	WR	ORE	CAP	ARG	
Phase IV	LX-11-129	CAS-050	31.2	33.2	WR	ORE	CAP	ARG	
Phase IV	LX-11-130	CAS-050	38.4	41.4	WR	ORE	CAP	ARG	
Phase IV	LX-11-131	CAS-075	12.75	15.75	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-132	CAS-075	24.75	27.75	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-133	CAS-075	30.75	33.75	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-134	CAS-075	42.75	45.75	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-135	CAS-075	51.75	54.75	WR	WASTE	CAP	ARG	PHY

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-136	CAS-075	63.75	66.75	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-137	CAS-075	75.75	78.75	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-138	CAS-075	84.75	87.75	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-139	CAS-075	91.87	94.87	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-140	CAS-075	103	106	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-141	CAS-025	1.52	4.57	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-142	CAS-025	4.57	6.1	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-143	CAS-025	6.1	9	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-144	CAS-025	9	12	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-145	CAS-025	12	15	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-146	CAS-025	15	18	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-147	CAS-025	18	21	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-148	CAS-025	21	24	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-149	CAS-025	24	27	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-150	CAS-025	27	30	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-151	CAS-025	30	33	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-152	CAS-025	33	36	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-153	CAS-025	36	39	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-154	CAS-025	42	45	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-155	CAS-025	45	48	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-156	CAS-025	48	51	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-157	CAS-048	21.05	24.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-158	CAS-048	27.4	30.4	WR	ORE	CAP	ARG	
Phase IV	LX-11-159	CAS-048	37.55	39.55	WR	WASTE	CAP	ARG	
Phase IV	LX-11-160	CAS-048	44.2	47.2	WR	WASTE	CAP	ARG	
Phase IV	LX-11-161	CAS-047	21	24	WR	ORE	CAP	ARG	
Phase IV	LX-11-162	CAS-047	36	39	WR	WASTE	CAP	ARG	
Phase IV	LX-11-163	CAS-047	51	54	WR	WASTE	CAP	ARG	
Phase IV	LX-11-164	CAS-081	26	29	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-165	CAS-081	44	47	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-166	CAS-081	77	80	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-167	CAS-081	106.5	109.5	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-168	93-179	124.05	127.1	WR	ORE	CAP	PHY	ARG
Phase IV	LX-11-169	93-179	151.49	154.53	WR	ORE	CAP	PHY	ARG
Phase IV	LX-11-170	CAS-026	4.57	7.57	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-171	CAS-026	17.98	20.98	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-172	CAS-026	27.75	30.75	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-173	CAS-026	42.75	45.75	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-174	CAS-079	12	15	WR	WASTE	CAP	ARG	
Phase IV	LX-11-175	CAS-079	24	27	WR	WASTE	CAP	ARG	
Phase IV	LX-11-176	CAS-079	36	39	WR	WASTE	CAP	ARG	
Phase IV	LX-11-177	CAS-079	45	48	WR	ORE	CAP	ARG	
Phase IV	LX-11-178	93-187	14.78	17.83	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-179	93-187	58.52	61.57	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-180	CAS-003	9.14	12.19	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-181	CAS-003	18.29	21.34	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-182	CAS-003	27.43	30.48	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-183	CAS-003	36.58	39.62	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-184	CAS-003	45.72	48.77	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-185	CAS-082	30	33	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-186	CAS-082	57	60	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-187	CAS-082	81	84	WR	ORE	CAP	PHY	ARG
Phase IV	LX-11-188	CAS-037	4	7	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-189	CAS-037	16	19	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-190	CAS-037	26	29	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-191	CAS-037	39.9	42.9	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-192	CAS-037	48.9	51.9	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-193	CAS-037	60.9	63.9	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-194	CAS-037	69.9	72.9	PP	WASTE	SOX	ARG	PHY
Phase IV	LX-11-195	CAS-068	17.1	19.1	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-196	CAS-068	27.3	30.3	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-197	CAS-068	39.3	42.3	PP	WASTE	CAP	ARG	PHY
Phase IV	LX-11-198	CAS-023	9	12	PP	WASTE	CAP	PHY	ARG
Phase IV	LX-11-199	CAS-023	21	24	PP	WASTE	CAP	PHY	ARG
Phase IV	LX-11-200	CAS-023	33	36	PP	WASTE	CAP	PHY	ARG
Phase IV	LX-11-201	CAS-023	45	48	PP	WASTE	CAP	PHY	ARG
Phase IV	LX-11-202	CAS-077	19.6	22.6	WR	WASTE	CAP		
Phase IV	LX-11-203	CAS-077	40.6	42.6	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-204	93-182	64.62	67.67	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-205	CAS-072	9.14	12.14	PP	WASTE	CAP	ARG	
Phase IV	LX-11-206	CAS-072	18.14	21.14	PP	WASTE	CAP	ARG	
Phase IV	LX-11-207	CAS-072	27.14	29.14	PP	WASTE	CAP	ARG	
Phase IV	LX-11-208	CAS-046	16.15	18.15	WR	ORE	CAP	ARG	PHY
Phase IV	LX-11-209	CAS-044	6.8	9.8	WR	WASTE	CAP	ARG	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-210	CAS-044	28.65	31.65	WR	ORE	CAP	ARG	
Phase IV	LX-11-211	CAS-080	11	14	WR	WASTE	CAP	ARG	
Phase IV	LX-11-212	93-225	44.81	47.85	PP	ORE	SUS	ARG	PHY
Phase IV	LX-11-213	94-320	118.57	121.01	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-214	CAS-005	21.34	24	WR	WASTE	CAP	ARG	
Phase IV	LX-11-215	CAS-005	27	29.05	WR	ORE	CAP	ARG	
Phase IV	LX-11-216	CAS-005	33	36	WR	WASTE	CAP	ARG	
Phase IV	LX-11-217	CAS-045	3.05	6.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-218	CAS-045	6.05	9.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-219	CAS-045	9.05	12.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-220	CAS-045	12.05	15.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-221	CAS-045	15.05	18.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-222	CAS-045	18.05	21.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-223	CAS-045	21.05	24.05	WR	ORE	CAP	ARG	
Phase IV	LX-11-224	CAS-045	24.05	27.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-225	CAS-045	27.05	30.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-226	CAS-045	30.05	33.05	WR	ORE	CAP	ARG	
Phase IV	LX-11-227	CAS-045	33.05	36.05	WR	WASTE	CAP	ARG	
Phase IV	LX-11-228	CAS-045	36.05	39	WR	WASTE	CAP	ARG	
Phase IV	LX-11-229	CAS-045	39	41	WR	WASTE	CAP	ARG	
Phase IV	LX-11-230	CAS-045	41	42.7	WR	ORE	SOX	ARG	
Phase IV	LX-11-231	93-198	17.98	20.75	IX	ORE	CAP	ARG	POT
Phase IV	LX-11-232	CAS-085	12	15	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-233	93-183	14.33	17.07	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-234	93-183	53.95	57	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-235	93-183	99.67	102.72	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-236	93-147	35.2	37.34	IX	ORE	CAP	ARG	POT
Phase IV	LX-11-237	CAS-006	26.3	29	WR	ORE	SOX	ARG	
Phase IV	LX-11-238	CAS-006	36	39	WR	ORE	SOX	ARG	
Phase IV	LX-11-239	CAS-087	10	13	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-240	CAS-087	19	22	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-241	CAS-087	31	34	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-242	CAS-087	43	46	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-243	CAS-087	131	134	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-244	92-132	24.99	27.74	IX	ORE	CAP	ARG	POT
Phase IV	LX-11-245	92-132	50.9	53.95	IX	ORE	CAP	ARG	POT
Phase IV	LX-11-246	92-132	138.99	141.88	IX	ORE	CAP	ARG	POT
Phase IV	LX-11-247	CAS-008	10	12	WR		CAP	ARG	PHY
Phase IV	LX-11-248	CAS-008	20	22	WR		CAP	ARG	PHY
Phase IV	LX-11-249	CAS-008	28.96	30.7	WR	ORE	SOX	ARG	PHY
Phase IV	LX-11-251	94-339	40.23	43.28	WR	WASTE	CAP	ARG	
Phase IV	LX-11-254	94-339	92.05	94.79	WR	WASTE	CAP	ARG	
Phase IV	LX-11-255	93-168	44.81	46.63	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-256	93-168	87.17	89	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-257	93-168	105.77	107.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-258	93-168	117.96	121	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-259	92-138	93.57	96.62	IX	ORE	CAP	ARG	PHY
Phase IV	LX-11-260	93-159	14.33	17.07	IX	ORE	CAP	ARG	POT
Phase IV	LX-11-261	CAS-013	12.5	15.24	WR	WASTE	CAP	ARG	
Phase IV	LX-11-262	CAS-013	15.24	17.37	WR	ORE	SUS	ARG	
Phase IV	LX-11-263	93-163	23.47	26.52	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-264	93-163	72.24	75.29	MX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-265	94-327	73.15	75.29	IX	ORE	CAP	ARG	PHY
Phase IV	LX-11-266	CAS-009	19.7	22.7	WR	ORE	CAP	ARG	
Phase IV	LX-11-267	CAS-009	25.7	28.7	WR	WASTE	CAP	ARG	
Phase IV	LX-11-268	CAS-009	31.7	34.7	WR	ORE	CAP	ARG	
Phase IV	LX-11-269	CAS-014	10.52	13.52	WR	WASTE	CAP	PHY	POT
Phase IV	LX-11-270	CAS-014	22.46	25.46	WR	WASTE	CAP	PHY	POT
Phase IV	LX-11-271	CAS-012	3.05	6.05	WR	WASTE	CAP	POT	PHY
Phase IV	LX-11-272	CAS-012	18.05	21.05	WR	WASTE	CAP	POT	PHY
Phase IV	LX-11-273	CAS-007	4.57	7.62	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-274	CAS-007	7.62	10	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-275	CAS-007	10	13	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-276	CAS-007	13	16	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-277	CAS-007	16	19	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-278	CAS-007	19	22	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-279	CAS-007	22	25	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-280	CAS-007	25	28	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-281	CAS-007	28	29.35	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-282	93-235	29.57	32.46	WR	ORE	CAP	ARG	POT
Phase IV	LX-11-283	94-252	29.26	32.61	WR	ORE	CAP	ARG	POT
Phase IV	LX-11-284	94-271	16.76	18.9	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-286	94-271	35.05	37.49	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-287	94-271	39.01	40.84	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-288	94-267	6.1	8.84	WR	WASTE	CAP	ARG	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-289	94-267	12.5	15.54	WR	WASTE	CAP	ARG	
Phase IV	LX-11-290	94-267	21.64	24.69	WR	WASTE	CAP	ARG	
Phase IV	LX-11-291	94-267	32.31	35.36	WR	WASTE	CAP	ARG	
Phase IV	LX-11-292	94-267	41.45	43.89	WR	WASTE	CAP	ARG	
Phase IV	LX-11-293	93-223	22.25	24.99	WR	ORE	SOX	ARG	
Phase IV	LX-11-294	CAS-004	12	15	WR	WASTE	CAP	PHY	ARG
Phase IV	LX-11-295	CAS-004	20.44	23	WR	WASTE	CAP	PHY	ARG
Phase IV	LX-11-296	CAS-004	33	35	WR	WASTE	CAP	PHY	ARG
Phase IV	LX-11-297	93-218	21.34	24.38	WR	WASTE	OVB	ARG	
Phase IV	LX-11-298	93-218	30.48	33.53	WR	WASTE	CAP	ARG	
Phase IV	LX-11-299	93-218	36.58	39.62	WR	ORE	SUS	ARG	
Phase IV	LX-11-300	HG10-05	10	12	WR	WASTE	CAP		
Phase IV	LX-11-301	CAS-041	4.6	7.6	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-302	CAS-041	7.6	10.6	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-303	CAS-041	13.6	16.6	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-304	CAS-041	19.6	22.6	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-305	CAS-041	25.6	28.6	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-306	93-144	14.33	16.46	WR	ORE	SOX	ARG	PHY
Phase IV	LX-11-307	93-144	18.9	21.82	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-308	93-199	14.32	17.37	WR	WASTE	CAP	ARG	PRO
Phase IV	LX-11-309	93-199	24.08	27.13	WR	WASTE	CAP	ARG	PRO
Phase IV	LX-11-310	93-199	30.48	34.14	WR	ORE	CAP	ARG	PRO
Phase IV	LX-11-311	CAS-016	3.05	6	WR	WASTE	CAP	ARG	
Phase IV	LX-11-312	CAS-016	9	12	WR	WASTE	CAP	ARG	
Phase IV	LX-11-313	93-157	20.42	22.86	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-314	93-157	66.14	69.18	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-316	HG10-01	21	23	WR	WASTE	CAP		
Phase IV	LX-11-317	HG10-01	43	45	WR	WASTE	SOX		
Phase IV	LX-11-318	HG10-04	13	15	WR	WASTE	CAP		
Phase IV	LX-11-319	93-217	10.67	12.5	WR	ORE	SOX	ARG	
Phase IV	LX-11-320	DH10-19B	4	6	WR	WASTE	CAP		
Phase IV	LX-11-321	DH10-19B	18	20	WR	WASTE	CAP		
Phase IV	LX-11-322	DH10-19B	42	44	WR	WASTE	CAP		
Phase IV	LX-11-323	94-308	79.86	81.99	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-324	94-308	109	111	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-325	94-308	129.54	132.59	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-326	93-224	48.77	51.82	WR	WASTE	CAP	PHY	ARG
Phase IV	LX-11-327	CAS-022	25.91	27.91	WR	WASTE	CAP	ARG	POT
Phase IV	LX-11-328	93-242	20.42	32.61	WR	ORE	SUS	ARG	POT
Phase IV	LX-11-329	93-167	28.04	31.09	WR	WASTE	CAP	ARG	
Phase IV	LX-11-330	CAS-033	4.57	7.57	IX	WASTE	CAP	ARG	PHY
Phase IV	LX-11-331	CAS-033	11	14	IX	ORE	CAP	ARG	PHY
Phase IV	LX-11-332	CAS-033	20	22	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-333	CAS-033	24.1	26.9	PP	ORE	CAP	ARG	PHY
Phase IV	LX-11-334	93-244	17.37	20.42	WR	ORE	SUS	ARG	PRO
Phase IV	LX-11-335	93-244	26.52	28.96	WR	ORE	SUS	ARG	PRO
Phase IV	LX-11-336	93-244	35.36	38.4	WR	WASTE	SUS	ARG	PRO
Phase IV	LX-11-337	DH10-20	6	8	WR	ORE	CAP		
Phase IV	LX-11-338	DH10-20	36	38	WR	WASTE	CAP		
Phase IV	LX-11-339	93-189	9.6	12.19	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-340	93-189	31.09	34.29	WR	WASTE	CAP	ARG	PHY
Phase IV	LX-11-341	CAS-071	16.62	19.62	PP	WASTE	CAP	ARG	
Phase IV	LX-11-342	CAS-071	25.62	28.62	PP	WASTE	CAP	ARG	
Phase IV	LX-11-343	CAS-071	34.62	37.62	PP	ORE	CAP	ARG	
Phase IV	LX-11-344a	CAS-071	49.62	52.62	PP	ORE	CAP	ARG	
Phase IV	LX-11-344b	DH11-35	0	4.51					
Phase IV	LX-11-345	DH11-35	7.21	10.09	MX		CAP		
Phase IV	LX-11-346	DH11-35	13.32	16.09	MX		CAP		
Phase IV	LX-11-347	DH11-35	18.99	22.35	MX		CAP		
Phase IV	LX-11-348	DH11-35	25.01	28.64	MX		CAP		
Phase IV	LX-11-349	DH11-35	31.42	34.65	MX		CAP		
Phase IV	LX-11-350	DH11-35	37.72	40.42	MX		CAP		
Phase IV	LX-11-351	DH11-35	43.03	46.01	MX		CAP		
Phase IV	LX-11-352	DH11-35	48.77	51.82	MX		CAP		
Phase IV	LX-11-353	DH11-35	54.55	56.37	MX		SOX		
Phase IV	LX-11-354	DH11-35	59.44	62.48	MX		SOX		
Phase IV	LX-11-355	DH11-35	68.6	71.02	MX		SOX		
Phase IV	LX-11-356	DH11-35	73.16	76.2	MX		SUS		
Phase IV	LX-11-357	DH11-35	82.3	84.3	MX		HYP		
Phase IV	LX-11-358	DH11-37	0	3.05	WR	WASTE	CAP		
Phase IV	LX-11-359	DH11-37	7.15	9.95	WR	WASTE	CAP		
Phase IV	LX-11-360	DH11-37	12.71	15.59	WR	WASTE	CAP		
Phase IV	LX-11-361	DH11-37	18.79	21.33	WR	WASTE	CAP		
Phase IV	LX-11-362	DH11-37	24	27.01	WR	WASTE	CAP		
Phase IV	LX-11-363	DH11-37	33.08	35.95	WR	WASTE	CAP		

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-364	DH11-37	38.4	40.31	WR	WASTE	CAP		
Phase IV	LX-11-365	DH11-37	43.33	46.16	WR	WASTE	CAP		
Phase IV	LX-11-366	DH11-37	48.77	50.89	WR	WASTE	CAP		
Phase IV	LX-11-367	DH11-37	53.5	56.1	WR	WASTE	CAP		
Phase IV	LX-11-368	DH11-37	59.3	62.18	WR	WASTE	CAP		
Phase IV	LX-11-369	DH11-37	65.1	68.7	WR	WASTE	CAP		
Phase IV	LX-11-370	DH11-37	70.93	73.7	WR	WASTE	CAP		
Phase IV	LX-11-371	DH11-37	76.2	78.8	WR	WASTE	CAP		
Phase IV	LX-11-372	DH11-37	83.82	86.86	WR	WASTE	CAP		
Phase IV	LX-11-373	DH11-37	89	92.06	WR	WASTE	CAP		
Phase IV	LX-11-374	DH11-37	96	99.06	WR	WASTE	CAP		
Phase IV	LX-11-375	DH11-37	101	104.1	WR	WASTE	CAP		
Phase IV	LX-11-376	DH11-37	108	111.25	WR	WASTE	CAP		
Phase IV	LX-11-377	DH11-37	114.3	116.8	WR	WASTE	CAP		
Phase IV	LX-11-378	DH11-37	117.35	120.8	WR	ORE	CAP		
Phase IV	LX-11-379	DH11-37	125.4	128.02	WR	WASTE	CAP		
Phase IV	LX-11-380	DH11-37	133.25	136.3	WR	WASTE	SOX		
Phase IV	LX-11-381	DH11-37	140.21	143.25	WR	WASTE	SOX		
Phase IV	LX-11-382	DH11-37	146.9	149.55	WR	WASTE	SOX		
Phase IV	LX-11-383	DH11-37	152	154.31	WR	WASTE	SOX		
Phase IV	LX-11-384	DH11-37	156.31	158.4	WR	WASTE	SOX		
Phase IV	LX-11-385	DH11-37	160.02	162.2	WR	WASTE	SOX		
Phase IV	LX-11-386	DH11-37	166.2	169.2	WR	WASTE	SOX		
Phase IV	LX-11-387	DH11-36	1.52	4.57	WR	WASTE	CAP		
Phase IV	LX-11-388	DH11-36	6.4	9.4	WR	WASTE	CAP		
Phase IV	LX-11-389	DH11-36	12.37	15.15	WR	WASTE	CAP		
Phase IV	LX-11-390	DH11-36	18.15	21.34	WR	WASTE	CAP		
Phase IV	LX-11-391	DH11-36	24.28	26.95	WR	WASTE	CAP		
Phase IV	LX-11-392	DH11-36	29.46	32	WR	WASTE	CAP		
Phase IV	LX-11-393	DH11-36	34.75	37.77	WR	WASTE	CAP		
Phase IV	LX-11-394	DH11-36	40.75	44.03	WR	WASTE	CAP		
Phase IV	LX-11-395	DH11-36	47.03	49.93	WR	WASTE	CAP		
Phase IV	LX-11-396	DH11-36	54.86	57.07	WR	WASTE	CAP		
Phase IV	LX-11-397	DH11-36	62.63	65.4	WR	WASTE	CAP		
Phase IV	LX-11-398a	DH11-39	27.43	30.56	WR	WASTE	CAP		
Phase IV	LX-11-398b	DH11-36	70.1	73.1	WR	WASTE	SUS		
Phase IV	LX-11-401	92-126	535.53	538.58	IX	ORE	HYP		
Phase IV	LX-11-402	92-126	556.87	559.92	IX	ORE	HYP		
Phase IV	LX-11-403	92-126	587.35	590.4	IX	ORE	HYP	POT	
Phase IV	LX-11-404	92-127	324.15	327.35	PP	WASTE	HYP	POT	
Phase IV	LX-11-405	92-128	529.44	532.49	IX	ORE	HYP	POT	PHY
Phase IV	LX-11-406	92-132	313.03	316.08	PP	ORE	HYP	POT	
Phase IV	LX-11-407	92-133	469.39	472.44	PP	ORE	HYP	POT	
Phase IV	LX-11-408	92-134	471.53	474.57	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-409	92-134	485.85	488.9	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-410	92-134	213.36	217.93	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-411	92-134	383.13	386.18	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-412	92-136	419.71	422.76	IX	ORE	HYP	POT	
Phase IV	LX-11-413	92-136	441.05	444.09	IX	ORE	HYP	POT	
Phase IV	LX-11-414	92-136	480.67	483.72	IX	ORE	HYP	PHY	
Phase IV	LX-11-415	92-138	541.32	544.53	IX	ORE	HYP	POT	
Phase IV	LX-11-416	92-138	569.06	572.11	IX	WASTE	HYP	POT	
Phase IV	LX-11-417	92-140	255.57	259.2	PP	ORE	HYP	POT	
Phase IV	LX-11-418	92-141	361.8	364.84	IX	ORE	HYP	POT	
Phase IV	LX-11-419	92-142	294.74	297.79	IX	WASTE	HYP	POT	
Phase IV	LX-11-420	93-146	502	505.05	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-421	93-147	477.62	480.67	IX	ORE	HYP	POT	PHY
Phase IV	LX-11-422	93-147	508.1	511.15	IX	WASTE	HYP	POT	PHY
Phase IV	LX-11-423	93-147	537.05	540.11	IX	ORE	HYP	POT	PHY
Phase IV	LX-11-424	93-147	562.96	566.01	IX	ORE	HYP	POT	PHY
Phase IV	LX-11-425	93-147	581.25	584.3	IX	ORE	HYP	POT	PHY
Phase IV	LX-11-426	93-147	599.54	602.59	IX	ORE	HYP	POT	PHY
Phase IV	LX-11-427	93-151	355.7	358.75	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-428	93-151	422.45	425.5	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-429	93-151	450.19	453.24	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-430	93-151	478.54	481.58	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-431	93-152	566.01	569.06	IX	ORE	HYP	POT	PHY
Phase IV	LX-11-432	93-153	76.81	79.86	WR	ORE	SUS	POT	ARG
Phase IV	LX-11-433	93-155	367.89	370.94	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-434	93-162	163.68	166.73	PP	WASTE	HYP	PHY	
Phase IV	LX-11-435	93-162	188.06	191.11	PP	WASTE	HYP	PHY	
Phase IV	LX-11-438	93-163	313.03	316.08	MX	WASTE	HYP	PHY	
Phase IV	LX-11-439	93-163	163.67	166.73	MX	WASTE	HYP	PHY	
Phase IV	LX-11-440	93-163	215.49	218.54	MX	WASTE	HYP	PHY	
Phase IV	LX-11-441	93-163	288.65	291.69	MX	WASTE	HYP	PHY	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-442	93-165	285.6	288.65	WR	WASTE	HYP	PHY	
Phase IV	LX-11-443	93-165	386.18	389.23	WR	WASTE	HYP	PHY	
Phase IV	LX-11-444	93-165	331.32	334.37	WR	WASTE	HYP	PHY	
Phase IV	LX-11-445	93-168	346.56	349.61	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-446	93-168	370.94	373.99	WR	WASTE	HYP	PHY	
Phase IV	LX-11-447	93-168	395.33	398.37	WR	WASTE	HYP	PHY	
Phase IV	LX-11-455	93-171	123.14	127.1	WR	WASTE	SUS	PHY	
Phase IV	LX-11-456	93-172	100.13	102.41	WR	ORE	HYP	POT	
Phase IV	LX-11-457	93-172	117.5	120.7	WR	ORE	HYP	POT	
Phase IV	LX-11-458	93-172	136.09	139.14	WR	ORE	HYP	POT	
Phase IV	LX-11-459	93-172	25.91	28.96	WR	ORE	SOX	ARG	POT
Phase IV	LX-11-460	93-172	55.93	58.52	WR	ORE	SOX	ARG	POT
Phase IV	LX-11-461	93-173	407.52	410.57	IX	ORE	HYP	PHY	POT
Phase IV	LX-11-462	93-173	441.05	444.09	IX	ORE	HYP	PHY	POT
Phase IV	LX-11-463	93-174	509.02	512.06	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-464	93-175	407.52	410.56	WR	ORE	HYP	PHY	
Phase IV	LX-11-465	93-177	212.45	215.49	MX	WASTE	HYP	PHY	
Phase IV	LX-11-466	93-180	99.67	103.33	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-467	93-180	33.22	35.66	WR	ORE	SUS	PHY	POT
Phase IV	LX-11-468	93-182	339.85	342.6	WR	WASTE	HYP	PHY	
Phase IV	LX-11-469	93-182	366.37	368.5	WR	WASTE	HYP	PHY	
Phase IV	LX-11-470	93-182	316.53	319.13	WR	WASTE	HYP	PHY	
Phase IV	LX-11-471	93-182	185.01	187.47	WR	ORE	SUS	PHY	ARG
Phase IV	LX-11-472	93-183	300.84	303.89	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-473	93-184	389.23	392.28	WR	ORE	HYP	POT	
Phase IV	LX-11-474	93-186	230.73	233.78	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-475	93-187	206.35	209.4	WR	WASTE	HYP	PHY	
Phase IV	LX-11-476	93-187	221.59	224.64	WR	WASTE	HYP	PHY	
Phase IV	LX-11-477	93-187	245.97	249.02	WR	WASTE	HYP	PHY	
Phase IV	LX-11-478	93-187	144.78	147.98	WR	WASTE	HYP	PHY	
Phase IV	LX-11-479	93-187	172.82	175.87	WR	WASTE	HYP	PHY	
Phase IV	LX-11-480	93-187	114.91	117.96	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-483	93-189	202.08	203.61	WR	ORE	HYP	PHY	
Phase IV	LX-11-484	93-189	217.02	219.76	WR	WASTE	HYP	PHY	
Phase IV	LX-11-485	93-189	253.59	255.12	WR	WASTE	HYP	PHY	
Phase IV	LX-11-486	93-189	275.84	278.89	WR	WASTE	HYP	PHY	
Phase IV	LX-11-487	93-189	74.68	77.72	WR	WASTE	SUS	PHY	
Phase IV	LX-11-488	93-189	119.18	121.62	WR	WASTE	SUS	PHY	
Phase IV	LX-11-489	93-190	434.64	437.69	WR	WASTE	HYP	PHY	
Phase IV	LX-11-490	93-190	419.4	422.45	WR	WASTE	HYP	PHY	
Phase IV	LX-11-491	93-191	309.98	313.03	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-492	93-191	233.78	236.83	IX	ORE	HYP	POT	
Phase IV	LX-11-493	93-191	352.65	355.7	IX	WASTE	HYP	POT	
Phase IV	LX-11-494	93-191	117.96	120.55	IX	ORE	SUS	POT	
Phase IV	LX-11-495	93-193	447.14	450.19	WR	ORE	HYP	PHY	ARG
Phase IV	LX-11-496	93-193	462.38	465.43	WR	ORE	HYP	PHY	ARG
Phase IV	LX-11-497	93-193	492.86	495.91	WR	ORE	HYP	PHY	ARG
Phase IV	LX-11-498	93-193	87.48	90.53	WR	ORE	SUS	POT	PHY
Phase IV	LX-11-499	93-194	397.76	401.12	PP	WASTE	HYP	PHY	ARG
Phase IV	LX-11-500	93-195	156.06	157.89	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-501	93-195	209.4	212.45	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-502	93-197	358.75	361.8	WR	ORE	HYP	POT	
Phase IV	LX-11-503	93-197	383.13	386.18	WR	ORE	HYP	POT	
Phase IV	LX-11-504	93-198	367.89	370.94	IX	WASTE	HYP	POT	
Phase IV	LX-11-505	93-198	279.5	282.55	PP	ORE	HYP	POT	PHY
Phase IV	LX-11-506	93-199	136.86	139.29	WR	WASTE	HYP	POT	PRO
Phase IV	LX-11-507	93-200	176.78	179.83	WR	WASTE	HYP	PHY	
Phase IV	LX-11-508	93-201	331.17	334.37	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-509	93-201	352.65	355.7	PP	WASTE	HYP	POT	
Phase IV	LX-11-510	93-201	386.18	388.01	PP	ORE	HYP	POT	
Phase IV	LX-11-511	93-203	306.93	309.98	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-512	93-203	334.37	337.41	WR	WASTE	HYP	POT	
Phase IV	LX-11-513	93-204	441.04	444.09	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-514	93-205	169.47	172.52	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-515	93-205	190.8	194.01	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-516	93-205	208.48	211.53	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-517	93-205	267.31	270.36	WR	WASTE	HYP	POT	
Phase IV	LX-11-518	93-205	119.48	123.14	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-519	93-206	306.93	309.98	PP	WASTE	HYP	POT	PHY
Phase IV	LX-11-520	93-206	331.32	334.37	PP	WASTE	HYP	POT	PHY
Phase IV	LX-11-521	93-206	364.85	367.89	PP	WASTE	HYP	POT	PHY
Phase IV	LX-11-522	93-206	151.49	154.53	PP	WASTE	SUS	POT	PHY
Phase IV	LX-11-523	93-207	304.8	307.85	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-524	93-207	329.18	332.23	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-525	93-207	356.62	359.66	WR	WASTE	HYP	PHY	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-526	93-207	393.19	396.24	WR	WASTE	HYP	PHY	
Phase IV	LX-11-529	93-210	198.12	201.17	WR	ORE	HYP	POT	
Phase IV	LX-11-530	93-211	227.69	229.51	PP	ORE	HYP	POT	PHY
Phase IV	LX-11-531	93-211	343.51	346.56	PP	WASTE	HYP	POT	PHY
Phase IV	LX-11-532	93-212	408.43	411.48	MX	WASTE	HYP	PHY	
Phase IV	LX-11-533	93-212	445.01	448.06	MX	WASTE	HYP	PHY	
Phase IV	LX-11-534	93-212	353.57	356.62	MX	WASTE	HYP	PHY	
Phase IV	LX-11-535	93-213	185.01	188.06	WR	WASTE	HYP	POT	
Phase IV	LX-11-536	93-217	154.43	157.58	WR	ORE	HYP	PHY	
Phase IV	LX-11-537	93-217	184.4	187.45	WR	ORE	HYP	PHY	
Phase IV	LX-11-538	93-217	230.73	233.78	WR	ORE	HYP	PHY	
Phase IV	LX-11-539	93-217	258.17	261.21	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-540	93-221	67.97	71.02	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-541	93-221	101.2	104.24	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-542	93-221	122.53	125.58	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-543	93-222	279.5	282.55	WR	WASTE	HYP	PHY	
Phase IV	LX-11-544	93-222	319.13	322.17	WR	WASTE	HYP	PHY	
Phase IV	LX-11-545	93-222	358.75	361.8	WR	WASTE	HYP	PHY	
Phase IV	LX-11-546	93-224	182.88	185.93	WR	WASTE	HYP	PHY	
Phase IV	LX-11-547	93-224	210.31	213.36	WR	WASTE	HYP	PHY	
Phase IV	LX-11-548	93-226	54.86	57.91	WR	ORE	SUS	PHY	ARG
Phase IV	LX-11-549	93-228	154.53	157.58	PP	WASTE	HYP	POT	
Phase IV	LX-11-550	93-228	209.4	212.45	PP	WASTE	HYP	POT	
Phase IV	LX-11-552	93-229	264.26	267.31	PP	WASTE	HYP	PHY	
Phase IV	LX-11-553	93-229	142.04	145.39	PP	WASTE	SUS	ARG	
Phase IV	LX-11-554	93-233	84.43	87.48	PP	ORE	HYP	PHY	
Phase IV	LX-11-555	93-233	185.01	188.06	PP	WASTE	HYP	PHY	PRO
Phase IV	LX-11-556	93-238	169.77	172.82	PP	WASTE	HYP	PHY	
Phase IV	LX-11-557	93-238	187.63	190.8	PP	WASTE	HYP	PHY	
Phase IV	LX-11-558	93-238	224.64	227.69	PP	WASTE	HYP	PHY	
Phase IV	LX-11-559	93-240	170.99	172.82	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-560	93-240	191.11	194.16	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-561	93-240	245.97	249.02	PP	WASTE	HYP	POT	
Phase IV	LX-11-562	93-243	175.87	178.92	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-563	93-244	86.26	89.31	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-564	93-244	96.32	99.67	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-565	93-244	32.31	35.36	WR	WASTE	SUS	ARG	PRO
Phase IV	LX-11-566	93-244	62.33	65.68	WR	ORE	SUS	POT	PHY
Phase IV	LX-11-567	93-245	181.97	185.01	PP	WASTE	HYP	POT	PHY
Phase IV	LX-11-568	93-245	236.83	239.88	PP	WASTE	HYP	POT	PHY
Phase IV	LX-11-569	93-245	255.12	258.17	PP	WASTE	HYP	POT	PHY
Phase IV	LX-11-570	93-249	194.16	197.21	WR	ORE	HYP	PHY	ARG
Phase IV	LX-11-571	94-251	83.97	86.26	WR	ORE	HYP	PHY	PRO
Phase IV	LX-11-572	94-251	134.42	137.46	WR	WASTE	HYP	PRO	POT
Phase IV	LX-11-573	94-251	164.9	168.1	WR	ORE	HYP	PRO	POT
Phase IV	LX-11-574	94-251	193.85	195.53	WR	WASTE	HYP	PRO	POT
Phase IV	LX-11-575	94-252	65.53	68.43	WR	ORE	HYP	POT	
Phase IV	LX-11-576	94-252	88.09	91.44	WR	ORE	HYP	POT	
Phase IV	LX-11-577	94-252	116.43	118.72	WR	ORE	HYP	POT	
Phase IV	LX-11-578	94-252	40.23	42.98	WR	ORE	SUS	POT	ARG
Phase IV	LX-11-579	94-253	46.33	49.38	WR	ORE	HYP	PRO	PHY
Phase IV	LX-11-580	94-253	85.34	88.39	WR	ORE	HYP	PRO	PHY
Phase IV	LX-11-581	94-253	102.72	105.77	WR	WASTE	HYP	PRO	PHY
Phase IV	LX-11-582	94-253	134.42	137.46	WR	ORE	HYP	PRO	PHY
Phase IV	LX-11-583	94-253	175.87	178.92	WR	ORE	HYP	POT	PRO
Phase IV	LX-11-584	94-253	233.78	236.83	WR	WASTE	HYP	POT	PRO
Phase IV	LX-11-586	94-254	89	91.59	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-587	94-254	137.77	140.82	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-588	94-254	174.34	177.39	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-589	94-254	226.16	227.68	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-590	94-255	175.87	178.92	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-591	94-256	107.9	110.95	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-592	94-256	42.06	45.11	WR	ORE	SOX	POT	ARG
Phase IV	LX-11-593	94-257	117.04	119.48	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-594	94-259	30.94	33.83	WR	ORE	SOX	PHY	ARG
Phase IV	LX-11-595	94-261	82.91	85.95	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-596	94-261	122.53	125.58	WR	WASTE	HYP	PHY	
Phase IV	LX-11-597	94-261	142.34	144.78	WR	WASTE	HYP	PHY	
Phase IV	LX-11-598	94-262	148.44	151.49	WR	WASTE	HYP	POT	
Phase IV	LX-11-599	94-262	185.01	188.06	WR	WASTE	HYP	POT	
Phase IV	LX-11-601	94-266	129.84	132.59	IX	ORE	HYP	PHY	POT
Phase IV	LX-11-602	94-269	129.84	133.2	WR	WASTE	HYP	POT	
Phase IV	LX-11-603	94-284	175.56	179.22	WR	ORE	SUS	POT	
Phase IV	LX-11-604	94-287	124.51	126.19	IX	ORE	SUS	POT	ARG
Phase IV	LX-11-605	94-292	148.44	151.49	PP	ORE	SUS	PHY	ARG

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-610	94-320	242.93	245.97	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-611	94-320	300.84	303.89	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-612	94-320	325.22	328.27	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-613	94-320	346.5	349.61	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-614	94-320	194.16	197.21	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-615	94-320	163.68	166.73	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-616	94-320	188.06	191.11	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-617	94-320	215.49	218.54	WR	ORE	SUS	PHY	ARG
Phase IV	LX-11-618	94-330	157.58	161.24	MX	ORE	SUS	PHY	
Phase IV	LX-11-619	94-336	47.85	50.44	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-620	94-336	56.69	60.05	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-621	94-337	67.67	70.71	WR	WASTE	SUS	POT	PHY
Phase IV	LX-11-622	94-338	42.98	46.02	WR	ORE	SOX	PHY	
Phase IV	LX-11-623	94-339	97.84	99.97	WR	WASTE	CAP	ARG	
Phase IV	LX-11-624	CAS-003	260.6	263.65	WR	WASTE	SUS	PHY	
Phase IV	LX-11-625	CAS-003	291.08	294.76	WR	WASTE	HYP	PHY	
Phase IV	LX-11-626	CAS-004	73	76	WR	ORE	SOX	PHY	
Phase IV	LX-11-627	CAS-004	109	111	WR	WASTE	SUS	PHY	
Phase IV	LX-11-628	CAS-004	141	144	WR	WASTE	SUS	PHY	
Phase IV	LX-11-629	CAS-004	210	213	WR	WASTE	HYP	PHY	
Phase IV	LX-11-630	CAS-004	234	235.1	WR	WASTE	HYP	PHY	
Phase IV	LX-11-631	CAS-004	267	270	WR	WASTE	HYP	PHY	
Phase IV	LX-11-632	CAS-004	306	309	WR	WASTE	HYP	PHY	
Phase IV	LX-11-633	CAS-004	333	336	WR	ORE	HYP	PHY	
Phase IV	LX-11-634	CAS-005	116.24	119	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-635	CAS-007	82	85	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-636	CAS-007	103.21	105.37	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-637	CAS-007	176	179	WR	WASTE	HYP	PHY	
Phase IV	LX-11-638	CAS-007	191.4	193.25	WR	WASTE	HYP	PHY	
Phase IV	LX-11-639	CAS-007	218	220.98	WR	WASTE	HYP	PHY	
Phase IV	LX-11-640	CAS-007	300	303	IX	WASTE	HYP	PHY	
Phase IV	LX-11-641	CAS-007	309	312	IX	WASTE	HYP	PHY	
Phase IV	LX-11-642	CAS-007	337.34	339.85	PP	WASTE	HYP	PHY	
Phase IV	LX-11-643	CAS-007	373.8	376.4	PP	WASTE	HYP	PHY	
Phase IV	LX-11-644	CAS-007	416	419	MX	WASTE	HYP	PHY	
Phase IV	LX-11-645	CAS-007	472.46	474.72	MX	WASTE	HYP	PHY	
Phase IV	LX-11-646	CAS-008	39	42	WR	ORE	SUS	ARG	PHY
Phase IV	LX-11-647	CAS-008	85	87	WR	ORE	SUS	PHY	PHY
Phase IV	LX-11-648	CAS-009	40.7	43.7	WR	ORE	SUS	POT	
Phase IV	LX-11-649	CAS-009	46	49	WR	ORE	SUS	POT	
Phase IV	LX-11-650	CAS-009	52	55	WR	ORE	SUS	POT	
Phase IV	LX-11-651	CAS-009	59.5	60.96	WR	ORE	SUS	POT	
Phase IV	LX-11-652	CAS-009	65.53	68.53	WR	ORE	HYP	POT	
Phase IV	LX-11-653	CAS-009	71	74	WR	ORE	HYP	POT	
Phase IV	LX-11-654	CAS-009	77	80	WR	WASTE	HYP	POT	
Phase IV	LX-11-655	CAS-009	83	86	WR	ORE	HYP	POT	
Phase IV	LX-11-656	CAS-009	89	92	WR	WASTE	HYP	POT	
Phase IV	LX-11-657	CAS-009	96	99	WR	ORE	HYP	POT	
Phase IV	LX-11-658	CAS-009	102	105	WR	ORE	HYP	POT	
Phase IV	LX-11-659	CAS-009	108	111	WR	ORE	HYP	POT	
Phase IV	LX-11-660	CAS-009	114	117	WR	ORE	HYP	POT	
Phase IV	LX-11-661	CAS-009	120	123	WR	ORE	HYP	POT	
Phase IV	LX-11-662	CAS-009	127.1	129.2	WR	ORE	HYP	POT	
Phase IV	LX-11-663	CAS-009	131.2	133.75	WR	ORE	HYP	POT	
Phase IV	LX-11-664	CAS-009	136	138.15	WR	ORE	HYP	POT	
Phase IV	LX-11-665	CAS-009	143.26	144.95	WR	ORE	HYP	POT	
Phase IV	LX-11-666	CAS-009	147	150	WR	ORE	HYP	POT	
Phase IV	LX-11-667	CAS-009	154.12	157	WR	ORE	HYP	POT	
Phase IV	LX-11-668	CAS-009	160	163	WR	ORE	HYP	POT	
Phase IV	LX-11-669	CAS-009	166	169	WR	ORE	HYP	POT	
Phase IV	LX-11-670	CAS-009	172	175	WR	ORE	HYP	POT	
Phase IV	LX-11-671	CAS-009	178	181	WR	ORE	HYP	POT	
Phase IV	LX-11-672	CAS-009	184	187	WR	ORE	HYP	POT	
Phase IV	LX-11-673	CAS-009	190.4	191.98	WR	WASTE	HYP	POT	
Phase IV	LX-11-674	CAS-009	194	197	WR	ORE	HYP	POT	
Phase IV	LX-11-675	CAS-009	200	201.5	WR	ORE	HYP	POT	
Phase IV	LX-11-676	CAS-009	207.5	210.5	WR	ORE	HYP	POT	
Phase IV	LX-11-677	CAS-009	213.5	216.5	WR	ORE	HYP	POT	
Phase IV	LX-11-678	CAS-009	220.7	223.2	WR	ORE	HYP	POT	
Phase IV	LX-11-679	CAS-009	226	229	WR	ORE	HYP	POT	
Phase IV	LX-11-680	CAS-009	232	235	WR	ORE	HYP	POT	
Phase IV	LX-11-681	CAS-009	237.81	240.1	WR	WASTE	HYP	POT	
Phase IV	LX-11-682	CAS-009	243.1	246.1	WR	WASTE	HYP	POT	
Phase IV	LX-11-683	CAS-009	249.1	252.1	WR	WASTE	HYP	POT	
Phase IV	LX-11-684	CAS-009	254.8	257.08	WR	ORE	HYP	POT	

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-685	CAS-009	261	262.46	WR	WASTE	HYP	POT	
Phase IV	LX-11-686	CAS-009	265.48	266.35	WR	ORE	HYP	POT	
Phase IV	LX-11-687	CAS-009	268.56	271.56	WR	ORE	HYP	POT	
Phase IV	LX-11-688	CAS-009	274.56	277.56	WR	ORE	HYP	POT	
Phase IV	LX-11-689	CAS-009	280.56	283.56	WR	ORE	HYP	POT	
Phase IV	LX-11-690	CAS-009	286.56	289.56	WR	WASTE	HYP	POT	
Phase IV	LX-11-691	CAS-011	241	244	MX	WASTE	HYP	PHY	
Phase IV	LX-11-692	CAS-011	268	270.27	MX	WASTE	HYP	PHY	
Phase IV	LX-11-693	CAS-011	289.96	293	MX	WASTE	HYP	PHY	
Phase IV	LX-11-694	CAS-011	322.43	324.61	MX	ORE	HYP	PHY	
Phase IV	LX-11-695	CAS-011	348	351	MX	WASTE	HYP	PHY	
Phase IV	LX-11-696	CAS-011	375	378	MX	WASTE	HYP	PHY	
Phase IV	LX-11-697	CAS-011	399	402	MX	ORE	HYP	PHY	
Phase IV	LX-11-698	CAS-011	420	423	MX	WASTE	HYP	PHY	
Phase IV	LX-11-699	CAS-011	444	447	MX	WASTE	HYP	PHY	
Phase IV	LX-11-700	CAS-011	477	480	MX	WASTE	HYP	PHY	
Phase IV	LX-11-701	CAS-011	514.25	517	MX	WASTE	HYP	PHY	
Phase IV	LX-11-702	CAS-012	43.3	46.3	WR	WASTE	SUS	POT	PHY
Phase IV	LX-11-703	CAS-012	79.3	82.3	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-704	CAS-012	96.5	99.5	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-705	CAS-012	127.9	130.9	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-706	CAS-012	153.6	155.45	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-707	CAS-012	179.83	182.83	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-708	CAS-012	201.2	204	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-709	CAS-012	235	238	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-710	CAS-013	31	34	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-711	CAS-013	50	53	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-712	CAS-013	67	68.28	WR	ORE	HYP	PHY	ARG
Phase IV	LX-11-713	CAS-013	82	85	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-714	CAS-013	102	103.3	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-715	CAS-013	130.2	133.2	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-716	CAS-014	27.46	30.46	WR	WASTE	SUS	PHY	POT
Phase IV	LX-11-717	CAS-014	51.5	54.5	WR	WASTE	SUS	PHY	POT
Phase IV	LX-11-718	CAS-014	69	72	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-719	CAS-014	90	93	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-720	CAS-014	110.57	113.57	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-721	CAS-014	134.4	136.52	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-722	CAS-016	28	31	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-723	CAS-016	55	58	WR	WASTE	HYP	ARG	PHY
Phase IV	LX-11-724	CAS-016	67.76	70	WR	WASTE	HYP	ARG	PHY
Phase IV	LX-11-725	CAS-016	107.51	108.85	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-726	CAS-016	120	123	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-727	CAS-018	19	22	WR	WASTE	SOX	PHY	ARG
Phase IV	LX-11-728	CAS-018	53	54.15	WR	WASTE	HYP	PHY	
Phase IV	LX-11-729	CAS-018	68.74	70.1	WR	WASTE	HYP	PHY	
Phase IV	LX-11-730	CAS-018	83	86	WR	WASTE	HYP	PHY	
Phase IV	LX-11-731	CAS-018	104	107	WR	WASTE	HYP	PHY	
Phase IV	LX-11-732	CAS-018	146	149	WR	WASTE	HYP	PHY	
Phase IV	LX-11-733	CAS-018	187	190	WR	WASTE	HYP	PHY	
Phase IV	LX-11-734	CAS-020	19.81	22	WR	ORE	SOX	ARG	PHY
Phase IV	LX-11-735	CAS-020	43	46	WR	WASTE	HYP	PHY	
Phase IV	LX-11-736	CAS-020	71	74	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-737	CAS-020	100	103	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-738	CAS-022	98.3	101.3	WR	ORE	HYP	POT	
Phase IV	LX-11-739	CAS-023	104.8	107.8	PP	WASTE	SOX	PHY	
Phase IV	LX-11-740	CAS-023	142.82	144	PP	WASTE	HYP	PHY	
Phase IV	LX-11-741	CAS-023	161	163	PP	ORE	HYP	PHY	
Phase IV	LX-11-742	CAS-025	205	208	PP	ORE	HYP	PHY	
Phase IV	LX-11-743	CAS-028	130.4	133.4	PP	WASTE	SUS	PHY	
Phase IV	LX-11-744	CAS-029	86	88	MX	WASTE	SOX	PHY	
Phase IV	LX-11-745	CAS-029	115.1	118	MX	WASTE	HYP	PHY	
Phase IV	LX-11-746	CAS-029	133	136	MX	WASTE	HYP	PHY	
Phase IV	LX-11-747	CAS-029	155	158	MX	WASTE	HYP	PHY	
Phase IV	LX-11-748	CAS-029	175	178	MX	WASTE	HYP	PHY	
Phase IV	LX-11-749	CAS-032	159.35	162.35	PP	ORE	SUS	PHY	ARG
Phase IV	LX-11-750	CAS-033	120.5	123.5	IX	ORE	SUS	POT	PHY
Phase IV	LX-11-751	CAS-034	74.85	77.85	MX	WASTE	SUS	PHY	ARG
Phase IV	LX-11-752	CAS-036	12.19	13.2	WR	WASTE	SUS	PHY	POT
Phase IV	LX-11-753	CAS-036	41	44	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-754	CAS-036	79.3	82.3	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-755	CAS-036	109.3	111.3	WR	WASTE	HYP	POT	
Phase IV	LX-11-756	CAS-039	181.9	184.9	PP	WASTE	SUS	PHY	
Phase IV	LX-11-757	CAS-041	62	64	WR	WASTE	SOX	ARG	PHY
Phase IV	LX-11-758	CAS-041	80.45	83.45	WR	WASTE	SOX	ARG	PHY
Phase IV	LX-11-759	CAS-041	104.6	106.7	WR	WASTE	SOX	ARG	PHY

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-760	CAS-041	133.7	136.7	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-761	CAS-042	55.8	58.8	WR	WASTE	SOX	PHY	
Phase IV	LX-11-762	CAS-042	122	125	WR	WASTE	SUS	PHY	
Phase IV	LX-11-763	CAS-042	158.35	161.35	WR	WASTE	HYP	PHY	
Phase IV	LX-11-764	CAS-042	179.35	181.85	WR	WASTE	HYP	PHY	
Phase IV	LX-11-765	CAS-042	201.85	204.85	WR	WASTE	HYP	PHY	
Phase IV	LX-11-766	CAS-042	240.85	243.85	WR	WASTE	HYP	PHY	
Phase IV	LX-11-767	CAS-043	61.17	64.17	WR	ORE	SUS	POT	ARG
Phase IV	LX-11-768	CAS-043	97.85	99.5	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-769	CAS-043	131.3	134.3	PP	WASTE	HYP	POT	PHY
Phase IV	LX-11-770	CAS-043	154.95	157.95	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-771	CAS-043	175.1	178.1	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-772	CAS-043	202.1	204.1	PP	ORE	HYP	PHY	POT
Phase IV	LX-11-773	CAS-043	227.7	230.7	PP	ORE	HYP	POT	PHY
Phase IV	LX-11-774	CAS-044	114.55	117.55	WR	WASTE	HYP	POT	
Phase IV	LX-11-775	CAS-044	128.4	131.4	WR	WASTE	HYP	POT	
Phase IV	LX-11-776	CAS-045	69.8	71.8	WR	ORE	SOX	POT	PHY
Phase IV	LX-11-777	CAS-045	103	106	WR	ORE	SUS	POT	PHY
Phase IV	LX-11-778	CAS-045	135.05	138.05	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-779	CAS-045	154.2	156.9	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-780	CAS-045	178.4	181.4	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-781	CAS-046	102.7	105.7	WR	ORE	SUS	PHY	POT
Phase IV	LX-11-782	CAS-046	168.65	171.65	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-783	CAS-046	189.4	191.9	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-784	CAS-048	98.6	101.6	WR	WASTE	SUS	PHY	
Phase IV	LX-11-785	CAS-048	192.15	195.15	WR	WASTE	HYP	PHY	
Phase IV	LX-11-786	CAS-049	190	193	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-787	CAS-052	74.6	77.6	WR	ORE	SUS	PHY	POT
Phase IV	LX-11-788	CAS-055	82.3	85.3	WR	ORE	SUS	POT	PRO
Phase IV	LX-11-789	CAS-057	142	144	WR	WASTE	SUS	PHY	
Phase IV	LX-11-790	CAS-057	154	156.85	WR	ORE	SUS	PHY	
Phase IV	LX-11-791	CAS-060	56.6	59.6	WR	WASTE	SUS	PHY	
Phase IV	LX-11-792	CAS-060	87.57	90.57	WR	ORE	SUS	PHY	
Phase IV	LX-11-793	CAS-060	119.08	120.87	WR	ORE	SUS	PHY	
Phase IV	LX-11-794	CAS-060	145.38	148.38	WR	WASTE	HYP	PHY	
Phase IV	LX-11-795	CAS-060	170.31	171.9	WR	ORE	HYP	PHY	
Phase IV	LX-11-796	CAS-060	190.46	193.46	WR	ORE	HYP	PHY	
Phase IV	LX-11-797	CAS-064	115.95	117.45	PP	WASTE	SUS	PHY	
Phase IV	LX-11-798	CAS-065	97.3	100.3	MX	WASTE	SUS	PHY	
Phase IV	LX-11-799	CAS-065	115.3	118.3	MX	WASTE	SUS	PHY	
Phase IV	LX-11-800	CAS-065	139.3	142.3	MX	WASTE	SUS	PHY	
Phase IV	LX-11-801	CAS-066	71.3	74.3	WR	ORE	SUS	PHY	
Phase IV	LX-11-802	CAS-066	101.3	104.3	WR	ORE	SUS	PHY	
Phase IV	LX-11-803	CAS-066	125.3	128.3	WR	ORE	SUS	PHY	
Phase IV	LX-11-804	CAS-067	99.7	102.7	PP	ORE	SUS	PHY	
Phase IV	LX-11-805	CAS-067	157.6	160.6	PP	WASTE	SUS	PHY	
Phase IV	LX-11-806	CAS-067	217.7	220.7	PP	WASTE	HYP	PHY	
Phase IV	LX-11-807	CAS-067	241.7	243.94	PP	WASTE	HYP	PHY	
Phase IV	LX-11-808	CAS-069	156.92	159.8	PP	ORE	SUS	PHY	POT
Phase IV	LX-11-809	CAS-069	209	212	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-810	CAS-069	225.7	228.25	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-811	CAS-069	246.25	248.25	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-812	CAS-071	117.6	120.6	PP	ORE	SUS	PHY	
Phase IV	LX-11-813	CAS-071	150.6	153.6	PP	WASTE	SUS	PHY	
Phase IV	LX-11-814	CAS-071	179	182	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-815	CAS-071	200	203	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-816	CAS-071	224	227	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-817	CAS-071	248	250	PP	WASTE	HYP	PHY	POT
Phase IV	LX-11-818	CAS-072	48.05	51.05	PP	WASTE	SOX	PHY	
Phase IV	LX-11-819	CAS-072	68.58	69.58	PP	WASTE	SUS	PHY	
Phase IV	LX-11-820	CAS-072	101.77	104.77	PP	WASTE	HYP	PHY	
Phase IV	LX-11-821	CAS-072	126.7	128.9	PP	WASTE	HYP	PHY	
Phase IV	LX-11-822	CAS-072	161.9	164.9	PP	WASTE	HYP	PHY	
Phase IV	LX-11-823	CAS-072	191.9	194.9	PP	WASTE	HYP	PHY	
Phase IV	LX-11-824	CAS-073	153.7	156.7	WR	ORE	SUS	PHY	ARG
Phase IV	LX-11-825	CAS-073	325.05	328.05	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-826	CAS-074	279	282	WR	ORE	HYP	PHY	
Phase IV	LX-11-827	CAS-075	137.15	140.15	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-828	CAS-075	142.78	144.78	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-829	CAS-075	147.78	150.78	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-830	CAS-075	153.78	156.78	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-831	CAS-075	158.6	161.6	WR	ORE	SUS	PHY	ARG
Phase IV	LX-11-832	CAS-075	163.1	164.55	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-833	CAS-075	167.55	170.55	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-834	CAS-075	173.55	176.55	WR	WASTE	SUS	PHY	ARG

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-835	CAS-075	179.55	182.55	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-836	CAS-075	184.35	187.35	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-837	CAS-075	190.35	193.35	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-838	CAS-075	195.4	198.4	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-839	CAS-075	201.4	204.4	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-840	CAS-075	207.4	210.4	WR	WASTE	SUS	PHY	ARG
Phase IV	LX-11-841	CAS-075	212.4	213.95	WR	WASTE	SUS	PHY	
Phase IV	LX-11-842	CAS-075	215.75	218.75	WR	WASTE	HYP	PHY	
Phase IV	LX-11-843	CAS-075	221.75	224.75	WR	WASTE	HYP	PHY	
Phase IV	LX-11-844	CAS-075	227.75	230.75	WR	WASTE	HYP	PHY	
Phase IV	LX-11-845	CAS-075	233.75	236.75	WR	WASTE	HYP	PHY	
Phase IV	LX-11-846	CAS-075	237.75	240.75	WR	WASTE	HYP	PHY	
Phase IV	LX-11-847	CAS-075	243.75	246.75	WR	WASTE	HYP	PHY	
Phase IV	LX-11-848	CAS-075	249.75	252.75	WR	WASTE	HYP	PHY	
Phase IV	LX-11-849	CAS-075	255.75	257.75	WR	WASTE	HYP	PHY	
Phase IV	LX-11-850	CAS-075	259.7	261.7	WR	WASTE	HYP	PHY	
Phase IV	LX-11-851	CAS-075	264.7	267.2	WR	WASTE	HYP	PHY	
Phase IV	LX-11-852	CAS-075	270.2	273.2	WR	WASTE	HYP	PHY	
Phase IV	LX-11-853	CAS-075	276.2	279.2	WR	WASTE	HYP	PHY	
Phase IV	LX-11-854	CAS-075	282.2	284.2	WR	WASTE	HYP	PHY	
Phase IV	LX-11-855	CAS-075	286	288	WR	ORE	HYP	PHY	
Phase IV	LX-11-856	CAS-075	290.3	293.3	WR	WASTE	HYP	PHY	
Phase IV	LX-11-857	CAS-075	295.3	297.5	WR	WASTE	HYP	PHY	
Phase IV	LX-11-858	CAS-075	300.5	303.5	WR	WASTE	HYP	PHY	
Phase IV	LX-11-859	CAS-075	306.5	308.45	WR	WASTE	HYP	PHY	
Phase IV	LX-11-860	CAS-076	90.96	93.96	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-861	CAS-076	108.96	111.96	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-862	CAS-076	129.96	132.96	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-863	CAS-077	76	79	WR	ORE	SOX	ARG	
Phase IV	LX-11-864	CAS-078	59	62	WR	ORE	SOX	ARG	PHY
Phase IV	LX-11-865	CAS-078	86	89	WR	WASTE	SOX	ARG	PHY
Phase IV	LX-11-866	CAS-078	124	127	WR	WASTE	SUS	ARG	PHY
Phase IV	LX-11-867	CAS-079	70	73	WR	ORE	SUS	ARG	POT
Phase IV	LX-11-868	CAS-079	106	109	WR	WASTE	HYP	ARG	POT
Phase IV	LX-11-869	CAS-080	56	59	WR	ORE	SOX	ARG	POT
Phase IV	LX-11-870	CAS-080	87.5	90.5	WR	WASTE	SUS	ARG	POT
Phase IV	LX-11-871	CAS-080	127.9	130.9	WR	ORE	SUS	PHY	POT
Phase IV	LX-11-872	CAS-080	150.8	153.8	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-873	CAS-081	301.7	304.7	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-874	CAS-081	322.7	325.7	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-875	CAS-081	346.7	349.7	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-876	CAS-081	370.7	373.7	WR	WASTE	HYP	PHY	ARG
Phase IV	LX-11-877	CAS-082	345	348	WR	ORE	HYP	PHY	ARG
Phase IV	LX-11-878	CAS-083	194.3	197.3	PP	WASTE	SUS	POT	PHY
Phase IV	LX-11-879	CAS-083	280	283	IX	WASTE	HYP	POT	PHY
Phase IV	LX-11-880	CAS-083	356.6	359.6	IX	WASTE	HYP	POT	PHY
Phase IV	LX-11-881	CAS-084	201	204	IX	ORE	SUS	PHY	POT
Phase IV	LX-11-882	CAS-085	226	229	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-883	CAS-085	301	304	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-884	CAS-085	335	338	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-885	CAS-085	360	363	WR	WASTE	HYP	PHY	POT
Phase IV	LX-11-886	CAS-087	264	267	WR	ORE	HYP	PHY	POT
Phase IV	LX-11-887	CAS-087	332	335	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-888	CAS-087	365	368	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-889	CAS-087	380	383	WR	ORE	HYP	POT	PHY
Phase IV	LX-11-890	CAS-087	392	395	WR	WASTE	HYP	POT	PHY
Phase IV	LX-11-891	DH10-19B	125	128	WR	WASTE	SUS		
Phase IV	LX-11-892	DH10-19B	163.8	166.8	WR	WASTE	SUS		
Phase IV	LX-11-893	DH10-19B	224	227	WR	WASTE	HYP		
Phase IV	LX-11-894	DH10-19B	242	245	WR	ORE	HYP		
Phase IV	LX-11-895	DH10-19B	257	260	WR	WASTE	HYP		
Phase IV	LX-11-896	HG10-01	48.24	51.24	WR	ORE	SOX		
Phase IV	LX-11-897	HG10-01	75.24	78.24	WR	WASTE	SUS		
Phase IV	LX-11-898	HG10-10	201	204	PP	WASTE	HYP		
Phase IV	LX-11-899	HG10-10	228	231	PP	WASTE	HYP		
Phase IV	LX-11-900	HG10-10	255	258	PP	WASTE	HYP		
Phase IV	LX-11-901	DH11-35	88.39	91.39	MX		HYP		
Phase IV	LX-11-902	DH11-35	100.58	103.2	MX		HYP		
Phase IV	LX-11-903	DH11-35	115	118	MX	WASTE	HYP		
Phase IV	LX-11-904	DH11-35	130	133	MX	WASTE	HYP		
Phase IV	LX-11-905	DH11-35	145	148	MX	WASTE	HYP		
Phase IV	LX-11-906	DH11-35	160	163	MX	WASTE	HYP		
Phase IV	LX-11-907	DH11-35	175.68	178.31	MX		HYP		
Phase IV	LX-11-908	DH11-35	191.57	194.7	MX		HYP		
Phase IV	LX-11-909	DH11-35	205.7	208.9	MX		HYP		

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-910	DH11-35	220.4	223.8	MX		HYP		
Phase IV	LX-11-911	DH11-35	237.1	240.1	MX		HYP		
Phase IV	LX-11-912	DH11-35	249.8	253.35	MX		HYP		
Phase IV	LX-11-913	DH11-35	266	269	MX		HYP		
Phase IV	LX-11-914	DH11-35	291.5	293.5	MX		HYP		
Phase IV	LX-11-915	DH11-35	293.5	295.66			HYP		
Phase IV	LX-11-916	DH11-37	245	248	WR	WASTE	SUS		
Phase IV	LX-11-917	DH11-37	260	263	WR	WASTE	HYP		
Phase IV	LX-11-918	DH11-37	275	278	WR	WASTE	HYP		
Phase IV	LX-11-919	DH11-37	290	293	WR	WASTE	HYP		
Phase IV	LX-11-920	DH11-37	305	308	WR	WASTE	HYP		
Phase IV	LX-11-921	DH11-37	320	323	WR	WASTE	HYP		
Phase IV	LX-11-922	DH11-37	335	338	WR	WASTE	HYP		
Phase IV	LX-11-923	DH11-37	350	353	WR	WASTE	HYP		
Phase IV	LX-11-924	DH11-37	365	368	WR	WASTE	HYP		
Phase IV	LX-11-925	DH11-37	380	383	WR	WASTE	HYP		
Phase IV	LX-11-926	DH11-37	392	395	WR	WASTE	HYP		
Phase IV	LX-11-927	DH11-36	88	91	WR	WASTE	SUS		
Phase IV	LX-11-928	DH11-36	109	112	WR	WASTE	SUS		
Phase IV	LX-11-929	DH11-36	127	130	WR	WASTE	SUS		
Phase IV	LX-11-930	DH11-36	151.45	153.5	WR		HYP		
Phase IV	LX-11-931	DH11-36	168.29	170.69	WR		HYP		
Phase IV	LX-11-932	DH11-36	188.57	191.5	WR		HYP		
Phase IV	LX-11-933	DH11-36	208.99	211.84	WR		HYP		
Phase IV	LX-11-934	DH11-36	230.12	233.17	WR		HYP		
Phase IV	LX-11-935	DH11-36	250.7	252.9	WR		HYP		
Phase IV	LX-11-936	DH11-36	268.22	271.27	WR		HYP		
Phase IV	LX-11-937	DH11-36	289.56	292.66	WR		HYP		
Phase IV	LX-11-938	DH11-36	309.9	312.4	WR		HYP		
Phase IV	LX-11-939	DH11-36	330.49	333.76	WR		HYP		
Phase IV	LX-11-940	DH11-36	349	351.9	WR		HYP		
Phase IV	LX-11-941	DH11-36	362.71	364.8	WR		HYP		
Phase IV	LX-11-942	DH11-38	40	43	WR	ORE	HYP		
Phase IV	LX-11-943	DH11-38	55	58	WR	ORE	HYP		
Phase IV	LX-11-944	DH11-38	70	73	WR	ORE	HYP		
Phase IV	LX-11-945	DH11-38	83.9	86.26	WR	ORE	HYP		
Phase IV	LX-11-946	DH11-38	105.3	108.2	WR		HYP		
Phase IV	LX-11-947	DH11-38	124.05	127.3	WR		HYP		
Phase IV	LX-11-948	DH11-38	139.05	142.3	WR	ORE	HYP		
Phase IV	LX-11-949	DH11-38	154.05	157.3	WR	ORE	HYP		
Phase IV	LX-11-950	DH11-38	169.05	172.3	WR	ORE	HYP		
Phase IV	LX-11-951	DH11-38	184.05	187.3	WR	ORE	HYP		
Phase IV	LX-11-952	DH11-38	199.05	202.3	WR	ORE	HYP		
Phase IV	LX-11-953	DH11-38	214.05	217.3	WR	WASTE	HYP		
Phase IV	LX-11-954	DH11-38	229.05	232.3	WR	WASTE	HYP		
Phase IV	LX-11-955	DH11-38	244.05	247.3	WR	ORE	HYP		
Phase IV	LX-11-956	DH11-38	259.05	262.3	WR	ORE	HYP		
Phase IV	LX-11-957	DH11-38	275	278	WR	ORE	HYP		
Phase IV	LX-11-958	DH11-38	281	284	WR	ORE	HYP		
Phase IV	LX-11-959	DH11-38	287	290	WR	WASTE	HYP		
Phase IV	LX-11-960	DH11-38	296	299	WR	ORE	HYP		
Phase IV	LX-11-961	DH11-38	304	305.7	WR	ORE	HYP		
Phase IV	LX-11-962	DH11-38	311.5	314.5	WR	WASTE	HYP		
Phase IV	LX-11-963	DH11-38	318	321	WR	ORE	HYP		
Phase IV	LX-11-964	DH11-38	329	332	WR	WASTE	HYP		
Phase IV	LX-11-965	DH11-38	335	338	WR	WASTE	HYP		
Phase IV	LX-11-966	DH11-38	342.4	345	WR	WASTE	HYP		
Phase IV	LX-11-967	DH11-38	345	347.5	WR	WASTE	HYP		
Phase IV	LX-11-968	DH11-38	353.57	356.57	WR	ORE	HYP		
Phase IV	LX-11-969	DH11-38	363.2	366	WR	WASTE	HYP		
Phase IV	LX-11-970	DH11-38	372	375	WR	WASTE	HYP		
Phase IV	LX-11-971	DH11-38	381	384	WR	WASTE	HYP		
Phase IV	LX-11-972	DH11-38	390	393	WR	WASTE	HYP		
Phase IV	LX-11-973	DH11-38	396	399	WR	WASTE	HYP		
Phase IV	LX-11-974	DH11-38	405	408	WR	WASTE	HYP		
Phase IV	LX-11-975	DH11-38	411	414	WR	WASTE	HYP		
Phase IV	LX-11-976	DH11-38	420	423	WR	WASTE	HYP		
Phase IV	LX-11-977	DH11-38	426	429	WR	WASTE	HYP		
Phase IV	LX-11-978	DH11-38	435	437	WR	WASTE	HYP		
Phase IV	LX-11-979	DH11-38	441	444	WR	WASTE	HYP		
Phase IV	LX-11-980	DH11-38	447	450	WR	WASTE	HYP		
Phase IV	LX-11-981	DH11-39	32.5	35	WR	ORE	SUS		
Phase IV	LX-11-982	DH11-39	50	53	WR	ORE	SUS		
Phase IV	LX-11-983	DH11-39	71	74	WR	WASTE	HYP		
Phase IV	LX-11-984	DH11-39	89	92	WR	WASTE	HYP		

Type	Lorax ID	Drill Hole	From (m)	To (m)	Lithology	Class	Zone	Alteration 1	Alteration 2
Phase IV	LX-11-985	DH11-39	110	113	WR	ORE	HYP		
Phase IV	LX-11-986	DH11-39	128	131	WR	ORE	HYP		
Phase IV	LX-11-987	DH11-39	149	152	WR	WASTE	HYP		
Phase IV	LX-11-988	DH11-39	170	173	WR	ORE	HYP		
Phase IV	LX-11-989	DH11-39	188	191	WR	ORE	HYP		
Phase IV	LX-11-990	DH11-39	202.6	205.74	WR	ORE	HYP		
Phase IV	LX-11-991	DH11-39	218.4	220.98	WR		HYP		
Phase IV	LX-11-992	DH11-39	238.4	240.79	WR		HYP		
Phase IV	LX-11-993	DH11-39	260.6	263.38	WR		HYP		
Phase IV	LX-11-994	DH11-39	280.2	283.95	WR		HYP		
Phase IV	LX-11-995	DH11-39	287.24	287.7	WR		HYP		
Phase IV	LX-11-996	DH11-39	300.23	303.28	WR		HYP		
Phase IV	LX-11-997	DH11-39	320.04	323.09	WR		HYP		
Phase IV	LX-11-998	DH11-39	327.1	329.6	WR		HYP		
Phase IV	LX-11-999	DH11-39	344.05	354.06	WR		HYP		
Phase IV	LX-11-1000	DH11-39	357.9	360.58	WR		HYP		
Phase IV	LX-11-1001	DH11-39	376.69	377.83	WR		HYP		
Phase IV	LX-11-1002	DH11-39	388.3	391.67	WR		HYP		
Phase IV	LX-11-1003	DH11-39	408.2	410.9	WR		HYP		
Phase IV	LX-11-1004	DH11-39	430.2	433.34	WR		HYP		
Phase IV	LX-11-1005	DH11-35	279.1	282.3	IX		HYP		
Phase IV	LX-11-1006	DH11-39	284.99	287.24	WR		HYP		
Phase IV	LX-11-1007	CAS-075	218.75	221.75	WR	WASTE	PHY	HYP	

Appendix A2: Casino Cross Sections

Appendix A3: Samples Selected for Mineralogical Investigation

Table A.2.1: 2011 and 2012 Test Pit Samples

Sample ID	Depth (m)	Description	Coordinates[1]	
			Northing (m)	Easting (m)
Tailings Management Facility				
TP11-TMF-01	1.22-1.42	Gravel, some sand, some silt, trace clay	6953050	611640
TP11-TMF-05	2.10-2.30	Sand, some silt, trace gravel, trace clay	6953238	611535
TP11-TMF-09	0.85-1.05	Silt, trace clay, trace sand	6952824	612173
TP11-TMF-10	1.00-1.20	Gravel, some sand, some silt, trace clay	6952750	612298
TP11-TMF-12	0.90-1.10	Gravelly sand, some silt, trace clay	6952564	612547
TP11-TMF-13	1.35-1.55	Sandy gravel, trace silt, trace clay	6952373	612582
TP11-TMF-34	0.80-1.00	Silt and sand, some gravel, trace clay	6952595	611616
TP11-TMF-94	1.30-1.50	Sandy, silty gravel, trace clay	6953490	611070
TP11-TMF-99	0.50-0.70	Silty sand and gravel, trace clay	6953994	610782
TP11-TMF-100	1.00-1.20	Sand and gravel, some silt, trace clay	6952258	610726
Heap Leach Facility				
TP11-HLF-01	2.00-2.10	Silty sand, some gravel, trace clay	6956530	610215
TP11-HLF-05	1.50-1.90	Gravelly sand, some silt	6956232	610207
TP11-HLF-13	1.80-2.00	Gravelly sand, some silt, trace clay	6955743	610458
TP11-HLF-16	2.80-3.00	Gravel and sand, some silt, trace clay	6955855	610123
TP11-HLF-21	0.80-1.00	Silty sand, some gravel, trace clay	6956000	610627
TP11-HLF-41	1.50-1.70	Gravelly sand, some silt, trace clay	6955702	610214
Plant Site				
TP11-04	0.77-0.97	Silt and sand, trace clay, trace gravel	6957850	612100
TP11-06	0.84-1.04	Sandy silt, some gravel, trace clay	6956510	612000
TP11-10	0.30-0.65	Sandy silt, some gravel, trace clay	6956750	611700
TP11-11	1.10-1.30	Sand and gravel, some silt, trace clay	6956830	611650
TP11-18	1.20-1.40	Silty sand, trace clay, trace gravel	6956661	611920
TP11-20	1.25-1.45	Sandy silt, some gravel, trace clay	6956719	611803
Potential NAG Storage Area				
TP11-NAG-02	1.20-1.40	Silty sand, some gravel, trace clay	6957142	611262
TP11-NAG-06	3.20-3.40	Gravelly sand, some silt, trace clay	6956798	610802
TP11-NAG-07	0.70-0.90	Sand and silt, some gravel, trace clay	6956937	610824
TP11-NAG-08	0.60-0.80	Silty, gravelly sand, trace clay	6957067	611072
Open Pit				
36-1	3.05-4.57	Sand and gravel, trace silt, trace clay	6957926	610572
38-3	15.24-16.76	Silty sand, trace gravel, trace clay	6958803	611381
38-4	18.29-19.81	Sand and silt, trace clay, trace gravel	6958803	611381
39-1	7.62-7.80	Silty sand, fine to coarse	6959007	611019
TP12-PIT-01	0.80-1.00		6958503	610507
TP12-PIT-04	3.00-3.20		6958874	610215
TP12-PIT-05	3.80-4.00		6958617	611365
TP12-PIT-06	1.60-1.80		6958861	611015

Note:

1. UTM NAD 83

Table A.2.2: 1994 Overburden Samples -Open Pit Area

Sample ID	External ID	Depth (m)	Coordinates[2]	
			Northing	Easting
Surface Sample	598151	unknown	54200	10600
Surface Sample	598152	unknown	54200	10800
Surface Sample	598153	unknown	54200	10800
Surface Sample	598154	unknown	54200	11000
Surface Sample	598155	unknown	54200	11000
Surface Sample	598156	unknown	54386	10765
Surface Sample	598157	unknown	54386	10765
Surface Sample	598158	unknown	54420	10600
Surface Sample	598159	unknown	54420	11000
Surface Sample	598160	unknown	54420	11000
Surface Sample	598161	unknown	54580	11000
Surface Sample	598162	unknown	54600	10800
Surface Sample	598163	unknown	54600	10800
Surface Sample	598164	unknown	54600	11200
Surface Sample	598165	unknown	54600	11200
Surface Sample	598166	unknown	54600	11400
Surface Sample	598167	unknown	54600	11400
Surface Sample	598168	unknown	54685	11015
Surface Sample	598169	unknown	54780	10980
Surface Sample	598170	unknown	54800	10800
Surface Sample	598171	unknown	54800	10800
Surface Sample	598172	unknown	54800	11180
Surface Sample	598173	unknown	54800	11400
94-264	598174	0-23.44	54951	11688
94-265	598175	0-22.25	54944	11818
Surface Sample	598176	unknown	55000	10800
Surface Sample	598177	unknown	54950	10950
Surface Sample	598178	unknown	54975	11180
Surface Sample	598179	unknown	55050	11400
Surface Sample	598180	unknown	55200	10850
Surface Sample	598181	unknown	55200	11000
Surface Sample	598182	unknown	55200	11200
Surface Sample	598183	unknown	unknown	
Surface Sample	598184	unknown	unknown	
Surface Sample	598185	unknown	unknown	
Surface Sample	598186	unknown	unknown	
94-264	598187	0-17.98	54951	11688
94-264	598188	17.98-18.9	54951	11688
94-264	598189	18.9-19.81	54951	11688
94-264	598190	19.81-21.64	54951	11688
94-264	598191	21.64-23.44	54951	11688
94-265	598192	0-15.24	54944	11818
94-265	598193	15.24-18.59	54944	11818
94-265	598194	18.59-22.25	54944	11818
94-252	598195	0-5.18	55200	11401
94-252	598196	5.18-8.23	55200	11401
94-252	598197	8.23-11.28	55200	11401
94-252	598198	11.28-14.33	55200	11401
94-252	598199	14.33-17.37	55200	11401
94-252	598200	17.37-28.04	55200	11401
94-252	598201	28.04-29.26	55200	11401
94-253	598202	0-12.34	55200	11600

Note:
2. Mine Grid

Appendix A4: Samples Selected for Mineralogical Investigation

CAP Samples

Sample	Zone	Mineralization	Rock Unit	Drill Hole	From (m)	To (m)	wt. %
Oxide Composite (lower layer of Sat Col 9)	100% CAP	CAP	MX	94-289	15	15.3	11.1
		CAP	PP	93-240	10	10.3	11.1
		CAP	WR	93-179	27	27.3	11.1
				93-239	32.61	34.61	11.1
				93-224	25	25.3	11.1
				93-189	24.99	26.99	11.1
				94-308	26.52	28.52	11.1
				93-195	28	28.3	11.1
				93-165	44.81	46.81	11.1
Col 1	100% CAP	CAP	WR	93-21	10.4	38.7	53
				93-237	15.2	36.6	49.4
				93-247	13.4	43	48.6
Col 2A and Col 2B	95% CAP, 5% SUS	CAP	WR	93-187	34.14	36.14	20
				94-339	12.8	14.8	20
				93-168	19.51	21.51	20
				94-335	9.75	11.75	20
		SUS	WR	93-213	57	59	5
		CAP	PP	93-233	11.28	13.28	5
		CAP	MX	93-163	11.28	13.28	5
		CAP	IX	93-245	11.28	13.28	5
Col 3	80% CAP, 20% SOX	SOX	WR	93-243	54.86	56.86	20
		CAP	WR	93-246	14.63	16.63	20
				93-168	60.05	62.05	20
				93-238	22.4	24.4	5
				93-179	44.8	46.8	5
		CAP	IX	94-308	96.01	98.01	20
		CAP	PP	93-153	55.47	57.47	5
		CAP	MX	93-163	53.95	55.95	5
Col 4a	6.7% OVB, 80% CAP, 13.4% SUP	CAP	PP	93-175	4.57	4.87	6.2
				93-240	5.18	7.18	6.3
				93-153	15.09	17.09	6.3
		CAP	WR	94-256	17.37	19.37	12.5
				94-336	11.13	13.13	6.3
				94-335	18.9	20.9	6.3
				93-247	13.41	13.71	6.3
				94-251	21.95	23.95	6.3
				93-165	4	4.3	6.3
				93-235	43.89	45.89	6.3
				93-165	44.81	46.81	6.3
		OVB	WR	93-219	23.47	25.47	6.3
		SUS	WR	93-213	57	59	6.3
		SUS	WR	93-213	29.57	31.57	6.3
FB1	100% CAP	CAP	WR	94-320	54	81.4	-
				94-339	52.4	76.8	-
FB2	100% CAP	CAP	WR	93-241	10.4	38.7	-
				93-237	15.2	36.6	-
				93-247	13.4	43	-
FB3	100% CAP	CAP	WR	93-216	28.6	44.8	-
				93-210	44.2	59.4	-
				94-268	20.1	35.4	-
FB4	100% CAP	CAP	PP	94-300	14.3	43.3	-
			MX	94-304	9.8	28.3	-

SUP Samples

Sample	Zone	Mineralization	Rock Unit	Drill Hole	From (m)	To (m)	wt. %
Sat Col 5	5% CAP, 90% SUS, 5% HYP	SUS	WR	Sep-21	169.16	172.21	25
				Sep-22	174.31	176.78	20
				Sep-23	208.79	211.84	25
				9-Sep	140.4	143.4	20
		HYP	MX	Sep-34	217.93	220.93	5
		CAP	WR	Sep-35	39	42	5
Sat Col 6	50% CAP, 50% SUS	SUS	WR	Sep-25	146.3	149.35	50
		CAP	WR	Sep-26	137.16	140.21	50
Lower Sat Col 12 & Sat Col 14	SUP (acidic)	SUP	WR	94-260	53.95	55.95	42.3
				93-243	54.9	56.9	24.7
				CAS-003	146.3	149.35	20.9
			IX	94-307	38.71	39.01	4.4
				94-307	62.2	62.5	7.7
Lower Sat Col 13 & Full Sat Col 15	SUP (neutral)	SUP	PP	93-229	72	72.3	4.9
				93-206	193	193.3	5.7
				93-228	108.81	110.81	23.2
				93-229	160.63	162.63	23.2
			WR	94-260	35.05	37.05	20.9
				94-260	29.57	31.57	22.3
08-270	100% SUS	SUS	PP	93-240	57	59	100
Ore (HC2)	28.3% SOX, 53.3% SUS, 18.3% HYP	SOX	IX	CAS-002	83.8	86.87	5
		SUS	IX	CAS-002	111.25	114.3	17.5
		SUS	IX	CAS-002	147.83	150.88	17.5
		HYP	WR	CAS-005	97	100	18.3
		SUS	WR	93-239	74.07	76.07	18.3
		SOX	WR	93-238	75.29	77.29	18.3
		SOX	WR	94-254	26.21	28.21	5
08-058 (HC12)	100% SUS	SUS	WR	93-226	75	75.3	100
08-068 (HC11)	100% SUS	SUS	WR	93-186	60	60.3	100
FB5	SUP & CAP	SUP	WR	94-262	13.1	29.3	-
				94-254	16.8	34.6	-
		CAP	WR	94-267	53	61.1	-
				94-341	24.5	42.8	-

HYP Samples

Sample	Zone	Mineralization	Rock Unit	Drill Hole	From (m)	To (m)	wt. %
Hypogene Composite (upper layer of Sat Col 9)	11.1% SUS, 88.9% HYP	HYP	PP	93-238	203.3	205.3	11.1
		HYP	WR	93-236	319.13	321.13	11.1
				94-256	71	71.3	11.1
				94-256	163.68	165.68	11.1
				93-221	94	94.3	11.1
				93-230	192	192.3	11.1
				93-187	191.11	193.11	11.1
				93-237	120.09	122.09	11.1
		SUS	WR	93-205	34.14	34.44	11.1
Ore (HC1)	100% HYP	HYP	WR	CAS-012	127.9	130.9	20
		HYP	IX	CAS-002	213.36	214.96	10
		HYP	IX	CAS-002	364.24	367.28	15
		HYP	WR	93-247	205.13	207.13	20
		HYP	WR	93-246	164.59	166.59	20
		HYP	WR	93-217	203.3	205.3	15
Sat Col 3 and Sat Col 7	100% HYP	HYP	WR	Sep-15	393.19	396.24	20
				Sep-20	306.32	309.37	20
				Sep-18	341.16	344.42	20
				Sep-36	228	331	10
		HYP	PP	Sep-13	209	212	20
		HYP	MX	Sep-33	461	464	10
Sat Col 4	100% HYP	HYP	WR	Sep-19	329.47	332.23	30
				Sep-17	356.62	359.66	30
				Sep-36	228	331	10
		HYP	PP	9-Nov	178.9	181.9	20
		HYP	MX	Sep-33	461	464	10
Upper Sat Col 12, Sat Col 13 & Sat Col 14	100% HYP	HYP	WR	93-203	279.5	281.5	20
		HYP	WR	94-259	177.39	179.39	20
		HYP	WR	93-168	270.4	272.4	20
		HYP	MX	93-163	270.4	272.4	20
		HYP	IX	93-227	191.1	193.1	20
08-218	100% HYP	HYP	IX	93-150	459.3	461.3	100
08-234	100% HYP	HYP	WR	93-224	225.6	227.6	100
08-285	100% HYP	HYP	WR	93-217	23.8	25.8	100
08-296	100% HYP	HYP	WR	94-259	177.4	179.4	100
08-302	100% HYP	HYP	WR	93-248	132.1	134.1	100
08-407	100% HYP	HYP	WR	93-219	236.8	238.8	100
08-416	100% HYP	HYP	WR	94-253	67.7	69.7	100
08-028 (HC6)	100% HYP	HYP	WR	93-153	220.1	220.4	100
08-143 (HC8)	100% HYP	HYP	MX	94-304	136.3	138.3	100
08-260 (HC9)	100% HYP	HYP	PP	93-228	178.9	180.9	100
08-276 (HC3)	100% HYP	HYP	PP	93-233	75.3	77.3	100
08-277 (HC5)	100% HYP	HYP	PP	93-233	206.4	208.4	100
08-294 (HC4)	100% HYP	HYP	WR	94-259	106.5	108.5	100
08-043 (HC7)	100% HYP	HYP	IX	93-171	200	200.3	100
08-225 (HC7)	100% HYP	HYP	MX	93-163	118	120	100
08-059 (HC10)	100% HYP	HYP	WR	93-226	116	116.3	100
08-178 (HC10)	100% HYP	HYP	WR	93-177	206.4	208.4	100
FB7	100% HYP	HYP	WR	93-203	270.4	295.9	-
		HYP	WR	94-259	103.5	131.7	-
FB8	100% HYP	HYP	PP	93-233	197.2	215.8	-
		HYP	PP	93-229	*236.8*	270.4	-

Appendix B
Static Testing Analytical Procedures

CASiNO
COPPER AND GOLD

SGS CEMI Inc.

Static Testing Procedures

for

Western Copper Corporation (Casino Project)

July 3, 2009

1.0 Sample Receiving

Four hundred and forty-nine waste rock samples were received at SGS CEMI between May 28, 2008 and November 13, 2008. The samples were logged in and sample weights recorded.

2.0 Sample Preparation

Wet samples were air-dried at ambient temperatures before preparation. Samples were crushed in a 5x7 jaw crusher to approximately 80% -3/8 inch. Representative splits of the crushed samples were made using a 12.7 mm opening splitter box. To produce a finely ground sample for analysis, 200 g was placed in a ring pulverizer to produce 80% -200 mesh.

3.0 Analysis

Acid-Base Accounting and Total Metals were determined on all samples. Eighty-five samples were selected for Shake Flask Extraction Tests.

3.1 Paste pH

Paste pH was conducted at CEMI according to the procedure by Sobek, A. A., *et al.* 1978. "Field and Laboratory Methods Applicable to Overburdens and Minesoils", Report EPA-600/2-78-054.

3.2 Acid Base Accounting

The samples were analyzed at CEMI according to the procedure outlined in Leavitt, B. J., *et al.* 1995. "Effects of Siderite on the Neutralization Potential in the Acid-base Account" In: Proc. 17th Annual West Virginia Surface Mine Drainage Task Force Symposium, 4-5 April, West Virginia Univ., Morgantown.

3.3 Total Sulphur , Total Carbon

Total sulphur and total carbon were determined by Assayers Canada using a Leco induction furnace.

3.4 Sulphate-Sulphur

Three hundred and two samples were sent to Assayers Canada and one hundred and forty-seven samples were sent to International Plasma Labs Ltd. (IPL) for acid-soluble sulphate analysis according to ASTM D2492-02 "Standard Test Method for Forms of Sulfur in Coal". In this procedure, the sample is digested with 20% hydrochloric acid and the sulphur content measured by ICP.

3.5 Sulphide-Sulphur

Sulphide-sulphur was determined by Assayers Canada on 302 samples. The procedure is based on a modified sulphide-sulphur method by Sobek, A. A., *et al.* 1978. "Field and Laboratory Methods Applicable to Overburdens And Minesoils", Report EPA-600/2-78-054. In this procedure, acid-soluble sulphate is first removed by treatment with 20% hydrochloric acid. The sulphide-sulphur in the residue is oxidized to sulphate in a 1:7 nitric acid to water solution, and the sulphur content is then measured by ICP.

Sulphide-sulphur was also determined by IPL on 147 samples using a variation of the procedure outlined in the above paragraph. After treatment of the sulphate residue with a 1:7 nitric acid to water solution, the oxidized sulphide is determined gravimetrically by precipitation with barium chloride.

3.6 Insoluble Sulphur

Insoluble sulphur is calculated as the difference between total sulphur and the sum of sulphate-sulphur and sulphide-sulphur (Total S – Sulphate S + Sulphide S). Insoluble sulphur is considered as acid-insoluble sulphur and is attributed to refractory sulphate compounds such as barite and alunite and to organic sulphur found in coal.

3.7 Inorganic Carbon

Total inorganic carbon was determined by Assayers Canada. In this procedure, a known weight of sample is placed into a glass test tube and acidified with 25% hydrochloric acid. The sample is boiled to evolve CO_2 which is measured by coulometric titration with a UIC Carbon Dioxide Analyzer.

3.8 Total Metals

Total metals were conducted by Acme Analytical Laboratories Ltd. (Acme) on a pulverized sample by digesting 0.500 g in aqua regia at 95^{o}C for 1 hour. The extract is then diluted to 10.0 mL and analyzed for metals by ICP-MS.

3.9 Shake Flask Extraction

Eighty-five samples of crushed waste rock were selected for analysis by shake flask extraction using a 3:1 liquid to solid ratio as described by W. A. Price "Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia", British Columbia Ministry of Employment and Investment, Energy and Minerals Division.

The leachate was filtered through 0.45µm membrane filter paper and submitted for analysis. The pH was measured using a pH electrode; conductivity was measured with a conductivity probe; the oxidation-reduction potential was measured with an ORP electrode; acidity was determined by titration with base to an end point of either pH 4.5 (free acidity) and/or pH 8.3 (total acidity); alkalinity was determined by titration with an

acid to an end point of pH 4.5; sulphate was measured by the turbidimetric method. Subsamples of the filtered leachate were sent to Maxxam Analytics Inc. for metals analysis by ICP-MS.

Appendix C
Mineralogical Results

CASINO
COPPER AND GOLD

Appendix C1: XRD Results

QUANTITATIVE PHASE ANALYSIS OF NINE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0852 Western Copper Casino – PO# 42055)

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February 2, 2010

EXPERIMENTAL METHOD

The nine samples of **Project 0852 Western Copper Casino** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 9.

Note that the broad calculated peaks indicated by the vertical lines in Figures 1 and 4 are used to better fit the X-ray patterns and are the result of the presence of a small amount of an unknown clay mineral which could not be refined and measured.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**COL 1**	**COL 2A**	**COL 2B**	**COL 3**	**COL 3 SAT**	**COL 4 SAT**	**COL 5 SAT**	**COL 6 SAT**	**COL 7 SAT**
Quartz	SiO_2	32.3	44.4	45.2	43.8	40.9	43.6	43.1	51.3	39.5
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	10.3	1.5	1.8		3.2	1.2	1.2		2.3
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.8	1.6	1.4	4.2	4.0	3.2	3.3	2.4	4.7
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	25.5	28.8	29.8	31.4	23.4	25.7	30.9	34.8	25.0
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	6.3								
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	11.9	12.0	10.7	3.1	7.7	7.3	7.0		6.8
K-feldspar	$KAlSi_3O_8$	9.2	9.2	8.5	11.3	13.0	8.4	9.8	6.3	13.2
Calcite	$CaCO_3$					1.0	1.0			1.4
Gypsum	$CaSO_4{\cdot}2H_2O$					1.5	1.4			1.4
Jarosite	$K_2Fe^{3+}{}_6(SO_4)_4(OH)_{12}$	0.7	2.6	2.6	5.1				2.9	
Ankerite ?	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$						0.5			
Pyrite	FeS_2				1.0	5.4	7.8	4.7	2.2	5.7
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

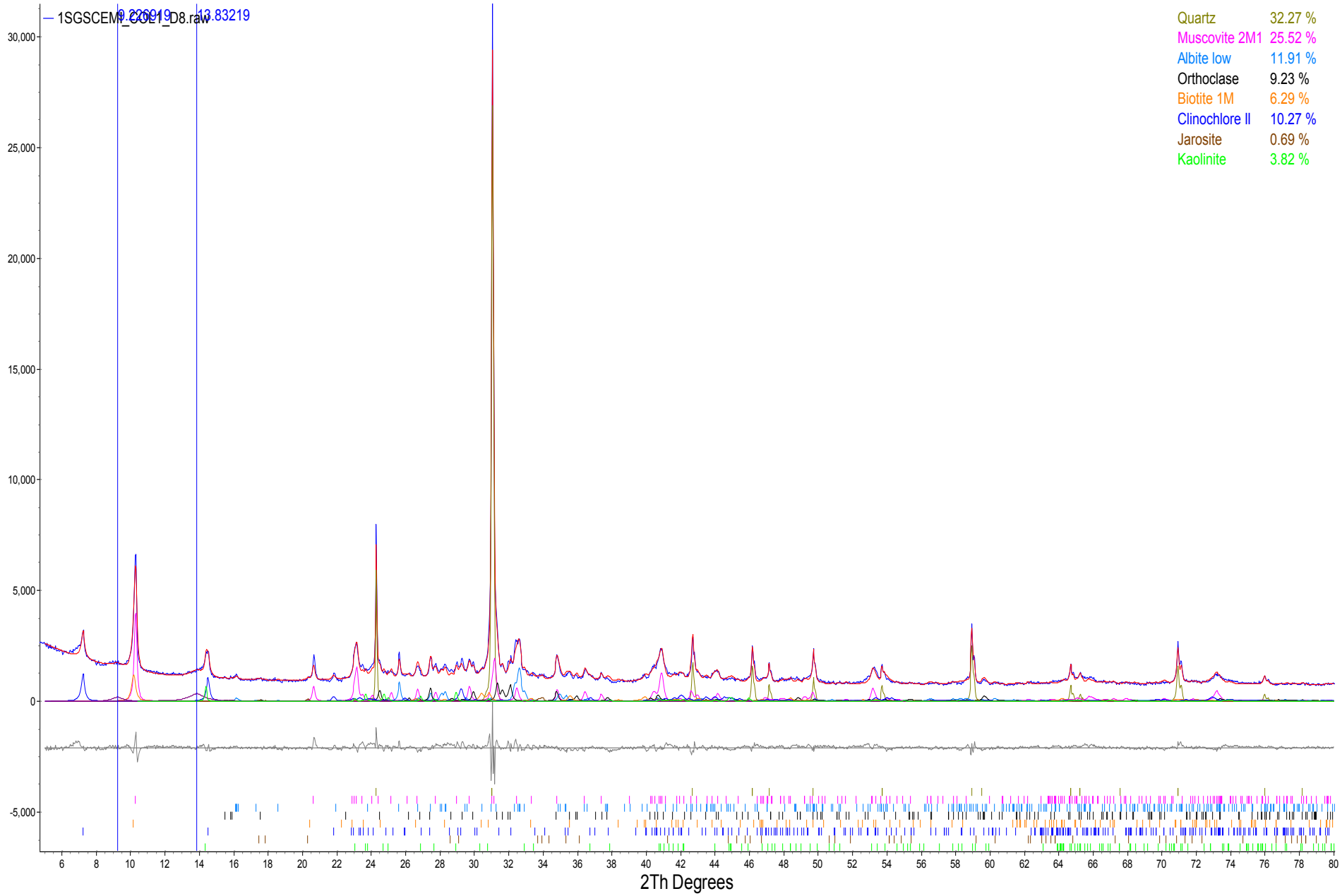


Figure 1. Rietveld refinement plot of sample **SGS CEMI "COL 1"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

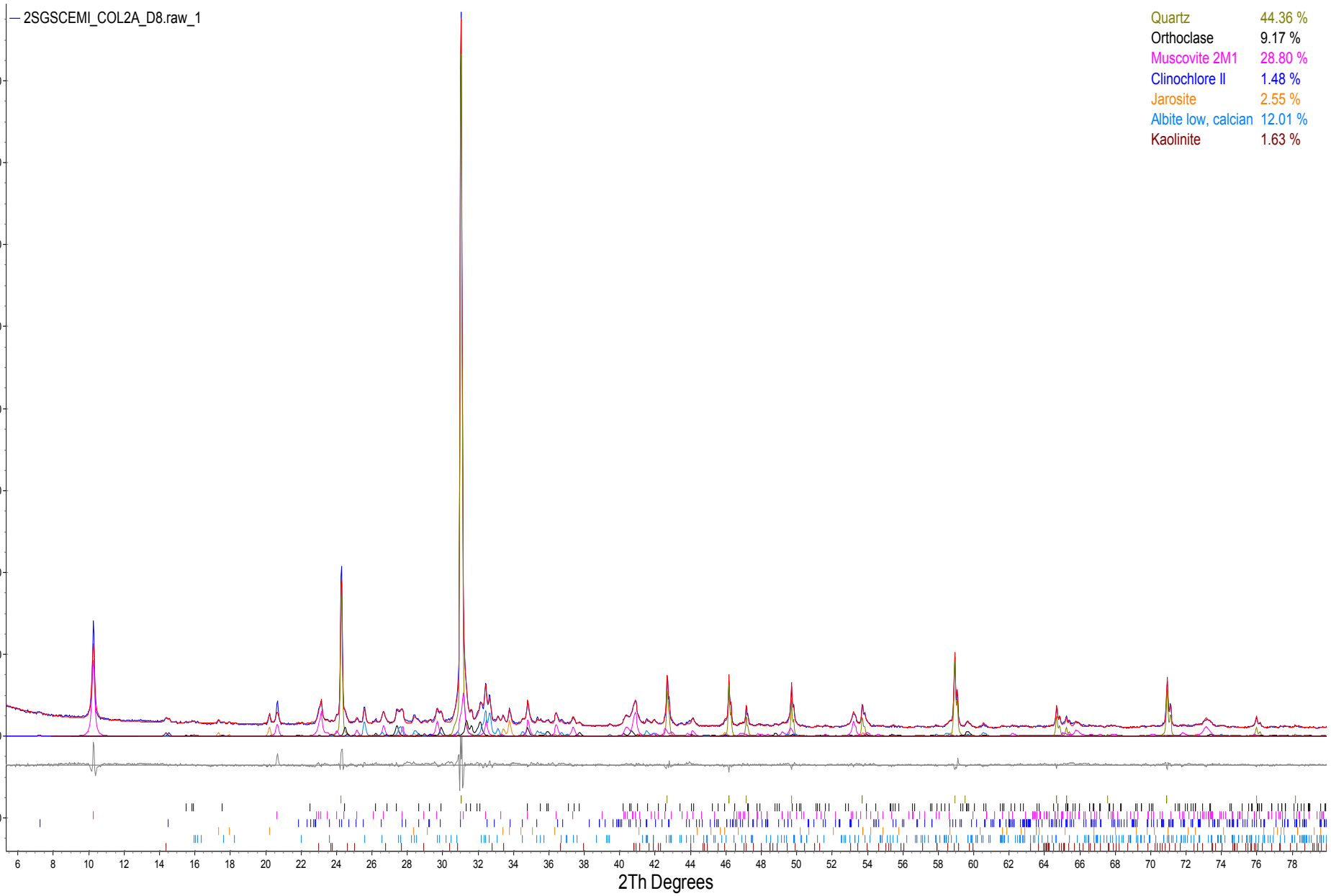


Figure 2. Rietveld refinement plot of sample **SGS CEMI "COL 2A"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

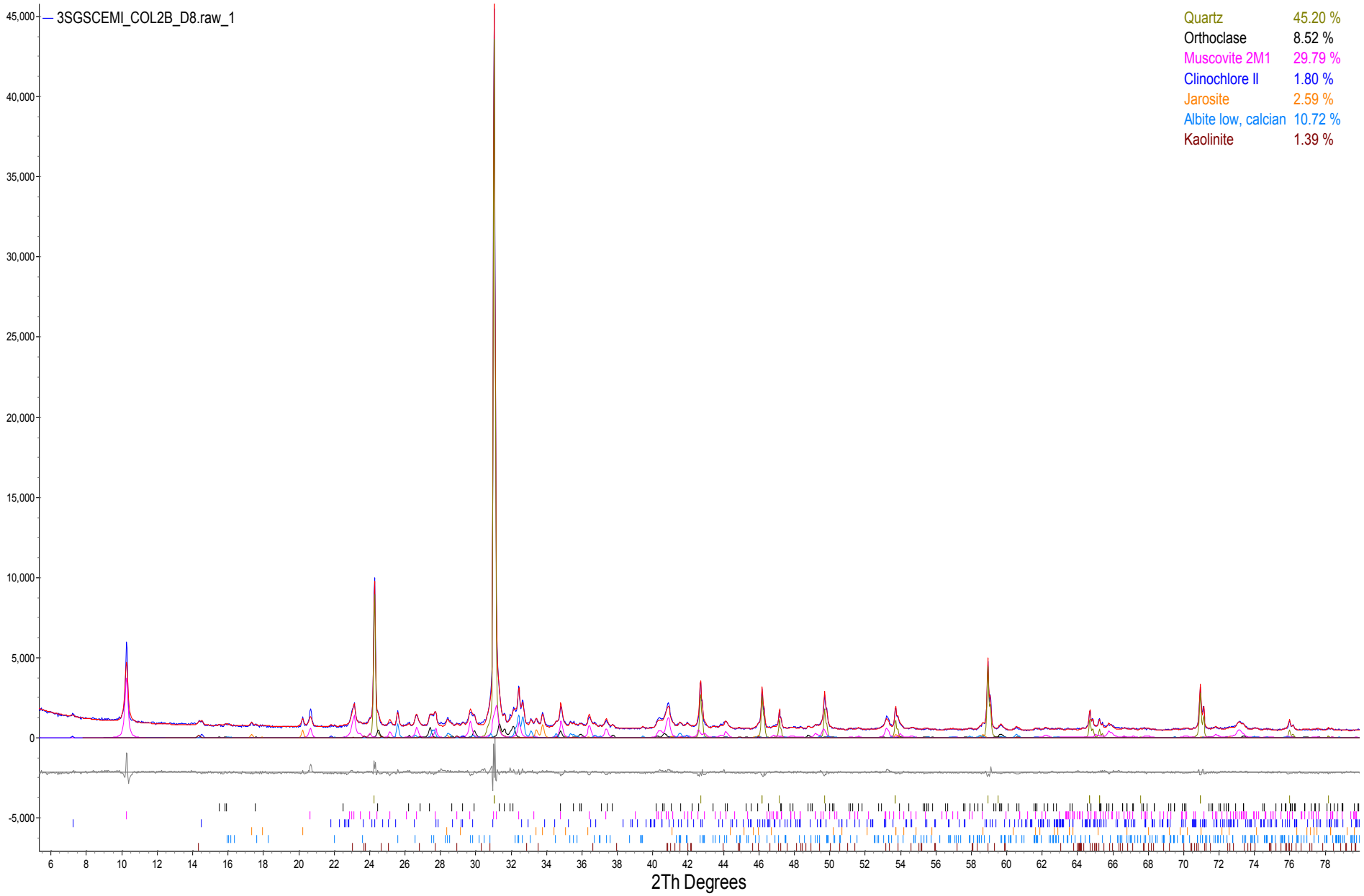


Figure 3. Rietveld refinement plot of sample **SGS CEMI "COL 2B"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

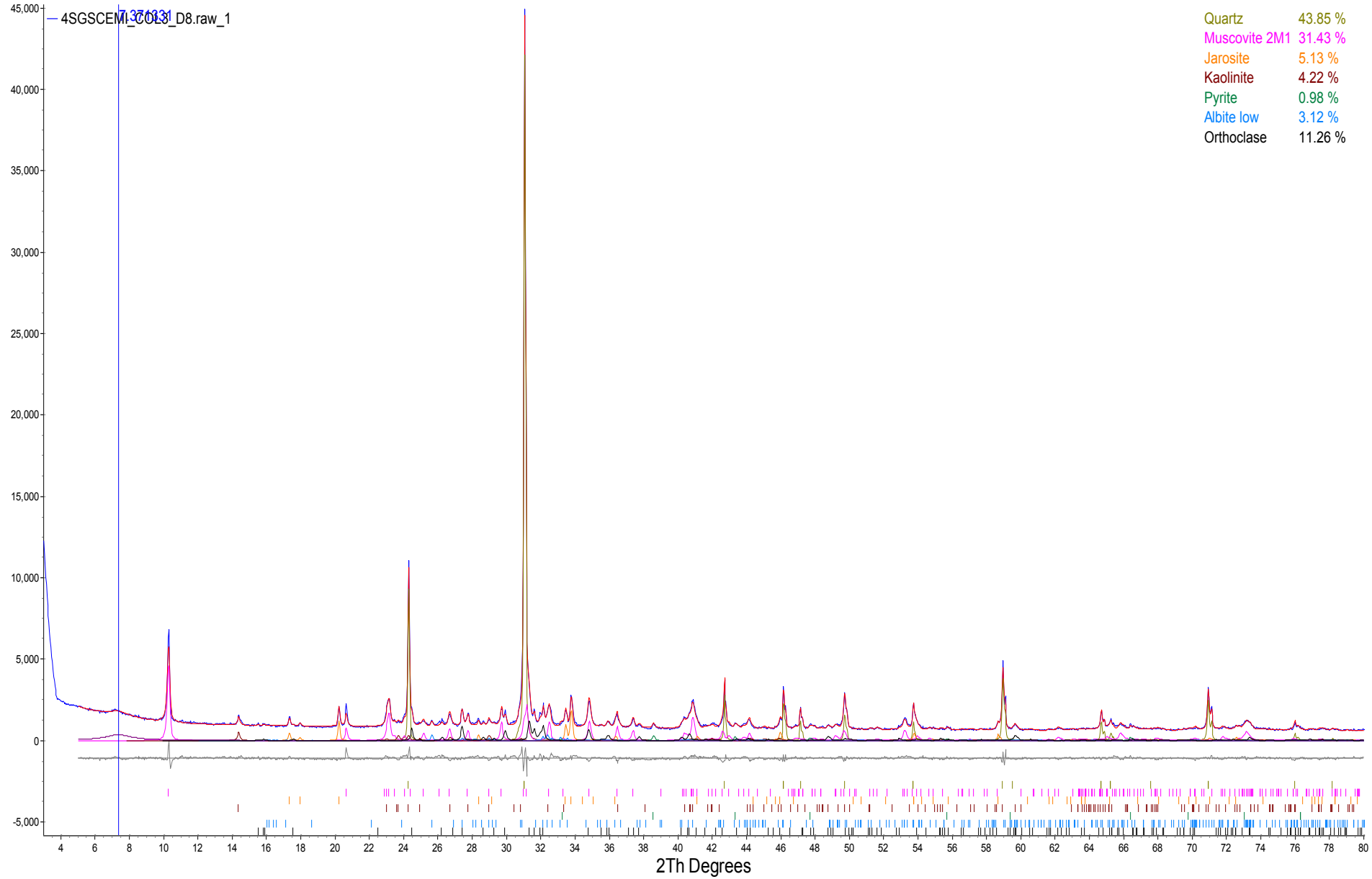


Figure 4. Rietveld refinement plot of sample **SGS CEMI "COL 3"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

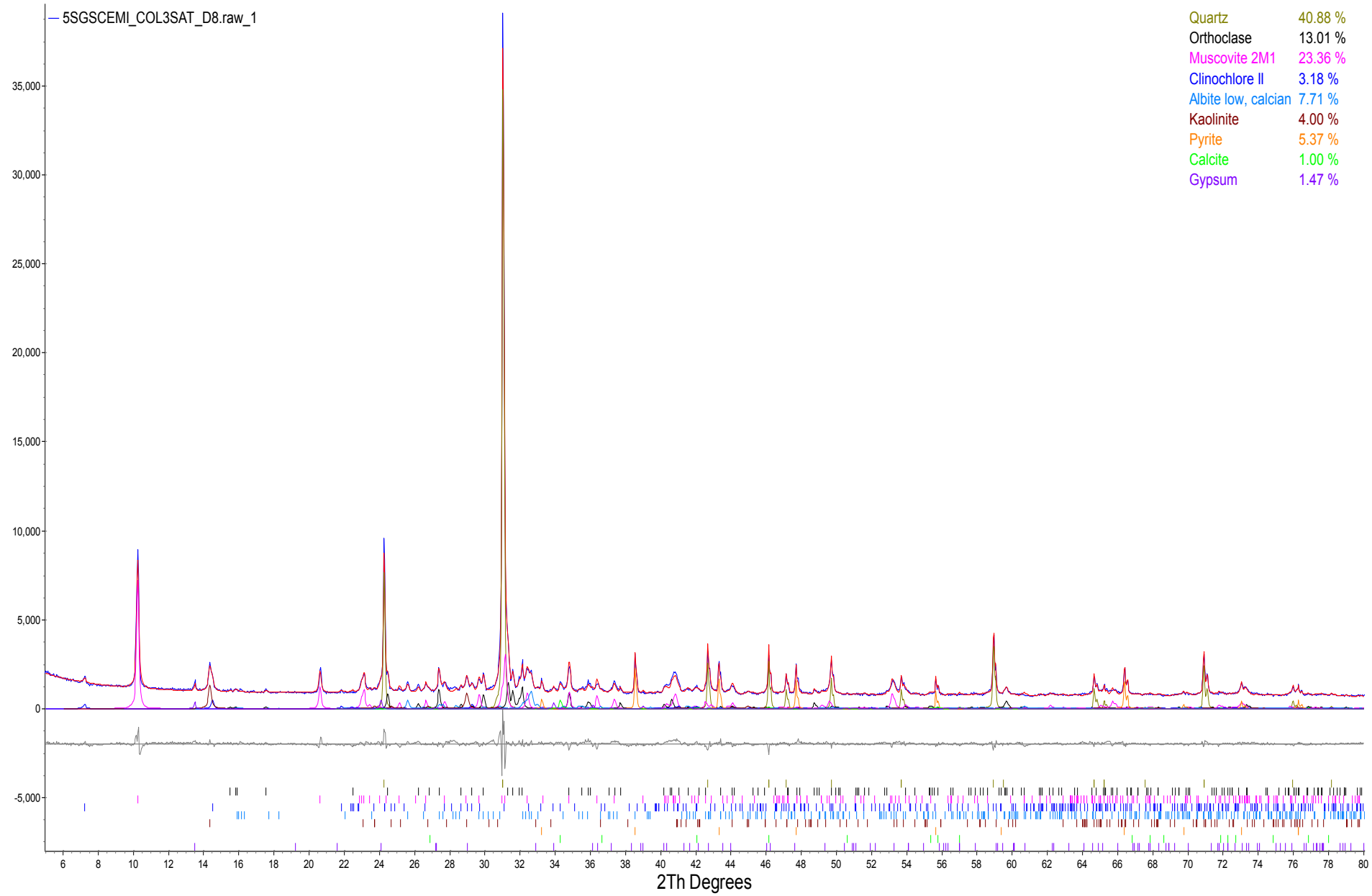


Figure 5. Rietveld refinement plot of sample **SGS CEMI "COL 3 SAT"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

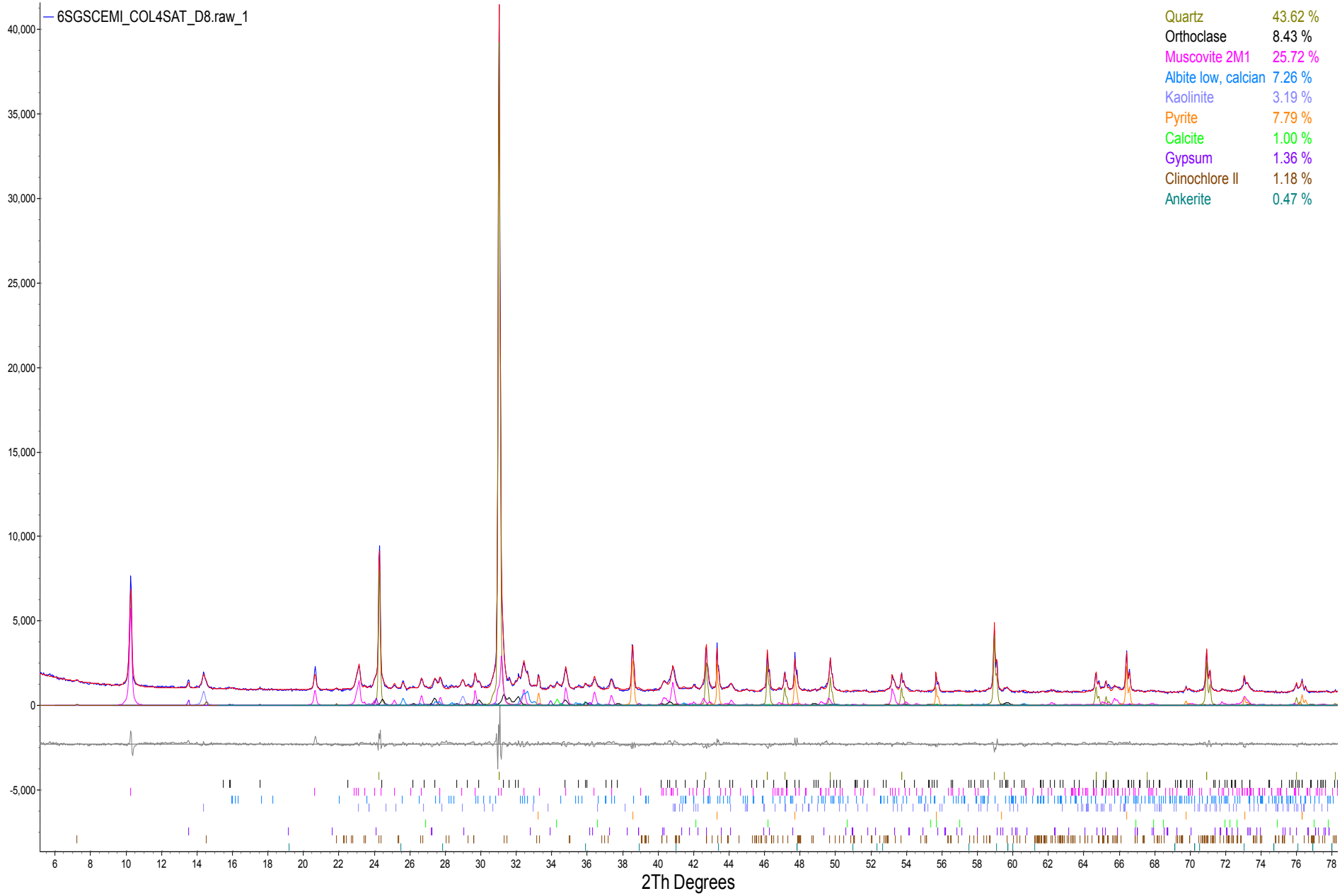


Figure 6. Rietveld refinement plot of sample **SGS CEMI "COL 4 SAT"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

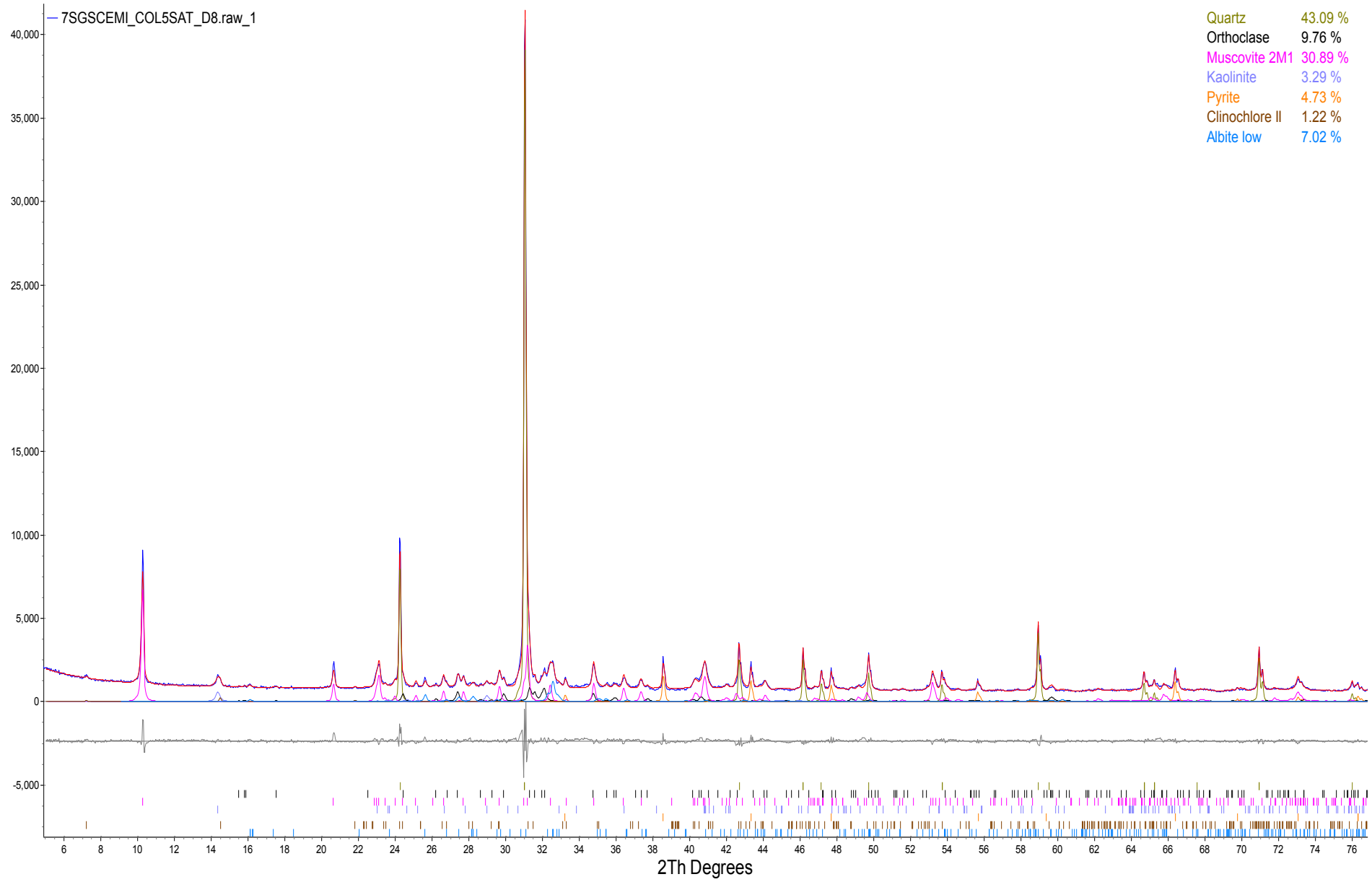


Figure 7. Rietveld refinement plot of sample **SGS CEMI "COL 5 SAT"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

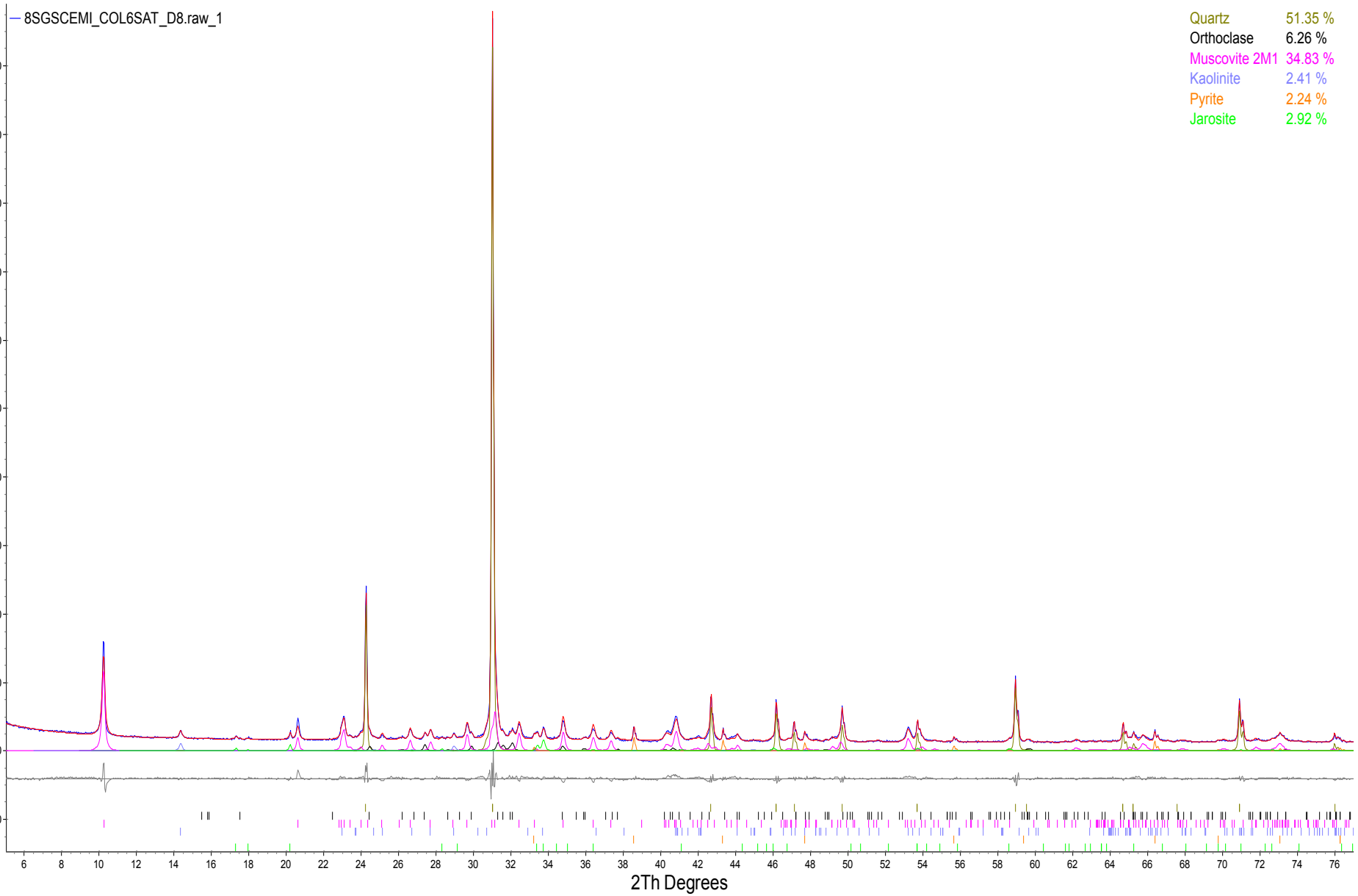


Figure 8. Rietveld refinement plot of sample **SGS CEMI "COL 6 SAT"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

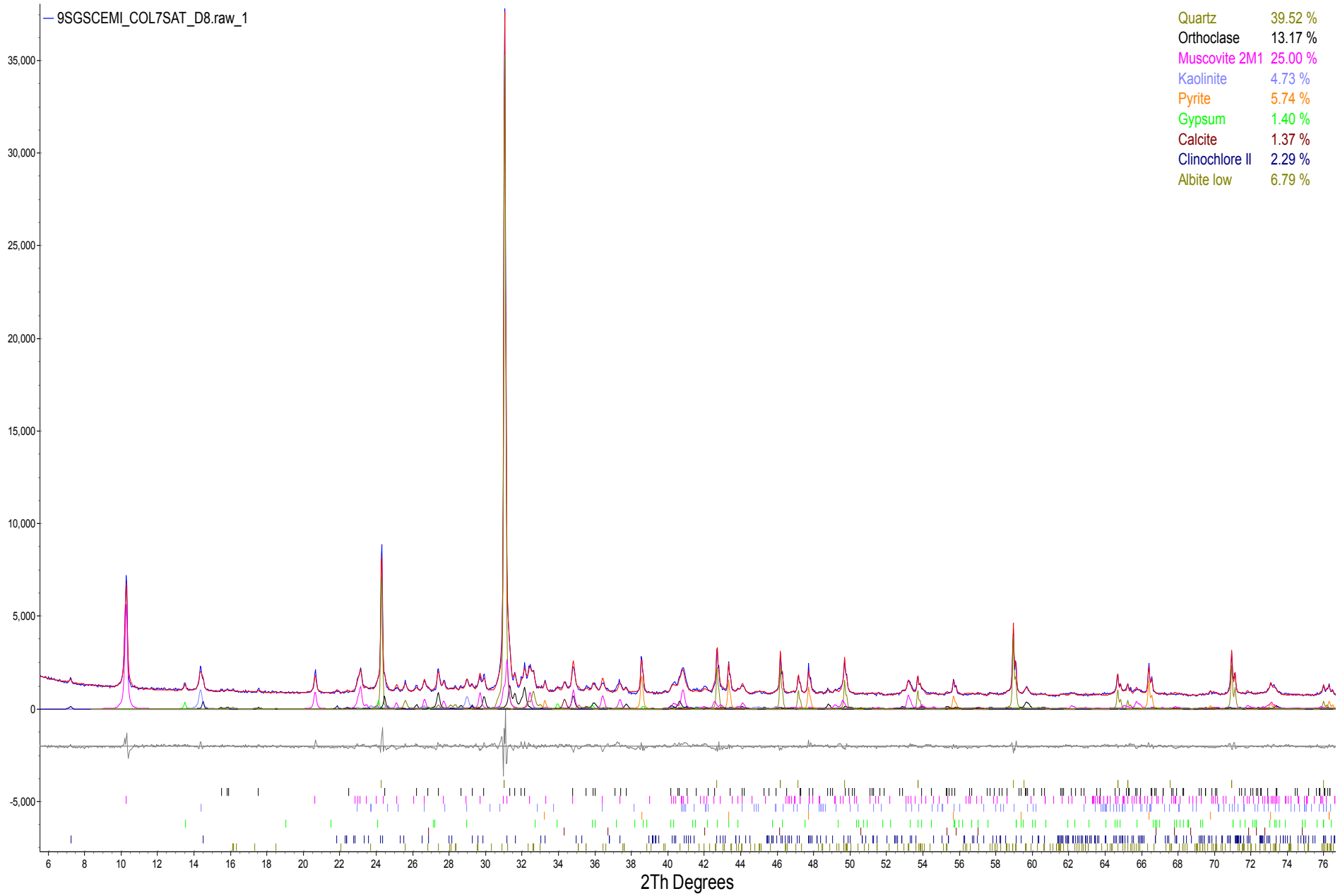


Figure 9. Rietveld refinement plot of sample **SGS CEMI "COL 7 SAT"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF THREE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0852 Western Copper – PO# 42095)

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March 30, 2010

EXPERIMENTAL METHOD

The three samples of **Project 0852 Western Copper** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 3.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**Col. 4 (Oxide pH>6.0)**	**Hypogene Composite**	**Oxide Composite**
Quartz	SiO_2	35.6	38.4	48.3
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	19.2	14.1	32.6
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	1.5	2.8	
K-Feldspar	$KAlSi_3O_8$	11.0	12.1	6.3
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	21.1	14.2	4.4
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.7	4.1	3.0
Calcite	$CaCO_3$		2.9	
Pyrite	FeS_2	2.1	3.6	
Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$	0.2	2.1	
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	5.5	3.8	
Gypsum	$CaSO_4{\cdot}2H_2O$		1.1	
Dolomite	$CaMg(CO_3)_2$		0.8	
Jarosite	$K_2Fe^{3+}{}_6(SO_4)_4(OH)_{12}$			3.3
Tobermorite ?	$Ca_5Si_6(O,OH)_{18}\ 5H_2O$			2.1
Total		100.0	100.0	100.0

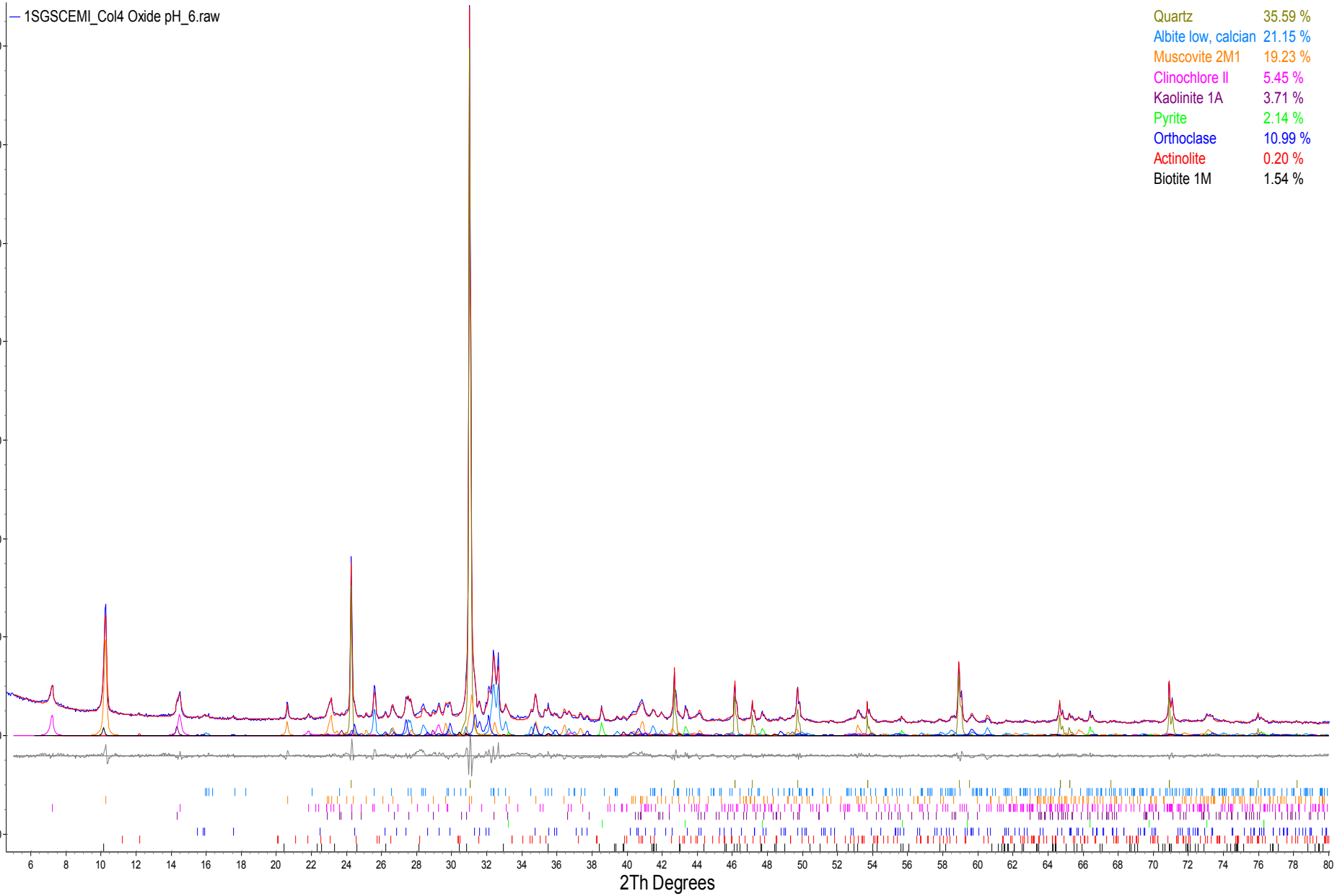


Figure 1. Rietveld refinement plot of sample **SGS CEMI "Col. 4 (Oxide pH>6.0)"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

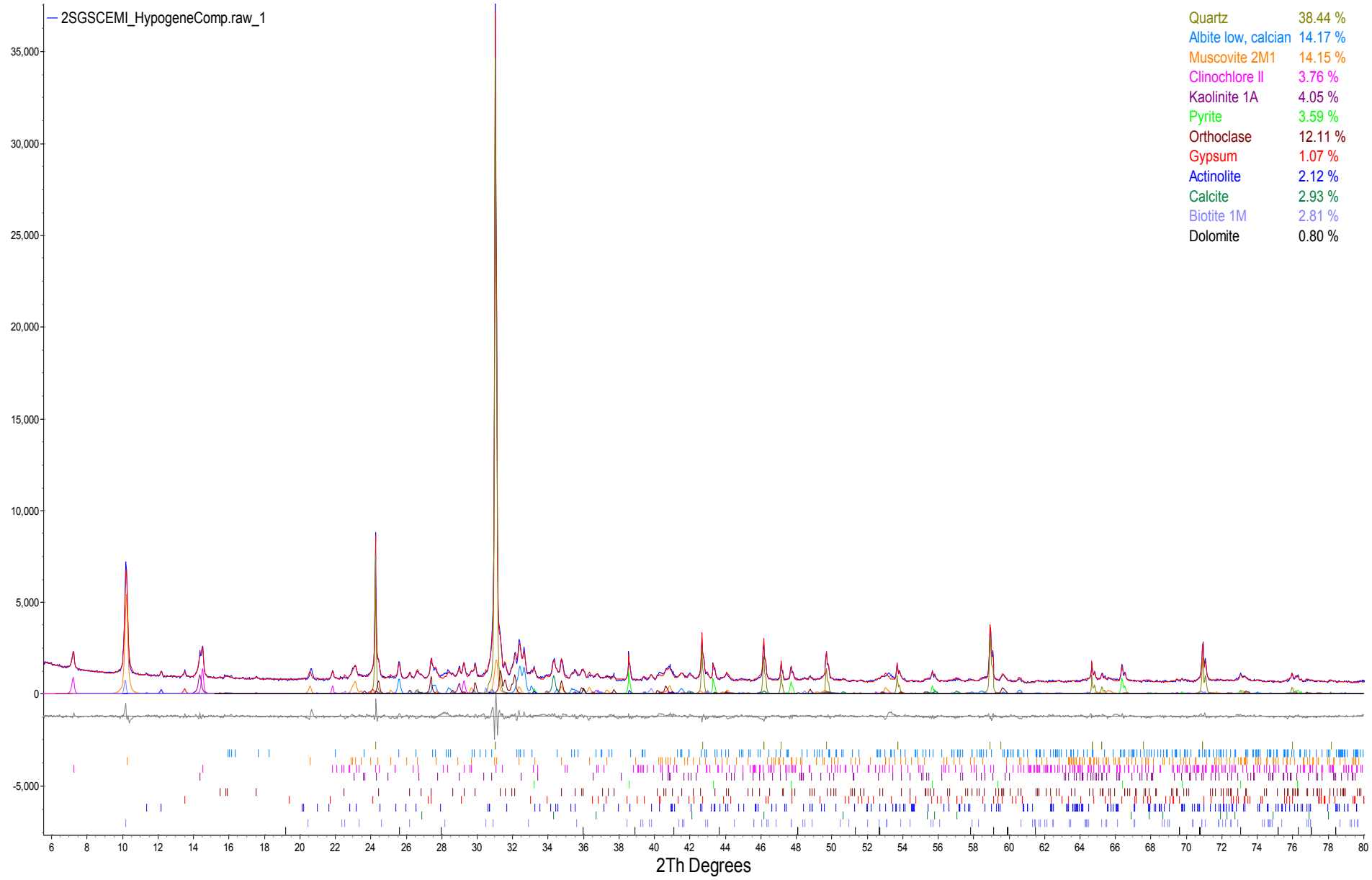


Figure 2. Rietveld refinement plot of sample **SGS CEMI "Hypogene Composite"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

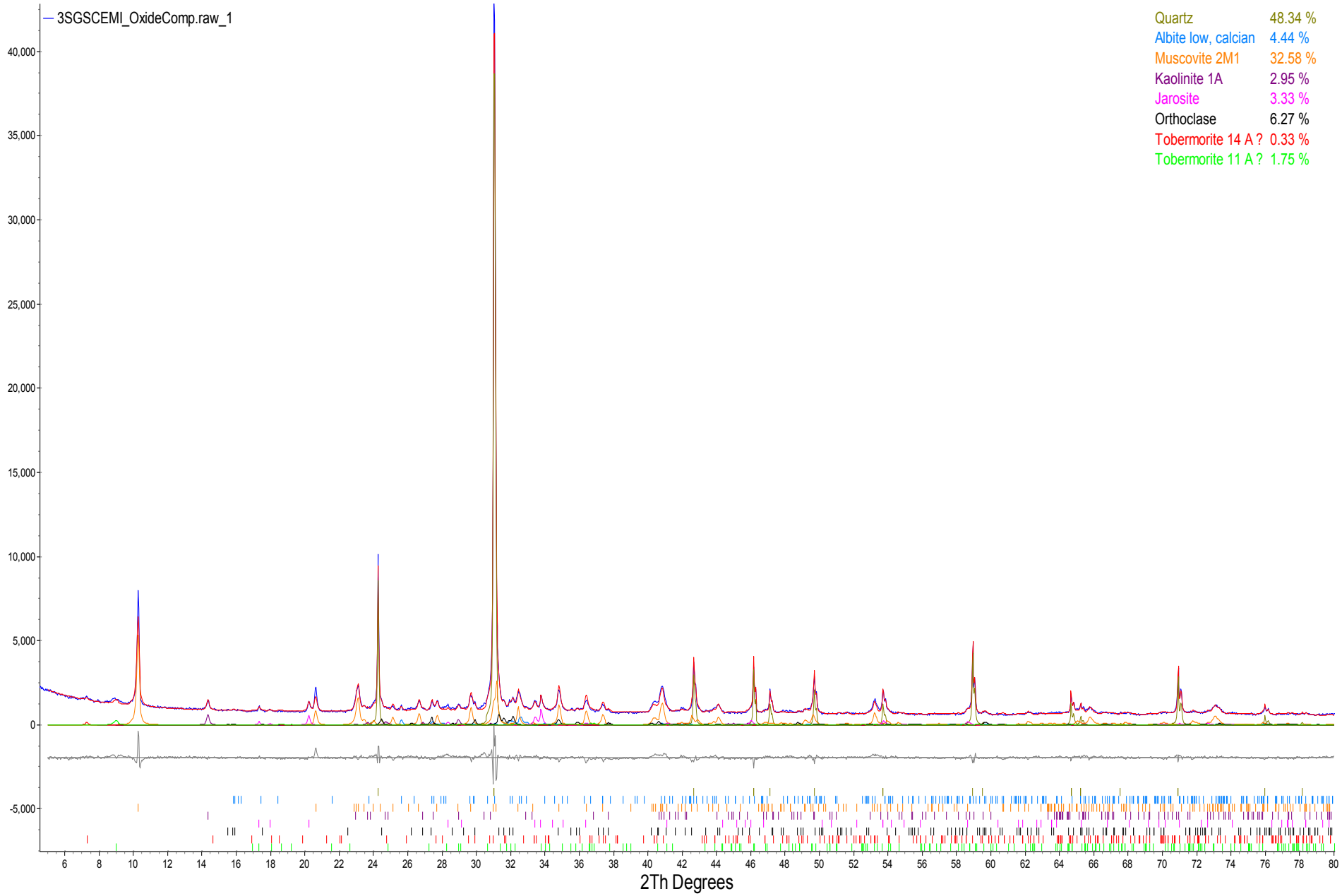


Figure 3. Rietveld refinement plot of sample **SGS CEMI "Oxide Composite"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF THREE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

Project: 0852 Western Copper – PO# 42650

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February 22, 2013

EXPERIMENTAL METHOD

The three samples of **Project 0852 Western Copper** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Continuous-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Bruker. X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 3.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**Acidic Sup**	**Neutral Sup**	**HYP Col 12**
Ankerite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$			3.4
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$		1.8	1.8
Calcite	$CaCO_3$		0.2	2.7
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	1.4	3.9	2.0
Gypsum	$CaSO_4 \cdot 2H_2O$	0.7		
Jarosite	$K_2Fe_6^{3+}(SO_4)_4(OH)_{12}$	1.5		
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.1		2.5
K-feldspar	$KAlSi_3O_8$	26.5	20.0	20.1
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	17.5	11.0	18.3
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	4.2	30.7	10.5
Pyrite	FeS_2	1.8	1.7	4.8
Quartz	SiO_2	43.3	30.7	33.9
Total		100.0	100.0	100.0

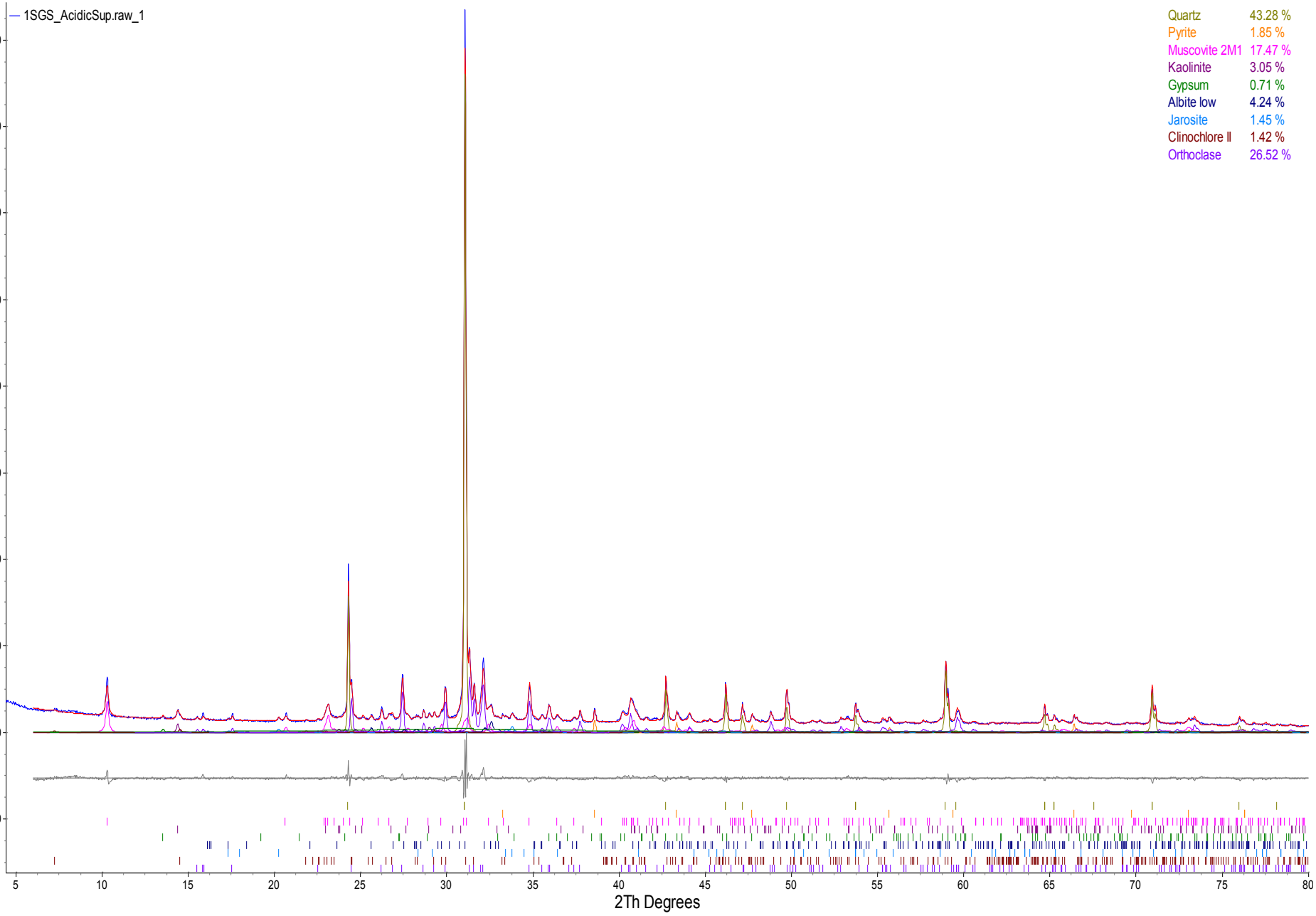


Figure 1. Rietveld refinement plot of sample **SGS Canada "Acidic Sup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

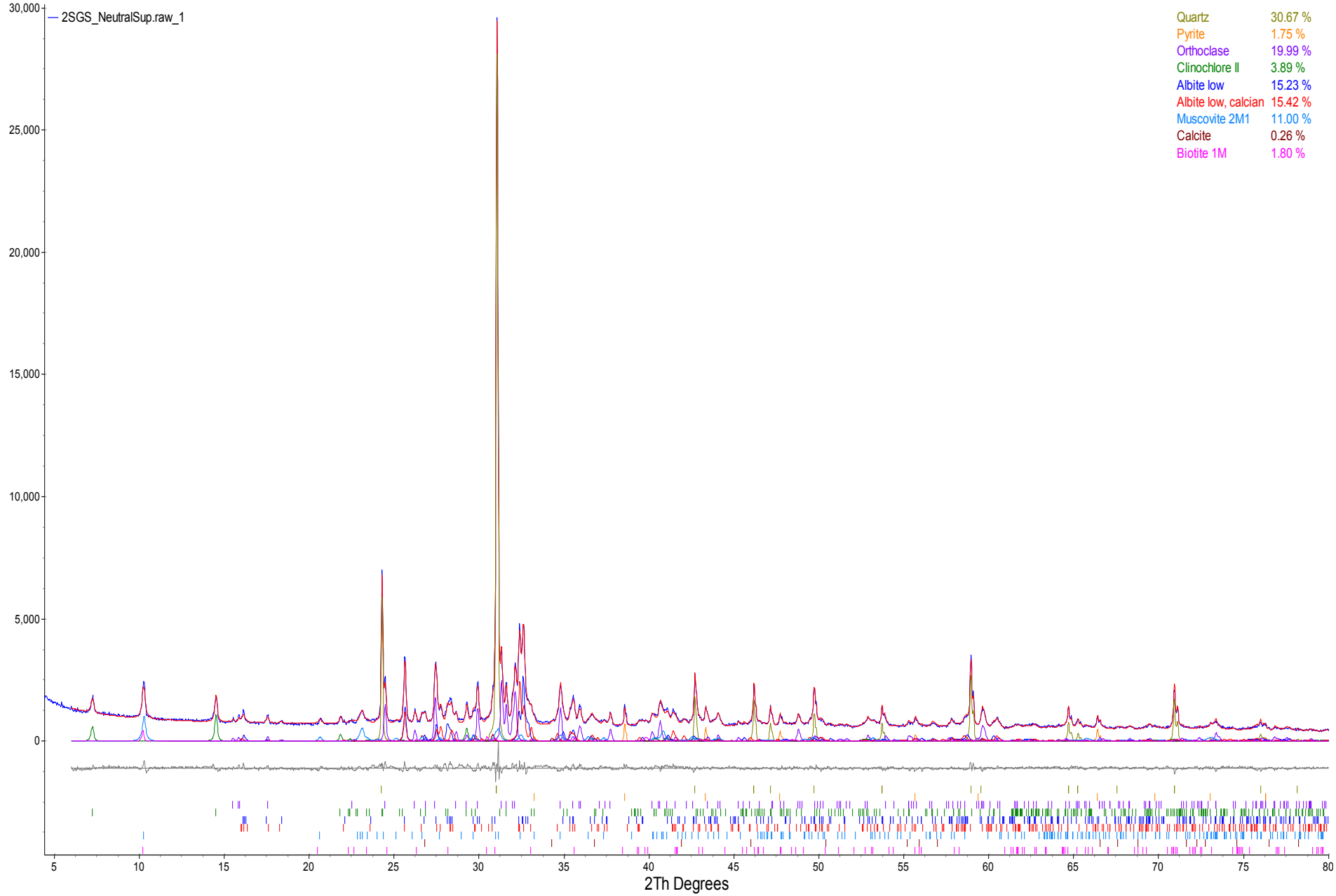


Figure 2. Rietveld refinement plot of sample **SGS Canada "Neutral Sup"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

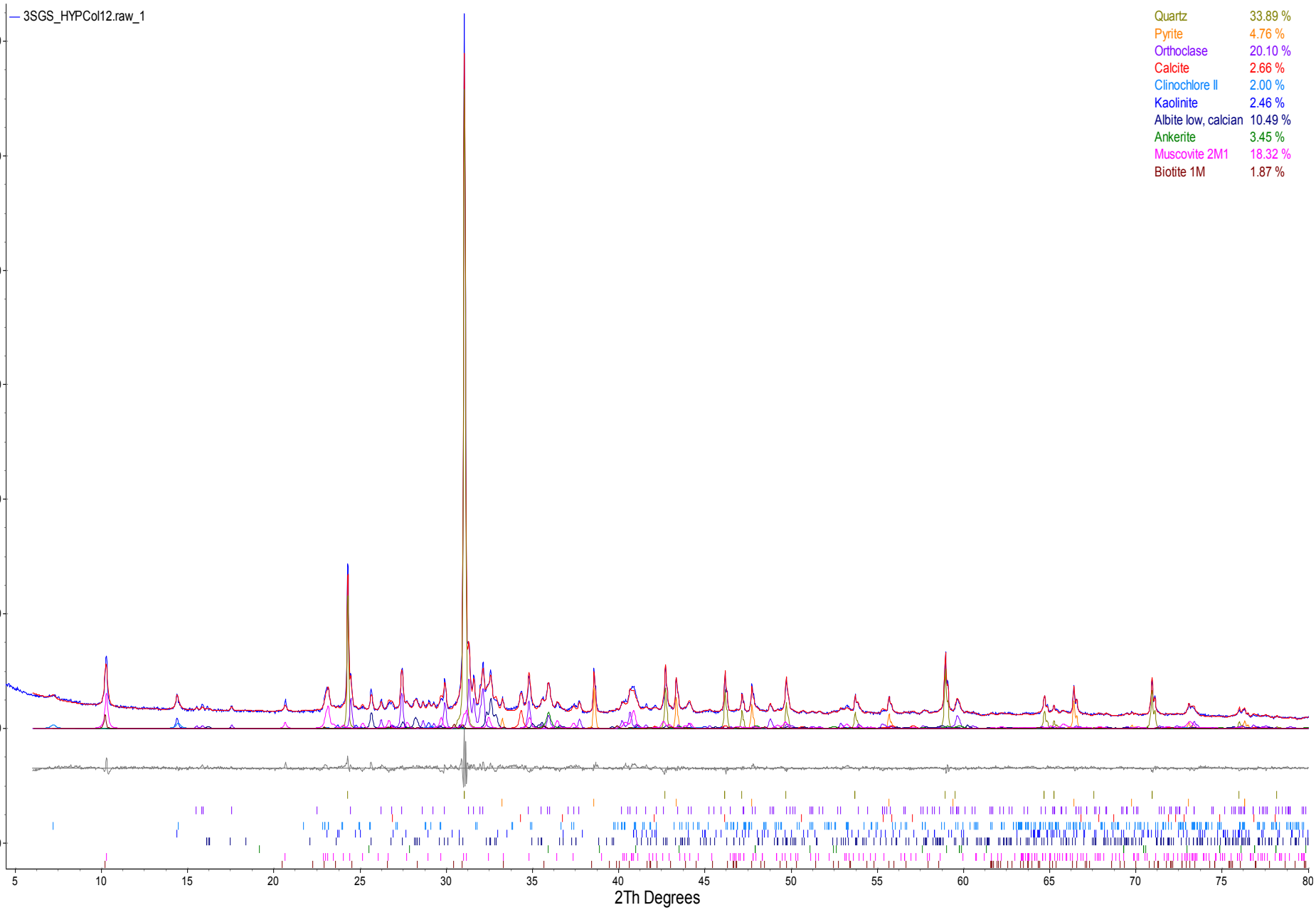


Figure 3. Rietveld refinement plot of sample **SGS Canada "HYP Col 12"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF 8 POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0852 Western Copper Casino – P.O. 41894)

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June 1, 2009

EXPERIMENTAL METHOD

The eight samples of **Project 0852 Western Copper Casino** were reduced into fine powder to the optimum grain-size range for X-ray analysis (<10μm) grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKα radiation on a standard Siemens (Bruker) D5000 Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a Vantec-1 strip detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS AND DISCUSSION

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 using Search-Match software by Siemens (Bruker). X-ray powder-diffraction data were refined with Rietveld program Topas 3 (Bruker AXS).

The results of quantitative phase analysis by Rietveld refinement are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots for the samples are shown in Figures 1-8.

Note that the patterns of samples **08-285, 08-302** and **08-407** show a hump between 5-9º2θ that likely corresponds to a disordered clay mineral, probably smectite. As these disordered clays do not have predictable crystal structure, we have used an empirical structural model for montmorillonite that has been fitted as an approximation. Therefore the determined amount is semi-quantitative.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal formula**	**08-218**	**08-234**	**08-270**	**08-285***	**08-296**	**08-302***	**08-407***	**08-416**
Quartz	SiO_2	42.6	48.6	31.1	21.1	21.5	29.4	41.2	14.0
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	18.0	28.4	16.8	7.0	14.6	12.2	5.6	15.2
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$				11.9		1.8		
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$			9.3		7.5			4.1
Kaolinite	$Al_2Si_2O_5(OH)_4$	9.2	6.0		7.5		3.0	2.1	
K-feldspar	$KalSi_3O_8$	18.2	1.9	24.1	4.3	14.1	11.2	30.1	13.1
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$			9.9	7.1	31.3	15.1	2.0	49.0
Calcite	$CaCO_3$	1.5		0.3	10.2	2.5	5.3	0.6	3.6
Ankerite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$					1.2			
Dolomite	$CaMg(CO_3)_2$	6.6	6.6					3.8	
Pyrite	FeS_2	2.4	8.4	8.4	3.6	7.3	2.6	1.3	1.0
Rutile ?	TiO_2	1.3							
Molybdenite	MoS_2	0.2							
Montmorillonite Model	$(Na,Ca)_{0.3}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot nH_2O$				27.2		19.3	13.2	
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

* Approximate results

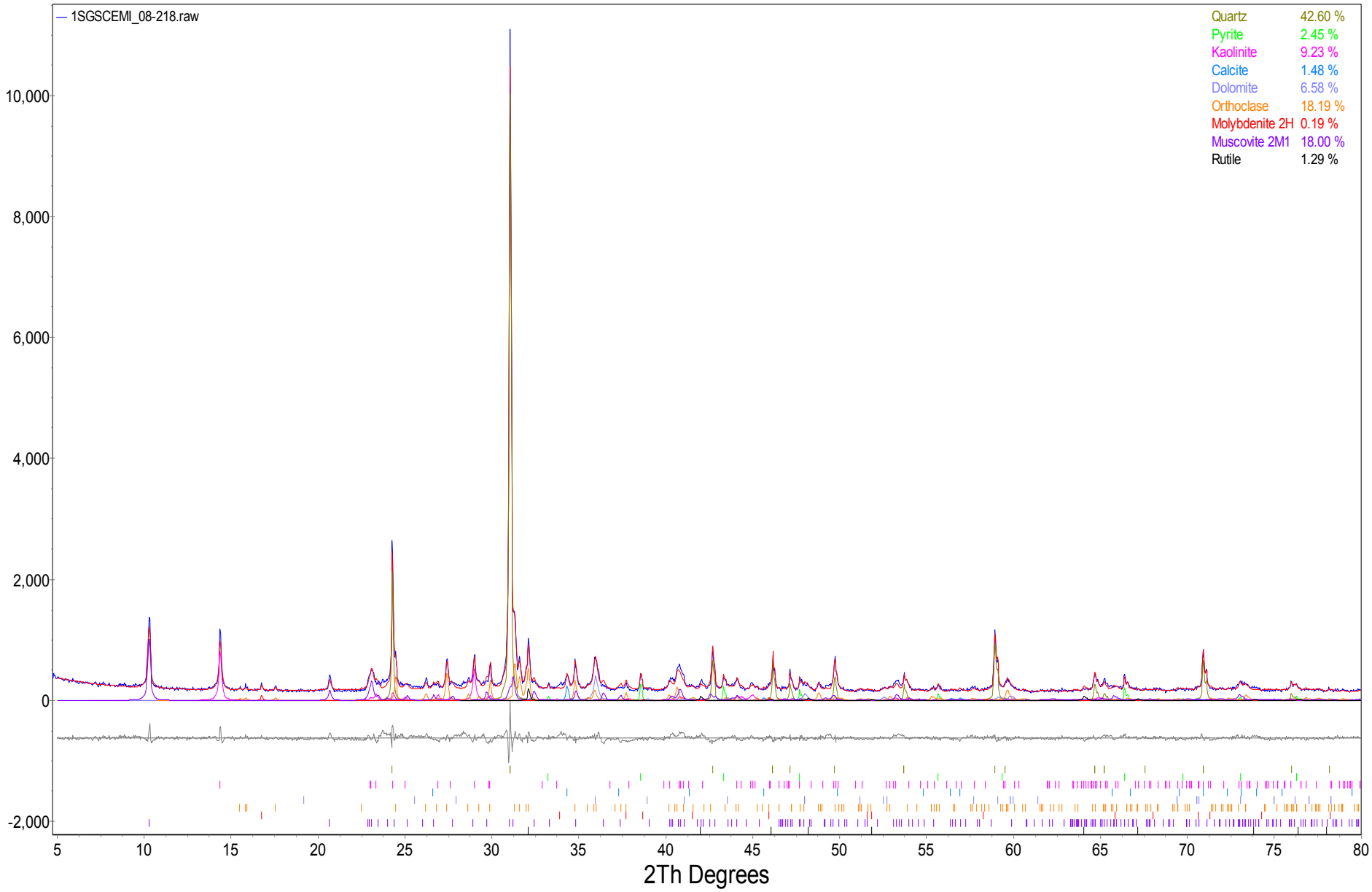


Figure 1. Rietveld refinement plot of sample **SGS CEMI 08-218** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

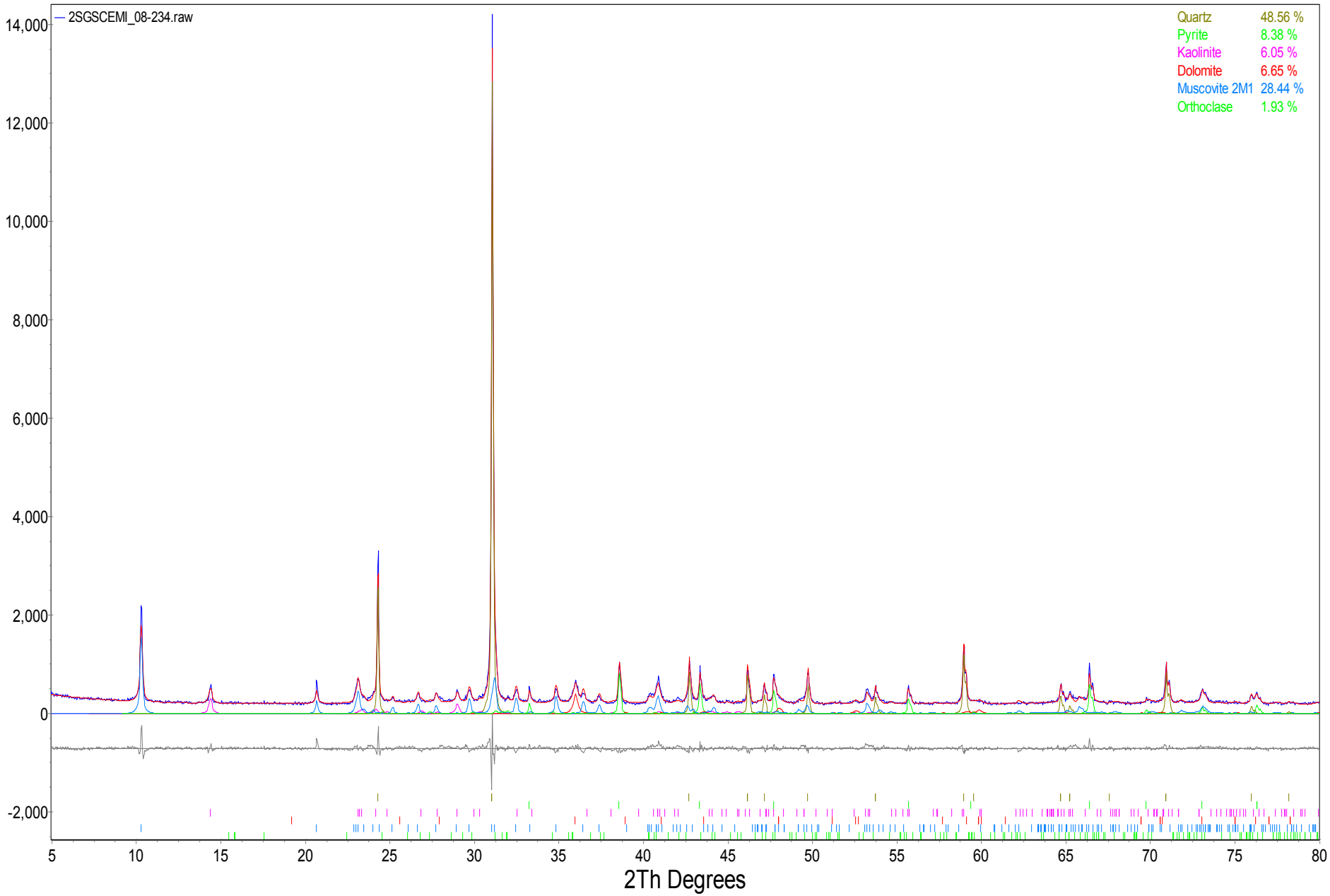


Figure 2. Rietveld refinement plot of sample **SGS CEMI 08-234** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

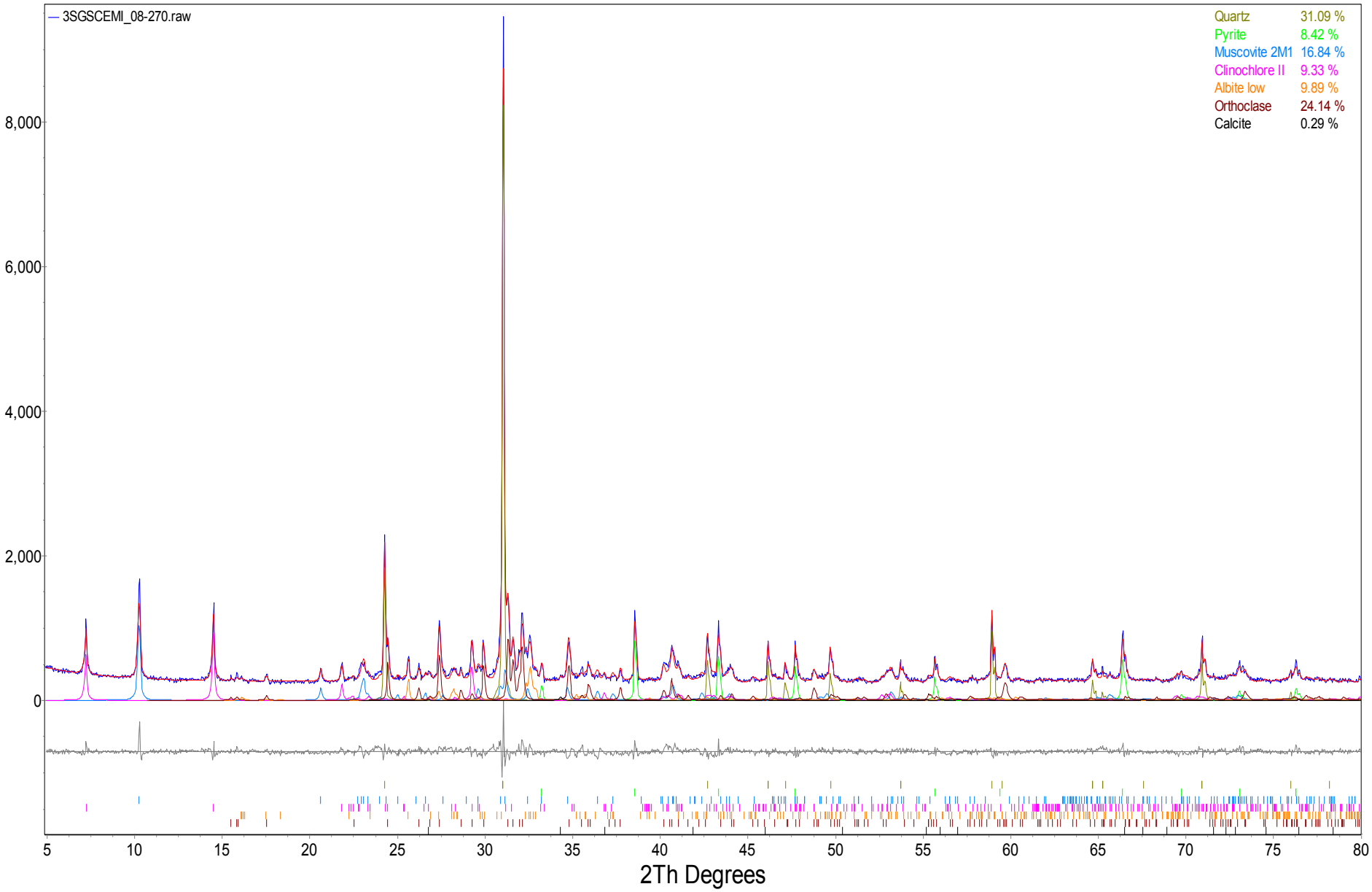


Figure 3. Rietveld refinement plot of sample **SGS CEMI 08-270** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

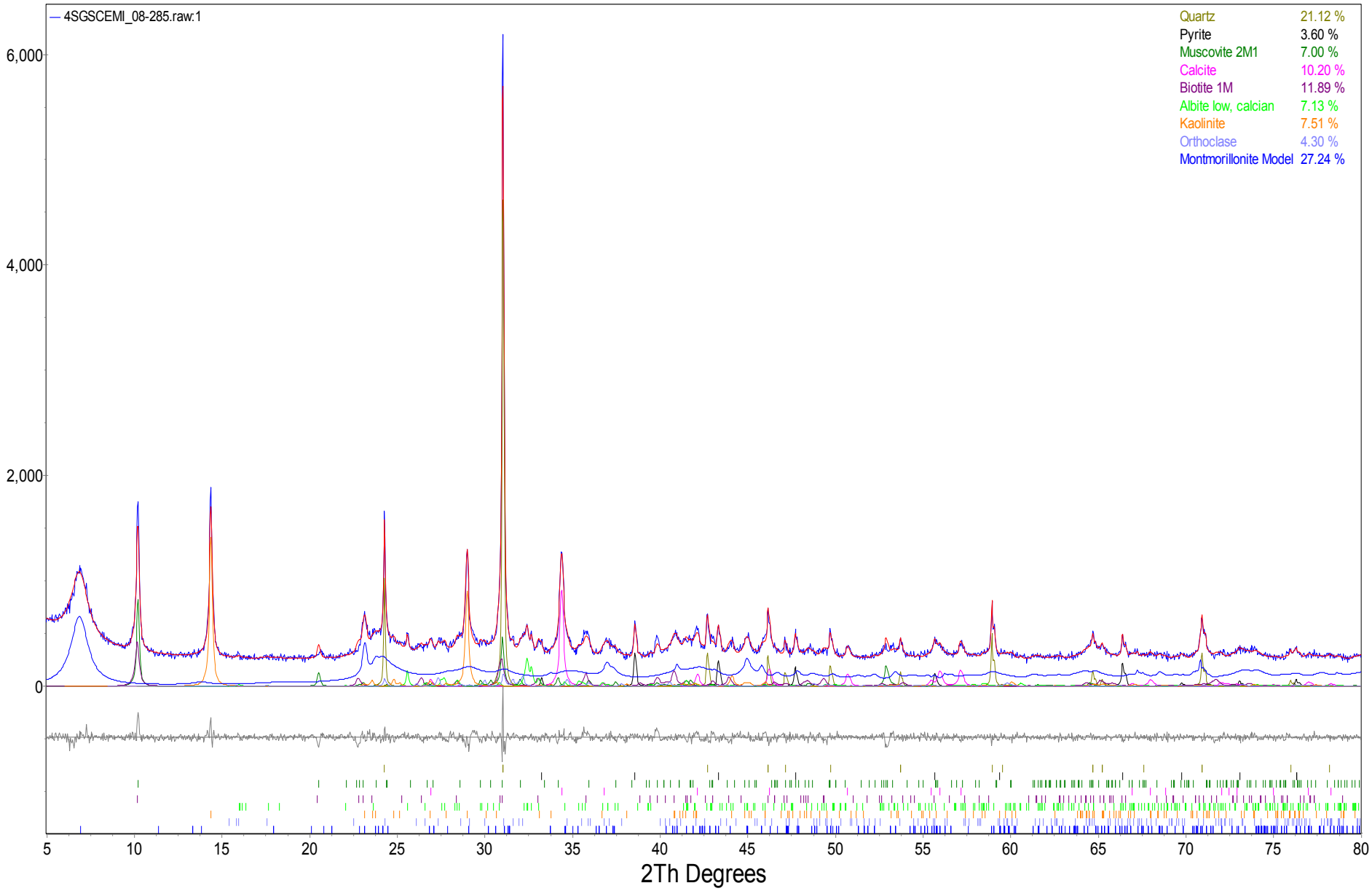


Figure 4. Rietveld refinement plot of sample **SGS CEMI 08-285** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

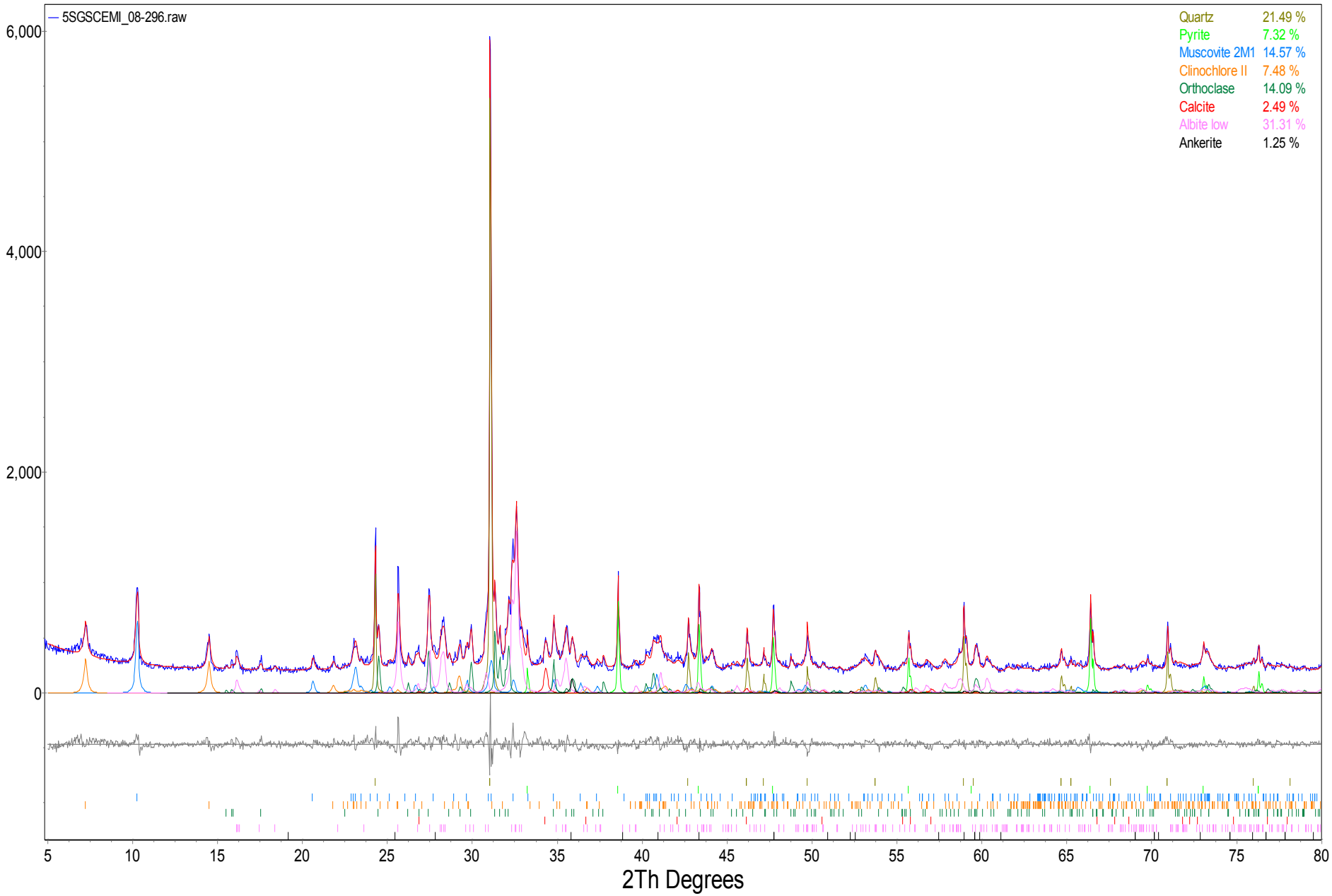


Figure 5. Rietveld refinement plot of sample **SGS CEMI 08-296** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

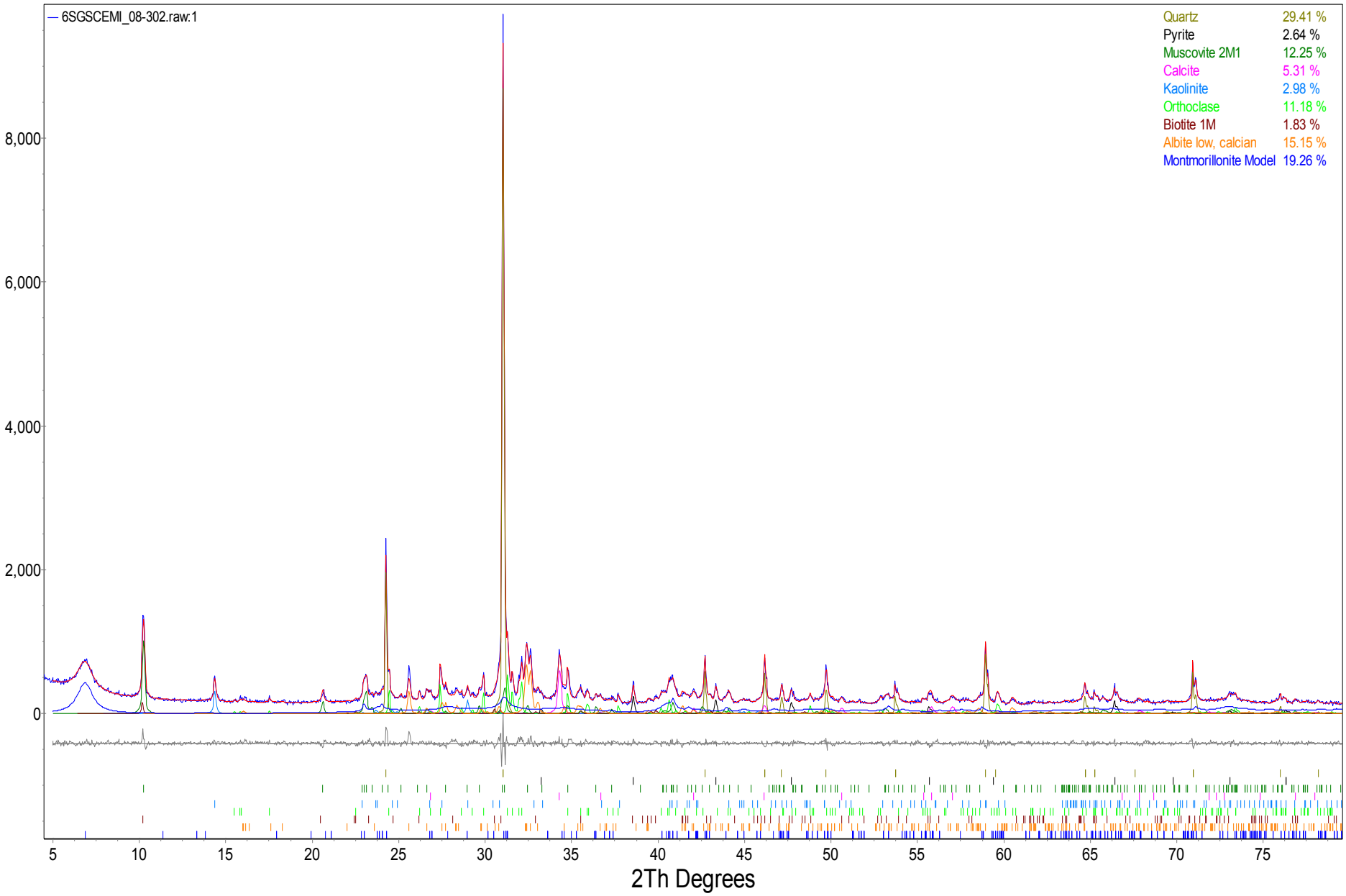


Figure 6. Rietveld refinement plot of sample **SGS CEMI 08-302** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

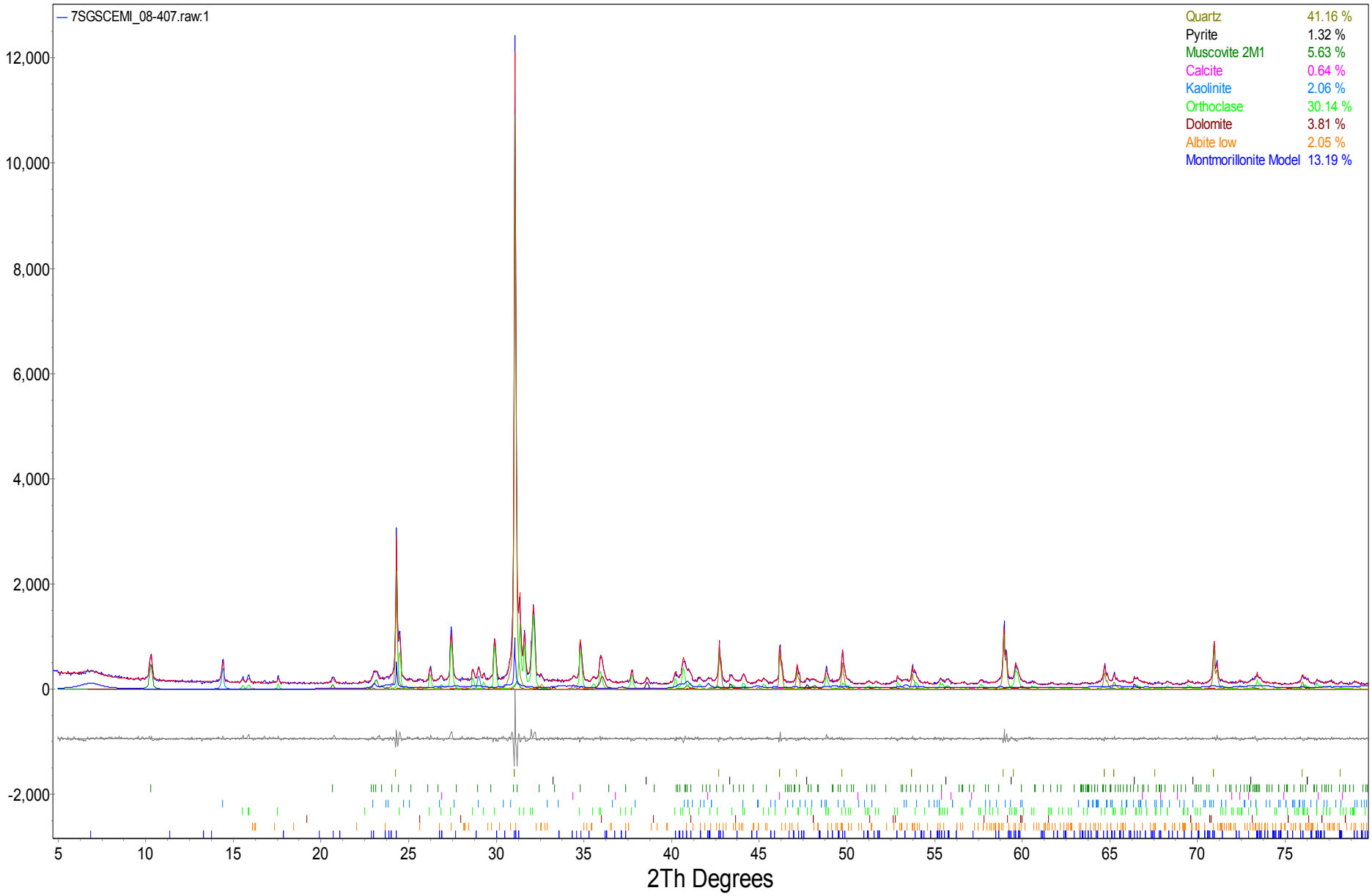


Figure 7. Rietveld refinement plot of sample **SGS CEMI 08-407** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

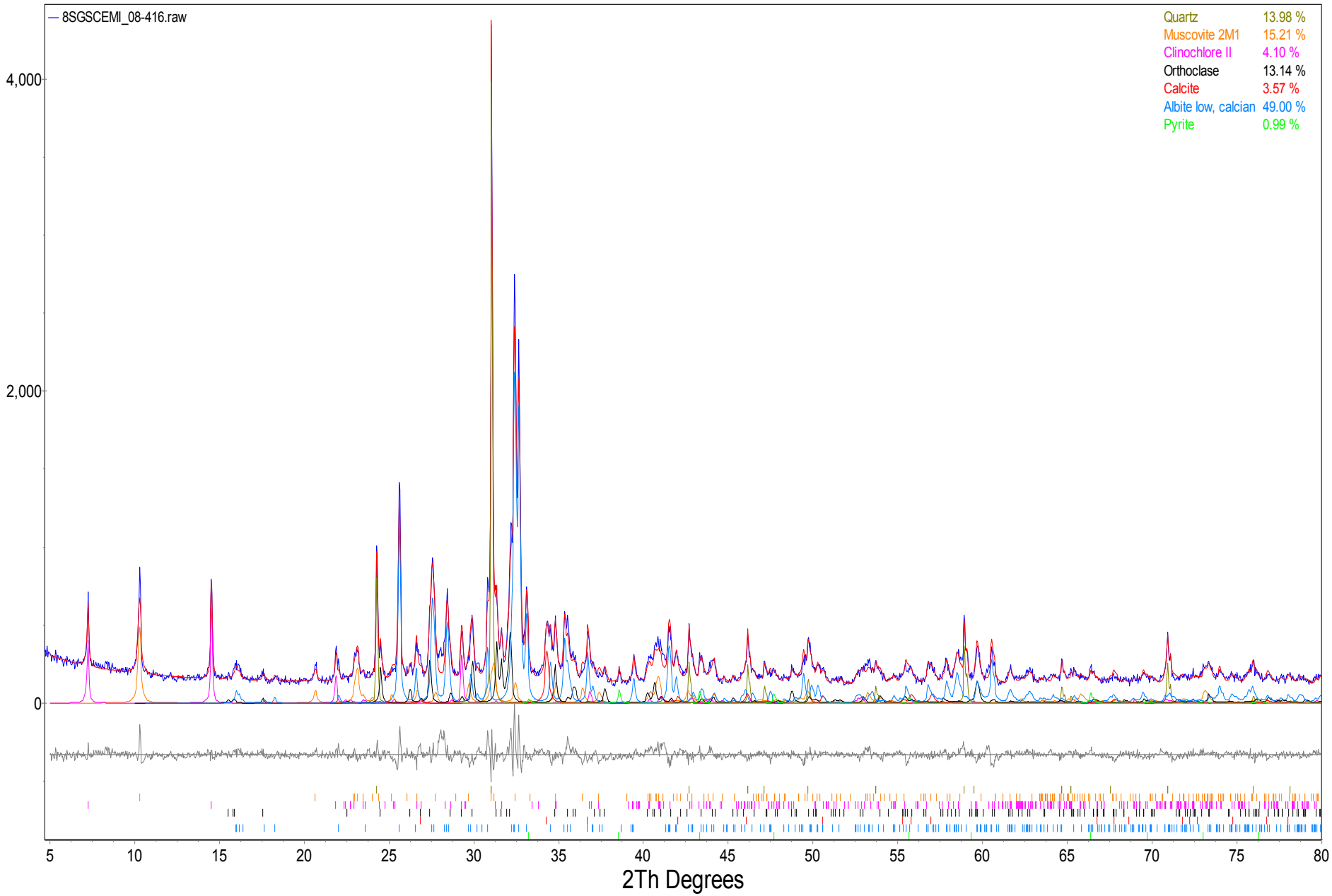


Figure 8. Rietveld refinement plot of sample **SGS CEMI 08-416** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF 10 POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0852 Western Copper – PO# 42438)

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December 13, 2011

EXPERIMENTAL METHOD

The ten samples of **Project 0852 Western Copper** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1 (separate file, ***SGS CEMI Results Dec 13 2011 – Proj 0852 Western Copper.xls***). These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 10. Ideal formulae for the minerals are given in Table 2.

Table 2.

Mineral	**Ideal Formula**
Ankerite-Dolomite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2/CaMg(CO_3)_2$
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$
Calcite	$CaCO_3$
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$
Dravite	$NaMg_3Al_6(BO_3)_3Si_6O_{18}(OH)_4$
Gypsum	$CaSO_4 \cdot 2H_2O$
Kaolinite	$Al_2Si_2O_5(OH)_4$
K-Feldspar	$KAlSi_3O_8$
Molybdenite	MoS_2
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$
Pyrite	FeS_2
Quartz	SiO_2

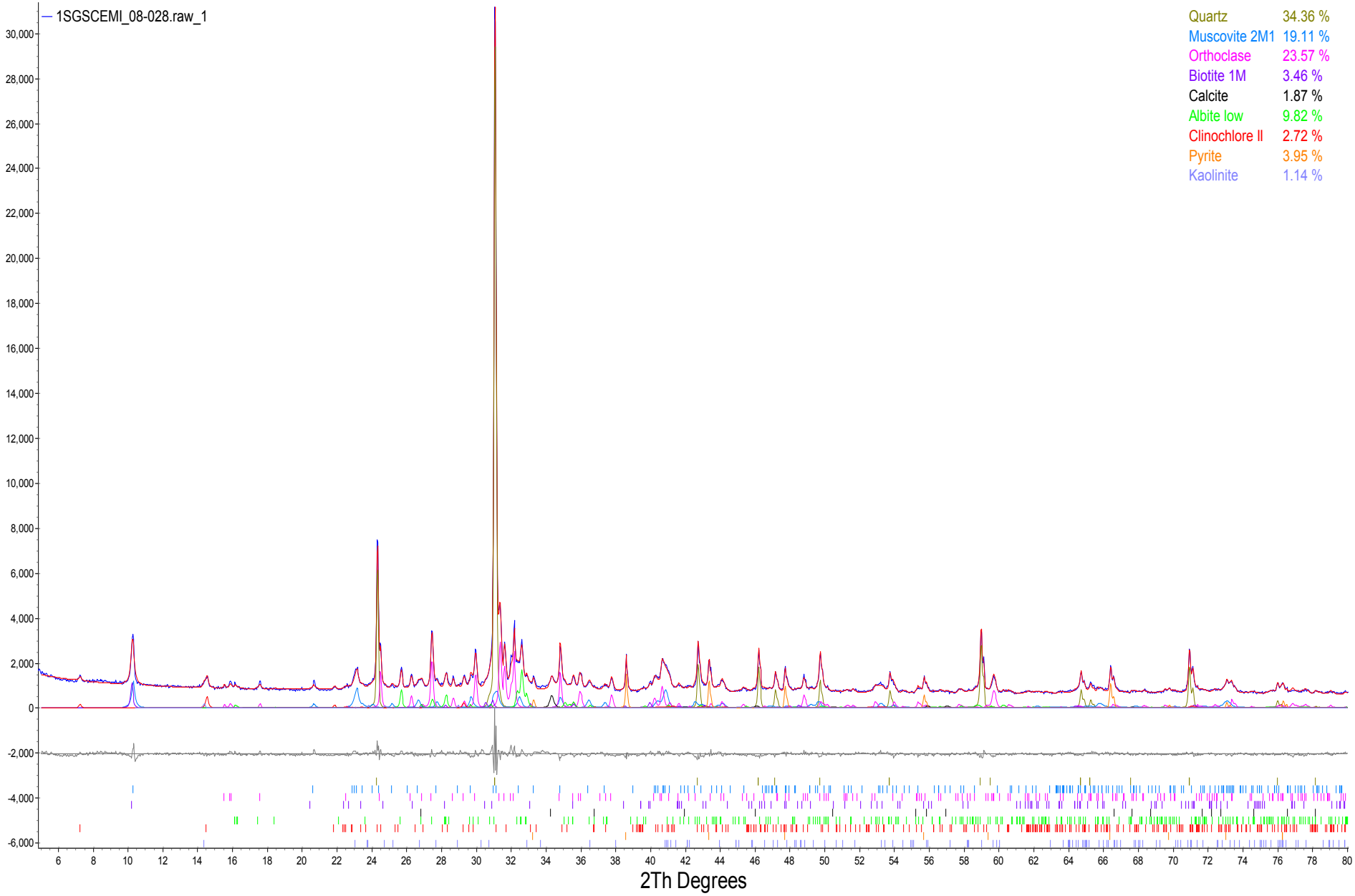


Figure 1. Rietveld refinement plot of sample **SGS CEMI "08-028"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

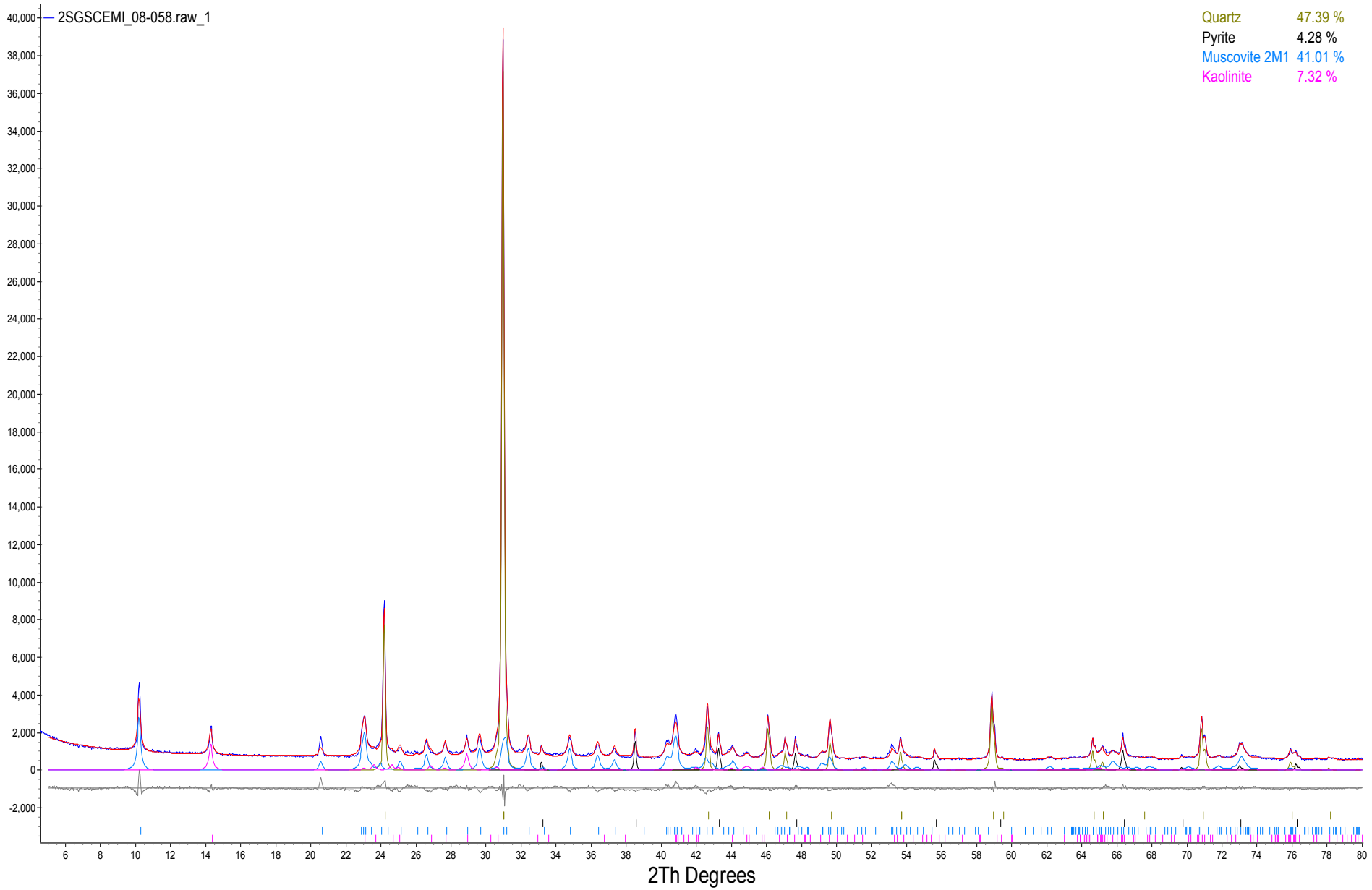


Figure 2. Rietveld refinement plot of sample **SGS CEMI "08-058"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

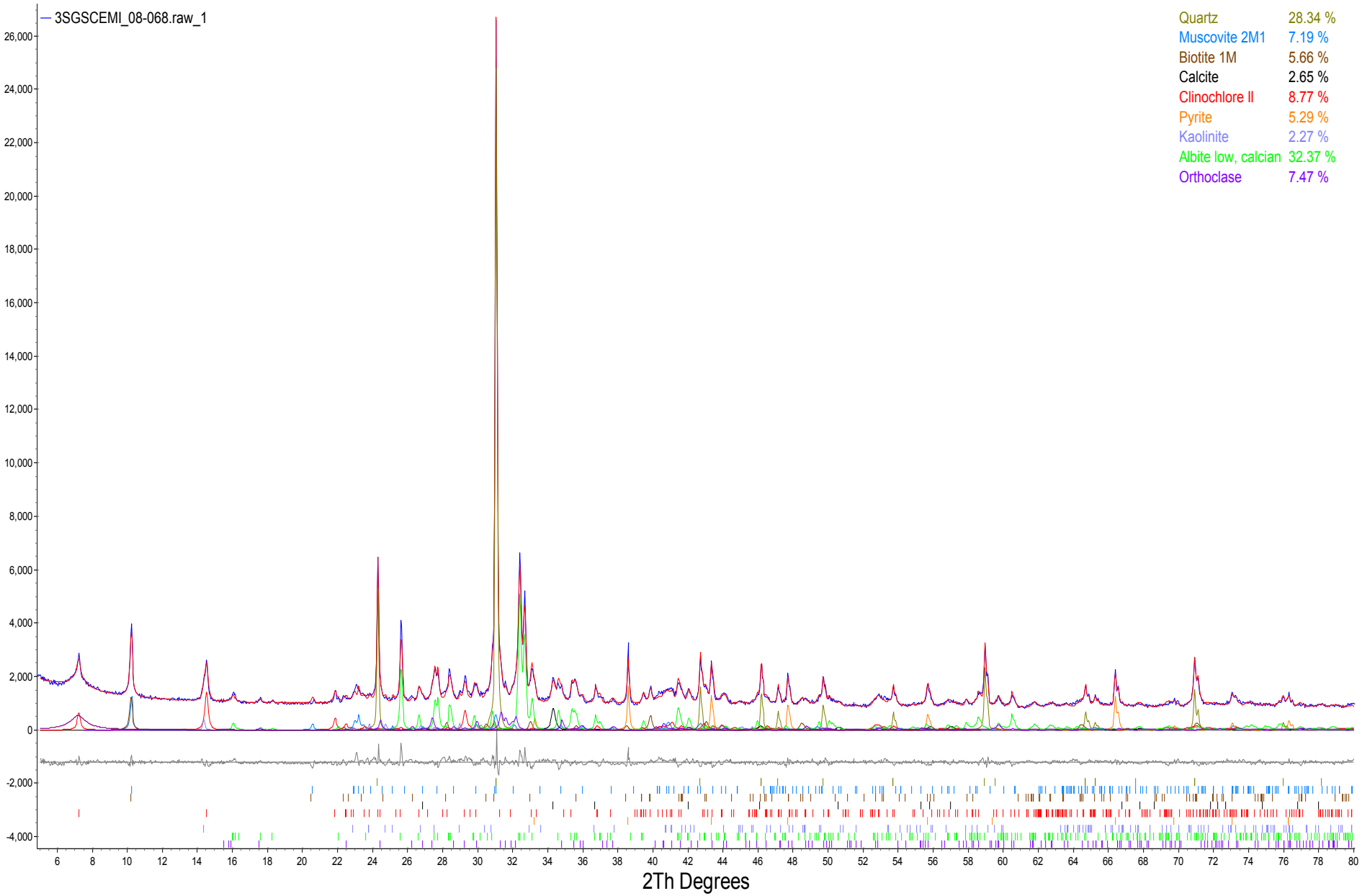


Figure 3. Rietveld refinement plot of sample **SGS CEMI "08-068"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

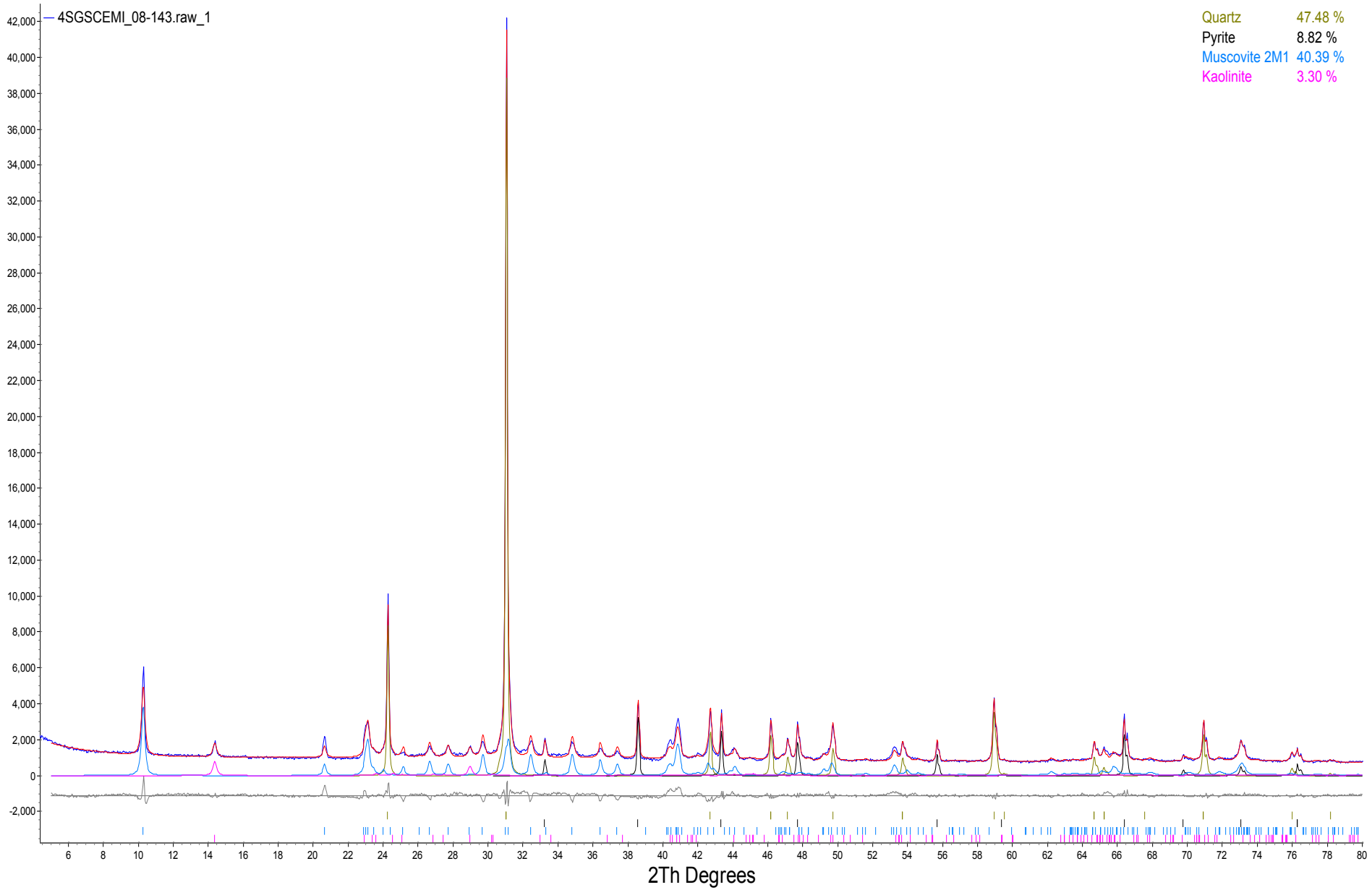


Figure 4. Rietveld refinement plot of sample **SGS CEMI "08-143"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

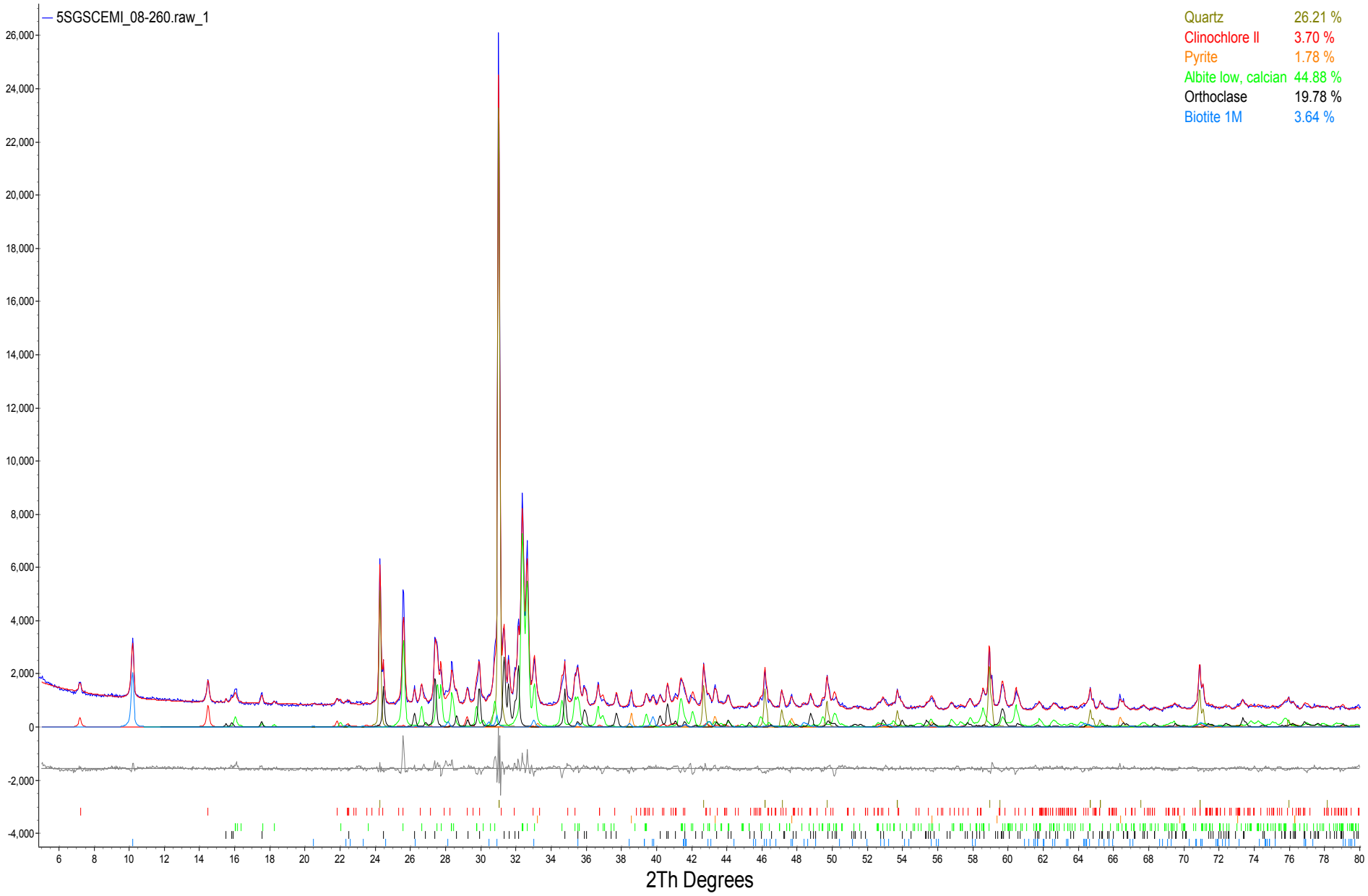


Figure 5. Rietveld refinement plot of sample **SGS CEMI "08-260"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

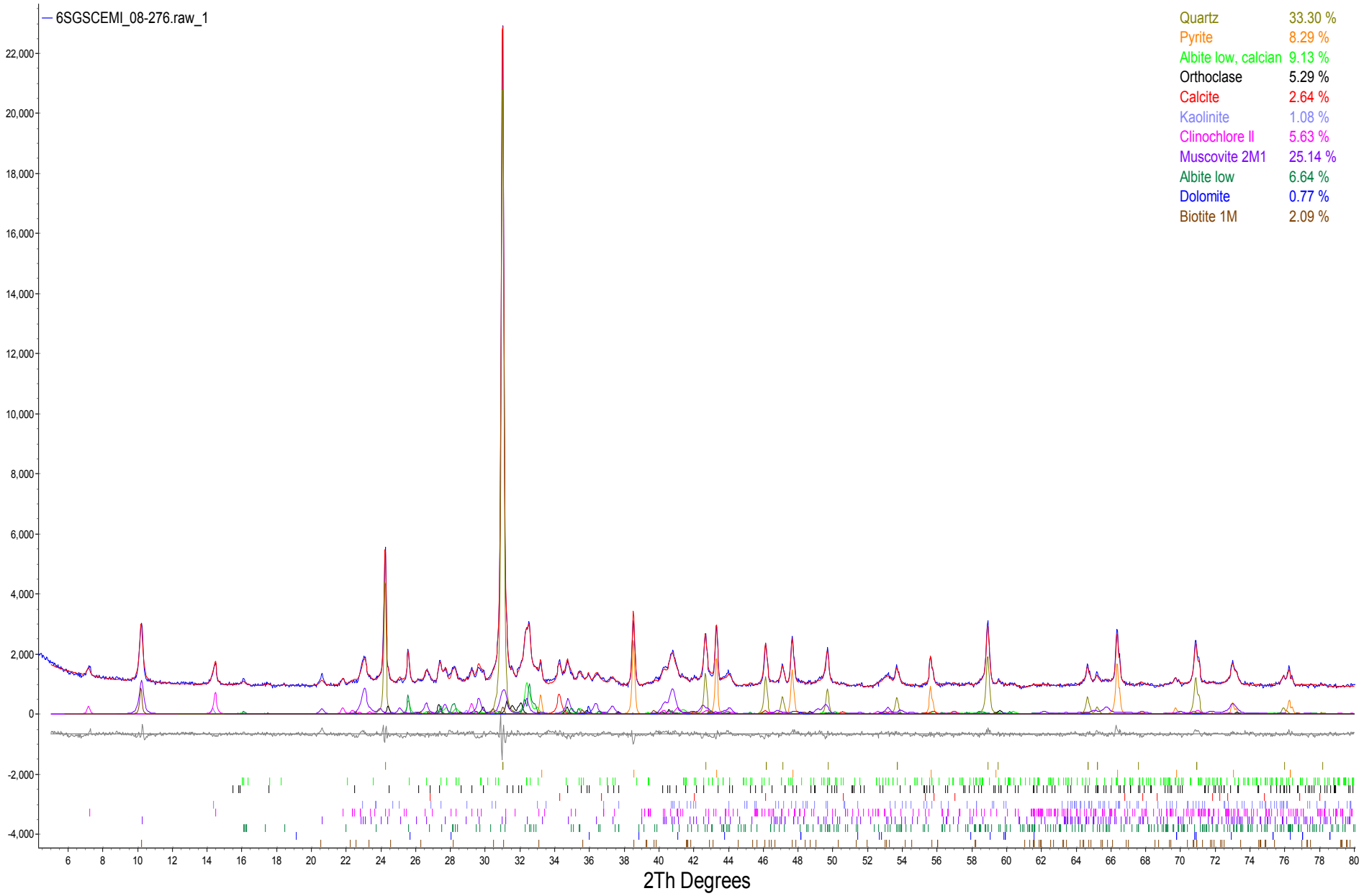


Figure 6. Rietveld refinement plot of sample **SGS CEMI "08-276"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

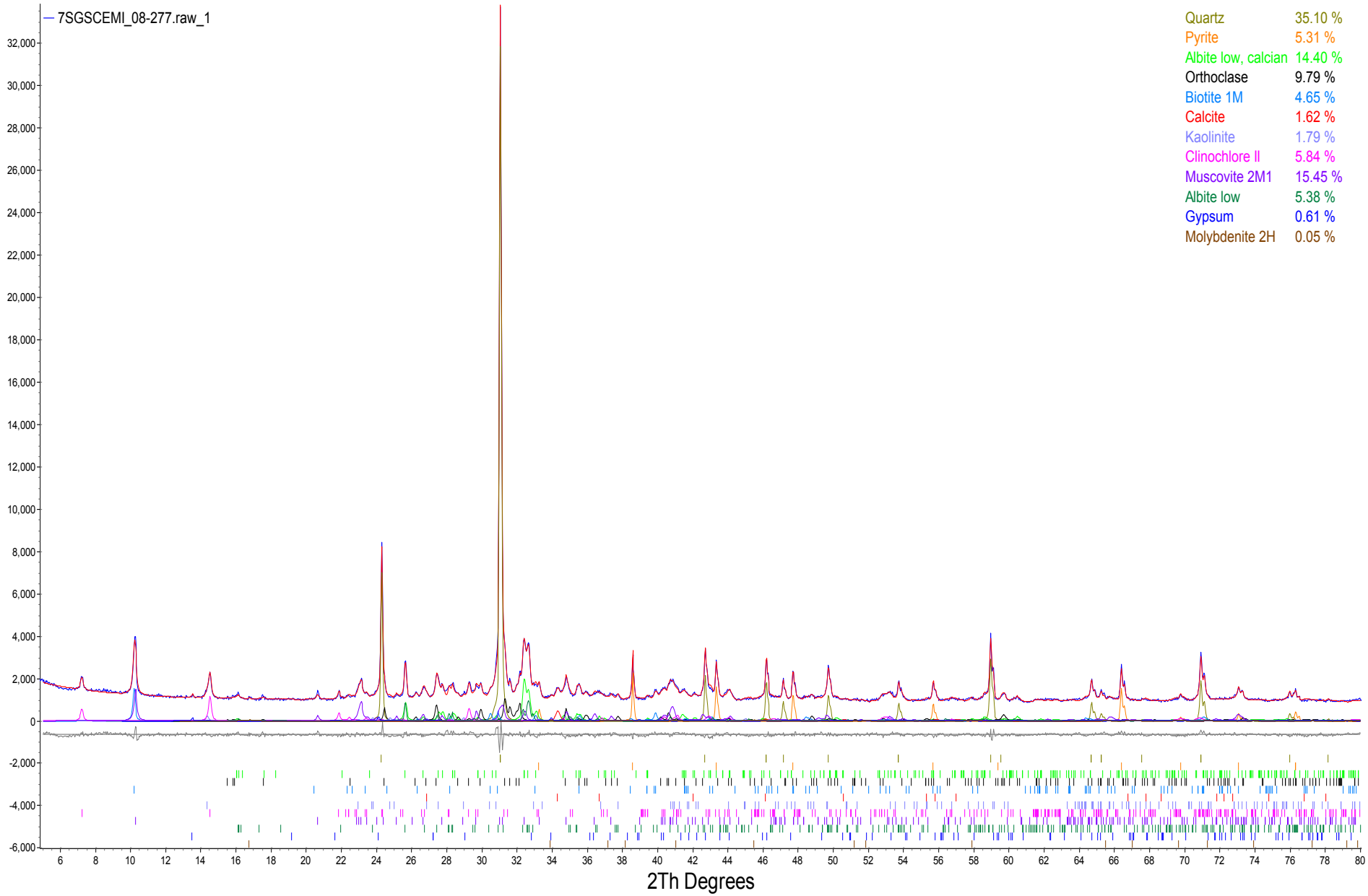


Figure 7. Rietveld refinement plot of sample **SGS CEMI "08-277"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

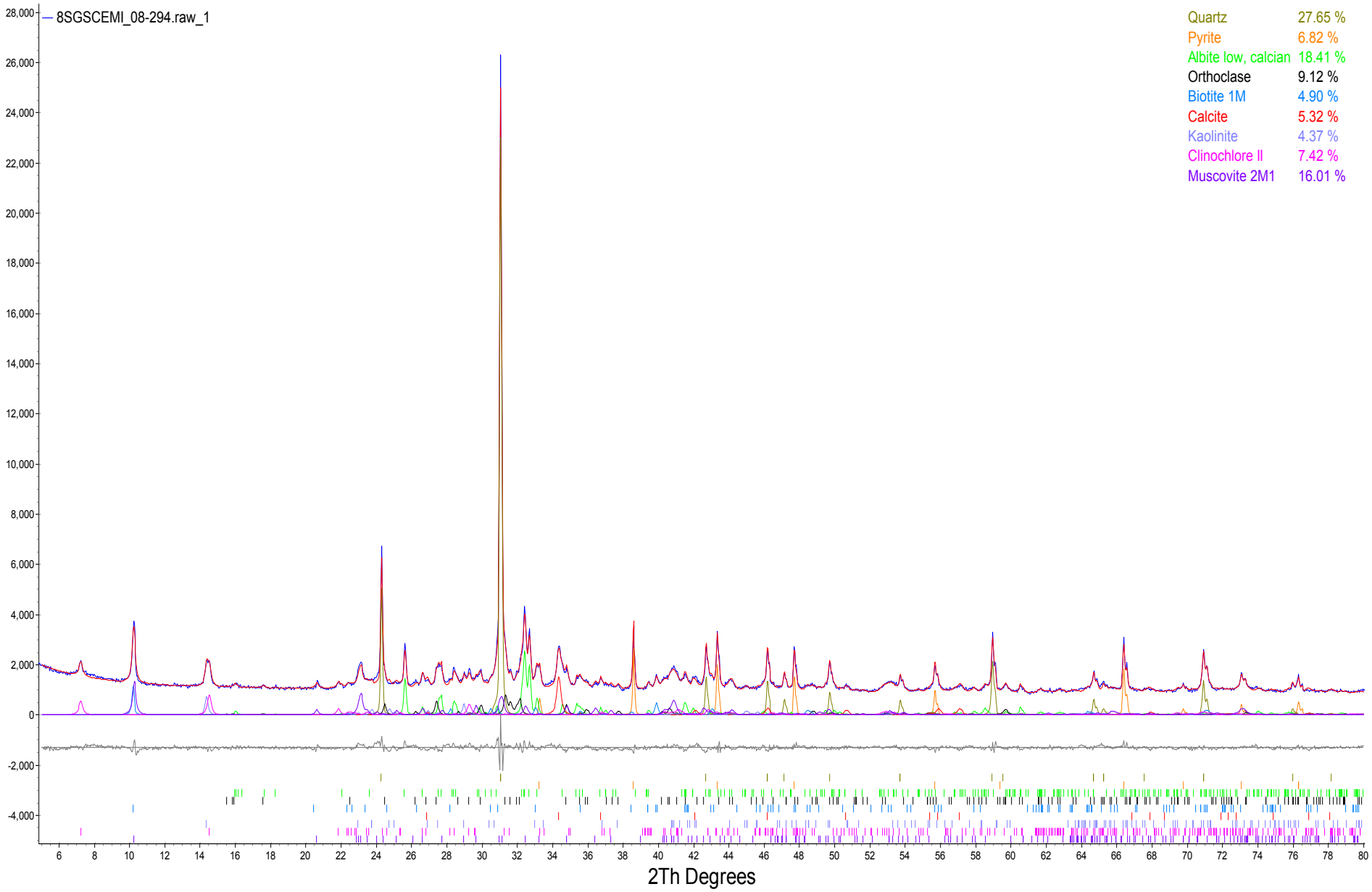


Figure 8. Rietveld refinement plot of sample **SGS CEMI "08-294"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

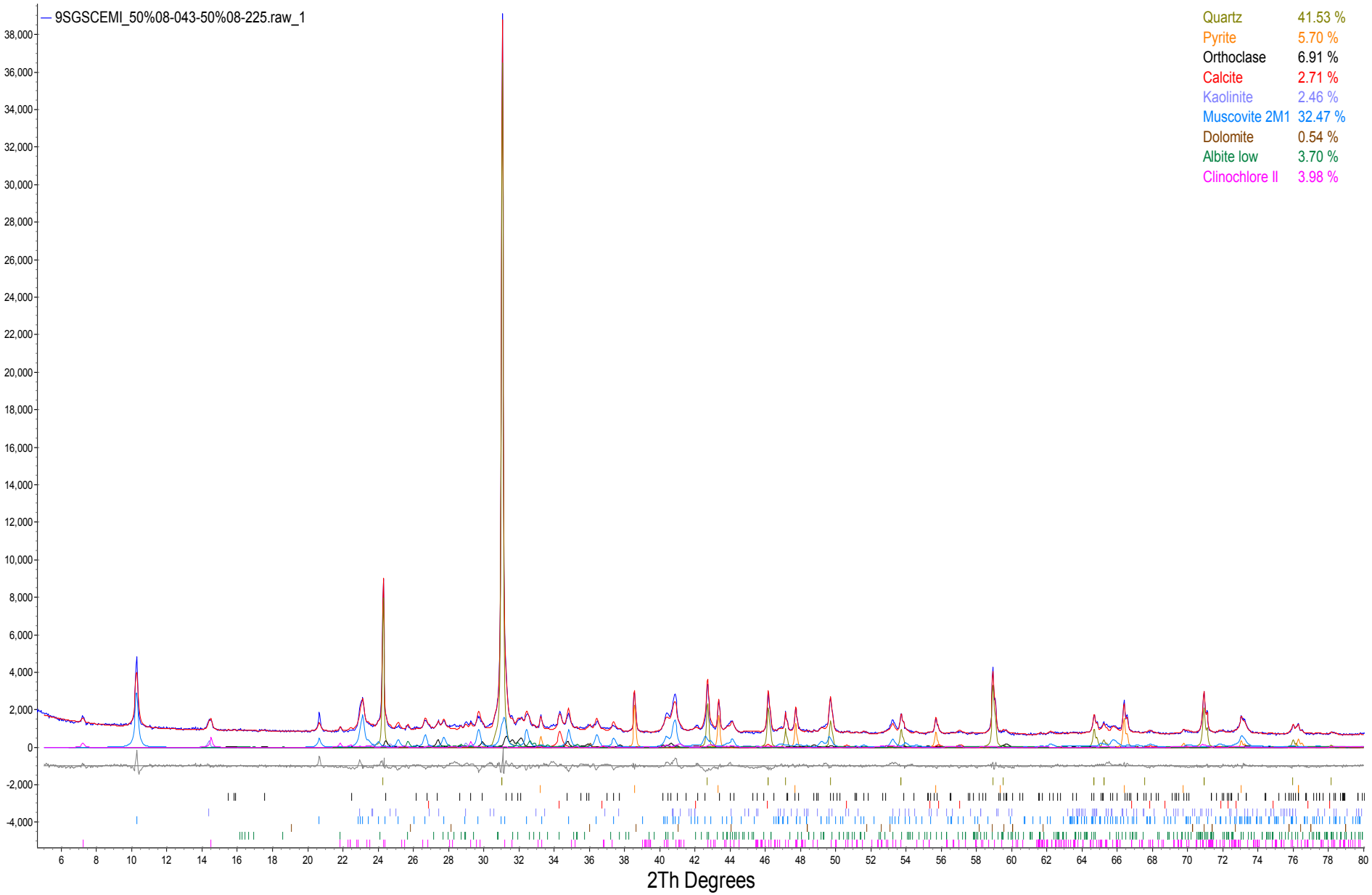


Figure 9. Rietveld refinement plot of sample **SGS CEMI "50% 08-043 & 50% 08-225"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

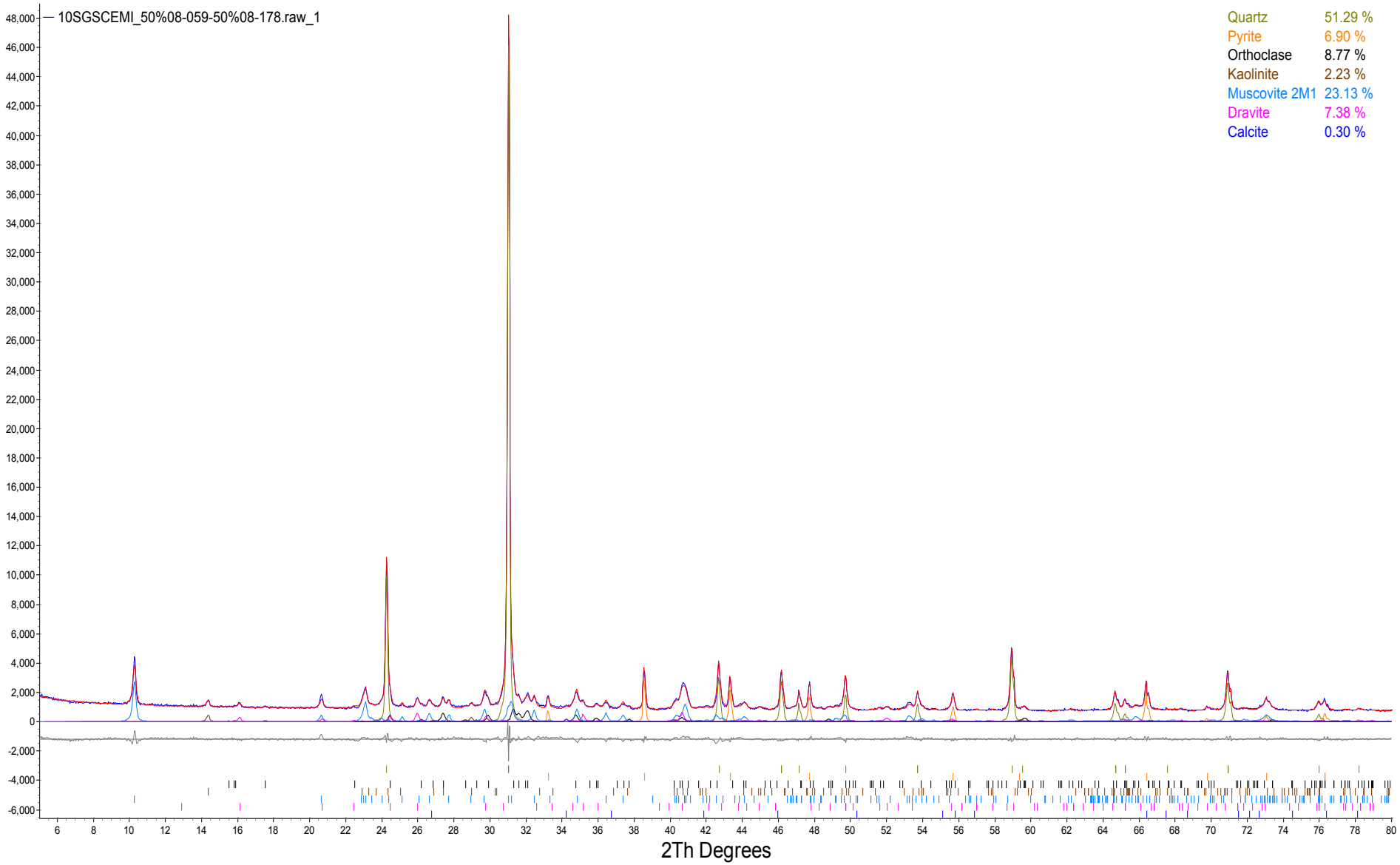


Figure 10. Rietveld refinement plot of sample **SGS CEMI "50% 08-059 & 50% 08-178"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF TWO POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0833 Western Copper Casino - PO# 42021)

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December 4, 2009

EXPERIMENTAL METHOD

The two samples of **Project 0833 Western Copper Casino** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 3 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 2.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**HC Ore 1**	**HC Ore 2**
Quartz	SiO_2	30.2	36.9
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.1	1.8
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	12.5	11.5
K-Feldspar	$KAlSi_3O_8$	27.1	33.7
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	17.0	8.0
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.2	5.2
Gypsum	$CaSO_4{\cdot}2H_2O$	1.4	
Calcite	$CaCO_3$	1.4	0.8
Ankerite / Dolomite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$ / $CaMg(CO_3)_2$	2.7	
Pyrite	FeS_2	2.3	2.0
Molybdenite	MoS_2	0.1	trace
Total		100.0	100.0

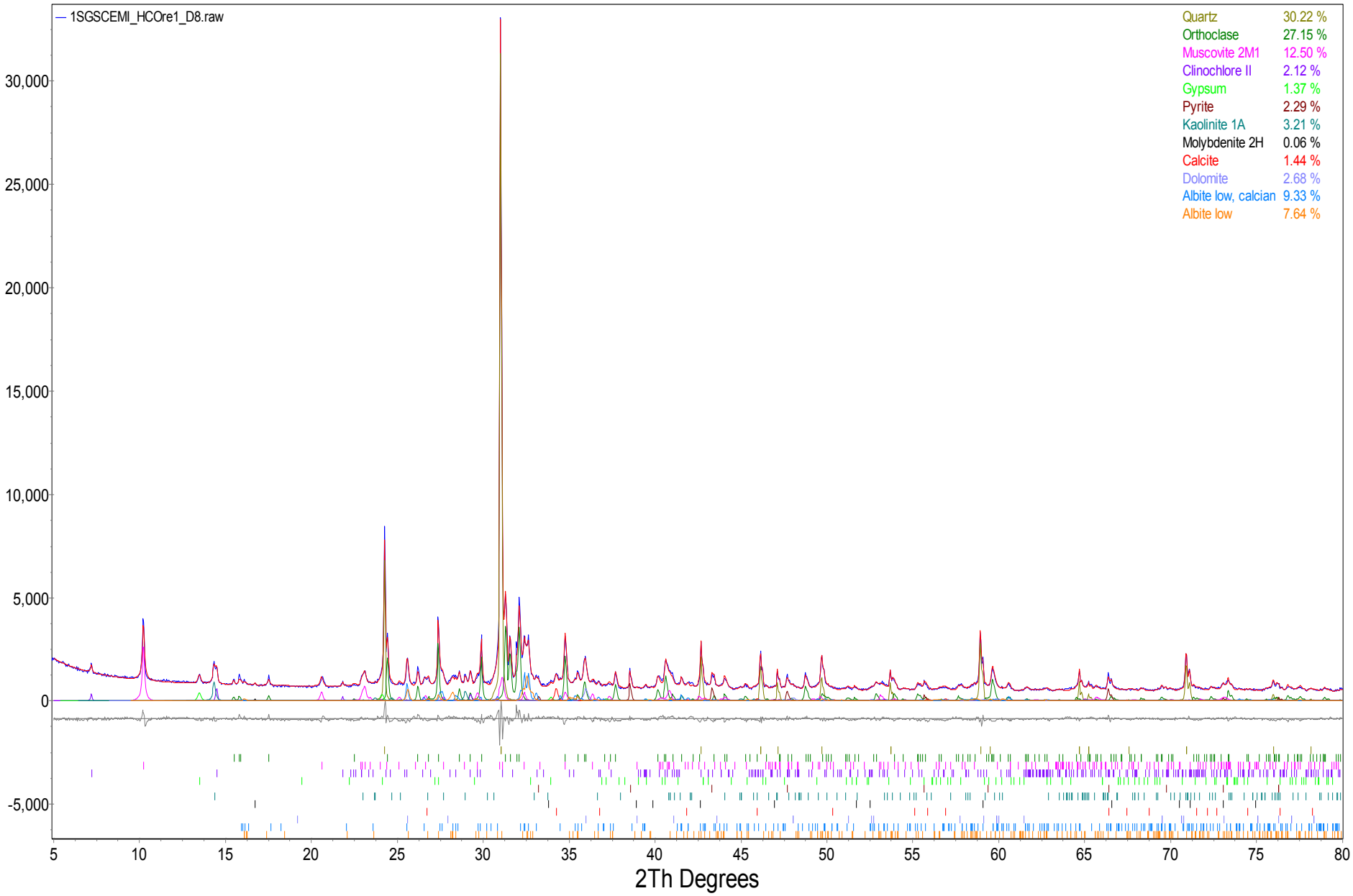


Figure 1. Rietveld refinement plot of sample **SGS CEMI "HC Ore 1"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

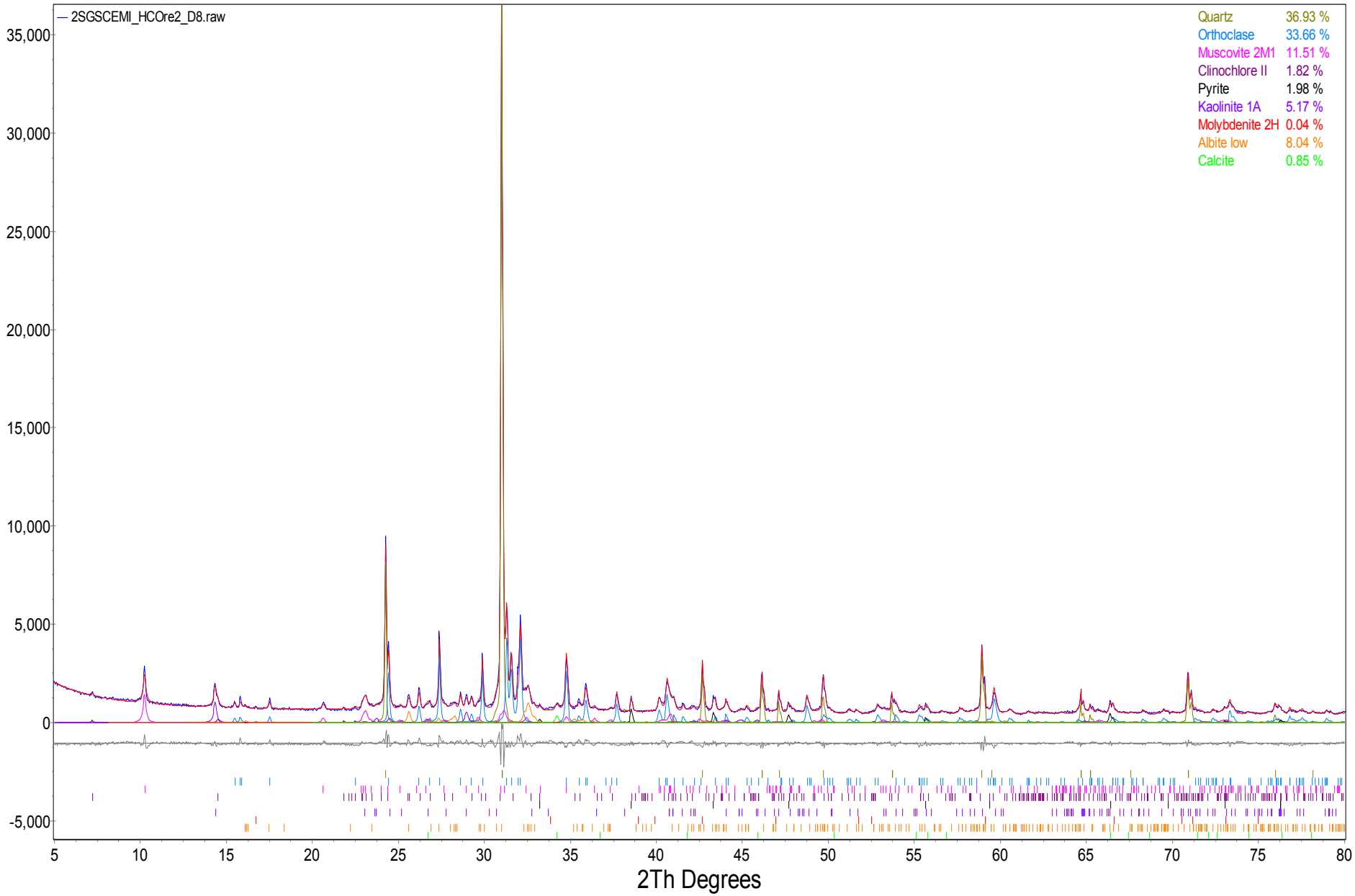


Figure 2. Rietveld refinement plot of sample **SGS CEMI "HC Ore 2"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF 8 POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0852 Western Copper Casino – PO# 41939)

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August 4, 2009

EXPERIMENTAL METHOD

The 8 samples of the project **0852 Western Copper Casino** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Fine grain-size is an important factor in reducing micro-absorption contrast between phases.

Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 using Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 3 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 8.

Table 1. Results of quantitative phase analysis (wt.%).

Mineral	**Ideal Formula**	**FB1**	**FB2**	**FB3**	**FB4**	**FB5**	**FB6**	**FB7**	**FB8**
Quartz low	SiO_2	48.5	35.0	49.5	44.6	32.3	30.1	44.1	29.1
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$		8.6	4.0		19.7	28.8	2.4	28.3
K-feldspar	$KAlSi_3O_8$	2.9	10.4	19.5	15.8	12.4	12.1	18.2	12.5
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	42.9	30.5	20.8	23.7	22.7	18.9	20.4	14.2
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$		4.1						
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$		9.0			3.9	3.9		6.0
Kaolinite	$Al_2Si_2O_5(OH)_4$	2.0		4.1	4.3	4.3		4.6	2.1
Gypsum	$CaSO_4 \cdot 2H_2O$						1.0		0.7
Jarosite	$K_2Fe^{3+}_6(SO_4)_4(OH)_{12}$	3.7	1.2	1.8	11.0	1.5			
Hematite	$\alpha\text{-}Fe_2O_3$				0.4				
Pyrite	FeS_2		0.6	0.3	0.2	3.2	2.9	6.1	4.2
Calcite	$CaCO_3$						2.3	2.4	1.8
Dolomite-Ankerite	$Ca(Mg,Fe)CO_3$							1.8	1.1
Anatase	TiO_2		0.6						
Total		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

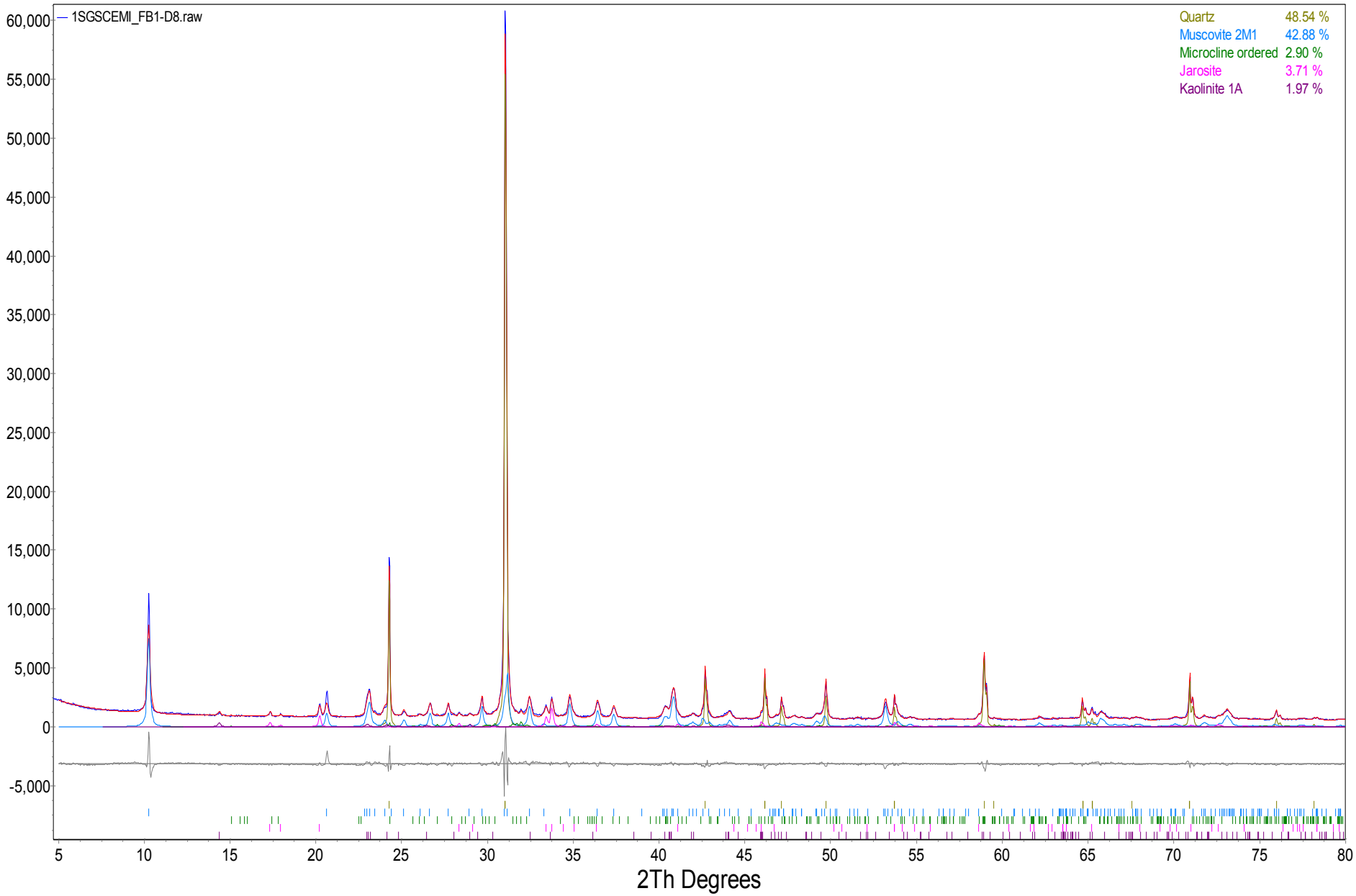


Figure 1. Rietveld refinement plot of sample **SGS CEMI "FB1 #4-3" / Passing #4"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

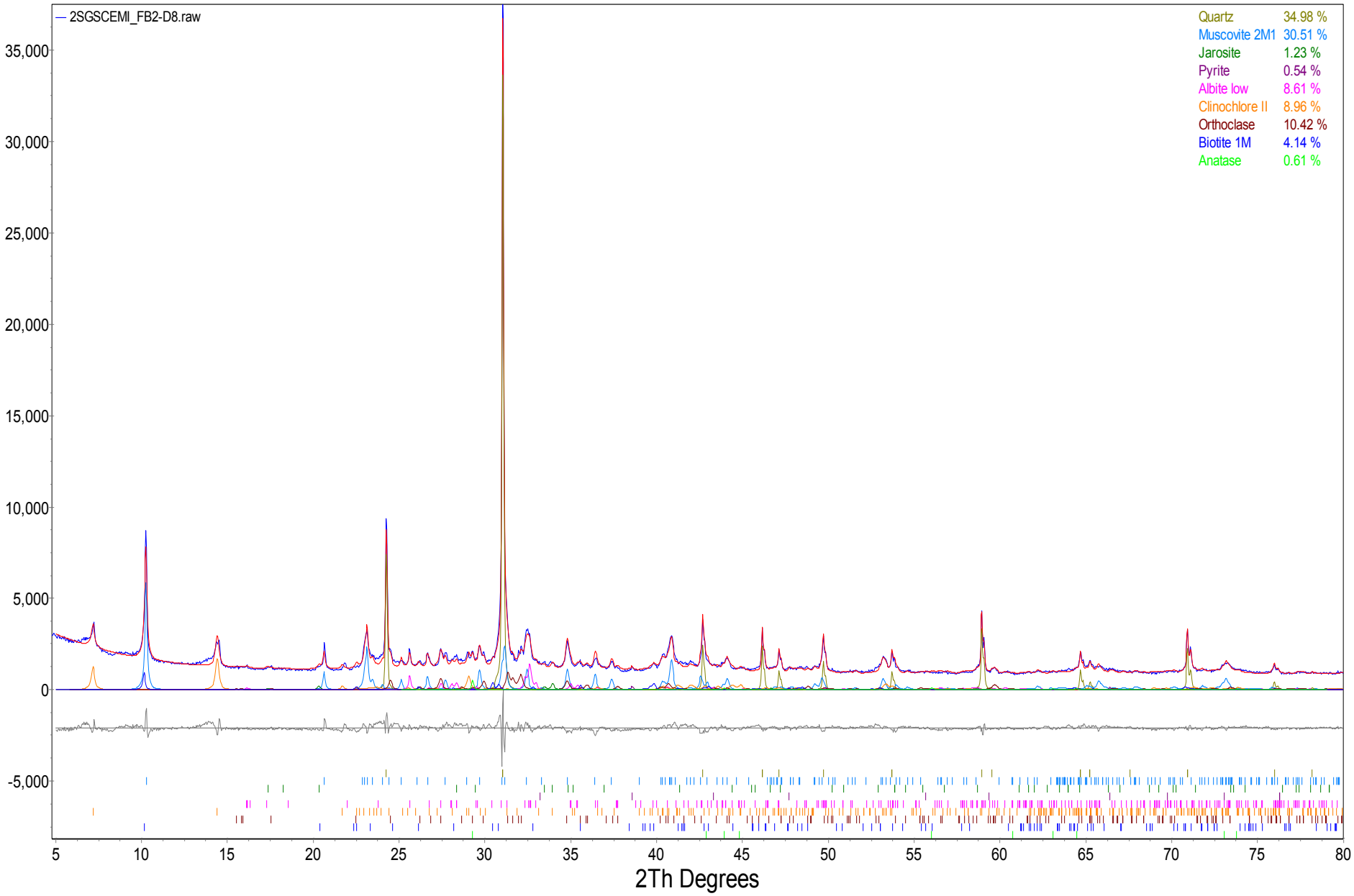


Figure 2. Rietveld refinement plot of sample **SGS CEMI "FB2 #4-3" / Passing #4"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

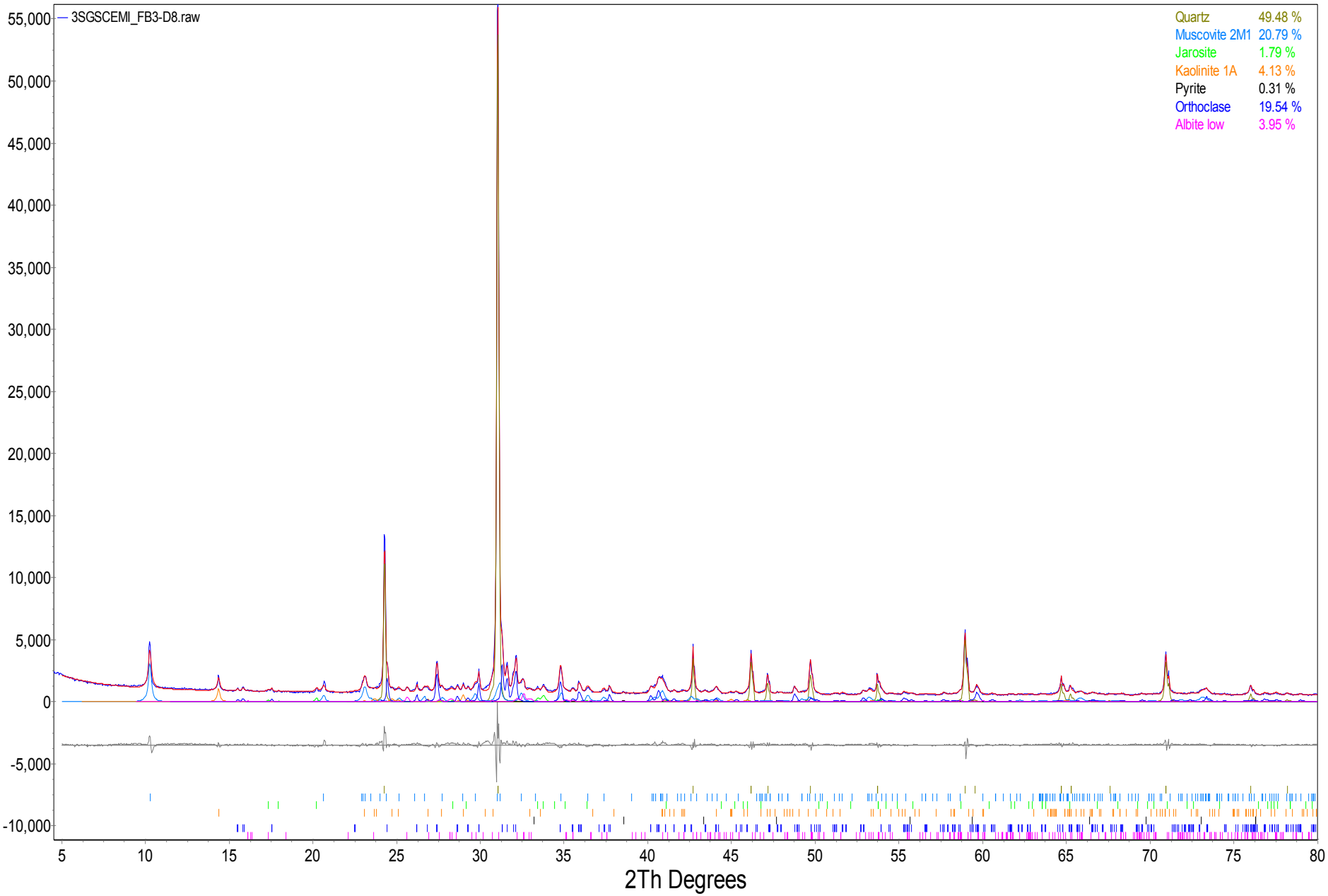


Figure 3. Rietveld refinement plot of sample **SGS CEMI "FB3 #4-3" / Passing #4"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

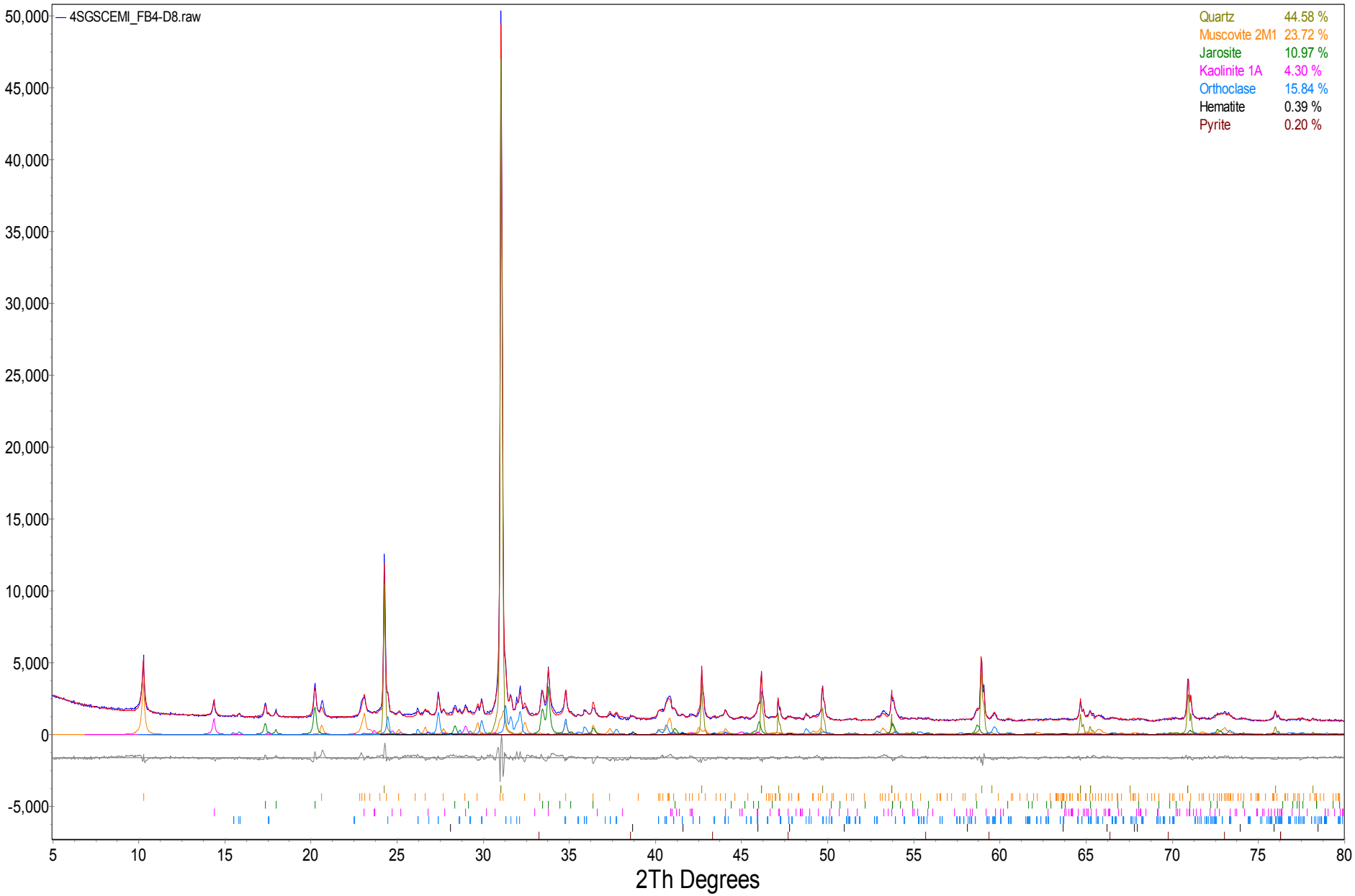


Figure 4. Rietveld refinement plot of sample **SGS CEMI "FB4 #4-3" / Passing #4"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

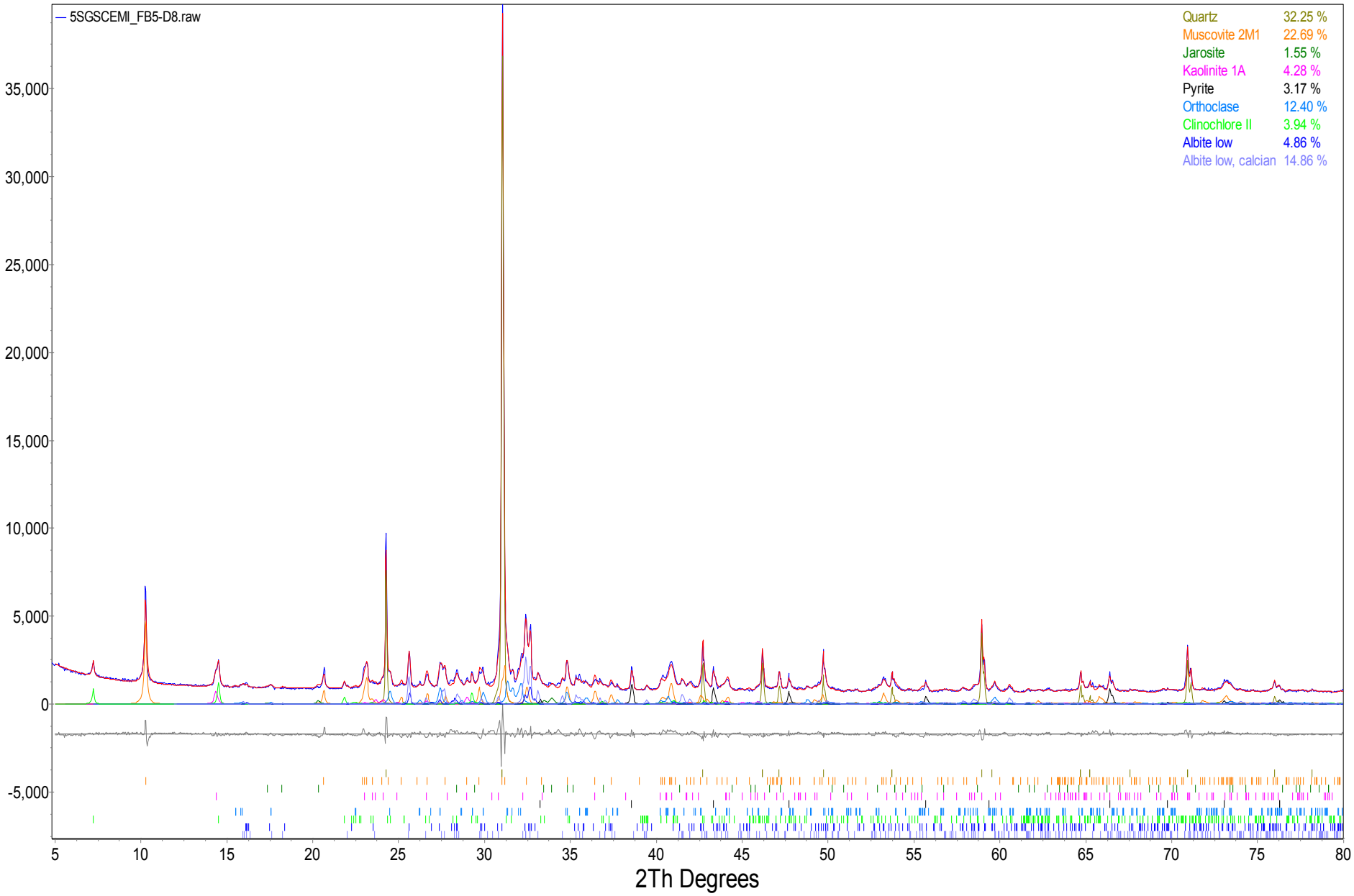


Figure 5. Rietveld refinement plot of sample **SGS CEMI "FB5 #4-3" / Passing #4"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

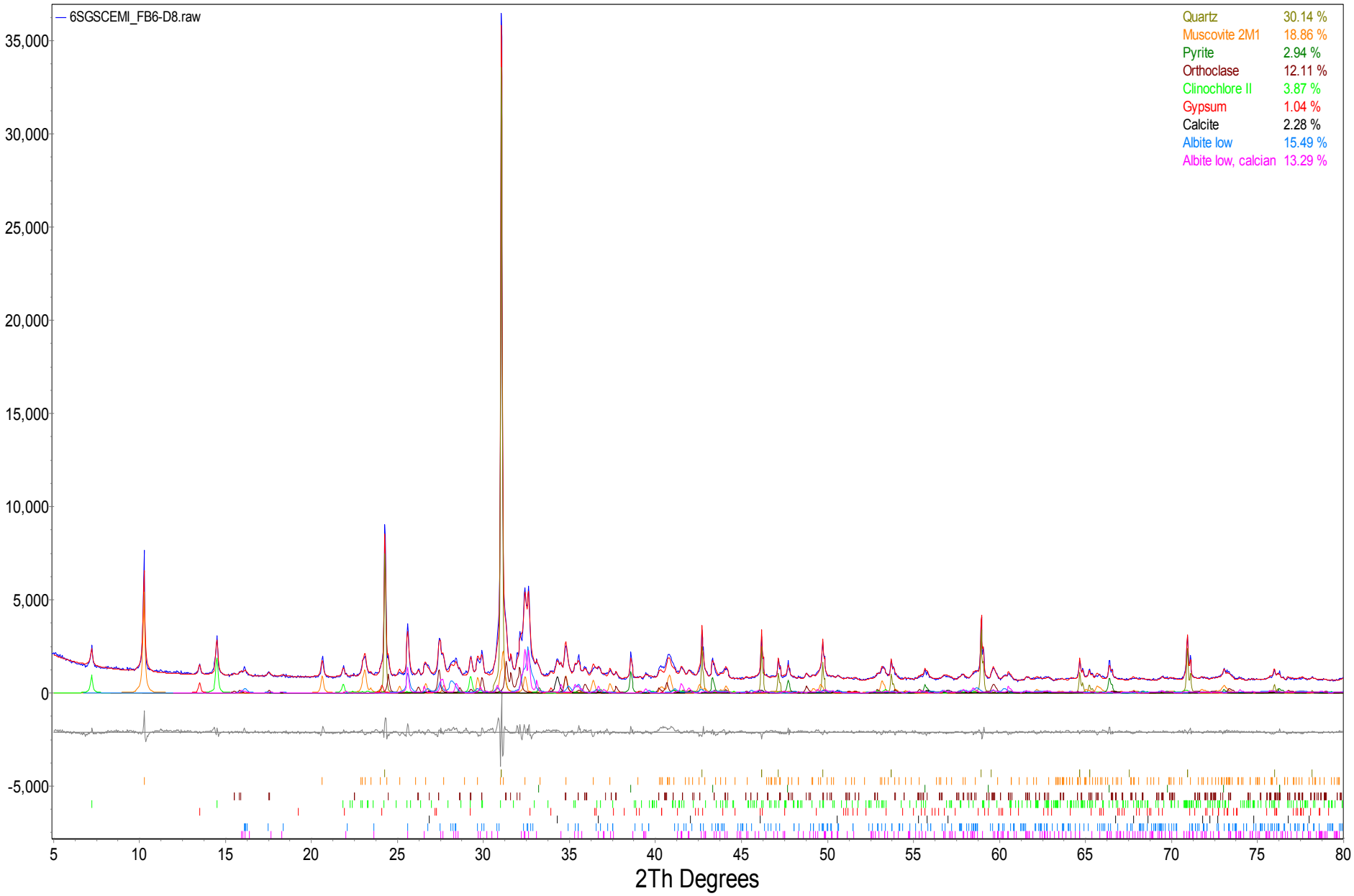


Figure 6. Rietveld refinement plot of sample **SGS CEMI "FB6 #4-3" / Passing #4"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

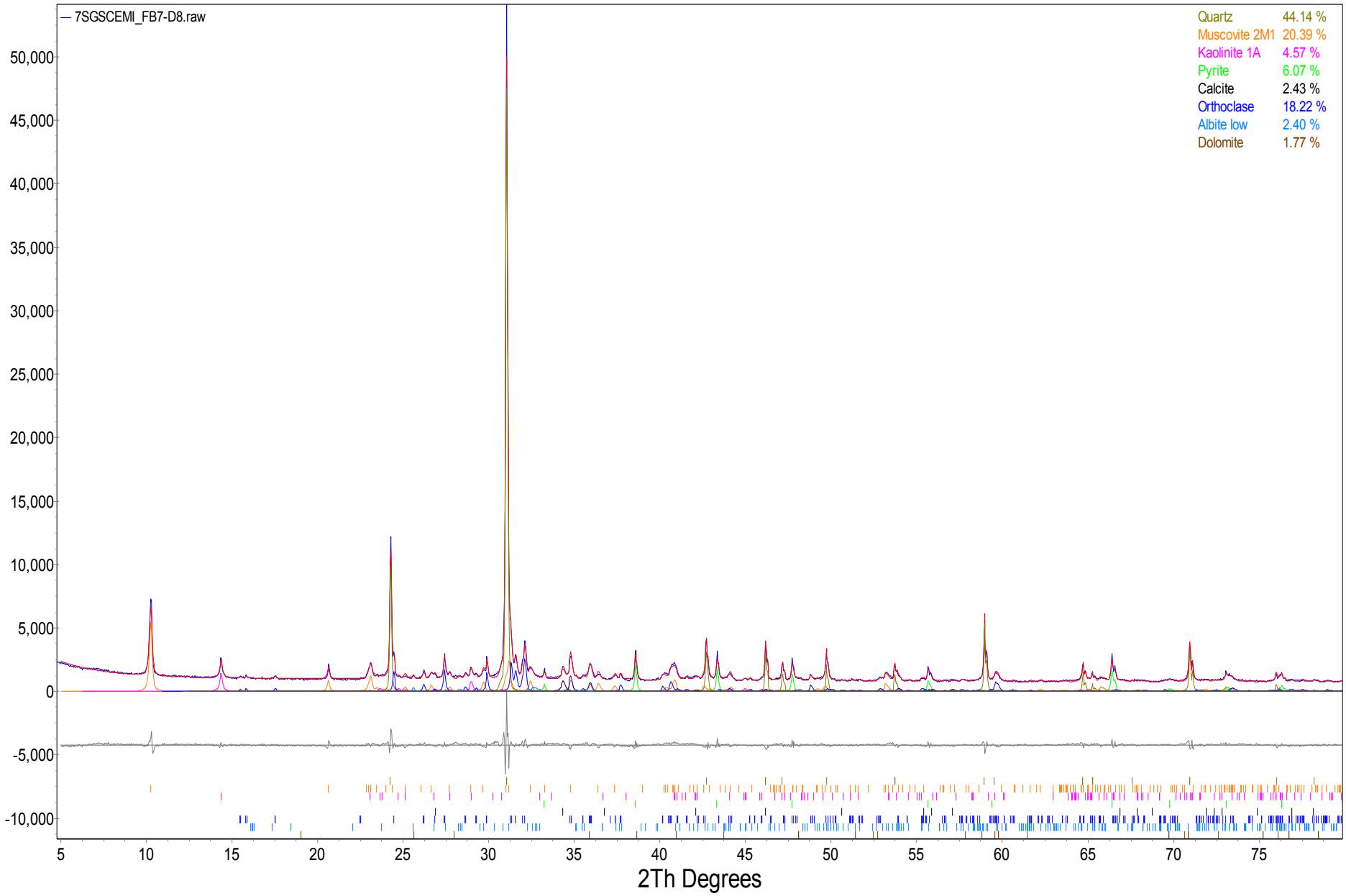


Figure 7. Rietveld refinement plot of sample **SGS CEMI "FB7 #4-3" / Passing #4"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

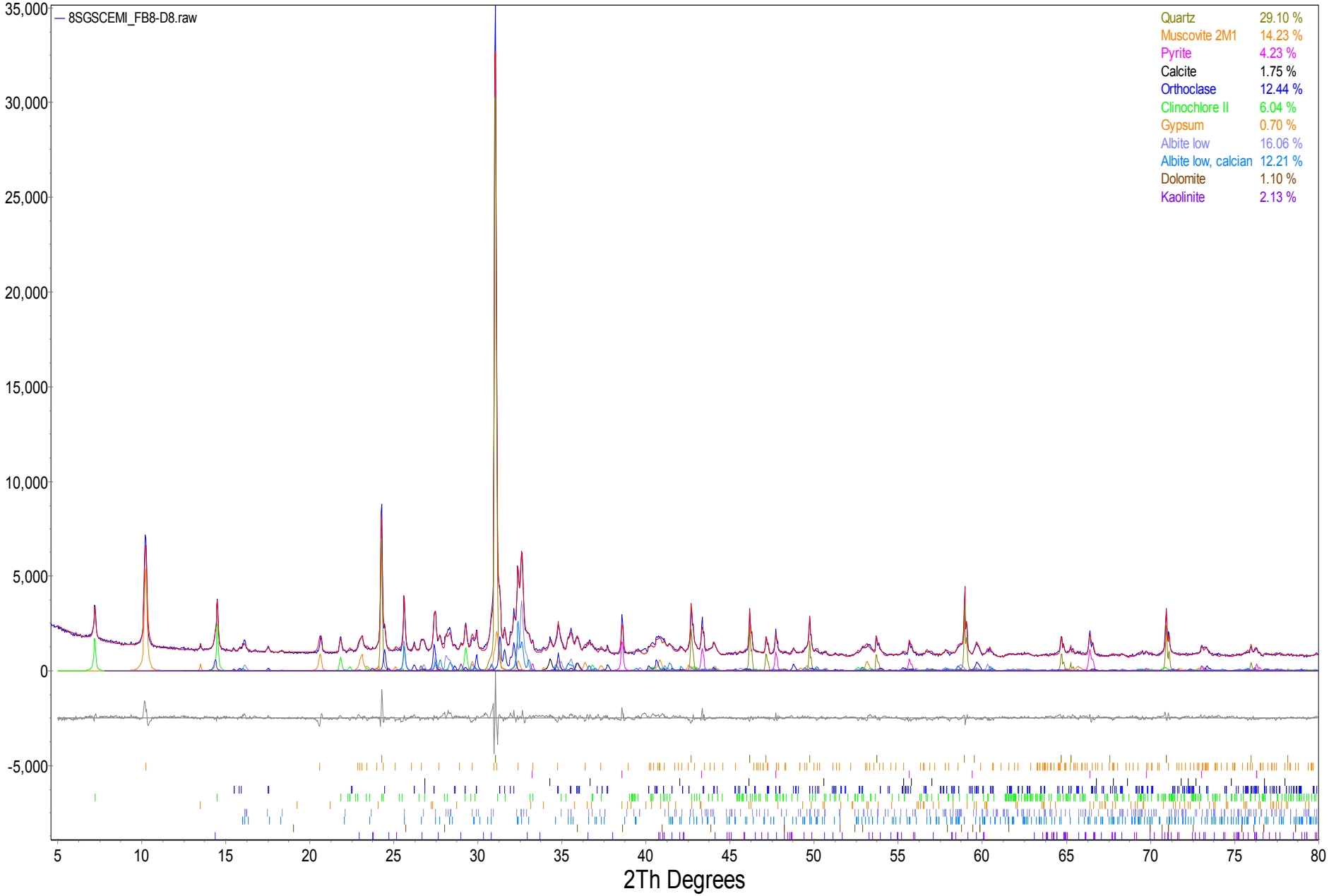


Figure 8. Rietveld refinement plot of sample **SGS CEMI "FB8 #4-3" / Passing #4"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

Appendix C2: Static Test ABA Results

		Parameters	Paste pH	TIC	Total C	Total S	Sulphate S	Sulphide S	Insoluble S	non-sulphate S	TAP	Non-SO_4 AP	SO_4 AP + Non-SO_4AP (for CAP)	CaNP	ScNP	CaNP / TAP	ScNP / non-SO_4 AP	ScNP / TAP	Available CaNP / non-SO_4 AP	CaNP/(SO_4 AP + Non-SO_4AP)	Net NP
		Units	s.u.	%	%	%	%	%	%	%	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	ratio
Kinetic Test ID	*Sample ID / Lab ID*	*Dry Wt (kg)*																			
Sat Col 3			7.6	0.33	0.38	3.1	0.24	2.9	<0.01	2.8	96	89		28	25	0.29	0.28	0.25	0.27		-66
Sat Col 4			7.5	0.28	0.33	4.3	0.27	4.2	<0.01	4.1	135	127		23	21	0.17	0.17	0.16	0.15		-110
Sat Col 5			6.3	0.090	0.11	2.4	0.10	2.3	<0.01	2.3	74	71		7.5	11	0.10	0.15	0.15	0.07		-61
Sat Col 6			3.8	<0.01	0.030	1.6	0.48	1.2	<0.01	1.1	51	36		0.80	-4.1	0.016	-0.12	-0.081	0.003		-41
Sat Col 7			7.6	0.34	0.39	3.0	0.24	2.8	<0.01	2.8	95	88		28	23	0.30	0.27	0.25	0.28		-64
Sat Col 9 (CAP)	Oxide Composite		4.2	<0.01	0.030	0.49	0.20	0.020	0.27	0.29	15	9.1	13.8	0.80	3.3	0.052	0.36	0.22		0.06	2.7
Sat Col 9 (HYP)	Hypogene Composite		8.0	0.50	0.54	2.2	0.41	1.9	<0.01	1.8	69	57		42	40	0.60	0.70	0.57	0.67		-18
Sat Col 12 & 14 (acidic SUP)	upper layers		4.0	<0.01	0.020	1.4	0.35	0.83	0.24	1.1	44	33		0.80	3.8	0.018	0.11	0.086	0.003		-22
Sat Col 13 & 15 (neutral SUP)	Sat Col 13 (upper), Sat Col 15 (full)		7.7	0.080	0.10	1.0	0.020	0.88	0.10	0.98	31	31		6.7	17	0.21	0.54	0.53	0.14		-11
Sat Col 12, 13 & 14 (HYP)	lower layers		8.2	0.77	0.78	2.7	0.030	2.5	0.13	2.6	83	82		64	62	0.77	0.75	0.74	0.74		-16
Col 1			4.4	<0.01	0.070	0.19	0.15	0.050	<0.01	0.040	5.9	1.3	4.8	0.80	5.8	0.13	4.6	0.98		0.17	4.2
Col 2A, Sat Col 2			5.3	<0.01	0.030	0.32	0.31	0.020	<0.01	0.010	10	0.31	7.6	0.80	6.3	0.080	20	0.63		0.11	5.7
Col 2B			5.3	<0.01	0.030	0.31	0.31	0.010	<0.01	<0.01	9.7	0.31	7.6	0.80	5.2	0.083	17	0.54		0.11	4.9
	Col 2B kinetic test residue	8.0	5.5	<0.01	0.020	0.28	0.29	<0.01	<0.01	<0.01	8.8	0.31	7.1	0.80	11	0.091	34	1.2		0.11	11
Col 3			3.9	0.010	0.040	1.2	0.77	0.45	0.010	0.46	38	14	32.4	0.83	0.60	0.022	0.042	0.016		0.03	-13
	Col 3 kinetic test residue	4.1	4.4	<0.01	0.020	0.93	0.67	0.28	<0.01	0.26	29	8.1	23.8	0.80	8.9	0.028	1.1	0.31		0.03	0.12
Col 4a	Oxide pH >6.0		6.5	0.020	0.050	0.16	0.10	0.050	0.010	0.060	5.0	1.9	4.2	1.7	12	0.33	6.3	2.4		0.40	10
	Col 4a kinetic test residue	4.2	7.7	0.020	0.050	0.14	0.070	0.060	0.010	0.070	4.4	2.2	3.8	1.7	18	0.38	8.3	4.1		0.44	16
HC3	08-276		8.4	0.27	0.28	4.2	0.030	4.0	0.23	4.2	132	131		23	32	0.17	0.24	0.24	0.14		-92
HC4	08-294		8.3	0.69	0.72	4.3	0.030	4.2	0.040	4.3	134	133		58	68	0.43	0.51	0.50	0.40		-64
HC5	08-277		8.1	0.21	0.21	2.2	0.070	2.1	0.030	2.1	69	67		18	27	0.25	0.40	0.39	0.21		-39
HC6	08-028		8.1	0.19	0.20	1.8	0.020	1.7	0.14	1.8	57	56		16	27	0.28	0.48	0.48	0.22		-25
HC7	08-043		7.9	0.48	0.51	2.9	0.12	2.7	0.040	2.8	90	87		40	48	0.44	0.56	0.53	0.42		-37
HC7	08-225		6.3	0.10	0.10	3.6	0.030	3.6	0.010	3.6	113	112		8.3	9.2	0.074	0.082	0.081	0.04		-103
HC8	08-143		5.1	<0.01	0.010	4.3	0.030	4.1	0.12	4.3	134	133		0.80	3.2	0.0015	0.024	0.024	0.0001		-126
HC9	08-260		7.9	<0.01	0.010	0.92	0.020	0.86	0.040	0.90	29	28		0.80	14	0.0070	0.51	0.50	0.0004		-13
HC10	08-059		4.7	<0.01	0.010	2.0	0.060	1.7	0.24	1.9	62	60		0.80	4.1	0.0032	0.068	0.066	0.0002		-49
HC10	08-178		5.4	<0.01	0.020	5.1	0.030	4.2	0.85	5.1	160	159		0.80	1.5	0.0013	0.0095	0.0094	0.0001		-131
HC11	08-068		8.2	0.22	0.23	2.3	0.030	2.0	0.29	2.2	71	70		18	33	0.26	0.47	0.47	0.23		-28
HC12	08-058		5.4	<0.01	<0.01	3.1	0.040	2.9	0.13	3.1	97	96		0.80	3.7	0.0021	0.039	0.038	0.001		-88
N/A	08-270		5.5	<0.01	0.010	3.7	0.040	3.9	<0.01	3.7	117	115		<0.8	9.0	0.0069	0.078	0.078	0.001		-112
N/A	08-218		8.3	0.74	0.75	1.4	0.020	1.3	0.080	1.4	44	44		62	61	1.4	1.4	1.4	1.32		20
N/A	08-234		7.9	0.65	0.65	4.2	0.040	4.2	<0.02	4.2	131	130		54	54	0.41	0.42	0.41	0.39		-75
N/A	08-285		8.1	1.5	1.7	1.4	0.030	1.4	0.020	1.4	45	44		125	151	2.8	3.4	3.3	2.75		107
N/A	08-296		8.5	0.43	0.43	3.6	0.030	3.5	0.060	3.6	112	111		36	40	0.32	0.36	0.35	0.29		-70
N/A	08-302		8.1	0.51	0.54	1.3	0.040	1.3	0.020	1.3	42	41		43	60	1.0	1.5	1.4	0.95		20
N/A	08-407		8.5	0.43	0.44	0.54	0.030	0.44	0.070	0.51	17	16		36	37	2.1	2.4	2.2	2.01		24
N/A	08-416		8.9	0.28	0.28	0.62	0.020	0.48	0.12	0.60	19	19		23	31	1.2	1.7	1.6	1.05		16
	Gravel		5.9	<0.01	*ND*	0.42	0.45	<0.01	<0.01	<0.01	13	0.16	10.9	0.80	0.10	0.030	0.64	0.0076		0.07	0.10
FB-1	Sand & Fines		7.8	<0.01	*ND*	0.30	0.22	0.10	<0.01	0.080	9.4	2.5	7.7	0.80	0.60	0.043	0.24	0.064		0.10	-2.5
	Adjusted Average		*6.1*	*<0.01*	*ND*	*0.41*	*0.43*	*0.013*	*<0.01*	*0.011*	*13*	*0.36*		*0.80*	*0.14*	*0.031*	*0.40*	*0.011*			*-0.12*
	Gravel		6.2	<0.01	*ND*	0.34	0.12	0.22	<0.01	0.22	11	6.9	9.7	0.80	5.9	0.038	0.86	0.56		0.08	-0.98
FB-2	Sand & Fines		5.9	<0.01	*ND*	0.26	0.23	0.030	<0.01	0.030	8.1	0.94	6.3	0.80	3.3	0.049	3.5	0.41		0.13	2.4
	Adjusted Average		*6.1*	*<0.01*	*ND*	*0.31*	*0.16*	*0.14*	*<0.01*	*0.14*	*9.6*	*4.5*		*0.80*	*4.9*	*0.042*	*1.1*	*0.50*			*0.36*
	Gravel		5.8	<0.01	*ND*	0.19	0.18	0.020	<0.01	0.010	5.9	0.31	4.5	0.80	2.8	0.067	9.0	0.47		0.18	2.2
FB-3	Sand & Fines		5.9	<0.01	*ND*	0.36	0.37	0.020	<0.01	<0.01	11	0.16	9.0	0.80	1.7	0.036	11	0.15		0.09	1.1
	Adjusted Average		*5.8*	*<0.01*	*ND*	*0.20*	*0.19*	*0.020*	*<0.01*	*0.0097*	*6.2*	*0.30*		*0.80*	*2.7*	*0.064*	*9.0*	*0.44*			*2.1*
	Gravel		5.3	<0.01	*ND*	1.6	1.4	0.10	0.050	0.15	48	4.7	37.5	0.80	-0.40	0.0083	-0.085	-0.0083		0.02	-3.5
FB-4	Sand & Fines		5.7	<0.01	*ND*	1.4	1.1	0.38	<0.01	0.33	45	10	36.1	0.80	0.50	0.0090	0.048	0.011		0.02	-11
	Adjusted Average		*5.3*	*<0.01*	*ND*	*1.5*	*1.4*	*0.11*	*0.048*	*0.16*	*48*	*4.9*		*0.80*	*-0.36*	*0.0083*	*-0.074*	*-0.0075*			*-3.8*
	Gravel		8.1	0.030	*ND*	1.4	0.11	1.2	0.050	1.3	43	40		2.5	13	0.058	0.32	0.30	0.004		-25
FB-5	Sand & Fines		7.3	<0.01	*ND*	2.8	0.29	2.6	<0.01	2.5	87	78		0.80	10	0.0046	0.13	0.12	0.001		-72
	Adjusted Average		*8.0*	*0.027*	*ND*	*1.5*	*0.13*	*1.4*	*0.045*	*1.4*	*48*	*44*		*2.3*	*13*	*0.048*	*0.29*	*0.26*			*-30*
	Gravel		8.4	0.24	*ND*	1.5	0.18	1.3	0.060	1.3	47	41		20	26	0.43	0.63	0.55	0.48		-13
FB-6	Sand & Fines		8.0	0.35	*ND*	6.7	0.62	5.9	0.15	6.0	208	188		29	34	0.14	0.18	0.16	0.15		-150
	Adjusted Average		*8.4*	*0.24*	*ND*	*1.6*	*0.19*	*1.4*	*0.062*	*1.4*	*51*	*45*		*20*	*26*	*0.40*	*0.58*	*0.51*	*0.45*		*-17*
	Gravel		8.5	0.44	*ND*	3.0	0.060	3.0	<0.01	3.0	94	93		37	38	0.39	0.41	0.40	0.36		-55
FB-7	Sand & Fines		8.2	0.51	*ND*	1.8	0.060	1.6	0.12	1.7	55	53		43	55	0.78	1.0	1.0	0.73		6.0
	Adjusted Average		*8.5*	*0.45*	*ND*	*2.9*	*0.060*	*2.8*	*0.020*	*2.8*	*89*	*87*		*37*	*40*	*0.42*	*0.46*	*0.45*			*-47*
	Gravel		8.4	0.34	*ND*	1.8	0.10	1.7	0.00	1.7	55	52		28	34	0.52	0.66	0.62	0.47		-18
FB-8	Sand & Fines		8.3	0.52	*ND*	5.7	0.51	4.9	0.38	5.2	179	163		43	41	0.24	0.25	0.23	0.24		-111
	Adjusted Average		*8.4*	*0.34*	*ND*	*1.9*	*0.11*	*1.7*	*0.010*	*1.8*	*58*	*55*		*29*	*34*	*0.49*	*0.62*	*0.59*			*-20*
HC1	HC Ore 1		7.9	0.32	0.34	1.5	0.25	1.1	0.19	1.3	34	40		27	35	0.78	0.88	1.0	0.57		0.94
HC2	HC Ore 2		5.4	0.080	0.11	1.2	0.040	0.99	0.20	1.2	31	37		6.7	10	0.22	0.27	0.32	0.116		-21

Note:
Available CaNP subtracts the unavailable CaNP from the CaNP. The unavailable CaNP is 2.36 $kgCaCO_3/t$ for the SUP and 3.72 $kgCaCO_3/t$ for the HYP.

Appendix C3: Static Test Aqua Regia Metals Results

Parameter		Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
Units		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Kinetic Test ID	*Sample ID / Lab ID*																																				
Sat Col 3		1.1	0.94	23	273	<20	48	10	0.98	1.2	19	85	760	3.9	3.0	<0.01	0.40	16	0.45	249	75	0.014	7.6	0.059	11	3.1	0.70	2.6	2.3	56	14	0.034	0.20	9.1	25	1.2	102
Sat Col 4		0.90	0.81	21	287	<20	27	4.2	0.87	0.50	22	83	895	4.2	2.0	0.020	0.33	15	0.32	297	37	0.016	7.4	0.051	8.2	4.2	0.50	1.9	3.0	42	13	0.014	0.20	7.7	18	3.0	36
Sat Col 5		0.80	1.1	8.1	95	<20	111	2.0	0.25	<0.1	18	80	773	2.6	2.0	<0.01	0.36	17	0.29	103	48	0.015	7.7	0.042	4.6	2.4	0.60	1.6	1.8	11	14	0.0070	0.20	5.8	14	1.5	15
Sat Col 6		1.2	0.70	29	167	<20	85	6.4	0.020	<0.1	11	92	438	2.6	2.0	<0.01	0.38	18	0.10	45	39	0.013	3.3	0.031	7.6	1.7	0.40	0.90	2.6	12	15	0.0020	0.20	4.6	9.0	1.7	13
Sat Col 7		0.90	0.94	23	616	<20	80	9.7	1.0	0.60	19	77	744	3.6	3.0	<0.01	0.39	20	0.44	277	40	0.014	6.7	0.060	17	3.0	0.90	2.6	2.6	48	15	0.035	0.20	9.5	23	0.80	54
Sat Col 9 (CAP)	Oxide Composite	1.0	0.81	15	66	<20	321	2.4	0.030	<0.1	1.5	50	165	2.4	2.0	<0.01	0.42	18	0.18	41	124	0.036	2.8	0.040	15	0.47	1.3	1.7	2.9	27	7.1	0.013	0.30	2.5	16	1.5	30
Sat Col 9 (HYP)	Hypogene Composite	0.50	1.4	8.6	35	<20	58	1.0	1.8	0.20	16	72	671	3.3	4.0	<0.01	0.47	14	0.92	281	25	0.068	7.6	0.055	6.0	2.0	0.70	5.9	1.6	44	10	0.066	0.40	3.9	55	0.40	37
Sat Col 12 & 14 (acidic SUP)	upper layers	0.96	0.86	8.0	40	267	0.30	1.7	0.090	0.090	10	76	813	2.5	2.0	0.020	0.33	21	0.26	46	120	0.020	7.7	370	5.5	1.6	1.3	2.4	1.0	11	16	0.010	0.22	4.3	13	1.2	14
Sat Col 13 & 15 (neutral SUP)	Col 13 (upper), Col 15 (full)	0.46	1.2	5.0	40	147	0.50	1.0	0.30	0.19	9.4	83	455	2.9	5.1	0.030	0.32	14	0.76	222	60	0.040	12	590	4.1	1.1	0.30	4.5	<1	18	13	0.060	0.20	3.3	33	3.0	48
Sat Col 12, 13 & 14 (HYP)	lower layers	0.45	0.82	10	40	143	0.50	2.5	1.8	0.10	19	83	495	3.9	2.8	0.020	0.37	17	0.72	175	30	0.020	10	600	6.9	3.0	0.73	3.5	2.0	63	12	0.020	0.23	3.9	26	1.0	19
Col 1		1.2	2.8	17	73	<20	498	0.90	0.060	<0.1	3.1	45	318	3.0	6.0	<0.01	0.53	15	0.96	93	396	0.033	6.0	0.064	9.1	0.18	0.90	6.1	1.2	74	8.9	0.091	0.30	7.2	62	0.50	22
Col 2A		0.80	0.85	8.7	49	<20	302	1.8	0.12	<0.1	1.9	72	164	1.6	3.0	<0.01	0.31	16	0.16	39	17	0.045	2.6	0.021	23	0.32	1.1	1.5	1.8	20	9.1	0.012	0.10	1.4	12	1.0	16
Col 2B		0.80	0.82	8.6	48	<20	328	2.1	0.11	<0.1	1.3	72	124	1.5	3.0	<0.01	0.31	16	0.15	33	16	0.044	2.8	0.020	23	0.32	1.2	1.5	1.7	21	8.6	0.012	0.20	1.3	11	1.0	12
Col 3		1.0	0.94	12	49	<20	181	1.4	0.080	<0.1	3.5	59	308	2.6	2.0	<0.01	0.52	16	0.20	34	77	0.020	3.8	0.021	19	1.3	0.10	1.4	3.7	22	8.9	0.0030	0.20	1.2	10	2.2	9.0
Col 4a	Oxide pH >6.0	0.70	1.7	12	81	<20	389	1.2	0.33	<0.2	6.1	60	461	2.5	4.0	<0.03	0.33	17	0.65	118	91	0.057	6.4	0.049	15	0.15	2.2	4.8	1.2	29	8.4	0.060	0.30	3.0	42	0.80	44
HC3	08-276	0.80	1.4	1.8	120	<20	37	0.50	0.98	0.20	22	78	845	4.7	5.0	<0.01	0.54	20	0.95	188	71	0.022	20	0.069	2.7	3.8	0.20	2.1	1.9	25	6.8	0.025	0.30	18	25	2.3	31
HC4	08-294	0.30	2.3	<0.5	33	<20	13	0.20	2.6	0.10	63	44	809	5.3	5.0	<0.01	0.72	12	1.3	155	14	0.062	7.2	0.095	5.8	4.2	0.40	7.8	8.4	57	6.0	0.078	0.60	5.7	76	0.20	23
HC5	08-277	0.60	1.8	3.0	159	<20	93	0.70	0.88	<0.1	22	80	580	4.2	6.0	<0.01	0.78	32	1.3	205	73	0.039	19	0.081	1.8	2.2	0.20	3.1	1.6	49	7.1	0.055	0.40	4.6	31	2.2	23
HC6	08-028	0.70	1.3	14	87	<20	87	1.6	0.86	<0.1	12	107	557	2.5	4.0	<0.01	0.58	28	0.91	110	11	0.017	14	0.071	3.4	1.9	0.20	1.8	1.7	16	8.0	0.034	0.60	2.6	21	5.7	13
HC7	08-043	0.40	0.75	33	241	<20	102	1.3	2.0	0.20	39	101	455	2.9	2.0	<0.01	0.20	13	0.56	268	13	0.0090	5.1	0.055	11	2.9	0.50	1.2	2.0	111	12	0.0020	0.10	7.2	9.0	1.6	26
HC7	08-225	1.1	0.35	23	27	<20	107	3.1	0.22	0.30	12	35	645	3.5	1.0	<0.01	0.21	25	0.10	122	70	0.0060	8.9	0.047	22	3.5	0.60	1.3	2.7	13	13	0.0010	0.20	2.9	<2	0.30	21
HC8	08-143	0.60	0.37	6.3	28	<20	53	2.8	0.030	0.10	9.1	40	373	3.7	<1	<0.01	0.22	15	0.050	16	26	0.0060	9.9	0.066	11	3.8	0.30	0.70	1.9	57	9.5	<0.001	0.10	4.7	<2	0.20	14
HC9	08-260	0.50	1.2	3.9	25	<20	242	0.40	0.33	0.20	7.9	66	604	2.7	5.0	<0.01	0.43	12	0.79	174	14	0.092	8.1	0.082	2.4	0.90	<0.1	3.3	2.2	53	7.5	0.17	0.10	3.9	40	2.8	33
HC10	08-059	2.0	0.42	44	36	<20	103	0.40	0.050	0.50	20	104	607	1.9	<1	0.10	0.12	18	0.050	28	84	0.013	7.3	0.018	6.6	2.0	30	1.2	2.8	17	27	<0.001	0.30	4.8	6.0	0.80	71
HC10	08-178	0.60	0.28	16	63	<20	42	5.4	0.030	<0.1	21	62	428	4.5	<1	<0.01	0.17	13	0.020	13	223	0.0060	5.8	0.038	7.0	4.7	0.30	0.80	1.5	86	21	<0.001	<0.1	5.0	2.0	5.0	4.0
HC11	08-068	0.40	2.2	8.0	75	<20	102	0.60	1.2	<0.1	27	92	840	4.1	8.0	<0.01	0.67	17	1.6	163	4.3	0.050	4.8	0.098	3.9	2.3	0.30	10	4.3	31	7.2	0.071	0.50	5.0	89	0.40	29
HC12	08-058	0.50	0.33	7.7	17	<20	45	0.90	0.070	0.20	12	123	635	2.7	<1	0.010	0.13	19	0.020	11	4.4	0.013	3.3	0.029	6.8	3.1	13	0.50	4.3	23	16	<0.001	<0.1	4.1	<2	0.70	28
N/A	08-270	0.60	2.2	1.5	16	<20	81	0.30	0.040	<0.1	28	30	1482	5.0	6	0.010	0.54	10	1.1	160	31.9	0.019	14	0.049	3.3	3.5	0.20	2.1	3.0	21	7.4	0.012	0.30	6.8	18	9.4	25
N/A	08-218	1.7	0.57	13	237	<20	23	2.1	1.6	0.80	11	51	1584	2.0	1	0.060	0.20	17	0.54	263	391	0.0090	12	0.077	16	1.3	3.8	2.8	1.5	23	8.1	0.0020	0.20	9.8	15	0.70	28
N/A	08-234	0.40	0.34	120	86	<20	81	1.0	1.2	1.3	19	41	74	3.7	<1	0.11	0.19	6	0.48	2524	3.5	0.010	3.0	0.045	33	3.9	7.5	1.5	3.8	14	11	0.0010	0.30	4.2	7.0	1.0	77
N/A	08-285	0.40	2.4	14	95	<20	47	0.30	4.8	0.60	39	21	602	4.6	7	0.050	0.71	24	1.3	1420	6.2	0.049	6.5	0.13	8.4	1.4	1.1	12	1.3	53	4.7	0.091	0.50	5.5	101	0.10	137
N/A	08-296	0.20	1.2	1.7	21	<20	24	0.30	1.4	<0.1	28	52	492	4.1	4	<0.01	0.36	19	0.93	74	6.0	0.042	11	0.064	4.1	3.7	0.20	4.6	5.1	50	15	0.014	0.30	7.9	42	0.30	9.0
N/A	08-302	1.0	1.3	8.3	128	<20	63	1.3	2.2	<0.1	11	93	1587	2.1	3	0.010	0.40	33	0.56	166	169	0.038	5.6	0.045	5.5	1.4	0.20	4.2	1.4	36	11	0.026	0.30	5.4	31	33	21
N/A	08-407	0.30	0.38	7.8	44	<20	388	0.80	1.0	0.10	3	50	433	0.77	<1	0.020	0.17	27	0.36	321	93.9	0.012	3.2	0.028	6.5	0.55	1.8	1.9	0.60	38	22	0.0010	<0.1	4.6	7.0	0.60	13
N/A	08-416	0.40	1.4	3.2	56	<20	307	0.20	1.5	0.20	8	57	915	1.5	4	<0.01	0.16	8	0.50	105	20.9	0.21	3.4	0.045	5.6	0.57	0.30	2.7	1.6	92	5.5	0.014	0.10	2.1	22	0.10	20
	Gravel	0.70	0.24	10	62	*ND*	205	1.5	<0.1	<0.1	0.30	104	31	1.3	2.0	0.020	0.33	8.0	0.020	12	14	0.0080	1.8	0.015	15	0.41	1.2	0.80	2.8	5.0	14	0.0020	0.20	0.50	4.0	2.0	3.0
FB-1	Sand & Fines	0.70	0.20	8.4	112	*ND*	339	2.0	0.040	<0.1	0.40	91	18	0.94	1.0	<0.01	0.26	10	0.020	21	17	0.010	2.1	0.0090	15	0.26	1.5	0.50	5.8	5.0	5.6	0.0040	0.10	0.60	4.0	4.4	5.0
	Adjusted Average	*0.70*	*0.24*	*10.0*	*66*	*ND*	*216*	*1.5*	*0.0080*	*<0.1*	*0.31*	*103*	*30*	*1.3*	*1.9*	*0.019*	*0.32*	*8.2*	*0.020*	*13*	*14*	*0.0082*	*1.8*	*0.014*	*15*	*0.40*	*1.2*	*0.77*	*3.1*	*5.0*	*13*	*0.0022*	*0.19*	*0.51*	*4.0*	*2.2*	*3.2*
	Gravel	1.3	1.8	16	72	*ND*	432	0.80	0.040	0.40	3.7	69	313	2.7	5.0	<0.01	0.55	8.0	0.87	84	400	0.030	5.1	0.054	7.4	0.29	2.1	5.7	1.7	59	5.8	0.086	0.50	5.2	56	0.80	19
FB-2	Sand & Fines	1.2	1.9	23	144	*ND*	443	1.2	0.080	0.80	2.7	64	381	2.9	4.0	0.010	0.44	19	0.68	84	495	0.057	5.2	0.075	12	0.22	3.8	5.1	1.9	88	7.9	0.057	0.30	8.1	45	0.90	23
	Adjusted Average	*1.3*	*1.9*	*19*	*101*	*ND*	*436*	*0.96*	*0.056*	*0.56*	*3.3*	*67*	*340*	*2.8*	*4.6*	*0.0070*	*0.51*	*12*	*0.79*	*84*	*438*	*0.041*	*5.1*	*0.062*	*9.0*	*0.26*	*2.8*	*5.5*	*1.8*	*71*	*6.6*	*0.074*	*0.42*	*6.4*	*52*	*0.84*	*21*
	Gravel	0.80	0.51	83	57	*ND*	102	2.4	0.030	0.20	1.4	119	302	1.3	1.0	0.040	0.30	25	0.20	25	212	0.013	3.5	0.034	8.3	0.18	3.6	2.4	1.7	16	9.7	0.010	0.20	2.0	17	0.60	16
FB-3	Sand & Fines	1.3	1.0	127	188	*ND*	163	5.1	0.10	0.80	3.5	99	724	3.2	2.0	0.070	0.45	40	0.32	70	474	0.029	6.0	0.094	24	0.36	15	4.1	3.9	59	19	0.015	0.30	7.9	30	1.4	44
	Adjusted Average	*0.83*	*0.54*	*85*	*64*	*ND*	*105*	*2.5*	*0.034*	*0.23*	*1.5*	*118*	*324*	*1.4*	*1.1*	*0.042*	*0.31*	*26*	*0.21*	*27*	*225*	*0.014*	*3.6*	*0.037*	*9.1*	*0.19*	*4.2*	*2.5*	*1.8*	*18*	*10*	*0.010*	*0.21*	*2.3*	*18*	*0.64*	*17*
	Gravel	0.80	0.48	18	145	*ND*	208	1.7	0.010	0.20	1.4	89	96	3.5	5.0	<0.01	0.75	18	0.030	58	93	0.044	2.0	0.046	8.3	1.3	0.70	1.5	2.0	46	13	0.0060	0.50	0.80	9.0	9.0	24
FB-4	Sand & Fines	1.6	0.38	26	330	*ND*	202	3.3	0.030	0.20	1.5	95	95	3.9	5.0	0.020	0.72	19	0.030	67	149	0.063	2.6	0.037	21	1.3	1.5	1.1	2.9	40	15	0.0040	0.80	1.0	9.0	7.3	37
	Adjusted Average	*0.83*	*0.48*	*19*	*152*	*ND*	*208*	*1.8*	*0.011*	*0.20*	*1.4*	*89*	*96*	*3.5*	*5.0*	*0.0056*	*0.75*	*18*	*0.030*	*58*	*96*	*0.045*	*2.0*	*0.046*	*8.8*	*1.3*	*0.73*	*1.5*	*2.0*	*46*	*13*	*0.0059*	*0.51*	*0.81*	*9.0*	*8.9*	*25*
	Gravel	0.50	0.78	14	54	*ND*	256	1.4	0.27	0.60	15	111	1583	2.2	3.0	0.020	0.22	13	0.37	77	20	0.058	4.3	0.044	12	1.3	2.9	2.1	3.2	54	16	0.011	0.20	2.8	20	0.90	39
FB-5	Sand & Fines	0.50	0.82	21	64	*ND*	130	1.6	0.23	1.1	26	100	1435	3.8	3.0	0.030	0.25	17	0.34	120	30	0.050	4.9	0.056	37	2.6	3.0	3.4	5.4	87	23	0.0080	0.20	4.1	17	1.4	60
	Adjusted Average	*0.50*	*0.78*	*14*	*55*	*ND*	*243*	*1.4*	*0.27*	*0.65*	*16*	*110*	*1567*	*2.3*	*3.0*	*0.021*	*0.22*	*13*	*0.37*	*82*	*21*	*0.057*	*4.4*	*0.045*	*15*	*1.4*	*2.9*	*2.2*	*3.4*	*58*	*17*	*0.011*	*0.20*	*2.9*	*20*	*0.95*	*41*
	Gravel	0.60	0.88	5.5	86	*ND*	98	0.50	1.1	0.20	13	113	659	1.9	3.0	<0.01	0.22	15	0.47	118	39	0.067	4.2	0.046	6.4	1.4	1.0	2.8	1.7	57	8.6	0.020	0.10	4.2	21	0.70	21
FB-6	Sand & Fines	1.5	1.2	22	162	*ND*	69	3.1	2.0	0.60	40	107	1593	6.1	3.0	0.030	0.20	17	0.47	180	79	0.084	7.1	0.057	39	6.0	1.9	3.5	6.4	122	11	0.015	0.20	9.3	23	1.5	62
	Adjusted Average	*0.62*	*0.89*	*5.9*	*88*	*ND*	*97*	*0.57*	*1.2*	*0.21*	*13*	*113*	*683*	*2.0*	*3.0*	*0.0056*	*0.22*	*15*	*0.47*	*120*	*40*	*0.067*	*4.3*	*0.046*	*7.2*	*1.5*	*1.0*	*2.8*	*1.8*	*59*	*8.7*	*0.020*	*0.10*	*4.3*	*21*	*0.72*	*22*
	Gravel	0.50	0.50	8.7	30	*ND*	119	1.7	1.2	0.10	17	119	413	3.2	2.0	<0.01	0.25	8.0	0.34	144	47	0.016	8.4	0.045	9.4	2.9	5.5	1.9	2.5	26	11	0.012	0.20	3.0	14	1.1	14
FB-7	Sand & Fines	1.0	1.3	15	49	*ND*	167	0.70	1.7	0.50	20	68	683	2.8	4.0	0.020	0.55	12	0.87	177	44	0.034	9.1	0.073	24	1.5	9.7	6.0	2.9	45	11	0.060	0.50	3.5	45	0.80	39
	Adjusted Average	*0.56*	*0.60*	*9.5*	*33*	*ND*	*125*	*1.6*	*1.3*	*0.15*	*18*	*112*	*448*	*3.1*	*2.3*	*0.0069*	*0.29*	*8.5*	*0.41*	*148*	*47*	*0.018*	*8.5*	*0.049*	*11*	*2.7*	*6.0*	*2.4*	*2.6*	*28*	*11*	*0.018*	*0.24*	*3.1*	*18*	*1.1*	*17*
	Gravel	0.40	1.0	3.8	28	*ND*	112	0.80	1.1	1.0	11	98	507	2.8	4.0	<0.01	0.37	17	0.97	173	52	0.031	15	0.078	7.4	1.7	0.30	2.4	1.4	55	6.3	0.053	0.20	3.1	26	25	49
FB-8	Sand & Fines	0.70	1.1	15	39	*ND*	75	2.5	2.0	2.6	31	110	639	5.5	4.0	<0.01	0.43	23	0.85	280	170	0.031	22	0.083	20	5.2	0.70	2.7	4.0	118	7.7	0.041	0.30	5.5	26	>100	87
	Adjusted Average	*0.41*	*1.0*	*4.1*	*28*	*ND*	*111*	*0.85*	*1.1*	*1.0*	*11*	*98*	*511*	*2.8*	*4.0*	*0.0050*	*0.37*	*17*	*0.97*	*176*	*55*	*0.031*	*15*	*0.078*	*7.7*	*1.8*	*0.31*	*2.4*	*1.5*	*57*	*6.3*	*0.053*	*0.20*	*3.2*	*26*	*27*	*50*
HC1	HC Ore 1	1.1	0.94	11	143	<20	52	1.0	1.2	0.10	14	78	1656	1.9	3.0	0.020	0.26	16	0.62	148	160	0.063	7.9	0.041	5.7	1.5	1.4	3.2	2.3	57	12	0.022	0.10	4.2	23	0.60	23
	HC1 kinetic test residue	1.2	0.96	10	124	<20	171	0.80	0.99	<0.1	13	62	1525	1.9	3.0	<0.01	0.26	17	0.61	146	208	0.060	7.6	0.041	5.1	1.4	1.2	3.1	1.4	44	10	0.023	0.20	3.4	23	0.40	23
HC2	HC Ore 2	0.80	0.81	10	258	<20	92	1.0	0.24	1.0	11	77	2496	1.7	2.0	0.020	0.17	26	0.21	100	161	0.024	7.8	0.040	20	1.2	2.8	2.0	1.7	21	13	0.0030	<0.1	6.7	13	0.90	42
	HC2 kinetic test residue	1.0	0.74	8.4	65	<20	85	0.70	0.21	0.80	10	65	2371	1.6	1.0	0.010	0.16	20	0.21	87	128	0.017	6.5	0.037	15	1.3	2.2	2.0	1.1	17	11	0.0030	<0.1	5.5	12	0.50	38

Appendix D
Static Test Results for Drill Core Samples

CASINO
COPPER AND GOLD

Appendix D1: Static Test ABA Results

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Overburden (OVB) samples																								
Phase I	08-124	OVB			ARG		7.5	***0.005***	***0.4***	0.05	0.03	0.05	***0.0025***	***0.005***	***0.005***		0.94	0.08	***0.15***	13.30	13.30	5.12		None
Phase II	08-400	OVB	WASTE	WR	ARG	POT	7.4	***0.005***	***0.4***	0.03	0.02	0.02	***0.0025***	***0.005***	***0.005***		0.63	0.08	***0.15***	23.46	23.46	5.12		None
Phase IV	LX-11-297	OVB	WASTE	WR	ARG		4.56																	
Oxide Leach Cap (CAP) - Ore Designated Samples																								
Phase I	08-014	CAP	ORE	WR	PHY	ARG	4.63	***0.005***	***0.4***	***0.005***	6.92	0.06	6.86	6.88	***0.005***	215.8	216.25	214.38	215.00	2.20	-212.80	0.002		None
Phase I	08-077	CAP	ORE	WR	ARG	PHY	5.85	***0.005***	***0.4***	***0.005***	0.57	0.61	0.0025	0.03	***0.005***	14.4	17.81	0.08	0.94	1.00	0.06	0.028		None
Phase I	08-078	CAP	ORE	IX	ARG	POT	5.67	0.01	0.8	0.04	0.17	0.2	0.0025	0.01	***0.005***	4.8	5.31	0.08	0.31	9.00	8.69	0.175		None
Phase I	08-095	CAP	ORE	WR			5.28	***0.005***	***0.4***	0.05	0.28	0.34	0.0025	0.02	***0.005***	8.0	8.75	0.08	0.63	4.30	3.68	0.050		None
Phase I	08-097	CAP	ORE	WR	ARG	PHY	4.35	0.01	0.8	0.03	0.04	0.07	0.0025	0.02	***0.005***	1.7	1.25	0.08	0.63	3.70	3.08	0.485		None
Phase I	08-114	CAP	ORE	WR	ARG	PHY	7.05	0.01	0.8	0.14	0.02	0.03	0.0025	0.04	***0.005***	0.8	0.63	0.08	1.25	12.00	10.75	1.067		Slight
Phase I	08-128	CAP	ORE	IX	ARG		5.2	***0.005***	***0.4***	0.01	0.15	0.17	0.0025	0.02	***0.005***	4.1	4.69	0.08	0.63	2.60	1.98	0.098		None
Phase II	08-144	CAP	ORE	WR	ARG	PHY	5.61	***0.005***	***0.4***	0.02	1.38	1.32	0.06	0.02	0.04	32.8	43.13	1.87	0.63	1.23	0.60	0.012		None
Phase II	08-145	CAP	ORE	WR	ARG	PHY	5.43	***0.005***	***0.4***	0.01	1.29	1.19	0.1	0.04	0.06	31.0	40.31	3.13	1.25	3.32	2.07	0.013		None
Phase II	08-147	CAP	ORE	WR	ARG		5.75	***0.005***	***0.4***	0.02	1.03	1.01	0.02	0.01	0.01	24.3	32.19	0.63	0.31	5.04	4.72	0.016		None
Phase II	08-152	CAP	ORE	WR	ARG	PHY	4.94	***0.005***	***0.4***	0.01	0.75	0.59	0.16	0.15	0.01	18.8	23.44	5.00	4.69	0.98	-3.70	0.021		None
Phase II	08-155	CAP	ORE	WR	PHY	ARG	4.91	***0.005***	***0.4***	0.01	7.97	0.04	7.93	7.42	0.51	248.8	249.06	247.81	231.88	2.70	-229.17	0.002		None
Phase II	08-170	CAP	ORE	IX	ARG	PHY	3.48	***0.005***	***0.4***	0.02	2.17	2.15	0.02	0.02	***0.005***	51.0	67.81	0.63	0.63	-2.70	-3.33	0.008		None
Phase II	08-171	CAP	ORE	IX	ARG	PHY	3.76	***0.005***	***0.4***	0.01	2.5	2.46	0.04	0.03	0.01	58.9	78.13	1.25	0.94	-0.37	-1.31	0.007		None
Phase II	08-210	CAP	ORE	IX	ARG	POT	4.66	***0.005***	***0.4***	0.02	0.24	0.24	0.0025	***0.005***	***0.005***	5.7	7.50	0.08	***0.15***	1.25	1.25	0.070		None
Phase II	08-211	CAP	ORE	IX	POT		3.9	***0.005***	***0.4***	0.02	0.49	0.44	0.05	0.03	0.02	11.9	15.31	1.56	0.94	-1.13	-2.07	0.034		None
Phase II	08-244	CAP	ORE	WR	POT	ARG	4.8	***0.005***	***0.4***	0.01	0.61	0.61	0.0025	***0.005***	***0.005***	14.4	19.06	0.08	***0.15***	2.96	2.96	0.028		None
Phase II	08-249	CAP	ORE	WR	ARG	PHY	4.85	***0.005***	***0.4***	0.01	1.02	0.16	0.86	0.86	***0.005***	30.6	31.88	26.88	26.88	1.60	-25.27	0.013		None
Phase II	08-253	CAP	ORE	IX	ARG	POT	4.98	***0.005***	***0.4***	0.02	0.46	0.5	0.0025	***0.005***	***0.005***	11.8	14.38	0.08	***0.15***	6.65	6.65	0.034		None
Phase II	08-254	CAP	ORE	IX	ARG	POT	4.49	***0.005***	***0.4***	0.03	0.26	0.28	0.0025	***0.005***	***0.005***	6.6	8.13	0.08	***0.15***	6.40	6.40	0.060		None
Phase II	08-297	CAP	ORE	WR	ARG		5.57	***0.005***	***0.4***	0.02	0.1	0.05	0.05	0.05	***0.005***	2.7	3.13	1.56	1.56	3.45	1.89	0.146		None
Phase II	08-298	CAP	ORE	WR	ARG		5.69	***0.005***	***0.4***	0.03	0.06	0.09	0.0025	0.01	***0.005***	2.2	1.88	0.08	0.31	4.43	4.12	0.183		None
Phase II	08-314	CAP	ORE	WR	ARG		4.96	***0.005***	***0.4***	0.04	0.04	0.04	0.0025	***0.005***	***0.005***	1.0	1.25	0.08	***0.15***	5.42	5.42	0.394		None
Phase II	08-315	CAP	ORE	WR	ARG		5.22	***0.005***	***0.4***	0.05	0.23	0.23	0.0025	***0.005***	***0.005***	5.5	7.19	0.08	***0.15***	4.80	4.80	0.073		None
Phase II	08-321	CAP	ORE	WR	ARG	POT	4.97	***0.005***	***0.4***	0.04	0.07	0.07	0.0025	***0.005***	***0.005***	1.7	2.19	0.08	***0.15***	5.05	5.05	0.233		None
Phase II	08-343	CAP	ORE	IX	ARG	POT	5.2	***0.005***	***0.4***	0.01	0.25	0.25	0.0025	***0.005***	***0.005***	5.9	7.81	0.08	***0.15***	9.98	9.98	0.067		None
Phase II	08-357	CAP	ORE	WR	ARG		5.16	***0.005***	***0.4***	0.04	0.02	0.02	0.0025	***0.005***	***0.005***	0.5	0.63	0.08	***0.15***	9.71	9.71	0.731		None
Phase II	08-358	CAP	ORE	WR	ARG		4.99	***0.005***	***0.4***	0.03	0.25	0.14	0.11	0.11	***0.005***	6.7	7.81	3.44	3.44	7.00	3.56	0.060		None
Phase II	08-433	CAP	ORE	WR	ARG		5.03	***0.005***	***0.4***	0.03	0.3	0.29	0.01	***0.005***	0.01	7.1	9.38	0.31	***0.15***	3.48	3.48	0.056		None
Phase II	08-435	CAP	ORE	WR	ARG		5.29	***0.005***	***0.4***	0.06	0.09	0.08	0.01	***0.005***	0.01	2.2	2.81	0.31	***0.15***	5.20	5.20	0.183		None
Phase III	09-01	CAP	ORE	PP	ARG		4.68	***0.005***	***0.4***	0.01	1.2	1.12	0.08	***0.005***	0.08	28.8	37.50	2.50	***0.15***	-0.10	-0.10	0.014		None
Phase III	09-02	CAP	ORE	PP	ARG		3.86	***0.005***	***0.4***	0.01	2.67	0.96	1.71	1.37	1.30	75.9	83.44	53.44	42.81	-4.70	-47.51	0.005		None
Phase IV	LX-11-001	CAP	ORE	WR	ARG		6.44																	
Phase IV	LX-11-002	CAP	ORE	WR	ARG		6.88																	
Phase IV	LX-11-003	CAP	ORE	WR	ARG		6.65																	
Phase IV	LX-11-004	CAP	ORE	WR	ARG		3.93																	
Phase IV	LX-11-019	CAP	ORE	WR	ARG	PHY	6.57																	
Phase IV	LX-11-020	CAP	ORE	WR	ARG	PHY	6.66																	
Phase IV	LX-11-021	CAP	ORE	WR	ARG	PHY	6.17																	
Phase IV	LX-11-030	CAP	ORE	WR	ARG	PHY	4.11																	
Phase IV	LX-11-031	CAP	ORE	WR	ARG	PHY	4.32																	
Phase IV	LX-11-032	CAP	ORE	WR	ARG	PHY	4.07																	
Phase IV	LX-11-040	CAP	ORE	WR	ARG		6.26																	
Phase IV	LX-11-043	CAP	ORE	WR	ARG		6.41																	
Phase IV	LX-11-051	CAP	ORE	PP	ARG	PHY	3.87																	
Phase IV	LX-11-052	CAP	ORE	PP	ARG	PHY	3.68																	
Phase IV	LX-11-059	CAP	ORE	WR	ARG	PHY	4.67																	
Phase IV	LX-11-060	CAP	ORE	WR	ARG	PHY	4.56																	
Phase IV	LX-11-061	CAP	ORE	WR	ARG	PHY	4.18																	
Phase IV	LX-11-084	CAP	ORE	WR	ARG	PHY	3.95																	
Phase IV	LX-11-088	CAP	ORE	WR	ARG	PHY	7.22																	
Phase IV	LX-11-108	CAP	ORE	PP	ARG		3.7																	
Phase IV	LX-11-109	CAP	ORE	WR	ARG		4.7																	
Phase IV	LX-11-110	CAP	ORE	WR	ARG		4.37																	
Phase IV	LX-11-111	CAP	ORE	WR	ARG		3.59																	
Phase IV	LX-11-112	CAP	ORE	IX	ARG	PHY	4.76																	
Phase IV	LX-11-115	CAP	ORE	IX	ARG	PHY	4.67																	
Phase IV	LX-11-117	CAP	ORE	WR	ARG	PHY	5																	
Phase IV	LX-11-118	CAP	ORE	WR	ARG	PHY	4.76																	
Phase IV	LX-11-119	CAP	ORE	WR	ARG	PHY	4.71																	
Phase IV	LX-11-121	CAP	ORE	IX	ARG	PHY	4.76																	
Phase IV	LX-11-128	CAP	ORE	WR	ARG		4.81																	
Phase IV	LX-11-129	CAP	ORE	WR	ARG		4.69																	
Phase IV	LX-11-130	CAP	ORE	WR	ARG		3.82																	
Phase IV	LX-11-141	CAP	ORE	PP	ARG	PHY	5.62																	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-144	CAP	ORE	PP	ARG	PHY	4.9																	
Phase IV	LX-11-145	CAP	ORE	PP	ARG	PHY	4.63																	
Phase IV	LX-11-146	CAP	ORE	PP	ARG	PHY	4.69																	
Phase IV	LX-11-147	CAP	ORE	PP	ARG	PHY	4.43																	
Phase IV	LX-11-158	CAP	ORE	WR	ARG		4.65																	
Phase IV	LX-11-161	CAP	ORE	WR	ARG		4.48																	
Phase IV	LX-11-168	CAP	ORE	WR	PHY	ARG	3.27																	
Phase IV	LX-11-169	CAP	ORE	WR	PHY	ARG	3.74																	
Phase IV	LX-11-170	CAP	ORE	PP	ARG	PHY	5																	
Phase IV	LX-11-172	CAP	ORE	PP	ARG	PHY	4.81																	
Phase IV	LX-11-173	CAP	ORE	PP	ARG	PHY	4.2																	
Phase IV	LX-11-177	CAP	ORE	WR	ARG		3.56																	
Phase IV	LX-11-180	CAP	ORE	WR	ARG	PHY	4.33																	
Phase IV	LX-11-182	CAP	ORE	WR	ARG	PHY	4.37																	
Phase IV	LX-11-185	CAP	ORE	WR	ARG	PHY	3.43																	
Phase IV	LX-11-186	CAP	ORE	WR	ARG	PHY	3.85																	
Phase IV	LX-11-187	CAP	ORE	WR	PHY	ARG	3.14																	
Phase IV	LX-11-195	CAP	ORE	PP	ARG	PHY	6.09																	
Phase IV	LX-11-204	CAP	ORE	WR	ARG	PHY	4.68																	
Phase IV	LX-11-208	CAP	ORE	WR	ARG	PHY	4.89																	
Phase IV	LX-11-210	CAP	ORE	WR	ARG		4.79																	
Phase IV	LX-11-215	CAP	ORE	WR	ARG		6.51																	
Phase IV	LX-11-223	CAP	ORE	WR	ARG		5.76																	
Phase IV	LX-11-226	CAP	ORE	WR	ARG		6.21																	
Phase IV	LX-11-231	CAP	ORE	IX	ARG	POT	4.33																	
Phase IV	LX-11-236	CAP	ORE	IX	ARG	POT	4.014																	
Phase IV	LX-11-244	CAP	ORE	IX	ARG	POT	4.59																	
Phase IV	LX-11-245	CAP	ORE	IX	ARG	POT	4.53																	
Phase IV	LX-11-246	CAP	ORE	IX	ARG	POT	3.84																	
Phase IV	LX-11-259	CAP	ORE	IX	ARG	PHY	3.94																	
Phase IV	LX-11-260	CAP	ORE	IX	ARG	POT	3.42																	
Phase IV	LX-11-265	CAP	ORE	IX	ARG	PHY	3.49																	
Phase IV	LX-11-266	CAP	ORE	WR	ARG		5.12																	
Phase IV	LX-11-268	CAP	ORE	WR	ARG		6.26																	
Phase IV	LX-11-282	CAP	ORE	WR	ARG	POT	6.41																	
Phase IV	LX-11-283	CAP	ORE	WR	ARG	POT	6.42																	
Phase IV	LX-11-310	CAP	ORE	WR	ARG	PRO	6.48																	
Phase IV	LX-11-331	CAP	ORE	IX	ARG	PHY	4.28																	
Phase IV	LX-11-332	CAP	ORE	PP	ARG	PHY	4.61																	
Phase IV	LX-11-333	CAP	ORE	PP	ARG	PHY	4.34																	
Phase IV	LX-11-337	CAP	ORE	WR			6.52																	
Phase IV	LX-11-343	CAP	ORE	PP	ARG		4.63																	
Phase IV	LX-11-344a	CAP	ORE	PP	ARG		3.55																	
Phase IV	LX-11-378	CAP	ORE	WR			4.34																	
						Maximum	7.22	0.010	0.83	0.14	8.0	2.5	7.9	7.4	1.3	249	249	248	232	12.0	10.8	1.1		
						90^{th} percentile	6.41	***0.0050***	***0.40***	0.049	2.47	1.2	0.79	0.79	0.06	58.1	77.1	24.7	24.7	8.8	8.5	0.38		
						75^{th} percentile	5.29	***0.0050***	***0.40***	0.033	1.1	0.61	0.06	0.040	0.010	29.2	33.5	2.0	1.3	5.3	5.1	0.2		
						Mean	4.87	***0.0055***	***0.44***	0.027	1.1	0.49	0.57	0.54	0.068	29.3	32.8	17.7	16.8	3.6	-13.1	0.1		
						Median	4.70	***0.0050***	***0.40***	0.020	0.29	0.25	0.0063	0.020	***0.0050***	7.6	9.1	0.20	0.63	3.5	3.0	0.1		
						25^{th} percentile	4.28	***0.0050***	***0.40***	0.010	0.14	0.078	0.0025	***0.0050***	***0.0050***	3.7	4.3	0.078	***0.15***	1.2	-0.40	0.01		
						10^{th} percentile	3.73	***0.0050***	***0.40***	0.010	0.042	0.041	0.0025	***0.0050***	***0.0050***	1.7	1.3	0.078	***0.15***	-0.34	-23.1	0.007		
						Minimum	3.14	***0.0050***	***0.40***	***0.0050***	0.020	0.020	0.0025	***0.0050***	***0.0050***	0.55	0.63	0.078	***0.15***	-4.70	-229	0.00161		
						No of samples	109	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32		
Oxide Leach Cap (CAP) - Waste Designated Samples																								
Phase I	08-001	CAP	WASTE	WR	ARG	PHY	5.83	***0.005***	***0.4***	***0.005***	1.11	1.23	0.0025	0.01	***0.005***	28.9	34.69	0.08	0.31	2.00	1.69	0.01		None
Phase I	08-002	CAP	WASTE	WR	ARG	PHY	5.39	***0.005***	***0.4***	***0.005***	0.83	0.9	0.0025	0.01	***0.005***	21.2	25.94	0.08	0.31	0.70	0.39	0.02		None
Phase I	08-006	CAP	WASTE	WR	ARG	PHY	6.02	***0.005***	***0.4***	***0.005***	0.34	0.43	0.0025	0.04	***0.005***	10.2	10.63	0.08	1.25	1.20	-0.05	0.04		None
Phase I	08-007	CAP	WASTE	WR	PHY	ARG	5.25	***0.005***	***0.4***	0.04	2.18	0.03	2.15	2.28	***0.005***	67.9	68.13	67.19	71.25	1.00	-70.25	0.01		None
Phase I	08-009	CAP	WASTE	MX			5.24	***0.005***	***0.4***	0.03	0.76	0.83	0.0025	0.04	***0.005***	19.5	23.75	0.08	1.25	-0.20	-1.45	0.02		None
Phase I	08-012	CAP	WASTE	WR	ARG	PHY	3.74	***0.005***	***0.4***	0.04	0.45	0.42	0.03	0.09	***0.005***	10.8	14.06	0.94	2.81	-2.20	-5.01	0.04		None
Phase I	08-013	CAP	WASTE	WR	PHY	ARG	3.23	***0.005***	***0.4***	0.01	1.92	1.67	0.25	0.35	***0.005***	47.0	60.00	7.81	10.94	-8.80	-19.74	0.01		None
Phase I	08-015	CAP	WASTE	PP	ARG	PHY	3.5	***0.005***	***0.4***	0.03	1.1	1.12	0.0025	0.03	***0.005***	26.3	34.38	0.08	0.94	-3.50	-4.44	0.02		None
Phase I	08-016	CAP	WASTE	PP	PHY	ARG	7.33	0.51	42.5	0.56	3.81	0.09	3.72	3.68	0.04	118.4	119.06	116.25	115.00	25.20	-89.80	0.36		Slight
Phase I	08-017	CAP	WASTE	WR	ARG	PHY	4.59	***0.005***	***0.4***	***0.005***	0.22	0.31	0.0025	0.02	***0.005***	7.3	6.88	0.08	0.63	1.70	1.08	0.05		None
Phase I	08-018	CAP	WASTE	WR	ARG	PHY	4.92	***0.005***	***0.4***	***0.005***	1.29	1.43	0.0025	0.01	***0.005***	33.6	40.31	0.08	0.31	0.60	0.29	0.01		None
Phase I	08-019	CAP	WASTE	WR	ARG	PHY	6.85	***0.005***	***0.4***	***0.005***	0.13	0.2	0.0025	0.02	***0.005***	4.8	4.06	0.08	0.63	1.20	0.58	0.08		None
Phase I	08-021	CAP	WASTE	PP	ARG	PHY	4.61	***0.005***	***0.4***	***0.005***	1.4	1.57	0.0025	0.01	***0.005***	36.9	43.75	0.08	0.31	-0.50	-0.81	0.01		None
Phase I	08-022	CAP	WASTE	MX	ARG	PHY	5.09	***0.005***	***0.4***	***0.005***	0.76	0.87	0.0025	***0.005***	***0.005***	20.5	23.75	0.08	***0.15***	0.40	0.40	0.02		None
Phase I	08-023	CAP	WASTE	MX	PHY	ARG	4.19	***0.005***	***0.4***	***0.005***	3.74	0.09	3.65	3.81	***0.005***	116.2	116.88	114.06	119.06	0.70	-118.36	0.00		None

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase I	08-026	CAP	WASTE	PP	ARG	PHY	6.38	***0.005***	***0.4***	***0.005***	0.11	0.14	0.0025	0.04	***0.005***	3.4	3.44	0.08	1.25	6.30	5.05	0.12		None
Phase I	08-027	CAP	WASTE	PP	ARG		5.45	0.06	5.0	0.07	3.68	1.25	2.43	2.52	***0.005***	105.2	115.00	75.94	78.75	13.60	-65.15	0.05		None
Phase I	08-029	CAP	WASTE	WR	ARG	PHY	4.92	***0.005***	***0.4***	***0.005***	1.42	1.59	0.0025	0.05	***0.005***	37.3	44.38	0.08	1.56	0.20	-1.36	0.01		None
Phase I	08-034	CAP	WASTE	WR	ARG	PHY	4.01	***0.005***	***0.4***	0.01	0.53	0.61	0.0025	0.01	***0.005***	14.4	16.56	0.08	0.31	4.10	3.79	0.03		None
Phase I	08-035	CAP	WASTE	WR	ARG	PHY	4.39	***0.005***	***0.4***	0.01	2.21	2.26	0.0025	0.01	***0.005***	53.1	69.06	0.08	0.31	2.50	2.19	0.01		None
Phase I	08-036	CAP	WASTE	WR	PHY	ARG	3.78	***0.005***	***0.4***	***0.005***	1.59	0.71	0.88	0.81	0.07	44.1	49.69	27.50	25.31	3.50	-21.81	0.01		None
Phase I	08-037	CAP	WASTE	PP	ARG		4.66	***0.005***	***0.4***	***0.005***	0.12	0.2	0.0025	0.01	***0.005***	4.8	3.75	0.08	0.31	9.40	9.09	0.08		None
Phase I	08-041	CAP	WASTE	WR	ARG	PHY	7.32	***0.005***	***0.4***	0.02	0.04	0.08	0.0025	0.05	***0.005***	2.0	1.25	0.08	1.56	2.30	0.74	0.20		None
Phase I	08-042	CAP	WASTE	WR	PHY	ARG	4.59	***0.005***	***0.4***	***0.005***	4.12	0.04	4.08	3.89	0.19	128.4	128.75	127.50	121.56	5.60	-115.96	0.00		None
Phase I	08-046	CAP	WASTE	WR	ARG	PHY	4.31	0.01	0.8	***0.005***	4.96	0.04	4.92	4.86	0.06	154.7	155.00	153.75	151.88	2.60	-149.28	0.01		None
Phase I	08-047	CAP	WASTE	MX	ARG	PHY	5.33	***0.005***	***0.4***	***0.005***	1.83	1.95	0.0025	0.02	***0.005***	45.8	57.19	0.08	0.63	2.80	2.18	0.01		None
Phase I	08-048	CAP	WASTE	MX	ARG	PHY	4.83	***0.005***	***0.4***	***0.005***	1.53	1.62	0.0025	0.01	***0.005***	38.1	47.81	0.08	0.31	1.10	0.79	0.01		None
Phase I	08-049	CAP	WASTE	MX	PHY		4.06	***0.005***	***0.4***	***0.005***	2.97	0.09	2.88	2.95	***0.005***	92.1	92.81	90.00	92.19	14.40	-77.79	0.00		None
Phase I	08-050	CAP	WASTE	PP	ARG	PHY	4.46	***0.005***	***0.4***	***0.005***	0.8	0.83	0.0025	0.01	***0.005***	19.5	25.00	0.08	0.31	2.60	2.29	0.02		None
Phase I	08-053	CAP	WASTE	MX	ARG	PHY	4.83	***0.005***	***0.4***	***0.005***	1.12	1.23	0.0025	0.02	***0.005***	28.9	35.00	0.08	0.63	2.00	1.38	0.01		None
Phase I	08-054	CAP	WASTE	WR	ARG	PHY	4.49	***0.005***	***0.4***	0.01	0.94	0.91	0.03	0.01	0.02	22.3	29.38	0.94	0.31	4.90	4.59	0.02		None
Phase I	08-057	CAP	WASTE	WR	ARG	PHY	6.96	***0.005***	***0.4***	0.03	1.72	0.04	1.68	1.66	0.02	53.4	53.75	52.50	51.88	4.00	-47.88	0.01		None
Phase I	08-061	CAP	WASTE	WR	PHY	ARG	5.07	***0.005***	***0.4***	0.01	0.14	0.2	0.0025	0.03	***0.005***	4.8	4.38	0.08	0.94	1.00	0.06	0.08		None
Phase I	08-063	CAP	WASTE	PP	PHY		8.03	0.41	34.2	0.47	0.6	0.13	0.47	0.46	***0.01***	17.7	18.75	14.69	14.38	41.10	26.73	1.93		Slight
Phase I	08-066	CAP	WASTE	IX	ARG	PHY	4.84	***0.005***	***0.4***	***0.005***	0.62	0.68	0.0025	0.02	***0.005***	16.0	19.38	0.08	0.63	-0.70	-1.33	0.02		None
Phase I	08-067	CAP	WASTE	WR	ARG	PHY	4.92	***0.005***	***0.4***	0.01	0.81	0.55	0.26	0.26	***0.005***	21.0	25.31	8.13	8.13	5.30	-2.83	0.02		None
Phase I	08-079	CAP	WASTE	PP	ARG	PHY	5.59	0.01	0.8	0.01	0.36	0.04	0.32	0.34	***0.005***	10.9	11.25	10.00	10.63	6.50	-4.13	0.08		None
Phase I	08-081	CAP	WASTE	IX	ARG	POT	4.48	***0.005***	***0.4***	0.03	0.03	0.02	0.01	0.02	***0.005***	0.8	0.94	0.31	0.63	3.30	2.68	0.51		None
Phase I	08-082	CAP	WASTE	PP	ARG	PHY	5.15	***0.005***	***0.4***	0.01	0.42	0.45	0.0025	***0.005***	***0.005***	10.6	13.13	0.08	***0.15***	4.80	4.80	0.04		None
Phase I	08-093	CAP	WASTE	WR	ARG		4.89	***0.005***	***0.4***	***0.005***	0.06	0.1	0.0025	0.01	***0.005***	2.4	1.88	0.08	0.31	3.30	2.99	0.17		None
Phase I	08-098	CAP	WASTE	PP	PHY	ARG	3.71	***0.005***	***0.4***	0.01	0.2	0.26	0.0025	***0.005***	***0.005***	6.2	6.25	0.08	***0.15***	-0.60	-0.60	0.06		None
Phase I	08-099	CAP	WASTE	WR	ARG	PHY	4.52	***0.005***	***0.4***	***0.005***	1.09	1.22	0.0025	***0.005***	***0.005***	28.7	34.06	0.08	***0.15***	0.90	0.90	0.01		None
Phase I	08-103	CAP	WASTE	IX	ARG	POT	4.44	0.01	0.8	***0.005***	0.1	0.11	0.0025	0.04	***0.005***	2.7	3.13	0.08	1.25	4.30	3.05	0.31		None
Phase I	08-104	CAP	WASTE	WR	ARG	POT	7.28	0.01	0.8	0.05	0.01	0.02	0.0025	0.02	***0.005***	0.5	0.31	0.08	0.63	20.60	19.98	1.52		None
Phase I	08-115	CAP	WASTE	WR	ARG	PHY	3.91	***0.005***	***0.4***	0.01	0.1	0.14	0.0025	***0.005***	***0.005***	3.4	3.13	0.08	***0.15***	3.30	3.30	0.12		None
Phase I	08-117	CAP	WASTE	WR	ARG	PHY	4.86	***0.005***	***0.4***	***0.005***	0.83	0.82	0.01	0.01	***0.005***	19.5	25.94	0.31	0.31	2.00	1.69	0.02		None
Phase I	08-118	CAP	WASTE	WR	ARG	PHY	4.1	***0.005***	***0.4***	0.03	0.45	0.4	0.05	0.1	***0.005***	10.9	14.06	1.56	3.13	2.30	-0.83	0.04		None
Phase I	08-122	CAP	WASTE	WR	ARG	POT	4.65	***0.005***	***0.4***	***0.005***	0.53	0.56	0.0025	***0.005***	***0.005***	13.2	16.56	0.08	***0.15***	1.60	1.60	0.03		None
Phase I	08-125	CAP	WASTE	WR	POT	ARG	7.52	***0.005***	***0.4***	0.02	***0.005***	0.01	0.0025	***0.005***	***0.005***	0.3	0.08	0.08	***0.15***	11.70	11.70	1.28		None
Phase II	08-132	CAP	WASTE	WR	ARG	PHY	4.09	***0.005***	***0.4***	0.01	0.4	0.34	0.06	0.04	0.02	9.8	12.50	1.88	1.25	2.00	0.75	0.04		None
Phase II	08-135	CAP	WASTE	WR	ARG	PHY	5.33	***0.005***	***0.4***	0.01	0.34	0.32	0.02	0.01	0.01	8.1	10.63	0.63	0.31	1.72	1.41	0.05		None
Phase II	08-138	CAP	WASTE	MX	ARG		4.81	***0.005***	***0.4***	0.01	0.97	0.96	0.01	***0.005***	0.01	22.8	30.31	0.31	***0.15***	3.19	3.19	0.02		None
Phase II	08-139	CAP	WASTE	MX	ARG		4.75	***0.005***	***0.4***	0.02	0.69	0.68	0.01	***0.005***	***0.01***	16.3	21.56	0.31	***0.15***	3.44	3.44	0.02		None
Phase II	08-148	CAP	WASTE	WR	ARG	PHY	4.85	***0.005***	***0.4***	0.01	0.56	0.53	0.03	0.02	0.01	13.4	17.50	0.94	0.63	2.46	1.83	0.03		None
Phase II	08-153	CAP	WASTE	WR	ARG	PHY	2.92	***0.005***	***0.4***	0.03	4.47	2.93	1.54	1.29	0.25	116.8	139.69	48.13	40.31	-49.26	-89.58	0.00		None
Phase II	08-154	CAP	WASTE	WR	PHY	ARG	3.32	***0.005***	***0.4***	0.01	1.33	1.19	0.14	0.13	0.01	32.3	41.56	4.38	4.06	-7.86	-11.92	0.01		None
Phase II	08-161	CAP	WASTE	PP	PHY	ARG	3.17	***0.005***	***0.4***	0.01	2.12	1.01	1.11	1.11	***0.005***	58.4	66.25	34.69	34.69	-7.49	-42.18	0.01		None
Phase II	08-164	CAP	WASTE	WR	ARG	PHY	6.86	0.01	0.8	0.03	0.17	0.15	0.02	0.02	***0.005***	4.1	5.31	0.63	0.63	2.95	2.32	0.20		None
Phase II	08-167	CAP	WASTE	WR	ARG		5.22	***0.005***	***0.4***	0.01	0.4	0.38	0.02	0.02	***0.005***	9.5	12.50	0.63	0.63	2.58	1.95	0.04		None
Phase II	08-169	CAP	WASTE	FZ	ARG	PHY	3.51	***0.005***	***0.4***	0.05	1.48	1.28	0.2	0.2	***0.005***	36.3	46.25	6.25	6.25	-4.67	-10.92	0.01		None
Phase II	08-172	CAP	WASTE	PP	ARG	PHY	3.84	***0.005***	***0.4***	0.01	1.5	1.48	0.02	0.01	0.01	35.3	46.88	0.63	0.31	-0.49	-0.80	0.01		None
Phase II	08-175	CAP	WASTE	MX	PHY	ARG	5.3	***0.005***	***0.4***	0.04	0.22	0.21	0.01	0.01	***0.005***	5.2	6.88	0.31	0.31	2.63	2.32	0.08		None
Phase II	08-183	CAP	WASTE	PP	ARG		7.97	0.21	17.5	0.23	1.14	0.23	0.91	0.9	***0.01***	33.8	35.63	28.44	28.13	32.33	4.21	0.52		Slight
Phase II	08-184	CAP	WASTE	PP	ARG	POT	8.03	0.26	21.7	0.28	1.24	0.11	1.13	1.12	***0.01***	37.9	38.75	35.31	35.00	36.97	1.97	0.57		Slight
Phase II	08-192	CAP	WASTE	WR	ARG		5.86	***0.005***	***0.4***	0.03	0.21	0.2	0.01	0.01	***0.005***	5.0	6.56	0.31	0.31	2.26	1.94	0.08		None
Phase II	08-193	CAP	WASTE	IX	ARG	PHY	5.68	***0.005***	***0.4***	0.02	1.12	1.09	0.03	0.02	0.01	26.5	35.00	0.94	0.63	1.38	0.75	0.02		None
Phase II	08-194	CAP	WASTE	WR	ARG	PHY	6.73	***0.005***	***0.4***	0.02	0.24	0.15	0.09	0.09	***0.005***	6.3	7.50	2.81	2.81	2.13	-0.68	0.06		None
Phase II	08-195	CAP	WASTE	WR	ARG	PHY	5.93	***0.005***	***0.4***	0.01	0.59	0.55	0.04	0.02	0.02	14.1	18.44	1.25	0.63	1.13	0.50	0.03		None
Phase II	08-204	CAP	WASTE	PP	ARG	PHY	4.9	***0.005***	***0.4***	0.02	1.1	0.9	0.2	0.06	0.14	27.3	34.38	6.25	1.88	2.13	0.26	0.01		None
Phase II	08-205	CAP	WASTE	PP	ARG	PHY	3.72	***0.005***	***0.4***	0.01	1.78	1.1	0.68	0.48	0.2	47.0	55.63	21.25	15.00	-5.51	-20.51	0.01		None
Phase II	08-220	CAP	WASTE	MX	ARG	PHY	4.92	***0.005***	***0.4***	0.01	1.29	1.23	0.06	0.02	0.04	30.7	40.31	1.88	0.63	0.99	0.37	0.01		None
Phase II	08-221	CAP	WASTE	MX	ARG	PHY	4.54	***0.005***	***0.4***	0.02	1.5	1.32	0.18	0.12	0.06	36.6	46.88	5.63	3.75	0.50	-3.25	0.01		None
Phase II	08-222	CAP	WASTE	MX	ARG	PHY	4.5	***0.005***	***0.4***	0.02	0.29	0.32	0.0025	***0.005***	***0.005***	7.6	9.06	0.08	***0.15***	0.62	0.62	0.05		None
Phase II	08-223	CAP	WASTE	MX	ARG	PHY	5.39	***0.005***	***0.4***	0.02	1.24	1.19	0.05	0.05	***0.005***	29.5	38.75	1.56	1.56	0.87	-0.70	0.01		None
Phase II	08-224	CAP	WASTE	MX	ARG	PHY	4.81	***0.005***	***0.4***	0.01	1.74	1.47	0.27	0.27	***0.005***	42.9	54.38	8.44	8.44	0.37	-8.07	0.01		None
Phase II	08-230	CAP	WASTE	WR	ARG	PHY	5.34	***0.005***	***0.4***	0.03	0.07	0.05	0.02	0.02	***0.005***	1.8	2.19	0.63	0.63	3.22	2.59	0.22		None
Phase II	08-231	CAP	WASTE	WR	PHY	ARG	6.43	***0.005***	***0.4***	0.02	4.68	0.03	4.65	4.65	***0.005***	146.0	146.25	145.31	145.31	5.07	-140.24	0.00		None
Phase II	08-241	CAP	WASTE	WR	PHY	ARG	4.85	***0.005***	***0.4***	0.01	2.32	0.14	2.18	2.17	***0.01***	71.4	72.50	68.13	67.81	1.72	-66.09	0.01		None
Phase II	08-243	CAP	WASTE	WR	POT	PHY	4.75	***0.005***	***0.4***	0.02	0.46	0.47	0.0025	***0.005***	***0.005***	11.1	14.38	0.08	***0.15***	5.30	5.30	0.04		None
Phase II	08-263	CAP	WASTE	IX	ARG	POT	5.45	***0.005***	***0.4***	0.03	0.26	0.27	0.0025	***0.005***	***0.005***	6.4	8.13	0.08	***0.15***	5.20	5.20	0.06		None
Phase II	08-264	CAP	WASTE	IX	ARG	POT	4.25	***0.005***	***0.4***	0.02	0.12	0.12	0.0025	***0.005***	***0.005***	2.9	3.75	0.08	***0.15***	2.60	2.60	0.14		None
Phase II	08-267	CAP	WASTE	PP	ARG	PHY	6.85	***0.005***	***0.4***	0.02	0.1	0.12	0.0025	***0.005***	***0.005***	2.9	3.13	0.08	***0.15***	7.67	7.67	0.14		None
Phase II	08-268	CAP	WASTE	PP	ARG	PHY	4.89	***0.005***	***0.4***	0.01	0.52	0.57	0.0025	***0.005***	***0.005***	13.4	16.25	0.08	***0.15***	7.18	7.18	0.03		None
Phase II	08-269	CAP	WASTE	PP	PHY	ARG	4.85	***0.005***	***0.4***	0.01	2.46	0.25	2.21	2.38	***-0.17***	74.9	76.88	69.06	74.38	4.33	-70.04	0.01		None
Phase II	08-275	CAP	WASTE	PP	ARG	PHY	4.88	***0.005***	***0.4***	0.01	0.7	0.74	0.0025	***0.005***	***0.005***	17.4	21.88	0.08	***0.15***	4.46	4.46	0.02		None

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase II	08-284	CAP	WASTE	IX	ARG	PHY	4.72	***0.005***	***0.4***	0.01	1.26	0.71	0.55	0.24	0.31	33.8	39.38	17.19	7.50	-1.24	-8.74	0.01		None
Phase II	08-322	CAP	WASTE	WR	ARG	PHY	4.75	***0.005***	***0.4***	0.02	0.22	0.23	0.0025	***0.005***	***0.005***	5.5	6.88	0.08	***0.15***	4.56	4.56	0.07		None
Phase II	08-328	CAP	WASTE	WR	ARG	PHY	5.03	***0.005***	***0.4***	0.01	0.69	0.56	0.13	0.11	0.02	17.2	21.56	4.06	3.44	1.23	-2.21	0.02		None
Phase II	08-329	CAP	WASTE	WR	ARG	PHY	4.7	***0.005***	***0.4***	0.01	0.72	0.69	0.03	0.01	0.02	17.1	22.50	0.94	0.31	3.69	3.38	0.02		None
Phase II	08-335	CAP	WASTE	IX	ARG	POT	4.41	***0.005***	***0.4***	0.01	0.94	0.85	0.09	***0.005***	0.09	22.7	29.38	2.81	***0.15***	5.17	5.17	0.02		None
Phase II	08-355	CAP	WASTE	WR	ARG	POT	6.53	***0.005***	***0.4***	0.02	0.01	***0.005***	0.01	***0.005***	0.01	0.4	0.31	0.31	***0.15***	16.58	16.58	0.93		None
Phase II	08-374	CAP	WASTE	WR	ARG		7.45	***0.005***	***0.4***	0.04	0.09	0.08	0.01	0.01	***0.005***	2.2	2.81	0.31	0.31	12.29	11.97	0.18		None
Phase II	08-411	CAP	WASTE	WR	ARG		7.26	***0.005***	***0.4***	0.03	0.05	0.02	0.03	0.03	***0.005***	1.4	1.56	0.94	0.94	13.51	12.58	0.28		None
Phase II	08-418	CAP	WASTE	WR	ARG	POT	7.97	***0.005***	***0.4***	0.05	0.06	0.06	0.0025	***0.005***	***0.005***	1.5	1.88	0.08	***0.15***	6.72	6.72	0.27		None
Phase II	08-423	CAP	WASTE	WR	ARG		8.16	***0.005***	***0.4***	0.03	0.02	0.01	0.01	***0.005***	0.01	0.5	0.63	0.31	***0.15***	13.18	13.18	0.73		None
Phase II	08-427	CAP	WASTE	WR	ARG		4.22	***0.005***	***0.4***	0.03	0.28	0.21	0.07	0.06	0.01	7.1	8.75	2.19	1.88	6.84	4.97	0.06		None
Phase II	08-428	CAP	WASTE	WR	ARG		7.13	***0.005***	***0.4***	0.02	0.04	0.02	0.02	0.02	***0.005***	1.1	1.25	0.63	0.63	9.83	9.20	0.37		None
Phase II	08-429	CAP	WASTE	WR	ARG		7.04	***0.005***	***0.4***	0.01	0.36	0.02	0.34	0.31	0.03	11.1	11.25	10.63	9.69	10.57	0.88	0.04		None
Phase II	08-432	CAP	WASTE	WR	ARG	PHY	5.13	***0.005***	***0.4***	0.01	0.65	0.61	0.04	***0.005***	0.04	15.5	20.31	1.25	***0.15***	0.25	0.25	0.03		None
Phase II	08-434	CAP	WASTE	WR	ARG		6.26	***0.005***	***0.4***	0.1	0.05	0.04	0.01	0.01	***0.005***	1.3	1.56	0.31	0.31	7.34	7.03	0.32		None
Phase III	09-26	CAP	WASTE	WR	PHY	ARG	3.75	***0.005***	***0.4***	0.03	1.08	0.66	0.42	0.37	0.05	28.6	33.75	13.13	11.56	-4.70	-16.26	0.01		None
Phase III	09-35	CAP	WASTE	WR	ARG		4.12	***0.005***	***0.4***	0.02	0.49	0.13	0.36	0.3	0.06	14.3	15.31	11.25	9.38	0.60	-8.78	0.03		None
Phase IV	LX-11-005	CAP	WASTE	WR	ARG		3.59																	
Phase IV	LX-11-006	CAP	WASTE	WR	ARG		7.37																	
Phase IV	LX-11-007	CAP	WASTE	WR	ARG		6.96																	
Phase IV	LX-11-008	CAP	WASTE	WR	ARG		6.82																	
Phase IV	LX-11-009	CAP	WASTE	WR	ARG		6.85																	
Phase IV	LX-11-010	CAP	WASTE	WR	ARG	PHY	7.06																	
Phase IV	LX-11-011	CAP	WASTE	WR	ARG	PHY	5.74																	
Phase IV	LX-11-012	CAP	WASTE	WR	ARG	PHY	6.53																	
Phase IV	LX-11-013	CAP	WASTE	WR	ARG	PHY	5.91																	
Phase IV	LX-11-014	CAP	WASTE	WR	ARG	PHY	7.09																	
Phase IV	LX-11-015	CAP	WASTE	WR	ARG	PHY	7.01																	
Phase IV	LX-11-016	CAP	WASTE	WR	ARG	PHY	7.15																	
Phase IV	LX-11-017	CAP	WASTE	WR	ARG	PHY	6.9																	
Phase IV	LX-11-018	CAP	WASTE	WR	ARG	PHY	6.82																	
Phase IV	LX-11-022	CAP	WASTE	WR	ARG	PHY	5.86																	
Phase IV	LX-11-023	CAP	WASTE	WR	ARG	PHY	6.04																	
Phase IV	LX-11-024	CAP	WASTE	WR	ARG	PHY	6.19																	
Phase IV	LX-11-025	CAP	WASTE	WR	ARG	PHY	5.79																	
Phase IV	LX-11-026	CAP	WASTE	WR	ARG	PHY	5.55																	
Phase IV	LX-11-027	CAP	WASTE	WR	ARG	PHY	5.46																	
Phase IV	LX-11-028	CAP	WASTE	WR	ARG	PHY	4.81																	
Phase IV	LX-11-029	CAP	WASTE	WR	ARG	PHY	4.73																	
Phase IV	LX-11-033	CAP	WASTE	WR	ARG	PHY	4.38																	
Phase IV	LX-11-034	CAP	WASTE	WR	ARG	PHY	4.37																	
Phase IV	LX-11-035	CAP	WASTE	WR	ARG	PHY	4.39																	
Phase IV	LX-11-036	CAP	WASTE	WR	ARG	PHY	4.47																	
Phase IV	LX-11-037	CAP	WASTE	WR	ARG	PHY	4.26																	
Phase IV	LX-11-038	CAP	WASTE	WR	PHY		4.41																	
Phase IV	LX-11-039	CAP	WASTE	WR	ARG		6.39																	
Phase IV	LX-11-041	CAP	WASTE	WR	ARG		5.97																	
Phase IV	LX-11-042	CAP	WASTE	WR	ARG		6.35																	
Phase IV	LX-11-044	CAP	WASTE	WR	ARG		5.26																	
Phase IV	LX-11-045	CAP	WASTE	MX	ARG	PHY	3.89																	
Phase IV	LX-11-046	CAP	WASTE	MX	ARG	PHY	4.26																	
Phase IV	LX-11-047	CAP	WASTE	MX	ARG	PHY	4.07																	
Phase IV	LX-11-053	CAP	WASTE	PP	ARG	PHY	3.74																	
Phase IV	LX-11-054	CAP	WASTE	MX	ARG	PHY	4.3																	
Phase IV	LX-11-055	CAP	WASTE	MX	ARG	PHY	3.95																	
Phase IV	LX-11-056	CAP	WASTE	MX	ARG	PHY	3.91																	
Phase IV	LX-11-057	CAP	WASTE	MX	ARG	PHY	3.79																	
Phase IV	LX-11-058	CAP	WASTE	MX	ARG	PHY	3.87																	
Phase IV	LX-11-062	CAP	WASTE	WR	ARG		3.99																	
Phase IV	LX-11-063	CAP	WASTE	PP	ARG		4.13																	
Phase IV	LX-11-064	CAP	WASTE	PP	ARG		4.03																	
Phase IV	LX-11-065	CAP	WASTE	WR	ARG		4.19																	
Phase IV	LX-11-066	CAP	WASTE	WR	ARG		4.41																	
Phase IV	LX-11-067	CAP	WASTE	WR	ARG		5.24																	
Phase IV	LX-11-068	CAP	WASTE	MX	ARG	PHY	4.48																	
Phase IV	LX-11-069	CAP	WASTE	MX	ARG	PHY	4.49																	
Phase IV	LX-11-070	CAP	WASTE	MX	ARG	PHY	3.99																	
Phase IV	LX-11-071	CAP	WASTE	MX	ARG	PHY	3.65																	
Phase IV	LX-11-072	CAP	WASTE	MX	ARG	PHY	3.53																	
Phase IV	LX-11-073	CAP	WASTE	MX	ARG	PHY	3.31																	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-074	CAP	WASTE	WR	ARG	PHY	4.56																	
Phase IV	LX-11-075	CAP	WASTE	IX	ARG	PHY	4.12																	
Phase IV	LX-11-076	CAP	WASTE	IX	ARG	PHY	3.74																	
Phase IV	LX-11-077	CAP	WASTE	IX	ARG	PHY	3.87																	
Phase IV	LX-11-078	CAP	WASTE	PP	PHY	ARG	3.69																	
Phase IV	LX-11-079	CAP	WASTE	PP	PHY	ARG	3.88																	
Phase IV	LX-11-080	CAP	WASTE	PP	PHY	ARG	3.32																	
Phase IV	LX-11-082	CAP	WASTE	WR	ARG	PHY	4.24																	
Phase IV	LX-11-083	CAP	WASTE	WR	ARG	PHY	4.16																	
Phase IV	LX-11-085	CAP	WASTE	WR	ARG	PHY	4.15																	
Phase IV	LX-11-086	CAP	WASTE	WR	ARG		4.91																	
Phase IV	LX-11-087	CAP	WASTE	WR	ARG		5.16																	
Phase IV	LX-11-089	CAP	WASTE	WR	ARG	PHY	4.39																	
Phase IV	LX-11-090	CAP	WASTE	WR	ARG	PHY	4.88																	
Phase IV	LX-11-091	CAP	WASTE	WR	ARG	PHY	6.67																	
Phase IV	LX-11-092	CAP	WASTE	WR	ARG	PHY	4.96																	
Phase IV	LX-11-093	CAP	WASTE	WR	ARG	PHY	4.87																	
Phase IV	LX-11-094	CAP	WASTE	WR	ARG	PHY	4.71																	
Phase IV	LX-11-095	CAP	WASTE	WR	ARG	PHY	4.07																	
Phase IV	LX-11-096	CAP	WASTE	WR	ARG	PHY	4.68																	
Phase IV	LX-11-097	CAP	WASTE	PP	ARG	PHY	4.49																	
Phase IV	LX-11-098	CAP	WASTE	PP	ARG	PHY	5.31																	
Phase IV	LX-11-099	CAP	WASTE	PP	ARG	PHY	4.28																	
Phase IV	LX-11-100	CAP	WASTE	PP	ARG	PHY	3.81																	
Phase IV	LX-11-101	CAP	WASTE	PP	ARG	PHY	3.72																	
Phase IV	LX-11-102	CAP	WASTE	PP	ARG	PHY	3.55																	
Phase IV	LX-11-103	CAP	WASTE	PP	ARG	PHY	3.47																	
Phase IV	LX-11-104	CAP	WASTE	PP	ARG	PHY	3.49																	
Phase IV	LX-11-105	CAP	WASTE	PP	ARG		4																	
Phase IV	LX-11-106	CAP	WASTE	PP	ARG		3.98																	
Phase IV	LX-11-107	CAP	WASTE	PP	ARG		3.68																	
Phase IV	LX-11-113	CAP	WASTE	IX	ARG	PHY	4.6																	
Phase IV	LX-11-114	CAP	WASTE	IX	ARG	PHY	4.4																	
Phase IV	LX-11-116	CAP	WASTE	IX	ARG	PHY	5.11																	
Phase IV	LX-11-120	CAP	WASTE	WR	ARG	PHY	4.73																	
Phase IV	LX-11-122	CAP	WASTE	PP	ARG	PHY	4.65																	
Phase IV	LX-11-123	CAP	WASTE	PP	ARG	PHY	3.72																	
Phase IV	LX-11-124	CAP	WASTE	PP	ARG	PHY	3.9																	
Phase IV	LX-11-125	CAP	WASTE	PP	ARG	PHY	3.68																	
Phase IV	LX-11-126	CAP	WASTE	PP	ARG	PHY	3.62																	
Phase IV	LX-11-127	CAP	WASTE	PP	ARG	PHY	4.3																	
Phase IV	LX-11-131	CAP	WASTE	WR	ARG	PHY	4.5																	
Phase IV	LX-11-132	CAP	WASTE	WR	ARG	PHY	3.74																	
Phase IV	LX-11-133	CAP	WASTE	WR	ARG	PHY	3.45																	
Phase IV	LX-11-134	CAP	WASTE	WR	ARG	PHY	3.25																	
Phase IV	LX-11-135	CAP	WASTE	WR	ARG	PHY	3.31																	
Phase IV	LX-11-136	CAP	WASTE	WR	ARG	PHY	3.27																	
Phase IV	LX-11-137	CAP	WASTE	WR	ARG	PHY	3.27																	
Phase IV	LX-11-138	CAP	WASTE	WR	ARG	PHY	3.54																	
Phase IV	LX-11-139	CAP	WASTE	WR	ARG	PHY	3.86																	
Phase IV	LX-11-140	CAP	WASTE	WR	ARG	PHY	3.41																	
Phase IV	LX-11-142	CAP	WASTE	PP	ARG	PHY	5.57																	
Phase IV	LX-11-143	CAP	WASTE	PP	ARG	PHY	5.03																	
Phase IV	LX-11-148	CAP	WASTE	PP	ARG	PHY	4.44																	
Phase IV	LX-11-149	CAP	WASTE	PP	ARG	PHY	4.57																	
Phase IV	LX-11-150	CAP	WASTE	PP	ARG	PHY	4.55																	
Phase IV	LX-11-151	CAP	WASTE	PP	ARG	PHY	4.57																	
Phase IV	LX-11-152	CAP	WASTE	PP	ARG	PHY	4.41																	
Phase IV	LX-11-153	CAP	WASTE	PP	ARG	PHY	4.24																	
Phase IV	LX-11-154	CAP	WASTE	PP	ARG	PHY	4.27																	
Phase IV	LX-11-155	CAP	WASTE	PP	ARG	PHY	4.16																	
Phase IV	LX-11-156	CAP	WASTE	PP	ARG	PHY	3.92																	
Phase IV	LX-11-157	CAP	WASTE	WR	ARG		4.7																	
Phase IV	LX-11-159	CAP	WASTE	WR	ARG		3.58																	
Phase IV	LX-11-160	CAP	WASTE	WR	ARG		3.57																	
Phase IV	LX-11-162	CAP	WASTE	WR	ARG		4.04																	
Phase IV	LX-11-163	CAP	WASTE	WR	ARG		3.6																	
Phase IV	LX-11-164	CAP	WASTE	WR	ARG	PHY	4.74																	
Phase IV	LX-11-165	CAP	WASTE	WR	ARG	PHY	5.25																	
Phase IV	LX-11-166	CAP	WASTE	WR	ARG	PHY	4.83																	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-167	CAP	WASTE	WR	ARG	PHY	4.07																	
Phase IV	LX-11-171	CAP	WASTE	PP	ARG	PHY	4.49																	
Phase IV	LX-11-174	CAP	WASTE	WR	ARG		4.56																	
Phase IV	LX-11-175	CAP	WASTE	WR	ARG		4.61																	
Phase IV	LX-11-176	CAP	WASTE	WR	ARG		3.9																	
Phase IV	LX-11-178	CAP	WASTE	WR	ARG	PHY	4.83																	
Phase IV	LX-11-179	CAP	WASTE	WR	ARG	PHY	3.66																	
Phase IV	LX-11-181	CAP	WASTE	WR	ARG	PHY	4.54																	
Phase IV	LX-11-183	CAP	WASTE	WR	ARG	PHY	4.3																	
Phase IV	LX-11-184	CAP	WASTE	WR	ARG	PHY	4.99																	
Phase IV	LX-11-188	CAP	WASTE	PP	ARG	PHY	5.44																	
Phase IV	LX-11-189	CAP	WASTE	PP	ARG	PHY	4.77																	
Phase IV	LX-11-190	CAP	WASTE	PP	ARG	PHY	4.99																	
Phase IV	LX-11-191	CAP	WASTE	PP	ARG	PHY	4.16																	
Phase IV	LX-11-192	CAP	WASTE	PP	ARG	PHY	4.16																	
Phase IV	LX-11-193	CAP	WASTE	PP	ARG	PHY	3.98																	
Phase IV	LX-11-196	CAP	WASTE	PP	ARG	PHY	4.6																	
Phase IV	LX-11-197	CAP	WASTE	PP	ARG	PHY	4.04																	
Phase IV	LX-11-198	CAP	WASTE	PP	PHY	ARG	4.74																	
Phase IV	LX-11-199	CAP	WASTE	PP	PHY	ARG	4.8																	
Phase IV	LX-11-200	CAP	WASTE	PP	PHY	ARG	3.94																	
Phase IV	LX-11-201	CAP	WASTE	PP	PHY	ARG	3.86																	
Phase IV	LX-11-202	CAP	WASTE	WR			4.63																	
Phase IV	LX-11-203	CAP	WASTE	WR	ARG	PHY	3.87																	
Phase IV	LX-11-205	CAP	WASTE	PP	ARG		4.21																	
Phase IV	LX-11-206	CAP	WASTE	PP	ARG		4.32																	
Phase IV	LX-11-207	CAP	WASTE	PP	ARG		3.6																	
Phase IV	LX-11-209	CAP	WASTE	WR	ARG		5.56																	
Phase IV	LX-11-211	CAP	WASTE	WR	ARG		6.3																	
Phase IV	LX-11-213	CAP	WASTE	WR	ARG	PHY	4.84																	
Phase IV	LX-11-214	CAP	WASTE	WR	ARG		6.64																	
Phase IV	LX-11-216	CAP	WASTE	WR	ARG		3.9																	
Phase IV	LX-11-217	CAP	WASTE	WR	ARG		6.68																	
Phase IV	LX-11-218	CAP	WASTE	WR	ARG		6.5																	
Phase IV	LX-11-219	CAP	WASTE	WR	ARG		6.09																	
Phase IV	LX-11-220	CAP	WASTE	WR	ARG		6.22																	
Phase IV	LX-11-221	CAP	WASTE	WR	ARG		6.37																	
Phase IV	LX-11-222	CAP	WASTE	WR	ARG		6.57																	
Phase IV	LX-11-224	CAP	WASTE	WR	ARG		6.11																	
Phase IV	LX-11-225	CAP	WASTE	WR	ARG		6.3																	
Phase IV	LX-11-227	CAP	WASTE	WR	ARG		6.3																	
Phase IV	LX-11-228	CAP	WASTE	WR	ARG		6.48																	
Phase IV	LX-11-229	CAP	WASTE	WR	ARG		5.04																	
Phase IV	LX-11-232	CAP	WASTE	WR	ARG	PHY	5.58																	
Phase IV	LX-11-233	CAP	WASTE	WR	ARG	PHY	5.71																	
Phase IV	LX-11-234	CAP	WASTE	WR	ARG	PHY	4.27																	
Phase IV	LX-11-235	CAP	WASTE	WR	ARG	PHY	4.03																	
Phase IV	LX-11-239	CAP	WASTE	WR	ARG	PHY	5.26																	
Phase IV	LX-11-240	CAP	WASTE	WR	ARG	PHY	5.47																	
Phase IV	LX-11-241	CAP	WASTE	WR	ARG	PHY	4.99																	
Phase IV	LX-11-242	CAP	WASTE	WR	ARG	PHY	6.2																	
Phase IV	LX-11-243	CAP	WASTE	WR	ARG	PHY	4.24																	
Phase IV	LX-11-251	CAP	WASTE	WR	ARG		4.86																	
Phase IV	LX-11-254	CAP	WASTE	WR	ARG		4.9																	
Phase IV	LX-11-255	CAP	WASTE	WR	ARG	PHY	5.45																	
Phase IV	LX-11-256	CAP	WASTE	WR	ARG	PHY	4.59																	
Phase IV	LX-11-257	CAP	WASTE	WR	ARG	PHY	4.04																	
Phase IV	LX-11-258	CAP	WASTE	WR	ARG	PHY	3.63																	
Phase IV	LX-11-261	CAP	WASTE	WR	ARG		6.51																	
Phase IV	LX-11-263	CAP	WASTE	MX	ARG	PHY	4.05																	
Phase IV	LX-11-264	CAP	WASTE	MX	ARG	PHY	3.24																	
Phase IV	LX-11-267	CAP	WASTE	WR	ARG		4.94																	
Phase IV	LX-11-269	CAP	WASTE	WR	PHY	POT	5.07																	
Phase IV	LX-11-270	CAP	WASTE	WR	PHY	POT	4.5																	
Phase IV	LX-11-271	CAP	WASTE	WR	POT	PHY	6.36																	
Phase IV	LX-11-272	CAP	WASTE	WR	POT	PHY	4.27																	
Phase IV	LX-11-273	CAP	WASTE	WR	ARG	PHY	5.83																	
Phase IV	LX-11-274	CAP	WASTE	WR	ARG	PHY	4.56																	
Phase IV	LX-11-275	CAP	WASTE	WR	ARG	PHY	4.48																	
Phase IV	LX-11-276	CAP	WASTE	WR	ARG	PHY	4.7																	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-277	CAP	WASTE	WR	ARG	PHY	4.42																	
Phase IV	LX-11-278	CAP	WASTE	WR	ARG	PHY	4.58																	
Phase IV	LX-11-279	CAP	WASTE	WR	ARG	PHY	4.75																	
Phase IV	LX-11-280	CAP	WASTE	WR	ARG	PHY	3.82																	
Phase IV	LX-11-281	CAP	WASTE	WR	ARG	PHY	3.27																	
Phase IV	LX-11-284	CAP	WASTE	WR	ARG	PHY	4.73																	
Phase IV	LX-11-286	CAP	WASTE	WR	ARG	PHY	3.55																	
Phase IV	LX-11-287	CAP	WASTE	WR	ARG	PHY	3.75																	
Phase IV	LX-11-288	CAP	WASTE	WR	ARG		4.68																	
Phase IV	LX-11-289	CAP	WASTE	WR	ARG		4.74																	
Phase IV	LX-11-290	CAP	WASTE	WR	ARG		4.67																	
Phase IV	LX-11-291	CAP	WASTE	WR	ARG		3.49																	
Phase IV	LX-11-292	CAP	WASTE	WR	ARG		3.52																	
Phase IV	LX-11-294	CAP	WASTE	WR	PHY	ARG	4.51																	
Phase IV	LX-11-295	CAP	WASTE	WR	PHY	ARG	4.45																	
Phase IV	LX-11-296	CAP	WASTE	WR	PHY	ARG	6.17																	
Phase IV	LX-11-298	CAP	WASTE	WR	ARG		4.85																	
Phase IV	LX-11-300	CAP	WASTE	WR			3.93																	
Phase IV	LX-11-301	CAP	WASTE	WR	ARG	PHY	5.08																	
Phase IV	LX-11-302	CAP	WASTE	WR	ARG	PHY	4.92																	
Phase IV	LX-11-303	CAP	WASTE	WR	ARG	PHY	4.29																	
Phase IV	LX-11-304	CAP	WASTE	WR	ARG	PHY	4.18																	
Phase IV	LX-11-305	CAP	WASTE	WR	ARG	PHY	3.95																	
Phase IV	LX-11-308	CAP	WASTE	WR	ARG	PRO	6.6																	
Phase IV	LX-11-309	CAP	WASTE	WR	ARG	PRO	6.27																	
Phase IV	LX-11-311	CAP	WASTE	WR	ARG		7.81																	
Phase IV	LX-11-312	CAP	WASTE	WR	ARG		7.85																	
Phase IV	LX-11-313	CAP	WASTE	WR	ARG	PHY	4.4																	
Phase IV	LX-11-314	CAP	WASTE	WR	ARG	PHY	3.52																	
Phase IV	LX-11-316	CAP	WASTE	WR			7.55																	
Phase IV	LX-11-318	CAP	WASTE	WR			8.24																	
Phase IV	LX-11-320	CAP	WASTE	WR			5.14																	
Phase IV	LX-11-321	CAP	WASTE	WR			4.73																	
Phase IV	LX-11-322	CAP	WASTE	WR			4.27																	
Phase IV	LX-11-323	CAP	WASTE	IX	ARG	PHY	5.58																	
Phase IV	LX-11-324	CAP	WASTE	IX	ARG	PHY	5.07																	
Phase IV	LX-11-325	CAP	WASTE	IX	ARG	PHY	4.92																	
Phase IV	LX-11-326	CAP	WASTE	WR	PHY	ARG	5.68																	
Phase IV	LX-11-327	CAP	WASTE	WR	ARG	POT	6.56																	
Phase IV	LX-11-329	CAP	WASTE	WR	ARG		4.46																	
Phase IV	LX-11-330	CAP	WASTE	IX	ARG	PHY	4.57																	
Phase IV	LX-11-338	CAP	WASTE	WR			3.89																	
Phase IV	LX-11-339	CAP	WASTE	WR	ARG	PHY	3.7																	
Phase IV	LX-11-340	CAP	WASTE	WR	ARG	PHY	3.454																	
Phase IV	LX-11-341	CAP	WASTE	PP	ARG		4.38																	
Phase IV	LX-11-342	CAP	WASTE	PP	ARG		4.16																	
Phase IV	LX-11-358	CAP	WASTE	WR			6.36																	
Phase IV	LX-11-359	CAP	WASTE	WR			6.6																	
Phase IV	LX-11-360	CAP	WASTE	WR			6.36																	
Phase IV	LX-11-361	CAP	WASTE	WR			6.03																	
Phase IV	LX-11-362	CAP	WASTE	WR			5.74																	
Phase IV	LX-11-363	CAP	WASTE	WR			5.43																	
Phase IV	LX-11-364	CAP	WASTE	WR			6.53																	
Phase IV	LX-11-365	CAP	WASTE	WR			6.18																	
Phase IV	LX-11-366	CAP	WASTE	WR			5.88																	
Phase IV	LX-11-367	CAP	WASTE	WR			5.5																	
Phase IV	LX-11-368	CAP	WASTE	WR			5.08																	
Phase IV	LX-11-369	CAP	WASTE	WR			4.3																	
Phase IV	LX-11-370	CAP	WASTE	WR			3.98																	
Phase IV	LX-11-371	CAP	WASTE	WR			3.96																	
Phase IV	LX-11-372	CAP	WASTE	WR			4.5																	
Phase IV	LX-11-373	CAP	WASTE	WR			4.12																	
Phase IV	LX-11-374	CAP	WASTE	WR			4.07																	
Phase IV	LX-11-375	CAP	WASTE	WR			3.96																	
Phase IV	LX-11-376	CAP	WASTE	WR			4.03																	
Phase IV	LX-11-377	CAP	WASTE	WR			4.45																	
Phase IV	LX-11-379	CAP	WASTE	WR			3.81																	
Phase IV	LX-11-387	CAP	WASTE	WR			4.89																	
Phase IV	LX-11-388	CAP	WASTE	WR			4.71																	
Phase IV	LX-11-389	CAP	WASTE	WR			4.95																	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC %	CaNP kg $CaCO_3$/t	C(T) %	S(T) %	$S(SO_4)$ %	non-sulphate S %	$S(S^{-2})$ %	Insoluble S %	SO_4 AP + Non-SO_4 AP kg $CaCO_3$/t	TAP kg $CaCO_3$/t	Non-SO_4 AP kg $CaCO_3$/t	SAP kg $CaCO_3$/t	ScNP (Lab) kg $CaCO_3$/t	Net NP	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
Phase IV	LX-11-390	CAP	WASTE	WR			5.08																	
Phase IV	LX-11-391	CAP	WASTE	WR			4.7																	
Phase IV	LX-11-392	CAP	WASTE	WR			5.45																	
Phase IV	LX-11-393	CAP	WASTE	WR			5.2																	
Phase IV	LX-11-394	CAP	WASTE	WR			5.22																	
Phase IV	LX-11-395	CAP	WASTE	WR			4.97																	
Phase IV	LX-11-396	CAP	WASTE	WR			4.89																	
Phase IV	LX-11-397	CAP	WASTE	WR			4.95																	
Phase IV	LX-11-398a	CAP	WASTE	WR			7.06																	
Phase IV	LX-11-623	CAP	WASTE	WR	ARG				3.1	0.04	0.73						22.81					0.14		
						Maximum	8.24	0.51	42.5	0.56	5.0	2.9	4.9	4.9	0.31	155	155	154	152	41.1	26.7	1.9		
						90th percentile	6.59	***0.0050***	***0.75***	0.040	2.2	1.3	1.7	1.6	0.049	66.9	68.9	52.1	50.7	12.2	7.2	0.32		
						75th percentile	5.45	***0.0050***	***0.40***	0.030	1.3	0.90	0.24	0.23	0.010	34.9	40.9	7.4	7.2	5.2	3.4	0.08		
						Mean	4.91	0.019	1.60	0.032	1.0	0.58	0.45	0.45	0.020	27.7	31.4	14.1	13.9	3.8	-10.0	0.1		
						Median	4.70	***0.0050***	***0.40***	0.010	0.69	0.41	0.020	0.020	***0.0050***	17.2	21.6	0.63	0.63	2.5	0.77	0.03		
						25th percentile	4.08	***0.0050***	***0.40***	***0.0075***	0.22	0.12	0.0025	0.010	***0.0050***	6.2	6.9	0.078	0.31	0.87	-3.1	0.013		
						10th percentile	3.69	***0.0050***	***0.40***	***0.0050***	0.062	0.040	0.0025	***0.0050***	***0.0050***	2.0	1.9	0.078	***0.15***	-0.69	-63.4	0.0075		
						Minimum	2.92	***0.0050***	***0.40***	***0.0050***	***0.0050***	***0.0050***	0.0025	***0.0050***	***-0.17***	0.313	0.078	0.078	***0.15***	-49.26	-149.3	0.0027		
						No of samples	374	102	103	103	103	102	102	102	102	102	103	102	102	102	102	103		
Oxide Leach Cap (CAP) - Unknown Ore/Waste Designation																								
Phase IV	LX-11-247	CAP		WR	ARG	PHY	4.73																	
Phase IV	LX-11-248	CAP		WR	ARG	PHY	5.79																	
Phase IV	LX-11-345	CAP		MX			4.47																	
Phase IV	LX-11-346	CAP		MX			4.52																	
Phase IV	LX-11-347	CAP		MX			3.74																	
Phase IV	LX-11-348	CAP		MX			4.06																	
Phase IV	LX-11-349	CAP		MX			4.79																	
Phase IV	LX-11-350	CAP		MX			4.6																	
Phase IV	LX-11-351	CAP		MX			5.87																	
Phase IV	LX-11-352	CAP		MX			5.96																	
						Maximum	5.96																	
						90th percentile	5.88																	
						75th percentile	5.54																	
						Mean	4.85																	
						Median	4.67																	
						25th percentile	4.48																	
						10th percentile	4.03																	
						Minimum	3.74																	
						No of samples	10																	
Supergene Oxide Zone (SOX) - Ore Designated Samples																								
Phase II	08-173	SOX	ORE	PP	PHY	ARG	4.85	***0.005***	***0.4***	0.02	8.31	0.11	8.2	7.4	0.8	258.8	259.69	256.25	231.25	3.32	-227.93	0.002	0.0004	None
Phase II	08-174	SOX	ORE	PP	PHY	ARG	4.85	***0.005***	***0.4***	0.01	7	0.09	6.91	6.21	0.7	218.0	218.75	215.94	194.06	2.76	-191.31	0.002	0.0005	None
Phase II	08-282	SOX	ORE	IX	ARG	POT	4.89	***0.005***	***0.4***	0.01	0.18	0.19	0.0025	***0.005***	***0.005***	4.5	5.63	0.08	***0.15***	10.52	10.52	0.088	0.0221	None
Phase II	08-299	SOX	ORE	WR	POT	ARG	5.16	***0.005***	***0.4***	0.02	0.27	0.03	0.24	0.23	0.01	8.2	8.44	7.50	7.19	3.82	-3.37	0.049	0.0122	None
Phase II	08-300	SOX	ORE	WR	POT	ARG	5.37	***0.005***	***0.4***	0.03	0.07	0.02	0.05	0.05	***0.005***	2.0	2.19	1.56	1.56	5.05	3.49	0.197	0.0492	None
Phase II	08-349	SOX	ORE	WR	ARG	POT	8.3	0.03	2.5	0.04	0.04	***0.005***	0.04	0.04	***0.005***	1.4	1.25	1.25	1.25	11.95	10.70	1.829	0.1024	None
Phase II	08-350	SOX	ORE	WR	ARG	POT	7.14	***0.005***	***0.4***	0.02	0.13	0.12	0.01	***0.005***	0.01	3.1	4.06	0.31	***0.15***	3.20	3.20	0.128	0.0320	None
Phase II	08-351	SOX	ORE	FZ	POT		4.39	***0.005***	***0.4***	0.02	0.28	0.28	0.0025	***0.005***	***0.005***	6.6	8.75	0.08	***0.15***	0.62	0.62	0.060	0.0151	None
Phase II	08-352	SOX	ORE	FZ	POT		4.93	***0.005***	***0.4***	0.03	0.18	0.05	0.13	0.12	0.01	5.2	5.63	4.06	3.75	18.47	14.72	0.076	0.0191	None
Phase II	08-353	SOX	ORE	WR	POT		5.5	***0.005***	***0.4***	0.01	0.58	0.02	0.56	0.5	0.06	18.0	18.13	17.50	15.63	5.05	-10.58	0.022	0.0056	None
Phase II	08-354	SOX	ORE	IX	ARG	POT	5.57	***0.005***	***0.4***	0.02	0.09	0.09	0.0025	***0.005***	***0.005***	2.2	2.81	0.08	***0.15***	5.30	5.30	0.183	0.0457	None
Phase II	08-383	SOX	ORE	WR	ARG	PHY	7.01	0.01	0.8	0.04	0.07	0.03	0.04	0.04	***0.005***	2.0	2.19	1.25	1.25	5.41	4.16	0.427	0.0512	None
Phase II	08-384	SOX	ORE	WR	ARG	PHY	8.18	0.12	10.0	0.12	0.06	0.03	0.03	0.03	***0.005***	1.6	1.88	0.94	0.94	19.90	18.96	6.095	4.6565	Slight
Phase II	08-414	SOX	ORE	WR	PHY	PRO	7.27	0.01	0.8	0.04	1.15	0.06	1.09	0.92	0.17	35.5	35.94	34.06	28.75	10.93	-17.82	0.023	0.0028	None
Phase II	08-419	SOX	ORE	WR	POT	PHY	8.03	***0.005***	***0.4***	0.02	0.28	0.02	0.26	0.22	0.04	8.6	8.75	8.13	6.88	11.07	4.19	0.047	0.0116	None
Phase II	08-425	SOX	ORE	WR	ARG	PHY	8.2	0.89	74.2	0.94	2.17	0.02	2.15	2.11	0.04	67.7	67.81	67.19	65.94	78.98	13.04	1.096	1.0613	Moderate
Phase III	09-03	SOX	ORE	PP	PHY		4.65	***0.005***	***0.4***	0.02	5.21	0.05	5.16	4.59	0.57	162.4	162.81	161.25	143.44	5.70	-137.74	0.002	0.0006	None
Phase III	09-04	SOX	ORE	PP	PHY		5.80	0.04	3.3	0.06	6.48	0.03	6.45	5.61	0.84	202.3	202.50	201.56	175.31	5.50	-169.81	0.016	0.0048	None
Phase III	09-27	SOX	ORE	IX	ARG	PHY	4.02	***0.005***	***0.4***	0.01	0.4	0.32	0.08	0.04	0.04	10.0	12.50	2.50	1.25	-1.80	-3.05	0.040	0.0100	None
Phase IV	LX-11-230	SOX	ORE	WR	ARG		4.9																	
Phase IV	LX-11-237	SOX	ORE	WR	ARG		4.92																	
Phase IV	LX-11-238	SOX	ORE	WR	ARG		3.83																	
Phase IV	LX-11-249	SOX	ORE	WR	ARG	PHY	6.78																	
Phase IV	LX-11-293	SOX	ORE	WR	ARG		5.65																	
Phase IV	LX-11-306	SOX	ORE	WR	ARG	PHY	6.58																	
Phase IV	LX-11-319	SOX	ORE	WR	ARG		6.88																	
Phase IV	LX-11-459	SOX	ORE	WR	ARG	POT			56.1	0.72	0.9						28.13					1.99	1.91	
Phase IV	LX-11-460	SOX	ORE	WR	ARG	POT			1.6	0.02	0.29						9.06					0.17	0.01	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-592	SOX	ORE	WR	POT	ARG			1.6	0.02	1.11						34.69					0.04	0.00	
Phase IV	LX-11-594	SOX	ORE	WR	PHY	ARG			6.2	0.08	4.09						127.81					0.05	0.03	
Phase IV	LX-11-622	SOX	ORE	WR	PHY				2.3	0.03	5.76						180.00					0.01	0.00	
Phase IV	LX-11-626	SOX	ORE	WR	PHY				5.5	0.07	6.78						211.88					0.03	0.01	
Phase IV	LX-11-734	SOX	ORE	WR	ARG	PHY			9.3	0.12	3.99						124.69					0.07	0.06	
Phase IV	LX-11-776	SOX	ORE	WR	POT	PHY			15.6	0.2	0.8						25.00					0.62	0.53	
Phase IV	LX-11-863	SOX	ORE	WR	ARG				21.0	0.27	2.23						69.69					0.30	0.27	
Phase IV	LX-11-864	SOX	ORE	WR	ARG	PHY			1.6	0.02	1.01						31.56					0.05	0.00	
Phase IV	LX-11-869	SOX	ORE	WR	ARG	POT			8.6	0.11	0.06						1.88					4.57	3.31	
Phase IV	LX-11-896	SOX	ORE	WR					4.7	0.06	6.46						201.88					0.02	0.01	
						Maximum	8.30	0.89	74.2	0.94	8.3	0.32	8.2	7.4	0.84	259	260	256	231	79.0	19.0	6.1	4.7	
						90th percentile	8.11	0.06	15.6	0.20	6.5	0.21	6.5	5.7	0.72	205	203	204	179	18.8	13.4	1.83	1.06	
						75th percentile	6.98	0.010	5.84	0.075	4.0	0.10	1.6	1.5	0.12	52	126	50.6	47.3	11.0	7.9	0.2	0.1	
						Mean	5.91	0.061	7.4	0.103	2.1	0.082	1.7	1.5	0.18	53.6	67.0	51.7	46.3	10.8	-35.4	0.6	0.4	
						Median	5.54	***0.0050***	1.56	0.030	0.80	0.050	0.13	0.12	0.010	8.2	25.0	4.1	3.8	5.4	3.2	0.060	0.015	
						25th percentile	4.89	***0.0050***	***0.40***	0.020	0.18	0.025	0.035	0.035	***0.0050***	2.7	5.6	1.1	1.1	3.6	-14.2	0.025	0.005	
						10th percentile	4.52	***0.0050***	***0.40***	0.010	0.070	0.020	0.0025	***0.0050***	***0.0050***	1.9	2.2	0.078	***0.15***	2.3	-174.1	0.0130	0.0006	
						Minimum	3.83	***0.0050***	***0.40***	0.010	0.040	***0.0050***	0.0025	***0.0050***	***0.0050***	1.4	1.3	0.078	***0.15***	-1.8	-227.9	0.00155	0.00039	
						No of samples	26	19	31	31	31	19	19	19	19	19	31	19	19	19	19	31	31	
Supergene Oxide Zone (SOX) - Waste Designated Samples																								
Phase I	08-010	SOX	WASTE	MX	ARG	PHY	3.84	***0.005***	***0.4***	***0.005***	1.95	0.68	1.27	1.21	0.06	55.6	60.94	39.69	37.81	-4.70	-42.51	0.01	0.002	None
Phase I	08-051	SOX	WASTE	PP	ARG	PHY	7.83	0.36	30.0	0.37	5.12	0.09	5.03	4.95	0.08	159.3	160.00	157.19	154.69	34.10	-120.59	0.19	0.174	Slight
Phase I	08-055	SOX	WASTE	WR	PHY	ARG	5.98	***0.005***	***0.4***	***0.005***	5.25	0.04	5.21	4.94	0.27	163.8	164.06	162.81	154.38	4.40	-149.98	0.00	0.001	None
Phase I	08-062	SOX	WASTE	WR	PHY		7.82	0.64	53.3	0.75	2.2	0.01	2.19	1.94	0.25	68.7	68.75	68.44	60.63	52.20	-8.43	0.78	0.742	Moderate
Phase I	08-074	SOX	WASTE	WR	ARG	PHY	6.52	0.02	1.7	0.02	3.02	0.04	2.98	2.96	0.02	94.1	94.38	93.13	92.50	5.90	-86.60	0.02	0.001	None
Phase I	08-110	SOX	WASTE	WR	ARG	POT	8.45	0.26	21.7	0.24	1.24	0.01	1.23	1.11	0.12	38.7	38.75	38.44	34.69	27.30	-7.39	0.56	0.499	Slight
Phase II	08-140	SOX	WASTE	MX	ARG	PHY	5.23	0.14	11.7	0.14	3.32	1.03	2.29	2.11	0.18	95.7	103.75	71.56	65.94	12.04	-53.90	0.12	0.097	None
Phase II	08-232	SOX	WASTE	WR	PHY	ARG	6.87	0.09	7.5	0.11	3.83	0.04	3.79	3.78	0.01	119.4	119.69	118.44	118.13	7.43	-110.70	0.06	0.043	None
Phase II	08-235	SOX	WASTE	WR	PHY	ARG	5.98	***0.005***	***0.4***	0.01	5.28	0.05	5.23	5.22	0.01	164.6	165.00	163.44	163.13	3.45	-159.68	0.00	0.001	None
Phase II	08-242	SOX	WASTE	WR	PHY		5.48	***0.005***	***0.4***	0.01	4.88	0.04	4.84	4.74	0.1	152.2	152.50	151.25	148.13	3.08	-145.05	0.00	0.001	None
Phase II	08-281	SOX	WASTE	IX	ARG	POT	4.99	***0.005***	***0.4***	0.01	0.6	0.28	0.32	0.17	0.15	16.6	18.75	10.00	5.31	9.03	3.72	0.02	0.006	None
Phase II	08-323	SOX	WASTE	WR	PHY	ARG	4.68	***0.005***	***0.4***	0.01	1.78	0.05	1.73	1.56	0.17	55.2	55.63	54.06	48.75	4.80	-43.95	0.01	0.002	None
Phase II	08-324	SOX	WASTE	WR	PHY	ARG	4.98	***0.005***	***0.4***	0.01	1.25	0.03	1.22	1.12	0.1	38.8	39.06	38.13	35.00	7.88	-27.12	0.01	0.003	None
Phase II	08-330	SOX	WASTE	WR	PHY	ARG	6.15	***0.005***	***0.4***	0.02	1.55	0.03	1.52	1.51	0.01	48.2	48.44	47.50	47.19	10.22	-36.97	0.01	0.002	None
Phase II	08-336	SOX	WASTE	IX	ARG	POT	4	***0.005***	***0.4***	0.01	2.92	0.71	2.21	2.2	***0.01***	85.7	91.25	69.06	68.75	0.99	-67.76	0.00	0.001	None
Phase II	08-337	SOX	WASTE	IX	ARG	POT	7.12	***0.005***	***0.4***	0.02	1.79	0.04	1.75	1.74	0.01	55.6	55.94	54.69	54.38	10.47	-43.91	0.01	0.002	None
Phase II	08-385	SOX	WASTE	WR	ARG	PHY	8.33	***0.005***	***0.4***	0.02	0.01	0.01	0.0025	***0.005***	***0.005***	0.3	0.31	0.08	***0.15***	10.32	10.32	1.28	0.320	None
Phase II	08-386	SOX	WASTE	WR	ARG	PHY	7.52	***0.005***	***0.4***	0.02	0.01	0.01	0.0025	***0.005***	***0.005***	0.3	0.31	0.08	***0.15***	7.74	7.74	1.28	0.320	None
Phase II	08-387	SOX	WASTE	WR	ARG	PHY	4.21	***0.005***	***0.4***	0.02	0.36	0.24	0.12	0.09	0.03	9.4	11.25	3.75	2.81	0.00	-2.81	0.04	0.011	None
Phase II	08-424	SOX	WASTE	WR	ARG		7.48	***0.005***	***0.4***	0.03	0.03	0.02	0.01	0.01	***0.005***	0.8	0.94	0.31	0.31	11.69	11.38	0.51	0.128	None
Phase IV	LX-11-048	SOX	WASTE	MX	ARG	PHY	5.99																	
Phase IV	LX-11-049	SOX	WASTE	MX	ARG	PHY	7.81																	
Phase IV	LX-11-050	SOX	WASTE	MX	ARG	PHY	8.19																	
Phase IV	LX-11-194	SOX	WASTE	PP	ARG	PHY	4.02																	
Phase IV	LX-11-317	SOX	WASTE	WR			6.93																	
Phase IV	LX-11-380	SOX	WASTE	WR			3.59																	
Phase IV	LX-11-381	SOX	WASTE	WR			3.15																	
Phase IV	LX-11-382	SOX	WASTE	WR			3.52																	
Phase IV	LX-11-383	SOX	WASTE	WR			3.3																	
Phase IV	LX-11-384	SOX	WASTE	WR			3.1																	
Phase IV	LX-11-385	SOX	WASTE	WR			3.55																	
Phase IV	LX-11-386	SOX	WASTE	WR			3.03																	
Phase IV	LX-11-727	SOX	WASTE	WR	PHY	ARG			1.6	0.02	1.19						37.19					0.04	0.003	
Phase IV	LX-11-739	SOX	WASTE	PP	PHY				14.8	0.19	1.12						35.00					0.42	0.355	
Phase IV	LX-11-744	SOX	WASTE	MX	PHY				12.5	0.16	3.37						105.31					0.12	0.096	
Phase IV	LX-11-757	SOX	WASTE	WR	ARG	PHY			0.8	0.01	3.32						103.75					0.01	0.001	
Phase IV	LX-11-758	SOX	WASTE	WR	ARG	PHY			0.4	***0.005***	4.36						136.25					0.00	0.001	
Phase IV	LX-11-759	SOX	WASTE	WR	ARG	PHY			0.8	0.01	8.81						275.31					0.00	0.000	
Phase IV	LX-11-761	SOX	WASTE	WR	PHY				18.7	0.24	4.21						131.56					0.14	0.124	
Phase IV	LX-11-818	SOX	WASTE	PP	PHY				1.6	0.02	4.17						130.31					0.01	0.001	
Phase IV	LX-11-865	SOX	WASTE	WR	ARG	PHY			4.7	0.06	0.85						26.56					0.18	0.087	
						Maximum	8.45	0.64	53.3	0.75	8.8	1.0	5.2	5.2	0.27	165	275	163	163	52.2	11.4	1.3	0.7	
						90th percentile	7.83	0.27	19.3	0.24	5.1	0.68	5.0	4.9	0.19	160	161	158	154	28.0	8.0	0.60	0.33	
						75th percentile	7.21	0.038	7.5	0.11	4.2	0.13	3.2	3.2	0.13	102	130	99.5	98.9	10.8	-6.2	0.18	0.12	
						Mean	5.61	0.079	6.5	0.088	2.7	0.17	2.1	2.1	0.080	71.1	83.8	67.1	64.6	10.9	-53.7	0.20	0.10	
						Median	5.73	***0.0050***	***0.40***	0.020	2.2	0.040	1.7	1.7	0.045	55.6	68.8	54.4	51.6	7.8	-43.2	0.024	0.003	
						25th percentile	3.96	***0.0050***	***0.40***	0.010	1.2	0.028	1.0	0.88	0.010	33.1	37.2	31.1	27.3	4.2	-92.6	0.007	0.001	
						10th percentile	3.32	***0.0050***	***0.40***	***0.0090***	0.29	0.010	0.0093	***0.010***	***0.0050***	0.7	9.2	0.29	***0.30***	0.89	-146	0.0028	0.0006	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC %	CaNP kg $CaCO_3$/t	C(T) %	S(T) %	$S(SO_4)$ %	non-sulphate S %	$S(S^{-2})$ %	Insoluble S %	SO_4 AP + Non-SO_4 AP kg $CaCO_3$/t	TAP kg $CaCO_3$/t	Non-SO_4 AP kg $CaCO_3$/t	SAP kg $CaCO_3$/t	ScNP (Lab) kg $CaCO_3$/t	Net NP	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
						Minimum	3.03	***0.0050***	***0.39***	***0.0050***	0.010	0.010	0.0025	***0.0050***	***0.0050***	0.31	0.31	0.078	***0.15***	-4.70	-160	0.0024	0.0004	
						No of samples	32	20	29	29	29	20	20	20	20	20	29	20	20	20	20	29	29	
Supergene Oxide Zone (SOX) - Unknown Ore/Waste Designation																								
Phase IV	LX-11-353	SOX		MX			4.5																	
Phase IV	LX-11-354	SOX		MX			4.41																	
Phase IV	LX-11-355	SOX		MX			3.86																	
Supergene Sulphide Zone (SUS) - Ore Designated Samples																								
Phase II	08-149	SUS	ORE	WR	PHY	ARG	5.55	***0.005***	***0.4***	0.01	2.84	0.03	2.81	2.79	0.02		88.75	87.81	87.19	2.70	-84.48	0.005	0.001	None
Phase II	08-162	SUS	ORE	IX	PHY		7.57	0.03	2.5	0.04	3.91	0.04	3.87	3.56	0.31		122.19	120.94	111.25	7.62	-103.63	0.021	0.001	None
Phase II	08-163	SUS	ORE	WR	PHY	ARG	6.25	0.01	0.8	0.02	2.31	0.07	2.24	2.14	0.1		72.19	70.00	66.88	10.93	-55.94	0.012	0.001	None
Phase II	08-209	SUS	ORE	PP	PHY		7.62	0.04	3.3	0.07	5.13	0.02	5.11	4.76	0.35		160.31	159.69	148.75	13.91	-134.84	0.021	0.006	None
Phase II	08-212	SUS	ORE	PP	PHY	POT	8.51	0.75	62.5	0.75	0.71	0.01	0.7	0.65	0.05		22.19	21.88	20.31	60.03	39.71	2.857	2.749	Slight
Phase II	08-245	SUS	ORE	WR	POT	ARG	4.41	***0.005***	***0.4***	0.05	1.88	0.45	1.43	1.43	***0.005***		58.75	44.69	44.69	3.94	-40.75	0.009	0.002	None
Phase II	08-271	SUS	ORE	PP	PHY	ARG	6.1	***0.005***	***0.4***	0.01	1.57	0.03	1.54	0.77	0.77		49.06	48.13	24.06	9.53	-14.53	0.008	0.002	None
Phase II	08-279	SUS	ORE	PP	POT	PHY	8.53	0.36	30.0	0.37	2.79	0.02	2.77	2.56	0.21		87.19	86.56	80.00	31.06	-48.94	0.347	0.319	Slight
Phase II	08-316	SUS	ORE	WR	POT		4.65	***0.005***	***0.4***	0.02	1.93	0.04	1.89	1.66	0.23		60.31	59.06	51.88	4.93	-46.95	0.007	0.002	None
Phase II	08-344	SUS	ORE	WR	PHY	POT	6.31	0.2	16.7	0.21	3.05	0.04	3.01	3.01	***0.005***		95.31	94.06	94.06	11.82	-82.24	0.177	0.152	Slight
Phase II	08-388	SUS	ORE	WR	PHY	ARG	8.1	0.24	20.0	0.24	1.14	0.02	1.12	1.1	0.02		35.63	35.00	34.38	20.15	-14.23	0.571	0.504	Slight
Phase II	08-389	SUS	ORE	WR	ARG	POT	6.46	***0.005***	***0.4***	0.02	0.14	0.14	0.0025	***0.005***	***0.005***		4.38	0.08	***0.15***	2.46	2.46	5.120	1.280	None
Phase II	08-390	SUS	ORE	WR	ARG	POT	5.24	***0.005***	***0.4***	0.03	0.04	0.04	0.0025	***0.005***	***0.005***		1.25	0.08	***0.15***	4.73	4.73	5.120	1.280	None
Phase II	08-391	SUS	ORE	WR	ARG	POT	5.4	0.08	6.7	0.09	0.48	0.06	0.42	0.42	***0.005***		15.00	13.13	13.13	5.16	-7.97	0.508	0.328	None
Phase II	08-401	SUS	ORE	WR	PHY	POT	8.16	0.14	11.7	0.14	1.89	0.02	1.87	1.55	0.32		59.06	58.44	48.44	14.86	-33.57	0.200	0.159	Slight
Phase II	08-430	SUS	ORE	WR	POT	ARG	7.97	***0.005***	***0.4***	0.01	0.61	0.01	0.6	0.51	0.09		19.06	18.75	15.94	12.56	-3.38	0.021	0.005	None
Phase II	08-431	SUS	ORE	WR	POT	ARG	6.6	***0.005***	***0.4***	0.02	1.06	0.24	0.82	0.75	0.07		33.13	25.63	23.44	8.08	-15.35	0.016	0.004	None
Phase II	08-436	SUS	ORE	IX	POT	PHY	7.25	***0.005***	***0.4***	0.01	0.93	0.02	0.91	0.58	0.33		29.06	28.44	18.13	10.30	-7.83	0.014	0.004	None
Phase III	09-05	SUS	ORE	PP	PHY		7.16	0.23	19.2	0.26	5.79	0.07	5.72	4.71	1.01		180.94	178.75	147.19	17.90	-129.29	0.107	0.094	Slight
Phase III	09-08	SUS	ORE	PP	PHY		5.81	0.07	5.8	0.11	3.95	0.02	3.93	3.36	0.57		123.44	122.81	105.00	10.00	-95.00	0.047	0.028	None
Phase III	09-21	SUS	ORE	WR	PHY	ARG	4.18	0.01	0.8	0.02	2.66	0.16	2.5	2.42	0.08		83.13	78.13	75.63	0.60	-75.03	0.011	0.001	None
Phase III	09-22	SUS	ORE	WR	PHY	ARG	4.28	***0.005***	***0.4***	0.02	2.18	0.09	2.09	1.97	0.12		68.13	65.31	61.56	1.60	-59.96	0.006	0.002	None
Phase III	09-23	SUS	ORE	WR	PHY		5.36	0.04	3.3	0.06	2.83	0.03	2.8	2.57	0.23		88.44	87.50	80.31	3.30	-77.01	0.038	0.011	None
Phase III	09-24	SUS	ORE	WR	PHY		5.31	0.04	3.3	0.06	3.41	0.03	3.38	3.06	0.32		106.56	105.63	95.63	5.20	-90.43	0.032	0.009	None
Phase III	09-28	SUS	ORE	IX	ARG	PHY	5.65	***0.005***	***0.4***	0.01	0.65	0.02	0.63	0.45	0.18		20.31	19.69	14.06	3.00	-11.06	0.020	0.005	None
Phase III	09-29	SUS	ORE	IX	ARG	PHY	7.12	0.01	0.8	0.02	1.01	***0.005***	1.01	0.57	0.44		31.56	31.41	17.81	3.30	-14.51	0.027	0.003	None
Phase III	09-37	SUS	ORE	WR	PHY		8.26	0.97	80.8	0.99	0.65	0.03	0.62	0.46	0.16		20.31	19.38	14.38	81.50	67.13	4.172	4.050	Slight
Phase IV	LX-11-212	SUS	ORE	PP	ARG	PHY	4.09																	
Phase IV	LX-11-262	SUS	ORE	WR	ARG		6.01																	
Phase IV	LX-11-299	SUS	ORE	WR	ARG		5.84																	
Phase IV	LX-11-328	SUS	ORE	WR	ARG	POT	4.59																	
Phase IV	LX-11-334	SUS	ORE	WR	ARG	PRO	7.02																	
Phase IV	LX-11-335	SUS	ORE	WR	ARG	PRO	6.97																	
Phase IV	LX-11-432	SUS	ORE	WR	POT	ARG			0.8	0.01	0.98						30.63					0.03	0.003	
Phase IV	LX-11-467	SUS	ORE	WR	PHY	POT			1.6	0.02	0.98						30.63					0.05	0.003	
Phase IV	LX-11-471	SUS	ORE	WR	PHY	ARG			1.6	0.02	4.11						128.44					0.01	0.001	
Phase IV	LX-11-494	SUS	ORE	IX	POT				1.6	0.02	4.35						135.94					0.01	0.001	
Phase IV	LX-11-498	SUS	ORE	WR	POT	PHY			26.5	0.34	1.46						45.63					0.58	0.529	
Phase IV	LX-11-548	SUS	ORE	WR	PHY	ARG			3.9	0.05	5.75						179.69					0.02	0.009	
Phase IV	LX-11-566	SUS	ORE	WR	POT	PHY			1.6	0.02	1.39						43.44					0.04	0.002	
Phase IV	LX-11-578	SUS	ORE	WR	POT	ARG			3.1	0.04	0.31						9.69					0.32	0.078	
Phase IV	LX-11-603	SUS	ORE	WR	POT				6.2	0.08	0.31						9.69					0.64	0.400	
Phase IV	LX-11-604	SUS	ORE	IX	POT	ARG			1.6	0.02	1.21						37.81					0.04	0.003	
Phase IV	LX-11-605	SUS	ORE	PP	PHY	ARG			0.8	0.01	3.47						108.44					0.01	0.001	
Phase IV	LX-11-617	SUS	ORE	WR	PHY	ARG			3.1	0.04	6.2						193.75					0.02	0.004	
Phase IV	LX-11-618	SUS	ORE	MX	PHY				12.5	0.16	7.86						245.63					0.05	0.041	
Phase IV	LX-11-646	SUS	ORE	WR	ARG	PHY			71.7	0.92	2.79						87.19					0.82	0.795	
Phase IV	LX-11-647	SUS	ORE	WR	PHY	PHY			74.8	0.96	3.04						95.00					0.79	0.762	
Phase IV	LX-11-648	SUS	ORE	WR	POT				1.6	0.02	0.47						14.69					0.11	0.007	
Phase IV	LX-11-649	SUS	ORE	WR	POT				5.5	0.07	0.56						17.50					0.31	0.177	
Phase IV	LX-11-650	SUS	ORE	WR	POT				1.6	0.02	0.7						21.88					0.07	0.005	
Phase IV	LX-11-651	SUS	ORE	WR	POT				56.1	0.72	0.86						26.88					2.09	1.999	
Phase IV	LX-11-749	SUS	ORE	PP	PHY	ARG			0.4	***0.005***	6.16						192.50					0.00	0.001	
Phase IV	LX-11-750	SUS	ORE	IX	POT	PHY			8.6	0.11	1.28						40.00					0.21	0.155	
Phase IV	LX-11-767	SUS	ORE	WR	POT	ARG			3.9	0.05	1.55						48.44					0.08	0.032	
Phase IV	LX-11-777	SUS	ORE	WR	POT	PHY			16.4	0.21	0.56						17.50					0.93	0.800	
Phase IV	LX-11-781	SUS	ORE	WR	PHY	POT			7.0	0.09	1.06						33.13					0.21	0.140	
Phase IV	LX-11-787	SUS	ORE	WR	PHY	POT			3.9	0.05	1.31						40.94					0.10	0.037	
Phase IV	LX-11-788	SUS	ORE	WR	POT	PRO			14.0	0.18	1.61						50.31					0.28	0.232	
Phase IV	LX-11-790	SUS	ORE	WR	PHY				52.2	0.67	2.1						65.63					0.80	0.759	
Phase IV	LX-11-792	SUS	ORE	WR	PHY				1.6	0.02	2.23						69.69					0.02	0.001	
Phase IV	LX-11-793	SUS	ORE	WR	PHY				3.1	0.04	3.52						110.00					0.03	0.007	
Phase IV	LX-11-801	SUS	ORE	WR	PHY				2.3	0.03	3.65						114.06					0.02	0.001	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-802	SUS	ORE	WR	PHY				13.2	0.17	4.78						149.38					0.09	0.073	
Phase IV	LX-11-803	SUS	ORE	WR	PHY				24.9	0.32	3.86						120.63					0.21	0.187	
Phase IV	LX-11-804	SUS	ORE	PP	PHY				0.8	0.01	3.21						100.31					0.01	0.001	
Phase IV	LX-11-808	SUS	ORE	PP	PHY	POT			4.7	0.06	5.34						166.88					0.03	0.014	
Phase IV	LX-11-812	SUS	ORE	PP	PHY				1.6	0.02	2.02						63.13					0.02	0.002	
Phase IV	LX-11-824	SUS	ORE	WR	PHY	ARG			0.8	0.01	2.16						67.50					0.01	0.001	
Phase IV	LX-11-831	SUS	ORE	WR	PHY	ARG			1.6	0.02	7.12						222.50					0.01	0.000	
Phase IV	LX-11-867	SUS	ORE	WR	ARG	POT			0.8	0.01	5.1						159.38					0.00	0.001	
Phase IV	LX-11-871	SUS	ORE	WR	PHY	POT			22.6	0.29	0.52						16.25					1.39	1.245	
Phase IV	LX-11-881	SUS	ORE	IX	PHY	POT			4.7	0.06	4.28						133.75					0.03	0.017	
Phase IV	LX-11-981	SUS	ORE	WR					2.3	0.03	0.54						16.88					0.14	0.006	
Phase IV	LX-11-982	SUS	ORE	WR					16.4	0.21	0.71						22.19					0.74	0.631	
						Maximum	8.53	0.97	80.8	0.99	7.9	0.45	5.7	4.8	1.0		246	179	149	81.5	67.1	5.1	4.1	
						90^{th} percentile	8.15	0.29	27.2	0.35	5.2	0.15	3.9	3.4	0.49		162	122	108	24.5	3.4	0.84	0.80	
						75^{th} percentile	7.25	0.11	12.5	0.16	3.5	0.065	2.8	2.7	0.32		110	87.7	83.8	13.2	-9.5	0.31	0.19	
						Mean	6.31	0.12	11.0	0.14	2.4	0.065	2.0	1.8	0.22		75.6	62.3	55.3	13.4	-42.0	0.45	0.29	
						Median	6.25	0.010	3.12	0.040	1.9	0.030	1.9	1.6	0.16		60.3	58.4	48.4	8.1	-40.7	0.041	0.009	
						25^{th} percentile	5.36	***0.0050***	0.83	0.020	0.93	0.020	0.76	0.58	0.035		29.1	23.8	18.0	3.6	-79.6	0.0161	0.0021	
						10^{th} percentile	4.45	***0.0050***	***0.40***	0.010	0.54	0.016	0.53	0.44	***0.0050***		16.8	16.5	13.7	2.6	-98.5	0.0076	0.0010	
						Minimum	4.09	***0.0050***	***0.39***	***0.0050***	0.040	***0.0050***	0.0025	***0.0050***	***0.0050***		1.3	0.078	***0.15***	0.60	-135	0.0020	0.0004	
						No of samples	33	27	69	69	69	27	27	27	27		69	27	27	27	27	69	69	
Supergene Sulphide Zone (SUS) - Waste Designated Samples																								
Phase I	08-003	SUS	WASTE	WR	PHY	ARG	4.29	***0.005***	***0.4***	***0.005***	5.7	0.07	5.63	5.58	0.05		178.125	175.9375	174.375	2.5	-171.88	0.002	0.001	None
Phase I	08-004	SUS	WASTE	WR	PHY	ARG	5.1	***0.005***	***0.4***	***0.005***	3.35	0.03	3.32	3.4	***0.005***		104.69	103.75	106.25	3.30	-102.95	0.004	0.001	None
Phase I	08-005	SUS	WASTE	WR	PHY	ARG	4.44	***0.005***	***0.4***	***0.005***	7.78	0.04	7.74	7.7	0.04		243.13	241.88	240.63	2.20	-238.43	0.002	0.000	None
Phase I	08-030	SUS	WASTE	WR	PHY	POT	4.75	0.31	25.8	0.34	2.86	0.04	2.82	2.92	***0.005***		89.38	88.13	91.25	20.40	-70.85	0.293	0.266	Slight
Phase I	08-032	SUS	WASTE	IX	ARG	POT	4.22	***0.005***	***0.4***	***0.005***	2.18	0.88	1.3	1.23	0.07		68.13	40.63	38.44	10.40	-28.04	0.010	0.002	None
Phase I	08-033	SUS	WASTE	IX	ARG	POT	4.23	***0.005***	***0.4***	***0.005***	2.89	1.5	1.39	1.24	0.15		90.31	43.44	38.75	3.00	-35.75	0.009	0.002	None
Phase I	08-058	SUS	WASTE	WR	PHY	ARG	5.38	***0.005***	***0.4***	***0.005***	3.11	0.04	3.07	2.94	0.13		97.19	95.94	91.88	3.70	-88.18	0.004	0.001	None
Phase I	08-064	SUS	WASTE	PP	PHY		7.93	0.53	44.2	0.57	0.76	0.03	0.73	0.72	0.01		23.75	22.81	22.50	51.40	28.90	1.936	1.833	Moderate
Phase I	08-068	SUS	WASTE	WR	POT		8.23	0.22	18.3	0.23	2.27	0.03	2.24	1.95	0.29		70.94	70.00	60.94	33.00	-27.94	0.262	0.228	Slight
Phase I	08-069	SUS	WASTE	WR	PHY	POT	7.68	0.06	5.0	0.1	1.93	0.08	1.85	1.72	0.13		60.31	57.81	53.75	15.60	-38.15	0.086	0.046	None
Phase I	08-105	SUS	WASTE	WR	POT	PHY	8.17	0.24	20.0	0.3	0.86	***0.005***	0.86	0.79	0.07		26.88	26.72	24.69	28.30	3.61	0.749	0.660	Slight
Phase I	08-116	SUS	WASTE	WR	PHY	ARG	6.73	0.08	6.7	0.15	1.3	0.02	1.28	1.13	0.15		40.63	40.00	35.31	10.20	-25.11	0.167	0.108	None
Phase I	08-119	SUS	WASTE	PP	PHY		7.99	0.54	45.0	0.59	1.19	0.02	1.17	1.13	0.04		37.19	36.56	35.31	27.70	-7.61	1.231	1.166	Slight
Phase I	08-120	SUS	WASTE	PP	PHY		7.84	0.18	15.0	0.21	1.11	***0.005***	1.11	1.05	0.06		34.69	34.53	32.81	12.80	-20.01	0.434	0.366	None
Phase I	08-129	SUS	WASTE	WR	PHY		7.66	0.02	1.7	0.03	5.07	0.02	5.05	5.14	***0.005***		158.44	157.81	160.63	20.70	-139.93	0.011	0.001	None
Phase II	08-136	SUS	WASTE	WR	PHY	ARG	5.23	***0.005***	***0.4***	0.02	3.62	0.03	3.59	3.57	0.02		113.13	112.19	111.56	5.65	-105.91	0.004	0.001	None
Phase II	08-176	SUS	WASTE	MX	PHY	ARG	5.19	***0.005***	***0.4***	0.01	6.68	0.03	6.65	6.17	0.48		208.75	207.81	192.81	2.26	-190.56	0.002	0.000	None
Phase II	08-177	SUS	WASTE	WR	PHY		6.16	***0.005***	***0.4***	0.01	3.44	0.02	3.42	3.13	0.29		107.50	106.88	97.81	5.14	-92.67	0.004	0.001	None
Phase II	08-196	SUS	WASTE	WR	ARG	PHY	7.46	0.39	32.5	0.41	2.58	0.05	2.53	2.42	0.11		80.63	79.06	75.63	22.81	-52.82	0.411	0.381	Slight
Phase II	08-206	SUS	WASTE	PP	ARG	PHY	7.76	***0.005***	***0.4***	0.01	1.33	0.02	1.31	1.29	0.02		41.56	40.94	40.31	15.16	-25.15	0.010	0.002	None
Phase II	08-207	SUS	WASTE	PP	ARG	PHY	5.59	***0.005***	***0.4***	0.01	3.38	0.03	3.35	3.28	0.07		105.63	104.69	102.50	11.53	-90.97	0.004	0.001	None
Phase II	08-208	SUS	WASTE	PP	ARG	PHY	6.52	***0.005***	***0.4***	0.02	1.77	0.02	1.75	1.74	0.01		55.31	54.69	54.38	17.17	-37.21	0.007	0.002	None
Phase II	08-236	SUS	WASTE	WR	PHY	ARG	7.55	0.08	6.7	0.1	2.49	0.06	2.43	2.43	***0.005***		77.81	75.94	75.94	24.38	-51.55	0.088	0.057	None
Phase II	08-258	SUS	WASTE	PP	POT		7.94	0.12	10.0	0.13	0.74	0.02	0.72	0.71	0.01		23.13	22.50	22.19	11.63	-10.55	0.444	0.340	None
Phase II	08-265	SUS	WASTE	PP	POT	PHY	8.29	0.24	20.0	0.27	0.72	0.02	0.7	0.7	***0.005***		22.50	21.88	21.88	11.39	-10.49	0.914	0.806	Slight
Phase II	08-270	SUS	WASTE	PP	PHY	ARG	5.54	***0.005***	***0.4***	0.01	3.73	0.04	3.69	3.86	***-0.17***		116.56	115.31	120.63	9.03	-111.59	0.003	0.001	None
Phase II	08-278	SUS	WASTE	PP	POT	PHY	6.48	0.01	0.8	0.01	2.19	0.13	2.06	2	0.06		68.44	64.38	62.50	14.85	-47.65	0.013	0.002	None
Phase II	08-310	SUS	WASTE	WR	PHY	POT	6.07	***0.005***	***0.4***	0.02	0.76	0.03	0.73	0.73	***0.005***		23.75	22.81	22.81	14.16	-8.65	0.018	0.004	None
Phase II	08-317	SUS	WASTE	WR	POT		5.23	0.04	3.3	0.07	0.93	0.02	0.91	0.81	0.1		29.06	28.44	25.31	6.53	-18.79	0.117	0.034	None
Phase II	08-325	SUS	WASTE	WR	PHY	ARG	7.32	0.03	2.5	0.03	0.96	0.02	0.94	0.87	0.07		30.00	29.38	27.19	8.74	-18.44	0.085	0.005	None
Phase II	08-326	SUS	WASTE	WR	PHY	ARG	7.96	0.09	7.5	0.09	1.45	0.02	1.43	1.34	0.09		45.31	44.69	41.88	14.78	-27.10	0.168	0.115	None
Phase II	08-331	SUS	WASTE	PP	PHY		8.08	0.48	40.0	0.5	1.94	0.02	1.92	1.7	0.22		60.63	60.00	53.13	21.18	-31.94	0.667	0.627	Slight
Phase II	08-338	SUS	WASTE	PP	POT		7.74	0.04	3.3	0.05	0.59	0.02	0.57	0.57	***0.005***		18.44	17.81	17.81	13.30	-4.51	0.187	0.055	None
Phase II	08-379	SUS	WASTE	WR	PHY	POT	4.96	***0.005***	***0.4***	0.03	0.28	0.03	0.25	0.24	0.01		8.75	7.81	7.50	7.74	0.24	0.051	0.013	None
Phase II	08-392	SUS	WASTE	WR	ARG	POT	6.01	***0.005***	***0.4***	0.02	0.19	0.03	0.16	0.15	0.01		5.94	5.00	4.69	1.97	-2.72	0.080	0.020	None
Phase II	08-393	SUS	WASTE	WR	POT		7.34	***0.005***	***0.4***	0.02	0.57	0.03	0.54	0.48	0.06		17.81	16.88	15.00	2.70	-12.30	0.024	0.006	None
Phase II	08-415	SUS	WASTE	WR	PHY	PRO	8.67	0.1	8.3	0.11	0.6	0.01	0.59	0.4	0.19		18.75	18.44	12.50	21.14	8.64	0.452	0.324	Slight
Phase II	08-426	SUS	WASTE	WR	PHY	POT	8.63	0.19	15.8	0.2	0.63	0.02	0.61	0.56	0.05		19.69	19.06	17.50	26.87	9.37	0.831	0.707	Slight
Phase III	09-09	SUS	WASTE	PP	PHY		8.06	0.24	20.0	0.29	3.44	0.01	3.43	3.23	0.2		107.50	107.19	100.94	24.80	-76.14	0.187	0.165	Slight
Phase III	09-25	SUS	WASTE	WR	PHY	ARG	3.77	***0.005***	***0.4***	0.01	2.63	0.32	2.31	2.22	0.09		82.19	72.19	69.38	-2.10	-71.48	0.006	0.001	None
Phase IV	LX-11-307	SUS	WASTE	WR	ARG	PHY	5.54																	
Phase IV	LX-11-336	SUS	WASTE	WR	ARG	PRO	7.24																	
Phase IV	LX-11-398b	SUS	WASTE	WR					1.6	0.02	0.73						22.81					0.07	0.004	
Phase IV	LX-11-455	SUS	WASTE	WR	PHY				42.8	0.55	2.15						67.19					0.64	0.603	
Phase IV	LX-11-480	SUS	WASTE	WR	PHY	ARG			14.8	0.19	5.77						180.31					0.08	0.069	
Phase IV	LX-11-487	SUS	WASTE	WR	PHY				9.3	0.12	3.11						97.19					0.10	0.072	
Phase IV	LX-11-488	SUS	WASTE	WR	PHY				35.1	0.45	3.77						117.81					0.30	0.278	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-500	SUS	WASTE	WR	PHY	ARG			1.6	0.02	5.11						159.69					0.01	0.001	
Phase IV	LX-11-501	SUS	WASTE	WR	PHY	ARG			17.1	0.22	4.24						132.50					0.13	0.112	
Phase IV	LX-11-522	SUS	WASTE	PP	POT	PHY			37.4	0.48	5.49						171.56					0.22	0.204	
Phase IV	LX-11-553	SUS	WASTE	PP	ARG				0.8	0.01	2.59						80.94					0.01	0.001	
Phase IV	LX-11-562	SUS	WASTE	WR	PHY	ARG			5.5	0.07	2.58						80.63					0.07	0.038	
Phase IV	LX-11-565	SUS	WASTE	WR	ARG	PRO			3.1	0.04	0.57						17.81					0.17	0.042	
Phase IV	LX-11-614	SUS	WASTE	WR	PHY	ARG			3.1	0.04	4.02						125.63					0.02	0.006	
Phase IV	LX-11-615	SUS	WASTE	WR	PHY	ARG			2.3	0.03	4.35						135.94					0.02	0.001	
Phase IV	LX-11-616	SUS	WASTE	WR	PHY	ARG			2.3	0.03	4.95						154.69					0.02	0.001	
Phase IV	LX-11-621	SUS	WASTE	WR	POT	PHY			21.0	0.27	2.29						71.56					0.29	0.261	
Phase IV	LX-11-624	SUS	WASTE	WR	PHY				1.6	0.02	8.26						258.13					0.01	0.000	
Phase IV	LX-11-627	SUS	WASTE	WR	PHY				26.5	0.34	4.91						153.44					0.17	0.157	
Phase IV	LX-11-628	SUS	WASTE	WR	PHY				1.6	0.02	8.27						258.44					0.01	0.000	
Phase IV	LX-11-635	SUS	WASTE	WR	ARG	PHY			10.9	0.14	4.65						145.31					0.08	0.059	
Phase IV	LX-11-636	SUS	WASTE	WR	ARG	PHY			42.1	0.54	3.12						97.50					0.43	0.407	
Phase IV	LX-11-702	SUS	WASTE	WR	POT	PHY			1.6	0.02	2.83						88.44					0.02	0.001	
Phase IV	LX-11-716	SUS	WASTE	WR	PHY	POT			2.3	0.03	0.45						14.06					0.17	0.007	
Phase IV	LX-11-717	SUS	WASTE	WR	PHY	POT			5.5	0.07	2.15						67.19					0.08	0.046	
Phase IV	LX-11-722	SUS	WASTE	WR	ARG	PHY			2.3	0.03	1.5						46.88					0.05	0.002	
Phase IV	LX-11-743	SUS	WASTE	PP	PHY				0.8	0.01	3.32						103.75					0.01	0.001	
Phase IV	LX-11-751	SUS	WASTE	MX	PHY	ARG			65.4	0.84	2.87						89.69					0.73	0.703	
Phase IV	LX-11-752	SUS	WASTE	WR	PHY	POT			14.8	0.19	1.22						38.13					0.39	0.326	
Phase IV	LX-11-756	SUS	WASTE	PP	PHY				20.3	0.26	3.2						100.00					0.20	0.179	
Phase IV	LX-11-760	SUS	WASTE	WR	ARG	PHY			33.5	0.43	3.74						116.88					0.29	0.266	
Phase IV	LX-11-762	SUS	WASTE	WR	PHY				11.7	0.15	6.07						189.69					0.06	0.049	
Phase IV	LX-11-768	SUS	WASTE	WR	PHY	ARG			13.2	0.17	0.4						12.50					1.06	0.871	
Phase IV	LX-11-784	SUS	WASTE	WR	PHY				1.6	0.02	2.04						63.75					0.02	0.002	
Phase IV	LX-11-789	SUS	WASTE	WR	PHY				0.8	0.01	2.09						65.31					0.01	0.002	
Phase IV	LX-11-791	SUS	WASTE	WR	PHY				3.1	0.04	0.91						28.44					0.11	0.027	
Phase IV	LX-11-797	SUS	WASTE	PP	PHY				23.4	0.3	2.97						92.81					0.25	0.226	
Phase IV	LX-11-798	SUS	WASTE	MX	PHY				0.8	0.01	4.27						133.44					0.01	0.001	
Phase IV	LX-11-799	SUS	WASTE	MX	PHY				1.6	0.02	4.94						154.38					0.01	0.001	
Phase IV	LX-11-800	SUS	WASTE	MX	PHY				1.6	0.02	5.2						162.50					0.01	0.001	
Phase IV	LX-11-805	SUS	WASTE	PP	PHY				4.7	0.06	3.82						119.38					0.04	0.019	
Phase IV	LX-11-813	SUS	WASTE	PP	PHY				0.4	***0.005***	1.95						60.94					0.01	0.002	
Phase IV	LX-11-819	SUS	WASTE	PP	PHY				38.2	0.49	4.29						134.06					0.28	0.267	
Phase IV	LX-11-827	SUS	WASTE	WR	PHY	ARG			0.4	***0.005***	3.34						104.38					0.00	0.001	
Phase IV	LX-11-828	SUS	WASTE	WR	PHY	ARG			1.6	0.02	4.2						131.25					0.01	0.001	
Phase IV	LX-11-829	SUS	WASTE	WR	PHY	ARG			0.4	***0.005***	5.58						174.38					0.00	0.001	
Phase IV	LX-11-830	SUS	WASTE	WR	PHY	ARG			0.8	0.01	6.42						200.63					0.00	0.000	
Phase IV	LX-11-832	SUS	WASTE	WR	PHY	ARG			0.4	***0.005***	4.96						155.00					0.00	0.001	
Phase IV	LX-11-833	SUS	WASTE	WR	PHY	ARG			1.6	0.02	6.6						206.25					0.01	0.000	
Phase IV	LX-11-834	SUS	WASTE	WR	PHY	ARG			0.8	0.01	4.48						140.00					0.01	0.001	
Phase IV	LX-11-835	SUS	WASTE	WR	PHY	ARG			0.4	***0.005***	6.29						196.56					0.00	0.001	
Phase IV	LX-11-836	SUS	WASTE	WR	PHY	ARG			10.9	0.14	4.42						138.13					0.08	0.062	
Phase IV	LX-11-837	SUS	WASTE	WR	PHY	ARG			4.7	0.06	3.58						111.88					0.04	0.021	
Phase IV	LX-11-838	SUS	WASTE	WR	PHY	ARG			2.3	0.03	5.63						175.94					0.01	0.001	
Phase IV	LX-11-839	SUS	WASTE	WR	PHY	ARG			1.6	0.02	5.67						177.19					0.01	0.001	
Phase IV	LX-11-840	SUS	WASTE	WR	PHY	ARG			0.8	0.01	4.77						149.06					0.01	0.001	
Phase IV	LX-11-841	SUS	WASTE	WR	PHY				0.4	***0.005***	9.78						305.63					0.00	0.000	
Phase IV	LX-11-860	SUS	WASTE	WR	ARG	PHY			1.6	0.02	4.17						130.31					0.01	0.001	
Phase IV	LX-11-861	SUS	WASTE	WR	ARG	PHY			8.6	0.11	3.12						97.50					0.09	0.064	
Phase IV	LX-11-862	SUS	WASTE	WR	ARG	PHY			18.7	0.24	3.06						95.63					0.20	0.171	
Phase IV	LX-11-866	SUS	WASTE	WR	ARG	PHY			1.6	0.02	1.11						34.69					0.04	0.003	
Phase IV	LX-11-870	SUS	WASTE	WR	ARG	POT			2.3	0.03	0.6						18.75					0.12	0.005	
Phase IV	LX-11-878	SUS	WASTE	PP	POT	PHY			2.3	0.03	2.48						77.50					0.03	0.001	
Phase IV	LX-11-891	SUS	WASTE	WR					3.9	0.05	3.47						108.44					0.04	0.014	
Phase IV	LX-11-892	SUS	WASTE	WR					20.3	0.26	3.1						96.88					0.21	0.185	
Phase IV	LX-11-897	SUS	WASTE	WR					7.8	0.1	7.37						230.31					0.03	0.024	
Phase IV	LX-11-916	SUS	WASTE	WR					44.4	0.57	5.09						159.06					0.28	0.264	
Phase IV	LX-11-927	SUS	WASTE	WR					49.1	0.63	3.34						104.38					0.47	0.448	
Phase IV	LX-11-928	SUS	WASTE	WR					23.4	0.3	5.91						184.69					0.13	0.114	
Phase IV	LX-11-929	SUS	WASTE	WR					21.8	0.28	3.85						120.31					0.18	0.162	
						Maximum	8.67	0.54	65.4	0.84	9.8	1.5	7.7	7.7	0.48		306	242	241	51.4	28.9	1.9	1.8	
						90^{th} percentile	8.16	0.32	34.0	0.44	5.8	0.09	3.8	4.0	0.20		182	120	125	26.9	0.58	0.45	0.39	
						75^{th} percentile	7.91	0.18	16.2	0.21	4.5	0.04	3.1	3.0	0.12		141	97.9	93.4	20.8	-10.5	0.20	0.17	
						Mean	6.59	0.11	10.4	0.14	3.3	0.10	2.2	2.1	0.080		102	67.3	65.0	14.0	-51.1	0.17	0.14	
						Median	6.99	0.025	2.8	0.035	3.1	0.030	1.6	1.5	0.060		97.3	49.7	47.5	12.2	-30.0	0.056	0.013	
						25^{th} percentile	5.27	***0.0050***	***0.78***	0.020	1.7	0.020	0.83	0.78	0.010		53.2	25.7	24.2	5.5	-79.1	0.0095	0.0010	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC %	CaNP kg $CaCO_3$/t	C(T) %	S(T) %	$S(SO_4)$ %	non-sulphate S %	$S(S^{-2})$ %	Insoluble S %	SO_4 AP + Non-SO_4 AP kg $CaCO_3$/t	TAP kg $CaCO_3$/t	Non-SO_4 AP kg $CaCO_3$/t	SAP kg $CaCO_3$/t	ScNP (Lab) kg $CaCO_3$/t	Net NP	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
						10^{th} percentile	4.47	***0.0050***	***0.40***	***0.0050***	0.73	0.019	0.59	0.55	***0.005***		22.7	18.4	17.3	2.5	-114	0.0038	0.0006	
						Minimum	3.77	***0.0050***	***0.39***	***0.0050***	0.19	***0.0050***	0.16	0.15	***-0.17***		5.9	5.0	4.7	-2.1	-238	0.00127	0.00033	
						No of samples	42	40	108	108	108	40	40	40	40		108	40	40	40	40	108	108	
Supergene Sulphide Zone (SUS) - Unknown Ore/Waste Designation																								
Phase IV	LX-11-356	SUS		MX			3.91																	
Hypogene Zone (HYP) - Ore Designated Samples																								
Phase II	08-146	HYP	ORE	WR	PHY		4.99	***0.005***	***0.4***	0.01	4.67	0.03	4.64	4.44	0.2		145.94	145.00	138.75	2.95	-135.80	0.00	0.001	None
Phase II	08-150	HYP	ORE	WR	PHY	ARG	6.11	***0.005***	***0.4***	0.01	1.97	0.02	1.95	1.84	0.11		61.56	60.94	57.50	4.67	-52.83	0.01	0.002	None
Phase II	08-156	HYP	ORE	WR	PHY	ARG	5.13	***0.005***	***0.4***	0.01	6.51	0.05	6.46	5.87	0.59		203.44	201.88	183.44	3.93	-179.51	0.00	0.000	None
Phase II	08-157	HYP	ORE	WR	PHY	ARG	4.24	***0.005***	***0.4***	0.01	11	0.08	10.92	10.2	0.72		343.75	341.25	318.75	2.46	-316.29	0.00	0.000	None
Phase II	08-158	HYP	ORE	WR	PHY	ARG	5.09	0.05	4.2	0.05	3.01	0.07	2.94	2.74	0.2		94.06	91.88	85.63	7.49	-78.13	0.05	0.005	None
Phase II	08-159	HYP	ORE	WR	PHY	ARG	5.88	0.01	0.8	0.01	3.22	0.06	3.16	3.08	0.08		100.63	98.75	96.25	7.25	-89.00	0.01	0.001	None
Phase II	08-160	HYP	ORE	WR	PHY	POT	7.19	0.14	11.7	0.14	8.29	0.06	8.23	7.45	0.78		259.06	257.19	232.81	17.08	-215.74	0.05	0.031	None
Phase II	08-181	HYP	ORE	WR	PHY		6.54	0.01	0.8	0.02	3.24	0.2	3.04	2.71	0.33		101.25	95.00	84.69	4.14	-80.55	0.01	0.001	None
Phase II	08-182	HYP	ORE	WR	PHY		7.88	0.74	61.7	0.74	1.62	0.05	1.57	1.29	0.28		50.63	49.06	40.31	54.51	14.20	1.26	1.181	Slight
Phase II	08-185	HYP	ORE	WR	POT		7.53	0.01	0.8	0.03	2.65	0.03	2.62	2.24	0.38		82.81	81.88	70.00	18.05	-51.95	0.01	0.001	None
Phase II	08-187	HYP	ORE	IX	PHY		7.87	0.32	26.7	0.35	1.46	0.08	1.38	1.05	0.33		45.63	43.13	32.81	26.69	-6.12	0.62	0.532	Slight
Phase II	08-188	HYP	ORE	WR	POT	PHY	8.4	0.75	62.5	0.8	1.62	0.02	1.6	1.5	0.1		50.63	50.00	46.88	65.91	19.04	1.25	1.176	Slight
Phase II	08-189	HYP	ORE	IX	PHY	POT	8.05	0.47	39.2	0.5	0.89	0.01	0.88	0.77	0.11		27.81	27.50	24.06	28.07	4.01	1.42	1.289	Slight
Phase II	08-190	HYP	ORE	IX	PHY	POT	8.18	0.2	16.7	0.21	0.89	0.02	0.87	0.71	0.16		27.81	27.19	22.19	25.94	3.75	0.61	0.476	Slight
Phase II	08-191	HYP	ORE	IX	PHY	POT	8.23	0.14	11.7	0.15	0.71	0.01	0.7	0.54	0.16		22.19	21.88	16.88	23.31	6.43	0.53	0.363	Slight
Phase II	08-213	HYP	ORE	PP	PHY	POT	8.52	0.55	45.8	0.58	1.92	0.01	1.91	1.83	0.08		60.00	59.69	57.19	55.60	-1.59	0.77	0.706	Slight
Phase II	08-216	HYP	ORE	PP	PHY	POT	8.02	0.51	42.5	0.54	2.41	0.05	2.36	2.24	0.12		75.31	73.75	70.00	58.30	-11.70	0.58	0.526	Slight
Phase II	08-217	HYP	ORE	PP	PRO	POT	8.29	0.61	50.8	0.61	0.81	0.02	0.79	0.76	0.03		25.31	24.69	23.75	68.44	44.69	2.06	1.908	Slight
Phase II	08-218	HYP	ORE	IX	PHY		8.26	0.74	61.7	0.75	1.42	0.02	1.4	1.32	0.08		44.38	43.75	41.25	60.77	19.52	1.41	1.324	Slight
Phase II	08-246	HYP	ORE	WR	POT	PHY	7.88	0.16	13.3	0.16	2.13	0.02	2.11	1.96	0.15		66.56	65.94	61.25	16.01	-45.24	0.20	0.146	Slight
Phase II	08-247	HYP	ORE	WR	PHY	POT	7.94	0.09	7.5	0.09	2.52	0.09	2.43	2.25	0.18		78.75	75.94	70.31	18.23	-52.09	0.10	0.050	Slight
Phase II	08-248	HYP	ORE	WR	PHY	POT	8.16	0.15	12.5	0.15	1.07	0.36	0.71	0.62	0.09		33.44	22.19	19.38	26.48	7.10	0.56	0.396	Slight
Phase II	08-251	HYP	ORE	WR	PHY	POT	8.42	0.24	20.0	0.24	5.04	0.03	5.01	5	***0.01***		157.50	156.56	156.25	30.54	-125.71	0.13	0.104	Slight
Phase II	08-252	HYP	ORE	WR	PHY	POT	8.12	0.19	15.8	0.19	7.28	0.04	7.24	7.22	0.02		227.50	226.25	225.63	23.03	-202.60	0.07	0.054	Slight
Phase II	08-255	HYP	ORE	IX	POT		7.49	0.61	50.8	0.71	2.27	0.03	2.24	2.22	0.02		70.94	70.00	69.38	19.18	-50.19	0.73	0.673	Slight
Phase II	08-256	HYP	ORE	IX	POT		8.04	0.26	21.7	0.26	1.04	0.32	0.72	0.61	0.11		32.50	22.50	19.06	26.36	7.30	0.96	0.798	Slight
Phase II	08-261	HYP	ORE	IX	POT		8.18	0.19	15.8	0.2	1.71	1.1	0.61	0.55	0.06		53.44	19.06	17.19	26.73	9.55	0.83	0.635	Slight
Phase II	08-272	HYP	ORE	PP	PHY	POT	7.87	0.03	2.5	0.03	0.79	0.03	0.76	0.35	0.41		24.69	23.75	10.94	14.11	3.17	0.11	0.004	None
Phase II	08-283	HYP	ORE	IX	POT	ARG	8.28	0.2	16.7	0.2	0.66	0.01	0.65	0.48	0.17		20.63	20.31	15.00	21.91	6.91	0.82	0.637	Slight
Phase II	08-286	HYP	ORE	WR	PHY		8.17	0.32	26.7	0.34	1.12	0.02	1.1	1.02	0.08		35.00	34.38	31.88	34.78	2.90	0.78	0.668	Slight
Phase II	08-301	HYP	ORE	WR	POT	ARG	5.15	***0.005***	***0.4***	0.02	0.89	0.02	0.87	0.83	0.04		27.81	27.19	25.94	4.80	-21.13	0.01	0.004	None
Phase II	08-302	HYP	ORE	WR	POT		8.07	0.51	42.5	0.54	1.34	0.04	1.3	1.28	0.02		41.88	40.63	40.00	60.10	20.10	1.05	0.955	Slight
Phase II	08-312	HYP	ORE	WR	PHY	POT	8.15	0.26	21.7	0.27	2.03	0.53	1.5	1.22	0.28		63.44	46.88	38.13	30.30	-7.83	0.46	0.383	Slight
Phase II	08-340	HYP	ORE	PP	POT		8.44	0.18	15.0	0.18	0.3	***0.005***	0.3	0.26	0.04		9.38	9.22	8.13	14.16	6.04	1.63	1.224	Slight
Phase II	08-346	HYP	ORE	WR	PHY	POT	8.49	0.9	75.0	1.05	0.67	0.01	0.66	0.62	0.04		20.94	20.63	19.38	59.73	40.35	3.64	3.456	Slight
Phase II	08-356	HYP	ORE	WR	POT	PHY	8.35	0.35	29.2	0.36	0.33	0.02	0.31	0.21	0.1		10.31	9.69	6.56	32.19	25.62	3.01	2.627	Slight
Phase II	08-359	HYP	ORE	WR	PHY	POT	8.07	0.29	24.2	0.31	0.5	0.02	0.48	0.27	0.21		15.63	15.00	8.44	23.10	14.66	1.61	1.363	Slight
Phase II	08-360	HYP	ORE	WR	POT	PHY	8.03	0.23	19.2	0.23	1.07	0.05	1.02	0.96	0.06		33.44	31.88	30.00	29.48	-0.52	0.60	0.485	Slight
Phase II	08-361	HYP	ORE	WR	POT	PHY	8.5	0.04	3.3	0.04	1.07	0.75	0.32	0.23	0.09		33.44	10.00	7.19	20.27	13.08	0.33	0.010	None
Phase II	08-365	HYP	ORE	WR	PRO	POT	8.34	0.48	40.0	0.53	1.01	0.02	0.99	0.92	0.07		31.56	30.94	28.75	57.90	29.15	1.29	1.173	Slight
Phase II	08-367	HYP	ORE	WR	POT	PHY	8.28	0.27	22.5	0.29	0.6	0.03	0.57	0.51	0.06		18.75	17.81	15.94	26.90	10.97	1.26	1.054	Slight
Phase II	08-370	HYP	ORE	WR	PHY	POT	7.98	1.58	131.7	1.59	2.4	0.72	1.68	1.67	0.01		75.00	52.50	52.19	169.15	116.97	2.51	2.437	Moderate
Phase II	08-381	HYP	ORE	WR	POT	PHY	8.42	0.1	8.3	0.11	0.61	0.02	0.59	0.48	0.11		19.06	18.44	15.00	21.38	6.38	0.45	0.250	Slight
Phase II	08-399	HYP	ORE	WR	POT		8.07	1.27	105.8	1.3	4.29	0.07	4.22	3.28	0.94		134.06	131.88	102.50	110.07	7.57	0.80	0.774	Moderate
Phase II	08-402	HYP	ORE	WR	PHY	POT	8.54	0.2	16.7	0.22	0.7	0.01	0.69	0.49	0.2		21.88	21.56	15.31	31.33	16.01	0.77	0.600	Slight
Phase II	08-403	HYP	ORE	WR	PHY	POT	8.52	0.29	24.2	0.31	1.13	0.02	1.11	0.87	0.24		35.31	34.69	27.19	33.54	6.35	0.70	0.589	Slight
Phase II	08-404	HYP	ORE	WR	PHY	POT	8.68	0.21	17.5	0.23	0.58	0.02	0.56	0.42	0.14		18.13	17.50	13.13	21.99	8.87	1.00	0.787	Slight
Phase II	08-410	HYP	ORE	WR	POT	PHY	8.22	0.55	45.8	0.6	2.32	0.06	2.26	2.14	0.12		72.50	70.63	66.88	40.17	-26.70	0.65	0.596	Slight
Phase II	08-412	HYP	ORE	WR	PHY	PRO	8.26	1.02	85.0	1.05	1.67	0.04	1.63	1.42	0.21		52.19	50.94	44.38	90.80	46.43	1.67	1.596	Moderate
Phase II	08-413	HYP	ORE	WR	PHY	PRO	8.71	0.16	13.3	0.19	0.37	0.02	0.35	0.2	0.15		11.56	10.94	6.25	25.92	19.67	1.22	0.879	Slight
Phase II	08-417	HYP	ORE	WR	POT	PRO	8.74	0.16	13.3	0.17	0.4	0.02	0.38	0.24	0.14		12.50	11.88	7.50	30.85	23.35	1.12	0.810	Slight
Phase III	09-07	HYP	ORE	PP	PHY		7.69	0.35	29.2	0.38	5.79	1.94	3.85	2.64	1.21		180.94	120.31	82.50	31.00	-51.50	0.24	0.212	Slight
Phase III	09-12	HYP	ORE	PP	PHY		8.21	0.16	13.3	0.19	2.01	0.56	1.45	1.12	0.33		62.81	45.31	35.00	24.00	-11.00	0.29	0.212	Slight
Phase III	09-30	HYP	ORE	IX	PHY		8.35	0.22	18.3	0.24	0.47	***0.005***	0.47	0.25	0.22		14.69	14.53	7.81	22.20	14.39	1.26	1.006	Slight
Phase III	09-31	HYP	ORE	WR	POT		8.10	0.3	25.0	0.33	1.43	0.32	1.11	0.78	0.33		44.69	34.69	24.38	31.70	7.33	0.72	0.613	Slight
Phase III	09-32	HYP	ORE	IX	POT		8.25	0.66	55.0	0.69	0.79	***0.005***	0.79	0.44	0.35		24.69	24.53	13.75	56.90	43.15	2.24	2.090	Slight
Phase III	09-38	HYP	ORE	WR	POT	PHY	8.04	0.44	36.7	0.47	1.71	0.01	1.7	1.53	0.17		53.44	53.13	47.81	32.60	-15.21	0.69	0.620	Slight
Phase III	09-39	HYP	ORE	WR	POT		8.10	0.09	7.5	0.11	0.79	0.34	0.45	0.29	0.16		24.69	14.06	9.06	21.70	12.64	0.53	0.269	Slight
Phase IV	LX-11-401	HYP	ORE	IX					29.6	0.38	0.73						22.81					1.30	1.135	
Phase IV	LX-11-402	HYP	ORE	IX					63.1	0.81	0.6						18.75					3.37	3.167	
Phase IV	LX-11-403	HYP	ORE	IX	POT				77.1	0.99	0.56						17.50					4.41	4.194	
Phase IV	LX-11-405	HYP	ORE	IX	POT	PHY			56.1	0.72	1.25						39.06					1.44	1.341	
Phase IV	LX-11-406	HYP	ORE	PP	POT				7.8	0.1	0.8						25.00					0.31	0.163	
Phase IV	LX-11-407	HYP	ORE	PP	POT				70.9	0.91	1.88						58.75					1.21	1.143	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-408	HYP	ORE	WR	PHY	POT			11.7	0.15	0.9						28.13					0.42	0.283	
Phase IV	LX-11-409	HYP	ORE	WR	PHY	POT			5.5	0.07	2.26						70.63					0.08	0.025	
Phase IV	LX-11-412	HYP	ORE	IX	POT				15.6	0.2	0.99						30.94					0.50	0.383	
Phase IV	LX-11-413	HYP	ORE	IX	POT				35.1	0.45	1.35						42.19					0.83	0.743	
Phase IV	LX-11-414	HYP	ORE	IX	PHY				15.6	0.2	1.89						59.06					0.26	0.201	
Phase IV	LX-11-415	HYP	ORE	IX	POT				42.1	0.54	1.1						34.38					1.22	1.115	
Phase IV	LX-11-417	HYP	ORE	PP	POT				8.6	0.11	2.1						65.63					0.13	0.074	
Phase IV	LX-11-418	HYP	ORE	IX	POT				50.6	0.65	4.08						127.50					0.40	0.368	
Phase IV	LX-11-420	HYP	ORE	WR	PHY	POT			25.7	0.33	0.31						9.69					2.65	2.270	
Phase IV	LX-11-421	HYP	ORE	IX	POT	PHY			53.7	0.69	1.58						49.38					1.09	1.013	
Phase IV	LX-11-423	HYP	ORE	IX	POT	PHY			56.9	0.73	0.86						26.88					2.12	1.977	
Phase IV	LX-11-424	HYP	ORE	IX	POT	PHY			38.2	0.49	0.61						19.06					2.00	1.807	
Phase IV	LX-11-425	HYP	ORE	IX	POT	PHY			21.8	0.28	0.58						18.13					1.20	0.998	
Phase IV	LX-11-426	HYP	ORE	IX	POT	PHY			83.3	1.07	1.77						55.31					1.51	1.440	
Phase IV	LX-11-427	HYP	ORE	WR	POT	PHY			32.7	0.42	0.87						27.19					1.20	1.067	
Phase IV	LX-11-428	HYP	ORE	WR	POT	PHY			8.6	0.11	1.19						37.19					0.23	0.130	
Phase IV	LX-11-429	HYP	ORE	WR	POT	PHY			44.4	0.57	3.55						110.94					0.40	0.367	
Phase IV	LX-11-430	HYP	ORE	WR	POT	PHY			8.6	0.11	0.69						21.56					0.40	0.225	
Phase IV	LX-11-431	HYP	ORE	IX	POT	PHY			33.5	0.43	0.53						16.56					2.02	1.798	
Phase IV	LX-11-433	HYP	ORE	WR	PHY	POT			37.4	0.48	0.64						20.00					1.87	1.684	
Phase IV	LX-11-456	HYP	ORE	WR	POT				3.9	0.05	0.33						10.31					0.38	0.017	
Phase IV	LX-11-457	HYP	ORE	WR	POT				6.2	0.08	0.37						11.56					0.54	0.217	
Phase IV	LX-11-458	HYP	ORE	WR	POT				13.2	0.17	0.3						9.38					1.41	1.016	
Phase IV	LX-11-461	HYP	ORE	IX	PHY	POT			56.1	0.72	1.92						60.00					0.93	0.873	
Phase IV	LX-11-462	HYP	ORE	IX	PHY	POT			7.8	0.1	0.85						26.56					0.29	0.153	
Phase IV	LX-11-463	HYP	ORE	WR	POT	PHY			14.8	0.19	0.99						30.94					0.48	0.358	
Phase IV	LX-11-464	HYP	ORE	WR	PHY				43.6	0.56	3.48						108.75					0.40	0.367	
Phase IV	LX-11-472	HYP	ORE	WR	POT	PHY			24.9	0.32	1.61						50.31					0.50	0.422	
Phase IV	LX-11-473	HYP	ORE	WR	POT				7.8	0.1	1.37						42.81					0.18	0.095	
Phase IV	LX-11-474	HYP	ORE	WR	PHY	POT			27.3	0.35	1.04						32.50					0.84	0.724	
Phase IV	LX-11-483	HYP	ORE	WR	PHY				7.0	0.09	6.48						202.50					0.03	0.016	
Phase IV	LX-11-492	HYP	ORE	IX	POT				53.7	0.69	4.08						127.50					0.42	0.392	
Phase IV	LX-11-495	HYP	ORE	WR	PHY	ARG			37.4	0.48	2.66						83.13					0.45	0.405	
Phase IV	LX-11-496	HYP	ORE	WR	PHY	ARG			12.5	0.16	1.26						39.38					0.32	0.222	
Phase IV	LX-11-497	HYP	ORE	WR	PHY	ARG			17.1	0.22	2.04						63.75					0.27	0.210	
Phase IV	LX-11-502	HYP	ORE	WR	POT				10.9	0.14	2.03						63.44					0.17	0.113	
Phase IV	LX-11-503	HYP	ORE	WR	POT				67.0	0.86	3.56						111.25					0.60	0.569	
Phase IV	LX-11-505	HYP	ORE	PP	POT	PHY			23.4	0.3	0.67						20.94					1.12	0.938	
Phase IV	LX-11-510	HYP	ORE	PP	POT				12.5	0.16	1.57						49.06					0.25	0.178	
Phase IV	LX-11-513	HYP	ORE	WR	POT	PHY			7.0	0.09	1.87						58.44					0.12	0.056	
Phase IV	LX-11-514	HYP	ORE	WR	POT	PHY			14.8	0.19	2.78						86.88					0.17	0.128	
Phase IV	LX-11-529	HYP	ORE	WR	POT				20.3	0.26	1.82						56.88					0.36	0.291	
Phase IV	LX-11-530	HYP	ORE	PP	POT	PHY			19.5	0.25	1.22						38.13					0.51	0.413	
Phase IV	LX-11-536	HYP	ORE	WR	PHY				98.2	1.26	1.12						35.00					2.80	2.698	
Phase IV	LX-11-537	HYP	ORE	WR	PHY				63.1	0.81	4.88						152.50					0.41	0.389	
Phase IV	LX-11-538	HYP	ORE	WR	PHY				85.7	1.1	0.73						22.81					3.76	3.593	
Phase IV	LX-11-539	HYP	ORE	WR	POT	PHY			13.2	0.17	1.7						53.13					0.25	0.179	
Phase IV	LX-11-540	HYP	ORE	WR	PHY	POT			89.6	1.15	4.39						137.19					0.65	0.626	
Phase IV	LX-11-554	HYP	ORE	PP	PHY				21.0	0.27	2.82						88.13					0.24	0.196	
Phase IV	LX-11-563	HYP	ORE	WR	POT	PHY			15.6	0.2	2.75						85.94					0.18	0.138	
Phase IV	LX-11-564	HYP	ORE	WR	POT	PHY			3.1	0.04	2.02						63.13					0.05	0.002	
Phase IV	LX-11-570	HYP	ORE	WR	PHY	ARG			27.3	0.35	1.98						61.88					0.44	0.381	
Phase IV	LX-11-571	HYP	ORE	WR	PHY	PRO			42.1	0.54	1.36						42.50					0.99	0.902	
Phase IV	LX-11-573	HYP	ORE	WR	PRO	POT			23.4	0.3	0.44						13.75					1.70	1.429	
Phase IV	LX-11-575	HYP	ORE	WR	POT				3.9	0.05	0.45						14.06					0.28	0.012	
Phase IV	LX-11-576	HYP	ORE	WR	POT				18.7	0.24	0.34						10.63					1.76	1.409	
Phase IV	LX-11-577	HYP	ORE	WR	POT				35.1	0.45	0.35						10.94					3.20	2.865	
Phase IV	LX-11-579	HYP	ORE	WR	PRO	PHY			15.6	0.2	0.33						10.31					1.51	1.150	
Phase IV	LX-11-580	HYP	ORE	WR	PRO	PHY			13.2	0.17	0.46						14.38					0.92	0.662	
Phase IV	LX-11-582	HYP	ORE	WR	PRO	PHY			10.9	0.14	0.58						18.13					0.60	0.396	
Phase IV	LX-11-583	HYP	ORE	WR	POT	PRO			18.7	0.24	0.51						15.94					1.17	0.940	
Phase IV	LX-11-587	HYP	ORE	WR	POT	PHY			52.2	0.67	1.36						42.50					1.23	1.140	
Phase IV	LX-11-590	HYP	ORE	WR	POT	PHY			33.5	0.43	0.82						25.63					1.31	1.162	
Phase IV	LX-11-601	HYP	ORE	IX	PHY	POT			75.6	0.97	2.19						68.44					1.10	1.050	
Phase IV	LX-11-633	HYP	ORE	WR	PHY				51.4	0.66	7.8						243.75					0.21	0.196	
Phase IV	LX-11-634	HYP	ORE	WR	POT	PHY			149.6	1.92	2.77						86.56					1.73	1.685	
Phase IV	LX-11-652	HYP	ORE	WR	POT				21.8	0.28	0.85						26.56					0.82	0.681	
Phase IV	LX-11-653	HYP	ORE	WR	POT				17.1	0.22	0.46						14.38					1.19	0.933	
Phase IV	LX-11-655	HYP	ORE	WR	POT				52.2	0.67	0.54						16.88					3.09	2.872	
Phase IV	LX-11-657	HYP	ORE	WR	POT				53.7	0.69	1.38						43.13					1.25	1.160	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-658	HYP	ORE	WR	POT				29.6	0.38	0.99						30.94					0.96	0.837	
Phase IV	LX-11-659	HYP	ORE	WR	POT				42.8	0.55	0.69						21.56					1.99	1.814	
Phase IV	LX-11-660	HYP	ORE	WR	POT				28.0	0.36	1.06						33.13					0.85	0.734	
Phase IV	LX-11-661	HYP	ORE	WR	POT				53.7	0.69	0.67						20.94					2.57	2.389	
Phase IV	LX-11-662	HYP	ORE	WR	POT				60.8	0.78	1.07						33.44					1.82	1.706	
Phase IV	LX-11-663	HYP	ORE	WR	POT				56.9	0.73	1.24						38.75					1.47	1.371	
Phase IV	LX-11-664	HYP	ORE	WR	POT				67.0	0.86	0.57						17.81					3.76	3.552	
Phase IV	LX-11-665	HYP	ORE	WR	POT				29.6	0.38	1.15						35.94					0.82	0.720	
Phase IV	LX-11-666	HYP	ORE	WR	POT				48.3	0.62	1.12						35.00					1.38	1.274	
Phase IV	LX-11-667	HYP	ORE	WR	POT				57.6	0.74	1.41						44.06					1.31	1.224	
Phase IV	LX-11-668	HYP	ORE	WR	POT				38.2	0.49	0.88						27.50					1.39	1.253	
Phase IV	LX-11-669	HYP	ORE	WR	POT				21.0	0.27	0.95						29.69					0.71	0.583	
Phase IV	LX-11-670	HYP	ORE	WR	POT				15.6	0.2	1.05						32.81					0.47	0.361	
Phase IV	LX-11-671	HYP	ORE	WR	POT				28.8	0.37	1.22						38.13					0.76	0.658	
Phase IV	LX-11-672	HYP	ORE	WR	POT				38.2	0.49	1.12						35.00					1.09	0.984	
Phase IV	LX-11-674	HYP	ORE	WR	POT				18.7	0.24	1.02						31.88					0.59	0.470	
Phase IV	LX-11-675	HYP	ORE	WR	POT				29.6	0.38	0.64						20.00					1.48	1.294	
Phase IV	LX-11-676	HYP	ORE	WR	POT				31.2	0.4	1.05						32.81					0.95	0.836	
Phase IV	LX-11-677	HYP	ORE	WR	POT				68.5	0.88	0.51						15.94					4.30	4.068	
Phase IV	LX-11-678	HYP	ORE	WR	POT				53.0	0.68	1.24						38.75					1.37	1.271	
Phase IV	LX-11-679	HYP	ORE	WR	POT				37.4	0.48	0.42						13.13					2.85	2.565	
Phase IV	LX-11-680	HYP	ORE	WR	POT				36.6	0.47	1.68						52.50					0.70	0.627	
Phase IV	LX-11-684	HYP	ORE	WR	POT				34.3	0.44	0.41						12.81					2.68	2.385	
Phase IV	LX-11-686	HYP	ORE	WR	POT				175.3	2.25	8.57						267.81					0.65	0.641	
Phase IV	LX-11-687	HYP	ORE	WR	POT				64.7	0.83	1.53						47.81					1.35	1.274	
Phase IV	LX-11-688	HYP	ORE	WR	POT				37.4	0.48	2.54						79.38					0.47	0.424	
Phase IV	LX-11-689	HYP	ORE	WR	POT				57.6	0.74	0.32						10.00					5.76	5.392	
Phase IV	LX-11-694	HYP	ORE	MX	PHY				53.7	0.69	3.65						114.06					0.47	0.439	
Phase IV	LX-11-697	HYP	ORE	MX	PHY				84.1	1.08	3.07						95.94					0.88	0.838	
Phase IV	LX-11-705	HYP	ORE	WR	POT	PHY			13.2	0.17	2						62.50					0.21	0.152	
Phase IV	LX-11-708	HYP	ORE	WR	POT	PHY			57.6	0.74	2.15						67.19					0.86	0.803	
Phase IV	LX-11-712	HYP	ORE	WR	PHY	ARG			58.4	0.75	0.72						22.50					2.60	2.431	
Phase IV	LX-11-713	HYP	ORE	WR	PHY	POT			113.7	1.46	1.86						58.13					1.96	1.893	
Phase IV	LX-11-714	HYP	ORE	WR	POT	PHY			64.7	0.83	0.51						15.94					4.06	3.823	
Phase IV	LX-11-715	HYP	ORE	WR	POT	PHY			70.1	0.9	1.34						41.88					1.67	1.585	
Phase IV	LX-11-738	HYP	ORE	WR	POT				49.9	0.64	1.03						32.19					1.55	1.433	
Phase IV	LX-11-741	HYP	ORE	PP	PHY				56.1	0.72	3.1						96.88					0.58	0.541	
Phase IV	LX-11-742	HYP	ORE	PP	PHY				35.1	0.45	1.61						50.31					0.70	0.623	
Phase IV	LX-11-772	HYP	ORE	PP	PHY	POT			27.3	0.35	0.66						20.63					1.32	1.142	
Phase IV	LX-11-773	HYP	ORE	PP	POT	PHY			33.5	0.43	1.29						40.31					0.83	0.739	
Phase IV	LX-11-778	HYP	ORE	WR	POT	PHY			27.3	0.35	0.92						28.75					0.95	0.819	
Phase IV	LX-11-779	HYP	ORE	WR	POT	PHY			54.5	0.7	1.54						48.13					1.13	1.056	
Phase IV	LX-11-783	HYP	ORE	WR	PHY	POT			17.9	0.23	2.95						92.19					0.19	0.154	
Phase IV	LX-11-786	HYP	ORE	WR	POT	PHY			38.9	0.5	2.36						73.75					0.53	0.478	
Phase IV	LX-11-795	HYP	ORE	WR	PHY				28.8	0.37	1.92						60.00					0.48	0.418	
Phase IV	LX-11-796	HYP	ORE	WR	PHY				29.6	0.38	2.11						65.94					0.45	0.393	
Phase IV	LX-11-825	HYP	ORE	WR	PHY	POT			17.9	0.23	0.88						27.50					0.65	0.516	
Phase IV	LX-11-826	HYP	ORE	WR	PHY				1.6	0.02	2.64						82.50					0.02	0.001	
Phase IV	LX-11-855	HYP	ORE	WR	PHY				0.8	0.01	5.5						171.88					0.00	0.001	
Phase IV	LX-11-877	HYP	ORE	WR	PHY	ARG			6.2	0.08	2.72						85.00					0.07	0.030	
Phase IV	LX-11-886	HYP	ORE	WR	PHY	POT			21.8	0.28	1.79						55.94					0.39	0.323	
Phase IV	LX-11-887	HYP	ORE	WR	POT	PHY			47.5	0.61	2.05						64.06					0.74	0.684	
Phase IV	LX-11-889	HYP	ORE	WR	POT	PHY			49.1	0.63	2.49						77.81					0.63	0.583	
Phase IV	LX-11-894	HYP	ORE	WR					6.2	0.08	5.1						159.38					0.04	0.016	
Phase IV	LX-11-942	HYP	ORE	WR					38.9	0.5	0.38						11.88					3.28	2.967	
Phase IV	LX-11-943	HYP	ORE	WR					7.8	0.1	0.33						10.31					0.76	0.395	
Phase IV	LX-11-944	HYP	ORE	WR					16.4	0.21	0.56						17.50					0.93	0.722	
Phase IV	LX-11-945	HYP	ORE	WR					9.3	0.12	0.62						19.38					0.48	0.290	
Phase IV	LX-11-948	HYP	ORE	WR					43.6	0.56	0.53						16.56					2.63	2.409	
Phase IV	LX-11-949	HYP	ORE	WR					14.8	0.19	0.39						12.19					1.21	0.909	
Phase IV	LX-11-950	HYP	ORE	WR					9.3	0.12	0.82						25.63					0.36	0.220	
Phase IV	LX-11-951	HYP	ORE	WR					9.3	0.12	0.33						10.31					0.91	0.546	
Phase IV	LX-11-952	HYP	ORE	WR					13.2	0.17	0.36						11.25					1.18	0.846	
Phase IV	LX-11-955	HYP	ORE	WR					10.1	0.13	0.97						30.31					0.33	0.211	
Phase IV	LX-11-956	HYP	ORE	WR					10.1	0.13	1.49						46.56					0.22	0.138	
Phase IV	LX-11-957	HYP	ORE	WR					14.8	0.19	1.02						31.88					0.46	0.348	
Phase IV	LX-11-958	HYP	ORE	WR					27.3	0.35	1.12						35.00					0.78	0.673	
Phase IV	LX-11-960	HYP	ORE	WR					21.8	0.28	1.12						35.00					0.62	0.517	
Phase IV	LX-11-961	HYP	ORE	WR					28.8	0.37	0.84						26.25					1.10	0.956	
Phase IV	LX-11-963	HYP	ORE	WR					21.8	0.28	0.35						10.94					1.99	1.654	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC %	CaNP kg $CaCO_3$/t	C(T) %	S(T) %	$S(SO_4)$ %	non-sulphate S %	$S(S^{-2})$ %	Insoluble S %	SO_4 AP + Non-SO_4 AP kg $CaCO_3$/t	TAP kg $CaCO_3$/t	Non-SO_4 AP kg $CaCO_3$/t	SAP kg $CaCO_3$/t	ScNP (Lab) kg $CaCO_3$/t	Net NP	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
Phase IV	LX-11-968	HYP	ORE	WR					85.7	1.1	1.68						52.50					1.63	1.561	
Phase IV	LX-11-985	HYP	ORE	WR					56.1	0.72	0.5						15.63					3.59	3.351	
Phase IV	LX-11-986	HYP	ORE	WR					36.6	0.47	0.49						15.31					2.39	2.148	
Phase IV	LX-11-988	HYP	ORE	WR					63.1	0.81	0.65						20.31					3.11	2.923	
Phase IV	LX-11-989	HYP	ORE	WR					51.4	0.66	1.5						46.88					1.10	1.017	
Phase IV	LX-11-990	HYP	ORE	WR					24.9	0.32	1.32						41.25					0.60	0.514	
						Maximum	8.74	1.6	175	2.3	11.0	1.9	10.9	10.2	1.2		344	341	319	169	117	5.8	5.4	
						90th percentile	8.51	0.74	64.7	0.83	3.3	0.41	4.3	3.6	0.39		102	136	113	60.3	26.7	2.51	2.28	
						75th percentile	8.33	0.48	50.8	0.65	2.0	0.07	2.3	2.2	0.24		63.4	70.5	68.8	34.5	14.3	1.4	1.2	
						Mean	7.79	0.33	33.7	0.43	1.7	0.15	1.9	1.7	0.21		52.8	60.7	54.1	33.6	-20.5	1.06	0.93	
						Median	8.14	0.23	27.3	0.35	1.1	0.030	1.2	1.04	0.15		35.6	37.7	32.3	26.6	6.2	0.78	0.66	
						25th percentile	7.88	0.14	13.3	0.18	0.68	0.020	0.69	0.52	0.080		21.1	21.6	16.2	19.5	-40.6	0.40	0.29	
						10th percentile	6.04	0.010	7.01	0.090	0.45	0.010	0.46	0.27	0.037		14.0	14.4	8.3	6.5	-100	0.127	0.048	
						Minimum	4.24	***0.0050***	***0.40***	0.010	0.30	***0.0050***	0.30	0.20	***0.010***		9.4	9.2	6.3	2.5	-316	0.00117	0.00029	
						No of samples	58	58	210	210	210	58	58	58	58		210	58	58	58	58	210	210	
Hypogene Zone (HYP) - Waste Designated Samples																								
Phase I	08-008	HYP	WASTE	WR	PHY	ARG	4.12	***0.005***	***0.4***	***0.005***	7.47	0.05	7.42	7.4	0.02		233.44	231.88	231.25	3.00	-228.25	0.00	0.000	None
Phase I	08-011	HYP	WASTE	MX	PHY		4.49	***0.005***	***0.4***	0.01	6.03	0.06	5.97	5.9	0.07		188.44	186.56	184.38	0.90	-183.48	0.00	0.001	None
Phase I	08-020	HYP	WASTE	WR	PHY		6.15	0.1	8.3	0.14	2.23	0.04	2.19	2.07	0.12		69.69	68.44	64.69	7.50	-57.19	0.12	0.067	None
Phase I	08-024	HYP	WASTE	WR	PHY		4.75	***0.005***	***0.4***	***0.005***	6.32	0.04	6.28	6.14	0.14		197.50	196.25	191.88	1.70	-190.18	0.00	0.001	None
Phase I	08-025	HYP	WASTE	MX	PHY		4.67	0.01	0.8	***0.005***	5.56	0.08	5.48	5.09	0.39		173.75	171.25	159.06	3.30	-155.76	0.00	0.001	None
Phase I	08-028	HYP	WASTE	WR	POT		8.05	0.19	15.8	0.2	1.81	0.02	1.79	1.65	0.14		56.56	55.94	51.56	26.90	-24.66	0.28	0.217	Slight
Phase I	08-031	HYP	WASTE	WR	PHY	POT	3.98	0.13	10.8	0.15	14	0.18	13.82	13.44	0.38		437.50	431.88	420.00	10.10	-409.90	0.03	0.016	Slight
Phase I	08-038	HYP	WASTE	PP	POT	PHY	8.49	0.15	12.5	0.16	1.33	0.01	1.32	1.28	0.04		41.56	41.25	40.00	29.40	-10.60	0.30	0.213	Slight
Phase I	08-039	HYP	WASTE	IX	POT		8.36	0.35	29.2	0.46	1.47	***0.005***	1.47	1.32	0.15		45.94	45.78	41.25	39.10	-2.15	0.64	0.556	Slight
Phase I	08-040	HYP	WASTE	WR	POT	PHY	8.13	0.26	21.7	0.26	5.2	0.02	5.18	5.02	0.16		162.50	161.88	156.88	28.50	-128.38	0.13	0.111	Slight
Phase I	08-043	HYP	WASTE	IX	PHY		7.88	0.48	40.0	0.51	2.89	0.12	2.77	2.73	0.04		90.31	86.56	85.31	48.10	-37.21	0.46	0.419	Moderate
Phase I	08-044	HYP	WASTE	WR	PHY		8.42	0.63	52.5	0.64	3.88	***0.005***	3.88	3.76	0.12		121.25	121.09	117.50	66.70	-50.80	0.43	0.403	Moderate
Phase I	08-045	HYP	WASTE	WR	PHY		7.98	0.79	65.8	0.84	5.39	0.03	5.36	5.28	0.08		168.44	167.50	165.00	67.80	-97.20	0.39	0.371	Moderate
Phase I	08-052	HYP	WASTE	PP	PHY		8.01	0.24	20.0	0.26	2.7	0.06	2.64	2.7	***0.005***		84.38	82.50	84.38	32.60	-51.78	0.24	0.197	Slight
Phase I	08-056	HYP	WASTE	WR	PHY	ARG	7.7	0.47	39.2	0.53	2.98	0.02	2.96	3.23	***0.005***		93.13	92.50	100.94	34.70	-66.24	0.42	0.383	Moderate
Phase I	08-059	HYP	WASTE	PP	PHY	ARG	4.69	***0.005***	***0.4***	0.01	1.99	0.06	1.93	1.69	0.24		62.19	60.31	52.81	4.10	-48.71	0.01	0.002	None
Phase I	08-060	HYP	WASTE	WR	PHY		7.79	0.6	50.0	0.65	4.21	0.02	4.19	4.11	0.08		131.56	130.94	128.44	53.60	-74.84	0.38	0.353	Moderate
Phase I	08-065	HYP	WASTE	PP	POT	PHY	8.45	0.85	70.8	0.88	1.92	***0.005***	1.92	1.81	0.11		60.00	59.84	56.56	76.00	19.44	1.18	1.121	Moderate
Phase I	08-070	HYP	WASTE	WR	PHY	POT	8.21	0.68	56.7	0.71	3.2	0.04	3.16	3.07	0.09		100.00	98.75	95.94	54.80	-41.14	0.57	0.536	Moderate
Phase I	08-071	HYP	WASTE	WR	PHY	POT	8.35	0.64	53.3	0.69	2.2	0.01	2.19	1.87	0.32		68.75	68.44	58.44	62.50	4.06	0.78	0.725	Moderate
Phase I	08-072	HYP	WASTE	WR	POT	PHY	8.51	0.43	35.8	0.46	0.77	0.03	0.74	0.71	0.03		24.06	23.13	22.19	38.90	16.71	1.55	1.389	Slight
Phase I	08-073	HYP	WASTE	WR	PHY	POT	8.65	0.28	23.3	0.3	1.13	0.01	1.12	0.98	0.14		35.31	35.00	30.63	27.40	-3.23	0.67	0.560	Slight
Phase I	08-075	HYP	WASTE	WR	POT	PHY	8.04	0.26	21.7	0.3	5.61	0.02	5.59	5.44	0.15		175.31	174.69	170.00	22.60	-147.40	0.12	0.103	Slight
Phase I	08-076	HYP	WASTE	WR	PHY		8.12	0.55	45.8	0.58	5.81	0.04	5.77	5.55	0.22		181.56	180.31	173.44	47.50	-125.94	0.25	0.234	Slight
Phase I	08-080	HYP	WASTE	PP	POT		6.64	0.01	0.8	***0.005***	0.96	0.01	0.95	0.99	***0.005***		30.00	29.69	30.94	10.10	-20.84	0.03	0.003	None
Phase I	08-083	HYP	WASTE	PP	PHY	PRO	7.26	0.54	45.0	0.59	5.67	0.11	5.56	5.37	0.19		177.19	173.75	167.81	41.60	-126.21	0.26	0.238	Slight
Phase I	08-086	HYP	WASTE	WR	ARG		8.02	0.69	57.5	0.75	3.29	***0.005***	3.29	3.03	0.26		102.81	102.66	94.69	69.40	-25.29	0.56	0.524	Moderate
Phase I	08-087	HYP	WASTE	WR	POT		8.38	0.91	75.8	0.95	0.78	***0.005***	0.78	0.73	0.05		24.38	24.22	22.81	63.60	40.79	3.13	2.978	Moderate
Phase I	08-088	HYP	WASTE	WR	PHY	POT	8.44	0.67	55.8	0.74	0.52	***0.005***	0.52	0.53	***0.005***		16.25	16.09	16.56	55.60	39.04	3.47	3.238	Moderate
Phase I	08-089	HYP	WASTE	WR	PHY		8.61	0.99	82.5	1.07	4.17	***0.005***	4.17	3.83	0.34		130.31	130.16	119.69	89.30	-30.39	0.63	0.605	Moderate
Phase I	08-090	HYP	WASTE	WR	POT		8.34	0.25	20.8	0.33	1.45	0.03	1.42	1.43	***0.005***		45.31	44.38	44.69	23.80	-20.89	0.47	0.386	Slight
Phase I	08-091	HYP	WASTE	WR	PHY		8.02	0.58	48.3	1.2	4.39	0.03	4.36	4.29	0.07		137.19	136.25	134.06	84.00	-50.06	0.35	0.327	Slight
Phase I	08-092	HYP	WASTE	WR	PHY	ARG	8.05	0.13	10.8	0.14	1.28	0.02	1.26	1.23	0.03		40.00	39.38	38.44	23.60	-14.84	0.28	0.181	Slight
Phase I	08-094	HYP	WASTE	WR	PHY		7.95	0.6	50.0	0.65	3.74	0.03	3.71	3.68	0.03		116.88	115.94	115.00	53.30	-61.70	0.43	0.399	Moderate
Phase I	08-096	HYP	WASTE	PP	PHY	POT	7.83	0.47	39.2	0.56	2.39	0.05	2.34	2.36	***0.005***		74.69	73.13	73.75	42.10	-31.65	0.54	0.485	Slight
Phase I	08-100	HYP	WASTE	PP	PHY		8.03	0.84	70.0	0.88	1.66	0.02	1.64	1.59	0.05		51.88	51.25	49.69	67.40	17.71	1.37	1.293	Moderate
Phase I	08-101	HYP	WASTE	IX	PHY		7.82	0.5	41.7	0.53	5.33	0.02	5.31	5.25	0.06		166.56	165.94	164.06	29.10	-134.96	0.25	0.229	Slight
Phase I	08-102	HYP	WASTE	IX	PHY		7.91	0.94	78.3	1.03	7	0.02	6.98	7	***0.005***		218.75	218.13	218.75	75.80	-142.95	0.36	0.342	Slight
Phase I	08-106	HYP	WASTE	WR	POT	PHY	7.93	0.45	37.5	0.51	0.99	0.01	0.98	0.89	0.09		30.94	30.63	27.81	38.00	10.19	1.22	1.103	Moderate
Phase I	08-107	HYP	WASTE	WR	POT	PHY	8.37	0.09	7.5	0.08	0.6	***0.005***	0.6	0.58	0.02		18.75	18.59	18.13	22.10	3.98	0.40	0.203	Slight
Phase I	08-108	HYP	WASTE	WR	POT		8.07	0.23	19.2	0.23	1.38	0.95	0.43	0.42	***0.01***		43.13	13.44	13.13	21.60	8.48	1.43	1.150	Slight
Phase I	08-109	HYP	WASTE	WR	POT		8.3	0.33	27.5	0.34	0.51	0.02	0.49	0.45	0.04		15.94	15.31	14.06	30.60	16.54	1.80	1.553	Moderate
Phase I	08-111	HYP	WASTE	WR	POT		8.42	0.11	9.2	0.11	2.2	***0.005***	2.2	1.96	0.24		68.75	68.59	61.25	25.70	-35.55	0.13	0.079	Slight
Phase I	08-112	HYP	WASTE	WR	POT		8.09	0.83	69.2	0.76	2.96	0.01	2.95	3.02	***0.005***		92.50	92.19	94.38	63.70	-30.68	0.75	0.710	Moderate
Phase I	08-113	HYP	WASTE	WR	POT		7.93	0.33	27.5	0.29	4.49	0.61	3.88	3.84	0.04		140.31	121.25	120.00	37.20	-82.80	0.23	0.196	Slight
Phase I	08-121	HYP	WASTE	PP	PHY		8.32	0.8	66.7	0.85	1.09	0.02	1.07	1.04	0.03		34.06	33.44	32.50	57.80	25.30	1.99	1.883	Moderate
Phase I	08-123	HYP	WASTE	IX	POT		8.09	0.77	64.2	0.81	1.09	0.02	1.07	1.02	0.05		34.06	33.44	31.88	47.90	16.03	1.92	1.808	Moderate
Phase I	08-126	HYP	WASTE	WR	POT	PHY	8.08	0.69	57.5	0.76	2.61	0.19	2.42	2.31	0.11		81.56	75.63	72.19	61.70	-10.49	0.76	0.711	Moderate
Phase I	08-127	HYP	WASTE	WR	PHY	POT	8.24	0.13	10.8	0.14	0.76	0.01	0.75	0.71	0.04		23.75	23.44	22.19	14.70	-7.49	0.46	0.304	Slight
Phase II	08-134	HYP	WASTE	WR	PHY		6.79	0.05	4.2	0.06	5.03	0.03	5	4.92	0.08		157.19	156.25	153.75	7.74	-146.01	0.03	0.003	None
Phase II	08-137	HYP	WASTE	WR	PHY		8.12	0.5	41.7	0.51	4.03	0.02	4.01	3.92	0.09		125.94	125.31	122.50	42.38	-80.12	0.33	0.303	Slight
Phase II	08-141	HYP	WASTE	MX	PHY		4.53	***0.005***	***0.4***	0.01	4.52	0.11	4.41	4.01	0.4		141.25	137.81	125.31	2.95	-122.36	0.00	0.001	None
Phase II	08-142	HYP	WASTE	MX	PHY		4.58	***0.005***	***0.4***	0.01	4.31	0.04	4.27	3.97	0.3		134.69	133.44	124.06	3.32	-120.75	0.00	0.001	None

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase II	08-143	HYP	WASTE	MX	PHY		5.09	***0.005***	***0.4***	0.01	4.28	0.03	4.25	4.13	0.12		133.75	132.81	129.06	3.19	-125.87	0.00	0.001	None
Phase II	08-151	HYP	WASTE	PP	PHY		8.14	0.77	64.2	0.83	3.91	0.13	3.78	3.66	0.12		122.19	118.13	114.38	69.90	-44.47	0.54	0.512	Slight
Phase II	08-165	HYP	WASTE	WR	PHY		8.12	0.42	35.0	0.45	4.51	0.03	4.48	4.21	0.27		140.94	140.00	131.56	37.59	-93.97	0.25	0.223	Slight
Phase II	08-166	HYP	WASTE	WR	PHY		7.78	0.3	25.0	0.31	4.33	0.04	4.29	4.09	0.2		135.31	134.06	127.81	30.10	-97.71	0.19	0.159	Slight
Phase II	08-178	HYP	WASTE	WR	PHY		5.37	***0.005***	***0.4***	0.02	5.12	0.03	5.09	4.24	0.85		160.00	159.06	132.50	1.50	-131.00	0.00	0.001	None
Phase II	08-179	HYP	WASTE	MX	PHY		5.1	***0.005***	***0.4***	0.01	4.27	0.05	4.22	3.78	0.44		133.44	131.88	118.13	4.39	-113.74	0.00	0.001	None
Phase II	08-186	HYP	WASTE	WR	POT		8.53	0.14	11.7	0.14	0.77	0.01	0.76	0.71	0.05		24.06	23.75	22.19	26.82	4.63	0.49	0.335	Slight
Phase II	08-197	HYP	WASTE	WR	PHY	POT	8.17	0.93	77.5	1.01	1.98	0.04	1.94	1.86	0.08		61.88	60.63	58.13	60.40	2.28	1.28	1.217	Slight
Phase II	08-198	HYP	WASTE	WR	PHY	POT	8.11	0.24	20.0	0.27	4.27	0.03	4.24	4.22	0.02		133.44	132.50	131.88	29.95	-101.93	0.15	0.123	Slight
Phase II	08-199	HYP	WASTE	PP	PHY		7.93	0.4	33.3	0.45	7.59	0.04	7.55	7.32	0.23		237.19	235.94	228.75	40.35	-188.40	0.14	0.126	Slight
Phase II	08-200	HYP	WASTE	PP	PHY		8.13	0.11	9.2	0.11	5.61	0.03	5.58	5.22	0.36		175.31	174.38	163.13	19.05	-144.08	0.05	0.031	Slight
Phase II	08-201	HYP	WASTE	WR	PHY		7.87	0.44	36.7	0.44	7.37	0.04	7.33	6.95	0.38		230.31	229.06	217.19	35.71	-181.47	0.16	0.144	Slight
Phase II	08-202	HYP	WASTE	WR	PHY		8.24	0.61	50.8	0.61	7.92	0.03	7.89	7.5	0.39		247.50	246.56	234.38	53.63	-180.74	0.21	0.191	Slight
Phase II	08-203	HYP	WASTE	WR	PHY		7.76	0.06	5.0	0.06	5.07	0.03	5.04	4.87	0.17		158.44	157.50	152.19	7.27	-144.92	0.03	0.008	None
Phase II	08-215	HYP	WASTE	PP	PHY	POT	7.9	0.65	54.2	0.67	1.74	0.15	1.59	1.47	0.12		54.38	49.69	45.94	55.57	9.63	1.09	1.015	Slight
Phase II	08-219	HYP	WASTE	IX	PHY		8.42	0.43	35.8	0.44	0.68	0.01	0.67	0.64	0.03		21.25	20.94	20.00	42.20	22.20	1.71	1.534	Slight
Phase II	08-225	HYP	WASTE	MX	PHY	ARG	6.28	0.1	8.3	0.1	3.62	0.03	3.59	3.58	0.01		113.13	112.19	111.88	9.16	-102.72	0.07	0.041	None
Phase II	08-226	HYP	WASTE	MX	PHY	ARG	8.1	0.33	27.5	0.34	4.43	0.03	4.4	3.73	0.67		138.44	137.50	116.56	32.92	-83.64	0.20	0.173	Slight
Phase II	08-227	HYP	WASTE	MX	PHY		7.52	0.42	35.0	0.42	4.53	0.02	4.51	4.42	0.09		141.56	140.94	138.13	22.65	-115.48	0.25	0.222	Slight
Phase II	08-228	HYP	WASTE	MX	PHY		8.3	0.82	68.3	0.86	3.94	0.02	3.92	3.91	***0.01***		123.13	122.50	122.19	58.91	-63.28	0.56	0.527	Slight
Phase II	08-229	HYP	WASTE	MX	PHY		8.53	1.15	95.8	1.22	2.87	0.02	2.85	2.85	***0.005***		89.69	89.06	89.06	81.68	-7.38	1.08	1.034	Slight
Phase II	08-233	HYP	WASTE	WR	PHY	ARG	8.09	0.23	19.2	0.25	6.06	0.02	6.04	5.99	0.05		189.38	188.75	187.19	25.99	-161.20	0.10	0.082	Slight
Phase II	08-234	HYP	WASTE	WR	PHY		7.88	0.65	54.2	0.65	4.2	0.04	4.16	4.15	***0.01***		131.25	130.00	129.69	54.46	-75.23	0.42	0.388	Slight
Phase II	08-237	HYP	WASTE	WR	PHY	ARG	7.71	0.26	21.7	0.27	2.49	0.07	2.42	2.41	0.01		77.81	75.63	75.31	21.67	-53.64	0.29	0.237	Slight
Phase II	08-238	HYP	WASTE	WR	PHY	ARG	6.84	0.2	16.7	0.21	2.01	0.07	1.94	1.92	0.02		62.81	60.63	60.00	7.14	-52.86	0.27	0.214	Slight
Phase II	08-239	HYP	WASTE	WR	PHY	ARG	7.18	0.24	20.0	0.24	5.05	0.16	4.89	4.87	0.02		157.81	152.81	152.19	21.67	-130.51	0.13	0.107	Slight
Phase II	08-240	HYP	WASTE	WR	PHY		8.15	0.68	56.7	0.69	4.4	0.03	4.37	4.35	0.02		137.50	136.56	135.94	65.52	-70.42	0.41	0.388	Slight
Phase II	08-250	HYP	WASTE	WR	PHY	POT	8.29	0.18	15.0	0.19	3.25	0.03	3.22	3.2	0.02		101.56	100.63	100.00	22.04	-77.96	0.15	0.112	Slight
Phase II	08-257	HYP	WASTE	PP	POT	PHY	8.11	0.37	30.8	0.37	1.45	0.13	1.32	1.3	0.02		45.31	41.25	40.63	34.16	-6.47	0.75	0.657	Slight
Phase II	08-259	HYP	WASTE	PP	POT		7.6	***0.005***	***0.4***	0.01	0.89	0.02	0.87	0.84	0.03		27.81	27.19	26.25	16.96	-9.29	0.01	0.004	None
Phase II	08-260	HYP	WASTE	PP	POT		7.85	***0.005***	***0.4***	0.01	0.92	0.02	0.9	0.86	0.04		28.75	28.13	26.88	14.23	-12.64	0.01	0.004	None
Phase II	08-262	HYP	WASTE	PP	PHY	POT	8.25	0.92	76.7	0.99	1.62	0.12	1.5	1.47	0.03		50.63	46.88	45.94	68.69	22.75	1.64	1.556	Slight
Phase II	08-266	HYP	WASTE	PP	POT	PHY	8.74	0.37	30.8	0.39	0.48	0.02	0.46	0.45	***0.01***		15.00	14.38	14.06	35.64	21.58	2.14	1.886	Slight
Phase II	08-273	HYP	WASTE	PP	POT		8.25	0.26	21.7	0.26	1.13	0.45	0.68	0.33	0.35		35.31	21.25	10.31	30.57	20.26	1.02	0.845	Slight
Phase II	08-274	HYP	WASTE	PP	POT		8.26	1.84	153.3	1.97	2.22	0.72	1.5	0.71	0.79		69.38	46.88	22.19	163.20	141.01	3.27	3.192	Moderate
Phase II	08-276	HYP	WASTE	PP	PHY		8.41	0.27	22.5	0.28	4.23	0.03	4.2	3.97	0.23		132.19	131.25	124.06	32.05	-92.01	0.17	0.143	Slight
Phase II	08-277	HYP	WASTE	PP	PHY	PRO	8.05	0.21	17.5	0.21	2.21	0.07	2.14	2.11	0.03		69.06	66.88	65.94	26.61	-39.33	0.26	0.206	Slight
Phase II	08-280	HYP	WASTE	PP	POT	PHY	8.28	0.04	3.3	0.05	1.15	0.46	0.69	0.36	0.33		35.94	21.56	11.25	20.79	9.54	0.15	0.005	None
Phase II	08-285	HYP	WASTE	WR	ARG		8.1	1.5	125.0	1.65	1.44	0.03	1.41	1.39	0.02		45.00	44.06	43.44	150.74	107.31	2.84	2.752	Moderate
Phase II	08-287	HYP	WASTE	WR	PHY		8.22	0.5	41.7	0.55	1.55	0.03	1.52	1.38	0.14		48.44	47.50	43.13	39.85	-3.27	0.88	0.799	Slight
Phase II	08-288	HYP	WASTE	WR	PHY	POT	8.12	0.17	14.2	0.18	0.57	0.11	0.46	0.22	0.24		17.81	14.38	6.88	26.49	19.61	0.99	0.727	Slight
Phase II	08-289	HYP	WASTE	WR	PHY	POT	8.49	0.27	22.5	0.27	0.77	***0.005***	0.77	0.57	0.2		24.06	23.91	17.81	26.98	9.17	0.94	0.786	Slight
Phase II	08-290	HYP	WASTE	WR	PHY	POT	8.63	0.25	20.8	0.26	0.52	0.02	0.5	0.4	0.1		16.25	15.63	12.50	36.01	23.51	1.33	1.095	Slight
Phase II	08-291	HYP	WASTE	WR	PHY	POT	8.05	0.24	20.0	0.24	0.99	0.43	0.56	0.55	0.01		30.94	17.50	17.19	26.61	9.42	1.14	0.930	Slight
Phase II	08-292	HYP	WASTE	WR	PHY	POT	8.54	0.05	4.2	0.05	0.82	0.52	0.3	0.29	***0.01***		25.63	9.38	9.06	22.90	13.83	0.44	0.048	None
Phase II	08-293	HYP	WASTE	WR	PHY		8.39	0.02	1.7	0.03	4.79	0.03	4.76	4.03	0.73		149.69	148.75	125.94	22.28	-103.66	0.01	0.001	None
Phase II	08-294	HYP	WASTE	WR	POT		8.34	0.69	57.5	0.72	4.29	0.03	4.26	4.22	0.04		134.06	133.13	131.88	67.70	-64.18	0.43	0.404	Moderate
Phase II	08-295	HYP	WASTE	WR	PHY	POT	7.88	0.48	40.0	0.5	3.72	0.1	3.62	3.56	0.06		116.25	113.13	111.25	52.50	-58.75	0.35	0.321	Slight
Phase II	08-296	HYP	WASTE	WR	PHY	POT	8.5	0.43	35.8	0.43	3.58	0.03	3.55	3.49	0.06		111.88	110.94	109.06	39.53	-69.53	0.32	0.289	Slight
Phase II	08-303	HYP	WASTE	WR	POT		8.17	0.09	7.5	0.09	1.48	0.82	0.66	0.5	0.16		46.25	20.63	15.63	18.97	3.34	0.36	0.183	Slight
Phase II	08-304	HYP	WASTE	WR	POT		8.57	0.02	1.7	0.02	1.85	0.95	0.9	0.9	***0.005***		57.81	28.13	28.13	21.67	-6.45	0.06	0.004	None
Phase II	08-307	HYP	WASTE	WR	PHY	POT	8.37	0.34	28.3	0.34	1.01	0.02	0.99	0.98	0.01		31.56	30.94	30.63	35.10	4.47	0.92	0.796	Slight
Phase II	08-311	HYP	WASTE	WR	PHY	POT	7.88	0.2	16.7	0.21	1.02	0.25	0.77	0.76	0.01		31.88	24.06	23.75	15.89	-7.86	0.69	0.538	Slight
Phase II	08-313	HYP	WASTE	WR	PHY	POT	8.03	0.25	20.8	0.27	2.52	0.56	1.96	1.67	0.29		78.75	61.25	52.19	29.43	-22.75	0.34	0.279	Slight
Phase II	08-318	HYP	WASTE	WR	POT	PHY	8.06	0.73	60.8	0.73	0.84	0.05	0.79	0.67	0.12		26.25	24.69	20.94	58.87	37.93	2.46	2.313	Slight
Phase II	08-319	HYP	WASTE	WR	POT	PHY	8.19	0.5	41.7	0.5	1.54	0.48	1.06	0.89	0.17		48.13	33.13	27.81	40.27	12.46	1.26	1.146	Slight
Phase II	08-320	HYP	WASTE	WR	POT	PHY	8.16	0.84	70.0	0.87	2.4	0.56	1.84	1.83	***0.01***		75.00	57.50	57.19	67.49	10.30	1.22	1.153	Slight
Phase II	08-327	HYP	WASTE	WR	PHY	POT	8.04	0.06	5.0	0.06	1.52	0.02	1.5	1.48	0.02		47.50	46.88	46.25	14.90	-31.35	0.11	0.027	None
Phase II	08-332	HYP	WASTE	PP	PHY		8.57	0.64	53.3	0.66	1.31	0.02	1.29	1.16	0.13		40.94	40.31	36.25	43.10	6.85	1.32	1.231	Slight
Phase II	08-333	HYP	WASTE	PP	PHY		8.27	0.58	48.3	0.64	1.53	0.02	1.51	1.51	***0.005***		47.81	47.19	47.19	31.40	-15.78	1.02	0.945	Slight
Phase II	08-334	HYP	WASTE	PP	PHY		8.08	0.23	19.2	0.24	1.48	0.04	1.44	1.43	0.01		46.25	45.00	44.69	30.79	-13.90	0.43	0.343	Slight
Phase II	08-339	HYP	WASTE	IX	POT	ARG	8.51	0.33	27.5	0.34	0.89	***0.005***	0.89	0.88	0.01		27.81	27.66	27.50	19.70	-7.80	0.99	0.860	Slight
Phase II	08-341	HYP	WASTE	IX	POT		8.17	0.86	71.7	0.91	1.89	0.06	1.83	1.82	***0.01***		59.06	57.19	56.88	65.89	9.01	1.25	1.188	Slight
Phase II	08-342	HYP	WASTE	IX	POT		8.74	0.38	31.7	0.4	0.53	0.02	0.51	0.5	0.01		16.56	15.94	15.63	20.07	4.45	1.99	1.754	Slight
Phase II	08-347	HYP	WASTE	WR	PHY	POT	8.14	0.23	19.2	0.24	3.35	0.03	3.32	3.31	0.01		104.69	103.75	103.44	30.67	-72.77	0.18	0.149	Slight
Phase II	08-348	HYP	WASTE	WR	POT		8.36	0.22	18.3	0.22	1.59	0.03	1.56	1.55	0.01		49.69	48.75	48.44	24.51	-23.93	0.38	0.300	Slight
Phase II	08-362	HYP	WASTE	WR	POT	PHY	8.57	0.35	29.2	0.38	0.47	0.02	0.45	0.42	0.03		14.69	14.06	13.13	36.49	23.36	2.07	1.810	Slight
Phase II	08-363	HYP	WASTE	WR	POT		8.3	0.32	26.7	0.36	0.47	0.03	0.44	0.37	0.07		14.69	13.75	11.56	38.82	27.26	1.94	1.669	Slight
Phase II	08-364	HYP	WASTE	WR	POT	PHY	8.46	0.37	30.8	0.38	1.42	0.02	1.4	1.4	***0.005***		44.38	43.75	43.75	32.80	-10.95	0.70	0.620	Slight
Phase II	08-366	HYP	WASTE	WR	POT	PHY	8.34	0.71	59.2	0.74	0.98	0.02	0.96	0.83	0.13		30.63	30.00	25.94	66.46	40.52	1.97	1.848	Slight

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase II	08-368	HYP	WASTE	WR	POT	PRO	8.43	0.03	2.5	0.03	0.86	0.64	0.22	0.18	0.04		26.88	6.88	5.63	18.67	13.05	0.36	0.015	None
Phase II	08-369	HYP	WASTE	WR	POT	PRO	8.36	0.18	15.0	0.19	0.55	0.44	0.11	0.1	0.01		17.19	3.44	3.13	33.29	30.17	4.36	3.281	Slight
Phase II	08-371	HYP	WASTE	WR	PHY	POT	8.07	0.82	68.3	0.87	1.6	0.47	1.13	1.13	***0.005***		50.00	35.31	35.31	79.61	44.29	1.94	1.830	Moderate
Phase II	08-372	HYP	WASTE	WR	PHY	POT	8.3	0.45	37.5	0.45	1.78	0.03	1.75	1.57	0.18		55.63	54.69	49.06	41.15	-7.91	0.69	0.618	Slight
Phase II	08-373	HYP	WASTE	WR	POT		5.68	0.01	0.8	0.03	1.34	0.99	0.35	0.23	0.12		41.88	10.94	7.19	15.48	8.29	0.08	0.009	None
Phase II	08-375	HYP	WASTE	WR	PHY	POT	8.25	0.11	9.2	0.11	1.56	0.01	1.55	1.54	0.01		48.75	48.44	48.13	10.32	-37.81	0.19	0.112	Slight
Phase II	08-376	HYP	WASTE	WR	PHY	POT	8.55	0.32	26.7	0.33	0.68	0.01	0.67	0.53	0.14		21.25	20.94	16.56	31.10	14.54	1.27	1.096	Slight
Phase II	08-377	HYP	WASTE	WR	POT		8.1	0.24	20.0	0.24	1.83	1.2	0.63	0.61	0.02		57.19	19.69	19.06	27.52	8.46	1.02	0.827	Slight
Phase II	08-378	HYP	WASTE	WR	POT		7.87	0.15	12.5	0.16	0.99	0.41	0.58	0.58	***0.005***		30.94	18.13	18.13	19.66	1.53	0.69	0.484	Slight
Phase II	08-380	HYP	WASTE	WR	POT		7.85	0.07	5.8	0.07	1.94	0.34	1.6	1.48	0.12		60.63	50.00	46.25	20.88	-25.37	0.12	0.042	Slight
Phase II	08-382	HYP	WASTE	WR	POT	PHY	8.21	0.17	14.2	0.17	0.68	0.03	0.65	0.55	0.1		21.25	20.31	17.19	21.01	3.82	0.70	0.514	Slight
Phase II	08-394	HYP	WASTE	WR	POT		8.42	0.63	52.5	0.66	0.53	0.02	0.51	0.42	0.09		16.56	15.94	13.13	56.76	43.63	3.29	3.061	Slight
Phase II	08-395	HYP	WASTE	WR	POT		8.01	0.43	35.8	0.43	3.47	1.35	2.12	2.11	0.01		108.44	66.25	65.94	33.78	-32.15	0.54	0.485	Slight
Phase II	08-396	HYP	WASTE	WR	POT		8.44	0.26	21.7	0.27	0.46	0.04	0.42	0.41	0.01		14.38	13.13	12.81	27.40	14.58	1.65	1.367	Slight
Phase II	08-397	HYP	WASTE	WR	POT		8.34	0.04	3.3	0.04	1.24	1.15	0.09	0.09	***0.005***		38.75	2.81	2.81	16.83	14.02	1.19	0.036	None
Phase II	08-398	HYP	WASTE	WR	POT		8.06	0.33	27.5	0.36	1.04	0.29	0.75	0.74	0.01		32.50	23.44	23.13	34.28	11.15	1.17	1.015	Slight
Phase II	08-405	HYP	WASTE	WR	POT		9	0.06	5.0	0.06	0.18	0.01	0.17	0.13	0.04		5.63	5.31	4.06	23.71	19.65	0.94	0.241	Slight
Phase II	08-406	HYP	WASTE	WR	PHY	POT	8.32	1.43	119.2	1.48	2.12	0.03	2.09	1.8	0.29		66.25	65.31	56.25	134.33	78.08	1.82	1.768	Moderate
Phase II	08-407	HYP	WASTE	WR	POT	PHY	8.54	0.43	35.8	0.44	0.54	0.03	0.51	0.44	0.07		16.88	15.94	13.75	37.47	23.72	2.25	2.015	Slight
Phase II	08-408	HYP	WASTE	WR	PHY	POT	8.38	0.1	8.3	0.1	0.82	0.73	0.09	0.07	0.02		25.63	2.81	2.19	20.40	18.21	2.96	1.640	Slight
Phase II	08-409	HYP	WASTE	WR	PHY	POT	8.58	0.45	37.5	0.46	0.36	0.07	0.29	0.21	0.08		11.25	9.06	6.56	39.56	33.00	4.14	3.727	Slight
Phase II	08-416	HYP	WASTE	WR	PRO	PHY	8.91	0.28	23.3	0.28	0.62	0.02	0.6	0.48	0.12		19.38	18.75	15.00	31.09	16.09	1.24	1.046	Slight
Phase II	08-420	HYP	WASTE	WR	POT	PHY	8.49	0.28	23.3	0.29	0.53	0.02	0.51	0.39	0.12		16.56	15.94	12.19	33.33	21.15	1.46	1.231	Slight
Phase II	08-421	HYP	WASTE	WR	POT	PHY	8.11	0.31	25.8	0.32	1.05	0.64	0.41	0.23	0.18		32.81	12.81	7.19	32.34	25.15	2.02	1.726	Slight
Phase II	08-422	HYP	WASTE	WR	POT	PHY	7.98	0.48	40.0	0.49	0.56	0.08	0.48	0.38	0.1		17.50	15.00	11.88	33.71	21.83	2.67	2.419	Slight
Phase III	09-06	HYP	WASTE	PP	PHY		7.90	0.55	45.8	0.59	4.79	0.6	4.19	3.69	0.50		149.69	130.94	115.31	41.70	-73.61	0.35	0.322	Slight
Phase III	09-10	HYP	WASTE	PP	PHY		8.25	0.39	32.5	0.44	2.72	0.83	1.89	1.65	0.24		85.00	59.06	51.56	32.10	-19.46	0.55	0.487	Slight
Phase III	09-11	HYP	WASTE	PP	PHY		8.16	0.43	35.8	0.48	3.17	1.03	2.14	1.83	0.31		99.06	66.88	57.19	32.30	-24.89	0.54	0.480	Slight
Phase III	09-13	HYP	WASTE	PP	PHY		8.27	0.17	14.2	0.22	1.35	0.53	0.82	0.58	0.24		42.19	25.63	18.13	25.00	6.88	0.55	0.408	Slight
Phase III	09-14	HYP	WASTE	WR	PHY		5.93	0.04	3.3	0.07	3.17	0.02	3.15	2.93	0.22		99.06	98.44	91.56	6.50	-85.06	0.03	0.001	None
Phase III	09-15	HYP	WASTE	WR	PHY		6.56	0.05	4.2	0.09	2.88	0.02	2.86	2.65	0.21		90.00	89.38	82.81	6.80	-76.01	0.05	0.005	None
Phase III	09-16	HYP	WASTE	WR	PHY		6.51	0.2	16.7	0.23	3.38	0.02	3.36	3.12	0.24		105.63	105.00	97.50	7.80	-89.70	0.16	0.123	None
Phase III	09-17	HYP	WASTE	WR	PHY		6.45	0.04	3.3	0.08	3.61	0.01	3.6	3.57	0.03		112.81	112.50	111.56	7.60	-103.96	0.03	0.001	None
Phase III	09-18	HYP	WASTE	WR	PHY		6.53	0.09	7.5	0.12	3.38	0.02	3.36	3.31	0.05		105.63	105.00	103.44	7.40	-96.04	0.07	0.036	None
Phase III	09-19	HYP	WASTE	WR	PHY		6.00	0.15	12.5	0.19	4.81	0.02	4.79	4.49	0.30		150.31	149.69	140.31	6.30	-134.01	0.08	0.059	None
Phase III	09-20	HYP	WASTE	WR	PHY		6.75	0.49	40.8	0.54	2.76	0.01	2.75	2.42	0.33		86.25	85.94	75.63	11.30	-64.33	0.48	0.432	None
Phase III	09-33	HYP	WASTE	MX	PHY		8.28	0.82	68.3	0.86	3.68	0.02	3.66	3.38	0.28		115.00	114.38	105.63	58.90	-46.73	0.60	0.565	Slight
Phase III	09-34	HYP	WASTE	MX	PHY		8.51	0.9	75.0	0.94	2.95	0.01	2.94	2.65	0.29		92.19	91.88	82.81	63.80	-19.01	0.82	0.776	Slight
Phase IV	LX-11-404	HYP	WASTE	PP	POT				24.1	0.31	0.23						7.19					3.36	2.842	
Phase IV	LX-11-410	HYP	WASTE	WR	PHY	POT			31.2	0.4	1.49						46.56					0.67	0.589	
Phase IV	LX-11-411	HYP	WASTE	WR	PHY	POT			79.5	1.02	1.45						45.31					1.75	1.671	
Phase IV	LX-11-416	HYP	WASTE	IX	POT				40.5	0.52	0.56						17.50					2.31	2.102	
Phase IV	LX-11-419	HYP	WASTE	IX	POT				32.7	0.42	1.01						31.56					1.04	0.919	
Phase IV	LX-11-422	HYP	WASTE	IX	POT	PHY			24.1	0.31	0.69						21.56					1.12	0.947	
Phase IV	LX-11-434	HYP	WASTE	PP	PHY				70.1	0.9	1.67						52.19					1.34	1.272	
Phase IV	LX-11-435	HYP	WASTE	PP	PHY				56.9	0.73	1.44						45.00					1.26	1.181	
Phase IV	LX-11-438	HYP	WASTE	MX	PHY				56.9	0.73	3.96						123.75					0.46	0.429	
Phase IV	LX-11-439	HYP	WASTE	MX	PHY				36.6	0.47	4.2						131.25					0.28	0.251	
Phase IV	LX-11-440	HYP	WASTE	MX	PHY				60.0	0.77	2.84						88.75					0.68	0.634	
Phase IV	LX-11-441	HYP	WASTE	MX	PHY				44.4	0.57	4.05						126.56					0.35	0.321	
Phase IV	LX-11-442	HYP	WASTE	WR	PHY				38.9	0.5	2.63						82.19					0.47	0.429	
Phase IV	LX-11-443	HYP	WASTE	WR	PHY				37.4	0.48	3.01						94.06					0.40	0.358	
Phase IV	LX-11-444	HYP	WASTE	WR	PHY				12.5	0.16	3.14						98.13					0.13	0.089	
Phase IV	LX-11-445	HYP	WASTE	WR	PHY	POT			4.7	0.06	6.98						218.13					0.02	0.004	
Phase IV	LX-11-446	HYP	WASTE	WR	PHY				13.2	0.17	7.13						222.81					0.06	0.043	
Phase IV	LX-11-447	HYP	WASTE	WR	PHY				36.6	0.47	4.72						147.50					0.25	0.223	
Phase IV	LX-11-465	HYP	WASTE	MX	PHY				1.6	0.02	3.41						106.56					0.01	0.001	
Phase IV	LX-11-466	HYP	WASTE	WR	POT	PHY			17.1	0.22	2.03						63.44					0.27	0.212	
Phase IV	LX-11-468	HYP	WASTE	WR	PHY				1.6	0.02	3.2						100.00					0.02	0.001	
Phase IV	LX-11-469	HYP	WASTE	WR	PHY				6.2	0.08	6.17						192.81					0.03	0.013	
Phase IV	LX-11-470	HYP	WASTE	WR	PHY				7.8	0.1	3.64						113.75					0.07	0.036	
Phase IV	LX-11-475	HYP	WASTE	WR	PHY				46.0	0.59	4.7						146.88					0.31	0.288	
Phase IV	LX-11-476	HYP	WASTE	WR	PHY				54.5	0.7	3.62						113.13					0.48	0.449	
Phase IV	LX-11-477	HYP	WASTE	WR	PHY				41.3	0.53	3.81						119.06					0.35	0.316	
Phase IV	LX-11-478	HYP	WASTE	WR	PHY				47.5	0.61	5.45						170.31					0.28	0.257	
Phase IV	LX-11-479	HYP	WASTE	WR	PHY				42.1	0.54	4.44						138.75					0.30	0.276	
Phase IV	LX-11-484	HYP	WASTE	WR	PHY				60.0	0.77	3.49						109.06					0.55	0.516	
Phase IV	LX-11-485	HYP	WASTE	WR	PHY				21.8	0.28	3.39						105.94					0.21	0.171	
Phase IV	LX-11-486	HYP	WASTE	WR	PHY				18.7	0.24	4.81						150.31					0.12	0.100	
Phase IV	LX-11-489	HYP	WASTE	WR	PHY				39.7	0.51	4.37						136.56					0.29	0.264	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-490	HYP	WASTE	WR	PHY				52.2	0.67	4.55						142.19					0.37	0.341	
Phase IV	LX-11-491	HYP	WASTE	WR	PHY	POT			22.6	0.29	2.07						64.69					0.35	0.292	
Phase IV	LX-11-493	HYP	WASTE	IX	POT				20.3	0.26	2.41						75.31					0.27	0.220	
Phase IV	LX-11-499	HYP	WASTE	PP	PHY	ARG			24.1	0.31	1.27						39.69					0.61	0.515	
Phase IV	LX-11-504	HYP	WASTE	IX	POT				36.6	0.47	1.86						58.13					0.63	0.566	
Phase IV	LX-11-506	HYP	WASTE	WR	POT	PRO			21.0	0.27	2.39						74.69					0.28	0.232	
Phase IV	LX-11-507	HYP	WASTE	WR	PHY				57.6	0.74	3.14						98.13					0.59	0.550	
Phase IV	LX-11-508	HYP	WASTE	PP	PHY	POT			65.4	0.84	1.6						50.00					1.31	1.234	
Phase IV	LX-11-509	HYP	WASTE	PP	POT				16.4	0.21	1.65						51.56					0.32	0.245	
Phase IV	LX-11-511	HYP	WASTE	WR	PHY	POT			13.2	0.17	1.78						55.63					0.24	0.171	
Phase IV	LX-11-512	HYP	WASTE	WR	POT				21.8	0.28	1.88						58.75					0.37	0.308	
Phase IV	LX-11-515	HYP	WASTE	WR	POT	PHY			5.5	0.07	2.26						70.63					0.08	0.025	
Phase IV	LX-11-516	HYP	WASTE	WR	POT	PHY			10.1	0.13	1.5						46.88					0.22	0.137	
Phase IV	LX-11-517	HYP	WASTE	WR	POT				12.5	0.16	1.28						40.00					0.31	0.219	
Phase IV	LX-11-518	HYP	WASTE	WR	POT	PHY			27.3	0.35	0.65						20.31					1.34	1.159	
Phase IV	LX-11-519	HYP	WASTE	PP	POT	PHY			21.8	0.28	2.37						74.06					0.29	0.244	
Phase IV	LX-11-520	HYP	WASTE	PP	POT	PHY			49.1	0.63	3.47						108.44					0.45	0.418	
Phase IV	LX-11-521	HYP	WASTE	PP	POT	PHY			28.0	0.36	1.75						54.69					0.51	0.445	
Phase IV	LX-11-523	HYP	WASTE	WR	PHY	POT			61.5	0.79	4.41						137.81					0.45	0.420	
Phase IV	LX-11-524	HYP	WASTE	WR	PHY	POT			36.6	0.47	4.91						153.44					0.24	0.214	
Phase IV	LX-11-525	HYP	WASTE	WR	PHY				36.6	0.47	4.47						139.69					0.26	0.235	
Phase IV	LX-11-526	HYP	WASTE	WR	PHY				61.5	0.79	4.73						147.81					0.42	0.391	
Phase IV	LX-11-531	HYP	WASTE	PP	POT	PHY			42.8	0.55	2.64						82.50					0.52	0.474	
Phase IV	LX-11-532	HYP	WASTE	MX	PHY				73.2	0.94	3.2						100.00					0.73	0.695	
Phase IV	LX-11-533	HYP	WASTE	MX	PHY				61.5	0.79	2.52						78.75					0.78	0.734	
Phase IV	LX-11-534	HYP	WASTE	MX	PHY				63.9	0.82	2.88						90.00					0.71	0.668	
Phase IV	LX-11-535	HYP	WASTE	WR	POT				21.0	0.27	1.34						41.88					0.50	0.413	
Phase IV	LX-11-541	HYP	WASTE	WR	PHY	POT			58.4	0.75	1.51						47.19					1.24	1.159	
Phase IV	LX-11-542	HYP	WASTE	WR	PHY	POT			51.4	0.66	3.71						115.94					0.44	0.411	
Phase IV	LX-11-543	HYP	WASTE	WR	PHY				38.9	0.5	4.7						146.88					0.27	0.240	
Phase IV	LX-11-544	HYP	WASTE	WR	PHY				39.7	0.51	6.34						198.13					0.20	0.182	
Phase IV	LX-11-545	HYP	WASTE	WR	PHY				60.8	0.78	4.46						139.38					0.44	0.409	
Phase IV	LX-11-546	HYP	WASTE	WR	PHY				44.4	0.57	5.12						160.00					0.28	0.254	
Phase IV	LX-11-547	HYP	WASTE	WR	PHY				36.6	0.47	5.01						156.56					0.23	0.210	
Phase IV	LX-11-549	HYP	WASTE	PP	POT				0.8	0.01	0.79						24.69					0.03	0.004	
Phase IV	LX-11-550	HYP	WASTE	PP	POT				7.0	0.09	1.58						49.38					0.14	0.067	
Phase IV	LX-11-552	HYP	WASTE	PP	PHY				15.6	0.2	2.23						69.69					0.22	0.170	
Phase IV	LX-11-555	HYP	WASTE	PP	PHY	PRO			72.4	0.93	2.95						92.19					0.79	0.745	
Phase IV	LX-11-556	HYP	WASTE	PP	PHY				43.6	0.56	1.58						49.38					0.88	0.808	
Phase IV	LX-11-557	HYP	WASTE	PP	PHY				28.8	0.37	1.73						54.06					0.53	0.464	
Phase IV	LX-11-558	HYP	WASTE	PP	PHY				54.5	0.7	2.09						65.31					0.83	0.778	
Phase IV	LX-11-559	HYP	WASTE	PP	PHY	POT			42.8	0.55	2.15						67.19					0.64	0.582	
Phase IV	LX-11-560	HYP	WASTE	PP	PHY	POT			27.3	0.35	0.9						28.13					0.97	0.837	
Phase IV	LX-11-561	HYP	WASTE	PP	POT				37.4	0.48	1.16						36.25					1.03	0.929	
Phase IV	LX-11-567	HYP	WASTE	PP	POT	PHY			13.2	0.17	0.83						25.94					0.51	0.367	
Phase IV	LX-11-568	HYP	WASTE	PP	POT	PHY			17.9	0.23	0.82						25.63					0.70	0.554	
Phase IV	LX-11-569	HYP	WASTE	PP	POT	PHY			21.8	0.28	0.94						29.38					0.74	0.616	
Phase IV	LX-11-572	HYP	WASTE	WR	PRO	POT			6.2	0.08	0.28						8.75					0.71	0.287	
Phase IV	LX-11-574	HYP	WASTE	WR	PRO	POT			21.0	0.27	0.23						7.19					2.93	2.409	
Phase IV	LX-11-581	HYP	WASTE	WR	PRO	PHY			4.7	0.06	0.4						12.50					0.37	0.076	
Phase IV	LX-11-584	HYP	WASTE	WR	POT	PRO			21.8	0.28	1.15						35.94					0.61	0.503	
Phase IV	LX-11-586	HYP	WASTE	WR	POT	PHY			14.0	0.18	0.67						20.94					0.67	0.492	
Phase IV	LX-11-588	HYP	WASTE	WR	POT	PHY			27.3	0.35	0.7						21.88					1.25	1.076	
Phase IV	LX-11-589	HYP	WASTE	WR	POT	PHY			64.7	0.83	0.76						23.75					2.72	2.566	
Phase IV	LX-11-591	HYP	WASTE	WR	PHY	POT			13.2	0.17	2.55						79.69					0.17	0.119	
Phase IV	LX-11-593	HYP	WASTE	WR	POT	PHY			27.3	0.35	0.96						30.00					0.91	0.785	
Phase IV	LX-11-595	HYP	WASTE	WR	POT	PHY			44.4	0.57	5.01						156.56					0.28	0.260	
Phase IV	LX-11-596	HYP	WASTE	WR	PHY				56.1	0.72	5.63						175.94					0.32	0.298	
Phase IV	LX-11-597	HYP	WASTE	WR	PHY				55.3	0.71	3.96						123.75					0.45	0.417	
Phase IV	LX-11-598	HYP	WASTE	WR	POT				28.0	0.36	2.02						63.13					0.44	0.385	
Phase IV	LX-11-599	HYP	WASTE	WR	POT				45.2	0.58	1.7						53.13					0.85	0.780	
Phase IV	LX-11-602	HYP	WASTE	WR	POT				11.7	0.15	0.25						7.81					1.50	1.019	
Phase IV	LX-11-610	HYP	WASTE	WR	PHY	ARG			15.6	0.2	3.86						120.63					0.13	0.098	
Phase IV	LX-11-611	HYP	WASTE	WR	PHY	ARG			1.6	0.02	5.47						170.94					0.01	0.001	
Phase IV	LX-11-612	HYP	WASTE	WR	PHY	ARG			10.9	0.14	5.2						162.50					0.07	0.044	
Phase IV	LX-11-613	HYP	WASTE	WR	PHY	ARG			7.0	0.09	5.52						172.50					0.04	0.019	
Phase IV	LX-11-619	HYP	WASTE	WR	PHY	POT			2.3	0.03	0.9						28.13					0.08	0.004	
Phase IV	LX-11-620	HYP	WASTE	WR	PHY	POT			10.1	0.13	0.62						19.38					0.52	0.331	
Phase IV	LX-11-625	HYP	WASTE	WR	PHY				56.1	0.72	3.8						118.75					0.47	0.441	
Phase IV	LX-11-629	HYP	WASTE	WR	PHY				38.9	0.5	5.97						186.56					0.21	0.189	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-630	HYP	WASTE	WR	PHY				52.2	0.67	6.45						201.56					0.26	0.240	
Phase IV	LX-11-631	HYP	WASTE	WR	PHY				78.7	1.01	9.37						292.81					0.27	0.256	
Phase IV	LX-11-632	HYP	WASTE	WR	PHY				68.5	0.88	5.99						187.19					0.37	0.346	
Phase IV	LX-11-637	HYP	WASTE	WR	PHY				33.5	0.43	5.57						174.06					0.19	0.171	
Phase IV	LX-11-638	HYP	WASTE	WR	PHY				29.6	0.38	7.78						243.13					0.12	0.106	
Phase IV	LX-11-639	HYP	WASTE	WR	PHY				38.9	0.5	6.3						196.88					0.20	0.179	
Phase IV	LX-11-640	HYP	WASTE	IX	PHY				34.3	0.44	5.23						163.44					0.21	0.187	
Phase IV	LX-11-641	HYP	WASTE	IX	PHY				42.8	0.55	4.78						149.38					0.29	0.262	
Phase IV	LX-11-642	HYP	WASTE	PP	PHY				80.2	1.03	3.8						118.75					0.68	0.644	
Phase IV	LX-11-643	HYP	WASTE	PP	PHY				86.5	1.11	2.69						84.06					1.03	0.984	
Phase IV	LX-11-644	HYP	WASTE	MX	PHY				57.6	0.74	3.68						115.00					0.50	0.469	
Phase IV	LX-11-645	HYP	WASTE	MX	PHY				81.0	1.04	2.39						74.69					1.08	1.035	
Phase IV	LX-11-654	HYP	WASTE	WR	POT				14.8	0.19	0.35						10.94					1.35	1.013	
Phase IV	LX-11-656	HYP	WASTE	WR	POT				48.3	0.62	0.45						14.06					3.43	3.170	
Phase IV	LX-11-673	HYP	WASTE	WR	POT				94.3	1.21	0.57						17.81					5.29	5.083	
Phase IV	LX-11-681	HYP	WASTE	WR	POT				30.4	0.39	0.49						15.31					1.98	1.741	
Phase IV	LX-11-682	HYP	WASTE	WR	POT				43.6	0.56	0.57						17.81					2.45	2.240	
Phase IV	LX-11-683	HYP	WASTE	WR	POT				38.2	0.49	0.57						17.81					2.14	1.934	
Phase IV	LX-11-685	HYP	WASTE	WR	POT				19.5	0.25	0.64						20.00					0.97	0.788	
Phase IV	LX-11-690	HYP	WASTE	WR	POT				21.8	0.28	2.37						74.06					0.29	0.244	
Phase IV	LX-11-691	HYP	WASTE	MX	PHY				57.6	0.74	3.97						124.06					0.46	0.435	
Phase IV	LX-11-692	HYP	WASTE	MX	PHY				55.3	0.71	3.3						103.13					0.54	0.500	
Phase IV	LX-11-693	HYP	WASTE	MX	PHY				58.4	0.75	3.82						119.38					0.49	0.458	
Phase IV	LX-11-695	HYP	WASTE	MX	PHY				63.9	0.82	3.14						98.13					0.65	0.613	
Phase IV	LX-11-696	HYP	WASTE	MX	PHY				47.5	0.61	2.81						87.81					0.54	0.499	
Phase IV	LX-11-698	HYP	WASTE	MX	PHY				71.7	0.92	3.08						96.25					0.74	0.706	
Phase IV	LX-11-699	HYP	WASTE	MX	PHY				81.0	1.04	2.7						84.38					0.96	0.916	
Phase IV	LX-11-700	HYP	WASTE	MX	PHY				73.2	0.94	2.05						64.06					1.14	1.085	
Phase IV	LX-11-701	HYP	WASTE	MX	PHY				64.7	0.83	1.85						57.81					1.12	1.054	
Phase IV	LX-11-703	HYP	WASTE	WR	POT	PHY			32.7	0.42	3.74						116.88					0.28	0.248	
Phase IV	LX-11-704	HYP	WASTE	WR	POT	PHY			51.4	0.66	2.45						76.56					0.67	0.623	
Phase IV	LX-11-706	HYP	WASTE	WR	POT	PHY			12.5	0.16	1.08						33.75					0.37	0.259	
Phase IV	LX-11-707	HYP	WASTE	WR	POT	PHY			49.1	0.63	1.48						46.25					1.06	0.981	
Phase IV	LX-11-709	HYP	WASTE	WR	POT	PHY			14.0	0.18	1.04						32.50					0.43	0.317	
Phase IV	LX-11-710	HYP	WASTE	WR	PHY	ARG			47.5	0.61	1.29						40.31					1.18	1.086	
Phase IV	LX-11-711	HYP	WASTE	WR	PHY	ARG			60.8	0.78	1.27						39.69					1.53	1.437	
Phase IV	LX-11-718	HYP	WASTE	WR	PHY	POT			54.5	0.7	2.47						77.19					0.71	0.658	
Phase IV	LX-11-719	HYP	WASTE	WR	PHY	POT			17.9	0.23	3.26						101.88					0.18	0.139	
Phase IV	LX-11-720	HYP	WASTE	WR	PHY	POT			36.6	0.47	2.27						70.94					0.52	0.464	
Phase IV	LX-11-721	HYP	WASTE	WR	PHY	POT			42.8	0.55	2.51						78.44					0.55	0.499	
Phase IV	LX-11-723	HYP	WASTE	WR	ARG	PHY			10.9	0.14	3.36						105.00					0.10	0.068	
Phase IV	LX-11-724	HYP	WASTE	WR	ARG	PHY			126.2	1.62	4.43						138.44					0.91	0.885	
Phase IV	LX-11-725	HYP	WASTE	WR	POT	PHY			34.3	0.44	1.62						50.63					0.68	0.604	
Phase IV	LX-11-726	HYP	WASTE	WR	POT	PHY			3.1	0.04	1						31.25					0.10	0.003	
Phase IV	LX-11-728	HYP	WASTE	WR	PHY				14.0	0.18	3.55						110.94					0.13	0.093	
Phase IV	LX-11-729	HYP	WASTE	WR	PHY				61.5	0.79	2.79						87.19					0.71	0.663	
Phase IV	LX-11-730	HYP	WASTE	WR	PHY				5.5	0.07	2.25						70.31					0.08	0.025	
Phase IV	LX-11-731	HYP	WASTE	WR	PHY				10.1	0.13	1.44						45.00					0.23	0.142	
Phase IV	LX-11-732	HYP	WASTE	WR	PHY				11.7	0.15	1.52						47.50					0.25	0.168	
Phase IV	LX-11-733	HYP	WASTE	WR	PHY				26.5	0.34	2.41						75.31					0.35	0.302	
Phase IV	LX-11-735	HYP	WASTE	WR	PHY				77.1	0.99	3.37						105.31					0.73	0.697	
Phase IV	LX-11-736	HYP	WASTE	WR	PHY	POT			52.2	0.67	0.98						30.63					1.70	1.583	
Phase IV	LX-11-737	HYP	WASTE	WR	PHY	POT			22.6	0.29	0.77						24.06					0.94	0.784	
Phase IV	LX-11-740	HYP	WASTE	PP	PHY				56.1	0.72	1.28						40.00					1.40	1.309	
Phase IV	LX-11-745	HYP	WASTE	MX	PHY				24.9	0.32	2.77						86.56					0.29	0.245	
Phase IV	LX-11-746	HYP	WASTE	MX	PHY				20.3	0.26	4.28						133.75					0.15	0.124	
Phase IV	LX-11-747	HYP	WASTE	MX	PHY				42.1	0.54	2.89						90.31					0.47	0.425	
Phase IV	LX-11-748	HYP	WASTE	MX	PHY				46.0	0.59	2.98						93.13					0.49	0.454	
Phase IV	LX-11-753	HYP	WASTE	WR	POT	PHY			27.3	0.35	1.81						56.56					0.48	0.416	
Phase IV	LX-11-754	HYP	WASTE	WR	POT	PHY			7.8	0.1	2.78						86.88					0.09	0.047	
Phase IV	LX-11-755	HYP	WASTE	WR	POT				13.2	0.17	1.91						59.69					0.22	0.160	
Phase IV	LX-11-763	HYP	WASTE	WR	PHY				25.7	0.33	5.25						164.06					0.16	0.134	
Phase IV	LX-11-764	HYP	WASTE	WR	PHY				27.3	0.35	8.04						251.25					0.11	0.094	
Phase IV	LX-11-765	HYP	WASTE	WR	PHY				66.2	0.85	4.61						144.06					0.46	0.434	
Phase IV	LX-11-766	HYP	WASTE	WR	PHY				45.2	0.58	5.42						169.38					0.27	0.245	
Phase IV	LX-11-769	HYP	WASTE	PP	POT	PHY			4.7	0.06	0.18						5.63					0.83	0.170	
Phase IV	LX-11-770	HYP	WASTE	PP	PHY	POT			8.6	0.11	2.75						85.94					0.10	0.056	
Phase IV	LX-11-771	HYP	WASTE	PP	PHY	POT			25.7	0.33	0.78						24.38					1.05	0.902	
Phase IV	LX-11-774	HYP	WASTE	WR	POT				17.1	0.22	0.44						13.75					1.25	0.976	
Phase IV	LX-11-775	HYP	WASTE	WR	POT				11.7	0.15	1.24						38.75					0.30	0.206	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-780	HYP	WASTE	WR	POT	PHY			10.1	0.13	1.02						31.88					0.32	0.201	
Phase IV	LX-11-782	HYP	WASTE	WR	PHY	POT			27.3	0.35	2.13						66.56					0.41	0.354	
Phase IV	LX-11-785	HYP	WASTE	WR	PHY				48.3	0.62	1.56						48.75					0.99	0.914	
Phase IV	LX-11-794	HYP	WASTE	WR	PHY				49.1	0.63	3.14						98.13					0.50	0.462	
Phase IV	LX-11-806	HYP	WASTE	PP	PHY				26.5	0.34	4.76						148.75					0.18	0.153	
Phase IV	LX-11-807	HYP	WASTE	PP	PHY				24.1	0.31	5.1						159.38					0.15	0.128	
Phase IV	LX-11-809	HYP	WASTE	PP	PHY	POT			32.7	0.42	1.9						59.38					0.55	0.488	
Phase IV	LX-11-810	HYP	WASTE	PP	PHY	POT			46.7	0.6	2.77						86.56					0.54	0.497	
Phase IV	LX-11-811	HYP	WASTE	PP	PHY	POT			21.0	0.27	2.22						69.38					0.30	0.250	
Phase IV	LX-11-814	HYP	WASTE	PP	PHY	POT			14.8	0.19	3.64						113.75					0.13	0.097	
Phase IV	LX-11-815	HYP	WASTE	PP	PHY	POT			22.6	0.29	1.65						51.56					0.44	0.366	
Phase IV	LX-11-816	HYP	WASTE	PP	PHY	POT			43.6	0.56	2.43						75.94					0.57	0.525	
Phase IV	LX-11-817	HYP	WASTE	PP	PHY	POT			31.9	0.41	1.72						53.75					0.59	0.525	
Phase IV	LX-11-820	HYP	WASTE	PP	PHY				8.6	0.11	1.48						46.25					0.19	0.105	
Phase IV	LX-11-821	HYP	WASTE	PP	PHY				7.8	0.1	2.39						74.69					0.10	0.054	
Phase IV	LX-11-822	HYP	WASTE	PP	PHY				14.8	0.19	2.54						79.38					0.19	0.140	
Phase IV	LX-11-823	HYP	WASTE	PP	PHY				18.7	0.24	2.23						69.69					0.27	0.215	
Phase IV	LX-11-842	HYP	WASTE	WR	PHY				2.3	0.03	4.75						148.44					0.02	0.001	
Phase IV	LX-11-843	HYP	WASTE	WR	PHY				1.6	0.02	6.37						199.06					0.01	0.001	
Phase IV	LX-11-844	HYP	WASTE	WR	PHY				4.7	0.06	4.92						153.75					0.03	0.006	
Phase IV	LX-11-845	HYP	WASTE	WR	PHY				0.4	***0.005***	5.93						185.31					0.00	0.001	
Phase IV	LX-11-846	HYP	WASTE	WR	PHY				1.6	0.02	4.62						144.38					0.01	0.001	
Phase IV	LX-11-847	HYP	WASTE	WR	PHY				1.6	0.02	4.57						142.81					0.01	0.001	
Phase IV	LX-11-848	HYP	WASTE	WR	PHY				0.8	0.01	7.16						223.75					0.00	0.000	
Phase IV	LX-11-849	HYP	WASTE	WR	PHY				0.8	0.01	5.02						156.88					0.00	0.001	
Phase IV	LX-11-850	HYP	WASTE	WR	PHY				0.8	0.01	5.21						162.81					0.00	0.001	
Phase IV	LX-11-851	HYP	WASTE	WR	PHY				0.8	0.01	5.62						175.63					0.00	0.001	
Phase IV	LX-11-852	HYP	WASTE	WR	PHY				0.8	0.01	5.84						182.50					0.00	0.001	
Phase IV	LX-11-853	HYP	WASTE	WR	PHY				3.1	0.04	7.06						220.63					0.01	0.000	
Phase IV	LX-11-854	HYP	WASTE	WR	PHY				0.8	0.01	4.23						132.19					0.01	0.001	
Phase IV	LX-11-856	HYP	WASTE	WR	PHY				0.8	0.01	6.34						198.13					0.00	0.001	
Phase IV	LX-11-857	HYP	WASTE	WR	PHY				0.8	0.01	4.84						151.25					0.01	0.001	
Phase IV	LX-11-858	HYP	WASTE	WR	PHY				0.4	***0.005***	4.77						149.06					0.00	0.001	
Phase IV	LX-11-859	HYP	WASTE	WR	PHY				6.2	0.08	3.39						105.94					0.06	0.024	
Phase IV	LX-11-868	HYP	WASTE	WR	ARG	POT			28.0	0.36	1.77						55.31					0.51	0.440	
Phase IV	LX-11-872	HYP	WASTE	WR	PHY	POT			59.2	0.76	0.61						19.06					3.11	2.911	
Phase IV	LX-11-873	HYP	WASTE	WR	PHY	ARG			11.7	0.15	4.8						150.00					0.08	0.053	
Phase IV	LX-11-874	HYP	WASTE	WR	PHY	ARG			1.6	0.02	5.84						182.50					0.01	0.001	
Phase IV	LX-11-875	HYP	WASTE	WR	PHY	ARG			12.5	0.16	2.56						80.00					0.16	0.109	
Phase IV	LX-11-876	HYP	WASTE	WR	PHY	ARG			10.1	0.13	5.03						157.19					0.06	0.041	
Phase IV	LX-11-879	HYP	WASTE	IX	POT	PHY			23.4	0.3	3.58						111.88					0.21	0.176	
Phase IV	LX-11-880	HYP	WASTE	IX	POT	PHY			10.9	0.14	2.61						81.56					0.13	0.088	
Phase IV	LX-11-882	HYP	WASTE	WR	PHY	POT			0.8	0.01	4.5						140.63					0.01	0.001	
Phase IV	LX-11-883	HYP	WASTE	WR	PHY	POT			3.9	0.05	6.38						199.38					0.02	0.001	
Phase IV	LX-11-884	HYP	WASTE	WR	PHY	POT			46.7	0.6	4.54						141.88					0.33	0.303	
Phase IV	LX-11-885	HYP	WASTE	WR	PHY	POT			17.9	0.23	4.56						142.50					0.13	0.100	
Phase IV	LX-11-888	HYP	WASTE	WR	POT	PHY			30.4	0.39	2.04						63.75					0.48	0.418	
Phase IV	LX-11-890	HYP	WASTE	WR	POT	PHY			30.4	0.39	1.15						35.94					0.85	0.742	
Phase IV	LX-11-893	HYP	WASTE	WR					6.2	0.08	4.82						150.63					0.04	0.017	
Phase IV	LX-11-895	HYP	WASTE	WR					6.2	0.08	3.08						96.25					0.06	0.026	
Phase IV	LX-11-898	HYP	WASTE	PP					73.2	0.94	4.72						147.50					0.50	0.471	
Phase IV	LX-11-899	HYP	WASTE	PP					75.6	0.97	5.25						164.06					0.46	0.438	
Phase IV	LX-11-900	HYP	WASTE	PP					44.4	0.57	3.54						110.63					0.40	0.368	
Phase IV	LX-11-903	HYP	WASTE	MX					1.6	0.02	6.6						206.25					0.01	0.000	
Phase IV	LX-11-904	HYP	WASTE	MX					1.6	0.02	7.1						221.88					0.01	0.000	
Phase IV	LX-11-905	HYP	WASTE	MX					2.3	0.03	5.81						181.56					0.01	0.001	
Phase IV	LX-11-906	HYP	WASTE	MX					1.6	0.02	6.69						209.06					0.01	0.000	
Phase IV	LX-11-917	HYP	WASTE	WR					29.6	0.38	6.18						193.13					0.15	0.134	
Phase IV	LX-11-918	HYP	WASTE	WR					51.4	0.66	4.77						149.06					0.34	0.320	
Phase IV	LX-11-919	HYP	WASTE	WR					66.2	0.85	5.49						171.56					0.39	0.364	
Phase IV	LX-11-920	HYP	WASTE	WR					20.3	0.26	4.72						147.50					0.14	0.112	
Phase IV	LX-11-921	HYP	WASTE	WR					21.8	0.28	7.25						226.56					0.10	0.080	
Phase IV	LX-11-922	HYP	WASTE	WR					24.1	0.31	3.11						97.19					0.25	0.210	
Phase IV	LX-11-923	HYP	WASTE	WR					24.1	0.31	3.3						103.13					0.23	0.198	
Phase IV	LX-11-924	HYP	WASTE	WR					38.2	0.49	3.24						101.25					0.38	0.340	
Phase IV	LX-11-925	HYP	WASTE	WR					14.0	0.18	3.78						118.13					0.12	0.087	
Phase IV	LX-11-926	HYP	WASTE	WR					27.3	0.35	3.06						95.63					0.29	0.246	
Phase IV	LX-11-953	HYP	WASTE	WR					12.5	0.16	0.21						6.56					1.90	1.332	
Phase IV	LX-11-954	HYP	WASTE	WR					11.7	0.15	0.34						10.63					1.10	0.750	
Phase IV	LX-11-959	HYP	WASTE	WR					29.6	0.38	0.58						18.13					1.63	1.428	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-962	HYP	WASTE	WR					17.1	0.22	1.08						33.75					0.51	0.398	
Phase IV	LX-11-964	HYP	WASTE	WR					35.8	0.46	0.34						10.63					3.37	3.022	
Phase IV	LX-11-965	HYP	WASTE	WR					24.9	0.32	0.35						10.94					2.28	1.939	
Phase IV	LX-11-966	HYP	WASTE	WR					89.6	1.15	1.55						48.44					1.85	1.773	
Phase IV	LX-11-967	HYP	WASTE	WR					39.7	0.51	1						31.25					1.27	1.152	
Phase IV	LX-11-969	HYP	WASTE	WR					30.4	0.39	0.37						11.56					2.63	2.306	
Phase IV	LX-11-970	HYP	WASTE	WR					19.5	0.25	0.33						10.31					1.89	1.528	
Phase IV	LX-11-971	HYP	WASTE	WR					17.9	0.23	0.1						3.13					5.73	4.543	
Phase IV	LX-11-972	HYP	WASTE	WR					21.8	0.28	0.19						5.94					3.67	3.047	
Phase IV	LX-11-973	HYP	WASTE	WR					42.8	0.55	0.31						9.69					4.42	4.039	
Phase IV	LX-11-974	HYP	WASTE	WR					21.8	0.28	0.35						10.94					1.99	1.654	
Phase IV	LX-11-975	HYP	WASTE	WR					18.7	0.24	0.22						6.88					2.72	2.178	
Phase IV	LX-11-976	HYP	WASTE	WR					37.4	0.48	0.06						1.88					19.94	17.958	
Phase IV	LX-11-977	HYP	WASTE	WR					11.7	0.15	0.12						3.75					3.12	2.124	
Phase IV	LX-11-978	HYP	WASTE	WR					39.7	0.51	0.29						9.06					4.38	3.973	
Phase IV	LX-11-979	HYP	WASTE	WR					21.8	0.28	0.06						1.88					11.63	9.649	
Phase IV	LX-11-980	HYP	WASTE	WR					20.3	0.26	0.51						15.94					1.27	1.037	
Phase IV	LX-11-983	HYP	WASTE	WR					28.0	0.36	0.69						21.56					1.30	1.128	
Phase IV	LX-11-984	HYP	WASTE	WR					15.6	0.2	0.92						28.75					0.54	0.413	
Phase IV	LX-11-987	HYP	WASTE	WR					24.9	0.32	0.62						19.38					1.29	1.095	
Phase IV	LX-11-1007	HYP	WASTE	WR	PHY				3.9	0.05	4.62						144.38					0.03	0.001	
						Maximum	9.00	1.8	153	2.0	14.0	1.4	13.8	13.4	0.85		438	432	420	163	141	19.9	18.0	
						90th percentile	8.51	0.82	64.5	0.83	5.5	0.56	5.2	5.0	0.32		172	162	157	66.7	23.4	1.90	1.66	
						75th percentile	8.36	0.58	46.2	0.59	4.3	0.10	4.0	3.8	0.18		136	125	118	47.9	10.2	1.0	0.8	
						Mean	7.81	0.38	31.5	0.40	2.8	0.15	2.5	2.4	0.13		88.8	78.9	75.1	36.1	-39.0	0.79	0.68	
						Median	8.12	0.32	27.3	0.34	2.5	0.030	1.9	1.8	0.070		77.5	59.8	56.3	31.4	-20.8	0.43	0.37	
						25th percentile	7.88	0.14	12.5	0.16	1.2	0.020	0.78	0.71	0.020		35.9	24.2	22.2	20.9	-78.0	0.17	0.12	
						10th percentile	6.45	0.030	3.1	0.040	0.57	0.010	0.49	0.41	***0.010***		17.8	15.3	12.8	7.5	-131	0.029	0.004	
						Minimum	3.98	***0.0050***	***0.39***	***0.0050***	0.060	***0.0050***	0.090	0.070	***0.0050***		1.9	2.8	2.2	0.90	-410	0.00173	0.00043	
						No of samples	161	161	424	424	424	161	161	161	161		424	161	161	161	161	424	424	
Hypogene Zone (HYP) - Unknown Ore/Waste Designation																								
Phase IV	LX-11-357	HYP		MX			3.69																	
Phase IV	LX-11-901	HYP		MX					0.4	***0.005***	2.19						68.44					0.01	0.001	
Phase IV	LX-11-902	HYP		MX					0.4	***0.005***	4.58						143.13					0.00	0.001	
Phase IV	LX-11-907	HYP		MX					2.3	0.03	5.43						169.69					0.01	0.001	
Phase IV	LX-11-908	HYP		MX					24.9	0.32	3.62						113.13					0.22	0.187	
Phase IV	LX-11-909	HYP		MX					49.1	0.63	4.95						154.69					0.32	0.293	
Phase IV	LX-11-910	HYP		MX					56.9	0.73	2.77						86.56					0.66	0.614	
Phase IV	LX-11-911	HYP		MX					50.6	0.65	3.56						111.25					0.46	0.422	
Phase IV	LX-11-912	HYP		MX					46.0	0.59	4.22						131.88					0.35	0.320	
Phase IV	LX-11-913	HYP		MX					70.9	0.91	2.37						74.06					0.96	0.907	
Phase IV	LX-11-914	HYP		MX					89.6	1.15	3.2						100.00					0.90	0.859	
Phase IV	LX-11-930	HYP		WR					63.9	0.82	4.57						142.81					0.45	0.421	
Phase IV	LX-11-931	HYP		WR					65.4	0.84	3.7						115.63					0.57	0.534	
Phase IV	LX-11-932	HYP		WR					15.6	0.2	5.97						186.56					0.08	0.064	
Phase IV	LX-11-933	HYP		WR					63.9	0.82	11.8						368.75					0.17	0.163	
Phase IV	LX-11-934	HYP		WR					56.1	0.72	4.94						154.38					0.36	0.339	
Phase IV	LX-11-935	HYP		WR					28.8	0.37	4						125.00					0.23	0.201	
Phase IV	LX-11-936	HYP		WR					38.9	0.5	5.12						160.00					0.24	0.220	
Phase IV	LX-11-937	HYP		WR					41.3	0.53	5.28						165.00					0.25	0.228	
Phase IV	LX-11-938	HYP		WR					51.4	0.66	3.8						118.75					0.43	0.402	
Phase IV	LX-11-939	HYP		WR					21.8	0.28	8.58						268.13					0.08	0.067	
Phase IV	LX-11-940	HYP		WR					50.6	0.65	2.08						65.00					0.78	0.722	
Phase IV	LX-11-941	HYP		WR					57.6	0.74	2.81						87.81					0.66	0.614	
Phase IV	LX-11-946	HYP		WR					14.0	0.18	0.41						12.81					1.09	0.804	
Phase IV	LX-11-947	HYP		WR					8.6	0.11	0.63						19.69					0.44	0.246	
Phase IV	LX-11-991	HYP		WR					63.1	0.81	2.18						68.13					0.93	0.872	
Phase IV	LX-11-992	HYP		WR					26.5	0.34	0.82						25.63					1.03	0.888	
Phase IV	LX-11-993	HYP		WR					9.3	0.12	0.84						26.25					0.36	0.214	
Phase IV	LX-11-994	HYP		WR					14.8	0.19	0.58						18.13					0.82	0.611	
Phase IV	LX-11-995	HYP		WR					19.5	0.25	0.77						24.06					0.81	0.655	
Phase IV	LX-11-996	HYP		WR					10.1	0.13	1.6						50.00					0.20	0.128	
Phase IV	LX-11-997	HYP		WR					20.3	0.26	1.18						36.88					0.55	0.448	
Phase IV	LX-11-998	HYP		WR					31.9	0.41	1.54						48.13					0.66	0.586	
Phase IV	LX-11-999	HYP		WR					24.9	0.32	0.83						25.94					0.96	0.818	
Phase IV	LX-11-1000	HYP		WR					60.8	0.78	0.45						14.06					4.32	4.056	
Phase IV	LX-11-1001	HYP		WR					35.1	0.45	1.33						41.56					0.84	0.754	
Phase IV	LX-11-1002	HYP		WR					17.1	0.22	0.94						29.38					0.58	0.457	
Phase IV	LX-11-1003	HYP		WR					14.0	0.18	0.48						15.00					0.93	0.687	

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Paste and Rinse pH	TIC	CaNP	C(T)	S(T)	$S(SO_4)$	non-sulphate S	$S(S^{-2})$	Insoluble S	SO_4 AP + Non-SO_4 AP	TAP	Non-SO_4 AP	SAP	ScNP (Lab)	Net	NPR (CaNP/AP)	NPR (available CaNP/AP)	Fizz Test
								%	kg $CaCO_3$/t	%	%	%	%	%	%	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t	NP			
Phase IV	LX-11-1004	HYP		WR					14.0	0.18	0.24						7.50					1.87	1.374	
Phase IV	LX-11-1005	HYP		IX					77.9	1	2.47						77.19					1.01	0.961	
Phase IV	LX-11-1006	HYP		WR					42.8	0.55	0.55						17.19					2.49	2.276	
						Maximum			89.6	1.2	11.8						369					4.3	4.1	
						90^{th} percentile			64.0	0.82	5.3						165					1.0	0.9	
						75^{th} percentile			56.3	0.72	4.3						135					0.9	0.8	
						Mean			36.3	0.47	2.9						91.7					0.70	0.61	
						Median	3.69		33.5	0.43	2.4						75.6					0.56	0.45	
						25^{th} percentile			15.4	0.20	0.84						26.2					0.25	0.22	
						10^{th} percentile			9.3	0.12	0.54						17.0					0.083	0.067	
						Minimum			0.39	***0.0050***	0.24						7.5					0.0027	0.0006	
						No of samples	1		40	40	40						40					40	40	
Samples with Unknown Zone																								
Phase I	08-130		WASTE				8.48	0.14	11.67	0.16	0.030	***0.0050***	0.03	0.050	***0.0050***		0.94	0.781	1.56	18.1	16.5	14.9		Slight
Phase I	08-131		WASTE				8.50	0.02	1.67	0.030	0.020	***0.0050***	0.03	0.030	***0.0050***		0.63	0.469	0.94	13.2	12.3	3.6		None
Phase III	09-36		WASTE	WR	PHY		8.13	0.46	38.3	0.49	4.16	0.03	4.13	3.94	0.19		130.00	129.06	123.13	40.50	-82.6	0.30		Slight
Phase IV	LX-11-344b						4.73																	

Notes:
Bold italic indicates 0.5*DL (value is less than the detection limit

When $S(SO_4)$% is greater than S(T)%, a value of 0.0025% is assigned for non-sulphate S (%)

NPR = NP/AP

where NP is calculated from TIC for Phase I, II and III samples and from TC with a correction factor for Phase IV samples; and

AP is calculated from the SO_4 S+Non-SO_4 S for the Phase I, II and III CAP and SOX samples, from the Non-SO_4 S for the Phase I, II and III SUS and HYP samples and Total S for the Phase IV samples

Available CaNP subtracts the unavailable CaNP from the CaNP. The unavailable CaNP is 2.36 kg$CaCO_3$/t for the SUP and 3.72 kg$CaCO_3$/t for the HYP.

Appendix D2: Static Test Aqua Regia Metals Results

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
DL							<0.1		<0.5	<0.5	<20		<0.1	<0.01	<0.1					<1	<0.01			<0.01								<0.05	<0.1	<0.1	<0.5			<0.001	<0.1		<2	<0.1	
Overburden (OVB) Samples																																										
Phase I	08-124	OVB			ARG		0.7	2.09	6.2	76.9	***10***	798	0.2	0.24	0.2	5.7	73	257.8	3.35	7	***0.005***	0.93	10	1.4	97	28.4	0.079	7.1	0.104	3.9	***0.025***	0.3	6.7	0.9	31	6.1	0.189	0.6	3	104	0.2	29
Phase II	08-400	OVB	WASTE	WR	ARG	POT	0.6	2.11	20.2	118.4	***10***	483	0.4	0.51	0.4	9.6	24	883.3	3.1	7	0.14	0.45	27	1.26	283	193.3	0.058	3.8	0.11	6	***0.025***	1	7.9	1.2	30	9.6	0.048	0.4	4.3	71	0.5	49
Phase IV	LX-11-297	OVB	WASTE	WR	ARG																																					
Oxide Leach Cap (CAP) - Ore Designated Samples																																										
Phase I	08-014	CAP	ORE	WR	PHY	ARG	0.2	0.24	8.1	80.2	***10***	38	1.7	0.01	0.1	12.8	116	212	5.59	2	***0.005***	0.18	17	0.03	14	191	0.011	5.6	0.021	8.9	6.57	0.7	2.9	3.8	25	43.6	0.001	0.1	18	2	10.6	5
Phase I	08-077	CAP	ORE	WR	ARG	PHY	1.6	0.25	11.6	84.9	***10***	467	0.4	0.02	0.4	0.5	149	132.1	1.77	***0.5***	0.2	0.44	11	0.03	14	247.9	0.018	2.8	0.044	8.9	0.63	0.4	0.5	1.2	20	10.9	0.001	0.1	0.7	***1***	1	4
Phase I	08-078	CAP	ORE	IX	ARG	POT	0.5	2.95	3.7	34	***10***	296	0.3	0.11	***0.05***	2.5	65	320.6	4.22	10	0.02	0.65	33	1.01	218	38.6	0.068	12.7	0.073	5.1	0.2	***0.05***	4.3	***0.25***	61	6.5	0.106	0.4	4.5	50	1.3	37
Phase I	08-095	CAP	ORE	WR			0.8	0.42	8.2	74	***10***	198	0.8	0.11	0.5	0.6	76	159.7	1.57	***0.5***	***0.005***	0.26	18	0.08	17	503.4	0.05	1.9	0.028	10.8	0.35	0.2	0.9	0.6	29	6.9	***0.0005***	0.1	2.2	***1***	0.7	8
Phase I	08-097	CAP	ORE	WR	ARG	PHY	0.8	0.67	8.5	86.8	***10***	75	1.5	0.04	0.3	1.7	67	244.1	3.89	1	0.06	0.24	11	0.07	19	269.9	0.009	2	0.014	3	0.07	0.3	1.2	3.9	5	4.5	0.001	0.2	1.3	6	2	17
Phase I	08-114	CAP	ORE	WR	ARG	PHY	0.3	3.14	19.8	89	***10***	436	0.9	0.22	0.2	4	71	833.5	6.88	6	***0.005***	0.74	6	1.08	225	344.5	0.029	7.1	0.094	12.6	***0.025***	0.3	9.3	0.6	15	6.5	0.141	0.6	9.4	93	1.5	32
Phase I	08-128	CAP	ORE	IX	ARG		1.3	0.35	14.5	192	***10***	83	0.5	0.01	0.3	4	126	781.4	2.48	***0.5***	0.03	0.18	52	0.02	28	1043.6	0.011	4.4	0.014	10.6	0.16	12.9	2.1	2.3	7	15	***0.0005***	0.1	2.4	11	0.6	70
Phase II	08-144	CAP	ORE	WR	ARG	PHY	7.6	0.19	53.2	543.7	***10***	72	19	0.02	0.2	0.3	57	43.7	3.66	4	0.21	0.94	19	0.02	13	718.8	0.014	1.9	0.021	28.4	1.31	1.9	0.6	10.2	15	4.4	0.038	0.3	0.7	11	10.3	4
Phase II	08-145	CAP	ORE	WR	ARG	PHY	5.4	0.23	38.7	452.3	***10***	236	14.4	0.01	0.2	0.5	48	78.2	3.32	3	0.05	0.88	18	0.02	20	531.5	0.014	1.4	0.032	22.7	1.22	0.7	0.6	4.3	18	10.8	0.018	0.4	1.1	8	7.6	6
Phase II	08-147	CAP	ORE	WR	ARG		1	0.27	15.4	138.2	***10***	242	4.5	***0.005***	0.1	0.3	66	17.9	2.88	3	0.02	0.78	18	0.03	13	681.4	0.015	1.8	0.023	13.4	0.98	0.3	0.7	3.8	15	9.1	0.012	0.4	1.2	8	4.9	3
Phase II	08-152	CAP	ORE	WR	ARG	PHY	2.1	0.23	18	220.9	***10***	298	13.1	0.01	0.1	0.9	67	53.3	1.85	1	0.06	0.54	19	0.02	15	128.1	0.009	2.1	0.049	16.9	0.77	0.8	2.9	2.7	17	17	0.005	0.2	0.7	3	7.1	7
Phase II	08-155	CAP	ORE	WR	PHY	ARG	0.3	0.34	22.4	62.6	***10***	32	2.5	0.05	0.3	31.1	60	246.6	6.77	***0.5***	***0.005***	0.22	16	0.03	16	417	0.008	8.2	0.047	10.7	6.92	0.4	0.6	4	13	11.2	0.001	0.2	15.7	2	4.5	14
Phase II	08-170	CAP	ORE	IX	ARG	PHY	1.9	0.26	90.7	82.7	***10***	51	4.7	0.01	***0.05***	0.9	53	93.7	6.95	6	***0.005***	1.19	4	0.02	36	299	0.036	2	0.042	24.7	2.08	0.5	1	1.9	33	14.1	0.012	0.5	1.4	28	36.6	21
Phase II	08-171	CAP	ORE	IX	ARG	PHY	1.6	0.25	50.9	77	***10***	30	4.1	***0.005***	0.2	0.6	71	94.6	6.28	7	***0.005***	1.42	11	0.02	11	193.3	0.029	1.6	0.082	45.2	2.28	0.2	1.4	1.8	61	26.4	0.01	0.5	1.8	17	29.2	4
Phase II	08-210	CAP	ORE	IX	ARG	POT	2	0.34	12	495.6	***10***	341	1.1	0.01	0.2	2	47	758.4	2.78	***0.5***	0.05	0.28	26	0.02	254	253.2	0.01	2.2	0.04	41.3	0.22	1.4	1.2	1.5	10	14.7	0.002	0.2	2.1	12	5.7	81
Phase II	08-211	CAP	ORE	IX	POT		2.6	0.42	6.3	359.7	***10***	272	1	***0.005***	0.5	3.8	114	599.5	2.44	***0.5***	0.03	0.33	24	0.03	56	185.7	0.013	3.7	0.036	48.1	0.45	1.1	0.8	1	9	10	0.002	0.2	3.2	9	6.4	143
Phase II	08-244	CAP	ORE	WR	POT	ARG	1.3	0.52	7.4	101.4	***10***	281	0.9	0.02	0.2	0.6	97	116.1	1.97	***0.5***	***0.005***	0.47	25	0.08	20	186.7	0.018	2.5	0.054	7.6	0.57	0.4	0.7	2	130	17.7	***0.0005***	0.2	1.1	4	1.4	7
Phase II	08-249	CAP	ORE	WR	ARG	PHY	1.7	0.5	6.9	224.8	***10***	162	0.9	0.01	***0.05***	7	66	87.3	2.25	1	0.06	0.33	20	0.07	20	114.2	0.01	4.1	0.041	5.8	0.99	0.5	0.6	2.5	22	8.4	0.002	0.2	1.3	6	2.4	7
Phase II	08-253	CAP	ORE	IX	ARG	POT	0.7	1.95	2.4	150.3	***10***	197	0.4	0.02	0.1	1	58	321.4	5.8	7	***0.005***	0.87	27	0.87	122	134.4	0.044	10.1	0.054	3.1	0.46	0.1	4.4	1.2	35	8.8	0.107	0.6	1.8	72	3.3	25
Phase II	08-254	CAP	ORE	IX	ARG	POT	0.6	1.63	9.6	439.6	***10***	179	1.2	0.03	0.2	0.9	86	371.7	4.49	5	***0.005***	0.41	51	0.42	68	268.3	0.018	6.6	0.085	3.3	0.24	1	2.5	1.8	225	9.2	0.032	0.3	2.9	41	14.6	14
Phase II	08-297	CAP	ORE	WR	ARG		2.2	0.65	138.4	155.2	***10***	187	2.3	0.02	***0.05***	1.7	83	431.2	4.31	***0.5***	0.03	0.22	21	0.07	28	714.8	0.012	2.6	0.115	10.8	0.09	1.8	0.9	3	8	26.6	0.003	0.1	10.2	26	1	17
Phase II	08-298	CAP	ORE	WR	ARG		0.8	0.43	65.8	107.5	***10***	102	2	0.01	***0.05***	1.9	154	232.2	2.47	***0.5***	***0.005***	0.18	24	0.02	13	256.1	0.011	3.4	0.06	11.8	***0.025***	0.6	0.5	2.5	7	21.3	***0.0005***	***0.05***	5.6	15	1.3	15
Phase II	08-314	CAP	ORE	WR	ARG		0.2	1.87	13.6	77.3	***10***	113	0.6	0.02	0.1	3.9	34	705.3	4.97	2	***0.005***	0.27	3	0.33	52	239.6	0.014	6.4	0.084	3.9	***0.025***	0.1	4.3	0.6	4	7.1	0.033	0.2	13.5	28	0.6	37
Phase II	08-315	CAP	ORE	WR	ARG		2	2.02	3.8	155.4	***10***	225	0.8	0.03	0.1	1.9	23	256.2	2.9	4	***0.005***	0.68	29	0.87	98	558.9	0.046	4.3	0.077	4.1	0.2	0.1	6.6	2.6	86	9.3	0.082	0.5	5.5	55	0.8	23
Phase II	08-321	CAP	ORE	WR	ARG	POT	0.3	2.2	4.5	195.9	***10***	208	0.8	0.02	***0.05***	1.6	71	1246.4	8.19	5	0.01	0.58	8	0.69	75	235.3	0.014	7.1	0.086	3.9	0.06	0.2	5.6	1.7	5	14.1	0.086	0.5	5.7	52	2	29
Phase II	08-343	CAP	ORE	IX	ARG	POT	1	1.56	13.1	229.7	***10***	135	1.1	0.14	***0.05***	4.6	74	490.5	2.86	7	***0.005***	0.72	21	1.16	155	90.2	0.061	12.1	0.084	5	0.22	0.3	4.6	1.6	28	7.6	0.1	0.4	3.5	50	1.2	53
Phase II	08-357	CAP	ORE	WR	ARG		0.5	2.41	9.3	424.3	***10***	268	0.2	0.11	0.1	2.6	49	434.5	2.38	6	***0.005***	0.34	23	0.94	106	52.4	0.043	3	0.042	16.3	***0.025***	0.8	6.3	1.7	13	9.7	0.07	0.3	9.1	67	0.1	56
Phase II	08-358	CAP	ORE	WR	ARG		6.3	1.91	24.7	369	***10***	495	25.8	0.11	0.2	3.7	43	655.5	2.54	5	***0.005***	0.38	23	0.68	103	54.5	0.042	3.1	0.058	49.6	0.2	1.2	5.5	1.5	46	10.1	0.047	0.3	8.3	52	0.3	57
Phase II	08-433	CAP	ORE	WR	ARG		0.9	2.2	37.3	160.9	***10***	462	2	0.06	***0.05***	2.1	38	450.4	4.36	4	0.02	0.61	37	0.83	96	328.9	0.023	4.2	0.109	16.5	0.29	0.5	4.2	2.7	175	10.8	0.07	0.7	5.1	53	0.9	35
Phase II	08-435	CAP	ORE	WR	ARG		1.3	2.11	4	249.6	***10***	202	0.6	0.09	***0.05***	1.5	67	348.7	2.53	4	***0.005***	0.39	19	0.38	84	183.2	0.035	5.7	0.045	13.7	0.08	0.6	4.3	1.3	23	7.9	0.025	0.3	5.1	37	4	19
Phase III	09-01	CAP	ORE	PP	ARG		0.25	7.03	10	2.5			1	0.02	***0.025***	4	20	50	4.91	20		4.29	130	0.39	65	2460	0.16	0.5	0.083	7	1.26	2.5	6		146	10	0.13	5	5	60	180	15
Phase III	09-02	CAP	ORE	PP	ARG		***0.25***	7.09	27	***10***			***3***	0.02	***0.025***	6	21	35	5.18	20		4.65	40	0.41	28	660	0.21	***3***	0.058	11	3.49	***2.5***	6		149	***10***	0.09	***5***	***5***	49	80	4
						Maximum	7.6	7.1	138	544	***10***	495	25.8	0.22	0.50	31.1	154	1246	8.2	20.0	0.21	4.7	130	1.2	254	2460	0.21	12.7	0.12	49.6	6.9	12.9	9.3	10.2	225	43.6	0.14	5.0	18.0	93.0	180	143
						90th percentile	2.6	2.9	53.0	438	***10***	439	12.3	0.11	0.30	5.9	116	753	6.7	7.0	0.060	1.2	39.7	0.93	152	711	0.060	8.1	0.086	40.0	2.3	1.9	6.0	3.9	144	20.9	0.11	0.60	10.1	59.5	27.7	56.9
						75th percentile	1.9	2.0	25.3	235	***10***	279	2.63	0.053	0.20	3.9	77.8	460	5.0	6.0	0.030	0.75	26.3	0.68	96.5	510	0.042	5.9	0.082	16.6	1.0	1.0	4.5	2.7	49.8	14.3	0.073	0.50	5.6	50.5	7.2	35.5
						Mean	1.6	1.5	23.7	191	***10***	213	3.57	0.043	0.16	3.5	69.9	341	3.9	4.3	0.031	0.77	25.1	0.34	65.7	393	0.035	4.4	0.056	15.1	1.0	1.1	2.9	2.4	45.5	12.5	0.038	0.60	4.8	29.0	13.2	27.2
						Median	1.0	0.59	12.6	153	***10***	200	1.10	0.020	0.10	1.9	66.5	251	3.5	3.5	***0.0050***	0.46	20.5	0.075	32.0	255	0.018	3.3	0.052	10.8	0.32	0.50	2.3	1.9	21.0	10.0	0.015	0.30	3.4	21.5	2.2	17.0
						25th percentile	0.50	0.32	7.9	82.1	***10***	105	0.80	0.010	***0.050***	0.90	48.8	94.4	2.5	***0.50***	***0.0050***	0.28	16.8	0.028	16.8	185	0.012	2.1	0.039	5.6	0.14	0.30	0.78	1.4	12.3	8.3	0.0018	0.20	1.4	7.5	1.0	7.0
						10th percentile	0.26	0.24	4.1	63.7	***10***	50	0.41	0.010	***0.050***	0.51	34.4	50.3	2.0	***0.50***	***0.0050***	0.22	8.3	0.020	13.1	92.6	0.010	1.8	0.021	3.9	***0.029***	0.11	0.60	0.60	7.0	6.5	***0.00055***	0.10	1.10	2.1	0.61	4.0
						Minimum	0.20	0.19	2.4	2.5	***10***	30	0.20	***0.005***	***0.025***	0.30	20.0	17.9	1.6	***0.50***	***0.0050***	0.18	3.0	0.020	11.0	38.6	0.008	0.50	0.014	3.0	***0.025***	***0.050***	0.50	***0.25***	4.0	4.4	***0.00050***	***0.050***	0.70	***1.0***	0.10	3.0
						No of Samples	32	32	32	32	30	30	32	32	32	32	32	32	32	32	30	32	32	32	32	32	32	32	32	32	32	32	32	30	32	32	32	32	32	32	32	32
Oxide Leach Cap (CAP) - Waste Designated Samples																																										
Phase I	08-001	CAP	WASTE	WR	ARG	PHY	1.9	0.19	17.2	85.7	***10***	242	12.8	0.02	***0.05***	0.4	116	15.6	2.77	3	0.02	0.71	11	0.02	14	12.7	0.027	2.2	0.006	9.4	1.1	0.3	0.9	4.2	5	2	0.006	0.3	0.2	8	2.5	5
Phase I	08-002	CAP	WASTE	WR	ARG	PHY	1.9	0.19	21.8	97.3	***10***	229	6.5	***0.005***	***0.05***	0.3	115	12.8	2.15	3	0.01	0.56	9	0.02	14	12	0.022	2.1	0.008	17.5	0.83	0.4	0.8	3.6	5	9.4	0.004	0.3	0.2	6	1.7	4
Phase I	08-006	CAP	WASTE	WR	ARG	PHY	1.4	0.21	10.8	209.3	***10***	210	3.2	0.01	***0.05***	0.4	131	20.9	1.1	2	***0.005***	0.37	12	0.02	11	7.6	0.015	2.3	0.004	15.9	0.41	0.5	0.5	6.3	3	4.6	0.005	0.1	0.6	4	2.3	2
Phase I	08-007	CAP	WASTE	WR	PHY	ARG	0.3	0.2	4.2	32.8	***10***	77	1.1	0.01	***0.05***	16.8	125	17	1.93	***0.5***	0.03	0.15	5	0.02	13	14.5	0.013	3.1	0.002	7.1	2.1	0.2	0.3	4	4	5	***0.0005***	***0.05***	1.1	***1***	2.2	18
Phase I	08-009	CAP	WASTE	MX			1.4	0.22	7.9	28.1	***10***	81	5.3	***0.005***	***0.05***	0.3	82	17.2	2.04	2	***0.005***	0.45	21	0.02	10	79.5	0.042	1.6	0.016	24.5	0.8	0.6	0.4	1.5	8	16.9	0.001	0.3	0.3	***1***	0.5	5
Phase I	08-012	CAP	WASTE	WR	ARG	PHY	1	0.27	2.9	59.6	***10***	121	1.6	0.04	***0.05***	0.8	67	8.3	0.56	1	***0.005***	0.23	22	0.03	26	42.4	0.021	1.8	0.009	14.8	0.5	1.4	0.8	0.7	11	4.4	0.006	***0.05***	0.8	3	5.5	3
Phase I	08-013	CAP	WASTE	WR	PHY	ARG	0.3	0.36	22	45.2	***10***	161	4.7	0.02	0.2	5.1	99	31.2	3.21	3	***0.005***	0.8	17	0.03	17	262.6	0.034	2.6	0.012	9.6	1.97	0.7	1.2	2.6	6	6.1	0.012	0.3	0.5	15	10.9	8
Phase I	08-015	CAP	WASTE	PP	ARG	PHY	1.9	0.35	5.6	137.4	***10***	126	7.7	0.01	***0.05***	0.9	62	47.7	2.18	2	***0.005***	0.49	18	0.02	12	8.9	0.029	1.4	0.015	90.4	1.15	0.7	0.5	***0.25***	8	4.7	***0.0005***	0.3	0.7	4	0.5	5
Phase I	08-016	CAP	WASTE	PP	PHY	ARG	0.8	0.32	6.8	80.7	***10***	36	3.2	0.75	***0.05***	12.9	48	82.2	5.01	***0.5***	***0.005***	0.17	25	0.27	807	4.5	0.011	7.8	0.074	11.2	3.83	0.1	0.8	0.7	10	5	***0.0005***	***0.05***	3.5	3	0.3	47
Phase I	08-017	CAP	WASTE	WR	ARG	PHY	0.5	0.55	9.3	97.1	***10***	315	1.8	***0.005***	***0.05***	5	103	456.8	3.19	1	***0.005***	0.34	11	0.07	185	7.4	0.019	3.1	0.037	9.4	0.3	0.4	1.2	1	12	14	0.003	0.2	3.3	18	5.7	38
Phase I	08-018	CAP	WASTE	WR	ARG	PHY	1.3	0.25	15.3	162.2	***10***	172	4.3	***0.005***	***0.05***	0.3	59	35.3	3.17	3	***0.005***	0.75	13	0.02	9	19.9	0.027	1.1	0.029	9.9	1.28	0.4	0.6	6.2	12	12.5	0.006	0.4	0.9	7	3.1	3
Phase I	08-019	CAP	WASTE	WR	ARG	PHY	0.2	0.19	3.1	38.9	***10***	242	0.8	0.01	***0.05***	0.3	97	9.8	0.52	***0.5***	0.02	0.21	14	0.01	11	3.3	0.013	1.7	0.003	23.6	0.18	0.6	0.4	1	4	4.1	0.002	***0.05***	0.5	2	2.6	2
Phase I	08-021	CAP	WASTE	PP	ARG	PHY	1.6	0.41	9.7	89.9	***10***	217	0.9	***0.005***	0.2	0.5	68	76.2	3.09	4	0.02	0.76	23	0.02	9	188	0.026	1.1	0.033	4.3	1.42	0.5	1.1	0.8	36	8.8	0.003	0.5	0.6	7	1.7	2
Phase I	08-022	CAP	WASTE	MX	ARG	PHY	0.6	0.22	14.7	75	***10***	104	4.8	***0.005***	0.1	0.2	72	9.4	2.23	3	***0.005***	0.62	21	0.02	7	138.1	0.018	1.4	0.038	8.6	0.92	0.4	1.3	1	17	20.2	0.006	0.2	0.8	4	11.5	2
Phase I	08-023	CAP	WASTE	MX	PHY	ARG	0.7	0.23	6.2	46.3	***10***	45	3.9	***0.005***	0.2	7.6	97	38.9	3.22	***0.5***	***0.005***	0.21	10	0.03	10	178.5	0.011	10.2	0.005	8.5	3.81	0.8	0.5	2.2	6	4.6	0.001	0.1	0.6	2	2.2	9
Phase I	08-026	CAP	WASTE	PP	ARG	PHY	0.8	0.9	6.4	304.9	***10***	682	0.6	0.13	0.2	3.7	108	189.5	1.97	3	***0.005***	0.37	27	0.41	171	155	0.035	5.8	0.028	14.3	0.22	1.6	3	2	22	10.3	0.038	0.2	2.2	27	1.7	26
Phase I	08-027	CAP	WASTE	PP	ARG		1	1.42	11.8	47.5	***10***	91	7.8	1.48	0.2	17.3	78	942.5	3.96	4	***0.005***	0.6	15	0.9	205	18	0.027	18.3	0.073	18.1	3.72	0.5	1.7	1.9	34	6.5	0.027	0.6	3.8	18	1	57
Phase I	08-029	CAP	WASTE	WR	ARG	PHY	0.4	0.18	22.7	52.4	***10***	172	2.9	0.02	***0.05***	0.6	102	27.3	3.28	2	0.02	0.71	9	0.02	11	5.6	0.016	2	0.007	12.5	1.5	0.8	0.4	11.2	4	5.8	0.012	0.2	0.3	6	3.7	3
Phase I	08-034	CAP	WASTE	WR	ARG	PHY	0.5	1.12	5	68.4	***10***	70	0.9	0.03	***0.05***	1.3	131	290.8	4.02	5	***0.005***	0.35	9	0.53	49	51.4	0.069	7.3	0.08	4	0.61	0.2	2.6	0.7	43	5.9	0.024	0.3	2.4	36	3.1	12
Phase I	08-035	CAP	WASTE	WR	ARG	PHY	0.8	0.32	53.1	100.3	***10***	145	4.1	0.02	***0.05***	4.3	69	253.8	5.85	3	***0.005***	0.94	14	0.08	34	38.1	0.113	3.7	0.072	6.3	2.08	0.3	1.8	2.4	28	5	0.044	0.9	3.1	17	24.2	9
Phase I	08-036	CAP	WASTE	WR	PHY	ARG	0.9	1.5	13	173.4	***10***	173	2	0.01	***0.05***	7.6	100	476.8	3.82	5	***0.005***	0.57	13	0.68	76	12.1	0.038	5.7	0.034	10.6	1.59	0.3	4.9	1.2	29	12.2	0.062	0.6	1.4	49	3.6	22
Phase I	08-037	CAP	WASTE	PP	ARG		0.3	1.78	1.6	81.5	***10***	66	0.5	0.06	***0.05***	4.4	115	295.5	3.25	8	***0.005***	0.41	20	1	132	11.1	0.049	12.6	0.054	7.4	0.19	0.2	4.3	***0.25***	36	6.8	0.037	0.5	3.3	43	2.3	22
Phase I	08-041	CAP	WASTE	WR	ARG	PHY	1	0.15	4.3	115.9	***10***	282	0.5	0.02	***0.05***	0.4	122	10.2	0.27	***0.5***	***0.005***	0.16	16	***0.005***	17	3.9	0.014	2.3	0.009	32.5	0.1	0.5	0.4	1.7	4	4.3	0.009	***0.05***	0.8	2	1.9	3
Phase I	08-042	CAP	WASTE	WR	PHY	ARG	0.5	0.26	5.1

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
							ppm	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
Phase I	08-053	CAP	WASTE	MX	ARG	PHY	0.8	0.22	63	53.3	***10***	248	7.7	0.02	0.1	2.5	72	139.9	3.55	2	***0.005***	0.62	28	0.02	42	34	0.017	2.7	0.061	38.1	1.13	1.3	0.7	2.8	34	9.3	***0.0005***	0.5	1.5	5	0.4	150
Phase I	08-054	CAP	WASTE	WR	ARG	PHY	0.3	0.57	20.7	24.7	***10***	258	0.6	0.02	***0.05***	2.1	92	158.8	3.67	3	***0.005***	0.26	9	0.21	36	5.3	0.158	2.3	0.072	12.9	0.91	2	2.3	2.2	60	14.8	***0.0005***	0.2	1.7	17	0.3	35
Phase I	08-057	CAP	WASTE	WR	ARG	PHY	0.6	0.31	3.5	49	***10***	87	1.8	0.06	***0.05***	8.4	84	16.8	1.54	4	0.04	0.11	32	0.02	16	7.3	0.029	2.4	0.037	7.3	1.62	4.6	1	4.5	183	49.6	***0.0005***	0.1	1.6	3	0.9	5
Phase I	08-061	CAP	WASTE	WR	PHY	ARG	0.5	0.2	6.7	23.6	***10***	450	1.6	0.01	***0.05***	0.4	100	16.1	0.53	***0.5***	0.02	0.18	11	0.01	9	13.2	0.008	2.1	0.005	17.5	0.19	2.7	0.3	5	12	8.7	***0.0005***	0.2	0.3	***1***	1.3	2
Phase I	08-063	CAP	WASTE	PP	PHY		0.4	0.91	1.9	195.2	***10***	36	5.4	1.78	0.2	3.6	79	192.3	1.8	4	***0.005***	0.11	24	0.64	300	12.8	0.036	4.6	0.084	6.3	0.66	0.7	1.9	***0.25***	74	6.8	0.004	***0.05***	1.7	14	0.3	32
Phase I	08-066	CAP	WASTE	IX	ARG	PHY	***0.05***	0.18	20.6	15.7	***10***	98	1.2	0.02	0.3	1.3	139	24	1.58	2	0.02	0.44	16	***0.005***	12	212.1	0.011	3.1	0.013	10.1	0.68	2	0.3	3.4	10	17.4	0.003	0.2	0.9	3	8.3	8
Phase I	08-067	CAP	WASTE	WR	ARG	PHY	0.7	1.8	8.2	64.1	***10***	368	0.6	0.06	***0.05***	8.3	70	639.8	2.97	5	***0.005***	0.65	7	0.75	61	10.7	0.018	4.3	0.057	6.6	0.83	1	9.2	6.5	63	6.5	0.046	0.5	2.3	61	0.3	20
Phase I	08-079	CAP	WASTE	PP	ARG	PHY	2.2	2.19	2	36.5	***10***	153	0.7	0.07	0.5	3	112	325.6	2.27	6	***0.005***	0.49	13	0.88	148	466.8	0.042	8.5	0.085	2.7	0.39	0.1	3.8	1	29	5	0.15	0.2	7.4	47	0.5	26
Phase I	08-081	CAP	WASTE	IX	ARG	POT	0.2	1.92	1.5	54.8	***10***	39	0.4	0.06	***0.05***	1.2	68	180.8	2.71	3	***0.005***	0.21	26	0.25	34	71.6	0.008	4.1	0.059	3.7	***0.025***	***0.05***	3.9	0.7	34	7.2	0.022	0.2	6.9	31	7.1	7
Phase I	08-082	CAP	WASTE	PP	ARG	PHY	1.1	1.09	1	73	***10***	245	0.3	0.02	0.2	3.4	77	291.9	3.35	5	***0.005***	0.57	16	0.4	86	168.8	0.079	3.3	0.079	2.8	0.48	0.1	1.8	1.6	43	6.4	0.008	0.3	3.8	20	1.5	20
Phase I	08-093	CAP	WASTE	WR	ARG		1.1	0.31	15.9	111.1	***10***	171	2.2	0.03	0.1	0.4	62	57.4	0.97	***0.5***	0.01	0.13	13	0.03	9	41.2	0.01	1.2	0.018	12.7	0.09	0.8	0.4	0.8	30	2.9	***0.0005***	0.1	0.3	***1***	0.5	9
Phase I	08-098	CAP	WASTE	PP	PHY	ARG	1.4	0.59	42.2	162.8	***10***	57	20	0.01	0.2	3.5	80	309.7	3.61	***0.5***	0.11	0.18	7	0.05	23	111.9	0.023	3.8	0.034	11.8	0.27	0.5	1.5	5.2	7	9.6	***0.0005***	0.2	1.6	12	2.3	17
Phase I	08-099	CAP	WASTE	WR	ARG	PHY	0.7	0.32	56.7	41.1	***10***	221	1.7	***0.005***	***0.05***	0.6	110	228.8	5.37	2	0.02	0.68	14	0.05	13	71.6	0.028	2	0.099	51.1	1.09	1.6	1.1	3.2	30	9.3	0.017	0.5	1.5	10	1.1	6
Phase I	08-103	CAP	WASTE	IX	ARG	POT	0.4	0.43	3.6	113.1	***10***	43	0.8	0.02	***0.05***	1.5	140	425.4	1.48	2	***0.005***	0.24	20	0.18	46	36	0.017	3.9	0.01	23.1	0.13	0.7	1.1	***0.25***	6	16.6	0.006	0.1	1.3	13	0.7	31
Phase I	08-104	CAP	WASTE	WR	ARG	POT	0.9	2.83	9	54	***10***	581	0.2	0.36	0.5	19.5	112	978.6	4.33	9	***0.005***	1.08	19	2.27	219	11.4	0.06	12.6	0.058	142.5	***0.025***	0.2	16.4	1.3	36	7.5	0.131	1.1	2.3	128	0.4	84
Phase I	08-115	CAP	WASTE	WR	ARG	PHY	0.8	0.67	20.3	44.4	***10***	138	0.7	0.01	***0.05***	2	57	212.4	2.28	1	0.02	0.23	10	0.09	14	111.2	0.01	2.7	0.018	9.5	0.12	2.5	0.7	1.9	6	6.2	0.002	0.2	1.5	7	0.9	11
Phase I	08-117	CAP	WASTE	WR	ARG	PHY	0.6	0.38	19.2	43.9	***10***	255	1.5	***0.005***	***0.05***	0.9	83	220.7	4.28	2	0.02	0.58	11	0.06	17	19.6	0.013	2.1	0.037	4.7	0.84	0.5	1	1.8	26	9.2	0.011	0.3	1	11	0.4	15
Phase I	08-118	CAP	WASTE	WR	ARG	PHY	0.5	0.9	3.2	54.2	***10***	340	0.7	0.02	***0.05***	1.3	70	307.4	1.93	2	***0.005***	0.37	11	0.22	45	29.9	0.038	4.3	0.052	4	0.46	0.2	2.2	0.6	19	12.4	0.019	0.3	5.3	21	0.3	12
Phase I	08-122	CAP	WASTE	WR	ARG	POT	1.7	0.35	132.1	50	***10***	216	2.5	0.02	***0.05***	1.8	121	215.7	2.44	2	0.02	0.39	10	0.07	23	246.3	0.022	4.5	0.029	5.6	0.5	4.2	1.1	0.6	14	6.2	0.009	0.2	0.8	14	0.7	27
Phase I	08-125	CAP	WASTE	WR	POT	ARG	0.3	1.69	10	21.1	***10***	309	0.2	0.15	0.3	9.1	68	923.1	3.06	6	***0.005***	0.38	12	1.08	115	13.5	0.044	4.4	0.063	4.8	***0.025***	1.3	4.9	0.8	15	5.6	0.065	0.3	2.1	68	0.2	39
Phase II	08-132	CAP	WASTE	WR	ARG	PHY	0.5	0.23	16	81.7	***10***	81	3.4	0.14	***0.05***	0.9	47	48.9	1.32	***0.5***	***0.005***	0.18	8	0.02	26	4.5	0.011	2.3	0.01	21.8	0.37	0.6	0.4	3.3	7	3.6	***0.0005***	0.1	0.6	6	0.3	17
Phase II	08-135	CAP	WASTE	WR	ARG	PHY	1.3	0.19	5	72.5	***10***	168	4.3	0.01	***0.05***	0.2	44	13.2	0.96	***0.5***	0.02	0.32	11	0.01	13	2.1	0.008	1.3	0.008	34	0.32	1	0.3	1.4	4	10.1	***0.0005***	0.2	0.4	***1***	0.7	9
Phase II	08-138	CAP	WASTE	MX	ARG		1.3	0.28	26.5	62.7	***10***	288	2	***0.005***	0.2	0.5	34	21.3	2.98	2	0.02	0.67	24	0.02	23	137	0.021	1.4	0.052	18.3	0.91	0.8	1.2	3.5	25	22.8	***0.0005***	0.3	0.7	3	0.6	38
Phase II	08-139	CAP	WASTE	MX	ARG		1.6	0.28	22.6	124.2	***10***	138	2.3	***0.005***	0.1	0.2	32	27.7	1.89	2	0.02	0.52	12	0.02	12	37.4	0.016	1	0.02	44.8	0.65	0.4	0.5	1.7	11	18.6	0.001	0.4	0.5	3	0.3	6
Phase II	08-148	CAP	WASTE	WR	ARG	PHY	1.7	0.28	8.2	133.8	***10***	209	3.7	0.02	0.2	0.7	44	35.1	1.69	3	0.02	0.43	22	0.02	14	55.6	0.012	1	0.017	13.3	0.55	0.4	0.8	2.1	18	20.7	0.002	0.6	0.6	7	1.6	6
Phase II	08-153	CAP	WASTE	WR	ARG	PHY	1.8	1	12.7	238.9	***10***	62	4.3	0.02	0.1	4.3	32	47.9	4.4	2	0.02	0.91	8	0.09	12	58.7	0.025	4.7	0.004	18.6	4.06	0.7	1.5	1.7	3	7.2	0.012	0.2	0.9	12	17.3	7
Phase II	08-154	CAP	WASTE	WR	PHY	ARG	0.6	0.43	21.9	78.6	***10***	146	13.6	0.01	***0.05***	3.4	94	46.6	2.4	3	0.02	0.65	23	0.03	17	192.3	0.015	3.1	0.01	8.3	1.29	3.8	0.9	1	6	8.3	0.009	0.2	1	9	11.1	6
Phase II	08-161	CAP	WASTE	PP	PHY	ARG	1.7	0.42	8.2	146.2	***10***	100	5.4	***0.005***	0.1	3.5	55	176.4	2.65	2	0.01	0.36	17	0.03	10	4.1	0.011	5.5	0.021	35.7	1.91	0.1	0.9	***0.25***	9	9.7	0.001	0.2	2.1	4	0.8	10
Phase II	08-164	CAP	WASTE	WR	ARG	PHY	0.3	0.22	5.3	86.4	***10***	479	0.9	0.01	***0.05***	0.2	64	15.1	0.83	***0.5***	***0.005***	0.24	16	0.02	15	3	0.016	1.8	0.003	13.2	0.16	0.5	0.3	3.3	5	4.4	0.004	***0.05***	0.7	3	2.4	3
Phase II	08-167	CAP	WASTE	WR	ARG		1.2	0.26	10.5	66.6	***10***	220	2.8	0.02	***0.05***	0.5	41	24.9	1.23	2	0.03	0.4	13	0.03	13	4	0.013	1.5	0.014	28.8	0.39	1.8	0.5	2.6	11	11.8	0.002	0.2	0.8	4	1.6	5
Phase II	08-169	CAP	WASTE	FZ	ARG	PHY	1.1	0.56	23.7	43.3	***10***	159	1.5	0.01	0.1	2.2	68	107.1	3.75	7	***0.005***	0.64	17	0.08	35	165.2	0.051	2.8	0.045	6.5	1.42	0.2	1.9	1.4	37	12	0.016	0.5	1.5	17	2.6	27
Phase II	08-172	CAP	WASTE	PP	ARG	PHY	2.6	0.22	21.8	76.1	***10***	216	4.7	0.01	***0.05***	0.5	63	72.9	4.31	3	0.02	0.81	13	0.02	18	152.3	0.034	2.1	0.044	38.7	1.39	0.5	0.7	2.4	38	20	0.007	0.5	1.3	10	8	3
Phase II	08-175	CAP	WASTE	MX	PHY	ARG	0.7	0.18	7.5	89.6	***10***	41	5.1	***0.005***	***0.05***	0.2	22	13.1	0.58	1	***0.005***	0.27	16	0.03	8	132	0.012	0.7	0.014	19.6	0.2	0.5	0.3	0.8	34	17.7	***0.0005***	***0.05***	0.5	3	4.5	3
Phase II	08-183	CAP	WASTE	PP	ARG		0.9	1.19	8.8	177.3	***10***	167	4.1	1.39	0.3	16	48	545.3	3.1	5	***0.005***	0.48	27	0.96	336	18.2	0.022	15	0.073	17.8	1.1	0.6	2.9	1.2	34	7.3	0.021	0.3	2.2	29	0.6	77
Phase II	08-184	CAP	WASTE	PP	ARG	POT	0.6	1.13	28.3	129.1	***10***	186	3.2	1.4	0.2	9.5	59	527.9	2.63	4	***0.005***	0.72	32	0.96	229	73.1	0.023	13.9	0.078	8.3	1.23	0.2	2.9	0.7	25	7.9	0.051	0.5	2.4	28	4.3	30
Phase II	08-192	CAP	WASTE	WR	ARG		1.8	0.25	6	114	***10***	388	2.3	0.02	***0.05***	0.3	60	31.1	0.71	***0.5***	0.03	0.3	20	0.02	18	15	0.016	1.4	0.007	31.9	0.19	7	0.4	4.9	7	6.8	0.004	***0.05***	0.9	3	1.9	4
Phase II	08-193	CAP	WASTE	IX	ARG	PHY	1.1	0.23	26.2	85.2	***10***	246	2.4	0.01	***0.05***	0.5	63	23.4	2.89	2	***0.005***	0.84	10	0.02	17	15.9	0.02	2.2	0.008	42.4	1.05	0.2	0.7	7	6	6.2	0.007	0.1	0.6	7	7.9	4
Phase II	08-194	CAP	WASTE	WR	ARG	PHY	0.6	0.2	7.1	221.9	***10***	705	1	0.02	***0.05***	0.7	123	31.2	0.61	***0.5***	0.01	0.24	12	0.04	18	11.7	0.011	2.4	0.007	21.7	0.2	1.4	0.3	3.5	10	3.8	0.003	***0.05***	0.7	3	3.2	4
Phase II	08-195	CAP	WASTE	WR	ARG	PHY	0.4	0.24	5	82.9	***10***	237	1.2	0.02	***0.05***	0.2	58	16.7	1.59	***0.5***	0.01	0.51	14	0.02	16	1.8	0.012	1.6	0.006	16.4	0.56	0.4	0.4	4.1	6	3.8	0.003	0.2	0.3	4	1.7	4
Phase II	08-204	CAP	WASTE	PP	ARG	PHY	1.2	1.33	13.1	131.7	***10***	139	1.2	0.02	0.1	0.6	68	246	3.33	4	***0.005***	0.62	30	0.26	24	46.9	0.145	3.5	0.049	10.4	1.01	0.3	2.7	2	126	9.3	0.059	0.4	5.5	18	19.6	5
Phase II	08-205	CAP	WASTE	PP	ARG	PHY	2.1	0.38	31	66	***10***	197	5.3	0.01	***0.05***	2.2	88	81.2	2.99	1	0.01	0.66	15	0.04	17	56.9	0.049	4.6	0.031	43.3	1.58	0.4	0.7	2.8	26	3.8	0.007	0.3	0.7	2	12.5	8
Phase II	08-220	CAP	WASTE	MX	ARG	PHY	4.1	0.24	38.2	159.2	***10***	309	51.2	0.02	***0.05***	0.3	57	60.2	3.19	3	***0.005***	0.81	18	0.02	11	72.9	0.014	1.2	0.03	69	1.2	0.7	0.7	2.5	11	9.3	0.003	0.5	0.5	6	1.1	4
Phase II	08-221	CAP	WASTE	MX	ARG	PHY	2.5	0.22	25.9	156	***10***	203	27.6	0.01	***0.05***	0.5	66	29.8	3.38	3	***0.005***	0.81	10	0.02	12	51.6	0.019	1.3	0.021	42.4	1.46	0.6	0.5	4.7	6	7.1	0.007	0.5	0.4	4	5.2	3
Phase II	08-222	CAP	WASTE	MX	ARG	PHY	1.4	0.27	51.2	73.5	***10***	77	4.7	0.01	***0.05***	0.3	81	37.7	0.84	1	0.06	0.31	25	0.03	12	140.1	0.022	1	0.045	17	0.27	4.8	0.9	1.9	27	4.8	0.001	0.3	0.4	2	3.3	4
Phase II	08-223	CAP	WASTE	MX	ARG	PHY	1	0.25	28.3	119.5	***10***	262	7	0.02	***0.05***	0.5	59	24.8	2.98	3	***0.005***	0.79	7	0.03	14	32.5	0.012	1.1	0.036	38.2	1.21	0.5	0.6	3.8	13	7.7	0.007	0.4	0.6	3	2	5
Phase II	08-224	CAP	WASTE	MX	ARG	PHY	1.8	0.27	33.9	113.3	***10***	244	2.6	***0.005***	***0.05***	1	52	28.4	3.98	3	***0.005***	0.95	19	0.03	13	37.2	0.022	1	0.039	45.4	1.67	0.4	0.7	4.4	22	8.9	0.007	0.5	0.4	5	1.3	5
Phase II	08-230	CAP	WASTE	WR	ARG	PHY	0.5	0.34	20.7	35.6	***10***	99	2.9	0.03	***0.05***	2.6	55	207.5	3.73	1	0.04	0.17	14	0.07	40	30.2	0.012	1.4	0.027	51.2	0.07	3	1.1	2.7	11	6	0.002	0.2	1.1	7	0.7	43
Phase II	08-231	CAP	WASTE	WR	PHY	ARG	0.4	0.65	11.9	43.9	***10***	76	1.3	0.12	0.7	21.1	44	701.1	3.97	***0.5***	0.03	0.18	10	0.04	54	3.7	0.011	4.2	0.063	35.7	4.38	2.8	1.2	2.9	8	15	0.002	***0.05***	6.9	4	1.2	66
Phase II	08-241	CAP	WASTE	WR	PHY	ARG	0.2	0.47	9.9	10.6	***10***	21	0.7	0.02	***0.05***	7.4	58	446.2	2.37	1	0.02	0.21	15	0.03	15	8	0.005	3.1	0.027	5.4	2.16	1.7	2.6	4	36	18.1	***0.0005***	0.2	3.5	4	0.7	9
Phase II	08-243	CAP	WASTE	WR	POT	PHY	1	1.15	7.8	99.4	***10***	322	0.8	0.07	0.1	0.7	21	121.8	2.52	2	***0.005***	0.28	30	0.16	16	190	0.04	0.9	0.048	16.6	0.47	***0.05***	1.5	1.3	71	13.9	***0.0005***	0.1	0.8	4	0.6	9
Phase II	08-263	CAP	WASTE	IX	ARG	POT	0.8	1.08	2.9	31.2	***10***	145	0.4	0.1	***0.05***	2.3	47	252.8	2.68	3	***0.005***	0.47	21	0.24	45	74	0.027	3.4	0.047	3.6	0.24	***0.05***	2.5	0.6	31	7.9	0.007	0.3	4.1	23	1.6	19
Phase II	08-264	CAP	WASTE	IX	ARG	POT	2.1	0.87	1.9	245	***10***	59	0.7	0.03	***0.05***	4.5	65	178.8	1.96	2	0.02	0.22	17	0.12	24	163.7	0.02	3.1	0.036	4.4	0.11	***0.05***	2.7	1.4	14	9.5	0.007	0.1	3.5	37	2.9	6
Phase II	08-267	CAP	WASTE	PP	ARG	PHY	0.3	1.88	1.3	62.1	***10***	219	0.3	0.08	***0.05***	6.8	53	281.4	2.78	6	***0.005***	0.43	14	0.65	102	110	0.049	6.6	0.052	2.6	0.1	***0.05***	2.5	0.9	38	6.4	0.028	0.2	3.6	28	1.2	29
Phase II	08-268	CAP	WASTE	PP	ARG	PHY	0.3	1.61	1.1	5.9	***10***	163	0.4	0.01	***0.05***	0.7	45	174.4	3.23	5	***0.005***	0.54	9	0.7	58	165.6	0.079	3.7	0.037	3.3	0.5	***0.05***	2.1	1.7	30	6	0.006	0.2	1.7	25	8.6	15
Phase II	08-269	CAP	WASTE	PP	PHY	ARG	0.5	1.93	1.4	28.7	***10***	96	0.3	0.02	***0.05***	18.4	40	726.5	4.56	4	***0.005***	0.49	16	0.76	101	89.5	0.032	11	0.04	4.7	2.5	0.1	1.6	2.3	38	7.2	0.006	0.2	5.2	14	5.4	22
Phase II	08-275	CAP	WASTE	PP	ARG	PHY	1	1.14	8.1	100.4	***10***	154	0.6	0.03	***0.05***	4	58	457.6	4.61	7	***0.005***	0.57	28	0.44	59	66.8	0.111	7.6	0.078	3.9	0.68	0.6	2.5	1	56	6.7	0.029	0.4	3.2	32	1.5	28
Phase II	08-284	CAP	WASTE	IX	ARG	PHY	1	0.32	25.9	144.6	***10***	39	1.4	0.01	***0.05***	7.2	71	109.7	1.99	1	0.05	0.51	21	0.03	15	142.7	0.012	3	0.013	30.9	1.18	0.4	0.5	6.5	21	7.7	0.002	0.2	0.7	3	6.8	5
Phase II	08-322	CAP	WASTE	WR	ARG	PHY	0.7	1.27	7.1	98.6	***10***	244	1.1	0.01	***0.05***	1.3	122	200.7	2.88	3	***0.005***	0.74	14	0.79	59	69.7	0.017	15.9	0.032	4.7	0.2	0.3	3.5	1.4	17	9.4	0.047	0.5	2.6	31	0.7	18
Phase II	08-328	CAP	WASTE	WR	ARG	PHY	0.4	0.32	6.2	31.6	***10***	233	1	***0.005***	***0.05***	1	89	60.8	1.83	***0.5***	***0.005***	0.45	6	0.03	16	34	0.018	3	0.014	3.7	0.65	***0.05***	0.3	1.7	14	12.6	0.001	0.2	0.4	***1***	0.9	6
Phase II	08-329	CAP	WASTE	WR	ARG	PHY	0.5	0.61	4.8	121.4	***10***	207	0.8	***0.005***	***0.05***	0.7	49	126.8	2.38	2	***0.005***	0.49	9	0.11	19	32.7	0.041	2.3	0.026	3.7	0.66	***0.05***	1.4	1	22	8.8	0.007	0.3	0.9	15	0.4	12
Phase II	08-335	CAP	WASTE	IX	ARG	POT	0.6	1.04	18.4	37.3	***10***	171	4.6	0.02	0.2	4.8	61	482.1	5.28	6	***0.005***	0.71	19	0.58	76	114.7	0.068	8.9	0.057	3.5	0.87	0.2	3.7	***0.25***	20	9.8	0.049	0.3	1.2	41	1.8	32
Phase II	08-355	CAP	WASTE	WR	ARG	POT	0.9	4.63	8.4	104.3	***10***	714	1.7	0.45	0.2	10.3	98	645.1	3.81	11	***0.005***	1.31	13	2.28	221	15.5	0.103	20.8	0.086	7.6	***0.025***	0.2	13.7	***0.25***	35	9.1	0.293	0.8	5.3	169	0.4	64
Phase II	08-374	CAP	WASTE	WR	ARG		0.6	1.93	12.8	89.7	***10***	328	0.3	0.18	0.4	10.5	48	841.8	3.06	6	***0.005***	0.43	12	1.09	142	11.2	0.056	5.4	0.067	5.5	0.07	0.6	5.4	0.9	43	6.2	0.061	0.3	3.9	67	0.1	48
Phase II	08-411	CAP	WASTE	WR	ARG		0.6	2.06	21.1	123.4	***10***	182	0.2	0.67	0.2	5.4	32	644.6	2.24	5	0.01	0.11	12	0.53	65	16.7	0.227	3.6	0.045	47.6	***0.025***	0.6	3.2	0.6	64	6.4	0.045	***0.05***	2.4	28	0.8	61
Phase II	08-418	CAP	WASTE	WR	ARG	POT	0.8	1.2	21.8	302.1	***10***	452	0.4	0.23	0.1	3	49	556.7	1.25	3	0.01	0.14	11	0.34	56	47	0.131	1.8	0.04	22.9	0.05	0.7	1.3	2.1	47	7.2	***0.0005***	***0.05***	1.9	12	0.1	35
Phase II	08-423	CAP	WASTE	WR	ARG		0.2	1.7	2.2	18.2	***10***	584	0.1	0.53	0.3	5	53	350.9	1.72	5	***0.005***	0.13	11	0.57	69	3	0.19	2.1	0.042	7.5	***0.025***	***0.05***	3.3	1	71	6.1	0.016	***0.05***	1.3	28	***0.05***	27
Phase II	08-427	CAP	WASTE	WR	ARG		0.4	2.

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
							ppm	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
						Median	0.80	0.38	10.1	79.7	***10***	173	1.7	0.020	***0.050***	1.9	68.0	126	2.7	3.0	***0.005***	0.44	14.0	0.045	18.5	35.0	0.022	2.75	0.033	12.3	0.66	0.50	1.2	1.7	18.5	7.7	0.0060	0.20	1.3	8.5	1.6	9.0
						25th percentile	0.50	0.24	5.7	46.6	***10***	98.8	0.70	0.010	***0.050***	0.53	52.3	28.8	1.8	1.0	***0.005***	0.23	11.0	0.020	13.0	11.3	0.013	1.73	0.013	6.7	0.23	0.30	0.60	0.90	8.3	6.0	0.0020	0.10	0.60	3.3	0.63	5.0
						10th percentile	0.30	0.20	2.9	29.0	***10***	56.9	0.31	***0.0050***	***0.050***	0.30	40.1	15.7	0.98	***0.50***	***0.005***	0.15	9.0	0.020	10.0	4.5	0.011	1.11	0.007	4.0	0.072	0.10	0.40	0.60	5.0	4.4	***0.0005***	***0.050***	0.40	2.0	0.30	3.0
						Minimum	***0.050***	0.150	1.0	5.9	***10***	21.0	***0.050***	***0.0050***	***0.025***	0.20	6.0	8.3	0.270	***0.500***	***0.005***	0.090	3.0	***0.005***	7.0	1.8	0.004	0.70	0.002	2.6	***0.025***	***0.050***	0.30	***0.25***	3.0	2.0	***0.0005***	***0.050***	0.20	***1.0***	***0.050***	2.0
						No of Samples	102	102	102	102	100	100	102	102	102	102	102	102	102	102	100	102	102	102	102	102	102	102	102	102	102	102	102	100	102	102	102	102	102	102	102	102
Oxide Leach Cap (CAP) - Unknown Ore/Waste Designation																																										
Phase IV	LX-11-247	CAP		WR	ARG	PHY																																				
Phase IV	LX-11-248	CAP		WR	ARG	PHY																																				
Phase IV	LX-11-345	CAP		MX																																						
Phase IV	LX-11-346	CAP		MX																																						
Phase IV	LX-11-347	CAP		MX																																						
Phase IV	LX-11-348	CAP		MX																																						
Phase IV	LX-11-349	CAP		MX																																						
Phase IV	LX-11-350	CAP		MX																																						
Phase IV	LX-11-351	CAP		MX																																						
Phase IV	LX-11-352	CAP		MX																																						
Supergene Oxide Zone (SOX) - Ore Designated Samples																																										
Phase II	08-173	SOX	ORE	PP	PHY	ARG	1.6	0.47	43	70.3	***10***	30	3.9	0.03	0.2	12.8	50	1619.9	8.51	2	***0.005***	0.2	6	0.08	53	51.8	0.009	9.7	0.03	6.8	7.2	0.2	1.2	3	12	8.6	0.004	0.1	2.5	15	6.1	45
Phase II	08-174	SOX	ORE	PP	PHY	ARG	1.5	0.68	12.8	97.9	***10***	13	3.2	0.03	6.1	9.4	55	1257.5	6.71	2	***0.005***	0.2	9	0.18	71	104.6	0.008	10.2	0.038	115.6	6.08	0.3	1.4	1.5	19	8.8	0.004	0.1	3.5	13	2.4	308
Phase II	08-282	SOX	ORE	IX	ARG	POT	0.4	1.98	3	153.1	***10***	180	0.5	0.3	0.2	13	91	965.5	3.44	7	***0.005***	0.84	24	1.27	152	50.3	0.039	18.7	0.103	17.7	0.16	0.2	5.4	0.7	28	7	0.129	0.6	5	61	1.5	72
Phase II	08-299	SOX	ORE	WR	POT	ARG	1.5	2.35	9.1	138.5	***10***	89	1.4	0.05	***0.05***	6.2	66	814.6	1.39	3	***0.005***	0.15	13	0.46	44	112.2	0.031	3.3	0.049	9.5	0.27	***0.05***	1.1	1.5	15	8.6	***0.0005***	***0.05***	3.6	11	0.5	20
Phase II	08-300	SOX	ORE	WR	POT	ARG	1.4	2.56	11.6	263.2	***10***	145	1.7	0.07	***0.05***	1.4	83	262	1.54	4	***0.005***	0.2	11	0.6	109	186	0.047	3.9	0.049	13.2	0.06	***0.05***	1.6	1.2	49	10.3	0.003	0.2	4.3	20	0.5	27
Phase II	08-349	SOX	ORE	WR	ARG	POT	0.9	0.89	8	364.5	***10***	99	1.7	0.2	2.5	4	41	2258.4	0.83	3	***0.005***	0.37	30	0.65	123	186.6	0.034	5.5	0.028	30	***0.025***	0.6	2.2	1.3	9	15.4	0.025	0.2	2.4	25	0.5	188
Phase II	08-350	SOX	ORE	WR	ARG	POT	1	0.38	10.2	241.7	***10***	97	2.2	0.06	0.9	2.4	76	611	1.51	1	0.01	0.23	20	0.11	49	113.1	0.021	3.7	0.016	13.8	0.1	2.6	1.6	0.7	13	18.5	0.009	***0.05***	2.4	11	0.7	101
Phase II	08-351	SOX	ORE	FZ	POT		7.6	0.59	154.3	153.4	***10***	191	3.1	0.05	1.6	2.6	53	990	2.67	2	0.3	0.42	25	0.24	82	192.3	0.033	4.7	0.041	220.6	0.24	36.7	3.3	2.5	13	11.1	0.018	0.3	3.8	21	0.7	232
Phase II	08-352	SOX	ORE	FZ	POT		1.6	1.95	8	177.2	***10***	118	3.2	0.44	2.3	7.2	51	1366	2.07	6	***0.005***	0.65	28	1.33	187	78.3	0.025	8	0.078	13.4	0.14	1.4	6.4	2.2	10	8.8	0.041	0.3	2	71	0.3	262
Phase II	08-353	SOX	ORE	WR	POT		2.2	0.39	3.6	85.9	***10***	62	2.6	0.03	5.8	2.8	46	1289.9	0.76	1	***0.005***	0.21	9	0.16	35	229.6	0.03	2.7	0.015	16.4	0.51	0.8	0.8	0.9	7	9.8	0.001	***0.05***	1.3	6	0.7	518
Phase II	08-354	SOX	ORE	IX	ARG	POT	1.2	0.87	13.4	263.5	***10***	76	1	0.08	0.5	2.2	68	715.7	1.41	2	0.03	0.46	36	0.39	61	356.8	0.022	6.3	0.017	28.9	0.08	1.8	2.9	2.1	10	16.5	0.034	0.2	2.2	22	0.6	96
Phase II	08-383	SOX	ORE	WR	ARG	PHY	0.7	0.36	18.2	107	***10***	527	0.6	0.14	0.2	6.6	92	2059.7	0.73	***0.5***	0.02	0.12	23	0.05	143	134.3	0.023	4.2	0.018	4.3	0.06	0.7	0.4	***0.25***	16	14.5	***0.0005***	***0.05***	2.9	***1***	0.3	15
Phase II	08-384	SOX	ORE	WR	ARG	PHY	1.4	0.99	6.3	266.8	***10***	589	1.6	0.56	1.1	19.4	69	4115.2	1.95	3	0.01	0.41	37	0.45	795	120	0.045	8.7	0.078	3.9	0.06	2.6	4.3	1	26	12.6	0.034	0.4	2.8	32	0.9	62
Phase II	08-414	SOX	ORE	WR	PHY	PRO	2.5	0.88	70.9	84.6	***10***	139	3.3	0.34	0.7	11.2	45	3759.6	2.02	2	0.05	0.16	12	0.17	59	27.7	0.087	4	0.049	61.1	0.98	0.8	1.8	2.8	47	9.4	***0.0005***	***0.05***	2.2	10	0.5	94
Phase II	08-419	SOX	ORE	WR	POT	PHY	0.5	1.54	6.1	37.5	***10***	543	0.2	0.52	0.3	8.8	72	1439.9	1.44	4	***0.005***	0.15	9	0.44	74	16.4	0.189	3	0.043	14.7	0.24	0.7	2.7	2	68	6.5	0.002	***0.05***	1.4	20	***0.05***	63
Phase II	08-425	SOX	ORE	WR	ARG	PHY	0.3	0.26	194.1	44.3	***10***	50	***0.05***	3.1	1	9.5	47	2831.4	2.06	***0.5***	0.01	0.14	13	0.07	1114	10.1	0.009	6.8	0.081	58.6	2.17	0.2	1.6	***0.25***	102	2.5	***0.0005***	***0.05***	1.6	***1***	0.1	89
Phase III	09-03	SOX	ORE	PP	PHY		***0.25***	7.7	20	19			3	0.06	***0.025***	21	20	326	5.39	10		4.26	50	0.92	52	739	0.3	13	0.061	4	5.32	***2.5***	9		140	***10***	0.09	***5***	***5***	73	110	6
Phase III	09-04	SOX	ORE	PP	PHY		***0.25***	7.71	14	19			***1***	0.16	***0.025***	38	22	1165	6.49	10		4.3	40	0.58	114	501	0.2	15	0.085	7	6.53	***2.5***	7		139	***10***	0.09	***5***	***5***	58	130	19
Phase III	09-27	SOX	ORE	IX	ARG	PHY	1.5	7.2	17	430			2	0.02	***0.025***	5	14	1900	1.37	10		6.65	60	0.13	53	418	0.3	***0.5***	0.045	80	0.51	18	6		166	20	0.09	10	***5***	54	20	14
						Maximum	7.6	7.7	194	430	***10***	589	3.9	3.1	6.1	38.0	92.0	4115	8.5	10.0	0.30	6.7	60.0	1.3	1114	739	0.30	18.7	0.10	221	7.2	36.7	9.0	3.0	166	20.0	0.13	10.0	5.0	73.0	130	518
						90th percentile	2.3	7.3	87.6	286	***10***	535	3.2	0.53	3.2	19.7	84.6	3017	6.5	10.0	0.040	4.3	42.0	1.0	309	435	0.22	13.4	0.082	87.1	6.2	5.7	6.5	2.7	139	16.9	0.090	5.0	5.0	63.0	38.0	271
						75th percentile	1.6	2.2	19.1	252	***10***	183	3.1	0.32	1.4	12.0	70.5	1980	3.1	5.0	0.013	0.6	33.0	0.59	133	211	0.067	9.2	0.070	44.3	1.6	2.5	4.9	2.1	58.5	13.6	0.038	0.4	4.1	43.0	2.0	145
						Mean	1.5	2.1	32.8	159	***10***	184	1.9	0.33	1.2	9.7	55.8	1566	2.8	3.8	0.030	1.1	23.9	0.44	177	191	0.076	6.9	0.049	37.9	1.6	3.8	3.2	1.5	46.8	11.0	0.030	1.2	3.1	27.6	14.5	117
						Median	1.4	0.9	12.8	139	***10***	109	1.7	0.080	0.50	7.2	53.0	1290	2.0	3.0	***0.0050***	0.2	23.0	0.39	74	120	0.033	5.5	0.045	14.7	0.24	0.8	2.2	1.4	19.0	10.0	0.0090	0.20	2.8	20.0	0.70	72.0
						25th percentile	0.60	0.53	8.0	77.5	***10***	72.5	1.0	0.050	0.13	3.4	45.5	890	1.4	2.0	***0.0050***	0.18	11.5	0.15	53	65	0.023	3.80	0.029	8.25	0.090	0.25	1.50	0.85	12.5	8.7	0.0015	***0.050***	2.2	11.0	0.50	23.5
						10th percentile	0.29	0.38	5.6	33.8	***10***	40.0	0.44	0.030	***0.03***	2.4	21.6	554	0.82	***0.90***	***0.0050***	0.15	9.0	0.078	48	25	0.0090	2.94	0.017	4.24	0.060	0.17	1.04	***0.48***	9.8	6.9	***0.00050***	***0.050***	1.6	5.0	0.26	14.8
						Minimum	0.25	0.26	3.0	19.0	***10***	13.0	***0.050***	0.020	***0.025***	1.4	14.0	262	0.73	***0.50***	***0.0050***	0.12	6.0	0.050	35	10	0.0080	0.50	0.015	3.90	***0.025***	***0.050***	0.40	***0.25***	7.0	2.5	***0.00050***	***0.050***	1.3	***1.0***	***0.050***	6.0
						No of Samples	19	19	19	19	***16***	16	19	19	19	19	19	19	19	19	16	19	19	19	19	19	19	19	19	19	19	19	19	16	19	19	19	19	19	19	19
Supergene Oxide Zone (SOX) - Waste Designated Samples																																									
Phase I	08-010	SOX	WASTE	MX	ARG	PHY	0.7	0.27	67.8	44.7	***10***	70	2.6	***0.005***	***0.05***	4.8	91	32.7	2.72	2	0.02	0.48	6	0.03	17	73.9	0.018	5.6	0.021	5.9	1.92	0.3	0.4	3.1	13	6.6	0.002	0.3	0.5	***1***	0.7	10
Phase I	08-051	SOX	WASTE	PP	ARG	PHY	0.5	0.64	30.4	55.8	***10***	46	1.7	1.29	***0.05***	15.3	100	442.8	4.76	2	***0.005***	0.19	16	0.48	120	5.6	0.015	14.7	0.066	4.8	4.84	0.3	1	2.8	34	6	0.003	0.1	3	9	4.1	18
Phase I	08-055	SOX	WASTE	WR	PHY	ARG	0.1	0.42	4.9	12.2	***10***	51	0.8	0.09	***0.05***	13	107	1434.6	4.16	***0.5***	0.01	0.14	9	0.02	11	19	0.007	5.1	0.051	7.2	4.89	0.5	0.8	5.2	56	9.8	***0.0005***	***0.05***	4.7	3	1.1	12
Phase I	08-062	SOX	WASTE	WR	PHY		0.1	0.27	14.8	18.3	***10***	50	0.4	1.29	0.1	15.9	104	240.2	2.7	***0.5***	0.02	0.11	19	0.05	457	11.3	0.005	5	0.049	5.7	2.17	23.6	1	3.3	10	12.8	***0.0005***	***0.05***	4.2	6	0.7	53
Phase I	08-074	SOX	WASTE	WR	ARG	PHY	***0.05***	0.58	12.1	22.7	***10***	61	0.2	0.14	0.1	16.7	111	924.3	2.7	***0.5***	0.03	0.13	7	0.02	65	3.6	0.012	6.8	0.061	2.5	3	14.3	1	2.7	7	17.8	***0.0005***	***0.05***	3.4	7	0.6	30
Phase I	08-110	SOX	WASTE	WR	ARG	POT	0.2	1.6	4.2	21.2	***10***	203	0.2	0.84	0.4	25.1	102	457.3	3.62	6	***0.005***	0.36	18	1.31	187	4	0.049	6.6	0.099	2.6	1.14	0.1	4.4	1.8	26	13.6	0.057	0.3	5.5	71	***0.05***	60
Phase II	08-140	SOX	WASTE	MX	ARG	PHY	0.7	0.52	8.7	67.3	***10***	33	2	0.97	2.2	15.8	41	493.9	3.91	1	***0.005***	0.27	18	0.22	1974	26.5	0.041	20.2	0.068	9.5	2.98	0.4	1	1.5	42	8.4	0.001	0.2	2.2	6	0.4	193
Phase II	08-232	SOX	WASTE	WR	PHY	ARG	0.8	0.45	8.5	22.4	***10***	65	0.5	0.19	1.2	18.5	113	484	3.91	***0.5***	0.07	0.16	14	0.06	672	2.2	0.009	6.1	0.057	22.1	3.55	5.1	1.2	3	10	16	0.001	0.3	8.8	6	0.6	88
Phase II	08-235	SOX	WASTE	WR	PHY	ARG	0.6	0.59	91.2	74.7	***10***	44	2.7	0.06	0.1	40.6	53	1735.9	4.18	***0.5***	0.15	0.18	14	0.03	14	53.4	0.006	3.5	0.053	8.4	4.54	13	1.8	9.4	148	18.7	0.001	0.3	11.4	2	1.7	23
Phase II	08-242	SOX	WASTE	WR	PHY		0.1	0.47	5.7	7.6	***10***	12	0.8	0.08	***0.05***	14.4	132	570.4	3.97	***0.5***	0.03	0.19	12	0.03	12	5.1	0.007	5.5	0.037	5.4	4.49	1.8	0.9	4.8	56	15.3	0.001	0.1	5.4	4	0.8	10
Phase II	08-281	SOX	WASTE	IX	ARG	POT	1.7	1.64	6.3	941.8	***10***	54	3.3	0.18	0.3	7.3	96	1164.1	4.21	6	0.01	0.4	21	1.09	242	76.9	0.038	12.2	0.05	11.6	0.59	0.8	1.8	0.6	14	7.2	0.017	0.3	5.2	27	40.2	134
Phase II	08-323	SOX	WASTE	WR	PHY	ARG	0.9	1.15	2.3	63.6	***10***	86	0.5	***0.005***	***0.05***	16.3	56	1320.9	2.21	2	***0.005***	0.29	9	0.38	53	81.9	0.014	7.3	0.022	3.4	1.58	***0.05***	1.9	2.1	8	11.6	0.012	0.2	3.5	14	1.9	13
Phase II	08-324	SOX	WASTE	WR	PHY	ARG	0.7	1.06	1.7	48	***10***	94	0.4	0.01	***0.05***	9.9	87	1207.6	1.84	2	***0.005***	0.25	9	0.56	59	85	0.015	5.8	0.023	2.6	1.17	***0.05***	1.4	1.6	6	11.2	0.004	0.2	5.6	12	0.4	14
Phase II	08-330	SOX	WASTE	WR	PHY	ARG	0.3	1.02	3	40	***10***	54	0.7	0.11	0.1	11	92	1088.5	2.16	3	***0.005***	0.22	8	0.46	92	11.6	0.026	12.1	0.063	2.9	1.38	***0.05***	2.4	0.9	21	11.9	0.015	0.2	4.3	20	1.1	20
Phase II	08-336	SOX	WASTE	IX	ARG	POT	0.7	1.26	27.1	102.8	***10***	72	6.8	0.06	***0.05***	8.6	94	709.7	5.55	5	***0.005***	0.83	9	0.77	91	38.9	0.038	13	0.047	3.7	2.38	0.3	4.2	1.3	9	6.8	0.078	0.5	1.7	42	2.4	45
Phase II	08-337	SOX	WASTE	IX	ARG	POT	0.3	1.14	4.6	61.7	***10***	85	1.7	0.12	***0.05***	8.2	59	1061.4	4.08	5	***0.005***	0.51	9	0.75	130	35.2	0.025	11.8	0.04	3.1	1.67	0.2	3.4	0.9	7	7.2	0.052	0.3	1.3	38	0.7	27
Phase II	08-385	SOX	WASTE	WR	ARG	PHY	0.5	1.02	2.1	212.7	***10***	60	0.7	0.15	0.3	3.7	69	453.9	2.06	5	***0.005***	0.21	8	0.77	129	69.4	0.038	6.6	0.042	4	***0.025***	0.4	3.7	0.6	7	14.5	0.018	***0.05***	2.4	34	0.3	48
Phase II	08-386	SOX	WASTE	WR	ARG	PHY	0.5	0.7	2.6	67.8	***10***	86	1.1	0.06	0.2	4.6	66	541.6	1.56	2	***0.005***	0.22	8	0.44	93	132.5	0.034	5.2	0.021	3.7	***0.025***	0.4	1.8	***0.25***	8	14.8	0.008	0.1	2.1	14	0.7	61
Phase II	08-387	SOX	WASTE	WR	ARG	PHY	0.8	0.3	8	73.9	***10***	374	1	0.03	***0.05***	2.6	66	406.1	0.9	***0.5***	0.03	0.2	20	0.03	13	204	0.016	3	0.016	6.4	0.3	2	0.6	0.7	10	11.8	***0.0005***	***0.05***	1.5	2	0.6	9
Phase II	08-424	SOX	WASTE	WR	ARG		0.2	1.42	13.4	17.5	***10***	830	0.1	0.48	0.6	5.8	21	1147.3	1.42	4	***0.005***	0.14	12	0.33	42	3.6	0.14	1.7	0.043	28.4	***0.025***	0.2	2.4	1.9	74	6	0.003	***0.05***	2	16	***0.05***	75
						Maximum	1.7	1.6	91.2	942	***10***	830	6.8	1.3	2.2	40.6	132	1736	5.6	6.0	0.15	0.83	21.0	1.3	1974	204	0.14	20.2	0.099	28.4	4.9	23.6	4.4	9.4	148	18.7	0.078	0.50	11.4	71.0	40.2	193
						90th percentile	0.81	1.4	34.1	114	***10***	220	2.8	1.0	0.66	19.2	111	1332	4.3	5.1	0.034	0.48	19.1	0.80	479	89.8	0.042	13.2	0.066	12.7	4.6	13.1	3.8	4.8	57.8	16.2	0.053	0.30	5.9	38.4	2.6	92.6
						75th percentile	0.70	1.1	13.8	69.3	***10***	86.0	1.8	0.26	0.30	16.0	103	1152	4.1	4.3	0.023	0.31	16.5	0.61	144	74.7	0.038	11.9	0.058	7.5	3.1	1.9	2.4	3.0	36.0	14.6	0.016	0.30	5.3	21.8	1.3	60.3
						Mean	0.52	0.83	16.0	98.8	***10***	122	1.4	0.31	0.30	12.9	83.0	796	3.1	2.4	0.021	0.27	12.3	0.41	224	47.2	0.028	7.9	0.046	7.2	2.1	3.2	1.9	2.4	28.3	11.4	0.014	0.19	3.9	16.7	3.0	47.2
						Median	0.50	0.67	7.2	51.9	***10***	63.0	0.80	0.12	0.10	12.0	91.5	640	3.2	2.0	***0.0050***	0.22	10.5	0.41	91.5	30.9	0.017	6.4	0.048	5.1	1.8	0.40	1.6	1.9	11.5	11.7	0.0030	0.20	3.5	10.5	0.70	28.5
						25th percentile	0.20	0.47	3.9	22.1	***10***	50.8	0.48	0.060	***0.050***	6.9	64.3	456	2.1	***0.50***	***0.0050***	0.18	8.8	0.030	35.8	5.5	0.011	5.2	0.034	3.3	1.0	0.20	1.0	0.90	8.0	7.2	0.0010	***0.050***	2.1	5.5	0.55	13.8
						10th percentile	0.10	0.30	2.3	17.0	***10***	42.9	0.20	***0.010***	***0.050***	4.5	51.8	390	1.5	***0.50***	***0.0050***	0.14	7.9	0.029	12.9	3.6	0.0069	3.5	0.021	2.6	***0.025***	***0.050***	0.78	0.60	7.0	6.5	***0.0005***	***0.050***	1.5	2.0	0.28	10.0
						Minimum	***0.050***	0.27	1.7	7.6	***10***	12.0	0.10	***0.0050***	***0.050***	2.6	21.0	32.7	0.90	***0.50***	***0.0050***	0.11	6.0	0.020	11.0	2.2	0.0050	1.7	0.016	2.5	***0.025***	***0.050***	0.40	***0.25***	6.0	6.0	***0.0005***	***0.050***	0.50	***1.0***	***0.050***	9.0
						No of Samples	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20
Supergene Sulphide Zone (SUS) - Ore Designated Samples																																									

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
							ppm	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
Phase II	08-149	SUS	ORE	WR	PHY	ARG	1.9	0.34	3.6	106.3	***10***	54	6.8	0.03	***0.05***	19.3	49	1512.3	2.58	***0.5***	0.02	0.23	9	0.03	17	90.6	0.007	3.1	0.022	6.7	2.61	0.3	0.7	1.7	20	13	0.001	0.2	6.3	2	1.6	8
Phase II	08-162	SUS	ORE	IX	PHY		1.4	0.38	8.7	123.8	***10***	19	2.3	0.22	0.3	13.4	81	1905.2	3.46	***0.5***	***0.005***	0.17	21	0.04	43	217	0.009	5.5	0.04	7.8	3.54	0.4	0.8	2.8	15	9.2	0.001	0.1	3.9	5	0.8	10
Phase II	08-163	SUS	ORE	WR	PHY	ARG	1.2	0.87	2.4	156.4	***10***	104	2.1	0.12	0.2	17.5	67	1655.1	3.07	2	***0.005***	0.49	9	0.44	113	31.3	0.019	4.7	0.039	9.1	2.12	0.2	1.7	2.2	10	12.3	0.023	0.4	10.1	19	0.8	34
Phase II	08-209	SUS	ORE	PP	PHY		0.4	1.08	4.1	32.6	***10***	72	1.1	0.22	0.3	23.6	115	682.7	4.56	4	***0.005***	0.42	23	0.83	123	87.1	0.025	17.7	0.074	3.8	4.44	0.1	2.7	3.5	14	6.3	0.032	0.2	5.3	23	14.4	25
Phase II	08-212	SUS	ORE	PP	PHY	POT	1.4	0.61	13.3	833.4	***10***	144	8	2.11	0.7	7.8	34	593	1.66	3	***0.005***	0.23	25	0.35	519	2.4	0.017	3.9	0.083	13.6	0.65	1	1.3	***0.25***	59	6.8	0.002	0.1	3.8	7	0.2	83
Phase II	08-245	SUS	ORE	WR	POT	ARG	1.4	2.21	22.6	416.2	***10***	74	1	0.04	***0.05***	12.5	72	1569.6	3.23	4	0.02	0.6	29	0.68	68	157.4	0.019	3.9	0.129	9.8	1.73	1.6	6.2	2.6	79	15.4	0.029	0.7	7.4	46	0.7	20
Phase II	08-271	SUS	ORE	PP	PHY	ARG	0.5	1.78	1.7	19.3	***10***	50	0.9	0.1	***0.05***	16.4	60	1241.6	3.03	5	***0.005***	0.25	13	0.92	103	160.9	0.02	15.7	0.074	2.6	1.49	***0.05***	2.3	1.4	38	7	0.005	0.2	6.8	26	10.3	21
Phase II	08-279	SUS	ORE	PP	POT	PHY	1.2	1.56	16.4	165.5	***10***	36	1.6	0.96	***0.05***	17.8	60	1753.1	4.71	6	***0.005***	0.83	22	1.3	185	76	0.033	19	0.08	3.2	2.82	0.3	3.1	1.2	28	7.6	0.081	0.5	6.2	35	1.2	25
Phase II	08-316	SUS	ORE	WR	POT		0.6	0.84	1.9	54.1	***10***	52	0.4	0.06	1.6	10.1	51	1322.9	1.86	1	0.01	0.16	19	0.09	20	87.2	0.021	5.5	0.062	5.1	1.73	***0.05***	1.5	1.1	6	11.6	0.001	0.1	10.7	10	0.3	15
Phase II	08-344	SUS	ORE	WR	PHY	POT	0.9	0.33	14.1	94.1	***10***	60	4.3	0.25	0.5	12.6	50	1077.8	3.06	***0.5***	0.02	0.2	10	0.13	298	83.1	0.01	7.9	0.026	11.6	2.69	4.7	0.6	1	14	10.2	0.002	0.1	1.3	5	0.8	59
Phase II	08-388	SUS	ORE	WR	PHY	ARG	5.3	0.18	50.7	62.2	***10***	155	1.6	0.42	4.1	3.3	68	493.4	1.29	***0.5***	0.13	0.15	13	0.2	200	133.2	0.011	3.5	0.011	88.3	1.07	29.7	0.4	***0.25***	10	13.5	***0.0005***	***0.05***	1.7	***1***	0.7	163
Phase II	08-389	SUS	ORE	WR	ARG	POT	1.3	0.27	19.9	69.2	***10***	456	4.7	0.03	0.1	2.5	46	437.5	2.14	***0.5***	0.04	0.19	25	0.02	21	213.8	0.013	3.5	0.044	15.7	0.12	14.4	1.4	0.7	16	13	0.001	0.1	2.2	7	1.2	86
Phase II	08-390	SUS	ORE	WR	ARG	POT	0.9	0.48	90	111.8	***10***	316	0.4	0.2	0.5	19.1	56	1124.9	3.07	1	0.15	0.04	18	0.03	129	230.9	0.011	22.5	0.164	5.3	***0.025***	3.9	9.1	1.6	9	1.9	0.001	***0.05***	3.5	48	1.2	229
Phase II	08-391	SUS	ORE	WR	ARG	POT	0.6	0.45	40.5	93.6	***10***	115	0.8	0.15	2.8	13	104	1534	2.05	1	0.08	0.08	18	0.04	86	86.7	0.012	15	0.094	6.1	0.43	7.7	5.8	1.2	6	8.5	***0.0005***	0.2	3.2	25	0.6	170
Phase II	08-401	SUS	ORE	WR	PHY	POT	0.7	0.2	2.8	63.9	***10***	109	2.2	0.46	0.2	3.4	100	988.9	1.73	***0.5***	***0.005***	0.15	17	0.03	42	121.7	0.014	3.8	0.009	10.1	1.61	0.2	0.2	1.1	10	17.2	***0.0005***	***0.05***	2.4	***1***	0.5	14
Phase II	08-430	SUS	ORE	WR	POT	ARG	0.6	1.83	5.6	120.2	***10***	100	0.2	0.57	***0.05***	8.8	46	1910.7	1.83	6	***0.005***	0.13	9	0.6	70	35.6	0.238	3.1	0.043	8.8	0.61	0.3	3.7	0.6	74	7.2	0.016	0.1	2	27	***0.05***	18
Phase II	08-431	SUS	ORE	WR	POT	ARG	1	1.31	81.6	90	***10***	145	0.5	0.5	0.3	7.7	42	655.9	2.04	4	0.07	0.18	17	0.32	47	57.2	0.172	2.9	0.043	29	1.03	2.7	3.2	1.7	71	7.9	0.005	0.1	4.4	18	***0.05***	29
Phase II	08-436	SUS	ORE	IX	POT	PHY	1.3	1.44	2.3	810.6	***10***	106	1.5	0.16	***0.05***	8.4	69	7827.4	3.12	6	***0.005***	0.78	17	1.05	119	149.1	0.03	12.6	0.071	38.1	0.8	0.6	4	1.9	11	8	0.097	0.4	5	49	1	51
Phase III	09-05	SUS	ORE	PP	PHY		1	7.79	8	179			3	0.56	***0.025***	47	20	1460	6.35	10		4.09	40	0.75	156	1200	0.16	17	0.091	2	6.32	***2.5***	10		139	***10***	0.09	***5***	***5***	70	110	25
Phase III	09-08	SUS	ORE	PP	PHY		1.3	8.46	14	84			5	0.39	0.8	23	27	2130	5.14	20		2.97	60	0.92	148	59	0.85	18	0.129	6	4.31	***2.5***	9		182	***10***	0.19	***5***	10	80	70	35
Phase III	09-21	SUS	ORE	WR	PHY	ARG	1.6	7.97	19	178			3	0.05	***0.025***	17	16	1230	4.78	20		3.42	30	0.45	141	12	0.11	3	0.053	3	3	7	13		14	20	0.15	***5***	***5***	94	30	21
Phase III	09-22	SUS	ORE	WR	PHY	ARG	1.1	7.82	13	158			5	0.03	***0.025***	19	16	1240	3.78	10		3.45	30	0.41	65	109	0.12	4	0.032	7	2.82	***2.5***	12		16	***10***	0.13	***5***	***5***	89	40	15
Phase III	09-23	SUS	ORE	WR	PHY		1	8.03	17	256			***1***	0.05	***0.025***	21	16	990	4.46	10		3.58	30	0.41	214	9	0.11	3	0.065	3	3.56	8	13		14	20	0.12	***5***	***5***	96	20	21
Phase III	09-24	SUS	ORE	WR	PHY		1.4	6.89	6	172			3	0.07	***0.025***	27	20	1275	4.74	10		3.09	20	0.34	204	17	0.11	3	0.064	5	3.72	6	11		20	20	0.1	***5***	***5***	80	30	19
Phase III	09-28	SUS	ORE	IX	ARG	PHY	1	6.86	15	90			***1***	0.03	0.6	6	14	2870	1.22	10		5.06	60	0.13	38	252	0.28	4	0.041	56	0.66	11	5		142	***10***	0.06	***5***	***5***	36	10	63
Phase III	09-29	SUS	ORE	IX	ARG	PHY	1.2	6.67	14	437			***1***	0.04	0.7	17	12	4890	1.33	10		5.28	50	0.11	42	317	0.26	6	0.032	18	1.02	6	5		115	***10***	0.06	***5***	***5***	30	20	37
Phase III	09-37	SUS	ORE	WR	PHY		0.5	6.11	27	134			5	2.53	***0.025***	7	6	1280	1.11	10		3.65	20	0.44	250	135	0.18	2	0.027	20	0.73	11	6		199	20	0.1	***5***	***5***	38	***5***	24
						Maximum	5.3	8.5	90.0	833	***10***	456	8.0	2.5	4.1	47.0	115	7827	6.4	20.0	0.15	5.3	60.0	1.3	519	1200	0.85	22.5	0.16	88.3	6.3	29.7	13.0	3.5	199	20.0	0.19	5.0	10.7	96.0	110	229
						90th percentile	1.5	7.9	44.6	425	***10***	203	5.0	0.73	1.1	23.2	88.6	2426	4.8	10.0	0.10	3.8	44.0	0.92	228	239	0.25	17.8	0.11	32.6	4.0	11.0	11.4	2.7	140	20.0	0.12	5.0	8.4	83.6	34.0	117
						75th percentile	1.4	6.8	19.5	175	***10***	137	3.7	0.44	0.55	19.1	67.5	1704	4.1	10.0	0.035	3.3	29.5	0.64	171	159	0.14	13.8	0.077	14.7	2.9	6.5	7.6	1.9	72.5	13.3	0.094	5.0	5.8	48.5	17.2	55.0
						Mean	1.2	3.1	19.1	189	***10***	120	2.5	0.38	0.52	14.9	48.8	1691	3.0	5.8	0.033	1.5	24.2	0.41	128	153	0.11	7.9	0.061	14.6	2.1	4.6	4.9	1.5	49.3	11.4	0.048	1.8	5.0	35.8	13.8	48.9
						Median	1.1	1.4	14.0	120	***10***	102	1.6	0.16	0.20	13.4	49.0	1280	3.1	4.0	***0.0075***	0.42	20.0	0.35	113	90.6	0.025	4.0	0.053	7.8	1.7	2.5	3.7	1.3	16.0	10.0	0.023	0.20	5.0	27.0	1.2	25.0
						25th percentile	0.80	0.47	4.9	87.0	***10***	55.5	1.0	0.050	***0.05***	8.1	20.0	1034	1.8	1.0	***0.0050***	0.18	17.0	0.10	45.0	58.1	0.014	3.3	0.036	5.1	0.77	0.30	1.5	1.0	12.5	8.0	0.0010	0.10	3.7	8.5	0.70	19.5
						10th percentile	0.56	0.31	2.4	59.0	***10***	45.8	0.46	0.030	***0.025***	5.0	15.2	631	1.3	***0.50***	***0.0050***	0.14	9.6	0.030	31.2	15.0	0.011	3.0	0.024	3.0	0.54	0.16	0.66	***0.50***	9.6	6.9	***0.0008***	***0.080***	2.1	3.8	0.26	14.6
						Minimum	0.40	0.18	1.7	19.3	***10***	19.0	0.20	0.030	***0.025***	2.5	6.0	438	1.1	***0.50***	***0.0050***	0.040	9.0	0.020	17.0	2.4	0.007	2.0	0.009	2.0	***0.025***	***0.050***	0.20	***0.25***	6.0	1.9	***0.00050***	***0.050***	1.3	***1.0***	***0.050***	8.0
						No of Samples	27	27	27	27	18	18	27	27	27	27	27	27	27	27	18	27	27	27	27	27	27	27	27	27	27	27	18	27	27	27	27	27	27	27	27
Supergene Sulphide Zone (SUS) - Waste Designated Samples																																									
Phase I	08-003	SUS	WASTE	WR	PHY	ARG	0.4	0.45	6.9	53.7	***10***	54	1.6	0.1	***0.05***	12.9	127	197.3	4.49	***0.5***	0.02	0.17	18	0.03	15	4	0.011	5	0.075	2.1	5.18	0.9	1.3	3.9	5	16.5	0.001	***0.05***	4.6	7	1.1	12
Phase I	08-004	SUS	WASTE	WR	PHY	ARG	0.6	0.42	4.9	48	***10***	76	1.1	0.07	0.3	9.4	144	1077.6	2.77	***0.5***	0.02	0.18	20	0.04	21	23.7	0.012	4.7	0.041	4.3	3.23	0.4	0.8	2.5	60	10.8	***0.0005***	0.2	6.2	6	0.6	32
Phase I	08-005	SUS	WASTE	WR	PHY	ARG	2.2	0.34	3.2	117.7	***10***	51	18.4	0.08	0.3	16.6	140	804.6	6.45	***0.5***	***0.005***	0.22	18	0.05	18	12.3	0.012	4.8	0.045	6.4	7.32	0.6	0.6	4	21	8.1	0.001	0.1	3.9	4	1.6	16
Phase I	08-030	SUS	WASTE	WR	PHY	POT	0.5	0.28	8.9	43.6	***10***	79	0.8	0.43	0.2	36.3	94	759	2.99	***0.5***	***0.005***	0.18	10	0.22	181	39	0.01	4.5	0.04	4.6	2.88	0.7	0.5	2.3	13	12.6	0.002	0.1	4.2	5	2	21
Phase I	08-032	SUS	WASTE	IX	ARG	POT	0.4	1.25	3.4	132.6	***10***	92	1.5	1	***0.05***	10	91	707	3.13	4	***0.005***	0.49	9	0.71	146	73.5	0.024	17.1	0.077	4.3	2.25	0.2	3.1	***0.25***	19	6.6	0.047	0.6	3.2	26	0.7	27
Phase I	08-033	SUS	WASTE	IX	ARG	POT	0.9	1.08	33.7	271.5	***10***	114	1.4	0.43	***0.05***	12.9	107	698.6	4.46	5	***0.005***	1.02	11	0.85	76	149.2	0.064	7.6	0.049	3.2	2.87	0.2	6.8	2.1	13	8.2	0.126	0.8	3.5	54	1.6	19
Phase I	08-058	SUS	WASTE	WR	PHY	ARG	0.5	0.33	7.7	17.1	***10***	45	0.9	0.07	0.2	12.3	123	635.2	2.74	***0.5***	0.01	0.13	19	0.02	11	4.4	0.013	3.3	0.029	6.8	3.08	13.2	0.5	4.3	23	15.6	***0.0005***	***0.05***	4.1	***1***	0.7	28
Phase I	08-064	SUS	WASTE	PP	PHY		0.4	0.7	2.3	48	***10***	290	3.7	1.87	0.3	5.9	68	340.3	1.7	3	***0.005***	0.22	24	0.46	224	4.1	0.034	4.8	0.086	4.4	0.87	0.3	1.2	***0.25***	90	7.1	0.003	0.2	3.9	9	0.2	25
Phase I	08-068	SUS	WASTE	WR	POT		0.4	2.17	8	74.6	***10***	102	0.6	1.18	***0.05***	27.1	92	839.6	4.11	8	***0.005***	0.67	17	1.61	163	4.3	0.05	4.8	0.098	3.9	2.28	0.3	10.1	4.3	31	7.2	0.071	0.5	5	89	0.4	29
Phase I	08-069	SUS	WASTE	WR	PHY	POT	***0.05***	2.75	3.4	8.8	***10***	121	0.2	0.59	0.2	21.9	58	154.9	5.11	8	***0.005***	0.48	15	1.52	359	1.6	0.076	6.2	0.162	4	1.8	0.5	8.3	1.4	40	6.8	0.053	0.4	4.3	99	***0.05***	84
Phase I	08-105	SUS	WASTE	WR	POT	PHY	0.3	4.18	7.3	31.5	***10***	324	0.2	2.18	0.2	27.8	118	486.7	3.85	9	***0.005***	0.69	9	2.06	309	2.7	0.32	18.4	0.065	6.1	0.87	0.2	13	1.2	105	3.7	0.121	0.6	2.8	136	0.1	63
Phase I	08-116	SUS	WASTE	WR	PHY	ARG	1	1.81	3.5	198.6	***10***	192	0.4	0.22	1	22.5	66	1279	3.31	5	***0.005***	0.92	12	1	295	169	0.035	8.9	0.07	3.2	1.3	0.2	7.9	1.6	11	7.9	0.139	0.6	5.3	86	0.7	67
Phase I	08-119	SUS	WASTE	PP	PHY		0.5	0.33	5.5	146.3	***10***	91	0.8	0.55	1	15.9	109	592.7	2.51	***0.5***	0.02	0.15	11	0.42	349	30.6	0.021	10	0.047	3.4	1.19	0.1	0.9	0.6	20	7.6	0.002	***0.05***	3	10	0.3	58
Phase I	08-120	SUS	WASTE	PP	PHY		0.3	0.52	3	19	***10***	25	0.4	0.24	0.7	13.9	61	237	2.44	2	***0.005***	0.15	17	0.29	283	12.7	0.025	7.8	0.06	2.3	1.13	***0.05***	1.5	0.7	10	9.5	0.003	0.1	3.7	13	0.4	39
Phase I	08-129	SUS	WASTE	WR	PHY		0.5	1.87	7.3	121.8	***10***	61	0.8	0.48	0.6	50.2	73	867.5	5.96	7	***0.005***	0.86	15	1.42	160	12.4	0.04	9.9	0.124	3.5	4.81	0.5	6.8	10.2	15	7.4	0.09	0.8	6	91	0.4	46
Phase II	08-136	SUS	WASTE	WR	PHY	ARG	0.4	0.58	7.3	304.9	***10***	67	2	0.09	0.6	9.3	49	312.1	3.41	***0.5***	0.01	0.18	15	0.05	110	0.9	0.005	4.2	0.056	12.9	3.34	2.4	0.8	2.7	7	16.5	***0.0005***	0.1	16.6	9	1.9	55
Phase II	08-176	SUS	WASTE	MX	PHY	ARG	0.8	0.2	15.9	175	***10***	28	9.1	***0.005***	***0.05***	6.8	24	60.5	5.6	***0.5***	***0.005***	0.21	7	0.03	10	21.8	0.009	9.2	0.003	15.8	5.88	0.4	0.9	1.2	6	15.2	***0.0005***	***0.05***	1.2	2	2.2	5
Phase II	08-177	SUS	WASTE	WR	PHY		0.3	0.22	18.2	39.2	***10***	49	3.8	0.02	0.1	6	64	200	3.14	***0.5***	***0.005***	0.22	11	0.03	14	114.7	0.006	5.3	0.025	5.8	3.22	0.2	0.6	0.6	12	14.2	***0.0005***	***0.05***	4.7	2	2.9	5
Phase II	08-196	SUS	WASTE	WR	ARG	PHY	0.5	0.67	4.1	104.7	***10***	69	1.2	0.51	0.7	80.8	77	1129.4	3.81	1	***0.005***	0.23	12	0.31	427	21.8	0.009	5.6	0.051	16.2	2.22	0.6	1.3	2.4	12	12.1	0.004	0.1	6.9	12	1.6	100
Phase II	08-206	SUS	WASTE	PP	ARG	PHY	0.3	1.86	2.9	18.2	***10***	95	0.5	0.24	***0.05***	10.2	83	1051.4	2.91	7	***0.005***	0.26	12	1.2	113	5.7	0.043	17.7	0.089	5	1.23	0.1	4.3	0.8	18	7.4	0.034	0.2	3.2	41	2.5	25
Phase II	08-207	SUS	WASTE	PP	ARG	PHY	0.3	1.47	14	16.3	***10***	51	1.3	0.23	0.2	13.6	65	977.2	3.41	4	***0.005***	0.29	29	0.74	83	60.7	0.021	16.2	0.09	6.9	2.96	0.2	2.1	1.4	12	7.3	0.007	0.2	4.3	16	7.9	19
Phase II	08-208	SUS	WASTE	PP	ARG	PHY	0.4	1.5	9.8	19.4	***10***	92	1.3	0.31	0.1	11.3	67	443.4	3.11	6	***0.005***	0.38	8	1.11	162	38.2	0.035	15.4	0.087	4.9	1.62	0.2	3.5	1.5	17	6.7	0.099	0.3	3	36	6.9	31
Phase II	08-236	SUS	WASTE	WR	PHY	ARG	0.2	4.22	3	18.6	***10***	115	0.4	0.63	0.7	32.8	40	832.8	5.57	10	0.01	1.03	18	2.24	559	4	0.054	5	0.124	5.1	2.18	0.4	11.6	3.2	33	7	0.092	0.8	5.3	129	0.1	101
Phase II	08-258	SUS	WASTE	PP	POT		0.3	1.09	1.5	9.7	***10***	252	0.3	0.24	0.2	11.7	70	307.7	2.76	4	***0.005***	0.37	19	0.67	390	15.1	0.061	7.3	0.076	2	0.74	***0.05***	3.2	1	25	8	0.084	0.1	3.1	32	0.1	52
Phase II	08-265	SUS	WASTE	PP	POT	PHY	***0.05***	1.02	1.1	***0.25***	***10***	89	0.2	0.3	0.2	25.1	49	117.5	3.6	4	***0.005***	0.18	29	0.57	648	0.9	0.024	7.7	0.075	4.4	0.73	***0.05***	1.4	0.6	10	7.9	0.002	***0.05***	4.1	20	0.2	73
Phase II	08-270	SUS	WASTE	PP	PHY	ARG	0.6	2.16	1.5	15.5	***10***	81	0.3	0.04	***0.05***	28.2	30	1481.6	5.01	6	0.01	0.54	10	1.08	160	31.9	0.019	14	0.049	3.3	3.53	0.2	2.1	3	21	7.4	0.012	0.3	6.8	18	9.4	25
Phase II	08-278	SUS	WASTE	PP	POT	PHY	0.7	1.73	12	61.2	***10***	54	3.2	0.25	0.2	9.5	69	1360.5	4.89	6	***0.005***	0.59	20	1.18	151	26	0.03	18	0.076	7.9	2.21	0.4	2.7	1.1	18	7.3	0.056	0.4	3.2	35	9.2	52
Phase II	08-310	SUS	WASTE	WR	PHY	POT	0.4	8.4	4.6	36.3	***10***	178	0.1	0.53	1.3	29.8	37	1377.8	4.98	12	***0.005***	1.65	11	2.75	304	42.6	0.143	46.7	0.085	6	0.84	***0.05***	17.2	1.1	80	4	0.292	1.1	4.5	217	0.1	135
Phase II	08-317	SUS	WASTE	WR	POT		0.6	0.66	2	64.6	***10***	86	0.4	0.13	0.3	10.9	60	840.5	1.3	***0.5***	0.02	0.15	13	0.1	136	131.1	0.013	4.6	0.032	5.6	0.86	0.2	1	0.9	10	13.2	***0.0005***	***0.05***	3.9	5	0.9	29
Phase II	08-325	SUS	WASTE	WR	PHY	ARG	0.7	0.98	1.3	57.8	***10***	95	0.9	0.09	0.4	13.4	48	969.1	1.83	3	***0.005***	0.35	14	0.55	160	82.1	0.028	7.9	0.031	3.6	0.93	0.2	2.8	1.2	11	13.1	0.023	0.3	3.9	22	0.7	28
Phase II	08-326	SUS	WASTE	WR	PHY	ARG	0.5	3.63	2.1	102.1	***10***	116	0.5	0.3	0.6	24.6	73	1114	5.97	10	***0.005***	1.7	44	2.47	283	115.9	0.056	13.6	0.117	3.3	1.35	***0.05***	23.9	1.5	13	34.1	0.333	1.1	4.1	178	0.5	52
Phase II	08-331	SUS	WASTE	PP	PHY		1	0.44	3.6	76.5	***10***	86	0.8	0.3	0.8	20.5	56	1164	3.33	2	***0.005***	0.19	17	0.36	359	83.3	0.021	11.7	0.048	3.4	1.8	***0.05***	1.2	1.5	20	7.7	0.007	0.1	2.7	11	0.7	62
Phase II	08-338	SUS	WASTE	PP	POT		0.

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
							ppm	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
Phase III	09-25	SUS	WASTE	WR	PHY	ARG	1	7.91	8	205			2	0.04	***0.025***	17	11	938	4.91	10		3.73	20	0.45	102	19	0.21	2	0.064	7	2.91	2.5	10		69	20	0.13	5	10	76	20	30
						Maximum	2.2	8.4	33.7	305	***10***	722	18.4	2.2	3.3	80.8	144	1864	6.5	12.0	0.070	3.7	44.0	2.8	648	169	1.8	46.7	0.16	16.9	7.3	13	23.9	10.2	539	34.1	0.33	5.0	16.6	217	20.0	135
						90th percentile	1.0	4.2	13.5	201	***10***	300	3.3	1.1	1.0	30.1	119	1287	5.6	10.0	0.020	1.1	24.5	1.7	362	115	0.19	17.7	0.12	11.2	3.7	2.5	10.3	3.9	81.0	16.5	0.13	0.83	7.0	102	8.0	74.1
						75th percentile	0.70	1.9	7.8	125	***10***	154	1.4	0.54	0.63	23.0	91.3	1080	4.6	7.0	0.010	0.73	19.0	1.2	296	70.9	0.055	13.7	0.086	6.8	3.0	0.53	6.9	2.4	31.5	13.1	0.094	0.60	5.1	64.8	1.9	55.5
						Mean	0.55	1.8	6.8	84.9	***10***	143	1.7	0.44	0.44	18.0	71.3	763	3.5	4.5	0.010	0.61	16.8	0.79	190	43.2	0.10	9.6	0.066	6.1	2.1	1.2	4.5	1.9	40.0	10.5	0.057	0.55	4.6	43.7	2.5	42.4
						Median	0.50	1.2	5.3	50.9	***10***	92.0	0.85	0.25	0.20	13.5	66.5	819	3.4	4.0	***0.0050***	0.28	15.0	0.62	156	24.9	0.029	7.5	0.065	5.0	1.8	0.25	2.7	1.4	17.5	7.9	0.010	0.20	4.0	22.0	0.70	31.5
						25th percentile	0.30	0.45	3.2	19.3	***10***	67.5	0.40	0.090	***0.05***	9.5	49.0	334	2.8	***0.50***	***0.0050***	0.18	11.0	0.19	84.5	5.4	0.013	4.8	0.044	3.6	0.87	0.20	0.98	0.83	11.0	7.3	0.0018	***0.088***	3.1	8.5	0.28	25.0
						10th percentile	0.25	0.27	2.0	16.2	***10***	50.4	0.20	0.038	***0.050***	6.7	36.3	200	1.7	***0.50***	***0.0050***	0.15	9.9	0.030	14.9	2.7	0.010	3.2	0.029	3.2	0.55	***0.050***	0.59	0.57	9.7	6.5	***0.0005***	***0.05***	2.6	2.0	0.10	15.6
						Minimum	***0.050***	0.18	1.1	***0.25***	***10***	25.0	0.10	***0.0050***	***0.025***	1.6	11.0	60.5	0.39	***0.50***	***0.0050***	0.12	7.0	***0.005***	10.0	0.90	0.0050	2.0	0.0030	2.0	0.17	***0.050***	0.10	***0.25***	4.0	3.7	***0.0005***	***0.05***	0.70	***1.0***	***0.050***	5.0
						No of Samples	40	40	40	40	38	38	40	40	40	40	40	40	40	40	38	40	40	40	40	40	40	40	40	40	40	40	40	38	40	40	40	40	40	40	40	40
Hypogene Zone (HYP) - Ore Designated Samples																																										
Phase II	08-146	HYP	ORE	WR	PHY		2.2	0.52	9.3	110.2	***10***	55	4.3	0.06	0.4	20.4	61	1837.3	4.18	***0.5***	0.01	0.28	24	0.08	24	138.9	0.008	4.8	0.062	7.9	4.28	0.4	1.1	2.8	13	19.3	0.002	0.2	13.3	5	10.5	20
Phase II	08-150	HYP	ORE	WR	PHY	ARG	1.4	0.35	2.3	118.6	***10***	78	2	0.08	***0.05***	11.3	51	1666.1	1.77	***0.5***	0.01	0.19	23	0.05	15	476	0.008	3.2	0.041	5	1.82	0.2	0.7	1.2	20	14.8	0.001	0.1	7.3	2	2	7
Phase II	08-156	HYP	ORE	WR	PHY	ARG	1.2	0.41	24.2	103.5	***10***	24	4.9	0.07	0.2	40.2	76	867.3	5.66	***0.5***	0.02	0.24	18	0.04	17	198.1	0.011	6.1	0.041	17.1	5.83	0.5	0.8	3.8	28	13.6	0.001	0.1	24.3	4	4.9	11
Phase II	08-157	HYP	ORE	WR	PHY	ARG	0.2	0.22	12.6	70.6	***10***	11	2.4	0.13	0.6	50.7	42	33	9.27	***0.5***	***0.005***	0.19	20	0.02	15	1395.9	0.007	10.9	0.04	5.4	9.61	0.3	0.4	3.8	6	5	0.001	0.1	74.9	2	>100.0	6
Phase II	08-158	HYP	ORE	WR	PHY	ARG	1.3	0.51	3.5	94.3	***10***	25	2	0.13	0.2	34.2	73	1868.3	2.99	***0.5***	0.01	0.17	19	0.07	79	37.8	0.007	5	0.06	9.1	2.67	0.2	2.2	2.1	7	17	0.001	0.2	7.6	13	4.1	21
Phase II	08-159	HYP	ORE	WR	PHY	ARG	1.2	0.41	2.9	106.4	***10***	32	4.4	0.13	0.2	53.5	44	1334.9	3.3	***0.5***	***0.005***	0.19	22	0.07	32	18	0.007	4.7	0.05	7.7	3.09	0.6	1.7	3	5	15.4	0.001	0.1	6.7	8	3.8	13
Phase II	08-160	HYP	ORE	WR	PHY	POT	1.3	0.4	6.8	107.8	***10***	30	5.3	0.39	0.1	84.9	57	1092.7	6.88	***0.5***	0.01	0.29	8	0.3	70	169.5	0.01	11.5	0.041	11.6	7.18	0.5	1.3	5.1	9	14.4	0.008	0.1	5.2	9	2.6	12
Phase II	08-181	HYP	ORE	WR	PHY		1.3	0.28	11.8	182.9	***10***	50	4.6	0.28	***0.05***	18	70	731.1	2.7	***0.5***	0.02	0.15	12	0.04	27	1380.1	0.007	4.8	0.037	14.9	3	1.2	0.7	3	17	14.1	***0.0005***	***0.05***	3.9	4	4.7	10
Phase II	08-182	HYP	ORE	WR	PHY		1.3	0.29	1.6	129.9	***10***	122	2	1.38	0.2	10.6	50	1634.5	2.07	***0.5***	0.01	0.12	16	0.47	389	231.4	0.009	4.7	0.047	8.5	1.52	0.2	3.9	1.4	20	13.3	***0.0005***	***0.05***	8	18	2.1	21
Phase II	08-185	HYP	ORE	WR	POT		3	2.17	6.3	343.6	***10***	88	2.7	0.35	0.3	24.3	66	3458.5	4.33	6	***0.005***	1.37	7	1.9	256	189.6	0.036	11.6	0.085	10.2	2.57	0.3	9.3	3.3	11	5.2	0.165	1	2.9	95	1.7	36
Phase II	08-187	HYP	ORE	IX	PHY		2	0.62	3	184.6	***10***	130	0.9	0.73	***0.05***	15.5	75	3171.1	2.33	2	***0.005***	0.39	23	0.56	225	459.3	0.014	6.4	0.041	4.1	1.42	0.1	4.3	2.6	16	11.6	0.033	0.2	2.4	40	1.5	19
Phase II	08-188	HYP	ORE	WR	POT	PHY	1.1	0.72	2.1	109.2	***10***	130	0.8	1.92	***0.05***	11.4	50	1006.8	2.32	2	***0.005***	0.52	29	0.78	160	68.9	0.024	4.9	0.049	6.6	1.6	0.1	4.6	1.3	44	11.3	0.04	0.2	4.6	33	0.3	17
Phase II	08-189	HYP	ORE	IX	PHY	POT	1	0.53	2.1	86.2	***10***	43	0.6	0.74	0.2	12.5	65	1549.3	2.07	2	***0.005***	0.25	14	0.45	360	82.8	0.009	4.7	0.052	9	0.87	0.3	6.9	1	13	12.5	0.009	***0.05***	3.7	30	3.6	35
Phase II	08-190	HYP	ORE	IX	PHY	POT	0.8	0.62	4.8	60.6	***10***	72	0.7	0.77	0.3	6.2	98	1147.8	1.19	2	0.01	0.33	44	0.51	132	1093.2	0.011	6.1	0.043	11.9	0.93	0.4	3.3	1.5	30	12	0.017	***0.05***	2.9	22	0.9	18
Phase II	08-191	HYP	ORE	IX	PHY	POT	0.9	0.73	2.1	57.5	***10***	111	0.2	0.52	***0.05***	8.5	53	1781.4	0.95	2	***0.005***	0.39	40	0.57	65	515.4	0.013	4.6	0.036	9.2	0.66	0.2	6.8	1.5	41	17.4	0.018	0.1	6.4	38	1.4	17
Phase II	08-213	HYP	ORE	PP	PHY	POT	0.9	0.59	54.9	1147.7	***10***	59	4.8	1.8	0.5	5.1	71	295.1	2.18	2	***0.005***	0.22	26	0.39	351	3.6	0.012	4.5	0.084	23.5	1.79	1.1	1.6	***0.25***	40	6.9	0.003	0.1	3	6	0.2	37
Phase II	08-216	HYP	ORE	PP	PHY	POT	1.2	0.72	8.5	127	***10***	110	2.9	1.88	0.2	10.5	48	808.2	2.38	2	0.02	0.32	36	0.52	229	221	0.013	15.2	0.092	10.5	2.25	0.8	2.1	1.6	32	6.9	0.008	0.2	8.4	11	1.5	22
Phase II	08-217	HYP	ORE	PP	PRO	POT	1.1	1.27	4.4	63.3	***10***	76	0.7	2.49	0.4	15.8	47	915	1.64	4	0.02	0.42	23	0.72	232	518.5	0.019	12.6	0.062	6.4	0.85	0.8	3.2	1.3	56	7.6	0.023	0.3	6.7	30	0.7	24
Phase II	08-218	HYP	ORE	IX	PHY		1.7	0.57	12.5	236.5	***10***	23	2.1	1.63	0.8	11.3	51	1584.2	2.03	1	0.06	0.2	17	0.54	263	390.7	0.009	12.3	0.077	16.4	1.32	3.8	2.8	1.5	23	8.1	0.002	0.2	9.8	15	0.7	28
Phase II	08-246	HYP	ORE	WR	POT	PHY	1.3	0.92	6.7	281.2	***10***	79	0.7	0.45	0.3	23	56	1880	2.79	1	***0.005***	0.31	27	0.29	237	293.6	0.013	4.8	0.049	7	2.15	0.1	1.2	2.6	11	11.9	0.005	0.2	5.1	11	0.8	44
Phase II	08-247	HYP	ORE	WR	PHY	POT	1.8	0.95	8.2	171.9	***10***	63	1.4	0.51	0.4	19.4	79	2294.3	2.49	3	***0.005***	0.35	18	0.67	103	112.8	0.023	5.4	0.037	8.7	2.44	0.2	2.3	1.8	15	14.3	0.018	0.3	4.5	20	0.8	31
Phase II	08-248	HYP	ORE	WR	PHY	POT	1.1	1.49	9	131.8	***10***	148	0.6	1.18	0.2	12.8	68	1390.6	2.27	5	***0.005***	0.73	15	1.01	170	69.9	0.058	4.7	0.048	4.6	1.04	0.2	6.9	1.2	43	11.6	0.094	0.5	3	59	0.3	29
Phase II	08-251	HYP	ORE	WR	PHY	POT	0.6	1.28	24.3	62.4	***10***	33	0.6	1	0.8	22.8	118	553.4	4.97	4	0.01	0.71	22	1.01	116	1514.8	0.033	11	0.04	4.3	4.83	0.6	4.7	3.7	15	11.4	0.053	0.5	4.7	43	2.2	20
Phase II	08-252	HYP	ORE	WR	PHY	POT	1.6	0.35	56.4	45.9	***10***	9	1.1	0.81	0.2	39.3	50	1516.1	5.88	***0.5***	0.03	0.23	14	0.08	80	185.6	0.009	9.7	0.036	8.1	7.33	15.5	0.7	7.3	20	9.2	0.002	0.1	2.5	3	1.6	28
Phase II	08-255	HYP	ORE	IX	POT		1.5	1.45	29	308.8	***10***	48	1.3	0.26	1.9	35.6	102	1753.7	6.72	4	0.15	0.57	35	0.68	555	638.7	0.014	15.2	0.064	4.6	2.28	6.9	4.6	1.4	44	8.8	0.052	0.9	9.5	70	6.7	71
Phase II	08-256	HYP	ORE	IX	POT		1.5	1.38	4.2	101	***10***	202	0.9	1.26	0.2	12.2	82	1865.7	3.74	7	***0.005***	0.75	24	0.98	172	93.3	0.049	13.5	0.081	2.4	1.06	0.6	4.4	1.6	47	5.7	0.127	0.4	3.4	50	1.5	21
Phase II	08-261	HYP	ORE	IX	POT		1.5	1.28	1.5	145.5	***10***	119	0.5	2.07	0.1	8.6	45	1483	2.1	6	***0.005***	0.61	15	1.1	141	210.8	0.037	6.7	0.047	2.8	1.74	0.1	6.8	0.7	96	7.7	0.1	0.3	3.2	63	0.8	23
Phase II	08-272	HYP	ORE	PP	PHY	POT	1.1	1.49	1.9	64.3	***10***	31	0.5	0.21	0.6	26.1	65	1246.2	5.29	8	***0.005***	0.24	14	1.11	237	193.8	0.027	15.7	0.07	1.5	0.75	***0.05***	3.5	0.9	8	6.9	0.031	***0.05***	6.8	52	2.6	33
Phase II	08-283	HYP	ORE	IX	POT	ARG	0.8	0.34	7.7	206.1	***10***	149	1.1	0.71	0.4	12.2	80	1826.1	0.86	***0.5***	***0.005***	0.16	29	0.16	166	165.1	0.029	4.3	0.015	24.9	0.64	0.2	0.6	1.5	15	18.1	***0.0005***	***0.05***	6.3	3	0.6	52
Phase II	08-286	HYP	ORE	WR	PHY		3.3	0.34	37.6	534.1	***10***	132	6.7	0.87	1.3	10.7	56	1445.8	1.31	***0.5***	0.03	0.16	13	0.31	162	63.7	0.006	3.4	0.026	29	1.12	20.7	0.4	1.6	18	19.3	***0.0005***	***0.05***	5.1	***1***	0.5	77
Phase II	08-301	HYP	ORE	WR	POT	ARG	1	0.64	6.5	83.6	***10***	122	0.9	0.09	0.3	5.4	130	1899.7	1.01	***0.5***	***0.005***	0.12	13	0.07	29	100.5	0.012	4	0.02	8.6	0.92	***0.05***	0.2	1.1	9	16.5	***0.0005***	***0.05***	5.2	***1***	0.5	26
Phase II	08-302	HYP	ORE	WR	POT		1	1.3	8.3	128.4	***10***	63	1.3	2.2	***0.05***	11.4	93	1586.6	2.05	3	0.01	0.4	33	0.56	166	169.4	0.038	5.6	0.045	5.5	1.39	0.2	4.2	1.4	36	11.1	0.026	0.3	5.4	31	33.1	21
Phase II	08-312	HYP	ORE	WR	PHY	POT	1.4	0.53	6.4	93.6	***10***	66	0.9	1.39	***0.05***	6.8	71	1440.5	1.54	1	***0.005***	0.23	15	0.5	113	718.7	0.023	4	0.039	3.2	1.98	0.2	1.1	0.9	101	12.1	0.002	0.1	3.9	8	0.4	17
Phase II	08-340	HYP	ORE	PP	POT		0.5	1.45	1.1	128.9	***10***	114	0.4	0.3	0.4	15.6	61	788.3	3.22	7	***0.005***	0.79	22	1.26	408	108.3	0.036	16.2	0.094	1.9	0.28	0.2	4.9	0.8	15	8.3	0.114	0.4	1.6	56	0.6	69
Phase II	08-346	HYP	ORE	WR	PHY	POT	0.8	0.39	11.9	91.7	***10***	99	1.2	1.89	0.2	8.3	116	1175.4	2.15	1	0.06	0.12	22	0.27	371	121.8	0.008	7.5	0.035	6.9	0.65	4.5	4.2	0.7	12	11	0.001	0.1	2	18	0.6	38
Phase II	08-356	HYP	ORE	WR	POT	PHY	0.8	0.3	15.1	99.8	***10***	261	0.9	0.94	0.7	3	68	1274.4	0.55	***0.5***	0.02	0.14	22	0.23	120	156.6	0.02	3.4	0.018	42.5	0.29	1.5	1	1.2	42	12.1	***0.0005***	***0.05***	4.2	6	0.2	48
Phase II	08-359	HYP	ORE	WR	PHY	POT	1	0.92	24.3	603.8	***10***	370	0.7	0.81	0.3	13.5	41	2357.7	1.93	4	0.06	0.31	25	0.35	432	302.9	0.013	7.8	0.064	25	0.44	2.5	10.5	1.8	26	9.1	0.036	0.3	3.4	48	0.5	57
Phase II	08-360	HYP	ORE	WR	POT	PHY	1.1	1.62	5.7	279.8	***10***	189	0.7	1.03	0.2	18.6	56	1946.9	3.1	6	***0.005***	0.55	16	1.2	188	64.1	0.037	7	0.032	9.4	0.99	0.1	5.7	2.4	37	18.8	0.059	0.4	5.1	65	0.3	43
Phase II	08-361	HYP	ORE	WR	POT	PHY	0.4	4.89	4.3	88.1	***10***	341	0.1	2.99	0.1	17.1	69	1093	3.8	11	***0.005***	1.35	5	1.98	269	35.1	0.422	8.6	0.095	4.4	0.95	***0.05***	11.1	1.5	250	4.6	0.337	0.7	2.1	217	1.3	35
Phase II	08-365	HYP	ORE	WR	PRO	POT	2.8	1.8	26.2	115.6	***10***	178	0.2	2	0.2	18.8	45	1293.4	2.92	6	0.05	0.59	17	1.09	361	26.4	0.042	5.8	0.085	27.3	0.9	3.6	7.5	2.5	42	7	0.069	0.4	2.6	85	0.2	36
Phase II	08-367	HYP	ORE	WR	POT	PHY	0.5	0.28	16	92.3	***10***	340	0.4	1.01	***0.05***	5.1	49	1400.7	0.66	***0.5***	0.01	0.1	22	0.05	102	47.9	0.018	2.5	0.016	13.3	0.55	3.1	0.7	1.9	62	15.6	***0.0005***	***0.05***	4.9	2	0.1	12
Phase II	08-370	HYP	ORE	WR	PHY	POT	1.9	1.91	24.1	83.4	***10***	45	2	6.42	0.1	18	32	1246.3	3.35	5	0.03	0.53	13	0.91	1099	55.2	0.039	10.1	0.079	6.8	2.23	0.4	6.4	1.1	129	5.6	0.048	0.3	2.5	66	***0.05***	55
Phase II	08-381	HYP	ORE	WR	POT	PHY	0.7	1.29	3.4	119.2	***10***	272	0.5	0.68	0.1	7.6	70	1455.9	1.36	4	***0.005***	0.63	11	0.84	95	169.9	0.061	4.7	0.052	6.4	0.59	0.3	6.4	1.5	144	10.5	0.107	0.4	3.5	51	0.7	20
Phase II	08-399	HYP	ORE	WR	POT		1.4	0.37	66.4	90.7	***10***	40	11.5	3.42	0.1	6.1	73	1647.1	4.04	1	0.02	0.12	15	0.47	239	59.6	0.013	5.4	0.054	9.6	3.81	6.8	2	1.6	19	9.2	***0.0005***	0.4	13.6	8	0.5	16
Phase II	08-402	HYP	ORE	WR	PHY	POT	0.3	1.98	2	42.2	***10***	361	0.3	1.07	0.1	9.7	57	855.6	3.12	7	0.02	0.89	8	1.58	133	91.7	0.074	5	0.069	4	0.66	0.4	8.3	1	22	6.8	0.204	0.5	4.8	107	0.7	28
Phase II	08-403	HYP	ORE	WR	PHY	POT	0.7	0.8	2.1	62.9	***10***	188	0.8	1.19	0.2	8.8	52	1141.2	1.6	2	0.01	0.23	22	0.72	113	91.7	0.024	5.4	0.045	4.5	1.08	0.1	1.4	0.9	23	13.5	0.005	0.1	3	15	0.2	25
Phase II	08-404	HYP	ORE	WR	PHY	POT	0.5	0.18	2	73	***10***	179	0.6	0.78	***0.05***	4	93	1182.4	0.58	***0.5***	***0.005***	0.13	19	0.02	52	119.9	0.028	2.5	0.011	7.8	0.54	0.1	0.3	0.8	15	16.4	***0.0005***	***0.05***	2.9	***1***	0.2	17
Phase II	08-410	HYP	ORE	WR	POT	PHY	10.4	2.42	39.8	134.7	***10***	35	17.1	1.92	1.9	21.5	44	1262.5	4.96	7	0.16	0.59	20	1.73	536	161.3	0.049	8.3	0.143	74.3	2.04	10.2	10.2	1.8	69	5.8	0.057	0.3	2.9	117	2.1	220
Phase II	08-412	HYP	ORE	WR	PHY	PRO	1	1.08	165.9	174.4	***10***	111	1.7	3.86	0.3	5.8	43	875.7	1.85	3	0.14	0.16	14	0.25	914	132.5	0.123	2.5	0.039	14.3	1.51	5.6	1.5	1.2	95	6.9	***0.0005***	0.1	2.2	9	0.2	39
Phase II	08-413	HYP	ORE	WR	PHY	PRO	0.7	1.77	4.1	102.1	***10***	592	0.3	1.26	***0.05***	8.5	53	1499.4	1.5	6	***0.005***	0.3	7	0.74	114	62.3	0.267	3.6	0.056	5	0.29	0.4	4.1	0.9	106	6.2	0.064	0.2	1.8	42	0.3	19
Phase II	08-417	HYP	ORE	WR	POT	PRO	0.4	2.83	6.5	36.9	***10***	719	***0.05***	1.21	0.2	15.3	80	1085.4	4.08	8	***0.005***	1.13	7	2.21	296	13.9	0.169	8.2	0.104	6.4	0.32	***0.05***	12.3	1.3	67	4.4	0.284	0.6	1.7	180	1.9	41
Phase III	09-07	HYP	ORE	PP	PHY		***0.25***	6.97	7	30			2	3.73	***0.025***	14	21	302	3.15	10		3.91	50	0.91	95	534	0.18	9	0.078	5	5.44	***2.5***	6		386	***10***	0.09	***5***	***5***	44	90	15
Phase III	09-12	HYP	ORE	PP	PHY		1.1	7.11	***2.5***	134			***1***	1.71	***0.025***	25	30	1235	2.97	20		4.13	20	1.13	135	129	1.42	12	0.079	16	2.19	***2.5***	7		502	***10***	0.23	***5***	10	71	10	21
Phase III	09-30	HYP	ORE	IX	PHY		1.6	6.44	***2.5***	255			***1***	0.48	***0.025***	10	19	2130	1.07	10		4.05	50	0.56	128	383	0.32	3	0.036	12	0.53	***2.5***	6		134	20	0.08	***5***	***5***	41	10	26
Phase III	09-31	HYP	ORE	WR	POT		1.1	8.54	8	176			***1***	1.93	***0.025***	24	19	2810	3.18	20		3.44	40	1.54	176	289	2.64	4	0.09	8	1.61	***2.5***	19		315	20	0.32	***5***	10	126	10	24
Phase III	09-32	HYP	ORE	IX	POT		1.7	8.56	13	289			***1***	1.54	***0.025***	9	29	2200	1.59	20		5.47	30	0.95	196	457	0.25	6	0.09	12	0.65	11	10		244	20	0.21	***5***	***5***	86	30	17
Phase III	09-38	HYP	ORE	WR	POT	PHY	0.5	5.78	12	56			***1***	0.68	1.2	8	11	1710	1.87	10		3.99	30	0.44	214	118	0.18	5	0.025	10	1.28	15	4		107	20	0.08	***5***	***5***	33	10	43
Phase III	09-39	HYP	ORE	WR	POT		1.7	6.79	11	323			***1***	5.63	***0.025***	9	8	1610	1.98	20		1.83	10	0.52	127	18	2.27	2	0.045	12	2	2.5	8		654	10	0.21	***5***	***5***	49	***5***	18
						Maximum

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
							ppm	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
						Minimum	0.20	0.18	1.1	30.0	***10***	9.0	***0.050***	0.060	***0.025***	3.0	8.0	33.0	0.55	***0.50***	***0.005***	0.10	5.0	0.02	15.0	3.6	0.0060	2.0	0.011	1.5	0.28	***0.050***	0.20	***0.25***	5.0	4.4	***0.0005***	***0.050***	1.6	***1.0***	***0.050***	6.0
						No of Samples	58	58	58	58	51	51	58	58	58	58	58	58	58	58	51	58	58	58	58	58	58	58	58	58	58	58	58	51	58	58	58	58	58	57	58
Hypogene Zone (HYP) - Waste Designated Samples																																									
Phase I	08-008	HYP	WASTE	WR	PHY	ARG	0.2	0.3	5.8	67.5	***10***	43	1.3	0.13	0.1	20.2	123	202.2	6.04	***0.5***	***0.005***	0.16	8	0.04	29	7.6	0.012	5.3	0.054	4.1	6.92	0.3	0.7	10.1	6	12.6	***0.0005***	***0.05***	5	5	1.1	11
Phase I	08-011	HYP	WASTE	MX	PHY		0.7	0.37	20.9	33	***10***	60	4.8	0.05	***0.05***	12.1	92	279.1	4.61	4	0.03	0.19	14	0.05	14	66.4	0.017	15.3	0.082	7.7	5.73	1.6	4.3	2.2	322	40.9	0.001	0.2	6.8	***1***	0.4	6
Phase I	08-020	HYP	WASTE	WR	PHY		0.5	0.44	2.2	45.6	***10***	46	0.6	0.16	0.2	27.8	106	674.3	2.78	***0.5***	***0.005***	0.16	21	0.11	367	5.2	0.012	4.7	0.059	11.1	2.24	0.6	1.5	3.8	7	15.2	0.001	0.1	5	8	2.2	38
Phase I	08-024	HYP	WASTE	WR	PHY		0.5	0.2	8.5	37.8	***10***	36	5.4	0.03	0.2	11.5	118	241.5	4.81	***0.5***	***0.005***	0.17	10	0.02	11	113.1	0.012	6.8	0.039	4.9	6.13	0.6	0.4	0.7	11	8.7	***0.0005***	***0.05***	5.3	***1***	2.6	6
Phase I	08-025	HYP	WASTE	MX	PHY		1	0.63	34.7	158.2	***10***	38	4.8	0.12	0.1	19.4	59	1231.2	4.1	***0.5***	***0.005***	0.2	15	0.03	11	38.7	0.013	13.7	0.088	12.9	5.12	0.3	1.2	1.2	23	6.5	0.001	0.2	9.1	6	17.7	8
Phase I	08-028	HYP	WASTE	WR	POT		0.7	1.28	14.4	86.8	***10***	87	1.6	0.86	***0.05***	12.2	107	557.1	2.47	4	***0.005***	0.58	28	0.91	110	10.9	0.017	13.7	0.071	3.4	1.86	0.2	1.8	1.7	16	8	0.034	0.6	2.6	21	5.7	13
Phase I	08-031	HYP	WASTE	WR	PHY	POT	1.2	0.2	23.7	28.5	***10***	23	14.8	0.4	0.1	48.1	120	44.5	11.96	***0.5***	0.08	0.15	3	0.13	248	4.8	0.007	6.8	0.04	12.7	>10.00	1.7	0.5	14.4	7	9.6	0.001	0.2	6.4	***1***	2.2	7
Phase I	08-038	HYP	WASTE	PP	POT	PHY	0.4	1.34	2.3	27.7	***10***	92	0.5	0.85	***0.05***	8.4	130	418	2.68	7	***0.005***	0.41	7	1.32	119	5.5	0.041	17.4	0.083	6.4	1.4	0.2	4.1	0.7	25	7.4	0.075	0.3	3.8	47	2.6	17
Phase I	08-039	HYP	WASTE	IX	POT		0.6	1.52	1.9	69.7	***10***	198	0.3	1.47	0.1	11.2	103	717.4	3.02	8	***0.005***	0.73	32	1.54	146	52.7	0.035	10.2	0.083	3.7	1.5	0.1	10	1.4	31	20.6	0.141	0.5	3.5	98	0.3	22
Phase I	08-040	HYP	WASTE	WR	POT	PHY	0.5	0.42	4.3	26.1	***10***	41	1.4	1.01	0.3	16.6	126	581.3	4.39	2	***0.005***	0.24	19	0.37	46	55.1	0.024	9.7	0.036	5.3	5.07	0.5	3.2	3.1	23	11.2	0.019	0.2	1.7	20	1.7	9
Phase I	08-043	HYP	WASTE	IX	PHY		0.4	0.75	32.6	241.2	***10***	102	1.3	1.98	0.2	39.4	101	454.9	2.94	2	***0.005***	0.2	13	0.56	268	12.6	0.009	5.1	0.055	10.9	2.88	0.5	1.2	2	111	11.6	0.002	0.1	7.2	9	1.6	26
Phase I	08-044	HYP	WASTE	WR	PHY		0.6	0.9	3.2	17.1	***10***	43	4.3	2.27	***0.05***	4.9	67	230.6	3.52	4	***0.005***	0.17	36	0.75	161	2.7	0.022	9.6	0.117	6.9	3.61	0.3	1.7	2.2	62	5.5	0.002	0.1	1.2	13	0.2	10
Phase I	08-045	HYP	WASTE	WR	PHY		0.4	0.27	12.8	23.5	***10***	38	0.8	1.55	***0.05***	154.4	108	668.8	4.4	***0.5***	***0.005***	0.17	33	0.71	65	9.7	0.006	5.2	0.043	12.2	4.92	1.6	0.8	12.8	16	24.8	0.001	0.1	14.9	5	2.3	12
Phase I	08-052	HYP	WASTE	PP	PHY		0.1	1.04	3.1	34.6	***10***	112	0.7	1.14	***0.05***	16	108	99.8	2.81	4	***0.005***	0.41	23	1.01	82	73.2	0.033	15.5	0.065	4	2.63	0.2	2.4	1.9	29	6.1	0.056	0.3	2.9	25	10.9	15
Phase I	08-056	HYP	WASTE	WR	PHY	ARG	0.2	0.33	4.6	12	***10***	36	0.6	0.94	0.1	20.3	119	272	3.34	***0.5***	0.03	0.09	45	0.35	477	2.4	0.012	5.8	0.063	7.6	3.1	3.6	1.2	1.8	12	35.7	***0.0005***	***0.05***	3.3	10	0.8	47
Phase I	08-059	HYP	WASTE	PP	PHY	ARG	2	0.42	43.7	35.6	***10***	103	0.4	0.05	0.5	19.6	104	607.2	1.93	***0.5***	0.1	0.12	18	0.05	28	83.9	0.013	7.3	0.018	6.6	1.95	29.8	1.2	2.8	17	26.7	***0.0005***	0.3	4.8	6	0.8	71
Phase I	08-060	HYP	WASTE	WR	PHY		0.6	0.25	6.7	14.9	***10***	44	1.2	1.31	0.1	15.2	112	194.3	3.59	***0.5***	0.02	0.14	3	0.51	213	2.8	0.009	4.8	0.059	2.8	3.87	3.6	1.5	2.3	13	10.5	***0.0005***	***0.05***	2.5	10	1.1	21
Phase I	08-065	HYP	WASTE	PP	POT	PHY	0.3	0.29	4.4	13.8	***10***	35	2.7	2.62	0.1	4.3	59	324.4	1.87	***0.5***	***0.005***	0.15	6	0.37	63	3	0.019	4.1	0.085	2.9	2.1	0.3	0.7	***0.25***	106	5.7	***0.0005***	***0.05***	1.9	***1***	0.3	4
Phase I	08-070	HYP	WASTE	WR	PHY	POT	0.1	0.32	3.3	10.7	***10***	60	0.7	1.66	***0.05***	39.4	113	200.3	3.19	***0.5***	0.02	0.13	18	0.36	238	18.3	0.03	5.3	0.056	4.4	3.17	0.9	1.2	3.6	17	18.4	***0.0005***	***0.05***	3.8	7	0.6	12
Phase I	08-071	HYP	WASTE	WR	PHY	POT	0.3	0.8	5.4	25.9	***10***	40	1.5	2.27	***0.05***	15.6	100	309.6	2.66	2	***0.005***	0.13	26	0.47	137	2.3	0.022	4.5	0.056	7.2	2.28	0.5	2.2	2.1	42	18.8	***0.0005***	***0.05***	5.4	15	0.6	17
Phase I	08-072	HYP	WASTE	WR	POT	PHY	0.2	0.22	8.1	51.9	***10***	360	0.1	1.4	0.1	8.3	127	359.8	0.79	***0.5***	0.01	0.12	20	0.1	143	21.6	0.015	3.2	0.021	5.8	0.79	0.7	0.4	1.1	46	20.1	***0.0005***	***0.05***	4.8	***1***	0.2	13
Phase I	08-073	HYP	WASTE	WR	PHY	POT	0.1	0.18	5.1	9.3	***10***	129	0.2	1.03	0.3	21.4	123	255.5	1.05	***0.5***	***0.005***	0.12	23	0.03	59	5.4	0.024	3.1	0.015	11	1.09	0.9	0.3	2.3	26	15.7	***0.0005***	***0.05***	4.4	***1***	0.2	12
Phase I	08-075	HYP	WASTE	WR	POT	PHY	0.8	3.63	8.8	570.9	***10***	93	2	1.03	2.5	63.3	61	1302.2	9.04	9	***0.005***	0.63	11	2.2	725	3.6	0.095	8.4	0.148	5.5	5.38	0.5	12.4	7.8	81	4.4	0.058	0.6	6.4	139	4.1	111
Phase I	08-076	HYP	WASTE	WR	PHY		0.1	0.28	2.5	10.1	***10***	49	0.3	1.22	0.2	29.2	124	59	5.04	***0.5***	***0.005***	0.16	17	0.46	113	3.5	0.011	5.7	0.066	9.7	5.67	0.3	0.9	4.6	22	18	0.001	***0.05***	4.1	6	0.4	14
Phase I	08-080	HYP	WASTE	PP	POT		0.3	0.93	1.8	6.3	***10***	42	0.5	0.12	***0.05***	4.2	107	290.5	1.64	4	***0.005***	0.13	19	0.6	70	31.2	0.034	8.5	0.074	4.8	1.03	***0.05***	1.4	0.6	21	9	0.003	***0.05***	4.7	16	0.4	19
Phase I	08-083	HYP	WASTE	PP	PHY	PRO	1.3	0.36	17.9	35.2	***10***	24	8.3	1.18	1.3	17.5	87	1155.9	5.03	1	0.28	0.22	10	0.47	261	62.5	0.007	17	0.092	27.9	5.47	4	1	2.2	40	5.8	0.002	0.3	5.7	4	1.5	59
Phase I	08-086	HYP	WASTE	WR	ARG		1.5	3.43	10.6	63.1	***10***	78	0.7	2.96	***0.05***	34.7	52	1347	6.44	10	***0.005***	1.15	8	2.25	427	2.8	0.134	9.4	0.176	4.3	3.16	0.4	14.3	5.5	66	1.9	0.168	1.1	2.2	160	0.6	55
Phase I	08-087	HYP	WASTE	WR	POT		0.8	0.25	10.2	175.4	***10***	40	0.1	1.72	0.2	9.2	121	1680.1	1.71	***0.5***	0.02	0.11	12	0.51	498	7.7	0.008	3.7	0.02	25	0.81	5	0.6	1.4	12	18	***0.0005***	***0.05***	2.1	3	0.3	19
Phase I	08-088	HYP	WASTE	WR	PHY	POT	0.4	0.81	7.7	29.5	***10***	181	0.1	1.82	***0.05***	12.4	96	1130.7	1.78	3	0.01	0.27	20	0.46	154	19.6	0.034	4.5	0.052	9.1	0.57	0.3	8.8	1.9	58	17.8	0.011	0.3	6.9	35	0.4	12
Phase I	08-089	HYP	WASTE	WR	PHY		0.2	1.71	5.1	116.9	***10***	103	0.2	3.96	***0.05***	22.6	59	157.5	4.65	5	***0.005***	0.33	11	0.75	204	1.5	0.069	6.2	0.135	9.9	4.01	0.2	6.1	2.7	55	7.5	0.007	0.3	3.5	54	0.1	40
Phase I	08-090	HYP	WASTE	WR	POT		3	0.21	29	18	***10***	185	0.3	0.62	1.1	27.7	123	317	1.48	***0.5***	0.05	0.13	10	0.23	261	4	0.013	3.7	0.009	65	1.45	35.5	0.3	3.1	12	17.3	***0.0005***	***0.05***	2.8	***1***	0.5	73
Phase I	08-091	HYP	WASTE	WR	PHY		0.4	0.35	26.3	71.2	***10***	33	0.2	2.53	***0.05***	49.6	108	1459.6	4.63	***0.5***	0.01	0.13	5	0.82	137	28.9	0.008	43	0.111	5.5	4.5	1.9	3.8	7.7	21	2.5	0.001	0.2	2.1	20	0.6	12
Phase I	08-092	HYP	WASTE	WR	PHY	ARG	0.9	1.17	4.9	25.1	***10***	54	0.7	0.8	0.2	8.9	96	602.5	1.5	2	***0.005***	0.31	7	0.7	132	10.2	0.053	3.4	0.045	8.9	1.26	0.3	1.7	1.2	265	14	0.008	0.3	6.6	15	0.8	32
Phase I	08-094	HYP	WASTE	WR	PHY		0.6	0.22	10.9	22.9	***10***	73	2.1	2.13	0.2	10.5	104	467.9	3.12	***0.5***	***0.005***	0.16	9	0.07	168	22.4	0.01	4.6	0.037	5.9	3.6	0.7	0.5	2	14	12.2	***0.0005***	***0.05***	3.3	***1***	0.9	16
Phase I	08-096	HYP	WASTE	PP	PHY	POT	0.8	0.47	3.5	26.2	***10***	98	1.2	1.46	0.3	17.3	121	762.2	2.53	1	0.13	0.28	24	0.47	253	197.6	0.011	5.7	0.057	6.9	2.59	3.5	2.3	1.6	34	12.2	0.01	0.1	4.8	11	1.2	15
Phase I	08-100	HYP	WASTE	PP	PHY		0.3	0.38	8	9.6	***10***	95	1.4	2.09	0.1	8.3	81	329.4	2.18	1	0.02	0.22	15	0.46	163	89	0.007	6.9	0.067	4.6	***0.025***	0.4	1.1	1.1	31	7.4	0.001	0.1	5	3	0.7	11
Phase I	08-101	HYP	WASTE	IX	PHY		0.3	0.8	2.3	24.8	***10***	33	1.7	0.65	***0.05***	106.7	91	489	6.77	4	0.04	0.34	12	0.86	251	22.3	0.016	21.3	0.074	1.6	5.28	0.3	1.6	2.3	16	6.9	0.021	0.3	1.7	22	>100.0	29
Phase I	08-102	HYP	WASTE	IX	PHY		0.4	0.32	2.4	9.2	***10***	24	3	1.8	0.5	15.3	100	217.1	6.29	***0.5***	***0.005***	0.23	4	0.84	547	38.5	0.013	15.5	0.061	20	6.73	0.2	0.9	2.3	34	6.2	0.003	0.1	2.3	9	5.4	27
Phase I	08-106	HYP	WASTE	WR	POT	PHY	0.7	0.46	6.9	55.1	***10***	104	0.2	1.36	0.3	18.2	101	1017	1.85	***0.5***	***0.005***	0.17	14	0.22	179	21.1	0.009	4.7	0.034	9.9	1.04	1.1	0.7	2.2	26	16.8	***0.0005***	0.1	3.8	5	0.3	35
Phase I	08-107	HYP	WASTE	WR	POT	PHY	0.2	2.58	4.4	21.7	***10***	291	0.1	0.77	***0.05***	24.7	141	393.1	3.71	7	***0.005***	0.85	9	2.12	139	5.1	0.119	13	0.054	7.1	0.64	0.1	8.1	1.8	38	17.1	0.175	0.7	8.9	111	1.2	25
Phase I	08-108	HYP	WASTE	WR	POT		0.7	0.17	6.2	15.4	***10***	144	0.7	1.9	0.3	6.9	138	709.9	0.58	***0.5***	***0.005***	0.11	10	0.02	97	9.9	0.021	3.8	0.008	15.3	1.45	1.8	***0.05***	0.7	140	19.8	***0.0005***	***0.05***	6	***1***	0.7	19
Phase I	08-109	HYP	WASTE	WR	POT		0.5	0.26	6	52.5	***10***	189	0.2	1.15	0.1	6.7	148	1213.9	0.64	***0.5***	***0.005***	0.12	25	0.09	52	17.8	0.025	5.4	0.025	6.2	0.54	0.4	0.3	1.3	35	14.2	***0.0005***	***0.05***	5.8	3	0.2	8
Phase I	08-111	HYP	WASTE	WR	POT		0.1	2.99	7.3	11.9	***10***	183	0.2	1.4	0.2	21.6	122	250.2	3.99	8	***0.005***	0.7	6	2.04	179	6.1	0.27	13.9	0.068	4.3	2.1	***0.05***	12.6	2.6	80	3.6	0.146	0.6	1.3	141	0.7	25
Phase I	08-112	HYP	WASTE	WR	POT		0.5	0.28	3.2	67.7	***10***	50	0.2	2.47	***0.05***	28	109	310.6	2.73	***0.5***	***0.005***	0.09	5	0.06	125	3	0.007	5.6	0.005	13.1	2.89	0.7	0.3	6	39	12	0.001	***0.05***	4.3	***1***	0.3	9
Phase I	08-113	HYP	WASTE	WR	POT		0.3	4.63	7.2	34.3	***10***	63	0.2	2.89	***0.05***	44.6	59	645.9	5.97	11	***0.005***	1.48	5	2.91	239	2.1	0.261	12.2	0.111	2.8	4.21	0.2	16.5	4.3	145	3.8	0.176	1.3	2.5	193	***0.05***	24
Phase I	08-121	HYP	WASTE	PP	PHY		***0.05***	0.35	1.6	29.2	***10***	158	0.5	1.39	***0.05***	5.5	89	70.3	2.33	1	***0.005***	0.17	16	0.61	143	7.9	0.02	8.6	0.054	3.4	1.16	***0.05***	0.8	0.8	31	8.8	0.001	***0.05***	3.7	11	0.4	16
Phase I	08-123	HYP	WASTE	IX	POT		0.2	0.83	4.3	21	***10***	51	0.8	1.37	***0.05***	10.6	115	179.6	3.81	4	***0.005***	0.55	15	0.73	312	28	0.011	10.4	0.068	3.4	1.1	0.2	4.6	***0.25***	18	7.3	0.051	0.3	0.9	41	1.8	23
Phase I	08-126	HYP	WASTE	WR	POT	PHY	0.9	2.7	8.5	55.1	***10***	36	0.4	2.12	0.9	34.7	65	1054.9	6.32	11	0.04	1.47	9	2.24	508	2.4	0.053	9.3	0.11	6.9	2.34	0.9	17.9	4.3	56	3.8	0.228	1.6	4.1	163	0.5	89
Phase I	08-127	HYP	WASTE	WR	PHY	POT	0.4	0.21	7	29.6	***10***	96	0.4	0.48	0.2	14.9	110	590	0.8	***0.5***	***0.005***	0.14	6	0.03	78	10.2	0.007	2.2	0.006	18.2	0.76	1.8	0.3	1.8	9	25.5	***0.0005***	***0.05***	10.1	***1***	0.5	14
Phase II	08-134	HYP	WASTE	WR	PHY		0.6	0.21	24.6	147	***10***	32	3.7	0.21	0.1	7.5	53	263.8	4.64	***0.5***	0.04	0.16	6	0.06	114	4.6	0.008	3.2	0.038	15.4	4.66	0.8	0.6	2.1	14	17	***0.0005***	0.2	9.3	3	1.9	17
Phase II	08-137	HYP	WASTE	WR	PHY		0.5	0.27	7.4	101	***10***	61	1.7	1.08	1.2	10.4	58	312	3.73	***0.5***	***0.005***	0.15	18	0.4	248	0.6	0.007	3.9	0.053	10.4	3.65	0.8	0.9	2.6	8	8.2	***0.0005***	***0.05***	4.5	7	0.4	132
Phase II	08-141	HYP	WASTE	MX	PHY		0.6	0.3	19.6	81.2	***10***	60	3.5	0.02	***0.05***	7.3	43	171.5	3.94	1	0.05	0.25	10	0.03	14	14	0.007	9.1	0.035	10.6	3.97	1	1.1	2.5	68	17.3	0.001	0.2	2.2	***1***	0.3	7
Phase II	08-142	HYP	WASTE	MX	PHY		0.4	0.37	6.7	54	***10***	67	2.1	0.02	0.2	9	33	175.2	3.67	1	0.01	0.24	14	0.05	15	31	0.01	9.6	0.06	13.7	3.81	0.4	1.3	2	76	12	0.001	0.2	4.7	***1***	0.2	12
Phase II	08-143	HYP	WASTE	MX	PHY		0.6	0.37	6.3	28.2	***10***	53	2.8	0.03	0.1	9.1	40	373.3	3.69	***0.5***	***0.005***	0.22	15	0.05	16	26	0.006	9.9	0.066	10.9	3.83	0.3	0.7	1.9	57	9.5	***0.0005***	0.1	4.7	***1***	0.2	14
Phase II	08-151	HYP	WASTE	PP	PHY		1.8	0.37	22.5	74.1	***10***	39	4.5	2.54	0.1	5.6	45	665.6	3.44	1	***0.005***	0.17	26	0.33	181	2.3	0.009	5.2	0.075	12.8	3.75	0.3	0.5	***0.25***	368	6.3	***0.0005***	***0.05***	3.5	3	1	13
Phase II	08-165	HYP	WASTE	WR	PHY		0.4	0.36	8	42.9	***10***	56	1.2	1.01	1.1	25.7	56	320.6	4.33	***0.5***	***0.005***	0.19	12	0.38	191	20.8	0.007	3.9	0.052	33.8	4.19	0.5	0.7	6.7	12	13.3	0.001	0.1	13	5	1.7	85
Phase II	08-166	HYP	WASTE	WR	PHY		0.2	0.4	2.2	63.4	***10***	27	1.4	0.62	***0.05***	20.2	76	210.8	4.05	***0.5***	0.01	0.19	14	0.36	208	4.7	0.008	4.6	0.051	9.5	3.93	0.5	1	3.3	14	11.3	0.002	***0.05***	6.3	8	1	21
Phase II	08-178	HYP	WASTE	WR	PHY		0.6	0.28	16.3	62.8	***10***	42	5.4	0.03	***0.05***	21.1	62	427.6	4.47	***0.5***	***0.005***	0.17	13	0.02	13	223	0.006	5.8	0.038	7	4.69	0.3	0.8	1.5	86	21.1	***0.0005***	***0.05***	5	2	5	4
Phase II	08-179	HYP	WASTE	MX	PHY		0.7	0.38	18.6	67.9	***10***	20	4.2	0.13	***0.05***	26.7	51	578.7	3.94	***0.5***	0.01	0.21	5	0.04	15	24	0.007	7.5	0.085	13.9	4.13	0.3	0.8	1.5	109	12.6	***0.0005***	***0.05***	9.1	3	6.1	5
Phase II	08-186	HYP	WASTE	WR	POT		0.6	1.43	2.4	74.3	***10***	185	2.6	0.79	***0.05***	13.6	92	525.3	2.91	6	***0.005***	0.76	11	1.15	190	28.5	0.036	13.3	0.071	5.5	0.75	0.1	3.8	***0.25***	19	6.8	0.084	0.5	2.4	43	0.4	24
Phase II	08-197	HYP	WASTE	WR	PHY	POT	0.6	0.54	8.6	99.3	***10***	107	0.6	1.29	0.3	47.2	52	1012.7	3.33	1	0.01	0.3	17	0.79	309	9.6	0.013	4.7	0.038	10.4	1.81	2	1.8	2	32	12	0.008	0.2	6	17	1	47
Phase II	08-198	HYP	WASTE	WR	PHY	POT	0.4	0.3	18.2	54.9	***10***	23	1.3	0.71	0.2	24.8	47	301.8	3.87	***0.5***	0.02	0.21	5	0.28	215	2.2	0.008	4.1	0.047	11	3.73	3	0.7	3.1	13	29.6	0.001	***0.05***	8.1	5	2	35
Phase II	08-199	HYP	WASTE	PP	PHY		1.1	0.37	2.5	84.1	***10***	8	4	1.01	***0.05***	61.1	57	350.1	6.81	***0.5***	***0.005***	0.25	6	0.46	139	16.2	0.007	21.7	0.073	8.4	6.79	0.6	0.8	9.4	38	5.3	0.003	***0.05***	5.1	7	1.9	25
Phase II	08-200	HYP	WASTE	PP	PHY		0.2	0.98	2.1	20.4	***10***	41	0.6	0.37	***0.05***	23.2	62	177.9	5.29	2	***0.005***	0.51	14	0.86	171	4.7	0.009	24.4	0.078	6.8	5.02	0.6	1	5.7	16	6.4	0.024	0.3	4.4	14	1.6	45

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
							ppm	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm
Phase II	08-233	HYP	WASTE	WR	PHY	ARG	0.2	0.34	38.5	104	***10***	78	1.4	0.62	0.4	18.1	52	270.6	5.06	***0.5***	0.01	0.22	3	0.25	164	35.8	0.01	4.2	0.058	4.2	5.6	1.7	1.1	3.6	9	9.8	0.002	0.1	4.3	4	1.3	32
Phase II	08-234	HYP	WASTE	WR	PHY		0.4	0.34	120.1	86.2	***10***	81	1	1.22	1.3	18.5	41	73.5	3.71	***0.5***	0.11	0.19	6	0.48	2524	3.5	0.01	3	0.045	32.5	3.94	7.5	1.5	3.8	14	10.5	0.001	0.3	4.2	7	1	77
Phase II	08-237	HYP	WASTE	WR	PHY	ARG	0.4	0.41	16.2	59	***10***	100	1	0.52	0.4	20.7	52	822.6	2.72	***0.5***	0.03	0.13	22	0.23	377	6.2	0.013	3.3	0.05	10.1	2.44	6.3	1	3.4	13	21.5	***0.0005***	0.1	4.2	***1***	0.6	66
Phase II	08-238	HYP	WASTE	WR	PHY	ARG	0.3	0.56	44.6	29.6	***10***	156	0.6	0.12	0.3	24.2	65	621.4	3.08	***0.5***	0.05	0.14	18	0.06	584	57.3	0.014	5	0.028	7.7	1.85	25.7	1.5	2.8	10	14.2	***0.0005***	0.2	8.2	3	0.6	93
Phase II	08-239	HYP	WASTE	WR	PHY	ARG	0.1	0.36	16	16.3	***10***	38	1.1	0.69	***0.05***	11.1	30	110	4.19	***0.5***	0.06	0.16	5	0.17	226	2.6	0.01	2.5	0.043	4.1	4.35	3.3	1.8	3.2	13	11.9	***0.0005***	0.4	3.8	6	1.2	13
Phase II	08-240	HYP	WASTE	WR	PHY		***0.05***	0.32	2.9	8.4	***10***	101	0.7	1.72	***0.05***	9.6	41	226.8	3.75	***0.5***	***0.005***	0.14	13	0.51	75	1	0.009	3.1	0.056	3.2	4.08	0.4	1.3	2.6	22	10.3	0.001	0.1	6.8	6	1	8
Phase II	08-250	HYP	WASTE	WR	PHY	POT	1.2	0.55	3.4	54.3	***10***	46	1.3	0.58	0.3	13.6	67	1507.6	3	***0.5***	***0.005***	0.33	11	0.25	78	52	0.015	4.9	0.026	6.1	3.16	0.4	0.7	3.3	12	12.6	0.002	0.2	13.3	4	1.7	17
Phase II	08-257	HYP	WASTE	PP	POT	PHY	0.9	1.41	1.6	25	***10***	146	0.9	1.28	***0.05***	11.1	62	570.4	3.24	7	***0.005***	0.74	22	1.15	188	123.1	0.044	13.7	0.084	3.6	1.48	0.1	3.7	1.1	39	5.1	0.105	0.5	3.5	40	0.5	23
Phase II	08-259	HYP	WASTE	PP	POT		0.4	1.3	1.9	12.3	***10***	185	0.4	0.24	0.1	6.5	43	493.7	1.98	6	***0.005***	0.32	16	0.76	134	20.6	0.049	7	0.072	3.1	0.86	***0.05***	2.6	***0.25***	30	7.5	0.109	0.1	4.3	34	0.8	28
Phase II	08-260	HYP	WASTE	PP	POT		0.5	1.24	3.9	24.7	***10***	242	0.4	0.33	0.2	7.9	66	604	2.67	5	***0.005***	0.43	12	0.79	174	14	0.092	8.1	0.082	2.4	0.9	***0.05***	3.3	2.2	53	7.5	0.167	0.1	3.9	40	2.8	33
Phase II	08-262	HYP	WASTE	PP	PHY	POT	0.8	0.5	3.4	72	***10***	60	2	2.07	0.7	6.3	53	474.6	2.37	2	***0.005***	0.19	29	0.61	225	12.4	0.03	8.2	0.076	7.9	1.6	0.4	1.8	0.5	95	8.5	0.002	***0.05***	3.7	16	0.8	66
Phase II	08-266	HYP	WASTE	PP	POT	PHY	0.2	0.96	2.8	11.5	***10***	63	0.3	1.33	***0.05***	7.7	66	98.6	3.15	5	***0.005***	0.18	19	0.61	190	19.4	0.029	6.3	0.07	5.3	0.47	0.2	1.6	***0.25***	60	8.3	0.002	***0.05***	3.1	22	0.4	22
Phase II	08-273	HYP	WASTE	PP	POT		0.4	1.3	2.2	26.4	***10***	41	0.5	1.54	***0.05***	12.2	56	406.4	3.28	7	***0.005***	0.25	18	1.05	177	67.7	0.025	13.9	0.061	1.8	1.08	0.2	3.2	0.6	55	7.1	0.015	***0.05***	2.9	40	1.6	21
Phase II	08-274	HYP	WASTE	PP	POT		1.1	0.87	1.4	134.7	***10***	110	0.7	5.17	***0.05***	33.6	45	1074.9	3.77	3	***0.005***	0.37	64	1.36	281	157.1	0.025	12.8	0.061	3.5	2.21	***0.05***	3.8	2.1	180	7.1	0.035	0.2	6.5	31	2.7	18
Phase II	08-276	HYP	WASTE	PP	PHY		0.8	1.37	1.8	119.6	***10***	37	0.5	0.98	0.2	21.6	78	845	4.74	5	***0.005***	0.54	20	0.95	188	71.3	0.022	19.9	0.069	2.7	3.75	0.2	2.1	1.9	25	6.8	0.025	0.3	18.4	25	2.3	31
Phase II	08-277	HYP	WASTE	PP	PHY	PRO	0.6	1.8	3	159.4	***10***	93	0.7	0.88	***0.05***	22.3	80	579.6	4.2	6	***0.005***	0.78	32	1.29	205	72.6	0.039	19.3	0.081	1.8	2.16	0.2	3.1	1.6	49	7.1	0.055	0.4	4.6	31	2.2	23
Phase II	08-280	HYP	WASTE	PP	POT	PHY	0.3	1.7	4.9	16.4	***10***	89	0.4	1.05	0.1	23.4	86	320	5.3	7	***0.005***	0.7	15	1.32	211	50.1	0.044	20.9	0.074	3.7	1.15	0.2	3.4	***0.25***	65	7	0.144	0.3	11.2	43	28.4	28
Phase II	08-285	HYP	WASTE	WR	ARG		0.4	2.43	13.6	94.7	***10***	47	0.3	4.78	0.6	38.8	21	602.3	4.6	7	0.05	0.71	24	1.32	1420	6.2	0.049	6.5	0.128	8.4	1.41	1.1	12	1.3	53	4.7	0.091	0.5	5.5	101	0.1	137
Phase II	08-287	HYP	WASTE	WR	PHY		1.5	0.51	36.5	131.8	***10***	51	2.7	1.24	0.1	20.8	55	1658.7	1.99	1	0.07	0.22	28	0.41	264	12	0.01	19.8	0.033	13.3	1.62	1.6	1.5	1.9	25	18.7	0.001	0.1	4.1	7	0.3	39
Phase II	08-288	HYP	WASTE	WR	PHY	POT	0.4	0.83	2.6	75.1	***10***	181	0.2	1.03	***0.05***	9.5	108	601	1.64	3	***0.005***	0.13	30	0.46	104	20.9	0.035	3.6	0.032	6.4	0.63	0.2	2.3	1	147	23.6	0.003	***0.05***	6.3	23	0.2	17
Phase II	08-289	HYP	WASTE	WR	PHY	POT	0.7	0.41	33.8	127.6	***10***	117	0.2	0.92	0.5	11.6	61	1418	0.8	***0.5***	0.02	0.15	20	0.16	53	8.3	0.006	2.3	0.029	29.5	0.73	1.9	0.6	1.4	12	22.8	***0.0005***	***0.05***	6.1	***1***	0.2	41
Phase II	08-290	HYP	WASTE	WR	PHY	POT	0.3	1.7	1.6	48	***10***	173	0.2	1.41	0.1	15.5	89	632.1	2.38	6	0.01	0.65	16	0.97	130	10	0.069	9.3	0.048	7.3	0.54	***0.05***	7.9	1.2	40	34.3	0.099	0.5	6.8	62	0.2	18
Phase II	08-291	HYP	WASTE	WR	PHY	POT	0.5	0.44	3.8	29	***10***	155	0.9	1.47	***0.05***	8.7	61	820.3	0.81	1	***0.005***	0.12	24	0.16	53	33.8	0.032	3	0.013	12.4	0.99	0.3	0.9	1.3	67	19.7	0.001	***0.05***	5.5	6	0.2	9
Phase II	08-292	HYP	WASTE	WR	PHY	POT	0.3	2.48	4.8	33.8	***10***	328	0.2	1.76	***0.05***	14.7	181	752.1	2.72	7	***0.005***	1.01	9	1.82	225	6.5	0.223	34.2	0.085	3.8	0.83	***0.05***	7.8	1.2	92	6.2	0.256	0.6	2.5	95	0.7	28
Phase II	08-293	HYP	WASTE	WR	PHY		0.1	3.3	4.3	25.9	***10***	13	0.2	0.99	0.1	26.4	45	282.2	5.91	8	***0.005***	0.81	5	1.95	128	1.7	0.191	7.4	0.12	9.2	4.65	0.2	10.1	4.2	85	3	0.134	0.8	2.7	117	0.4	32
Phase II	08-294	HYP	WASTE	WR	POT		0.3	2.26	***0.25***	33.4	***10***	13	0.2	2.6	0.1	62.8	44	808.8	5.28	5	***0.005***	0.72	12	1.27	155	14.2	0.062	7.2	0.095	5.8	4.21	0.4	7.8	8.4	57	6	0.078	0.6	5.7	76	0.2	23
Phase II	08-295	HYP	WASTE	WR	PHY	POT	0.3	0.72	14.5	13.4	***10***	31	4.3	1.82	1	22.8	55	247.9	3.47	2	0.02	0.2	21	0.48	97	4.6	0.012	16.7	0.039	47.8	3.55	0.2	1.3	3.3	32	15.8	0.001	0.3	4	9	0.4	91
Phase II	08-296	HYP	WASTE	WR	PHY	POT	0.2	1.18	1.7	21	***10***	24	0.3	1.44	***0.05***	27.6	52	492.2	4.11	4	***0.005***	0.36	19	0.93	74	6	0.042	11.2	0.064	4.1	3.66	0.2	4.6	5.1	50	14.8	0.014	0.3	7.9	42	0.3	9
Phase II	08-303	HYP	WASTE	WR	POT		0.6	0.97	3.6	98.7	***10***	122	0.7	1.76	0.2	8.7	87	934.6	1.56	3	***0.005***	0.53	20	0.72	110	49	0.04	4	0.049	4.6	1.54	0.1	5.2	1	57	14.3	0.068	0.4	3.1	41	0.3	25
Phase II	08-304	HYP	WASTE	WR	POT		0.3	7.04	5	68.9	***10***	34	0.3	4.02	***0.05***	24.8	45	596.4	5.44	12	***0.005***	1.9	5	2.89	300	257.7	0.461	8.9	0.086	3.7	1.77	***0.05***	11.3	1.5	405	4.2	0.316	1.5	2.1	280	0.8	25
Phase II	08-307	HYP	WASTE	WR	PHY	POT	1.3	1.08	3.2	353.2	***10***	114	0.7	1.38	***0.05***	7.4	71	1265.8	2.15	4	***0.005***	0.27	29	0.75	171	101.1	0.044	4.1	0.057	4.7	1.02	0.1	4.2	0.8	27	14.1	0.019	0.2	6.3	34	0.2	33
Phase II	08-311	HYP	WASTE	WR	PHY	POT	1.3	0.87	2.9	72.4	***10***	151	0.6	0.72	0.1	16.1	92	1013.4	2.21	3	***0.005***	0.31	29	0.66	343	78	0.041	6.8	0.05	6.5	1.11	0.2	3.1	0.5	24	15.5	0.025	0.2	5.8	24	0.5	42
Phase II	08-313	HYP	WASTE	WR	PHY	POT	0.8	0.49	6.1	43.7	***10***	90	1.3	1.51	0.1	7.1	76	810.3	1.83	2	***0.005***	0.24	18	0.46	84	92.1	0.021	4.9	0.042	3.7	2.26	0.3	1.3	1.1	109	11	0.009	0.1	4.2	9	0.8	17
Phase II	08-318	HYP	WASTE	WR	POT	PHY	0.6	0.46	2.5	73.8	***10***	127	0.3	1.66	0.1	7.4	82	516.9	1.31	1	***0.005***	0.16	18	0.44	154	45.3	0.022	4.5	0.043	9.7	0.78	***0.05***	1.6	1.1	33	14	0.001	***0.05***	3.9	10	0.3	17
Phase II	08-319	HYP	WASTE	WR	POT	PHY	0.6	0.54	3.3	39.8	***10***	112	0.4	1.93	0.2	9.1	100	846.2	1.49	2	***0.005***	0.18	19	0.51	112	47.9	0.031	4.6	0.049	6.2	1.44	***0.05***	1.8	0.9	110	10.6	0.003	***0.05***	4.5	14	0.2	19
Phase II	08-320	HYP	WASTE	WR	POT	PHY	0.4	0.57	3.5	67.8	***10***	108	2.1	2.3	***0.05***	15.4	81	188.2	2.07	2	0.04	0.29	15	0.78	114	42.6	0.031	5.1	0.04	6.2	2.2	0.4	3	1.1	131	13.2	0.01	0.2	3.1	19	0.8	19
Phase II	08-327	HYP	WASTE	WR	PHY	POT	0.6	1.09	2.9	73.8	***10***	90	0.5	0.25	0.2	11.5	63	778.7	2.26	4	***0.005***	0.31	12	0.73	129	36.8	0.03	8.2	0.051	7.7	1.47	0.3	2.9	1.5	11	10.5	0.021	0.2	2.3	27	2.5	35
Phase II	08-332	HYP	WASTE	PP	PHY		0.3	0.37	11.2	42.8	***10***	140	1.5	0.97	0.2	7.4	69	337.3	2.12	1	0.04	0.17	13	0.43	269	56.8	0.019	7.9	0.047	3.3	1.15	0.5	1	0.6	23	8	0.004	0.1	2.7	8	0.4	22
Phase II	08-333	HYP	WASTE	PP	PHY		0.5	0.52	12.4	16	***10***	116	0.6	0.75	0.2	14.2	59	272	2.81	2	0.07	0.24	10	0.49	495	26.2	0.021	9.9	0.044	3.1	1.5	4.5	1.5	0.9	19	8.7	0.013	0.3	4.4	15	0.5	34
Phase II	08-334	HYP	WASTE	PP	PHY		0.3	0.87	1.6	29.5	***10***	68	1	1.07	***0.05***	7.5	84	262	2.54	5	***0.005***	0.33	11	0.61	126	80.6	0.025	9.8	0.049	4.4	1.34	0.3	2.3	0.9	25	7.7	0.036	0.2	1.8	29	0.6	15
Phase II	08-339	HYP	WASTE	IX	POT	ARG	0.5	1.08	3.1	29.1	***10***	100	1.7	0.31	0.4	12.1	150	453.9	2.97	5	***0.005***	0.83	16	1.06	294	35.4	0.032	14.2	0.046	5.3	0.91	0.3	5.1	***0.25***	16	8.9	0.103	0.4	1	38	0.7	48
Phase II	08-341	HYP	WASTE	IX	POT		0.3	0.83	3	121.3	***10***	55	1.6	2.04	***0.05***	7.6	50	202.1	3.4	4	***0.005***	0.45	17	0.72	135	30	0.015	9.6	0.066	5.1	1.75	0.2	3	0.5	26	6.5	0.046	0.3	1.3	23	0.7	15
Phase II	08-342	HYP	WASTE	IX	POT		0.1	0.76	1.1	30	***10***	63	0.5	0.46	***0.05***	9.3	76	152.9	2.88	5	***0.005***	0.44	17	0.68	198	78	0.032	10	0.054	3	0.48	0.1	3.4	***0.25***	16	8.2	0.051	0.2	1.8	31	1.2	20
Phase II	08-347	HYP	WASTE	WR	PHY	POT	0.5	0.72	5.8	76.6	***10***	28	2.4	1.09	***0.05***	12.4	48	450.8	3.42	2	***0.005***	0.28	7	0.32	132	50.6	0.01	8.1	0.039	5.6	3.03	0.8	1.9	1.3	33	12.1	0.014	0.1	1.7	15	0.8	9
Phase II	08-348	HYP	WASTE	WR	POT		0.2	0.79	1.5	68.4	***10***	118	0.8	0.71	***0.05***	7.6	103	317.2	3.45	5	***0.005***	0.43	9	0.59	82	36	0.024	9.3	0.059	5.1	1.6	0.5	3.2	0.9	36	9.5	0.048	0.2	1.6	32	1	14
Phase II	08-362	HYP	WASTE	WR	POT	PHY	0.4	0.52	9	69.9	***10***	166	0.7	1.31	0.4	6.1	56	711	0.67	1	0.01	0.2	18	0.19	143	132.6	0.02	2.8	0.036	16.1	0.41	0.4	1.4	0.9	39	15.6	0.003	0.1	4.9	10	0.3	18
Phase II	08-363	HYP	WASTE	WR	POT		0.7	2.22	3	60.5	***10***	225	7.2	1.45	***0.05***	12.4	111	1126	2.72	8	***0.005***	0.74	18	1.61	263	173.8	0.059	28.1	0.041	7.5	0.44	0.1	7.8	1.1	55	16.8	0.122	0.4	1.9	84	0.4	43
Phase II	08-364	HYP	WASTE	WR	POT	PHY	1.3	0.28	12.4	143.2	***10***	136	5.8	1.13	***0.05***	3.7	40	681.3	1.43	***0.5***	0.01	0.26	13	0.09	175	79.7	0.009	1.8	0.011	8	1.26	0.4	0.3	0.8	19	21	***0.0005***	0.2	5.4	***1***	0.4	11
Phase II	08-366	HYP	WASTE	WR	POT	PHY	1.5	0.6	40	140.4	***10***	193	1	2.43	0.1	9.8	67	1898	1.28	2	0.07	0.21	15	0.24	275	44.3	0.017	4.4	0.035	10.4	0.8	1.4	3.4	1.5	48	14.3	0.007	0.2	7.1	20	0.2	20
Phase II	08-368	HYP	WASTE	WR	POT	PRO	0.2	2.25	5	125.7	***10***	190	0.2	1.63	***0.05***	10.1	85	501.4	2.46	6	***0.005***	0.74	7	1.42	165	33.2	0.216	11.3	0.043	4.1	0.77	***0.05***	8.6	1.1	89	10	0.183	0.5	3.8	90	0.8	24
Phase II	08-369	HYP	WASTE	WR	POT	PRO	0.2	3.91	3.5	41.5	***10***	524	0.2	2.14	***0.05***	15.7	60	317.6	3.47	10	***0.005***	1.38	8	2.34	448	25.8	0.218	14.8	0.075	3.5	0.53	0.1	8.8	***0.25***	119	8.8	0.207	0.8	3	118	0.3	36
Phase II	08-371	HYP	WASTE	WR	PHY	POT	0.8	3.4	12.1	59.5	***10***	100	0.1	3.84	0.1	23.3	65	682.3	3.95	8	0.01	0.86	7	1.96	599	60.1	0.155	14.4	0.078	4.2	1.42	0.1	10.8	1.6	112	8.9	0.159	0.5	2.9	154	0.2	61
Phase II	08-372	HYP	WASTE	WR	PHY	POT	10.7	0.34	52	68.7	***10***	88	10.4	1.58	1.8	3.3	38	2838.1	1.72	***0.5***	0.14	0.17	17	0.05	561	22.3	0.01	2.4	0.022	88.7	1.58	5.6	0.6	0.5	38	15.3	***0.0005***	0.1	4.7	2	0.4	88
Phase II	08-373	HYP	WASTE	WR	POT		0.5	2.33	5.6	74.4	***10***	105	0.3	2.01	***0.05***	11.1	62	667	3.08	7	***0.005***	1.13	9	1.24	205	175.4	0.17	7.4	0.091	5.1	1.17	0.1	8.7	1	137	9.3	0.263	0.5	2.1	104	2.1	25
Phase II	08-375	HYP	WASTE	WR	PHY	POT	2	0.23	146	50.8	***10***	56	4.1	0.22	2.2	17.2	69	639.5	1.52	***0.5***	0.11	0.2	7	0.07	222	27	0.009	2.8	0.006	48.5	1.45	13	0.2	1.8	6	22.3	***0.0005***	0.3	4.5	***1***	1.1	190
Phase II	08-376	HYP	WASTE	WR	PHY	POT	0.6	0.31	9.2	126.9	***10***	175	0.3	1.07	0.2	6.9	86	1102.8	0.79	***0.5***	0.01	0.11	17	0.08	139	14.4	0.019	3.3	0.016	10.6	0.62	1	0.4	1.4	34	11	***0.0005***	***0.05***	7.9	***1***	0.1	20
Phase II	08-377	HYP	WASTE	WR	POT		0.7	2.08	5.1	66.8	***10***	57	0.2	2.43	***0.05***	19.4	65	1079.2	3.05	7	***0.005***	0.98	14	1.32	195	52.9	0.132	5.6	0.068	2.7	1.72	0.1	11.3	2.2	106	5.9	0.173	0.6	2.1	100	0.2	40
Phase II	08-378	HYP	WASTE	WR	POT		0.4	0.97	4.8	54.4	***10***	180	0.4	1.07	***0.05***	9.8	89	733.1	1.76	3	***0.005***	0.26	25	0.44	106	11	0.071	5.2	0.034	5.3	0.92	0.1	3.5	1.8	61	16.8	0.031	0.2	3.6	28	0.2	14
Phase II	08-380	HYP	WASTE	WR	POT		1	1.48	13.8	132.9	***10***	129	0.9	1.1	0.5	17.7	33	1636.8	3.9	6	***0.005***	0.49	7	0.92	185	54.4	0.055	3	0.174	9.4	1.73	0.2	3.6	2.5	69	6.2	0.065	0.4	2.1	53	0.5	47
Phase II	08-382	HYP	WASTE	WR	POT	PHY	0.5	0.39	4.1	57.3	***10***	81	1	0.71	***0.05***	2.6	54	810.6	0.67	***0.5***	***0.005***	0.15	24	0.17	45	61.9	0.028	2.1	0.018	6.4	0.59	0.2	0.9	0.6	17	21.1	0.001	***0.05***	5.4	5	0.3	10
Phase II	08-394	HYP	WASTE	WR	POT		0.7	0.22	15.5	30.7	***10***	216	0.8	1.88	0.1	4.3	59	751.9	0.57	***0.5***	0.06	0.12	19	0.16	124	43.9	0.011	2.7	0.009	6.6	0.5	1.7	0.2	0.8	23	23.8	***0.0005***	***0.05***	4.2	***1***	0.5	13
Phase II	08-395	HYP	WASTE	WR	POT		0.4	0.41	4.1	34.3	***10***	67	2.3	2.65	***0.05***	6.3	79	418.2	2.39	2	***0.005***	0.18	17	0.37	63	320.5	0.022	3.6	0.046	4.2	3.17	0.3	1.5	1.1	129	15.7	0.003	***0.05***	3.6	14	0.9	9
Phase II	08-396	HYP	WASTE	WR	POT		0.3	0.23	7.5	35	***10***	392	0.9	1.01	0.1	1.9	78	254.2	0.47	***0.5***	0.01	0.1	9	0.05	60	64	0.024	3.1	0.011	8.2	0.44	0.2	0.2	***0.25***	83	21.8	***0.0005***	***0.05***	5	***1***	0.2	15
Phase II	08-397	HYP	WASTE	WR	POT		0.2	1.42	2.6	35.1	***10***	221	0.1	1.73	***0.05***	9.9	80	407.9	2.54	6	0.01	1.08	8	1.34	135	94.2	0.097	6.8	0.064	3.6	1.2	***0.05***	9.7	0.5	74	7.4	0.241	0.5	2.2	91	0.6	23
Phase II	08-398	HYP	WASTE	WR	POT		0.3	0.71	1.7	14.8	***10***	61	2.4	1.6	0.1	4.2	58	212.5	1.21	2	0.02	0.22	19	0.44	70	105	0.024	4.1	0.035	4.8	0.96	0.7	2.7	0.5	57	17.2	0.005	0.2	4.8	20	0.3	15
Phase II	08-405	HYP	WASTE	WR	POT		0.3	1.86	4.2	35.7	***10***	277	0.2	0.76	***0.05***	10.2	76	470.2	3.55	7	***0.005***	0.82	11	1.53	209	74.8	0.124	6.2	0.082	3.3	0.16	0.2	8.5	0.7	34	10.3	0.229	0.4	3.4	105	0.5	30
Phase II	08-406	HYP	WASTE	WR	PHY	POT	0.4	0.44	76.7	60.2	***10***	35	1.3	4.76	***0.05***	7.5	78	553.9	2.15	1	0.03	0.14	29	0.16	464

Type	Lorax ID	Zone	Class	Lithology	Alteration 1	Alteration 2	Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
							ppm	%	ppm	ppb	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	%	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
Phase III	09-13	HYP	WASTE	PP	PHY		***0.25***	7.24	***2.5***	52			3	2.29	***0.025***	10	30	363	2.78	10		4.34	20	1.18	151	110	1.64	13	0.098	14	1.54	***2.5***	7		649	***10***	0.27	***5***	10	71	***5***	19
Phase III	09-14	HYP	WASTE	WR	PHY		0.8	7.47	10	121			***1***	0.15	0.6	24	19	807	4.35	10		2.87	20	0.33	157	7	0.11	5	0.068	8	3.25	***2.5***	13		25	***10***	0.16	***5***	***5***	99	40	56
Phase III	09-15	HYP	WASTE	WR	PHY		0.6	7.44	***2.5***	78			***1***	0.16	***0.025***	19	14	507	5.46	20		2.63	20	0.36	425	12	0.09	5	0.064	3	3.32	6	14		15	***10***	0.2	***5***	***5***	105	40	35
Phase III	09-16	HYP	WASTE	WR	PHY		0.7	7.22	7	94			***1***	0.13	***0.025***	29	17	749	5.24	10		3.23	30	0.34	456	36	0.13	6	0.058	***1***	3.6	***2.5***	13		19	***10***	0.12	***5***	***5***	100	40	28
Phase III	09-17	HYP	WASTE	WR	PHY		1.1	7.58	20	166			3	0.14	***0.025***	18	14	1005	5.25	10		2.99	20	0.34	202	25	0.12	3	0.059	6	4.28	***2.5***	14		19	***10***	0.15	***5***	***5***	98	30	17
Phase III	09-18	HYP	WASTE	WR	PHY		1.3	7.88	6	134			4	0.18	***0.025***	26	13	997	4.72	20		2.95	20	0.38	272	38	0.11	3	0.074	6	3.22	7	14		17	20	0.17	***5***	***5***	104	30	22
Phase III	09-19	HYP	WASTE	WR	PHY		0.6	7.2	10	121			***1***	0.11	***0.025***	28	13	717	5.97	10		3.27	20	0.32	596	23	0.12	2	0.049	7	4.95	***2.5***	13		17	***10***	0.11	***5***	***5***	96	30	26
Phase III	09-20	HYP	WASTE	WR	PHY		0.7	7.3	***2.5***	172			2	0.19	***0.025***	26	11	921	6.44	20		3.27	20	0.45	730	34	0.13	2	0.058	7	3.29	5	12		26	***10***	0.13	***5***	***5***	97	20	37
Phase III	09-33	HYP	WASTE	MX	PHY		1.6	7.66	91	152			7	1.72	***0.025***	8	11	431	4.28	20		4.06	30	0.74	217	34	0.11	2	0.065	6	3.07	***2.5***	7		393	20	0.14	***5***	***5***	55	20	13
Phase III	09-34	HYP	WASTE	MX	PHY		1.2	7.28	37	95			5	1.7	***0.025***	8	23	344	4.42	20		3.48	30	0.73	210	22	0.08	9	0.071	7	3.49	9	6		86	***10***	0.12	***5***	***5***	50	10	23
						Maximum	10.7	7.9	389	648	***10***	828	14.8	5.2	2.8	154	181	2838	12.0	20.0	0.28	4.4	64.0	2.9	2524	543	2.2	43.0	0.18	154	6.9	35.5	17.9	14.4	730	40.9	0.32	5.0	27.7	280	40.0	190
						90th percentile	1.2	3.6	33.8	134	***10***	203	4.3	2.4	0.50	33.6	119	1156	5.3	10.0	0.050	1.4	29.0	1.3	448	102	0.13	14.8	0.085	15.8	4.9	4.0	10.1	4.8	140	21.1	0.17	1.1	7.9	100	5.7	66.0
						75th percentile	0.70	1.4	13.7	78.0	***10***	141	2.1	1.8	0.20	21.6	96.0	807	4.3	6.0	0.020	0.55	20.0	0.84	248	57.3	0.049	9.9	0.071	10.4	3.8	1.7	4.6	2.6	75.0	16.8	0.075	0.40	5.6	41.0	1.7	33.0
						Mean	0.67	1.4	15.6	72.6	***10***	112	1.7	1.3	0.25	18.4	71.9	612	3.3	3.8	0.021	0.59	16.2	0.65	220	47.8	0.087	8.0	0.057	10.5	2.5	1.8	3.7	2.3	71.7	12.5	0.047	0.62	4.9	33.7	3.2	29.5
						Median	0.50	0.57	5.8	54.0	***10***	90.0	0.90	1.2	0.10	12.4	65.0	507	3.1	2.0	***0.005***	0.24	15.0	0.47	165	25.1	0.022	5.8	0.055	6.9	1.9	0.40	1.8	1.6	34.0	10.5	0.0030	0.20	4.4	15.0	0.70	21.0
						25th percentile	0.30	0.36	3.0	26.4	***10***	43.0	0.40	0.71	***0.050***	8.1	50.0	279	2.0	***0.50***	***0.005***	0.16	9.0	0.24	110	9.6	0.010	4.0	0.040	4.4	1.0	0.20	0.90	0.90	18.0	7.5	0.0010	***0.050***	2.9	5.0	0.30	14.0
						10th percentile	0.20	0.26	1.9	14.9	***10***	32.7	0.20	0.16	***0.050***	6.1	33.0	175	1.2	***0.50***	***0.005***	0.13	6.0	0.060	59.0	3.5	0.0070	3.0	0.021	3.3	0.57	0.10	0.50	0.50	12.0	5.8	***0.0005***	***0.050***	2.1	***1.0***	0.20	9.0
						Minimum	***0.050***	0.17	***0.25***	6.3	***10***	8.0	0.10	0.020	***0.025***	1.9	11.0	32.3	0.47	***0.50***	***0.005***	0.09	3.0	0.020	11.0	0.60	0.0060	1.5	0.0040	1.0	***0.025***	***0.050***	***0.050***	***0.25***	6.0	1.9	***0.0005***	***0.050***	0.90	***1.0***	***0.050***	4.0
						No of Samples	161	161	161	161	148	148	161	161	161	161	161	161	161	161	148	161	161	161	161	161	161	161	161	160	161	161	148	161	161	161	161	161	161	160	161
Samples with Unknown Zone - Waste																																									
Phase I	08-130		WASTE				***0.05***	0.29	13.3	1.3	***10***	31	0.2	0.51	***0.05***	6.6	106	17.1	2.24	1	0.02	0.11	18	0.12	513	4	0.023	11.4	0.036	17.5	***0.025***	0.6	2.6	***0.25***	12	11	0.002	***0.05***	5	9	0.2	48
Phase I	08-131		WASTE				***0.05***	0.81	12.2	1.4	***10***	55	1	0.17	***0.05***	4	130	11.1	1.56	6	0.01	0.57	38	0.43	183	2.9	0.055	7.8	0.05	4.1	***0.025***	0.2	3.8	***0.25***	10	17.7	0.084	0.7	5.9	18	0.5	22
Phase III	09-36		WASTE	WR	PHY		***0.25***	6.39	***2.5***	11		230	***1***	1.38	***0.025***	8	9	113	4.13	***10***		2.87	20	0.36	247	1	0.28	1	0.039	23	3.94	***2.5***	7		74	20	0.11	***5***	***5***	48	10	43
	Notes:																																								
	Bold italic indicates 0.5*DL (value is less than the detection limit)																																								

Appendix E
Static Test Results for Overburden Samples

CASINO
COPPER AND GOLD

Appendix E1: Static Test ABA Results

Sample ID	Rinse pH	Paste pH	TIC %	$CaCO_3$ NP	C(T) %	S(T) %	$S(SO_4)$ %	$S(S^{-2})$ %	Insoluble S %	SAP $mgCaCO_3/kg$	Non-SO_4 AP $mgCaCO_3/kg$	NP $mgCaCO_3/kg$	Net NP	Fizz Test
Tailings Management Facility														
TP11-TMF-01	4.99	5.35	0.02	1.7	0.58	0.07	0.06	<0.01	0.01	<0.3	0.31	14.8	14.8	None
TP11-TMF-05	5.64	6.67	<0.01	<0.8	0.06	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	15.1	15.1	None
TP11-TMF-09	6.66	6.59	0.17	14.2	2.24	0.02	0.02	<0.01	<0.01	<0.3	0.08	38.8	38.8	Slight
TP11-TMF-10	4.97	5.38	0.01	0.8	0.58	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	17.4	17.4	None
TP11-TMF-12	4.19	4.89	<0.01	<0.8	0.75	0.01	<0.01	<0.01	0.01	<0.3	0.08	13.1	13.1	None
TP11-TMF-13	6.71	6.73	0.05	4.2	0.17	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	14.2	14.2	None
TP11-TMF-34	5.09	5.30	0.01	0.8	2.37	0.02	0.01	<0.01	0.01	<0.3	0.31	19.1	19.1	None
TP11-TMF-94	5.14	5.45	0.03	2.5	0.69	0.07	0.08	<0.01	<0.01	<0.3	0.08	22.2	22.2	None
TP11-TMF-99	4.25	5.11	<0.01	<0.8	0.37	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	15.3	15.3	None
TP11-TMF-100	5.15	5.23	0.01	0.8	2.32	0.02	0.01	<0.01	0.01	<0.3	0.31	18.5	18.5	None
Heap Leach Facility														
TP11-HLF-01	4.74	4.89	<0.01	<0.8	1.27	0.01	0.01	<0.01	<0.01	<0.3	0.08	16.0	16.0	None
TP11-HLF-05	4.53	5.34	<0.01	<0.8	0.38	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	13.4	13.4	None
TP11-HLF-13	5.34	5.86	0.01	0.8	0.18	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	12.1	12.1	None
TP11-HLF-16	4.92	6.00	0.01	0.8	0.18	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	13.2	13.2	None
TP11-HLF-21	5.90	5.81	0.02	1.7	0.97	0.01	<0.01	<0.01	0.01	<0.3	0.16	18.6	18.6	None
TP11-HLF-41	6.86	6.22	0.01	0.8	0.1	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	12.6	12.6	None
Plant Site														
TP11-04	4.31	4.45	<0.01	<0.8	1.24	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	11.6	11.6	None
TP11-06	4.48	4.37	0.01	0.8	3.17	0.03	0.02	<0.01	0.01	<0.3	0.31	11.7	11.7	None
TP11-10	4.14	4.26	<0.01	<0.8	1.35	0.02	0.01	<0.01	0.01	<0.3	0.31	13.4	13.4	None
TP11-11	4.98	5.47	<0.01	<0.8	0.2	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	17.0	17.0	None
TP11-18	5.47	5.34	0.01	0.8	0.36	0.09	0.1	0.01	<0.01	0.3	0.08	14.8	14.5	None
TP11-20	4.50	4.95	<0.01	<0.8	0.47	<0.01	<0.01	<0.01	<0.01	<0.3	0.08	17.1	17.1	None
Potential NAG Storage Area														
TP11-NAG-02	4.69	5.12	<0.01	<0.8	0.98	0.03	0.01	<0.01	0.02	<0.3	0.63	16.4	16.4	None
TP11-NAG-06	5.10	5.90	<0.01	<0.8	0.08	<0.01	<0.01	0.01	<0.01	0.3	0.08	25.2	24.9	Slight
TP11-NAG-07	4.54	4.88	<0.01	<0.8	1.13	0.02	0.01	<0.01	0.01	<0.3	0.31	15.5	15.5	None
TP11-NAG-08	4.43	4.92	<0.01	<0.8	0.91	0.02	0.01	0.01	<0.01	0.3	0.31	15.4	15.1	None
Open Pit														
38-3	4.54	5.00	<0.01	<0.8	0.05	0.05	0.05	<0.01	<0.01	<0.3	0.08	12.8	12.8	None
38-4	4.38	4.85	<0.01	<0.8	0.04	0.04	0.02	<0.01	0.02	<0.3	0.63	28.1	28.1	None
39-1	5.06	5.37	<0.01	<0.8	0.4	0.11	0.13	<0.01	<0.01	<0.3	0.08	11.2	11.2	None
TP-PIT-01	3.57	3.71	<0.01	<0.8	0.78	1.04	1.13	<0.01	<0.01	<0.3	0.08	4.8	4.8	None
TP-PIT-04	4.58	4.76	<0.01	<0.8	0.27	0.08	0.1	<0.01	<0.01	<0.3	0.08	9.4	9.4	None
TP-PIT-05	3.72	4.06	<0.01	<0.8	0.12	0.1	0.11	<0.01	<0.01	<0.3	0.08	10.1	10.1	None
TP-PIT-06	5.08	5.67	<0.01	<0.8	0.15	0.12	0.12	<0.01	<0.01	<0.3	0.08	13.2	13.2	None

Sample ID	Rinse pH	Paste pH	TIC %	$CaCO_3$ NP	C(T) %	S(T) %	$S(SO_4)$ %	$S(S^{-2})$ %	Insoluble S %	SAP $mgCaCO_3/kg$	Non-SO_4 AP $mgCaCO_3/kg$	NP $mgCaCO_3/kg$	Net NP	Fizz Test
1994 Surface Samples														
598151		4.9				0.75	0.267				15.09	-1	-9	
598152		5.1				1	0.324				21.13	0	-10	
598153		5.1				0.82	0.27				17.19	1	-7	
598154		6.3				0.46	0.115				10.78	1	-3	
598155		5.9				0.46	0.142				9.94	1	-3	
598156		5.2				1.59	0.622				30.25	0	-19	
598157		5.2				1.38	0.539				26.28	0	-17	
598158		5.2				0.78	0.258				16.31	-1	-9	
598159		5.3				0.9	0.302				18.69	-1	-10	
598160		5.6				1.09	0.414				21.13	0	-13	
598161		4.7				1.36	0.418				29.44	-1	-14	
598162		4.9				4.57	1.53				95.00	-1	-49	
598163		4.5				1.18	0.351				25.91	-2	-13	
598164		5.1				3.19	1.01				68.13	0	-32	
598165		5.1				2.3	0.715				49.53	0	-22	
598166		5.4				2.2	0.728				46.00	0	-23	
598167		5.4				3.05	1.04				62.81	0	-33	
598168		4.8				0.81	0.275				16.72	-1	-10	
598169		5.3				0.57	0.191				11.84	0	-6	
598170		5				2.33	0.753				49.28	-1	-25	
598171		4.7				1.86	0.619				38.78	-1	-20	
598172		5.7				0.45	0.14				9.69	0	-4	
598173		5.1				1.2	0.408				24.75	0	-13	
598176		5.5				0.53	0.153				11.78	0	-5	
598177		5.5				0.46	0.139				10.03	2	-2	
598178		5.7				0.46	0.152				9.63	1	-4	
598179		5				0.45	0.154				9.25	0	-5	
598180		5.3				1.31	0.39				28.75	2	-10	
598181		5.6				0.53	0.155				11.72	2	-3	
598182		5.6				0.03	0.055				0.08	1	-1	
598183		5.7				1.15	0.369				24.41	1	-11	
598184		6.9				0.37	0.12				7.81	1	-3	
598185		5.5				1.53	0.508				31.94	0	-16	
598186		5.7				1.56	0.505				32.97	1	-15	

Note:

AP = Acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material. SAP is determined from the measured sulphide sulphur content, Non-SO_4 AP is determined from the non-SO_4 sulphur content.

NP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material.

NET NP = NP - AP

Carbonate NP is calculated from TIC originating from carbonates and is expressed in kg $CaCO_3$/tonne.

Sulphate Sulphur determined by 25% HCL with Gravimetric Finish

Sulphide Sulphur determined by Sobek 1:7 Nitric Acid with S by ICP-MS Finish

Insoluble S is acid insoluble S (Total S - (Sulphate S + Sulphide S)).

For the 1994 samples, total S and sulphate S results were switched from the original result sheet because $S(SO_4)$ was greater than S(T) for all samples.

Appendix E2: Static Test Aqua Regia Metals Results

Sample ID	Ag ppm	Al %	As ppm	B ppm	Ba ppm	Be ppm	Bi ppm	Ca %	Cd ppm	Ce ppm	Co ppm	Cr ppm	Cs ppm	Cu ppm	Fe %	Ga ppm	Ge ppm	Hf ppm	Hg ppm	In ppm	K %	La ppm	Li ppm	Lu ppm	Mg %	Mn ppm	Mo ppm	Na %	Nb ppm	Ni ppm	P ppm	Pb ppm	Rb ppm	S %	Sb ppm	Sc ppm	Se ppm	Sn ppm	Sr ppm	Ta ppm	Tb ppm	Te ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Yb ppm	Zn ppm	Zr ppm
Tailings Management Facility																																																		
TP11-TMF-01	0.31	1.54	672	50	1050	1.1	0.67	0.25	2.92	50.2	22.7	122	4.07	65.2	5	5.7	<0.1	0.06	0.58	0.04	0.26	23.5	13	0.22	0.38	2380	2.1	0.02	0.79	58.8	0.07	73.4	22.3	0.05	17.5	8.7	<1	0.9	23	<0.05	0.65	0.13	7.9	0.07	3.85	1.75	67	1	18.6	1.5	629	4.1
TP11-TMF-05	0.05	1.16	3	60	125	0.5	0.17	0.28	0.04	48.3	5.6	116	4.35	16.2	1.96	5	<0.1	0.34	0.01	<0.02	0.35	30.5	10	0.17	0.43	508	1.02	0.05	0.99	4.9	0.021	6.3	46.5	<0.01	0.28	5.2	<1	1.1	13.9	<0.05	0.3	<0.05	22.3	0.07	0.33	1.17	43	0.2	9.34	2	42	9.9
TP11-TMF-09	0.1	1.74	10	60	187	0.5	0.14	1.49	0.25	29.7	13	46	0.93	39.4	3.41	5.4	<0.1	0.17	0.02	0.03	0.12	14.6	13	0.13	0.76	580	0.84	0.06	1.89	29.8	0.087	7.9	10.2	0.01	0.46	6	<1	0.5	56.6	<0.05	0.41	<0.05	3.8	0.16	0.12	0.62	89	0.2	11.1	1	76	8.7
TP11-TMF-10	0.27	2.32	10	60	120	0.5	0.2	0.89	0.1	41.2	10.9	81	1.65	17	3.02	7.3	<0.1	0.27	0.03	0.02	0.19	23.1	13	0.14	0.64	468	1.9	0.08	1.56	12.3	0.04	8.7	22.5	<0.01	0.65	6.8	<1	0.7	43.8	<0.05	0.34	<0.05	10.7	0.17	0.21	1.45	85	1.6	9.6	0.9	58	13
TP11-TMF-12	0.04	1.6	3	60	177	0.3	0.08	0.39	0.08	24.8	8.9	97	1.89	23	2.46	5.4	<0.1	0.08	<0.01	<0.02	0.29	13.1	10	0.09	0.52	434	1.52	0.07	1.6	5.9	0.032	5.8	28	<0.01	0.31	4.6	<1	0.7	19.2	<0.05	0.2	<0.05	9.6	0.11	0.2	1.14	65	7.9	5.9	0.6	44	4.6
TP11-TMF-13	0.25	0.85	5	50	58	0.7	0.2	0.31	0.09	65.4	6.8	73	5.66	6.1	2.9	4.1	<0.1	0.27	0.02	<0.02	0.16	38.7	4	0.24	0.19	440	0.87	0.03	0.24	4.6	0.023	15.4	15.7	<0.01	1.09	6.8	<1	0.7	12	<0.05	0.49	<0.05	20	0.01	0.13	2.37	59	1.4	14	1.6	42	12.3
TP11-TMF-34	0.05	1.85	12	60	153	0.4	0.13	0.73	0.13	32.2	10.3	87	1.7	28.3	2.95	5.7	<0.1	0.15	0.03	0.02	0.16	17.2	12	0.14	0.58	519	0.78	0.07	1.86	15.3	0.038	6.8	20.3	<0.01	0.56	6.2	<1	0.7	35.5	<0.05	0.34	<0.05	8.2	0.12	0.19	1.83	72	0.3	10.1	0.9	61	8.1
TP11-TMF-94	0.6	2.15	366	50	2130	0.9	0.25	0.51	1.05	53.8	29	169	8.99	97.4	5.87	8.9	0.1	<0.05	0.42	0.06	0.49	25.3	16	0.23	1.04	1420	4.05	0.03	2.39	84.9	0.154	16.5	36	0.04	12.2	14.2	2	0.9	32.1	<0.05	0.73	0.1	5.8	0.14	5.11	2.66	162	1.2	19.9	1.6	203	4.1
TP11-TMF-99	0.07	2.03	35	60	335	1.3	0.44	0.37	0.1	84.7	12.4	143	5.03	29.4	3.87	9.3	0.2	0.15	0.02	0.05	0.52	74.8	13	0.31	0.66	658	1.99	0.05	2.28	32.3	0.053	11.3	59.4	<0.01	0.8	12.1	1	0.9	22.6	<0.05	1.19	0.06	13.1	0.15	0.57	2.66	78	0.3	26.7	2.1	93	7.1
TP11-TMF-100	0.05	1.84	5	60	150	0.4	0.14	0.74	0.11	32.4	10	95	1.71	78.7	2.9	5.7	<0.1	0.14	0.02	0.02	0.15	17.3	12	0.13	0.57	491	0.7	0.08	2.03	14.7	0.038	6.5	20	<0.01	0.41	6.2	<1	0.7	36.4	<0.05	0.33	<0.05	8.2	0.13	0.17	1.81	73	0.2	9.78	0.9	67	7.8
Heap Leach Facility																																																				
TP11-HLF-01	0.5	1.75	33	50	310	0.4	0.47	0.48	3.25	43.2	11.3	116	3.32	22.3	3.64	5.8	<0.1	0.06	0.03	0.08	0.19	22.3	11	0.16	0.62	1160	1.16	0.04	1.46	12.8	0.062	114	21.9	<0.01	2.02	7.1	<1	0.7	29.2	<0.05	0.4	<0.05	10.5	0.1	0.31	3.94	75	0.5	11.3	1.1	566	4
TP11-HLF-05	0.26	1.1	43	60	201	0.3	0.36	0.31	2.22	32.8	9.4	160	1.25	9.6	2.67	3.8	<0.1	<0.05	<0.01	0.04	0.14	12.4	7	0.09	0.4	1410	0.96	0.05	0.98	9.6	0.043	42.5	15.3	<0.01	0.96	3.7	<1	0.5	19.1	<0.05	0.19	<0.05	9.6	0.07	0.18	1.8	52	0.4	5.09	0.5	188	1.5
TP11-HLF-13	0.37	0.62	16	50	353	0.8	0.58	0.19	3.63	46.1	6.2	136	11.5	9.9	2.42	2.1	<0.1	0.08	0.05	0.14	0.28	25	2	0.16	0.11	1940	2.96	0.02	0.2	5.8	0.041	157	18	<0.01	1.86	3.6	<1	0.4	13.5	<0.05	0.34	<0.05	18.8	<0.01	0.42	4.31	16	0.3	9.31	1.1	481	4.2
TP11-HLF-16	0.47	0.57	8	50	367	0.7	1.1	0.21	2.3	51.7	7.4	84	8.64	16.2	2.5	2.1	<0.1	0.1	0.05	<0.02	0.26	26.2	1	0.14	0.1	2180	7.17	0.02	0.15	7.9	0.042	33.4	20.7	<0.01	2.32	3.7	<1	<0.3	11.3	<0.05	0.31	<0.05	23.3	<0.01	0.49	5.53	20	0.2	8.13	1	280	5.3
TP11-HLF-21	0.43	1.2	19	60	311	0.5	5.01	0.48	1.04	45.1	10.4	107	5.1	30.1	3.22	4.5	<0.1	0.06	0.04	0.04	0.2	21.8	8	0.14	0.45	1580	4.07	0.04	1.1	12.6	0.052	63.5	21.6	<0.01	1.88	5.7	<1	0.5	32.3	<0.05	0.34	<0.05	11.9	0.08	0.41	2.34	60	0.7	8.94	0.9	193	3.7
TP11-HLF-41	0.65	0.53	10	50	418	0.7	0.36	0.17	0.69	51.2	7.1	115	5.15	12.3	1.73	1.7	<0.1	0.17	0.08	<0.02	0.2	24.6	2	0.16	0.08	1790	3.48	0.01	0.21	6.7	0.029	111	14.6	<0.01	1.88	3.1	<1	0.4	10	<0.05	0.31	<0.05	27.1	<0.01	0.28	5.78	15	0.5	7.84	1	259	7.1
Plant Site																																																			
TP11-04	0.17	1.82	80	50	214	0.4	0.2	0.38	0.48	31.4	11.5	118	2.14	16.8	3.4	5.9	<0.1	<0.05	0.01	0.11	0.13	15.7	12	0.09	0.55	945	1.09	0.04	1.6	16.3	0.057	32.3	16	<0.01	0.61	5.2	<1	0.7	22.5	<0.05	0.26	<0.05	8.2	0.12	0.21	1.76	75	0.2	6.55	0.6	150	2.3
TP11-06	0.39	1.7	31	50	216	0.4	0.27	0.38	0.69	30.7	10.3	80	2.07	23.2	2.95	5.2	<0.1	<0.05	0.05	0.07	0.09	14.8	10	0.13	0.42	805	1.94	0.03	1.48	16.7	0.057	43.5	12.1	0.02	0.71	5.1	<1	0.6	24.9	<0.05	0.33	0.06	7.4	0.08	0.21	3.45	64	0.2	8.96	0.9	143	1.9
TP11-10	0.36	1.9	17	50	234	0.5	0.24	0.35	0.63	34	10.9	115	2.61	19.5	3.45	6.2	<0.1	<0.05	0.03	0.06	0.13	17.4	9	0.13	0.48	767	1.02	0.03	1.21	17.4	0.061	87	16.6	<0.01	0.94	6.7	<1	0.7	24.5	<0.05	0.35	<0.05	6.4	0.09	0.28	2.36	76	0.2	9.5	0.9	181	1
TP11-11	0.12	1.76	5	60	538	0.4	0.09	0.38	0.14	60.3	9.8	106	9.09	8.5	3.53	6.8	<0.1	0.16	0.02	0.04	0.43	34.2	12	0.25	0.63	846	0.52	0.04	1.08	6.5	0.054	13.7	41.2	<0.01	0.59	12.5	<1	1.2	20.2	<0.05	0.57	<0.05	22.8	0.13	0.46	4.28	83	0.2	15.3	1.7	82	6.3
TP11-18	0.94	1	694	40	233	0.7	0.49	0.25	9.45	45	8.9	132	3.62	21.7	3.55	3.1	<0.1	<0.05	0.1	0.79	0.24	24.7	4	0.22	0.2	1900	2.01	0.02	0.43	7.3	0.052	68.8	16	0.09	3.61	5.1	<1	0.5	26	<0.05	0.4	<0.05	16.7	0.02	0.64	5.28	34	0.3	12.2	1.4	1100	1.3
TP11-20	0.48	1.97	12	60	333	0.5	0.21	0.44	0.77	43.6	11.9	97	2.83	26.8	3.53	6.4	<0.1	0.06	0.03	0.04	0.18	22.9	11	0.19	0.6	1060	0.84	0.04	1.13	20.1	0.058	88.3	22.1	<0.01	1.29	8.3	<1	0.8	31.3	<0.05	0.46	<0.05	10.7	0.14	0.28	2.57	83	1	12.9	1.3	145	4.8
Potential NAG Storage Area																																																			
TP11-NAG-02	0.8	1.43	14	60	221	0.4	1.01	0.43	0.64	31.8	11.1	143	1.43	27.2	3.38	5	<0.1	<0.05	0.02	0.06	0.13	15.2	9	0.12	0.52	1010	1.43	0.06	1.46	14.4	0.063	53.2	15.3	<0.01	1.03	5.6	<1	0.8	24.4	<0.05	0.28	<0.05	8.2	0.11	0.21	2.14	75	0.2	7.67	0.7	140	2.3
TP11-NAG-06	0.4	1.87	27	50	437	0.6	0.11	0.41	2.71	48	9.4	105	4.98	11.6	3.67	6.5	<0.1	0.1	0.01	0.09	0.43	22.6	9	0.18	0.72	2070	0.76	0.03	0.51	4.8	0.056	282	31.5	<0.01	1.88	8.2	<1	0.8	19.6	<0.05	0.37	<0.05	18.6	0.07	0.39	3.92	75	0.2	10.5	1.2	452	2.2
TP11-NAG-07	2.66	1.69	31	60	308	0.6	1.37	0.39	2.02	46.2	12.9	121	2.39	54.8	3.91	5.7	<0.1	<0.05	0.03	0.11	0.17	23.4	10	0.19	0.53	1990	1.15	0.04	1.46	18	0.062	178	21	<0.01	3.57	7.1	<1	0.9	23.9	<0.05	0.44	<0.05	10.1	0.11	0.3	4.62	77	0.3	12.7	1.2	253	3.7
TP11-NAG-08	1.76	1.76	14	60	264	0.4	1.95	0.43	1.16	41.7	11.9	127	1.98	50.8	3.55	5.9	<0.1	<0.05	0.02	0.08	0.15	20.7	11	0.14	0.59	1280	1.22	0.05	1.42	17.3	0.062	87	18.9	<0.01	1.18	6.9	<1	0.8	25.1	<0.05	0.36	<0.05	9.9	0.12	0.26	3.19	81	0.3	9.88	0.9	245	2.7
Open Pit																																																			
38-3	0.33	2.93	10	60	383	0.7	0.43	0.24	0.33	110	92.9	65	2.37	2510	2.5	6.4	0.2	0.19	<0.01	0.02	0.15	50.5	8	0.35	0.49	1630	29.2	0.06	0.42	7.2	0.035	15	17.1	0.03	1.45	4.8	1	0.7	35.5	<0.05	1.82	0.07	9.1	0.09	0.24	7.76	45	1	33.8	2.8	85	5.7
38-4	0.96	3.36	12	50	435	0.8	0.23	0.68	0.42	80.7	177	59	4.3	1540	3.75	9.9	0.2	0.1	<0.01	0.02	0.58	56.5	11	0.51	1.4	3450	50.8	0.05	0.22	3.9	0.05	17.1	47.3	<0.01	1.58	11.5	1	1.2	36.6	<0.05	2.19	<0.05	6.9	0.07	0.69	5.87	100	0.7	56	3.7	150	1.8
39-1	0.73	1.23	41	50	335	0.3	1.72	0.23	0.22	34.8	5.7	116	1.82	116	2.85	3.9	<0.1	0.18	0.01	0.03	0.19	18.8	4	0.08	0.3	275	2.83	0.07	0.5	8.5	0.044	33.1	11.9	0.12	3.76	2.9	1	0.5	50.3	<0.05	0.27	0.27	12.4	0.03	0.18	1.91	29	0.7	5.48	0.5	60	9.5
TP-PIT-01	0.64	0.95	14	50	404	0.2	1.3	0.06	<0.01	50.3	2.8	66	1.22	129	4.75	3.9	<0.1	<0.05	<0.01	0.02	0.73	28.4	4	0.03	0.24	94	208	0.06	0.41	3.1	0.095	10.7	37	1.05	1.81	2.1	2	0.4	60.8	<0.05	0.18	0.14	7.1	0.03	0.4	1.67	27	106	2.65	0.2	18	3.7
TP-PIT-04	1.04	1.66	18	40	183	0.7	1.48	0.09	0.13	23.6	4.9	64	1.99	1110	9.18	7.1	<0.1	0.58	0.03	0.04	0.32	12.5	3	0.15	0.35	168	435	0.02	0.44	5.6	0.127	20	22.2	0.09	1.69	6.5	2	0.5	15.3	<0.05	0.29	0.18	18.1	0.04	0.25	8.74	46	2.3	6.7	0.9	33	23.8
TP-PIT-05	0.58	1.36	22	60	353	0.3	1.53	0.23	0.21	35.5	15.2	89	1.39	353	2.92	4.5	<0.1	0.2	<0.01	0.05	0.23	19.2	6	0.09	0.41	434	47.2	0.06	0.71	9.4	0.048	21.1	18	0.1	2.38	3.8	<1	0.6	29.7	<0.05	0.27	0.25	10.1	0.07	0.22	1.88	41	2.3	6.14	0.6	55	8.3
TP-PIT-06	1.6	1.36	24	60	230	0.4	1.94	0.25	0.41	57.8	7.9	110	2.5	1010	3.65	5.5	<0.1	0.23	<0.01	0.13	0.49	30.8	7	0.12	0.72	220	303	0.04	0.95	16	0.07	30.2	42.7	0.1	7.69	6.3	1	1	26.1	<0.05	0.39	0.24	11.7	0.1	0.42	3.12	64	1.9	9.39	0.8	99	9.7
1994 Surface Samples																																																			
598151	1.2	0.7	2		240	<DL	6	0.07	<DL		1	102		16	1.59	<DL			<DL		0.33	20			0.1	55	1	0.01		2	0.016	30			<DL	1			11					0.01	<DL	<DL	18	<DL			14	
598152	1	0.88	6		280	<DL	6	0.02	<DL		1	142		20	1.63	<DL			<DL		0.56	20			0.09	65	3	0.01		1	0.013	18			<DL	1			6					<DL	<DL	<DL	14	<DL			14	
598153	0.8	0.68	6		210	<DL	4	0.03	<DL		1	98		21	1.42	<DL			<DL		0.43	20			0.08	65	4	0.01		1	0.012	14			<DL	1			6					<DL	<DL	<DL	12	<DL			14	
598154	0.4	0.68	6		140	<DL	<DL	0.04	<DL		1	120		6	0.73	<DL			<DL		0.37	20			0.06	70	3	0.01		2	0.012	6			<DL	1			6					0.01	<DL	<DL	12	<DL			8	
598155	0.2	0.5	6		110	<DL	<DL	0.04	<DL		1	89		6	0.77	<DL			<DL		0.28	20			0.06	70	1	0.01		2	0.012	8			<DL	1			5					0.01	<DL	<DL	10	<DL			8	
598156	2.6	0.92	16		390	<DL	14	0.04	<DL		1	116		33	2.52	<DL			<DL		0.71	20			0.1	65	17	0.02		2	0.025	32			<DL	2			11					0.01	<DL	<DL	20	<DL			12	
598157	2.2	0.57	12		340	<DL	8	0.02	<DL		1	69		33	2.08	<DL			<DL		0.54	20			0.06	45	13	0.01		1	0.018	28			<DL	1			8					<DL	<DL	<DL	14	<DL			18	
598158	0.8	1.19	6		240	<DL	4	0.09	<DL		3	107		22	2.19	<DL			<DL		0.33	10			0.19	110	1	0.01		7	0.02	28			<DL	2			13					0.02	<DL	<DL	30	<DL			22	
598159	0.2	1.52	6		220	<DL	<DL	0.1	<DL		5	84		17	2.34	<DL			<DL		0.4	20			0.27	160	10	0.02		12	0.021	18			<DL	2			19					0.04	<DL	<DL	33	<DL			30	
598160	0.2	1.11	4		270	<DL	<DL	0.03	<DL		1	130		13	1.75	<DL			<DL		0.65	30			0.12	60	12	0.02		5	0.018	18			<DL	1			17					0.01	<DL	<DL	17	<DL			16	
598161	0.8	0.63	42		240	<DL	<DL	0.01	<DL		<DL	86		125	2.01	<DL			<DL		0.47	30			0.04	35	45	0.01		<DL	0.063	30			2	1			10					<DL	<DL	<DL	13	<DL			12	
598162	1.6	0.98	2		150	<DL	<DL	0.01	<DL		1	105		230	4.15	<DL			<DL		1.1	20			0.12	15	127	0.04		1	0.032	10			<DL	4			20					0.04	<DL	<DL	34	<DL			14	
598163	1.8	0.79	38		290	<DL	4	0.04	<DL		2	77		170	2.54	<DL			<DL		0.38	20			0.12	70	72	0.01		4	0.042	38			12	1			13					0.01	<DL	<DL	21	<DL			28	
598164	1.4	0.49	12		190	<DL	<DL	<DL	<DL		<DL	84		61	2.83	<DL			<DL		0.79	20			0.04	15	30	0.02		<DL	0.016	110			<DL	1			8					<DL	<DL	<DL	11	<DL			6	
598165	3	0.38	22		180	<DL	14	<DL	<DL		<DL	63		47	2.07	<DL			<DL		0.61	30			0.03	10	23	0.01		1	0.015	262			22	1			14					<DL	<DL	<DL	9	<DL			6	
598166	0.4	0.81	14		210	<DL	2	0.04	<DL		3	80		17	2.79	<DL			<DL		0.55	10			0.12	85	18	0.01		6	0.013	22			2	1			7					0.02	<DL	<DL	18	<DL			12	
598167	0.4	0.39	8		180	<DL	<DL	0.02	<DL		1	52		15	3	<DL			<DL		0.67	10			0.04	35	11	0.01		1	0.012	62			<DL	1			7					0.01	<DL	<DL	11	<DL			8	
598168	0.8	0.93	10		180	<DL	<DL	0.06	<DL		8	103		212	4.25	<DL			<DL		0.35	30			0.11	130	68	0.01		6	0.035	18			<DL	1			14					0.02	<DL	<DL	45	90			100	
598169	1.6	1.27	16		120	<DL	<DL	0.08	<DL		7	61		589	5.31	<DL			<DL		0.28	20			0.31	165	63	0.01		10	0.032	22			<DL	2			13					0.02	<DL	<DL	37	<DL			70	
598170	4.8	1.38	134		250	<DL	4	0.04	<DL		3	87		775	6.55	<DL			<DL		0.66	20			0.28	100	76	0.02		6	0.049	40			6	3			21					0.01	<DL	<DL	37	<DL			58	
598171	2.4	1.38	74		240	<DL	4	0.03	<DL		3	65		513	6.09	<DL			<DL		0.64	20			0.45	100	60	0.03		7	0.044	20			2	2			19					0.02	<DL	<DL	33	<DL			56	
598172	0.8	0.97	18		130	<DL	<DL	0.04	<DL		3	78		861	5.31	<DL			<DL		0.31	40			0.09	105	178	0.01		6	0.033	188			2	1			10					0.01	<DL	<DL	30	<DL			132	
598173	1.2	0.48	46		420	<DL	<DL	0.03	<DL		<DL	72		39	1.3	<DL			<DL		0.45	40			0.03	15	114	0.01		1	0.025	24			4	<DL			17					<DL	<DL	<DL	2	<DL			6	
598176	1.4	1.48	22		190	<DL	2	0.11	<DL		6	99		424	4.54	<DL			<DL		0.49	30			0.35	125	87	0.03		10	0.049	22			2	3			22					0.03	<DL	<DL	33	<DL			46	
598177	1.6	1.1	6		140	<DL	<DL	0.1	<DL		14	68		1134	3.82	<DL			<DL		0.47	40			0.46	415	177	0.02		10	0.044	12			<DL	3			18					0.04	<DL	<DL	35	<DL			86	
598178	0.8	1.26	26		290	0.5	2	0.04	<DL		7	82		977	4.1	<DL			<DL		0.6	40			0.44	175	187	0.01		8	0.033	56			2	3			14					0.02	<DL	<DL	32	<DL			116	
598179	1.4	1.47	22		880	<DL	<DL	0.08	<DL		9	65		1446	3.1	<DL			<DL		0.39	30			0.45	195	156	0.02		6	0.057	34			2	5			41					0.03	<DL	<DL	45	<DL			70	
598180	1	1.16	12		230	<DL	2	0.15	<DL		4	42		430	4.81	<DL			<DL		0.48	30			0.48	125	123	0.04		10	0.079	12			<DL	6			39					0.06	<DL	<DL	55	<DL			56	
598181	1.2	1.36	20		150	<DL	2	0.19	<DL		9	79		883	3.77	<DL			<DL		0.43	20			0.62	295	108	0.02		13	0.053	22			<DL	4			19					0.07	<DL	<DL	47	<DL			74	
598182	0.4	2.28	10		480	<DL	<DL	0.46	<DL		13	85		862	4.77	<DL			<DL		0.44	30			0.9	305	65	0.07	

Appendix F
CAP and HYP Correlations

CASiNO
COPPER AND GOLD

Appendix F1: CAP Correlations

Appendix F-1: CAP and HYP Correlations

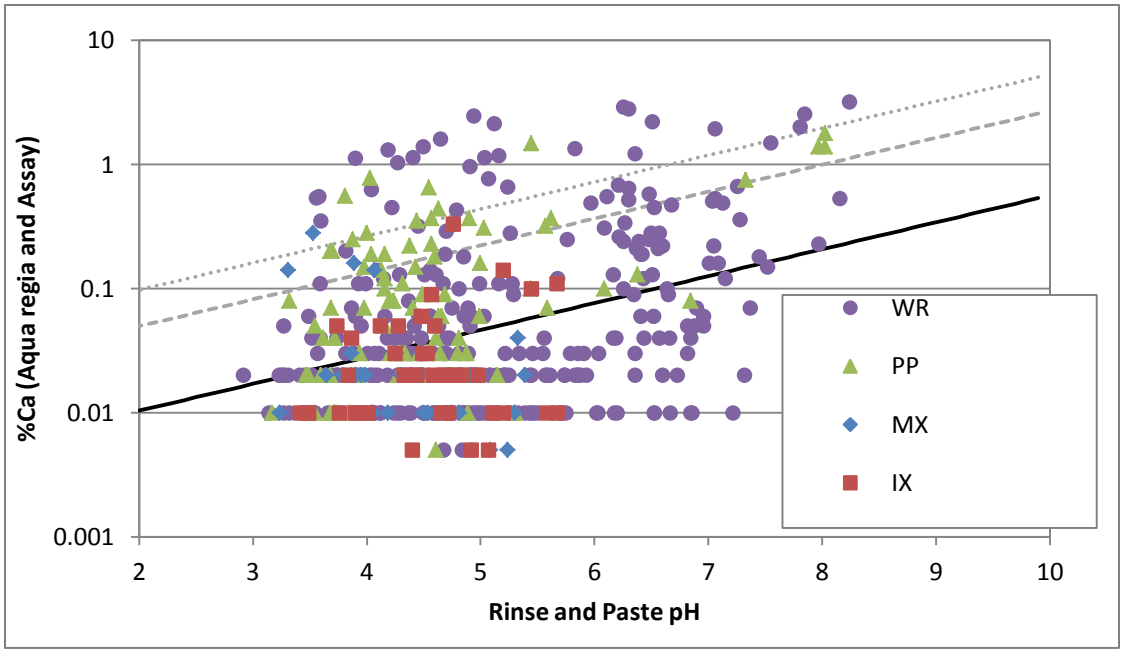


Figure F-1-1: %Ca vs. pH for the CAP samples. The correlation was not strong enough to use this relationship to designate neutral material. %Ca is from aqua regia and assay data.

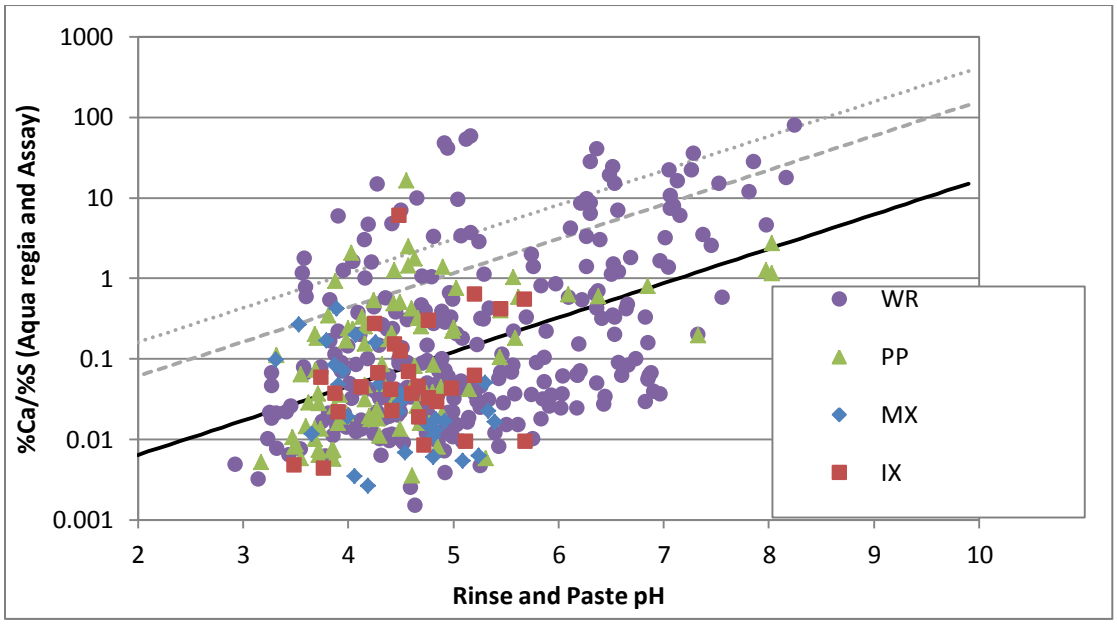


Figure F-1-2: %Ca/%S vs. pH for the CAP samples. The correlation was not strong enough to use this relationship to designate neutral material. %Ca and %S are from aqua regia and assay data.

Appendix F2: Neutral Oxide CAP Plan View Sections

Plan Section 1125

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

CAS-053
CAS-055
93-167
CAS-014
CAS-080
CAS-045
CAS-013
CAS-012
DH11-39
CAS-044
CAS-005
CAS-008
CAS-009
CAS-054
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CAS-047
94-336
CAS-057
CAS-022
CAS-049
DH10-20
CAS-050
CAS-048
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CAS-077
CAS-046
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CAS-016
CAS-076
CAS-061
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93-239
93-243
93-238
CAS-023
93-227
93-203
94-274
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94-256
93-218
93-199
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HG10-01
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CAS-085
CAS-034
93-195
DH10-19B
CAS-075
CAS-081
CAS-003
93-182
94-320
DH11-37
93-189
93-187
DH11-36

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1140

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

CAS-053
CAS-055
93-167
CAS-014
CAS-080
CAS-045
CAS-013
CAS-012
DH11-39
CAS-008
CAS-009
CAS-044
CAS-005
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HG10-01
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CAS-085
CAS-034
93-195
DH10-19B
CAS-075
CAS-081
CAS-003
93-182
94-320
DH11-37
93-189
93-187
DH11-36

Rinse pH within CAP
0 - 6.4
6.4 - 7.1
> 7.1

Western Copper and Gold

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Plan Sections at 15m Intervals
UTM, Zone 9N

Plan Section 1155

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

CAS-053 CAS-055 93-167 CAS-054 CAS-056 CAS-047 CAS-014 CAS-080 CAS-045 CAS-013 CAS-012 CAS-044 CAS-005 CAS-008 DH11-39 CAS-009 CAS-057 CAS-022 CAS-049 DH10-20 CAS-050 CAS-048 CAS-079 CAS-077 CAS-046 94-336 94-252 94-251 94-254 CAS-016 CAS-076 CAS-061 93-248 93-247 93-239 93-243 93-238 CAS-023 93-227 93-203 94-274 93-235 93-236 94-256 93-199 CAS-060 93-230 93-241 93-234 93-148 93-232 93-162 93-198 94-276 93-159 93-205 CAS-062 93-246 93-231 93-250 93-228 93-245 93-240 CAS-068 93-233 94-279 94-327 CAS-066 CAS-033 CAS-028 CAS-025 CAS-026 CAS-024 CAS-072 93-206 92-132 93-185 94-267 93-186 CAS-032 CAS-064 CAS-069 CAS-071 CAS-037 93-229 94-289 93-150 92-138 93-163 94-271 CAS-004 93-226 94-338 CAS-067 94-330 CAS-065 94-312 93-191 93-147 94-308 93-171 CAS-007 94-341 CAS-041 CAS-073 DH11-35 CAS-070 CAS-029 94-300 93-177 93-175 93-153 93-168 HG10-05 HG10-01 93-169 93-188 93-157 93-179 CAS-082 94-313 93-178 93-183 CAS-080 93-165 CAS-085 DH11-37 CAS-034 93-195 DH10-198 CAS-075 CAS-081 CAS-003 93-182 94-320 93-189 93-187 DH11-36

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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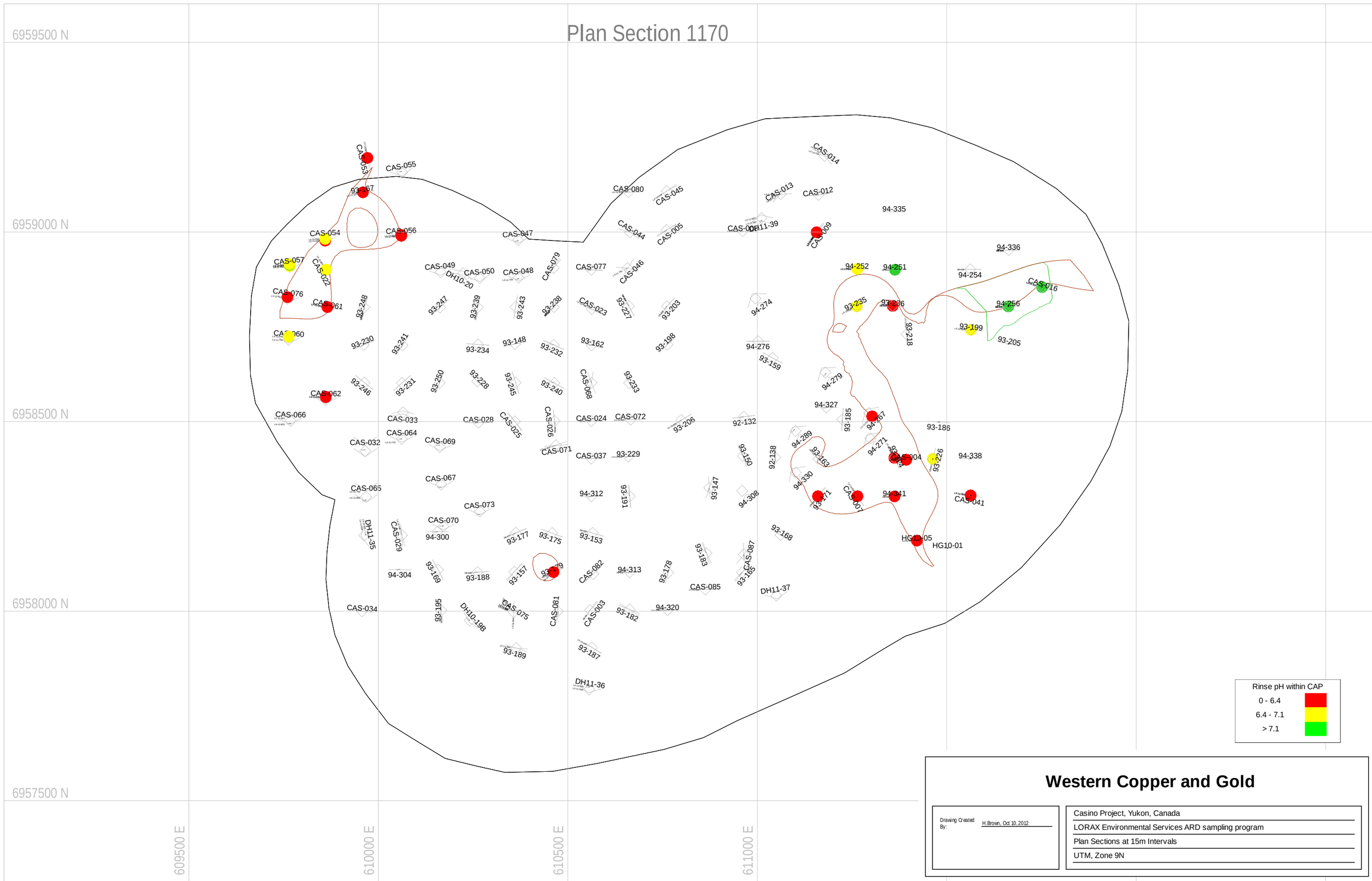
Casino Project, Yukon, Canada

LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1170



Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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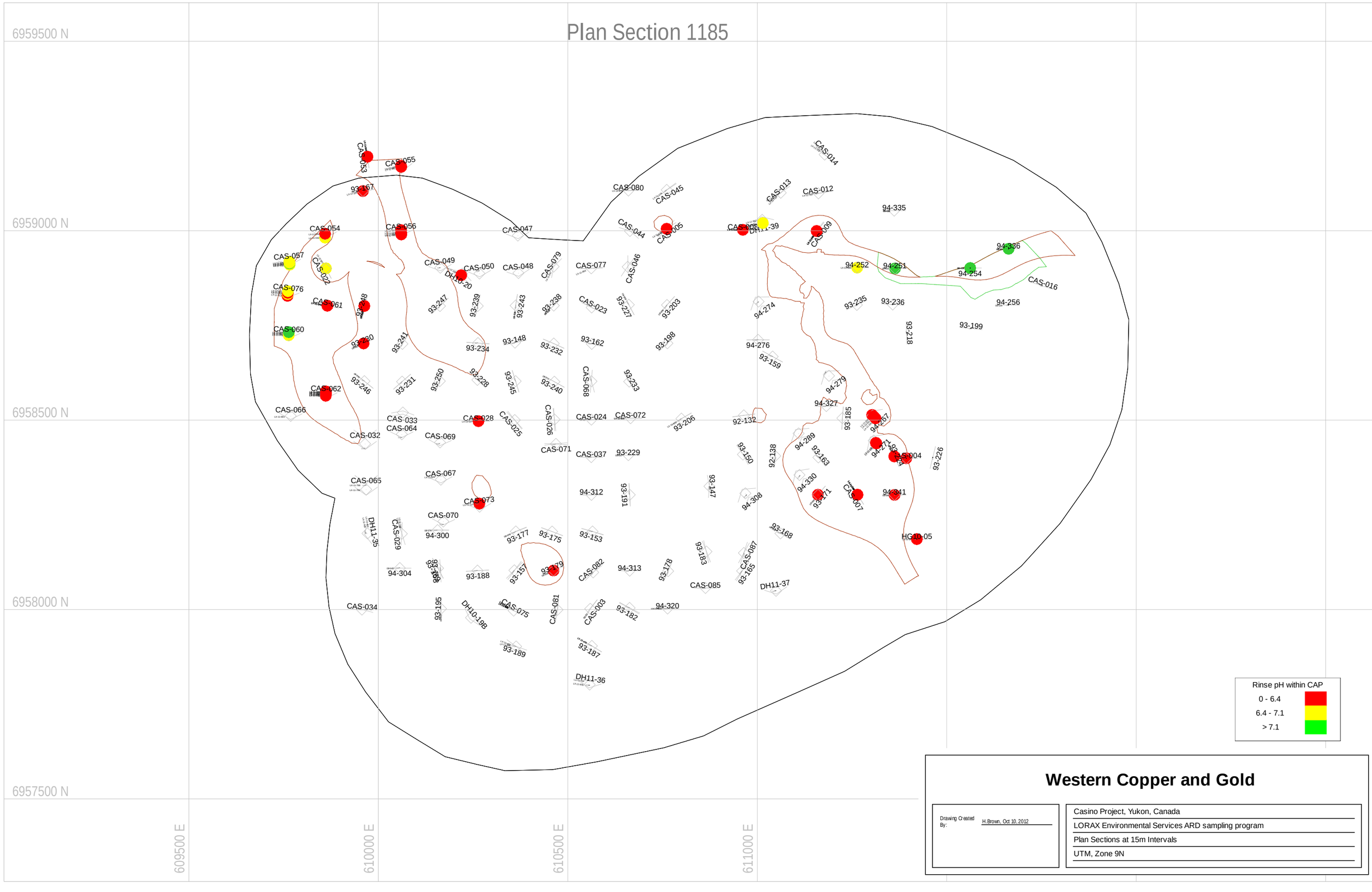
Casino Project, Yukon, Canada

LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1185



Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1200

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

CAS-053 CAS-055 93-167 CAS-054 CAS-056 CAS-047 CAS-057 CAS-022 CAS-049 CAS-050 CAS-048 DH10-20 CAS-076 CAS-061 93-249 93-247 93-239 93-243 93-238 CAS-060 93-240 93-241 93-234 93-148 93-232 CAS-062 93-246 93-231 93-250 93-228 93-245 CAS-066 CAS-032 CAS-064 CAS-069 CAS-028 CAS-025 CAS-026 CAS-065 CAS-067 CAS-073 CAS-070 DH11-35 CAS-029 94-300 93-177 93-175 94-304 93-188 93-157 93-179 CAS-034 93-195 DH10-19B CAS-075 CAS-081 93-189 CAS-080 CAS-045 CAS-044 CAS-005 CAS-079 CAS-077 CAS-046 CAS-023 93-227 93-203 93-162 93-198 CAS-068 93-233 CAS-024 CAS-072 93-206 CAS-071 CAS-037 93-229 93-312 93-191 93-153 93-147 93-313 93-178 93-183 CAS-082 CAS-085 CAS-087 93-165 93-168 CAS-003 93-182 94-320 93-187 DH11-36 DH11-37 CAS-014 CAS-013 CAS-012 CAS-008 DH11-39 CAS-009 94-335 94-336 94-254 94-252 94-251 93-235 93-236 94-274 94-276 93-159 94-279 94-327 93-185 94-267 92-132 92-138 93-150 94-289 94-263 CAS-004 94-330 93-171 CAS-007 94-341 94-308

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1215

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

CAS-053
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CAS-007
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93-168

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1230

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

CAS-055
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CAS-085
CAS-082
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CAS-081
CAS-003
93-182
94-320
93-187
DH11-36
93-153

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1245

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

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CAS-085
CAS-034
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DH10-19B
CAS-075
CAS-081
CAS-003
93-182
94-320
93-187
93-189
DH11-36

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1260

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

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CAS-085
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CAS-075
CAS-081
CAS-003
93-182
93-189
93-187
DH11-36

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1275

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

CAS-077
93-238
CAS-023
93-227
93-203
93-232
93-262
93-198
94-276
93-159
CAS-068
93-223
93-240
94-327
CAS-026
CAS-024
CAS-072
93-206
92-132
93-185
CAS-069
CAS-065
CAS-067
CAS-071
CAS-037
93-229
93-150
92-138
CAS-073
93-147
CAS-070
94-312
93-191
94-308
94-300
93-177
93-175
93-153
93-181
CAS-082
CAS-083
93-339
94-304
93-188
93-157
93-179
94-313
93-178
CAS-085
CAS-034
93-195
DH10-19B
CAS-075
CAS-081
CAS-003
93-182
94-320
93-189
93-187
DH11-36

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1290

6959500 N

6959000 N

6958500 N

6958000 N

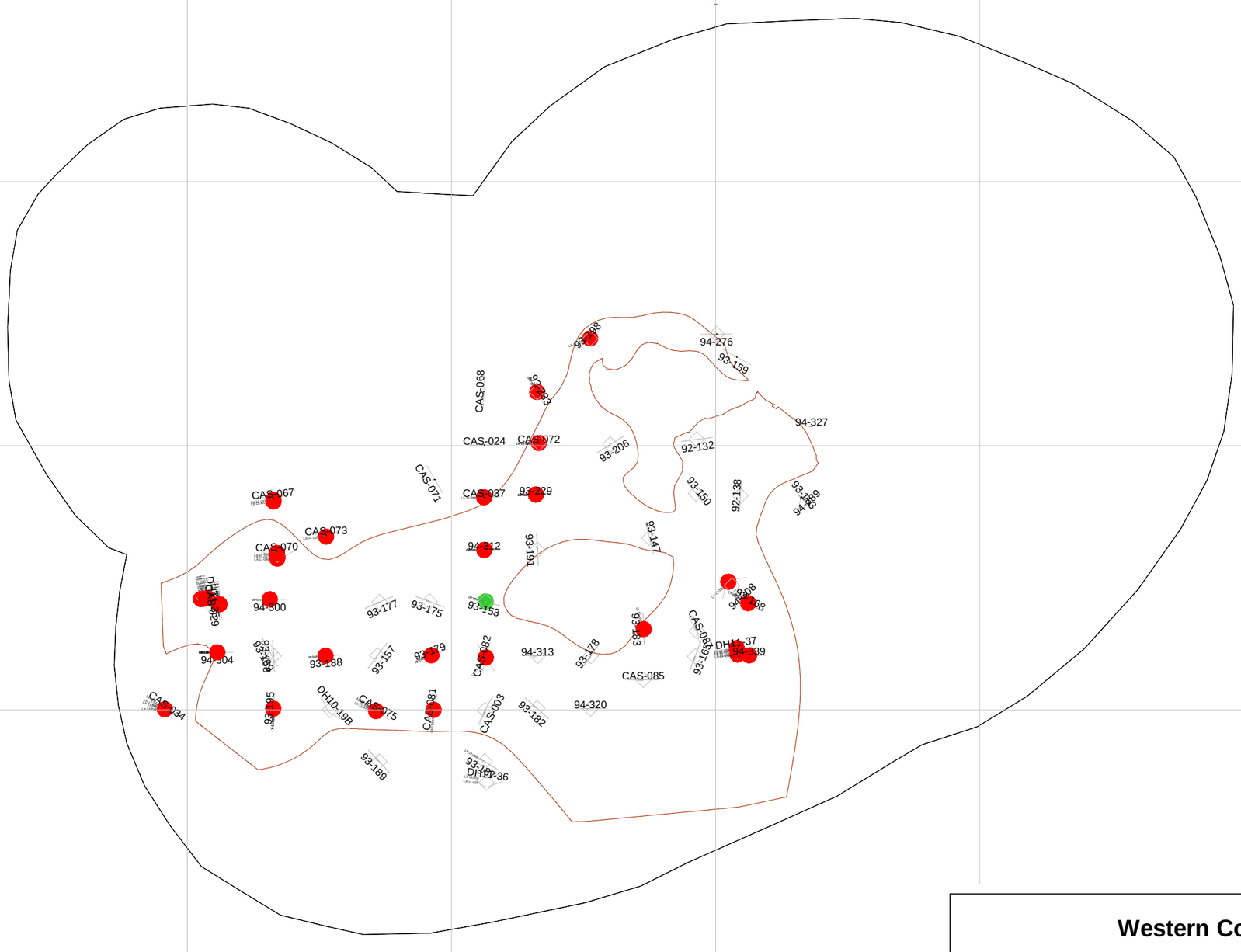
6957500 N

609500 E

610000 E

610500 E

611000 E



Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1305

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

93-198
94-276
93-233
CAS-072
93-206
92-132
93-229
93-150
92-138
CAS-070
94-312
93-191
93-147
94-300
93-177
93-175
93-153
93-168
93-183
CAS-083
DH 93-37
94-304
93-188
93-157
93-179
CAS-082
94-313
94-339
CAS-085
CAS-034
93-195
DH 93-19B
CAS-075
CAS-081
CAS-003
93-182
94-320
93-189
93-136

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1320

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

93-206

92-132

93-229

93-150

92-138

94-312

93-191

93-197

94-300

93-177

93-175

93-153

94-304

93-188

93-157

93-179

CAS-082

94-313

93-178

93-183

CAS-085

CAS-065

DH11-37

94-339

CAS-034

DH10-19B

CAS-075

CAS-081

CAS-003

93-182

94-320

93-189

DH11-36

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1335

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

93-206
92-132
92-138
92-150
93-191
93-147
94-300
93-177
93-175
93-153
94-304
93-188
93-157
93-179
CAS-082
94-313
93-178
93-183
CAS-085
DH11-37
94-339
93-165
CAS-034
93-195
DH10-198
CAS-075
CAS-081
CAS-003
93-192
94-320
DH11-36
93-189

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1350

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

92-132
93-150
93-147
93-153
93-175
93-179
93-157
93-183
93-178
94-313
CAS-082
CAS-085
94-339
94-320
CAS-003
CAS-081
CAS-075
93-182
93-195
93-189
DH11-36

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1365

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

92-132

93-150

93-147

93-175

93-179

93-195

93-183

93-178

94-313

94-320

93-182

93-189

93-187

CAS-082

CAS-081

CAS-075

CAS-003

CAS-085

DH11-36

DH11-37

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

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Casino Project, Yukon, Canada

LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1380

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

611500 E

92-132

93-147

93-183

CAS-083

93-165

94-313

93-178

CAS-082

CAS-085

CAS-075

CAS-081

CAS-003

93-182

94-320

DH11-36

93-189

93-181

Rinse pH within CAP

0 - 6.4	
6.4 - 7.1	
> 7.1	

Western Copper and Gold

Drawing Created By: H.Brown, Oct 10, 2012

Casino Project, Yukon, Canada

LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Plan Section 1395

6959500 N

6959000 N

6958500 N

6958000 N

6957500 N

609500 E

610000 E

610500 E

611000 E

94-313

93-178

93-183

CAS-085

93-165

CAS-082

CAS-081

CAS-075

CAS-003

93-182

94-320

DH 94-36

93-189

93-187

Rinse pH within CAP

0 - 6.4

6.4 - 7.1

> 7.1

Western Copper and Gold

Drawing Created By: H.Brown, Oct 10, 2012

Casino Project, Yukon, Canada

LORAX Environmental Services ARD sampling program

Plan Sections at 15m Intervals

UTM, Zone 9N

Appendix F3: HYP Correlations

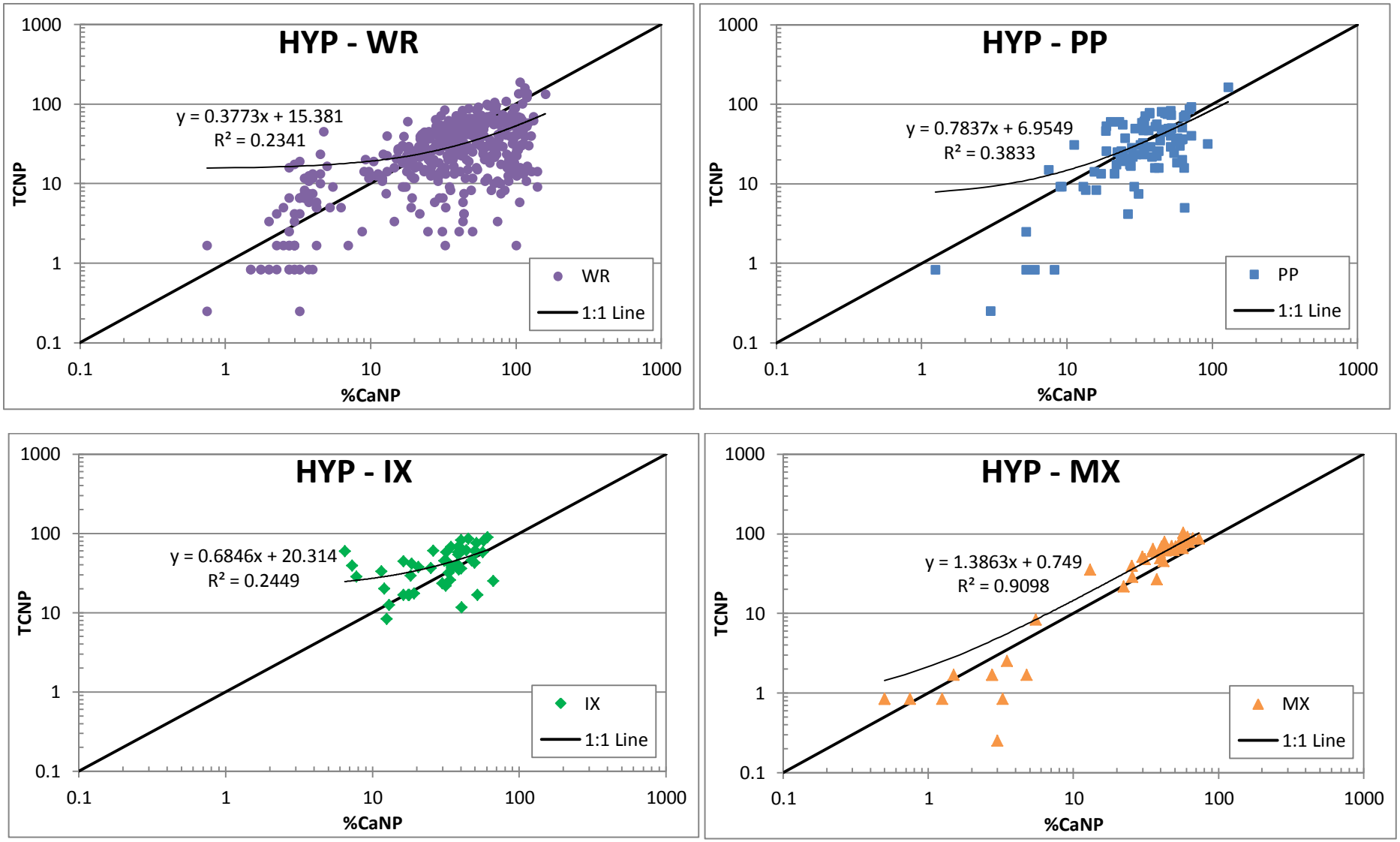


Figure F.3-1: **TCNP vs. %CaNP for the different lithological units in the HYP zone. The correlations were not strong enough to use for delineating neutral zones within the HYP. TCNP (total carbon neutralization potential) is calculated from the total carbon results, while %CaNP (Ca neutralization potential) is calculated from the assay data.**

Appendix G
Shake Flask Extraction Results

CASiNO
COPPER AND GOLD

Type	Lorax ID	Drill Hole	Interval		Class	Relog Lithology	2010 MET Zone	Relog Alteration 1	Relog Alteration 2	Volume Nanopure water	Sample Weight	pH	Redox	Conductivity	Acidity (to pH 4.5)	Total Acidity (to pH 8.3)	Alkalinity	Chloride	Fluoride	Bromide	Sulphate	Major Anions	Major Cations	Difference	Balance (%)	Hardness $CaCO_3$
			From (m)	To (m)						mL	g		mV	uS/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	meq/L	%	mg/L
Phase I	08-001	93-195	20.4	20.7	WASTE	WR	CAP	ARG	PHY	750	250	6.95	316.89	115.15	#N/A	2.37	7.57				29	0.756	0.951	-0.195	-0.114	3.1
Phase I	08-002	93-195	28.0	28.3	WASTE	WR	CAP	ARG	PHY	750	250	5.81	297.85	69.09	#N/A	6.61	2.26				15	0.358	0.548	-0.190	-0.210	<0.5
Phase I	08-005	93-195	250.0	250.3	WASTE	WR	SUS	PHY	ARG	750	250	3.9	366.21	308.95	21.17	109.5	#N/A				137	2.854	2.835	0.019	0.003	27
Phase I	08-006	94-320	50.0	50.3	WASTE	WR	CAP	ARG	PHY	750	250	6.33	236.32	54.41	#N/A	3.89	1.83				14	0.328	0.394	-0.066	-0.091	2.3
Phase I	08-009	94-304	10.0	10.3	WASTE	MX	CAP			750	250	6.54	302.24	105.64	#N/A	4	3.24				26	0.606	0.877	-0.271	-0.183	<0.5
Phase I	08-010	94-304	50.0	50.3	WASTE	MX	SOX	ARG	PHY	750	250	3.27	414	966	425	537.5	#N/A				521	10.854	10.415	0.439	0.021	55.5
Phase I	08-012	93-179	27.0	27.3	WASTE	WR	CAP	ARG	PHY	750	250	3.56	435	1904	750	1075	#N/A				1459	30.396	29.397	0.999	0.017	342
Phase I	08-013	93-179	100.0	100.3	WASTE	WR	CAP	PHY	ARG	750	250	3.38	405	2510	1550	2087.5	#N/A				2355	49.063	48.701	0.362	0.004	129
Phase I	08-014	93-179	182.0	182.3	ORE	WR	CAP	PHY	ARG	750	250	4.45	403.32	182.41	1.21	42.56	#N/A				62	1.292	1.484	-0.192	-0.069	23.4
Phase I	08-015	94-313	60.0	60.3	WASTE	PP	CAP	ARG	PHY	750	250	3.47	399	2100	1037.5	1462.5	#N/A				1638	34.125	33.496	0.629	0.009	159
Phase I	08-017	93-178	57.0	57.3	WASTE	WR	CAP	ARG	PHY	750	250	4.63	370.6	144.33	#N/A	21.72	<0.1				45	0.938	0.982	-0.045	-0.023	18.5
Phase I	08-018	93-178	82.6	82.9	WASTE	WR	CAP	ARG	PHY	750	250	4.85	343.26	65.79	#N/A	6.27	<0.1				15	0.313	0.409	-0.096	-0.133	3.4
Phase I	08-019	93-165	4.0	4.3	WASTE	WR	CAP	ARG	PHY	750	250	6.97	304.19	75.63	#N/A	4.01	5.69				13	0.385	0.633	-0.248	-0.244	8.2
Phase I	08-021	94-300	20.0	20.3	WASTE	PP	CAP	ARG	PHY	750	250	3.82	469.72	253.22	21.2	67.58	#N/A				93	1.938	1.932	0.006	0.002	22.3
Phase I	08-022	93-177	106.0	106.3	WASTE	MX	CAP	ARG	PHY	750	250	4.29	442.38	151.79	3.04	30.05	#N/A				49	1.021	1.189	-0.168	-0.076	11.6
Phase I	08-025	93-177	230.0	230.3	WASTE	MX	HYP	PHY		750	250	4.47	423.33	141	1.01	39.94	#N/A				50	1.042	1.161	-0.119	-0.054	13.2
Phase I	08-026	93-175	4.6	4.9	WASTE	PP	CAP	ARG	PHY	750	250	5.46	<1	57.84	#N/A	6.07	0.98				17	0.374	0.364	0.010	0.013	6.2
Phase I	08-027	93-153	30.0	30.3	WASTE	PP	CAP	ARG		750	250	6.88	394.53	2416.95	#N/A	4.59	9.04				1704	35.681	36.504	-0.823	-0.011	1800
Phase I	08-028	93-153	220.1	220.4	WASTE	WR	HYP	POT		750	250	8.08	356.44	183.89	#N/A	2.24	62.88				25	1.778	1.925	-0.147	-0.040	79.5
Phase I	08-029	93-168	72.0	72.3	WASTE	WR	CAP	ARG	PHY	750	250	4.33	473.14	177.43	4.5	29.64	#N/A				58	1.208	1.418	-0.210	-0.080	39.3
Phase I	08-032	94-307	38.7	39.0	WASTE	IX	SUS	ARG	POT	750	250	4.19	544.43	2754.24	11.42	258.5	#N/A				2248	46.833	47.676	-0.843	-0.009	2090
Phase I	08-034	94-312	14.0	14.3	WASTE	WR	CAP	ARG	PHY	750	250	4.64	459.96	157.56	#N/A	13.52	<0.1				61	1.271	1.322	-0.051	-0.020	32.6
Phase I	08-035	94-312	30.0	30.3	WASTE	WR	CAP	ARG	PHY	750	250	4.61	476.56	141.28	#N/A	8.34	<0.1				48	1.000	1.143	-0.143	-0.067	15
Phase I	08-036	94-312	52.0	52.3	WASTE	WR	CAP	PHY	ARG	750	250	3.63	512	1284	237.5	550	#N/A				1097	22.854	24.293	-1.439	-0.031	673
Phase I	08-037	93-191	15.6	15.9	WASTE	PP	CAP	ARG		750	250	5.38	485.83	153.73	#N/A	11.77	1.12				52	1.106	1.214	-0.108	-0.047	15
Phase I	08-040	93-191	383.1	383.4	WASTE	WR	HYP	POT	PHY	750	250	7.77	406.73	362.67	#N/A	3.51	58.03				108	3.411	3.953	-0.542	-0.074	150
Phase I	08-041	93-171	15.0	15.3	WASTE	WR	CAP	ARG	PHY	750	250	7.6	386.23	131.14	#N/A	2.63	22.32				18	0.821	1.147	-0.326	-0.166	5.5
Phase I	08-042	93-171	85.0	85.3	WASTE	WR	CAP	PHY	ARG	750	250	3.97	542.96	250.26	8.23	53.14	#N/A				89	1.854	1.954	-0.100	-0.026	28.6
Phase I	08-044	93-171	339.0	339.3	WASTE	WR	HYP	PHY		750	250	7.85	357.91	229.63	#N/A	3.16	70.97				33	2.107	2.302	-0.195	-0.044	97.2
Phase I	08-047	94-330	5.0	5.3	WASTE	MX	CAP	ARG	PHY	750	250	6.93	366.69	64.19	#N/A	2.89	3.19				18	0.439	0.488	-0.049	-0.053	8
Phase I	08-048	94-330	30.0	30.3	WASTE	MX	CAP	ARG	PHY	750	250	4.88	471.19	54.25	#N/A	6.79	0.14				12	0.253	0.316	-0.063	-0.111	7.5
Phase I	08-050	93-229	30.0	30.3	WASTE	PP	CAP	ARG	PHY	750	250	4.58	492.18	140.32	#N/A	9	<0.1				46	0.958	0.880	0.078	0.043	13.1
Phase I	08-053	94-289	15.0	15.3	WASTE	MX	CAP	ARG	PHY	750	250	5.4	292.96	43.27	#N/A	5.15	0.86				11	0.246	0.286	-0.039	-0.074	0.5
Phase I	08-054	93-224	25.0	25.3	WASTE	WR	CAP	ARG	PHY	750	250	4.53	375.97	114.77	#N/A	8.46	<0.1				39	0.813	0.742	0.071	0.046	5.2
Phase I	08-057	93-226	15.0	15.3	WASTE	WR	CAP	ARG	PHY	750	250	7.45	393.55	323.37	#N/A	3.2	17.21				96	2.344	2.752	-0.408	-0.080	4.6
Phase I	08-061	94-338	10.0	10.3	WASTE	WR	CAP	PHY	ARG	750	250	4.62	387.69	150.42	#N/A	12.49	<0.1				47	0.979	1.014	-0.035	-0.017	18.5
Phase I	08-062	94-338	75.0	75.3	WASTE	WR	SOX	PHY		750	250	7.77	384.76	261.21	#N/A	3.03	62.02				37	2.011	2.628	-0.617	-0.133	120
Phase I	08-065	93-206	301.0	301.3	WASTE	PP	HYP	POT	PHY	750	250	8.05	361.81	200.68	#N/A	2.43	74.08				21	1.919	2.019	-0.100	-0.025	83.5
Phase I	08-066	93-185	20.0	20.3	WASTE	IX	CAP	ARG	PHY	750	250	3.53	554.19	629.08	255.72	401.93	#N/A				394	8.208	8.030	0.178	0.011	41.8
Phase I	08-067	93-186	14.3	14.6	WASTE	WR	CAP	ARG	PHY	750	250	4.66	471.67	126.39	#N/A	15.82	<0.1				41	0.854	0.871	-0.017	-0.010	28.1
Phase I	08-071	93-221	94.0	94.3	WASTE	WR	HYP	PHY	POT	750	250	7.82	367.18	378.4	#N/A	5.07	82.12				87	3.455	3.764	-0.309	-0.043	92.4
Phase I	08-077	93-231	30.5	30.8	ORE	WR	CAP	ARG	PHY	750	250	6.74	368.65	59.15	#N/A	4.17	2.56				14	0.343	0.332	0.011	0.017	2.4
Phase I	08-078	93-250	3.1	3.4	ORE	IX	CAP	ARG	POT	750	250	6.85	360.83	45.22	#N/A	3.15	3.54				10	0.279	0.374	-0.095	-0.146	<0.5
Phase I	08-079	93-228	45.0	45.3	WASTE	PP	CAP	ARG	PHY	750	250	5.48	423.82	143.61	#N/A	5.05	1.14				52	1.106	1.031	0.075	0.035	8.6
Phase I	08-080	93-228	145.0	145.3	WASTE	PP	HYP	POT		750	250	5.92	430.17	101.67	#N/A	5.72	1.21				33	0.712	0.788	-0.076	-0.051	7.3
Phase I	08-081	93-245	32.6	32.9	WASTE	IX	CAP	ARG	POT	750	250	5.94	432.12	41.78	#N/A	4.48	1.13				10	0.231	0.304	-0.074	-0.137	3.4
Phase I	08-082	93-240	10.0	10.3	WASTE	PP	CAP	ARG	PHY	750	250	6.16	411.13	61.99	#N/A	2.93	1.43				22	0.487	0.473	0.014	0.015	1
Phase I	08-087	93-217	54.0	54.3	WASTE	WR	HYP	POT		750	250	7.8	374.51	146.68	#N/A	2.64	53.46				13	1.340	1.481	-0.141	-0.050	58.5
Phase I	08-089	94-259	50.0	50.3	WASTE	WR	HYP	PHY		750	250	8.19	356.93	334.44	#N/A	3.09	130.23				37	3.375	3.583	-0.208	-0.030	16
Phase I	08-091	94-259	190.0	190.3	WASTE	WR	HYP	PHY		750	250	7.65	372.07	455.17	#N/A	7.22	48.2				187	4.860	5.025	-0.165	-0.017	230
Phase I	08-093	93-230	30.5	30.8	WASTE	WR	CAP	ARG		750	250	7.26	362.79	68.05	#N/A	5.44	3.46				23	0.548	0.536	0.012	0.011	2.2
Phase I	08-095	93-241	10.0	10.3	ORE	WR	CAP			750	250	6.75	395.01	107.02	#N/A	6.07	5.65				29	0.717	0.975	-0.258	-0.152	1
Phase I	08-096	93-241	195.1	195.4	WASTE	PP	HYP	PHY	POT	750	250	7.7	410.15	543.49	#N/A	3.44	50.31				207	5.319	5.671	-0.352	-0.032	257
Phase I	08-097	93-148	29.6	29.9	ORE	WR	CAP	ARG	PHY	750	250	4.22	528.32	191.61	5.45	24.69	#N/A				75	1.563	1.438	0.125	0.042	32.1
Phase I	08-098	93-232	32.6	32.9	WASTE	PP	CAP	PHY	ARG	750	250	3.19	577.63	1301.18	413.44	625.38	#N/A				865	18.021	17.618	0.403	0.011	224
Phase I	08-099	93-162	10.0	10.3	WASTE	WR	CAP	ARG	PHY	750	250	4.68	456.54	85.86	#N/A	9.33	<0.1				25	0.521	0.523	-0.002	-0.002	12.4
Phase I	08-103	94-276	17.4	17.7	WASTE	IX	CAP	ARG	POT	750	250	5.47	472.16	81.83	#N/A	5.72	0.78				21	0.453	0.509	-0.056	-0.058	6.4
Phase I	08-104	93-205	15.8	16.1	WASTE	WR	CAP	ARG	POT	750	250	7.43	407.22	156.67	#N/A	2.68	22.2				38	1.236	1.442	-0.206	-0.077	12
Phase I	08-105	93-205	34.1	34.4	WASTE	WR	SUS	POT	PHY	750	250	7.88	391.6	229.33	#N/A	2.36	74.11				33	2.170	2.429	-0.259	-0.056	79
Phase I	08-113	94-262	170.0	170.3	WASTE	WR	HYP	POT		750	250	7.54	407.71	2394.52	#N/A	4.44	34.96				1760	37.366	32.678	4.688	0.067	1570
Phase I	08-114	93-247	13.4	13.7	ORE	WR	CAP	ARG	PHY	750	250	7.85	433.1	203.81	#N/A	2.39	52.03				30	1.666	2.200	-0.534	-0.138	37.7
Phase I										750	250	4.61	508.3	237.53	#N/A	45.63	<0.1				101	2.104	2.078	0.026	0.006	43.4
Phase I	08-115	93-243	35.0	35.3	WASTE	WR	CAP	ARG	PHY	750	250	3.77	598.63	596.74	90.11	220.87	#N/A				339	7.063	6.803	0.259	0.019	92.8
Phase I	08-117	93-238	10.0	10.3	WASTE	WR	CAP	ARG	PHY	750	250	4.82	537.1	72.24	#N/A	7.24	<0.1				18	0.375	0.486	-0.111	-0.129	7.2
Phase I	08-118	93-238	48.0	48.3	WASTE	WR	CAP	ARG	PHY	750	250	3.87	592.28	433.36	28.04	132.66	#N/A				210	4.375	4.527	-0.152	-0.017	73.4
Phase I	08-122	93-227	5.0	5.3	WASTE	WR	CAP	ARG	POT	750	250	5.31	508.3	73.93	#N/A	5.26	1.12				21	0.460	0.485	-0.025	-0.027	1.8
Phase I	08-124	94-256	5.0	5.3			OVB	ARG		750	250	7.43	420.89	110.86	#N/A	3.29	22.34				12	0.697	1.109	-0.413	-0.228	5.5
Phase I	08-128	94-274	39.9	40.2	ORE	IX	CAP	ARG		750	250	4.69	535.64	89.39	#N/A	7.65	<0.1				26	0.542	0.526	0.016	0.015	3.3
Phase I	08-129	93-186	41.8	42.1	WASTE	WR	SUS	PHY		750	250	7.36	436.03	257.58	#N/A	3.29	25.51				97	2.531	2.629	-0.098	-0.019	116

Type	Lorax ID	Drill Hole	Interval		Class	Relog Lithology	2010 MET Zone	Relog Alteration 1	Relog Alteration 2	Volume Nanopure water	Sample Weight	pH	Redox	Conductivity	Acidity (to pH 4.5)	Total Acidity (to pH 8.3)	Alkalinity	Chloride	Fluoride	Bromide	Sulphate	Major Anions	Major Cations	Difference	Balance (%)	Hardness $CaCO_3$
			From (m)	To (m)						mL	g		mV	uS/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	meq/L	meq/L	meq/L	%	mg/L
Phase II	08-132	93-189	25.0	27.0	WASTE	WR	CAP	ARG	PHY	750	250	3.39	434.08	1421.88	376.54	647.66	#N/A	< 3	0.27	< 0.3	1159	24.146	21.384	2.762	0.061	524
Phase II	08-135	93-187	34.1	36.1	WASTE	WR	CAP	ARG	PHY	750	250	5.18	358.39	62.11	#N/A	7.57	1.68	1.8	< 0.06	< 0.3	19	0.480	0.507	-0.026	-0.027	1.6
Phase II	08-138	94-304	26.5	28.5	WASTE	MX	CAP	ARG		750	250	4.55	400.39	121.35	#N/A	14.87	<0.1	1.4	0.07	< 0.3	46	0.998	0.849	0.149	0.081	6.2
Phase II	08-147	93-158	28.0	30.0	ORE	WR	CAP	ARG		750	250	5.55	311.03	71.93	#N/A	6.9	1.84	3.4	0.14	< 0.3	21	0.577	0.646	-0.068	-0.056	1.8
Phase II	08-164	93-165	44.8	46.8	WASTE	WR	CAP	ARG	PHY	750	250	6.82	266.11	124.56	#N/A	5.44	11.3	2.9	0.2	< 0.3	19	0.714	1.271	-0.557	-0.281	2.3
Phase II	08-183	93-153	15.1	17.1	WASTE	PP	CAP	ARG		750	250	7.35	307.61	1517.07	#N/A	6.07	43.93	<3	1.04	< 0.3	1013	22.038	21.555	0.482	0.011	1030
Phase II	08-192	94-308	26.5	28.5	WASTE	WR	CAP	ARG		750	250	5.42	293.94	189.61	#N/A	18.76	4.46	2.6	0.35	< 0.3	67	1.577	1.826	-0.249	-0.073	19.7
Phase II	08-193	94-308	96.0	98.0	WASTE	IX	CAP	ARG	PHY	750	250	6.34	221.67	101.6	#N/A	8.56	6.05	2.2	0.24	< 0.3	22	0.654	1.039	-0.385	-0.227	0.9
Phase II	08-195	93-168	60.0	62.0	WASTE	WR	CAP	ARG	PHY	750	250	5.35	301.26	76.24	#N/A	5.04	1.28	3.5	< 0.06	< 0.3	22	0.583	0.598	-0.015	-0.013	4.7
Phase II	08-204	93-229	12.8	14.8	WASTE	PP	CAP	ARG	PHY	750	250	5.65	266.11	125.59	#N/A	4.18	1.78	3.4	< 0.06	< 0.3	44	1.048	0.854	0.194	0.102	5.1
Phase II	08-223	93-163	11.3	13.3	WASTE	MX	CAP	ARG	PHY	750	250	5.23	304.19	55.11	#N/A	4.72	1.47	1.2	0.06	< 0.3	12	0.316	0.414	-0.098	-0.134	2.8
Phase II	08-230	93-224	12.2	14.2	WASTE	WR	CAP	ARG	PHY	750	250	5.91	273.92	74	#N/A	3.93	2.44	3.9	< 0.06	< 0.3	25	0.679	0.616	0.063	0.049	< 0.5
Phase II	08-241	94-338	21.8	23.8	WASTE	WR	CAP	PHY	ARG	750	250	4.1	401.36	224.53	4.05	30.54	#N/A	0.6	0.12	< 0.3	89	1.877	2.011	-0.134	-0.034	62.8
Phase II	08-249	93-231	39.6	41.6	ORE	WR	CAP	ARG	PHY	750	250	4.08	371.09	133.6	5.14	19.73	#N/A	1.7	0.32	< 0.3	41	0.919	0.751	0.167	0.100	9.4
Phase II	08-253	93-250	17.1	19.1	ORE	IX	CAP	ARG	POT	750	250	5.13	285.64	85.69	#N/A	4.33	1.21	1.9	< 0.06	< 0.3	24	0.578	0.685	-0.108	-0.085	2.2
Phase II	08-263	93-245	11.3	13.3	WASTE	IX	CAP	ARG	POT	750	250	5.58	305.17	54.33	#N/A	4.26	2.8	2.2	< 0.06	< 0.3	10	0.326	0.486	-0.160	-0.197	3.7
Phase II	08-267	93-240	5.2	7.2	WASTE	PP	CAP	ARG	PHY	750	250	6.24	291.99	132.43	#N/A	3.39	2.99	3.7	0.27	< 0.3	42	1.053	1.137	-0.083	-0.038	7.8
Phase II	08-268	93-240	26.5	28.5	WASTE	PP	CAP	ARG	PHY	750	250	5.52	301.75	112.54	#N/A	5.12	1.21	0.8	< 0.06	< 0.3	44	0.963	0.901	0.062	0.033	12.6
Phase II	08-297	93-248	14.3	16.3	ORE	WR	CAP	ARG		750	250	5.96	265.62	87.22	#N/A	5.04	2.91	4.8	< 0.06	< 0.3	22	0.652	0.661	-0.010	-0.007	2.7
Phase II	08-298	93-248	20.4	22.4	ORE	WR	CAP	ARG		750	250	5.77	292.96	122.53	#N/A	4.55	1.52	4.4	0.07	< 0.3	41	1.012	0.951	0.061	0.031	1.1
Phase II	08-315	93-239	32.6	34.6	ORE	WR	CAP	ARG		750	250	5.59	318.35	128.8	#N/A	4.35	1.14	4.1	< 0.06	< 0.3	48	1.138	1.074	0.064	0.029	< 0.5
Phase II	08-323	93-243	54.9	56.9	WASTE	WR	SOX	PHY	ARG	750	250	3.97	421.38	460.27	10.63	180.66	#N/A	2.7	0.23	< 0.3	241	5.109	4.901	0.208	0.021	38.4
Phase II	08-350	94-284	44.5	46.5	ORE	WR	SOX	ARG	POT	750	250	7.65	183.59	101.27	#N/A	3.84	20.97	5.3	1	< 0.3	20	1.038	1.006	0.032	0.016	2.2
Phase II	08-355	93-235	43.9	45.9	WASTE	WR	CAP	ARG	POT	750	250	6.16	263.18	64.09	#N/A	4.67	3.77	3.5	< 0.06	< 0.3	13	0.445	0.593	-0.148	-0.143	2.9
Phase II	08-374	94-256	17.4	19.4	WASTE	WR	CAP	ARG		750	250	6.81	253.41	132.23	#N/A	4.3	14.95	2.5	0.24	< 0.3	30	1.007	1.370	-0.363	-0.153	20.8
Phase II	08-386	94-260	35.0	37.0	WASTE	WR	SOX	ARG	PHY	750	250	7.08	251.46	121.94	#N/A	3.43	9.3	5.9	1.01	< 0.3	31	1.051	1.176	-0.125	-0.056	4.7
Phase II	08-389	93-213	29.6	31.6	ORE	WR	SUS	ARG	POT	750	250	7.08	260.25	90.34	#N/A	3.04	10.42	3.4	1.95	< 0.3	18	0.782	0.938	-0.156	-0.091	0.5
Phase II	08-392	93-213	57.0	59.0	WASTE	WR	SUS	ARG	POT	750	250	5.2	356.44	148	#N/A	22.64	1.1	4.3	1.92	< 0.3	52	1.328	1.556	-0.228	-0.079	7
Phase II	08-400	93-219	23.5	25.5	WASTE	WR	OVB	ARG	POT	750	250	7.4	348.14	110.81	#N/A	4.27	28.95	0.5	0.67	< 0.3	20	1.045	1.196	-0.151	-0.067	3
Phase II	08-411	94-251	22.0	24.0	WASTE	WR	CAP	ARG		750	250	6.86	367.18	232.8	#N/A	4.1	10.48	4.2	0.21	< 0.3	86	2.131	3.053	-0.923	-0.178	17
Phase II	08-418	94-254	4.9	6.9	WASTE	WR	CAP	ARG	POT	750	250	7.64	335.93	181.59	#N/A	3.45	48.37	3	0.46	< 0.3	29	1.680	1.936	-0.256	-0.071	6.2
Phase II	08-423	94-336	11.1	13.1	WASTE	WR	CAP	ARG		750	250	7.24	352.05	67.57	#N/A	3.37	17.03	2.2	0.33	< 0.3	6	0.545	0.735	-0.190	-0.148	5.2
Phase II	08-427	94-335	9.8	11.8	WASTE	WR	CAP	ARG		750	250	7.33	352.05	102.92	#N/A	3.37	20.92	1.9	1	< 0.3	24	1.025	1.000	0.025	0.012	2.8
Phase II	08-428	94-335	18.9	20.9	WASTE	WR	CAP	ARG		750	250	6.65	373.04	241.56	#N/A	3.67	4.15	3.1	0.07	< 0.3	95	2.153	3.181	-1.028	-0.193	10.3
Phase II	08-434	93-234	14.4	16.4	WASTE	WR	CAP	ARG		750	250	6.82	353.02	159.78	#N/A	3.04	6.1	3.5	0.09	< 0.3	62	1.517	1.462	0.055	0.018	1.1

D-Al mg/L	D-Sb mg/L	D-As mg/L	D-Ba mg/L	D-Be mg/L	D-Bi mg/L	D-B mg/L	D-Cd mg/L	D-Ca mg/L	D-Cr mg/L	D-Co mg/L	D-Cu mg/L	D-Fe mg/L	D-Pb mg/L	D-Li mg/L	D-Mg mg/L	D-Mn mg/L	D-Hg ug/L	D-Mo mg/L	D-Ni mg/L	D-P mg/L	D-K mg/L	D-Se mg/L	D-Si mg/L	D-Ag mg/L	D-Na mg/L	D-Sr mg/L	D-S mg/L	D-Tl mg/L	D-Sn mg/L	D-Ti mg/L	D-U mg/L	D-V mg/L	D-Zn mg/L	D-Zr mg/L
0.151	0.00073	0.00062	0.0418	<0.00001	0.000038	<0.05	0.000022	1.05	0.0016	0.000319	0.0127	0.366	0.000604	0.0016	0.11	0.0155	0.03	0.00818	0.00144	0.007	3.15	0.00223	4.22	0.000127	18.6	0.0074	10	0.000018	0.00004	0.0033	0.000329	0.0003	0.0043	0.0071
0.496	0.00063	0.00087	0.0168	<0.00001	0.000049	<0.05	0.000016	0.12	0.0033	0.000076	0.035	0.792	0.000642	0.0027	<0.05	0.00296	0.05	0.00174	0.00063	0.008	2.31	0.00193	2.09	0.000145	11.1	0.0009	5	0.000027	0.00005	0.003	0.000856	<0.0002	0.0036	0.0096
10.6	0.0012	0.0007	0.0187	0.00199	<0.00003	<0.3	0.0235	8.8	0.0022	0.0316	25.2	3.05	0.00053	0.007	1.23	0.252	<0.05	<0.0003	0.0123	0.048	2.02	0.0021	0.571	0.00014	1.68	0.0322	42	0.00007	0.00025	<0.003	0.0683	<0.001	0.831	<0.0005
0.188	0.00074	0.0008	0.0435	<0.00001	0.000083	<0.05	0.00002	0.63	0.001	0.000195	0.119	0.216	0.00148	0.0024	0.17	0.00836	0.03	0.00315	0.00155	0.008	2.12	0.00705	2	0.000901	6.77	0.00482	5	0.000037	0.00025	0.0117	0.000656	0.0002	0.004	0.002
0.406	0.00402	0.00592	0.00224	0.00002	0.000119	<0.05	0.00008	0.15	0.0166	0.000038	0.0661	0.455	0.000889	0.0019	<0.05	0.00081	0.02	0.285	0.0004	0.018	0.86	0.00199	2.9	0.000116	19.5	0.00098	10	0.000021	0.00003	0.0062	0.000762	0.0005	0.0016	0.0379
71.4	0.00009	0.00779	0.0157	0.00433	<0.000005	<0.05	0.00192	11.8	0.0259	0.0752	0.924	7.55	0.000822	0.0266	6.33	0.667	0.01	0.00078	0.0739	0.016	7.18	0.00854	1.71	0.000031	4.98	0.0233	178	0.000081	0.00015	0.0007	0.0107	0.0015	0.211	0.0018
190	0.0015	0.0012	0.0142	0.00422	<0.00003	<0.3	0.00192	104	0.0123	0.111	0.255	1.58	0.0231	0.028	20.2	4.48	<0.05	0.0241	0.0896	0.511	1.92	0.0086	1.49	0.00033	19.8	0.376	494	0.00007	0.00009	0.006	0.011	0.002	0.312	0.0115
397	0.0006	0.0092	0.0135	0.0036	<0.00005	<0.5	0.00181	15.5	0.092	0.472	0.764	5.72	0.0145	0.014	21.9	0.989	<0.1	0.0682	0.121	0.101	2.48	0.0038	<1	0.00019	28.2	0.0658	822	0.00013	0.0001	0.007	0.00918	0.019	0.82	0.023
1.3	0.0019	0.0018	0.0507	0.00015	<0.00003	<0.3	0.00075	7.84	0.0012	0.0238	19.3	0.515	0.00077	<0.003	0.93	0.263	<0.05	0.046	0.0097	0.099	5.02	0.0048	<0.5	<0.00003	3.11	0.044	22	0.00027	<0.00005	<0.003	0.0152	0.001	0.132	<0.0005
250	0.001	0.0092	0.0056	0.00998	<0.00003	<0.3	0.00479	30.2	0.0836	0.209	5.67	5.15	0.0025	0.041	20.3	1.22	<0.05	0.0013	0.129	0.046	1.96	0.0044	2.95	0.00016	37.3	0.0232	578	0.00003	0.00009	<0.003	0.0396	0.006	0.988	0.0415
2.25	<0.00002	0.00021	0.0485	0.00061	<0.000005	<0.05	0.000723	4.56	0.0006	0.0152	0.592	0.79	0.000708	0.0044	1.73	0.399	0.01	<0.00005	0.00324	0.008	8.48	0.00211	1.48	0.000028	3.34	0.0229	17	0.000281	0.00002	<0.0005	0.00669	0.0003	0.0596	<0.0001
0.193	0.00011	0.00012	0.0709	0.0001	<0.000005	<0.05	0.000115	0.92	0.0003	0.00123	0.0645	0.137	0.000441	0.006	0.26	0.0477	0.01	0.00007	0.00094	0.012	8.81	0.00205	2.17	0.000026	2.67	0.00792	6	0.000143	<0.00001	<0.0005	0.000432	<0.0002	0.0101	0.0003
0.175	0.00214	0.00087	0.0461	<0.00001	0.000049	<0.05	0.000039	2.36	0.001	0.000173	0.0184	0.101	0.002	0.0017	0.55	0.039	0.06	0.00136	0.00234	0.008	7.67	0.00061	2.78	0.000101	6.29	0.0171	6	0.000045	0.00002	0.0026	0.000492	0.0005	0.009	0.0165
8.57	0.00033	0.00062	0.0334	0.00142	0.00002	<0.05	0.000801	3	0.0377	0.0353	0.561	1.48	0.000433	0.0193	3.61	0.255	0.03	0.00572	0.028	0.006	7.29	0.00169	2.79	0.000068	6.13	0.0438	33	0.000439	0.00005	0.0009	0.00273	0.0004	0.153	0.0021
3.16	0.00045	0.00035	0.0238	0.00018	<0.000005	<0.05	0.000351	2.43	0.0023	0.00595	0.0797	1.04	0.000365	0.0028	1.34	0.174	<0.01	0.0383	0.00493	0.008	8.66	0.00061	1.61	0.000041	7.57	0.0242	18	0.000208	<0.00001	0.0011	0.00171	0.0007	0.0383	0.0158
2.78	0.0005	0.0007	0.0579	0.00091	<0.00003	<0.3	0.00041	4.25	0.0007	0.0123	12.6	0.745	0.00042	0.012	0.62	0.0951	<0.05	0.0012	0.0298	0.025	3.71	0.0008	1.08	0.00004	2.23	0.0261	19	0.00035	<0.00005	0.003	0.011	0.002	0.0844	<0.0005
0.225	0.00013	0.00046	0.0373	0.00012	<0.000005	<0.05	0.000238	1.97	0.0003	0.00107	0.186	0.113	0.000211	0.0054	0.32	0.0715	0.01	0.00191	0.0015	0.003	5.5	0.00026	2.91	0.000015	2.27	0.0102	7	0.000249	0.00003	<0.0005	0.00057	0.0003	0.0391	<0.0001
0.059	0.0002	0.0007	0.0117	0.00007	<0.00003	<0.3	0.00355	618	<0.0005	0.0609	0.255	0.012	0.00022	<0.003	62.8	2.46	<0.05	0.0048	0.0169	<0.01	7.66	0.0054	1.05	<0.00003	6.92	0.5	631	0.00018	0.00015	0.004	0.00096	<0.001	0.021	<0.0005
0.0754	0.00077	0.00148	0.0166	<0.00001	<0.000005	<0.05	0.00001	26.5	0.0002	0.000047	0.00241	0.008	0.000199	0.0016	3.24	0.00475	<0.01	0.00682	0.00037	0.003	8.37	0.00126	2.75	<0.000005	2.81	0.0674	10	0.000027	0.00002	0.0008	0.0114	0.0006	0.0025	<0.0001
3.71	0.00025	0.00059	0.0513	0.00022	<0.000005	<0.05	0.000461	13.7	0.0022	0.0166	0.124	0.807	0.00102	0.0033	1.27	0.21	<0.01	0.00007	0.00377	0.004	5.02	0.00685	1.07	0.000022	2.05	0.0461	25	0.000121	0.00002	0.0011	0.002	<0.0002	0.086	0.0001
30.6	<0.0001	0.0015	0.0231	0.0109	<0.00003	<0.3	0.00803	540	0.0016	0.33	47.6	1.69	0.00056	0.016	179	7.68	0.09	0.0007	0.186	0.119	5.69	0.0044	1.98	0.00004	11.9	0.315	805	0.00042	<0.00005	0.006	0.0409	<0.001	0.459	0.0005
0.724	<0.00002	0.00029	0.00115	0.00024	<0.000005	<0.05	0.000178	8.46	0.0014	0.00969	0.202	0.056	0.000014	0.0046	2.79	0.127	0.02	0.00025	0.00623	0.014	4.27	0.00056	3.44	<0.000005	12.9	0.00377	23	0.000026	<0.00001	<0.0005	0.000744	0.0002	0.027	<0.0001
0.23	<0.00002	0.00016	0.00461	0.00025	<0.000005	<0.05	0.000042	4.23	0.0014	0.00311	0.217	0.085	0.000029	0.0071	1.08	0.0401	0.02	<0.00005	0.00167	0.004	8.64	0.00144	3.47	0.000006	14.3	0.00271	20	0.000203	<0.00001	<0.0005	0.000799	0.0003	0.0061	<0.0001
87.4	0.00005	0.00095	0.00683	0.00628	<0.000005	<0.05	0.00157	15.1	0.014	0.284	9.84	6.26	0.000371	0.0547	154	1.57	0.02	<0.00005	0.111	0.015	1.46	0.00501	2.99	0.000008	4.1	0.0184	403	0.000198	0.00001	0.001	0.0362	0.0007	0.445	0.0015
1.12	0.00002	0.00005	0.00132	0.00027	<0.000005	<0.05	0.000045	4.24	0.0002	0.025	0.136	0.022	0.000437	0.0051	1.08	0.0455	0.04	0.00011	0.002	0.015	3.99	0.00071	3.36	0.000017	15.8	0.00554	21	0.000078	<0.00001	<0.0005	0.000256	<0.0002	0.0118	<0.0001
0.0192	0.00073	0.00143	0.0144	<0.00001	0.000024	<0.05	0.000273	48.2	0.0004	0.000559	0.0154	0.013	0.00071	0.0022	7.33	0.0193	<0.01	0.0355	0.0052	0.008	5.48	0.00097	1.63	0.000107	18.5	0.597	45	0.000008	<0.00001	0.0007	0.00846	<0.0002	0.0008	0.0037
0.046	0.0009	0.0086	0.0406	<0.00005	<0.00003	<0.3	<0.00003	1.97	0.0035	0.00049	0.027	0.974	0.00431	<0.003	0.14	0.0647	<0.05	0.0036	0.0086	0.22	1.98	0.0106	3.29	0.00005	22.7	0.0101	6	<0.00001	0.00021	0.007	0.0001	0.003	0.009	0.0156
3.51	0.0046	0.001	0.0466	0.00054	<0.00003	<0.3	0.00073	8.62	0.0022	0.0319	13.4	1.8	0.0138	0.005	1.72	0.388	<0.05	0.0011	0.0206	0.023	7.46	0.151	0.837	0.00003	6.51	0.0442	31	0.00034	<0.00005	0.004	0.00773	<0.001	0.106	0.0019
0.0459	0.00059	0.001	0.0117	<0.00001	0.000011	<0.05	0.000012	29.3	<0.0001	0.000013	0.00217	0.001	0.000116	0.0037	5.84	0.0115	<0.01	0.00415	0.00022	0.005	5.73	0.00054	1.5	0.000013	4.9	0.42	14	0.000017	0.00005	<0.0005	0.000416	0.0003	0.0002	<0.0001
0.0356	0.0275	0.00018	0.042	<0.00001	0.000008	<0.05	0.000019	2.15	0.0002	0.000967	0.00747	0.031	0.000346	0.0024	0.64	0.0182	0.02	0.00092	0.00088	0.005	4.81	0.00217	4.36	0.000012	4.71	0.0112	6	0.000027	0.00004	0.0006	0.000057	<0.0002	0.002	<0.0001
0.132	0.00124	0.00018	0.102	0.00003	<0.000005	<0.05	0.000073	2.57	0.0003	0.000675	0.0355	0.059	0.000368	0.0055	0.26	0.023	<0.01	0.00081	0.00051	<0.002	3.79	0.00403	1.97	0.000011	1.6	0.00805	5	0.000071	0.00001	<0.0005	0.000205	<0.0002	0.0092	<0.0001
0.122	<0.00002	0.00003	0.00088	0.00032	<0.000005	<0.05	0.000033	3.44	<0.0001	0.00269	0.118	0.004	0.000928	0.0079	1.09	0.0276	<0.01	<0.00005	0.00285	0.002	4.14	0.00085	3.54	0.000006	11.4	0.00268	16	0.000114	0.00002	<0.0005	0.000655	<0.0002	0.0047	<0.0001
0.123	0.0005	0.00349	0.0226	0.00003	0.000005	<0.05	0.000006	0.21	0.0003	0.000082	0.0678	0.062	0.000088	0.0028	<0.05	0.00265	0.02	0.00025	0.0004	0.038	2.19	0.00123	1.23	0.000031	5.04	0.00172	4	0.000059	<0.00001	<0.0005	0.000451	<0.0002	0.0018	0.0001
0.345	0.00017	0.00023	0.0057	0.00012	<0.000005	<0.05	0.000037	1.23	0.0006	0.00108	0.0483	0.086	0.000077	0.0035	0.52	0.0253	<0.01	<0.00005	0.0006	0.004	2.01	0.00172	2.6	<0.000005	12.6	0.00386	13	0.000079	<0.00001	<0.0005	0.000887	<0.0002	0.0095	<0.0001
0.202	0.0453	0.0191	0.00787	<0.00001	0.000402	<0.05	0.000127	1.49	0.0014	0.00224	0.0363	0.099	0.00114	0.0022	0.21	0.00829	0.06	0.108	0.00629	0.227	2.35	0.0957	5.56	0.000411	59.8	0.0346	36	0.000013	0.00008	0.002	0.00027	0.0013	0.0033	0.0019
0.813	0.00348	0.00151	0.0434	0.00011	0.000006	<0.05	0.000146	5.48	0.0021	0.00305	0.117	0.433	0.00616	0.0058	1.18	0.189	0.03	0.00007	0.00238	<0.002	2.37	0.00916	1.35	0.000013	13.4	0.0243	18	0.00004	<0.00001	<0.0005	0.00057	<0.0002	0.0282	0.0029
0.0106	0.0114	0.00015	0.00847	<0.00001	<0.000005	<0.05	0.000013	35	<0.0001	0.000467	0.00288	<0.001	0.000016	0.0006	7.95	0.0942	<0.01	0.00476	0.00042	0.003	3.9	0.00138	0.649	<0.000005	2.94	0.0833	14	0.000034	<0.00001	<0.0005	0.00424	<0.0002	0.0005	<0.0001
0.0235	0.00047	0.00139	0.0066	<0.00001	0.000005	<0.05	<0.000005	25.8	<0.0001	0.00003	0.00337	0.027	0.000027	0.0012	4.62	0.00749	<0.01	0.00312	0.0002	<0.002	3.91	0.00065	1.91	<0.000005	5.78	0.372	9	0.000007	<0.00001	<0.0005	0.00616	<0.0002	0.0004	<0.0001
61.3	0.0006	0.0016	0.0163	0.00068	<0.00003	<0.3	0.00073	9.63	0.025	0.207	0.626	1.49	0.00049	0.013	4.32	0.268	<0.05	0.132	0.0397	0.011	3.32	0.0069	0.546	<0.00003	5.01	0.0427	137	0.00002	<0.00005	0.004	0.00458	0.005	0.111	0.0027
0.298	0.00011	0.00012	0.0414	0.00014	<0.000005	<0.05	0.000476	8.35	0.0001	0.0172	2.32	0.007	0.000097	0.0048	1.76	0.164	0.02	0.0004	0.00556	0.004	3.99	0.00325	4.92	0.000008	3.09	0.0394	14	0.000139	<0.00001	<0.0005	0.000871	<0.0002	0.0456	<0.0001
0.037	0.00331	0.00861	0.00707	<0.00001	0.000006	<0.05	0.000036	26.8	0.0005	0.00125	0.0166	0.013	0.000208	0.0024	6.18	0.0102	<0.01	0.00681	0.00589	0.005	9.39	0.00212	1.27	0.000008	38.6	0.302	34	0.000024	0.00001	0.0008	0.0698	0.0013	0.001	0.0008
0.0225	0.00019	0.00017	0.0667	0.00002	<0.000005	<0.05	0.000068	0.65	0.0008	0.00037	0.0237	0.026	0.00003	0.0027	0.19	0.012	0.04	0.0304	0.00036	<0.002	4.15	0.00034	0.836	<0.000005	4.08	0.00379	7	0.000091	<0.00001	<0.0005	0.000128	<0.0002	0.0052	<0.0001
0.0434	0.00015	0.00047	0.00099	<0.00001	<0.000005	<0.05	0.000015	0.13	0.0003	0.000282	0.0236	0.071	0.000056	0.0007	<0.05	0.00158	0.04	0.0255	0.00065	0.11	0.26	0.00085	4.47	0.000019	8.31	0.00061	4	<0.000002	0.00002	0.0005	0.000372	0.0004	0.0012	0.0001
0.0223	0.00007	0.0001	0.0173	0.00002	<0.000005	<0.05	0.000057	1.86	<0.0001	0.00212	0.329	0.023	0.000048	0.0013	0.96	0.0453	0.03	0.0218	0.00267	0.021	2.33	0.00084	4.02	0.000011	18.4	0.0388	18	0.000093	<0.00001	<0.0005	0.000161	0.0002	0.0068	<0.0001
0.0733	0.00047	0.00196	0.0259	0.00004	<0.000005	<0.05	0.000103	2.2	0.0009	0.00198	1.51	0.009	0.000024	0.0029	0.43	0.0295	<0.01	0.0149	0.00116	0.084	3.05	0.00129	0.889	<0.000005	11.9	0.0171	12	0.000044	0.00005	<0.0005	0.000358	0.0006	0.0089	<0.0001
0.0274	0.00011	0.00022	0.00614	0.00002	<0.000005	<0.05	0.000013	0.92	<0.0001	0.000296	0.0564	0.006	0.000027	0.0011	0.27	0.0047	0.01	0.0034	0.00059	0.117	1.66	0.00043	4.55	<0.000005	4.46	0.0116	4	0.000061	0.00002	<0.0005	0.000331	<0.0002	0.0015	<0.0001
0.0417	0.00004	0.00015	0.00064	0.00001	<0.000005	<0.05	<0.000005	0.19	0.0001	0.000033	0.0195	0.016	0.000025	0.0008	0.13	0.00148	0.05	0.00376	0.00021	0.01	1.31	0.00056	1.69	<0.000005	9.64	0.00161	7	0.000007	0.00002	<0.0005	0.000181	<0.0002	0.0014	<0.0001
0.0326	0.0141	0.00099	0.00905	<0.00001	<0.000005	<0.05	0.000044	19.5	<0.0001	0.000168	0.0116	0.004	0.000166	0.0007	2.37	0.0552	<0.01	0.0183	0.00099	0.003	4.29	0.00417	0.885	<0.000005	4.68	0.0767	6	0.000015	0.00001	<0.0005	0.00179	<0.0002	0.0005	<0.0001
0.209	0.0057	0.00627	0.0018	0.00002	<0.000005	<0.05	0.000008	5.5	0.0004	0.000117	0.0162	0.125	0.000293	0.0014	0.56	0.00191	0.02	0.00562	0.00084	0.01	4.31	0.00107	2.43	0.000034	72.5	0.0398	15	0.000019	<0.00001	0.0008	0.0875	0.004	0.0027	<0.0001
0.0279	0.0101	0.02	0.012	<0.00001	<0.000005	<0.05	0.000022	69.9	<0.0001	0.000505	0.00711	0.003	0.000065	0.0012	13.4	0.0315	0.02	0.0138	0.0102	<0.002	6.35	0.00263	0.895	<0.000005	6.24	0.372	71	0.000158	<0.00001	0.0007	0.00607	0.0004	0.0013	<0.0001
0.0246	0.00006	0.00016	0.00384	0.00001	0.00001	<0.05	0.000055	0.65	<0.0001	0.000363	0.0432	0.031	0.000393	0.0015	0.14	0.0103	0.09	0.00006	0.00086	0.003	2.08	0.00024	1.77	0.000137	10.1	0.00633	9	0.000075	<0.00001	<0.0005	0.000056	0.0002	0.0085	<0.0001
0.658	0.0004	0.0015	0.0068	<0.00005	<0.00003	<0.3	0.00044	0.24	0.0006	0.00257	0.149	0.292	0.00057	<0.003	0.11	0.0028	<0.05	0.872	0.0021	0.035	0.93	0.003	2.76	0.00009	21.4	0.0027	10	0.00002	0.00045	0.005	0.00237	0.005	0.0085	0.0006
0.0144	0.00484	0.00024	0.0254	<0.00001	<0.000005	<0.05	0.000057	84.6	<0.0001	0.000932	0.008	0.005	0.000077	0.0025	11.2	0.1	0.01	0.0937	0.00506	0.004	6.84	0.00118	1.25	0.00001	8.11	0.732	73	0.000041	0.00003	<0.0005	0.0169	<0.0002	0.0008	<0.0001
2.05	0.00003	0.0001	0.0292	0.00041	<0.000005	<0.05	0.000221	7.01	0.0004	0.0175	0.659	0.224	0.00111	0.0032	3.54	0.161	0.18	0.00007	0.0096	0.005	6.55	0.0005	3.14	0.000213	6.95	0.0598	23	0.000512	0.00003	<0.0005	0.00354	0.0003	0.0219	0.0002
92.9	<0.0001	0.0015	0.0026	0.00311	0.00003	<0.3	0.00185	16.2	0.0141	0.429	7.84	2.31	0.00096	0.014	44.7	2.32	<0.05	<0.0003	0.24	<0.01	3.01	0.0095	2.51	0.00018	37.5	0.0157	264	0.00129	0.00014	<0.003	0.0514	0.004	0.465	0.0042
0.213	<0.00002	0.00006	0.0363	0.00007	<0.000005	<0.05	0.000108	2.76	0.0002	0.00336	0.0464	0.096	0.000955	0.0056	1.35	0.0677	0.02	<0.00005	0.0014	<0.002	7.95	0.00042	2.45	0.000011	1.63	0.0162	9	0.000247	0.00001	<0.0005	0.000261	<0.0002	0.0101	<0.0001
0.119	<0.00002	0.00011	0.0168	0.00015	<0.000005	<0.05	0.000291	1.43	0.0001	0.0016	0.861	0.047	0.000311	0.0036	0.69	0.0638	<0.01	<0.00005	0.0011	<0.002	5.85	0.00022	1.62	0.000008	5.31	0.00721	7	0.00009	<0.00001	<0.0005	0.000445	<0.0002	0.0219	<0.0001
0.0844	0.00049	0.00088	0.0735	<0.00001	<0.000005	<0.05	0.000082	3.96	0.0007	0.00202	0.0972	0.074	0.00108	0.001	0.51	0.0173	0.01	0.0851	0.00218	0.053	1.46	0.0008	3.78	0.000014	26.8	0.0356	15	0.000007	<0.00001	<0.0005	0.000096	0.0009	0.0046	0.0002
0.0631	0.00086	0.00046	0.0196	<0.00001	<0.000005	<0.05	0.000078	27.1	0.0003	0.000584	0.00633	0.021	0.000193	0.0015	2.73	0.0456	<0.01	0.0101	0.00058	0.018	4.91	0.00108	1.64	<0.000005	16.7	0.0806	13	0.000032	<0.00001	0.0016	0.0141	0.0012	0.0023	0.0001
0.043	0.0012	0.0009	0.0695	<0.00005	<0.00003	<0.3	0.00007	585	<0.0005	0.00047	0.0102	0.008	0.00014	<0.003	27.5	0.0318	<0.05	0.003	0.0023	<0.01	9.75	0.001	1.43	<0.00003	22.4	3.83	559	0.00012	<0.00005	<0.003	0.00269	<0.001	0.0023	<0.0005
0.222	0.00014	0.00042	0.081	<0.00001	0.000006	<0.05	0.000043	12.4	0.0002	0.000053	0.0124	0.049	0.000074	<0.0005	1.63	0.0528	0.03	0.12	0.00077	0.008	1.33	0.00073	1.4	0.00001	32.5	0.0775	14	0.000009	0.00001	0.0012	0.000423	<0.0002	0.0004	<0.0001
1.74	0.001	0.0009	0.0415	0.00018	<0.00003	<0.3	0.00091	15.6	0.001	0.0205	20.1	0.826	0.00093	0.003	1.06	0.189	<0.05	0.0584	0.012	0.037	6.37	0.0048	<0.5	<0.00003	3.38	0.0619	34	0.00027	<0.00005	0.007	0.0185	<0.001	0.0828	<0.0005
34.8	0.00004	0.00043	0.0267	0.00158	<0.000005	<0.05	0.000807	11.8	0.0013	0.209	7.33	0.18	0.00127	0.0142	15.4	0.56	0.04	0.00007	0.0736	0.012	6.53	0.00089	2.47	0.0036	11	0.0347	117	0.000686	0.00002	<0.0005	0.0238	<0.0002	0.146	0.0013
0.0474	<0.00002	0.00002	0.0139	0.00005	0.000009	<0.05	0.00007	1.45	<0.0001	0.000409	0.0539	0.03	0.000054	0.0035	0.88	0.025	0.02	0.00008	0.00053	0.004	5.78	0.00056	1.7	0.000043	4.44	0.0153	7	0.000272	<0.00001	<0.0005	0.00023	<0.0002	0.0037	<0.0001
17.9	0.00002	0.00035	0.0138	0.00305	<0.000005	<0.05	0.000671	10.9	0.0005	0.0645	16.2	0.425	0.000072	0.0215	11.2	0.593	<0.01	0.00017	0.0426	0.024	1.86	0.00056	1.98	0.000022	8.74	0.0261	77	0.000236	0.00001	<0.0005	0.0686	<0.0002	0.0869	<0.0001
0.0242	0.00015	0.00038	0.0402	0.00002	<0.000005	<0.05	0.000023	0.44	0.0001	0.000164	0.0361	0.041	0.000021	0.0039	0.16	0.00886	0.05	0.00204	0.0003	0.003	4.78	0.00028	2.18	0.000062	7.54	0.00292	8	0.000163	<0.00001	<0.0005	0.000093	<0.0002	0.0032	<0.0001
0.166	0.00131	0.00361	0.0163	<0.00001	0.000027	<0.05	0.000049	1.64	0.0008	0.000533	0.127	0.179	0.000139	0.0016	0.34	0.00515	0.03	0.0962	0.00139	0.541	0.66	0.00167	2.87	0.000397	22.6	0.0117	5	0.000004	0.00002	0.0048	0.000366	0.0025	0.0022	0.0002
0.0744	0.0001	0.0001	0.0325	0.00011	0.000007	<0.05

D-Al mg/L	D-Sb mg/L	D-As mg/L	D-Ba mg/L	D-Be mg/L	D-Bi mg/L	D-B mg/L	D-Cd mg/L	D-Ca mg/L	D-Cr mg/L	D-Co mg/L	D-Cu mg/L	D-Fe mg/L	D-Pb mg/L	D-Li mg/L	D-Mg mg/L	D-Mn mg/L	D-Hg ug/L	D-Mo mg/L	D-Ni mg/L	D-P mg/L	D-K mg/L	D-Se mg/L	D-Si mg/L	D-Ag mg/L	D-Na mg/L	D-Sr mg/L	D-S mg/L	D-Tl mg/L	D-Sn mg/L	D-Ti mg/L	D-U mg/L	D-V mg/L	D-Zn mg/L	D-Zr mg/L
90.5	< 0.0002	0.0006	0.0645	0.00406	< 0.00001	0.007	0.00132	180	0.0151	0.0623	1.43	2	0.0106	0.014	18.1	1.04	0.02	0.0001	0.0185	< 0.01	6.13	0.014	1.09	0.00001	2.1	0.127	319	< 0.0002	< 0.00001	0.0003	0.018	< 0.00003	0.251	0.00159
0.171	0.0021	0.0004	0.0219	0.00003	0.00002	0.007	0.000126	0.53	0.0015	0.00069	0.0192	0.13	0.00206	0.002	0.077	0.029	0.02	0.00009	0.0004	< 0.01	6.78	0.00084	1.26	0.00002	6.31	0.0053	5.72	< 0.0002	0.00001	0.0005	0.000683	< 0.00003	0.01	0.00454
0.541	0.0007	0.001	0.0329	0.00041	< 0.00001	0.012	0.000123	1.46	0.0018	0.00304	0.121	0.1	0.00005	0.009	0.621	0.048	0.01	0.00567	0.0021	0.01	9.12	0.00422	1.35	0.00001	9.07	0.0096	12.8	< 0.0002	0.00002	0.0001	0.00101	0.00004	0.025	0.00063
0.284	0.0003	0.0007	0.0474	< 0.00002	0.00044	0.021	0.000869	0.6	0.0013	0.000394	0.0502	0.59	0.00213	0.002	0.085	0.01	0.05	0.691	0.0005	0.03	1.78	0.00587	2.01	0.00006	11.5	0.0089	6.87	< 0.0002	0.00008	0.0041	0.00151	0.00022	0.006	0.0113
0.44	0.0047	0.0088	0.0423	< 0.00002	0.00022	0.007	0.000585	0.74	0.152	0.000191	0.0854	0.84	0.00563	0.001	0.114	0.023	0.04	0.00301	0.0015	0.04	4.95	0.0048	3.25	0.00045	23.1	0.004	5.4	< 0.0002	0.00016	0.0206	0.000773	< 0.00003	0.007	0.0393
0.0065	< 0.0002	0.0004	0.031	< 0.00002	< 0.00001	0.008	< 0.000003	323	0.0009	0.00075	0.0079	< 0.01	0.00005	0.002	54.8	0.082	0.01	0.0596	0.0007	< 0.01	13.3	0.00313	1.63	< 0.00001	13.5	1.1	321	< 0.0002	< 0.00001	0.0002	0.00274	0.00005	0.001	0.00028
1.26	0.0176	0.0009	0.0427	0.00003	0.00008	0.007	0.000496	4.8	0.003	0.00463	0.996	0.31	0.00684	0.005	1.86	0.271	0.05	0.00239	0.0028	0.01	14.3	0.0116	1.66	0.00018	20	0.0285	21	< 0.0002	0.00004	0.0056	0.0013	0.0002	0.043	0.0163
0.567	0.0011	0.0014	0.0285	< 0.00002	0.00005	0.015	0.000541	0.29	0.0086	0.000237	0.0845	1.08	0.00283	0.003	0.033	0.007	0.04	0.0641	0.0004	0.02	2.21	0.00762	2.31	0.00042	19.4	0.0026	7.83	< 0.0002	0.00005	0.0056	0.00097	0.00006	0.004	0.0259
0.0343	0.0005	0.0004	0.0545	< 0.00002	< 0.00001	0.012	0.000084	1.46	0.0006	0.00024	0.0131	0.05	0.00046	0.004	0.251	0.049	< 0.01	0.00087	0.0002	< 0.01	11	0.00496	1.4	< 0.00001	5.13	0.0165	6.67	< 0.0002	< 0.00001	0.0001	0.000075	< 0.00003	0.006	0.00027
0.0572	< 0.0002	0.0002	0.00652	0.00012	< 0.00001	0.006	0.000026	1.12	0.0019	0.00098	0.062	0.08	0.00005	0.005	0.56	0.022	< 0.01	0.0001	0.0018	< 0.01	5.09	0.00178	2.35	< 0.00001	14.3	0.019	13.9	< 0.0002	0.00004	0.0001	0.00117	< 0.00003	0.006	0.00007
0.0896	0.0006	0.0002	0.0364	0.00002	< 0.00001	0.021	0.000064	0.73	0.0018	0.000245	0.023	0.08	0.00055	0.004	0.243	0.015	0.01	0.00362	0.0006	< 0.01	7.25	0.0011	1.83	0.00001	3.96	0.0051	5.42	< 0.0002	0.00005	0.0006	0.000231	0.00003	0.005	0.00045
0.109	0.0002	< 0.0002	0.00285	< 0.00002	< 0.00001	0.011	0.000016	0.08	0.0026	< 0.000002	0.0282	0.12	0.00203	< 0.001	0.017	< 0.001	< 0.01	0.00079	0.0007	< 0.01	1.57	0.00109	1.41	0.00002	12.7	0.0006	7.27	< 0.0002	< 0.00001	0.0003	0.000132	< 0.00003	0.003	0.00255
0.759	0.01	0.0102	0.03	0.00033	< 0.00001	0.007	< 0.000003	19.9	0.0014	0.01	10.6	0.27	0.00069	0.004	3.21	0.192	0.04	0.00143	0.003	0.19	4.67	0.0731	0.9	< 0.00001	2.66	0.0281	30.3	< 0.0002	0.00003	0.0002	0.00857	0.00007	0.044	0.00006
0.874	< 0.0002	0.0002	0.0325	0.00024	< 0.00001	0.007	0.000192	2.08	0.0011	0.0475	0.228	0.72	0.00007	0.003	1.01	0.069	0.03	0.0009	0.0082	0.02	7.79	0.00265	1.17	0.00006	3.2	0.015	13.2	0.0003	0.00002	0.0001	0.000733	< 0.00003	0.027	0.00007
0.0157	< 0.0002	< 0.0002	0.00144	< 0.00002	< 0.00001	0.008	0.000004	0.46	0.0005	0.000552	0.0147	0.01	0.00028	0.001	0.269	0.017	< 0.01	0.00008	0.0003	< 0.01	1.4	0.00041	2.75	< 0.00001	13.9	0.0026	9.54	< 0.0002	< 0.00001	0.0001	0.000156	< 0.00003	0.001	0.00004
0.0529	0.0003	0.0003	0.00143	< 0.00002	< 0.00001	0.009	0.000003	1.02	0.0018	0.000462	0.0334	0.04	0.0001	0.001	0.274	0.012	< 0.01	0.00071	0.0009	< 0.01	2.63	0.00031	2.31	0.00002	7.95	0.0079	4.78	< 0.0002	0.00006	0.0003	0.000226	< 0.00003	0.001	0.00013
0.0934	< 0.0002	0.0004	0.00475	< 0.00002	< 0.00001	0.011	0.00007	1.42	0.001	0.00054	0.0138	0.06	0.00048	0.001	1.04	0.007	< 0.01	0.0758	0.0007	0.18	1.09	0.00073	3.64	< 0.00001	21.9	0.0202	15.2	< 0.0002	< 0.00001	0.0007	0.000095	0.00026	< 0.001	0.00008
0.0661	< 0.0002	< 0.0002	0.00213	0.0001	< 0.00001	0.005	0.000022	0.9	0.0006	0.00231	0.0239	0.18	0.00007	0.008	2.51	0.045	< 0.01	0.00091	0.0023	< 0.01	4.15	0.00104	2.41	< 0.00001	12.5	0.0075	14.7	< 0.0002	0.00008	0.0002	0.000691	< 0.00003	0.007	< 0.00001
0.0069	< 0.0002	0.0004	0.0234	< 0.00002	< 0.00001	0.009	0.000038	0.82	< 0.0005	0.00129	0.0142	< 0.01	0.00005	0.002	0.15	0.035	< 0.01	0.00492	0.0004	0.02	3.55	0.00032	1.54	0.00003	11.9	0.0104	6.99	< 0.0002	0.00005	< 0.0001	0.000055	< 0.00003	0.003	< 0.00001
0.0131	< 0.0002	0.0003	0.00612	< 0.00002	< 0.00001	0.009	0.000008	0.36	0.0009	0.00185	0.0252	0.02	0.00032	0.001	0.038	0.009	< 0.01	0.00069	0.0003	0.01	3.37	0.00075	1.39	< 0.00001	19.4	0.003	13.7	< 0.0002	0.00054	< 0.0001	0.000053	< 0.00003	0.007	0.00002
0.0384	< 0.0002	0.0003	0.00107	< 0.00002	< 0.00001	0.016	0.000014	0.05	0.001	0.000077	0.0189	0.04	0.00005	< 0.001	0.017	< 0.001	< 0.01	0.0162	0.0003	0.02	1.22	0.00135	2.74	0.00002	23.9	0.0007	15	< 0.0002	0.00026	0.0006	0.000342	0.00009	< 0.001	0.00007
5.76	< 0.0002	0.0003	0.0286	0.00079	< 0.00001	0.006	< 0.000003	3.89	0.0009	0.0424	87.1	0.9	0.00028	0.005	6.97	0.239	0.02	0.00043	0.0264	0.02	10.4	0.0068	2.05	< 0.00001	7.36	0.0421	73.3	0.0004	0.00008	0.0002	0.0234	< 0.00003	0.075	0.00006
0.146	0.0022	0.002	0.00472	< 0.00002	< 0.00001	0.017	0.000343	0.75	0.0018	0.00163	0.117	0.09	0.00018	< 0.001	0.089	0.004	0.06	0.325	0.003	0.02	2.53	0.00042	2.74	0.00009	19.7	0.0015	6.95	< 0.0002	< 0.00001	0.002	0.000433	0.00024	0.004	0.00089
0.0854	0.0004	0.0007	0.0115	< 0.00002	< 0.00001	0.005	0.00003	0.93	< 0.0005	0.000198	0.0588	0.03	0.00005	< 0.001	0.131	0.006	0.01	0.0157	0.0003	0.12	1.05	0.00031	5.96	0.00004	11.7	0.0087	4.93	< 0.0002	0.00015	0.0013	0.00017	0.00361	0.001	0.00001
0.132	0.0012	0.0014	0.0922	< 0.00002	< 0.00001	0.007	0.000103	5.83	0.0009	0.00266	0.225	0.13	0.00006	< 0.001	1.51	0.042	0.03	0.0612	0.001	0.13	2.54	0.00069	3.54	0.00004	19.8	0.0674	10	< 0.0002	0.00011	0.0013	0.000126	0.00073	0.001	0.00017
0.23	0.0003	0.0013	0.00751	< 0.00002	< 0.00001	0.018	0.000281	1.46	0.0022	0.000398	0.0871	0.1	0.00015	0.001	0.26	0.014	0.01	0.273	0.001	0.03	2.68	0.00027	2.31	0.00003	22.2	0.007	11.4	< 0.0002	0.0004	0.0014	0.000115	0.00022	0.002	0.00013
0.209	0.0079	0.0033	0.00848	< 0.00002	0.00002	0.013	0.000996	0.13	0.0011	0.000173	0.0318	0.19	0.00019	< 0.001	0.045	< 0.001	0.04	0.969	0.0006	0.43	2.32	0.00186	2.88	0.00012	17.8	0.0009	6.31	< 0.0002	0.00022	0.0022	0.000069	0.00039	0.001	0.00039
1.75	0.0325	0.0015	0.0451	0.0001	0.00014	0.011	0.000499	2.44	0.0033	0.0227	3.89	0.15	0.00031	0.002	0.23	0.051	0.11	0.021	0.001	< 0.01	8.28	0.00284	1.09	0.00014	20.2	0.0139	17.1	0.0002	0.00024	0.0005	0.000982	< 0.00003	0.02	0.0132
0.45	0.0066	0.0179	0.0149	< 0.00002	< 0.00001	0.012	0.000793	0.88	0.0011	0.000854	0.212	0.49	0.00376	< 0.001	0.203	0.002	0.15	0.731	0.0005	1.73	0.77	0.00138	5.53	0.00035	22.7	0.0055	6.67	< 0.0002	0.0001	0.0044	0.000242	0.00298	0.011	0.00025
0.0312	0.0003	0.001	0.00578	< 0.00002	< 0.00001	0.012	0.000056	5.94	0.001	0.00019	0.032	0.05	0.00048	< 0.001	0.519	0.021	0.01	0.0223	0.0003	0.01	2.08	0.00128	6.06	< 0.00001	61.2	0.031	29	< 0.0002	0.00032	0.0007	0.000084	0.00006	0.002	0.00002
0.549	0.0043	0.0284	0.039	< 0.00002	0.00001	0.038	0.000155	2.16	0.0035	0.000542	0.134	0.42	0.00098	< 0.001	0.205	0.007	0.02	0.182	0.0008	0.4	1.83	0.00283	4.14	0.0005	38.3	0.0139	10.7	< 0.0002	0.00015	0.0036	0.000776	0.00048	0.004	0.00049
0.147	0.0006	0.0022	0.0543	< 0.00002	< 0.00001	0.004	< 0.000003	1.66	0.0016	0.000712	0.0841	0.06	0.00091	< 0.001	0.25	0.007	0.01	0.0209	0.0004	0.05	0.59	0.00082	4.01	0.0001	13.8	0.0145	2.21	< 0.0002	0.00009	0.001	0.00032	0.00065	0.001	0.00038
0.285	0.0005	0.0049	0.00655	< 0.00002	< 0.00001	0.005	0.000122	0.82	0.0013	0.000128	0.0218	0.07	0.00014	< 0.001	0.186	0.004	< 0.01	0.12	0.0002	0.39	0.85	0.00115	5.48	0.00002	20.3	0.0094	7.79	< 0.0002	0.00007	0.0012	0.000055	0.00089	< 0.001	0.00005
0.0525	0.0016	0.003	0.00785	< 0.00002	< 0.00001	0.005	0.000075	3.16	0.0009	0.000341	0.0163	0.02	0.00009	< 0.001	0.594	0.04	< 0.01	0.0583	0.0002	0.08	0.88	0.00194	5.89	0.00001	67.9	0.0313	33	< 0.0002	0.00007	0.0007	0.000012	0.00036	< 0.001	0.00016
0.648	< 0.0002	0.0006	0.0104	< 0.00002	< 0.00001	0.017	< 0.000003	0.35	0.0014	0.000501	0.0255	0.09	0.00016	< 0.001	0.066	0.007	< 0.01	0.00266	0.0005	< 0.01	1.09	0.00039	3.12	0.00001	30.8	0.0026	18.8	< 0.0002	0.00009	0.0005	0.000189	0.00005	< 0.001	0.00009

CASINO
COPPER AND GOLD

Casino Geochemical Source Term Development



Project No. J862-5
4 December 2013

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Executive Summary

CASINO
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Executive Summary

The proposed Casino Project will entail open pit mining of a gold-copper-molybdenum porphyry deposit located in Yukon, approximately 115 km west of Pelly Crossing. The deposit consists of an oxide gold leach cap (CAP) overlying copper enriched supergene (SUP) and hypogene (HYP) zones. Gold and copper from the CAP ore will be extracted in a heap leach, whereas ore from the supergene and hypogene zones will be processed in a mill through a flotation circuit. As such, three waste streams will be produced during operations, including waste rock, flotation tailings from milled ore and residual heap leach residue.

Lorax has conducted an extensive geochemical characterization program of the various rock and waste types at the Casino site. This data, combined with mine facility design and site climate data, provide a basis for geochemical source term predictions. Source terms have been produced for the various mine facilities that will exist during mine operations and closure as described below.

Ore Stockpiles

During mine life six ore stockpiles are planned. The HYP LGO stockpile is the largest ore stockpile planned for the minesite, and will consist exclusively of HYP low grade ore. Hypogene LGO is considered potentially acid generating (PAG), however, a lag time of decades to centuries is expected before the onset of acidic drainage. As such, drainage from this stockpile is predicted to remain neutral during mine life, with limited metal leaching potential. Supergene ore will be placed in four separate facilities. The SUP ore is considered PAG, and is expected to produce acidic seepage and elevated metal concentrations in the time frame of the casino mine life. The oxide CAP gold ore will be stockpiled in a single facility. The oxide CAP material is a highly weathered unit deplete in most sulphide and carbonate minerals, however, it has a mildly acidic in-situ pH (4.7) and can be expected to produce mildly acidic drainage immediately upon excavation. However, acidity and most metal concentrations are expected to be orders of magnitude lower than that of the SUP ore stockpiles which contain sulphide mineralization.

Operational source terms are provided for each of these stockpiles. By the end of mine life, the material in these facilities is scheduled to be milled and deposited in the TMF as tailing or placed in the heap leach facility. It is assumed that some stockpile material at the base of these facilities will not be mineable, and will be deposited into the pit lake. Therefore a source term is also provided for metal release associated with sub-aqueous disposal of weathered ore.

Saturated Waste Rock and Tailings

Tailings and the majority of waste rock produced at the Casino minesite will be sub-aqueously disposed of in the Casino TMF. Sub-aqueous disposal will prevent sulphide oxidation in mine waste and is considered geochemically favorable compared to disposal in an unsaturated environment. Source terms are predicted for flows from the saturated facility to the overlying pond, underlying foundation and embankment during operations and closure time points.

PAG tailings and pyrite concentrate will be deposited into the centre of the impoundment and covered with a layer of depyritized (NAG) tailings at the end of mine life. Saturated source terms from both the PAG and NAG tailings are predicted to be pH-neutral with relatively low metal concentrations due to the stability of sulphide minerals under saturated conditions.

HYP waste rock is predicted to have low leaching rates of most metals compared to either oxide or supergene waste rock. The CAP waste rock and a portion of SUP waste rock will release metals and acidity from water soluble oxide / sulphate minerals under saturated conditions, albeit at a reduced rate compared to an unsaturated pile. However, movement of acidic porewater through the HYP waste rock or tailings produces significant attenuation of acidity and metals mobilized from the CAP and acidic SUP.

Unsaturated Waste Rock

Waste rock placed in the TMF will remain unsaturated for an average of three years prior to being flooded by the rising water table in the TMF. Initially waste rock in the TMF will be dominated by shallow CAP material, with quanitities of SUP and HYP gradually increasing as more waste rock is obtained from the deeper portions of the pit. In the final years of mine life, waste rock will primarily be composed of HYP. Accordingly, separate source terms are developed to reflect the changing composition of unsaturated waste rock. The source term will transition from mildly acidic drainage similar to that of the gold ore stockpile during early years of mine life, to neutral drainage similar to the HYP LGO stockpile at later time periods. At the end of mine life all waste rock in the TMF will be submerged beneath the TMF pond, therefore source terms for unsaturated waste rock are only applied during mine operations.

Tailings Beach and Embankment

The tailings beach and embankment will remain unsaturated during mine operation and after closure. To mitigate the potential for ARD from these structures, a pyrite rougher circuit will be operated to produce a stream of de-pyritized non-acid generating (NAG)

tailings for embankment and beach construction. Source terms are calculated for operations and closure time points of the tailings beach and embankment.

Pit Wall

Source terms are provided for saturated and sub-aerially exposed wall rock in the open pit. Separate source terms are developed for the mineralization zones (HYP, SUP and CAP) and weathering states (acidic vs. neutral) of pit wall rock. Inundation of pit wall rock by pit lake water will result in the release of accumulated weathering products. This source of metal loading is represented by an accumulation rate on the pit wall for every year of sub-aerial exposure.

Heap Leach Facility

Oxide CAP ore will be mixed with lime when placed in the lined heap leach facility (HLF) as required for cyanide gold leaching. This lime addition will neutralize water soluble acidity associated with CAP ore, and drainage is expected to remain neutral. Drainage released from the HLF will initially contain cyanide, which will support elevated concentrations of metals prone to cyanide complexation (Cu, Cd, Fe, *etc*.). In the long term, cyanide is expected to degrade to trace levels and metal leaching rates from the heap leach residue will decline. Three source terms are provided for the heap leach facility to reflect the expected evolution of HLF drainage chemistry. The first source term is for heap leach rinsing and drain down which will take place during active mine life. An intermediate source term is provided for the post drain-down scenario when the hydrology of the facility approaches steady state, and a long term source term is provided for this facility to represent drainage once stabilized weathering rates are reached.

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1. Introduction

CASINO
COPPER AND GOLD

1. Introduction

1.1 Project Background and Study Objectives

Lorax Environmental Services Ltd. (Lorax) was retained to produce geochemical source terms for planned mine facilities at Casino Mining Corporation's (CMC) proposed Casino Project. The Casino Project is a gold-copper-molybdenum porphyry deposit that consists of an oxide gold leach cap (CAP) overlying copper enriched supergene (SUP) and hypogene (HYP) zones. The site is located in the Yukon Territory at latitude 62° 44' 25"N and longitude 138° 50'32"W, 300 km northwest of Whitehorse (Figure 1-1). The deposit is situated on a small divide between Canadian Creek that flows into the Yukon River and Casino Creek that flows into Dip Creek and the Klotassin River. The village of Pelly Crossing is the nearest community, approximately 115 km to the east.



Figure 1-1: Map showing location of the Casino Deposit (M3 Engineering, 2008)

Mining will be carried out by open pit using conventional truck and shovel methods. CMC is planning to use two ore extraction processes based on the style of mineralization of the Casino deposit. Gold and copper from the leached oxide cap ore will be extracted in a heap leach, whereas ore from the supergene and hypogene zones will be processed in a mill through a flotation circuit. As such, three waste streams will be produced during operations, including waste rock, flotation tailings from milled ore and residual heap leach residue.

Lorax has conducted an extensive geochemical characterization program which has contributed to the development of waste rock and tailings management planning for the Casino Project. Techniques used to assess ML/ARD potential include static tests which examine the intrinsic ML/ARD potential of a sample, and kinetic tests which expose the material to various weathering conditions. Data gathered as part of the static and kinetic testwork program are presented in:

- *Casino Geochemical Static Test Assessment* (Lorax, 2013a); and
- *Kinetic Testwork Update in Support of Casino ML/ARD Assessment* (Lorax, 2013b).

The derivation of source terms relies not only on geochemical properties, but also on waste storage facility design, and climate conditions on site. This data is primarily provided in:

- *Casino Mining Corporation Project Description* (Knight Peisold, 2013a); and
- *YESAB Water Balance Model Report* (Knight Peisold, 2013b).

The results presented in these reports provide a basis for predicting drainage quality from various mine waste storage facilities at the proposed Casino mine site.

This report is prepared in support of CMC's proposal to the Yukon Environmental and Socio-economic Assessment Board. The primary objective of this study is to develop a set of geochemical source terms for drainage from each of the proposed mine facilities. These source terms are designed to be incorporated into a mass balance water quality model that will be used to predict the effect of the project on water quality.

1.2 Overview of Mine Rock Geochemical Properties

The Lorax (2013a) study concluded that ML/ARD characteristics varied within the Casino deposit primarily by mineralization zone and to a lesser extent lithologic unit. Trends were not identified based on the alteration zones of the Casino Intrusive Complex. Therefore, the Casino kinetic test program was primarily focused on geochemical characteristics of the mineralization zones (Lorax, 2013b). An overview of ML/ARD

properties of the three mineralization zones is provided below. Note that the NPR values sited below are defined by the ratio of neutralization potential (calculated from carbonate content) and acid potential (calculated from non-sulphate S content).

Oxide Leach CAP Zone

- The CAP samples (ore and waste) have acidic median paste pH values of 4.7, indicating that the majority of the CAP waste rock will be immediately acid generating when excavated.
- Secondary water soluble sulphate and oxide minerals, rather than sulphide minerals, are the major source of acidity and metal leaching from CAP samples.

Supergene (SUP) Zone (includes Supergene Oxide (SOX) and Supergene Sulphide (SUS))

- The majority of the SUP samples have a net potential ratio (NPR) < 2.0 (88% SOX and 97% SUS), which implies that waste rock and ore from this mineralization zone is PAG.
- Unlike the CAP sample set, some SUP samples still contain carbonate minerals capable of buffering pH; however, the samples also contain sulphide minerals in sufficient quantities to deplete the buffering capacity over time and provide an additional source of metal leaching.
- Similar to the CAP sample set, SUP samples contain oxide minerals as a source of acidity and metal leaching. The SUP samples (ore and waste) have a median paste pH of 6.1.

Hypogene (HYP) Zone

- The majority of the HYP samples (87% ore and 92% waste rock) have been identified as having a NPR < 2, which implies that under advanced weathering conditions waste rock and ore from the HYP zone will produce acidic drainage.
- Ore and waste rock samples from the HYP zone have the highest median carbonate neutralization potential (27 kg $CaCO_3$/t), and highest median paste pH (8.1) of the mineralization zones in the Casino deposit.

1.3 Mine Facility Overview

Geochemical source terms are provided for mine facilities during mine operations and closure. The general layout and maximum footprints of these facilities is provided in Figure 1-2.

610,000 612,000 614,000

6,960,000 6,958,000 6,956,000 6,954,000 6,952,000

N

Open Pit

Gold Ore Stockpile

Marginal Ore Stockpile

SUS LGO Stockpile

Supergene Ore Stockpile

Plant Site

Heach Leap Facility

HYP LGO Stockpile

SOX LGO Stockpile

Waste Rock Storage Area

NAG Tailings

PAG Tailings

Tailings Beach

Tailings Embankment

610,000 612,000 614,000

LEGEND

- Heach Leap Facility
- Tailings Embankment
- NAG Tailings
- Open Pit
- Ore Stockpile
- PAG Tailings
- Tailings Beach
- Waste Rock Storage Area
- 10m Elevation Contour

DATE SAVED:	Nov 12, 2013
DRAWN BY:	AL
REVIEWED:	BM
VERSION:	1

Coordinate System: *NAD 1983 UTM Zone 7N*
Projection: *Transverse Mercator*
Datum: *North American 1983*
Units: *Meter*

1:24,000

0 0.5 1 Km

CLIENT:

CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT:

Casino Project

TITLE:

General Arrangement and Maximum Footprint of Mine Facilities

PROJECT #: J862-5

FIGURE: 1-2

P:\J862 (Casino)\Road\Drafting\MXDs\Figure 1-1 General arrangement and maximum footprint of mine facilities_20131107.mxd

During mine life six ore stockpiles are planned. Operational source terms are provided for each of these stockpiles. At the end of mine life these facilities will be mined and deposited in the TMF or heap leach facility. It is assumed that some stockpile material at the base of these facilities will not be mineable, and will be deposited into the pit lake. Therefore a source term is also provided for metal release associated with sub-aqueous disposal of weathered ore.

Several distinct source terms are provided for the Casino tailings management facility (TMF) during operations and closure. These source terms reflect the variability in the weathering environment (saturated vs. unsaturated) and waste type (tailings vs. waste rock) being stored in the TMF. Operational and closure source terms are provided for the tailings embankment, the tailings beach and flows to the foundation, embankment and TMF pond originating from saturated waste rock and tailings. The only source terms that are exclusively applied to operational time points in the TMF is that of tailings process water and unsaturated waste rock which will be exposed above the water table during mine life.

Three source terms are provided for the heap leach facility (HLF) representing different time periods. The first source term is for heap leach rinsing and drain down which will take place during active mine life. An intermediate source term is provided for the post drain-down scenario when the hydrology of the facility approaches steady state. A long term source term is provided for this facility to represent drainage once stabilized weathering rates are reached.

Source terms are provided for saturated and sub-aerially exposed wall rock in the open pit. Separate source terms are developed for the mineralization zones (HYP, SUP and CAP) and weathering states (acidic vs. neutral) of pit wall rock. Initially a majority of PAG pit wall rock types (HYP and SUP) will produce neutral runoff, only becoming acidic at advanced weathering states. To represent this gradual acidification process, an equation is developed for SUP and HYP pit wall to predict the portion of the sub-aerially exposed pit wall that becomes acidic with time. Inundation of pit wall rock by pit lake water will result in the release of accumulated weathering products. This source of metal loading is represented by an accumulation rate on the pit wall for every year of sub-aerial exposure. In this way, the saturated pit wall source term can reflect the amount of time pit wall rock is sub-aerially exposed before being inundated by pit lake water.

1.4 Report Structure

Source terms relating to ore stockpiles are provided in Chapter 2. Chapter 3 describes source terms for unsaturated waste rock in the TMF. Chapter 4 describes source terms for the heap leach facility. Chapter 5 presents source terms for the tailings beach and

embankment. Chapter 6 presents predicted chemistry of tailings process water. In Chapter 7, source terms for the saturated components of the TMF are presented. In Chapter 8 source terms relating to the pit wall rock are presented. Finally, Chapter 9 provides a brief summary of source terms and how geochemical aspects of the different mine rock materials have impacted mine planning.

2. Ore Pile Source Terms

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2. Ore Pile Source Terms

Ore will be stored in five temporary stockpiles (three containing low grade ore, two containing ore) during the Casino mine life. In order to assess the impact of runoff and seepage from these temporary storage facilities, geochemical source terms were developed using lab- and field-based kinetic experiments of comparable materials. The various work stages leading to the development of these source term concentrations for the individual stockpiles can be summarizes as follows:

- Selection of kinetic tests representative of various rock types and weathering states (acidic vs. neutral) for model input;
- Calculation of temperature affects on acid generation and metal leaching rates;
- Estimate of percent of ore that can be expected to become acidic during mine life;
- Calculation of averaged loading rates to represent each ore stockpile;
- Scale-up of loads to simulate reaction within stockpiles;
- Application of secondary mineral controls (speciation calculations); and
- Comparison of output concentrations to other mine sites and adjustment of model parameters as necessary.

A detailed description of the individual of source term development is provided below.

2.1 Ore Pile Composition

Six temporary stockpiles will exist during the Casino mine life (Figure 1-1). An outline of the size, area, composition and duration of temporary ore stockpiles is provided in Table 2-1.

Table 2-1:
Description of temporary ore stockpile mass, area, ore type, and duration

Facility ID	Ore Type	Mass (MT)	Area (km^2)	Start (year)	End (year)
Gold Ore Stockpile	CAP Ore	35	0.55	-2	13
Supergene ore stockpile	SUP Ore	32	0.477	-2	12
HYP LGO stockpile	HYP LGO	90	1.3	2	22
SUS LGO stockpile	SUS LGO	39	0.47	-1	22
SOX LGO stockpile	SOX LGO	14	0.30	-1	22
MO Stockpile	SUP MO	9	0.2	-3	22

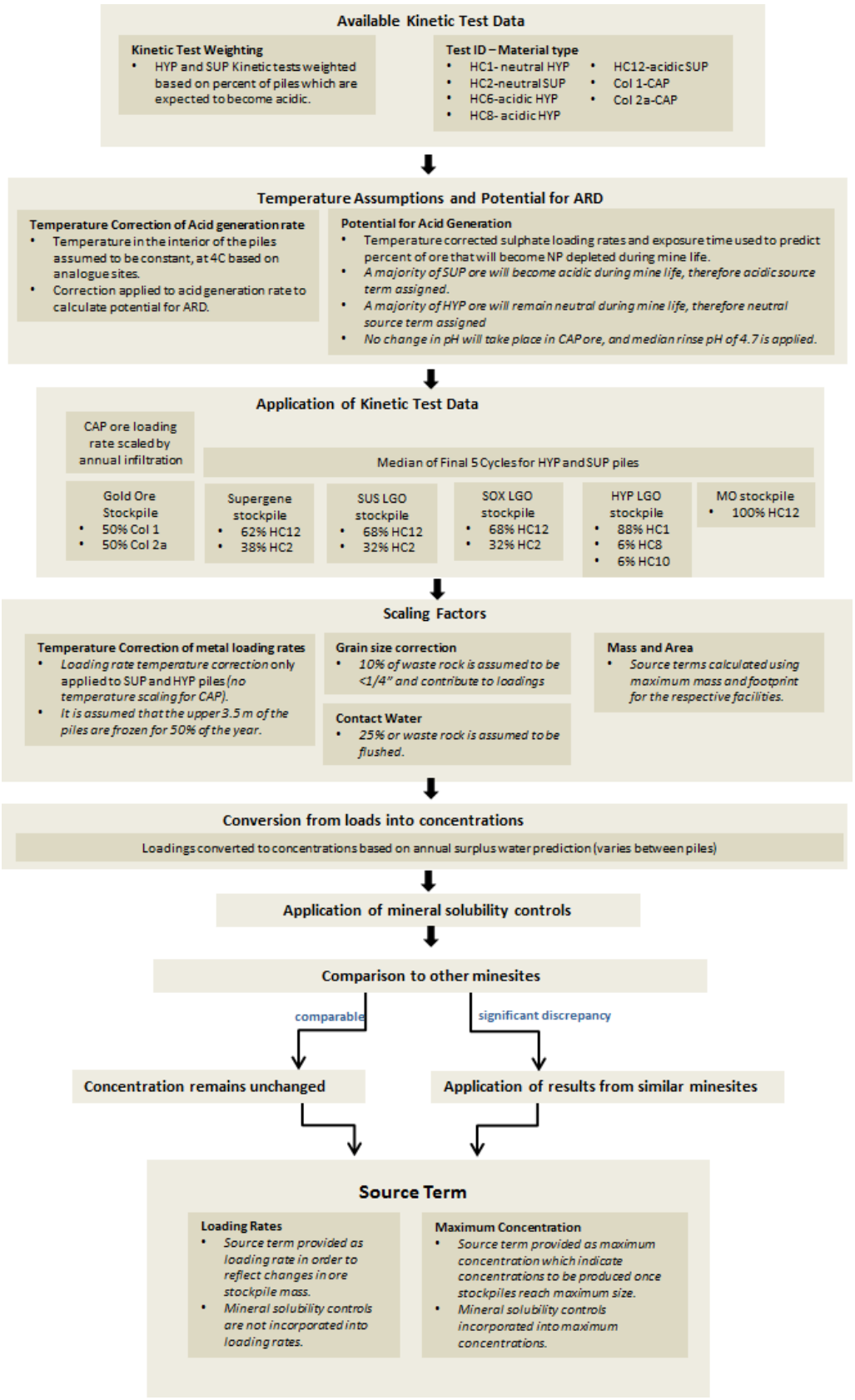


Figure 2-1: Flow chart of ore stockpile source term development

2.2 Kinetic Test Data

Kinetic tests used to develop ore stockpile source terms are outlined in Table 2-2. These tests include humidity cells conducted on HYP and SUP waste and ore, and unsaturated columns on CAP waste. For complete humidity cell results and static test results on humidity cell samples see Lorax, (2013a and 2013b).

Kinetic tests were initiated on HYP and SUP ore samples collected for the 2009 pilot plant. During drill core re-logging in 2010, approximately 18% of the drill core used to construct the SUP head sample was re-logged as HYP. These two humidity cells remained neutral for the duration of the kinetic tests (39 weeks). Humidity cells results are used to provide an estimate of the neutral pH loading rate for HYP and SUP ore and LGO.

Humidity cells HC8, HC10 and HC12 were initiated to provide an estimate of acidic loading rates. These samples were selected from drill core samples which were already deplete in NP and had an acidic paste pH as indicated by ABA data. The pH of the samples has gradually declined through the first 65 cycles, and are currently near a pH of 3.2. Although HC8, HC10 and HC12 samples were selected from waste rock drill core samples, they have relatively high sulphide contents relative to ore samples. These three samples have sulphide values greater than 2.9%, while median SUS, SOX and HYP ore samples have median sulphide contents of 1.52% or less (Lorax, 2013b). Therefore, although these samples are collected from drill core identified as waste rock, they are considered a conservative approximation for acidic weathering rates of ore and LGO rock types.

Five unsaturated columns have been initiated with CAP waste rock material (Col 1, Col 2a, Col 2b, Col 3 and Col 4). After the 2010 core re-logging, it was determined that Col 3 and Col 4 contained more than 20% SUP and/or overburden material. Therefore these two columns are excluded from the CAP source term. Unsaturated column Col 2b contains 10 kg and is a duplicate of Col 2a, this sample was initiated to examine scaling effects of CAP material. To avoid placing too much weight on a single CAP sample, Col 2b was excluded from source term calculation as well.

Table 2-2:
Humidity cells (HC) and unsaturated columns (Col) used to develop ore stockpile source terms

Test ID	HC1	HC2	HC8	HC10	HC12	Col1	Col2a
Sample Source	**2009 pilot plant head**	**2009 pilot plant head**	**Drill core**	**Drill core**	**Drill core**	**Drill core**	**Drill core**
Mineralization	HYP	18% HYP, 82% SUP	HYP	HYP	SUP	CAP	CAP
Material Type	Ore	Ore	Waste	Waste	Waste	Waste	Waste
Represents	Neutral HYP	Neutral SUP	Acidic HYP	Acidic HYP	Acidic SUP	CAP	CAP
Start Date	03-Dec-09	03-Dec-09	29-Nov-11	29-Nov-11	29-Nov-11	27-Jan-10	27-Jan-10
End Date	02-Sept-2010	02-Sept-2010	On-going	On-going	On-going	On-going	On-going
Data Used	Median of Cycles 33-39	Median of Cycles 33-39	Median of Cycle 49-65	Median of Cycle 49-65	Median of Cycle 49-65	Cumulative loading of Cycles 1 to 112	Cumulative loading of Cycles 1 to 108

2.3 Temperature Effects on Metal Loading and Acid Generation

Humidity cell loading rates have been adjusted where appropriate to reflect the lower temperatures that are present at the Casino site compared to laboratory temperatures. Lower temperatures affect both sulphide oxidation rates and mineral solubility as discussed in a detailed review of the Casino kinetic test program (Lorax, 2013b). Sulphide oxidation rates decrease with decreasing temperature, while mineral solubility can increase or decrease depending on the mineral phase.

The effects of temperature on the pit wall source terms are addressed by applying the following methods to adjust laboratory loadings rates:

- Acidic SUP and HYP loading rates are scaled based on a site-specific Arrhenius relationship.
- Neutral SUP and HYP loading rates are scaled based on observed variation from stabilized rates at laboratory and site temperatures.
- CAP loading rates are not adjusted for temperature.

2.3.1 Temperature of Ore piles

In order to derive an appropriate temperature correction an estimate of temperatures typical in the interior of ore pile facilities is required. Temperatures in the interior of a sulphidic rock pile are related to local climate conditions and thermal heating due to the exothermic nature of sulphide oxidation. An estimate of the temperature in the interior of ore piles for the Casino mine site is based on temperature profiles observed at other minesites.

The Aitik mine site is in a similar climatic setting, and has well studied waste dumps that are similar in size to ore piles planned for the Casino minesite. The Aitik mine is a copper porphyry deposit located the sub-arctic of northern Sweden. The average annual temperature and precipitation at this minesite is 0.6°C and 680 mm (Lindvall and Eriksson, 2003), similar to that at the Casino minesite (0.5°C and 500 mm). Temperature profile data is available at this site for an acid generating waste rock dump approximately 60 m in height. The temperature profile indicates that temperatures in the near surface varied seasonally between -5 to 12°C, while below 12 m temperatures were constant, and ranged from 1 to 4°C (Stromberg and Banwart 1994; Linklater *et al*., 2004). Moving forward, it is assumed that the interior temperature of the ore piles is 4°C.

Pyrite oxidation rates decrease with decreasing temperature following an Arrhenius relationship (Nicholson *et al*., 1988). The pyrite oxidation rate as a function of temperature for Casino mine waste was established using an activation energy (*Ea)* calculated from the temperature dependent rate change measured in Cell T1 (Figure 2-2). Humidity Cell T1 provides a reference because the cell was moved from standard laboratory temperature (20°C to 22°C) to cold temperature at 4°C once leaching rates had stabilized after 37 cycles (Lorax, 2013b). The *Ea* calculated for T1 is 43.9 KJ mol^{-1}, which is within the range of *Ea* values reported in the literature (39 KJ mol^{-1} to 88.0 KJ mol^{-1}) (Lowson, 1982).

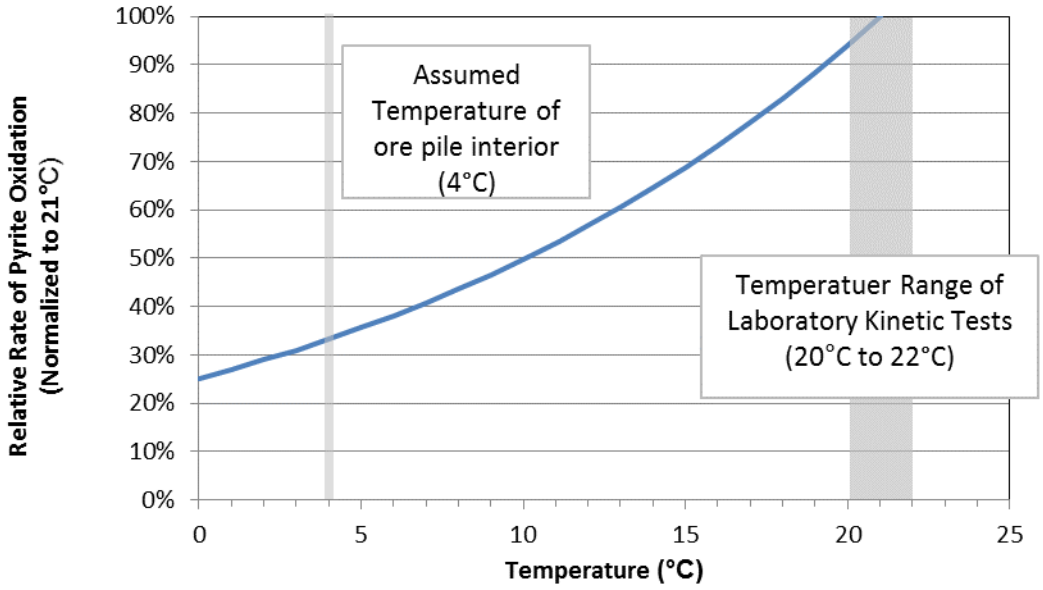


Figure 2-2: Temperature dependence of pyrite oxidation rate in Casino mine waste normalized to laboratory weathering rates

Site specific temperature correction factors are based on loading rates measured before and after the temperature change in the Casino humidity cell sample T1 (Table 2-3). The leaching rate of most parameters decreased when the humidity cell was moved from a 21˚C environment to the 4˚C environment. The leaching rates of some metals, notably Cu, were either unaffected or increased when the temperature was decreased. Other metals for which leaching rate increased include Ag, Co and Pb. This observed increase in leaching rates is not believed to be due to sulfide oxidation kinetics, as the oxidation rate of sulfide minerals uniformly decrease with decreasing temperature. The observed increases in these metals are likely do to temperature effects on oxide solubility and surface sorption.

Table 2-3:
Leaching rates from humidity cell T1 before and after temperature change

	SO_4	**Cd**	**Cu**	**Mo**	**Se**	**U**	**Zn**
	mg/kg/wk	**mg/kg/wk**	**mg/kg/wk**	**mg/kg/wk**	**mg/kg/wk**	**mg/kg/wk**	**mg/kg/wk**
21°C	19.0	3.017E-05	0.0050	0.021	0.00051	0.0012	0.00036
4°C	6.32	0.0000249	0.0053	0.0084	0.00018	0.00034	0.00035
rate (4°C) / rate (21°C)	0.33	0.82	1.06	0.41	0.35	0.28	0.95

2.3.1.1 Acidic SUP and HYP

The average temperature in the interior of the ore piles is assumed to be 4˚C, as discussed above. At this temperature oxidation rates will be 33% of those measured at standard laboratory temperatures (Figure 2-2). Under acidic conditions, the influence of oxide mineral solubility and metal adsorption will be less significant than under neutral pH. The metal leaching rate of most metal cations will be controlled by sulfide oxidation kinetics rather than metal solubility controls. Under such conditions it is assumed that leaching rates would decrease, similar to that observed for SO_4, the release of which is considered an indicator of the sulfide oxidation rate. Therefore, a temperature correction of 0.33 is applied to acidic loading rates for all parameters.

2.3.1.2 Neutral SUP and HYP

Under neutral conditions, mineral solubility will have a greater effect on metal loading than under acidic conditions where the primary sulphide oxidation rate will be the primary control. To reflect neutral weathering rates at a temperature of 4˚C, metal leaching rates are scaled by loading rate differences observed in humidity cell T1 (Table 2-3). For complete list of temperature correction of individual parameters see Lorax, 2013b.

2.3.2 Potential for Acid Generation during Mine Life

The Casino ABA dataset indicates that the HYP and SUP mineralization zones are predominately PAG (Lorax, 2013a and 2013b). However, many of these PAG rocks will remain non-acidic for years to centuries until the NP is depleted and acidic conditions develop. The ore piles at Casino will exist for between 14 to 25 years. Note that the MO stockpile will be composed exclusively of NP deplete rock, and is expected to be immediately acid generating.

The acid generating rate in neutral pH waste rock is estimated based on the stabilized SO_4 loading rates observed in the six pH-neutral HYP humidity cells (HC1, HC3, HC4, HC5, HC6, HC7) and the two pH-neutral SUP humidity cells (HC2 and HC11). A temperature correction of 0.33 is applied to this weathering rate, as discussed above. The NP consumption rate is calculated by multiplying the acid generation rate by the median carbonate molar ratio (CMR) observed in neutral pH humidity cells listed above. The CMR represents the amount of NP which is consumed by every unit of AP generated. The temperature corrected AP rate is multiplied by the CMR to produce the NP consumption rate. Input parameters for calculating the NP consumption rate for HYP and SUP are provided in Table 2-4.

Table 2-4:
Inputs used to calculate neutralization potential (NP) consumption rate of HYP and SUP pit wall

Input	Unit	HYP	SUP
HC SO_4 leaching rate	mg/kg/week	9.3	6.1
Acid Generation Rate	$kgCaCO_3$/tonne/week	0.0097	0.0064
Temp Corrected Acid Generation Rate	$kgCaCO_3$/tonne/year	0.0032	0.0021
CMR	ratio	1.59	1.75
NP Consumption Rate	$kgCaCO_3$/tonne/year	0.27	0.19

In order to determine the potential for acid generation in this time frame, the rate of NP consumption was calculated for the HYP and SUP ore samples (HC1 and HC2) and compared to the available NP in the ABA database. The variability of NP in the SUP and HYP mineralization zones is illustrated in Figure 2-3, which plots the cumulative percent of CaNP of ore material. A portion of the total CaNP can be expected to be unavailable. Unavailable NP represents measured NP that is ineffective at buffering the pH to a neutral value. The amount of NP that is unavailable for acid buffering was determined by comparing the paste pH and CaNP measured in ABA testwork. Any remaining NP in measured samples with a paste pH equal to or less than 6.0 is assumed to be unavailable. This approach indicates that 3.7 $kgCaCO_3$/tonne and 2.4 $kgCaCO_3$/tonne of the measured

CaNP is unavailable in the HYP and SUP mineralization zones, respectively (Lorax 2013b). By subtracting the unavailable NP, and applying the NP consumption rate developed in Table 2-4 an estimate of the amount of HYP and SUP ore that is NP depleted versus time can be developed (Figure 2-4).

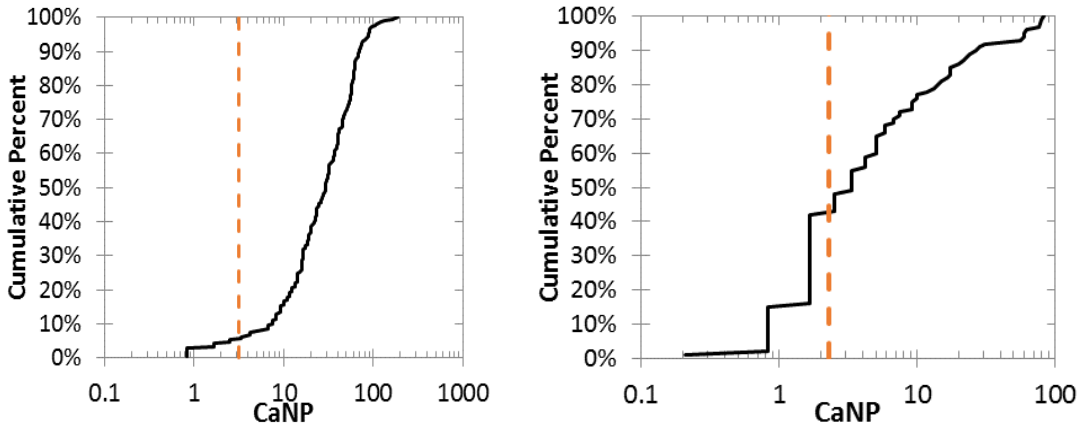


Figure 2-3: Cumulative percent CaNP in HYP (left) and SUP (right) material based on ABA database

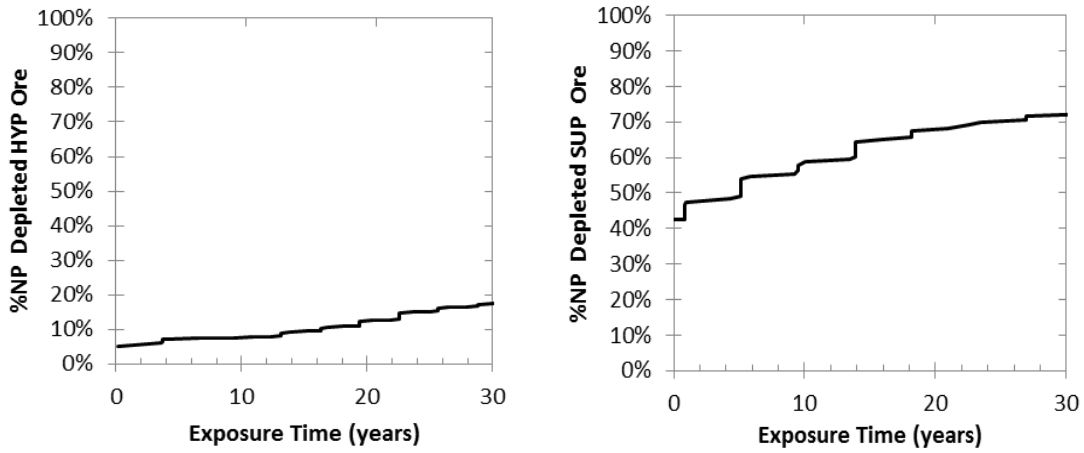


Figure 2-4: Percent of HYP (left) and SUP (right) that becomes CaNP depleted assuming an NP consumption rate of 0.27 kg$CaCO_3$/tonne/year for HYP and 0.19 kg$CaCO_3$/tonne/year for SUP

The percent of HYP and SUP which becomes CaNP depleted for the individual stockpiles is presented in Table 2-5. The HYP ore pile will exist for 20 years. Approximately 88% of HYP ore will have remaining NP after 20 years of exposure (Table 2-5 and Figure 2-4). Therefore, the HYP ore pile is expected to remain at a neutral pH for the duration of mine life. The SUP ore piles will exist for between 14 and

21 years. Between 62% and 68% of SUP ore can be expected to become acidic in this time frame (Table 2-5 and Figure 2-4). Furthermore, approximately 43% of SUP ore has no available NP and may become acidic shortly after exposure. Therefore the SUP piles are assumed to become acidic during mine life.

Table 2-5:
Exposure time and estimated percent CaNP depleted for the HYP and SUP temporary ore and LGO stockpiles

Facility ID	Ore Type	Exposure Time (year)	CaNP Depleted Ore %
Supergene ore stockpile	SUP Ore	14	62%
HYP LGO stockpile	HYP LGO	20	12%
SUS LGO stockpile	SUP LGO	23	69%
SOX LGO stockpile	SUP LGO	23	69%
MO Stockpile	SUP MGO	25	100%

2.4 Applied Kinetic Test Loadings

The loading rates applied to the five temporary stockpiles are described in this section.

2.4.1 Gold Ore Stockpile

Metal leaching from CAP material is driven by dissolution of secondary oxide and sulphate minerals rather than the kinetic oxidation of primary and secondary sulphide minerals. This mechanism of metal leaching from CAP material is not directly related to exposure time. Rather, the loading rate from this material is dependent on the degree of rinsing that has taken place. That is, metal loading is proportional to the volume of water which rinses the CAP material, rather than a kinetic loading rate driven by exposure time.

In order to reflect this understanding, loading rates from CAP material are calculated based on effluent volumes rather than elapsed time (*e.g.,* mass leached per volume effluent rather than of mass per time). To scale CAP column results in this manner, the cumulative load released from CAP columns after an effluent volume equivalent to a year of infiltration in the CAP stockpile is calculated. The inputs required to convert the column effluent volume to the equivalent infiltration rate expected for the Gold Ore pile (285 mm) are presented in Table 2-6. The mass of various parameters released per every 285 mm of water that passes through the column is assumed to be the annual loading rate of CAP material. These values are presented in Table 2-7.

Table 2-6:
Input parameters used to convert the column leachate volume (ml) to infiltration (mm)

Input	Unit	Value
Column Diameter (cm)	cm	20
Column Area (m2)	m^2	0.031
Gold Ore pile surplus water	mm	285
Column effluent volume equivalent to 285 mm	ml	8954

The CAP material in the Gold Ore pile will vary in age, as the CAP pile will exist for approximately 15 years. Loading rates from the CAP can be expected to decline with exposure time. As a conservative approximation, an average of the annual loading rates for the first four years of CAP rinsing is used for the Gold Ore stockpile source term calculations (Table 2-7). Note that the loading rates from Col 1 and Col 2a were weighted equally and no temperature correction is applied to the loading rate as metal leaching from CAP material is not driven by sulphide oxidation.

Table 2-7:
Mass of selected parameters released from CAP columns per effluent volume equivalent to 1 year of infiltration in the Gold Ore stockpile

	Effluent Volume (ml)	Equivalent Infiltration (mm)	Year	Cycles	pH	Sulphate mg/kg	Cd mg/kg	Cu mg/kg	Se mg/kg	Ù mg/kg	Zn mg/kg
Col 1	8954	285	1	1-29	5.6	263	0.000283	0.654	0.00754	0.00292	0.0364
Col 2a	8954	285	1	1-28	5.3	199	0.000788	0.414	0.013	0.000751	0.0608
Col 1	17907	570	2	30-57	6.2	85.1	0.000172	0.453	0.00202	0.000555	0.032
Col 2a	17907	570	2	29-54	5.5	87.7	0.00114	0.745	0.0029	0.00074	0.104
Col 1	26861	855	3	58-84	6.0	52.1	0.000326	0.976	0.000819	0.000774	0.0565
Col 2a	26861	855	3	55-80	6.0	38.1	0.000569	0.397	0.00126	0.000232	0.056
Col 1	35814	1140	4	85-112	5.7	72.8	0.000488	1.47	0.00114	0.00129	0.0816
Col 2a	35814	1140	4	81-108	6.2	29.4	0.000442	0.311	0.000604	0.000186	0.0375
Average applied to kinetic test (mg/kg/year)						*103*	*0.000526*	*0.678*	*0.00367*	*0.000931*	*0.0581*

2.4.2 Supergene Stockpiles

Loading rates measured from humidity cells HC2 and HC12 were used to develop source terms for ore stockpiles containing SUP, as described in Section 2.2. A temperature correction factor is applied to the neutral and acidic SUP loading rates, as discussed in section 2.3. The observed loading rates and temperature corrected loading rates for selected parameters of HC2 and HC12 are presented Table 2-8.

The loading rates from the neutral and acidic humidity cell are weighted proportional to the amount of SUP ore that is predicted to become depleted in NP over the lifetime of the stockpiles, as outlined in Table 2-5. That is to say, 68% of SUP can be expected to become depleted of NP. Therefore, the acidic SUP humidity cell is weighted as 68%, and the neutral SUP humidity cell (HC2) is weighted as 32% to calculate the weathering rate of the SUS LGO stockpile. Scaled loading rates for the three SUP containing stockpiles are presented in Table 2-8.

Table 2-8:
Observed humidity cell loading rates, temperature corrected loading rates, and applied loading rate for stockpiles composed of SUP material

	pH	Sulphate	Cd	Ca	Cu	Se	U	Zn
		mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk
HC2	6.98	7.74	0.0002957	3.2	0.00956	5.12E-05	2.57E-05	0.00104
HC12	3.81	25	0.0012	0.66	1.9	0.0006	0.014	0.12
Temp Corrected HC2		2.55	0.000219	2.637	0.0101	1.79E-05	7.21E-06	9.88E-04
Temp Corrected HC12		8.25	0.000396	0.2178	0.627	0.000198	0.00462	0.0396
SUP ore pile (62% HC12, 38% HC2)		6.09	0.000329	1.137	0.393	0.0001296	0.00287	0.0249
SUS LGO pile (68% HC12, 32% HC2)		6.43	0.000339	0.992	0.430	0.0001404	0.00314	0.0272
SOX LGO pile (68% HC12, 32% HC2)		6.43	0.000339	0.992	0.430	0.0001404	0.00314	0.0272
MO Stockpile (100% HC12)		8.25	0.000396	0.2178	0.627	0.000198	0.00462	0.0396

2.4.3 Hypogene stockpiles

Loading rates measured from humidity cells HC1, HC8 and HC10 were used to develop source terms for HYP ore stockpiles, as described in Section 2.2. A temperature correction factor is applied to the neutral and acidic HYP loading rates, as discussed in section 2.3. The loading rates from the neutral and acidic humidity cells are weighted proportional to the amount of HYP ore that is predicted to become depleted in NP over the lifetime of the stockpiles. That is to say, 12% of HYP can be expected to become depleted of NP during mine life (Table 2-5). Therefore, the acidic HYP humidity cells are weighted 6% each, and the neutral HYP humidity cell (HC1) is weighted as 88% to calculate the weathering rate of the HYP LGO stockpile. The observed humidity cell loading rates, temperature corrected loading rates and scaled loading rates for the HYP LGO pile are presented in Table 2-9.

Table 2-9:
Observed humidity cell laoding rates, temperature corrected loading rates, and applied loading rate for stockpiles composed of HYP material

	Cycles	pH	Sulphate	Cd	Ca	Cu	Se	Ù	Zn
			mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk
HC1	33-39	7.04	72	2.21E-05	26.1	0.0012	0.000216	0.00462	0.000176
HC10	49 - 65	3.15	75	0.00092	0.46	1.8	0.00049	0.019	0.19
HC8	49 - 65	3.34	46	0.00034	0.18	1.6	0.00021	0.018	0.033
Temp Corrected HC1			23.76	0.00000729	8.61	0.000396	0.0000713	0.001525	0.0000581
Temp Corrected HC10			24.75	0.000304	0.1518	0.594	0.0001617	0.00627	0.0627
Temp Corrected HC8			15.18	0.000112	0.0594	0.528	0.0000693	0.00594	0.01089
HYP LGO pile (88% HC1, 6% HC8, 6% HC10)			23.30	0.0000314	7.59	0.0677	7.66E-05	0.00207	0.00447

2.5 Physical Scaling Factors

A series of physical scaling factors are applied to adjust loading rates to account for differences between lab-based kinetic tests and the stockpiles. These include but are not limited to hydrogeological pathways, water/rock ratio, temperature, grain size distribution, and reaction mechanisms. Note that while research in reactive transport mechanisms in rock piles has brought forth an abundance of new models over the last decades, many of these parameters are still poorly constrained. Nevertheless, known discrepancies between humidity cell and field conditions cannot be ignored and the adjustment of chemical loads is necessary.

A summary of scaling factors used to relate the temperature corrected humidity cell loadings presented in Table 2-7, Table 2-8 and Table 2-9 to ore stockpile source term concentrations are presented in Table 2-9. To convert the loading rate into a concentration, the scaled loading rate is divided by the surplus water available for each facility. Surplus water values are provided by Knight Piesold, 2013b.

Table 2-10:
Summary of scaling factors used to predict source term concentrations

Scaling Factors	Unit	HYP Pile	SUS Pile	SOX Pile	SUP Pile	MO Pile	Gold Ore Pile
Surplus water	mm	285	307	285	285	285	285
Mass	kT	90,430	39,351	14,043	34,976	9,000	35,000
Area	km^2	1.3	0.47	0.3	0.477	0.2	0.55
Total Mass/Area	Tonnes/m^2	69.6	83.7	46.8	73.3	45.0	63.6
Frozen Thickness	m	3.5	3.5	3.5	3.5	3.5	NA
Winter mass/area[1]	Tonnes/m^2	63.6	77.8	40.9	67.4	39.1	NA
Reactive material <1/4"	-	10%	10%	10%	10%	10%	10%
Contact Water Factor	-	25%	25%	25%	25%	25%	50%

[1]Assumes upper 3.5 m frozen during winter and waste rock specific density of 1.7 g/$cm^{3.}$

2.5.1 Grain Size Factor

Humidity cells and unsaturated columns contain relatively fine grained particles (< ¼"), hence, material used in humidity cells have a greater surface area to mass ratio than material in ore piles. Kinetic reaction rates are partly a function of exposed surface area and thus, grain size. Grain size distribution of granitic waste rock at Sudbury, found that 12% of the waste is <0.78", while only 3% is < 0.24" (Fines *et al*., 2003). As a conservative approximation, it is assumed that 10% of the mass of the ore pile has a grain size of kinetic test material (< ¼") and that all metal leaching is associated with this grain size fraction.

2.5.2 Frozen Thickness

The Casino site the mean annual temperature is near 0ºC, and discontinuous permafrost is present in the proposed minesite area. It is reasonable to assume that a portion of the ore piles will freeze during winter months. Available data from the Casino minesite area indicates that the ground freezes to a depth of approximately 3.5 m. Therefore, it is assumed that during the 6 months when average monthly temperatures are below freezing, the upper 3.5 m of the ore piles are frozen. Note that this frozen thickness is not considered in the gold ore stockpile because metal leaching from CAP material is related to a flushing rate.

2.5.3 Contact Water

Humidity cells are designed to achieve complete flushing of mineral surfaces, ensured by the SOX sample size (1 kg) and high flushing rate (0.5 L/week). In unsaturated columns, complete mineral surface flushing is less certain, as the sample size is larger (5 kg) and the flushing rate is somewhat lower (0.3 L/week). Heterogeneous unsaturated rock piles are known to develop preferential water pathways with variable moisture content and more focused water flow. As a result, the entire mass of the reactive grain size fraction is not expected to be rinsed by infiltrating water. Consequently, an average contact water factor of 25% was implemented consistent with investigations on hydrogeological unsaturated flow mechanisms (Elboushi, 1975; Kempton, 2012). It is assumed that 100% of mineral surfaces in humidity cells are rinsed and that 50% of mineral surfaces in columns are flushed. Therefore, a rinsing factor of 25% is applied when upscaling humidity cells, and a rinsing factor of 50% is used when upscaling column data.

2.6 Secondary Mineral Control

Upscaling humidity cell loading rates often results in concentrations that exceed thermodynamic solubility controls. To account for mineral solubility controls that can be

reasonably expected to occur in the ore piles the USGS geochemical modelling program PHREEQC was applied using the Minteq.V4 database (Allison et al. 1991; Parkhurst and Apello, 1999). These solubility controls were incorporated by speciating the upscaled solution in PHREEQC, and allowing select minerals to precipitate to achieve equilibrium if the saturation indices (SI) was greater than zero.

The process of averaging and upscaling humidity cell results in a solution that is out of charge balance which can interfere with mineral solubility calculations in PHREEQC. Therefore some adjustments to major parameters were made before speciation modelling. These adjustments consist of:

- Setting alkalinity to zero in source terms predicted to be acidic (Supergene ore stockpile, SUS LGO stockpile, SOX LGO stockpile and MO stockpile).
- Setting alkalinity to median values observed in field bins containing respective material types for source terms predicted to have a pH greater than 4.5 (HYP LGO stockpile and Gold Ore Stockpile).
- Adjusting the concentration of Ca, Mg and Sr to achieve charge balance, while maintaining the relative concentration of these three major cations.

The mineral phases considered are listed with their chemical formulas in Table 2-11. Note that the mineral phases considered did not precipitate from all upscaled solutions. Particularly, few mineral solubility controls affected source terms predicted to be acidic. The source term most affected by mineral solubility controls is the HYP LGO stockpile owing to its neutral pH. All PHREEQC model inputs are provided in Appendix A.

Table 2-11:
Overview of secondary mineral equilibrated with model output solutions

Mineral Phase	Chemical Formula	MO Pile	Supergene Ore Pile	Gold Ore Pile	HYP LGO Pile	SUS LGO Pile	SOXLGO Pile
pH		3.2	3.2	4.7	7.2	3.2	3.2
Bassaluminite	$Al_4(OH)_{10}SO_4$						
Gibbsite	$Al(OH)_3$				x		
Barite	$BaSO_4$	x	x	x	x	x	x
Tenorite	CuO				x		
Celestite	$SrSO_4$				x		
Chalcedony	SiO_2	x	x	x	x	x	x
Dolomite	$(Ca,Mg)CO_3$						
Ferrihydrite	$Fe(OH)_3$				x		
Schwertmannite	$Fe_8O_8(OH)_{4.4}(SO_4)_{1.8}$			x		x	
Fluorite	CaF_2				x		
Gypsum	$CaSO_4{:}2(H_2O)$				x		
Manganite	MnOOH				x		

2.7 Predicted Source term and Screening

The predicted concentrations derived from upscaling kinetic loading rates and applying thermodynamic solubility controls are presented in Table 2-12. In order to ensure that the predicted concentrations are realistic, predictions are compared to observed drainage data at other minesites and the 90th percentile concentration of Casino field bins in this table. Waste rock seep statistics for six copper porphyry minesites in BC are provided, with data grouped by pH range. These statistics were originally compiled in Day and Rees (2006), and in AMEC (2004). Minesites incorporated into these statistics include Island Copper Mine, Gibraltar Mine, Mount Polley Mine, Huckleberry Mine, Kitsault Mine and one unidentified mine. In addition to these BC copper porphyry mines, data from the Aitik mine is provided. The Aitik mine is a copper porphyry mine in the Swedish subarctic, with a similar temperature range and annual precipitation as the Casino site, as discussed in Section 2.3.1. Data for the Aitik mine includes waste rock seepage data provided by Linlater *et al.* (2005), and data for a drainage collection ditch provided by Stromberg and Banwart (1994). Note that data quality for these comparative minesites could not be independently verified.

The predicted concentrations of Ni, Pb and Se in acidic supergene piles are relatively low compared to median values reported to BC copper porphyry deposits. Therefore these source terms are revised upwards, and set to the 95th percentile of waste rock seepage of BC copper porphyry mines. The predicted concentrations of SO_4, Al, Ca and Cu for the acidic supergene stockpiles are generally lower than the median value reported for BC copper porphyry mines, but greater than the average values reported for the Aitik mine. Therefore these concentrations are considered realistic and not adjusted.

A number of the predicted concentrations were beyond the maximum values reported for other sites. Specifically, Mo concentrations in supergene and gold ore stockpiles, and As in the hypogene stockpile are considerably greater than concentration observed at other minesites or in respective field bins. In the expected pH range of these drainages, sorption processes play an important role in controlling the concentrations of these oxyanion forming elements. Sorption processes were not considered in development of the Casino source term, leading to an over prediction of Mo and As in these source terms. Rather than incorporating a surface sorption module into the source term prediction, the concentrations of these element was adjusted downward to the 95th percentile observed in waste rock seeps in BC copper porphyry deposits (Table 2-12).

A number of Parameters in the gold ore stockpile are lower than concentrations observed at other BC porphyry mines. The gold ore stockpile is composed of oxide CAP material that is contains only trace sulphide mineralization, and is relatively deplete in metals. It is expected that this material will produce lower metal concentrations in drainage compared to sulphidic waste piles in a similar pH range. Therefore the gold ore stockpile source term are not adjusted.

Table 2-12:
Comparison of Predicted Casino Stockpile Source Term Concentrations to Analogue Mines and Field Bin drainage

Upscaled Concentrations	**pH**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
HYP Stockpile	7.20	68	1,900	0.0023	0.086	610.00	0.01	0.01	0.06	0.01	0.00	51.00	97.00	0.13	2.50	8.20	0.07	0.0024	0.28	0.02	0.49	0.57
SUS Stockpile	3.2	0	2200	120	0.046	300	0.12	0.021	150	130	0.0004	24	86	4.1	3	7.90	0.12	0.0041	0.12	0.049	1.1	9.5
SOX Stockpile	3.2	0	1300	71	0.027	180	0.072	0.012	87	77	0.00023	14	51	2.4	1.7	2.40	0.068	0.0024	0.072	0.029	0.65	5.6
SUP ORE Stockpile	3.2	0	1800	92	0.045	280	0.1	0.016	110	100	0.00037	24	81	4.1	3.1	4.00	0.091	0.0032	0.13	0.038	0.85	7.3
Oxide Stockpile	4.7	1	2300	5.8	0.022	260	0.012	0.035	15	0.3	0.0005	180	56	5.7	0.24	630.00	0.074	0.027	0.033	0.082	0.021	1.3
MO Stockpile	3.2	0	1600	98	0.0087	210	0.079	0.015	120	110	0.00014	3.3	29	0.46	0.00081	1.2	0.086	0.0032	0.0027	0.039	0.9	7.7
Corrected Concentrations																						
HYP Stockpile	7.2	68	1900	0.0023	0.03	610	0.0093	0.014	0.056	0.0099	0.0006	51	97	0.13	2.5	8.2	0.071	0.0024	0.28	0.3	0.49	0.57
SUS Stockpile	3.2	0	2200	120	0.046	300	0.12	0.021	150	130	0.0004	24	86	4.1	0.009	7.9	2	0.04	0.08	0.2	1.1	9.5
SOX Stockpile	3.2	0	1300	71	0.027	180	0.072	0.012	87	77	0.00023	14	51	2.4	0.009	2.4	2	0.04	0.072	0.2	0.65	5.6
SUP Ore Stockpile	3.2	0	1800	92	0.045	280	0.1	0.016	110	100	0.00037	24	81	4.1	0.009	4.00	2	0.04	0.13	0.2	0.85	7.3
Oxide Stockpile	4.7	1	2300	5.8	0.022	260	0.012	0.035	15	0.3	0.0005	180	56	5.7	0.03	630	0.074	0.027	0.033	0.082	0.021	1.3
MO stockpile	3.2	0	1600	98	0.0087	210	0.079	0.015	120	110	0.00014	3.3	29	0.46	0.00081	1.2	2	0.04	0.0027	0.2	0.9	7.7
Copper Porphyry in BC (Red Chris EA,2004)	**pH[1]**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Max	2.1	0	30910	766		804	0.02		655	1310	0.0011	148	213	56	0.009	204	2	0.04	0.13	0.2		6
pH <4 P95	2.5	0.15	7969	436		748	0.02		512	480	0.0011	134	163	41	0.009	91	2	0.04	0.09	0.2		5
P50	3.1	1	3220	239		532	0.007		249	14	0.0007	37	61	4	0.006	20	0.8	0.0155	0.02	0.09		2
Max	4	1.2	2930	47		832	0.04		370	5	0.0006	112	201	31	0.03	64	1	0.02	-	0.09		4
pH 4-6 P95	4.1	2	2440	40		793	0.04		340	3	0.0006	87	180	26	0.03	49	1	0.02	-	0.08		4
P50	5.3	5	1260	5		361	0.04		66	0.2	0.0006	3	39	9	0.0068	14	0.4	0.012	-	0.07		2
Max	6	1	1896	0.6	0.04	964	0.03		1	0.3	0.002	58	115	6	0.4	126	0.4	0.01	0.09	0.3		1
pH>6 P95	6.4	7.53	1531	0.2	0.03	727	0.007		0	0.2	0.00043	39	101	4	0.3	54	0.21	0.0036	0.08	0.3		0.8
P50	7.5	43.6	464	0	0.01	247	0		0.02	0	0.00005	4	24	1	0.03	11	0.006	0.00007	0.01	0.06		0.03
Aitik Mine Seeps (Linklater, 2005)	**pH[1]**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Max	3.3		3279	230		228			146	28.2												
Average	3.9		1267	68.1		140.8			28	3.2												
Min	6.3		518	1		95			0.18	0.1												
Aitik Mine Seeps (Stromberg and Banwart, 1994)	**pH[1]**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Average of Collection Ditch	3.8		1,310	75		185			19	2		17	57	12.1		46	1.3					5.8
Casino Field Bins	**pH[1]**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
HYP P90	7.19	126.5	1,360	0.026	0.01364	393	0.0030	0.00502	0.1618	0.0484	0.00005	18.42	52.48	0.144	0.6812	218.4	0.05086	0.007358	0.05646	0.03126	0.2852	0.04902
SUP P90	5.52	56.5	1,036	0.905	0.005571	273	0.24	0.00533	26.63	0.0518	0.00005	13.63	39.42	4.596	0.1704	228.8	0.04846	0.00733	0.01047	0.1967	0.02016	2.244
CAP P90	4.05	20.94	418.8	28.32	0.01392	14.46	0.001438	0.04564	1.57	2.192	0.000086	7.32	7.154	0.5038	0.6154	181.2	0.02314	0.02244	0.008328	0.0409	0.00556	0.3158

Red Highlight = Predicted concentration greater than maximum of BC copper porphyry deposits in the corresponding pH range.
Blue Highlight = Predicted concentration less than median of the BC copper porphyry deposits in the corresponding pH range.
Amber Highlight = Concentrations are adjusted based on comparison.
[1]Statistics for pH are reported as minimum, P5 and P10

2.7.1 Final Source Terms

Predicted concentrations and loading rates for Casino stockpiles are presented in Table 2-13 and Table 2-14, respectively. The concentrations presented in Table 2-13 represent the maximum concentrations calculated for the ore stockpiles. The loading rates in Table 2-14 can be applied to the water balance model to reflect changes in the quantity of ore in the stockpile over the mine life, while concentrations maximums in Table 2-13 can be used to cap the maximum concentration to reflect thermodynamic solubility controls.

Table 2-13:
Maximum source term concentrations for temporary stockpiles

Parameter	Unit	Gold Ore Pile	MGO Stockpile	SUP Ore Pile	SOX LGO Pile	SUS LGO Pile	HYP LGO Pile	MMER		
								MMM	MCS	MGS
pH	s.u.	4.7	3.2	3.2	3.2	3.2	7.2			
Acidity	$mgCaCO_3/L$	45	866	820	637	1046	0.27			
Alk.	$mgCaCO_3/L$	10	0	0	0	0	68.05			
SO_4	mg/L	2310	1590	1780	1300	2220	1890			
F	mg/L	3.68	6.25	23.8	14.4	24.7	2.35			
Cl	mg/L	80.9	2.98	15.9	9.34	16.1	37.4			
Ag	mg/L	0.0028	0.000538	0.0007	0.000496	0.000847	0.000701			
Al	mg/L	5.83	98.4	92.4	71	121	0.00226			
As	mg/L	0.0219	0.00874	0.0454	0.0267	0.0461	0.03	0.5	0.75	1
Ba	mg/L	0.00433	0.0229	0.00598	0.00668	0.00533	0.00559			
Ca	mg/L	259	211	279	181	302	609			
Cd	mg/L	0.0117	0.079	0.102	0.0721	0.123	0.00932			
Co	mg/L	0.248	0.238	0.278	0.201	0.343	0.0521			
Cr	mg/L	0.0352	0.0149	0.0164	0.0121	0.0206	0.0137			
Cu	mg/L	15.1	119	113	86.5	147	0.0562	0.3	0.45	0.6
Fe	mg/L	0.301	107	100	77	125	0.00986			
Hg	mg/L	0.00050	0.000136	0.000375	0.000234	0.00040	0.000601			
K	mg/L	182	3.35	24.3	14	24.3	51.4			
Mg	mg/L	56.2	28.6	80.8	51	85.6	96.8			
Mn	mg/L	5.7	0.458	4.12	2.35	4.07	0.127			
Mo	mg/L	0.03	0.001	0.009	0.009	0.009	2.48			
Na	mg/L	628	1.19	4.01	2.44	7.86	8.22			
Ni	mg/L	0.0743	2.0	2.0	2.0	2.0	0.071	0.5	0.75	1
Pb	mg/L	0.0273	0.04	0.04	0.04	0.04	0.0024	0.2	0.3	0.4
Sb	mg/L	0.0335	0.00272	0.13	0.0717	0.08	0.277			
Se	mg/L	0.0819	0.2	0.2	0.2	0.2	0.3			
Si	mg/L	7.78	21.5	7.82	7.85	7.81	7.84			
Sr	mg/L	2.57	1.21	0.803	0.546	0.91	12.4			
Tl	mg/L	0.0042	0.000272	0.0009	0.000545	0.00094	0.000501			
U	mg/L	0.0208	0.90	0.845	0.65	1.1	0.495			
Zn	mg/L	1.3	7.69	7.32	5.61	9.52	0.569	0.5	0.75	1

Table 2-14:
Predicted loading rates for stockpiles at the Casino minesite

Parameter	Units	GOLD ORE Pile	MGO Pile	SUP ORE Pile	SOX LGO Pile	SUS LGO Pile	HYP LGO Pile
Acidity	$mgCaCO_3/t/yr$	201	5309	3388	3695	3800	1605
Alk.	$mgCaCO_3/t/yr$	0	0	0	0	0	7,320
SO_4	mg/tonne/year	10300	10,040	7558	7900	8140	28,200
F	mg/tonne/year	16.5	39.6	101	88.1	90.7	75.2
Cl	mg/tonne/year	363	18.80	67.60	57.4	59.2	153
Ag	mg/tonne/year	0.0126	0.0034	0.00298	0.00302	0.00311	0.00281
Al	mg/tonne/year	26.1	623	393	430	442	247
As	mg/tonne/year	0.0981	0.0553	0.193	0.164	0.169	0.123
Ba	mg/tonne/year	10.6	0.145	3.64	2.93	3.01	3.17
Ca	mg/tonne/year	1010	1340	1180	1080	1110	11100
Cd	mg/tonne/year	0.0526	0.5	0.432	0.438	0.451	0.0383
Co	mg/tonne/year	1.11	1.51	1.18	1.22	1.26	0.213
Cr	mg/tonne/year	0.158	0.0942	0.0699	0.0733	0.0755	0.0559
Cu	mg/tonne/year	67.8	755	480	524	539	96.8
Fe	mg/tonne/year	3.33	676	426	466	480	75.4
Hg	mg/tonne/year	0.0021	0.000861	0.0016	0.00143	0.00148	0.00258
K	mg/tonne/year	814	21.2	103	86.4	89	210
Mg	mg/tonne/year	220	181	344	305	314	396
Mn	mg/tonne/year	25.5	2.9	17.5	14.5	14.9	17
Mo	mg/tonne/year	0.134	0.00511	0.0382	0.0548	0.033	10.2
Na	mg/tonne/year	2810	7.54	17	14.9	28.8	33.7
Ni	mg/tonne/year	0.333	12.7	8.5	12.2	7.33	0.291
Pb	mg/tonne/year	0.122	0.253	0.17	0.244	0.147	0.0099
Sb	mg/tonne/year	0.15	0.0172	0.552	0.443	0.456	1.13
Se	mg/tonne/year	0.367	1.27	0.85	1.22	0.733	1.23
Si	mg/tonne/year	3100	136	286	254	261	214
Sr	mg/tonne/year	10.1	7.64	3.41	3.24	3.34	55.9
Tl	mg/tonne/year	0.019	0.00172	0.00379	0.00334	0.00344	0.00204
U	mg/tonne/year	0.0931	5.7	3.59	3.93	4.05	2.02
Zn	mg/tonne/year	5.81	48.7	31.1	33.9	34.9	2.33

2.7.2 Disposal of Ore in Pit Lake

A portion of the stockpiled ore may not be processed at the end of mine life. The current mine plan envisions disposal of non-processed ore stockpile material into the pit lake. Sub-aqueous disposal of the ore will inhibit sulfide oxidation reactions preventing further acid release and metal leaching. However, a water soluble load of oxidation products will be available for dissolution when fully flooded in the pit lake. This water soluble load is anticipated to be an instantaneous release which takes place immediately upon disposal into the lake, analogous to saturation of pit wall units which will be discussed in Chapter 8. Source terms for sub-aqueous disposal of stockpile material is presented in Table 2-15. Development of these source terms is described below.

Table 2-15:
Available load from sub-aqueous disposal of ore stockpiles into the pit lake

Parameter	Units	Gold Ore Pile	SUP ORE PILE	SOX LGO PILE	SUS LGO PILE	HYP LGO PILE
Acidity	$mgCaCO_3$/tonne	604	143000	255000	262000	96300
Alkalinity	$mgCaCO_3$/tonne	0	0	0	0	439000
SO_4	mg/tonne	30900	319000	545000	562000	1690000
F	mg/tonne	49.5	4280	6080	6260	4510
Cl	mg/tonne	1090	2850	3960	4080	9180
Ag	mg/tonne	0.0378	0.126	0.208	0.215	0.169
Al	mg/tonne	78.3	16500	29700	30500	14800
As	mg/tonne	0.294	8.15	11.3	11.7	7.38
Ba	mg/tonne	31.8	153	202	208	190
Ca	mg/tonne	3030	45400	74500	76600	666000
Cd	mg/tonne	0.158	18.2	30.2	31.1	2.3
Co	mg/tonne	3.33	49.6	84.2	86.9	12.8
Cr	mg/tonne	0.474	2.94	5.06	5.21	3.35
Cu	mg/tonne	203	20200	36200	37200	5810
Fe	mg/tonne	9.99	17900	32200	33100	4520
Hg	mg/tonne	0.0063	0.0672	0.0987	0.102	0.155
K	mg/tonne	2440	4370	5960	6140	12600
Mg	mg/tonne	660	13200	21000	21700	23800
Mn	mg/tonne	76.5	739	1000	1030	1020
Mo	mg/tonne	0.402	1.47	3.78	2.28	612
Na	mg/tonne	8430	14900	38200	23000	13300
Ni	mg/tonne	0.999	326	842	506	17.5
Pb	mg/tonne	0.366	6.51	16.8	10.1	0.594
Sb	mg/tonne	0.45	23.3	30.6	31.5	67.8
Se	mg/tonne	1.1	32.6	84.2	50.6	73.8
Si	mg/tonne	9300	12100	17500	18000	12800
Sr	mg/tonne	30.3	131	224	230	3350
Tl	mg/tonne	0.057	0.16	0.23	0.237	0.122
U	mg/tonne	0.279	152	271	279	121
Zn	mg/tonne	17.4	1310	2340	2410	140

While the ore piles exist, it is assumed that 25% of rock surfaces are flushed by meteoric water (Table-10). For the sulphide bearing ore piles (Supergene ore pile, SOX LGO pile, SUS LGO pile and HYP LGO pile), the 75% of rock surfaces which are not flushed will accumulate an oxide load while the ore is subaerially exposed. In order to calculate the load available, it is assumed that three times the annual load presented in Table 2-14 is accumulated for every year that the ore is exposed. That is to say, the annual loading rate is multiplied by three (75%/25%) and then multiplied by the number of years of exposure (14 to 23 years) for the four different piles. The stockpile ages are outlined in Table 2-1.

The Gold ore stockpile material is unique from the other ore stockpiles, in that the ore material contains little or no sulphide mineralization. Owing to the lack of sulphide mineralization the water soluble oxide load on rock surfaces is not expected to accumulate with time. Therefore, the gold ore stockpile sub-aqueous loading term is independent of exposure time. It is assumed that the 75% of gold ore stockpile surfaces are not rinsed, similar to the sulphide stockpiles. The subaqueous load is therefore assumed to be three times the annual loading rate presented Table 2-14.

2.7.3 Diversion of Acidic Seepage to Mill

Seepage from the acidic supergene ore piles will be diverted to the mill and used in the ore processing circuit. The acidic seepage will be neutralized with lime to a pH >10 during the milling process, and the resulting effluent will be analogous to lime treated ARD. Diverting ARD from supergene stockpiles to the mill will result in some degradation of process water discharged to the TMF. Therefore a separate source term is provided for lime treated ARD.

Currently, analytical data is not available for Casino regarding neutralization of acidic drainage. Therefore, effluent from a simple lime treatment plant at a Copper-Zinc mine in Quebec is applied to this source term. Influent and effluent from this lime treatment plant is presented in Table 2-16. At this minesite ARD is treated using a relatively simple lime treatment system. The treatment plant is of relatively simple design, it is a low density lime treatment plant which raises influent pH to approximately 8.5 with no flocculent addition. Note that the oxyanion forming metals As, Sb, Mo, Se and U are expected to behave conservatively, and the concentration of these metals is not expected to be significantly drawn down in the milling circuit. For discussion regarding parameters that will behave conservatively in the milling circuit, see Chapter 6.

Table 2-16:
Inflow and Outflow Chemistry for lime treatment plant in at a copper zinc mine in Quebec. Outflow chemistry is applied to acidic stockpile drainage diverted to the mill

	Unit	Inflow	Outflow
pH	s.u.	2.8	8.5
Alkalinity	mg$CaCO_3$/L	-	52
SO_4	mg/L	7,200	2,830
Al	mg/L	198	0.014
As*	mg/L	-	-
Sb*	mg/L	-	-
Cd	mg/L	5.3	0.013
Ca	mg/L	222	649
Co	mg/L	0.96	<0.001
Cu	mg/L	155	0.064
Fe	mg/L	252	<0.03
Pb	mg/L	0.09	<0.0005
Mg	mg/L	650	170
Mn	mg/L	90	0.003
Mo*	mg/L	-	-
Ni	mg/L	0.3	<0.005
K	mg/L	<4.0	6.0
Se*	mg/L	-	-
Si	mg/L	16	0.28
Na	mg/L	<4.0	7.1
Sr	mg/L	0.4	1.2
U*	mg/L	-	-
Zn	mg/L	1160	0.048

* Metals expected to behave conservatively during lime neutralization

3. Unsaturated Waste Rock

CASINO
COPPER AND GOLD

3. Unsaturated Waste Rock

Waste rock produced by the Casino mine will be stored sub-aqueously in the upstream zones of the TMF. Sub-aquoeus disposal of waste rock will inhibit oxidation preventing release of metals and acidity associated with sulphide mineralization. Waste rock placed in the TMF will remain unsaturated for an average of three years before saturation. During this time period, the waste will oxidize releasing a metal load and acidity to the TMF pond. In order to assess the impact of runoff and seepage from unsaturated waste rock, geochemical source terms are developed using lab- and field- kinetic experiments of comparable materials. The various work stages leading to the development of this source term can be summarized as follows:

- Selection of kinetic tests representative of various rock types and weathering states (acidic vs. neutral) for model input;
- Calculation of temperature affects on acid generation and metal leaching rates;
- Estimate of percent of waste rock that can be expected to become acidic during exposure;
- Calculation of averaged loading rates to represent the waste rock;
- Scale-up of loads to simulate reaction within waste rock stockpile;
- Application of secondary mineral controls (speciation calculations); and
- Comparison of output concentrations to other mine sites and adjustment of model parameters as necessary.

A number of assumptions and scaling factors used to develop waste rock source terms are similar to those used to develop the temporary stockpile source terms presented in Chapter 2. A flow chart illustrating the steps and data used in source term development is provided in Figure 3-1.

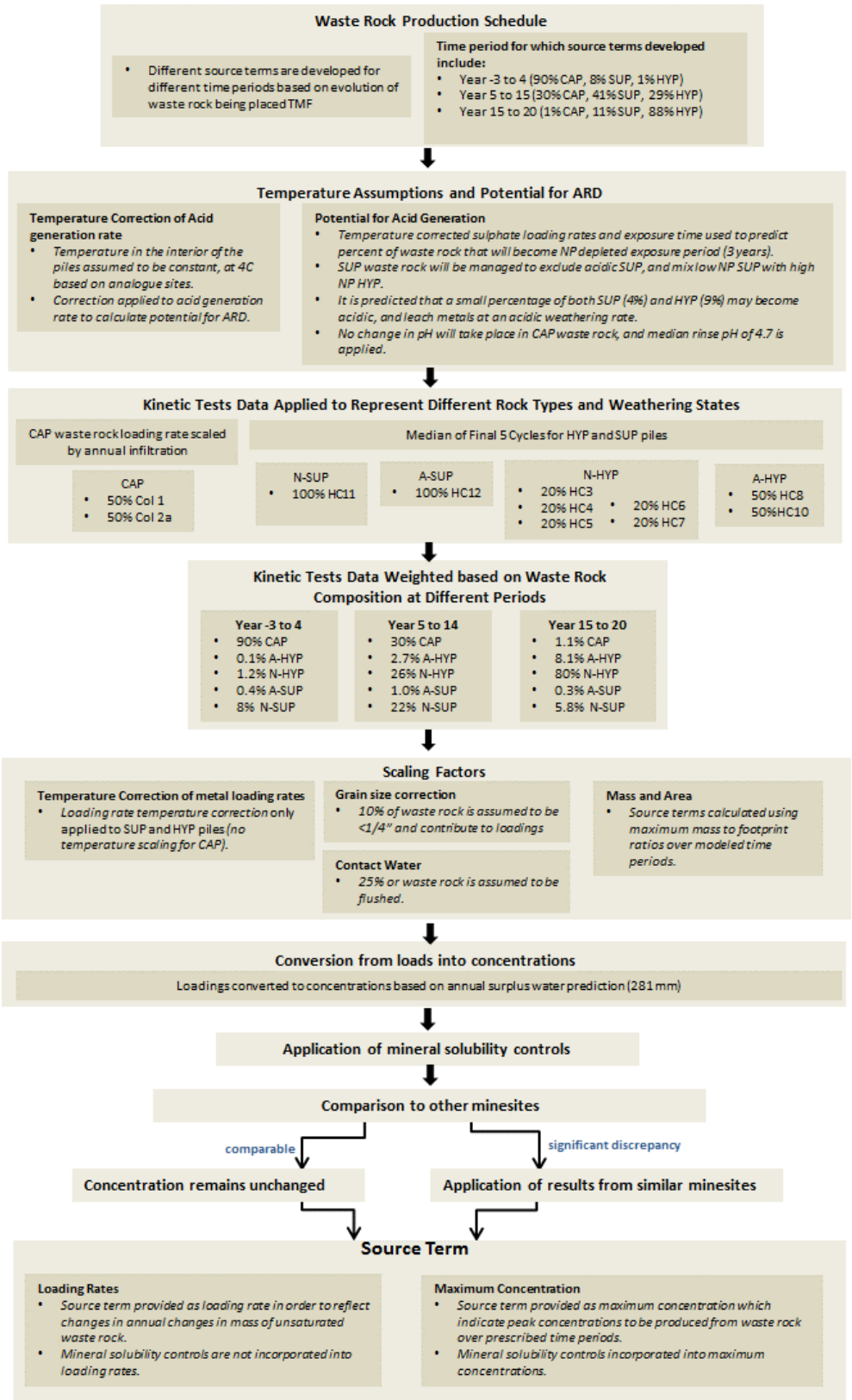


Figure 3-1: Flow chart illustrating source term development for unsaturated waste rock in TMF

3.1 Waste Rock Production and Placement

The annual production of waste rock is illustrated in Figure 3-2. Initially, waste rock will be dominated by shallow CAP material. As the pit shell deepens, increasing amounts of SUP and HYP waste rock will be produced. In the final years of mine life waste rock production will be dominated by HYP. Accordingly, separate source terms are developed for these three time periods. The amount of waste rock produced during, and the years that the three source terms apply are illustrated in Table 3-1.

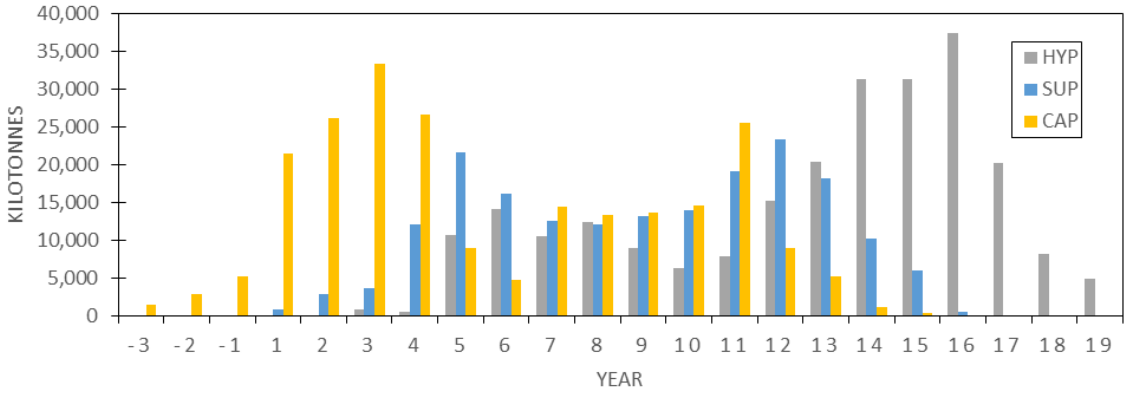


Figure 3-2: Annual waste rock mass and mineralization type placed in TMF

Table 3-1:
Composition of unsaturated waste rock during three modeled time periods

Modeled time period	Start (year)	End (year)	CAP %	SUP %	HYP %	Mass Deposited (MT)
CAP dominated period	-3	4	90.4	8.3	1.3	129
Mixed time period	5	14	29.9	41.1	29.0	409
HYP dominated period	15	20	1.1	11.1	87.9	109

3.2 Kinetic Test Data

Kinetic tests used to develop waste rock source terms are outlined in Table 3-2. These tests include humidity cells conducted on neutral HYP (N-HYP), neutral SUP (N-SUP), acidic HYP (A-HYP) acidic SUP (A-SUP), and unsaturated columns on CAP waste. For complete kinetic test results and static test results on these samples see Lorax, (2013b).

Table 3-2:
Humidity cells (HC) and unsaturated columns (Col) used to develop unsaturated waste rock source terms

Test ID	Mineralization	Lithology	Material Type	Represents	Start Date	End Date	Data Used
HC3	HYP	PP	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-60
HC4	HYP	WR	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-61
HC5	HYP	PP	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-62
HC6	HYP	WR	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-63
HC7	HYP	50% IX 50% MX	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-64
HC8	HYP	MX	Waste	Acidic HYP	29-Nov-11	On-going	Median of Cycle 49-65
HC10	HYP	WR	Waste	Acidic HYP	29-Nov-11	On-going	Median of Cycle 49-65
HC11	SUP	WR	Waste	Neutral SUP	29-Nov-11	On-going	Median of Cycle 49-65
HC12	SUP	WR	Waste	Acidic SUP	29-Nov-11	On-going	Median of Cycle 49-65
Col1	CAP	WR	Waste	CAP	27-Jan-10	On-going	Cumulative loading of Cycles 1 to 112
Col2a	95%CAP, 5% SUP	85% WR 5% IX 5% MX 5% PP	Waste	CAP	27-Jan-10	On-going	Cumulative loading of Cycles 1 to 108

3.3 Temperature Effects and Potential for Acid Generation

Assumptions regarding temperature of waste rock interior and temperature effects on loading rates are identical to those made for ore stockpile source term development. That is, the waste rock piles are assumed to weather at a temperature of 4C, and loading rates in HYP and SUP waste are adjusted based on results of humidity cell T4. For discussion of these assumptions see section 2.2.

3.3.1 Potential for Acid Generation

Waste rock will remain unsaturated for an average of three years after being placed in the TMF. During this time period there is the potential for some acid generation to take place. In the first four years of mine life, NP deplete SUP will not be placed in the TMF. After this time period, low NP SUP will be managed so that it is mixed with high NP HYP to prevent further acid generation. The potential for acid generation in waste rock piles is calculated using the same approach as for ore stockpiles (Section 2.3.2). It is estimated that 9% of HYP and 4% of SUP will become acidic in this time period. The proportion of neutral HYP (N-HYP), acidic HYP (A-HYP), neutral SUP (N-SUP) and acidic SUP (A-SUP) are produced over modeled time periods is presented in Table 3-3.

Table 3-3:
Percentage of different mineralization types breakdown of weathering state during modeled time periods

Mineralization type and weathering state	Average Composition Year -3 to 4	Average Composition Years 5 to14	Average Composition Year 15 to 20
CAP (%)	90	30	1.1
A-HYP (%)	0.1	2.7	8.1
N-HYP (%)	1.2	26	80
A-SUP (%)	0.4	1.0	0.3
N-SUP (%)	8.0	22	5.8

Note: Neutral HYP (N-HYP), acidic HYP (A-HYP), neutral SUP (N-SUP), acidic SUP (N-SUP)

3.4 Applied Kinetic Test Loadings

Loading rates for humidity cells and unsaturated columns outlined in Table 3-2 are used to develop the waste rock source terms. For the SUP and HYP humidity cells, the median loading rate from the final five cycles of available data was applied. Loading rates from CAP material are calculated based on effluent volumes rather than elapsed time, as discussed in section 2.4.1. Oxide CAP loading rates are calculated by taking the cumulative load released from CAP columns after an effluent volume equivalent to 3 years of infiltration (3 x 285mm). Select loading rates for the different material types used to develop waste rock source terms are presented in Table 3-4. Note the SUP and HYP results in this table have been corrected for temperature effects, as discussed in section 3.3.

Table 3-4:
Loading rates of different mineralization types and weathering states of material in unsaturated waste rock

	Units	N-HYP	A-HYP	N-SUP	A-SUP	CAP
SO_4	mg/kg/wk	2.6	20	1.5	8.2	2.3
As	mg/kg/wk	0.00021	0.00016	0.00026	0.000045	0.000021
Cd	mg/kg/wk	8.2E-06	0.00021	4.1E-06	0.00041	0.00001
Cu	mg/kg/wk	0.00065	0.56	0.0023	0.62	0.012
Mo	mg/kg/wk	0.00062	0.000048	0.00025	4.2E-06	0.00024
Mn	mg/kg/wk	0.0045	0.014	0.00072	0.0024	0.0049
Ni	mg/kg/wk	0.000065	0.0024	0.0001	0.00045	0.000061
Pb	mg/kg/wk	0.000018	0.000039	0.000017	0.000017	0.000021
Sb	mg/kg/wk	0.00015	0.000053	0.00045	0.000028	0.000035
Se	mg/kg/wk	0.000054	0.00012	0.000071	0.0002	0.000088
U	mg/kg/wk	0.00059	0.0062	0.00078	0.0047	0.000019
Zn	mg/kg/wk	0.00079	0.037	0.0015	0.04	0.0011

Note: SUP and HYP loading rates presented in this table are temperature corrected, no temperature correction is applied to CAP loadings.

3.5 Physical Scaling Factors

A series of physical scaling factors are applied to adjust loading rates to account for differences between lab-based kinetic tests and waste rock piles. A summary of scaling factors used to relate the kinetic test loadings to waste rock source term concentrations are presented in Table 3-5. For the scaling factor rational see Section 2.5. The mass of unsaturated waste rock in the TMF storage zone will fluctuate over the modeled time periods. The TMF design engineers estimated the quantity of waste rock exposed above the water table for each production year (Knight Peisold, 2013c). The quantities listed in Table 3-5 represent the maximum mass to area ratio (tonnes/m^2) that will be reached during the three incremental time periods for which source terms are calculated.

Table 3-5:
Summary of scaling factors used to predict source term concentrations

Scaling Factors	Unit	Year -3 to 4	Year 5 to 14	Year 15 to 20
Surplus water	mm	281	281	281
Mass	MT	37	134	148
Area	ha	130	289	329
Total Mass/Area	Tonnes/m^2	29	47	45
Reactive material <1/4"	-	10%	10%	10%
Contact Water Factor	-	25%	25%	25%

[1]Assumes upper 3.5 m frozen during winter and waste rock specific density of 1.7 g/cm^3

3.6 Secondary Mineral Control

Solubility controls were applied by speciating the upscaled solution in PHREEQC, and allowing select minerals to precipitate to achieve equilibrium if the saturation indices (SI) was greater than zero. The Year 5-14 source term was treated differently from the other source terms, in that it was speciated in two steps. This is because waste rock in the facility at this time point consists of similar portions of oxide CAP at an intermediate pH, and sulphidic SUP and HYP at a neutral pH. To calculate a source term for this facility, the SUP and HYP sections of the pile were upscaled and speciated separately from the CAP sections of the pile. The two resulting drainage chemistries were then mixed proportional to the composition of the dump.

Adjustments were made to major parameters before speciation modelling. These adjustments consist of:

- Setting alkalinity to median values observed in field bins containing respective material types for source terms predicted to have a pH greater than 4.5.

- Adjusting the concentration of Ca, Mg and Sr to achieve charge balance, while maintaining the relative concentration of these three major cations.
- During years -3 to 4 and years 5 to 14 the pH is set to the median rinse pH of CAP waste rock (4.7), as this is the most abundant individual waste type in the waste rock dump at these time periods. In year 15 to 20 HYP is the dominant rock type, and the pH is set to the 10th percentile observed in HYP field bins.

The mineral phases considered are listed with their chemical formulas in Table 3-6. Note that the mineral phases considered did not precipitate from all upscaled solutions.

Table 3-6:
Overview of secondary mineral equilibrated with model output solutions

Mineral Phase	Chemical Formula	Year -3 to 4	Year 5 to 14	Year 15 to 20
Bassaluminite[1]	$Al_4(OH)_{10}SO_4$			
Gibbsite[2]	$Al(OH)_3$		x	x
Barite	$BaSO_4$	x	x	x
Tenorite	CuO		x	x
Celestite	$SrSO_4$		x	x
Chalcedony	SiO_2	x	x	x
Ferrihydrite[1]	$Fe(OH)_3$		x	x
Schwertmannite[2,3]	$Fe_8O_8(OH)_{4.4}(SO4)_{1.8}$	x		
Fluorite	CaF_2		x	x
Gypsum	$CaSO_4{:}2(H_2O)$			
Manganite	MnOOH			x

3.7 Predicted Source Term and Screening

The predicted concentrations derived from upscaling kinetic loading rates and applying thermodynamic solubility controls are presented in Table 3-7. In order to ensure that the predicted concentrations are realistic, predictions are compared to observed drainage data at other minesites and the 90th percentile concentration of Casino field bins in this table. Waste rock seep statistics for six copper porphyry minesites in BC are provided, with data grouped by pH range. In addition to these BC copper porphyry mines, data from the Aitik mine is provided.

A number of predicted concentrations were below the values at other minesites provided for comparison in the year -3 to 4 source term, and in the year 5 to 14 source term to a lesser extent. This is expected, as a large portion of the unsaturated waste rock during these time periods is composed of oxide CAP material. The oxide CAP will produce a mildly acidic pH, however lower metal leaching rates can be expected from this material compared to sulphide bearing waste at a similar pH.

Table 3-7:
Comparison of Predicted Casino Waste Rock Source Term Concentrations to Analogue Mines and Field Bin drainage

TMF Unsaturated Waste rock-Upscaled Concentrations	**pH**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Years -3 to 4	4.7	0	590	1.9	0.0083	64	0.0028	0.012	3.2	0.33	0.0002	43	10	1.2	0.062	0.016	0.0052	0.014	0.022	0.017	0.31
Years 4 to 14	4.7	0	980	0.69	0.030	260	0.02	0.034	1.6	0.11	0.0006	44	35	0.87	0.078	0.049	0.0054	0.035	0.027	0.3	2.1
Years 15 to 19	7.2	9.3	840	0.0023	0.038	200	0.0089	0.046	0.046	0.0094	0.00076	34	27	0.089	0.1	0.055	0.0038	0.029	0.013	0.25	1.1
TMF Unsaturated Waste rock- Corrected Concentrations	**pH**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Years -3 to 4	4.7	0.82	590	1.9	0.0083	64	0.0028	0.012	3.2	0.33	0.0002	43	10	1.2	0.062	0.016	0.0052	0.014	0.08	0.017	0.31
Years 4 to 14	4.7	0.85	980	0.69	0.030	260	0.02	0.034	1.6	0.11	0.00059	44	35	0.87	0.078	0.049	0.0054	0.035	0.3	0.3	2.1
Years 15 to 19	7.2	9.3	840	0.0023	0.038	200	0.0089	0.046	0.046	0.0094	0.00076	34	27	0.089	0.10	0.055	0.0038	0.029	0.3	0.25	1.1
Copper Porphyry in BC (Red Chris EA,2004)	**pH[1]**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
	Max	2.1	0	30910	766		804	0.02		655	1310	0.0011	148	213	56	0.009	2	0.04	0.13	0.2		6
pH <4	P95	2.5	0.15	7969	436		748	0.02		512	480	0.0011	134	163	41	0.009	2	0.04	0.09	0.2		5
	P50	3.1	1	3220	239		532	0.007		249	14	0.0007	37	61	4	0.006	0.8	0.0155	0.02	0.09		2
	Max	4	1.2	2930	47		832	0.04		370	5	0.0006	112	201	31	0.03	1	0.02	-	0.09		4
pH 4-6	P95	4.1	2	2440	40		793	0.04		340	3	0.0006	87	180	26	0.03	1	0.02	-	0.08		4
	P50	5.3	5	1260	5		361	0.04		66	0.2	0.0006	3	39	9	0.0068	0.4	0.012	-	0.07		2
	Max	6	1	1896	0.6	0.04	964	0.03		1	0.3	0.002	58	115	6	0.4	0.4	0.01	0.09	0.3		1
pH>6	P95	6.4	7.53	1531	0.2	0.03	727	0.007		0	0.2	0.00043	39	101	4	0.3	0.21	0.0036	0.08	0.3		0.8
	P50	7.5	43.6	464	0.0	0.01	247	0.0		0.02	0.0	0.00005	4	24	1	0.03	0.006	0.00007	0.01	0.06		0.03
Aitik Mine Seeps (Linklater, 2005)	**pH[1]**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Max	3.3		3279	230		228			146	28.2											
Average	3.9		1267	68.1		140.8			28	3.2											
Min	6.3		518	1		95			0.18	0.1											
Aitik Mine Seeps (Stromberg and Banwart, 1994)	**pH[1]**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Average of Collection Ditch	3.8		1,310	75		185			19	2		17	57	12.1		1.3					5.8
Casino Field Bins	**pH[1]**	**Alkalinity**	**SO_4**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**K**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
HYP	90th Percentile	7.19	126.5	1,360	0.026	0.01364	393	0.0030	0.00502	0.1618	0.0484	0.00005	18.42	52.48	0.144	0.6812	0.05086	0.007358	0.05646	0.03126	0.2852	0.04902
SUP	90th Percentile	5.52	56.5	1,036	0.905	0.005571	273	0.24	0.00533	26.63	0.0518	0.00005	13.63	39.42	4.596	0.1704	0.04846	0.00733	0.01047	0.1967	0.02016	2.244
CAP	90th Percentile	4.05	20.94	419	28.32	0.01392	14.46	0.001438	0.04564	1.57	2.192	0.000086	7.32	7.154	0.5038	0.6154	0.02314	0.02244	0.008328	0.0409	0.00556	0.3158

Red Highlight = Predicted concentration greater than maximum of the BC copper porphyry deposits in the corresponding pH range.
Blue Highlight = Predicted concentration less than median of the BC copper porphyry deposits in the corresponding pH range.
Amber Highlight = Concentrations are adjusted based on comparison.
[1]Statistics for pH are reported as minimum, P5 and P10

The only upscaled concentration that is adjusted in the waste rock source terms is Se. The upscaled Se concentration is lower than the median concentration in other BC copper porphyry mines, and was also lower than 90th percentile concentrations observed in field bin data. Therefore it is set at the 90th percentile value reported for copper porphyry deposits in BC. The year 6 to 14 source term is set to the Se concentration observed in neutral pH mine drainages, because during this time period SUP waste rock will be relatively abundant in the waste rock facility, and field bin data indicates that SUP waste rock has the highest potential for Se leaching of any waste type present at Casino (Table 3-7).

Predicted concentrations and loading rates for unsaturated waste rock in the TMF are presented in Table 3-8 and Table 3-9, respectively. The concentrations presented in Table 3-8 represent the maximum concentrations calculated for the waste rock at three different time periods. A number of these concentrations represent thermodynamic solubility controls, as outlined in Table 3-7 while others represent maximum concentrations based on predicted loading rates and annual drainage volumes. Loading rates presented in Table 3-9 do not take into account thermodynamic solubility controls. It is envisioned that the loading rates in Table 3-9 can be applied to the water balance model to reflect changes in stockpile tonnage over the mine life, while concentrations maximums in Table 3-8 can be used to cap the concentration of certain parameters to reflect thermodynamic solubility controls.

Table 3-8:
Maximum source term concentrations for unsaturated waste rock in TMF

Parameter	Units	Year -3 to 4	Year 5 to 14	Year 15-20	MMER		
					MMM	MCS	MGS
pH	s.u.	4.7	4.7	7.2			
Acidity		14.6	6.7	0.2			
Alkalinity	$mgCaCO_3/L$	0	0	68			
SO_4	mg/L	590	980	840			
F	$mgCaCO_3/L$	1.8	2.6	3.1			
Cl	mg/L	23	23	42			
Ag	mg/L	0.00073	0.0012	0.0013			
Al	mg/L	1.9	0.69	0.0023			
As	mg/L	0.0083	0.030	0.038	0.5	0.75	1
Ba	mg/L	0.0079	0.0069	0.0069			
Ca	mg/L	64	260	200			
Cd	mg/L	0.0028	0.02	0.0089			
Co	mg/L	0.054	0.11	0.087			
Cr	mg/L	0.012	0.034	0.046			
Cu	mg/L	3.2	1.6	0.046	0.3	0.45	0.6
Fe	mg/L	0.33	0.11	0.0094			
Hg	mg/L	0.0002	0.00059	0.00076			
K	mg/L	43	44	34			
Mg	mg/L	10	35	27			
Mn	mg/L	1.2	0.87	0.089			
Mo	mg/L	0.062	0.078	0.1			
Na	mg/L	170	96	7.3			
Ni	ug/L	0.016	0.049	0.055	0.5	0.75	1
Pb	mg/L	0.0052	0.0054	0.0038	0.2	0.3	0.4
Sb	mg/L	0.014	0.035	0.029			
Se	mg/L	0.08	0.3	0.3			
Si	mg/L	7.9	7.9	7.9			
Sr	mg/L	0.51	2.3	2.2			
Tl	mg/L	0.0016	0.0014	0.00081			
U	mg/L	0.017	0.3	0.25			
Zn	mg/L	0.31	2.1	1.1	0.5	0.75	1

Table 3-9:
Predicted loading rates for unsaturated waste rock in TMF

Parameter	Units	Year -3 to 4	Year 5 to 14	Year 15-20
Alkalinity	$mgCaCO_3$/tonne/year	0	0	58
Acidity	$mgCaCO_3$/tonne/year	136.9	35.3	1.3
SO_4	mg/tonne/year	5700	5900	5,300.00
F	mg/tonne/year	17	16	19
Cl	mg/tonne/year	230	140	260
Ag	mg/tonne/year	0.0071	0.0073	0.01
Al	mg/tonne/year	19	4.1	0.02
As	mg/tonne/year	0.08	0.18	0.24
Ba	mg/tonne/year	0.076	0.042	0.04
Ca	mg/tonne/year	630	1600	1200
Cd	mg/tonne/year	0.027	0.12	0.06
Co	mg/tonne/year	0.53	0.68	0.55
Cr	mg/tonne/year	0.12	0.2	0.29
Cu	mg/tonne/year	31	9.5	0.29
Fe	mg/tonne/year	3.2	0.69	0.06
Hg	mg/tonne/year	0.002	0.0036	0
K	mg/tonne/year	420	270	210
Mg	mg/tonne/year	100	210	170
Mn	mg/tonne/year	12	5.3	0.56
Mo	mg/tonne/year	0.6	0.47	0.64
Na	mg/tonne/year	1700	580	46
Ni	mg/tonne/year	0.16	0.3	0.34
Pb	mg/tonne/year	0.051	0.033	0.02
Sb	mg/tonne/year	0.13	0.21	0.18
Se	mg/tonne/year	0.78	1.8	1.9
Si	mg/tonne/year	77	48	49
Sr	mg/tonne/year	4.9	14	14
Tl	mg/tonne/year	0.016	0.0084	0.01
U	mg/tonne/year	0.17	1.8	1.6
Zn	mg/tonne/year	3	13	7.2

4. Heap Leach Facility

CASINO
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4. Heap Leach Facility

Source terms for the heap leach facility (HLF) are presented in this chapter. Source terms were developed using samples collected from a cyanide leaching column (Cl-01) experiment conducted in 2012. The various work stages leading to the development of these source term concentrations for the individual stockpiles can be summarized as follows:

- Description of HLF and overview of time frames for which source terms are developed;
- Description of data sources;
- Consideration of potential for ARD, solute accumulation, and mineral solubility controls;
- Description of approach and scale up factors used to develop source terms;
- Application of secondary mineral controls; and
- Comparison of calculated source term to other HLF facilities,

A flow chart illustrating key steps in HLF source term development is provided in Figure 4-1

4.1 Heap Leach Facility Overview and Modeled Time Frames

A cyanide heap leaching facility is planned for extraction and recovery of gold and silver from oxide (CAP) ore. The ore will be crushed with 80% - 38 mm. Ore will be stacked onto a lined base from year -3 to year 14 in 8 m high lifts, reaching a maximum size of 157 M tonnes and footprint of 134 ha (Figure 1-1). Lime will be blended with the ore during stacking to raise the pH to a range favorable for gold recovery. Closure of the heap leach facility will involve the following steps:

- Rinsing of ore with recycled solution for five years;
- Drain down of heap and construction of vegetated cover;
- Treatment of drainage by Inco-SO_2 plant and wetlands (in parallel) until acceptable cyanide concentrations are met; and finally
- Drainage will be released directly to TMF-wetlands.

Cyanide destruction using the Inco-SO_2 process will take place throughout the mine life and continue during the rinse down phases. Laboratory testwork indicates that Inco-SO_2 process can reduce WAD-CN concentrations to less than 1 ppm (R&C Environmental Services Inc., 2010), however, WAD-CN concentrations of 5 to 10 ppm are considered a

more realistic objective for an operational cyanide destruction plant (Metallurgium, 2013). For more information on heap leach facility operation and closure, see Knight Peisold, (2013a).

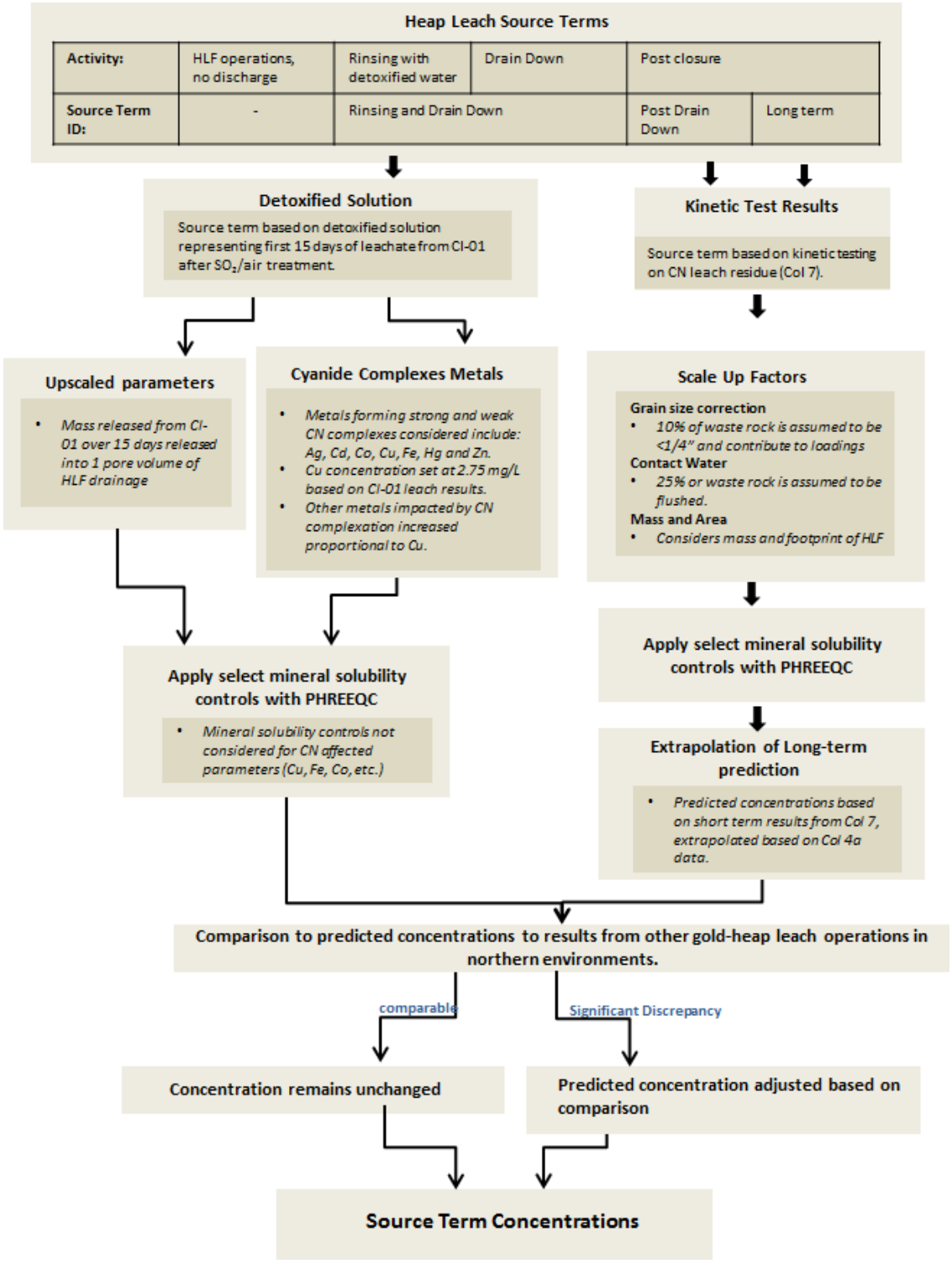


Figure 4-1: Heap leach facility source term flow chart

4.2 Data Sources and Results

In 2008, CAP ore collected from Casino drill core were sent to Metcom Research (Metcom) for a cyanide column leach study, referred to as Cl-01. For details of sample preparation and Cl-01 test procedures see Metcom, (2012). The initial leachate collected from Cl-01 was sent for cyanide destruction testwork and metals analysis, as described below. Upon completion of the cyanide leach column test, the residue was sent for static and kinetic testwork. A description of sample analysis and some results are provided below. For complete ARD/ML testwork on Cl-01 and gold ore samples see Lorax, (2013a) and Lorax (2013b).

4.2.1 Detoxified Solution

During the first 15 days, approximately 72 L of drainage was produced by Cl-01 and T-CN concentrations ranged from 31 to 270 mg/L. A portion of the solution was sent for Inco SO_2/Air cyanide destruction testwork at R&C Environmental Services Inc. Results for dissolved metals and cyanide species in the detoxified solution are provided in Table 4-1. The metal load released from Cl-01 in the first 15 days is calculated based on the volume of leachate (72 L) and mass of sample (45 kg). Note that some parameters are not expected to behave conservatively during cyanide destruction (*i.e.* cyanide complexes), and will be discussed further below. For complete results see the R&C Environmental Services Inc. (2010).

4.2.2 Static Test Data

The Cl-01 residue, in addition to a number of gold ore samples, were submitted for ABA, SFE, aqua regia and quantitative XRD analysis. In general, static test results for the kinetic test sample (Cl-01 residue) results were similar to CAP ore and waste rock with the exception of SFE data. For complete static test results on Cl-01 residue and gold ore samples see Lorax, 2013a.

Table 4-1:
Composition of detoxified solution and mass loading in first 15 days of Cl-01 cyanide leaching experiment

Parameter	Concentration (mg/L)	Mass Loading (mg/kg)
pH[1]	7.99	-
Alkalinity[2]	81	-
Free-CN[3]	0.097	-
T-CN[3]	0.217	-
WAD-CN[3]	0.101	-
SO_4	1701	2930
Sb	0.0004	0.0007
As	0.002	0.003
Cd	0.0006	0.001
Ca	439	756
Cr	<0.0005	<0.0009
Co	0.405	0.70
Cu	0.195	0.34
Fe	0.673	1.16
Pb	<0.0001	<0.00017
Mg	0.271	0.47
Mn	0.0002	0.00034
Hg	0.0013	0.0022
Mo	4.18	7.18
Ni	0.0134	0.023
K	7.4	12.7
Se	0.0222	0.038
Ag	0.0038	0.0068
Na	435	748
Tl	0.0001	0.00017
U	0.0001	0.00017
Zn	0.0051	0.0088

[1]Provided in standard units (s.u.)
[2]Concentration provided as mg$CaCO_3$/L
[3]Cyanide species are not released from oxide ore so calculation of loading rates are not applicable.

4.2.2.1 Mineralogy

Major rock forming minerals present in CAP oxide include Quartz, K-feldspar, plagioclase and muscovite. Quartz was the most abundant individual mineral, composing 34% to 48% of oxide CAP material. The dominant form of sulphur in CAP material is in the sulphate mineral jarosite. Jarosite is found in 6 of 7 of the samples analyzed from the oxide leach CAP (from 0.7 % to 3%). The only sulphide mineral identified in CAP material is pyrite in trace quantities.

4.2.2.2 Metal Content

Metals as measured by aqua regia for residue sample (Cl-01) and CAP ore samples are presented in Table 4-2. The relative metal abundance in oxide ore samples provides an indication of metal leaching potential. Comparing the relative metal abundance of the Cl-01 kinetic test sample against the greater population of oxide ore samples provides an indication of possible bias of kinetic test results compared to what can be expected in the field.

Table 4-2:
Aqua regia results for Cl-01 residue and statistics of CAP ore samples compared against average continental crust abundance

		Cl-01 Residue	***Oxide Leach Cap (CAP) Ore Samples (n = 32)***					**Average Continental Crust**
Element	**Unit**	**(Col 7 and Col 8)**	**Max**	**90th**	**Median**	**10th**	**Min**	
Ag	ppm	1.3	7.6	2.6	1	0.26	0.2	0.075
Al	%	0.84	7.1	2.9	0.59	0.24	0.19	8.23
As	ppm	32.6	138	53	12.6	4.1	2.4	1.8
Cd	ppm	0.6	0.5	0.3	0.1	***0.05***	***0.025***	0.15
Cr	ppm	69	154	116	66.5	34.4	20	105
Cu	ppm	569.3	1246	753	251	50.3	17.9	60
Fe	%	3.5	8.2	6.7	3.5	2	1.6	5.63
Hg	ppm	0.02	0.21	0.06	***0.005***	***0.005***	***0.005***	**0.08**
Mo	ppm	124.7	2460	711	255	92.6	38.6	**1.5**
Ni	ppm	6.8	12.7	8.1	3.3	1.8	0.5	84
Pb	ppm	28.2	49.6	40	10.8	3.9	3	**12.5**
Se	ppm	3.4	10.2	3.9	1.9	0.6	0.25	**0.05**
Tl	ppm	0.2	5	0.6	0.3	0.1	***0.05***	**0.001**
U	ppm	2.6	18	10.1	3.4	1.1	0.7	**2.7**
Zn	ppm	56	143	56.9	17	4	3	70

Notes: Values greater than or equal to 3 times the crustal concentration are shaded in light grey. Values greater than or equal to 10 times the crustal concentration are shaded in dark grey. Average continental crustal abundances according to Price (1997). Bold values are from CCR (1985).

Metals that are 3x or 10x average continental crust abundance in median CAP ore samples include Ag, As, Cu, Mo, Se and Tl. In general, metal content in the Cl-01 residue is greater than median oxide ore results, with the exception of Mo, Tl, and U.

4.2.2.3 Acid Base Accounting

Results were generally consistent with other oxide CAP samples in that a majority of T-S is in the form of SO_4 with only trace quantities of sulphide-S present. No sulphide minerals were detected in mineralogical analysis of Cl-01 residue, however, pyrite has been detected in other CAP samples. The only sulfur bearing mineral identified by XRD was K-jarosite, which has been found in most mineralogical testwork on CAP samples and is likely the primary reservoir of sulphate. Note that ABA results will be revisited Section 4.3, where the potential for ARD development from the heap leach facility is discussed.

4.2.3 Kinetic Testing

Lorax initiated two unsaturated column experiments at SGS using residues from Cl-01. Two columns (Col 7 and Col 8) with different masses and lengths were initiated to examine drainage chemistry and scaling effects of cyanide leach residue. Details of these two kinetic tests are provided in Table 4-3. The 25 kg kinetic test (Col 8) was terminated after 14 cycles, while the 10 kg kinetic test (Col 7) is ongoing and there is currently 28 cycles of data available.

Table 4-3:
Description of unsaturated columns set up using cyanide leach test residue

Test ID	Col 7	Col 8
Sample Description	**Cyanide leach test residue**	**Cyanide leach test residue**
Mass (kg)	10	25
Column Diameter (cm)	20	20
Column height (cm)	30	62
Sample height (cm)	20	59
Start Date	20-March-2013	20-March-2013
End Date	On-going	19-June-2013
Available cycles (n)	28	14

Kinetic testing indicates that metal concentrations decline over time and as a result stabilized leaching rates have not yet been established in the most recent kinetic test data. Loading rates from the most recent Col 7 data is provided in Table 4-4 and is used in source term development. However, it is important to note that these results over estimate stabilized long term loading rates, as discussed in section 4.4. The complete kinetic and static test results are presented in the 2013 Kinetic test report (Lorax, 2013).

Table 4-4:
Average loading rates for cycle 26 and 28 of Col 7

Parameter	unit	Cycles 26 & 28
pH	s.u.	7.7
SO_4	mg/kg/cycle	11.5
Cl	mg/kg/cycle	0.0767
F	mg/kg/cycle	0.0267
Al	mg/kg/cycle	0.000475
Sb	mg/kg/cycle	0.000245
As	mg/kg/cycle	0.000421
Ba	mg/kg/cycle	0.000611
Cd	mg/kg/cycle	0.00000158
Ca	mg/kg/cycle	4.69
Cr	mg/kg/cycle	0.0000124
Co	mg/kg/cycle	0.000812
Cu	mg/kg/cycle	0.000158
Fe	mg/kg/cycle	0.0000743
Pb	mg/kg/cycle	0.00000891
Mg	mg/kg/cycle	0.126
Mn	mg/kg/cycle	0.000131
Hg	mg/kg/cycle	0.000000248
Mo	mg/kg/cycle	0.0249
Ni	mg/kg/cycle	0.0000297
K	mg/kg/cycle	0.054
Se	mg/kg/cycle	0.000072
Si	mg/kg/cycle	0.832
Ag	mg/kg/cycle	0.000000248
Na	mg/kg/cycle	0.75
Tl	mg/kg/cycle	0.000000495
U	mg/kg/cycle	0.000199
Zn	mg/kg/cycle	0.000124

4.3 Geochemical Development of HLF

4.3.1 Potential for ARD

In-situ CAP ore and waste rock has a mildly acidic paste pH of approximately 4.7. During HLF construction, lime will be added to the CAP material to ensure a pH>10. Upon closure, the potential for ARD to develop will depend on the balance of acid generating minerals and acid neutralizing potential remaining in the facility. The amount of lime required to maintain pH neutral conditions in the HLF is calculated below.

Sources of acidity in the CAP material include acidic sulphate minerals, and trace sulphides. Mineralogical testwork indicates that most sulphate-S in the CAP material is K-jarosite and most sulphide-S is present as pyrite. Generally Na-Jarosite co-occurs with K-Jarosite, although only K-jarosite has been identified in mineralogical work. Under neutral pH, oxidizing conditions, dissolution of (K, Na)-jarosite can be described as:

$$(K,Na)Fe_3^{3+}(SO_4)_2(OH)_6 + 3H_2O = (K,Na)^+ + 2SO_4^{2-} + 3Fe(OH)_3 + 3H^+$$

and pyrite oxidation can be described as:

$$2FeS_2 + 7.5O_2 + 7H_2O = 4SO_4^{2-} + 2Fe(OH)_3 + 8H^+$$

note that (K, Na)-jarosite dissolution releases 1.5:1 molar ratio of H+:S while pyrite oxidation releases a 2:1 molar ratio of H+:S. The total AP for CAP ore and residue samples are calculated by assuming that all sulphate-S is in the form (K, Na)-jarosite and all sulphide-S is in the form of pyrite in Table 4-5. These calculations result in a median AP of 6.37 $kgCaCO_3$/tonne in CAP ore samples, and an AP of 12.6 for Cl-01 residue. To ensure neutral pH drainage the NP must be at least two times greater than AP. To achieve an NP of 12.74 a lime addition of 6.49 kgCaO/tonne would be required. During HLF operations, lime will be mixed with the oxide ore as it is stacked, and lime will be amended to the irrigation solution to maintain a pH > 10 during gold recovery. HLF drainage quality predictions assume that lime additions during operations will be sufficient to neutralize any acid generating potential.

Table 4-5:
Range of sulphur content in oxide ore static test samples and lime requirement to maintain pH neutral conditions

Sample	Statistics	$S(SO_4)$ %	$S(S^{-2})$ %	Jarosite AP $kgCaCO_3/t$	Sulphide AP $kgCaCO_3/t$	Total AP $kgCaCO_3/t$	NP $kgCaCO_3/t$	Lime Requirement[1] kgCaO/t
CAP ore (n=32)	Maximum	2.5	7.4	57.7	231.9	289.5	41.1	295.3
	90th percentile	1.2	0.79	27.7	24.7	52.4	12.2	53.4
	75th percentile	0.61	0.040	14.3	1.3	15.5	5.2	15.9
	Median	0.25	0.020	5.74	0.6	6.37	2.5	6.49
	25th percentile	0.078	<0.005	1.82	<0.16	1.98	0.87	2.02
	10th percentile	0.041	<0.005	0.96	<0.16	1.12	-0.69	1.14
	Minimum	0.020	<0.005	0.47	<0.16	0.63	-49.3	0.64
Column residue (Cl-01)		0.51	0.02	12.0	0.6	12.6	6.6	12.8

Note: statistics based on 32 oxide ore samples
[1]Lime (CaO) required to achieve an NPR of 2, assuming no NP contribution from oxide ore.

4.3.2 Potential Solubility Controls

CAP ore can be expected to have a mildly acidic pH and significant water soluble metal load prior to lime addition. Once lime is amended, much of the metal load will be attenuated by secondary mineral precipitation. These mineral solubility constraints will place limits on metal concentrations in HLF drainage. A comparison of maximum concentrations in the 10 kg Col 7 and the 25 kg Col 8 demonstrate that peak concentrations are similar for a number of metals (Table 4-6). With the exception of Zn and Pb, peak concentrations are within 30% of one another, despite Col 8 having a mass of that is 2.5 times larger than Col 7. Identifying specific mineral phases responsible for controlling metal concentrations is difficult, owing to the amorphous structure and trace abundance of most secondary precipitates. Determining what minerals are at or near equilibrium in the cyanide residue leachate can provide an indication of what mineral solubility controls may affect HLF drainage.

Table 4-6:
Comparison of maximum concentrations from Col 7 and Col 8

	unit	Col 7 Max	Col 8 Max	% Diff
pH	s.u.	7.3	7.56	3%
Alkalinity	mg$CaCO_3$/L	69.2	70.6	2%
Sulphate	mg/L	2010	2850	29%
Al	mg/L	0.0112	0.0087	-29%
Sb	mg/L	0.0096	0.0078	-23%
As	mg/L	0.0094	0.0098	4%
Ba	mg/L	0.0136	0.0145	6%
Cd	mg/L	0.000433	0.000342	-27%
Ca	mg/L	490	576	15%
Cr	mg/L	0.0008	0.001	20%
Co	mg/L	0.404	0.393	-3%
Cu	mg/L	0.0213	0.0308	31%
Fe	mg/L	0.014	0.018	22%
Pb	mg/L	0.00065	0.00015	-333%
Mg	mg/L	21.8	25.3	14%
Mn	mg/L	0.021	0.0251	16%
Mo	mg/L	2.1	2.02	-4%
Ni	mg/L	0.0024	0.0025	4%
K	mg/L	8.89	11.2	21%
Se	mg/L	0.0581	0.0753	23%
Na	mg/L	429	473	9%
Tl	mg/L	0.0001	0.00011	9%
U	mg/L	0.0273	0.0372	27%
Zn	mg/L	0.004	0.012	67%

Elements that have percent difference in single digits are most likely being constrained by a solubility control. These elements includes As, Ba, Cd, Co, Mo, Ni, Na, Tl. Potential solubility control mechanisms include mineral equilibrium, sorption or coprecipitation. If a mineral equilibrium is affecting column leachate, the mineral phase should be at or near equilibrium in column leachate. Thus, determining the saturation state of potential mineral solubility controls can provide an indication of whether the formation/dissolution of a discreet mineral phase is controlling leachate chemistry. Mineral solubility controls can be modeled with PHREEQC. Potential mineral solubility controls for these elements include Barite ($BaSO_4$) otavite ($CdCO_3$), $Co(OH)_2$, powellite ($CaMoO_4$), wulfenite ($PbMoO_4$), $NiCO_3$ and Na-jarosite [$NaFe_3(SO_4)_2(OH)_6$]. Note that no relevant mineral solubility control is known for As, as the behavior of As is largely controlled by sorption to Fe-oxide minerals. In order to determine if these potential solubility controls are exerting an influence on elements which are relatively non-variable between the two columns, the drainage chemistry is speciated in PHREEQC and solubility indices are calculated using the Minteq.V4 Database. Drainage is speciated in PHREEQC and the solubility indices (SI) for these parameters in addition to potential Cu secondary minerals are provided in Table 4-7. For model input see Appendix A.

Solubility indices provide an indication of the saturation state of a specific mineral phase. An SI of 0 indicates that a mineral is in equilibrium with the solution; a mineral may be dissolving or precipitating to achieve equilibrium. A positive SI indicates that a mineral is oversaturated and therefore likely to precipitate from solution. A negative SI indicates that a mineral is unsaturated; if the solid phase is present it may dissolve until equilibrium is reached. However, it should be noted that saturation indices are based on the thermodynamics of mineral formation/dissolution and do not account for kinetic limitations that affect mineral formation and dissolution.

The mineral phases Na-jarosite, Co(OH)2, Tl(OH)3, otavite and Ni(OH)2 are have strongly negative SI values in Col 7 and Col 8 leachate (Table 4-7). This indicates that these phases are not exerting a solubility control on their constituent elements. Conversely, the minerals powellite, wulfenite and barite are at or near equilibrium in column leachate. This indicates that these minerals could be controlling some metal concentrations in column leachate. At the relatively high pH of cyanide leach residue, the solubility of copper can be expected to be limited by solubility constraints. A number of possible Cu solubility constraints exists, including tenorite (CuO), malachite [$Cu_2(CO_3)(OH)_2$] and azurite [$Cu_3(CO_3)_2(OH)_2$]. Of these three minerals tenorite is closest to equilibrium at all time points in column leachate (Table 4-7).

Based on this analysis, the solubility of powellite, wulfenite, barite and tenorite will be incorporated into source term development.

Table 4-7:
Saturation indices for select minerals in the detoxified solution, Col 7 and Col 8 leachate

Column	Cycle	Azurite	Malachite	Tenorite	Barite	Powellite	Wulfenite	$Ni(OH)_2$	Otavite	$Tl(OH)_3$	$Co(OH)_2$	Na-Jarosite
	1	-2	-0.25	0.12	0.38	0.31	0.02	-5.55	-2.99	-6.64	-3.76	-1.53
	2	-2.1	-0.37	0.02	0.37	0.37	-0.26	-5.47	-4.93	-6.67	-3.71	-1.67
	3	-2	-0.30	0.10	0.33	0.47	0.07	-5.43	-4.81	-6.32	-3.41	-1.87
	4	-2.6	-0.67	-0.10	0.47	0.29	-0.23	-5.70	-3.96	-6.69	-3.77	-1.30
Col 8	6	-3.1	-1.01	-0.25	0.36	0.19	-0.22	-5.44	-4.09	-6.80	-3.85	-2.88
	8	-2.1	-0.35	0.09	0.44	-0.01	-0.86	-5.53	-3.85	-6.73	-3.98	-3.93
	10	-3.5	-1.33	-0.46	0.33	0.16	0.19	-5.62	-3.71	-7.11	-4.11	-3.85
	12	-3.5	-1.27	-0.43	0.30	0.12	-0.69	-5.56	-4.28	-7.16	-4.10	-4.28
	14	-3.5	-1.27	-0.40	0.27	0.15	-0.68	-5.54	-3.81	-7.12	-4.07	-4.22
	1	-2.7	-0.80	-0.27	0.34	0.35	-0.20	-5.87	-2.92	-7.10	-3.93	-1.74
	2	-2.5	-0.68	-0.17	0.29	0.42	0.04	-5.69	-3.95	-6.98	-3.75	-1.86
	3	-2.8	-0.84	-0.25	0.21	0.42	0.02	-5.82	-3.67	-7.05	-3.93	-3.47
	4	-3.2	-1.07	-0.33	0.26	0.19	-0.06	-5.95	-3.77	-7.05	-4.10	-3.40
Col 7	6	-3.4	-1.22	-0.36	0.11	0.10	-0.14	-5.44	-3.50	-6.84	-4.03	-4.68
	8	-2.9	-0.86	-0.20	0.13	-0.12	-0.78	-5.73	-3.78	-7.17	-4.34	-4.73
	10	-4.1	-1.70	-0.61	0.13	-0.15	-0.83	-5.56	-3.79	-7.22	-4.33	-5.07
	12	-4.6	-2.00	-0.80	0.07	-0.19	-0.53	-5.51	-3.08	-7.51	-4.47	-4.28
	14	-4.3	-1.82	-0.69	0.02	-0.17	-0.78	-5.72	-4.16	-7.50	-4.47	-5.41

4.3.3 Potential for Solute Accumulation

During operations and rinsing, recirculation of water through the HLF will result in some accumulation of solutes. Dissolved concentrations can be expected to increase until solubility constraints are reached. These solubility constraints can be estimated based on solubility of discrete mineral phases for some parameters. A number of parameters are poorly described by mineral solubility controls, particularly parameters affected by surface sorption (*e.g.,* As sorption to Fe-oxides) and co-precipitation (*e.g.,* Se replacement for SO_4 in gypsum). Thus, the concentration of these parameters would be overestimated by the application of a conservative mass loading model. Similarly, these parameters would be overestimated in a model that only applies solubility controls of oxide, sulphate or carbonate minerals presented in Table 4-7, without taking into account surface sorption and co-precipitation. To provide an indication of the degree of solute accumulation which will take place during heap leach operation, the chemical evolution of pregnant solution from a HLF of similar size is considered.

The first five years of pregnant solution chemistry being re-circulated at a gold-cyanide heap leach operation in the Peruvian Andes is provided in Table 4-8. At the end of this time period, the heap leach facility reached a size of 50-70 MT. At this facility, some accumulation can be seen in major parameters (Ca and SO_4) and As during the later time points. However, the concentration of most metals either fluctuates with WAD-CN concentration or remain stable. Based on these results, it is concluded that maximum concentrations will rapidly be reached for metals that are not controlled by CN complexation. However, major ions such as Ca and SO_4 may continue to increase until relevant solubility controls are reached.

4.4 Approach

Source terms for the HLF are predicted at three time points. The first time point is during drain down and rinsing of the heap leach. The second time point is for the time period after drain down, when most of the re-circulated pore water has drained from the facility. The third time point is for the decades after the heap leach facility has been closed, when metal leaching rates approach stabilized values. The approach and rationale for developing these three HLF source terms is described in this section.

Table 4-8:
Chemistry of pregnant solution from a 50-70 MT gold-cyanide heap leach operation in the Peruvian Andes

	Field-pH	CN-WAD	Ca	Mg	K	Na	SO_4	As	Cd	Cr	Cu	Fe	Pb	Mn	Hg	Se	Ag	Zn
Years	**s.u.**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
0.00	8.90	45.000	34.19	0.31	2.95	100.00	251.00	<0.005	<0.005	<0.030	1.16	0.16	0.080	<0.030	0.0860	0.1860	0.010	1.890
0.01	8.20	130.000	26.03	0.13	3.89	162.00	263.00	0.010	<0.005	<0.030	1.72	0.76	0.100	<0.030	0.0950	0.1610	0.010	5.180
0.04	8.80	70.000	38.60	0.13	3.72	111.60	201.00	<0.005	<0.005	<0.030	1.46	0.32	0.080	<0.030	0.0950	0.0900	<0.005	2.870
0.05	9.40	100.000	46.70	0.11	4.03	152.00	266.00	0.007	<0.005	<0.030	1.87	0.43	<0.030	<0.030	0.1890	0.0880	0.020	5.030
0.09	9.70	120.000	12.43	0.03	3.90	204.80	356.00	0.011	<0.005	<0.050	2.05	0.33	<0.030	<0.030	0.2800	0.0900	0.030	2.760
0.15	9.30	65.000	48.20	0.20	4.60	124.40	306.00	0.023	<0.005	<0.050	<0.03	0.16	<0.030	<0.030	0.1660	<0.0050	0.070	2.300
0.40	9.40	54.000	36.25	0.11	4.76	159.60	253.00	0.010	<0.005	<0.050	2.11	0.42	<0.030	<0.030	0.4460	0.3700	0.050	0.670
0.65	8.60	67.000	24.04	0.10	5.21	176.40	372.00	0.012	<0.005	<0.050	2.91	0.19	0.010	<0.030	1.9490	0.0130	0.010	1.160
0.90	8.90	80.000	23.24	0.56	5.30	192.00	270.00	0.016	<0.005	<0.020	3.24	0.38	<0.030	0.060	2.3630	0.0380	0.030	4.130
1.15	8.20	56.400	26.76	0.10	4.94	124.60	218.00	0.082	<0.005	<0.020	2.06	0.12	0.050	<0.030	1.2500	0.3580	0.010	1.100
1.42	9.10	**	88.00	4.00	4.00	120.00	130.00	<0.010	<0.010	<0.040	1.50	2.70	<0.100	<0.020	4.6000	0.0900	0.100	0.840
1.65	8.50	32.650	34.30	0.70	4.10	128.00	166.40	<0.010	<0.010	<0.040	1.65	0.24	<0.100	<0.020	1.1400	0.2000	0.080	0.360
1.92	9.10	31.000	44.00	0.28	6.20	147.50	255.10	<0.010	<0.010	<0.040	1.36	<0.20	<0.100	<0.020	2.9600	0.0600	0.200	0.400
2.15	7.90	18.800	44.80	0.64	5.50	139.00	165.40	0.160	<0.010	<0.040	1.09	<0.20	<0.100	<0.020	1.2570	0.0900	0.060	0.630
2.47	9.10	11.580	56.50	0.68	5.40	110.00	239.70	0.080	<0.010	<0.020	0.61	<0.20	<0.040	<0.030	0.5000	0.0800	0.070	0.270
2.67	9.30	11.200	72.00	0.42	5.35	103.00	283.80	<0.020	<0.010	<0.020	0.50	<0.20	<0.040	<0.030	0.4900	0.0090	0.170	0.100
2.89	9.20	6.440	70.50	0.19	6.35	100.00	248.80	0.040	<0.010	<0.020	0.63	<0.20	<0.040	<0.030	0.2400	0.0080	<0.020	0.080
3.14	11.30	9.100	135.00	0.30	4.65	83.50	87.90	<0.020	<0.010	<0.020	0.83	<0.20	<0.040	<0.030	1.1200	0.0200	<0.020	0.220
3.50	9.40	10.000	78.10	<0.20	5.60	94.40	270.00	0.148	<0.003	<0.050	1.00	0.04	<0.001	<0.005	2.5200	0.0180	0.050	0.080
3.72	8.90	6.200	80.20	0.20	6.00	101.00	270.00	0.140	<0.003	<0.050	0.97	0.04	<0.001	<0.030	1.5400	0.0090	0.080	0.070
3.89	9.40	8.000	79.40	0.20	6.00	106.00	250.00	0.300	<0.0005	<0.050	1.57	0.03	<0.001	<0.005	2.5500	0.0140	0.140	0.080
4.17	8.80	13.000	80.00	<1.00	8.00	139.00	310.00	0.184	<0.0005	<0.050	3.47	0.04	<0.001	<0.005	2.9400	0.0110	0.140	0.100
4.43	8.90	14.000	75.10	0.30	7.30	135.00	340.00	0.460	<0.0005	<0.050	2.77	0.04	<0.001	<0.005	2.5700	0.0090	0.030	0.070
4.64	8.90	11.500	72.90	0.30	8.10	127.00	340.00	0.340	<0.0005	<0.050	1.42	0.05	<0.001	0.010	1.7200	0.0320	0.110	2.000
4.89	8.41	19.800	84.00	0.20	8.20	134.00	300.00	0.240	<0.0005	<0.050	0.65	0.05	<0.001	<0.005	1.2700	0.0410	0.040	1.940
5.18	6.63	0.260	95.20	0.30	7.20	104.00	360.00	0.320	<0.0005	<0.010	0.17	0.02	0.009	0.005	0.4500	0.0410	0.011	0.010

4.4.1 Drain Down and Rinsing Source Term

During drain down and rinsing, water discharged from the facility will largely consist of detoxified solution which has been re-circulated several times through the HLF facility during operations and subsequent rinsing. During this time period, effluent is also assumed to contain a WAD-CN concentration of 5 mg/L (Metallurgium, 2013). This cyanide concentration is expected to support elevated concentrations of metals which from cyanide complexes. The re-circulated water during the initial drain down and rinsing will likely reflect metal leaching mechanisms that take place at a pH >10. Therefore this source term is calculated by scaling the loading produced from Cl-01 during the first 15 days of the column experiment up to the magnitude of the Casino HLF. The Cl-01 loads reflect metal leaching at the high pH expected during this time period. In this source term, the concentration of parameters affected by CN complexation (Cd, Co, Cu, Fe, Ag, Hg and Zn) are treated separately.

4.4.1.1 Scaling Factors

To predict the concentration of parameters not affected by cyanide complexation requires an estimate of the degree of accumulation that will take place while drainage is recycled during operations and rinsing. To estimate this concentration, it is assumed that the load released during the first fifteen days of the Cl-01 experiment, as measured by the detoxified solution, will be available to re-circulating process water during irrigation. The concentration of the detoxified solution (Table 4-1) is converted to a load by multiplying the concentration by the volume of water (77.4 L) and dividing it by the mass of Cl-01 (45 kg). This load is then scaled to the water:solids ratio of the HLF during active cyanide leaching of 0.095 L/kg (water content = 9.5 wt. %). Solubility constraints will be applied to some of these parameters, as described below. In summary, the concentration of parameters not affected by cyanide complexation in the drain down and rinsing source term is as follows:

- The mass released during the 15 days of Cl-01 is converted to a load.
- This load is divided into the water content of the HLF during operations.
- Sodium concentrations are assumed to be primarily controlled by NaCN degradation rather than ore weathering. Therefore Na concentrations are set at the peak concentrations observed in the detoxified solution.
- The pH during rinsing and drain down is set at the pH of the detoxified solution (pH 7.9).
- Solubility controls are applied using the geochemical modelling program PHREEQC, discussed in the following section.

4.4.1.2 Cyanide Complexation and Metal Solubility

Metals expected to be controlled by CN concentration for the drain down source term include Cd, Co, Cu, Fe, Ag, Hg and Zn. These metals form weak and strong cyanide complexes. WAD-CN concentrations in the detoxified solution were measured to be 0.1 mg/L, which is considerably lower than the concentration of 5 mg/L expected during rinsing and drain down. Thus, the concentration of the metals that form complexes with CN are estimated by adjusting their concentrations proportional to the increase observed for Cu between the detoxified solution and the pregnant column solution from Cl-01. At the end of the Cl-01 cyanide leach test, T-CN and Cu in the pregnant solution from the column were measured to be 26.5 mg/L and 2.75 mg/L, respectively. This Cu concentration is considered a conservative estimate of Cu concentrations at the end of HLF operation, when WAD-CN concentrations are expected to be less than 5 mg/L. Unfortunately, a full suite of metals were not analyzed in the pregnant column solution from Cl- 01. Thus, in order to estimate the concentration of metals that form CN complexes which were not measured in Cl-01 leachate, the concentrations are scaled based on the relative ratio observed in the detoxified solution. That is, Co and Cu have a 2.1:1 ratio in the detoxified solution. Therefore Co concentration is set at twice that (5.7 mg/L) in the rinsing and drain down source term.

In summary, the concentration of CN and CN affected metals are estimated using the following approach:

- WAD-CN is assumed to be 5 mg/L during rinsing and drain down.
- The ratio of T-CN to WAD-CN is assumed to be the same as that observed in the detoxified solution (2.1:1) resulting in a T-CN estimate of 10.7 mg/L.
- The concentration of Cu is assumed to be the concentration that was observed at the end of the Cl-01 cyanide leaching experiment of 2.75 mg/L. This is approximately 14 times the concentration in the detoxified solution (0.19 mg/L).
- The concentration of other metals which form cyanide complexes (Cd, Co, Fe, Ag, Hg and Zn) are expected to increase to a similar degree as Cu. That is, the concentration of these metals is expected to be fourteen times greater than what was observed in the detoxified solution for the rinsing and draindown source term.
- Metals concentrations influenced by cyanide complexation are not subjected to mineral solubility constraints.

4.4.2 Post-drain down and Long Term Closure

After drain down has occurred, a cover will be placed on the HLF and infiltration through the facility will approach a steady state. At this time seepage water will be primarily influenced by the infiltration of meteoric water rather than re-circulated process water. The methodology used to determine both the post-drain down and long term closure source terms is similar to that employed for oxide ore stockpiles described in Chapters 2.

4.4.2.1 Cyanide in Long Term Leachate

After drain down, drainage from the HLF will originate from infiltrating meteoric water rather than the recirculated detoxified solution which is the predominant water source during rinsing and drain down. Infiltrating meteoric water will pick up a trace CN concentration, analogous to the initial concentrations produced by the Col 7 and Col 8. Post-drain down CN concentrations are set at the maximum concentration observed in Col 7 and Col 8. It is assumed that CN will decline to below detection limits in the long-term source term.

4.4.2.2 Loading Rates

The post-drain down source term which represents the years immediately after drain down, is calculated by upscaling the average loading rates observed in the final two cycles (cycle 26 and 28 of Col 7 (Table 4-4). These results do not represent stabilized long term loading rates, due to the relatively short time the column has been operating.

An analogue kinetic test column is used to predict the stabilized loading rates from heap leached ore. The long term closure source term is based on loading rates determined by adjusting the predicted post-draindown loading rates by the % difference observed in the neutral pH oxide CAP column (Col 4a) between cycles 26 and 28, and stabilized loading rates measured in cycles 124 to 140. Results for loading rates and percent difference used to extrapolate the long term source term are provided in Table 4-9.

Table 4-9:
Intermediate loading rates (cycle 26 and 28) and final loading rates (cycles 124-140) for oxide waste rock Col 4a

parameter	units	Cycle 26 & 28	Cycles 124-140	% diff
pH	s.u.	7.24	7.33	
SO_4	mg/kg/cycle	2.18	0.441	-80%
Cl	mg/kg/cycle	0.0764	0.0122	-84%
F	mg/kg/cycle	0.0989	0.0415	-58%
Al	mg/kg/cycle	0.00808	0.00695	-14%
Sb	mg/kg/cycle	0.00119	0.000726	-39%
As	mg/kg/cycle	0.000336	0.000317	-6%
Cd	mg/kg/cycle	0.0000487	0.00000268	-94%
Ca	mg/kg/cycle	0.997	0.702	-30%
Cr	mg/kg/cycle	0.0000607	0.0000305	-50%
Co	mg/kg/cycle	0.0000408	0.00000781	-81%
Cu	mg/kg/cycle	0.00618	0.000433	-93%
Mg	mg/kg/cycle	0.14	0.0921	-34%
Mn	mg/kg/cycle	0.00202	0.00014	-93%
Hg	mg/kg/cycle	0.00000064	0.00000062	-3%
Mo	mg/kg/cycle	0.0874	0.0196	-78%
Ni	mg/kg/cycle	0.000235	0.0000183	-92%
K	mg/kg/cycle	0.139	0.08	-42%
Se	mg/kg/cycle	0.0000921	0.0000397	-57%
Si	mg/kg/cycle	1.31	1.22	-7%
Ag	mg/kg/cycle	0.00000229	0.00000183	-20%
Na	mg/kg/cycle	0.586	0.0214	-96%
Tl	mg/kg/cycle	0.0000128	0.00000124	-90%
U	mg/kg/cycle	0.0000276	0.00000763	-72%
Zn	mg/kg/cycle	0.000322	0.000183	-43%

4.4.2.3 Scaling Factors

A series of physical scaling factors are applied to adjust loading rates to account for differences between lab-based kinetic tests and the HLF. These include but are not limited to hydrogeological pathways, water/rock ratio, grain size distribution, and reaction mechanisms. A summary of scaling factors used to relate the column loading rates to the HLF source term concentrations are presented in Table 4-10. Note that no temperature correction is applied to the loading rate as metal leaching from gold ore in

the HLF is not driven by sulphide oxidation. To convert the loading rate into a concentration, the scaled loading rate is divided by the infiltration volume. Infiltration rates are provided by Knight Piesold, 2013b.

Table 4-10:
Summary of scaling factors used to predict source term concentrations

Scaling Factors	Unit	Values
Infiltration	mm	61
Mass	MT	157
Area	km^2	1.34
Total Mass/Area	$Tonnes/m^2$	117
Frozen Thickness	m	NA
Winter mass/area[1]	$Tonnes/m^2$	NA
Flushing factor	mm field/mm lab	10
Grain size correction	-	0.8
Contact Water Factor	-	0.5

(a) Flushing Rate

Metal leaching from oxide CAP material is driven by dissolution of secondary oxide and sulphate minerals rather than the kinetic oxidation of primary and secondary sulphide minerals. This mechanism of metal leaching from CAP material is not directly related to exposure time. Rather, the loading rate from this material is dependent on the degree of rinsing that the material is subjected to. That is, metal loading is proportional to the volume of water which rinses the CAP material, rather than a kinetic loading rate driven by exposure time.

In order to reflect this understanding, loading rates from HLF are calculated based on effluent volumes rather than elapsed time (*e.g.*, mass leached per volume effluent rather than of mass per time). To scale column results in this manner, the load released from CAP columns is normalized to infiltration rate rather than time. The inputs required to convert the column effluent volume to the equivalent annual infiltration rate expected for the HLF (61 mm) are presented in Table 4-11. The mass of various parameters released per every 61 mm of water that passes through the column is assumed to be the annual loading rate of HLF material. Note that the annual infiltration of the HLF is approximately 10 times greater than the infiltration experienced during one kinetic test cycle. Thus, a scaling factor of 10 is required to convert loading rates per cycle presented in Table 4-4 to annual loadings.

Table 4-11:
Input parameters used to convert the column leachate volume (ml) to infiltration (mm)

Input	Unit	Value
Column Diameter (cm)	cm	20
Column Area (m2)	m^2	0.031
Column Effluent/cycle	ml	495
Infiltration/cycle	mm/cycle	15.8
HLF infiltration	mm/yr	152
Flushing Factor		10

(b) Grain Size Factor

The oxide ore sample used in cyanide leach testing (Cl-01) was crushed to 100% passing 1.5 inches. The grain size distribution of the residue was not modified for kinetic testwork when preparing Col 7 and Col 8. The design criteria for the HLF is to have 80% of the ore crushed to <1.5 inches. To account for this difference in grain size, a scaling factor of 0.8 is applied.

(c) Contact Water

Humidity cells are designed to achieve complete flushing of mineral surfaces, ensured by the small sample size (1 kg) and high flushing rate (0.5 L/week). In unsaturated columns, a lower degree of mineral surface flushing occurs due to the larger sample size (10-25 kg). Heterogeneous unsaturated rock piles that are known to develop preferential water pathways with variable moisture content and more focused water flow. As a result, the entire mass of the reactive grain size fraction is not expected to be rinsed by infiltrating water. Consequently, an average contact water factor of 25% was assigned consistent with investigations on hydrogeological unsaturated flow mechanisms (Elboushi, 1975; Kempton, 2012). It is assumed that 50% of mineral surfaces in columns are flushed. Therefore, a contact water scaling factor of 50% is used when upscaling column data (*i.e.* 25% of surfaces flushed in the field divided by 50% of surfaces flushed in the laboratory column).

4.5 Secondary Mineral Control

Upscaling kinetic test results often results in concentrations that exceed thermodynamic solubility controls. To account for mineral solubility controls that can reasonably be expected to occur in the HLF the USGS geochemical modelling program PHREEQC was applied using the Minteq.V4 database (Allison *et al.* 1991; Parkhurst and Apello, 1999).

These solubility controls were applied by speciating the upscaled solution in PHREEQC, and allowing select minerals to precipitate if the saturation indices (SI) was greater than zero.

The process of averaging and upscaling test results in a solution that is out of charge balance which can interfere with mineral solubility calculations in PHREEQC. Therefore some adjustments to major parameters were made before speciation modelling. These adjustments consist of:

- Rinsing and drain down source term - alkalinity is set to observed value in the detoxified solution and pH is set to the final pH observed at the end of Cl-01 cyanide leach test.
- Post drain down and long term source term - Alkalinity and pH are set to the observed value in the final two cycles of Col 7 results (cycle 26 and 28) for the.
- The concentration of Ca, Mg and Sr is adjusted to achieve charge balance, while maintaining the relative concentration of these three major cations.
- No solubility controls are considered for CN affected parameters in the rinsing and post drain down soruce term. These parameters include Cd, Co,C, Fe, Hg Ag, and Zn.

The mineral phases considered are listed with their chemical formulas in Table 4-12. All PHREEQC model inputs are provided in Appendix A.

Table 4-12:
Overview of secondary mineral equilibrated with model output solutions

Mineral Phase	Chemical Formula	Rinsing and Drain Down	Post Drain Down	Long Term
pH		3.2	4.7	7.2
Gibbsite[2]	$Al(OH)_3$	x	x	x
Barite	$BaSO_4$	x	x	x
Tenorite	CuO		x	x
Celestite	$SrSO_4$	x	x	x
Chalcedony	SiO_2	x	x	x
Ferrihydrite[1]	$Fe(OH)_3$		x	x
Fluorite	CaF_2	x	x	x
Gypsum	$CaSO_4{:}2(H_2O)$	x	x	x
Powellite	$CaMoO_4$	x	x	x
Wulfenite	$PbMoO_4$	x	x	x
Manganite	MnOOH		x	x

4.6 Predicted Concentrations and Final Screening

The predicted concentrations are presented in Table 4-13. In order to provide context, predictions are compared to observed drainage data from two gold-cyanide heap leach operations in northern environments. Some background information on these minesites is provided below:

- *Zortman-Landusky Mine* - The Zortman-Landusky mines are adjacent minesites located in north-central Montana, approximately 250 km north of Billings. The Zortman-Landusky mines are where valley-fill-heap-leach cyanide processing was first used on a large scale for gold and silver extraction, mining over 117 million tonnes of ore between 1977 and 1998. Gold and silver mineralization is found in a syenite intrusion, and mining operations produced oxide and transition ore. The oxide ore at this minesite has trace quantities of sulphide and a T-S content is generally < 0.2 wt.%, while transition ore has a sulphide content generally <0.3 wt.%. Very little neutralization or buffering capacity is present in the residual ore, other than what was provided by lime and/or caustic soda addition which took place during operations (Shaw, 2000). Acid rock drainage was initially observed in the 1990s associated with some waste rock drainages. More recently ARD has been identified in some of the heap leach pads (Williams *et al.,* 2009). Water lime treatment plants were constructed to treat water from major drainages in 1994 and 1997 at the Zortman and Landusky mines, respectively. These drainages represent drainage from the HLF and other mine facilities (*i.e.* waste rock). In 2002 a bioreactor was constructed at the Landusky mine specifically to treat leach pad effluent. Water treatment plant and bioreactor influent, described as 'average' or 'typical', is reported in EQC, 2004 and Williams *et al.,* 2009, respectively. These results are provided in Table 4-13.
- *Brewery Creek Mine* - The Brewery creek mine is located in central Yukon approximately 55 km east of Dawson City. The mine operated a conventional heap leach facility from 1996 to 2001. Approximately 9.5 MT of ore were placed in the HLF during this time period. At this minesite, the HLF is divided into 7 cells that are approximately 3.8 ha in area and designed to accommodate approximately 1.5 MT of ore (Diment and Simson, 2009). Gold mineralization at this site is structurally controlled, being hosted in intrusive, sedimentary and volcanic rock. Ore production at the mine was largely from near surface oxide ore and minor amounts of transition ore. The oxide material is deplete in sulphide minerals and is considered to have low potential for acid generation (Alexco, 2011). The heap leach facility was detoxified in 2002 using in-situ bioremediation technology. Drain down of the facility took place in 2003, and

heap leach effluent has since been monitored at BC-28a. Results for this monitoring location from Alexco, 2010 and Golden predator Corp., 2012 are provided in Table 4-13.

In general, predicted HLF source term concentrations for Casino are similar or greater than drainage at other minesites (Table 4-13). However, in some cases upscaled concentrations do not accurately reflect what can reasonably be expected based on this comparison. Therefore some concentrations are adjusted. Concentrations adjusted to higher levels include Mo and Sb. Although predicted Mo is greater than any value observed in the analogue sites, it is still below what was observed in the detoxified solution and kinetic testwork. Therefore it is set to the highest concentration that was observed in laboratory testwork. The long term prediction for Mo is decreased proportional to the decrease in Mo loading rates observed in Col 4a similar to other long term predictions (Table 5-9). The predicted drain down and rinsing Sb concentration is lower than concentrations observed at other minesites, and it is lower than peak concentrations observed in kinetic tests. The rinsing and drain down Sb concentration is increased to the Sb concentration predicted for the post-rinsing source term (0.77 mg/L).

Concentrations adjusted downwards include As, Cr and Hg in the post drain down and long term source terms. The concentration As in heap leach effluent can be expected to be controlled in large part by sorption to the iron oxide minerals which are abundant in CAP oxide. Note that the peak and 90th percentile concentrations produced by the Col 7 and Col 8 are nearly identical, even though Col 8 has 2.5 times the mass of Col 7 (Table 4-13). Arsenic is set at the predicted rinsing and draindown value for all time points. The predicted Cr and Hg values are based on upscaling below detection limit values in the post drain down and long term source term, and Hg is based on detection limit values in the rinsing and drain down source term. Limited data is available on these two elements in drainage from analogue minesites, therefore the concentration is set at the maximum concentration observed in kinetic testwork.

Table 4-13:
Predicted Source Term Concentrations for Casino Heap Leach Facility Compared to Analogue Minesites

Upscaled Predictions	**pH**	**SO_4**	**T-CN**	**WAD-CN**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Rinsing and Drain Down	8.7	1,920	10.7	5.0	0.069	0.036	666	0.0084	0.00901	2.75	9.46	0.0183	7.8	0.00360	0.59	0.241	0.00147	532	0.40	0.00	0.07
Post Rinsing	7.7	2,100	0.20	0.03	0.007	1.3	756	0.0050	0.03892	0.01603	0.00403	0.00078	392	0.00447	0.52	0.093	0.00028	0.77	0.23	0.63	0.39
Long Term	7.7	424	0.0	0.0	0.006	1.2	532	0.00027	0.01956	0.00112	0.00403	0.00075	259	0.00031	0.12	0.0073	0.00028	0.47	0.098	0.17	0.22
Corrected Predictions	**pH**	**SO_4**	**T-CN**	**WAD-CN**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Rinsing and Drain Down	8.7	1,920	10.7	5.0	0.069	0.036	666	0.0084	0.0010	2.75	9.46	0.0183	7.83	0.00360	4.18	0.241	0.00147	0.771	0.40	0.002	0.072
Post Rinsing	7.7	2,100	0.200	0.030	0.007	0.036	756	0.0050	0.0010	0.0160	0.0040	0.00002	392	0.00447	4.18	0.093	0.00028	0.771	0.23	0.627	0.39
Long Term	7.7	424	0.0	0.0	0.006	0.036	532	0.0003	0.0010	0.0011	0.0040	0.00002	259	0.00031	0.94	0.007	0.00028	0.472	0.098	0.173	0.22
Brewery Creek Mine																					
Sample site	**Date (m/d/y)**	**pH**	**SO_4**	**T-CN**	**WAD-CN**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
BC-28a	6/14/2012	7.58	127		0.006	0.0374	0.0406	56.5	0.000035	0.00017	0.00183	0.0364		10.7	0.00523	0.00697	0.00139	0.0000949	0.332	0.033	0.00168	0.00188
BC-28a	3/19/2012	7.52	709	1.2	0.3	0.005	0.049	376	0.00012	0.0006	0.002	0.36		81.4	0.0117	0.0226	0.007	<0.0001	1.62	0.161	0.0208	0.004
BC-28a	6/4/2012	7.56	640	0.762	0.047	0.035	0.301	292	0.0002	<0.002	0.002	0.166	<0.0002	57.6	0.022	0.023	0.0071	<0.0001	1.69	0.15		0.006
BC-28a	9/3/2009	6.59	640	1.18	0.0517	0.02	0.31	310	0.0003	<0.002	0.004	0.336		68.1	0.031	0.021	0.0084	0.0001	1.87	0.168		0.011
BC-28a	12/11/2009	7.71	780	0.786	0.044	0.01	0.324	345	<0.0001	<0.002	0.001	0.398		73.1	0.013	0.024	0.0.0668		1.91	0.194		0.004
BC-28a	Max value 2001 to 2009			7.0	5.1		1.0						0.030							0.221		
Zortman-Landusky Mine																					
Sample Site	**Date**	**pH**	**SO_4**	**T-CN**	**WAD-CN**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Zortman Water Treatment plant influent	2004	3.5	3000	0.015			0.08		0.2		3.5	40			35			0.005		0.015		5
Zortman Water Treatment plant influent	2009	3.7	3000				0.23		0.22		6.95	40			35			0.005		0.012		7.02
Landusky Water Treatment Plant Influent	2004	6	650	0.05			0.15		0.015		0.03	10			4			0.004		0.005		0.8
Landusky Water Treatment Plant Influent	2009	5	991	<0.05			0.15		0.04		0.11	18.8			7.6			0.004		0.004		1.72
Leach Pad bioreactor influent	2004	6.8		0.37			0.01		0.75		0.10							0.002		0.47		
Casino Laboratory Results	**Statistic**	**pH[1]**	**SO_4**	**T-CN**	**WAD-CN**	**Al**	**As**	**Ca**	**Cd**	**Cr**	**Cu**	**Fe**	**Hg**	**Mg**	**Mn**	**Mo**	**Ni**	**Pb**	**Sb**	**Se**	**U**	**Zn**
Col 8 (25 kg)	max	7.75	2852	0.20	0.03	0.0087	0.0098	576	0.00034	0.001	0.031	0.018	0.00002	25.3	0.0251	2.02	0.0025	0.00015	0.0078	0.075	0.037	0.012
Col 8 (25 kg)	90th Percentile	7.718	2520	0.14	0.027	0.00838	0.00964	562	0.00017	0.00096	0.027	0.017	0.000018	24.74	0.02158	1.828	0.00242	0.000126	0.0077	0.068	0.035	0.0048
Col 7 (10 kg)	max	7.3	2010	0.15	0.02	0.0112	0.0094	490	0.00043	0.0008	0.021	0.014	0.00002	21.8	0.021	2.1	0.0024	0.00065	0.0096	0.058	0.027	0.004
Col 7 (10 kg)	90th Percentile	7.55	1784	0.13	< 0.01	0.01095	0.009	466	0.00012	0.0006	0.019	0.010	0.00001	20	0.0186	1.89	0.00205	0.000235	0.0085	0.046	0.021	0.0035
Detoxified Solution		8.00	1701	0.22	0.101	0.044	0.002	439	0.0006	0.0005	0.195	0.673	0.0013	0.271	0.0002	4.18	0.0134	0.0001	0.0004	0.022	0.0001	0.0051

Red Highlight = Predicted concentration greater than maximum of concentrations at analogue minesites.
Blue Highlight = Predicted concentration less than minimum concentration at analogue minesites.
Amber Highlight = Concentrations are adjusted based on comparison.
[1]Statistics for pH are reported as minimum, minimum and P10

4.6.1 Source Terms

Predicted concentrations for the HLF are presented in Table 4-14 and compared to MMER discharge limits. The rinsing and drain down source term represents drainage quality in years 19 to 28 of mine life. The post-drain down source term represents the years immediately after drain down (mine life year 29 onward). A gradual improvement in drainage chemistry can be expected after drain down is complete, as the most soluble metal oxides are rinsed from the HLF and remaining cyanide degrades, trending towards the long-term drainage prediction in the years after closure.

Table 4-14:
Heap leach facility source terms

Parameter	Units	Rinsing and Drain down	Post-Drain Down	Long Term	MMER		
					MMM	MCS	MGS
pH	s.u.	8.71	7.7	7.7			
Alkalinity	mg$CaCO_3$/L	70.2	47.3	47.3			
SO_4	mg/L	1920	2100	424			
T-CN	mg/L	10.7	0.2	0	1	1.5	2
WAD-CN	mg/L	5.00	0.03	0			
F	mg/L	2.13	2.97	1.25			
Cl	mg/L	638	240	38.3			
Ag	mg/L	0.0534	0.000778	0.000622			
Al	mg/L	0.0694	0.00695	0.00598			
As	mg/L	0.036	0.036	0.036	0.5	0.75	1
Ba	mg/L	0.00636	0.0077	0.0077			
Ca	mg/L	666	756	532			
Cd	mg/L	0.00843	0.00498	0.000275			
Co	mg/L	5.69	2.55	0.489			
Cr	mg/L	0.001	0.001	0.001			
Cu	mg/L	2.75	0.016	0.00112	0.3	0.45	0.6
Fe	mg/L	9.46	0.00403	0.00403			
Hg	mg/L	0.0183	0.00002	0.00002			
K	mg/L	214	170	97.8			
Hg	mg/L	0.0183	0.00002	0.00002			
K	mg/L	214	170	97.8			
Mg	mg/L	7.83	392	259			
Mn	mg/L	0.0036	0.00447	0.00031			
Mo	mg/L	4.18	4.18	0.939			
Na	mg/L	432	15.2	0.556			
Ni	mg/L	0.241	0.0934	0.00727	0.5	0.75	1
Pb	mg/L	0.00147	0.000279	0.000279	0.2	0.3	0.4
Sb	mg/L	0.771	0.771	0.472			
Se	mg/L	0.4	0.227	0.0975			
Si	mg/L	7.39	7.83	7.29			
Sr	mg/L	13.5	7.39	5.49			
Tl	mg/L	0.0018	0.00011	0.00011			
U	mg/L	0.0018	0.627	0.173			
Zn	mg/L	0.0716	0.389	0.221	0.5	0.75	1

5. Beach and Embankment

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5. Beach and Embankment

In this section the source terms for the tailings embankment dam and tailings beach are described and presented. In order to assess the impact of runoff and seepage from these exposed tailings facilities, geochemical source terms were developed using samples collected from metallurgical tailings samples produced in 2010 and 2012. These samples were subjected to static and kinetic laboratory tests which form the basis of source term development. The various work stages leading to the development of these source term concentrations for the individual stockpiles can be summarizes as follows:

- Description of tailings embankment and beach construction;
- Selection of kinetic test data for model input;
- Application of scaling factors;
- Application of secondary mineral controls (speciation calculations).

A flow chart illustrating the steps in tailings beach and embankment source term development are provided in Figure 5-1.

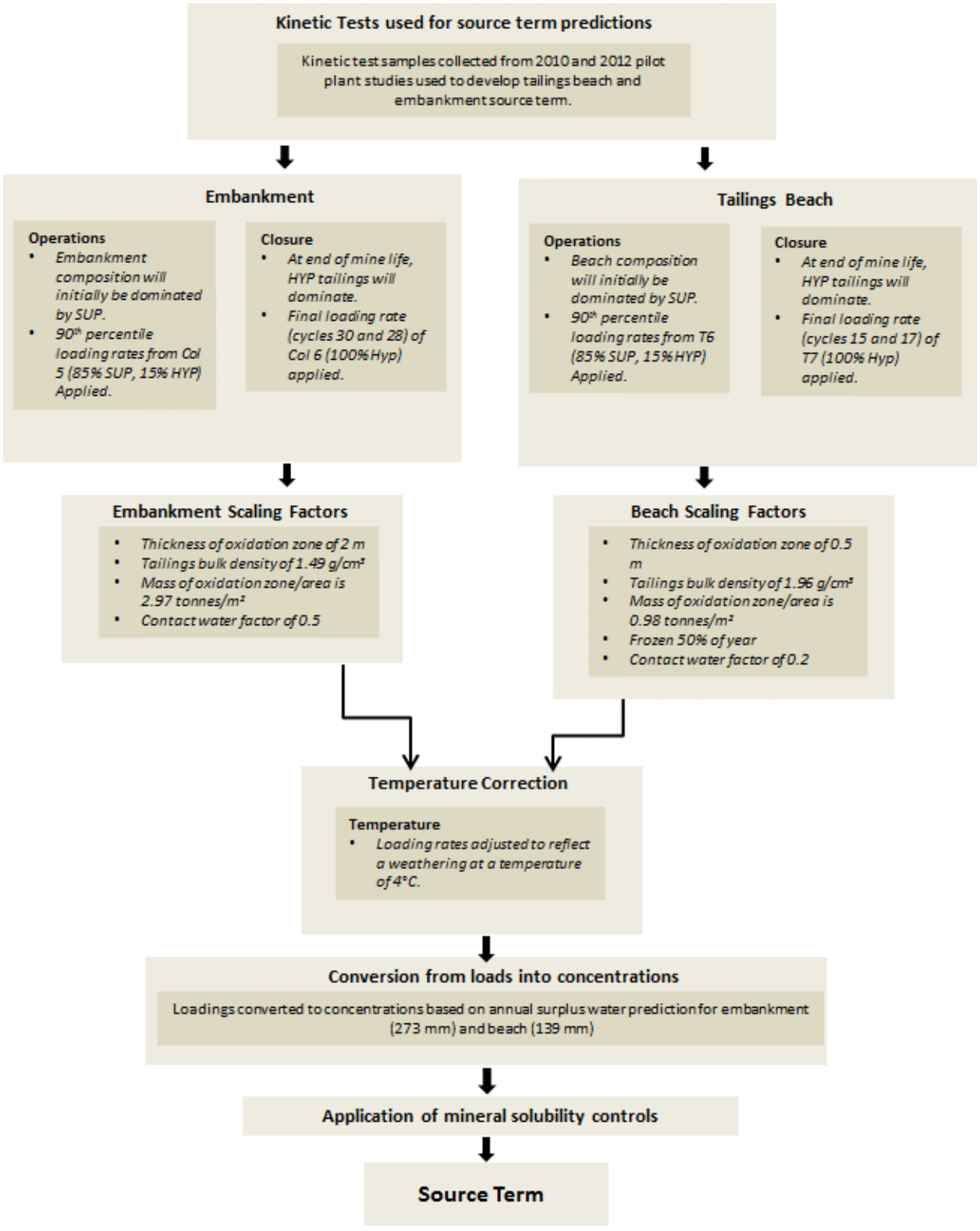


Figure 5-1: Flow chart illustrating tailings beach and embankment source term development

5.1 Embankment sands and Beach Composition

Starting in year 1 of mine operations, pyrite rougher tailings will be discharged to a center-line construction tailings dam. Cyclone overflow slimes and the bulk of the tailings supernatant will be deposited in the submerged upstream portion of the TMF. Tailings sands from the cyclone underflow will be deposited along the downstream crest of the embankment and will be used to construct the unsaturated tailings embankment. During the winter months, tailings cycloning ceases and whole tailings are discharged directly into the upstream portion of the TMF.

5.2 Kinetic Test Data and Sample Selection

Lorax initiated a kinetic test program using materials considered representative of the waste stream and grain size distributions that will be used to construct the tailings embankment and beach. The tailings embankment and tailings beach will remain unsaturated and subject to oxidation during mine life and upon closure. As such, these components of the TMF are designed to be constructed with non-acid generating material. A majority of ore that will be produced at the Casino minesite is potentially acid generating. Consequently, a pyrite rougher circuit will be operated to remove pyrite from tailings while the tailings embankment and beach are being constructed. Depyritized tailings (pyrite rougher tailings) were produced during metallurgical testwork in 2010 and 2012 (Lorax, 2013b). This testwork produced non-acid generating tailings samples with sulphide contents of less than 0.1%. Pyrite rougher tailings produced during this metallurgical testwork was used to construct two 5 kg unsaturated columns, and two 1 kg humidity cells, as outlined in Table 5-1. Note that kinetic tests on tailings were also initiated on metallurgical testwork conducted in 2008 and 2009, however these test programs did not include a pyrite rougher circuit, and therefore the tailings produced are not representative of what will be used in embankment and tailings beach construction.

Kinetic tests conducted on 2010 tailings were ran for approximately 19 months (83 cycles), while only 4 to 7 months (20-30 cycles) of data is available from 2012 tailings kinetic testwork (Table 5-1). The complete kinetic and static test results are presented in the Kinetic test report (Lorax, 2013b). Supplemental kinetic test data for the ongoing experiments (Col 6 and T7) are provided in Appendix B.

Table 5-1:
Humidity cells (T5, T6 and T7) and unsaturated columns (Col 5 and Col 6) used to develop embankment and tailings beach source terms

Test ID	Col 5	Col 6	T5	T7
Sample Description	2010 Pyrite Rougher Sands	2012 Pyrite Rougher Sands	2010 Pyrite Rougher Whole Tailings	2012 Pyrite Rougher Whole Tailings
Mineralization	15% HYP, 85% SUP	100% HYP	15% HYP, 85% SUP	100% HYP
Represents	Embankment Sands Operations	Embankment Sands Closure	Tailings Beach Operations	Tailings Beach Closure
Start Date	4-May-11	19-Dec-12	03-May-11	05-Mar-13
End Date	5-Dec-12	on-going	04-Dec-12	on-going
Data Used	90th Percentile Loading Rate	Average of final 2 cycles (30 and 28)	90th Percentile Loading Rate	Average of final 2 cycles (15 and 17)

5.2.1 Loading Rates Applied to Source Terms

The rock types used to produce the tailings used in dam construction will vary over the course of the mine life (Figure 5-2). Similar quantities of SUP and HYP ore will be processed in the first six years of mine life, after which, HYP ore becomes increasingly dominant. Upon completion of active mining, processing of LGO stockpiles will be staged such that SUP LGO is processed prior to HYP LGO. The purpose of this staging is to ensure that the final layer of tailings is composed of less reactive HYP material.

The 2010 tailings which are composed of a mix of SUP and HYP are used to represent the tailings embankment and beach during mine operations. The 90th percentile loading rates from these humidity cells is used to represent freshly exposed tailings. Note that these tailings are 15% HYP and 85% SUP. Supergene tailings are generally considered more reactive then HYP tailings owing to the presence of oxide minerals and secondary sulphides. Therefore using a kinetic test sample which has a relatively elevated proportion of SUP compared to ore production as indicated by the mining schedule is highly a conservative assumption.

The 2012 HYP tailings are used to represent the tailings embankment and beach upon closure. An average of the two most recent cycles measured in the two 2012 HYP kinetic tests are used to represent the closure loading rate. Note that these are relatively young kinetic tests, and most parameters have not yet stabilized. Therefore applying these kinetic tests to a closure scenario is considered highly conservative, as stabilized loading rates can be expected to be significantly less then what is currently observed.

5.2.1.1 Potential Contamination of T7

Evidence of arsenic contamination in T7 was identified by the analytical laboratory (SGS) conducting the kinetic testwork. The analytical laboratory conducting the humidity cell experiment, found that the silicon sealant with a new mould inhibitor. For supporting information and a letter from SGS describing the arsenic contamination in this humidity cell see Appendix G. Moving forward, arsenic data from T5 is used in place of arsenic data from T7 when deriving source terms.

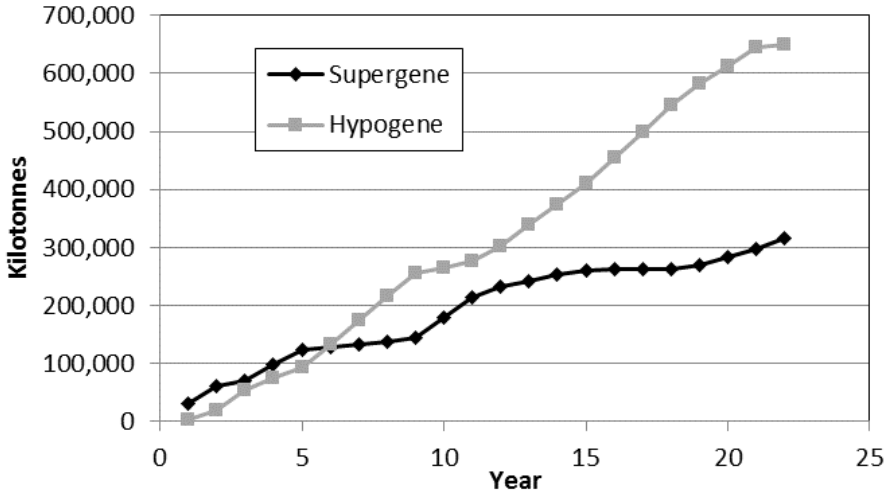


Figure 5-2: Cumulative production of Supergene (SUP) and Hypogene (HYP) tailings

5.2.2 Kinetic test grain size distribution

The downstream tailings embankment shell will be constructed with cyclone sands while the tailings beach will be constructed with whole tailings. Therefore, tailings samples were sieved to >74 µm grain size fraction to represent the embankment sands, while whole pyrite rougher tailings samples were used to represent the tailings beach (Table 5-1).

5.2.3 Detection Limit Values

A number of parameters were often below detection limits in the kinetic tests used to predict tailings and embankment source terms. For operations source terms, if the 90th percentile concentration is a detection limit value then the concentration is assumed to be at half the detection limit. For closure source terms an average of two cycles is used. If both cycles are below detection limits, then the concentration is assumed to be at half of the detection limit.

5.3 Temperature Effects

Kinetic test loading rates have been adjusted to reflect the lower temperatures that are present at the Casino site compared to laboratory temperatures. Lower temperatures affect both sulphide oxidation rates and mineral solubility. Sulphide oxidation rates decrease with decreasing temperature, while mineral solubility can increase or decrease depending on the mineral phase. Temperature effects on mine waste weathering are discussed in greater detail in Chapter 2.

The temperature correction for the pH-neutral tailings embankment and tailings beach is derived from the proportional change in loading rates observed from a Casino tailings cell at room temperature and again at 4°C. Details of how a 4°C temperature correction is applied to pH-neutral pH weathering rates is presented in Chapter 2. Thermal heating due to the exothermic nature of sulphide oxidation in the tailings embankment and beach can be expected to be considerably lower than in ore and waste rock piles, making this a conservative assumption.

5.4 Physical Scaling Factors

A series of physical scaling factors are applied to adjust loading rates to account for differences between lab-based kinetic tests and tailings in the field. These include but are not limited to hydrogeological pathways, water/rock ratio, temperature, grain size distribution, and reaction mechanisms. Values and rationale for these correction factors are described below. A summary of the scaling factors used to predict tailings embankment and tailings beach source terms are presented in Table 5-2

Table 5-2:
Summary of scaling factors used to predict source term concentrations

Scaling Factors	Unit	Embankment	Beach
Surplus water[1]	mm	273	139
Thickness of oxidation zone	m	2	0.5
Specific density	g/cm^3	2.8	2.8
porosity	ratio	0.47	0.3
Bulk density	g/cm^3	1.49	1.96
% of Year Frozen	m	0%	50%
Mass of oxidation zone/area	$Tonnes/m^2$	2.97	0.98
Contact Water Factor	-	0.5	0.2

5.4.1 Oxygen Ingress

Simulation of unsaturated sulfide oxidation at Casino Embankment Sand was conducted using a reactive transport code MIN3P (Mayer *et al.*, 2002). MIN3P is a general-purpose numerical model for reactive transport problems in variably saturated media. The model formulation includes the relevant transport and key geochemical processes influencing sulphide mineral oxidation within unsaturated waste rock piles. The model parameters are provided in Table 5-3.

Table 5-3:
Min3P model input parameters for predicting depth of oxygen ingress into tailings embankment

Parameter	Value	Source
Recharge rate (m s^{-1})	6.5×10^{-9}	75% of 273 mm/yr
Saturated hydraulic conductivity (m s^{-1})	2.0×10^{-5}	Estimated
Porosity	0.47	Provided from field data
van Genuchten - alpha	4.38	Estimated from grain size distribution and Rosetta Lite[a]
van Genuchten - n	2.09	Estimated from grain size distribution and Rosetta Lite[a]
Residual saturation	0.61	Calculated from gravimetric water content of 0.16
Diffusion coefficient - aqueous phase (m^2 s^{-1})	2.38×10^{-9}	Mayer, 1999
Diffusion coefficient - gas phase (m^2 s^{-1})	2.07×10^{-5}	Mayer, 1999
Pyrite volume fraction	1.18×10^{-4}	Average sulphide S content (0.02% to 0.08%)
Oxidation rate (mol L^{-1} bulk s^{-1})	3.96×10^{-11}	Average of humidity cell test sulphate loading rate (1.2 mg/kg/wk to 5.0 mg/kg/wk)
Thickness (m)	100	Arbitrary
Simulation time (years)	20, 50, 100	Arbitrary

[a]Embedded in Hydrus-1D (Šimůnek *et al.*, 2013).

Figure 5-3 shows the simulation results for oxygen concentration, pyrite volume fraction, and oxidation rate with depth. The depths with higher oxidation rates at each simulation time indicate where active pyrite oxidation is occurring at that time. This corresponds to approximately 8-10, 15-16, and 21-22 m for 20, 50, and 100 years of simulation times. Thus, the thickness of oxidizing tailings embankment was conservatively set to 2.0 m.

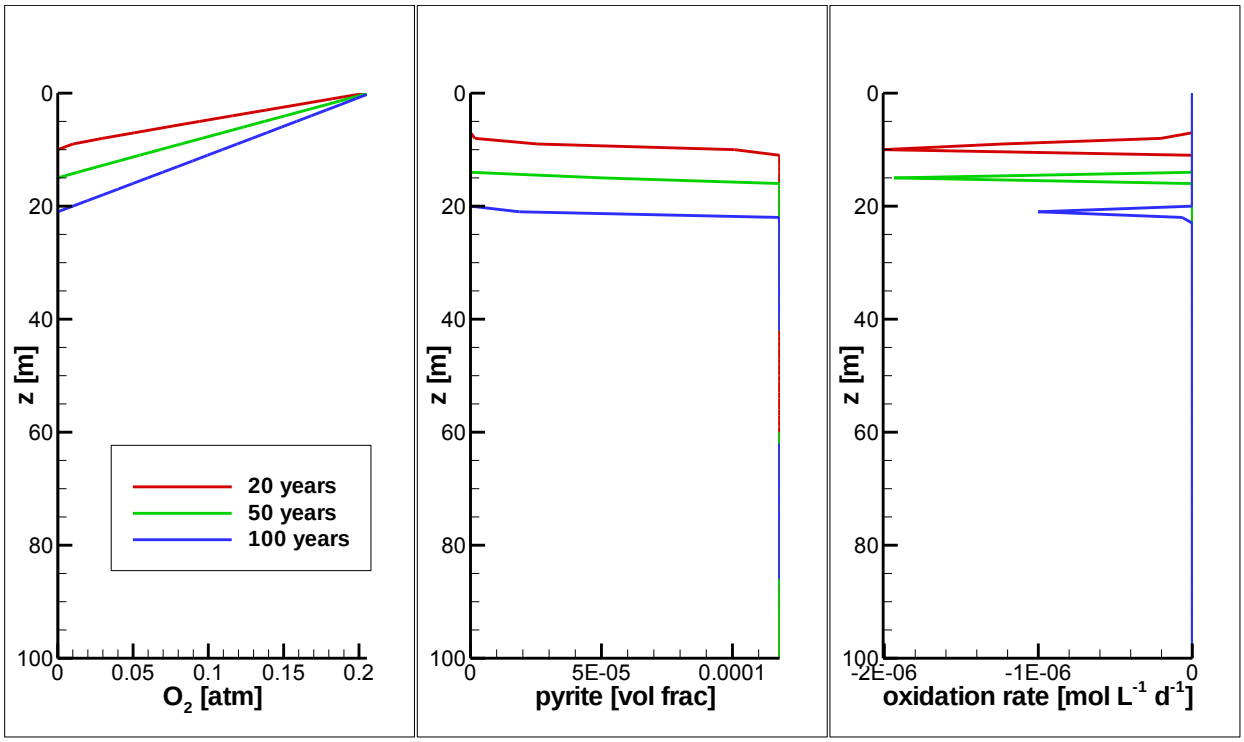


Figure 5-3: Embankment oxygen concentration, pyrite volume fraction, and oxidation rate with depth

Min3p was not used to model the depth of oxygen ingress into the tailings beach material. However, based on the tailings embankment results an active oxidation thickness of 0.5 m was assigned to the tailings beach. This value is considered conservative due to the finer grain size, higher pyrite content, and higher residual moisture content relative to the embankment sands. All three of these factors would reduce the oxygen penetration depth, which would in-turn reduce the thickness of active pyrite oxidation.

5.4.2 Frozen Thickness

The mean annual temperature at the Casino site is near 0ºC, and discontinuous permafrost is present in the minesite footprint. It is reasonable to assume that a portion of the tailings embankment and beach will freeze during winter months. Available data from the Casino minesite indicates that the ground freezes to a depth of approximately 3.5 m (Knight Peisold, 2013b). In the tailings embankment, the oxidation zone will decline a depth of 8-10 m within 20 years (Figure 5-3). Therefore winter freezing of the upper layer of the tailings embankment is not incorporated into the tailings embankment source term. The weathering zone of the tailings beach, although not explicitly modeled, is expected to be much nearer to the surface in the tailings beach than in the embankment sands. Therefore it is assumed that the tailings beach is frozen for 6 months of the year.

5.4.3 Contact Water

Humidity cells are designed to achieve complete flushing of mineral surfaces, ensured by the small sample size (1 kg) and high flushing rate (0.5 L/week). In unsaturated columns, mineral surface flushing is less complete, as the sample size is larger (5 kg) and the flushing rate is somewhat lower (0.3 L/week).

It is assumed that 100% of mineral surfaces in humidity cells are rinsed, that 50% of mineral surfaces in columns are flushed. In the field, it is assumed that approximately 20% of tailings surfaces are flushed. A rinsing factor of 20% is applied when upscaling humidity cell data used to model tailings beach weathering, and a rinsing factor of 50% is applied when upscaling unsaturated column data to model tailings embankments.

5.5 Secondary Mineral Control

Upscaling laboratory kinetic tests often results in concentrations that exceed thermodynamic solubility constraints. To account for mineral solubility controls that can reasonably be expected to occur in the field, the USGS geochemical modelling program PHREEQC was applied using the Minteq.V4 database (Allison *et al*. 1991; Parkhurst and Apello, 1999). These solubility controls were applied by speciating the upscaled solution in PHREEQC, and allowing select minerals to precipitate if the saturation indices (SI) was greater than zero.

The process of averaging loading rates over several cycles, and applying correction factors results in solutions that are out of charge balance and have unrealistic concentrations of some parameters, such as alkalinity. Therefore some adjustments to major parameters were made before speciation modelling. These adjustments include:

- Setting alkalinity to median values observed in respective kinetic tests.
- Adjusting the concentration of Ca, Mg and Sr to achieve charge balance, while maintaining the relative concentration of these three major cations.

The mineral phases considered are listed with their chemical formulas in Table 5-4. Note that other mineral solubility controls were considered, but were predicted to have SI values below 0, and therefore were not predicted to precipitate from the upscaled solutions. All PHREEQC model inputs are provided in Appendix A.

Table 5-4:
Overview of secondary mineral equilibrated with model output solutions

Mineral Phase	Chemical Formula	Beach Operations	Beach Closure	Embankment Operations	Embankment Closure
Gibbsite	$Al(OH)_3$	x	x	x	x
Barite	$BaSO_4$	x	x	x	x
Tenorite	CuO	x		x	
Chalcedony	SiO_2	x	x	x	x
Ferrihydrite	$Fe(OH)_3$	x	x	x	x
Fluorite	CaF_2		x		x
Manganite	MnOOH	x	x	x	x

5.6 Tailings Embankment and Beach Source Terms

Predicted concentrations for Casino tailings embankment and tailings beach during operations and closure is presented in Table 5-7. A number of these concentrations represent thermodynamic solubility controls, as outlined in Table 5-5 while others represent concentrations predicted by upscaling kinetic tests. Note that closure source terms are derived from relatively young humidity cells (less than 30 cycles) and not all parameters reflect stabilized loading rates. Further stabilization of loading rates would presumably result in lower source term predictions for tailings embankment and beach closure. For this reason, the closure source terms provided below are considered highly conservative and may be updated in the future when more kinetic testing data is available.

Table 5-5:
Predicted source term concentrations for the tailings beach and embankment sands during operations and closure scenarios

Parameter	Unit	Beach Operations	Beach Closure	Embankment Operations	Embankment Closure	MMER		
						MMM	MCS	MGS
pH	s.u.	7.5	7.5	7.5	7.5			
Acidity	$mgCaCO_3/L$	0.237	0.028	0.053	0.051			
Alkalinity	$mgCaCO_3/L$	67.9	75.3	95.1	124			
SO_4	mg/L	101	150	463	170			
F	mg/L	0.564	4.06	0.547	2.53			
Cl	mg/L	0.054	7.83	8.19	69.3			
Ag	mg/L	0.000467	0.000118	0.000359	0.000127			
Al	mg/L	0.038	0.000186	0.00398	0.00398			
As	mg/L	0.054	0.0289	0.0409	0.0257	0.5	0.75	1
Ba	mg/L	0.0292	0.0225	0.0102	0.0306			
Ca	mg/L	40.1	59.5	120	193			
Cd	mg/L	0.00483	0.000186	0.00539	0.00121			
Co	mg/L	0.00557	0.00162	0.00888	0.00428			
Cr	mg/L	0.0431	0.00823	0.0256	0.00797			
Cu	mg/L	0.038	0.00993	0.0477	0.0159	0.3	0.45	0.6
Fe	mg/L	0.00502	0.00506	0.00519	0.00517			
Hg	mg/L	0.000427	0.0000738	0.000121	0.0000797			
K	mg/L	66	54.1	184	26.1			
Mg	mg/L	2.32	7.42	8.1	21.6			
Mn	mg/L	0.00596	0.00648	0.00869	0.00725			
Mo	mg/L	2.8	0.176	1.73	0.387			
Na	mg/L	4.29	2.42	9.11	1.14			
Ni	mg/L	0.0177	0.00407	0.0272	0.00878	0.5	0.75	1
Pb	mg/L	0.0073	0.0002	0.0000553	0.0000924	0.2	0.3	0.4
Sb	mg/L	0.044	0.029	0.0445	0.149			
Se	mg/L	0.00223	0.00215	0.00329	0.0046			
Si	mg/L	7.63	7.94	7.92	7.93			
Sr	mg/L	0.201	0.388	0.569	1.64			
Tl	mg/L	0.000196	0.0000683	0.000519	0.000185			
U	mg/L	0.0169	0.0416	0.0456	0.0999			
Zn	mg/L	0.135	0.0149	0.109	0.0242	0.5	0.75	1

6. Tailings Process Water

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6. Tailings Process Water

In this chapter the predicted tailings process water chemistry is presented. A tailings slurry will be discharged to the TMF as 55% solids. The fluid component of the slurry will carry a dissolved load owing to reagents used in ore processing (*i.e.* lime), and release of water soluble metals associated with the ore. The tailings solids will settle in the TMF and the process water will accumulate in the tailings porewater and the overlying pond. Process water will be the largest inflow to the tailings pond during operations. The chemistry of the process water will evolve in the tailings pore space and pond. The source term developed in this chapter is envisioned as the initial process water chemistry discharged to the TMF and does not take into account any subsequent geochemical reactions. The primary data source used to estimate this chemistry is supernatant samples collected from decanted tailings slurry produced during metallurgical testwork. The various work stages leading to the development of these source term concentrations for the individual stockpiles can be summarizes as follows:

- Selection supernatant chemistries measured during metalurgical testwork;
- Identification of parameters which can be expected to accumulate in reclaim water recycled from the pond.

A flow chart illustrating the data sources and general approach to process water source term development is presented in Figure 6-1.

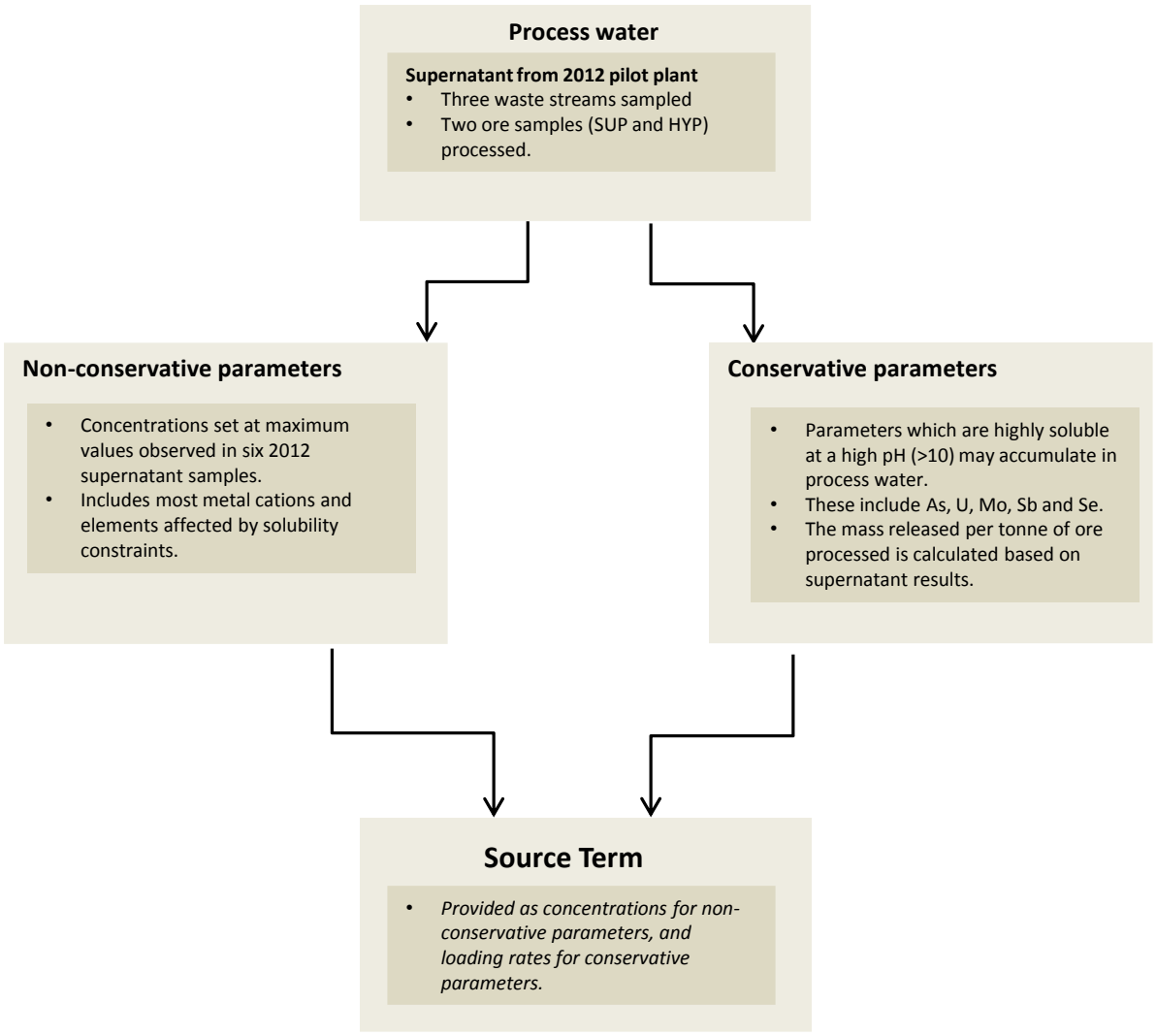


Figure 6-1: Flow chart illustrating process water source term development

6.1 Tailings Supernatant Sample Selection

Since 2008, four metallurgical test programs have been conducted to develop and assess copper recovery from Casino ore. This testwork includes two pilot plant studies (2008 and 2012) and two bench scale studies (2009 and 2010). During each program, tailings solids and supernatant were collected. For complete results of ML/ARD related testwork conducted on these samples, see Lorax, (2013b).

Pilot plant processing slurry is considered a better analogue to what will be produced by the operational ore processing plant than data collected from bench scale tailings. This is because the tests are conducted at a larger scale (*e.g.*, several tonnes of ore versus several kg), ran for a longer time period (days versus hours) and supernatant is recirculated allowing for some accumulation of soluble species during the test. Two pilot plant tests were conducted on Casino tailings, the first pilot plant test was conducted in 2008 and the

second in 2012. Of these two pilot plant tests, the 2012 supernatant reflects the processing circuit which is in the current mine plan. Specifically, the 2008 pilot plant processing circuit did not include a de-pyritization step. Furthermore, there are some issues regarding sample collection and preservation associated the 2008 supernatant sampling. Samples were not filtered or preserved on-site during 2008 supernatant collection. For these reasons, only 2012 pilot plant results are used in development of the process water source term.

6.2 Tailings Supernatant Results

Three waste streams were sampled during the 2012 pilot plant testing. These waste streams include pyrite rougher feed, pyrite rougher tailings and pyrite rougher concentrate. The pyrite rougher feed represents tailings prior to depyritization in the pyrite rougher. This waste stream will be discharged directly to the TMF during time periods when the embankment is not being constructed. The pyrite rougher tailings represents the de-pyritized tailings which will be used for tailings embankment construction. The pyrite rougher concentrate represents the pyrite concentrate extracted during de-pyritization which will be discharged into the upstream (permanently saturated) section of the TMF. Samples of these three waste streams were collected during processing of the two ore head samples (HYP and the SUP) during 2012 pilot plant testing.

Water quality results for the above described supernatant samples are presented in Table 6-1. Water quality was generally similar between all six samples. Based on these analyses potential elements of concern were identified as Al, Se and Mo. Notably, Cu concentrations were consistently low, ranging from 1 to 5 ug/L. These low concentrations reflect the limited mobility of Cu in the aqueous phase at alkaline pH and the effective separation of Cu minerals from the tailings during the flotation processing of the ore.

Table 6-1:
Supernatant chemistry of 2012 pilot plant tailings

Parameter	Unit	SUP Supernatant			HYP Supernatant			MMER		
		Pyrite Rougher Feed	Pyrite Rougher tailings	Pyrite Conc	Pyrite Rougher Feed	Pyrite Rougher tailings	Pyrite Conc	MMM	MCS	MGS
pH	s.u.	10.3	10.2	10.2	11	10.6	9.17			
Alkalinity	$mgCaCO_3/L$	74.1	74.3	56.6	86.3	60	27.8			
SO_4	mg/L	879	879	518	911	1320	592			
F	mg/L	2.02	2.22	1.38	1.23	1.54	0.72			
Cl	mg/L	31	30	19.6	34	36	17.4			
Ag	mg/L	<0.00004	<0.00004	<0.00004	<0.00004	<0.0001	<0.00002			
Al	mg/L	4.45	4.77	3.08	1.43	0.636	0.494			
As	mg/L	0.0035	0.0033	0.0033	0.0033	0.0038	0.00408	0.5	0.75	1
Ba	mg/L	0.031	0.042	0.023	0.035	0.058	0.02			
Ca	mg/L	350	347	222	397	497	169			
Cd	mg/L	<0.00008	<0.000068	<0.000034	<0.000068	<0.000085	0.000018			
Co	mg/L	<0.0006	<0.0006	<0.0006	<0.0006	<0.0015	<0.0003			
Cr	mg/L	<0.002	<0.002	<0.002	<0.002	<0.005	<0.001			
Cu	mg/L	0.0023	0.0025	0.002	0.0035	0.005	0.001	0.3	0.45	0.6
Fe	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03	0.060			
Hg	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001			
K	mg/L	55.2	85.8	56.4	50.2	78.9	19.1			
Mg	mg/L	0.22	0.24	0.33	0.12	0.21	1.29			
Mn	mg/L	<0.0006	<0.0006	<0.0006	<0.0006	<0.0015	0.00123			
Mo	mg/L	0.232	0.24	0.147	0.237	0.155	0.0474			
Na	mg/L	31.8	33.9	22.5	30.5	35.4	11			
Ni	mg/L	<0.002	<0.002	<0.002	<0.002	<0.005	<0.001	0.5	0.75	1
Pb	mg/L	<0.001	<0.001	<0.001	<0.001	<0.0025	<0.0005	0.2	0.3	0.4
Sb	mg/L	0.0019	0.0013	0.0010	0.0010	0.0025	0.0005			
Se	mg/L	0.0085	0.0082	0.0054	0.0079	0.0081	0.0018			
Tl	mg/L	<0.0004	<0.0004	<0.0004	<0.0004	<0.001	<0.0002			
U	mg/L	0.0004	0.00043	0.0004	0.0004	0.001	0.00308			
Zn	mg/L	0.0061	0.005	0.005	0.005	0.005	0.0053	0.5	0.75	1

6.3 Conservative and Non-Conservative Parameters

Water to be used in the milling circuit will be collected from a variety of sources, some of which are mine impacted and may contain elevated metal concentrations. Most metal cations will have non-conservative behavior in the processing circuit, as the high pH will result in hydrolysis, precipitation and sorption. Solubility of some metal cations at the relatively high pH of the milling circuit are illustrated in Figure 6-2. These solubility constraints result in non-conservative behaviour of most metals and the resulting low concentrations observed in supernatant waters during the pilot processing tests. As such, the concentration of most metals can be expected to remain relatively constant during ore processing, and a single concentration value is supplied as the process water source term for these elements.

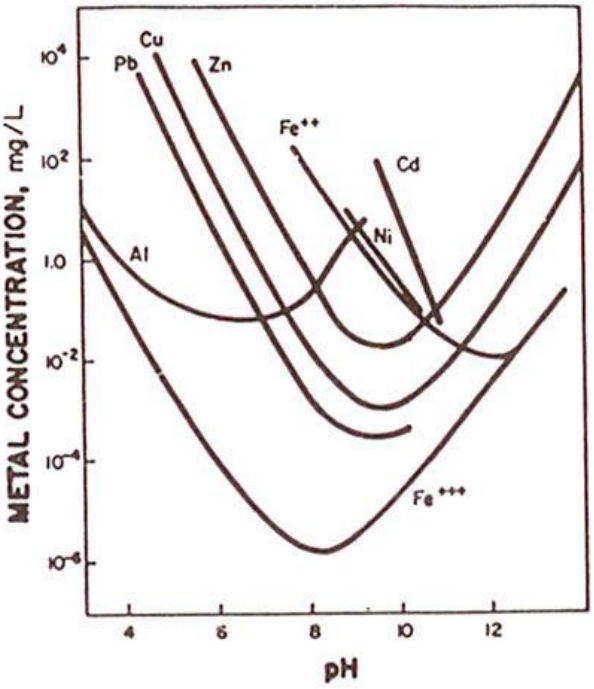


Figure 6-2: Solubility of various metal hydroxides (from Vachon *et al.,* 1987)

The high pH of the process water will not be effective at removing oxyanion forming elements from solution. Oxyanion elements of concern include As, Mo, Sb, Se, and U. These element will likely behave more conservatively in the alkaline mill circuit than most metals. As a result, they have the potential to accumulate in the tailings pond water as tailings process water is reclaimed and recycled through the mill. Therefore, the predicted concentration of these elements requires an estimate of their concentration in mill feed water, and an estimate of the mass released from ore during processing. The

composition of mill feed water may vary with time, and will be determined by the minesite water quality model. The tailings process water source term presented in this document, includes a mass load accumulation term of these oxyanion forming elements that is cumulative to the process water chemistry.

The oxyanion forming elements As, Mo, Sb, Se and U are not expected to be attenuated by the high pH of the mill circuit. The mass of these elements mobilized during ore processing are predicted based on the 2012 pilot plant results. Pilot plant tailings were produced as a 55:45 solid:liquid ratio. The mass released per kg of tailings is calculated by assuming this solid to liquid ratio, and using the maximum concentration observed in 2012 pilot plant testing. For example, the maximum observed aqueous concentration of Mo was 0.237 mg/L. By Assuming a sample is 55% solids, an estimate of 0.196 mg/kg water soluble Mo is produced. The mass release of As, Mo, Sb, Se and U per mass of ore processed is provided in Table 6-2

Table 6-2:
Mass release of oxyanion forming metals which may accumulate in process water tailings processed in milling circuit

Parameter	Unit	Value
As	g/tonne	0.00334
Mo	g/tonne	0.196
Sb	g/tonne	0.00205
Se	g/tonne	0.00695
U	g/tonne	0.00252

6.4 Process Water Source Term

The 2012 pilot plant supernatant is considered a good proxy for the concentration of most parameters in Casino process water. The six supernatant samples collected from the 2012 pilot plant generally had similar concentrations, as previously discussed. To provide a conservative estimate of tailings process water, the average pH and alkalinity, and maximum elemental concentrations observed in 2012 pilot plant supernatant (Table 6-1) is used to estimate the process water source term.

The source term for parameters which are expected to have a constant concentration in tailings process water are presented in Table 6-3.

Table 6-3:
Process water source term for parameters expected to remain at a constant concentration. Oxyanion forming elements are not provided as they are expected to accumulate in reclaimed process water

Parameter	Unit	Predicted Concentration	MMER		
			MMM	MCS	MGS
pH	s.u.	10.2			
Alkalinity	$mgCaCO_3/L$	63			
SO_4	mg/L	1320			
F	mg/L	2.22			
Cl	mg/L	36			
Ag	mg/L	0.0001			
Al	mg/L	4.77			
As	mg/L	-	0.5	0.75	1
Ba	mg/L	0.058			
Ca	mg/L	497			
Cd	mg/L	0.000085			
Co	mg/L	0.0015			
Cr	mg/L	0.005			
Cu	mg/L	0.005	0.3	0.45	0.6
Fe	mg/L	0.060			
Hg	mg/L	0.00001			
K	mg/L	85.8			
Mg	mg/L	1.29			
Mn	mg/L	0.0015			
Mo	mg/L	-			
Na	mg/L	35.4			
Ni	mg/L	0.0050	0.5	0.75	1
Pb	mg/L	0.0025	0.2	0.3	0.4
Sb	mg/L	-			
Se	mg/L	-			
Tl	mg/L	0.0010			
U	mg/L	-			
Zn	mg/L	0.0061	0.5	0.75	1

7. Saturated Impoundment

CASINO
COPPER AND GOLD

7. Saturated Impoundment

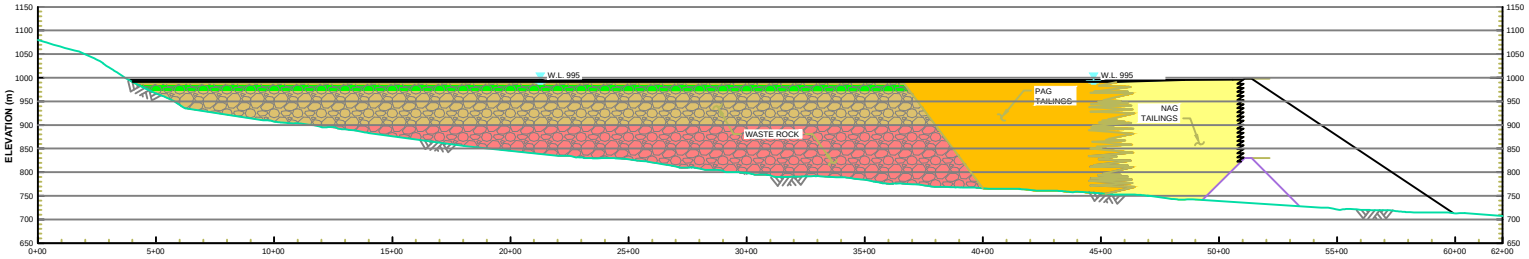
The Mine Waste Management Plan has assigned the majority of tailings and waste rock to be sub-aqueously disposed of in the Casino TMF. This will inhibit sulphide oxidation preventing further release of metals and acidity associated with the sulphide mine waste. Although long-term drainage chemistry from saturated mine waste is expected to be better than unsaturated rock piles, drainage from the saturated TMF will not be entirely benign due to the abundance of water soluble weathering products associated with mineralized zones that have been exposed to *in-situ* weathering processes. Extensive testwork using saturated columns has been undertaken to quantify the behavior and metal leaching potential of Casino waste rock and tailings under sub-aqueous conditions. Drainage quality is dependent not only on intrinsic metal leaching potential, but also on design and placement of waste within the facility. In this Chapter, geochemical source terms for the Casino TMF are discussed.

7.1 Background

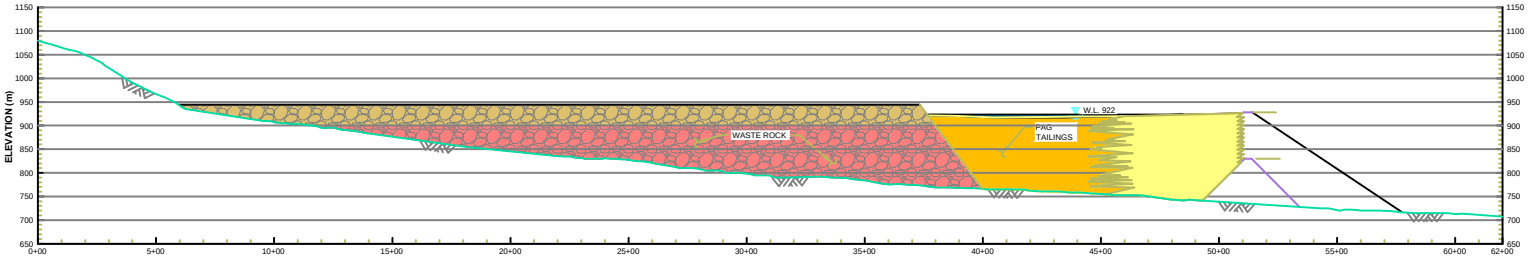
7.1.1 TMF Design

The drainage quality from the saturated TMF will be in large part determined by the facilities design and waste placement. For a description of facility design and waste placement see Knight Piesold, 2013a. A cross section of TMF design at the end of mine life is presented in Figure 7-1.

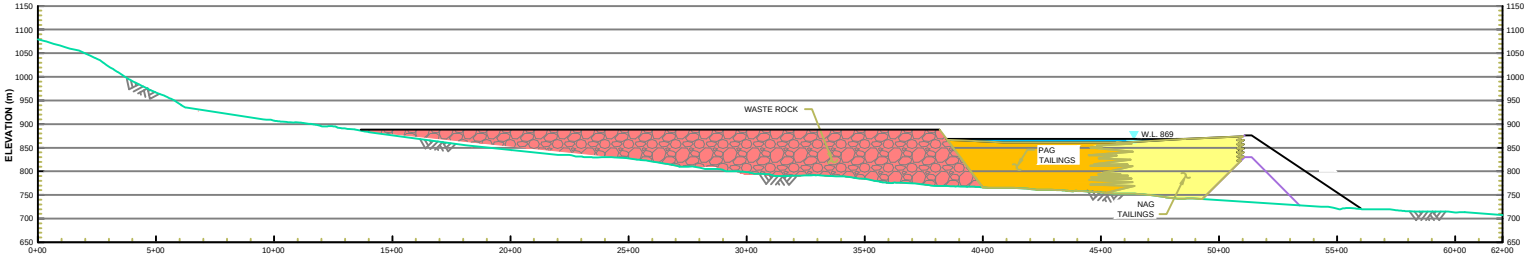
In general, the waste placement strategy is to locate the most reactive material in areas of the TMF where the lowest flow rates are expected, and the relatively non-reactive tailings where the highest seepage rates are expected. Waste rock is relatively reactive compared to the tailings in the TMF owing to the presence of weathered CAP and SUP. Therefore, waste rock is placed in the upstream section of the TMF, where hydrologic head gradients are generally expected to be lower than in the downstream portion of the facility. The tailings will be placed in the downstream section of the TMF, and further divided between NAG and PAG tailings, with the de-pyritized NAG tailings placed immediately upstream of the TMF and the PAG tailings placed between the waste rock zones and NAG tailings zones. In the final years of mine life, a layer of de-pyritized tailings will be placed over the waste rock.



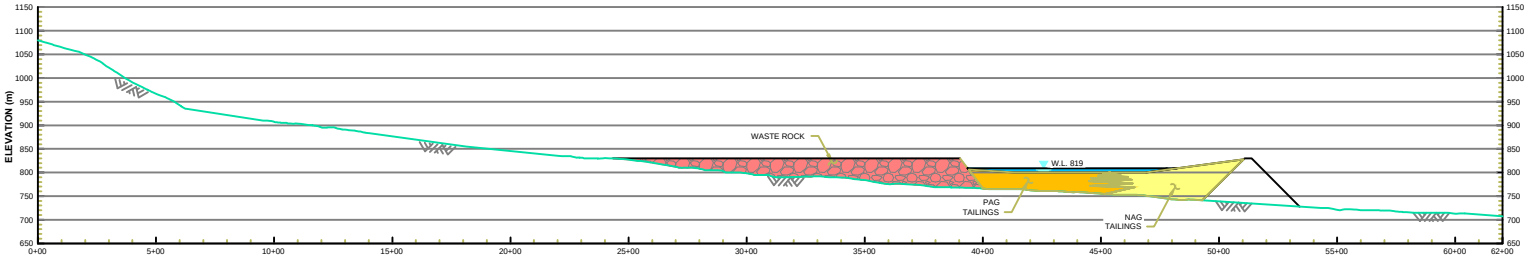
YEAR 22



YEAR 10



YEAR 4



YEAR 1

NOTES

Original Drawing obtained from Knight Piesold Figure 6
Drawing VA13-00949 Revised Waste Deposition Strategy
Typical Sections (Years 1, 4, 10)

DATE SAVED:	Nov 08, 2013
DRAWN BY:	GM
REVIEWED:	JD
VERSION:	1

CLIENT: CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT:

Casino Geochemical Source Term Report

TITLE:

Schematic of final Casino impoundment design. Waste storage areas are divided between the NAG tailings zone, PAG tailings zone, waste rock zone. The waste rock zone is subdivided between waste rock produced during year 3-5 (red), 6-14 (brown) and year 15-19 (green).

PROJECT #:	FIGURE:
J862-5	7-1

P:\J862 (Casino)\Lorax Drafting\Drawings\Schematic of final Casino impoundment design.dwg

The timing of waste rock production will result in vertical stratification of rock types in the waste rock storage area. For the first five years waste production will be dominated by CAP rock. Between years 5 to 15 a mix of the three mineralization types will be produced. After year 15, HYP will be the dominant rock type being placed in the facility. The elevation of these three different areas of the downstream waste rock zone is illustrated in Figure 7-1. The mass of SUP, HYP and CAP waste rock produced during the mine life is presented in Figure 3-2 and the amount of waste in the modeled time increments is discussed further below in Section 7.2.1.

There will be on average a 3 year delay between waste rock placement and waste rock saturation in the TMF. A portion of the HYP and SUP waste rock placed in the waste rock storage zone will be NP deplete, and may become acidic in this time period. Any HYP or SUP material which is deplete in NP will be blended with high NP HYP material in the mixed waste rock zone. Blending of these two rock types will prevent acid generation during the relatively brief time period that the waste rock is exposed before subaqueous disposal. During the first 5 years of mine life relatively little HYP material will be produced. During this time period NP deplete SUP will be excluded from the TMF, and placed in the marginal ore stockpile.

7.1.2 TMF Flow Rates

The three zones in the Casino TMF (NAG tailings, PAG tailings and waste rock) have distinct chemistries. Flux rates between the different zones have been delineated by three dimensional groundwater modelling presented in Knight Piesold, (2013d). Flux rates are listed in Table 7-2 and a schematic presents the spatial relationship of the flux ID numbers in Figure 7-2.

Flows between the three zones of the TMF (11 and 12) are further subdivided. Internal flows between the zones of the facility are assumed to mix completely. For instance, it is assumed that flow 11 (PAG tailings to NAG tailings) completely mixes within the NAG tailings zone, and is divided proportional to flux rate into flow 19, 7 and 10.

Table 7-1:
Description and flux rates of seepage paths in saturated TMF
(modified from Knight Piesold 2012d)

Flux Pathway	Simulated Flux Rates (l/s)				
	Year 4	Year 10	Year 19	Year 22	Post-Closure
(3) Seepage from Waste Rock to the Foundation	1.2	1.5	3.2	3.4	3.9
(5) Seepage from PAG Tailings to the Foundation	0.7	1.8	3.0	3.0	3.3
(7) Seepage from Non-PAG Tailings to the Foundation	3.0	9.9	15.6	16.5	14.8
(9) Seepage through Foundation under Embankment	4.8	13.2	21.7	22.9	22.0
(10) Seepage through Embankment	4.7	7.3	13.3	15.4	14.0
(11) Flux from PAG Tailings to NAG Tailings	1.0	0.8	3.1	3.0	5.1
(12) Flux from Waste Rock to PAG Tailings	0.2	0.3	0.7	0.9	1.1
(15) Flux from Waste Rock to TMF Pond	22.3	26.7	26.8	22.9	22.5
(17) Flux from PAG Tailings to TMF Pond	0.4	0.5	0.2	0.2	0.2
(19) Flux from NAG Tailings to TMF Pond	5.1	6.2	5.5	4.3	2.8

Note: Flux number corresponds to seepage flow paths outlined in Figure 7-2**Error! Reference source not found.**.

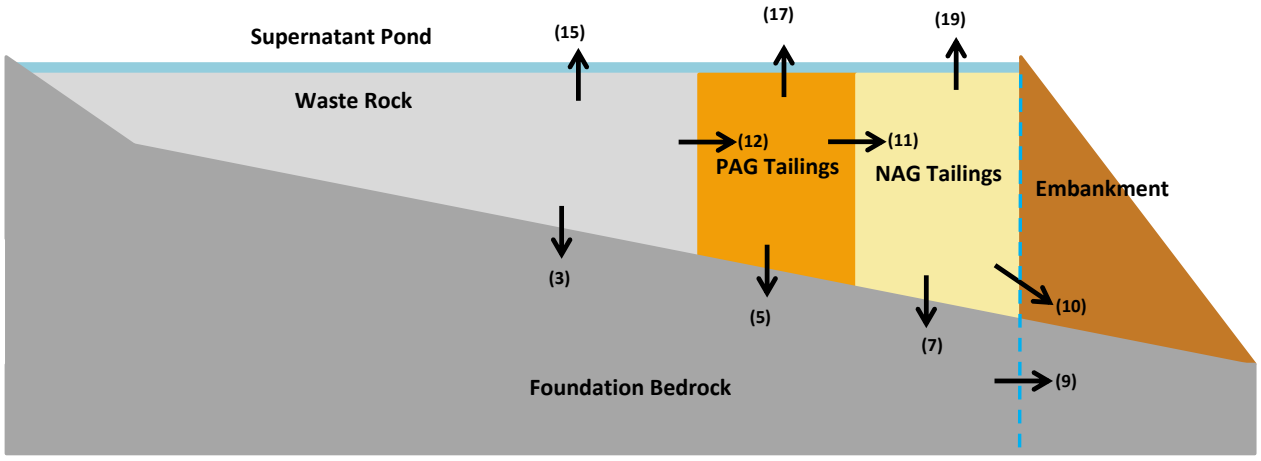


Figure 7-2: Schematic of TMF design and seepage flow paths (Modified from Knight Piesold, 2013d)

7.1.3 Geochemical Testwork

The primary source of metal leaching from sub-aqueously disposed waste rock and tailings is the rinsing of historical oxidation products. To develop an estimate of this geochemical source term several saturated column tests were initiated on material from each mineralized zone. The results for saturated columns are presented in the kinetic test

report (Lorax, 2013b). Conclusions which are most pertinent to the current work are as follows:

- HYP material produces the highest pH drainage and the lowest concentrations of most metals under saturated conditions relative to the other mineralization types. The only parameters which are elevated in HYP material relative to other mineralization zones are U and SO_4.
- A marked improvement in leachate chemistry was observed in CAP and SUP waste rock when it was layered with HYP material in a saturated column. A black precipitate formed on the interface of CAP or SUP and HYP material indicating that secondary mineral preciptiation contributed to the reduction in concentrations.
- There is evidence for reducing conditions in neutral SUP and tailings columns. The precipitation of secondary sulphide minerals is a potential mechanism for metal attenuation in highly reducing conditions.
- Saturated columns containing acidic supergene produced the highest concentrations of any saturated kinetic test.
- In general, increased residence time and column length does not affect peak concentrations produced from columns.
- Saturated column leachate concentrations rapidly decline after the first pore volume is flushed through the column. Concentrations stabilize after 15 to 73 pore volumes are flushed. Stabilized concentrations are generally orders of magnitude lower than peak concentrations observed during the first flush for most metals.
- Concentrations of Mn and Fe are observed to increase after the initial flush, reflecting reductive dissolution reactions associated with the onset of sub-oxia. Reducing conditions do not appear to drive release of other elements (*i.e*. As and Cu).
- The pH of acidic saturated columns remained consistent over more than 3 years of testing for both SUP and CAP samples. Conversely, acidity decreased rapidly in the first 100 days, similar to other dissolved constituents.

An overview of saturated column testwork conducted to date is provided in Table 7-2.

Table 7-2:
Overview of saturated column tests conducted to date

Kinetic Test Type	Sample ID	Sample Selection Rational	Sample Description		Test Details		
			Mineralization Zone	Lithology	Mass (kg)	Start Date	End Date
Saturated Waste Rock Columns	Sat Col 2	Moderate S CAP (duplicate of Col 2A)	95% CAP, 5% SUP	85% WR, 5% IX, 5% MX, 5% PP	5	24-Feb-10	11-Jan-13
	Sat Col 3	Moderate S HYP	HYP	70% WR, 20% PP,10% MX	5	24-Feb-10	11-Jan-13
	Sat Col 4	High S HYP	HYP	70% WR, 20% PP, 10% MX	5	24-Feb-10	11-Jan-13
	Sat Col 5	High S SUP	90% SUP, 5%CAP, 5%HYP	95% WR, 5% MX	5	24-Feb-10	11-Jan-13
	Sat Col 6	Acidic SUP	50%SUP, 50%CAP	WR	5	24-Feb-10	11-Jan-13
	Sat Col 7	Moderate S HYP (Duplicate of Sat Col3)	HYP	70% WR, 20% PP,10% MX	10	24-Feb-10	11-Jan-13
	Sat Col 9	Layered CAP and HYP (only upper port sampled)	89% HYP, 11% SUP	89% WR, 11% PP	5	1-Apr-10	25-May-12
			CAP	78% WR, 11% PP, 11% MX	5		
	Sat Col 12	Layered acidic SUP and HYP (upper and lower ports sampled)	25% HYP	60% WR, 20% MX, 20% IX	3	12-Jul-12	on-going
			75% acidic SUP	88% WR, 12% IX	9.1		on-going
	Sat Col 13	Layered neutral SUP and HYP (upper and lower ports sampled)	25% HYP	60% WR, 20% MX, 20% IX	3.3	12-Jul-12	on-going
			75% neutral SUP	57% PP, 43% WR	9.8		on-going
	Sat Col 14	Layered acidic SUP and HYP (upper and lower ports sampled)	50% HYP	60% WR, 20% MX, 20% IX	5.6	12-Jul-12	on-going
			50% acidic SUP	88% WR, 12% IX	5.6		
	Sat Col 15	Scaling of neutral SUP	neutral SUP	57% PP, 43% WR	7.9	17-Jul-12	on-going
Saturated Columns	Sat Col 1	2009-Rougher whole tailings	50% HYP, 50% SUP	66% PP, 34% IX	4.5	24-Feb-10	11-Jan-13
	Sat Col 8	2009-Rougher whole tailings	83% HYP, 17% SUP	55% PP, 45% IX	4.5	24-Feb-10	11-Jan-13
	Sat Col 10	2010-Pyrite rougher whole tailings	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	5	20-Jul-11	on-going
	Sat Col 11	2010-Pyrite concentrate with 21% slimes	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	5	28-Jul-11	on-going
	Sat Col 16	2012-Pyrite rougher whole tailings	100% HYP	87% IXWR, 13% IXPP	5.4	1-Mar-13	on-going
	Sat Col 17	2012-Pyrite concentrate	100% HYP	87% IXWR, 13% IXPP	6.6	1-Mar-13	on-going

7.1.4 Saturated Column Results

The composition of the saturated column leachate is controlled by flushing of water soluble oxidation products and reductive dissolution of reducible phases (*i.e.*, Fe and Mn-oxides). Peak concentrations are generally observed during the first pore volume that is flushed through the columns, although concentrations of some parameters have been observed to increase or remain constant with time. In the saturated TMF, flushing of one pore volume will take in excess of 100 years. During this time period waste rock and tailings will impart a concentration on drainage water which is best represented by the peak concentrations observed in the saturated columns. The 95th percentile concentrations observed in saturated column data is presented in Table 7-3 for waste rock and Table 7-4 for tailings. For complete saturated column results see Lorax 2013b. Supplemental results for tailings saturated columns which were not available at the time the above reference was prepared are provided in Appendix D

Table 7-3:
Measured 95th percentile concentrations of waste rock saturated column concentrations used in development of saturated TMF source term

		Cap	HYP		Neutral Sup			Acidic Sup			Neutralized Neutral SUP	Neutralized Acidic SUP		Neutralized CAP	MMER		
		SatCol 2	SatCol 3	SatCol 4	SatCol 5	SatCol 15	SatCol 13 Lower Port	SatCol 12 Lower Port	SatCol 14 Lower Port	SatCol 6	SatCol 13 Upper Port	SatCol 12 Upper Port	SatCol 14 Upper Port	SatCol 9	MMM	MCS	MGS
pH	s.u.	4.52	7.15	7.15	6.52	6.78	6.61	3.34	3.35	2.99	6.69	6.13	6.28	7.04	-	-	-
Alkalinity	mg/l	20	133	138	200	457	539	0	0	0	559	685	705	246	-	-	-
SO_4	mg/l	55.6	1460	1370	732	1090	1540	5080	6440	1540	1450	2740	2430	561	-	-	-
Cl	mg/l	6.81	7.9	6.8	5.37	56.8	63.9	29.1	40.4	6.77	63.4	44	44.2	5	-	-	-
F	mg/l	0.2	0.588	0.59	0.361	2.16	1.68	32.2	43.1	3.38	1.68	3.19	2.12	0.651	-	-	-
Al	mg/l	0.266	0.0135	0.0221	0.0197	0.0083	0.0249	402	566	203	0.00574	0.604	0.119	0.012	-	-	-
Sb	mg/l	0.00468	0.0011	0.001	0.00651	0.000605	0.00133	0.00657	0.00776	0.00485	0.00342	0.0053	0.00532	0.00222	-	-	-
As	mg/l	0.00109	0.00213	0.00105	0.00964	0.00485	0.00545	0.0167	0.0184	0.005	0.0131	0.0078	0.0118	0.00646	0.5	0.75	1
Ba	mg/l	0.232	0.0693	0.0534	0.063	0.0317	0.0247	0.0112	0.011	0.0766	0.0291	0.0259	0.0254	0.106	-	-	-
Cd	mg/l	0.000122	0.000246	0.000499	0.00372	<0.00255	0.0031	0.0202	0.0287	0.00385	0.000186	0.00349	0.00155	0.000133	-	-	-
Ca	mg/l	1.84	564	543	292	311	419	419	480	44.6	474	846	808	254	-	-	-
Cr	mg/l	0.00238	0.005	<0.005	0.0025	0.000232	<0.00298	0.0496	0.0713	0.0326	<0.000365	<0.0005	0.000726	0.00123	-	-	-
Co	mg/l	0.00243	0.001	0.00297	0.0274	0.018	0.0289	1.78	2.51	0.677	0.0148	0.339	0.176	0.00497	-	-	-
Cu	mg/l	0.0896	0.0011	0.001	0.155	0.0931	0.0902	405	537	45.6	0.0043	16.6	2.68	0.00576	0.3	0.45	0.6
Fe	mg/l	0.0785	0.126	0.142	0.257	1.69	2.51	74.8	93.9	62.5	2.43	6.9	3.75	0.213	-	-	-
Pb	mg/l	0.000731	0.0005	0.0005	0.000392	0.000132	0.0017	0.00082	0.00104	0.00242	0.00256	0.00101	0.000907	0.000359	0.2	0.3	0.4
Mg	mg/l	0.487	26.2	27.9	33.5	52.5	87.2	206	327	26.3	85	195	181	17.7	-	-	-
Mn	mg/l	0.0502	0.403	1.06	4.5	4.3	5.98	8.72	13.7	1.62	2.57	3.54	2.86	1.79	-	-	-
Hg	mg/l	<0.00005	<0.00005	<0.00005	<0.00002	<0.00001	<0.00001	0.0000244	0.0000244	<0.00005	<0.00001	0.000122	0.0000754	0.00006	-	-	-
Mo	mg/l	0.00328	0.00974	0.00574	0.0134	0.625	0.323	0.00707	0.00634	0.0025	0.34	0.0373	0.0341	0.0657	-	-	-
Ni	mg/l	0.00112	0.005	0.005	0.00997	0.00691	0.0205	0.48	0.678	0.0904	0.0215	0.0963	0.0689	0.00191	0.5	0.75	1
Se	mg/l	0.00467	0.00975	0.00978	0.0295	0.0149	0.0124	0.0565	0.0836	0.0485	0.0104	0.057	0.03	<0.005	-	-	-
Si	mg/l	20.2	3.34	2.68	2.44	15.7	14.5	26.4	30.9	17.7	14	11.2	12.6	6.87	-	-	-
Ag	mg/l	0.0000759	0.0001	0.0001	<0.00005	0.00000775	0.000149	0.000388	0.000388	0.000485	0.0000265	0.000033	0.0000435	0.0000245	-	-	-
Na	mg/l	26.3	10.9	21.2	9.96	217	231	104	157	4	201	124	110	34.4	-	-	-
Sr	mg/l	0.0232	3.87	3.93	0.311	1.06	1.96	0.629	0.841	<0.0304	3.03	5.36	5.19	0.742	-	-	-
Tl	mg/l	0.0002	<0.001	<0.001	0.0005	0.000144	0.000151	0.000916	0.00117	0.00485	0.0000299	0.000254	0.000159	0.000245	-	-	-
U	mg/l	0.000391	0.186	0.0944	0.00824	0.074	0.269	0.955	1.38	0.426	0.377	0.885	1.02	0.0801	-	-	-
Zn	mg/l	0.0389	0.0108	0.0148	0.0255	0.0192	0.0276	2.9	3.78	0.519	0.032	0.509	0.279	0.0111	0.5	0.75	1

Notes: Values which exceed CCME aquatic life guidelines shaded in blue, values exceeding MMM guidelines shaded in light grey, values exceeding MCS guidelines shaded

Table 7-4:
Measured 95th percentile concentrations of tailings saturated column concentrations used in development of saturated TMF source term

		2008-Rougher whole tailings	2009-Rougher whole tailings	2009-Rougher whole tailings	2010-Pyrite concentrate with 21% slimes	2012-Pyrite rougher whole tailings	2012-Pyrite concentrate	MMER		
		SatCol 1	SatCol 8	SatCol10	SatCol11	Sat Col 16	Sat Col 17	MMM	MCS	MGS
pH	s.u.	9.13	7.15	7.27	7.12	8.01	7.2	-	-	-
Alkalinity	mg/l	103	69.2	57.6	67	55	49.8	-	-	-
SO_4	mg/l	319	123	116	313	633	1460	-	-	-
Cl	mg/l	10	11.6	17.6	64.6	20.8	37.6	-	-	-
F	mg/l	0.289	2.68	0.028	0.19	0.664	0.923	-	-	-
Al	mg/l	15.4	0.0293	0.254	0.0784	0.00387	0.00574	-	-	-
Sb	mg/l	0.00281	0.00437	0.00158	0.00411	0.00093	0.00189	-	-	-
As	mg/l	0.0028	0.0201	0.00336	0.00392	0.00521	0.00211	0.5	0.75	1
Ba	mg/l	0.0638	0.503	0.191	0.137	0.0264	0.0212	-	-	-
Cd	mg/l	<0.0000842	<0.000117	0.0032	0.00217	0.00000653	0.0000564	-	-	-
Ca	mg/l	133	80.3	49.6	140	234	529	-	-	-
Cr	mg/l	<0.001	<0.001	0.0001	0.0001	<0.0001	<0.0002	-	-	-
Co	mg/l	<0.00047	0.0005	0.00127	0.00252	0.00000776	0.0000264	-	-	-
Cu	mg/l	0.00311	0.00126	0.0339	0.000628	0.0001	0.000345	0.3	0.45	0.6
Fe	mg/l	0.0726	0.146	0.00901	0.0508	0.0239	0.246	-	-	-
Pb	mg/l	0.000192	<0.000248	0.000191	0.000241	<0.000005	<0.00001	0.2	0.3	0.4
Mg	mg/l	0.3	5.24	1.31	8.79	3.5	9.17	-	-	-
Mn	mg/l	0.000999	0.0381	0.0208	0.0634	0.0295	0.0803	-	-	-
Hg	mg/l	<0.0000992	<0.0000595	<0.00002	<0.00002	<0.00001	<0.00001	-	-	-
Mo	mg/l	0.0138	0.0257	0.538	0.434	0.0348	0.17	-	-	-
Ni	mg/l	0.00226	0.00243	0.000488	0.0032	0.000177	0.00105	0.5	0.75	1
Se	mg/l	0.00308	0.00286	0.000888	0.000476	0.000434	0.00167	-	-	-
Si	mg/l	0.727	3.03	0.996	2.69	3.33	2.47	-	-	-
Ag	mg/l	<0.00003	0.00002	0.00000526	0.0000111	0.000005	0.0000347	-	-	-
Na	mg/l	9.56	13.8	9.96	17.4	30.4	49.4	-	-	-
Sr	mg/l	0.368	0.349	0.206	0.517	1.09	2.17	-	-	-
Tl	mg/l	<0.0002	<0.0002	0.0000488	0.00000985	0.000002	0.000096	-	-	-
U	mg/l	0.000141	0.00275	0.00478	0.00421	0.000132	0.0000617	-	-	-
Zn	mg/l	0.0106	0.00839	0.0195	0.0495	0.00133	0.00143	0.5	0.75	1

7.1.4.1 Copper Attenuation

The potential for high copper release from acidic supergene waste to be attenuated within the saturated TMF was demonstrated by layered subaqueous columns containing acidic SUP or Cap overlying neutral Hyp waste rock (Lorax, 2013b). Acidic SUP waste rock in saturated columns SatCol 12 and SatCol 14 displayed pore water concentrations measured in the rhizome ports (12-lower port and 14-lower port) with several hundred mg/L Cu. After interaction with neutral HYP, the Cu concentrations are reduced to approximately 3.5 to 0.9 mg/L (Table 7-3). It is clear that Cu concentrations can be attenuated to lower levels than this based on results from saturated columns SatCol 13 and SatCol 9 that demonstrated additional reduction of copper from neutral solutions.

In order to provide an indication of potential solubility controls attenuating Cu concentrations, saturation indices have been calculated for the four layered columns (Sat Col 9, 12, 13 and 14) using a PHREEQC speciation model with the Minteq.V4 database. Select results are provided in Figure 7-3, for model input see Appendix A. An SI of 0 indicates that a mineral is in equilibrium with the solution; a mineral may be dissolving or precipitating to achieve equilibrium. A positive SI denotes that a mineral is oversaturated and is therefore likely to precipitate from solution. A negative SI denotes that a mineral is under saturated; if the solid phase is present it will dissolve until equilibrium is reached. However, it should be noted that saturation indices are based on the thermodynamics of mineral formation/dissolution and do not account for kinetic limitations that affect mineral formation.

Potential Cu solubility controls considered in this analysis include tenorite (CuO), malachite [$Cu_2(CO_3)(OH)_2$] and azurite [$Cu_3(CO_3)_2(OH)_2$]. There is some indication of secondary sulphide precipitation in the saturated columns, however dissolved sulphide-sulphur is generally below detection limits in the waste rock columns making calculation of SI values for secondary sulphides in the columns highly speculative.

In Sat Col 12 and 14, the initial Cu concentrations are near tenorite equilibrium. Malachite and azurite are initially supersaturated in these two columns. All three mineral phases decline to below saturation between the 2nd and 9th sampling event. These results indicate that at early time points all three mineral phases could have been precipitating in Sat Col 12 and 15. The fact that malachite and azurite are considerably more supersaturated than tenorite indicates that tenorite may be more effective at controlling Cu concentration than the other two phases. In Sat Col 9 and 13 all three Cu phases have remained under saturated for the duration of column testwork.

Based on a comparison of lower and upper sampling ports in Sat Col 12, 13 and 14, it is clear that Cu attenuation is taking place at time points when all three Cu minerals are

under saturated. For instance, peak Cu concentrations in Sat Col 13 are reduced from 0.131 mg/L in the lower port to 0.002 mg/L in the upper port which reflects HYP interaction. This indicates that Cu attenuation is not limited to the precipitation of the three minerals considered in Figure 7-3. Potential mechanisms for additional Cu attenuation include secondary sulphide precipitation, co-precipitating with another mineral phase (*e.g.*, Fe-oxhydroxides) or surface sorption.

Moving forward, tenorite will be employed as a mineral solubility control for Cu. This is considered the most appropriate solubility control for Cu because malachite and azurite were considerably oversaturated at early time points for Sat Col 12 and 14. That is, if thermodynamic solubility modelling was employed on these samples, malachite and azurite would have predicted a lower Cu concentration than were actually observed while tenorite would have produced Cu concentrations similar to the observed values.

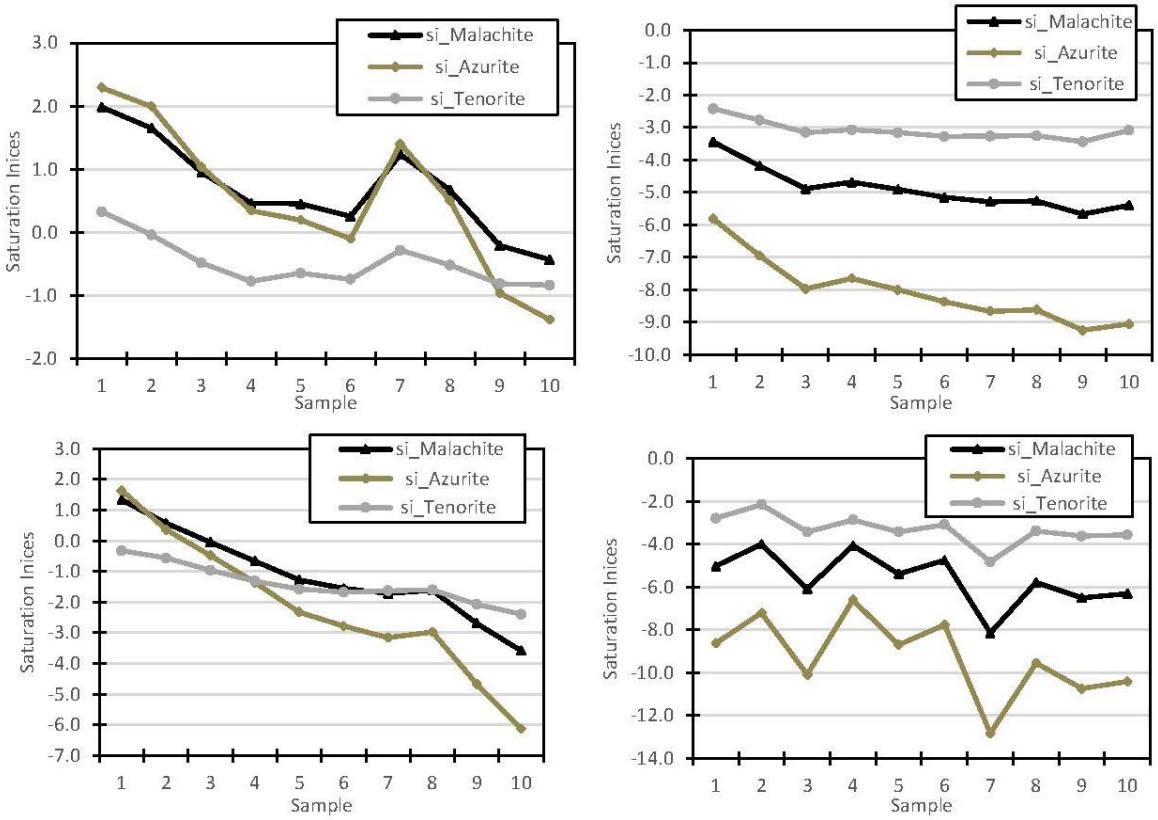


Figure 7-3: Saturation indices (SI) of leachate for select Cu precipitates for first ten sampling events from Sat Col 12 (upper left), Sat Col 13 (upper right), Sat Col 14 (lower left) and Sat Col 9 (lower right)

7.2 Source Term Approach

Geochemical source terms are developed for several flows exiting the saturated TMF including flow through the foundation of the facility (Flow 9), seepage through the embankment (Flow 10), seepage into the tailings pond from waste rock, PAG tailings and NAG tailings (Flows 15, 17 and 19, respectively). The model predicts that each of these flows will be influenced by porewaters originating from various zones within the TMF. Thus, several steps are required to develop saturated source terms from the TMF as listed below.

- Pore water chemistries for each waste zone in the TMF are calculated based on saturated column loading rates and proportioned relative to waste composition.
- The amount of seepage flux from or between each of the waste zones is determined in the Modflow model provided in Knight Piesold, 2013d.
- When a flow path encounters multiple waste zones, the waste zone with the highest pore water concentration is assigned. Seepage pathways are mixed in PHREEQC and some solubility controls are applied.

Due to varying composition of the three waste zones and changing flux rates geochemical source terms are developed for five time steps during the project life (year 4, year 10, year 19, year 22 and post closure). Flow charts outlining data inputs, mixing ratios, and modelling steps for the foundation flow geochemical source terms at each time period are presented in Figure 7-4, Figure 7-5, Figure 7-6, Figure 7-7 and Figure 7-8. The derivation of pond and embankment flow source terms are presented in Figure 7-9, Figure 7-10, Figure 7-11, Figure 7-12 and figure 7-13.

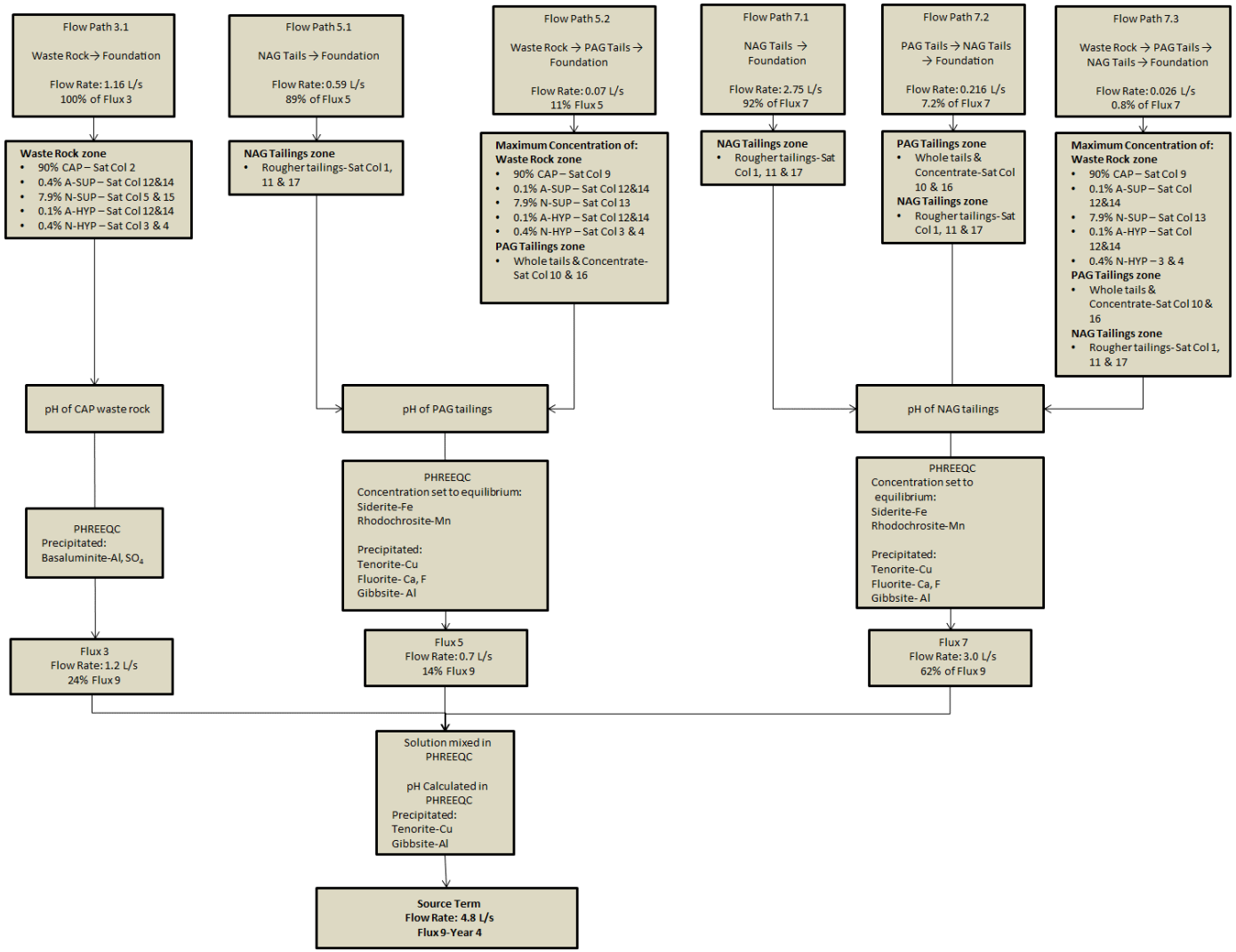


Figure 7-4: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of foundation seepage source terms for the year 4 scenario

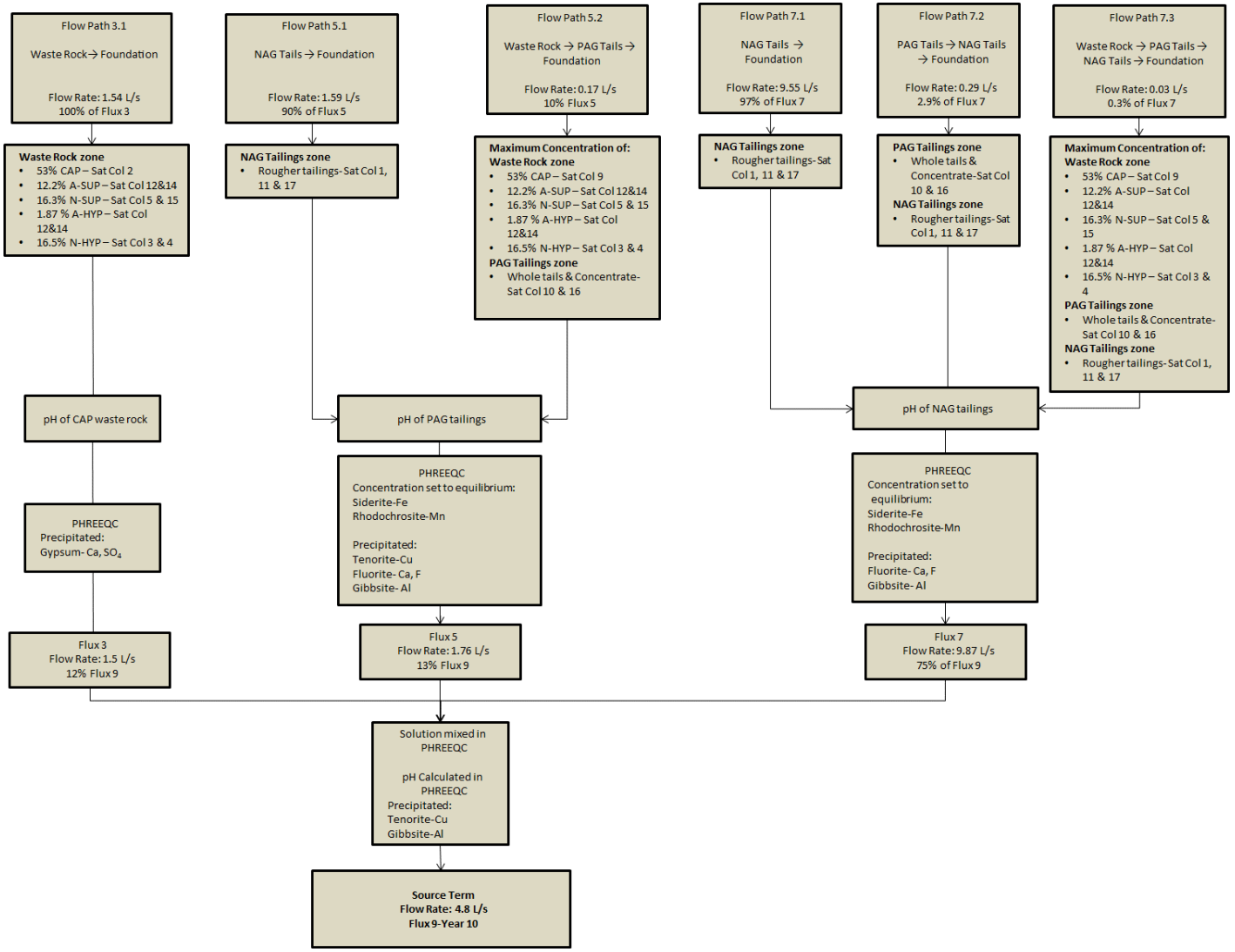


Figure 7-5: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of foundation seepage source terms for the year 10 scenario

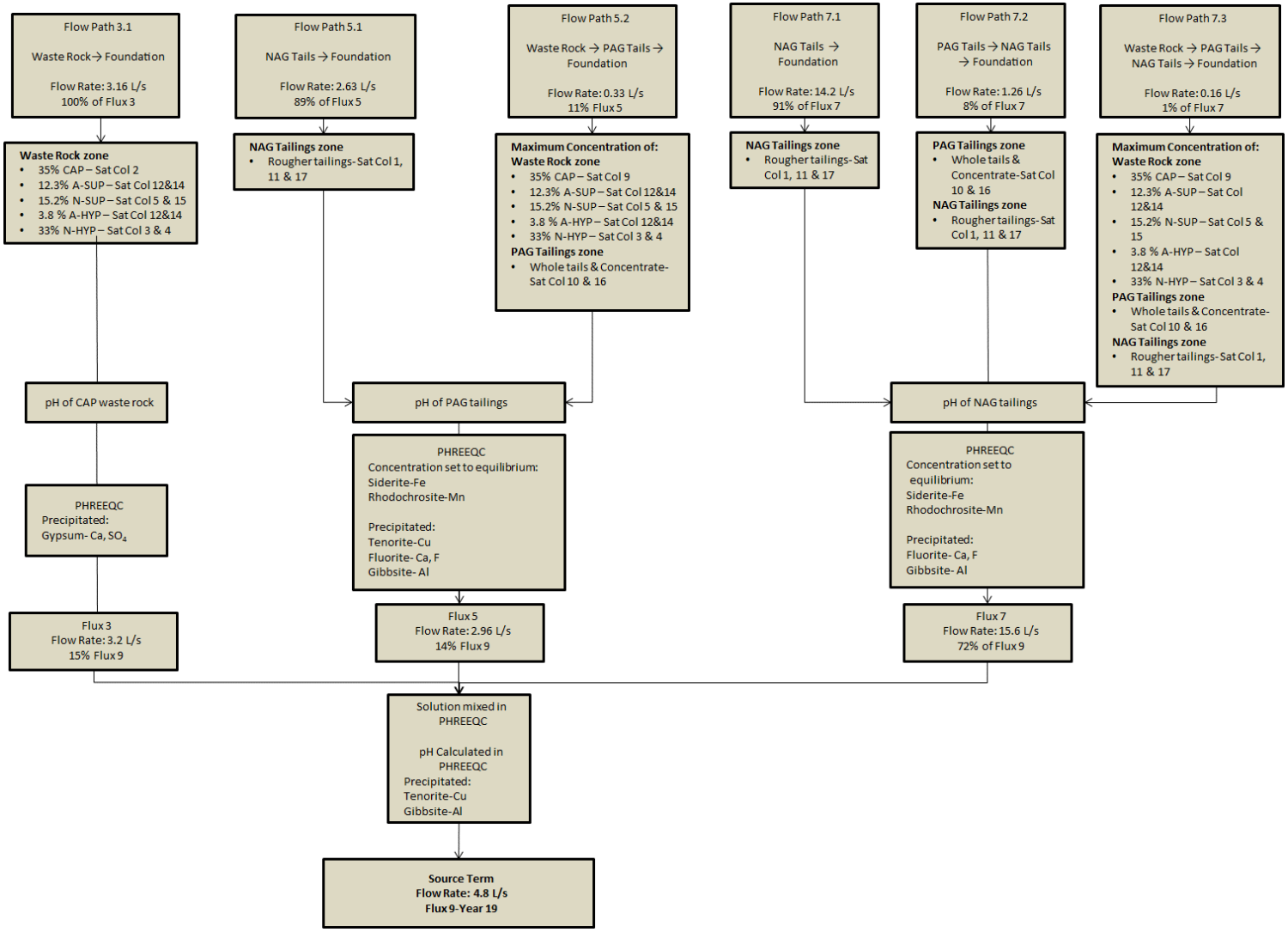


Figure 7-6: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of foundation seepage source terms for the year 19 scenario

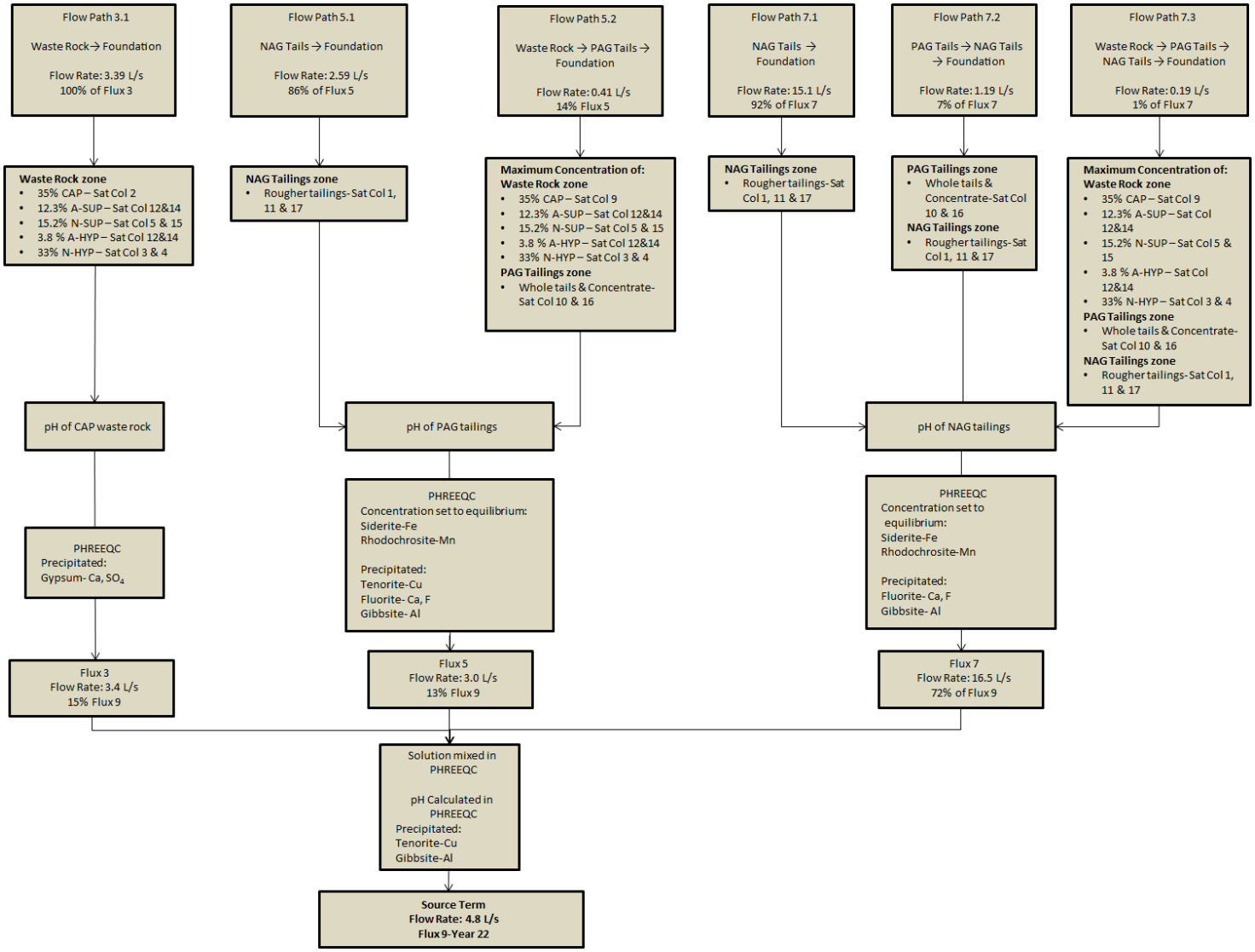


Figure 7-7: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of foundation seepage source terms for the year 22 scenario

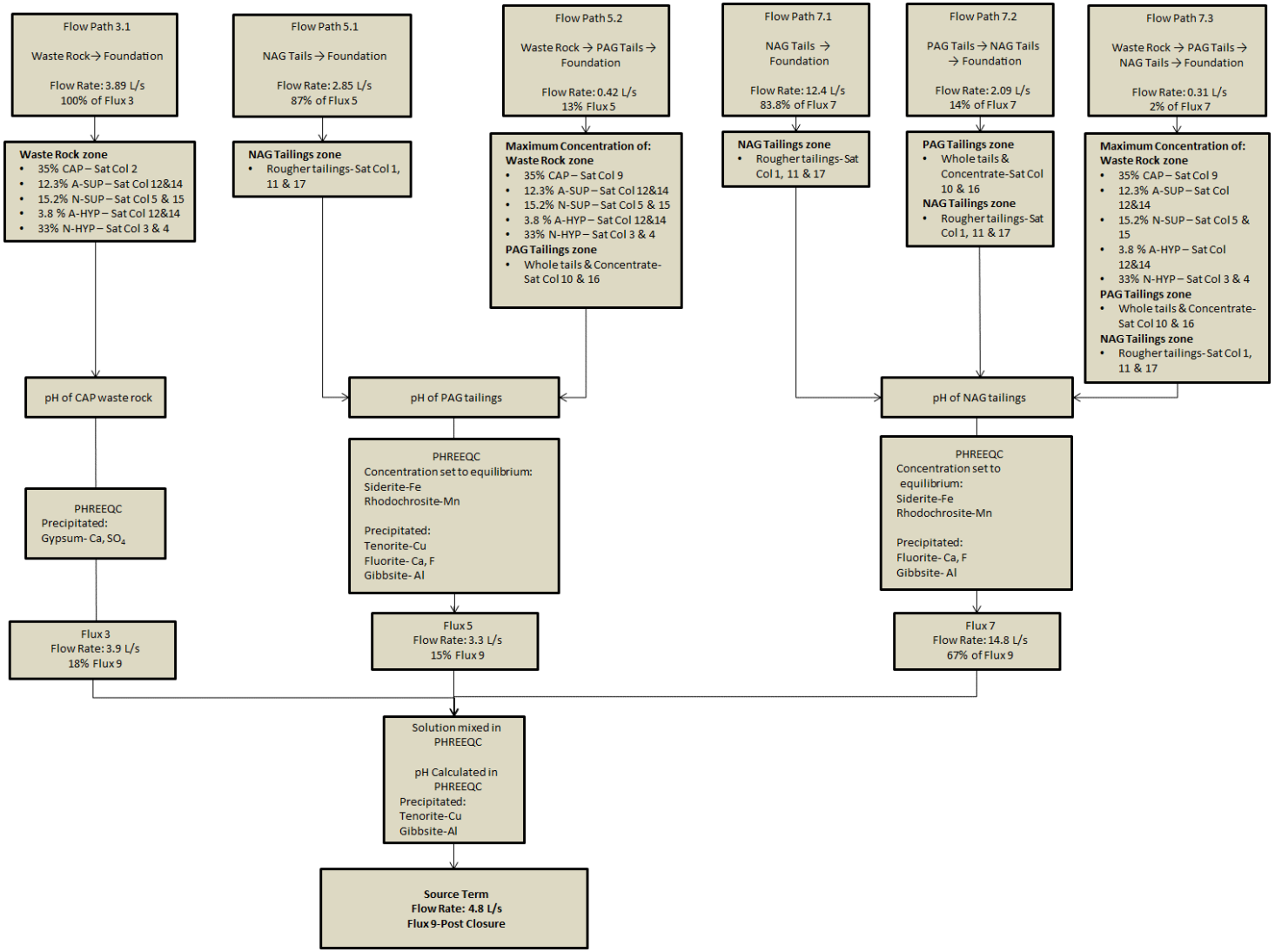


Figure 7-8: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of foundation seepage source terms for the year 22 scenario

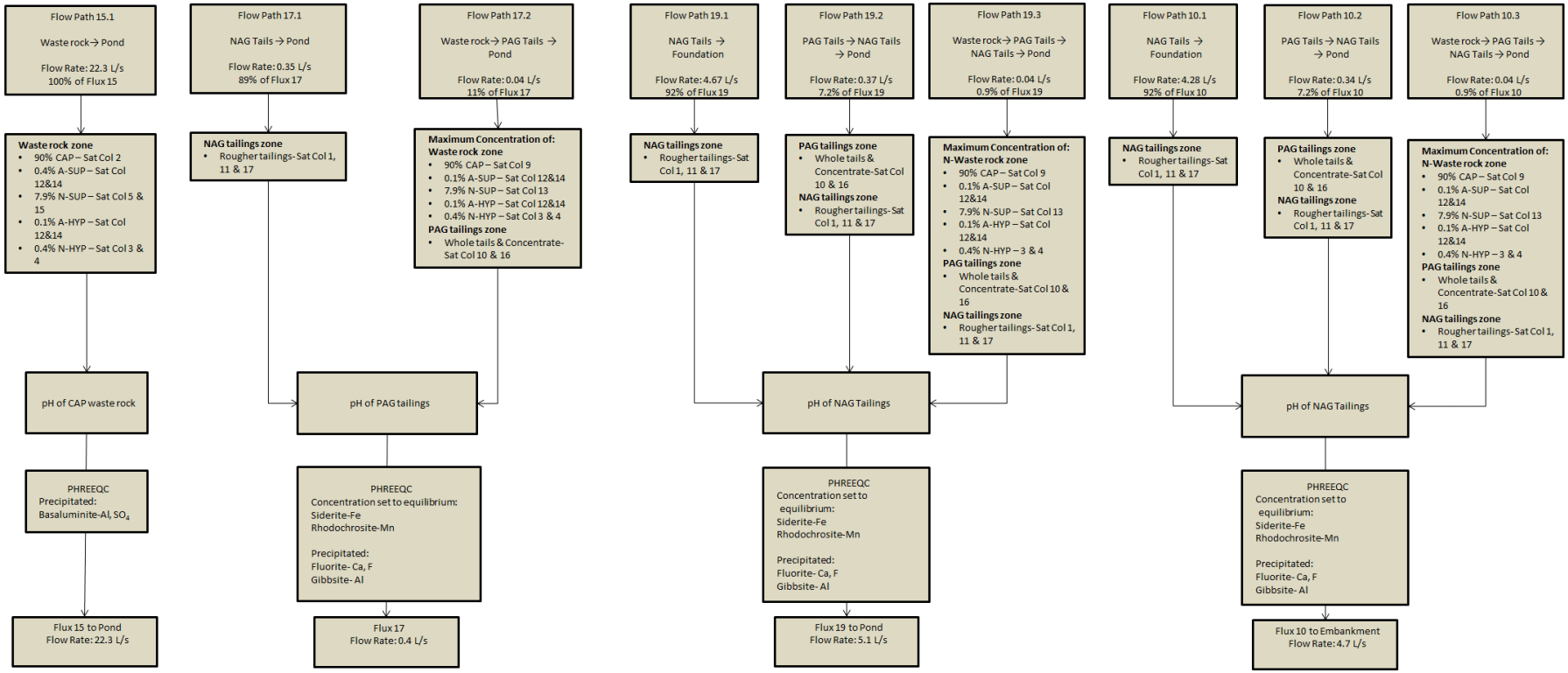


Figure 7-9: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of pond seepage source terms for the year 4 scenario

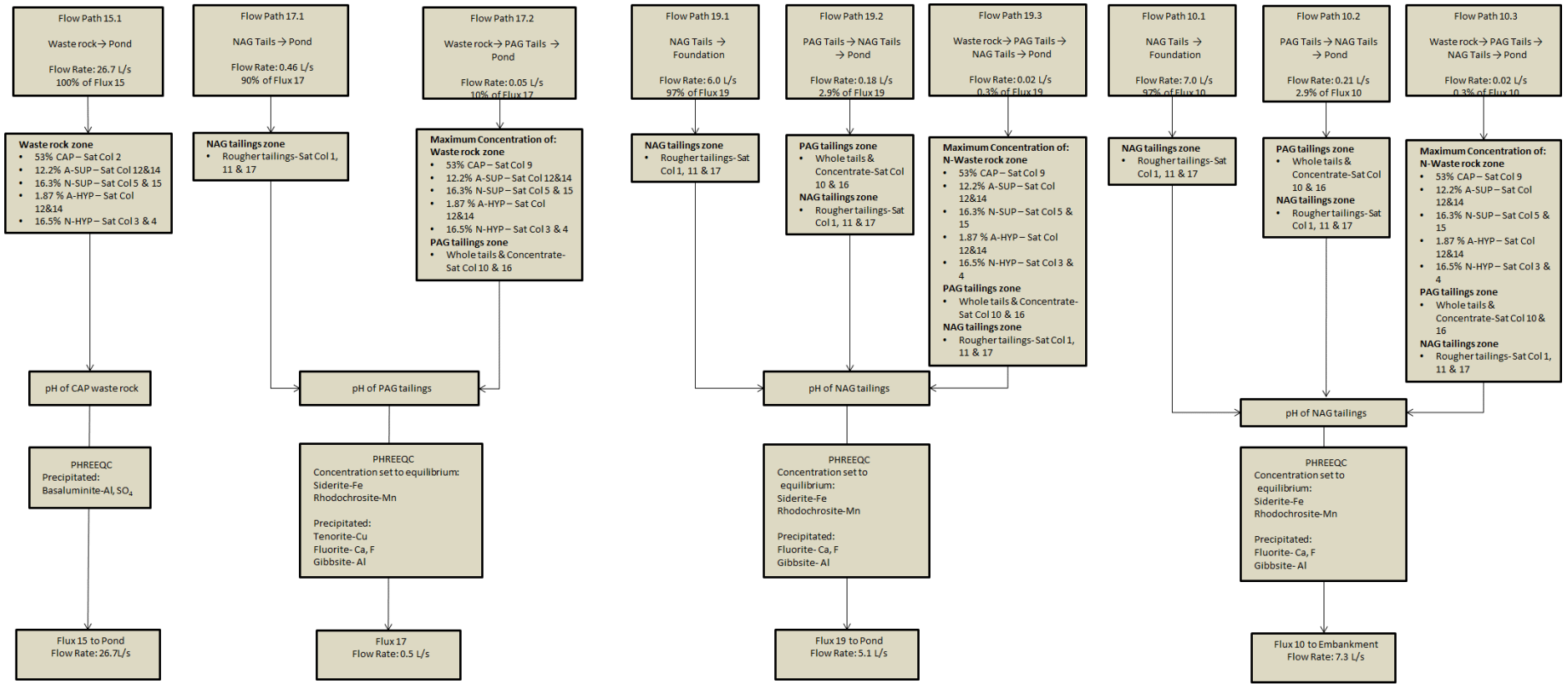


Figure 7-10: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of pond seepage source terms for the year 10 scenario

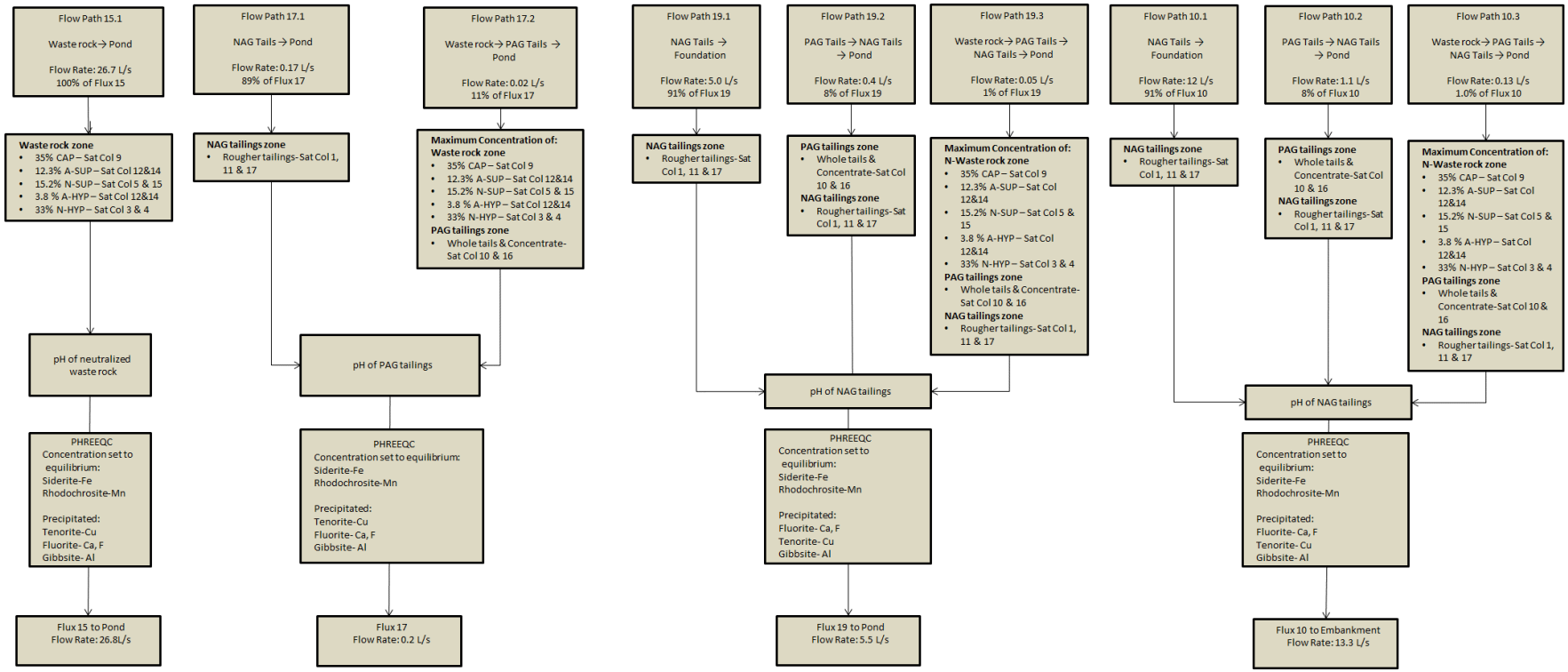


Figure 7-11: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of pond seepage source terms for the year 19 scenario

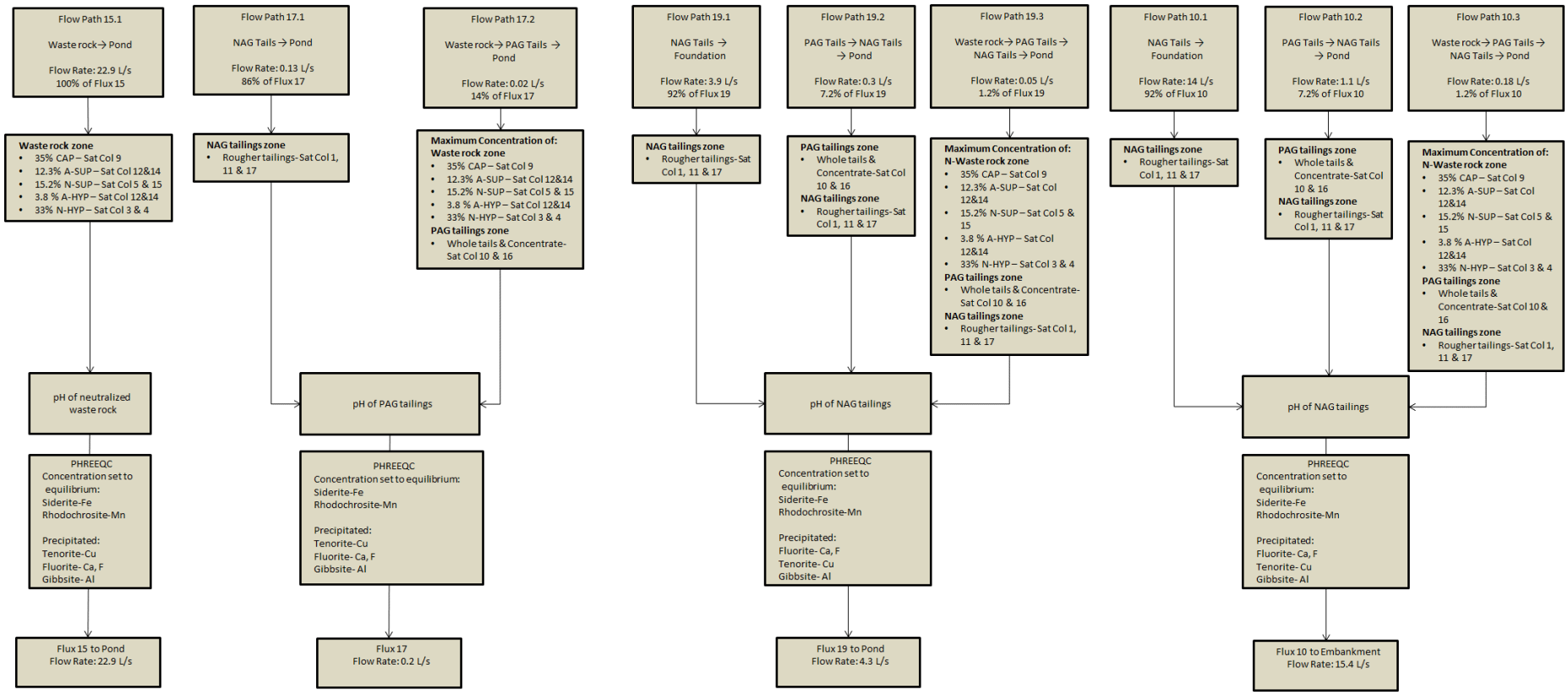


Figure 7-12: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of pond seepage source terms for the year 22 scenario

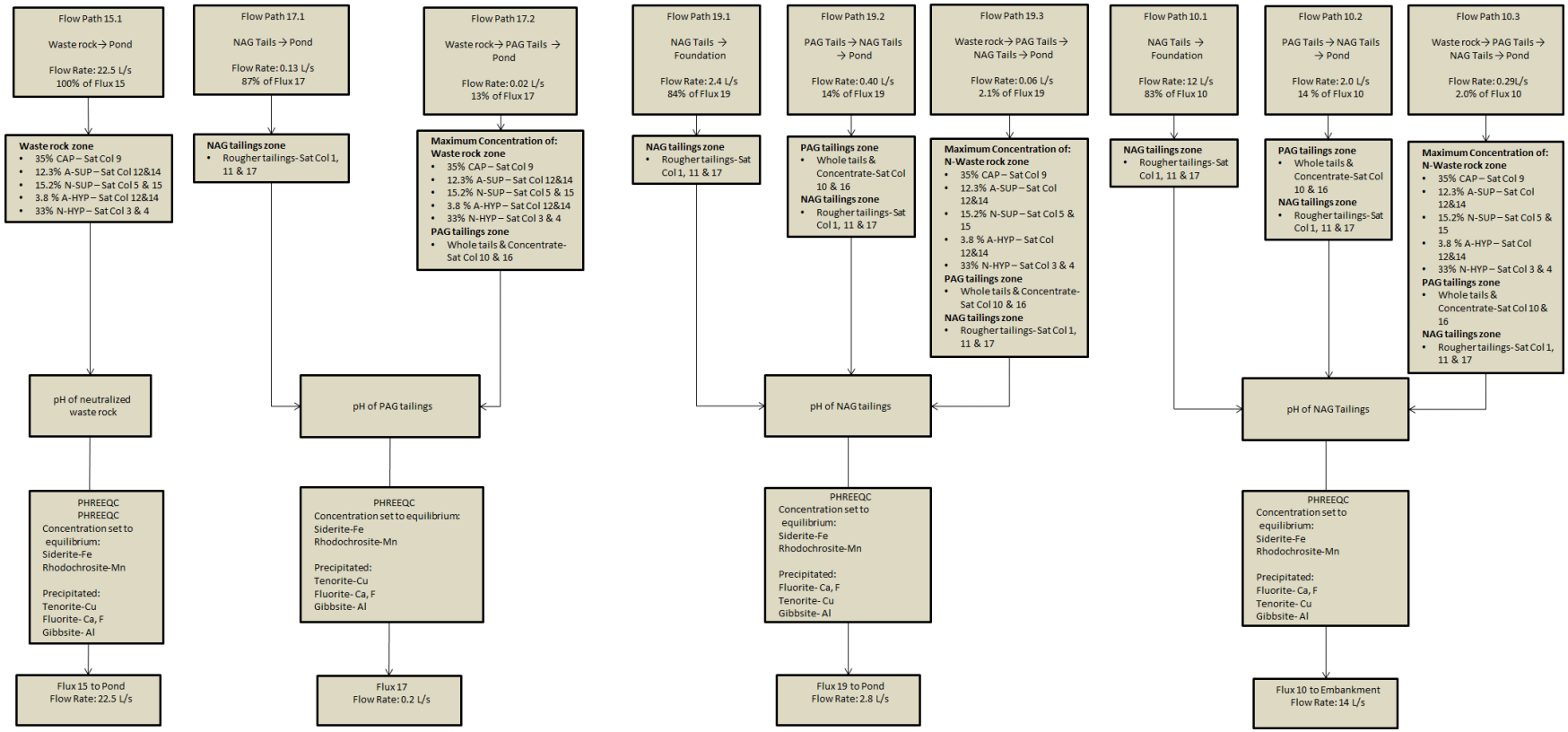


Figure 7-13: Flow chart outlining inputs, data sources, mixing ratios and modelling steps for development of pond seepage source terms for the post closure scenario

7.2.1 Pore chemistry in the Waste Rock, PAG Tailings and NAG Tailings Zones

Each of the waste storage zones in the TMF will have a unique geochemical signature. Thus, selection of the appropriate kinetic tests is required to assign an appropriate source term. The columns used to estimate the geochemical signature of waste storage zones are outlined in Table 7-5. The porewater for each zone is assigned the 95th percentile concentrations of the corresponding saturated column testwork presented in Table 7-3 and Table 7-4. When multiple columns exist which represent the same material (*i.e.* PAG tailings with Sat Col 10 and 16), the average of the 95th percentile values is applied. The composition of process water is considered in addition to column data as process water will comprise the initial pore water in tailings and waste rock. Therefore, if the process water concentration is greater than the column data representing the tailings zones for a given parameter, then the process water concentration presented in Table 6-3 is applied. For example, the average concentration of sulphate between the two columns used to represent PAG tailings (Sat Col 10 and 16) is 695 mg/L while process water is 1320 mg/L, therefore the PAG tailings zone is assigned a sulphate concentration of 1320 mg/L..

Table 7-5:
Saturated Columns Used to Represent Porewater in each Zone of the Impoundement

Waste Storage Zone	Waste Type	Column Data applied
Waste rock zone[1]	A-SUP	Sat Col 12 and 14
	N-SUP	Sat Col 5[2] & 15[2] or Sat Col 13[3]
	A-HYP	Sat Col 12 and 14
	N-HYP	Sat Col 3 and 4
	CAP	Sat Col 2[2] or Sat Col 9[3]
PAG tailings zone	Tailings concentrate	Sat Col 1, 11, 17 or Process water
NAG tailings zone	Rougher Tailings	Sat Col 10, 16 or Process water

[1] Relative portions of the different waste types in the downstream waste rock zone vary with time.
[2]Column data applied only to flow paths which do not encounter a neutralizing layer (tailings or HYP waste rock) before exiting facility.
[3]Columns data applied only to flow paths which encounter a neutralizing layer (tailings or HYP waste rock) before exiting facility.

Unlike the other waste zones, the waste rock storage zone will contain a mix of different waste rock types whose proportions will evolve with time. The composition of the waste rock storage zone at the modeled time points is presented in Table 7-6. To estimate the pore water chemistry of this waste zone, the concentrations from the columns identified in Table 7-5 representing different waste rock types are weighted by the relative proportion of the waste rock types outlined in Table 7-2 at each modeled stage (*i.e.* year

4, 10, 19, 22). For example, 33% of the waste rock in this area will be composed of N-HYP in year 19. Therefore the average of the 95th percentile concentrations from the two columns representing N-HYP (Sat Col 3 and 4) is weighted as 33% of the overall source term.

Waste rock deposited in the TMF will remain unsaturated for an average of 3 years before being inundated with water (Knight Peisold, 2013c). During this time period a portion of the HYP and SUP waste rock may become acidic (referred to as A-HYP and A-SUP in Table 7-6). The rate of waste rock acidification is described in Section 3.3, and the portions of acidic and neutral HYP and SUP in Table 7-2 account for both the amount of rock that is expected to be immediately acidic and the amount of rock that will become acidic over the 3 years of exposure. Low NP HYP and SUP waste rock will be blended with HYP material that has excess NP. Therefore, the neutralized acidic SUP columns (Sat Col 12 and 14) are used to represent A-HYP and A-SUP in the mixed waste rock zone, irrespective of flow path.

The HYP and tailings saturated columns generally produced higher pH drainage than CAP or SUP saturated columns. Seepage pathways originating from SUP or CAP dominated zones can be expected to experience an increase in pH and some metal attenuation when flowing through a HYP or tailings dominated zone. To account for this, the four layered saturated columns are used to represent water originating from acidic waste rock that flows through neutralizing material before discharge. For instance, Col 2 is used to represent CAP in the mixed waste rock zone for flows downward, while Sat Col 9 is used to represent CAP material in the mixed waste rock zone for horizontal flows into the PAG tailings zone.

Table 7-6:
Composition of waste rock zone at modeled time points. Note that no additional waste rock is placed after year 19

	Year 4		Year 10		Year 19 +	
	MT	**%**	**MT**	**%**	**MT**	**%**
A-SUP	0.49	0.38%	43.2	12.2%	80.1	12.3%
N-SUP	10.3	7.94%	57.6	16.3%	98.3	15.1%
A-HYP	0.17	0.131%	6.59	1.87%	24.6	3.79%
N-HYP	1.51	1.16%	58.2	16.5%	217	33.5%
CAP	118	90.4%	187	53.1%	229	35.3%
Total	130		353		649	

Note: Acidic supergene and hypogene is referred to as A-SUP and A-HYP, while neutral supergene and hypogene is referred to as N-SUP and N-HYP.

7.2.2 Integration of pore water chemistry with flow paths

Different porewater chemistries are developed for each seepage pathway encountering a unique combination of material types. These pathways are defined by the zones encountered prior to discharge and are outlined in Table 7-7 and Table 7-8. The chemistry of a flow path is based on the highest concentration encountered in each of the waste storage zones that the flow path encounters before exiting the TMF. For instance, the NAG tailings zone has a Zn concentration of 0.010 mg/L, while the PAG tailings zone has a Zn concentration of 0.021 mg/L. Flow paths traversing PAG and NAG tailings zones are assigned the higher of the two Zn concentrations (0.021 mg/L).

Each of the flow paths is assigned a pH, alkalinity and acidity of the last unit that the flow path passes through. For instance, if waste rock zone drainage passes through the PAG tailings zone then to the NAG tailings zone, it is assigned the pH and alkalinity of NAG tailings. The pH of seepage from the waste rock zone will vary depending on whether it flows upwards to the pond or downwards into the foundation owing to the stratification of waste rock that results from the varying proportions of waste rock types produced during each mining phase (Table 7-6). Water flowing downward to the foundation from the waste rock zone is assigned the median pH of CAP waste rock (pH 4.7), as the bottom layer of waste rock is composed of 90% CAP material (Figure 7-1). Similarly, water flowing upwards out of the waste rock zone is assigned this same pH during years 4 and 10. However, by year 19 when a layer of HYP exists at the top of the waste rock zone, dissolved elemental concentrations for the upwards seepage from this unit is assigned a value typical of the layered columns. However, this flow path is not assigned an alkaline pH typical of HYP waste rock pH because carbon dioxide degassing is not possible in a subaqueous environment, resulting in the accumulation of carbon dioxide in the solution when neutralization reactions take place. This lowers the equilibrium pH of carbonate minerals, preventing an alkaline pH from being reached. This is analogous to anoxic limestone drains used in the reclamation of ARD. In a survey of anoxic limestone drains, nine out of the ten sites were producing a pH between 6.2 and 6.7 (Watzlaf *et al.*, 2000). Thus a pH of 6.9 was assigned to waste rock porewater entering the TMF through the HYP waste rock layer. This pH is somewhat higher than the range observed by Watzlaf *et al.*, (2000) due to not all of the saturated waste being acidic below the HYP layer.

Table 7-7:
Break down of flow components and waste zones encountered for flows reporting to TMF foundation

Flux ID	Component	Waste Zones Encountered	Year 4 L/s	Year 10 L/s	Year 19 L/s	Year 22 L/s	Post Closure L/s
Flux 3	3.1	Waste Rock → Foundation	1.16	1.54	3.16	3.39	3.89
Flux 5	5.1	PAG Tails → Foundation	0.59	1.59	2.63	2.59	2.85
	5.2	Waste Rock → PAG Tails → Foundation	0.07	0.17	0.33	0.41	0.42
Flux 7	7.1	NAG Tails → Foundation	2.75	9.55	14.2	15.1	12.4
	7.2	PAG Tails → NAG Tails → Foundation	0.22	0.29	1.26	1.19	2.09
	7.3	Waste Rock → PAG Tails → NAG Tails → Foundation	0.03	0.03	0.16	0.19	0.31
Flux 9	Flux 3		1.16	1.54	3.16	3.39	3.89
	Flux 5		0.66	1.76	2.96	3.00	3.27
	Flux 7		2.99	9.87	15.63	16.50	14.83

Table 7-8:
Break down of flow components and waste zones encountered for flows reporting to pond

Flux ID	Component	Waste Zones Encountered	Year 4 L/s	Year 10 L/s	Year 19 L/s	Year 22 L/s	Post Closure L/s
Flux 15	15.1	Waste Rock → Pond	22.3	26.7	26.4	22.9	22.5
Flux 17	17.1	PAG Tails → Pond	0.35	0.46	0.17	0.13	0.13
	17.2	Waste Rock → PAG Tails → Pond	0.04	0.05	0.02	0.02	0.02
Flux 19	19.1	NAG Tails → Pond	4.67	5.97	4.98	3.90	2.35
	19.2	PAG Tails → NAG Tails → Pond	0.37	0.18	0.44	0.31	0.389
	19.3	Waste Rock → PAG Tails → NAG Tails → Pond	0.04	0.02	0.06	0.05	0.06
Flux 10	10.1	NAG Tails → Embankment	4.28	7.01	12.06	14.11	11.72
	10.2	PAG Tails → NAG Tails → Embankment	0.34	0.21	1.07	1.11	1.97
	10.3	Waste Rock → PAG Tails → NAG Tails → Embankment	0.04	0.02	0.13	0.18	0.29

7.2.3 Secondary Solubility Controls

The process of averaging saturated column concentrations and mixing flow paths results in some chemistries that exceed thermodynamic solubility controls. To account for mineral solubility controls that can be reasonably expected to occur in the porewater the USGS geochemical modelling program PHREEQC was applied using the Minteq.V4 database (Allison *et al*. 1991; Parkhurst and Apello, 1999).

These solubility controls were incorporated by speciating the flows exiting the TMF facility in PHREEQC, and allowing select minerals to achieve equilibrium. This includes flow 1, 3, 5, 7, 10, 15, 17 and 19 as indicated in Figure 7-2. The flow components exiting the base of the TMF (flow 1, 3, 5 and 7) are expected to mix to form flow 9 which represents the composite seepage which exits the TMF footprint in the subsurface. These four flow components are mixed using PHREEQC, and select mineral solubility controls are again allowed to precipitate. The pH of flow 9 is also calculated within PHREEQC. Note that this is the only flow component where PHREEQC is involved in pH determination.

The metals Mn and Fe are subject to reductive dissolution from oxide minerals in anaerobic environments. Due to the long residence (100+ years) of pore water in the dump, this reaction can be expected to progress until solubility controls for reduced Fe and Mn phases are reached. Likely solubility controls for these metals are rhodochrosite (MnCO3) and siderite (FeCO3). Therefore the concentration of Fe and Mn is increased until equilibrium with siderite and rhodochrosite is reached in neutral pH flow paths exiting the dump. Under acidic conditions microbial reduction of Fe and Mn will be inhibited, therefore siderite and rhodochrosite precipitation is not considered in flow path 3 at any time point or flow path 15 when during years 4 and 10.

Parameters which are affected by solubility controls calculated in PHREEQC are listed in Table 7-9 for flows exiting the base of the TMF, and in Table 7-10 for flows to the pond and embankment. Note that parameters affected by PHREEQC solubility controls are limited to Ca, SO4, F, Cu, Al and pH in the case of flow 9.

Table 7-9:
Overview of secondary minerals effecting source term predictions for flows exiting at the base of the Casino TMF

Flow ID		**3**					**5**					**7**					**9**				
Year		4	10	19	22	Post Closure	4	10	19	22	Post Closure	4	10	19	22	Post Closure	4	10	19	22	Post Closure
Mineral	Formula																				
Basaluminite	Al4(OH)10SO4	x	x																		
Gypsum	$CaSO_4$:2(H_2O)																				
Flourite	CaF_2						x	x	x	x	x	x	x	x	x	x					
Rhodochrosite	$MnCO_3$						+	+	+	+	+	+	+	+	+	+					
Siderite	$FeCO_3$						+	+	+	+	+	+	+	+	+	+					
Tenorite	CuO							x	x	x	x				x	x	x	x	x	x	x
Gibbsite	$Al(OH)_3$			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Note: Minerals which precipitate are indicated by (x), minerals allowed to dissolve to equilibrium are indicated by (+)

Table 7-10:
Overview of secondary minerals effecting source term predictions for flows exiting to the pond or embankment

Flow ID		**15**					**17**					**19**					**10**				
Year		4	10	19	22	Post Closure	4	10	19	22	Post Closure	4	10	19	22	Post Closure	4	10	19	22	Post Closure
Mineral	Formula																				
Basaluminite	Al4(OH)10SO4	x	x																		
Gypsum	$CaSO_4$:2(H_2O)																				
Flourite	CaF_2						x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Rhodochrosite	$MnCO_3$			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Siderite	$FeCO_3$			+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Tenorite	CuO			x	x	x		x	x	x	x			x	x	x			x	x	x
Gibbsite	$Al(OH)_3$			x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

Note: Minerals which precipitate are indicated by (x), minerals allowed to dissolve to equilibrium are indicated by (+)

7.3 TMF Source Term

Source terms calculated for flow paths exiting the Casino TMF facility are presented as concentrations in Table 7-11, Table 7-12 and Table 7-13 for fluxes to the foundation, pond and embankment, respectively. The only element which is predicted to exceed MMER water quality guidelines is Cu in seepage from the waste rock zone. Concentrations of Mn and Fe are predicted to be high in TMF seepage water owing to the reducing conditions expected in porewater from the interior of the TMF. Once porewater seeps from the TMF and discharges to surface waters, it will come into contact with the atmosphere and/or mix with oxygenated water. Under these conditions, dissolved Fe and Mn will oxidize and precipitate from solution, which can also be expected to remove some metals by sorption and co-precipitation. Other metals of potential concern in TMF seepage include Mo, Se, Cd and U.

Table 7-11:
Source term prediction for flows exiting the TMF into the subsurface

	FLOW ID	Flow 3					Flow 5					Flow 7					Flow 9					MMER		
	YEAR	4	10	19	22	PC	4	10	19	22	PC	4	10	19	22	PC	4	10	19	22	PC	MMM	MCS	MGS
pH	s.u.	4.7	4.7	4.7	4.7	4.7	7.82	7.82	7.82	7.82	7.82	7.64	7.64	7.64	7.64	7.64	7.13	7.44	7.38	7.38	7.31	-	-	-
Alk.	mgCaCO3/l	0	0	0	0	0	74.5	74.5	74.5	74.5	74.5	64.4	64.4	64.4	64.4	64.4	44.9	55.9	53.6	53.2	50.9	-	-	-
SO4	mg/l	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	-	-	-
Cl	mg/l	36.1	36.1	36.1	36.1	36.1	37.5	37.5	37.5	37.5	37.5	36.2	36.1	36.2	36.2	36.3	36.3	36.3	36.4	36.3	36.4	-	-	-
F	mg/l	2.22	2.22	2.22	2.22	2.22	2.15	2.15	2.16	2.16	2.16	2.13	2.13	2.13	2.13	2.13	2.15	2.14	2.15	2.15	2.15	-	-	-
Al	mg/l	4.78	4.78	4.78	4.78	4.78	0.00859	0.00859	0.00859	0.0086	0.0086	0.00579	0.00579	0.00579	0.00579	0.00579	0.00203	0.00371	0.00326	0.00321	0.00281	-	-	-
Sb	mg/l	0.00457	0.00398	0.00251	0.00338	0.00338	0.00294	0.00294	0.00294	0.00294	0.00294	0.00254	0.00252	0.00255	0.00254	0.00258	0.00309	0.00275	0.00281	0.00272	0.00277	-	-	-
As	mg/l	0.00409	0.00409	0.00633	0.00409	0.00409	0.00439	0.00439	0.00434	0.0044	0.00438	0.00432	0.0043	0.00431	0.00432	0.00433	0.00427	0.00429	0.00428	0.00429	0.0043	0.5	0.75	1
Ba	mg/l	0.214	0.145	0.0665	0.114	0.114	0.0767	0.0741	0.074	0.074	0.074	0.109	0.109	0.109	0.109	0.109	0.13	0.108	0.109	0.105	0.105	-	-	-
Cd	mg/l	0.000438	0.000848	0.000558	0.000905	0.000905	0.00077	0.00077	0.00077	0.00077	0.00077	0.00161	0.00161	0.00161	0.00161	0.00161	0.00121	0.00141	0.00138	0.00139	0.00136	-	-	-
Ca	mg/l	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	-	-	-
Cr	mg/l	0.0026	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00253	0.00251	0.00251	0.00251	0.00251	-	-	-
Co	mg/l	0.0149	0.0381	0.0421	0.0424	0.0424	0.00207	0.00513	0.00605	0.0071	0.0067	0.00155	0.00162	0.00191	0.00197	0.00234	0.00484	0.00636	0.00774	0.00864	0.0101	-	-	-
Cu	mg/l	2.48	1.04	1.11	1.16	1.16	0.00876	0.0179	0.0179	0.0179	0.0179	0.0173	0.0201	0.0262	0.0262	0.0262	0.117	0.0441	0.0522	0.0535	0.0646	0.3	0.45	0.6
Fe	mg/l	0.579	0.866	1.22	0.955	0.955	3.5	3.51	3.51	3.52	3.52	5.94	5.94	5.95	5.95	5.95	4.31	5.02	4.88	4.89	4.7	-	-	-
Pb	mg/l	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.2	0.3	0.4
Mg	mg/l	5.53	37.3	57.3	44.9	44.9	7.99	10.8	11.8	13.2	12.6	2.86	2.68	3.26	3.31	4.06	4.21	7.81	9.37	10.8	12.6	-	-	-
Mn	mg/l	0.461	1.31	1.78	1.44	1.44	1.43	1.44	1.44	1.44	1.44	2.44	2.44	2.44	2.44	2.44	1.83	2.18	2.14	2.16	2.12	-	-	-
Hg	mg/l	0.0000237	0.0000291	0.0000422	0.0000302	0.0000302	0.00004	0.000039	0.0000386	0.0000387	0.0000387	0.0000101	0.00000854	0.0000103	0.0000101	0.0000125	0.0000175	0.000015	0.0000169	0.0000168	0.0000196	-	-	-
Mo	mg/l	0.238	0.238	0.238	0.238	0.238	0.238	0.238	0.238	0.238	0.238	0.287	0.287	0.287	0.287	0.287	0.268	0.275	0.273	0.273	0.271	-	-	-
Ni	mg/l	0.00468	0.0129	0.0171	0.0149	0.0149	0.00265	0.00379	0.00414	0.00452	0.00438	0.00252	0.00255	0.00265	0.00267	0.00281	0.00306	0.00392	0.00434	0.00472	0.00517	0.5	0.75	1
Se	mg/l	0.00852	0.0126	0.0122	0.0139	0.0139	0.00852	0.00875	0.00893	0.00902	0.00899	0.00852	0.00853	0.00855	0.00856	0.00859	0.00852	0.00903	0.00919	0.00941	0.00958	-	-	-
Si	mg/l	8.95	6.72	3.49	5.34	5.34	2.16	2.19	2.18	2.21	2.2	2.02	2.02	2.02	2.03	2.04	3.71	2.59	2.73	2.54	2.65	-	-	-
Ag	mg/l	0.0000724	0.0000562	0.0000501	0.0000517	0.0000517	0.0000501	0.0000501	0.0000501	0.0000501	0.0000501	0.0000501	0.0000501	0.0000501	0.0000501	0.0000501	0.0000555	0.0000508	0.000051	0.0000503	0.0000504	-	-	-
Na	mg/l	35.4	50.5	65.6	49.4	49.4	38.5	40.6	40.6	41.4	41.1	37.7	37.7	37.9	38	38.3	37.3	39.6	40.1	40.1	40.7	-	-	-
Sr	mg/l	1.3	1.47	2.84	2.23	2.23	1.3	1.4	1.47	1.51	1.5	1.3	1.31	1.32	1.32	1.33	1.3	1.34	1.36	1.48	1.52	-	-	-
Tl	mg/l	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	-	-	-
U	mg/l	0.0112	0.161	0.282	0.203	0.203	0.0143	0.0284	0.0343	0.0416	0.0388	0.00399	0.00391	0.00591	0.0063	0.00885	0.00714	0.0256	0.0323	0.0401	0.0477	-	-	-
Zn	mg/l	0.0541	0.0733	0.0666	0.075	0.075	0.0205	0.0245	0.0257	0.0269	0.0264	0.0112	0.0109	0.0118	0.0118	0.013	0.0229	0.02	0.0226	0.0231	0.026	0.5	0.75	1

Table 7-12:
Source term prediction for flows exiting the TMF into the pond

	FLOW ID	15					17					19					MMER		
	YEAR	4	10	19	22	PC	4	10	19	22	PC	4	10	19	22	PC	MMM	MCS	MGS
pH	s.u.	4.7	5.54	6.88	6.89	6.89	7.82	7.82	7.82	7.82	7.82	7.64	7.64	7.64	7.64	7.64	-	-	-
Alkalinity	mg$CaCO_3$/l	0	0	329	329	329	74.5	74.5	74.5	74.5	74.5	57.6	57.6	57.6	57.6	57.6	-	-	-
SO4	mg/l	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	1320	-	-	-
Cl	mg/l	36.1	36.1	36.1	36.1	36.1	34.8	37.5	37.5	37.5	37.5	36.2	36.1	36.2	36.2	36.3	-	-	-
F	mg/l	2.22	2.22	2.23	2.23	2.23	2.14	2.15	2.16	2.16	2.16	2.13	2.12	2.13	2.13	2.13	-	-	-
Al	mg/l	4.78	1.36	0.00198	0.00196	0.00196	0.00859	0.00859	0.00859	0.0086	0.0086	0.00579	0.00579	0.00579	0.00579	0.00579	-	-	-
Sb	mg/l	0.00457	0.00398	0.00251	0.00251	0.00251	0.00294	0.00294	0.00294	0.00294	0.00294	0.00254	0.00252	0.00255	0.00254	0.00258	-	-	-
As	mg/l	0.00409	0.00409	0.00633	0.00633	0.00633	0.00439	0.00439	0.00434	0.0044	0.00438	0.00432	0.0043	0.00431	0.00432	0.00433	0.5	0.75	1
Ba	mg/l	0.214	0.145	0.0665	0.0665	0.0665	0.0767	0.0741	0.074	0.074	0.074	0.109	0.109	0.109	0.109	0.109	-	-	-
Cd	mg/l	0.000438	0.000848	0.000559	0.000559	0.000559	0.00077	0.00077	0.00077	0.00077	0.00077	0.00161	0.00161	0.00161	0.00161	0.00161	-	-	-
Ca	mg/l	498	498	498	498	498	498	498	498	498	498	498	498	498	498	498	-	-	-
Cr	mg/l	0.0026	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	0.00251	-	-	-
Co	mg/l	0.0149	0.0381	0.0422	0.0422	0.0422	0.00207	0.00513	0.00605	0.0071	0.0067	0.00155	0.00162	0.00191	0.00197	0.00234	-	-	-
Cu	mg/l	2.49	1.04	0.761	0.749	0.749	0.00876	0.0179	0.0179	0.0179	0.0179	0.0173	0.0201	0.0242	0.0242	0.0242	0.3	0.45	0.6
Fe	mg/l	0.579	0.866	6.86	6.77	6.77	3.5	3.51	3.51	3.52	3.52	6.67	6.67	6.67	6.67	6.67	-	-	-
Pb	mg/l	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.00125	0.2	0.3	0.4
Mg	mg/l	5.53	37.3	57.4	57.4	57.4	7.99	10.8	11.8	13.2	12.6	2.86	2.68	3.26	3.31	4.06	-	-	-
Mn	mg/l	0.461	1.31	2.88	2.85	2.85	1.43	1.44	1.44	1.44	1.44	2.74	2.74	2.74	2.74	2.74	-	-	-
Hg	mg/l	2.37E-05	2.91E-05	4.22E-05	4.22E-05	4.22E-05	0.00004	0.000039	3.86E-05	3.87E-05	3.87E-05	1.01E-05	8.54E-06	1.03E-05	1.01E-05	1.25E-05	-	-	-
Mo	mg/l	0.238	0.238	0.238	0.238	0.238	0.238	0.238	0.238	0.238	0.238	0.287	0.287	0.287	0.287	0.287	-	-	-
Ni	mg/l	0.00468	0.0129	0.0171	0.0171	0.0171	0.00265	0.00379	0.00414	0.00452	0.00438	0.00252	0.00255	0.00265	0.00267	0.00281	0.5	0.75	1
Se	mg/l	0.00852	0.0126	0.0122	0.0122	0.0122	0.00852	0.00875	0.00893	0.00902	0.00899	0.00852	0.00853	0.00855	0.00856	0.00859	-	-	-
Si	mg/l	8.95	6.72	3.49	3.49	3.49	2.16	2.19	2.18	2.21	2.2	2.02	2.02	2.02	2.03	2.04	-	-	-
Ag	mg/l	7.24E-05	5.62E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	-	-	-
Na	mg/l	35.5	56.7	65.9	65.9	65.9	36.8	40.6	40.6	41.4	41.1	38	38	38.2	38.3	38.5	-	-	-
Sr	mg/l	1.3	1.47	2.84	2.84	2.84	1.3	1.4	1.47	1.51	1.5	1.3	1.31	1.32	1.32	1.33	-	-	-
Tl	mg/l	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	0.000501	-	-	-
U	mg/l	0.0112	0.161	0.283	0.283	0.283	0.0143	0.0284	0.0343	0.0416	0.0388	0.00399	0.00391	0.00591	0.0063	0.00885	-	-	-
Zn	mg/l	0.0541	0.0733	0.0667	0.0667	0.0667	0.0205	0.0245	0.0257	0.0269	0.0264	0.0112	0.0109	0.0118	0.0118	0.013	0.5	0.75	1

Table 7-13:
Source term prediction for flows exiting the TMF into the embankment

		Flow 10					MMER		
	YEAR	4	10	19	22	PC	MMM	MCS	MGS
pH	s.u.	7.64	7.64	7.64	7.64	7.64	-	-	-
Alk.	mg$CaCO_3$/l	64	64	64	64	64	-	-	-
SO4	mg/l	1320	1320	1320	1320	1320	-	-	-
Cl	mg/l	36.2	36.1	36.2	36.2	36.3	-	-	-
F	mg/l	2.13	2.13	2.13	2.13	2.13	-	-	-
Al	mg/l	0.00574	0.00574	0.00574	0.00574	0.00575	-	-	-
Sb	mg/l	0.00254	0.00252	0.00255	0.00254	0.00258	-	-	-
As	mg/l	0.00432	0.0043	0.00431	0.00432	0.00433	0.5	0.75	1
Ba	mg/l	0.109	0.109	0.109	0.109	0.109	-	-	-
Cd	mg/l	0.00161	0.00161	0.00161	0.00161	0.00161	-	-	-
Ca	mg/l	498	498	498	498	498	-	-	-
Cr	mg/l	0.00251	0.00251	0.00251	0.00251	0.00251	-	-	-
Co	mg/l	0.00155	0.00162	0.00191	0.00197	0.00234	-	-	-
Cu	mg/l	0.0173	0.0201	0.0265	0.0265	0.0265	0.3	0.45	0.6
Fe	mg/l	5.94	5.94	5.95	5.95	5.95	-	-	-
Pb	mg/l	0.00125	0.00125	0.00125	0.00125	0.00125	0.2	0.3	0.4
Mg	mg/l	2.86	2.68	3.26	3.31	4.06	-	-	-
Mn	mg/l	2.44	2.44	2.44	2.44	2.45	-	-	-
Hg	mg/l	1.01E-05	8.54E-06	1.03E-05	1.01E-05	1.25E-05	-	-	-
Mo	mg/l	0.287	0.287	0.287	0.287	0.287	-	-	-
Ni	mg/l	0.00252	0.00255	0.00265	0.00267	0.00281	0.5	0.75	1
Se	mg/l	0.00852	0.00853	0.00855	0.00856	0.00859	-	-	-
Si	mg/l	2.02	2.02	2.02	2.03	2.04	-	-	-
Ag	mg/l	5.01E-05	5.01E-05	5.01E-05	5.01E-05	5.01E-05	-	-	-
Na	mg/l	37.7	37.7	37.9	38	38.2	-	-	-
Sr	mg/l	1.3	1.31	1.32	1.32	1.33	-	-	-
Tl	mg/l	0.000501	0.000501	0.000501	0.000501	0.000501	-	-	-
U	mg/l	0.00399	0.00391	0.00591	0.0063	0.00885	-	-	-
Zn	mg/l	0.0112	0.0109	0.0118	0.0118	0.013	0.5	0.75	1

8. Pit Wall Source Terms

CASINO
COPPER AND GOLD

8. Pit Wall Source Terms

This chapter discusses the development of source terms for the Casino pit wall. Source terms are developed for rinsing of sub-aerial pit wall by precipitation and inundation of exposed pit wall by the pit lake. The source terms were developed by scaling loading rates measured in laboratory-based kinetic tests (unsaturated columns and standard humidity cells) to field conditions and, where appropriate, adjusted based on fundamental geochemical principals and observed field bin leachate concentrations. A flow chart outlining source term development is provided in Figure 8-1.

Source terms have been developed for the Oxide Cap (CAP), Supergene (SUP), and Hypogene (HYP) mineralization zones that will be exposed on the Casino pit wall. The acid-base accounting results (ABA) indicate the SUP and HYP zones are potentially acid generating (PAG). Therefore both acidic and neutral source terms are calculated for the HYP and SUP mineralization zones in addition to the single CAP source term.

The rate at which portions of the HYP and SUP pit wall acidifies will influence the pit lake chemistry. Therefore weathering rates observed in neutral pH humidity cells are used to estimate NP depletion rates and predict time until acidification. These rates are used to develop an equation that estimates the proportion of acidic and neutral sub-aerially exposed pit wall over time.

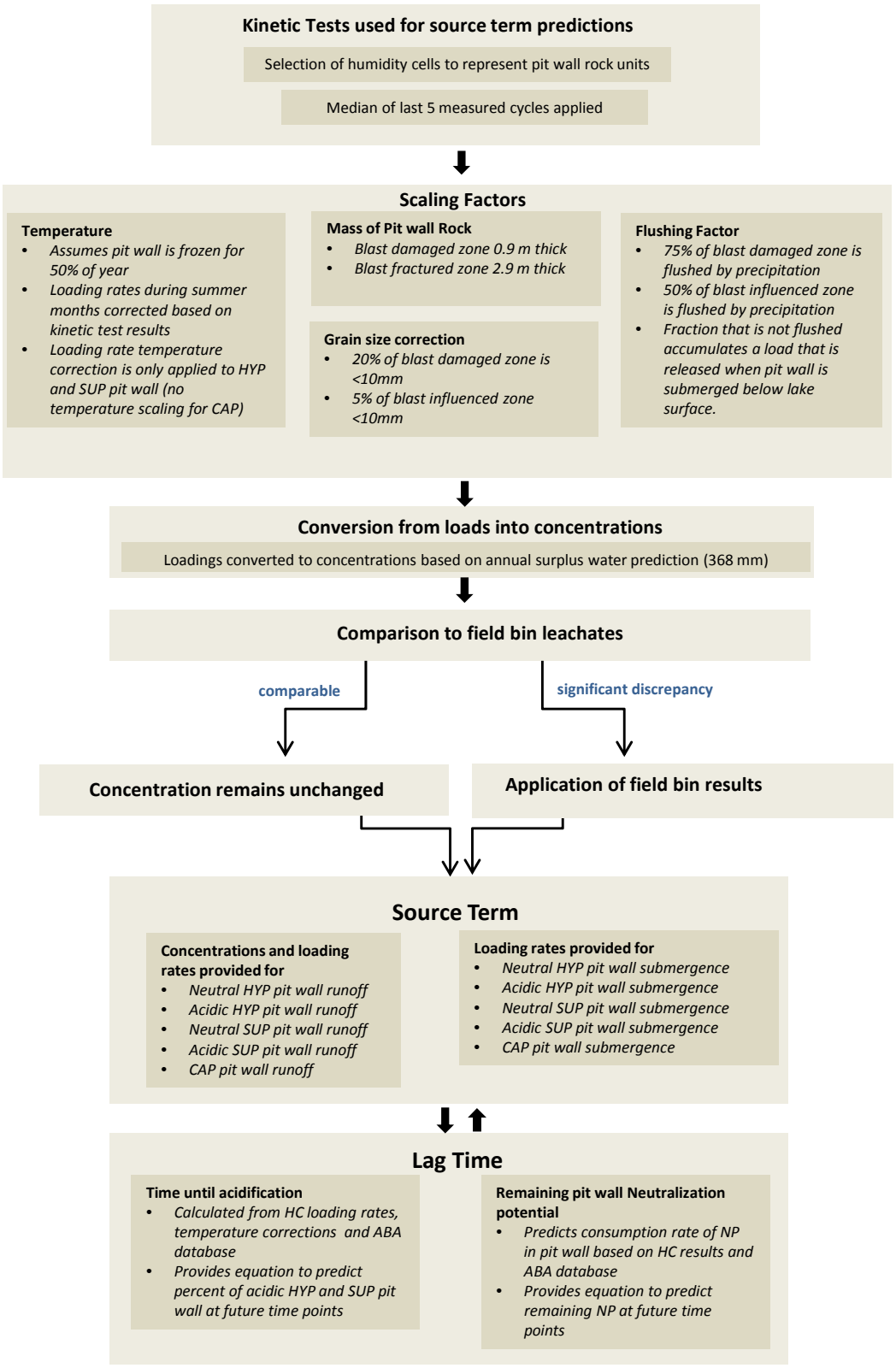


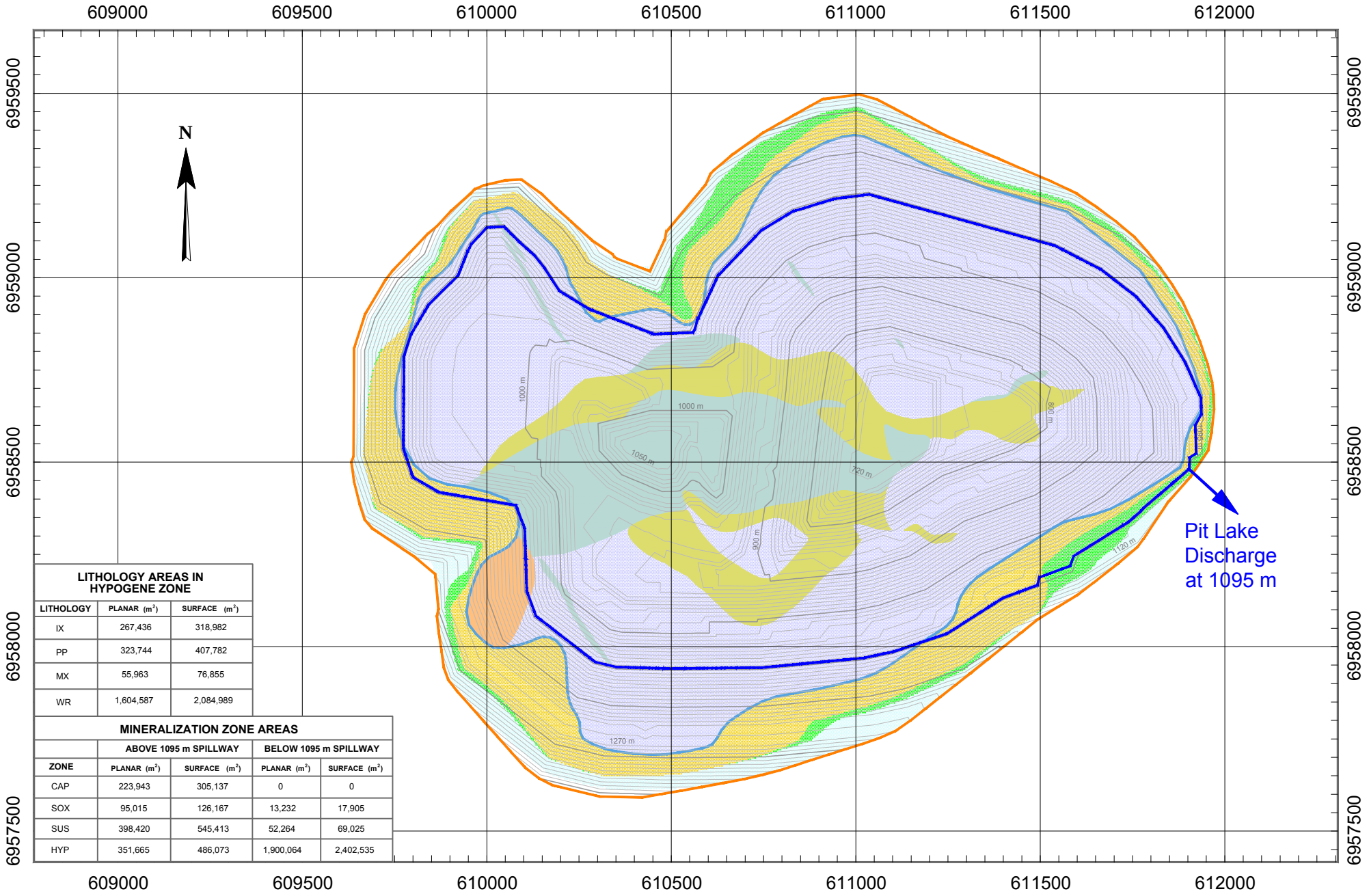
Figure 8-1: Flow chart illustrating work steps in pit wall source term development

8.1 Pit Wall Rock Exposures

The final pit shell with Exposure areas for CAP, SOX, SUP and HYP is illustrated in Figure 8-2. In this figure the hypogene mineralization zone which constitutes a majority of the pit shell is broken down further into four lithologic units: intrusive Brecia (IX), Paton Porphyry (PP), explosive breccia (MX) and Dawson Range (WR). The exposure areas of the various mineralization zones and HYP lithologies are tabulated in Table 8-1.

Table 8-1:
Plan view area of pit wall rock exposures by mineralization type and hypogene lithologies

Mineralization	Lithology	Area (ha)	Pit Wall Exposure (% of total)
CAP	-	22	7.4%
SOX	-	11	3.6%
SUS	-	45	15%
HYP	IX	27	8.8%
HYP	PP	32	11%
HYP	MX	6	1.8%
HYP	WR	160	53%



LITHOLOGY AREAS IN HYPOGENE ZONE

LITHOLOGY	PLANAR (m^2)	SURFACE (m^2)
IX	267,436	318,982
PP	323,744	407,782
MX	55,963	76,855
WR	1,604,587	2,084,989

MINERALIZATION ZONE AREAS

	ABOVE 1095 m SPILLWAY		BELOW 1095 m SPILLWAY	
ZONE	PLANAR (m^2)	SURFACE (m^2)	PLANAR (m^2)	SURFACE (m^2)
CAP	223,943	305,137	0	0
SOX	95,015	126,167	13,232	17,905
SUS	398,420	545,413	52,264	69,025
HYP	351,665	486,073	1,900,064	2,402,535

LEGEND

- Open Pit Elevation Contours
- Maximum Water Level (1095 m)
- Open Pit Extents

Lithology

- Heterolithic Intrusion Breccia (IX)
- Patton Porphyry (PP)
- Micro Breccia (MX)
- Dawson Range (WR)

Mineralization Zones

- Leached Cap Zone (CAP)
- Supergene Oxide Zone (SOX)
- Supergene Sulphide Zone (SUS)
- Hypogene Zone (HYP)

DATE SAVED:	Nov 06, 2013
DRAWN BY:	SSS
REVIEWED:	BM
VERSION:	1

Coordinate System: NAD 1983 UTM ZONE 8N
Projection: Transverse Mercator
Datum: North American 1983
Units: Metres

0 200 400

CLIENT: CASINO COPPER AND GOLD

LORAX ENVIRONMENTAL

PROJECT: **Casino Project**

TITLE: Pit Lithology

PROJECT #: J862-5

FIGURE: 8-2

P:\J862 (Casino)\Lorax Drafting\Pit_YR20_contours_with_geology_zones 2012 09 20.dwg

8.2 Application of Kinetic Test Data

Multiple unsaturated kinetic tests have been initiated on material from the three mineralized zones. A list of the laboratory-based kinetic tests, and cycles used in development of pit wall source terms is presented in Table 8-2. The loading rates from these kinetic tests were derived from the final 5 cycles from each of the tests and are presented in the 2013 Kinetic Test Report (Lorax 2013b).

8.2.1 CAP

Metal leaching from CAP material is driven by dissolution of secondary oxide and sulphate minerals rather than the kinetic oxidation of sulphides. A review of the metal leaching rates from the various columns indicates that leaching rates are also affected by pH.

The CAP kinetic testwork indicates that loading rates and concentrations stabilize with time. These stabilized rates are used to derive the pit wall source term to represent long-term runoff concentrations (decades). Accordingly, the median loading rates from the final 5 cycles from the CAP kinetic testwork were compiled along with the corresponding leachate pH. In order to derive a representative base loading term for the CAP utilizing all the available column data, a regression was developed between the final loading rates and leachate pH of the five unsaturated columns. This regression is used to interpolate loading rates to a pH = 4.7, which is a typical pH of the CAP unit as calculated from the CAP static test dataset. The columns and data used to develop this regression are those presented in Table 8-2.

8.2.2 SUP

Loading rates measured from humidity cells HC11 and HC12 were used to develop source terms for neutral and acidic SUP pit wall (Table 8-2). Humidity cell HC11 has a drainage pH of 7.1 and is used to estimate neutral SUP pit wall source term. Humidity cell HC12 is producing drainage at a pH of approximately 3.2, and is used to estimate drainage from acidic SUP pit wall.

Table 8-2:
Overview of Kinetic Tests Used for Pit Wall Source Term Calculation

Test ID	Mineralization	Lithology	Material Type	Represents	Start Date	End Date	Data Used
HC3	HYP	PP	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-60
HC4	HYP	WR	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-61
HC5	HYP	PP	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-62
HC6	HYP	WR	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-63
HC7	HYP	50% IX 50% MX	Waste	Neutral HYP	29-Nov-11	On-going	Median of Cycle 49-64
HC8	HYP	MX	Waste	Acidic HYP	29-Nov-11	On-going	Median of Cycle 49-65
HC10	HYP	WR	Waste	Acidic HYP	29-Nov-11	On-going	Median of Cycle 49-65
HC11	SUP	WR	Waste	Neutral SUP	29-Nov-11	On-going	Median of Cycle 49-65
HC12	SUP	WR	Waste	Acidic SUP	29-Nov-11	On-going	Median of Cycle 49-65
Col1	CAP	WR	Waste	CAP	27-Jan-10	On-going	Median of Cycle 144-160
Col2a	95%CAP, 5% SUP	85% WR 5% IX 5% MX 5% PP	Waste	CAP	27-Jan-10	On-going	Median of Cycle 144-160
Col2b	95%CAP, 5% SUP	85% WR 5% IX 5% MX 5% PP	Waste	CAP	27-Jan-10	On-going	Median of Cycle 132-148
Col 3	80% CAP 20% SUP	70% WR 20% PP 10% MX	Waste	CAP	27-Jan-10	05-Dec-12	Median of Cycle 132-148
Col 4a	81% CAP 13% SUP 6.3% OVB	81%WR 19% PP	Waste	CAP	01-Apr-10	05-Dec-12	Median of Cycle 124-140

8.2.3 HYP

Source term development for the exposure of HYP material in the pit wall considers the influence of both lithology and sulphur content under neutral leaching. Sulphur content alone is used to weight the two acidic HYP humidity cells under acidic leaching. Lithology was not considered in calculating source terms for SUP and CAP due to the strong influence of secondary weathering and secondary mineral assemblages rather than the residual primary lithology and mineralogy from these weathered horizons.

Neutral HYP weathering source terms were calculated from humidity cells HC3, HC4, HC5, HC6 and HC7 (Table 8-2). These five humidity cells were selected to represent the four major lithologic units in the HYP zone (Table 8-1). In order to derive a single pH-neutral source term from these various materials, the loading rates from these cells were weighted proportionally to the exposed area of the lithology on the ultimate pit wall (Figure 8-2). In addition, when multiple humidity cells that represent average and high sulphur content were available for an individual lithologic unit (*e.g.*, Dawson Range HC4 & HC6; Paton Porphyry HC3 & HC5), loadings from each cell were weighted based on the distribution of T-S measured for samples within the corresponding geologic unit. For instance, the HYP humidity cells HC4 and HC6 have a T-S content of 4.29% and 1.81 %, respectively. When compared to the overall ABA dataset, the T-S% of HC4 is in the 77th percentile while HC5 has a T-S% in the 47th percentile (Figure 8-3)). Thus, HC6 was weighted as 47% and HC4 was weighted as 53% of the WR lithology. This is considered a conservative means of weighting humidity cell results, as loading rates incorporate an average, and a high T-S% humidity cell. The final weightings assigned to each humidity cell when taking into account both sulphur content and lithology are listed in Table 8-3.

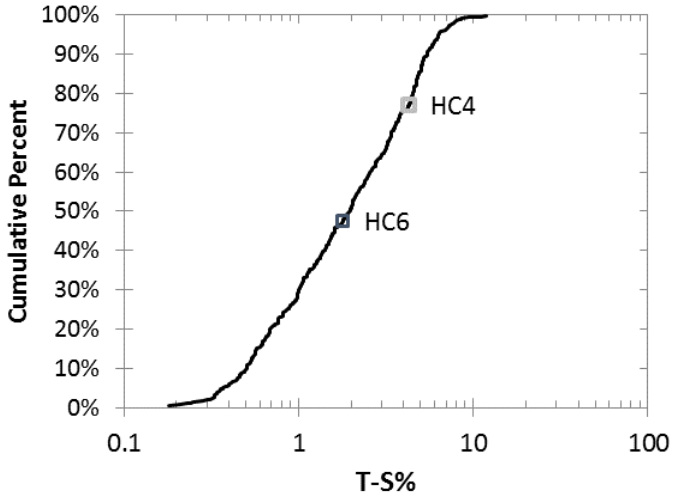


Figure 8-3: Total Sulfur cumulative percent frequency for Granodiorite (WR) Hypogene (HYP) along with the two humidity cells (HC4 and HC6) used to represent this unit in the pit wall source term

Table 8-3:
Lithology and Sulphur Associations of Hypogene Humidity Cells

Source Term	HC ID #	Lithology	Percentile of T-S	Proportion of Lithology	Proportion of source term
HYP-Neutral	HC3	PP	93%	39%	5.6%
	HC5	PP	71%	71%	10%
	HC4	WR	77%	53%	38%
	HC6	WR	47%	47%	33%
	HC7	IX, MX	66%	100%	14%
HYP-Acidic	HC8	MX	83%	-	29%
	HC10	WR	71%	-	71%

The two humidity cells used to calculate the acidic HYP source term were weighted based on T-S content, similar to the neutral HYP source term. Unlike the neutral HYP source term, lithology is not considered in the acidic HYP source term. Acidic HYP humidity cells were initiated for WR, PP and MX waste rock (HC8, HC9 and HC10). Humidity cells HC8 and HC10 have a relatively stable pH, and are currently producing drainage at a pH of 3.3 and 3.2, respectively. Humidity cell HC9 is not included because it currently has a variable and declining pH (approx. 5.4), that does not fully represent acidic loading conditions. The loading rates of HC8 and HC10 are proportioned based on sulfur content, as described above for neutral HYP mineralization zones, to produce an acidic HYP leaching rate for the HYP mineralization zone (Table 8-3).

8.3 Temperature Correction

The average annual temperature at the Casino mine site is approximately 0.5°C, which is considerably colder than laboratory kinetic tests which are conducted at room temperature. Lower temperatures affect both sulphide oxidation rates and mineral solubility as discussed in a detailed review in Lorax, 2013b. Sulphide oxidation rates decrease with decreasing temperature, while mineral solubility can increase or decrease depending on the mineral phase. Therefore, humidity cell loading rates are adjusted where appropriate to account for this discrepancy.

Temperature corrections used to develop the pit wall source terms can be summarized as follows:

- Acidic SUP and HYP loading rates are scaled based on a site-specific Arrhenius relationship.

- Neutral SUP and HYP loading rates are scaled based on observed variation from in loading rates from humidity cell T1 which was moved from room temperature to a cold environemnt (4C) after loadings had stabilized.
- CAP loading rates are not adjusted for temperature.

In addition to these temperature corrections applied to specific pit wall units, it is assumed that no metal loading or acid generation takes place on any of the pit wall units for the 6 months of the year with average temperatures below freezing.

8.3.1 Acidic SUP and HYP

Pyrite oxidation rates decrease with decreasing temperature following an Arrhenius relationship (Nicholson *et al*., 1988). The pyrite oxidation rate as a function of temperature for Casino mine waste is established using an activation energy calculated from the temperature dependent rate change measured in Cell T1 (Figure 8-4). Humidity Cell T1 provides a reference because the cell was moved from standard laboratory temperature (20°C to 22°C) to cold temperature at 4°C once leaching rates had stabilized after 37 cycles (Lorax, 2013b). Hence, the effect of temperature on loading rates for site-specific mineral phases can be measured.

The average monthly temperature at the Casino mine site between April and September ranges from 0.2°C to 10.4°C, with an average of 7.7°C. In this temperature range oxidation rates will be 54% to 25% of those measured at standard laboratory temperatures (Figure 8-4). Using this site-specific Arrhenius relationship, acidic SUP and HYP loading rates were adjusted by a factor of 0.43 to reflect the average temperature (7.7°C) during the 6 months when the average monthly temperature is above freezing. Under acidic conditions, the influence of oxide mineral solubility and metal adsorption will be less significant than under neutral pH. The metal leaching rate of most metal cations will be controlled by sulphide oxidation kinetics rather than metal solubility controls. Under such conditions it is assumed that leaching rates would decrease, similar to that observed for sulphate, the release of which is considered an indicator of the sulphide oxidation rate.

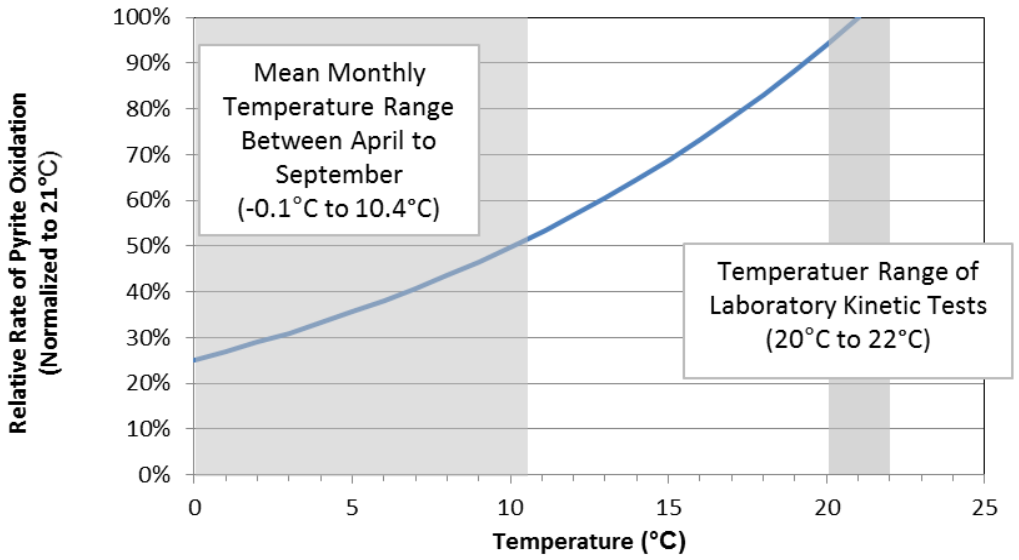


Figure 8-4: Temperature dependence of pyrite oxidation rate in Casino mine waste normalized to laboratory weathering rates

8.3.2 Neutral SUP and HYP

Under neutral conditions, mineral solubility will have a greater effect on metal loading than under acidic conditions where the primary sulphide oxidation rate will be the primary control. Site specific temperature correction factors are based on loading rates measured before and after the temperature change in the Casino humidity cell sample T1 (Table 8-4).

The leaching rate of most parameters decreased when the humidity cell was moved from a 21°C environment to the 4°C environment. Conversely, the leaching rates of a number of metals were either unaffected or increased when the temperature was decreased. Notable metals for which leaching rate increased include Cu, Ag, Co and Pb. This observed increase in leaching rates is not believed to be due to sulphide oxidation kinetics, as the oxidation rate of sulphide minerals uniformly decrease with decreasing temperature. The observed increases in these metals are likely due to temperature effects on oxide solubility and surface sorption. To reflect a temperature of 7.7°C, a linear extrapolation between the observed loading rate at 21°C and 4°C is applied, as shown in Table 8-4.

Table 8-4:
Leaching rates from humidity cell T1 before and after temperature change

	SO_4	As	Cu	Mo	Se	U	Zn
	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk
21°C	19.0	0.0013	0.0050	0.021	0.00051	0.0012	0.00036
4°C	6.32	0.00089	0.0053	0.0084	0.00018	0.00034	0.00035
Correction Factor (7.7°C)	0.47	0.72	1.04	0.53	0.48	0.43	0.96

8.4 Physical Scaling Factors

The loading rates measured in the laboratory kinetic tests were scaled to address the differences between laboratory and field conditions. Laboratory rates were adjusted to account for the expected flushing rate, blast influence, and grain size distribution for rock in the pit wall. The scaling factors used herein were originally developed in the MEA report, with minor changes to the flushing rates. A summary of scaling factors used to develop the source terms is provided below in Table 8-5. The assumptions used in developing these scaling factors are described below.

Table 8-5:
Physical Scaling Factors

Scaling Factors	Unit	Blast Damaged	Blast Fractured
Thickness (m)	m	0.9	2.9
Average Wall Slope	degree	45	45
Mass (CAP)	kg/m^2	3,207	10,335
Mass (SUP)	kg/m^2	3,309	10,663
Mass (HYP)	kg/m^2	3,373	10,868
% of reactive material -1/4"	-	20%	5%
% of material flushed	-	75%	50%

8.4.1 Mass of Pit Wall Rock

The degree of geochemical loading from the pit wall is greatly influenced by the fracture intensity of the walls induced by blasting. The blast effects in the pit wall can be subdivided into two zones; a blast influenced zone and a blast damaged zone. The blast damaged zone consists of highly fractured pit wall rock exposed on the pit wall face or ravel collected on benches. The blast influenced zone consists of more widely spaced fractures in to the pit wall behind the blast damaged zone that will become progressively

more fractured over time. The blast damaged zone is estimated to extend 0.9 m into the final pit wall, and the blast influenced zone is estimated to extend another 2.9 m into the pit wall. The effective volume of material in a planar unit area of 1 m^2 is increased by a factor 1.41 to account for the average pit wall slope of 45 degrees. Finally, the mass of rock in each unit area is determined by multiplying the effective volume by density as listed in Table 8-6

Table 8-6:
Specific density of mineralization zones

Mineralization Zone	Units	Density
CAP	Tonne/m^3	2.52
SUP	Tonne/m^3	2.60
HYP	Tonne/m^3	2.65

8.4.2 Grain Size Factor

Humidity cells and unsaturated columns contain relatively fine grained particles (<10 mm), hence, material used in humidity cells have a greater surface area to mass ratio than material in the blast damaged zone and blast influenced zone of the pit wall. Estimated grain size correction factors are 20% for the blast damaged zone and 5% for the blast influenced zone.

8.4.3 Flushing Factor

Laboratory kinetic tests are conducted at a relatively high flushing rate compared to field conditions. The high flushing rate ensures that mineral surfaces are in contact with the leachate solution, which prevents oxide weathering products from accumulating (armoring) mineral surfaces. Furthermore, preferential flow paths will develop in the heterogeneous pit wall rock and fracture zones, circumventing a portion of the exposed surface area. To account for these changes, a flushing factor is included in the source term calculation. It is assumed that 75% of rock surfaces on the blast damaged zone are flushed, and 50% of surfaces in the blast influenced zone are flushed while the pit wall is subaerially exposed.

Weathering products and acidity will accumulate on mineral surfaces not flushed by meteoric water. This load will become available in sections of the pit wall which become submerged as the pit lake surfaces rises in elevation. That is to say, that 25% of the rock surface in the blast damaged zone, and 50% of the surface in the blast influenced zone accumulates oxidation products which become available once the pit wall is submerged. Loadings associated with pit wall submergence is discussed further below.

8.5 Predicted Concentrations

The kinetic test data and scaling factors discussed in the previous sections are used to develop loading rates for the various pit wall units. In order to compare the pit wall source term to field bin results and qualitatively assess the results, the predicted loading rates are converted to concentrations. Average annual concentrations are calculated by assuming 368 mm/yr of runoff from the pit wall (Knight Piesold, 2013b).

8.5.1.1 Alkalinity and Major Ions

The upscaling approach used for most parameters is not an appropriate method to predict alkalinity in pit wall runoff. In neutral pH pit wall, alkalinity will be controlled by carbonate equilibrium, which is somewhat independent from other scaling factors. The scaling approach used to calculate pit wall source does not consider these mineral solubility controls, leading to unrealistically high alkalinity values. Rather than invoking geochemical modelling to predict alkalinities imparted from thermodynamic equilibria, the alkalinity for the neutral SUP, neutral HYP and CAP units is set equal to the median values observed in field bins for the corresponding unit.

The screening indicates that the predicted concentrations for sulphate were considerably lower than values observed in field bin leachate for the neutral HYP and SUP. That is, the sulphate concentration predicted for neutral HYP and SUP field bins was less than the minimum sulphate values observed in the respective field bins. Therefore sulphate concentrations are adjusted upwards to fall within the range of concentrations that are observed in SUP and HYP field bins.

Averaging of kinetic tests and importing select field bin results (*i.e.* SO_4 and alkalinity), leads to solutions which are out of charge balance. The concentration of Ca, Mg and Sr were adjusted to re-establish charge balance while these three cations maintain the same ratio within themselves as observed in humidity cell loading rates.

8.5.1.2 Trace Metals

The formation of secondary Al and Fe hydroxides in pH-neutral runoff from the SUP and HYP exposed in the pit walls would be expected to limit concentrations of Al and Fe in these waters. Thus, direct scaling of Al and Fe humidity cell loading rates produced unrealistic source term concentrations. For these metals median concentrations from the field bins were assigned for neutral SUP and neutral HYP source terms.

A number of trace metal were at or below detection limits (DL) in humidity cell cycles used to estimate loading rates. Parameters which were below DL in some or all of the

applied humidity cell results include Hg, Ag, Cr and Tl. For these parameters the median concentrations observed in field bins leachate are applied to pitwall source terms.

There are a number of upscaled trace metal concentrations which are below the 10^{th} percentile of respective field bins. The predicted concentrations of Mo and Mn are less than half of the minimum value observed in field bins for neutral SUP and/or neutral HYP. Therefore the Mo concentration in the neutral SUP and HYP source term is adjusted to median field bin values, and the Mn concentration in neutral SUP is adjusted to median field bin values.

A number of upscaled neutral SUP concentrations were above or below the 90^{th} and 10^{th} percentile, while most predicted values for neutral HYP and CAP pit wall fall within the 90^{th} and 10^{th} percentile of the HYP and CAP field bin results. This can partly be attributed to the relatively scarcity of SUP field bin data. Data exists for 3 HYP field bins and 4 CAP field bins, while only a single SUP field bin exists. Therefore the HYP and CAP field bin data represents drainage from a broader range of material, while the SUP field bin only represents a single SUP sample result which may not be representative in some instances. For example, aqua regia results indicate that Cd, Cu and Se in the SUP field bin (FB5) are twice that of what is typical of SUP waste material (Lorax 2013a and 2013b). Therefore no further adjustments are made to trace metal concentrations in the upscaled neutral SUP sample.

Table 8-7:
Comparison of Pit Wall Runoff Source Terms to Casino Field Bin Results

Upscaled values	**pH**	**Alkalinity**	**SO_4**	**Al**	**Sb**	**As**	**Cd**	**Ca**	**Cr**	**Cu**	**Fe**	**Pb**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**Se**	**Ag**	**Tl**	**U**	**Zn**
Neutral HYP	7.87	501	193	0.501	0.0121	0.0122	0.000428	214	0.0119	0.0343	0.0886	0.000911	22.3	0.147	0.000238	0.04	0.00374	0.00462	0.00035	0.000276	0.0556	0.0451
Neutral SUP	7.12	531	114	0.408	0.0277	0.0159	0.00023	188	0.0117	0.122	0.116	0.000889	16.9	0.0388	0.000234	0.0174	0.00533	0.00535	0.000344	0.000271	0.10	0.0816
CAP	4.70	0.0182	117	1.37	0.000939	0.00106	0.00066	21.7	0.00156	1.77	0.0681	0.000595	3.7	0.278	0.0000262	0.00127	0.00698	0.00194	0.000132	0.000236	0.00217	0.0645
Acidic HYP	3.20	0	1730	173	0.00437	0.0161	0.0194	9.85	0.0509	45.1	119	0.00302	10.2	1.52	0.000117	0.00314	0.226	0.0106	0.00043	0.000487	0.488	3.78
Acidic SUP	3.20	0	628	38.9	0.00215	0.00346	0.0313	16.7	0.00589	47.1	42.2	0.00128	2.26	0.181	0.000108	0.000319	0.034	0.0153	0.000213	0.000215	0.356	3.04
Corrected values	**pH**	**Alkalinity**	**SO_4**	**Al**	**Sb**	**As**	**Cd**	**Ca**	**Cr**	**Cu**	**Fe**	**Pb**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**Se**	**Ag**	**Tl**	**U**	**Zn**
Neutral HYP	7.87	68.1	488	0.005	0.0121	0.0122	0.000428	195	0.001	0.0343	0.03	0.000911	20.4	0.147	0.00003	0.320	0.00374	0.00462	0.00002	0.0001	0.0556	0.0451
Neutral SUP	7.12	38.7	524	0.007	0.0277	0.0159	0.00023	204	0.003	0.122	0.116	0.000889	18.4	0.48	0.00003	0.118	0.00533	0.00535	0.00005	0.0005	0.10	0.0816
CAP	4.70	2.0	117	1.37	0.000939	0.00106	0.00066	33.5	0.00156	1.77	0.0681	0.000595	5.72	0.278	0.0000262	0.00127	0.00698	0.00194	0.000132	0.000236	0.00217	0.0645
Acidic HYP	3.20	0	1730	173	0.00437	0.0161	0.0194	69.1	0.0509	45.1	119	0.00302	71.9	1.52	0.000117	0.00314	0.226	0.0106	0.00043	0.000487	0.488	3.78
Acidic SUP	3.20	0	628	38.9	0.00215	0.00346	0.0313	85.1	0.00589	47.1	42.2	0.00128	11.5	0.181	0.000108	0.000319	0.034	0.0153	0.000213	0.000215	0.356	3.04
Hyp Stats (FB 6-8)	**pH**	**Alkalinity**	**SO_4**	**Al**	**Sb**	**As**	**Cd**	**Ca**	**Cr**	**Cu**	**Fe**	**Pb**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**Se**	**Ag**	**Tl**	**U**	**Zn**
min	6.8	22.3	217	0.0025	0.00162	0.00203	0.00004	50.3	0.00021	0.0102	0.01	0.000054	7.37	0.00015	0.00001	0.0882	0.00141	0.0005	0.00001	0.00001	0.0306	0.0023
10th percentile	7.19	26.9	488	0.00308	0.00428	0.00244	0.000127	104	0.000374	0.0145	0.01	0.000105	11.8	0.000238	0.00001	0.113	0.00245	0.00092	0.00001	2.06E-05	0.0486	0.00324
25th percentile	7.42	43.3	656	0.0042	0.00578	0.00343	0.0003	182	0.0005	0.0225	0.03	0.000481	15.5	0.00072	0.00001	0.153	0.00459	0.00292	0.00002	3.05E-05	0.0714	0.005
Median	7.87	68.1	922	0.005	0.00595	0.00352	0.000355	257	0.001	0.0216	0.03	0.000491	31.4	0.000552	0.00003	0.320	0.00755	0.0033	2.65E-05	0.0001	0.119	0.005
75th percentile	7.88	91.8	1200	0.0069	0.0265	0.00823	0.00269	304	0.0025	0.115	0.03	0.00198	32.7	0.0552	0.00005	0.462	0.0247	0.00936	0.00005	0.0005	0.191	0.0364
90th percentile	8.01	127	1360	0.0256	0.0565	0.0136	0.00298	393	0.00502	0.162	0.0484	0.00736	52.5	0.144	0.00005	0.681	0.0509	0.0313	6.28E-05	0.0005	0.285	0.049
max	8.07	153	1650	0.122	0.0751	0.0172	0.00659	473	0.0076	0.513	0.323	0.0176	72.5	0.348	0.00005	0.927	0.0716	0.0632	0.011	0.0005	0.432	0.208
SUP Stats (FB-5)[1]	**pH**	**Alkalinity**	**SO_4**	**Al**	**Sb**	**As**	**Cd**	**Ca**	**Cr**	**Cu**	**Fe**	**Pb**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**Se**	**Ag**	**Tl**	**U**	**Zn**
min	6.36	22.1	377	0.0025	0.00466	0.00198	0.0256	42.7	0.0005	0.425	0.03	0.000151	4.39	0.192	0.00005	0.056	0.0081	0.0648	0.000014	0.00037	0.0054	0.0868
10th percentile	6.58	22.2	524	0.00382	0.00545	0.00235	0.0293	78.4	0.0013	0.489	0.03	0.000211	7.47	0.272	0.00005	0.0712	0.0087	0.0945	2.76E-05	0.000409	0.00896	0.11
25th percentile	6.92	22.3	744	0.0058	0.00664	0.00291	0.0348	132	0.0025	0.584	0.03	0.0003	12.1	0.391	0.00005	0.0939	0.00961	0.139	0.000048	0.000468	0.0143	0.145
Median	7.11	38.7	762	0.007	0.00922	0.00404	0.0357	136	0.0025	0.61	0.03	0.00038	12.9	0.483	0.00005	0.118	0.01	0.174	0.00005	0.0005	0.015	0.209
75th percentile	7.12	49.7	829	0.0105	0.0103	0.00549	0.055	161	0.0028	0.915	0.03	0.00116	18.3	0.945	0.00005	0.168	0.0106	0.191	0.00005	0.000503	0.0177	0.217
90th Percentile	7.29	70	938	0.233	0.0113	0.00598	0.0625	187	0.0061	2.37	0.161	0.00289	20.4	0.965	0.00005	0.182	0.0122	0.225	0.00005	0.000507	0.0325	0.29
max	7.4	83.5	1010	0.382	0.012	0.0063	0.0675	204	0.0083	3.34	0.248	0.00405	21.8	0.978	0.00005	0.192	0.0133	0.248	0.00005	0.00051	0.0423	0.339
CAP Stats (FB 1-4)	**pH**	**Alkalinity**	**SO_4**	**Al**	**Sb**	**As**	**Cd**	**Ca**	**Cr**	**Cu**	**Fe**	**Pb**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**Se**	**Ag**	**Tl**	**U**	**Zn**
min	3.87	1.0	28.6	0.01	0.0005	0.00033	0.00002	0.58	0.00013	0.0171	0.01	0.00005	0.1	0.00265	0.0000031	0.000293	0.0005	0.0027	0.00001	0.000023	0.000017	0.0016
10th percentile	4.05	1.0	45.6	0.0273	0.00067	0.000486	3.68E-05	1.05	0.0005	0.0365	0.03	0.00005	0.262	0.00436	0.00001	0.000993	0.000764	0.00318	0.00001	0.000036	0.000049	0.0046
25th percentile	4.32	2.0	60.3	0.211	0.000925	0.00078	0.000216	2.67	0.000735	0.0706	0.0545	0.000165	1.0	0.0245	0.00001	0.00495	0.00115	0.00369	0.000023	0.0001	0.0002	0.00745
Median	4.13	2.0	162	15.5	0.00093	0.00392	0.000792	7.99	0.0194	0.774	0.319	0.000378	2.55	0.42	0.00001	0.0482	0.0156	0.00927	0.000028	0.000195	0.00218	0.23
75th percentile	6.77	7.5	347	3.58	0.00356	0.00521	0.000779	13.3	0.0099	0.71	0.641	0.00358	4.57	0.245	0.00005	0.212	0.0109	0.0185	0.00123	0.000288	0.00297	0.103
90th percentile	7.03	20.9	419	28.3	0.00833	0.0139	0.00144	14.5	0.0456	1.57	2.19	0.0224	7.15	0.504	0.000086	0.615	0.0231	0.0409	0.00393	0.0008	0.00556	0.316
max	8	77.7	729	97	0.0212	0.0267	0.00416	25.2	0.109	2.91	8.58	0.253	11.3	1.53	0.000278	2.0	0.0689	0.180	0.0178	0.00215	0.011	0.825

Red Highlight = Predicted concentration greater than maximum of BC copper porphyry deposits in the corresponding pH range.
Blue Highlight = Predicted concentration less than median of the BC copper porphyry deposits in the corresponding pH range.
Amber Highlight = Concentrations are adjusted based on comparison.
[1]Only water quality measurements with pH values greater than 6 are considered in statistics of FB-5.

8.5.2 Pit Wall Runoff Source Term

The five pit wall source terms are presented in Table 8-8. The table highlights the predicted concentrations that exceed metal mining effluent regulation (MMER). The source terms are converted to annual loads assuming 368 mm/yr of runoff as presented in Table 8-9 for each horizontal planar unit area of pit wall. Acidity in pit wall runoff is calculated based on pH and dissolved Fe, Mn and Al (Kirby and Cravotta, 2005).

Table 8-8:
Casino pit wall runoff source term concentrations and water quality guidelines

		HYP	SUP	CAP	HYP	SUP	MMER		
		Neutral	Neutral	-	Acidic	Acidic	MMM	MCS	MGS
pH	s.u.	7.87	7.12	4.7	3.2	3.2			
Sulphate	mg/L	488	524	117	1730	628			
Alkalinity	mg$CaCO_3$/L	68.1	38.7	2	0	0			
Acidity	mg$CaCO_3$/L	0.376	1.23	9.27	1310	361			
Cl	mg/L	4.99	4.91	0.975	11.7	2.36			
F	mg/L	1.95	4.66	0.317	3.25	2.47			
Ag	mg/L	0.00002	0.00005	0.000132	0.00043	0.000213			
Al	mg/L	0.005	0.007	1.37	173	38.9			
As	mg/L	0.0122	0.0159	0.00106	0.0161	0.00346	0.5	0.75	1
Sb	mg/L	0.0121	0.0277	0.000939	0.00437	0.00215			
Ba	mg/L	0.205	0.441	0.116	0.0535	0.00907			
Cd	mg/L	0.000428	0.00023	0.00066	0.0194	0.0313			
Ca	mg/L	195	204	33.5	69.1	85.1			
Cr	mg/L	0.001	0.0028	0.00156	0.0509	0.00589			
Co	mg/L	0.00248	0.00724	0.0218	0.403	0.0941			
Cu	mg/L	0.03	0.122	1.77	45.1	47.1	0.3	0.45	0.6
Fe	mg/L	0.03	0.116	0.0681	119	42.2			
Pb	mg/L	0.000911	0.000889	0.000595	0.00302	0.00128	0.2	0.3	0.4
Mg	mg/L	20.4	18.4	5.72	71.9	11.5			
Mn	mg/L	0.147	0.483	0.278	1.52	0.181			
Hg	ug/L	0.00003	0.00005	2.62E-05	0.000117	0.000108			
Mo	mg/L	0.32	0.118	0.00127	0.00314	0.000319			
Ni	mg/L	0.00374	0.00533	0.00698	0.226	0.034	0.5	0.75	1
K	mg/L	15.2	15.2	8.56	2.78	1.33			
Se	mg/L	0.00462	0.00535	0.00194	0.0106	0.0153			
Na	mg/L	1.43	1.47	2.75	0.694	0.471			
Tl	mg/L	0.0001	0.0005	0.000236	0.000487	0.000215			
U	mg/L	0.0556	0.0644	0.00217	0.488	0.356			
Zn	mg/L	0.0451	0.0816	0.0645	3.78	3.04	0.5	0.75	1

Table 8-9:
Casino pit wall source term loading rates

Parameter	Unit	HYP Neutral	SUP Neutral	CAP -	HYP Acidic	SUP Acidic
pH	s.u.	7.87	7.12	4.7	3.2	3.2
Sulphate	mg/m^2/yr	179000	193000	43200	635000	231000
Alkalinity	mg/m^2/yr	25000	14200	736	0	0
Acidity	mg/m^2/yr	138	453	3,410	484,000	133,000
Cl	mg/m^2/yr	1840	1810	359	4300	867
F	mg/m^2/yr	717	1710	117	1200	910
Ag	mg/m^2/yr	0.00736	0.0184	0.0488	0.158	0.0783
Al	mg/m^2/yr	1.84	2.58	503	63700	14300
As	mg/m^2/yr	4.49	5.84	0.39	5.93	1.27
Sb	mg/m^2/yr	4.44	10.2	0.346	1.61	0.792
Ba	mg/m^2/yr	75.3	162	42.8	19.7	3.34
Cd	mg/m^2/yr	0.158	0.0845	0.243	7.15	11.5
Ca	mg/m^2/yr	71700	75200	12300	25400	31300
Cr	mg/m^2/yr	0.368	1.03	0.573	18.7	2.17
Co	mg/m^2/yr	0.912	2.66	8.03	148	34.6
Cu	mg/m^2/yr	12.6	44.7	653	16600	17400
Fe	mg/m^2/yr	11	42.6	25.1	43800	15500
Pb	mg/m^2/yr	0.335	0.327	0.219	1.11	0.47
Mg	mg/m^2/yr	7500	6750	2110	26400	4240
Mn	mg/m^2/yr	54.1	178	102	560	66.7
Hg	ug/m^2/yr	0.011	0.0184	0.00963	0.043	0.0396
Mo	mg/m^2/yr	118	43.4	0.469	1.15	0.117
Ni	mg/m^2/yr	1.38	1.96	2.57	83	12.5
K	mg/m^2/yr	5600	5580	3150	1020	488
Se	mg/m^2/yr	1.7	1.97	0.715	3.9	5.64
Na	mg/m^2/yr	526	543	1010	255	173
Tl	mg/m^2/yr	0.0368	0.184	0.087	0.179	0.0792
U	mg/m^2/yr	20.5	23.7	0.8	179	131
Zn	mg/m^2/yr	16.6	30	23.7	1390	1120

Note: Loading units are for exposure of horizontal planar unit area.

8.5.3 Pit Wall Submergence Source Term

While the pit wall is subaerially exposed, it is assumed that 75% of rock surfaces in the blast damaged zone and 50% of the blast fractured zone are flushed by meteoric water. When the pit wall becomes inundated by the pit lake, the blast fractured and blast influenced zone will be entirely flushed and any accumulated oxidation will become available at that time. That is to say, that 25% of the rock surface in the blast damaged zone and 50% of the surface in the blast fractured zone accumulates oxidation products, which only become available once the pit wall is submerged. The mass of metals which accumulate on pit wall surfaces per year is presented in Table 8-10 this load only becomes available once the pit wall is submerged.

Table 8-10:
Available load from sub-aqueous Casino pit wall per year of sub-aerial exposure

Parameter	Unit	HYP Neutral	SUP Neutral	CAP -	HYP Acidic	SUP Acidic
Sulphate	mg/m^2/yr	102000	109000	24500	360000	131000
Acidity	mg/m^2/yr	78.3	257	1930	274000	75300
Cl	mg/m^2/yr	1040	1020	203	2440	491
F	mg/m^2/yr	406	971	66	677	515
Br	mg/m^2/yr	1560	1530	162	731	673
Ag	mg/m^2/yr	0.00417	0.0104	0.0276	0.0895	0.0443
Al	mg/m^2/yr	1.04	1.46	285	36100	8110
As	mg/m^2/yr	2.54	3.31	0.221	3.36	0.72
Sb	mg/m^2/yr	2.51	5.78	0.196	0.911	0.449
Ba	mg/m^2/yr	42.7	91.8	24.3	11.2	1.89
Cd	mg/m^2/yr	0.0893	0.0478	0.138	4.05	6.52
Ca	mg/m^2/yr	40600	42600	6990	14400	17700
Cr	mg/m^2/yr	0.208	0.583	0.324	10.6	1.23
Co	mg/m^2/yr	0.516	1.51	4.55	83.9	19.6
Cu	mg/m^2/yr	7.15	25.3	370	9390	9830
Fe	mg/m^2/yr	6.25	24.2	14.2	24800	8800
Pb	mg/m^2/yr	0.19	0.185	0.124	0.63	0.266
Mg	mg/m^2/yr	4250	3820	1190	15000	2400
Mn	mg/m^2/yr	30.6	101	57.9	317	37.8
Hg	ug/m^2/yr	0.00625	0.0104	0.00545	0.0244	0.0224
Mo	mg/m^2/yr	66.7	24.6	0.265	0.654	0.0665
Ni	mg/m^2/yr	0.78	1.11	1.46	47	7.09
K	mg/m^2/yr	3170	3160	1780	580	276
Se	mg/m^2/yr	0.964	1.12	0.405	2.21	3.19
Na	mg/m^2/yr	298	307	573	145	98.2
Tl	mg/m^2/yr	0.0208	0.104	0.0493	0.102	0.0449
U	mg/m^2/yr	11.6	13.4	0.453	102	74.3
Zn	mg/m^2/yr	9.4	17	13.4	788	634

Note: Loading units are for exposure of horizontal planar unit area.
[1]See section 6.0 for description of saturated pit wall alkalinity.

Note that acidities but not alkalinities are associated with the sub-aqueous load presented in Table 8-10. Pit wall acidity is by and large stored in sulphide mineralization, which is released during oxidation. Acidity can then be stored on mineral surfaces in acidic oxide minerals (*i.e.* jarosite and alunite). This acidity stored in oxide minerals will be released upon pit wall submergence. Once the pit wall becomes submerged, oxidation and associated acidity release from primary sulphide minerals will largely be inhibited.

Alkalinities are not considered in Table 8-10. Unlike acidity and metals, alkalinity will not accumulate on mineral surfaces, hence, a stored alkalinity load cannot be calculated as per the method used to develop Table 8-10. Alkalinity associated with pit wall rock is stored in carbonate minerals and associated NP available on the wall rock surfaces. During subaerially exposure pit wall NP will be consumed in response to acid production. The time dependence of NP in submerged wall rock is discussed with lag time until acid generation of HYP and SUP exposed in the pit wall in the following section.

8.6 Lag Time

In this section, lag times of NP depletion rates for neutral HYP and SUP pit wall are considered. This has implications for the amount of NP that will be available from submerged sections of pit wall, and proportion of pit wall that is assigned an acidic source term. The Casino ABA dataset indicates that the HYP and SUP mineralization zones are predominately PAG. However, many of these PAG rocks will remain non-acidic for decades to centuries until the NP is depleted and acidic conditions develop. If HYP and SUP pit walls are saturated while available NP remains, the remaining NP will contribute to alkalinity in the pit lake.

8.6.1 Rate of NP Consumption

The acid generation rate of neutral HYP and SUP is calculated based on representative humidity cells as described in sections 8.2. Temperature correction factors to the acid generation rate are applied, as described in section 8.3. The NP consumption rate is calculated multiplying the acid generation rate by the carbonate molar ratio (CMR) observed in humidity cells. The CMR represents the amount of NP which is consumed by every unit of AP generated. Theoretically, a CMR can range from 1 to 2. CMR's measured above 2 are often the result of laboratory artefacts such as DI water leaching of carbonate minerals dominating NP depletion in humidity cells with relatively low rates of acid generation (Mattson, 2005). Therefore any CMR measured to above 2, has been set to a maximum value of 2.0. Input parameters for calculating the NP consumption rate for HYP and SUP pit wall are provided in Table 8-11.

Table 8-11:
Inputs used to calculate neutralization potential (NP) consumption rate of HYP and SUP pit wall

Input	Unit	HYP	SUP
HC SO_4 leaching rate[1]	mg/kg/week	7.5	4.5
Acid Generation Rate	kg$CaCO_3$/tonne/week	0.0072	0.0043
Temp Corrected Acid Generation Rate[2]	kg$CaCO_3$/tonne/year	0.19	0.11
CMR	ratio	1.8	2
NP Consumption Rate	kg$CaCO_3$/tonne/year	0.16	0.11

[1]Sulphate leaching rate is based on results from HC11 for SUP, and HC8, *etc*. for HYP. HYP humidity cells weighted based on sulphur content and wall rock exposures, as described in section 8.2.
[2] Assumes that pit wall is frozen for half of the year, and weathers at a temperature of 7.7°C when temperatures are above freezing (section 8.3).

8.6.2 Time until Acid Generation

The time required to deplete the NP in the SUP and HYP pit wall will vary depending on the amount of NP in any given section of pit wall. The time required to deplete NP is estimated by applying a constant NP consumption rate (Table 8-11) to the cumulative percent frequency of CaNP (Figure 8-5). Note that not all of HYP or SUP pit wall is potentially acid generating.

The variability of NP in the SUP and HYP mineralization zones is illustrated in Figure 8-5, which plots the cumulative percent of CaNP. A portion of the total CaNP can be expected to be unavailable. Unavailable NP represents measured NP that is ineffective at buffering the pH to a neutral value. The amount of NP that is unavailable for acid buffering was determined by comparing the paste pH and CaNP as measured in the Casino ABA dataset. Remaining NP in measured samples with a paste pH equal to or less than 6.0 is assumed to be unavailable. Based on the existing ABA database, 3.7 kg$CaCO_3$/tonne and 2.4 kg$CaCO_3$/tonne of the measured CaNP is unavailable in the HYP and SUP mineralization zones, respectively (Lorax, 2013a). By subtracting the unavailable NP, and applying the constant NP consumption rate presented in Table 8-11 an estimate of time until NP depletion was developed (Figure 8-6).

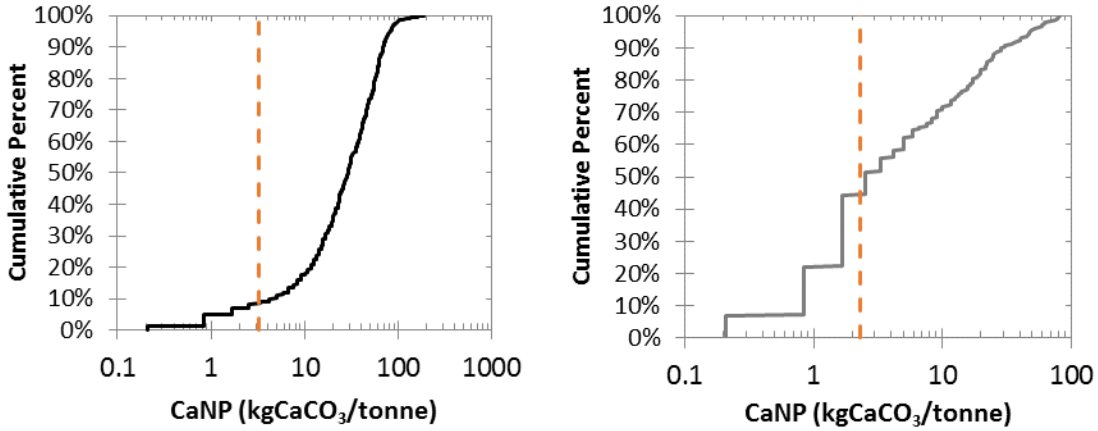


Figure 8-5: Cumulative percent frequency of CaNP for HYP (left) and SUP (right) pit wall rock. Red dotted line indicates unavailable CaNP

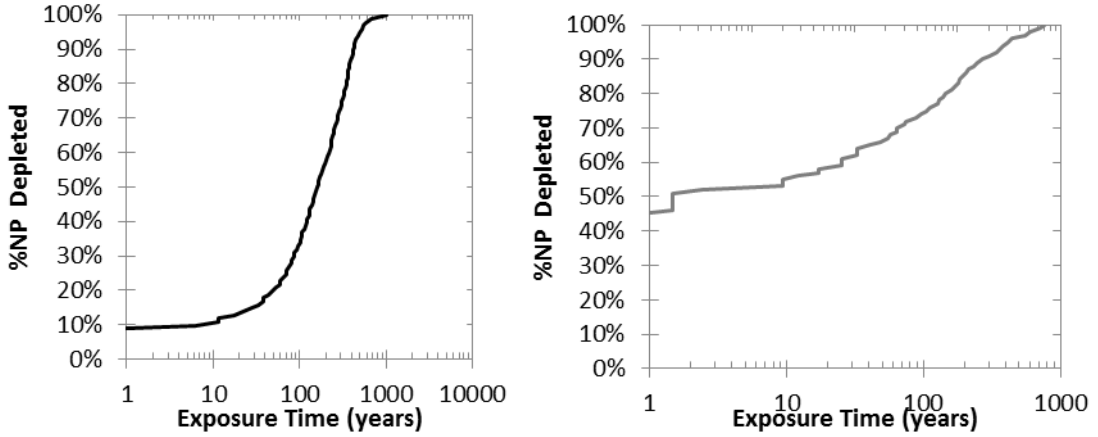


Figure 8-6: Exposure time versus percent of NP depleted HYP (left) and SUP (right) on pit wall

Note that it may take 100's to 1000's of years for portions of the pit wall to become acid generating. Over these extended time periods, the application of NP consumption rates and AP production rates measured in relatively short term humidity cell experiments becomes increasingly tenuous. The rate of NP depletion from the pit wall is plotted with for a 200 year time frame in Figure 8-7 and Figure 8-8 with the corresponding algorithms. The algorithms that are calculated from these relationships can be used to calculate the proportion of acidic HYP and SUP pit walls as the pit wall ages. Note that approximately 45% of SUP and 8% of HYP have little or no NP, hence, a portion of the HYP and SUP are acidic in year 1.

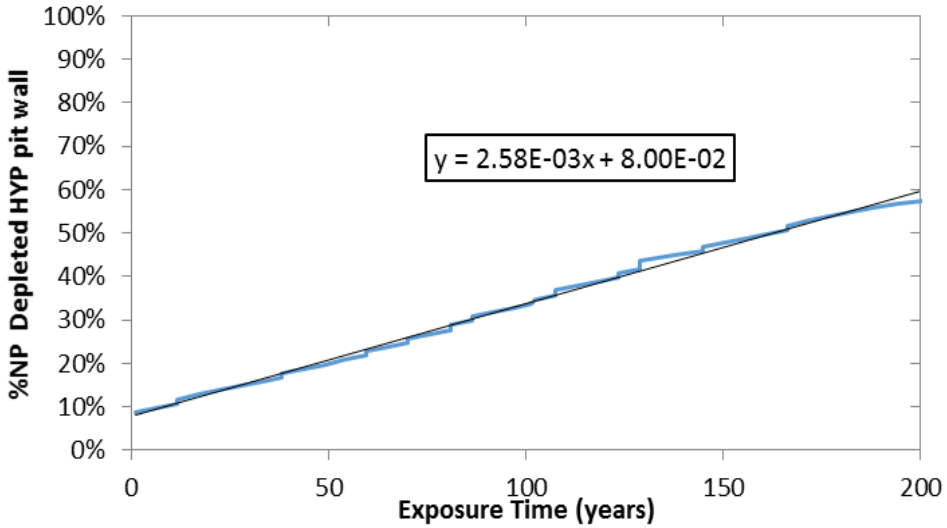


Figure 8-7: Rate that HYP wall rock becomes depleted in NP as a function of exposure time

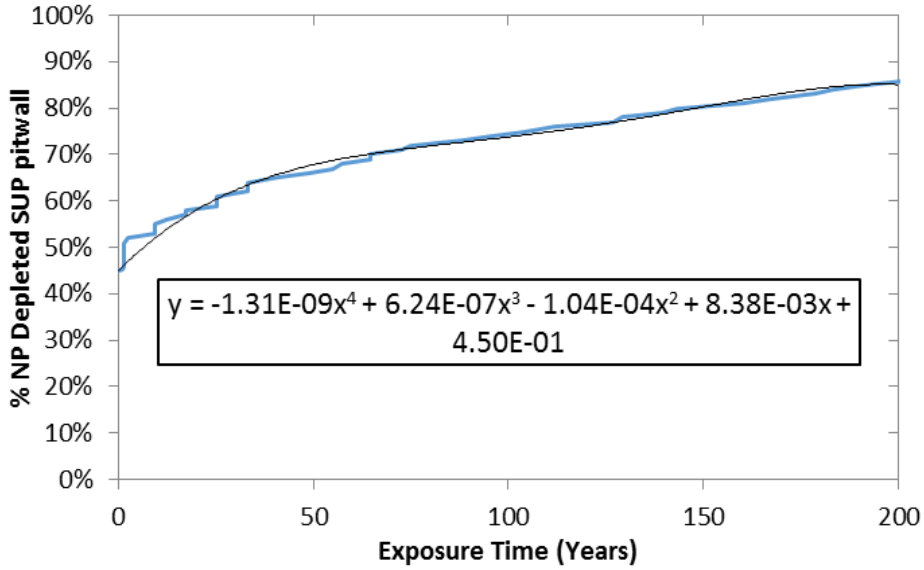


Figure 8-8: Rate that SUP wall rock becomes depleted in NP as a function of exposure time

8.6.3 Subaqueous NP Availability

Submergence of neutral HYP and SUP pit wall will make available some of the remaining carbonate mineral NP to the pit lake, providing a subaqueous source of alkalinity. Unlike submerged loading of other parameters, alkalinity will not be stored in oxides that accumulate on the pit wall. The amount of alkalinity contained in carbonate minerals on the pit wall that is available on the submerged sections of the pit wall depends on the quantity consumed to buffer acid generation while subaerially exposed.

The quantity of available NP is calculated by assuming that the remaining NP in the <1/4" grain size fraction in the blast damaged zone and blast fractured zone is available once submerged. For example, when the SUP pit wall is initially exposed, 55% of the wall rock has available NP and will be at a neutral pH. The mean available NP in this 55% of pit wall is 32 kg$CaCO_3$/tonne after one year of exposure. As per assumptions in Table 8-5, there is 1.2 tonnes of < ¼" material present per planar m^2 of pit wall. The product of these two values results in an estimate of 38 kg of NP available per m^2 of pit wall that is submerged in the first year of exposure. After 40 years of weathering, the proportion of SUP pit wall that has remaining NP has declined to 40% ((Figure 8-10). The mean available NP in the 40% of pit wall that is neutral is 31 kg $CaCO_3$/tonne (37 kg $CaCO_3/m^2$). Note that although this is a relatively small change in available NP, the amount of pit wall that it applies to have been reduced (Figure 8-8). The amount of remaining NP that will be available in submerged sections of neutral HYP and SUP wall rock is plotted against time in Figure 8-9 and Figure 8-10, respectively.

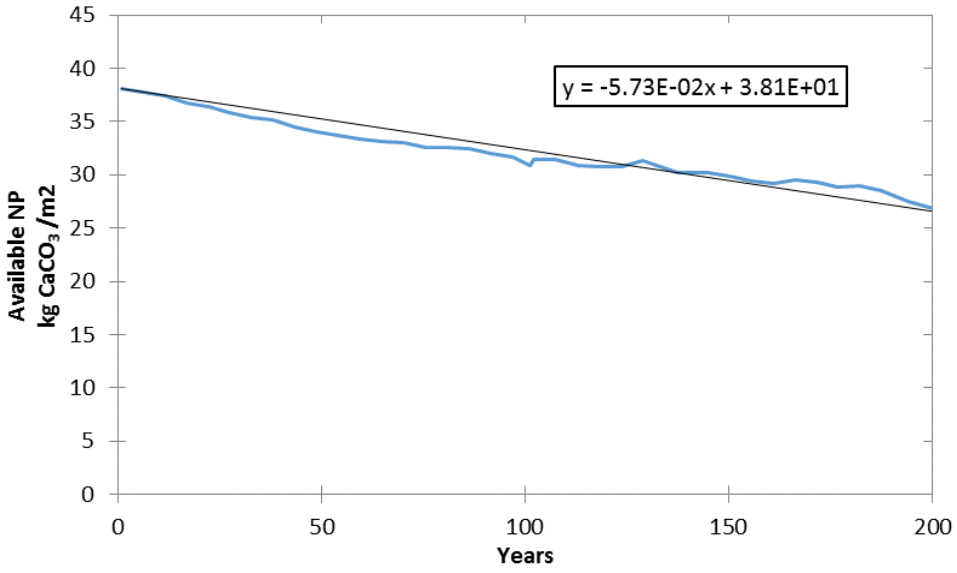


Figure 8-9: Amount of NP that will be available in neutral HYP wall rock as a function of exposure time

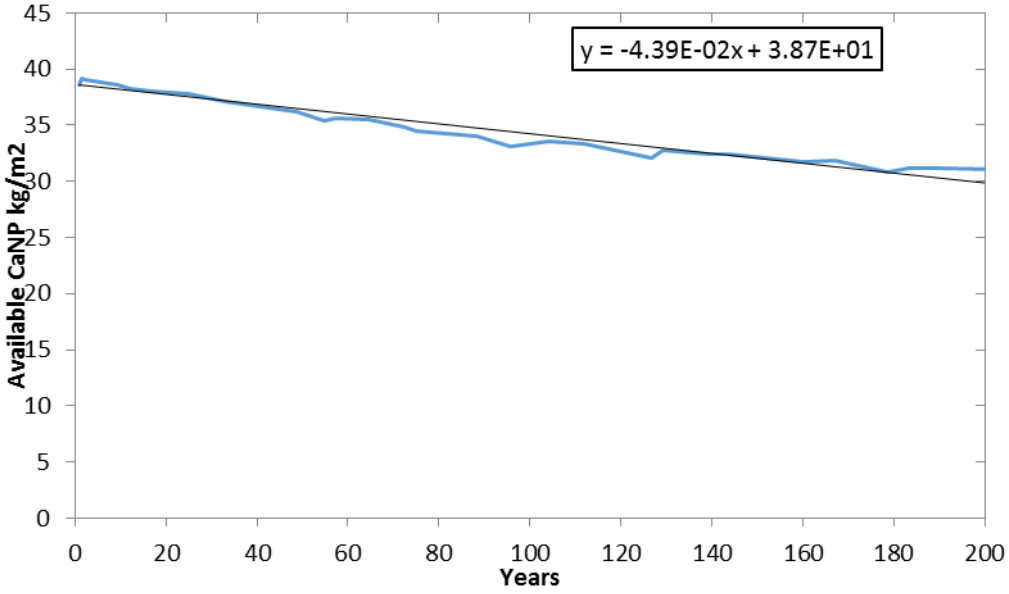


Figure 8-10: Amount of NP that will be available in neutral SUP wall rock as a function of exposure time

9. Summary

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9. Summary

The majority of rock that will be excavated at the Casino minesite is considered PAG and/or has a high ML potential. Accordingly, management of mine waste has been designed to mitigate the intrinsic ARD/ML potential of these rock types and improve the water quality of discharge from all facilities during operations and closure.

Mine plans in-place provide adequate mitigation to ensure neutral drainage from mine waste facilities at closure, although a few facilities are expected to produce acidic to mildly acidic drainage that will require management during mine operations. Acidic drainage is predicted for ore stockpiles containing SUP ore. Mildly acidic drainage is expected from the gold ore stockpile, and from waste rock stored in the TMF early in mine life before significant quantities of HYP waste rock are produced. Tailings are not predicted to have acid generating potential as the sulphide will be removed from the bulk rougher tailings and tailings sands used to construct the embankment. The pyrite concentrate produced from the sulphide removal process will be deposited into the centre of the TMF beneath the TMF pond to prevent ARD. Upon mine closure the ore stockpiles will be milled and the TMF waste rock will be saturated. Hence, none of these mine waste facilities at the Casino mine site are expected to produce ARD after mine closure has occurred. The only source of continued acid generation upon mine closure is from portions of the sub-aerially exposed pit wall.

A list of the facilities, number of source terms, and chapters in which they are located is provided in Table 9-1. A summary of the predicted geochemical source terms for each of the mine facilities is provided below.

9.1 Ore Stockpiles

A total of six ore stockpiles will be operated during the life of the mine. The ore placed in each pile will be segregated to include only rock from one of the major mineralization zones (Oxide CAP, Supergene or Hypogene) as listed in Table 9-1. A summary of the drainage chemistry predicted for each of the facilities is listed below.

9.1.1 HYP LGO Stockpile

The HYP LGO stockpile is the largest ore stockpile planned for the minesite, and will consist exclusively of HYP low grade ore. The HYP ore contains sulphide mineralization and is considered PAG. However, this unit has a relatively high NP (approx. 27 kgCaCO3/tonne) and is predicted to have a lag time of several decades to centuries before it becomes acid generating. As such, drainage from this stockpile is predicted to

remain neutral during mine life. Metal leaching from this pile is predicted to be significantly lower than the other ore stockpiles. Possible parameters of concern include Mo, Se, U and Zn.

9.1.2 SUS LGO, SOX LGO, SUP Ore, and Marginal Ore Stockpiles

Supergene ore will be placed in the SUP ore, SUS LGO, SOX LGO and Marginal Ore stockpiles. The SUP zone contains sulphide mineralization and relatively low *in-situ* pH of 6.1. A portion of the SUP ore is deplete in NP and will produce acidic drainage immediately. Given the low NP and the presence of acidic in-situ ore, these stockpiles are predicted to produce ARD during mine life. Metal leaching from these piles are expected to be considerably higher than from the other ore stockpiles, with parameters of concern including As, Cd, Cu, Ni, Se and Zn. In order to manage any acidic drainage generated from SUP ore, SUP ore will be segregated from other rock types (*i.e.* HYP). This will reduce the footprint and drainage volume from PAG ore stockpiles that will need to be managed. At the end of mine life all ore stockpiles will be processed and disposed of as tailings.

9.1.3 Gold Ore Stockpile

The Gold Ore Stockpile will contain oxide CAP ore, which is a highly weathered unit deplete in most sulphide and carbonate minerals. The geochemical characterization indicated that the oxide ore has a mildly acidic *in-situ* pH of 4.7. Thus, the Gold Ore Stockpile is predicted to produce mildly acidic drainage during mine life with some metal leaching potential. Specifically, the Gold Ore Stockpile is predicted to release significant levels of Cu and Zn. Notably, acidity concentration in Gold Ore Stockpile drainage is predicted to be orders of magnitude lower than other acidic stockpiles owing to the intermediate pH and absence of sulphide minerals.

9.2 Heap Leach Facility

Gold ore will be mixed with lime when placed in the HLF as required for cyanide gold leaching. This lime addition will neutralize water soluble acidity associated with CAP ore. Thus, the drainage from the HLF is predicted to be pH-neutral. During rinsing and drain-down the HLF drainage water is expected to contain significant levels of CN and Cu. The presence of CN is also expected to maintain elevated concentrations of other metals that complex with CN including Ag, Cd, Cu, Co, Fe, Hg and Zn. Post drain-down, following the detoxification of CN, concentrations of these metals are expected to decline.

9.3 Casino TMF Facility

9.3.1 Unsaturated Waste Rock

Waste rock placed in the TMF will remain unsaturated for an average of three years prior to being flooded by the rising water table in the TMF. In the early years of mine life (year -3 to year 4) waste rock mined from the Casino pit will predominantly be composed of CAP rock. Oxide CAP waste rock will produce a mildly acidic drainage pH (pH 4.7) and metal leaching characteristics similar to the Gold Ore stockpile. Between year 5 and 14, similar quantities of HYP, SUP and CAP waste rock will be produced. Hypogene waste rock has sufficient NP to remain neutral during the relatively brief exposure time period. However, a portion of the SUP has little or no NP and may become acidic. To mitigate this, supergene waste rock will be mixed with hypogene waste rock in the TMF. During this time period metals associated with HYP and SUP waste rock will increase in concentration (*i.e.*, SO_4, Cd, U, Zn). Potential parameters of concern include Cu, Cd, Se, Ni, U and Zn. In the final years of active mine life (year 15 to 19), waste rock production will be dominated by HYP. Hypogene waste rock is expected to produce neutral pH drainage and have metal leaching characteristics similar to the HYP LGO stockpile.

At the end of mine life all waste rock in the TMF will be submerged beneath the TMF pond to prevent sulphide oxidation and associated metal leaching from Casino waste rock. Finally, a layer of depyritized (NAG) tailings will be placed over the waste rock.

9.3.2 Saturated Waste Rock

All waste rock produced at the Casino mine will be placed in the TMF and fully saturated at the end of mine life. This will inhibit sulphide oxidation preventing further release of metals and acidity associated with the sulphide mine waste. Long-term drainage chemistry from saturated mine waste is expected to be better than unsaturated rock piles, however, drainage from the saturated TMF will not be entirely benign due to the abundance of water soluble weathering products associated with CAP and SUP mineralization zones.

Oxide waste rock kinetic tests have indicated that the metal leaching potential for oxide waste rock is reduced under saturated conditions (Lorax 2013b). This is attributed to upper limits on metal concentrations due to secondary mineral solubility and kinetic controls, limited water flux rates and the inhibition of sulphide oxidation under sub-aqueous conditions from trace quantities of pyrite. Under saturated conditions some metal leaching will continue, albeit at reduced rates, owing to the presence of oxide minerals and the mildly acidic pH.

Subaqueous disposal of PAG supergene waste rock in the TMF will prevent further acid generation by inhibiting sulphide oxidation. A portion of SUP waste rock is expected to have little or no available NP, and may become acidic prior to sub-aqueous disposal. Similar to the oxide CAP waste rock, SUP waste rock contains water soluble oxide minerals which may continue to release metals and acidity under saturated conditions, albeit at a reduced rate compared to an unsaturated pile.

Under saturated conditions the hypogene waste rock is predicted to have low leaching rates of most metals compared to either oxide or supergene waste rock. The majority of hypogene waste rock will be mined in the final years (year 15-19) of mine life. As such, it will form a cap of carbonate-containing material over the SUP and CAP waste rock in the TMF. A majority of seepage through the waste rock zone will move upwards, interacting with the carbonates contained in the hypogene material before seeping into the pond. This will ensure that any acidity associated with SUP waste rock in the TMF will be neutralized prior to discharge into the TMF pond.

Potential parameters of concern from saturated waste rock include SO_4, Cu, Fe, Mn, Mo, Se, Cd and U. Concentrations of Mn and Fe are predicted to be high in TMF seepage owing to the reducing conditions expected in TMF porewater. Once porewater seeps from the TMF and discharges to surface waters, it will come into contact with the atmosphere and/or mix with oxygenated water. Under these conditions, dissolved Fe and Mn will oxidize and precipitate from solution.

9.3.3 Saturated Tailings

The majority of the tailings that are disposed of in the upstream section of the TMF will remain permanently saturated. PAG tailings and pyrite concentrate will be deposited into the centre of the impoundment beneath the TMF pond to prevent ARD. Saturated column testwork indicates that metal leaching is minimal from saturated pyrite concentrate and PAG tailings. At the end of mine life, a layer of depyritized (NAG) tailings produced from HYP LGO will be placed as a cover over the PAG tailings and pyrite concentrate. Tailings porewater concentrations from the saturated portion of the TMF reflect the low metal leaching potential from all forms of sub-aqueous tailings due to the stability of sulphide minerals in a saturated condition. Saturated source terms from both the PAG and NAG tailings are predicted to be pH-neutral with relatively low metal concentrations. Potential parameters of concern from saturated tailings include SO_4, Mo, Fe, Mn, Cd, Cu and Zn. Similar to flows from saturated waste rock, Fe and Mn can be expected to oxidize and precipitate when seepage from saturated tailings interacts with oxygenated surface waters.

9.3.4 Tailings Beach and Embankment

Tailings beaches will be exposed during the operation of the tailings facility. In addition, de-pyritized cyclone tailings sands will be required to construct the embankment which will remain unsaturated in perpetuity. To mitigate the potential for ARD from these structures, a pyrite rougher circuit will be operated to produce a stream of de-pyritized tailings for embankment and beach construction.

Depyritized tailings produced from SUP ore has a higher metal leaching potential under unsaturated conditions compared to depyritized HYP tailings. To minimize the final surface exposure of supergene tailings, ore processing will be staged at the end of mine life so that SUP LGO piles are processed before HYP LGO stockpile material. This will ensure that the final surface layer of tailings is composed primarily of the less reactive HYP tailings.

Source terms from both the beach and embankment are predicted to be pH-neutral during operations and closure. With the exception of U, metal leaching rates are predicted to be lower during closure than operations due to the greater influence of hypogene. Due to the greater depth of oxidation expected in the tailings embankment, source term concentrations are predicted to be slightly higher than the exposed tailings beach.

9.3.5 Pit Walls

Source terms were developed for the oxide, supergene, and hypogene mineralization zones that will be exposed on the Casino pit wall. Source terms are developed for rinsing of sub-aerial pit wall by precipitation and inundation of exposed pit wall by the pit lake. Both acidic and pH-neutral source terms were developed for pit wall runoff from the HYP and SUP zones in addition to a single mildly acidic oxide CAP source term. The proportion of acidic to pH-neutral loading from the hypogene and supergene units is assigned based on the lag time calculated for the complete depletion of NP from these units. It is predicted that decades to centuries will be required until a majority of the pit wall becomes acid generating.

Source terms for pit wall runoff under acidic conditions are typically more than an order of magnitude greater than pH neutral source terms for potential parameters of concern Ag, Al, Cd, Cu, Fe, and Zn. Due to the relatively long exposure times, metal loads released from the inundation of the pit walls will be a major source of loading to the pit lake.

Table 9-1:
Outline of source terms provided in this report

	Source Terms	Operations	Closure	Chapter
Ore/LGO stockpiles	HYP LGO pile (Hypogene LGO)	x		2
	SUS LGO pile (Supergene LGO)	x		2
	SUP ore stockpile (Supergene MO)	x		2
	SOX LGO pile and (Supergene LGO)	x		2
	Gold ore stockpile (CAP Ore)	x		2
	Supergene ore stockpile (Supergene Ore)	x		2
Mine Pit	Pit Wall Runoff		3 rock types	8
	Saturated Pit Wall		3 rock types	8
	Heap Leach Facility	x	2 time points	4
TMF	Unsaturated waste rock in TMF	3 time points		3
	Embankment Sands	x	x	5
	Tailings Beach	x	x	5
	Process water	x		6
	Seepage from NAG tailings to pond	4 time points	x	7
	Seepage from PAG tailings to pond	4 time points	x	7
	Seepage from Saturated waste rock to pond	4 time points	x	7
	Seepage from saturated TMF to Foundation	4 time points	X	7
	Seepage from saturated TMF to Embankment	4 time points	x	7

10. Report Limitations

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10. Report Limitations

This report was prepared for the exclusive use of Casino Mining Corporation and its consultants in accordance with the rationale and study objectives described in Chapter 1 of this report. The Yukon Environmental and Socio-economic Assessment Board and other government agencies involved with reviewing the application may also rely upon this report; any other use or reliance on this report by any third party is at that party's sole risk. The authors accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Respectfully submitted,

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Original Signed

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Appendices

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Appendix A
PHREEQC Models

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#Gold Ore Stockpile PHREEQC input

```
      SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
          -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr
 Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn

      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891

      phases
      schwertmannite
      Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O

      log_k 10.5   #Yu et al., 1999

      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      SOLUTION 1        GOLD ORE-HYP
          temp      25
            pH    4.7
          pe        10
          redox     pe
          units   mg/L
          density   1.00404

      S(6)  2309.6441
      F     3.6823
      Cl    81.0895
      Ag    0.0028
      Al    5.8315
      As    0.0219
      Ba    2.3659
      Ca    259.1451
      Cd    0.0117
      Co    0.2484
      Cr    0.0352
      Cu    15.1375
      Fe    0.7430
```

```
Hg    0.0005
K     181.7581
Mg    56.2300
Mn    5.6997
Mo    0.2356
Na    627.8091
Ni    0.0743
Pb    0.0273
Sb    0.0335
Se    0.0819
Si    693.0260
Sr    2.5749
Tl    0.0042
U     0.0208
Zn    1.2968
-water    1 # kg
Equilibrium_phases
Al4(OH)10SO4      0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Gypsum      0     0
schwertmannite    0     0
CO2(g)      -3.2
fix_pe      -10   O2(g)
fix_pH      -4.7  HCl
end
```

```
#HYP LGO stockpile PHREEQC input
SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
          -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu
Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn


      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891

      phases
      schwertmannite
      Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O

      log_k 10.5   #Yu et al., 1999

      SOLUTION 1        HYP LGO stockpile
          temp      25
          pH      7.1900
          pe        10
          redox     pe
          units   mg/L
          density       1.009894
      Alkalinity  83.0210
      S(6)  6888.3122
      F     18.3644
      Cl    37.3342
      Ag    0.0007
      Al    60.2205     Gibbsite
      As    0.0863
      Ba    0.7727
      Ca    2710.1940
      Cd    0.0093
      Co    0.0520
      Cr    0.0137
      Cu    23.6303
      Fe    18.4091     Fe(OH)3(a)
```

```
Hg    0.0006
K     51.2502
Mg    96.6221
Mn    4.1536
Mo    2.4793
Na    14.1996
Ni    0.0709
Pb    0.0024
Sb    0.2760
Se    0.0243
Si    52.2014
Sr    13.6327
Tl    0.0005
U     0.4937
Zn    0.5684
-water    1 # kg
Equilibrium_phases
Gibbsite    0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
Fe(OH)3(a)  0     0
Fluorite    0     0
gypsum      0     0
tenorite    0     0
calcite     0     0
Manganite   0     0
CO2(g)      -3.2
fix_pe      -10   O2(g)
fix_pH      -7.19 NaOH
```

#Marginal Ore Stockpile PHREEQC input

```
SELECTED_OUTPUT
    -file                 selected.out
    -solution             true
    -ph                   true
    -pe                   true
      -water                true
    -temperature          true
    -alkalinity           true
    -charge_balance       true
    -percent_error        true
    -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn

phases
Fe(OH)3(a)
Fe(OH)3 + 3H+ = Fe+3 + 3H2O
log_k           4.891

phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O

log_k 10.5   #Yu et al., 1999

phases
fix_pe
e-=e-
log_k     0

phases
fix_pH
H+=H+
log_k     0

SOLUTION 2        Marginal Ore Stockpile
    temp      25
    pH      3.2
    pe        10
    redox     pe
    units   mg/L
    density   1.003231

S(6)  1585.8666
F     6.2494
Cl    2.9759
Ag    0.0005
Al    98.3775
As    0.0087
Ba    0.0229
Ca    211.3373
Cd    0.0790
Co    0.2379
Cr    0.0149
Cu    119.1320
Fe    106.7100
```

```
Hg    0.000136
K     3.3487
Mg    28.5894
Mn    0.4583
Mo    0.0008
Na    1.1904
Ni    0.0860
Pb    0.0032
Sb    0.0027
Se    0.0387
Si    21.5033
Sr    1.2065
Tl    0.0003
U     0.9004
Zn    7.6874
-water    1 # kg
Equilibrium_phases
Barite      0     0
Celestite   0     0
Chalcedony  0     0
schwertmannite    0     0
Fluorite    0     0
Gypsum      0     0
Malachite   0     0
Alunite     0     0
CO2(g)      -3.2
fix_pe      -10   O2(g)
fix_pH      -3.2  NaOH

end
```

```
#SOX LGO stockpile PHREEQC input
SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
            -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn



      phases
      schwertmannite
      Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O

      log_k 10.5   #Yu et al., 1999

      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891

      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0
      end

      SOLUTION 1        SOX LGO Stockpile
          temp      25
      pH    3.2
          pe        10
          redox     pe
          units   mg/L
          density   1.00187

      S(6)  1298.0971
      F     14.4707
      Cl    9.4337
      Ag    0.000495
      Al    70.5616
      As    0.0270
      Ba    0.4808
      Ca    176.7882
      Cd    0.0719
      Co    0.2008
      Cr    0.0120
```

```
Cu    85.9982
Fe    76.4929
Hg    0.000235
K     14.1941
Mg    50.0307
Mn    2.3797
Mo    1.7402
Na    2.4600
Ni    0.0675
Pb    0.0024
Sb    0.0728
Se    0.0288
Si    41.6428
Sr    0.5324
Tl    0.000549
U     0.6457
Zn    5.5706
-water    1 # kg
Equilibrium_phases
Barite      0     0
Celestite   0     0
Chalcedony  0     0
schwertmannite    0     0
Fluorite    0     0
Gypsum      0     0
Alunite     0     0
CO2(g)      -3.2
fix_pe      -10   O2(g)
fix_pH      -3.2  NaOH
End
```

```
#Supergene ore stockpile PHREEQC input
SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
            -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn


      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891

      phases
      schwertmannite
      Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O

      log_k 10.5   #Yu et al., 1999

      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      SOLUTION 1        SUP Ore Stockpile
          temp      25
          pH      3.2
          pe        10
          redox     pe
          units   mg/L
          density   1.003231

      S(6)  1779.0504
      F     23.8325
      Cl    15.9213
      Ag    0.0007
      Al    92.4443
      As    0.0454
      Ba    0.8565
      Ca    278.8647
      Cd    0.1017
      Co    0.2778
      Cr    0.0164
      Cu    112.9367
      Fe    100.1929
```

```
Hg    0.000375
K     24.3505
Mg    80.8969
Mn    4.1185
Mo    3.1288
Na    4.0067
Ni    0.0913
Pb    0.0032
Sb    0.1299
Se    0.0383
Si    67.3521
Sr    0.8037
Tl    0.0009
U     0.8458
Zn    7.3258
-water    1 # kg
Equilibrium_phases
Barite      0     0
Celestite   0     0
Chalcedony  0     0
schwertmannite    0     0
Fluorite    0     0
Gypsum      0     0
Malachite   0     0
Alunite     0     0
CO2(g)      -3.2
fix_pe      -10   O2(g)
fix_pH      -3.2  NaOH

end
```

#SUS LGO stockpile PHREEQC input

```
      SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
          -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn


      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0


      phases
      schwertmannite
      Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
      log_k 10.5   #Yu et al., 1999



      SOLUTION 1  SUS LGO Stockpile
          temp      25
          pH      3.20
          pe        10
          redox     pe
          units   mg/L
          density   1.0032

      S(6)  2219.9237
      F     24.7468
      Cl    16.1330
      Ag    0.000847
      Al    120.6700
      As    0.0461
      Ba    0.8222
      Ca    302.3308
      Cd    0.1230
      Co    0.3434
      Cr    0.0206
      Cu    147.0687
      Fe    130.8133
      Hg    0.0004
      K     24.2738
```

```
Mg    85.5590
Mn    4.0696
Mo    2.9760
Na    4.2070
Ni    0.1155
Pb    0.00411
Sb    0.1244
Se    0.0493
Si    71.2150
Sr    0.9105
Tl    0.00094
U     1.1042
Zn    9.5265
-water    1 # kg

Equilibrium_phases 1
Alunite     0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
schwertmannite    0     0
Fluorite    0     0
Gypsum      0     0
tenorite    0     0
CO2(g)      -3.2
fix_pe      -10   O2(g)
fix_pH      -3.20 NaOH
end
```

#Unsaturated Waste Rock Year -3 to 4

```
SELECTED_OUTPUT
          -file                  selected.out

          -solution              true
          -ph                    true
          -pe                    true
        -water                 true
          -temperature           true
          -alkalinity            true
          -charge_balance        true
          -percent_error         true
          -totals                      S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn


      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0


      phases
      schwertmannite
      Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O

      log_k 10.5   #Yu et al., 1999



      SOLUTION 1        Unsaturated Waste Rock Year -3 to 4
          temp      25
      pH    4.7
          pe        10
          redox     pe
          units   mg/L
          density   1.0029    1
      Alkalinity  1
      S(6)  589.3455723
      F     1.794845806
      Cl    23.21383544
      Ag    0.000735022
      Al    1.928292936
      As    0.008270884
      Ba    0.567189325
      Ca    64.47392133
      Cd    0.002825723
      Co    0.054497069
      Cr    0.012240709
      Cu    3.23435932
```

```
Fe    0.724287984
Hg    0.000201044
K     43.4688607
Mg    10.39162365
Mn    1.20500828
Mo    0.062069614
Na    172.1846152
Ni    0.01642961
Pb    0.005246111
Sb    0.013587006
Se    0.022336207
Si    157.1472851
Sr    0.507861015
Tl    0.001610637
U     0.017080703
Zn    0.310227331
-water    1 # kg
Equilibrium_phases
Al4(OH)10SO4      0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
schwertmannite    0     0
Fluorite    0     0
Manganite   0     0
Gypsum      0     0
tenorite    0     0
calcite     0     0
fix_pe      -10   O2(g)
fix_pH      -4.7  NaOH
```

#Unsaturated Waste Rock Year 5 to 15

```
      SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
       -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn


      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      phases
      schwertmannite
      Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
      log_k 10.5   #Yu et al., 1999

      phases
      Fe(OH)3(a)
       Fe(OH)3 + 3H+ = Fe+3 + 3H2O
       log_k           4.891



      SOLUTION 1  Unsaturated Waste Rock Year 5 to 15
          temp      25
      pH    7
          pe        10
          redox     pe
          units   mg/L
          density   1.0029    1
      Alkalinity  11.25999
      S(6)  974.183623
      F     11.39572419
      Cl    16.55059869
      Ag    0.001232835
      Al    48.07177883 gibbsite
      As    0.038436068
      Ba    0.811417193
      Ca    210.9957428
      Cd    0.027251412
      Co    0.120555197
      Cr    0.041035285
```

```
Cu    4.978820514
Fe    45.58846735 Fe(OH)3(a)
Hg    0.00073196
K     32.50473786
Mg    24.61939248
Mn    0.674956771
Mo    0.067466385
Na    3.965742171
Ni    0.058693021
Pb    0.003914483
Sb    0.043764331
Se    0.02210868
Si    29.89320169
Sr    1.744356969
Tl    0.000800804
U     0.430749946
Zn    2.865131927
-water    1 # kg
Equilibrium_phases
gibbsite    0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
Fe(OH)3(a)  0     0
Fluorite    0     0
Manganite   0     0
Gypsum      0     0
tenorite    0     0

fix_pe      -10   O2(g)
fix_pH      -7.0  NaOH
CO2(g)      -3.2
end

SOLUTION 1
    temp      25
pH    4.7
    pe        10
    redox     pe
    units   mg/L
    density   1.0029    1
S(6)  979.9620739
F     2.616104717
Cl    23.3170227
Ag    0.001207983
Al    0.687309186
As    0.029602955
Ba    0.258297819
Ca    257.8923087
Cd    0.020426385
Co    0.111884072
Cr    0.033768596
Cu    1.568350901
Fe    0.114316405
Hg    0.000590836
K     44.36885009
Mg    35.06708219
```

```
Mn    0.874207658
Mo    0.078310123
Na    95.93065631
Ni    0.048884812
Pb    0.005409507
Sb    0.035190767
Se    0.02684274
Si    87.9345882
Sr    2.278021133
Tl    0.001389999
U     0.30400481
Zn    2.147736202
-water    1 # kg
Equilibrium_phases
Al4(OH)10SO4      0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
schwertmannite    0     0
Fluorite    0     0
Manganite   0     0
Gypsum      0     0
tenorite    0     0
calcite     0     0
fix_pe      -10   O2(g)
fix_pH      -4.7  NaOH
CO2(g)      -3.2
end
```

#Unsaturated Waste Rock Year 15-19

```
SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
       -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn



      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0
      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O

      log_k           4.891



      SOLUTION 1        Unsaturated Waste Rock Year 15-19

          temp      25
      pH    7.19
          pe        10
          redox     pe
          units   mg/L
          density   1.0029    1
      Alkalinity  83.021
      S(6)  897.3295218
      F     8.986630256
      Cl    19.51771545
      Ag    0.001371646
      Al    40.58038434 gibbsite
      As    0.040808249
      Ba    0.680383911
      Ca    204.3505059
      Cd    0.009456492
      Co    0.092375792
      Cr    0.048850797
      Cu    16.42465267
      Fe    31.10011406 Fe(OH)3(a)
      Hg    0.000809661
```

```
K     36.15899814
Mg    27.17856351
Mn    1.046693097
Mo    0.10771716
Na    7.765933132
Ni    0.058071784
Pb    0.004085851
Sb    0.031063496
Se    0.014309614
Si    29.34993986
Sr    2.214989664
Tl    0.00085773
U     0.262836255
Zn    1.221642586
-water    1 # kg
Equilibrium_phases
gibbsite    0     0
Manganite   0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
Fe(OH)3(a)  0     0
Fluorite    0     0
Gypsum      0     0
tenorite    0     0
calcite     0     0
fix_pe      -10   O2(g)
fix_pH      -7.19 HCl
CO2(g)      -3.2
```

#Column 7 and 8 PHREEQC input

```
      SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
       -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -saturation_indices   K-Jarosite  Alunite  Na-Jarosite  gibbsite
                                            Fe(OH)3(a)  Ferrihydrite  CaMoO4
PbMoO4 Calcite    Dolomite(disordered)  Dolomite(ordered)  Aragonite  Gypsum
Anhydrite  Malachite  Tenorite  Barite Cerrusite  Fluorite  NiCO3
Ni(OH)2  Otavite  Cd(OH)2(am)  Tl(OH)3 Co(OH)2

      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      Fe(OH)3(a)
              Fe(OH)3 + 3H+ = Fe+3 + 3H2O
              log_k           4.891



      SOLUTION 1        Col 8 Cycle 1
          temp      25
      pH    7.65
          pe        10
          redox     pe
          units   mg/L
          density   1.06      1
      Alkalinity  69.6498
      S(6)  2187
      F     0.55
      Cl    140
      Ag    0.00001
      Al    0.0053
      As    0.0096
      Ba    0.0126
      Ca    551
      Cd    0.000342
      Co    0.311
      Cr    0.001
      Cu    0.0308
      Fe    0.017
      Hg    0.02
      K     10.7
```

```
Mg    24.6
Mn    0.0207
Mo    1.59
Na    469
Ni    0.0021
Pb    0.00011
Sb    0.0074
Se    0.0662
Si    15.8
Sr    0.315
Tl    0.00011
U     0.0226
Zn    0.003

-water    1 # kg
end
SOLUTION 1        Col 8 Cycle 2
    temp      25
pH    7.67
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  85.5708
S(6)  2095
F     0.52
Cl    150
Ag    0.00002
Al    0.0083
As    0.0089
Ba    0.0131
Ca    576
Cd    0.000003
Co    0.318
Cr    0.0005
Cu    0.0265
Fe    0.016
Hg    0.01
K     9.07
Mg    24
Mn    0.0178
Mo    1.71
Na    473
Ni    0.0023
Pb    0.00006
Sb    0.0077
Se    0.0593
Si    16.9
Sr    0.303
Tl    0.00009
U     0.0372
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 8 Cycle 3
    temp      25
```

```
pH    7.75
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  86.1076
S(6)  1658
F     0.52
Cl    180
Ag    0.00001
Al    0.0073
As    0.0098
Ba    0.0145
Ca    543
Cd    0.000003
Co    0.393
Cr    0.0006
Cu    0.0251
Fe    0.017
Hg    0.01
K     11.2
Mg    25.3
Mn    0.0251
Mo    2.02
Na    461
Ni    0.0016
Pb    0.00011
Sb    0.0078
Se    0.0753
Si    17.5
Sr    0.339
Tl    0.00011
U     0.0339
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 8 Cycle 4
    temp      25
pH    7.69
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  79.9588
S(6)  2852
F     0.53
Cl    110
Ag    0.00001
Al    0.0057
As    0.0081
Ba    0.0124
Ca    558
Cd    0.000035
Co    0.289
Cr    0.0005
Cu    0.0187
```

```
Fe    0.018
Hg    0.01
K     9.04
Mg    22.9
Mn    0.0191
Mo    1.78
Na    441
Ni    0.0014
Pb    0.00007
Sb    0.007
Se    0.0646
Si    18.6
Sr    0.304
Tl    0.00008
U     0.0261
Zn    0.012

-water    1 # kg
end
SOLUTION 1        Col 8 Cycle 6
    temp      25
pH    7.66
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  63.4888
S(6)  1967
F     0.53
Cl    56
Ag    0.00001
Al    0.0046
As    0.0076
Ba    0.0113
Ca    400
Cd    0.000026
Co    0.224
Cr    0.0005
Cu    0.0123
Fe    0.007
Hg    0.01
K     6.88
Mg    16.6
Mn    0.0146
Mo    1.52
Na    278
Ni    0.0025
Pb    0.00006
Sb    0.0058
Se    0.0392
Si    16.1
Sr    0.235
Tl    0.00007
U     0.0168
Zn    0.001

-water    1 # kg
```

```
end
SOLUTION 1        Col 8 Cycle 8
    temp      25
pH    7.69
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  66.368
S(6)  2437
F     0.49
Cl    37
Ag    0.00001
Al    0.0087
As    0.0072
Ba    0.011
Ca    362
Cd    0.000047
Co    0.162
Cr    0.0005
Cu    0.0262
Fe    0.003
Hg    0.01
K     5.71
Mg    13.4
Mn    0.013
Mo    1.24
Na    219
Ni    0.002
Pb    0.00002
Sb    0.0056
Se    0.0313
Si    15.8
Sr    0.198
Tl    0.00007
U     0.0144
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 8 Cycle 10
    temp      25
pH    7.57
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  66.2826
S(6)  1489
F     0.55
Cl    33
Ag    0.00001
Al    0.0057
As    0.0078
Ba    0.0127
Ca    378
Cd    0.000061
```

```
Co    0.161
Cr    0.0005
Cu    0.0097
Fe    0.004
Hg    0.01
K     4.91
Mg    13.1
Mn    0.012
Mo    1.26
Na    207
Ni    0.0022
Pb    0.00015
Sb    0.0068
Se    0.0278
Si    17.1
Sr    0.188
Tl    0.00006
U     0.0143
Zn    0.001

-water    1 # kg
end
SOLUTION 1        Col 8 Cycle 12
    temp      25
pH    7.58
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  64.1842
S(6)  1435
F     0.52
Cl    21
Ag    0.00001
Al    0.0068
As    0.0082
Ba    0.0118
Ca    348
Cd    0.000016
Co    0.155
Cr    0.0005
Cu    0.0101
Fe    0.003
Hg    0.01
K     4.61
Mg    12.5
Mn    0.011
Mo    1.21
Na    185
Ni    0.0024
Pb    0.00002
Sb    0.0061
Se    0.0235
Si    17.4
Sr    0.174
Tl    0.00005
U     0.0143
```

```
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 8 Cycle 14
    temp      25
pH    7.62
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  62.8178
S(6)  1219
F     0.52
Cl    20
Ag    0.00001
Al    0.0046
As    0.0076
Ba    0.0131
Ca    349
Cd    0.000041
Co    0.131
Cr    0.0005
Cu    0.0093
Fe    0.003
Hg    0.01
K     3.99
Mg    12.3
Mn    0.0119
Mo    1.22
Na    344
Ni    0.002
Pb    0.00002
Sb    0.0058
Se    0.0243
Si    18.8
Sr    0.175
Tl    0.00004
U     0.0117
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 1
    temp      25
pH    7.51
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  84.4606
S(6)  2010
F     0.52
Cl    130
Ag    0.00001
Al    0.0046
As    0.0094
```

```
Ba    0.0117
Ca    476
Cd    0.000433
Co    0.39
Cr    0.0008
Cu    0.0213
Fe    0.014
Hg    0.01
K     8.89
Mg    20.8
Mn    0.021
Mo    1.9
Na    416
Ni    0.0019
Pb    0.00005
Sb    0.0076
Se    0.0581
Si    16.7
Sr    0.256
Tl    0.0001
U     0.0207
Zn    0.003

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 2
    temp      25
pH    7.58
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  79.6538
S(6)  1851
F     0.55
Cl    130
Ag    0.00001
Al    0.0072
As    0.0089
Ba    0.0113
Ca    490
Cd    0.000035
Co    0.404
Cr    0.0005
Cu    0.0211
Fe    0.014
Hg    0.02
K     7.94
Mg    21.8
Mn    0.0189
Mo    2.1
Na    429
Ni    0.002
Pb    0.00008
Sb    0.0091
Se    0.0529
Si    19.5
```

```
Sr    0.26
Tl    0.00008
U     0.0273
Zn    0.003

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 3
    temp      25
pH    7.55
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  75.396
S(6)  1428
F     0.61
Cl    80
Ag    0.00001
Al    0.0062
As    0.0091
Ba    0.0111
Ca    455
Cd    0.000063
Co    0.272
Cr    0.0005
Cu    0.0178
Fe    0.005
Hg    0.01
K     8.15
Mg    19.2
Mn    0.0183
Mo    1.88
Na    322
Ni    0.0015
Pb    0.00007
Sb    0.0096
Se    0.0382
Si    19.9
Sr    0.24
Tl    0.00008
U     0.0212
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 4
    temp      25
pH    7.57
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  64.8064
S(6)  1716
F     0.6
Cl    43
```

```
Ag    0.00001
Al    0.0052
As    0.0077
Ba    0.00966
Ca    390
Cd    0.00006
Co    0.178
Cr    0.0005
Cu    0.0133
Fe    0.005
Hg    0.01
K     6
Mg    16.3
Mn    0.0142
Mo    1.42
Na    241
Ni    0.0011
Pb    0.00008
Sb    0.0079
Se    0.0259
Si    20.3
Sr    0.205
Tl    0.00007
U     0.0148
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 6
    temp      25
pH    7.65
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  63.7816
S(6)  991
F     0.58
Cl    19
Ag    0.00001
Al    0.0066
As    0.0084
Ba    0.00946
Ca    279
Cd    0.000068
Co    0.111
Cr    0.0005
Cu    0.0093
Fe    0.003
Hg    0.01
K     4.18
Mg    10.8
Mn    0.0094
Mo    1.16
Na    146
Ni    0.002
Pb    0.00007
```

```
Sb    0.0068
Se    0.0128
Si    17.8
Sr    0.146
Tl    0.00006
U     0.0114
Zn    0.003

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 8
    temp      25
pH    7.6
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  58.7674
S(6)  1011
F     0.54
Cl    11
Ag    0.00002
Al    0.0077
As    0.0073
Ba    0.00906
Ca    232
Cd    0.000043
Co    0.0696
Cr    0.0005
Cu    0.0151
Fe    0.003
Hg    0.01
K     3.21
Mg    8.66
Mn    0.0069
Mo    0.831
Na    98.3
Ni    0.0013
Pb    0.00002
Sb    0.0055
Se    0.0086
Si    15.9
Sr    0.117
Tl    0.00004
U     0.00829
Zn    0.003

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 10
    temp      25
pH    7.62
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  59.3042
```

```
S(6)  779
F     0.55
Cl    6.3
Ag    0.00001
Al    0.0067
As    0.0075
Ba    0.011
Ca    223
Cd    0.000035
Co    0.0577
Cr    0.0005
Cu    0.0054
Fe    0.003
Hg    0.01
K     2.52
Mg    8.12
Mn    0.0055
Mo    0.697
Na    73.8
Ni    0.0016
Pb    0.00002
Sb    0.0059
Se    0.00638
Si    16.2
Sr    0.106
Tl    0.00003
U     0.00796
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 12
    temp      25
pH    7.58
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  62.6592
S(6)  704
F     0.52
Cl    4.6
Ag    0.00006
Al    0.0056
As    0.0076
Ba    0.0101
Ca    203
Cd    0.000178
Co    0.0482
Cr    0.0007
Cu    0.0041
Fe    0.006
Hg    0.01
K     2.08
Mg    7.03
Mn    0.0045
Mo    0.654
```

```
Na    59.1
Ni    0.0021
Pb    0.00004
Sb    0.0051
Se    0.00445
Si    15.6
Sr    0.102
Tl    0.00002
U     0.00785
Zn    0.004

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 14
    temp      25
pH    7.58
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  57.1936
S(6)  583
F     0.53
Cl    4.3
Ag    0.00002
Al    0.0061
As    0.0074
Ba    0.0102
Ca    194
Cd    0.000015
Co    0.0452
Cr    0.0005
Cu    0.0049
Fe    0.003
Hg    0.01
K     1.95
Mg    6.35
Mn    0.0046
Mo    0.663
Na    47.9
Ni    0.0012
Pb    0.00002
Sb    0.005
Se    0.00526
Si    17.4
Sr    0.0959
Tl    0.00002
U     0.0062
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 16
    temp      25
pH    7.61
    pe        10
    redox     pe
```

```
    units   mg/L
    density   1.06      1
Alkalinity  58.9992
S(6)  506
F     0.46
Cl    3
Ag    0.00002
Al    0.0073
As    0.0074
Ba    0.00928
Ca    163
Cd    0.000036
Co    0.0367
Cr    0.0005
Cu    0.0057
Fe    0.003
Hg    0.01
K     1.62
Mg    5.06
Mn    0.0039
Mo    0.56
Na    36.7
Ni    0.0016
Pb    0.00013
Sb    0.0048
Se    0.00401
Si    15.3
Sr    0.08
Tl    0.00002
U     0.00528
Zn    0.003

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 18
    temp      25
pH    7.3
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  52.7894
S(6)  433
F     0.44
Cl    2.7
Ag    0.00007
Al    0.0111
As    0.0085
Ba    0.00989
Ca    135
Cd    0.000028
Co    0.0373
Cr    0.0005
Cu    0.0042
Fe    0.003
Hg    0.01
K     1.18
```

```
Mg    4.17
Mn    0.003
Mo    0.622
Na    25.6
Ni    0.0005
Pb    0.00004
Sb    0.0048
Se    0.00294
Si    14.9
Sr    0.0741
Tl    0.00002
U     0.00463
Zn    0.002

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 20
    temp      25
pH    7.66
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  56.4738
S(6)  294
F     0.46
Cl    2
Ag    0.00002
Al    0.0108
As    0.0074
Ba    0.00939
Ca    118
Cd    0.00003
Co    0.0311
Cr    0.0005
Cu    0.0046
Fe    0.003
Hg    0.01
K     1.26
Mg    3.43
Mn    0.0029
Mo    0.54
Na    22.6
Ni    0.0015
Pb    0.00004
Sb    0.0042
Se    0.00229
Si    16.1
Sr    0.0606
Tl    0.00002
U     0.00392
Zn    0.001

-water    1 # kg
end
SOLUTION 1        Col 7 Cycle 20
    temp      25
```

```
pH    7.64
    pe        10
    redox     pe
    units   mg/L
    density   1.06      1
Alkalinity  53.2774
S(6)  312
F     0.47
Cl    1.9
Ag    0.00001
Al    0.0112
As    0.0063
Ba    0.00978
Ca    109
Cd    0.000065
Co    0.0285
Cr    0.0005
Cu    0.0052
Fe    0.003
Hg    0.01
K     1.2
Mg    3.13
Mn    0.003
Mo    0.469
Na    19.6
Ni    0.0024
Pb    0.00065
Sb    0.0043
Se    0.00195
Si    15.7
Sr    0.0554
Tl    0.00004
U     0.00374
Zn    0.002

-water    1 # kg
```

#HLF drain down and rinsing PHREEQC input

```
SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
          -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn



      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891



      SOLUTION 1              HLF Rinsing and Drain Down
          temp      25
          pH      8.71
          pe        10
          redox     pe
          units   mg/L
          density   1.0611
      Alkalinity  98.82
      S(6)  30808.98947
      F     5.433684211
      Cl    633.9298246
      Ag    0.053672316
      Al    0.796940351 gibbsite
      As    0.036224561
      Ba    0.278929123
      Ca    12750.37613
      Cd    0.008474576
      Co    5.716101695
      Cr    0.00905614
      Cu    2.75
      Fe    9.505649718
      Hg    0.018361582
      K     215.0733703
      Mg    7.866767898
```

```
Mn    0.003622456
Mo    75.6296393
Na    434.548
Ni    0.242704561
Pb    0.001811228
Sb    0.007244912
Se    0.402092632
Si    15.88447018
Sr    16.41280653
Tl    0.001811228
U     0.001811228
Zn    0.072033898


-water    1 # kg
Equilibrium_phases
Gibbsite    0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0

Fluorite    0     0

Gypsum      0     0

CaMoO4      0     0
PbMoO4      0     0
fix_pe      -10   O2(g)
fix_pH      -8.71 HCl

end
```

#HLf post drain down PHREEQC input

```
SELECTED_OUTPUT
          -file                   selected.out
          -solution               true
          -ph                     true
          -pe                     true
       -water                  true
          -temperature            true
          -alkalinity             true
          -charge_balance         true
          -percent_error          true
          -totals                       S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn


      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891



      SOLUTION 1              Post Drain Down
          temp      25
          pH      7.7
          pe        10
          redox     pe
          units   mg/L
          density   1.06
      Alkalinity  57.9561
      S(6)  34806.77866
      F     83.75612776
      Cl    240.4111075
      Ag    0.00077552
      Al    1.488997827 gibbsite
      As    1.318383493
      Ba    1.915533663
      Ca    14519.74221
      Cd    0.004963326
      Co    2.543704621
      Cr    0.038775985
      Cu    0.496332609
      Fe    0.23265591
      Hg    0.00077552
      K     169.0632949
      Mg    390.5626859
      Mn    0.411025442
```

```
Mo     78.09483394
Na     15.15
Ni     0.093062364
Pb     0.027918709
Sb     0.767764504
Se     0.225676233
Si     2605.746197
Sr     7.367084389
Tl     0.001551039
U      0.62429336
Zn     0.387759851

-water    1 # kg
Equilibrium_phases
Gibbsite     0     0
Barite       0     0
Celestite    0     0
Chalcedony   0     0
Fe(OH)3(a)   0     0
Fluorite     0     0
Manganite    0     0
Gypsum       0     0
tenorite     0     0
CaMoO4       0     0
PbMoO4       0     0
fix_pe       -10   O2(g)
fix_pH       -7.70 HCl
CO2(g)       -3.1
end
```

#**Embankment closure PHREEQC input**

```
SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
       -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn



      phases
      fix_pe
      e-=e-
      log_k     0
      phases
      fix_pH
      H+=H+
      log_k     0
      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891







      SOLUTION 1        Embankment Closure
          temp      25
      pH    7.5
          pe        10
          redox     pe
          units   mg/L
          density   1.00
      Alkalinity  123.53
      S(6)  171.248637
      F     6.831701631
      Cl    11.81155554
      Ag    0.000127139
      Al    0.076318258 gibbsite
      As    0.02565751
      Ba    1.096278995
      Ca    197.0921437
      Cd    0.001211571
      Co    0.004273634
      Cr    0.007964493
      Cu    0.078417315
      Fe    0.02389348
```

```
Hg    7.96449E-05
K     26.12670905
Mg    21.57287911
Mn    0.890359548
Mo    0.387475347
Na    1.138572906
Ni    0.008772181
Pb    0.002575688
Sb    0.148882881
Se    0.004599212
Si    31.33165259
Sr    1.639966549
Tl    0.00018463
U     0.099860397
Zn    0.024154743
-water    1 # kg
Equilibrium_phases
Gibbsite    0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
Fe(OH)3(a)              0     0
Fluorite    0     0
gypsum      0     0
tenorite    0     0
Manganite   0     0
CO2(g)      -3.2
fix_pe      -10   O2(g)
fix_pH      -7.5  HCl
PbMoO4      0     0
```

#Embankment operations PHREEQC input

```
      SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
       -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn



      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891







      SOLUTION 1        Embankment Operations
          temp      25
          pH      7.5
          pe        10
          redox     pe
          units   mg/L
          density   1.00285
      Alkalinity  115.97
      S(6)  464.67
      F     0.548
      Cl    9.34
      Ag    0.00036
      Al    0.524
      As    0.041
      Ba    1.173
      Ca    120.35
      Cd    0.0054
      Co    0.0089
      Cr    0.0256
```

```
Cu    1.486
Fe    0.1172
Hg    0.000121
K     183.88
Mg    8.111
Mn    0.697
Mo    1.735
Na    9.13
Ni    0.0273
Pb    0.0066
Sb    0.0446
Se    0.0033
Si    19.65
Sr    0.57
Tl    0.00052
U     0.0457
Zn    0.1094
-water    1 # kg
Equilibrium_phases
Gibbsite    0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
Fe(OH)3(a)              0     0
Fluorite    0     0
gypsum      0     0
tenorite    0     0
Manganite   0     0
fix_pe      -10   O2(g)
fix_pH      -7.5  HCl
PbMoO4      0     0
```

#Tailings beach closure PHREEQC input

```
      SELECTED_OUTPUT
          -file                 selected.out

          -solution             true
          -ph                   true
          -pe                   true
       -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn


      phases
      fix_pe
      e-=e-
      log_k     0
      phases
      fix_pH
      H+=H+
      log_k     0
      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k           4.891



      SOLUTION 1        Beach Closure
          temp      25
      pH    7.50
          pe        10
          redox     pe
          units   mg/L
          density   1.00
      Alkalinity  91.9148
      S(6)  150.7040529
      F     6.716343281
      Cl    7.797726043
      Ag    0.000117785
      Al    0.134964988
      As    0.028924568
      Ba    0.913006915
      Ca    62.22970321
      Cd    0.000185799
      Co    0.001617222
      Cr    0.00822914
      Cu    0.009922187
      Fe    0.058854668
      Hg    7.37854E-05
      K     54.06576851
```

```
Mg    7.419031809
Mn    0.128520808
Mo    0.176322127
Na    2.420678739
Ni    0.004066127
Pb    0.00019997
Sb    0.028943354
Se    0.002148733
Si    49.33813969
Sr    0.387481803
Tl    6.83037E-05
U     0.041572043
Zn    0.014876759
-water    1 # kg
Equilibrium_phases
Gibbsite    0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
Fe(OH)3(a)              0     0
Fluorite    0     0
Gypsum      0     0
tenorite    0     0

Manganite   0     0
fix_pe      -10   O2(g)
fix_pH      -7.50 HCl
end
```

#Tailings beach operations PHREEQC input

```
      SELECTED_OUTPUT
          -file                 selected.out
          -solution             true
          -ph                   true
          -pe                   true
       -water                true
          -temperature          true
          -alkalinity           true
          -charge_balance       true
          -percent_error        true
          -totals                     S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe
Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn



      phases
      fix_pe
      e-=e-
      log_k     0

      phases
      fix_pH
      H+=H+
      log_k     0

      phases
      Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O

      log_k           4.891



      SOLUTION 1  Beach Operations
          temp      25
          pH      7.50
          pe        10
          redox     pe
          units   mg/L
          density   1.00
      Alkalinity  89.9079
      S(6)  103.4165516
      F     0.563986475
      Cl    0.053949342
      Ag    0.000467214
      Al    0.762797149
      As    0.053949342
      Ba    3.088497447
      Ca    40.12546806
      Cd    0.004825762
      Co    0.005568427
      Cr    0.043060453
      Cu    0.235611481
      Fe    0.111169928
      Hg    0.000427087
```

```
K     65.97456536
Mg    2.319085887
Mn    0.302661007
Mo    2.794368076
Na    4.558277589
Ni    0.017677154
Pb    0.007298889
Sb    0.044005602
Se    0.002226436
Si    16.32350298
Sr    0.201410148
Tl    0.000195536
U     0.016935312
Zn    0.135397957
-water    1 # kg
Equilibrium_phases
Gibbsite    0     0
Barite      0     0
Celestite   0     0
Chalcedony  0     0
Fe(OH)3(a)              0     0
Fluorite    0     0
Gypsum      0     0
tenorite    0     0
manganite   0     0
fix_pe      -10   O2(g)
fix_pH      -7.50 NaOH
end
```

#Seepage from saturated impoundment to embankment PHREEQC input

```
            SELECTED_OUTPUT
                -file                   selected.out
                -solution               true
                -ph                     true
                -pe                     true
             -water                  true
                -temperature            true
                -alkalinity             true
                -charge_balance         true
                -percent_error          true
                -totals                       S(6) F Cl Ag Al As Ba Ca Cd Co Cr
Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn



            phases
            fix_pe
            e-=e-
            log_k     0

            phases
            fix_pH
            H+=H+
            log_k     0

            phases
            Fe(OH)3(a)
            Fe(OH)3 + 3H+ = Fe+3 + 3H2O
            log_k           4.891



            SOLUTION    0     Flow  10    Year  4
                temp      25
                pH      7.64375
                pe        3
                redox     pe
                units   mg/L
                density   1.00

            Alkalinity  77.08366667             #     25
            S(6)  1320
            F     2.22
            Cl    36.11200812
            Ag    0.00005
            Al    4.800588627 gibbsite

            As    0.004306756
            Ba    0.1087575
            Ca    497
            Cd    0.001604265
            Co    0.001545943
            Cr    0.0025
            Cu    0.017219652
```

```
Fe(2) 0.067562221 siderite

Hg    1.01206E-05
K     85.8
Mg    2.854998136
Mn(2) 0.042411043 rhodochrosite

Mo    0.286495
Na    35.50631711
Ni    0.002511613
Pb    0.00125
Sb    0.002535466
Se    0.0085
Si    4.316712763
Sr    1.3
Tl    0.0005
U     0.003983444
Zn    0.011214391
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0

Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.64 NaOH

end
SOLUTION    0     Flow10      Year  10
    temp      25
    pH      7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  77.08366667             #     26

S(6)  1320
F     2.22
Cl    36.04517361
Ag    0.00005
Al    4.782336594 gibbsite

As    0.004293301
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001618259
Cr    0.0025
```

```
Cu    0.020104687
Fe(2) 0.065449825 siderite

Hg    8.52686E-06
K     85.8
Mg    2.676476569
Mn(2) 0.031989179 rhodochrosite

Mo    0.286495
Na    35.50859179
Ni    0.002541705
Pb    0.00125
Sb    0.002514304
Se    0.008507494
Si    4.302282629
Sr    1.303020323
Tl    0.0005
U     0.00390365
Zn    0.01085396
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.64 NaOH

end
SOLUTION    0     Flow10      Year  19
    temp      25

    pH      7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  77.08366667             #     27
S(6)  1320
F     2.22
Cl    36.12526263
Ag    0.00005
Al    4.804208341 gibbsite

As    0.004304591
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001910311
Cr    0.0025
```

```
Cu    0.028069282
Fe(2) 0.076814525 siderite

Hg    1.0307E-05
K     85.8
Mg    3.254980859
Mn(2) 0.044709937 rhodochrosite

Mo    0.286495
Na    35.70389753
Ni    0.002647747
Pb    0.00125
Sb    0.002539663
Se    0.008537025
Si    4.3220134
Sr    1.315480898
Tl    0.0005
U     0.005900398
Zn    0.011776633
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.64 NaOH

end
SOLUTION    0     Flow10      Year  22
    temp      25
    pH      7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  77.08366667             #     28

S(6)  1320
F     2.22
Cl    36.11561633
Ag    0.00005
Al    4.801574005 gibbsite

As    0.004307415
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001966574
Cr    0.0025
```

```
Cu    0.0295844
Fe(2) 0.07789683  siderite

Hg    1.00996E-05
K     85.8
Mg    3.300266537
Mn(2) 0.046947657 rhodochrosite

Mo    0.286495
Na    35.74556909
Ni    0.002668007
Pb    0.00125
Sb    0.002536609
Se    0.008542101
Si    4.326403197
Sr    1.317603697
Tl    0.0005
U     0.006287142
Zn    0.011770021
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.64 NaOH

end
SOLUTION    0     Flow10      Year  PC
    temp      25

pH    7.64375
    pe        3

    redox     pe

    units   mg/L
    density   1.00

Alkalinity  77.08366667            #     29

S(6)  1320
F     2.22
Cl    36.22364417
Ag    0.00005
Al    4.831075645 gibbsite

As    0.004326012
Ba    0.1087575
Ca    497
```

```
Cd    0.001604265
Co    0.002337149
Cr    0.0025
Cu    0.03956363
Fe(2) 0.092850192 siderite

Hg    1.25221E-05
K     85.8
Mg    4.055029145
Mn(2) 0.06454851  rhodochrosite

Mo    0.286495
Na    36.0200361
Ni    0.002801445
Pb    0.00125
Sb    0.002570814
Se    0.00857554
Si    4.355316305
Sr    1.33158537
Tl    0.0005
U     0.008834403
Zn    0.012979228
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.64 NaOH

end
```

#Seepage from saturated impoundment to foundation PHREEQC input

```
            SELECTED_OUTPUT
                -file                   selected.out
                -solution               true
                -ph                     true
                -pe                     true
             -water                  true
                -temperature            true
                -alkalinity             true
                -charge_balance         true
                -percent_error          true
                -totals                       S(6) F Cl Ag Al As Ba Ca Cd Co Cr
Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn


            phases
            fix_pe
            e-=e-
            log_k     0

            phases
            fix_pH
            H+=H+
            log_k     0

            phases
            Fe(OH)3(a)
            Fe(OH)3 + 3H+ = Fe+3 + 3H2O
            log_k           4.891


            phases
            schwertmannite
            Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
            log_k 10.5   #Yu et al., 1999




            SOLUTION    1     Flow  1     Year  All years
                temp      25
            pH    6.20525
                pe        3
                redox     pe
                units   mg/L
                density   1.00

            Alkalinity  841.5865
            S(6)  2427.25
            F     2.61375
            Cl    40.025
            Ag    0.00003645
            Al    0.343975    gibbsite
            As    0.0094475
            Ba    0.02453
```

```
Ca    799.2
Cd    0.00221675
Co    0.231875
Cr    0.00061275
Cu    6.858875
Fe(2) 4.5455      siderite
Hg    7.3525E-05
K     49.3
Mg    180.4
Mn(2) 3.17075     rhodochrosite

Mo    0.0307475
Na    108.2775
Ni    0.071285
Pb    0.0008127
Sb    0.005187
Se    0.0344375
Si    11.855
Sr    4.9915
Tl    0.000191825
U     0.9278
Zn    0.331625
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -6.205      NaOH
Save solution     1
end
SOLUTION    2           Flow 3      Year  4
    temp      25
pH    4.726080914
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  0                #     3
S(6)  1320
F     2.22
Cl    36
Ag    7.23015E-05
Al    4.77
As    0.00408
Ba    0.214063573
Ca    497
Cd    0.000436768
Co    0.014873424
Cr    0.002595374
```

```
Cu    2.48
Fe(2) 0.577630138
Hg    2.3608E-05
K     85.8
Mg    5.517970714
Mn(2) 0.459706786
Mo    0.237
Na    35.4
Ni    0.004673424
Pb    0.00125
Sb    0.004557644
Se    0.0085
Si    19.11322468
Sr    1.3
Tl    0.0005
U     0.011161983
Zn    0.05399864
-water    1 # kg
Equilibrium_phases

Al4(OH)10SO4      0     0

Celestite   0     0
#Chalcedony 0     0
schwertmannite    0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
fix_pe      -3    O2(g)

fix_pH      -4.7  NaOH
Save solution     2
end
SOLUTION    3     Flow3 Year  10
    temp      25
pH    4.7
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  0                 #     4
S(6)  1320
F     2.22
Cl    36
Ag    5.60387E-05
Al    4.77
As    0.00408
Ba    0.144367133
Ca    497
Cd    0.000846283
Co    0.038038044
Cr    0.0025
Cu    1.03583165
Fe(2) 0.86406758
Hg    2.8993E-05
```

```
K     85.8
Mg    37.17498376
Mn(2) 1.311854118
Mo    0.237
Na    50.3874631
Ni    0.012851948
Pb    0.00125
Sb    0.003967298
Se    0.012571964
Si    14.34338722
Sr    1.471416127
Tl    0.0005
U     0.160929383
Zn    0.073183901
-water    1 # kg
Equilibrium_phases

Al4(OH)10SO4      0     0

Celestite   0     0
#Chalcedony 0     0
schwertmannite    0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
fix_pe      -3    O2(g)

fix_pH      -4.70 NaOH
Save solution     3
end
SOLUTION    4     Flow3 Year  19
    temp      25
pH    4.7
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  0                 #     5
S(6)  1320
F     2.22
Cl    36
Ag    0.00005
Al    4.77
As    0.006319046
Ba    0.066368359
Ca    497
Cd    0.000557212
Co    0.042051651
Cr    0.0025
Cu    1.109037209
Fe(2) 1.220306192
Hg    4.21332E-05
K     85.8
Mg    57.22641404
Mn(2) 1.777045125
```

```
Mo    0.237
Na    65.43465208
Ni    0.017102055
Pb    0.00125
Sb    0.0025
Se    0.012159191
Si    7.453932723
Sr    2.830000575
Tl    0.0005
U     0.281824236
Zn    0.066506798
-water    1 # kg
Equilibrium_phases

Al4(OH)10SO4      0     0

Celestite   0     0
#Chalcedony 0     0
schwertmannite    0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
fix_pe      -3    O2(g)
fix_pH      -4.70 NaOH
Save solution     4
end

SOLUTION    5     Flow3 Year  22
    temp      25
    pH      4.7
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  0                #     6
S(6)  1320
F     2.22
Cl    36
Ag    5.15584E-05
Al    4.77
As    0.00408
Ba    0.113372018
Ca    497
Cd    0.000903439
Co    0.042349544
Cr    0.0025
Cu    1.156752252
Fe(2) 0.953060829
Hg    3.0174E-05
K     85.8
Mg    44.81051409
Mn(2) 1.439895436
Mo    0.237
Na    49.28654845
Ni    0.014840058
```

```
Pb    0.00125
Sb    0.003374138
Se    0.013833195
Si    11.39314839
Sr    2.222046127
Tl    0.0005
U     0.202869329
Zn    0.074844026
-water    1 # kg
Equilibrium_phases

Al4(OH)10SO4      0     0

Celestite   0     0
#Chalcedony 0     0
schwertmannite    0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
fix_pe      -3    O2(g)

fix_pH      -4.70 NaOH
Save solution     5
end
SOLUTION    6     Flow3 Year  PC
    temp      25
pH    4.7
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  0                 #     7
S(6)  1320
F     2.22
Cl    36
Ag    5.15584E-05
Al    4.77
As    0.00408
Ba    0.113372018
Ca    497
Cd    0.000903439
Co    0.042349544
Cr    0.0025
Cu    1.156752252
Fe(2) 0.953060829
Hg    3.0174E-05
K     85.8
Mg    44.81051409
Mn(2) 1.439895436
Mo    0.237
Na    49.28654845
Ni    0.014840058
Pb    0.00125
Sb    0.003374138
Se    0.013833195
```

```
Si    11.39314839
Sr    2.222046127
Tl    0.0005
U     0.202869329
Zn    0.074844026
-water    1 # kg
Equilibrium_phases

Al4(OH)10SO4      0     0

Celestite   0     0
#Chalcedony 0     0
schwertmannite    0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
fix_pe      -3    O2(g)

fix_pH      -4.70 HCl
Save solution     6
end
SOLUTION    7     Flow5 Year  4
    temp      25
pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  89.46646761             #     8
S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite
As    0.004382827
Ba    0.076554723
Ca    497
Cd    0.0007686
Co    0.002067819
Cr    0.0025
Cu    0.008738888
Fe(2) 0.153463176 siderite
Hg    3.98891E-05
K     85.8
Mg    7.975146861
Mn(2) 0.238738668 rhodochrosite

Mo    0.237
Na    36.71399691
Ni    0.002643524
Pb    0.00125
Sb    0.002938333
Se    0.0085
Si    4.620148998
Sr    1.3
```

```
Tl    0.0005
U     0.01424587
Zn    0.020505
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0

Celestite   0     0
Chalcedony  0     0

Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH
Save solution     7
end
SOLUTION    8     Flow5 Year  10
    temp      25
pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  89.46646761             #     9
S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite
As    0.004385214
Ba    0.07395968
Ca    497
Cd    0.0007686
Co    0.005124013
Cr    0.0025
Cu    0.100719514
Fe(2) 0.227008462 siderite
Hg    3.89677E-05
K     85.8
Mg    10.74656157
Mn(2) 0.235401834 rhodochrosite

Mo    0.237
Na    38.72776679
Ni    0.003778037
Pb    0.00125
Sb    0.002938333
Se    0.00872964
Si    4.666397935
Sr    1.392557016
Tl    0.0005
U     0.028320539
```

```
Zn    0.024415235
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0

Celestite   0     0
Chalcedony  0     0

Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH
Save solution     8
end
SOLUTION    9     Flow5 Year  19
    temp      25
pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  89.46646761             #     10
S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite
As    0.004330373
Ba    0.073871667
Ca    497
Cd    0.0007686
Co    0.00603453
Cr    0.0025
Cu    0.12845464
Fe(2) 0.245824835 siderite
Hg    3.85214E-05
K     85.8
Mg    11.80605695
Mn(2) 0.241541768 rhodochrosite

Mo    0.237
Na    38.75850742
Ni    0.004132818
Pb    0.00125
Sb    0.002938333
Se    0.008909175
Si    4.643794394
Sr    1.471086326
Tl    0.0005
U     0.034249483
Zn    0.025648971
-water    1 # kg
```

```
Equilibrium_phases

Gibbsite    0     0

Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH
Save solution     9
end

SOLUTION    10    Flow5 Year  22
    temp      25
pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  89.46646761             #     11
S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite
As    0.004388459
Ba    0.073871667
Ca    497
Cd    0.0007686
Co    0.007086532
Cr    0.0025
Cu    0.157095888
Fe(2) 0.274287876 siderite
Hg    3.86269E-05
K     85.8
Mg    13.1327129
Mn(2) 0.286391364 rhodochrosite

Mo    0.237
Na    39.53767492
Ni    0.004511628
Pb    0.00125
Sb    0.002938333
Se    0.009004102
Si    4.725874038
Sr    1.510778037
Tl    0.0005
U     0.041480746
Zn    0.026842363
-water    1 # kg
Equilibrium_phases
```

```
Gibbsite    0     0

Celestite   0     0
Chalcedony  0     0

Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH
Save solution     10
end

SOLUTION    11    Flow5 Year  PC
    temp      25
pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  89.46646761             #     12
S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite
As    0.004366115
Ba    0.073871667
Ca    497
Cd    0.0007686
Co    0.006681864
Cr    0.0025
Cu    0.146078612
Fe(2) 0.26333915  siderite
Hg    3.85863E-05
K     85.8
Mg    12.62239523
Mn(2) 0.269139309 rhodochrosite

Mo    0.237
Na    39.23795671
Ni    0.004365913
Pb    0.00125
Sb    0.002938333
Se    0.008967587
Si    4.694300899
Sr    1.495510038
Tl    0.0005
U     0.038699135
Zn    0.026383307
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0
```

```
Celestite   0     0
Chalcedony  0     0

Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH
Save solution     11
end

SOLUTION    12    Flow7 Year  4
    temp      25
pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  77.08366667             #     13
S(6)  1320
F     2.22
Cl    36.11200812
Ag    0.00005
Al    4.800588627 gibbsite
As    0.004306756
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001545943
Cr    0.0025
Cu    0.017219652
Fe(2) 0.067562221 siderite
Hg    1.01206E-05
K     85.8
Mg    2.854998136
Mn(2) 0.042411043 rhodochrosite

Mo    0.286495
Na    35.50631711
Ni    0.002511613
Pb    0.00125
Sb    0.002535466
Se    0.0085
Si    4.316712763
Sr    1.3
Tl    0.0005
U     0.003983444
Zn    0.011214391
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0
```

```
Celestite   0     0
Chalcedony  0     0

Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
Save solution     12
end

SOLUTION    13    Flow7 Year  10
    temp      25
pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  77.08366667             #     14
S(6)  1320
F     2.22
Cl    36.04517361
Ag    0.00005
Al    4.782336594 gibbsite
As    0.004293301
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001618259
Cr    0.0025
Cu    0.020104687
Fe(2) 0.065449825 siderite
Hg    8.52686E-06
K     85.8
Mg    2.676476569
Mn(2) 0.031989179 rhodochrosite

Mo    0.286495
Na    35.50859179
Ni    0.002541705
Pb    0.00125
Sb    0.002514304
Se    0.008507494
Si    4.302282629
Sr    1.303020323
Tl    0.0005
U     0.00390365
Zn    0.01085396
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0

Celestite   0     0
```

```
Chalcedony  0     0

Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
Save solution     13
end

SOLUTION    14    Flow 7      Year  19
    temp      25
pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  77.08366667             #     15
S(6)  1320
F     2.22
Cl    36.12526263
Ag    0.00005
Al    4.804208341 gibbsite
As    0.004304591
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001910311
Cr    0.0025
Cu    0.028069282
Fe(2) 0.076814525 siderite
Hg    1.0307E-05
K     85.8
Mg    3.254980859
Mn(2) 0.044709937 rhodochrosite

Mo    0.286495
Na    35.70389753
Ni    0.002647747
Pb    0.00125
Sb    0.002539663
Se    0.008537025
Si    4.3220134
Sr    1.315480898
Tl    0.0005
U     0.005900398
Zn    0.011776633
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0

Celestite   0     0
Chalcedony  0     0
```

```
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
Save solution     14
end
SOLUTION    15    Flow 7      Year  22
    temp      25
pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  77.08366667             #     16
S(6)  1320
F     2.22
Cl    36.11561633
Ag    0.00005
Al    4.801574005 gibbsite
As    0.004307415
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001966574
Cr    0.0025
Cu    0.0295844
Fe(2) 0.07789683  siderite
Hg    1.00996E-05
K     85.8
Mg    3.300266537
Mn(2) 0.046947657 rhodochrosite

Mo    0.286495
Na    35.74556909
Ni    0.002668007
Pb    0.00125
Sb    0.002536609
Se    0.008542101
Si    4.326403197
Sr    1.317603697
Tl    0.0005
U     0.006287142
Zn    0.011770021
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0

Celestite   0     0
Chalcedony  0     0

Fluorite    0     0
```

```
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
Save solution     15
end
SOLUTION    16    Flow 7      Year  PC
    temp      25
pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  77.08366667             #     17
S(6)  1320
F     2.22
Cl    36.22364417
Ag    0.00005
Al    4.831075645 gibbsite
As    0.004326012
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.002337149
Cr    0.0025
Cu    0.03956363
Fe(2) 0.092850192 siderite
Hg    1.25221E-05
K     85.8
Mg    4.055029145
Mn(2) 0.06454851  rhodochrosite

Mo    0.286495
Na    36.0200361
Ni    0.002801445
Pb    0.00125
Sb    0.002570814
Se    0.00857554
Si    4.355316305
Sr    1.33158537
Tl    0.0005
U     0.008834403
Zn    0.012979228
-water    1 # kg
Equilibrium_phases

Gibbsite    0     0

Celestite   0     0
Chalcedony  0     0

Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
```

```
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
Save solution     16
end


use solution      2
use solution      7
use solution      12
Mix 1 Year 4
2     1.16        #     Flow 3
7     0.66        #     Flow 5
12    2.99        #     Flow 7

equilibrium_phases

tenorite    0     0
gypsum      0     0
gibbsite    0     0
siderite    0     0
rhodochrosite     0     0
fix_pe      -3    O2(g)
end


use solution      3
use solution      8
use solution      13
Mix 1 Year 10
3     1.54        #     Flow 3
8     1.76        #     Flow 5
13    9.87        #     Flow 7

equilibrium_phases

tenorite    0     0
gypsum      0     0
gibbsite    0     0
siderite    0     0
rhodochrosite     0     0
fix_pe      -3    O2(g)
end


use solution      4
use solution      9
use solution      14
Mix 1 Year 19
3     3.16        #     Flow 3
9     2.96        #     Flow 5
14    15.63       #     Flow 7

equilibrium_phases

tenorite    0     0
```

```
gypsum      0     0
gibbsite    0     0
siderite    0     0
rhodochrosite     0     0
fix_pe      -3    O2(g)
end


use solution      5
use solution      10
use solution      15
Mix 1 Year 22
5     3.39        #     Flow 3
10    3           #     Flow 5
15    16.5        #     Flow 7

equilibrium_phases

tenorite    0     0
gypsum      0     0
gibbsite    0     0
siderite    0     0
rhodochrosite     0     0
fix_pe      -3    O2(g)
end


use solution      6
use solution      11
use solution      16
Mix 1 Post Closure
6     3.89        #     Flow 3
11    3.27        #     Flow 5
16    14.83       #     Flow 7

equilibrium_phases

tenorite    0     0
gypsum      0     0
gibbsite    0     0
siderite    0     0
rhodochrosite     0     0
fix_pe      -3    O2(g)

end
```

#Seepage from saturated impoundment to pond PHREEQC input

```
SELECTED_OUTPUT

    -file                 selected.out
    -solution             true
    -ph                   true
    -pe                   true
 -water                true
    -temperature          true
    -alkalinity           true
    -charge_balance       true
    -percent_error        true
      -totals                   S(6) F Cl Ag Al As Ba Ca Cd Co Cr
      Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr Tl U Zn



phases
fix_pe
e-=e-
log_k     0

phases
fix_pH
H+=H+
log_k     0

Fe(OH)3(a)

Fe(OH)3 + 3H+ = Fe+3 + 3H2O
log_k           4.891


phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999




SOLUTION    1     Flow15      Year  4
    temp      25
pH    4.7
    pe        3
    redox     pe
    units   mg/L
    density   1.00
S(6)  1320
F     2.22
Cl    36
Ag    7.23015E-05
Al    4.77
As    0.00408
```

```
Ba    0.214063573
Ca    497
Cd    0.000436768
Co    0.014873424
Cr    0.002595374
Cu    2.48036509
Fe(2) 0.577630138
Hg    2.3608E-05
K     85.8
Mg    5.517970714
Mn(2) 0.459706786
Mo    0.237
Na    35.4
Ni    0.004673424
Pb    0.00125
Sb    0.004557644
Se    0.0085
Si    19.11322468
Sr    1.3
Tl    0.0005
U     0.011161983
Zn    0.05399864
-water    1 # kg

Equilibrium_phases
Al4(OH)10SO4      0     0
Celestite   0     0
schwertmannite    0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
fix_pe      -3    O2(g)
fix_pH      -4.7  NaOH
Save solution     1

end

SOLUTION    2     Flow15      Year  10
    temp      25
    pH      5.537563369
    pe        3
    redox     pe
    units   mg/L
    density   1.00
S(6)  1320
F     2.22
Cl    36
Ag    5.60387E-05
Al    4.77
As    0.00408
Ba    0.144367133
Ca    497
Cd    0.000846283
Co    0.038038044
Cr    0.0025
Cu    1.03583165
```

```
Fe(2) 0.86406758
Hg    2.8993E-05
K     85.8
Mg    37.17498376
Mn(2) 1.311854118
Mo    0.237
Na    50.3874631
Ni    0.012851948
Pb    0.00125
Sb    0.003967298
Se    0.012571964
Si    14.34338722
Sr    1.471416127
Tl    0.0005
U     0.160929383
Zn    0.073183901
-water    1 # kg

Equilibrium_phases

Al4(OH)10SO4      0     0
Celestite   0     0
schwertmannite    0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
fix_pe      -3    O2(g)
fix_pH      -5.538      NaOH
Save solution     2
end

SOLUTION    3     Flow15      Year  19
    temp      25
pH    6.882564631
    pe        3
    redox     pe
    units   mg/L
    density   1.00
Alkalinity  400.2805951             #     4

S(6)  1320
F     2.22
Cl    36
Ag    0.00005
Al    4.77  gibbsite
As    0.006319046
Ba    0.066368359
Ca    497
Cd    0.000557212
Co    0.042051651
Cr    0.0025
Cu    1.109037209
Fe(2) 1.220306192 siderite

Hg    4.21332E-05
K     85.8
```

```
Mg    57.22641404
Mn(2) 1.777045125 rhodochrosite

Mo    0.237
Na    65.43465208
Ni    0.017102055
Pb    0.00125
Sb    0.0025
Se    0.012159191
Si    7.453932723
Sr    2.830000575
Tl    0.0005
U     0.281824236
Zn    0.066506798
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0
Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -6.883      NaOH
Save solution     3
end

SOLUTION    4     Flow15      Year  22
    temp      25
pH    6.888149231
    pe        3
    redox     pe
    units   mg/L
    density   1.00
Alkalinity  400.2805951             #     5
S(6)  1320
F     2.22
Cl    36
Ag    0.00005
Al    4.77  gibbsite
As    0.006319046
Ba    0.066368359
Ca    497
Cd    0.000557212
Co    0.042051651
Cr    0.0025
Cu    1.109037209
Fe(2) 1.220306192 siderite

Hg    4.21332E-05
K     85.8
Mg    57.22641404
```

```
Mn(2) 1.777045125 rhodochrosite

Mo    0.237
Na    65.43465208
Ni    0.017102055
Pb    0.00125
Sb    0.0025
Se    0.012159191
Si    7.453932723
Sr    2.830000575
Tl    0.0005
U     0.281824236
Zn    0.066506798
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -6.888      NaOH
Save solution     4
end

SOLUTION    5     Flow15      Year  PC
    temp      25

pH    6.888149231
    pe        3

    redox     pe

    units   mg/L
    density   1.00

Alkalinity  400.2805951             #     6

S(6)  1320
F     2.22
Cl    36
Ag    0.00005
Al    4.77  gibbsite
As    0.006319046
Ba    0.066368359
Ca    497
Cd    0.000557212
Co    0.042051651
Cr    0.0025
Cu    1.109037209
```

```
Fe(2) 1.220306192 siderite

Hg    4.21332E-05
K     85.8
Mg    57.22641404
Mn(2) 1.777045125 rhodochrosite

Mo    0.237
Na    65.43465208
Ni    0.017102055
Pb    0.00125
Sb    0.0025
Se    0.012159191
Si    7.453932723
Sr    2.830000575
Tl    0.0005
U     0.281824236
Zn    0.066506798
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -6.888      NaOH

Save solution     5

end
SOLUTION    6     Flow17      Year  4
    temp      25

pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  89.46646761             #     7
S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite

As    0.004382827
Ba    0.076554723
Ca    497
Cd    0.0007686
```

```
Co    0.002067819
Cr    0.0025
Cu    0.008738888
Fe(2) 0.153463176 siderite

Hg    3.98891E-05
K     85.8
Mg    7.975146861
Mn(2) 0.238738668 rhodochrosite

Mo    0.237
Na    36.71399691
Ni    0.002643524
Pb    0.00125
Sb    0.002938333
Se    0.0085
Si    4.620148998
Sr    1.3
Tl    0.0005
U     0.01424587
Zn    0.020505
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      HCl

Save solution     6

end

SOLUTION    7     Flow17      Year  10
    temp      25

pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  89.46646761             #     8

S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
```

```
Al    5.148051667 gibbsite

As    0.004385214
Ba    0.07395968
Ca    497
Cd    0.0007686
Co    0.005124013
Cr    0.0025
Cu    0.100719514
Fe(2) 0.227008462 siderite

Hg    3.89677E-05
K     85.8
Mg    10.74656157
Mn(2) 0.235401834 rhodochrosite

Mo    0.237
Na    38.72776679
Ni    0.003778037
Pb    0.00125
Sb    0.002938333
Se    0.00872964
Si    4.666397935
Sr    1.392557016
Tl    0.0005
U     0.028320539
Zn    0.024415235
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH

Save solution     7
end

SOLUTION    8     Flow17      Year  19
    temp      25
pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  89.46646761             #     9
S(6)  1320
F     2.22
```

```
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite

As    0.004330373
Ba    0.073871667
Ca    497
Cd    0.0007686
Co    0.00603453
Cr    0.0025
Cu    0.12845464
Fe(2) 0.245824835 siderite

Hg    3.85214E-05
K     85.8
Mg    11.80605695
Mn(2) 0.241541768 rhodochrosite

Mo    0.237
Na    38.75850742
Ni    0.004132818
Pb    0.00125
Sb    0.002938333
Se    0.008909175
Si    4.643794394
Sr    1.471086326
Tl    0.0005
U     0.034249483
Zn    0.025648971
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH

Save solution     8

end

SOLUTION    9     Flow17      Year  22
    temp      25
pH    7.8175
    pe        3
    redox     pe
    units   mg/L
    density   1.00
```

```
Alkalinity  89.46646761             #     10

S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite

As    0.004388459
Ba    0.073871667
Ca    497
Cd    0.0007686
Co    0.007086532
Cr    0.0025
Cu    0.157095888
Fe(2) 0.274287876 siderite

Hg    3.86269E-05
K     85.8
Mg    13.1327129
Mn(2) 0.286391364 rhodochrosite

Mo    0.237
Na    39.53767492
Ni    0.004511628
Pb    0.00125
Sb    0.002938333
Se    0.009004102
Si    4.725874038
Sr    1.510778037
Tl    0.0005
U     0.041480746
Zn    0.026842363
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH
Save solution     9
end

SOLUTION    10    Flow17      Year  PC
    temp      25
pH    7.8175
    pe        3
    redox     pe
    units   mg/L
```

```
    density   1.00

Alkalinity  89.46646761             #     11

S(6)  1320
F     2.22
Cl    37.38433333
Ag    0.00005
Al    5.148051667 gibbsite

As    0.004366115
Ba    0.073871667
Ca    497
Cd    0.0007686
Co    0.006681864
Cr    0.0025
Cu    0.146078612
Fe(2) 0.26333915  siderite

Hg    3.85863E-05
K     85.8
Mg    12.62239523
Mn(2) 0.269139309 rhodochrosite

Mo    0.237
Na    39.23795671
Ni    0.004365913
Pb    0.00125
Sb    0.002938333
Se    0.008967587
Si    4.694300899
Sr    1.495510038
Tl    0.0005
U     0.038699135
Zn    0.026383307
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.818      NaOH

Save solution     10

end

SOLUTION    11    Flow19      Year  4
```

```
    temp      25

pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  68.67380316             #     12

S(6)  1320
F     2.22
Cl    36.11200812
Ag    0.00005
Al    4.800588627 gibbsite

As    0.004306756
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001545943
Cr    0.0025
Cu    0.017219652
Fe(2) 0.067562221 siderite

Hg    1.01206E-05
K     85.8
Mg    2.854998136
Mn(2) 0.042411043 rhodochrosite

Mo    0.286495
Na    35.50631711
Ni    0.002511613
Pb    0.00125
Sb    0.002535466
Se    0.0085
Si    4.316712763
Sr    1.3
Tl    0.0005
U     0.003983444
Zn    0.011214391
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
Save solution     11
```

```
end

SOLUTION    12    Flow19      Year  10
    temp      25

pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  68.67380316             #     13

S(6)  1320
F     2.22
Cl    36.04517361
Ag    0.00005
Al    4.782336594 gibbsite

As    0.004293301
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001618259
Cr    0.0025
Cu    0.020104687
Fe(2) 0.065449825 siderite

Hg    8.52686E-06
K     85.8
Mg    2.676476569
Mn(2) 0.031989179 rhodochrosite

Mo    0.286495
Na    35.50859179
Ni    0.002541705
Pb    0.00125
Sb    0.002514304
Se    0.008507494
Si    4.302282629
Sr    1.303020323
Tl    0.0005
U     0.00390365
Zn    0.01085396
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
```

```
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH

Save solution     12

end

SOLUTION    13    Flow19      Year  19
    temp      25
    pH      7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  68.67380316             #     14

S(6)  1320
F     2.22
Cl    36.12526263
Ag    0.00005
Al    4.804208341 gibbsite

As    0.004304591
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001910311
Cr    0.0025
Cu    0.028069282
Fe(2) 0.076814525 siderite

Hg    1.0307E-05
K     85.8
Mg    3.254980859
Mn(2) 0.044709937 rhodochrosite

Mo    0.286495
Na    35.70389753
Ni    0.002647747
Pb    0.00125
Sb    0.002539663
Se    0.008537025
Si    4.3220134
Sr    1.315480898
Tl    0.0005
U     0.005900398
Zn    0.011776633
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
```

```
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
Save solution     13
end

SOLUTION    14    Flow19      Year  22
    temp      25
pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  68.67380316             #     15
S(6)  1320
F     2.22
Cl    36.11561633
Ag    0.00005
Al    4.801574005 gibbsite

As    0.004307415
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.001966574
Cr    0.0025
Cu    0.0295844
Fe(2) 0.07789683  siderite

Hg    1.00996E-05
K     85.8
Mg    3.300266537
Mn(2) 0.046947657 rhodochrosite

Mo    0.286495
Na    35.74556909
Ni    0.002668007
Pb    0.00125
Sb    0.002536609
Se    0.008542101
Si    4.326403197
Sr    1.317603697
Tl    0.0005
U     0.006287142
Zn    0.011770021
-water    1 # kg

Equilibrium_phases

Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
```

```
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
Save solution     14

end

SOLUTION    0     Flow19      Year  PC
    temp      25
pH    7.64375
    pe        3
    redox     pe
    units   mg/L
    density   1.00

Alkalinity  68.67380316             #     16

S(6)  1320
F     2.22
Cl    36.22364417
Ag    0.00005
Al    4.831075645 gibbsite

As    0.004326012
Ba    0.1087575
Ca    497
Cd    0.001604265
Co    0.002337149
Cr    0.0025
Cu    0.03956363
Fe(2) 0.092850192 siderite

Hg    1.25221E-05
K     85.8
Mg    4.055029145
Mn(2) 0.06454851  rhodochrosite

Mo    0.286495
Na    36.0200361
Ni    0.002801445
Pb    0.00125
Sb    0.002570814
Se    0.00857554
Si    4.355316305
Sr    1.33158537
Tl    0.0005
U     0.008834403
Zn    0.012979228
-water    1 # kg

Equilibrium_phases
```

```
Gibbsite    0     0
Celestite   0     0
Chalcedony  0     0
Fluorite    0     0
Rhodochrosite     0     0

Gypsum      0     0
tenorite    0     0
Siderite    0     0
fix_pe      -3    O2(g)
fix_pH      -7.644      NaOH
End
```

Appendix B
Supplemental Unsaturated Kinetic Test Results

CASiNO
COPPER AND GOLD

Appendix C
Letter from SGS Regarding Arsenic Contamination

CASINO
COPPER AND GOLD

August 14, 2013

Mr. John Dockery
Lorax Environmental
2289 Burrard St.
Vancouver, BC
V6J 3H9

Subject: Arsenic Contamination Western Copper Tailings Kinetic Test (T7)

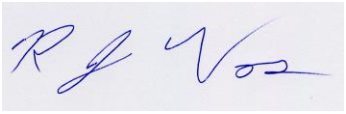
Dear Diana,

This letter is to notify you of arsenic contamination in tailings humidity cell T7, set up on March 5, 2013. Tests have traced the contamination source to the silicon sealant used to seal the edge of the filter cloth.

In the construction and set up of the tailings humidity cell, a filter cloth is used to prevent fines from passing through the cell. Silicon sealant is used to seal the edge of the cloth to the sides of the humidity cell. This has been our practice for more than 10 years without any signs of contamination during the leaching test. The sealant is purchased from a retail supplier such as Home Depot or Rona where it is sold for use in kitchens and baths. Recently, the suppliers introduced a new product that mitigated the growth of up to 5 moulds. Although the label on the sealant indicates that it is 100% silicon, the small amount of the mould inhibitor was enough to cause serious contamination in the kinetic test leachate. All arsenic results for this test have been removed from the date the test was started to the present.

To prevent future contamination from silicon sealant, we have gone back to our original product without the mould inhibitor; as a further precaution we have tested the regular silicon sealant to ensure that it does not leach any extraneous metals into the test.

Sincerely,



Rik Vos
ARD Testing Specialist
SGS Canada Inc.

Appendix D
Supplemental Saturated Column Results

CASiNO
COPPER AND GOLD

T7

Sample = HYP-PyRo Tails Whole															
Date	**Cycle**	**Volume mL**		**pH**	**Cond.**	**Acidity**	**Acidity**	**Alkalinity**	**Sulphate**	**Cl**	**F**	**Br**	**Total CN**	**WAD CN**	**Hardness**
	No.	**Input**	**Output**			**(pH 4.5)**	**(pH 8.3)**								**CaCO3**
					umhos/cm	**mgCaCO3/L**	**mgCaCO3/L**	**mgCaCO3/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
5-Mar-13	0	750	420	7.30	1829	#N/A	12.5	57.4	847	22	0.65	0.3	< 0.01	< 0.01	822
12-Mar-13	1	500	475	7.26	719	#N/A	8.5	52.4	273	4.0	0.74	< 0.3	< 0.01	< 0.01	312
19-Mar-13	2	500	450	7.33	666	#N/A	11.8	66.8	268	1.5	0.83	< 0.3	< 0.01	< 0.01	265
26-Mar-13	3	500	455	7.69	443	#N/A	7.9	61.8	138	0.5	0.73	< 0.3	< 0.01	< 0.01	185
2-Apr-13	4	500	430	7.45	376										
9-Apr-13	5	500	425	7.78	371	#N/A	6.6	69.2	106	< 0.2	0.89	< 0.3	< 0.01	< 0.01	144
16-Apr-13	6	500	440	7.45	376										
23-Apr-13	7	500	415	7.78	256	#N/A	6.4	66.2	65	0.2	0.87	< 0.3	< 0.01	< 0.01	97.7
30-Apr-13	8	500	400	7.56	271										
7-May-13	9	500	465	7.78	289	#N/A	11.4	83.7	73	0.3	0.64	< 0.3	< 0.01	< 0.01	129
14-May-13	10	500	425	7.41	266										
21-May-13	11	500	430	7.84	261	#N/A	6.3	73.3	56	0.3	0.61	< 0.3	< 0.01	< 0.01	105
28-May-13	12	500	485	7.31	242										
4-Jun-13	13	500	445	7.81	223	#N/A	6.0	76.2	40	0.3	0.52	< 0.3	< 0.01	< 0.01	101
11-Jun-13	14	500	445	7.28	212										
18-Jun-13	15	500	420	7.74	194	#N/A	7.4	70.6	31	0.6	0.46	< 0.3	#N/A	#N/A	89.8
25-Jun-13	16	500	430	7.42	189										
2-Jul-13	17	500	430	7.73	194	#N/A	10.0	80.1	27	0.4	0.40	< 0.3	#N/A	#N/A	81.9
9-Jul-13	18	500	420	7.76	185										
16-Jul-13	19	500	425	7.80	192	#N/A	5.1	71.2	22	< 1	0.33	< 0.3	#N/A	#N/A	86.7
23-Jul-13	20	500	430	7.77	161										
30-Jul-13	21	500	435	7.77	175	#N/A	6.4	70.6	21	0.3	0.32	< 0.3	#N/A	#N/A	79.0
6-Aug-13	22	500	430	7.79	166										
13-Aug-13	23	500	435	7.80	180	#N/A	5.5	70.5	14	< 1	0.29	< 0.3	#N/A	#N/A	79.4
20-Aug-13	24	500	365	7.68	178										
27-Aug-13	25	500	430	7.83	153	#N/A	3.8	63.8	13	0.4	0.22	< 0.3	#N/A	#N/A	69.7
3-Sep-13	26	500	435	7.78	146										
10-Sep-13	27	500	420	7.75	152	#N/A	4.8	62.5	11	0.3	0.24	< 0.3	#N/A	#N/A	72.4
17-Sep-13	28	500	425	7.81	159										
24-Sep-13	29	500	440	7.85	174	#N/A	3.0	65.3	13	0.4	0.21	< 0.3	#N/A	#N/A	81.9
1-Oct-13	30	500	435	7.88	171										
8-Oct-13	31	500	420	7.87	178	#N/A	2.6	68.7							

Mar 5/13 to July 30/13 As removed due to As contamination from silicon sealant.
Aug 20/13 New cell constructed using new sealant.

T7

Sample = HYP-PyRo Tails Whole															
Date	**Cycle No.**	**Al**	**Sb**	**As**	**Ba**	**Be**	**Bi**	**B**	**Cd**	**Ca**	**Cr**	**Co**	**Cu**	**Fe**	**Pb**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
5-Mar-13	0	0.0288	0.0014	#N/A	0.0278	< 0.00002	< 0.00001	0.0411	0.000022	304	< 0.0005	0.000304	0.0013	< 0.003	0.00018
12-Mar-13	1	0.0399	0.0012	#N/A	0.0158	< 0.00002	< 0.00001	0.0368	0.000021	113	< 0.0005	0.000082	0.0011	0.007	0.00012
19-Mar-13	2	0.0279	0.0013	#N/A	0.0209	< 0.00002	< 0.00001	0.0348	< 0.000003	93.5	< 0.0005	0.000153	0.0013	< 0.003	0.00011
26-Mar-13	3	0.0518	0.0010	#N/A	0.0174	< 0.00002	< 0.00001	0.0253	0.000024	64.8	< 0.0005	0.000225	0.0020	< 0.003	0.00007
2-Apr-13	4														
9-Apr-13	5	0.0266	0.0013	#N/A	0.0235	< 0.00002	< 0.00001	0.0246	0.000011	49.7	< 0.0005	0.000137	< 0.0005	< 0.003	0.00007
16-Apr-13	6														
23-Apr-13	7	0.0325	0.0017	#N/A	0.0303	< 0.00002	< 0.00001	0.0179	0.000012	32.9	< 0.0005	0.000058	0.0010	0.006	0.00008
30-Apr-13	8														
7-May-13	9	0.0192	0.0023	#N/A	0.0516	< 0.00002	< 0.00001	0.0163	0.000012	43.7	< 0.0005	0.000153	0.0005	< 0.003	0.00003
14-May-13	10														
21-May-13	11	0.0217	0.0028	#N/A	0.0497	< 0.00002	< 0.00001	0.0119	0.000004	35.7	< 0.0005	0.000037	0.0006	< 0.003	< 0.00002
28-May-13	12														
4-Jun-13	13	0.0201	0.0027	#N/A	0.0590	< 0.00002	< 0.00001	0.0097	0.000017	34.2	< 0.0005	0.000074	0.0139	< 0.003	< 0.00002
11-Jun-13	14														
18-Jun-13	15	0.0179	0.0032	#N/A	0.0653	< 0.00002	< 0.00001	0.0094	0.000021	30.2	< 0.0005	0.000150	< 0.0005	0.005	< 0.00002
25-Jun-13	16														
2-Jul-13	17	0.0265	0.0032	#N/A	0.0738	< 0.00002	< 0.00001	0.0082	0.000008	27.5	< 0.0005	0.000027	0.0007	< 0.003	< 0.00002
9-Jul-13	18														
16-Jul-13	19	0.0253	0.0029	#N/A	0.0821	< 0.00002	< 0.00001	0.0073	0.000011	29.1	< 0.0005	0.000047	0.0027	< 0.003	0.00003
23-Jul-13	20														
30-Jul-13	21	0.0235	0.0028	#N/A	0.0888	< 0.00002	< 0.00001	0.0077	0.000009	26.4	< 0.0005	0.000019	0.0006	< 0.003	0.00002
6-Aug-13	22														
13-Aug-13	23	0.0220	0.0027	#N/A	0.107	< 0.00002	< 0.00001	0.0064	0.000023	26.4	< 0.0005	0.000142	0.0007	0.010	0.00002
20-Aug-13	24														
27-Aug-13	25	0.0302	0.0022	#N/A	0.117	< 0.00002	< 0.00001	0.0298	< 0.000003	23.3	< 0.0005	0.000038	0.0010	< 0.003	0.00003
3-Sep-13	26														
10-Sep-13	27	0.0397	0.0021	#N/A	0.122	< 0.00002	< 0.00001	0.0164	0.000010	24.6	< 0.0005	0.000119	0.0009	0.012	0.00002
17-Sep-13	28														
24-Sep-13	29	0.0220	0.0025	#N/A	0.141	< 0.00002	< 0.00001	0.0140	0.000007	27.3	< 0.0005	0.000039	0.0009	< 0.003	0.00007
1-Oct-13	30														
8-Oct-13	31														

Mar 5/13 to July 30/13 As removed due to As contamination from silicon sealant.
Aug 20/13 New cell constructed using new sealant.

T7

Sample = HYP-PyRo Tails Whole															
Date	**Cycle No.**	**Li**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**P**	**K**	**Se**	**Si**	**Ag**	**Na**	**Sr**	**S**
		mg/L	**mg/L**	**mg/L**	**ug/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
5-Mar-13	0	0.004	15.3	0.0685	< 0.01	0.0189	0.0015	0.346	63.7	0.00267	13.4	0.00001	33.0	1.27	318
12-Mar-13	1	0.002	7.41	0.0365	< 0.01	0.0117	0.0007	0.105	32.8	0.00116	31.4	< 0.00001	9.18	0.508	112
19-Mar-13	2	0.002	7.59	0.0248	< 0.01	0.0126	0.0004	0.076	28.6	0.00102	16.8	< 0.00001	5.93	0.461	88.6
26-Mar-13	3	0.001	5.55	0.0184	< 0.01	0.00763	0.0003	0.048	18.8	0.00059	11.5	< 0.00001	2.64	0.312	51.9
2-Apr-13	4														
9-Apr-13	5	0.001	4.89	0.0161	< 0.01	0.00982	0.0002	0.018	15.7	0.00169	9.16	< 0.00001	1.56	0.260	35.4
16-Apr-13	6														
23-Apr-13	7	0.001	3.77	0.0103	< 0.01	0.00947	0.0003	0.020	12.3	0.00035	8.02	< 0.00001	0.84	0.192	19.1
30-Apr-13	8														
7-May-13	9	0.001	4.83	0.0169	< 0.01	0.0226	< 0.0001	0.019	11.7	0.00031	7.16	< 0.00001	0.69	0.259	22.9
14-May-13	10														
21-May-13	11	0.001	3.97	0.0121	< 0.01	0.0326	< 0.0001	0.019	8.83	0.00026	6.24	< 0.00001	0.47	0.212	17.9
28-May-13	12														
4-Jun-13	13	< 0.001	3.85	0.0111	< 0.01	0.0298	0.0029	0.016	8.35	0.00035	5.88	0.00001	0.38	0.199	12.4
11-Jun-13	14														
18-Jun-13	15	0.001	3.50	0.0094	< 0.01	0.0279	0.0002	0.017	7.14	0.00054	5.91	< 0.00001	0.37	0.185	10.6
25-Jun-13	16														
2-Jul-13	17	< 0.001	3.24	0.0071	< 0.01	0.0274	0.0003	0.015	6.40	0.00026	4.09	< 0.00001	0.29	0.171	9.39
9-Jul-13	18														
16-Jul-13	19	< 0.001	3.43	0.0050	< 0.01	0.0240	0.0003	0.016	5.53	0.00031	4.64	< 0.00001	0.31	0.176	8.00
23-Jul-13	20														
30-Jul-13	21	< 0.001	3.15	0.0036	0.01	0.0190	0.0001	0.020	5.01	0.00031	4.29	< 0.00001	0.26	0.162	5.87
6-Aug-13	22														
13-Aug-13	23	< 0.001	3.27	0.0034	< 0.01	0.0169	0.0006	0.018	4.59	0.00037	4.16	< 0.00001	0.25	0.172	5.29
20-Aug-13	24														
27-Aug-13	25	< 0.001	2.82	0.0023	0.01	0.0139	0.0002	< 0.009	4.04	0.00017	1.60	< 0.00001	0.31	0.150	4.49
3-Sep-13	26														
10-Sep-13	27	< 0.001	2.95	0.0004	< 0.01	0.0155	< 0.0001	< 0.009	3.80	0.00029	1.58	< 0.00001	0.27	0.151	4.96
17-Sep-13	28														
24-Sep-13	29	< 0.001	3.36	0.0021	< 0.01	0.0220	< 0.0001	< 0.009	4.00	0.00041	1.64	< 0.00001	0.28	0.168	6.76
1-Oct-13	30														
8-Oct-13	31														

Mar 5/13 to July 30/13 As removed due to As contamination from silicon sealant.
Aug 20/13 New cell constructed using new sealant.

T7

Sample = HYP-PyRo Tails Whole														
Date	**Cycle**	**Tl**	**Sn**	**Ti**	**U**	**V**	**Zn**	**Zr**			**Major**	**Major**	**Diff**	**Diff**
	No.								**SGS File #**		**Anions**	**Cations**		**(%)**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**						
5-Mar-13	0	0.00010	0.0168	0.0002	0.0431	0.00014	0.002	0.00007	CA15116-MAR13		19.45	19.54	0.09	0.2%
12-Mar-13	1	0.00005	0.0145	0.0004	0.0206	0.00014	0.001	< 0.00001	CA15226-MAR13		6.89	7.51	0.63	4.4%
19-Mar-13	2	0.00005	0.0153	0.0002	0.0263	< 0.00003	0.001	0.00001	CA15327-MAR13		7.00	6.30	-0.70	-5.3%
26-Mar-13	3	0.00003	0.0133	0.0001	0.0199	0.00015	0.001	0.00002	CA15431-MAR13		4.16	4.31	0.14	1.7%
2-Apr-13	4													
9-Apr-13	5	0.00003	0.0169	0.0001	0.0166	0.00014	< 0.001	< 0.00001	CA15189-APR13		3.64	3.37	-0.27	-3.9%
16-Apr-13	6													
23-Apr-13	7	0.00002	0.0236	0.0001	0.0112	0.00014	0.004	0.00003	CA15318-APR13		2.73	2.32	-0.41	-8.2%
30-Apr-13	8													
7-May-13	9	0.00003	0.0271	0.0001	0.0168	0.00020	0.001	< 0.00001	CA15169-MAY13		3.24	2.92	-0.32	-5.2%
14-May-13	10													
21-May-13	11	0.00003	0.0389	0.0002	0.0136	0.00018	< 0.001	0.00002	CA15297-MAY13		2.67	2.37	-0.31	-6.1%
28-May-13	12													
4-Jun-13	13	< 0.00002	0.0314	0.0001	0.0114	0.00017	< 0.001	0.00004	CA15027-JUN13		2.39	2.26	-0.13	-2.8%
11-Jun-13	14													
18-Jun-13	15	< 0.00002	0.0397	< 0.0001	0.0102	0.00017	0.001	< 0.00001	CA15260-JUN13		2.10	2.00	-0.10	-2.3%
25-Jun-13	16													
2-Jul-13	17	< 0.00002	0.0312	0.0002	0.00910	0.00027	0.001	< 0.00001	CA15072-JUL13		2.20	1.82	-0.37	-9.2%
9-Jul-13	18													
16-Jul-13	19	< 0.00002	0.0372	0.0001	0.00815	0.00018	0.002	0.00001	CA15331-JUL13		1.90	1.90	0.00	0.0%
23-Jul-13	20													
30-Jul-13	21	< 0.00002	0.0363	< 0.0001	0.00732	0.00018	< 0.001	< 0.00001	CA15571-JUL13		1.87	1.72	-0.15	-4.2%
6-Aug-13	22													
13-Aug-13	23	< 0.00002	0.04007	< 0.0001	0.00694	0.00016	0.002	< 0.00001	CA15169-AUG13		1.72	1.72	0.01	0.3%
20-Aug-13	24													
27-Aug-13	25	< 0.00002	0.0128	< 0.0001	0.00639	0.00024	< 0.001	< 0.00001	CA15350-AUG13		1.57	1.53	-0.04	-1.4%
3-Sep-13	26													
10-Sep-13	27	< 0.00002	0.00660	< 0.0001	0.00687	0.00021	0.001	< 0.00001	CA15108-SEP13		1.50	1.59	0.09	3.0%
17-Sep-13	28													
24-Sep-13	29	< 0.00002	0.00300	< 0.0001	0.00873	0.00018	< 0.001	< 0.00001	CA15308-SEP13		1.60	1.77	0.17	5.0%
1-Oct-13	30													
8-Oct-13	31													

Mar 5/13 to July 30/13 As removed due to As contamination from silicon sealant.
Aug 20/13 New cell constructed using new sealant.

Col 5

Sample = Pyrite Rougher Tails (>75 µm)																		
Date	**Cycle**	**Approxi.**	**Volume mL**		**pH**	**Cond.**	**Acidity**	**Acidity**	**Alkalinity**	**Sulphate**	**Cl**	**F**	**Br**	**Total CN**	**WAD CN**	**Hardness**	**Al**	**Sb**
	No.	**Flow Rate**	**Input**	**Output**		**umhos/cm**	**(pH 4.5)**	**(pH 8.3)**								**CaCO3**		
		(mL/min)					**mgCaCO3/L**	**mgCaCO3/L**	**mgCaCO3/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
4-May-11	1	0.5	1505	325	7.68	2297	#N/A	8.4	89.1	1224	62	< 0.06	< 0.3	< 0.01	< 0.01	1170	0.0462	0.0031
11-May-11	2	0.5	300	280	7.66	878	#N/A	5.1	82.7	363	2.5	0.06	< 0.3	< 0.01	< 0.01	313	0.0503	0.0030
18-May-11	3	0.5	300	305	#N/A	#N/A	#N/A	#N/A	#N/A	180	0.8	0.06	< 0.3	< 0.01	< 0.01	195	0.0642	0.0033
25-May-11	4	0.5	300	285	7.83	481	#N/A	5.9	81.6	131	0.6	< 0.06	< 0.3	< 0.01	< 0.01	157	0.0540	0.0033
1-Jun-11	5	0.5	300	290	7.81	436	#N/A	7.3	81.7									
8-Jun-11	6	0.5	350	300	7.66	418	#N/A	7.7	89.6	115	0.4	< 0.06	< 0.3	< 0.01	< 0.01	129	0.0521	0.0034
15-Jun-11	7	0.5	300	305	7.79	431												
22-Jun-11	8	0.5	300	305	8.01	355	#N/A	3.5	94.2	90	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	124	0.0504	0.0032
29-Jun-11	9	0.5	300	300	7.89	338												
6-Jul-11	10	0.5	300	300	7.79	330	#N/A	5.7	97.4	76	0.2	< 0.06	< 0.3	< 0.01	< 0.01	120	0.0693	0.0029
13-Jul-11	11	0.5	300	285	7.74	318												
20-Jul-11	12	0.5	300	290	7.88	310	#N/A	4.8	94.7	66	0.2	0.06	< 0.3	< 0.01	< 0.01	120	0.0404	0.0033
27-Jul-11	13	0.5	300	290	7.89	306												
3-Aug-11	14	0.5	300	190	7.79	299	#N/A	7.9	104.6	58	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	115	0.0380	0.0029
10-Aug-11	15	0.5	300	300	7.85	291												
17-Aug-11	16	0.5	300	295	7.88	292	#N/A	5.2	107.4	36	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	106	0.0379	0.0031
24-Aug-11	17	0.5	300	290	7.82	291												
31-Aug-11	18	0.5	300	300	7.88	301	#N/A	9.2	117.2	46	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	124	0.0472	0.0036
7-Sep-11	19	0.5	300	295	8.03	290												
14-Sep-11	20	0.5	300	310	7.97	282	#N/A	6.6	114.5	44	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	111	0.0391	0.0029
21-Sep-11	21	0.5	300	295	7.86	284												
28-Sep-11	22	0.5	300	295	7.92	283	#N/A	7.2	118.8	38	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	112	0.0659	0.0030
5-Oct-11	23	0.5	300	305	7.95	289												
12-Oct-11	24	0.5	300	305	8.03	288	#N/A	3.9	119.4	39	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	122	0.0331	0.0032
19-Oct-11	25	0.5	300	300	8.00	296												
26-Oct-11	26	0.5	300	300	7.94	292	#N/A	7.7	123.3	38	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	119	0.0602	0.0029
2-Nov-11	27	0.5	300	305	7.92	288												
9-Nov-11	28	0.5	300	290	7.89	290	#N/A	7.7	122.6	35	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	118	0.0436	0.0031
16-Nov-11	29	0.5	300	310	7.98	290												
23-Nov-11	30	0.5	300	300	7.94	285	#N/A	7.2	124.8	31	< 0.2	0.10	< 0.3	< 0.01	< 0.01	112	0.0643	0.0031
30-Nov-11	31	0.5	300	285	7.91	289												
7-Dec-11	32	0.5	300	305	7.95	282	#N/A	6.4	123.0	28	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	118	0.0458	0.0031
14-Dec-11	33	0.5	300	320	7.92	283												
21-Dec-11	34	0.5	300	260	7.93	279	#N/A	7.6	125.4	31	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	121	0.0762	0.0034
28-Dec-11	35	0.5	300	300	7.94	285												
4-Jan-12	36	0.5	300	295	7.91	281	#N/A	7.6	141.0	33	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	111	0.0889	0.0036
11-Jan-12	37	0.5	300	270	7.93	283												
18-Jan-12	38	0.5	300	305	7.91	282	#N/A	4.0	140.7	34	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	115	0.0567	0.0032
25-Jan-12	39	0.5	300	295	7.89	281												
1-Feb-12	40	0.5	300	290	7.89	284	#N/A	4.9	141.2	33	< 0.2	< 0.06	< 0.3	0.02	< 0.01	116	0.0570	0.0040
8-Feb-12	41	0.5	300	300	7.93	287												

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Sample = Pyrite Rougher Tails (>75 µm)																		
Date	**Cycle**	**Approxi.**	**Volume mL**		**pH**	**Cond.**	**Acidity**	**Acidity**	**Alkalinity**	**Sulphate**	**Cl**	**F**	**Br**	**Total CN**	**WAD CN**	**Hardness**	**Al**	**Sb**
	No.	**Flow Rate**	**Input**	**Output**		**umhos/cm**	**(pH 4.5)**	**(pH 8.3)**								**CaCO3**		
		(mL/min)					**mgCaCO3/L**	**mgCaCO3/L**	**mgCaCO3/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
15-Feb-12	42	0.5	300	290	7.89	285												
22-Feb-12	43	0.5	300	285	7.91	274												
29-Feb-12	44	0.5	300	300	7.89	273	#N/A	5.1	125.9	44	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	116	0.0365	0.0037
7-Mar-12	45	0.5	300	300	7.87	275												
14-Mar-12	46	0.5	300	305	7.88	279												
21-Mar-12	47	0.5	300	315	7.86	282												
28-Mar-12	48	0.5	300	340	7.91	289	#N/A	5.0	125.2	29	< 1	< 0.06	< 0.3	< 0.01	< 0.01	123	0.0555	0.0038
4-Apr-12	49	0.5	300	295	7.90	274												
11-Apr-12	50	0.5	300	290	8.01	278												
18-Apr-12	51	0.5	300	275	7.90	272												
25-Apr-12	52	0.5	300	310	7.94	277	#N/A	6.3	122.7	32	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	127	0.0686	0.0045
2-May-12	53	0.5	300	290	8.16	301												
9-May-12	54	0.5	300	290	7.99	272												
16-May-12	55	0.5	300	285	7.35	91												
23-May-12	56	0.5	300	290	7.85	269	#N/A	5.7	119.6	25	0.3	< 0.06	< 0.3	< 0.01	< 0.01	113	0.107	0.0039
30-May-12	57	0.5	300	295	7.94	274												
6-Jun-12	58	0.5	300	300	7.88	267												
13-Jun-12	59	0.5	300	295	7.86	267												
20-Jun-12	60	0.5	300	295	7.94	269	#N/A	6.1	125.7	24	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	120	0.0833	0.0041
27-Jun-12	61	0.5	300	295	7.67	273												
4-Jul-12	62	0.5	300	290	7.84	275												
11-Jul-12	63	0.5	300	290	7.95	268												
18-Jul-12	64	0.5	300	290	7.91	254	#N/A	5.3	121.7	21	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	115	0.0696	0.0042
25-Jul-12	65	0.5	300	300	7.79	262												
1-Aug-12	66	0.5	300	300	8.00	263												
8-Aug-12	67	0.5	300	295	7.96	260												
15-Aug-12	68	0.5	300	290	7.92	255	#N/A	5.4	116.9	20	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	111	0.0771	0.0044
22-Aug-12	69	0.5	300	290	7.88	255												
29-Aug-12	70	0.5	300	295	7.90	251												
5-Sep-12	71	0.5	300	300	7.91	261												
12-Sep-12	72	0.5	300	285	7.90	261	#N/A	5.4	118.2	22	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	111	0.0362	0.0043
19-Sep-12	73	0.5	300	295	7.87	257												
26-Sep-12	74	0.5	300	300	7.91	260												
3-Oct-12	75	0.5	300	295	7.91	260												
10-Oct-12	76	0.5	300	295	7.75	253	#N/A	9.5	128.1	21	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	111	0.0567	0.0048
17-Oct-12	77	0.5	300	305	7.93	260												
24-Oct-12	78	0.5	300	295	7.95	270												
31-Oct-12	79	0.5	300	300	7.98	253												
7-Nov-12	80	0.5	300	295	7.85	235	#N/A	6.5	123.1	22	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	112	0.0295	0.0044
14-Nov-12	81	0.5	300	290	7.87	253												
21-Nov-12	82	0.5	300	300	7.90	237												
28-Nov-12	83	0.5	300	295	7.81	261												
5-Dec-12	84	0.5	300	305	7.87	246	#N/A	11.6	124.7	19	< 0.2	< 0.06	< 0.3	< 0.01	< 0.01	112	0.0301	0.0046

Cell Terminated
May 18/11 Titrator malfunction, samples being repeated.
Feb, 2012 Change in analytical schedule.

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Sample = Pyrite Rougher Tails (>75 µm)																				
Date	**Cycle**	**As**	**Ba**	**Be**	**Bi**	**B**	**Cd**	**Ca**	**Cr**	**Co**	**Cu**	**Fe**	**Pb**	**Li**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**P**	**K**
	No.																				
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**ug/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
4-May-11	1	0.0049	0.0799	< 0.00002	< 0.00001	0.0735	0.00332	445	0.0011	0.0031	0.316	0.003	0.00244	< 0.001	14.8	0.109	0.03	1.10	0.0178	1.32	69.9
11-May-11	2	0.0036	0.0288	< 0.00002	0.00008	0.0663	0.00112	118	< 0.0005	0.0014	0.173	< 0.002	0.00028	< 0.001	4.30	0.0367	0.01	0.559	0.0010	0.196	33.9
18-May-11	3	0.0035	0.0266	< 0.00002	0.00004	0.0720	0.000634	72.0	0.0008	0.0008	0.138	< 0.002	0.00017	< 0.001	3.74	0.0276	0.01	0.425	0.0024	0.280	29.1
25-May-11	4	0.0035	0.0295	< 0.00002	0.00002	0.0654	0.000488	58.7	< 0.0005	0.0008	0.115	< 0.002	0.00010	< 0.001	2.44	0.0221	< 0.01	0.365	0.0029	0.276	23.8
1-Jun-11	5																				
8-Jun-11	6	0.0037	0.0281	< 0.00002	0.00002	0.0690	0.000472	48.2	< 0.0005	0.0006	0.0949	< 0.002	0.00019	< 0.001	2.21	0.0208	0.01	0.308	0.0016	0.278	21.4
15-Jun-11	7																				
22-Jun-11	8	0.0032	0.0281	< 0.00002	0.00003	0.0667	0.000386	46.2	< 0.0005	0.0004	0.0739	< 0.002	0.00014	< 0.001	2.15	0.0202	0.01	0.262	0.0001	0.174	20.4
29-Jun-11	9																				
6-Jul-11	10	0.0030	0.0326	< 0.00002	< 0.00001	0.0672	0.000318	44.6	< 0.0005	0.0005	0.0980	0.002	0.00037	< 0.001	2.16	0.0197	< 0.01	0.238	0.0011	0.141	19.7
13-Jul-11	11																				
20-Jul-11	12	0.0034	0.0382	< 0.00002	0.00001	0.0609	0.000431	44.3	< 0.0005	0.0003	0.0515	< 0.002	0.00008	< 0.001	2.20	0.0206	< 0.01	0.209	0.0015	0.125	19.2
27-Jul-11	13																				
3-Aug-11	14	0.0043	0.0384	< 0.00002	< 0.00001	0.0647	0.000229	42.7	0.0023	0.0004	0.0460	< 0.002	0.00013	< 0.001	2.13	0.0209	0.01	0.152	0.0001	0.096	18.9
10-Aug-11	15																				
17-Aug-11	16	0.0032	0.0450	< 0.00002	0.00001	0.0623	0.000183	39.0	0.0018	0.0003	0.0413	0.009	0.00008	< 0.001	2.05	0.0193	0.01	0.134	0.0002	0.098	18.1
24-Aug-11	17																				
31-Aug-11	18	0.0041	0.0516	< 0.00002	< 0.00001	0.0726	0.000190	45.7	0.0014	0.0003	0.0428	0.002	0.00019	< 0.001	2.40	0.0231	0.01	0.118	0.0016	0.070	21.4
7-Sep-11	19																				
14-Sep-11	20	0.0033	0.0507	< 0.00002	< 0.00001	0.0607	0.000172	40.8	0.0014	0.0003	0.0356	< 0.002	0.00020	< 0.001	2.22	0.0197	< 0.01	0.103	< 0.0001	0.074	18.2
21-Sep-11	21																				
28-Sep-11	22	0.0033	0.0534	< 0.00002	< 0.00001	0.0506	0.000184	41.0	0.0016	0.00036	0.0336	0.002	0.00021	< 0.001	2.28	0.0225	< 0.01	0.0927	0.0001	0.074	18.7
5-Oct-11	23																				
12-Oct-11	24	0.0037	0.0592	< 0.00002	< 0.00001	0.0556	0.000151	44.5	0.0017	0.000200	0.0321	0.002	0.00015	< 0.001	2.54	0.0239	< 0.01	0.0987	0.0011	0.086	21.0
19-Oct-11	25																				
26-Oct-11	26	0.0033	0.0635	< 0.00002	< 0.00001	0.0537	0.000127	43.4	0.0092	0.000309	0.0323	0.008	0.00010	< 0.001	2.53	0.0246	0.01	0.0842	0.0012	0.093	19.4
2-Nov-11	27																				
9-Nov-11	28	0.0033	0.0606	< 0.00002	< 0.00001	0.0434	0.000140	42.8	< 0.0005	0.000252	0.0292	< 0.003	0.00006	< 0.001	2.61	0.0287	< 0.01	0.0913	0.0018	0.091	18.1
16-Nov-11	29																				
23-Nov-11	30	0.0032	0.0610	< 0.00002	0.00001	0.0430	0.000148	40.9	< 0.0005	0.000302	0.0297	< 0.003	0.00006	< 0.001	2.45	0.0266	< 0.01	0.0852	0.0012	0.076	17.1
30-Nov-11	31																				
7-Dec-11	32	0.0032	0.0635	< 0.00002	< 0.00001	0.0410	0.000131	42.8	< 0.0005	0.000195	0.0279	< 0.003	< 0.00002	< 0.001	2.65	0.0279	0.01	0.0890	0.0003	0.087	18.1
14-Dec-11	33																				
21-Dec-11	34	0.0033	0.0647	< 0.00002	< 0.00001	0.0367	0.000103	43.8	< 0.0005	0.000212	0.0266	< 0.003	< 0.00002	< 0.001	2.75	0.0285	< 0.01	0.0748	0.0012	0.093	19.1
28-Dec-11	35																				
4-Jan-12	36	0.0033	0.0652	< 0.00002	< 0.00001	0.0379	0.000105	40.1	< 0.0005	0.000219	0.0237	< 0.003	0.00003	< 0.001	2.61	0.0278	< 0.01	0.0809	0.0020	0.071	17.4
11-Jan-12	37																				
18-Jan-12	38	0.0039	0.0655	< 0.00002	< 0.00001	0.0376	0.000097	41.7	< 0.0005	0.000301	0.0272	< 0.003	0.00004	< 0.001	2.62	0.0294	0.01	0.0732	0.0002	0.085	15.5
25-Jan-12	39																				
1-Feb-12	40	0.0033	0.0680	< 0.00002	< 0.00001	0.0314	0.000103	42.1	< 0.0005	0.000173	0.0209	< 0.003	0.00004	< 0.001	2.73	0.0311	< 0.01	0.0768	0.0008	0.081	17.1
8-Feb-12	41																				

Col 5

Sample = Pyrite Rougher Tails (>75 µm)																					
Date	**Cycle**	**As**	**Ba**	**Be**	**Bi**	**B**	**Cd**	**Ca**	**Cr**	**Co**	**Cu**	**Fe**	**Pb**	**Li**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**P**	**K**
	No.																				
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**ug/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
15-Feb-12	42																				
22-Feb-12	43																				
29-Feb-12	44	0.0034	0.0676	< 0.00002	< 0.00001	0.0254	0.000085	41.6	< 0.0005	0.0002	0.0194	< 0.003	0.00035	< 0.001	2.83	0.0317	< 0.01	0.0700	0.0004	0.079	16.2
7-Mar-12	45																				
14-Mar-12	46																				
21-Mar-12	47																				
28-Mar-12	48	0.0033	0.0717	< 0.00002	< 0.00001	0.0256	0.000075	44.3	0.0017	0.000142	0.0178	0.080	0.00032	< 0.001	3.02	0.0354	< 0.01	0.0662	0.0010	0.076	16.4
4-Apr-12	49																				
11-Apr-12	50																				
18-Apr-12	51																				
25-Apr-12	52	0.0034	0.0780	< 0.00002	< 0.00001	0.0241	0.000050	45.7	< 0.0005	0.000134	0.0173	< 0.003	0.00013	< 0.001	3.10	0.0372	0.02	0.0642	0.0006	0.077	15.8
2-May-12	53																				
9-May-12	54																				
16-May-12	55																				
23-May-12	56	0.0033	0.0707	< 0.00002	< 0.00001	0.0217	0.000040	40.7	< 0.0005	0.000140	0.0145	< 0.003	0.00004	< 0.001	2.86	0.0351	0.01	0.0634	0.0016	0.083	14.1
30-May-12	57																				
6-Jun-12	58																				
13-Jun-12	59																				
20-Jun-12	60	0.0032	0.0822	< 0.00002	< 0.00001	0.0253	0.000039	43.1	< 0.0005	0.000138	0.0139	< 0.003	0.00003	< 0.001	2.98	0.0378	< 0.01	0.0602	0.0009	0.085	12.9
27-Jun-12	61																				
4-Jul-12	62																				
11-Jul-12	63																				
18-Jul-12	64	0.0032	0.0777	< 0.00002	< 0.00001	0.0147	0.000053	41.2	< 0.0005	0.000167	0.0125	< 0.003	< 0.00002	< 0.001	2.94	0.0377	0.02	0.0588	0.0003	0.085	10.5
25-Jul-12	65																				
1-Aug-12	66																				
8-Aug-12	67																				
15-Aug-12	68	0.0028	0.0820	< 0.00002	< 0.00001	0.0138	< 0.000003	39.7	< 0.0005	0.000123	0.0113	0.004	< 0.00002	< 0.001	2.89	0.0375	0.01	0.0608	0.0004	0.071	10.6
22-Aug-12	69																				
29-Aug-12	70																				
5-Sep-12	71																				
12-Sep-12	72	0.0028	0.0808	< 0.00002	< 0.00001	0.0130	0.000076	39.8	< 0.0005	0.000101	0.0110	< 0.003	0.00006	< 0.001	2.87	0.0388	< 0.01	0.0595	0.0005	0.066	9.22
19-Sep-12	73																				
26-Sep-12	74																				
3-Oct-12	75																				
10-Oct-12	76	0.0048	0.0874	< 0.00002	< 0.00001	0.0211	0.000064	39.8	< 0.0005	0.000138	0.0115	< 0.003	0.00002	< 0.001	2.91	0.0411	< 0.01	0.0598	0.0002	0.070	9.20
17-Oct-12	77																				
24-Oct-12	78																				
31-Oct-12	79																				
7-Nov-12	80	0.0027	0.0804	< 0.00002	< 0.00001	0.0112	0.000059	39.8	< 0.0005	0.000127	0.0102	< 0.003	0.00037	< 0.001	2.98	0.0427	< 0.01	0.0580	0.0003	0.076	7.97
14-Nov-12	81																				
21-Nov-12	82																				
28-Nov-12	83																				
5-Dec-12	84	0.0031	0.0874	< 0.00002	< 0.00001	0.0116	0.000078	39.9	< 0.0005	0.000193	0.0118	< 0.003	0.00006	< 0.001	3.05	0.0433	< 0.01	0.0593	0.0004	0.073	8.39

Cell Terminated
May 18/11 Titrator malfunction, samples being repeated.
Feb, 2012 Change in analytical schedule.

Col 5

Sample = Pyrite Rougher Tails (>75 µm)																			
Date	**Cycle**	**Se**	**Si**	**Ag**	**Na**	**Sr**	**S**	**Tl**	**Sn**	**Ti**	**U**	**V**	**Zn**	**Zr**		**Major**	**Major**	**Diff**	**Diff**
	No.														**SGS File #**	**Anions**	**Cations**		**(%)**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**					
4-May-11	1	0.0255	2.31	0.00061	89.7	1.52	458	< 0.0002	0.00402	0.0021	0.136	0.00128	0.039	0.00005	CA14310-MAY11	29.03	29.19	0.16	0.3%
11-May-11	2	0.00105	1.66	0.00007	35.8	0.413	129	< 0.0002	0.00220	0.0007	0.0262	0.00128	0.004	0.00003	CA14451-MAY11	9.29	8.71	-0.58	-3.2%
18-May-11	3	0.00099	1.83	0.00087	32.3	0.270	77.0	< 0.0002	0.00291	0.0006	0.0155	0.00163	0.002	0.00001	CA14792-MAY11	#N/A	6.09	#N/A	#N/A
25-May-11	4	0.00145	1.57	0.00003	19.8	0.222	56.0	< 0.0002	0.00944	0.0008	0.0131	0.00144	0.002	0.00001	CA10944-JUN11	4.38	4.63	0.25	2.8%
1-Jun-11	5																		
8-Jun-11	6	0.00034	1.61	0.00004	13.1	0.190	38.2	0.00006	0.0651	0.0006	0.0120	0.00147	0.004	0.00002	CA11140-JUN11	4.20	3.74	-0.46	-5.8%
15-Jun-11	7																		
22-Jun-11	8	0.00025	1.47	< 0.00001	7.89	0.184	30.8	0.00005	0.197	0.0005	0.0103	0.00147	0.011	0.00001	CA10468-JUN11	3.76	3.39	-0.37	-5.2%
29-Jun-11	9																		
6-Jul-11	10	0.00026	1.55	< 0.00001	4.55	0.183	25.0	0.00006	0.390	0.0004	0.00904	0.00136	0.004	< 0.00001	CA15474-JUL11	3.54	3.15	-0.38	-5.7%
13-Jul-11	11																		
20-Jul-11	12	0.00094	1.48	< 0.00001	3.30	0.186	21.8	0.00005	0.381	0.0004	0.00920	0.00150	0.002	0.00001	CA16183-JUL11	3.28	3.07	-0.21	-3.3%
27-Jul-11	13																		
3-Aug-11	14	0.00056	1.46	< 0.00001	2.38	0.180	18.2	0.00006	0.380	0.0003	0.00905	0.00135	0.002	0.00001	CA14195-AUG11	3.30	2.93	-0.36	-5.8%
10-Aug-11	15																		
17-Aug-11	16	0.00023	1.26	< 0.00001	2.21	0.166	17.4	0.00005	0.466	0.0004	0.00944	0.00131	< 0.001	0.00001	CA14769-AUG11	2.90	2.72	-0.18	-3.2%
24-Aug-11	17																		
31-Aug-11	18	0.00036	1.59	< 0.00001	1.86	0.200	16.9	0.00006	0.454	0.0004	0.00873	0.00147	0.003	0.00001	CA14272-SEP11	3.30	3.15	-0.15	-2.3%
7-Sep-11	19																		
14-Sep-11	20	0.00034	1.35	< 0.00001	1.39	0.179	14.1	0.00005	0.414	0.0004	0.00910	0.00133	0.002	0.00001	CA17319-SEP11	3.21	2.79	-0.42	-7.0%
21-Sep-11	21																		
28-Sep-11	22	0.00043	1.39	< 0.00001	1.22	0.181	13.1	0.00006	0.418	0.0003	0.00899	0.00127	0.003	0.00002	CA18914-SEP11	3.17	2.81	-0.36	-6.0%
5-Oct-11	23																		
12-Oct-11	24	0.00039	1.57	< 0.00001	1.23	0.201	13.9	0.00006	0.427	0.0003	0.00906	0.00131	0.003	0.00003	CA14526-OCT11	3.20	3.06	-0.14	-2.2%
19-Oct-11	25																		
26-Oct-11	26	0.00035	1.38	< 0.00001	1.11	0.197	13.5	0.00006	0.411	0.0003	0.00944	0.00130	0.004	0.00002	CA18601-OCT11	3.26	2.96	-0.30	-4.8%
2-Nov-11	27																		
9-Nov-11	28	0.00062	1.39	< 0.00001	1.13	0.198	11.9	0.00006	0.396	0.0005	0.00895	0.00150	0.002	< 0.00001	CA18507-NOV11	3.18	2.90	-0.28	-4.6%
16-Nov-11	29																		
23-Nov-11	30	0.00009	1.39	< 0.00001	0.83	0.188	11.2	0.00006	0.435	0.0004	0.00818	0.00184	0.003	< 0.00001	CA18847-NOV11	3.14	2.76	-0.39	-6.5%
30-Nov-11	31																		
7-Dec-11	32	0.00045	1.42	0.00005	0.83	0.197	12.4	0.00006	0.394	0.0003	0.00810	0.00147	0.002	0.00001	CA14307-DEC11	3.04	2.89	-0.15	-2.6%
14-Dec-11	33																		
21-Dec-11	34	< 0.00004	1.39	< 0.00001	0.84	0.198	12.2	0.00005	0.416	0.0006	0.00855	0.00174	0.004	< 0.00001	CA10461-DEC11	3.15	2.98	-0.18	-2.9%
28-Dec-11	35																		
4-Jan-12	36	0.00038	1.40	< 0.00001	0.75	0.193	10.8	0.00006	0.377	0.0006	0.00825	0.00178	0.002	0.00001	CA10145-JAN12	3.51	2.73	-0.77	-12.4%
11-Jan-12	37																		
18-Jan-12	38	0.00035	1.33	< 0.00001	0.74	0.190	11.0	0.00007	0.364	0.0005	0.00796	0.00175	0.002	< 0.00001	CA11259-JAN12	3.52	2.76	-0.76	-12.1%
25-Jan-12	39																		
1-Feb-12	40	0.00037	1.49	< 0.00001	0.70	0.197	11.3	0.00005	0.361	0.0003	0.00776	0.00178	0.002	< 0.00001	CA14084-FEB12	3.51	2.83	-0.68	-10.8%
8-Feb-12	41																		

Col 5

Sample = Pyrite Rougher Tails (>75 µm)																			
Date	**Cycle**	**Se**	**Si**	**Ag**	**Na**	**Sr**	**S**	**Tl**	**Sn**	**Ti**	**U**	**V**	**Zn**	**Zr**		**Major**	**Major**	**Diff**	**Diff**
	No.														**SGS File #**	**Anions**	**Cations**		**(%)**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**					
15-Feb-12	42																		
22-Feb-12	43																		
29-Feb-12	44	0.00031	2.01	< 0.00001	0.70	0.197	10.3	0.00005	0.302	0.0004	0.00780	0.00155	0.003	< 0.00001	CA14028-MAR12	3.43	2.78	-0.65	-10.5%
7-Mar-12	45																		
14-Mar-12	46																		
21-Mar-12	47																		
28-Mar-12	48	0.00039	1.63	< 0.00001	0.90	0.214	10.7	0.00007	0.387	0.0003	0.00834	0.00158	0.001	< 0.00001	CA14955-MAR12	3.11	2.95	-0.16	-2.6%
4-Apr-12	49																		
11-Apr-12	50																		
18-Apr-12	51																		
25-Apr-12	52	0.00036	1.68	< 0.00001	0.66	0.222	10.6	0.00005	0.326	0.0004	0.00729	0.00205	0.003	< 0.00001	CA15000-APR12	3.12	3.00	-0.12	-1.9%
2-May-12	53																		
9-May-12	54																		
16-May-12	55																		
23-May-12	56	0.00024	1.56	< 0.00001	0.53	0.202	9.70	0.00006	0.278	0.0004	0.00763	0.00200	0.010	< 0.00001	CA14956-MAY12	2.91	2.68	-0.23	-4.1%
30-May-12	57																		
6-Jun-12	58																		
13-Jun-12	59																		
20-Jun-12	60	0.00049	1.68	< 0.00001	0.57	0.216	9.42	0.00006	0.260	0.0003	0.00763	0.00186	0.006	< 0.00001	CA15313-JUN12	3.01	2.78	-0.23	-4.0%
27-Jun-12	61																		
4-Jul-12	62																		
11-Jul-12	63																		
18-Jul-12	64	0.00039	1.53	< 0.00001	0.53	0.202	9.17	0.00004	0.251	0.0003	0.00697	0.00177	0.002	0.00004	CA15227-JUL12	2.87	2.62	-0.25	-4.6%
25-Jul-12	65																		
1-Aug-12	66																		
8-Aug-12	67																		
15-Aug-12	68	0.00045	1.52	< 0.00001	0.49	0.201	8.62	0.00005	0.210	0.0003	0.00679	0.00169	0.003	0.00002	CA15197-AUG12	2.75	2.54	-0.22	-4.1%
22-Aug-12	69																		
29-Aug-12	70																		
5-Sep-12	71																		
12-Sep-12	72	0.00032	1.49	< 0.00001	0.52	0.202	8.46	0.00006	0.196	0.0002	0.00719	0.00128	0.003	0.00010	CA15471-SEP12	2.82	2.50	-0.32	-6.0%
19-Sep-12	73																		
26-Sep-12	74																		
3-Oct-12	75																		
10-Oct-12	76	0.00035	1.65	< 0.00001	0.47	0.204	8.17	0.00005	0.194	0.0003	0.00665	0.00159	0.002	< 0.00001	CA15509-OCT12	3.00	2.51	-0.49	-8.9%
17-Oct-12	77																		
24-Oct-12	78																		
31-Oct-12	79																		
7-Nov-12	80	0.00025	1.46	< 0.00001	0.42	0.209	7.86	0.00005	0.161	0.0002	0.00544	0.00135	0.002	< 0.00001	CA15211-NOV12	2.92	2.47	-0.45	-8.3%
14-Nov-12	81																		
21-Nov-12	82																		
28-Nov-12	83																		
5-Dec-12	84	0.00030	1.48	< 0.00001	0.44	0.210	7.95	0.00005	0.140	0.0002	0.00616	0.00140	0.002	< 0.00001	CA15126-DEC12	2.89	2.50	-0.39	-7.3%

Cell Terminated
May 18/11 Titrator malfunction, samples being repeated.
Feb, 2012 Change in analytical schedule.

Col 6

Sample = HPY Pyrite Rougher Sands																	
Date	**Cycle**	**Approx.**	**Volume mL**		**pH**	**Cond.**	**Acidity**	**Acidity**	**Alkalinity**	**Sulphate**	**Cl**	**F**	**Br**	**Hardness**	**Al**	**Sb**	**As**
	No.	**Flow Rate**	**Input**	**Output**			**(pH 4.5)**	**(pH 8.3)**						**CaCO3**			
		(mL/min)				**umhos/cm**	**mgCaCO3/L**	**mgCaCO3/L**	**mgCaCO3/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
19-Dec-12	1	1.0	300	220	7.66	2145	#N/A	11.1	154.2	1177	42	0.52	< 0.3	1300	0.0328	0.0030	0.0033
26-Dec-12	2	1.0	300	330	7.72	896	#N/A	9.9	116.2	276	5.3	0.65	< 0.3	409	0.0228	0.0029	0.0025
2-Jan-13	3	1.0	300	275	7.73	745	#N/A	8.7	107.6	270	1.6	0.67	< 0.3	319	0.0363	0.0030	0.0023
9-Jan-13	4	1.0	300	300	7.74	753	#N/A	11.3	109.4	309	0.8	0.64	< 0.3	351	0.0306	0.0034	0.0023
16-Jan-13	5	1.0	300	295	7.83	744											
23-Jan-13	6	1.0	300	300	7.71	715	#N/A	12.2	114.6	288	0.6	0.60	< 0.3	319	0.0344	0.0068	0.0024
30-Jan-13	7	1.0	300	300	7.81	646											
6-Feb-13	8	1.0	300	270	7.75	584	#N/A	10.1	114.0	159	1.0	0.66	< 0.3	242	0.0120	0.0119	0.0029
13-Feb-13	9	1.0	300	295	7.71	476											
20-Feb-13	10	1.0	300	290	7.83	431	#N/A	7.9	133.6	102	0.9	0.77	< 0.3	213	0.0151	0.0150	0.0029
27-Feb-13	11	1.0	300	295	7.79	391											
6-Mar-13	12	1.0	300	300	7.64	380	#N/A	8.2	129.6	65	0.8	0.80	< 0.3	170	0.0138	0.0212	0.0033
13-Mar-13	13	1.0	300	295	7.86	336											
20-Mar-13	14	1.0	300	305	7.98	319	#N/A	8.1	117.1	61	0.8	0.75	< 0.3	152	0.0103	0.0205	0.0040
27-Mar-13	15	1.0	300	295	7.96	318											
3-Apr-13	16	1.0	300	290	7.86	313	#N/A	9.1	116.6	46	0.8	0.71	< 0.3	150	0.0141	0.0205	0.0030
10-Apr-13	17	1.0	300	290	7.92	301											
17-Apr-13	18	1.0	300	290	7.63	301	#N/A	#N/A	92.1	52	0.7	0.65	< 0.3	139	0.0159	0.0218	0.0033
24-Apr-13	19	1.0	300	300	7.83	296											
1-May-13	20	1.0	300	295	7.88	284	#N/A	8.6	113.8	49	0.6	0.58	< 0.3	133	0.0118	0.0182	0.0027
8-May-13	21	1.0	300	300	7.71	275											
15-May-13	22	1.0	300	300	7.76	248	#N/A	11.2	114.1	39	0.7	0.52	< 0.3	133	0.0132	0.0188	0.0027
22-May-13	23	1.0	300	300	7.82	258											
29-May-13	24	1.0	300	300	7.82	262	#N/A	9.6	113.0	33	0.6	0.47	< 0.3	121	0.0136	0.0170	0.0025
5-Jun-13	25	1.0	300	295	7.76	268											
12-Jun-13	26	1.0	300	295	7.70	260	#N/A	13.7	112.9	29	0.6	0.45	< 0.3	116	0.0082	0.0167	0.0025
19-Jun-13	27	1.0	300	295	7.75	275											
26-Jun-13	28	1.0	300	295	7.85	272	#N/A	6.3	105.8	30	0.7	0.42	< 0.3	124	0.0109	0.0153	0.0023
3-Jul-13	29	1.0	300	305	7.80	261											
10-Jul-13	30	1.0	300	300	7.69	259	#N/A	12.6	111.9	31	0.7	0.39	< 0.3	128	0.0124	0.0152	0.0024
17-Jul-13	31	1.0	300	295	7.80	261											
24-Jul-13	32	1.0	300	305	7.65	261	#N/A	13.2	106.4	28	0.7	0.37	< 0.3	122	0.0107	0.0136	0.0021
31-Jul-13	33	1.0	300	300	7.75	267											
7-Aug-13	34	1.0	300	300	7.67	268	#N/A	12.2	105.8	32	0.6	0.33	< 0.3	118	0.0099	0.0137	0.0021
14-Aug-13	35	1.0	300	300	7.80	273											
21-Aug-13	36	1.0	300	295	7.69	275	#N/A	10.7	102.4	27	0.6	0.34	< 0.3	124	0.0128	0.0132	0.0019
28-Aug-13	37	1.0	300	295	7.88	253											
4-Sep-13	38	1.0	300	295	7.78	249	#N/A	7.9	102.5	25	0.6	0.29	< 0.3	126	0.0097	0.0116	0.0017
11-Sep-13	39	1.0	300	305	7.81	250											
18-Sep-13	40	1.0	300	300	7.79	258	#N/A	8.8	103.4	27	0.6	0.33	< 0.3	126	0.0418	0.0122	0.0020
25-Sep-13	41	1.0	300	300	8.06	259											
2-Oct-13	42	1.0	300	295	7.93	259	#N/A	5.0	105.4								
9-Oct-13	43	1.0	300	295	7.93	257											

Apr 17/13. Acidity 33.1 Suspect instrumental error, not repeated.

Col 6

Sample = HPY Pyrite Rougher Sands																		
Date	**Cycle**	**Ba**	**Be**	**Bi**	**B**	**Cd**	**Ca**	**Cr**	**Co**	**Cu**	**Fe**	**Pb**	**Li**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**
	No.																	
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**ug/L**	**mg/L**	**mg/L**
19-Dec-12	1	0.0550	< 0.00002	< 0.00001	0.0354	0.000406	457	< 0.0005	0.000475	0.0063	< 0.003	0.00162	0.002	39.8	0.194	< 0.01	0.0482	0.0007
26-Dec-12	2	0.0253	< 0.00002	< 0.00001	0.0398	0.000173	141	< 0.0005	0.000218	0.0018	< 0.003	0.00047	0.001	13.8	0.0640	< 0.01	0.0329	0.0014
2-Jan-13	3	0.0292	< 0.00002	< 0.00001	0.0320	0.000123	111	< 0.0005	0.000192	0.0011	0.005	0.00028	0.001	10.1	0.0574	< 0.01	0.0258	0.0009
9-Jan-13	4	0.0349	< 0.00002	< 0.00001	0.0332	0.000125	122	< 0.0005	0.000232	0.0024	< 0.003	0.00020	0.001	11.0	0.0675	< 0.01	0.0253	0.0018
16-Jan-13	5																	
23-Jan-13	6	0.0329	< 0.00002	0.00001	0.0282	0.000162	111	< 0.0005	0.000313	0.0027	< 0.003	0.00018	0.001	10.2	0.0749	< 0.01	0.0351	0.0032
30-Jan-13	7																	
6-Feb-13	8	0.0332	< 0.00002	< 0.00001	0.0303	0.000138	83.1	< 0.0005	0.000270	0.0030	0.004	0.00021	0.001	8.50	0.0709	< 0.01	0.0553	0.0009
13-Feb-13	9																	
20-Feb-13	10	0.0304	< 0.00002	< 0.00001	0.0231	0.000124	74.6	< 0.0005	0.000185	0.0048	< 0.003	0.00014	0.001	6.48	0.0601	< 0.01	0.0800	0.0004
27-Feb-13	11																	
6-Mar-13	12	0.0377	< 0.00002	< 0.00001	0.0204	0.000135	58.5	< 0.0005	0.000248	0.0032	< 0.003	0.00014	0.001	5.72	0.0587	< 0.01	0.119	0.0004
13-Mar-13	13																	
20-Mar-13	14	0.0440	< 0.00002	< 0.00001	0.0146	0.000119	52.2	< 0.0005	0.000236	0.0035	< 0.003	0.00011	0.001	5.21	0.0556	< 0.01	0.137	0.0002
27-Mar-13	15																	
3-Apr-13	16	0.0495	< 0.00002	< 0.00001	0.0138	0.000122	51.7	< 0.0005	0.000227	0.0035	< 0.003	0.00011	0.001	5.09	0.0553	< 0.01	0.131	0.0003
10-Apr-13	17																	
17-Apr-13	18	0.0576	< 0.00002	< 0.00001	0.0174	0.000111	47.2	< 0.0005	0.000527	0.0040	< 0.003	0.00012	0.001	5.02	0.0537	< 0.01	0.143	0.0005
24-Apr-13	19																	
1-May-13	20	0.0511	< 0.00002	< 0.00001	0.0178	0.000093	45.5	< 0.0005	0.000221	0.0039	< 0.003	0.00006	0.001	4.70	0.0529	< 0.01	0.121	0.0004
8-May-13	21																	
15-May-13	22	0.0627	< 0.00002	< 0.00001	0.0157	0.000135	45.5	< 0.0005	0.000182	0.0038	< 0.003	0.00036	0.001	4.62	0.0520	< 0.01	0.0878	0.0005
22-May-13	23																	
29-May-13	24	0.0668	< 0.00002	< 0.00001	0.0120	0.000103	40.9	< 0.0005	0.000157	0.0060	0.011	0.00019	0.001	4.53	0.0548	< 0.01	0.0774	0.0010
5-Jun-13	25																	
12-Jun-13	26	0.0721	< 0.00002	< 0.00001	0.0090	0.000098	39.5	< 0.0005	0.000168	0.0046	< 0.003	0.00005	0.001	4.19	0.0457	< 0.01	0.0655	0.0003
19-Jun-13	27																	
26-Jun-13	28	0.0747	< 0.00002	< 0.00001	0.0102	0.000071	42.1	< 0.0005	0.000168	0.0042	< 0.003	0.00020	0.001	4.50	0.0514	< 0.01	0.0580	0.0004
3-Jul-13	29																	
10-Jul-13	30	0.0801	< 0.00002	< 0.00001	0.0106	0.000103	43.4	< 0.0005	0.000261	0.0046	< 0.003	0.00004	0.001	4.67	0.0543	< 0.01	0.0546	0.0006
17-Jul-13	31																	
24-Jul-13	32	0.0762	< 0.00002	< 0.00001	0.0124	0.000100	41.3	< 0.0005	0.000178	0.0043	< 0.003	0.00006	0.001	4.52	0.0534	< 0.01	0.0506	0.0006
31-Jul-13	33																	
7-Aug-13	34	0.0807	< 0.00002	< 0.00001	0.0103	0.000096	40.1	< 0.0005	0.000190	0.0045	< 0.003	0.00005	0.001	4.30	0.0512	< 0.01	0.0488	0.0009
14-Aug-13	35																	
21-Aug-13	36	0.0768	< 0.00002	< 0.00001	0.0146	0.000119	41.6	< 0.0005	0.000160	0.0048	0.087	0.00003	0.001	4.79	0.0520	< 0.01	0.0455	< 0.0001
28-Aug-13	37																	
4-Sep-13	38	0.0781	< 0.00002	< 0.00001	0.0194	0.000102	42.6	< 0.0005	0.000171	0.0049	< 0.003	0.00007	0.001	4.70	0.0563	< 0.01	0.0389	0.0006
11-Sep-13	39																	
18-Sep-13	40	0.0832	< 0.00002	< 0.00001	0.0176	0.000080	42.5	< 0.0005	0.000255	0.0045	< 0.003	0.00005	0.001	4.79	0.0512	< 0.01	0.0378	0.0003
25-Sep-13	41																	
2-Oct-13	42																	
9-Oct-13	43																	

Apr 17/13. Acidity 33.1 Suspect instrumental error, not repeated.

Col 6

Sample = HPY Pyrite Rougher Sands																					
Date	**Cycle**	**P**	**K**	**Se**	**Si**	**Ag**	**Na**	**Sr**	**S**	**Tl**	**Sn**	**Ti**	**U**	**V**	**Zn**	**Zr**		**Major**	**Major**	**Diff**	**Diff**
	No.																**SGS File #**	**Anions**	**Cations**		**(%)**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**					
19-Dec-12	1	0.235	38.5	0.00316	3.11	0.00007	46.7	1.76	414	0.00005	0.00042	0.0005	0.254	0.00089	0.004	0.00010	CA15305-DEC12	28.82	29.13	0.32	0.5%
26-Dec-12	2	0.135	20.3	0.00081	2.73	0.00002	16.2	0.748	120	0.00003	0.00026	0.0002	0.0851	0.00061	0.002	0.00002	CA15366-DEC12	8.26	9.41	1.16	6.5%
2-Jan-13	3	0.112	17.7	0.00044	3.02	0.00008	9.76	0.621	91.6	0.00003	0.00038	0.0005	0.0773	0.00085	0.003	0.00003	CA15062-JAN13	7.86	7.27	-0.58	-3.9%
9-Jan-13	4	0.092	19.0	0.00052	2.73	< 0.00001	6.78	0.692	82.5	0.00003	0.00031	0.0003	0.0838	0.00081	0.002	0.00004	CA15248-JAN13	8.68	7.80	-0.88	-5.3%
16-Jan-13	5																				
23-Jan-13	6	0.086	17.1	0.00049	2.95	0.00013	2.85	0.676	86.8	0.00003	0.00062	0.0005	0.0780	0.00076	0.002	0.00006	CA15419-JAN13	8.34	6.97	-1.37	-9.0%
30-Jan-13	7																				
6-Feb-13	8	0.064	15.1	0.00058	3.22	< 0.00001	1.70	0.591	60.6	0.00003	0.00105	0.0002	0.0728	0.00049	0.002	0.00005	CA15098-FEB13	5.66	5.33	-0.33	-3.0%
13-Feb-13	9																				
20-Feb-13	10	0.083	13.4	0.00070	3.03	< 0.00001	1.26	0.470	36.9	0.00003	0.00179	0.0002	0.0466	0.00058	0.004	0.00005	CA15261-FEB13	4.86	4.67	-0.19	-2.0%
27-Feb-13	11																				
6-Mar-13	12	0.072	11.5	0.00087	3.13	< 0.00001	0.88	0.426	25.6	0.00003	0.00242	< 0.0001	0.0371	0.00058	< 0.001	0.00006	CA15116-MAR13	4.01	3.74	-0.27	-3.5%
13-Mar-13	13																				
20-Mar-13	14	0.070	11.5	0.00081	2.98	< 0.00001	0.80	0.393	20.0	0.00003	0.00329	0.0001	0.0328	0.00031	0.001	0.00002	CA15327-MAR13	3.68	3.38	-0.30	-4.2%
27-Mar-13	15																				
3-Apr-13	16	0.070	11.3	0.00052	3.08	< 0.00001	0.66	0.392	17.5	0.00003	0.00445	0.0001	0.0290	0.00046	< 0.001	0.00002	CA15081-APR13	3.35	3.33	-0.02	-0.3%
10-Apr-13	17																				
17-Apr-13	18	0.075	11.1	0.00079	3.13	< 0.00001	0.62	0.391	16.1	0.00003	0.00546	0.0001	0.0327	0.00054	0.002	< 0.00001	CA15252-APR13	2.98	3.10	0.12	1.9%
24-Apr-13	19																				
1-May-13	20	0.058	9.66	0.00072	3.00	< 0.00001	0.56	0.364	13.8	0.00002	0.00620	0.0001	0.0260	0.00059	0.001	0.00001	CA15086-MAY13	3.34	2.94	-0.40	-6.4%
8-May-13	21																				
15-May-13	22	0.062	9.66	0.00078	2.90	< 0.00001	0.47	0.354	12.1	0.00003	0.00783	0.0001	0.0260	0.00051	0.002	< 0.00001	CA15254-MAY13	3.14	2.93	-0.21	-3.4%
22-May-13	23																				
29-May-13	24	0.060	9.00	0.00063	2.78	< 0.00001	0.45	0.349	10.7	0.00002	0.00923	0.0003	0.0229	0.00050	0.002	0.00001	CA15422-MAY13	2.99	2.68	-0.31	-5.5%
5-Jun-13	25																				
12-Jun-13	26	0.060	7.93	0.00069	2.73	< 0.00001	0.38	0.320	9.08	0.00003	0.00942	< 0.0001	0.0224	0.00046	0.004	< 0.00001	CA15169-JUN13	2.90	2.55	-0.36	-6.5%
19-Jun-13	27																				
26-Jun-13	28	0.057	8.25	0.00080	2.90	< 0.00001	0.40	0.347	10.6	0.00002	0.00971	< 0.0001	0.0202	0.00045	< 0.001	< 0.00001	CA15012-JUL13	2.78	2.71	-0.07	-1.3%
3-Jul-13	29																				
10-Jul-13	30	0.052	8.20	0.00078	2.97	< 0.00001	0.38	0.358	10.6	0.00003	0.0104	< 0.0001	0.0227	0.00048	0.002	0.00002	CA15234-JUL13	2.92	2.79	-0.13	-2.3%
17-Jul-13	31																				
24-Jul-13	32	0.054	7.50	0.00087	2.84	< 0.00001	0.34	0.345	10.1	0.00002	0.00943	0.0001	0.0225	0.00050	0.002	0.00002	CA15472-JUL13	2.75	2.65	-0.10	-1.8%
31-Jul-13	33																				
7-Aug-13	34	0.038	7.10	0.00098	2.84	< 0.00001	0.34	0.335	9.60	0.00002	0.00854	< 0.0001	0.0236	0.00036	< 0.001	< 0.00001	CA15097-AUG13	2.82	2.56	-0.25	-4.7%
14-Aug-13	35																				
21-Aug-13	36	0.051	6.12	0.00085	2.72	0.00001	0.43	0.388	9.84	0.00003	0.00768	< 0.0001	0.0222	0.00054	0.001	0.00001	CA15287-AUG13	2.64	2.66	0.02	0.3%
28-Aug-13	37																				
4-Sep-13	38	0.057	6.70	0.00080	2.90	< 0.00001	0.32	0.358	9.75	0.00002	0.00646	< 0.0001	0.0209	0.00043	0.002	0.00001	CA15053-SEP13	2.60	2.71	0.11	2.1%
11-Sep-13	39																				
18-Sep-13	40	0.050	6.44	0.00091	2.77	< 0.00001	0.37	0.349	9.72	< 0.00002	0.00701	< 0.0001	0.0230	0.00041	0.001	< 0.00001	CA15265-SEP13	2.66	2.72	0.05	0.9%
25-Sep-13	41																				
2-Oct-13	42																				
9-Oct-13	43																				

Apr 17/13. Acidity 33.1 Suspect instrumental error, not repeated.

Col 7

Sample = CL-01 L Residue															
Date	Cycle	Approx.	Volume mL		pH	Cond.	Acidity	Acidity	Alkalinity	Sulphate	Total CN	WAD CN	SCN	CNO	Nitrate
	No.	Flow Rate	Input	Output			(pH 4.5)	(pH 8.3)							
		(mL/min)				umhos/cm	mgCaCO3/L	mgCaCO3/L	mgCaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
20-Mar-13	1	1.0	470	490	7.51	3710	#N/A	17.1	69.2	2010	0.13	< 0.01	< 2	< 1	60.8
27-Mar-13	2	1.0	470	480	7.58	3765	#N/A	13.7	65.3	1851	0.15	0.02	< 1	< 2	60.8
3-Apr-13	3	1.0	495	475	7.55	3257	#N/A	15.7	61.8	1428	0.12	0.02	< 2	< 1	36.4
10-Apr-13	4	1.0	470	480	7.57	2729	#N/A	12.2	53.1	1716	0.06	< 0.01	< 2	< 1	20.1
17-Apr-13	5	1.0	470	560	7.56	2183									
24-Apr-13	6	1.0	470	460	7.65	1943	#N/A	12.4	52.3	991	0.11	< 0.01	< 1	< 2	6.28
1-May-13	7	1.0	470	460	7.59	1789									
8-May-13	8	1.0	470	485	7.60	1513	#N/A	15.4	48.2	1011	0.03	< 0.01	< 2	< 1	2.87
15-May-13	9	1.0	470	520	7.55	1335									
22-May-13	10	1.0	470	520	7.62	1302	#N/A	11.5	48.6	779	0.03	< 0.01	< 2	< 1	1.59
29-May-13	11	1.0	470	490	7.62	1396									
5-Jun-13	12	1.0	470	490	7.58	1206	#N/A	11.6	51.4	704	0.03	#N/A	#N/A	#N/A	1.06
12-Jun-13	13	1.0	470	490	7.71	1182									
19-Jun-13	14	1.0	470	520	7.58	1202	#N/A	9.6	46.9	583	0.02	#N/A	#N/A	#N/A	< 0.6
26-Jun-13	15	1.0	470	520	7.66	1068									
3-Jul-13	16	1.0	470	455	7.61	978	#N/A	10.9	48.4	506	0.02	#N/A	#N/A	#N/A	1.16
10-Jul-13	17	1.0	470	495	7.69	908									
17-Jul-13	18	1.0	470	495	7.30	854	#N/A	9.0	43.3	433	0.02	#N/A	#N/A	#N/A	1.17
24-Jul-13	19	1.0	470	515	7.66	790									
31-Jul-13	20	1.0	470	495	7.66	728	#N/A	9.2	46.3	294	0.01	#N/A	#N/A	#N/A	0.77
7-Aug-13	21	1.0	470	490	7.63	716									
14-Aug-13	22	1.0	470	490	7.64	702	#N/A	7.8	43.7	312	0.02	#N/A	#N/A	#N/A	0.56
21-Aug-13	23	1.0	470	500	7.65	696									
28-Aug-13	24	1.0	470	490	7.70	630	#N/A	5.7	43.0	251	0.02	#N/A	#N/A	#N/A	0.43
4-Sep-13	25	1.0	470	480	7.70	606									
11-Sep-13	26	1.0	470	495	7.68	581	#N/A	7.4	48.2	251	0.01	#N/A	#N/A	#N/A	0.27
18-Sep-13	27	1.0	470	500	7.71	537									
25-Sep-13	28	1.0	470	495	7.79	561	#N/A	4.1	46.8	212	0.02	#N/A	#N/A	#N/A	0.20
2-Oct-13	29	1.0	470	500	7.78	537									
9-Oct-13	30	1.0	470	475	7.75	518	#N/A	7.2	49.7						

May 22/13 Change in analytical schedule

Col 7

Sample = CL-01 L Residue																
Date	**Cycle**	**Nitrite**	**Ammonia**	**Cl**	**F**	**Br**	**Hardness**	**Al**	**Sb**	**As**	**Ba**	**Be**	**Bi**	**B**	**Cd**	**Ca**
	No.						**CaCO3**									
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
20-Mar-13	1	0.90	< 0.1	130	0.52	< 0.3	1270	0.0046	0.0076	0.0094	0.0117	< 0.00002	< 0.00001	0.0845	0.000433	476
27-Mar-13	2	0.12	0.1	130	0.55	< 0.3	1310	0.0072	0.0091	0.0089	0.0113	< 0.00002	< 0.00001	0.0858	0.000035	490
3-Apr-13	3	< 0.3	< 0.1	80	0.61	< 3	1210	0.0062	0.0096	0.0091	0.0111	< 0.00002	< 0.00001	0.0634	0.000063	455
10-Apr-13	4	< 0.3	< 0.1	43	0.60	< 3	1040	0.0052	0.0079	0.0077	0.00966	< 0.00002	0.00001	0.0579	0.000060	390
17-Apr-13	5															
24-Apr-13	6	< 0.3	0.1	19	0.58	< 3	742	0.0066	0.0068	0.0084	0.00946	< 0.00002	< 0.00001	0.0415	0.000068	279
1-May-13	7															
8-May-13	8	< 0.3	< 0.1	11	0.54	< 3	614	0.0077	0.0055	0.0073	0.00906	< 0.00002	< 0.00001	0.0360	0.000043	232
15-May-13	9															
22-May-13	10	< 0.3	< 0.1	6.3	0.55	< 3	590	0.0067	0.0059	0.0075	0.0110	< 0.00002	< 0.00001	0.0270	0.000035	223
29-May-13	11															
5-Jun-13	12	#N/A	#N/A	4.6	0.52	< 3	536	0.0056	0.0051	0.0076	0.0101	< 0.00002	< 0.00001	0.0289	0.000178	203
12-Jun-13	13															
19-Jun-13	14	#N/A	#N/A	4.3	0.53	< 3	509	0.0061	0.0050	0.0074	0.0102	< 0.00002	< 0.00001	0.0326	0.000015	194
26-Jun-13	15															
3-Jul-13	16	#N/A	#N/A	3.0	0.46	< 3	428	0.0073	0.0048	0.0074	0.00928	< 0.00002	< 0.00001	0.0268	0.000036	163
10-Jul-13	17															
17-Jul-13	18	#N/A	#N/A	2.7	0.44	< 3	354	0.0111	0.0048	0.0085	0.00989	< 0.00002	< 0.00001	0.0189	0.000028	135
24-Jul-13	19															
31-Jul-13	20	#N/A	#N/A	2.0	0.46	< 0.3	309	0.0108	0.0042	0.0074	0.00939	< 0.00002	< 0.00001	0.0276	0.000030	118
7-Aug-13	21															
14-Aug-13	22	#N/A	#N/A	1.9	0.47	< 0.3	285	0.0112	0.0043	0.0063	0.00978	< 0.00002	< 0.00001	0.0223	0.000065	109
21-Aug-13	23															
28-Aug-13	24	#N/A	#N/A	1.6	0.49	< 0.3	266	0.0098	0.0045	0.0079	0.0108	< 0.00002	< 0.00001	0.0261	0.000032	102
4-Sep-13	25															
11-Sep-13	26	#N/A	#N/A	1.7	0.55	< 0.3	251	0.0089	0.0047	0.0081	0.0111	< 0.00002	< 0.00001	0.0232	0.000033	96.8
18-Sep-13	27															
25-Sep-13	28	#N/A	#N/A	1.4	0.53	< 0.3	242	0.0103	0.0052	0.0089	0.0136	< 0.00002	< 0.00001	0.0245	0.000031	92.8
2-Oct-13	29															
9-Oct-13	30															

May 22/13 Change in analytical schedule

Col 7

Sample = CL-01 L Residue																	
Date	**Cycle**	**Cr**	**Co**	**Cu**	**Fe**	**Pb**	**Li**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**	**P**	**K**	**Se**	**Si**	**Ag**
	No.																
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**ug/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**
20-Mar-13	1	0.0008	0.390	0.0213	0.014	0.00005	0.003	20.8	0.0210	0.01	1.90	0.0019	< 0.009	8.89	0.0581	16.7	< 0.00001
27-Mar-13	2	< 0.0005	0.404	0.0211	0.014	0.00008	0.003	21.8	0.0189	0.02	2.10	0.0020	< 0.009	7.94	0.0529	19.5	0.00001
3-Apr-13	3	< 0.0005	0.272	0.0178	0.005	0.00007	0.002	19.2	0.0183	< 0.01	1.88	0.0015	< 0.009	8.15	0.0382	19.9	< 0.00001
10-Apr-13	4	< 0.0005	0.178	0.0133	0.005	0.00008	0.002	16.3	0.0142	< 0.01	1.42	0.0011	< 0.009	6.00	0.0259	20.3	< 0.00001
17-Apr-13	5																
24-Apr-13	6	< 0.0005	0.111	0.0093	< 0.003	0.00007	0.002	10.8	0.0094	< 0.01	1.16	0.0020	0.017	4.18	0.0128	17.8	0.00001
1-May-13	7																
8-May-13	8	< 0.0005	0.0696	0.0151	< 0.003	0.00002	0.001	8.66	0.0069	< 0.01	0.831	0.0013	0.018	3.21	0.00860	15.9	0.00002
15-May-13	9																
22-May-13	10	< 0.0005	0.0577	0.0054	< 0.003	< 0.00002	0.001	8.12	0.0055	< 0.01	0.697	0.0016	0.025	2.52	0.00638	16.2	< 0.00001
29-May-13	11																
5-Jun-13	12	0.0007	0.0482	0.0041	0.006	0.00004	0.001	7.03	0.0045	< 0.01	0.654	0.0021	0.013	2.08	0.00445	15.6	0.00006
12-Jun-13	13																
19-Jun-13	14	< 0.0005	0.0452	0.0049	< 0.003	< 0.00002	0.001	6.35	0.0046	< 0.01	0.663	0.0012	0.015	1.95	0.00526	17.4	0.00002
26-Jun-13	15																
3-Jul-13	16	< 0.0005	0.0367	0.0057	< 0.003	0.00013	< 0.001	5.06	0.0039	< 0.01	0.560	0.0016	0.031	1.62	0.00401	15.3	0.00002
10-Jul-13	17																
17-Jul-13	18	< 0.0005	0.0373	0.0042	< 0.003	0.00004	< 0.001	4.17	0.0030	< 0.01	0.622	0.0005	0.009	1.18	0.00294	14.9	0.00007
24-Jul-13	19																
31-Jul-13	20	< 0.0005	0.0311	0.0046	< 0.003	0.00004	< 0.001	3.43	0.0029	< 0.01	0.540	0.0015	0.015	1.26	0.00229	16.1	0.00002
7-Aug-13	21																
14-Aug-13	22	< 0.0005	0.0285	0.0052	< 0.003	0.00065	< 0.001	3.13	0.0030	< 0.01	0.469	0.0024	0.020	1.20	0.00195	15.7	< 0.00001
21-Aug-13	23																
28-Aug-13	24	< 0.0005	0.0272	0.0060	< 0.003	< 0.00002	< 0.001	2.77	0.0031	< 0.01	0.490	0.0004	0.018	1.10	0.00185	15.4	< 0.00001
4-Sep-13	25																
11-Sep-13	26	< 0.0005	0.0138	0.0032	< 0.003	< 0.00002	< 0.001	2.60	0.0026	< 0.01	0.484	< 0.0001	0.012	1.08	0.00148	16.6	< 0.00001
18-Sep-13	27																
25-Sep-13	28	< 0.0005	0.0190	0.0032	< 0.003	0.00034	< 0.001	2.50	0.0027	< 0.01	0.523	0.0011	0.011	1.10	0.00143	17.0	< 0.00001
2-Oct-13	29																
9-Oct-13	30																

May 22/13 Change in analytical schedule

Col 7

Sample = CL-01 L Residue																
Date	**Cycle**	**Na**	**Sr**	**S**	**Tl**	**Sn**	**Ti**	**U**	**V**	**Zn**	**Zr**		**Major**	**Major**	**Diff**	**Diff**
	No.											**SGS File #**	**Anions**	**Cations**		**(%)**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**					
20-Mar-13	1	416	0.256	625	0.00010	0.00012	0.0005	0.0207	0.00041	0.003	0.00004	CA15325-MAR13	46.95	43.87	3.08	3.4%
27-Mar-13	2	429	0.260	623	0.00008	0.00019	0.0006	0.0273	0.00046	0.003	0.00003	CA15432-MAR13	43.56	45.19	-1.63	-1.8%
3-Apr-13	3	322	0.240	575	0.00008	0.00017	0.0004	0.0212	0.00052	0.002	0.00002	CA15081-APR13	33.27	38.57	-5.30	-7.4%
10-Apr-13	4	241	0.205	486	0.00007	0.00033	0.0004	0.0148	0.00044	0.002	0.00003	CA15189-APR13	38.06	31.50	6.55	9.4%
17-Apr-13	5															
24-Apr-13	6	146	0.146	342	0.00006	0.00041	0.0005	0.0114	0.00052	0.003	0.00001	CA15395-APR13	22.26	21.31	0.94	2.2%
1-May-13	7															
8-May-13	8	98.3	0.117	259	0.00004	0.00004	0.0005	0.00829	0.00048	0.003	0.00002	CA15170-MAY13	22.36	16.68	5.68	14.5%
15-May-13	9															
22-May-13	10	73.8	0.106	234	0.00003	0.00015	0.0005	0.00796	0.00049	0.002	< 0.00001	CA15349-MAY13	17.41	15.10	2.30	7.1%
29-May-13	11															
5-Jun-13	12	59.1	0.102	220	0.00002	0.00006	0.0004	0.00785	0.00045	0.004	< 0.00001	CA15084-JUN13	15.85	13.36	2.49	8.5%
12-Jun-13	13															
19-Jun-13	14	47.9	0.0959	192	< 0.00002	0.00010	0.0005	0.00620	0.00037	0.002	0.00002	CA15342-JUN13	13.23	12.37	0.86	3.4%
26-Jun-13	15															
3-Jul-13	16	36.7	0.0800	156	< 0.00002	0.00015	0.0006	0.00528	0.00044	0.003	0.00003	CA15109-JUL13	11.62	10.21	1.40	6.4%
10-Jul-13	17															
17-Jul-13	18	25.6	0.0741	129	< 0.00002	0.00005	0.0004	0.00463	0.00045	0.002	0.00003	CA15360-JUL13	9.99	8.25	1.74	9.5%
24-Jul-13	19															
31-Jul-13	20	22.6	0.0606	108	< 0.00002	0.00013	0.0007	0.00392	0.00041	0.001	0.00003	CA15038-AUG13	7.13	7.21	-0.08	-0.5%
7-Aug-13	21															
14-Aug-13	22	19.6	0.0554	93.8	0.00004	0.00008	0.0012	0.00374	0.00038	0.002	0.00001	CA15209-AUG13	7.45	6.60	0.85	6.1%
21-Aug-13	23															
28-Aug-13	24	15.2	0.0531	81.2	< 0.00002	0.00030	0.0004	0.00365	0.00045	0.001	< 0.00001	CA15449-AUG13	6.16	6.03	0.13	1.1%
4-Sep-13	25															
11-Sep-13	26	15.0	0.0489	77.8	< 0.00002	0.00010	0.0006	0.00415	0.00044	0.001	0.00004	CA15177-SEP13	6.27	5.74	0.53	4.4%
18-Sep-13	27															
25-Sep-13	28	15.3	0.0473	73.5	< 0.00002	0.00035	0.0005	0.00390	0.00048	0.004	0.00002	CA15348-SEP13	5.42	5.55	-0.13	-1.2%
2-Oct-13	29															
9-Oct-13	30															

May 22/13 Change in analytical schedulei

Col 8

Sample = CL-01 L Residue																				
Date	Cycle	Approx.	Volume mL		pH	Cond.	Acidity	Acidity	Alkalinity	Sulphate	Total CN	WAD CN	Thiocyanate	Cyanate	Nitrate	Nitrite	Ammonia	Cl	F	Br
	No.	Flow Rate	Input	Output			(pH 4.5)	(pH 8.3)												
		(mL/min)				umhos/cm	mgCaCO3/L	mgCaCO3/L	mgCaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
20-Mar-13	1	1.0	470	850	7.65	4170	#N/A	18.1	57.1	2187	0.12	< 0.01	< 2	< 1	68.1	2.05	0.1	140	0.55	< 0.3
27-Mar-13	2	1.0	570	480	7.67	4128	#N/A	15.8	70.1	2095	0.12	0.01	< 1	< 2	68.9	0.71	< 0.1	150	0.52	< 0.3
3-Apr-13	3	1.0	495	480	7.75	4275	#N/A	15.8	70.6	1658	0.20	0.03	< 2	< 1	82.3	< 0.3	< 0.1	180	0.52	< 3
10-Apr-13	4	1.0	470	485	7.69	3748	#N/A	12.7	65.5	2852	0.11	0.02	< 2	< 1	56.3	< 0.3	< 0.1	110	0.53	< 3
17-Apr-13	5	1.0	470	490	7.61	3169														
24-Apr-13	6	1.0	470	500	7.66	2957	#N/A	11.9	52.0	1967	0.12	0.01	< 1	< 2	28.7	< 0.3	0.2	56	0.53	< 3
1-May-13	7	1.0	470	555	7.69	2588														
8-May-13	8	1.0	470	460	7.69	2437	#N/A	16.3	54.4	2437	0.06	< 0.01	< 2	< 1	16.7	< 0.3	0.2	37	0.49	< 3
15-May-13	9	1.0	470	460	7.56	2353														
22-May-13	10	1.0	470	480	7.57	2421	#N/A	14.1	54.3	1489	0.06	< 0.01	< 2	< 1	14.5	< 0.3	< 0.1	33	0.55	< 3
29-May-13	11	1.0	470	470	7.64	2353														
5-Jun-13	12	1.0	470	470	7.58	2280	#N/A	13.2	52.6	1435	0.06	#N/A	#N/A	#N/A	11.7	#N/A	#N/A	21	0.52	< 3
12-Jun-13	13	1.0	470	465	7.73	2022														
19-Jun-13	14	1.0	470	440	7.62	2169	#N/A	12.1	51.5	1219	0.05	#N/A	#N/A	#N/A	9.42	#N/A	#N/A	< 20	0.52	< 3

Cell Terminated
May 22/13 Change in analytical schedule.

Col 8

Sample = CL-01 L Residue																						
Date	**Cycle**	**Hardness**	**Al**	**Sb**	**As**	**Ba**	**Be**	**Bi**	**B**	**Cd**	**Ca**	**Cr**	**Co**	**Cu**	**Fe**	**Pb**	**Li**	**Mg**	**Mn**	**Hg**	**Mo**	**Ni**
	No.	**CaCO3**																				
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**ug/L**	**mg/L**	**mg/L**
20-Mar-13	1	1520	0.0053	0.0074	0.0096	0.0126	< 0.00002	< 0.00001	0.0709	0.000342	551	0.0010	0.311	0.0308	0.017	0.00011	0.005	24.6	0.0207	0.02	1.59	0.0021
27-Mar-13	2	1540	0.0083	0.0077	0.0089	0.0131	< 0.00002	< 0.00001	0.0755	< 0.000003	576	< 0.0005	0.318	0.0265	0.016	0.00006	0.004	24.0	0.0178	< 0.01	1.71	0.0023
3-Apr-13	3	1460	0.0073	0.0078	0.0098	0.0145	< 0.00002	< 0.00001	0.0646	< 0.000003	543	0.0006	0.393	0.0251	0.017	0.00011	0.004	25.3	0.0251	0.01	2.02	0.0016
10-Apr-13	4	1490	0.0057	0.0070	0.0081	0.0124	< 0.00002	< 0.00001	0.0609	0.000035	558	< 0.0005	0.289	0.0187	0.018	0.00007	0.004	22.9	0.0191	0.01	1.78	0.0014
17-Apr-13	5																					
24-Apr-13	6	1070	0.0046	0.0058	0.0076	0.0113	< 0.00002	< 0.00001	0.0411	0.000026	400	< 0.0005	0.224	0.0123	0.007	0.00006	0.003	16.6	0.0146	< 0.01	1.52	0.0025
1-May-13	7																					
8-May-13	8	960	0.0087	0.0056	0.0072	0.0110	< 0.00002	< 0.00001	0.0418	0.000047	362	< 0.0005	0.162	0.0262	0.003	0.00002	0.003	13.4	0.0130	< 0.01	1.24	0.0020
15-May-13	9																					
22-May-13	10	998	0.0057	0.0068	0.0078	0.0127	< 0.00002	< 0.00001	0.0302	0.000061	378	< 0.0005	0.161	0.0097	0.004	0.00015	0.002	13.1	0.0120	< 0.01	1.26	0.0022
29-May-13	11																					
5-Jun-13	12	921	0.0068	0.0061	0.0082	0.0118	< 0.00002	< 0.00001	0.0330	0.000016	348	< 0.0005	0.155	0.0101	< 0.003	< 0.00002	0.002	12.5	0.0110	< 0.01	1.21	0.0024
12-Jun-13	13																					
19-Jun-13	14	923	0.0046	0.0058	0.0076	0.0131	< 0.00002	< 0.00001	0.0385	0.000041	349	< 0.0005	0.131	0.0093	< 0.003	< 0.00002	0.003	12.3	0.0119	< 0.01	1.22	0.0020

Cell Terminated
May 22/13 Change in analytical schedule.

Col 8

Sample = CL-01 LResidue																					
Date	**Cycle**	**P**	**K**	**Se**	**Si**	**Ag**	**Na**	**Sr**	**S**	**Tl**	**Sn**	**Ti**	**U**	**V**	**Zn**	**Zr**		**Major**	**Major**	**Diff**	**Diff**
	No.																**SGS File #**	**Anions**	**Cations**		**(%)**
		mg/L	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**	**mg/L**					
20-Mar-13	1	< 0.009	10.7	0.0662	15.8	< 0.00001	469	0.315	703	0.00011	0.00009	0.0004	0.0226	0.00046	0.003	0.00004	CA15325-MAR13	50.68	50.26	-0.42	-0.4%
27-Mar-13	2	< 0.009	9.07	0.0593	16.9	0.00002	473	0.303	687	0.00009	0.00016	0.0005	0.0372	0.00057	0.002	0.00002	CA15432-MAR13	49.30	51.60	2.29	2.3%
3-Apr-13	3	< 0.009	11.2	0.0753	17.5	0.00001	461	0.339	673	0.00011	0.00021	0.0004	0.0339	0.00057	0.002	0.00002	CA15081-APR13	41.05	49.60	8.55	9.4%
10-Apr-13	4	< 0.009	9.04	0.0646	18.6	< 0.00001	441	0.304	689	0.00008	0.00064	0.0004	0.0261	0.00048	0.012	0.00002	CA15189-APR13	63.85	49.21	-14.64	-13.0%
17-Apr-13	5																				
24-Apr-13	6	< 0.009	6.88	0.0392	16.1	< 0.00001	278	0.235	498	0.00007	0.00017	0.0005	0.0168	0.00052	0.001	< 0.00001	CA15395-APR13	43.63	33.65	-9.97	-12.9%
1-May-13	7																				
8-May-13	8	0.022	5.71	0.0313	15.8	< 0.00001	219	0.198	436	0.00007	0.00006	0.0006	0.0144	0.00059	0.002	0.00001	CA15170-MAY13	52.93	28.89	-24.04	-29.4%
15-May-13	9																				
22-May-13	10	0.023	4.91	0.0278	17.1	< 0.00001	207	0.188	436	0.00006	0.00009	0.0005	0.0143	0.00055	0.001	< 0.00001	CA15349-MAY13	33.07	29.12	-3.95	-6.4%
29-May-13	11																				
5-Jun-13	12	0.026	4.61	0.0235	17.4	< 0.00001	185	0.174	382	0.00005	0.00009	0.0004	0.0143	0.00055	0.002	0.00001	CA15084-JUN13	31.57	26.60	-4.96	-8.5%
12-Jun-13	13																				
19-Jun-13	14	0.018	3.99	0.0243	18.8	0.00001	344	0.175	393	0.00004	0.00012	0.0006	0.0117	0.00047	0.002	< 0.00001	CA15342-JUN13	26.45	33.54	7.08	11.8%

Cell Terminated
May 22/13 Change in analytical schedule.

		Cycle	Volume	pH-L	Cond-L	T-Alk	SO4	D-Cl	D-F	D-Br	DOC	NH3	NO3-N	NO2-N	TD-PO4	D-Sulphide	D-Al	D-Sb
Stn.Code	Collect Date/Time		output	pH	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Col 16	3/1/2013	0	174	8.23	1326	55	639	20.0	0.62	<0.5	107	0.111	<0.05	0.021	1.29	0.176	0.00239	0.000477
Col 16	3/12/2013	1	229	8.32	1282	50	602	19.7	0.67	<0.5	125	0.144	<0.05	0.036	1.38	0.76	0.00393	0.000200
Col16	4/12/2013	2	232	8.04	949	55	392	20.9	0.48	<0.5	101	0.0244	<0.05	<0.01	1.07	0.177	0.00353	0.000217
Col16	5/7/2013	3	224	8.01	658	53	238	14.2	0.63	<0.25	89.1	0.0258	<0.025	0.0104	0.925	0.160	0.00247	0.00101
		Cycle	Volume	pH-L	Cond-L	T-Alk	SO4	D-Cl	D-F	D-Br	DOC	NH3	NO3-N	NO2-N	TD-PO4	D-Sulphide	D-Al	D-Sb
Stn.Code	Collect Date/Time		output	pH	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Col17	3/1/2013	0	169	7.65	2484	43	1480	38	0.77	<1	44.6	0.895	<0.1	<0.02	2.10	0.089	0.0059	0.00180
Col17	3/12/2013	1	219	7.23	2247	51	1320	35	0.93	<1	39.6	0.838	<0.1	<0.02	1.75	0.0457	0.0048	0.00191
Col17	4/11/2013	2	321	7.2	1889	38	1030	29	0.88	<1	26.7	0.648	<0.1	<0.02	1.50	0.0177	0.0038	0.00155
Col17	5/7/2013	3	231	7.65	1595	37	837	26	0.79	<1	24.7	0.642	<0.1	<0.02	1.36	0.0184	0.00252	0.00122

		Cycle	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg
Stn.Code	Collect Date/Time		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Col 16	3/1/2013	0	0.00462	0.0248	<0.00001	<0.000005	0.0219	0.0000068	238	<0.0001	0.0000057	<0.0001	0.0129	<0.000005	<0.0005	3.59	0.0264	<0.00001
Col 16	3/12/2013	1	0.00481	0.0231	<0.00001	<0.000005	0.0226	<0.000005	213	<0.0001	0.0000081	<0.0001	0.0100	<0.000005	0.00072	3.00	0.0147	<0.00001
Col16	4/12/2013	2	0.00528	0.0246	<0.00001	<0.000005	0.0221	<0.000005	135	<0.0001	0.0000058	<0.0001	0.0258	<0.000005	<0.0005	2.28	0.0300	<0.00001
Col16	5/7/2013	3	0.00483	0.0267	<0.00001	<0.000005	0.0232	<0.000005	80.0	<0.0001	<0.000005	<0.0001	0.0104	<0.000005	0.00096	1.67	0.0250	<0.00001
		Cycle	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg
Stn.Code	Collect Date/Time		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Col17	3/1/2013	0	0.00213	0.0214	<0.00002	<0.00001	0.028	0.000061	544	<0.0002	0.000027	<0.0002	0.110	<0.00001	<0.001	9.38	0.0690	<0.00001
Col17	3/12/2013	1	0.00198	0.0201	<0.00002	<0.00001	0.028	<0.00003	447	<0.0002	0.000023	<0.0002	0.167	<0.00001	<0.001	7.97	0.0743	<0.00001
Col17	4/11/2013	2	0.00152	0.0203	<0.00002	0.000062	0.028	0.000015	346	<0.0002	0.000018	0.00037	0.260	<0.00001	0.0011	7.43	0.0808	<0.00001
Col17	5/7/2013	3	0.00126	0.0192	<0.00001	<0.000005	0.0272	<0.000005	282	<0.0001	0.0000102	<0.0001	0.124	<0.000005	0.00153	6.14	0.0774	<0.00001

		Cycle	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
Stn.Code	Collect Date/Time		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Col 16	3/1/2013	0	0.0374	0.000174	1.32	49.0	0.000444	2.66	<0.000005	30.3	1.10	<0.000002	0.000026	<0.0005	0.0000289	<0.00005	<0.0005	<0.0001
Col 16	3/12/2013	1	0.0200	0.000178	1.31	43.6	0.000377	2.77	<0.000005	30.4	1.05	<0.000002	0.000021	<0.0005	0.0000152	<0.00005	0.00148	<0.0001
Col16	4/12/2013	2	0.00497	0.000133	1.04	38.4	0.000340	3.10	<0.000005	27.0	0.719	<0.000002	<0.00001	<0.0005	0.000147	<0.00005	<0.0005	<0.0001
Col16	5/7/2013	3	0.00307	0.000065	0.93	32.3	0.000207	3.37	<0.000005	24.5	0.489	<0.000002	<0.00001	<0.0005	0.0000449	<0.00005	<0.0005	<0.0001
		Cycle	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
Stn.Code	Collect Date/Time		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Col17	3/1/2013	0	0.177	0.00075	2.05	74.3	0.00182	1.69	<0.00001	50.2	2.21	0.0000054	0.000122	<0.001	0.0000672	<0.0001	0.0015	<0.0002
Col17	3/12/2013	1	0.133	0.00100	1.76	68.0	0.000800	1.81	<0.00001	44.8	1.96	<0.000004	0.000063	<0.001	0.0000308	<0.0001	<0.001	<0.0002
Col17	4/11/2013	2	0.0475	0.00106	1.50	62.1	0.000691	2.22	0.000039	40.1	1.57	0.000112	0.000039	<0.001	0.0000139	<0.0001	<0.001	<0.0002
Col17	5/7/2013	3	0.0169	0.000242	1.31	61.8	0.000277	2.51	<0.000005	39.3	1.39	<0.000002	<0.00001	<0.0005	0.0000103	<0.00005	<0.0005	<0.0001

Appendix E
MEA Pit Wall Scaling Factors Report

CASINO
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Marsland Environmental Associates

TECHNICAL MEMORANDUM

Date: **July 17, 2012**

To: **Casino Project Team**

From: **Rob Griffith, Rina Freed and Rob Marsland**

Subject: **Casino Pit Lake Preliminary Water Quality Model for Mine Closure – Pit-Wall Loading Rate Correction Factors**

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1 Introduction

Fracturing of open pit mine walls due to blasting exposes the wall rock to the forces of weathering. The fractured rock can be expected to contribute loadings of solutes into the pit lake following mine closure. It will be necessary to predict the post-closure impact of the fractured wall rock on pit lake water quality for closure planning purposes.

Laboratory humidity cell testing is presently underway under the direction of Lorax, for samples of drill core that have been selected to represent waste rock types which would be present in the fractured wall rock upon closure. The humidity cell/field bin results will be used in pit closure water quality modelling to characterise the mass loading rates of solutes from the pit wall rock. The humidity cell data comes in the form of weekly mass loading rates in units of mg/kg/week derived from a typical 1 kg sample of crushed drill core. The core was crushed to <10 mm and flushed each week with 500 mL of deionized water. This represents a 2:1 solid:liquid ratio on a weekly basis, but a 1:26 S:L ratio on an annual basis. Detailed description of the testing program is provided in Lorax's report titled "Kinetic Testing Update in Support of Casino ARD/ML Assessment", dated March 20, 2012.

An initial assessment of pit wall rock loading rates was carried out by Lorax and presented in the memo titled “Preliminary Geochemical Source Terms”, dated October 14, 2011. The results of that assessment were based on initial pit closure water quality modelling assumptions and preliminary humidity cell data. Since the time of the assessment, updated kinetic data was provided by Lorax (2012).

The scale-up of laboratory humidity cell mass loading rates from bench scale to mine scale is necessary to account for differences between the laboratory and field conditions. The following document was developed in support of the Casino Mine water quality model and identifies a number of correction factors that could be applied to the humidity cell mass loading rates (provided by Lorax, 2012) to characterise loading rates from the pit walls for water quality modeling of the pit lake following closure.

In addition to the laboratory tests, Lorax has installed field bins at the site. Each field bin contains approximately 150 kg of broken drill core. These provide an intermediary step in the scale-up from the lab tests to actual the pit wall rock.

2 Lab-to-Field Correction Factors

The following section provides a summary of the laboratory testing conditions for which loading rates are dependent on, with proposed correction factors to be used to scale laboratory loading rates to field loading rates.

2.1 Grain Size Distribution of Wall Rock

Humidity cell samples are composed of particles with diameter less than 10 mm, while only a fraction of the pit wall rock would have particle sizes less than 10 mm. A lab-to-field adjustment for grain size would be applied to the wall rock to account for the difference in specific area (unit surface area per unit mass) between the humidity cell samples and the fractured pit wall rock.

The final pit walls would be fractured as a result of blasting. Fracturing of the pit walls exposes the wall rock to the forces of weathering and hence can be expected to contribute loadings of solutes into the pit lake. In this assessment, it was assumed that controlled blasting would be used at the limits of the proposed open pit mine. However, controlled blasting of rock does not completely eliminate fracture of underlying rock, but results in a blast damage transition zone extending into the pit walls. The blast damage transition zone comprises a crushed zone, fractured zone and an influenced zone. The crushed zone would be removed for processing or waste dump disposal, and the fractured and influenced zones would remain in place upon closure of the mine. Blast zones following closure are illustrated in Figure 1. The method for estimating the depth of blast damage in the transition zones was sourced from Hustrulid (1999). Each zone was calculated based on controlled blasting patterns and practices for medium strength rock and ANFO (ammonium nitrate and fuel oil) used as the blasting agent. Under these assumptions, blast fractured zone depth would be expected to range from a minimum of 0.85 m to maximum depth of 1.05 m. Blast influenced zone depth would typically range from 2.65 m to 3.15 m. For the purposes of the Casino open pit water quality model, the blast fractured and blast influenced zones were defined as:

1. Blast fractured zone into the final wall of 0.9 m; and
2. Blast influenced zone extending another 2.9 m.

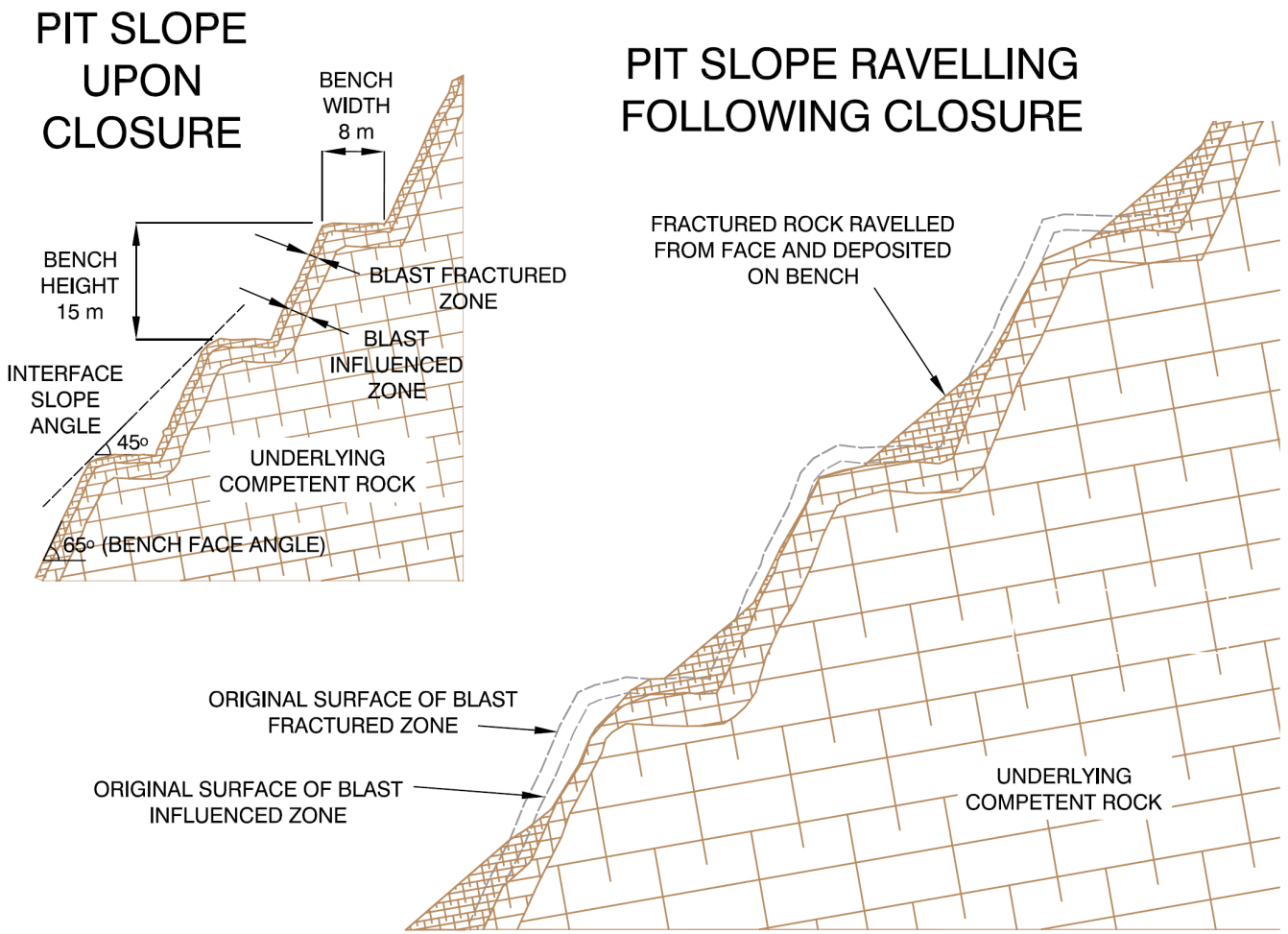
Ravelling of rock from the blast fractured and perhaps locally from blast influenced zones can be expected following closure of the mine. The ravelled rock would become deposited on the pit slope benches directly below the pit face from which the material was mobilized from, as illustrated in Figure 1. Ravelling of wall rock would change the placement of the blasted rock, but would not change the mass of rock contributing to loading into the pit lake. Any wall rock that might ravel all the way to the pit lake would become submerged and would no longer contribute loading induced through sulphide oxidation.

Increased specific area of pit wall rock as a result of breakdown due to freeze thaw processes or impact from ravelling rock can be expected to occur over time. However, the overall impact on pit water quality due to these processes was considered to be relatively small and at least partially offset by compensating factors such as vegetative growth and

sulphide riming and occlusion. They are accounted for in this assessment by making incremental offsetting adjustments resulting in no net effect.

Specific locations around the pit wall rock could have increased ravelling due to localized failures of the pit slope, and development of talus from weaker rock types within the wall rock. These zones will be relatively small compared to the ~1 km^2 area of post-closure unsubmerged pit wall rock. Because the extent of talus development and the geochemistry of talus materials cannot be quantified at this time, the influence of talus material on pit lake water quality in the closure water quality model, is also addressed through an incremental offsetting adjustment.

To develop a correction factor for grain size, the specific areas between humidity cells, and pit walls would be compared using respective grain size distributions. While grain size distributions for the humidity cell samples are readily available, the grain size distribution of a typical blast damage layer of wall rock is not available at this time. In this assessment, grain size correction factors were estimated as the fraction of wall rock that would have a similar grain size distribution (i.e. < 10 mm particles) as the humidity cell samples. The ratio of specific area of pit wall rock to humidity cell samples after many years of weathering was conservatively estimated to be 0.2 and 0.05 for the blast fractured wall rock and blast influenced wall rock zones, respectively. This is basically like saying that 20% of the blast fractured rock would become <10 mm particles, while 5% of the blast influenced (though still quite competent) would become <10 mm particles, and the remaining rock mass (comprising larger blocky particles) would not contribute any loading. The weighted average based on relative thicknesses of the blast zones would result in an overall ratio of approximately 0.085. A conservative factor of 0.1 (17% higher than 0.085) was selected (to allow for even more contributing surface area from the wall rock than assumed) and is applied to the humidity cell loading rates to account for differences in grain size between the lab test material and post-closure pit wall material.


PIT SLOPE UPON CLOSURE
BENCH WIDTH 8 m
BENCH HEIGHT 15 m
BLAST FRACTURED ZONE
BLAST INFLUENCED ZONE
INTERFACE SLOPE ANGLE
45°
UNDERLYING COMPETENT ROCK
65° (BENCH FACE ANGLE)
PIT SLOPE RAVELLING FOLLOWING CLOSURE
FRACTURED ROCK RAVELLED FROM FACE AND DEPOSITED ON BENCH
ORIGINAL SURFACE OF BLAST FRACTURED ZONE
ORIGINAL SURFACE OF BLAST INFLUENCED ZONE
UNDERLYING COMPETENT ROCK

2.2 Seasonality Effects

Humidity cells undergo weekly flushing year-round (52 flushes per year). The pit wall would only see free water between April and October, at most (mean monthly temperature is above freezing only 5 months a year). The oxidation reactions that occur on the rocks are biologically mediated, and continual sub-zero temperatures severely inhibit bacterial activity, so there would be no accumulation of fresh oxidation products over the winter. Because the weekly loading rates from the humidity cells would be applied in the water quality model on an annual basis, a factor of 0.5 should be applied to account for the six of the twelve months for which water would be frozen, and therefore unavailable for mass transport of leached solutes from the wall rock.

2.3 Temperature Effects

Ambient temperatures of the wall rock during the open water season would be much lower than the temperatures of 20°C to 22°C that are maintained in the laboratory. According to Lorax (Lorax, 2012, Section 6.3 – Temperature Dependence), average monthly temperature at the site between April and September ranges from -0.1°C to 11.1°C. In some instances, exothermic heating of the rock by sulphide oxidation can increase the temperature of the material above ambient temperatures and lead to increased kinetic reaction rates. However, because sulphide content in the wall rock is low, exothermic heating is not expected to increase rock temperature beyond the ambient temperature of the pit walls, and air temperature can be assumed to be controlling oxidation reaction rates.

In order to assess temperature effects on kinetic reaction rates, Lorax (2012) allowed a tailings sample (T1) to reach stable loading rates under room temperature (21^{o}C) prior to changing ambient temperature of the humidity cell to 4°C. The sulphate release rates at 21°C and 4°C, respectively, were used to fit a curve of pyrite oxidation rate vs. temperature using the Arrhenius equation. Pyrite oxidation rates for average monthly temperatures were then calculated from the Arrhenius equation to be 25% to 54% of the laboratory oxidation rates for the range of average monthly temperatures at the mine site.

Mass loading rates for some metals (e.g. Cu, Co, Pb) did not appear to decline in the laboratory conditions with decreased ambient temperatures, with data remaining within the range of normal scatter. According to Lorax (2012), the loading rates for some of the metals are likely more

dependent on hydroxide solubility controls rather than oxidation kinetics. Therefore, application of a correction factor to humidity cell laboratory loading rate data for temperature effects may only be applicable for some solutes, particularly those that can be expected to be dependent on pyrite oxidation kinetics.

Although the temperature effects were assessed on a tailings sample (T1), and not waste rock/pit wall rock samples, the results of the assessment by Lorax (2012) still illustrate the general relationship between reaction rates and temperature. Although the average temperature over the "summer" period is 8°C, which corresponds to a factor of around 43%, a correction factor of 0.5 will be applied to parameters like sulphate and parameters not otherwise controlled by solubility limits (see Section 3.4 below). The temperature correction factor may not be entirely applicable for some parameters, and its application will need to be evaluated for the water quality model on a parameter by parameter basis.

2.4 Water Contact Effects

A de-rating effect on loading (and concentration) caused by an increasing solid:liquid ratio was observed by Lorax (Lorax, 2012 – Section 7.1.1) when comparing the data from Humidity Cell 2a (a 5 kg sample) with Humidity Cell 2b (a 10 kg sample). The quantity of water applied to (and recovered from) each cell was similar (31 L vs 28 L over the entire 92 week test duration), and yet peak concentrations were found to increase by only 30% to 55%, instead of doubling in keeping with the increased contaminant availability from the additional rock mass in the sample. The effects of temperature and particle size distribution were controlled in this test, by running both tests on the same material at the same temperature. Solubility limits were also not likely to be a factor, given that the effect was observed at similar levels across a wide selection of parameters. This de-rating is expected to become more extreme as water availability decreases and preferential flow path development increases.

Humidity cell flushing rates (liquid flushing rate per unit mass per unit time) are much higher than that which would be induced by precipitation on the Casino pit walls. The annual solid to liquid ratio in humidity cells is 0.04 (1 kg of rock flushed by 26 L of water each year). The annual solid to liquid ratio in the blast damaged zones of the pit wall was calculated to be 2.5 using the following assumptions:

- density of rock = 2.7 t/m^3
- total depth of blast fractured rock = 3.8 m
- mass fraction of wall rock contributing to loading = 10 % (see Section 2.1)
- mean annual precipitation = 500 mm (assuming all precipitation infiltrates and comes in contact with the rock, a conservative assumption given an annual evaporation rate of 309 mm)
- average pit wall slope = 45°

The annual water availability to flush the equivalent specific area of rock was estimated to be ~65 times higher in the humidity cells than in the pit walls.

This lower flushing rate in the pit walls might be expected to result in much higher concentrations of some parameters in the seepage flowing through and draining from the wall rock. It could then be possible that some of these parameters may then exceed the solubility limit and re-precipitate before reaching the pit pond – further reducing loadings to the pit lake. This is discussed further in Section 3.4.

It is well recognized that at field scale, water contact is less intimate than in the lab. Preferential flow paths form where water takes the path of least resistance (the largest fractures and open voids). This further exacerbates the reduced water available for flushing.

Although water contact is expected to reduce loading rates between lab-to-field scale conditions, a conservative contact factor of 1.0 (no de-rating) was selected for this stage of the water quality modelling assessment. This factor will be subject to re-evaluation in future revisions of the water quality model, particularly as additional field bin data becomes available for comparison with humidity cell loading rates. Comparison between field bin data and humidity cell data is described in Section 3.3.

3 Summary and Discussion

3.1 Laboratory Data Correction Factor Summary

The following factors could be applied to the humidity cell loading rates to account for variation between bench scale, and mine scale conditions:

- 0.1 – grain size distribution (broken wall rock only has a small percentage of rock <10 mm in diameter)
- 0.5 – seasonality effects (to account for no water flowing for half the year)
- 0.5 – temperature differences (may not apply to some parameters) to correct for the lower ambient temperature during the summer (<7°C at the mine vs 21°C in the lab)
- 1.0 – water contact effects (A higher solid:liquid ratio and preferential flow path development can be expected in the field conditions. However, a factor of 1.0 was conservatively selected in this assessment at this time)

Overall, it is expected that on an annual basis, pit wall loading rates would be 2.5% of the laboratory mass loading rate for parameters for which temperature differences apply. Annual loading rates would be 5% of humidity cell loading rates for some metals (e.g., Cu) whose loading rates may not be as strongly affected by lower ambient temperature.

3.2 pH Effects on Loading Rates

Lorax (2012) identified that 50% of the SUP waste rock is expected to have no neutralization potential (NP) and would undergo acidic drainage shortly after excavation. Also, a portion of the SUP and HYP waste rock can be expected to undergo neutral drainage until NP depletion. After NP depletion, drainage from those rock sources would also be acidic.

Loading rates from a given rock type would be different under acidic drainage conditions, compared with loading rates from the same rock type under neutral drainage conditions. Consequently, for acid generating (AG) or potentially acid generating (PAG) rock types, loading rates for both drainage conditions (i.e. acidic and neutral) should be developed as source terms for water quality modelling. The source terms would be based on stabilized loading rates from kinetic testing.

Humidity cells for HYP waste rock (HC3 to HC10), neutral SUP waste rock (HC11) and acidic SUP waste rock (HC12), were commissioned by Lorax in 2011. The waste rock samples in HC3 to HC12 are considered to be the most representative of residual wall rock. However, stabilized loading rates from these samples are not available at this time. In place of laboratory loading rates for HYP and SUP waste rock, Lorax (2011) estimated HYP and SUP neutral loading rates from HYP ore (HC1) and SUP ore (HC2) humidity cell results. HC1 and HC2 were decommissioned prior to the onset of acidic drainage. However, acidic loading rates from HC1 and HC2 were approximated by Lorax by up-scaling the neutral loading rates using a pH regression developed for acidic HYP and SUP shake flask extraction (SFE) data.

Lorax (2011) presented the acidic loading rates for acidic HYP and SUP in units of mg/m^2/wk, which is mass loading per unit area of pit wall rock, per unit time. Some details of the calculation by Lorax (2011) to convert the humidity cell rates from mass based loading rates (mg/kg/wk) to pit wall area loading rates (mg/m^2/wk) were not provided in the Lorax (2011) source term memo. The mass based rates have been re-approximated by MEA assuming a rock mass density of 2.7 t/m^3 (SUS rock is reported to have an average SG = 2.62).. Lorax's assumption of a 1 m blast fractured zone corresponds to 2.7 t of rock contained within each m^2 of pit wall. The Lorax (2011) loading rates were converted by MEA from units of mg/m^2/week, to mg/kg/wk, by dividing by 2700 kg/m^2. For example, Lorax (2011) estimated the pH adjusted Cu loading rate for acidic SUP to be 440 mg/m^2/wk, which corresponds to a mass loading rate of 0.163 mg/kg/wk.

3.3 Use of Field Bins in Development and Validation of Correction Factors

Field bins have been commissioned at the Casino site for various mine ore and waste rock samples, as described by Lorax (2012). Concurrent loading rates between field bins and lab humidity cells for similar rock samples may be used to verify or refine lab-to-field correction factor estimates for temperature and water availability. For example, Unsaturated Column 1 (Col 1) and Field Bin 2 (FB2) were assembled with similar rock material (low sulphur CAP waste rock). Comparison of results between these two testing methods was carried out by MEA to illustrate the variation in loading rates that can be expected between lab and field conditions. MEA calculated specific surface area for each sample based on particle size distributions provided by Lorax (2012). The surface area calculations showed that Col 1 has a specific surface area that is 25% greater than FB2. The solid:liquid ratio in FB2 was calculated to be

~30 times greater than Col 1. Annual mass loading rates from FB2 are subject to seasonality effects because it is operated outdoors at the Casino site. Comparison between field and lab kinetic test results showed that 2010-2011 annual Cu loading rates from FB2 were 2% - 2.5% of the stabilized humidity cell loading rates from Col 1. Overall, this initial assessment strongly supports the development of lab-to-field correction factors.

Field bin loading rates could be used as source terms in water quality modelling as an alternative to laboratory loading rates. The benefit in using field bin data is that correction factors between field bin loading rates and full-scale pit wall loading rates for seasonality and temperature would not be required. However, correction factors for grain size and water contact effects may still be applicable.

Field Bin 5 (FB5) is considered to be the best proxy field bin to the acidic SUP wall rock at this time because it contains approximately 33% SUP. The remainder of the field bin consists of 77% CAP. FB5 showed acidic drainage characteristics in 2011.

In this assessment, a correction factor to account for grain size between FB5 and the full-scale pit wall would still need to be applied. The particle size distribution from Lorax (2012) indicates that approximately 15% (by mass) of the FB5 sample is <10 mm particles, while it was estimated by MEA (Section 2.1) that the pit wall would contain 8.5% (by mass) particles with <10 mm diameter. Comparison of mass fraction <10 mm in wall rock and FB5, respectively (8.5% / 15% ~ 60%), indicates that the pit wall rock would have roughly 60% of the specific area of the FB5 sample. Therefore, for this assessment a correction factor of 0.6 would be applied to the field bin loading rates to estimate the full scale wall rock loading rate from field bin loading rate data.

Continued comparison between lab loading rates and field bin loading rates can be used to refine the lab-to-field correction factors. However, additional field bin data will not be available until the end of the summer of 2012 or even after spring thaw in 2013 and so further comparison of field bin data with lab data may not be ready in time for EA submission.

3.4 Mineralogical Solubility Controls

Flushing rates in humidity cells are relatively high compared to the mass of sample material in the humidity cells. The intent of the high flushing rates is to ensure solubility limits are unlikely to be limiting the rate of mass loading. The lower flushing rate (higher solid to liquid ratio) expected in the field conditions may result in some elements reaching their solubility limits (e.g., sulphate, possibly Cu). In pit closure water quality modelling, it may be necessary to calculate pit wall seepage concentrations based on mass loading rates and estimated average pit wall seepage rates, and subsequently evaluate solubility limits (e.g., with pHREEQC modelling) of various solutes such that realistic inflow concentrations would be entering the pit lake.

3.5 Testing of Waste Rock Samples instead of Ore Samples

The materials tested in HC1 and HC2 were intended to be representative of ore samples. Additional testing is underway by Lorax on waste rock samples (HC3 to HC12) that are expected to be more representative of residual pit wall materials. However, stabilized loading rates from the waste rock samples are not available at this time. Source terms for water quality modelling will be updated when the new data becomes available.

3.6 Comparison of Results with Analogue Mine Sites

Post-closure mine sites with similar environmental and geological conditions as the proposed Casino site may exist. Such sites may be suitable “analogue” sites, where post-closure geochemistry and water quality conditions could be expected to be similar between the existing site and the Casino site. Identification of appropriate analogue mine sites should be carried out. The Casino humidity cell correction factors and solubility modelling results can be verified or refined by comparing analogue pit lake water quality monitoring data to the Casino pit lake water quality model output.

The best analogue to use is the existing drainage from the mineralized zones. MEA will work with Lorax and the baseline water chemistry assessment team to evaluate opportunities for comparable site data as an analogue.

3.7 Application of Correction Factors in the Pit Lake Loading Model

As an example, a 1 m^2 (horizontal projection) area of unsubmerged acidic SUP pit wall was considered for estimation of mass loading. With average overall pit wall side slopes of 45°, the inclined surface area was calculated to be 1.41 m^2. The total depth of the blast damaged zones (3.8 m) was used to calculate total volume and mass of contributing wall rock. Total contact water available was calculated as the annual sum of direct precipitation (500 mm/yr) on the pit wall rock. Input assumptions and calculated results for wall rock mass and contact water volumes are presented in Table 1.

Table 1 – Estimation of Mass of Fractured Wall Rock and Volume of Contact Water

Mass of Pit Wall Contributing to Mass Loading	**Unit**	
area (horizontal projection) of unsubmerged wall rock	m^2	1
average pit wall side slope	degrees	45
surface area of unusbmerged pit wall rock	m^2	1.41
density of pit wall rock	t/m^3	2.7
depth of blast fractured zone	m	0.90
depth of blast influenced zone	m	2.9
total volume of wall rock in the (3.8 m deep) blast damaged zone	m^3	5.4
total mass of wall rock in the (3.8 m deep) blast damaged zone	t	14.5
Volume of Contact Water Available on the Pit Walls	**Unit**	
mean annual precipitation depth	mm/yr	500
mean annual precipitation volume (per 1 m^2 of unsubmerged pit wall rock)	m^3/yr	0.5

Table 2 summarizes the input assumptions and calculated results for Cu mass loading from a 1 m^2 (horizontal projection) section of blast damaged, acid generating SUP wall rock. The appropriate correction factors for grain size (0.1), seasonality (0.5), temperature (1.0) and water contact (1.0) are applied to the pH-adjusted humidity cell loading rate for Cu (Section 3.2). Dividing the annual Cu loading by the annual volume of contact water results in an average annual pit wall runoff concentration for a unit area (1 m^2 horizontal projection) of SUP pit wall rock.

Table 2 – Example Calculation of Mass Loading from SUP Pit Wall Rock

Mass Loading Correction Factors	**Unit**	**Copper**
grain size correction factor	-	0.1
seasonality factor	-	0.5
temperature factor	-	1.0
water contact factor	-	1.0
overall correction factor	-	0.05
Mass Loading Rates	**Unit**	**Copper**
median humidity cell loading rate (from HC2 laboratory results with pH adjustment applied)	mg/kg/wk	0.163
median humidity cell loading rate (annual) (from HC2 laboratory results with pH adjustment applied)	mg/kg/yr	8.5
wall rock loading rate (HC2 loading rate with correction applied)	mg/kg/yr	0.425
Mass Loading Calculations	**Unit**	**Copper**
total mass of rock in the blast damaged zones (per 1 m^2 of unsubmerged SUP pit wall rock)	t	14.5
annual mass loading from the pit walls to the pit pond (per 1 m^2 of unsubmerged SUP pit wall rock)	kg/yr	0.0062
total annual contact water available on the pit walls (per 1 m^2 of unsubmerged SUP pit wall rock)	m^3/yr	0.5
annual average wall rock runoff concentration for SUP wall rock material (calculated)	mg/L	12.3

Field Bin 5 (FB5) is considered to be the best proxy field bin to the acidic SUP wall rock at this time. Leachate chemistry and calculated Cu annual loading rate based on 2011 data from FB5 are presented in Table 3 for comparison with the acidic SUP copper loading rates presented in Table 2.

In this assessment, a correction factor to account for grain size between FB5 and the full-scale pit wall was calculated in Section 3.3.

Table 3 – 2011 Field Bin 5 Leachate Chemistry

Field Bin 5 (FB5) Results	**Unit**	
mass of rock in sample (note 1)	kg	150
Leachate volume collected (note 2)	L	22
leachate pH (lab)	pH units	6.32 – 6.08
leachate pH (field)	pH units	5.56 – 5.04
2011 copper concentration	mg/L	6.38 – 6.97
2011 copper loading rate (note 3)	mg/kg/yr	0.95
Estimation of Loading Rate in Full Scale Pit Walls		
grain size correction factor	-	0.6
wall rock loading rate	mg/kg/yr	0.57

Notes:

1. Mass of Rock in FB5 was not provided by Lorax (2012). However, the mass of rock in FB2 was reported by Lorax (2012) to be 151 kg, Therefore, MEA estimated the mass of Field Bin 5 to be 150 kg.
2. Lorax (2012) reported that some leaking was observed from FB5 during 2011. Therefore, the total volume of leachate may have been under reported. While FB5 did not have the lowest leachate volume collected in 2011, the volume was 20% lower than the average. Hence the mass loading rate calculated may be underestimated by a similar amount.
3. 2011 copper loading rate was calculated from the 2011 leachate concentrations, leachate volume reported by Lorax (2012), and sample mass of 150 kg.

3.8 Conclusion

Although there is only one year of field bin data available at present, the copper loading rate predicted for the post-closure pit wall is greater based on the field bin, than that derived based on the laboratory testing. Since fewer scale-up factors need to be considered when working with field bin tests than with lab tests, the FB5 derived rates will be used for all parameters for acidic SUP pit wall rock for the post-closure pit lake water quality prediction in support of the

Feasibility Study. This approach will be revisited for the EA, once the 2012 field data are available. All other rock units will rely on scaled-up humidity cell data.

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Casino Kinetic Testwork Update for Ore, Waste Rock and Tailings



Project No. J862-5
11 December 2013

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Executive Summary

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Executive Summary

The Casino kinetic test program evaluates the metal leaching and acid rock drainage (ML/ARD) potential of waste rock, tailings and ore samples in support of the geochemical assessment for the Casino Project. The greatest geologic control on the ML/ARD characteristics within the Casino porphyry deposit is the mineralization zone. Mineralization zones include the oxide leach cap (CAP) near the surface of the deposit and the supergene (SUP) and hypogene (HYP) zones at depth. A total of 53 kinetic tests have been undertaken for the Casino Project, which includes saturated columns, unsaturated columns, humidity cells and field weathering bins.

The key findings from the current analysis of the kinetic database are as follows.

Waste Rock

- SUP waste rock generally has a greater immediate metal leaching potential than HYP waste rock in both saturated and unsaturated environments. However, these mineralization zones are both potentially acid generating, and have similar metal leaching potential under advanced (acidic) weathering states.
- The unsaturated metal leaching potential of CAP waste rock is lower than that of SUP or HYP in a similar pH range. The highly weathered CAP oxide unit is relatively deplete in most metals compared to the SUP and HYP units. However, it is important to note that the majority of the CAP unit has an acidic pH and can be expected to be immediately acid generating.
- Differences in metal leaching potential between the various HYP lithologies are minor.
- The parameter with the greatest leaching potential is copper, which was observed to exceed MMER guidelines in several kinetic tests from each mineralized rock type.
- HYP material produces the highest pH drainage and the lowest concentrations of most metals under saturated conditions relative to the other mineralization types. Sulphate is the only parameter that was consistently higher from HYP material.
- In a saturated environment, the highest metal leaching potential is associated with SUP and CAP material that is acidic prior to submersion. Metal leaching from this saturated acidic material can be largely ameliorated by mixing with HYP material that contains carbonate neutralization potential.

- Kinetic testwork indicates that it is geochemically favorable to store CAP waste rock in saturated conditions. This is attributed to upper limits on metal concentrations due to secondary mineral solubility and kinetic controls, and the inhibition of sulphide oxidation under sub-aqueous conditions from trace quantities of pyrite present in CAP material.

Tailings

- SUP tailings and ore samples have higher metal leaching potential under saturated and unsaturated conditions than tailings samples composed of HYP, with the exception of U and SO_4 which were released at higher rates from HYP tailings.
- Pyrite concentrate has similar or lower metal leaching potential than depyritized rougher tailings under saturated conditions, which indicates that saturation affectively ameliorates metal leaching from pyrite.
- Reducing the temperature of a tailings humidity cell from 21°C to 4°C resulted in a 67% reduction in the sulphate leaching rate. This temperature dependence is similar to literature values regarding temperature effects on the rate of pyrite oxidation. However, the temperature related reduction in sulphide oxidation rates did not uniformly result in a reduction of metal leaching rates.

A number of kinetic tests discussed in this report are ongoing with the intention of providing future updates. Some additional kinetic testwork has also been initiated, however results were not available before the cut-off date for data reporting.

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1. Overview

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1. Overview

1.1 Introduction

A series of laboratory and field based kinetic tests have been conducted to evaluate the acid rock drainage and metal leaching potential (ML/ARD) for waste rock, tailings and ore that will be produced during mine operations at Casino Mining Corporation's (CMC) Casino Project in the Yukon. The Casino kinetic test program includes humidity cells, unsaturated columns, saturated columns and field weathering bins. A variety of static testing was conducted on kinetic test samples to characterize the acid generating characteristics, elemental composition, grain size distribution and mineralogical components of kinetic test samples.

The primary objective of this report is to provide an update of the ongoing kinetic test program in order to better constrain Casino source term predictions, and identify specific elements of concern under saturated and unsaturated conditions. This report presents the static and kinetic test results of completed and on-going kinetic tests as well as an overview of the kinetic tests that have recently been initiated.

1.2 Geology

A brief review of the Casino property geology and mineralization relevant to the geochemical assessment and kinetic test program are provided below. A more detailed description of the site geology can be found in Lorax (2013).

The Casino deposit is a large gold-copper-molybdenum (Au-Cu-Mo) porphyry deposit that occurs in the Yukon Crystalline Terrane. The Terrane is dominated by the Yukon Group Metamorphics which were intruded by the Dawson Range Batholith.

The mineralization zones identified in the core of the Casino deposit include:

- Leached oxide cap zone (CAP);
- Supergene (SUP) Zone (Supergene Oxide (SOX) + Supergene Sulphide (SUS)); and
- Hypogene Zone (HYP).

In general, sulphide minerals have been leached from the uppermost rock of the Casino deposit leaving a Au-rich and trace molybdenite horizon identified as the CAP. Copper sulphates have percolated downward through the deposit and re-precipitated creating a Cu-rich horizon identified as the SUP. The lower-most zone of the deposit is unweathered and is identified as the HYP.

The CAP is 0-70 m thick zone at the top and in the core of the deposit. Rocks from the CAP are orange/tan/brown/yellow in colour, friable and weathered with pervasive clay (secondary argillic overprint). The removal of sulphides has resulted in secondary Fe-oxides formation.

The SOX is a 0-10 m thick zone below the CAP or occurs as pockets within the SUS zone. Rocks from the SOX are friable and weathered with pervasive clay (secondary argillic overprint). Predominantly Cu-sulphide minerals are identified in the SOX including, chalcanthite, brochanthite, malachite, azurite, cuprite, tenorite as well as molybdenite and native Cu.

The SUS is an approximately 60 m thick zone, below the CAP. Rocks from the SUS are friable and weathered with pervasive clay (secondary argillc overprint). Sulphide minerals identified in this zone include, pyrite, diginite, chalcocite, covellite, molybdenite and native Cu. The SUS has the highest Cu grades of the deposit.

The HYP is an unweathered zone of hydrothermal mineralization located below the CAP and SUS zones. Rocks of the HYP have been hydrothermally altered, resulting in generally potassic, phyllic propylitic alteration. Sulphide minerals identified in the HYP include, pyrite, chalcopyrite, bornite, molybdenite, tetrahedrite, sphalerite and galena.

Lithologic units of the Casino Intrusive Complex relevant to the kinetic test program include (M3, 2013):

- Dawson Range Diorite/Granodiorite (WR);
- Patton Porphyry intrusives (PP);
- Intrusive Breccia (IX); and
- Explosive Breccia (MX).

Several alteration zones occur in the core and outwards of the Casino deposit, including potassic, phyllic, argillic and propylitic alteration.

1.3 ARD/ML Background

1.3.1 2010 Drill Core Re-logging

In 2010, inconsistencies in drill core logs for the Casino deposit were recognized. CMC re-logged the drill corein 2010 which resulted in a revised rock categorization system that included revision of the mineralization zone and lithologic unit designations in the logs. The revised system has the most significant effect on categorization within the lithologic units; however, the spatial extent of the major mineralization zones were also refined.

All kinetic tests initiated prior to 2011 are composed of material selected according to the earlier logging procedures outlined in Titley (1993). As a result of the 2010 core re-

logging, some of kinetic tests are composed of mixed material from more than one mineralization zone and/or lithologic unit. All kinetic test sample descriptions presented in this report are based on the updated 2010 re-logging.

1.3.2 Relevant Interpretations from Past ML/ARD Work

Techniques used to assess ML/ARD potential include static tests which examine the intrinsic ML/ARD potential of a sample, and kinetic tests which expose the material to various weathering conditions. Kinetic testing is relatively expensive and time consuming compared to static testing; therefore, a phased approach was recommended. In the initial phases, a large number of samples (129 samples for Phase I and 304 samples for Phase II) were submitted for static testing to characterize the ML/ARD potential of various lithologic units, alteration types and mineralization zones. Based on static test results, kinetic test samples were selected which are representative of specific rock types within each mineralization zone and waste type.

Prior to the 2010 re-logging of the Casino drill core, Lorax Environmental Services Ltd. (Lorax) submitted two geochemical characterization reports:

- *Casino Phase I Geochemical Assessment Report* (Lorax, 2009); and
- *Casino Phase II Geochemical Assessment Report* (Lorax, 2010);

Data from Phase I and Phase II have since been updated according to the re-logging, compiled with new static test data collected in support of Phase III and Phase IV programs and presented in the Lorax (2013) Casino Geochemical Static Test Assessment.

Lorax (2013) concluded that ML/ARD characteristics varied within the Casino deposit primarily by mineralization zone and, to a lesser extent, lithologic unit. Trends were not identified based on the alteration zones of the Casino Intrusive Complex. Therefore, the focus of the Casino kinetic test program is primarily based on geochemical characteristics of the mineralization zones and, to a lesser extent, the lithologies of the HYP zone.

1.4 Report Structure

A description and rationale for waste rock, tailings and ore material used for the kinetic test program is provided in Chapter 2 and an overview of the field and analytical methods applied for the static and kinetic tests in provided in Chapter 3. Chapters 4, 5, 6 and 7 discuss the results of the static tests, saturated column tests, unsaturated kinetic tests and field bin experiments, respectively. Chapter 8 presents an overview of the program and a summary and interpretation of the most salient results from the kinetic test program.

2. Sample Selection and Rationale

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2. Sample Selection and Rationale

Kinetic testing aims to reproduce natural weathering conditions that the mined material will be exposed to in its stored and/or disposal environment. The inherent difficulties of reproducing environmental conditions in a laboratory setting have led to the development of a variety of kinetic testing techniques, each with advantages and disadvantages. This section provides an overview and rationale of the Casino kinetic test program. The specific test procedures and methodologies are described in detail in Chapter 3.

2.1 Kinetic Testwork Approach

2.1.1 Humidity Cells

The humidity cell is the most commonly used standardized kinetic test for ML/ARD assessments. The widespread application of humidity cells facilitates comparison of waste material between various mines, and has also created regulatory precedent in that the tests are an expected part of a complete ML/ARD assessment (Price, 1997). In the humidity cell, air and water are flushed through the material at an accelerated rate relative to natural environmental conditions. The purpose of flushing high volumes of water through a humidity cell is to prevent the accumulation of oxidation products, which allows for a more accurate calculation of sulphide oxidation rates from the test. The accelerated weathering rates reduce the length of time for which testwork must be run.

2.1.2 Laboratory Columns

Unlike the humidity cell procedure, there is little, if any, standardization of column testwork procedure. This allows for considerable flexibility and permits the column operation to be highly site or material specific with regard to material particle size and size range, sample mass, water infiltration or flow rate and degree of oxygenation.

2.1.2.1 Unsaturated Columns

Unsaturated columns are conducted to simulate leaching effects of water infiltrating through unsaturated mine waste. Unsaturated columns typically employ a larger volume of test material, have lower flushing rates, and operate by trickle leach whereby water is added to the column at a continuous rate rather than a weekly flushing event.

2.1.2.2 Saturated Columns

Saturated column testwork is conducted to simulate sub-aqueous disposal of mine waste. Sub-aqueous disposal of mine waste prevents oxygen ingress, inhibiting mine waste

oxidation and acid generation. In a saturated column, historical oxidation products are rinsed from mineral surfaces, and reductive dissolution of Fe and Mn oxides may take place. The historical oxidation products will eventually become depleted, however, some metal leaching associated with the reductive dissolution of Fe and Mn oxides may continue. Flushing rates can also be varied to mimic those expected at site.

2.1.3 Field Experiments

Field weathering experiments are advantageous because they more closely resemble the actual conditions present with natural waste piles, including site-specific climatic conditions, scale, grain size, and water-rock ratios than laboratory-based testing. Field bins are a relatively inexpensive way to provide long-term monitoring of water quality from geologic materials. A drawback of field bins is that they may not produce timely results, as they only produce drainage during rainfall events. Due to the slow weathering rates associated with field experiments more time is required to observe the evolution of drainage chemistry relative to laboratory experiments.

2.2 Test Program Overview

A total of 53 kinetic tests have been undertaken for the Casino Project, including:

- waste rock: 11 saturated columns, 5 unsaturated columns, 10 humidity cells, and 8 field bins;
- tailings: 6 saturated columns, 4 unsaturated columns (including 2 composed of CAP heap leach residue), and 7 humidity cells; and
- ore: 2 humidity cells.

A more detailed summary of the Casino kinetic testwork is provided for waste rock in Table 2-1 and for tailings and ore in Table 2-2. The first kinetic testing was initiated in May of 2008. Since then, changes have been made to the mine plan and rock classification schemes and the kinetic test programs have therefore been revised and redirected accordingly.

The unsaturated column and humidity cell tests are being conducted at SGS in Burnaby, B.C., the saturated columns are conducted in house at Lorax, and the field bins are conducted at the Casino exploration camp. In the subsequent sections, the rational of sample selection for the kinetic test programs are described.

Table 2-1:
Summary of seepage stream water quality data, July 12 and 13, 2011

Kinetic Test Type	Sample ID	Sample Selection Rational	Sample Description		Test Details		
			Mineralization Zone	Lithology	Mass (kg)	Start Date	End Date
Saturated Waste Rock Columns	Sat Col 2	Moderate S CAP (duplicate of Col 2A)	95% CAP, 5% SUP	85% WR, 5% IX, 5% MX, 5% PP	5	24-Feb-10	11-Jan-13
	Sat Col 3	Moderate S HYP	HYP	70% WR, 20% PP,10% MX	5	24-Feb-10	11-Jan-13
	Sat Col 4	High S HYP	HYP	70% WR, 20% PP, 10% MX	5	24-Feb-10	11-Jan-13
	Sat Col 5	High S SUP	90% SUP, 5%CAP, 5%HYP	95% WR, 5% MX	5	24-Feb-10	11-Jan-13
	Sat Col 6	Acidic SUP	50%SUP, 50%CAP	WR	5	24-Feb-10	11-Jan-13
	Sat Col 7	Moderate S HYP (Duplicate of Sat Col3)	HYP	70% WR, 20% PP,10% MX	10	24-Feb-10	11-Jan-13
	Sat Col 9	Layered CAP and HYP (only upper port sampled)	89% HYP, 11% SUP	89% WR, 11% PP	5	1-Apr-10	25-May-12
			CAP	78% WR, 11% PP, 11% MX	5		
	Sat Col 12	Layered acidic SUP and HYP (upper and lower ports sampled)	25% HYP	60% WR, 20% MX, 20% IX	3	12-Jul-12	on-going
			75% acidic SUP	88% WR, 12% IX	9.1	13-Jul-12	on-going
	Sat Col 13	Layered neutral SUP and HYP (upper and lower ports sampled)	25% HYP	60% WR, 20% MX, 20% IX	3.3	17-Jul-12	on-going
			75% neutral SUP	57% PP, 43% WR	9.8	18-Jul-12	on-going
	Sat Col 14	Layered acidic SUP and HYP (upper and lower ports sampled)	50% HYP	60% WR, 20% MX, 20% IX	5.6	12-Jul-12	on-going
			50% acidic SUP	88% WR, 12% IX	5.6	13-Jul-12	on-going
	Sat Col 15		neutral SUP	57% PP, 43% WR	7.9	17-Jul-12	on-going
Unsaturated Waste Rock Columns	Col 1	Low S CAP (duplicate of FB2)	CAP	WR	5	27-Jan-10	on-going
	Col 2A	5 kg Moderate S CAP (duplicate of Sat Col 2 & Col 2B)	95% CAP, 5% SUP	85% WR, 5% IX,5% MX, 5% PP	5	27-Jan-10	on-going
	Col 2B	10 kg Moderate S CAP (duplicate of Sat Col 2 and Col 2b)	95% CAP, 5% SUP	85% WR, 5% IX, 5% MX, 5% PP	10	27-Jan-10	5-Dec-12
	Col 3	High S CAP	80% CAP, 20% SUP	70% WR, 20% PP, 10% MX	5	27-Jan-10	5-Dec-12

Kinetic Test Type	Sample ID	Sample Selection Rational	Sample Description		Test Details		
			Mineralization Zone	Lithology	Mass (kg)	Start Date	End Date
	Col 4a	Neutral CAP (pH > 6)	81% CAP, 13% SUP, 6.3% OVB	81%WR, 19% PP	5	1-Apr-10	5-Dec-12
Waste Rock Humidity Cells	HC3	Neutral pH, high S (sample: 08-276)	HYP	PP	1	29-Nov-12	on-going
	HC4	Neutral pH, high S (sample 08-294)	HYP	WR	1	29-Nov-12	on-going
	HC5	Neutral pH, moderate S (sample 08-277)	HYP	PP	1	29-Nov-12	on-going
	HC6	Neutral pH, moderate S (sample 08-028)	HYP	WR	1	29-Nov-12	on-going
	HC7	Neutral pH, moderate S (50% of 08-043 & 08-225)	HYP	50% IX, 50% MX	1	29-Nov-12	on-going
	HC8	Acidic paste pH (sample 08-143)	HYP	MX	1	29-Nov-12	on-going
	HC9	Carbonate depleted (sample 08-260)	HYP	PP	1	29-Nov-12	on-going
	HC10	Acidic paste pH (50% of 08-059 / 08-178)	HYP	WR	1	29-Nov-12	on-going
	HC11	Neutral SUP (sample 08-068)	SUS	WR	1	29-Nov-12	on-going
	HC12	Acidic SUP (sample 08-058)	SUS	WR	1	29-Nov-12	on-going
Waste Rock Field Bins	FB1	pH>6 Moderate S CAP	CAP	WR	166	1-Sep-08	on-going
	FB2	pH > 6 Low S CAP	CAP	WR	151	1-Sep-08	on-going
	FB3	pH<6 Low S CAP	CAP	WR	155	1-Sep-08	on-going
	FB4	pH<6 High S CAP	CAP	52% PP, 48% MX	150	1-Sep-08	on-going
	FB5	Neutral SUP	56% SUP, 44% CAP	WR	169	1-Sep-08	on-going
	FB6	Moderate S HYP	92% HYP, 8% SUP	WR	172	1-Sep-08	on-going
	FB7	High S HYP	HYP	WR	132	1-Sep-08	on-going
	FB8	Moderate S HYP	HYP	PP	163	1-Sep-08	on-going

Table 2-2:
Summary of tailings and ore kinetic tests for the Casino Project.

Kinetic Test Type	Sample ID	Sample Selection Rational	Sample Description			Test Details		
			Material Type	Mineralization Zone	Lithology	Mass (kg)	Start Date	End Date
Ore Kinetic Tests								
Humidity Cells	HC1	HYP Ore	2009-Ore	100% HYP	75% WR, 25% IX	5	3-Dec-09	1-Sep-10
	HC2	SUP Ore	2009-Ore	81.7% SUP, 18.3% HYP	60% WR, 40% IX	5	3-Dec-09	1-Sep-10
Tailings Kinetic Tests								
Saturated Columns	Sat Col 1	Rougher whole tailings	2009-Bench	50% HYP, 50% SUP	66% PP, 34% IX	4.5	24-Feb-10	11-Jan-13
	Sat Col 8	Rougher whole tailings	2009-Bench	83% HYP, 17% SUP	55% PP, 45% IX	4.5	24-Feb-10	11-Jan-13
	Sat Col 10	Pyrite rougher whole tailings	2010-Bench	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	5	20-Jul-11	on-going
	Sat Col 11	Pyrite concentrate with 21% slimes	2010-Bench	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	5	28-Jul-11	on-going
	*Sat Col 16	Pyrite rougher whole tailings	2012-Pilot Plant	100% HYP	87% IXWR, 13% IXPP	5.4	1-Mar-13	on-going
	*Sat Col 17	Pyrite concentrate	2012-Pilot Plant	100% HYP	87% IXWR, 13% IXPP	6.6	1-Mar-13	on-going
Unsaturated Columns	Col 5	Pyrite rougher tailings sands (duplicate of T6)	2010-Bench	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	4.96	4-May-11	5-Dec-12
	Col 6	Pyrite rougher tailings sands	2012-Pilot Plant	100% HYP	87% IXWR, 13% IXPP	1	3-May-11	on-going
	*Col 7	Heap leach residue (sample CL-01 L)	Column leach residue	100% CAP	Mixed	10	20-Mar-13	on-going
	*Col 8	Heap leach residue (sample CL-01 L)	Column leach residue	100% CAP	Mixed	25	20-Mar-13	on-going
Humidity Cells	T1	Rougher whole tailings	2008-Pilot Plant	71% SUP, 22% HYP, 7% CAP	52% IX, 43% WR, 5% PP	5	1-May-08	1-May-10
	T2	Rougher whole tailings	2008-Pilot Plant			5	1-May-08	1-May-10
	T3	Rougher whole tailings	2008-Pilot Plant			5	1-May-08	12-Feb-09
	T4	Rougher whole tailings	2009-Bench	60% HYP, 40% SUP	59% IX, 22% PP, 20% WR	1	15-Dec-09	on-going
	T5	Pyrite rougher whole tailings	2010-Bench	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	0.9	3-May-11	4-Dec-12
	T6	Pyrite rougher tailings sands	2010-Bench	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	1	3-May-11	4-Dec-12
	T7	Pyrite rougher whole tailings	2012-Pilot Plant	100% HYP	87% IXWR, 13% IXPP	1	5-Mar-13	on-going

Notes: * Kinetic test data not presented. Tests were initiated recently, therefore, insufficient leachate data for presentation. Only static test data is presented for the test samples.

2.2.1 Waste Rock Sample Selection

2.2.1.1 Field Bins

Eight field bin experiments were initiated in September of 2008. A summary of the drill core used in each field bin is provided in Table 2-3. Note that at the time of construction, drill core used for field bin tests FB5 and FB6 were classified as SUP and HYP respectively. However, following the 2010 re-logging, FB5 is composed of 56% SUP and 44% CAP and FB6 is composed of 92% HYP and 8% SUP. The purpose of the HYP and SUP field bins is to provide information regarding metal leaching behaviour of sub-aerially stockpiled waste rock and exposed pit wall. The purpose of the non-sulphide bearing CAP waste rock field bins is to provide information on the range of pH and dissolved metals in water coming into contact with the CAP waste and the amount of time to deplete the oxidation products. The CAP material is being considered for construction material in the starter dam.

Table 2-3:
Geologic material used in field bin kinetic tests.

Bin #	Mineralized Zone	Rock Unit	Drill Hole	From (m)	To (m)
FB1	CAP	WR	94-320	54.0	81.4
			94-339	52.4	76.8
FB2	CAP	WR	93-241	10.4	38.7
			93-237	15.2	36.6
			93-247	13.4	43.0
FB3	CAP	WR	93-216	28.6	44.8
			93-210	44.2	59.4
			94-268	20.1	35.4
FB4	CAP	PP	94-300	14.3	43.3
		MX	94-304	9.8	28.3
FB5	SUP	WR	94-262	13.1	29.3
			94-254	16.8	34.6
	CAP	WR	94-267	53.0	61.1
			94-341	24.5	42.8
FB6	HYP	WR	94-254	51.8	75.0
			93-239	236.7	258.5
			93-196	285.29	296.4
	SUP	WR	93-196	280.1	285.29
FB7	HYP	WR	93-203	270.4	295.9
			94-259	103.5	131.7
FB8	HYP	PP	93-233	197.2	215.8
			93-229	*236.8*	270.4

2.2.1.2 Unsaturated Columns

In early 2010, five unsaturated columns containing CAP waste rock were initiated to assess leachate chemistry of sub-aerially stored CAP material. Drill core intervals used to construct the unsaturated columns are provided in Table 2-4. Following the 2010 re-logging, four of the five columns contain a mix of predominantly CAP (>80%) and SUP material. Col 1, constructed from the representative sample collected from FB2 during construction of the bins, was initiated to compare field and laboratory weathering rates. Col 2A and Col 2B are composed of the same CAP material containing average total sulphur (S) content (0.32%), a value derived for the CAP zone based on the static test results from Lorax (2013). Col 2B contains twice the mass (10 kg) of Col 2A in order to assess weathering rates at different scales of the laboratory experiment. Col 3 is composed of CAP waste rock with relatively high total S content (1.23%) and Col 4A is composed of CAP waste rock with a paste pH > 6.0.

2.2.1.3 Saturated Columns

In the spring of 2010, six saturated columns containing waste rock were initiated to assess the long term drainage chemistry of sub-aqueously disposed waste rock. Drill core used to construct the saturated waste rock columns are provided in Table 2-5. Sat Col 2 is constructed of the same material as Col 2A and Col 2B to compare different disposal options for the CAP waste. Saturated columns Sat Col 3 through Sat Col 6 are composed of HYP or SUP material with moderate to high total S (Table 2-5). Sat Col 7 is a duplicate of Sat Col 3 but contains twice the mass (10 kg) in order to address scaling issues. Sat Col 9 is composed of a 5 kg layer of HYP waste rock over a 5 kg layer of CAP waste rock to assess leachate chemistry from mixed waste rock under saturated conditions. Flow in Sat Col 9 is in an upward direction through the CAP waste and then through the HYP waste to assess the neutralizing capacity of the HYP waste of the acidity produced by the CAP waste. Leachate is collected from a sampling port at the top of the column.

In July of 2012, three layered saturated columns (Sat Col 12 through Sat Col 14) and one saturated column composed of neutral SUP (Sat Col 15) were constructed to assess saturated disposal strategies for the SUP and HYP waste rock. The columns are composed of various proportions of SUP and HYP waste rock to assess the capacity of the HYP waste to neutralize acidity produced by acidic and neutral SUP waste.

Table 2-4:
Waste rock samples selected for unsaturated columns

ID	Mineralization	Rock Unit	Drill Hole	From (m)	To (m)	wt. %
Col 1	CAP	WR	93-21	10.4	38.7	53
			93-237	15.2	36.6	49.4
			93-247	13.4	43	48.6
Col 2A and Col 2B	CAP	WR	93-187	34.14	36.14	20
			94-339	12.8	14.8	20
			93-168	19.51	21.51	20
			94-335	9.75	11.75	20
	SUS	WR	93-213	57	59	5
	CAP	PP	93-233	11.28	13.28	5
	CAP	MX	93-163	11.28	13.28	5
	CAP	IX	93-245	11.28	13.28	5
Col 3	SOX	WR	93-243	54.86	56.86	20
	CAP	WR	93-246	14.63	16.63	20
			93-168	60.05	62.05	20
			93-238	22.4	24.4	5
			93-179	44.8	46.8	5
	CAP	IX	94-308	96.01	98.01	20
	CAP	PP	93-153	55.47	57.47	5
	CAP	MX	93-163	53.95	55.95	5
Col 4a	CAP	PP	93-175	4.57	4.87	6.2
			93-240	5.18	7.18	6.3
			93-153	15.09	17.09	6.3
	CAP	WR	94-256	17.37	19.37	12.5
			94-336	11.13	13.13	6.3
			94-335	18.90	20.90	6.3
			93-247	13.41	13.71	6.3
			94-251	21.95	23.95	6.3
			93-165	4.00	4.30	6.3
			93-235	43.89	45.89	6.3
			93-165	44.81	46.81	6.3
	OVB	WR	93-219	23.47	25.47	6.3
	SUS	WR	93-213	57.00	59.00	6.3
	SUS	WR	93-213	29.57	31.57	6.3

Table 2-5:
Waste rock samples selected for saturated columns.

	Mineralization	Rock Unit	Drill Hole	From (m)	To (m)	wt. %
Sat Col 1	SUP	IX	CAS-002	183.18	187.54	20
	SUP	PP	CAS-002	187.54	202.08	30
	HYP	IX	CAS-002	202.08	221	50
Sat Col 2	CAP	WR	93-187	34.14	36.14	20
			94-339	12.8	14.8	20
			93-168	19.51	21.51	20
			94-335	9.75	11.75	20
	SUP	WR	93-213	57	59	5
	CAP	PP	93-233	11.28	13.28	5
	CAP	MX	93-163	11.28	13.28	5
	CAP	IX	93-245	11.28	13.28	5
Sat Col 3 & Sat Col 7	HYP	WR	09-15	393.19	396.24	20
			09-20	306.32	309.37	20
			09-18	341.16	344.42	20
			09-36	228	331	10
	HYP	PP	09-13	209	212	20
	HYP	MX	09-33	461	464	10
Sat Col 4	HYP	WR	09-19	329.47	332.23	30
			09-17	356.62	359.66	30
			09-36	228	331	10
	HYP	PP	09-11	178.9	181.9	20
	HYP	MX	09-33	461	464	10
Sat Col 5	SUS	WR	09-21	169.16	172.21	25
			09-22	174.31	176.78	20
			09-23	208.79	211.84	25
			09-09	140.4	143.4	20
	HYP	MX	09-34	217.93	220.93	5
	CAP	WR	09-35	39	42	5
Sat Col 6	SUS	WR	09-25	146.3	149.35	50
	CAP	WR	09-26	137.16	140.21	50
Sat Col 8	HYP	PP	CAS-002	630.94	633.98	20
	HYP	IX	CAS-002	618.13	630.94	63
	SUP	WR	CAS-003	160.88	195.07	17
Upper Sat Col 9	HYP	WR	93-236	319.13	321.13	11.1
			94-256	71	71.3	11.1
			94-256	163.68	165.68	11.1
			93-221	94	94.3	11.1
			93-230	192	192.3	11.1
			93-187	191.11	193.11	11.1
			93-237	120.09	122.09	11.1
		PP	93-238	203.3	205.3	11.1
	SUS	WR	93-205	34.14	34.44	11.1
Lower Sat Col 9	CAP	WR	93-179	27	27.3	11.1
			93-239	32.61	34.61	11.1
			93-224	25	25.3	11.1
			93-189	24.99	26.99	11.1
			94-308	26.52	28.52	11.1
			93-195	28	28.3	11.1
			93-165	44.81	46.81	11.1

	Mineralization	Rock Unit	Drill Hole	From (m)	To (m)	wt. %
		PP	93-240	10	10.3	11.1
		MX	94-289	15	15.3	11.1
Upper Sat Col 12, Sat Col 13 & Sat Col 14	HYP	WR	93-203	279.5	281.5	20
			94-259	177.39	179.39	20
			93-168	270.4	272.4	20
		MX	93-163	270.4	272.4	20
		IX	93-227	191.1	193.1	20
Lower Sat Col 12 & Sat Col 14	SUP (acidic)	WR	94-260	53.95	55.95	42.3
			93-243	54.9	56.9	24.7
			CAS-003	146.3	149.35	20.9
		IX	94-307	38.71	39.01	4.4
			94-307	62.2	62.5	7.7
Lower Sat Col 13 & Full Sat Col 15	SUP (neutral)	PP	93-229	72	72.3	4.9
			93-206	193	193.3	5.7
			93-228	108.81	110.81	23.2
			93-229	160.63	162.63	23.2
		WR	94-260	35.05	37.05	20.9
			94-260	29.57	31.57	22.3

- Sat Col 12 is composed of 3 kg of HYP waste overlying 9.1 kg of acidic SUP waste (at a 3 to 1 ratio);
- Sat Col 13 is composed of 3.3 kg of HYP waste overlying 9.8 kg of neutral SUP waste (at a 3 to 1 ratio); and
- Sat Col 14 is composed of 5.6 kg HYP waste overlying 5.6 kg acidic SUP waste (at a 1 to 1 ratio).

Flow in these columns is in an upward direction with leachate interacting with SUP then HYP as it moves through the layered columns (Sat Col 12, 13 and 14). In these columns, rhizome sampling ports were installed in the centre of the columns approximately 1.5 cm below the HYP:SUP interface. These ports were installed so leachate which had interacted with SUP could be sampled before and after interaction with the neutralizing HYP layer.

2.2.1.4 Humidity Cells

In November 2011, ten waste rock humidity cells were initiated on waste rock samples selected from drill core. These tests were initiated to provide an estimate of neutral and acidic weathering rates for the HYP and SUP mineralization zones. Furthermore, humidity cells were selected to represent each of the major HYP lithologies. These included multiple WR and PP samples containing typical and elevated sulphur content with average NP values. Acidic HYP drill core availability is limited, as a vast majority of HYP is at a neutral-alkaline paste pH. Therefore only a single sample for the WR and PP lithologies were selected to represent acidic HYP weathering (HC10 and HC9, respectively). No acidic IX or MX HYP samples were available, therefore a sample with no carbonate NP

was selected with the expectation that it would become acid generating relatively quickly under humidity cell conditions (HC7). Drill core used to construct the humidity cells is provided in Table 2-6. A description of the sample selection for the humidity cells is provided in Table 2-1.

Table 2-6:
Waste rock samples selected for humidity cells.

ID	Mineralization	Rock Unit	Sample ID	Drill Hole	From (m)	To (m)	wt. %
HC3	HYP	PP	08-276	93-233	75.29	77.29	100
HC4	HYP	WR	08-294	94-259	106.53	108.53	100
HC5	HYP	PP	08-277	93-233	206.35	208.35	100
HC6	HYP	WR	08-028	93-153	220.07	220.37	100
HC7	HYP	IX	08-043	93-171	200.00	200.30	50
	HYP	MX	08-225	93-163	117.96	119.96	50
HC8	HYP	MX	08-143	94-304	136.25	138.25	100
HC9	HYP	PP	08-260	93-228	178.92	180.92	100
HC10	HYP	WR	08-059	93-226	116.00	116.30	50
			08-178	93-177	206.35	208.35	50
HC11	SUP	WR	08-068	93-186	60.00	60.30	100
HC12	SUP	WR	08-058	93-226	75.00	75.30	100

2.2.2 Ore Sample Selection

In December of 2009, two humidity cells (HC1 and HC2) were initiated to assess drainage quality from stockpiled ore. Drill core samples selected for HC1 and HC2 are summarized in Table 2-7. Both humidity cells are composed of ore samples from the 2008-2009 drilling program. HC1 is composed of HYP ore and consists of a mix of rock types according to the proportions outlined in the 2007 mining schedule. HC2 is composed of SUP ore. Following the 2010 re-logging, one drill core interval in the HC2 test was re-categorized as HYP material. In addition to the ore material used for HC1 and HC2, ore head samples which correspond to tailings produced during metallurgical testing were also submitted for static test work and are discussed in Chapter 3.

Table 2-7:
Identification of ore samples selected for humidity cells

Test ID	Mineralization	Lithology	Drill hole	From (m)	To (m)	wt. %
HC1	HYP	WR	CAS-012	127.9	130.9	20
	HYP	IX	CAS-002	213.36	214.96	10
	HYP	IX	CAS-002	364.24	367.28	15
	HYP	WR	93-247	205.13	207.13	20
	HYP	WR	93-246	164.59	166.59	20
	HYP	WR	93-217	203.3	205.3	15
HC2	SOX	IX	CAS-002	83.8	86.87	5
	SUS	IX	CAS-002	111.25	114.30	17.5
	SUS	IX	CAS-002	147.83	150.88	17.5
	HYP	WR	CAS-005	97.0	100.00	18.3
	SUS	WR	93-239	74.07	76.07	18.3
	SOX	WR	93-238	75.29	77.29	18.3
	SOX	WR	94-254	26.21	28.21	5

2.2.3 Tailings Sample Selection

Since 2008, four metallurgical test programs have been conducted to develop and assess copper recovery from the Casino ore, including two pilot plant studies (2008 and 2012) and two bench scale studies (2009 and 2010) (Table 2-2). During each program, tailings solids and supernatant were collected. Drill core selected for the metallurgical tests are provided in the G & T Metallurgical Services Ltd. (G&T) reports in Appendix A.

Tailings supernatant samples were collected from flotation tailings samples produced by the pilot plant and bench scale tests. Following the processing tests, the tailings were allowed to settle out in buckets before the supernatant was siphoned with disposable syringes, filtered and acidified as necessary. The supernatant samples were analyzed for pH, conductivity, anions, nutrients, and total and dissolved metal. Ageing tests were conducted for the 2010 and 2012 tailings; therefore, supernatant samples were also collected from these tailings one week and, for the 212 tailings, two weeks after processing.

2.2.3.1 2008 Pilot Plant Tailings (KM2084)

In April of 2008, pilot plant testing was conducted by G&T using weathered drill core samples collected during the 1992-1994 drilling program. One composite tailings sample was produced during the testwork and labeled KM2084. This testwork was initiated to provide metallurgical data in support of the pre-feasibility study. In this initial testing a

sulphide flotation process was developed to recover copper, molybdenum and gold into a single concentrate. The sulphide minerals were liberated from the ore in a primary grind circuit where water and fuel oil were added. A pH of 11 was maintained through the addition of lime. The ground ore was then put through three rougher flotation separation circuits with reagents, Aerophine 3418A promoter (sodium-diisobutyl dithiophosphinate), Aerofloat 208 promoter (sodium diethyl dithiophosphate/ sodium di-secondary butyl thiophosphate) and Methyl Isobutyl Carbinol (MIBC) frother to produce a copper-molybdenum concentrate. The concentrate was then reground and limed to a pH of 11 before being passed through three cleaner circuits.

The drill core used in this metallurgical program was partially weathered, having been stored at the Casino site in core racks for approximately 15 years. The composite ore feed for the pilot scale test was predominately composed of a mix of HYP and SUS drill core; however, some CAP material was also included. The drill core used in producing this composite sample consisted of over 100 drill core samples.

Three tailings samples (T1, T2 and T3) were collected from the pilot plant test. The samples were collected at discrete intervals during the pilot plant run and are not duplicates of one another. The samples were submitted for static and humidity cell testwork to assess the ML/ARD potential and leachate chemistry of unsaturated tailings that will be placed in the embankment and beach of the tailings storage facility. The effect of temperature on weathering rates for Casino tailings was investigated by moving humidity cell T1 after 37 weeks of kinetic testing at room temperature (~22°C) to a temperature controlled room maintained at 4°C.

2.2.3.2 2009 Bench Scale Tailings Samples (KM20459- 08, 09, and 10)

In September of 2009, bench scale testing was conducted by G&T on core samples collected during the 2009 drilling program. Three 6 kg samples of fresh drill core were processed. The composite ore feed samples are composed of the following materials:

- KM2459-10 is composed of processed ore collected from the SUP (50%) and HYP (50%) zones (SSH Comp 1);
- KM2459-09 is composed of processed ore exclusively from the HYP zone (HZ Comp 2); and
- KM2459-08 is composed of processed ore exclusively from the SUP zone (SS Comp 2).

The three tailings samples produced from the 2009 bench scale tests were mixed in various proportions to produce one humidity cell and two saturated column tests (T4, Sat Col 1 and

Sat Col 8; Table 2-2). The proportions of the composite samples for the 2009 bench scale tests were produced according to the approximate proportions of SUP and HYP ore presented in the 2008 Pre-Feasibility Study (M3 Engineering and Technology Corp., 2008).

- T4 is a 1kg composite sample of 40% SSH Comp 1, 40% HZ Comp 2, and 20% SS Comp 3 (*i.e.,* 60% HYP and 40% SUP);
- Sat Col 1 is composed of 4.5 kg of SSH Comp 1 (*i.e.,* 60% HYP and 40% SUP); and
- Sat Col 8 is composed of 4.5 kg of 83% HZ Comp 2 and 17% SS Comp 3 (*i.e.,* 83% HYP and 17% SUP).

2.2.3.3 2010 Bench Scale Tailings Samples (KM2721)

In December of 2010, G & T conducted a series of 10 locked cycle tests using SUP ore and produced approximately 20 kg of tailings. A flow diagram for the 2010 bench scale tailings processing is shown in Figure 2-3. An initial grind of ore produced 10 charges of 2 kg each with a nominal size of 222µm K80. Each charge was subjected to a copper rougher flotation test. The floated concentrate was collected and re-ground to a nominal size of 17 µm K80 and introduced into a cleaner flotation cell, which produced both a copper concentrate and cleaner scavenger tailings. The rougher tailings were separated into a pyrite concentrate and depyritized tailings in the pyrite rougher circuit. The pyrite rougher circuit was collected and wet sieved using a 74 µm sieve to produce sands (>74 µm fraction), which represents material that will be used for dam construction, and slimes (<74 µm fraction), which represents tailings that will be placed in the tailings impoundment. Some of the pyrite rougher tailings were retained un-sieved and identified as whole pyrite rougher tailings. During periods of operation when the tailings embankment is not being built, whole pyrite rougher tailings will be deposited into the tailings storage facility. The pyrite concentrate and the cleaner scavenger tailings are high sulphide products that will require direct sub-aqueous deposition to inhibit the development of ARD.

Five kinetic tests were initiated using the 2010 bench scale SUP tailings, including two humidity cells (T5 and T6), one unsaturated column (Col 5) and two saturated columns (Sat Col 10 and Sat Col 11) (Table 2-8).

- T5 is composed of 1 kg of whole pyrite rougher (PyRo) tailings;
- T6 is composed of pyrite rougher (PyRo) sands (>74 µm);

- Sat Col 10 is composed of recombined >74 µm sands and <74 µm slimes to produce a 5.06 kg whole pyrite rougher (PyRo) tailings;
- Sat Col 11 is composed of tailings slimes (<74 µm fraction), pyrite rougher concentrate (PyRo Conc.), and cleaner tailings; and
- Col 5 is composed of pyrite rougher sands to better constrain scaling factors that may affect metal leaching rates from tailings embankment sands.

Sat Col 10 was initiated to assess the porewater chemistry from the pyrite rougher tailings that will be deposited in saturated zones of the tailings impoundment. Sat Col 11 was initiated to assess the porewater chemistry in areas that potentially acid generating pyrite rougher concentrate will be deposited.

Supernatant samples were collected from each of the pyrite rougher tailings, cleaner scavenger tailings, pyrite concentrate and final concentrate. Supernatant was collected twice from each 2010 bench scale tailings sample, one after the locked cycle test and a second one month later. This was conducted to assess the effect of "aging" on the tailings sample. Effluent samples collected shortly after the locked cycle tests were analyzed only for dissolved metals. The aged effluent samples were analyzed for both total and dissolved metals.

Table 2-8:
Laboratory kinetic tests composed of tailings produced by the 2010 bench scale metallurgical tests (SUP ore).

Kinetic Test ID	Type of Test	Material Description
T5	Humidity Cell	Pyrite rougher whole tailings
T6	Humidity Cell	Pyrite rougher tailings sands >74µm
Col 5	Unsaturated Column	Pyrite rougher tailings sands >74µm
Sat Col 10	Saturated Column	Pyrite rougher whole tailings
Sat Col 11	Saturated Column	55% cleaner scavenger tailings, 24% pyrite concentrate, 21% pyrite rougher slimes (< 74 µm)

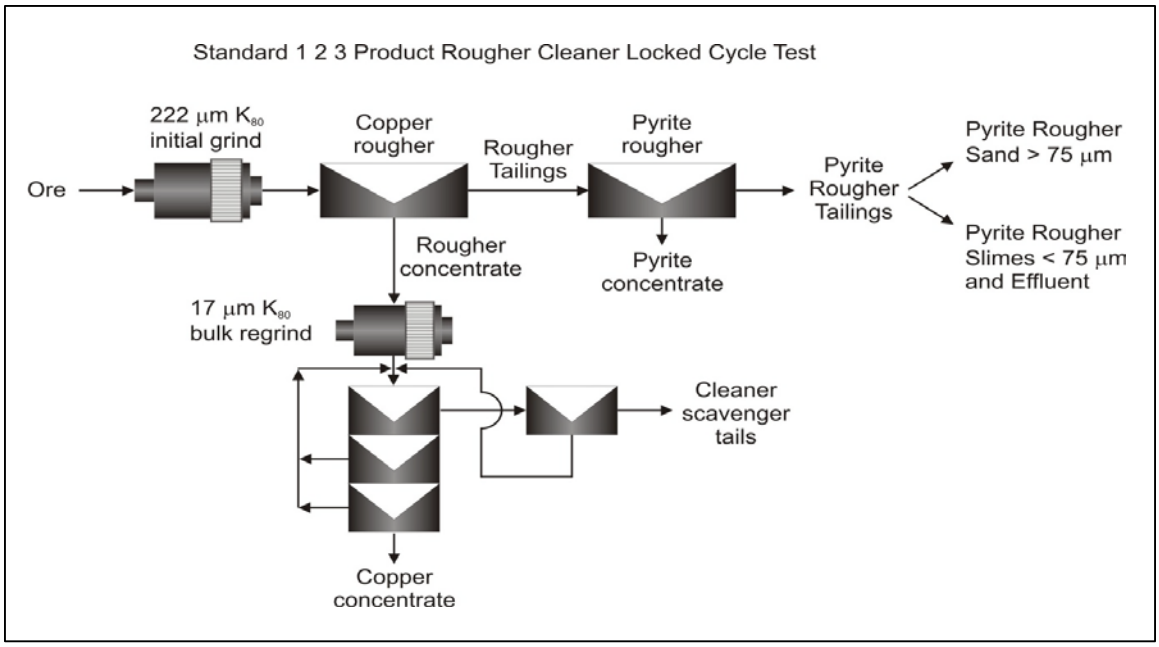


Figure 2-1: Flow sheet for Casino 2010 bench scale locked cycle tests

2.2.3.4 2012 Pilot Plant Tailings

In October of 2012, a pilot plant program was conducted on SUP and HYP head samples using fresh drill core to produce tailings composed of 100% SUP and 100% HYP. The previous Casino metallurgical programs used core sample that had been stored on site for several years. Processing conducted during the 2012 metallurgical program follows that of the 2010 program illustrated in Figure 2-3. Four kinetic tests were initiated on the HYP waste products produced by the 2012 program, as outlined in Table 2-9. However, saturated columns Sat Col 16 and Sat Col 17 were initiated March 1, 2013; therefore, there is not sufficient leachate data to be presented to calculate stabilized leaching rates for the development of source terms. Static testwork conducted for test samples are presented in Chapter 3.

Table 2-9:
Laboratory kinetic tests composed of tailings produced by the 2012 pilot plant metallurgical tests (HYP ore)

Kinetic Test ID	Type of Test	Material Description
T7	Humidity Cell	Pyrite rougher whole tailings
Col 6	Unsaturated Column	Pyrite rougher tailings sands >74µm
Sat Col 16	Saturated Column	Pyrite rougher whole tailings
Sat Col 17	Saturated Column	Pyrite concentrate

Supernatant samples were collected from the SUP and HYP 2012 metallurgical test products (Table 2-10). Supernatant was also collected from mixed waste streams to identify any non-conservative behavior that will take place when the two waste streams are mixed. Supernatant from the pyrite concentrate and pyrite rougher (whole) tailings were mixed at a 1 to 6 ratio, which is the approximate ratio produced by the pilot plant.

All waste products were allowed to settle for approximately 30 minutes before supernatant samples were collected for analysis. Water quality samples were collected using a peristaltic pump with inline filtration and preserved according to analytical requirements. Four supernatant samples were also sampled 7 days and 21 days after processing to assess the effect of ageing on supernatant chemistry (Table 2-10). The aged samples were collected in five-gallon buckets that were open to the atmosphere.

Table 2-10:
Supernatant samples collected from 2012 pilot plant products.

Sample ID	Waste Description	Ore Type	Ageing Tests
HYP-PYRO-FEED	Rougher whole tailings (feed)	HYP	x
HYP-RO-TAILS	Pyrite rougher whole tailings	HYP	x
HYP-PYR-CON-RO	Pyrite concentrate	HYP	x
HYP-1:6-MIX	Mixed supernatant	HYP	
SUP-1:6-MIX	Mixed supernatant	SUP	
SUP-PY-RO-FEED	Rougher whole tailings (feed)	SUP	x
SUP-WHOLE-RO-TAILS	Pyrite rougher whole tailings	SUP	
SUP-PY-CON	Pyrite concentrate	SUP	

2.2.3.5 CAP Heap Leach Residue

In early 2012, METCON Research (METCON) conducted a preliminary open cycle column leach study (CL-01) on Casino drill core from the CAP zone at their facility in Tucson, Arizona. The main objective of the column leach study was to determine the amenability of this composite sample to gold and silver extraction by a heap leach type process. A secondary objective was to produce pregnant solutions and residues to be evaluated in an environmental impact study. The metallurgical report produced by METCON is provided in Appendix A. Unsaturated Col 7 and Col 8 were constructed using leached CAP ore (*i.e.*, heap leach residue) produced by the column leach test. The kinetic tests were initiated in March 2013; therefore, there is not sufficient leachate data to be presented. However, static testwork conducted for the sample CL-01 L residue is discussed in Chapter 3.

3. Analytical and Test Methods

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3. Analytical and Test Methods

This chapter discusses the configuration and analytical methods employed for the saturated (columns), unsaturated (columns and humidity cells) and field kinetic tests. The kinetic tests are used to assess long term drainage chemistry, develop source terms for water quality predictions and evaluate disposal and storage strategies/options for waste rock, tailings and ore that will be produced during mining of the Casino deposit. Also presented are the static test methods used to assess the ML/ARD potential of samples from each kinetic test. These tests include mineralogical investigations by X-ray diffraction (XRD) and optical and scanning electron microscopy (SEM), acid base accounting (ABA), aqua regia digestion, X-ray flouresence (XRF), particle size distribution (PSD) and shake flask extraction (SFE).

3.1 Kinetic Testing Methods

3.1.1 Saturated Columns

The saturated columns are composed of Plexiglas cylinders (15.0 cm inside diameter, 20.0 cm length; Col 7 is 40.0 cm length) filled with 5 kg or 10 kg of sample crushed to approximately minus 6 mm. Peristaltic pumps are used to force distilled de-ionized water in near the base and through each column to maintain saturated conditions. Leachate from the single unit columns is collected from a port at the top of the column using a vacuum and collection containers. Leachate from the layered columns is collected from a port at the top of the columns and a port near the base of the columns. Prior to commencing kinetic testing, each column was rinsed with distilled de-ionized water. The rinse is indicated as cycle 0 in the plotted time series for saturated column loadings. A water cover ranging from < 1 cm to 5 cm is maintained above the waste rock and tailings. No air flow is forced over the cover water.

Flow rates for Sat Col 1 through Sat Col 9, which were initiated in February of 2010, varied throughout the experiments. Input water volumes initially ranged from 130-140 mL/day resulting in approximately 4900 mL of leachate in the first month of the experiments and 4500 mL of leachate after the first month until January 2011. In January 2011, flow rate was reduced to approximately 10 mL/day when it became evident that higher flow rates than intended were passing through the column and to examine the effect of flow rate on leachate chemistry. High flow rates through flooded wastes can result in large inputs of dissolved oxygen which can in turn result in higher rates of sulphide oxidation than observed under field conditions (where oxygen inputs are limited by diffusion from the overlying water cover) (Price, 2009).

After January 5, 2012, flow was shut off for all saturated columns (Sat Col 1 through Sat Col 17) between sampling dates. The columns are maintained at saturation by activating the pumps on sampling dates to replace the volume of leachate removed for analysis (approximately 200 mL over a 3 hour time period). Prior to sample collection, supernatant from the layered columns is cleared from the headspace. Details with respect to flow volumes and rates for the saturated columns are provided in Chapter 5.

Leachate collected from the saturated columns is analyzed for pH and alkalinity in the Lorax Laboratory and analyzed for hardness, anions, nutrients and dissolved metals, including dissolved Hg, at ALS Environmental Laboratories in Vancouver, B.C.

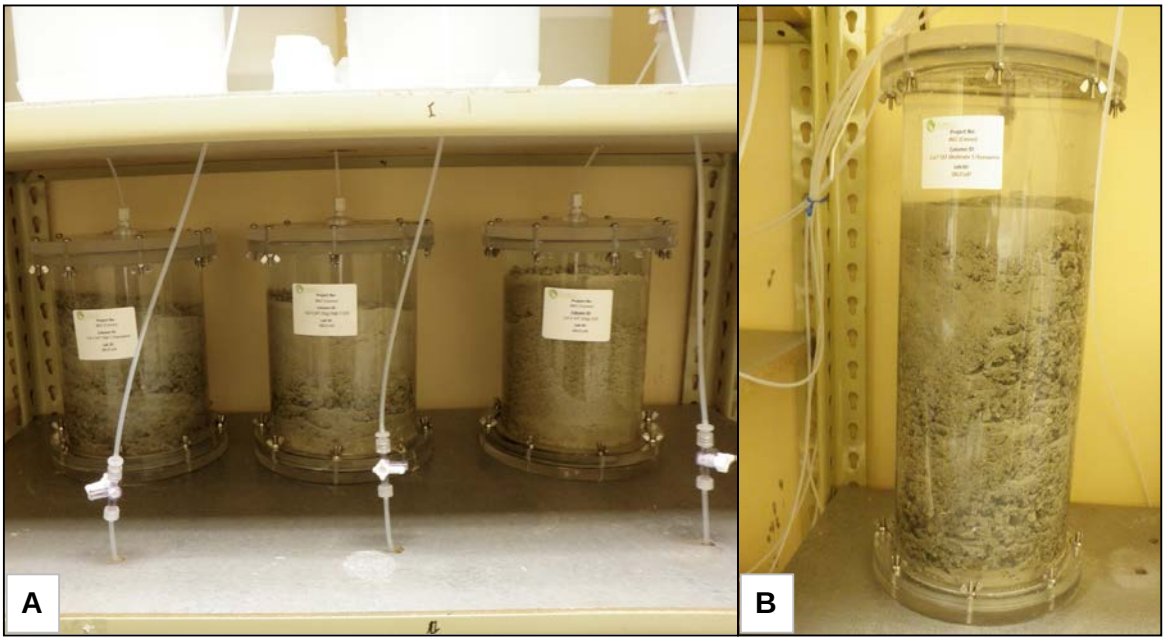


Figure 3-1: Photographs of Casino saturated columns at Lorax in Vancouver, B.C. A) 20 cm length saturated columns; B) Sat Col 7, measuring 40 cm in length.

3.1.2 Unsaturated Columns

The unsaturated columns for the Casino Project are constructed of Plexiglas cylinders (21.0 cm inside diameter, 20.5 cm length) filled with 1 kg, 5 kg or 10 kg of sample (Table 2-1 and Table 2-2). Columns containing waste rock have the sample crushed to approximately minus 6 mm. The unsaturated columns are subjected to a trickle leach, whereby the pump that provides 300 mL of distilled de-ionized water to the columns is turned on the day before the weekly sampling event (between 2-4 pm) and the water is trickle leached overnight. This is equivalent to 8.7 mm of rainfall on a weekly basis and corresponds to the mean annual precipitation for the site which is 310 mm,

198 mm of which falls as rain (Environment Canada, 2009). The leachate is analyzed for the same parameters as the humidity cells (pH, conductivity, hardness, anions and dissolved metals, including mercury).

3.1.3 Humidity Cells

Humidity cell testwork for the Casino project follows MEND procedures as outlined in Price (2009). The humidity cells for the Casino Project are composed of Plexiglas cylinders (10.2 cm inside diameter, 25.5 cm length) filled with 1 kg of sample crushed to approximately minus 6 mm. A picture of humidity cell T1 is provided in Figure 3-2. The sample material is placed on a perforated acrylic disk covered in a nylon mesh. The contents of the cell are subjected to three days dry air permeation followed by three days of humid air permeation (< 10% relative humidity). On the seventh day, at the end of each wet/dry cycle, the contents of the cell are leached with a 500 mL of distilled de-ionized water. The purpose of the leaching step is to recover any readily soluble reaction products that have formed due to mineral dissolution or sulphide oxidation in order to determine the dissolved load contributed from the previous week. The leachate is then analyzed for pH, conductivity, hardness, anions and dissolved metals, including dissolved Hg.



Figure 3-2: Photograph of Casino humidity cell (T1) at SGS in Burnaby, B.C.

3.1.4 Field Bins

Lorax personnel conducted a site visit in early September of 2008 to implement the Casino field-based kinetic program. Two cribs were constructed to house eight field bins (Figure 3-3). Leachate is collected from each field bin two to three times per year (ideally late spring, summer, and early fall) to determine drainage chemistry and help predict acid and metal loadings that may leach from the waste rock.

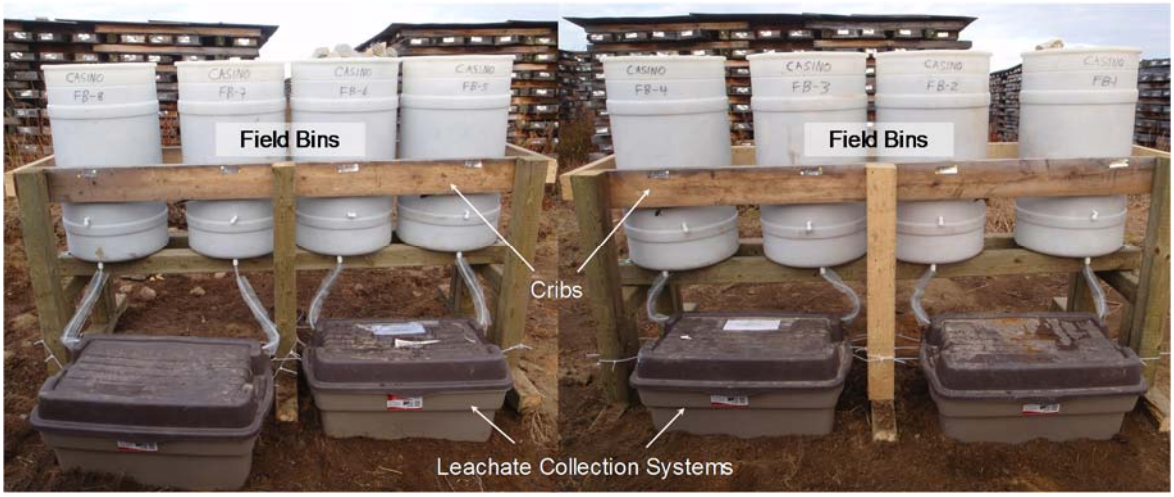


Figure 3-3: Field Weathering Bins for Casino Field Kinetic Program

3.1.4.1 Field Bin Construction

Each crib is eight-feet long, approximately 40-inches tall, and four-feet wide. The cribs are supported on a slight incline to improve the flow of leachate towards the drainage tap and leachate catchment system (Figure 3-3). Field bins consist of 30 inch high HDPE barrels with a 19 inch diameter. A hole is drilled and threaded in the bottom of each barrel. This is where the acid washed tubing and fittings are securely fit to allow leachate to drain to the catchment system s. Two pieces of nylon mesh are placed over the hole at the bottom of the bin to prevent fines from clogging the drain.

Prior to placing the test material in a barrel, the samples were weighed, mixed and split using the cone and quarter technique. The split sample, comprising roughly 12.5% of the original material, was sent to the analytical laboratory for physical sediment characteristics and geochemical static testwork. The quartering process is performed in order to ensure that each sample is properly mixed and that a representative sample is obtained for further analyses.

3.1.4.2 Field Bin Leachate Sample Collection

The initial leachate sample was achieved by irrigating the field bins with approximately 8L of distilled-deionized water. Subsequent sampling is conducted when sufficient volumes of natural precipitation have collected in the leachate collection jugs (Figure 3-3). Precipitation percolates through, and reacts with, the mine rock stored in the field bins then flows through tubing attached to the bottom of each bin into collection jugs located in Rubbermaid totes.

3.2 Static Test Methods

A summary of the static test work completed for waste rock kinetic test samples is provided in Table 3-1 and for tailings and ore kinetic test samples in Table 3-2. A description of the static test work methods, analysis and instrumentation is provided.

3.2.1 Mineralogical Identification

3.2.1.1 X-Ray Diffraction

Quantitative X-ray analyses were conducted at the University of British Columbia (UBC) Earth & Ocean Sciences Department. Samples were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°. The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 using Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 3 (Bruker AXS).

3.2.1.2 Petrographic Analyses

Polished thin sections of waste rock and tailings kinetic test samples were examined with a petrographic microscope, Scanning Electron Microscope (SEM) and Electron Microprobe in the Department of Geology at the University of New Brunswick.

Concentrations in the ppm range (*e.g.*, trace metals) can be very difficult to detect using SEM-EDS. Therefore, the approach taken was to first evaluate the samples by automated elemental mapping with the microprobe and Wavelength Dispersive Spectroscopy (WDS), and then use the results of the mapping to target areas for investigation with SEM-EDS for mineral phase identification.

Electron microprobe analysis was carried out using a JEOL JXA-733 Microprobe with Geller Microanalytical automation control. The microprobe was operated at an accelerating voltage of 15 kV, and a probe current of 150 nA. The dwell time per pixel was 25 ms, and the total collection time per map was 15h10m. Tiles of BSE images and elemental maps for copper (Cu), fluoride (F), iron (Fe) and sulphur (S) were collected for each sample and the tiles were stitched together to form mosaic images of the entire thin section. Total area analyzed per sample was approximately 19 x 38 mm.

A JEOL JSM6400 Scanning Electron Microscope equipped with an EDAX Genesis Energy Dispersive X-ray Spectroscopy (EDS) system was operated with a 15 keV accelerating voltage and a 1.5 nA beam current. Back scattered electron (BSE) images and point EDS spectra were collected. The maximum resolution for imaging and chemical analyses for this system (*i.e.*, the beam interaction volume) operated under these conditions is approximately 1-2 μm in x and y and 2-3 μm in z.

3.2.2 Grain Size Analysis

Particle size distributions for the Casino mine rock, flotation tailings and ore feed samples were sieved following ASTM E 276-03 using a Ro-tap sieve shaker fitted with 8 inch diameter wire mesh screens (ASTM E11 specification) ranging from 35 to 400 mesh.

3.2.3 Acid Base Accounting

Acid base accounting (ABA) was conducted by SGS in Burnaby, B.C. according to the modification of Sobek *et al.* (1978) *Field and Laboratory Methods Applicable to Overburdens and Minesoils* (Report EPA-600/2-78-054) (*i.e.*, Modification of Conventional EPA Neutralization Potential Determination by Addition of Hydrogen Peroxide). The procedure is outlined in MEND *Project 1.16.1c* (1991). The fizz test was conducted in accordance with the procedure.

Total sulphur (S) and carbon (C) were determined using a Leco furnace. Total inorganic carbon (TIC) was determined by placing a sample in a glass test tube and acidified with 25% hydrochloric acid (HCl). The sample was boiled to evolve CO_2 which was measured by coulometric titration with the Carbon Dioxide Analyzer. Sulphate-S was determined by the procedure outlined in ASTM D2492-02, *Standard Test Method for Forms of Sulphur in Coal*. In this procedure sulphate-S is dissolved with HCl and measured gravimetrically after precipitation of barium chloride ($BaCl_2$).

Sulphide-S was determined by leaching residue from the sulphate-S in a 1:7 nitric acid (HNO_3) to water ratio, according to the procedure by Sobek *et al.* (1978). The oxidized sulphide was then determined gravimetrically after precipitation with $BaCl_2$.

3.2.4 Solid Phase Metals and Whole Rock Analysis

Solid phase metals were conducted on pulverized samples by digesting 0.500 g in aqua regia at 95°C for one hour. The extract was then diluted to 10.0 mL and analyzed for metals by ICP-MS. Whole rock analysis (WRA) was conducted by X-ray fluorescence on a finely ground sample fused with lithium tetra borate at Global Discovery Labs.

3.2.5 Shake Flask Extraction

Shake flask extractions (SFE) were conducted as described by Price (1997) in *Draft Guidelines and Recommended Methods for the Prediction of Metal Leaching and Acid Rock Drainage at Minesites in British Columbia,* using a 24 hour NanoPure water leach extraction test at a 3:1 liquid to solid ratio. The leachate was filtered and submitted for analysis including pH, conductivity, anions, nutrients, thiosalts, thiocyanate, total cyanide, weak acid dissociable (WAD) cyanide and total and dissolved metals. All procedures are outlined in *Standard Methods for the Examination of Water and Wastewater*, 20th Edition APHA AWWA, and WEF, 1998.

3.2.6 Tailings Supernatant

Tailings supernatant samples were collected from settled flotation tailings samples produced by the pilot plant and bench scale tests. Supernatant provides a direct measure of the effect of short term rinsing of water soluble products from the tailings. Following the processing tests, the tailings were allowed to settle out in buckets before the supernatant was siphoned with disposable syringes. The supernatant samples were filtered and submitted to ALS Environmental for analyses including pH, conductivity, anions, nutrients, thiocyanate, total cyanide, WAD cyanide and total and dissolved metal.

Table 3-1:
Summary of static test work completed for waste rock kinetic test samples

Kinetic Test	Test ID	Static Testwork								
		PSD	ABA	Aqua Regia	XRF	SFE	XRD	Optical	SEM	residue ABA
Saturated Columns	Sat Col 2		x	x		x	x		x	
	Sat Col 3		x	x		x	x		x	
	Sat Col 4		x	x		x	x		x	
	Sat Col 5		x	x		x	x			
	Sat Col 6		x	x		x	x			
	Sat Col 7		x	x		x	x			
	Sat Col 9		x	x		x	x		x	
	Sat Col 12	x	x	x		x	x			
	Sat Col 13	x	x	x		x	x			
	Sat Col 14	x	x	x		x	x			
	Sat Col 15	x	x	x		x	x			
Unsaturated Columns	Col 1		x	x		x	x			
	Col 2A		x	x	x	x	x			
	Col 2B		x	x	x	x	x			x
	Col 3		x	x		x	x			x
	Col 4a	x	x	x		x	x			x
Humidity Cells	HC3	x	x	x			x			
	HC4	x	x	x			x			
	HC5	x	x	x			x			
	HC6	x	x	x			x			
	HC7	x	x	x			x			
	HC8	x	x	x			x			
	HC9	x	x	x			x			
	HC10	x	x	x			x			
	HC11	x	x	x			x			
	HC12	x	x	x			x			
Field Bins	FB1	x	x	x		x	x	x		
	FB2	x	x	x		x	x	x		
	FB3	x	x	x		x	x	x		
	FB4	x	x	x		x	x	x		
	FB5	x	x	x		x	x	x	x	
	FB6	x	x	x		x	x	x	x	
	FB7	x	x	x		x	x	x	x	
	FB8	x	x	x		x	x	x	x	

Table 3-2:
Summary of static test work completed for ore and tailings kinetic test samples.

Kinetic Tests	Test ID	Static Test Work									
		PSD	**ABA**	**Aqua Regia**	**XRF**	**SFE**	**Super-natant**	**XRD**	**Optical**	**SEM**	**residue ABA**
Ore Kinetic Tests											
Humidity Cells	HC1	x	x	x	x			x			
	HC2	x	x	x	x			x			
Metallurgical Head	2008 PP Head #1		x	x	x						
	2008 PP Head #2		x	x	x						
	2012 SUP-Head		x	x		x					
	2012 HYP-Head		x	x		x					
Tailings Kinetic Tests											
Saturated Columns	Sat Col 1	x	x	x			x	x	x	x	
	Sat Col 8	x	x	x			x	x	x		
	Sat Col 10		x	x	x			x	x		
	Sat Col 11		x	x	x			x	x		
	Sat Col 16	x	x	x			x				
	Sat Col 17		x	x			x				
Unsaturated Columns	Col 5		x	x	x			x	x		x
	Col 6		x	x			x	x			
	Col 7		x	x	x	x					
	Col 8		x	x	x	x					
Humidity Cells	T1	x	x	x	x	x	x	x	x		
	T2	x	x	x	x	x	x	x	x		
	T3	x	x	x	x	x	x	x	x		
	T4	x	x	x	x		x	x			
	T5		x	x	x			x	x		x
	T6		x	x	x			x	x		x
	T7	x	x	x			x	x			
Metallurgical Feed	SUP-PyRo-Feed		x	x							
	HYP-PyRo-Feed		x	x							

4. Static Test Results

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4. Static Test Results

Chapter 4 presents the static test results for waste rock, tailings and ore kinetic test samples. Static testing is important not only for the interpretation of the kinetic results, but also to ensure that the material selected for kinetic testing is representative of the material that will be extracted and stored during mining of the Casino deposit. Presentation of static test results is organized by waste rock, tailings and ore. Waste rock is further discussed according to mineralization zone while tailings are discussed according to different waste streams.

4.1 Mineralogical Identification

Mineralogical work conducted on Casino kinetic test samples includes X-ray diffraction (XRD), optical microscopy and scanning electron microscopy (SEM) with energy dispersive spectroscopy (EDS). Mineralogical testwork for ML/ARD characterizations is used to identify minerals that can generate or neutralize acidity and minerals (primary and secondary) that may be potential sources of metal leaching under different environment conditions (*i.e.,* sub-aerial or sub-aqueous disposal). The following sections provide a summary of the acid generating, acid neutralizing, and secondary minerals identified in the Casino waste rock (Table 4-1 through Table 4-4), tailings (Table 4-5 and Table 4-6), heap leach residue (Table 4-7) and ore (Table 4-8) samples.

4.1.1.1 Waste Rock Samples

Acid Generating Minerals

The dominant sulphide mineral identified by XRD and SEM in the Casino waste rock samples is pyrite (Table 4-1). However, kinetic tests composed exclusively or dominantly (>80%) of CAP material comprise little to no (<1 wt.%) pyrite or other sulphides. Sulphide minerals present at less than 1 wt.% are generally difficult to identify by XRD method. However, optical spectroscopy and SEM-EDS analysis are more proficient at identifying sulphides in low concentrations. In addition to pyrite, chalcopyrite was identified by SEM-EDS in samples from field bins FB-5 (CAP + SUP), FB-6 and FB-7 (HYP) and covellite was identified in FB-5 (Table 4-4) (Appendix B). Molybdenite was identified by XRD only in the sample from HC5 (HYP) (Table 4-3).

In general, sulphide mineral grains are relatively rare in samples from FB-5 (1-2% of samples), and consist mostly of discrete grains of pyrite (< 2 mm) and chalcopyrite (<50 um) (Appendix B.2.1). Covellite occurs as mantles (<5 um wide) and along internal fractures of chalcopyrite.

Field bin samples FB-6, FB-7 and FB-8, which are composed of waste rock from the HYP zone, comprise subhedral pyrite (50-250 um) that may contain fine-grained, anhedral inclusions of chalcopyrite or pyrrhotite (10-20 um) or may be mantled by thin rims of (10-20 um) chalcopyrite (Appendix B). Anhedral chalcopyrite (<100 um) also occurs as less abundant, discrete grains. Relatively coarse-grained pyrite (0.5-2.0 mm) occurs as discrete fragments. Overall, sulphides comprise approximately 2% of these samples.

Neutralizing Minerals

The mineralogical studies for the Casino waste rock identified several minerals capable of neutralizing acid to some degree, including carbonates (calcite and ankerite-dolomite), aluminosilicates (plagioclase, chlinochlore, and biotite) and clay minerals (kaolinite and montmorillonite). No carbonate minerals were identified in samples composed predominantly of CAP waste rock (Table 4-1). Carbonate minerals were identified in all samples from kinetic tests composed primarily of HYP waste rock (Table 4-3 and FB-6, FB-7 and FB-8 in Table 4-4). With the exception of HYP waste rock placed in the upper layers of Sat Col 12, Sat Col 13 and Sat Col 14, calcite is the dominant carbonate in each sample. Higher concentration of dolomite-ankerite was identified in the HYP sample from the upper layer of Sat Col 12, 13 and 14 (Table 4-3). Although, carbonate minerals are the most effective form of NP and are capable of maintaining a neutral pH, not all carbonates are as effective as calcite for neutralizing acidity. Calcite buffers a solution at the highest pH and it provides the maximum quantity of NP per mole of carbonate. Dolomite provides a similar molar ratio as calcite; however it buffers the pH and alkalinity at a lower rate than calcite. The other three carbonate minerals identified in Casino waste rock, ankerite, ferroan-dolomite and siderite, contain variable amounts of Fe^{2+} and Mn^{2+}. When Fe and Mn are released from carbonate minerals in the presence of atmospheric oxygen they will oxidize and produce acid, negating a portion of the NP contained in the carbonate.

Furthermore, with the exception of some types of plagioclase, aluminosilicates and clays are typically considered kinetically too slow to react to maintain a neutral pH in a sulphide oxidizing system. The ability of plagioclase to buffer the pH is dependent on ratio of Ca to Na. Calcium rich plagioclase (anorthite) is the more affective, while Na-rich plagioclase (albite) is less affective (Jambor *et al.*, 2007). X-ray diffraction techniques have difficulty identifying plagioclase mineralogy with certainty, however albite is considered to be the most abundant plagioclase mineral in the Casino samples analysed based on the plagioclase diffraction peaks in the XRD patterns (pers. comm. Mati Raudsepp). Furthermore, albite was identified by SEMD-EDS in the samples from FB-8 that contains HYP waste rock.

Secondary Minerals

Secondary minerals identified in Casino waste rock include gypsum, jarosite, and Fe-oxides/hydroxides. Gypsum was identified by XRD to occur in some samples from the HYP waste rock tests (Table 4-3). This is of note given that drill core from the HYP zone was considered to be relatively unweathered. Gypsum is highly soluble and will dissolve quickly upon exposure to infiltrating fluids. The presence of gypsum indicates that Ca and SO_4 can be expected in relatively high concentrations during the initial flush of water through a sample. Jarosite was identified by XRD and SEM to occur in all CAP samples (Table 4-1) and a samples composed of acidic SUP (Sat Col 6, Sat Col 12 and 14 and FB5 in Table 4-2). Jarosite is an acidic secondary Fe-sulphate precipitate that is unstable under neutral pH conditions and will dissolve releasing K, Fe^{3+} and SO_4. The re-precipitation of Fe^{3+} at neutral pH as a hydrous ferric oxide results in a net release of H^+ and, therefore, acidity.

Copper and Fluoride bearing Minerals

In addition to the mineralogical results presented herein, a number of samples from the CAP, including Col 1, Col 2A, Col 3 and Col 4a, were submitted for SEM-EDS analysis with the sole objective of identifying the speciation of Cu and F within the CAP material. The analysis did not detect any discrete Cu-bearing secondary minerals, such as malachite or tenorite. Copper was identified as an impurity in iron oxide minerals; however, it was not identified in jarosite (Appendix B). This indicates that Cu may be leached if Fe-oxides become unstable. Iron-oxides become unstable under reducing and/or acidic conditions.

Table 4-1:
X-ray diffraction results for CAP waste rock kinetic tests samples.

Sample Description			**CAP**	**CAP**	**95% CAP 5% SUS**	**95% CAP 5% SUS**	**80% CAP 20% SOX**	**81% CAP 13% SUS 6.3% OVB**	**CAP**	**CAP**	**CAP**	**CAP**
Kinetic Test			**Sat Col 9** (lower)	**Col 1**	**Sat Col 2 & Col 2A**	**Col 2B**	**Col 3**	**Col 4a**	**FB1**	**FB2**	**FB3**	**FB4**
Mineral		**Ideal formula**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**
Sulphides	Pyrite	FeS_2					1			0.6	0.3	0.2
Secondary	Hematite	α-Fe_2O_3										0.4
	Jarosite	$K_2Fe^{3+}{}_6(SO_4)_4(OH)_{12}$	3.3	0.7	2.6	2.6	5.1	0.5	3.7	1.2	1.8	11
Major Rock Forming	Actinolite	$Ca_2(Mg,Fe)_5Si_8O_{22}(OH)_2$						0.8				
	Anatase	TiO_2								0.6		
	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$		6.3				1.6		4.1		
	Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$		10.3	1.5	1.8		5.4		9		
	Kaolinite	$Al_2Si_2O_5(OH)_4$	3	3.8	1.6	1.4	4.2	5.9	2		4.1	4.3
	K-feldspar	$KAlSi_3O_8$	6.3	9.2	9.2	8.5	11.3	15.4	2.9	10.4	19.5	15.8
	Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	32.6	25.5	28.8	29.8	31.4	16.3	42.9	30.5	20.8	23.7
	Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	4.4	11.9	12	10.7	3.1	19.9		8.6	4	
	Quartz	SiO_2	48.3	32.3	44.4	45.2	43.8	34.1	48.5	35	49.5	44.6
	Tobermorite	$Ca_5Si_6(O,OH)_{18}\ 5H_2O$	2.1									
Total			*100.0*	*100.0*	*100.1*	*100.0*	*98.9*	*99.9*	*100.0*	*99.4*	*99.7*	*99.8*

Table 4-2:
X-ray diffraction results for SUP waste rock kinetic tests samples.

		Sample Description	**90% SUP 5% CAP 5% HYP**	**50% SUP 50% CAP**	**SUP (acidic)**	**SUP (neutral)**	**SUP (08-068)**	**SUP (08-058)**	**56% SUP 44% CAP**
		Kinetic Test	**Sat Col 5**	**Sat Col 6**	**Sat Col 12 & 14 (lower)**	**Sat Col 13 (lower) & Sat Col 15 (full)**	**HC11**	**HC12**	**FB5**
Mineral		**Ideal formula**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**
Sulphides	Pyrite	FeS_2	4.7	2.2	1.8	1.7	5.29	4.28	3.2
Carbonates	Calcite	$CaCO_3$				0.2	2.65		
Secondary	Gypsum	$CaSO_4 \cdot 2H_2O$			0.7				
	Jarosite	$K_2Fe^{3+}{}_6(SO_4)_4(OH)_{12}$		2.9	1.5				1.5
Major Rock Forming	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$				1.8	5.66		
	Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	1.2		1.4	3.9	8.77		3.9
	Kaolinite	$Al_2Si_2O_5(OH)_4$	3.3	2.4	3.1		2.27	7.32	4.3
	K-feldspar	$KAlSi_3O_8$	9.8	6.3	26.5	20	7.47		12.4
	Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	30.9	34.8	17.5	11	7.19	41.01	22.7
	Plagioclase (calcian Albite-low)	$NaAlSi_3O_8 - CaAl_2Si_2O_8$	7		4.2	30.7	32.37		19.7
	Plagioclase (Albite-low)								
	Quartz	SiO_2	43.1	51.3	43.3	30.7	28.34	47.39	32.3
		Total	*100.0*	*99.9*	*100.0*	*100.0*	*100.0*	*100.0*	*100.0*

Table 4-3:
X-ray diffraction results for HYP waste rock kinetic tests samples

Sample Description			**HYP**	**HYP**	**HYP**	**89% HYP 11% SUP**	**HYP**	**HYP (08-276)**	**HYP (08-294)**	**HYP (08-277)**	**HYP (08-028)**	**HYP (08-043/08-225)**	**HYP (08-143)**	**HYP (08-260)**	**HYP (08-059/08-178)**	**92% HYP 8% SUP**	**HYP**	**HYP**
Kinetic Test			**Sat Col 3**	**Sat Col 4**	**Sat Col 7**	**Sat Col 9 (upper)**	**Sat Col 12, 13 & 14 (upper)**	**HC3**	**HC4**	**HC5**	**HC6**	**HC7**	**HC8**	**HC9**	**HC10**	**FB6**	**FB7**	**FB8**
Mineral		**Ideal formula**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**	**wt.%**
Sulphides	Pyrite	FeS_2	5.4	7.8	5.7	3.6	4.8	8.29	6.82	5.31	3.95	5.7	8.82	1.78	6.9	2.9	6.1	4.2
	Molybdenite	MoS_2								0.05								
Carbonates	Calcite	$CaCO_3$	1	1	1.4	2.9	2.7	2.64	5.32	1.62	1.87	2.71			0.3	2.3	2.4	1.8
	Dolomite-Ankerite	$Ca(Mg,Fe)CO_3$		0.5		0.8	3.4	0.77				0.54					1.8	1.1
Secondary	Gypsum	$CaSO_4 \cdot 2H_2O$	1.5	1.4	1.4	1.1				0.61						1		0.7
Major Rock Forming	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$				2.8	1.8	2.09	4.9	4.65	3.46			3.64				
	Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	3.2	1.2	2.3	3.8	2	5.63	7.42	5.84	2.72	3.98		3.7		3.9		6
	Kaolinite	$Al_2Si_2O_5(OH)_4$	4	3.2	4.7	4.1	2.5	1.08	4.37	1.79	1.14	2.46	3.3		2.23		4.6	2.1
	K-feldspar	$KAlSi_3O_8$	13	8.4	13.2	12.1	20.1	5.29	9.12	9.79	23.57	6.91		19.78	8.77	12.1	18.2	12.5
	Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	23.4	25.7	25	14.1	18.3	25.14	16.01	15.45	19.11	32.47	40.39		23.13	18.9	20.4	14.2
	Plagioclase (calcian Albite)	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	7.7	7.3	6.8	14.2	10.5	9.13	18.41	14.4				44.88		28.8	2.4	28.3
	Plagioclase (Albite-low)							6.64		5.38	9.82	3.7						
	Quartz	SiO_2	40.9	43.6	39.5	38.4	33.9	33.3	27.65	35.1	34.36	41.53	47.48	26.21	51.29	30.1	44.1	29.1
	Tourmaline (Dravite)	$NaMg_3Al_6(BO_3)_3Si_6O_{18}(OH)_4$													7.38			
Total			100.1	100.1	100.0	97.9	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Table 4-4:
Minerals identified by SEM in field bin samples (FB5 – FB8)

		Sample Description	56% SUP, 44% CAP	92% HYP, 8% SUP	HYP	HYP
		Kinetic Test	**FB5**	**FB6**	**FB7**	**FB8**
Mineral		**Ideal Formula**				
Sulphides	Chalcopyrite	$CuFeS_2$	x	x	x	
	Covellite	CuS	x			
	Pyrite	FeS_2	x	x	x	x
	Galena (?)	PbS	x			
	Pyrrhotite	$Fe_{1-x}S$ (x=0-0.17)		x		
Carbonates	Calcite	$CaCO_3$		x	x	
	Dolomite	$MgCa(CO_3)_2$				x
	Ferroan Dolomite	$Ca(Mg, Fe)(CO_3)_2$			x	x
	Siderite	$FeCO_3$				x
Secondary	Fe-oxides/hydroxides	FeOH	x			
	Jarosite	$KFe(SO_4)_2(OH)_6$	x			
	Magnetite/Hematite	Fe_3O_4		x		
Major Rock Forming	Apatite	$Ca_5(PO_4)_3(OH, F, Cl)$	x	x	x	x
	Barite	$BaSO_4$	x			
	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	x		x	x
	Chlorite	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	x	x	x	x
	Kaolinite	$Al_2Si_2O_5(OH)_4$	x	x	x	x
	K-feldspar	$KAlSi_3O_8$	x	x	x	x
	Muscuvite	$K(Al_2(Si_3Al)O_{10}(OH, F)_2$	x	x	x	x
	Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	x	x		x
	Quartz	SiO_2	x	x	x	x
	Rutile	SnO_2		x	x	
	Smeite				x	x
	Titanite	TiO_2		x		x
	Zircon	$ZrSiO_4$	x			

4.1.2 Ore, Tailings and Heap Leach Residue Samples

Acid Generating Minerals

The dominant sulphide mineral identified by XRD and SEM in the Casino ore and tailings samples is pyrite (Tables 4-5, 4-6 and 4-7). Molybdenite was identified by XRD in trace quantities (<0.1 wt.%) in ore samples from tests HC1 and HC2 (Table 4-5) and chalcopyrite was identified by XRD in low concentrations (<0.5 wt.%) in the HYP pyrite rougher concentrate produced by the 2012 pilot plant study (Sat Col 17 in Table 4-6). In addition to pyrite and chalcopyrite, arsenopyrite, bornite, covellite, chalcocite, diginite, molybdenite and possibly galena were identified by SEM-EDS in one or more tailings samples produced during the 2008, 2009 and 2010 metallurgical studies (Table 4-7). No sulphides were identified in the sample CL-01 L residue produced by column leaching of CAP ore (Table 4-8).

Pyrite occurs in the tailings samples as very fine-grained fragments or shards, measuring <400 μm (Appendix B). The mineral typically occurs as liberated unaltered or only slightly oxidized grains with irregular grain boundaries and sporadically within masses of, or rimmed by, Fe-oxides and/or hydroxides. Chalcopyrite grains are <200 μm in size and locally display rims of blue (Fe, Cu)-sulphides (covellite, chalcocite) and/or Fe-oxides and/or hydroxides. Bornite occurs as inclusions in pyrite, while covellite occurs as rims and sporadically as pseudomorphs after chalcopyrite.

Neutralizing Minerals

Several types of minerals capable of neutralizing acid to some degree were identified in the tailings and ore, including carbonates (calcite, dolomite-ankerite and siderite), aluminosilicates (plagioclase, chlinochlore, and biotite) and clay minerals (kaolinite and montmorillonite). No carbonates were identified in sample CL-01 L residue.

Carbonate minerals were identified in ore samples from tests HC1 and HC2 (Table 4-5) and all tailings samples produced during metallurgical testing (Table 4-6 and Table 4-7). In the tailings samples, the carbonate minerals are colourless, fine-grained (<200 μm) and occur as disseminated broken grains and small shards or, less commonly, as a very fine grained aggregates replacing feldspars. Calcite was the dominant carbonate in all samples with the exception of 2009 Bench scale tailings samples HZ Comp 2 (HYP) and SS Comp 3 (SUP), which comprised greater concentrations of dolomite-ankerite.

Secondary Minerals

Fe-oxides/hydroxides were identified in Casino tailings and ore samples. Gypsum was only identified in the SSH Comp 1 sample (Sat Col 1). Jarosite (3 wt. %) was only identified in CL-01 L residue.

Table 4-5:
X-ray diffraction results for samples of SUP & HYP ore used in humidity cell tests.

Sample Description			**HYP**	**81.7% SUP 18.3% HYP**
Kinetic Test			**HC1**	**HC2**
Mineral		**Ideal formula**	**wt. %**	**wt. %**
Sulphides	Molybdenite	MoS_2	0.1	tr
	Pyrite	FeS_2	2.3	2
Carbonates	Calcite	$CaCO_3$	1.4	0.8
Secondary	Gypsum	$CaSO_4 \cdot 2H_2O$	1.4	
Major Rock Forming	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	2.7	
	Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.1	1.8
	Kaolinite	$Al_2Si_2O_5(OH)_4$	3.2	5.2
	K-feldspar	$KAlSi_3O_8$	27.1	33.7
	Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	12.5	11.5
	Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	17	8
	Quartz	SiO_2	30.2	36.9
Total			*100.0*	*99.9*

Table 4-6:
X-ray diffraction results for SUP and HYP tailings produced during 2008, 2009, 2010 and 2012 metallurgical testing

Sample Description			2008 Pilot Plant (71% SUP, 22% HYP, 7% CAP)			2009 Bench Scale			2010 Bench Scale (85% SUS and 15% HYP)					2012 Pilot Plant (HYP)	
			Sample 1	Sample 2	Sample 3	SSH Comp 1 (50% HYP 50% SUS)	HZ Comp 2 (HYP)	SS Comp 3 (SUS)	PyRo Tails whole	PyRo Sands >74mm	PyRo Tails <74mm	PyRo Conc.	Cleaner Tails	PyRo Sands >74 mm	PyRo Conc.
Kinetic Test			**T1**	**T2**	**T3**	**T4**			**Sat Col 10**	**Col 5**	**Sat Col 11**			**Col 6**	**Sat Col 17**
						Sat Col 1	**Sat Col 8**		**T5**	**HC T6**					
Mineral		**Ideal Formula**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**	**wt. %**
Sulphides	Chalcopyrite	$CuFeS_2$													0.5
	Pyrite	FeS_2	1.5	1.8	0.7	6.8	0.4	0.2				22.1	22.5		20.4
	Calcite	$CaCO_3$	1.5	1.1	1.3	0.4		0.4	0.5	0.3	0.5	0.9	0.6	0.9	1.7
	Dolomite-Ankerite	$Ca(Mg,Fe)CO_3$					1.6	2.3						0.9	0.9
	Siderite	$Fe^{2+}CO_3$					0.4								
Secondary	Gypsum	$CaSO_4 \cdot 2H_2O$				0.5									
	Hematite	$\alpha\text{-}Fe_2O_3$												0.3	
	Magnetite	Fe_3O_4	0.4	0.4	0.4								0.5	0.5	
Major Rock Forming	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$						2.1	3.1	2.5	3.3	2.2	2.3	2.3	2.2
	Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	4.7	3.7	6.7				2.3	2.6	3	2.2	2.5		0.7
	Kaolinite	$Al_2Si_2O_5(OH)_4$	5.5	5.8	4.1	4.6	2.5	2.7	3.9	4.1	10.8	5.3	7	1.6	3.3
	K-feldspar	$KAlSi_3O_8$	22.7	21.7	22.3	3.5	57.5	60.5	15	14.5	16.6	10.3	11.7	29.4	25.1
	Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	17.6	17.4	22.2	36.6	4.7	2.4	19.3	20.2	28.9	23.6	23.6	13.3	18.1
	Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	8	7	6.6				12	11.5	11.2	7.2	7.4	7.8	3.8
	Quartz	SiO_2	38.1	41.1	35.8	47.5	32.9	29.5	44	44.3	25.7	26.2	21.9	42.1	23.3
	Rutile	TiO_2												0.9	
		Total	*100*	*100*	*100.1*	*99.9*	*100*	*100.1*	*100.1*	*100*	*100*	*100*	*100*	*100*	*100*

Notes: PyRo = pyrite rougher; Conc. = concentrate;
Kinetic tests shaded in beige are composed of various proportions of tailings components produced during metallurgical tests according to:
T4 = 40% SSH Comp 1, 40% HZ Comp 2, 20% SS Comp 3; Sat Col 8 = 83% HZ Comp 2 and 17% SS Comp 3; and Sat Col 11 = 21% PyRo tailings (<74 µm) + 23% Pyrite Conc. + 56% Cleaner tailings.

Table 4-7:
Proportions of mineral phases identified by petrographic analysis in SUP and HYP tailings produced during metallurgical testing

		Tailings Sample Description	2008 Pilot Plant (71% SUP, 22% HYP, 7% CAP)			2009 Bench Scale			2010 Bench Scale (85% SUS and 15% HYP)				
			Sample 1	Sample 2	Sample 3	SSH Comp 1 (50% HYP 50% SUS)	HZ Comp 2 (HYP)	SS Comp 3 (SUS)	PyRo whole	PyRo sands >74mm	PyRo slimes <74mm	Pyrite Conc.	Cleaner tailings
		Kinetic Test	T1	T2	T3	T4			Sat Col 10 & T5	Col 5 & T6	Sat Col 11		
						Sat Col 1	Sat Col 8						
Mineral		**Ideal Formula**	%	%	%	%	%	%	%	%	%	%	%
Sulphides	Arsenopyrite	$FeAsS$	tr										
	Bornite	Cu_5FeS_4				tr							
	Chalcocite	Cu_2S	tr	tr	tr								
	Chalcopyrite	$CuFeS_2$	tr	tr	tr	tr	tr	tr	tr	tr	tr	1 - 2	tr
	Covellite	CuS	tr	tr	tr	tr			tr	tr		tr	
	Diginite	Cu_9S_5							tr	tr		tr	
	Molybdenite	MoS							tr				
	Pyrite	FeS_2	2	1-2	tr-1	7	tr-1	tr-1	tr	tr	tr	25	*
	Undetermined / Galena?	PbS	tr	tr	tr	tr	tr	tr					
Carbonates	Carbonate	$Ca(Mg,Fe)CO_3$	tr-1	1	NA		5	10	tr	tr	tr - 1	tr - 1	*
Secondary	Magnetite / Hematite	Fe_3O_4	tr-1	tr	tr	tr		tr	1	tr - 1	tr - 1	tr	tr
	Fe-oxides/hydroxides	$FeOH$	tr	tr	tr	tr-1	tr	tr-1	tr	tr	tr	tr	tr
Major Rock Forming	Amphibole									tr	1	1	*
	Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	5	3	NA		5	15	7	10	15	10	*
	Chlorite (Clinochlore)	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2	1			1	2	2	2	1	1	*
	Clay (Montmorillonite?)	$(Na,Ca)_{0.33}(Al,Mg)_2Si_4O_{10}(OH)_2 \cdot nH_2O$	tr-1	tr									
	Epidote	$Ca_2(Al, Fe)_3(SiO_4)_3(OH)$	tr	tr					tr		tr	tr	*
	Kaolinite	$Al_2Si_2O_5(OH)_4$	tr-1										
	K-feldspar	$KAlSi_3O_8$	7	10	NA		75*	65*	10	12	5	5	*
	Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	(20)	(20)					20	20	30	15	*
	Quartz	SiO_2	(50)	(50)	NA	50			30	30	20	15	*
	Rutile	SnO_2	tr	tr	tr	1-2	tr-1	tr	tr - 1	tr - 1	tr - 1	tr - 1	tr - 1
	Illite-Sericite / Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	8	10	NA	40	10	5	25	20	20	20	*
	Titanite	TiO_2	tr-1	tr-1	NA				tr	tr	tr	tr	*
	Tourmaline		tr	tr									

Notes: PyRo = pyrite rougher; Conc. = concentrate; Relative proportions of quartz and plagioclase (in parentheses) could not be determined precisely due to very fine grain size and fact that untwinned colourless feldspar grains could not be confidently distinguished from quartz; NA: relative amounts could not be determined, nor could identity of possible additional transparent minerals due to very fine grain size and thickness of aggregates. * 20-25% pyrite; illite-sericite, plagioclase, quartz and biotite recognized but abundance undetermined; presence of K-feldspar, amphibole, chlorite, epidote, titanite and carbonate unconfirmed.

Table 4-8:
X-ray diffraction results for CAP heap leach residue sample.

	Sample Description	**CL-01 L Residue (CAP)**
Mineral	**Ideal Formula**	**wt. %**
Jarosite	$K_2Fe_6^{3+}(SO_4)_4(OH)_{12}$	3
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.5
K-feldspar	$KAlSi_3O_8$	30
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	22.1
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	3
Quartz	SiO_2	38.4
	Total	*100*

4.2 Particle Size Distribution

The kinetic rate at which a material will react is in part dependent on the specific surface area of a sample. It is important to have an estimate of specific surface area of kinetic test samples to compensate for scale differences between the laboratory and field kinetic tests and the particle size segregation of a site waste rock dump or tailings impoundment.

4.2.1 Waste Rock Samples

The particle size distribution for samples of saturated waste rock columns, unsaturated waste columns and field bin tests are presented in Table 4-9, Table 4-10 and Table 4-11, respectively. In general, the largest volume (>75%) of particles in the waste rock column tests fall within the 0.425 to 6.3 mm range. The particle size of waste rock placed in the field bin tests are considerably larger, with >50% of particles measuring >37.5 mm in size (Table 4-11). The exception is FB-2, which has a finer grain size distribution then contents of the other field bins.

Table 4-9:
Particle size distribution for samples of saturated waste rock kinetic tests.

Sample Description	**HYP**	**90% SUS, 5%CAP, 5%HYP**	**50%SUS, 50%CAP**	**CAP**	**HYP**	**SUP (neutral)**	**SUP (acidic)**	**HYP**
Kinetic Test	**Sat Col 4**	**Sat Col 5**	**Sat Col 6**	**Sat Col 9** (lower)	**Sat Col 9** (upper)	**Sat Col 13** (upper) **& Sat Col 15** (full)	**Sat Col 12 & 14** (upper)	**Sat Col 12, 13 & 14** (lower)
Aperture (mm)	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
9.5	0	5.8	4.6	3.4	4	1.4	2.4	8.1
6.3	23.4	25.2	17.5	28.7	19	23.9	9	25.3
3.36	23.8	23.1	22.7	13.7	14.1	17	8.4	16.3
1.7	11.8	11.5	15.7	29.7	22.4	15	15.4	15.3
0.425	21.3	17.9	23.6	15.3	20.8	21.3	34.1	19.1
0.15	6.7	5.4	5.8	4.2	8.8	8.8	14.6	6.7
0.053	6.3	5.3	5.4	2.4	5.5	6.3	8.9	4.5
>0.53	6.6	5.9	4.7	2.7	5.3	6.3	7.2	4.7
Total	*99.9*	*100.1*	*100*	*100.1*	*99.9*	*100*	*100*	*100*

Table 4-10:
Particle size distribution for samples of unsaturated waste rock kinetic tests

Sample Description	**CAP**	**95% CAP, 5% SUS**	**80% CAP, 20% SOX**	**81% CAP, 13% SUS, 6.3% OVB**
Kinetic Test	**Col 1**	**Sat Col 2, Col 2A & Col 2B**	**Col 3**	**Col 4a**
Aperture (mm)	**%**	**%**	**%**	**%**
9.5	0.9	3.4	1.1	3
6.3	6.6	13.4	16.8	16.1
3.36	14.9	20.7	26.1	16.2
1.7	16.7	14.9	16.8	24.6
0.425	34.1	26.9	25.2	22
0.15	10.1	7.6	5.2	8.7
0.053	8.9	6.9	4.5	5.2
>0.53	7.7	6.2	4.3	4.3
Total	*99.9*	*100*	*100*	*100.1*

Table 4-11:
Particle size distribution for samples of field bin tests

Sample Description		CAP	CAP	CAP	CAP	56% SUP	92% HYP	HYP	HYP
						44% CAP	8% SUP		
Kinetic Test		**FB1**	**FB2**	**FB3**	**FB4**	**FB5**	**FB6**	**FB7**	**FB8**
Aperture (mm)		**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Gravel	37.5	64.7	13.4	69	71.2	51.8	68.1	67.2	55.8
	19	18.4	19.6	16	16.8	22.6	21.4	11.6	31.9
	9.5	5	16	7.1	5.8	10.5	6.1	5.3	7.9
Sand	4.75	3.4	10.9	2.7	2.2	4.4	1.9	3.1	1.7
	2.36	3.2	5.8	0.9	1	2.1	0.7	2.3	0.7
	1.18	2.3	6.2	0.8	0.9	1.8	0.4	2.2	0.4
	0.6	1.1	5.9	0.8	0.5	1.6	0.3	1.8	0.3
	0.3	0.5	5	0.5	0.4	1.1	0.3	1.3	0.2
	0.15	0.4	3.5	0.5	0.3	0.8	0.2	0.9	0.2
	0.075	0.2	2.5	0.3	0.2	0.5	0.1	0.5	0.2
Fines	<0.075	0.8	11.2	1.4	0.7	2.8	0.5	3.8	0.7
	Total	*100*	*100*	*100*	*100*	*100*	*100*	*100*	*100*

4.2.2 Ore and Tailings Samples

The PSD for samples from ore test HC1 ranges from <0.53 to 9.5 mm in diameter, with the largest volume (50%) in the 3.36 and 6.3 mm fraction (Table 4-12). The PSD for ore test HC2 is finer, ranging from <0.53 to 6.3 mm and the largest fraction (30%) in the 0.425 mm fraction.

The PSD for the Casino tailings samples are presented in Table 4-13 and Table 4-14. With the exception of Sample 3 from the 2008 Pilot Plant tests, the largest volume of particles for each of the flotation tailings samples is comprised in the finest fraction (*i.e.*, <0.045 and <0.038). Sample 3 is significantly coarser than other samples, with 38% of the material measuring >0.425 mm in diameter.

The CAP heap leach residue sample (CL-01) was sieved for particles greater than and less than 9.5 mm diameter. Sample CL-01 is composed of 85.9% particles greater than 9.5 mm and 14.1% particles less than 9.5 mm in size.

Table 4-12:
Particle size distribution for samples of ore humidity cell tests.

Sample	HYP	18.3% HYP 81.7% SUP
Kinetic Test	**HC1**	**HC2**
Aperture (mm)	**%**	**%**
9.5	10.4	0
6.3	24.7	7.9
3.36	25	21.5
1.7	8.7	11
0.425	17.4	32
0.15	5.7	11.8
0.053	4.1	7.8
<0.53	3.9	8.1

Table 4-13:
Particle size distribution of tailings produced by 2008 and 2012 pilot plant metallurgical tests.

Sample Description	**2008 Pilot Plant**			**2012 Pilot Plant**		
	(71% SUP, 22% HYP, 7% CAP)			**(HYP)**		
	Sample 1	**Sample 2**	**Sample 3**	**PyRo whole**		
Kinetic Test	**T1**	**T2**	**T3**	**T7 & Sat Col 6**	**Col 6**	**Sat Col 17**
Aperture (mm)	**%**	**%**	**%**	**%**	**%**	**%**
0.425	0	0	38	0	0	0
0.25	1.6	2.9	6.3	16.5	32.3	0
0.15	3.4	7.3	7	20.6	40.3	0
0.106	8.9	14.1	3.7	14	27.4	0
0.053	2.5	0.9	2.3	24.2	0	0
0.045	34.8	37.2	6.6	12.7	0	0
<0.045	48.7	37.4	36.1	12	0	100
Total	*99.9*	*99.8*	*100*	*100*	*100*	*100*

Note: PyRo = pyrite rougher; Conc. Concentrate:
Values shaded in beige were calculated from 2012 Whole PyRo Tails according to proportions used for kinetic tests:
Col 6 = pyrite rougher sands (>74 mm) from 2012 bench scale metallurgical tests;
Sat Col 17 = pyrite rougher concentrate from 2012 bench scale metallurgical tests.

Table 4-14:
Particle size distribution of tailings produced by 2009 and 2010 bench scale tests.

Sample Description	2009 Bench Scale			2010 Bench Scale (85% SUS and 15% HYP)				
	SSH Comp 1 (50% HYP 50% SUS)	HZ Comp 2 (HYP)	SS Comp 3 (SUS)			PyRo whole		
Kinetic Test	**Sat Col 1**			**T4**	**Sat Col 8**	**Sat Col 10 & T5**	**Col 5 & T6**	**Sat Col 11**
Aperture (mm)	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
0.425	0	0	0	0	0	0	0	0
0.3	0	0.1	0.3	0.1	0.13	4.9	8.6	0
0.212	0.5	6.4	7.7	4.3	6.6	17.3	30.4	0
0.15	10.6	18.5	16.7	15	18.2	14.2	25	0
0.106	19.9	13.9	16.4	16.8	14.3	11.6	20.4	0
0.075	15.8	10.4	10.8	12.6	10.5	8.9	15.6	0
0.053	10.4	8.3	9.1	9.3	8.4	7.3	0	3.6
0.038	6	6.2	6.1	6.1	6.2	6	0	2.9
<0.038	36.8	36.2	32.9	35.8	35.6	29.8	0	93.5
Total	*100*	*100*	*100*	*100*	*99.93*	*100*	*100*	*100*

Note: PyRo = pyrite rougher; Conc. Concentrate:
Values shaded in beige are calculated based on the proportions used for kinetic tests:
T4 = 40% SSH Comp 1, 40% HZ Comp 2, 20% SS Comp 3;
Sat Col 8 = 83% HZ Comp 2 and 17% SS Comp 3;
Col 5 & T6 = PyRo tailings sands (>75 µm); and
Sat Col 11 = 21% PyRo slimes (<75 µm) + 23% Pyrite Conc. + 56% Cleaner tailings.

4.3 Acid Base Accounting

This section presents the ABA results for waste rock, tailings and ore kinetic test samples and compares the results to the larger Casino static test inventory from Lorax (2013) to demonstrate that the kinetic test samples and leached products are representative of the waste and ore that will be extracted from the Casino deposit. Test results for paste pH, acid potential (AP) and neutralization potential (NP) are discussed.

Both carbonate NP (CaNP) and Siderite corrected NP (ScNP) values were determined for the kinetic test samples. The CaNP method assumes that all carbonates are in the form of calcite ($CaCO_3$) while the ScNP method is not mineral specific and measures the bulk NP of a sample. The purpose of two NP methods is to avoid overestimating the amount of available NP in a sample by differentiating between the NP contributions by Ca and Mg bearing carbonates (*i.e.*, calcite, Mg-calcite and dolomite), which are net neutralizing under oxidizing conditions, from the NP contributions by Fe and Mn bearing carbonates (*i.e.*,

ankerite and siderite), which do not contribute to the overall net neutralization of a material under the same conditions (Price, 2009). Previous geochemical assessments determined that CaNP would be the most reliable and conservative source of NP for the Casino waste products (Lorax, 2013).

The AP for HYP and SUP samples is calculated from non-sulphate S. Non-sulphate-S is calculated from the difference between sulphate S and total S. This estimate of AP includes the insoluble S fraction which was not released during the digestion used to measure sulphide S, while excluding sulphate-S which is primarily associated with non-acidic oxide minerals (i.e. gypsum). Conversely, in the CAP material the secondary sulphate mineral, Jarosite, was detected in many of the CAP waste rock (and heap leach residue) samples (Table 4-1 and Table 4-7), which will contribute to the overall acid generation of the CAP waste and is therefore incorporated into the AP values (calculated as (sulphide S * 31.25) + (sulphate S * 23.44)) in Table 4-15.

The acid generating potential of the SUP and HYP rocks is determined by the net potential ratio (NPR), whereby NPR is defined by the ratio CaNP to non-sulphate S AP (CaNPR). Samples with NPR<2 are categorized as potentially acid generating (PAG), samples with NPR>2 are not acid generating (NAG) (Price 1997). The net neutralization potential (NNP), which is calculated by subtracting the AP from the CaNP, provides a measure of how much acid generating potential remains when the CaNP is exhausted.

Given the extremely low sulphide and carbonate content of the leached oxide CAP rocks, and the acid contributions from soluble sulphates, paste pH, which provides information on the amount and availability of NP by indicating whether or not a sample was actively producing net acidity prior to sampling, is used to determine if a CAP sample is PAG (Lorax, 2013).

4.3.1 Waste Rock Samples

The ABA results for the waste rock laboratory and field kinetic test samples are presented in Table 4-15, Table 4-16 and Table 4-17 according to the dominant mineralization zone they represent. Given the wide range of particle sizes in the field bin sample, and the higher reactivity of fine particles relative to larger particles, ABA and metals for the field bin samples were analyzed for both a gravel (4.75 – 75 mm) and sand + fines (< 4.75 mm) fraction for field bin samples. The values presented in the tables are *adjusted values* that were calculated based on the relative PSD proportions presented in Table 4-11. The ABA results for the gravel and fines fractions are presented in Appendix C.

4.3.1.1 CAP

All kinetic tests composed of CAP waste rock paste pH values < 6.5, low to no measurable total inorganic carbon (TIC) (<0.02%) and measurable total sulphur (S) concentrations

predominantly in the form of sulphate (Table 4-15). The kinetic test sample Col 4a, which has the highest paste pH of 6.5, is composed of 13% SUS and 6.3% overburden. All other CAP samples have a paste pH of 6.1 or lower. As previously discussed, paste pH was determined to be a representative index for the ARD potential for CAP waste due to the fact that (1) water soluble sulphate minerals, rather than sulphide minerals, are the major available source of acidity in most CAP samples, and (2) CAP samples typically lack carbonate minerals to buffer at neutral or alkaline pH. Therefore the CAP waste rock kinetic test samples are near or currently acid generating (AG).

4.3.1.2 SUP

Kinetic tests composed of SUP waste rock have a range of paste pH, NP and S values (Table 4-16). Paste pH values range from 4 to 8.4. Although values with paste pH <6 are considered to be already AG, all CaNPR and ScNPR values for kinetic tests composed of SUP waste rock are <0.6 indicating that the test samples are either AG or PAG. This is further supported by negative NNP values for the test samples, indicating that there is not sufficient available NP to neutralize the available AP.

4.3.1.3 HYP

The majority of the kinetic test HYP samples are neutral to slightly alkaline (Table 4-17). Samples HC8 and HC10 have paste pH values of <6 and are considered to be already AG. For the HYP waste rock, paste pH values appear to be primarily dependent on the amount of available NP. Samples with paste pH <6 have <0.005% TIC and ScNP of <4.1 kg$CaCO_3$/t. All HYP waste rock kinetic test samples have CaNPR and ScNPR values of <1 and negative NNP values indicating that the test samples are PAG and likely to generate acid once the NP has been depleted.

Figure 4-1 and Figure 4-2 present box plots of select ABA parameter distributions for the Casino deposit mineralization zones (CAP, SUP and HYP) and HYP zone lithologies (IX/MX, PP and WR) with kinetic test sample results superimposed to demonstrate how the kinetic test samples relate to the range of values measured for the respective zone and lithology.

Figure 4-1 demonstrates that the waste rock selected for kinetic testing is representative of the ABA distribution for the larger static test dataset of their respective mineralization zone. Figure 4-2 demonstrates that the samples selected for HYP kinetic testing are generally within the 5^{th} and 95^{th} percentile distribution of the larger dataset for their respective lithologies. Exceptions include samples from Sat Col 5 (SUP) and HC10 (WR), that were selected to represent acidic leaching rates and as a result have paste pH and CaNPR values below the 95^{th} percentile of their respective static test datasets. Therefore, they are considered to be a worst case scenario for the SUP and HYP (and Dawson Range) zones.

Table 4-15:
Acid-base accounting results for CAP waste rock kinetic tests samples.

Sample Description		CAP	CAP	95% CAP 5% SUS	95% CAP 5% SUS	80% CAP 20% SOX	81% CAP 13% SUS 6.3% OVB	CAP	CAP	CAP	CAP
Kinetic Test		**Sat Col 9 (lower)**	**Col 1**	**Sat Col 2 & Col 2A**	**Col 2B**	**Col 3**	**Col 4a**	**FB1**	**FB2**	**FB3**	**FB4**
Parameter	**Unit**										
Paste pH	s.u.	4.2	4.4	5.3	5.3	3.9	6.45	6.1	6.0	5.8	5.3
TIC	%	<0.01	<0.01	<0.01	<0.01	0.01	0.02	<0.01	<0.01	<0.01	<0.01
Total C	%	0.03	0.07	0.03	0.03	0.04	0.05	*ND*	*ND*	*ND*	*ND*
Total S	%	0.49	0.19	0.32	0.31	1.23	0.16	0.41	0.30	0.2	1.55
Sulphate S	%	0.2	0.15	0.31	0.31	0.77	0.1	0.43	0.18	0.19	1.39
Sulphide S	%	0.02	0.05	0.02	0.01	0.45	0.05	0.02	0.12	0.02	0.11
Insoluble S	%	0.27	<0.01	<0.01	<0.01	0.01	0.01	<0.01	<0.01	<0.01	0.05
Non-Sulphate S	%	0.29	0.04	0.01	<0.01	0.46	0.06	0.02	0.12	0.01	0.16
AP	$kgCaCO_3/t$	5.3	5.1	7.9	7.6	32.1	3.9	10.7	8.0	5.1	36.0
CaNP	$kgCaCO_3/t$	<0.8	<0.8	<0.8	<0.8	0.8	1.7	<0.8	<0.8	<0.8	<0.8
ScNP	$kgCaCO_3/t$	3.3	5.8	6.3	5.2	0.6	11.9	0.15	4.57	2.74	-0.37

Notes: ND = no data
TIC = total inorganic carbon, originating from carbonates;
Non-Sulphate S is calculated by subtracting Sulphate S from the Total S value;
AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated as (sulphide S * 31.25) + (sulphate S *23.44);
CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC; and
ScNP = Siderite corrected neutralization potential.

Table 4-16:
Acid-base accounting results for SUP waste rock kinetic tests samples.

Sample Description		90% SUP 5% CAP 5% HYP	50% SUS 50% CAP	SUP (acidic)	SUP (neutral)	SUP (WR)	SUP (WR)	56% SUP 44% SUP
Kinetic Test		Sat Col 5	Sat Col 6	Sat Col 12 & 14 (lower)	Sat Col 13 (lower) & Sat Col 15 (full)	HC11	HC12	FB5
Parameter	**Unit**							
Paste pH	s.u.	6.3	3.8	3.99	7.68	8.2	5.4	8.0
TIC	%	0.09	<0.01	<0.01	0.08	0.22	<0.01	0.03
Total C	%	0.11	0.03	0.02	0.1	0.23	<0.01	*ND*
Total S	%	2.36	1.62	1.42	1	2.27	3.11	1.52
Sulphate S	%	0.1	0.48	0.35	0.02	0.03	0.04	0.13
Sulphide S	%	2.3	1.19	0.83	0.88	1.95	2.94	1.36
Insoluble S	%	<0.01	<0.01	0.24	0.1	0.29	0.13	0.05
Non-Sulphate S	%	2.26	1.14	1.07	0.98	2.24	3.07	1.39
AP	$kgCaCO_3/t$	71	36	33	31	70	96	43.5
CaNP	$kgCaCO_3/t$	7.5	<0.8	<0.8	6.7	18.3	<0.8	2.29
ScNP	$kgCaCO_3/t$	10.7	-4.1	3.8	16.5	33	3.7	12.5
CaNPR	CaNP/AP	0.11	0.022	0.024	0.22	0.26	0.0083	0.05
ScNPR	ScNP/AP	0.15	-0.12	0.11	0.54	0.47	0.039	0.29
Net NP	ratio	-61.2	-41.3	-22.1	-11	-27.9	-88.2	-30.3

Notes: ND = no data
TIC = total inorganic carbon, originating from carbonates;
Non-Sulphate S is calculated by subtracting Sulphate S from the Total S value;
AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated as non-sulphate S * 31.25;
CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC;
ScNP = Siderite corrected neutralization potential; and
NPR = net potential ratio.

Table 4-17:
Acid-base accounting results HYP waste rock kinetic tests samples

Sample Description		HYP	HYP	HYP	89% HYP 11% SUS	HYP	HYP (PP)	HYP (WR)	HYP (PP)	HYP (WR)	HYP (IX)	HYP (MX)	HYP (MX)	HYP (PP)	HYP (WR)	HYP (WR)	92% HYP 8% SUP	HYP	HYP
Kinetic Test		**Sat Col 3**	**Sat Col 4**	**Sat Col 7**	**Sat Col 9 (upper)**	**Sat Col 12, 13 & 14 (upper)**	**HC3**	**HC4**	**HC5**	**HC6**	**HC7**		**HC8**	**HC9**	**HC10**		**FB6**	**FB7**	**FB8**
Parameter	**Unit**																		
Paste pH	s.u.	7.6	7.5	7.6	8.0	8.15	8.4	8.3	8.1	8.1	7.9	6.3	5.1	7.9	4.7	5.4	8.4	8.5	8.4
TIC	%	0.33	0.28	0.34	0.5	0.77	0.27	0.69	0.21	0.19	0.48	0.1	<0.01	<0.01	<0.01	<0.01	0.24	0.45	0.34
Total C	%	0.38	0.33	0.39	0.54	0.78	0.28	0.72	0.21	0.2	0.51	0.1	0.01	0.01	0.01	0.02	*ND*	*ND*	*ND*
Total S	%	3.08	4.33	3.04	2.22	2.65	4.23	4.29	2.21	1.81	2.89	3.62	4.28	0.92	1.99	5.12	1.63	2.88	1.84
Sulphate S	%	0.24	0.27	0.24	0.41	0.03	0.03	0.03	0.07	0.02	0.12	0.03	0.03	0.02	0.06	0.03	0.19	0.06	0.11
Sulphide S	%	2.9	4.18	2.81	1.86	2.49	2.04	4.22	1.07	1.65	2.73	3.58	4.13	0.86	1.69	4.24	1.38	2.81	1.72
Insoluble S	%	<0.01	<0.01	<0.01	<0.01	0.13	2.16	0.04	1.07	0.14	0.04	0.01	0.12	0.04	0.24	0.85	0.06	0.02	0.01
Non-Sulphate S	%	2.84	4.06	2.8	1.81	2.62	4.2	4.26	2.14	1.79	2.77	3.59	4.25	0.9	1.93	5.09	1.44	2.82	1.73
AP	$kgCaCO_3/t$	89	127	88	57	82	131	133	67	56	87	112	133	28	60	159	44.9	88.1	54.1
CaNP	$kgCaCO_3/t$	27.5	23.3	28.3	41.7	64.2	22.5	57.5	17.5	15.8	40	8.3	<0.8	<0.8	<0.8	<0.8	20.2	37.3	28.6
ScNP	$kgCaCO_3/t$	24.5	21.1	23.4	39.8	61.5	32.1	67.7	26.6	26.9	48.1	9.2	3.2	14.2	4.1	1.5	26.1	39.3	34.1
CaNPR	CaNP/AP	0.31	0.18	0.32	0.74	0.78	0.17	0.43	0.26	0.28	0.46	0.074	0.0060	0.028	0.013	0.0050	0.45	0.42	0.53
ScNPR	ScNP/AP	0.28	0.17	0.27	0.70	0.75	0.24	0.51	0.40	0.48	0.56	0.082	0.024	0.50	0.068	0.0094	0.58	0.45	0.63
Net NP		-66.1	-109.5	-64.4	-18.3	-16.3	-31.7	-64.2	-6.8	-24.7	-37.2	-102.7	-125.9	-12.6	-48.7	-131	-16.9	-47.2	-20.4

Notes: ND = no data

TIC = total inorganic carbon, originating from carbonates;
Non-Sulphate S is calculated by subtracting Sulphate S from the Total S value;
AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated as non-sulphate S * 31.25;
CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC;
ScNP = Siderite corrected neutralization potential; and
NPR = net potential ratio.

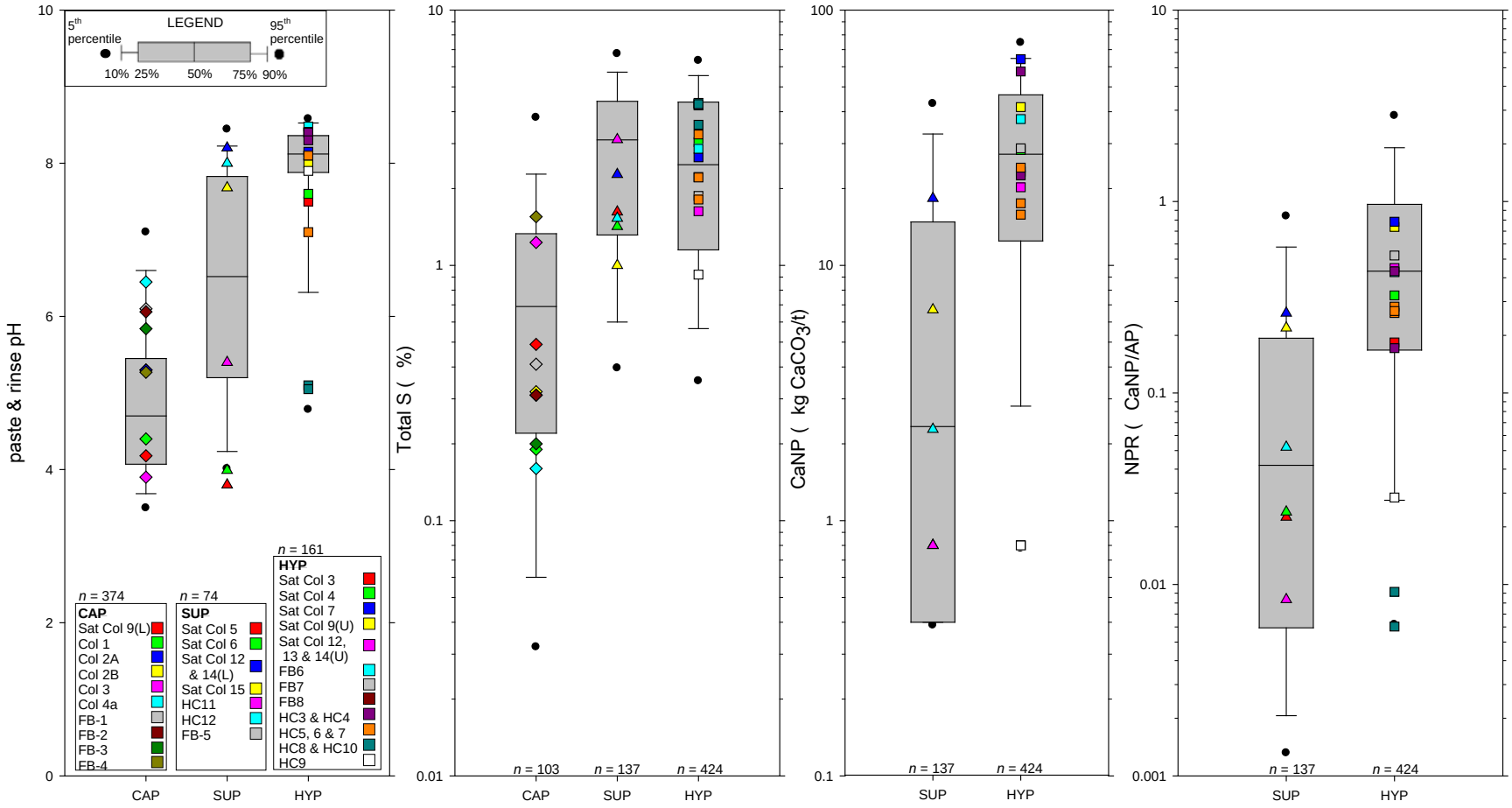


Figure 4-1: Comparison of waste rock kinetic test samples with distribution of re-logged drill core static test results from Lorax (2013) for mineralization zones of the Casino deposit.

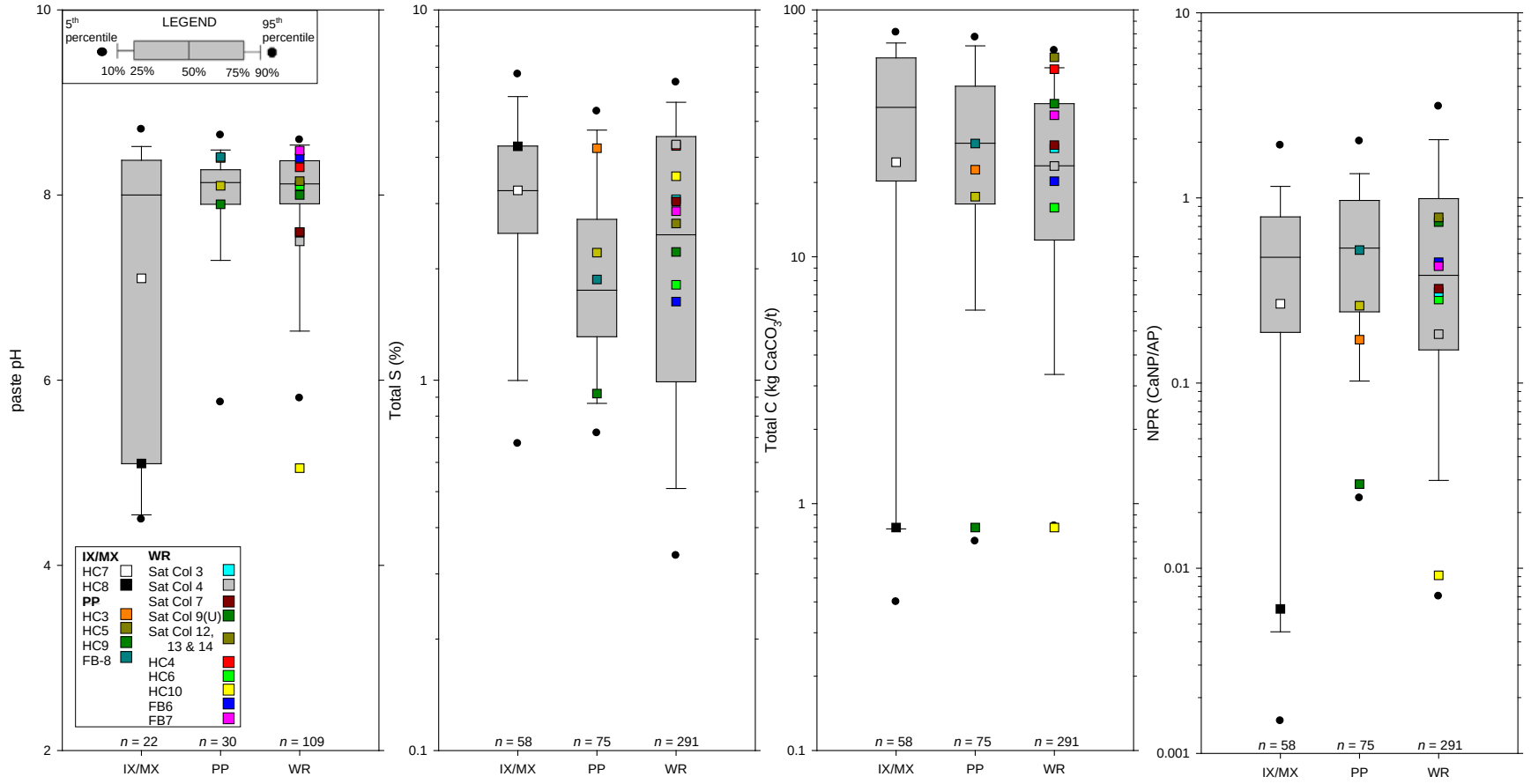


Figure 4-2: Comparison of waste rock kinetic test samples with distribution of re-logged drill core static test results from Lorax (2013) for HYP zone lithologies of the Casino deposit.

4.3.2 Ore Samples

The samples from the ore humidity cell tests and feed samples to the 2012 metallurgical tests are presented in Table 4-18. Only the sample from humidity cell HC2, which is composed predominantly of SUP, has a paste pH of 5.4 and is therefore currently AG. All other ore samples are neutral to slightly alkaline with paste pH values ranging from 7.0 to 8.0. The paste pH of the HYP and SUP ore samples are reflective of TIC concentrations. Consistent with a lower paste pH, TIC for the HC2 sample is 0.08% while all other ore samples have TIC values ranging from 0.21% to 0.33%. Total S ranges from 1.23% to 2.43%, predominantly in the form of non-sulphate S. Only the sample from the HYP ore humidity cell (HC1) comprises 0.25% sulphate S, consistent with the identification of gypsum (1.4 wt. %, Table 4-8) by XRD. NPR values for all ore samples are <1 and, therefore, PAG.

Table 4-18:
Acid-base accounting results for ore samples in humidity cell and metallurgical tests.

Sample Description		**HYP**	**81.7% SUP 18.3% HYP**	**PP Ore Head #1**	**PP Ore Head #2**	**SUP-Head**	**HYP-Head**
Kinetic Test		**HC1**	**HC2**	**2008 pilot plant head samples**		**2012 pilot plant head samples**	
Parameter	**Unit**						
Paste pH	s.u.	7.9	5.4	7.0	7.0	7.2	8.0
TIC	%	0.32	0.08	0.24	0.23	0.21	0.33
Total C	%	0.34	0.11	*ND*	*ND*	0.24	0.35
Total S	%	1.53	1.23	2.30	2.34	2.43	1.41
Sulphate S	%	0.25	0.04	0.10	0.10	0.07	0.08
Sulphide S	%	1.09	0.99	2.30	2.34	1.85	1.1
Insoluble S	%	0.19	0.20	<0.1	<0.1	0.51	0.23
Non-Sulphate S	%	1.28	1.19	2.20	2.24	2.36	1.33
AP	$kgCaCO_3/t$	40.0	37.2	68.8	70.0	73.8	41.6
CaNP	$kgCaCO_3/t$	26.7	6.7	20.0	19.2	17.5	27.5
ScNP	$kgCaCO_3/t$	35.0	10.0	14.1	16.1	24	34.5
CaNPR	CaNP/AP	0.67	0.18	0.29	0.27	0.24	0.66
ScNPR	ScNP/AP	0.88	0.27	0.21	0.23	0.33	0.83
Net NP		-5.0	-27.2	-57.8	-57.0	-49.8	-7.1

Notes: TIC = total inorganic carbon, originating from carbonates; Non-Sulphate S is calculated by subtracting Sulphate S from Total S; SAP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from non-sulphate S; CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC; ScNP = Siderite corrected neutralization potential; and NPR = net potential ratio.

Figure 4-3 presents box plots of select ABA parameter distributions for Casino SUP and HYP ore samples with the results of the ore humidity cell samples and the 2008 and 2012 metallurgical head samples superimposed to demonstrate how these samples relate to the range of values measured for the respective mineralization zone. The results of Figure 4-3 demonstrate that the HYP and SUP ore samples used for metallurgical and kinetic testwork correspond to the 25th to 90th percentile ranges calculated for the ore drill core static test dataset assessed in Lorax (2013).

4.3.3 Tailings

The ABA results for Casino SUP and HYP tailings produced by the 2008, 2009, 2010 and 2012 metallurgical studies are presented according to the different waste streams and depositional environment (whole tailings in Table 4-19 and sands, fines and concentrate in Table 4-20). Note that three of the tailings kinetic tests (T4, Sat Col 8 and Sat Col 11) contain composite samples from different waste streams produced during the metallurgical testing. ABA parameters were not measured for subsamples of the composite samples used in the kinetic tests but rather the individual products. Therefore, calculated values are also presented for these three samples and are highlighted in beige in the tables.

The tailings kinetic test samples are slightly alkaline with paste pH values ranging from 7.7 to 8.7. This is in part due to the processing fluid from the flotation circuit which has lime added to maintain a pH greater than 10. TIC ranges from 0.05% (SSH Comp 1/Sat Col 1) to 0.41% (SS Comp 3) and ScNP ranges from 11.1 to 34.1 kg $CaCO_3$/t in the tailings samples. Of note is that the <74 µm fraction has more than twice the amount of CaNP than the >74 µm fraction (Table 4-20), indicating that carbonate minerals may be concentrated in the finer grained fraction of the tailings. Total S values are predominantly in the form of non-sulphate S that range from 0.12% (SS Comp 3) to 3.39% (SSH Comp 1/Sat Col 1) for whole tailings samples (Table 4-19) and from 8.8% to 12.3% for the pyrite concentrate and cleaner tailings samples (Table 4-20). The proportions of non-sulphate S in the depyritized tailings sands and fines fraction range from 0.03 to 0.12% indicating that the flotation process is effective at removing sulphide from the tailings.

The 2008 whole tailings samples are PAG with NPR values of < 1.5 (Table 4-19). Both PAG and NAG whole tailings were produced during the 2009 metallurgical test work. SSH Comp 1 has low TIC, high total S and produced a CaNPR of 0.04 whereas the HZ Comp 2 and SS Comp 3 samples have higher TIC and lower total S and produced NPR values of > 3.25. The 2010 and 2012 depyritized whole tailings have CaNPR values of 3 and 11, respectively, and are therefore NAG. However, the pyrite concentrates and cleaner tailings produced during 2010 and 2012 metallurgical test work are PAG, producing very low NPR values of <0.1 (Table 4-20). The 2010 and 2012 tailings sands (> 74 mm) and fines (< 74 mm) have NPR values between 7 (CaNPR) and nearly 35 (ScNPR) and are therefore NAG.

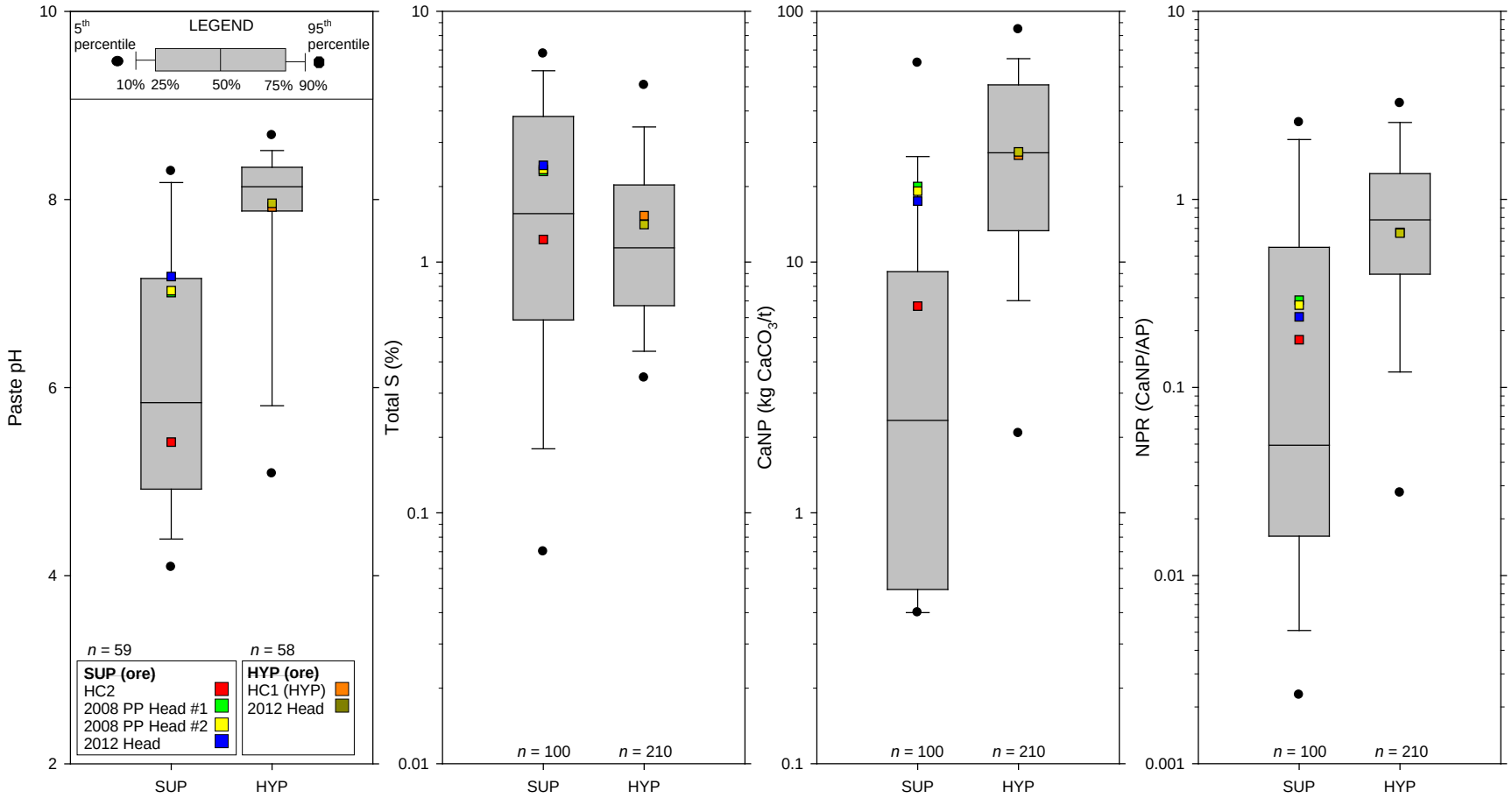


Figure 4-3: Comparison of ore humidity cell samples and metallurgical head samples (2008 and 2012 pilot plant testwork) with distribution of re-logged drill core static test samples from Lorax (2010).

Table 4-19:
Acid-base accounting results for whole tailings samples produced by metallurgical tests.

Sample Description		2008			2009					2010	2012		
		Sample 1	Sample 2	Sample 3	SSH Comp 1 (50% HYP 50% SUS)	HZ Comp 2 (HYP)	SS Comp 3 (SUS)	40% SSH Comp 1, 40% HZ Comp 2, 20% SS Comp 3	83% HZ Comp 2, 17% SS Comp 3	PyRo whole (85% SUS and 15% HYP)	PyRo whole (HYP)	PyRo feed (SUP)	PyRo feed (HYP)
		(71% SUP, 22% HYP, 7% CAP)											
Kinetic Test		**T1**	**T2**	**T3**	**Sat Col 1**			**T4**	**Sat Col 8**	**Sat Col 10 & T5**	**Sat Col 16 & T7**		
Parameter	**Unit**												
Paste pH	s.u.	8.7	8.6	8.5	8.5	8.6	8.6	8.6	8.6	8.5	8.3	8.1	7.9
TIC	%	0.27	0.26	0.31	0.05	0.22	0.41	0.19	0.25	0.08	0.34	0.31	0.36
Total C	%	*ND*	*ND*	*ND*	0.06	0.24	0.43	0.21	0.27	0.09	0.35	0.32	0.36
Total S	%	1.18	1.09	0.65	3.47	0.19	0.14	1.49	0.18	0.01	0.11	0.96	1.07
Sulphate S	%	0.05	0.05	0.07	0.08	<0.01	0.02	0.04	0.01	0.03	0.03	0.1	0.05
Sulphide S	%	1.13	1.04	0.65	3.18	0.16	0.11	1.36	0.15	0.07	0.05	0.79	0.92
Insoluble S	%	<0.01	<0.01	<0.01	0.21	0.03	0.01	0.1	0.03	<0.01	0.03	0.07	0.1
Non-Sulphate S	%	1.13	1.04	0.58	3.39	0.18	0.12	1.45	0.17	0.07	0.08	0.86	1.02
AP	kg$CaCO_3$/t	35.3	32.5	18.1	105.9	5.6	3.8	45.3	5.3	2.2	2.5	26.9	31.9
CaNP	kg$CaCO_3$/t	22.5	21.7	25.8	4.2	18.3	34.2	15.83	21.0	6.7	28.3	25.8	30
ScNP	kg$CaCO_3$/t	19.3	17.3	21.7	11.1	18.9	32.3	18.46	21.2	14.2	34.1	33	31.4
CaNPR	CaNP/AP	0.64	0.67	1.42	0.04	3.25	9.12	0.35	3.96	3.06	11.32	0.96	0.94
ScNPR	ScNP/AP	0.55	0.53	1.20	0.10	3.36	8.61	0.41	3.99	6.49	13.64	1.23	1.0
Net NP		-16	-15.2	1.4	-88.3	13.9	28.9	-23.98	-3.47	12	32.5	6.1	-0.5

Notes: PyRo = pyrite rougher; Conc. Concentrate:
Values shaded in beige are calculated based on the proportions used for kinetic testing
TIC = total inorganic carbon, originating from carbonates;
Non-Sulphate S is calculated by subtracting Sulphate S from the Total S value;
AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from non-sulphate S;
CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC;
ScNP = Siderite corrected neutralization potential; and
NPR = net potential ratio.
Note that for sample Sat Col 10 & T5 the sulphide S value was used for the non-sulphate S value.

Table 4-20:
Acid-base accounting results for tailings components (sands, fines and concentrate) produced by metallurgical tests.

Sample Description		2010					2012	
		85% SUS and 15% HYP					HYP	
		PyRo Sands >74mm	PyRo slimes <74mm	Pyrite Conc.	Cleaner tailings	21% PyRo slimes (<74 µm), 23% Pyrite Conc, 56% Cleaner tailings	PyRo sands >74 mm	Pyrite Conc.
Kinetic Test		**Col 5 & T6**				**Sat Col 11**	**Col 6**	**Sat Col 17**
Parameter	**Unit**							
Paste pH	s.u.	8.55	8.5	8.55	8.15	8.3	8.4	7.7
TIC	%	0.06	0.15	0.09	0.12	0.12	0.21	0.3
Total C	%	0.09	0.18	0.13	0.19	0.17	0.27	0.33
Total S	%	0.09	0.07	12.4	11.3	9.19	0.13	10.8
Sulphate S	%	0.02	0.04	0.08	0.62	0.37	0.01	0.1
Sulphide S	%	0.02	0.02	10.8	11.5	8.93	0.08	9.92
Insoluble S	%	0.05	0.01	1.52	<0.01	0.36	0.04	0.78
Non-Sulphate S	%	0.07	0.03	12.3	10.7	8.82	0.12	10.7
AP	$kgCaCO_3/t$	2.19	0.94	385	334	276	3.75	334
CaNP	$kgCaCO_3/t$	5	12.5	7.5	10	9.95	17.5	25
ScNP	$kgCaCO_3/t$	15.8	21.4	16.3	20.8	19.9	27.5	30
CaNPR	CaNP/AP	2.29	13.3	0.02	0.03	0.04	4.67	0.07
ScNPR	ScNP/AP	7.22	22.8	0.04	0.06	0.07	7.33	0.09
Net NP		15.2	20.8	-321	-339	-256	25	-280

Notes: PyRo = pyrite rougher; Conc. Concentrate:
Values shaded in beige are calculated based on the proportions used for kinetic testing;
TIC = total inorganic carbon, originating from carbonates;
Non-Sulphate S is calculated by subtracting Sulphate S from the Total S value;
AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from non-sulphate S;
CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC;
ScNP = Siderite corrected neutralization potential; and
NPR = net potential ratio.

4.3.4 Heap Leach Residue

ABA results for the residue sample CL-01 L Residue, produced by column leaching of CAP ore, are presented in Table 4-21. Determination of ARD/ML potential for the leached residue of CAP ore follows the same methodology as that applied to the CAP waste rock whereby a sample with a paste pH <6 is PAG. Sample CL-01 has low CaNP and sulphide S content, but 0.5 % sulphate-S, identified by XRD (Table 4-7) to be the acid generating sulphate mineral, jarosite (3 wt.%). The sample has a paste pH of 7.5 and is, therefore, not currently AG.

Table 4-21:
Acid-base accounting results for CAP heap leach residue.

Sample Description		**CL-01 L Residue (CAP)**
Kinetic Test		**Col 7 & Col 8**
Parameter	**Unit**	
Paste pH	s.u.	7.51
TIC	%	0.03
Total C	%	0.06
Total S	%	0.46
Sulphate S	%	0.51
Sulphide S	%	0.02
Insoluble S	%	<0.01
Non-Sulphate S	%	<0.01
AP	kg$CaCO_3$/t	<0.3
CaNP	kg$CaCO_3$/t	2.5
ScNP	kg$CaCO_3$/t	7.2

Notes: TIC = total inorganic carbon, originating from carbonates; Non-Sulphate S is calculated by subtracting Sulphate S from Total S; AP = acid potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from non-sulphate S; CaNP = Neutralization potential in tonnes $CaCO_3$ equivalent per 1000 tonnes of material, calculated from TIC; and ScNP = Siderite corrected neutralization potential.

4.4 Metals by Aqua Regia and X-Ray Fluorescence

Solid-phase metals data are used to identify which metals are enriched in the various waste materials. The solid phase metal abundance of the Casino waste rock, ore and tailings kinetic test samples were measured by aqua regia digestion and compared to the statistical distribution of static test samples for their respective mineralogical zone (Lorax, 2013) to demonstrate the representativeness of the selected samples for kinetic testwork to the mineralogical zone as a whole.

The aqua regia method is efficient at digesting sulphide and most oxide phases; however, it does not measure the elemental content of the entire sample, as some refractory silicate minerals are not dissolved in the procedure and therefore may not be an accurate measure of major elements such as Si and Al. However, it is a good measure of the total leachable content of a sample.

The Lorax 2013 report highlighted several metals within each mineralization zone of the Casino deposit that are enriched with respect to average continental crustal abundances. These include silver (Ag), bismuth (Bi), molybdenum (Mo), sulphur (S), selenium (Se) and tellurium (Tl), which are elevated in ore and waste samples from each mineralization zone of the Casino deposit. Additionally, arsenic (As) is elevated in waste and ore from each zone except median values for SUS waste rock and copper (Cu) is elevated in waste and ore from each zone except CAP waste rock. Cadmium (Cd) and antimony (Sb) are generally not elevated except in SUP ore samples, with Cd elevated in SOX samples and Sb elevated in SOX and SUS samples.

4.4.1 Waste Rock Samples

Solid phase elements are presented for the CAP, SUP and HYP waste rock kinetic test samples in Table 4-22, Table 4-23 and Table 4-24, respectively, and compared to the statistical distribution of static test samples for their respective mineralogical zone. Values shaded in grey in the tables are higher than the 90th percentile for the static test samples and values shaded in blue are lower than the 10th percentile for the static test samples.

Solid phase metal concentrations for the CAP waste rock kinetic test samples are generally between the 10th and 90th percentile values for the CAP waste rock static test database. Exceptions include Col 1, FB-2 and FB-3, composed exclusively of CAP waste, which contain elevated concentrations of Al, As, Cd, Cr, Mo, Hg and/or U compared to the CAP waste rock unit as a whole (Table 4-22) and will provide an idea of the upper extent to which these metals will leach from stockpiled CAP waste rock and pit walls. Of particular note are the elevated concentration of As and Cr for FB-3, Mo for Col 1 and FB2, and Zn for Col 4A.

Overall, the SUS waste rock kinetic test samples are generally within the 10th and 90th percentile of the static test sample database for SUS waste rock (Table 4-23). Of note, are the elevated Mo in Sat Col 12 and Sat Col 14; elevated Se in HC11 and HC12; and elevated Cu in FB-5 above the 90th percentile of the SUS waste rock static test samples.

The HYP waste rock kinetic test samples are generally within the 10th and 90th percentile of the static test sample database for HYP waste rock (Table 4-24). A few elements for Sat Col 3 and Sat Col 7 are indicated to be elevated above the 90th percentile for the static test database. Of note is kinetic test sample HC10, which contains Ag, As, Hg and Zn at concentrations above the 90th percentiles.

Table 4-22:
Solid phase metal results for Oxide Leach Cap (CAP) waste rock kinetic tests samples compared to the statistical distribution of CAP waste rock static test samples.

Oxide Leach Cap (CAP)		*CAP Waste Kinetic Test Samples*										*Statistical Range of Static Test Samples for CAP Waste (n = 102)*				
		Sat Col 9 (lower)	Col 1	Sat Col 2, Col 2A	Col 2B	Col 3	Col 4A	FB-1	FB-2	FB-3	FB-4	Max	90th PCTL	Median	10th PCTL	Min
Ag	ppm	1.0	1.2	0.80	0.80	1.0	0.70	0.70	1.3	0.83	0.83	5.0	1.9	0.80	0.30	***0.050***
Al	%	0.81	2.8	0.85	0.82	0.94	1.7	0.24	1.9	0.54	0.48	7.3	1.9	0.38	0.20	0.150
As	ppm	15	17	8.7	8.6	12	12	10.0	19	85	19	132	28.9	10.1	2.9	1.0
Cd	ppm	<0.1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	0.56	0.23	0.20	0.70	0.20	0.050	***0.050***	***0.025***
Cr	ppm	50	45	72	72	59	60	103	67	118	89	140	115	68.0	40.1	6.0
Cu	ppm	165	318	164	124	308	461	30	340	324	96	979	581	126	15.7	8.3
Fe	%	2.4	3.0	1.6	1.5	2.6	2.5	1.3	2.8	1.4	3.5	5.9	4.3	2.7	0.98	0.270
Hg	ppm	<0.01	<0	<0.01	<0.01	<0.01	<0.03	0.020	0.010	0.040	0.010	0.11	0.030	***0.005***	***0.005***	***0.005***
Mo	ppm	124	396	17	16	77	91	14	438	225	96	467	166	35.0	4.5	1.8
Ni	ppm	2.8	6.0	2.6	2.8	3.8	6.4	1.8	5.1	3.6	2.0	20.80	8.43	2.75	1.11	0.70
Pb	ppm	15	9.1	23	23	19	15	15	9.0	9.1	8.8	179	44.7	12.3	4.0	2.6
Se	ppm	2.9	1.2	1.8	1.7	3.7	1.2	3.1	1.8	1.8	2.0	13.5	5.3	1.7	0.60	***0.25***
Tl	ppm	0.30	0.30	0.10	0.20	0.20	0.30	0.19	0.42	0.21	0.51	5.0	0.50	0.20	0.050	***0.050***
U	ppm	2.5	7.2	1.4	1.3	1.2	3.0	0.51	6.4	2.3	0.81	8.2	4.1	1.3	0.40	0.20
Zn	ppm	30	22	16	12	9.0	44	3.2	21	17	25	150	38.9	9.0	3.0	2.0

Notes: Values shaded in grey are higher than the 90th percentile for CAP waste static test samples; Values shaded in blue are lower than the 10th percentile for CAP waste static test samples. Values in bold italics for static test distribution include values below the limit of detection, which have been set at half the limit for statistical calculation purposes (Lorax, 2013). Values below detection for kinetic test samples have been set at the analytical limit. The full suite of solid phase element concentrations is provided in Appendix C.

Table 4-23:
Solid phase metal results for Supergene Sulphide Zone (SUS) waste rock kinetic test samples compared to the statistical distribution of SUS waste rock static test samples

Supergene Sulphide Zone (SUS)		*SUS Waste Kinetic Test Samples*							*Static Test Samples for SUS Waste (n = 40)*				
		Sat Col 5	**Sat Col 6**	**Sat Col 12 & 14 (lower)**	**Sat Col 13 (lower) & Sat Col 15 (full)**	**HC11**	**HC12**	**FB-5**	**Max**	**90th PCTL**	**Median**	**10th PCTL**	**Min**
Ag	ppm	0.80	1.2	0.96	0.46	0.40	0.50	0.50	2.2	1.0	0.50	0.25	***0.050***
Al	%	1.1	0.70	0.86	1.2	2.2	0.33	0.78	8.4	4.2	1.2	0.27	0.18
As	ppm	8.1	29	8.0	5.0	8.0	7.7	14	33.7	13.5	5.3	2.0	1.1
Cd	ppm	<0.1	<0.1	0.090	0.19	0.025	0.20	0.65	3.3	1.0	0.20	***0.050***	***0.025***
Cr	ppm	80	92	76	83	92	123	110	144	119	66.5	36.3	11.0
Cu	ppm	773	438	813	455	840	635	1567	1864	1287	819	200	60.5
Fe	%	2.6	2.6	2.5	2.9	4.1	2.7	2.3	6.5	5.6	3.4	1.7	0.39
Hg	ppm	<0.01	<0.01	0.020	0.030	<0.01	0.01	0.020	0.070	0.020	***0.0050***	***0.0050***	***0.0050***
Mo	ppm	48	39	120	60	4.3	4.4	21	169	115	24.9	2.7	0.90
Ni	ppm	7.7	3.3	7.7	12	4.8	3.3	4.4	46.7	17.7	7.5	3.2	2.0
Pb	ppm	4.6	7.6	5.5	4.1	3.9	6.8	15	16.9	11.2	5.0	3.2	2.0
Se	ppm	1.8	2.6	1.0	<1	4.3	4.3	3.4	10.2	3.9	1.4	0.57	***0.25***
Tl	ppm	0.20	0.20	0.22	0.20	0.50	<0.010	0.20	5.0	0.83	0.20	***0.05***	***0.05***
U	ppm	5.8	4.6	4.3	3.3	5.0	4.1	2.9	16.6	7.0	4.0	2.6	0.70
Zn	ppm	15	13	14	48	29	28	41	135	74.1	31.5	15.6	5.0

Notes: Values shaded in grey are higher than the 90th percentile for SUS waste static test samples; Values shaded in blue are lower than the 10th percentile for SUS waste static test samples. Values in bold italics for static test distribution include values below the limit of detection, which have been set at half the limit for statistical calculation purposes (Lorax, 2013). Values below detection for kinetic test samples have been set at the analytical limit. The full suite of solid phase element concentrations is provided in Appendix C.

Table 4-24:
Solid phase metal results for Hypogene Zone (HYP) waste rock kinetic tests samples compared to the statistical distribution of HYP waste rock static test samples

Hypogene Zone		*HYP Waste Kinetic Test Samples*																	*Static Test Samples for HYP Waste (n = 161)*				
		Sat Col 3	**Sat Col 4**	**Sat Col 7**	**Sat Col 9 (upper)**	**Sat Col 12, 13 & 14 (upper)**	**HC3**	**HC4**	**HC5**	**HC6**	**HC7**		**HC8**	**HC9**	**HC10**		**FB-6**	**FB-7**	**FB-8**	**Max**	**90th PCTL**	**Median**	**10th PCTL**	**Min**
Ag	ppm	1.1	0.90	0.90	0.50	0.45	0.80	0.30	0.60	0.70	0.40	1.1	0.60	0.50	2.0	0.60	0.62	0.56	0.41	10.7	1.2	0.50	0.20	***0.050***
Al	%	0.94	0.81	0.94	1.4	0.82	1.4	2.3	1.8	1.3	0.75	0.35	0.37	1.2	0.42	0.28	0.89	0.60	1.0	7.9	3.6	0.57	0.26	0.17
As	ppm	23	21	23	8.6	10	1.8	<0.5	3.0	14	33	23	6.3	3.9	44	16	5.9	9.5	4.1	389	33.8	5.8	1.9	***0.25***
Cd	ppm	1.2	0.50	0.60	0.20	0.10	0.20	0.10	<0.1	<0.01	0.20	0.30	0.10	0.20	0.50	<0.1	0.21	0.15	1.0	2.8	0.50	0.10	***0.050***	***0.025***
Cr	ppm	85	83	77	72	83	78	44	80	107	101	35	40	66	104	62	113	112	98	181	119	65.0	33.0	11.0
Cu	ppm	760	895	744	671	495	845	809	580	557	455	645	373	604	607	428	683	448	511	2838	1156	507	175	32.3
Fe	%	3.9	4.2	3.6	3.3	3.9	4.7	5.3	4.2	2.5	2.9	3.5	3.7	2.7	1.9	4.5	2.0	3.2	2.8	12.0	5.3	3.1	1.2	0.47
Hg	ppm	<0.01	0.020	<0.01	<0.01	0.020	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.10	<0.01	0.010	0.010	<0.01	0.28	0.050	***0.005***	***0.005***	***0.005***
Mo	ppm	75	37	40	25	30	71	14	73	11	13	70	26	14	84	223	40	47	55	543	102	25.1	3.5	0.60
Ni	ppm	7.6	7.4	6.7	7.6	10	20	7.2	19	14	5.1	8.9	9.9	8.1	7.3	5.8	4.3	8.5	15	43.0	14.8	5.8	3.0	1.5
Pb	ppm	11	8.2	17	6.0	6.9	2.7	5.8	1.8	3.4	11	22	11	2.4	6.6	7.0	7.2	11	7.8	154	15.8	6.9	3.3	1.0
Se	ppm	2.3	3.0	2.6	1.6	2.0	1.9	8.4	1.6	1.7	2.0	2.7	1.9	2.2	2.8	1.5	1.8	2.6	1.5	14.4	4.8	1.6	0.50	***0.25***
Tl	ppm	0.20	0.20	0.20	0.40	0.23	0.30	0.60	0.40	0.60	0.10	0.20	0.10	0.10	0.30	<0.01	0.10	0.24	0.20	5.0	1.1	0.20	***0.050***	***0.050***
U	ppm	9.1	7.7	9.5	3.9	3.9	18	5.7	4.6	2.6	7.2	2.9	4.7	3.9	4.8	5.0	4.3	3.1	3.2	27.7	7.9	4.4	2.1	0.90
Zn	ppm	102	36	54	37	19	31	23	23	13	26	21	14	33	71	4.0	22	17	50	190	66.0	21.0	9.0	4.0

Notes: Values shaded in grey are higher than the 90th percentile for HYP waste static test samples; Values shaded in blue are lower than the 10th percentile for HYP waste static test samples.
Values in bold italics for static test distribution include values below the limit of detection, which have been set at half the limit for statistical calculation purposes (Lorax, 2013).
Values below detection for kinetic test samples have been set at the analytical limit. The full suite of solid phase element concentrations is provided in Appendix C.

4.4.2 Ore Samples

The results of the aqua regia digestion analysis for ore samples are presented in Table 4-25 and Table 4-26, respectively, and compared to the statistical distribution of static test samples for their respective mineralogical zone. X-ray Florescence results for ore kinetic and metallurgical test samples are presented in Table 4-27.

With the exception of Cu, the SUS ore kinetic test sample (HC2) contains metals that are within the 10th and 90th percentile of the static test sample database for SUS ore (Table 4-25). The SUS ore samples used for metallurgical testwork, in particular those from the 2008 pilot plant study (*i.e.*, PP Ore Head #1 and PP Ore Head #2), have several metals that are higher than the 90th percentile of the static test sample database for SUS ore. It was noted that the 2008 pilot plant samples contained elevated metals and are not considered representative of the SUS ore as a whole. The 2012 pilot plant head sample is considered representative of the SUS ore. The HYP ore kinetic and metallurgical test samples are within the 10th and 90th percentile of the static test sample database for HYP ore (Table 4-26).

In general, the proportions measured by XRF analysis are consistent with the results of the aqua regia tests. However, as observed with tailings samples, consistent concentrations of Ba(F) were measured by XRF in ore samples compared to notably lower values measured by aqua regia digestion.

Table 4-25:
Solid phase metal results for Supergene Sulphide Zone (SUS) ore kinetic test samples compared to the statistical distribution of SUS ore static test samples.

Supergene Sulphide Zone (SUS)		*SUS Ore Kinetic and Metallurgical Test Samples*				*SUS Ore Samples (n = 27)*				
		HC2	**2008 PP Ore (Head #1)**	**2008 PP Ore (Head #2)**	**2012 pilot plant head sample**	**Max**	**90th PCTL**	**Median**	**10th PCTL**	**Min**
Ag	ppm	0.8	3.9	3.2	2.17	5.3	1.5	1.1	0.56	0.40
Al	%	0.81	0.84	0.88	1.36	8.5	7.9	1.4	0.31	0.18
As	ppm	10.4	69.1	59.4	37	90.0	44.6	14.0	2.4	1.7
Cd	ppm	1	1.5	1.9	0.77	4.1	1.1	0.20	***0.025***	***0.025***
Cr	ppm	77	84	89	74	115	88.6	49.0	15.2	6.0
Cu	ppm	2496	4447	4639	3600	7827	2426	1280	631	438
Fe	%	1.69	3.05	3.09	3.65	6.4	4.8	3.1	1.3	1.1
Hg	ppm	0.02	0.08	0.08	0.05	0.15	0.10	0.0075	***0.005***	***0.005***
Mo	ppm	160.9	229.7	241.5	330	1200	239	90.6	15.0	2.4
Ni	ppm	7.8	9.9	11.1	8.4	22.5	17.8	4.0	3.0	2.0
Pb	ppm	20.2	117.7	70.7	11.8	88.3	32.6	7.8	3.0	2.0
Se	ppm	1.7	3.6	3.9	1	3.5	2.7	1.3	***0.50***	***0.25***
Tl	ppm	<0.1	0.4	0.4	0.71	5.0	5.0	0.20	***0.080***	***0.050***
U	ppm	6.7	7.3	11.4	12	10.7	8.4	5.0	2.1	1.3
Zn	ppm	42	93	99	76	229	117	25.0	14.6	8.0

Notes: Values shaded in grey are higher than the 90th percentile for SUS ore static test samples;
Values shaded in blue are lower than the 10th percentile for SUS ore static test samples.
Values in bold italics for static test distribution include values below the limit of detection, which have been set at half the limit for statistical calculation purposes (Lorax, 2013).
Values below detection for kinetic test samples have been set at the analytical limit.
The full suite of solid phase element concentrations is provided in Appendix C.

Table 4-26:
Solid phase metal results for Hypogene Zone (HYP) ore kinetic test samples compared to the statistical distribution of HYP ore static test samples.

Hypogene Zone		*HYP Ore Kinetic and Metallurgical Test Samples*		*HYP Ore Samples (n = 58)*				
		HC1	**2012 pilot plant head sample**	**Max**	**90th PCTL**	**Median**	**10th PCTL**	**Min**
Ag	ppm	1.1	1.33	10.4	1.9	1.1	0.50	0.20
Al	%	0.94	0.85	8.6	6.0	0.92	0.33	0.18
As	ppm	10.8	6	166	31.6	6.9	2.1	1.1
Cd	ppm	0.1	0.32	1.9	0.73	0.20	***0.043***	***0.025***
Cr	ppm	78	83	130	93.0	56.5	29.7	8.0
Cu	ppm	1656	2020	3459	2151	1443	802	33.0
Fe	%	1.87	2.27	9.3	5.1	2.3	1.1	0.55
Hg	ppm	0.02	0.02	0.16	0.060	0.010	***0.005***	***0.005***
Mo	ppm	160.2	350	1515	565	159	37.0	3.6
Ni	ppm	7.9	6.8	16.2	12.4	5.4	3.3	2.0
Pb	ppm	5.7	8.3	74.3	23.9	8.3	4.1	1.5
Se	ppm	2.3	<1	7.3	3.3	1.5	0.90	***0.25***
Tl	ppm	0.1	0.32	5.0	5.0	0.20	***0.050***	***0.050***
U	ppm	4.2	6.82	74.9	9.9	4.9	2.3	1.6
Zn	ppm	23	40	220	52.9	24.0	12.7	6.0

Notes: Values shaded in grey are higher than the 90th percentile for HYP ore static test samples;
Values shaded in blue are lower than the 10th percentile for HYP ore static test samples.
Values in bold italics for static test distribution include values below the limit of detection, which have been set at half the limit for statistical calculation purposes (Lorax, 2013).
Values below detection for kinetic test samples have been set at the analytical limit.
The full suite of solid phase element concentrations is provided in Appendix C.

Table 4-27:
X-ray fluorescence results for humidity cell ore samples and metallurgical tests.

Sample Description		**HYP**	**82% SUP 18% HYP**	**PP Ore Head #1**	**PP Ore Head #2**
Kinetic Test		**HC1**	**HC2**	**2008 SUS Metallurgical Test**	
Oxide	**Unit**				
Al_2O_3	%	15.6	14.6	14.63	14.78
Ba	%	0.19	0.18	0.15	0.15
CaO	%	2.56	0.61	1.10	1.15
Cr_2O_3	%	*ND*	*ND*	*ND*	*ND*
Fe_2O_3	%	2.93	2.75	5.27	5.48
K_2O	%	5.72	6.43	5.32	5.36
MgO	%	1.33	0.6	1.22	1.24
MnO	%	0.01	0.01	0.05	0.04
Na_2O	%	1.19	0.74	0.69	0.75
P_2O_5	%	0.11	0.11	0.15	0.16
SiO_2	%	64.3	69.3	64.94	64.39
TiO_2	%	0.42	0.32	0.44	0.46
LOI	%	4.9	3.8	5.12	5.25
Total	%	99.26	99.45	99.08	99.21

Notes**:** ND = no data; LOI = loss on ignition.

4.4.3 Tailings

Solid phase elements for whole tailings and tailings components (*i.e.*, sands, fines and concentrate) produced by the Casino metallurgical tests are presented in Table 4-28 and Table 4-29, respectively. As expected, the pyrite concentrate and cleaner samples (Table 4-29) have higher metal concentrations compared to the whole tailings (Table 4-28) and, in particular, the depyritized sands (>74 mm) and fines (<74 mm) (Table 4-29), which are deplete of metals. Of note, is the higher concentration of metals for the 2008 whole tailings compared to the 2009, 2010, and 2012 samples. The higher metal values for the 2008 tailings is due, in part, to the higher concentration of SUP in the 2008 samples and to the fact that the 2010 and 2012 tailings are pyrite rougher (*i.e.*, depyritized) whole tailings.

Results of the XRF analysis are provided in Table 4-30. This technique is more robust than the aqua regia technique in that it measures the entire composition of a rock, rather than just the phases which can be digested by aqua regia. In general, the proportions measured by XRF analysis are consistent with the results of the aqua regia tests. However, higher concentrations of Ba(F) were measured by XRF in the tailings products (Table 4-30) compared to notably lower values measured in the 2012 pyrite rougher concentrate and cleaner tailings by aqua regia digestion. This may be due to the inefficient dissolution of the non-acid generating Ba-sulphate mineral barite by aqua regia digestion.

Table 4-28:
Solid phase metal results for SUP and HYP whole tailings compared to the statistical distribution for their respective ore static test samples.

Sample Description		2008			2009					2010	2012		
		(71% SUP, 22% HYP, 7% CAP)			SSH Comp 1 (50% HYP 50% SUS)	HZ Comp 2 (HYP)	SS Comp 3 (SUS)	40% SSH Comp 1, 40% HZ Comp 2, 20% SS Comp 3	83% HZ Comp 2, 17% SS Comp 3	PyRo whole (85% SUS and 15% HYP)	PyRo whole (HYP)	PyRo feed (SUP)	PyRo feed (HYP)
Kinetic Test		T1	T2	T3	Sat Col 1			T4	Sat Col 8	Sat Col 10 & T5	Sat Col 16 & T7		
Ag	ppm	1.4	1.5	2	0.4	0.2	0.2	0.28	0.2	0.3	0.27	0.5	0.65
Al	%	0.72	0.7	0.88	0.42	0.42	0.48	0.43	0.43	0.97	1.03	1.08	2.15
As	ppm	41.7	43.6	43.3	17.5	3.1	4.1	9.06	3.3	3.6	3	6	15
Cd	ppm	1.1	0.9	1.7	0.2	0.2	0.1	0.18	0.18	0.3	0.41	0.48	1.09
Cr	ppm	14	10	21	17	34	46	29.6	36	9	121	107	101
Cu	ppm	1424	1436	1853	388	102	102	216	102	283	195	301	533
Fe	%	2.5	2.4	3.2	3.4	0.84	1.15	1.93	0.89	1.2	1.72	2.77	3.56
Hg	ppm	0.05	0.05	0.07	<0.01	<0.01	<0.01	0.01	0.01	<0.01	0.03	0.05	0.05
Mo	ppm	51.5	58.6	91.4	14.8	16	14.3	15.2	16	137	37.5	34.8	25.4
Ni	ppm	10.5	9.9	19.7	10.3	12.2	17.4	12.5	13	3.8	26.6	35.7	38.8
Pb	ppm	62	66.6	108.7	6.1	4.5	2.9	4.82	4.2	4.4	5	6.5	11.4
Se	ppm	2	1.7	1.7	4.5	0.6	0.7	2.18	0.62	0.5	<1	1	1
Tl	ppm	0.3	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.3	0.31	0.53	0.28
U	ppm	8.2	9.4	10.7	5.6	5.5	2.6	4.96	5	*ND*	5.31	6.46	4.34
Zn	ppm	77	65	85	14	24	22	19.6	24	31	36	67	36

Notes: ND = no data;
Values below detection for kinetic test samples have been set at the analytical limit. The full suite of solid phase element concentrations is provided in Appendix C.

Table 4-29:
Solid phase metal results for SUP and HYP tailings components compared to the statistical distribution for their respective ore static test samples.

Sample Description		**2010**					**2012**	
		85% SUS and 15% HYP					**HYP**	
		PyRo Sands >74mm	**PyRo Tails <74mm**	**PyRo Conc.**	**Cleaner Tails**	**21% PyRo (<74 µm), 23% PyRo Conc, 56% Cleaner Tails**	**PyRo Sands >74 mm**	**PyRo Conc.**
Kinetic Test		**Col 5 & T6**				**Sat Col 11**	**Col 6**	**Sat Col 17**
Ag	ppm	0.2	0.2	2.2	1.9	1.61	0.32	3.26
Al	%	1.01	1.62	1.02	1.33	1.32	0.71	0.87
As	ppm	3.3	5.4	45	46.7	37.6	2	36
Cd	ppm	0.3	0.8	0.5	0.8	0.73	0.25	1.21
Cr	ppm	8	17	10	165	98.3	88	133
Cu	ppm	283	339	1146	906	842	381	2940
Fe	%	1.23	1.67	10.9	10.9	8.95	1.14	9.79
Hg	ppm	<0.01	<0.01	0.03	0.03	0.03	0.01	0.12
Mo	ppm	95.6	19.9	228	657	425	85.3	634
Ni	ppm	4.2	8.4	27.7	146	90.1	6.7	52.4
Pb	ppm	3.7	8.4	12.8	19.6	15.7	4.2	21
Se	ppm	<0.5	<0.5	7.5	7.6	6.09	<0.5	9
Tl	ppm	0.3	0.3	0.4	0.4	0.38	0.23	0.44
U	ppm	*ND*	*ND*	*ND*	*ND*	*ND*	2.46	8.7
Zn	ppm	31	48	48	62	55.8	27	58

Notes: Values shaded in grey are higher than the 90th percentile for respective ore static test samples.
Values shaded in blue are lower than the 10th percentile for respective ore static test samples.
Values in bold italics for static test distribution include values below the limit of detection, which have been set at half the limit for statistical calculation purposes (Lorax, 2013).
Values below detection for kinetic test samples have been set at the analytical limit. The full suite of solid phase element concentrations are provided in Appendix C.

Table 4-30:
X-ray fluorescence results for tailings produced by metallurgical tests.

Sample Description		2008 Pilot Plant (71% SUP, 22% HYP, 7% CAP)			2010 Bench Scale (85% SUS and 15% HYP)					
		Sample 1	Sample 2	Sample 3	PyRo Tails whole	PyRo Sands >74mm	PyRo Tails <74mm	PyRo Conc.	Cleaner Tails	21% PyRo Tails 23% PyRo Conc. 56% Cleaner Tails
Kinetic Test		T1	T2	T3	Sat Col 10 & T5	Col 5 & T6				Sat Col 11
Oxide	**Unit**									
Al_2O_3	%	14.91	14.73	16.32	15.11	14.89	20.15	14.27	15.4	16.14
Ba(F)	%	0.16	0.16	0.16	0.17	0.18	0.18	0.14	0.14	0.15
CaO	%	1.39	1.3	1.52	0.95	0.97	1.38	0.81	1.2	1.15
Cr_2O_3	%	*ND*	*ND*	*ND*	<0.001	<0.001	0.002	0.004	0.048	0.03
Fe_2O_3	%	4.49	4.27	5.39	2.54	2.49	3.33	17.12	16.54	13.9
K_2O	%	5.39	5.29	5.27	4.56	4.56	5.29	4.01	4.02	4.28
MgO	%	1.25	1.24	1.38	1.59	1.61	2.05	1.48	1.61	1.67
MnO	%	0.05	0.05	0.1	0.03	0.03	0.04	0.03	0.03	0.03
Na_2O	%	0.69	0.74	0.65	1.06	1.09	1	0.69	0.73	0.78
P_2O_5	%	0.16	0.15	0.17	0.16	0.16	0.29	0.16	0.2	0.21
SiO_2	%	65.96	66.79	62.21	69.2	70	59.7	49.4	47.6	50.56
TiO_2	%	0.45	0.46	0.52	0.49	0.5	0.69	0.51	0.54	0.56
LOI	%	*4.34*	*4.2*	*4.83*	*3.23*	*3.11*	*5.59*	*10.91*	*11.3*	
Total	%	*99.24*	*99.38*	*98.52*	*99.16*	*99.56*	*99.69*	*99.53*	*99.29*	

Notes: ND: no data; LOI = loss on ignition
Values listed for Sat Col 11 were calculated based on the proportions used in the kinetic test.

4.4.4 CAP Oxide Heap Leach Residue

The results of the aqua regia digestion and XRF analysis for residue sample CL-01 L produced by the column leach of CAP ore are presented in Table 4-31. Similar to the SUP and HYP whole tailings and concentrate samples, the oxide heap leach residue sample has elevated solid phase concentrations of Ag, As, Bi, Cd, Cu, Mo, Sb, Se and Th.

In general, the proportions measured by XRF analysis are consistent with the results of the aqua regia tests. However, a considerably higher proportion of Al_2O_3 was measured relative to the aqua regia method, possibly owing to undigested aluminosilicate minerals by the less robust aqua regia digestion.

Table 4-31:
Solid phase metal and XRF results for CAP heap leach residue sample CL-01 L.

Aqua Regia						XRF		
Metal	**Unit**	**Results**	**Metal**	**Unit**	**Results**	**Parameter**	**Unit**	**Results**
Ag	ppm	1.3	Mo	ppm	124.7	Al_2O_3	%	13.85
Al	%	0.84	Na	%	0.022	Ba(F)	%	0.16
As	ppm	32.6	Ni	ppm	6.8	CaO	%	0.52
Ba	ppm	84	P	%	0.049	Fe_2O_3	%	5.85
Bi	ppm	3.6	Pb	ppm	28.2	K_2O	%	5.53
Ca	%	0.36	Sb	ppm	2.9	MgO	%	0.93
Cd	ppm	0.6	Se	ppm	3.4	MnO	%	0.01
Co	ppm	6.3	Sr	ppm	29	Na_2O	%	0.37
Cr	ppm	69	Th	ppm	9.9	P_2O_5	%	0.11
Cu	ppm	569.3	Ti	%	0.018	SiO_2	%	66.96
Fe	%	3.45	Tl	ppm	0.2	TiO_2	%	0.40
Hg	ppm	0.02	U	ppm	2.6	LOI	%	4.34
K	%	0.54	V	ppm	27	*Total*	*%*	*99.03*
Mg	%	0.34	Zn	ppm	56			
Mn	ppm	92						

Notes: LOI = loss on ignition.
The full suite of solid phase element concentrations is provided in Appendix C.

4.5 Shake Flask Extractions

Metal contents measured in SFE provide a measure of the mass of readily soluble metals which will be immediately available for leaching upon exposure to infiltrating water. In order to highlight the significance of various SFE results, the results are compared to Metal Mining Effluent Regulations (MMER, 2002) and Canadian Council of Ministers of the Environment (CCME, 2007) water quality guidelines for the protection of aquatic life. These guidelines are presented in Table 4-32. Any parameter that exceeds the maximum authorized monthly mean (MMM) is shaded in light grey in the SFE results tables; the maximum authorized concentration in a composite sample (MCS) is shaded in medium grey, the maximum authorized concentration in a grab sample (MGS) is shaded in dark grey, and the maximum CCME guideline is shaded in blue. Hardness dependent guidelines, including Cd, Cu, Ni and Pb, were calculated based on the mean water hardness of 111.4 mg $CaCO_3$/L.

Table 4-32:
MMER and CCME Water Quality Guidelines for Protection of Aquatic Life.

Parameter	Symbol	Units	MMER			CCME
			MMM	MCS	MGS	Max
pH			*NP*	*NP*	*NP*	6.5 – 9.0
Nitrite	NO_2	mg/L	*NP*	*NP*	*NP*	0.06
Nitrate	NO_3	mg/L	*NP*	*NP*	*NP*	13
Total Cyanide	CN	mg/L	*NP*	*NP*	*NP*	0.005
Silver	Ag	mg/L	*NP*	*NP*	*NP*	0.0001
Aluminum	Al	mg/L	*NP*	*NP*	*NP*	0.1
Arsenic	As	mg/L	0.5	0.75	1	0.005
Cadmium	Cd	mg/L	*NP*	*NP*	*NP*	0.000036*
Chromium	Cr	mg/L	*NP*	*NP*	*NP*	0.0089
Copper	Cu	mg/L	0.3	0.45	0.6	0.0026*
Iron	Fe	mg/L	*NP*	*NP*	*NP*	0.3
Mercury	Hg	mg/L	*NP*	*NP*	*NP*	0.000026
Molybdenum	Mo	mg/L	*NP*	*NP*	*NP*	0.073
Nickel	Ni	mg/L	0.5	0.75	1	0.104*
Lead	Pb	mg/L	0.2	0.3	0.4	0.0036*
Selenium	Se	mg/L	*NP*	*NP*	*NP*	0.001
Thallium	Tl	mg/L	*NP*	*NP*	*NP*	0.0008
Uranium	U	mg/L	*NP*	*NP*	*NP*	0.015
Zinc	Zn	mg/L	0.5	0.75	1	0.03

Notes: NP = none proposed;
MMER = Metal Mining Effluent Regulations (MMER, 2002);
MMM = maximum authorized monthly mean;
MCS = maximum authorized concentration in a composite sample; and
MGS = maximum authorized concentration in a grab sample.
CCME = Canadian Council of Ministers of the Environment (CCME, 2007).
*Hardness dependent guidelines were calculated based on a mean water hardness of 111.4 mg $CaCO_3$/L for WQ station W4 on lower Casino Creek.

4.5.1 Waste Rock

The SFE results for waste rock laboratory and field kinetic test samples are presented according to mineralization zone in Table 4-33, Table 4-34 and Table 4-35. All CAP kinetic test samples except Col 4a have acidic rinse pH values of < 6 (Table 4-33). Col 4a has a rinse pH of 7.6, consistent with a higher paste pH of 6.45.

The only parameter to exceed MMER MCS or MMM guidelines in shake flask extraction tests for the CAP samples is dissolved Cu. Metals which consistently exceed the CCME guideline in CAP samples include Al, Cd, Cu, Fe, Hg, Se and Zn (Table 4-33). Additionally, D-Cr, Tl and U in Col 3 SFE exceed CCME guidelines and D-Mo in Col 4a and FB-3 fines SFEs exceed the CCME guideline. The overall highest concentrations of metals in SFE are from Col 3 and the finer fractions of FB-3 and FB-4. The highest leached D-Mo concentration is from Col 4a, despite below average solid phase content (91 ppm in

Table 4-23). In general, concentrations of metals in SFE from CAP waste rock do not correspond to solid phase concentrations, but rather reflect drainage pH.

Several SUP kinetic test samples, including Sat Col 5, Sat Col 6 and the lower layer for Sat Col 12 and 14 have acidic rinse pH values (< 5.3) (Table 4-34). The 'neutral' SUP placed in Sat Col 15 and the lower layer of Sat Col 13 has a rinse pH of 7.6. Both the gravel and finer fraction of FB-5, which is composed of nearly 1:1 SUP and CAP waste rock, produced a neutral rinse pH of 7.1. This is of note given that Sat Col 6, which is composed of equal proportions of SUS and CAP, has a very acidic rinse pH of 3.4.

Dissolved Cu is leached at concentrations that exceed the MMER MCS guideline in the low rinse pH SUP samples (Table 4-34). Dissolved Cu also exceeds the MMER MMM guideline in FB-5 despite the neutral pH and likely reflects the higher solid phase Cu content of the sample (1567 ppm in Table 4-24). Dissolved Zn exceeds the MMER MMM guideline only in SFE from the 'acidic' SUP (lower layer of Sat Col 12 and 14). Metals which exceed the CCME guideline in SUP sample SFEs include Al, Cd, Cu, Se and Zn. Additionally, D-Cr, Fe and U in SFEs from the low rinse pH samples, D-Mo in SFE from the 'neutral' SUP (Sat Col 15 and the lower layer of Sat Col 13) and D-Hg in SFE from both fractions of FB-5 exceed CCME guidelines. The overall highest sulphate and metal loads are in SFEs from Sat Col 6 and Sat Col 12 and 14, consistent with low drainage pH.

All HYP waste rock kinetic test samples have neutral to slightly alkaline rinse pH values and metal concentrations below the MMER guidelines (Table 4-35). Metals which consistently exceed the CCME guideline in HYP sample SFEs include D-Cd, Cu, Se and U. Additionally, D-Hg and Mo in SFEs from the finer fractions of FB-6, FB-7 and FB-8 also exceed CCME guidelines. In general, a higher dissolved sulphate and metal load is associated with the finer grain size fraction of the HYP field bins, indicating that the finer grained material has a greater mass of oxides relative to the gravel sized fraction.

A comparison of the waste rock from the different mineralization zones of the Casino deposit demonstrates that the overall highest dissolved loads in SFEs, including Al, Cd, Co, Cr, Cu, Mn, Ni, Pb, Se, Zn and, to a lesser extent, sulphate, are from the 'acidic' SUP (lower layer of Sat Col 12 and 14), Sat Col 6 (50% SUP, 50% CAP) and Col 3 (80% CAP, 20% SOX), all of which have the lowest rinse pH values of 3.4 – 3.7. The highest sulphate and D-Mo are in SFEs from the fine fraction of HYP zone field bin tests (FB-6, FB-7 and FB-8). Collectively, SFEs from HYP waste rock samples have the highest sulphate concentrations. The greatest concentrations of D-Hg are generally observed for the CAP waste rock samples.

Table 4-33:
Shake flask extractions for CAP waste rock kinetic test samples.

Sample Description		**CAP**	**CAP**	**95% CAP 5% SUS**	**95% CAP 5% SUS**	**80% CAP 20% SOX**	**81% CAP 13% SUS 6.3% OVB**	**CAP**		**CAP**		**CAP**		**CAP**	
								gravel	**sand/fines**	**gravel**	**sand/fines**	**gravel**	**sand/fines**	**gravel**	**sand/fines**
Kinetic Test		**Sat Col 9** (lower)	**Col 1**	**Sat Col 2& Col 2A**	**Col 2B**	**Col 3**	**Col 4a**	**FB1**		**FB2**		**FB3**		**FB4**	
Parameter	**Units**														
pH		4	6	5.9	5.9	3.7	7.6	6	7.6	5.6	5.1	5.1	5.4	4.1	4.9
Redox	mV	402	370	348	357	382	366	275	334	289	328	278	234	432	251
Conductivity	uS/cm	492	155	74	76	1491	396	37	151	118	218	182	312	170	312
T-Acidity (to pH 8.3)	mg $CaCO_3$/L	93	7	6.5	6.7	725	2.8	5	3.4	6.5	15	14	16	37	39
T-Alkalinity	mg $CaCO_3$/L	*NA*	4.7	2.3	2.2	*NA*	39	1.9	61	3.2	2.1	0.57	2.7	*NA*	0.6
Chloride	mg/L	2.2	4.8	2.4	2.4	<3	3.5	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Fluoride	mg/L	0.51	<0.06	0.33	0.34	0.68	0.34	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Sulphate	mg/L	265	40	20	17	1080	146	11	12	39	67	73	127	51	125
Dissolved Metals															
Hardness	mg $CaCO_3$/L	123	3.9	1.2	1.7	290	127	1.2	43	5	7.5	41	58	8	21
Ag	mg/L	0.00005	0.00003	0.00003	0.00004	0.00005	0.00006	0.000042	0.000076	0.000035	0.000017	0.000026	0.000016	0.000025	0.000024
Al	mg/L	13	0.15	0.24	0.32	103	0.015	0.16	0.063	0.11	0.62	0.81	1.1	3.7	3.6
As	mg/L	0.0005	0.0005	0.0006	0.0007	0.0008	0.0009	0.00074	0.0017	0.00039	0.00092	0.0015	0.0028	0.0014	0.0045
B	mg/L	0.009	0.008	0.008	0.009	0.013	0.009	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.19
Ba	mg/L	0.038	0.041	0.01	0.014	0.029	0.077	0.049	0.058	0.058	0.041	0.071	0.061	0.026	0.024
Bi	mg/L	<0.00001	<0.00001	0.00002	0.00004	<0.00001	0.00006	0.000012	0.000063	<0.000005	<0.000005	<0.000005	0.000006	<0.000005	<0.000005
Ca	mg/L	37	1.1	0.34	0.49	75	40	0.35	16	1.3	2.2	12	19	1.4	6.5
Cd	mg/L	0.0003	0.000057	0.000035	0.000039	0.0015	0.00026	0.000034	0.00005	0.000052	0.00078	0.0015	0.0011	0.00026	0.00085
Co	mg/L	0.019	0.00083	0.00038	0.00057	0.068	0.00096	0.00015	0.00031	0.00073	0.001	0.043	0.016	0.013	0.034
Cr	mg/L	0.0057	0.0008	0.0014	0.0013	0.011	0.0024	0.002	0.0019	0.0005	0.0023	0.0006	0.0017	0.0059	0.019
Cu	mg/L	0.89	0.25	0.095	0.11	21.4	0.024	0.036	0.02	0.21	0.57	2	1.5	0.28	0.47
Fe	mg/L	0.76	0.04	0.03	0.07	39	<0.01	0.12	0.084	0.027	0.13	0.15	1	0.62	4.8
Hg	mg/L	0.00003	<0.00001	<0.00001	<0.00001	<0.00001	0.00008	0.00004	0.00004	0.00003	0.00008	0.00008	0.00014	0.00002	0.00002
K	mg/L	8.4	2.4	2.3	2.5	26	4.1	2.6	3.4	2.3	2.7	8.8	8	4.2	13
Mg	mg/L	7.7	0.27	0.086	0.1	25	6.8	0.08	0.99	0.41	0.47	2.6	2.4	1.1	1.2
Mn	mg/L	0.75	0.026	0.008	0.009	0.71	0.13	0.0082	0.037	0.018	0.057	0.2	0.54	0.079	0.39
Mo	mg/L	0.003	0.02	0.005	0.0051	0.0042	0.15	0.0011	0.03	0.0094	0.039	0.013	0.1	0.02	0.0091
Na	mg/L	21	24	13	12	15	36	5	16	19	39	10	33	11	37
Ni	mg/L	0.013	0.001	0.0005	0.0005	0.046	0.0013	0.00084	0.0046	0.00078	0.0011	0.0083	0.012	0.0061	0.011
P	mg/L	0.01	0.03	<0.01	<0.01	<0.01	0.04	0.004	0.022	0.028	0.05	0.015	0.038	0.007	0.01
Pb	mg/L	0.0021	0.00014	0.00028	0.00033	0.0012	0.00004	0.00028	0.0028	0.00017	0.0084	0.00045	0.00031	0.13	0.0021
Sb	mg/L	0.0005	0.0005	0.0026	0.0026	0.0003	0.0021	0.001	0.0012	0.00019	0.0011	0.0017	0.0015	0.00033	0.0017
Se	mg/L	0.0038	0.0012	0.0015	0.0016	0.0057	0.0014	0.0037	0.015	0.00086	0.0021	0.0064	0.015	0.0023	0.0052
Si	mg/L	2.2	6.1	3.5	3.4	2.9	2.6	2	4.8	8.1	8.1	3	3.9	1.5	4.6
Sr	mg/L	0.16	0.01	0.0037	0.0044	0.37	0.19	0.0031	0.039	0.015	0.017	0.051	0.077	0.022	0.037
Tl	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	0.0009	<0.0002	0.000053	0.000025	0.000097	0.000091	0.0002	0.00014	0.00027	0.00022
U	mg/L	0.0094	0.0011	0.00031	0.00054	0.032	0.00049	0.0004	0.00037	0.00076	0.0032	0.00075	0.0013	0.0014	0.0014
Zn	mg/L	0.47	0.009	0.004	0.003	0.11	0.001	0.0035	0.0026	0.005	0.032	0.052	0.066	0.057	0.13

Note: 24 Hour NanoPure Water Leach Extraction Test at 3:1 Liquid to Solid Ratio;
Values shaded in blue exceed the maximum CCME guidelines and values shaded in grey exceed the MMER guidelines according to the limits outlined in Table 4-32.

Table 4-34:
Shake flask extractions for SUP waste rock kinetic test samples.

Sample Description		**90% SUS 5% CAP 5% HYP**	**50% SUS 50% CAP**	**SUP (neutral)**	**SUP (acidic)**	**56% SUP 44% CAP**	
						gravel	**sand & fines**
Kinetic Test		**Sat Col 5**	**Sat Col 6**	**Sat Col 13** (lower) **& Sat Col 15** (full)	**Sat Col 12 & 14** (lower)	**FB5**	
Parameter	**Units**						
pH		5.3	3.4	7.6	3.7	7.1	7.1
Redox	mV	360	442	261	403	133	224
Conductivity	uS/cm	499	1266	267	1272	95	234
Total Acidity (pH 8.3)	mg $CaCO_3$/L	21	725	6.8	401	3.6	4.3
Alkalinity	mg $CaCO_3$/L	1.1	*ND*	55	*ND*	9.9	8.9
Chloride	mg/L	2.4	<3	*ND*	*ND*	*ND*	*ND*
Fluoride	mg/L	0.48	0.94	*ND*	*ND*	*ND*	*ND*
Sulphate	mg/L	243	950	92	927	28	67
Dissolved Metals							
Hardness	mg $CaCO_3$/L	202	107	76	390	11	9.3
Ag	mg/L	<0.00001	0.00003	0.00002	0.00008	0.00001	0.000011
Al	mg/L	0.86	133	0.014	75	0.052	0.093
As	mg/L	0.0006	0.0012	0.0007	0.0019	0.0014	0.0042
B	mg/L	0.006	0.006	0.017	0.0047	<0.05	<0.05
Ba	mg/L	0.02	0.012	0.03	0.013	0.033	0.0088
Bi	mg/L	<0.00001	0.00002	<0.00001	<0.00001	0.000028	0.000014
Ca	mg/L	66	18	23	111	3.8	3
Cd	mg/L	0.0032	0.0019	0.000079	0.0026	0.00071	0.00048
Co	mg/L	0.081	0.36	0.0016	0.3	0.0011	0.0014
Cr	mg/L	<0.0005	0.033	<0.0005	0.0081	0.0001	0.0004
Cu	mg/L	3.3	21	0.03	73	0.27	0.49
Fe	mg/L	1	15	<0.003	4.2	0.031	0.048
Hg	mg/L	<0.00001	<0.00001	0.00001	<0.00001	0.00004	0.00004
K	mg/L	5.7	0.46	6.4	5.5	2.1	2.5
Mg	mg/L	8.9	15	4.4	27	0.4	0.45
Mn	mg/L	1.9	0.95	0.2	1.2	0.026	0.027
Mo	mg/L	0.0002	0.00069	0.12	0.00094	0.017	0.056
Na	mg/L	3	1.3	19	13	13	41
Ni	mg/L	0.017	0.051	0.0008	0.071	0.0034	0.0016
P	mg/L	<0.01	<0.01	<0.009	0.19	0.012	0.074
Pb	mg/L	0.00031	0.00066	0.00003	0.00011	0.00033	0.00075
Sb	mg/L	0.0011	0.0002	0.0002	0.0037	0.0055	0.0086
Se	mg/L	0.0078	0.011	0.001	0.007	0.0069	0.02
Si	mg/L	0.67	1.1	1.3	2.2	1.9	3.6
Sr	mg/L	0.18	0.01	0.098	0.062	0.022	0.0096
Tl	mg/L	<0.0002	<0.0002	0.00003	0.00026	0.000036	0.000028
U	mg/L	0.0079	0.33	0.00089	0.2	0.00017	0.00025
Zn	mg/L	0.11	0.24	0.002	0.87	0.011	0.015

Note: 24 Hour NanoPure Water Leach Extraction Test at 3:1 Liquid to Solid Ratio; Values shaded in blue exceed the maximum CCME guidelines and values shaded in grey exceed the MMER guidelines according to the limits outlined in Table 4-32.

Table 4-35:
Shake flask extractions for HYP waste rock kinetic test samples.

Sample Description		HYP	HYP	HYP	89% HYP 11% SUS	HYP	92% HYP 8% SUP		HYP		HYP	
							gravel	sand & fines	gravel	sand & fines	gravel	sand & fines
Kinetic Test		**Sat Col 3**	**Sat Col 4**	**Sat Col 7**	**Sat Col 9 (upper)**	**Sat Col 12, 13 & 14 (upper)**	**FB6**		**FB7**		**FB8**	
Parameter	**Units**											
pH		7.1	7.5	7	7.3	7.5	7.5	7.5	8	8	7.7	7.7
Redox	mV	289	300	330	273	225	242	264	235	240	259	270
Conductivity	uS/cm	1528	1634	1408	1518	265	1223	2482	237	484	709	2615
Total Acidity (to pH 8.3)	mg $CaCO_3$/L	11	8.6	11	6.5	9.8	5.5	7.5	2.9	3.2	3.7	7
Alkalinity	mg $CaCO_3$/L	42	41	45	44	69	42	49	77	84	51	60
Chloride	mg/L	2.7	3	2.7	3.1	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Fluoride	mg/L	0.31	0.35	0.3	0.6	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Sulphate	mg/L	910	903	793	990	83	673	1663	45	129	331	1820
Dissolved Metals												
Hardness	mg $CaCO_3$/L	835	871	769	938	101	763	1590	99	120	371	1770
Ag	mg/L	0.00001	0.00003	<0.00001	<0.00001	0.00002	0.000007	0.00004	0.000008	0.000017	0.000006	0.00009
Al	mg/L	0.0083	0.02	0.0071	0.0064	0.021	0.049	0.096	0.047	0.075	0.029	0.065
As	mg/L	0.0009	0.0009	0.0007	0.0011	0.0014	0.00082	0.0032	0.00095	0.005	0.0006	0.0021
B	mg/L	0.007	0.009	0.011	0.009	0.009	<0.05	<0.3	<0.05	<0.05	<0.05	0.54
Ba	mg/L	0.025	0.023	0.023	0.026	0.038	0.028	0.058	0.042	0.017	0.032	0.065
Bi	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.000005	<0.00003	0.000006	0.000005	<0.000005	<0.00003
Ca	mg/L	316	334	290	347	30	294	609	33	41	131	635
Cd	mg/L	0.00018	0.00068	0.00019	<0.000003	0.000029	0.00026	0.0011	0.00013	0.0023	0.00021	0.00078
Co	mg/L	0.0016	0.0059	0.0016	0.0019	0.00055	0.002	0.0039	0.00061	0.00071	0.00048	0.0028
Cr	mg/L	<0.0005	<0.0005	<0.0005	0.0008	<0.0005	0.0002	0.001	0.0001	0.0005	0.0002	0.0006
Cu	mg/L	0.0044	0.007	0.0022	0.0098	0.015	0.01	0.048	0.0064	0.026	0.017	0.037
Fe	mg/L	<0.01	<0.01	<0.01	<0.01	<0.003	0.006	0.018	0.009	0.04	0.002	0.013
Hg	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.00005	<0.00001	0.00002	<0.00001	<0.00005
K	mg/L	12	13	11	15	8.4	4.1	11	5.6	11	6	29
Mg	mg/L	11	9.2	11	17	6.4	6.8	18	4.2	4.5	11	45
Mn	mg/L	0.38	0.93	0.43	0.19	0.0082	0.15	0.7	0.022	0.014	0.036	0.41
Mo	mg/L	0.0039	0.0032	0.0032	0.021	0.016	0.047	0.34	0.019	0.1	0.029	0.23
Na	mg/L	6.4	10	6.5	19	7.8	12	66	10	55	16	59
Ni	mg/L	0.0018	0.0037	0.0017	0.0021	0.0025	0.0036	0.0089	0.0039	0.0057	0.0023	0.022
P	mg/L	<0.01	<0.01	<0.01	0.01	<0.009	0.005	0.014	<0.002	0.022	0.004	0.023
Pb	mg/L	<0.00002	0.00002	<0.00002	0.00006	0.00013	0.0006	0.00098	0.00054	0.0032	0.00015	0.00043
Sb	mg/L	0.0008	0.0009	0.0007	0.002	0.0018	0.0015	0.0045	0.0078	0.029	0.0004	0.0016
Se	mg/L	0.0015	0.0019	0.0015	0.001	0.0016	0.0011	0.0062	0.0019	0.005	0.00046	0.0026
Si	mg/L	1	0.93	0.98	1.1	1.7	1	2	1.1	2.1	1.2	2.2
Sr	mg/L	1.4	1.6	1.3	1.1	0.25	0.79	1.8	0.24	0.35	0.95	4
Tl	mg/L	<0.0002	<0.0002	<0.0002	<0.0002	0.00002	0.000033	0.00004	0.000021	0.000036	0.00002	0.00005
U	mg/L	0.034	0.023	0.033	0.033	0.012	0.023	0.072	0.015	0.036	0.01	0.074
Zn	mg/L	0.002	0.002	0.002	0.003	<0.001	0.0022	0.0092	0.0013	0.023	0.0019	0.0055

Note: 24 Hour NanoPure Water Leach Extraction Test at 3:1 Liquid to Solid Ratio;
Values shaded in blue exceed the maximum CCME guidelines and values shaded in grey exceed the MMER guidelines according to the limits outlined in Table 4-32.

4.5.2 Ore, Tailings and Heap Leach Residue

4.5.2.1 Ore

The SFE results for SUP and HYP ore samples used in the 2012 metallurgical tests are presented in Table 4-36. The complete results are provided in Appendix C Rinse pH is neutral for both samples. Only D-Cd and D-Se exceed the CCME guidelines for aquatic life in both the SUP and HYP ore samples. Additionally, D-Cu exceeds the guideline in the SUP ore and D-U exceeds the guideline in the HYP ore.

4.5.2.2 2008 Tailings

The SFE results for tailings produced during the 2008 metallurgical tests are presented in Table 4-37. The complete results are provided in Appendix C Rinse pH is neutral for all three samples. Dissolved Al, As, Cd, Cu, Mo and Se exceed CCME guidelines for aquatic life in SFEs from each of the 2008 tailings. Additionally, D-Hg exceeds the CCME guideline in sample T3.

4.5.2.3 CAP Heap Leach Residue

The SFE results for the residue sample CL-01 L produced by column leaching of CAP ore is presented in Table 4-38. The complete results are provided in Appendix C Rinse pH is neutral. Parameters which exceed the CCME guidelines for aquatic life in the residue SFE include, nitrite (as N), total cyanide and D-As, Mo and Se, consistent with neutral drainage pH and enriched solid phase concentrations of As, Mo and Se.

Table 4-36:
Shake flask extractions for ore samples used in 2012 metallurgical tests.

Sample Description		HYP Head	SUP Head
Parameter	**Units**		
pH		7.5	7.6
Redox	mV	398	380
Conductivity	uS/cm	892	785
T-Acidity (to pH 8.3)	$mgCaCO_3/L$	9.5	10.6
T-Alkalinity	$mgCaCO_3/L$	36.7	56.7
Sulphate	mg/L	360	291
Dissolved Metals			
Hardness as $CaCO_3$	mg/L	406	343
Ag	mg/L	<0.00001	0.00002
Al	mg/L	0.0248	0.0093
As	mg/L	0.0027	0.0027
B	mg/L	0.0106	0.0104
Ba	mg/L	0.0295	0.0225
Bi	mg/L	<0.00001	0.00002
Ca	mg/L	142	105
Cd	mg/L	0.000305	0.00426
Co	mg/L	0.000613	0.00521
Cr	mg/L	<0.0005	<0.0005
Cu	mg/L	0.0032	0.0279
Fe	mg/L	<0.003	<0.003
Hg	mg/L	<0.00001	<0.00001
K	mg/L	13.6	16.5
Mg	mg/L	12.6	19.5
Mn	mg/L	0.0682	0.565
Mo	mg/L	0.0230	0.0126
Na	mg/L	5.23	7.19
Ni	mg/L	0.0005	0.0009
P	mg/L	0.010	0.009
Pb	mg/L	0.00003	0.00009
Sb	mg/L	0.0011	0.0028
Se	mg/L	0.00187	0.00299
Si	mg/L	1.84	1.48
Sr	mg/L	0.440	0.108
Ti	mg/L	<0.0001	0.0001
Tl	mg/L	0.00005	0.00017
U	mg/L	0.0199	0.00395
V	mg/L	0.00097	0.00101
Zn	mg/L	0.002	0.005

Notes: 750 mL volume of Nanopure water added to a 250 g dry weight of sample; Values shaded in blue exceed the maximum CCME guidelines in Table 4-32.

Table 4-37:
Shake flask extractions for tailings produced during 2008 metallurgical tests.

	Sample Description	Sample 1	Sample 2	Sample 3
	Kinetic Test	**T1**	**T2**	**T3**
Parameter	**Units**			
pH		7.8	7.9	7.9
Redox	mV	387	356	341
Conductivity	uS/cm	292	280	360
Total Acidity (to pH 8.3)	mg $CaCO_3$/L	2.3	2.2	2.5
Alkalinity	mg $CaCO_3$/L	42	40	48
Chloride	mg/L	2.9	1.9	7.2
Fluoride	mg/L	0.77	0.85	0.91
Bromide	mg/L	0.80	0.20	1.8
Sulphate	mg/L	84	75	108
Nitrite	mg/L	<0.5	<0.5	<0.5
Nitrate	mg/L	<2	<2	<2
Ammonia	mg/L	0.057	<0.005	<0.005
Thiosulphate	mg/L	1.0	<0.2	<0.2
Total Cyanide	mg/L	0.0029	0.0020	0.0031
WAD Cyanide	mg/L	<0.0005	<0.0005	<0.0005
Dissolved Metals				
Hardness	mg $CaCO_3$/L	115	110	137
Ag	mg/L	<0.000005	0.0000070	0.000045
Al	mg/L	0.14	0.14	0.12
As	mg/L	0.0073	0.0074	0.0060
B	mg/L	<0.05	<0.05	<0.05
Ba	mg/L	0.018	0.021	0.021
Be	mg/L	<0.00001	<0.00001	<0.00001
Bi	mg/L	<0.000005	<0.000005	<0.000005
Ca	mg/L	44	42	52
Cd	mg/L	0.000063	0.000057	0.000051
Co	mg/L	0.000023	0.000036	0.000045
Cr	mg/L	<0.0001	0.00040	0.0012
Cu	mg/L	0.0059	0.0071	0.018
Fe	mg/L	0.0010	0.013	0.0020
Hg	ug/L	<0.01	0.010	0.050
K	mg/L	12	13	17
Li	mg/L	0.00070	0.00080	0.0010
Mg	mg/L	1.1	1.2	1.4
Mn	mg/L	0.0047	0.0059	0.0084
Mo	mg/L	0.17	0.17	0.092
Na	mg/L	4.6	5.3	5.8
Ni	mg/L	0.00050	0.00038	0.00055
P	mg/L	0.045	0.067	0.21
Pb	mg/L	0.000037	0.000063	0.000049
Sb	mg/L	0.020	0.018	0.036
Se	mg/L	0.0022	0.0024	0.0038
Si	mg/L	1.3	1.4	1.3
Sn	mg/L	0.000050	0.000050	0.000050
Sr	mg/L	0.13	0.14	0.16
Ti	mg/L	<0.0005	<0.0005	<0.0005
Tl	mg/L	0.000064	0.000080	0.000071
U	mg/L	0.0018	0.0022	0.0032
V	mg/L	0.00070	0.00070	0.00040
Zn	mg/L	0.00070	0.00060	0.00070

Notes: 24 Hour NanoPure Water Leach Extraction Test at 3:1 Liquid to Solid Ratio; Values shaded in blue exceed the maximum CCME guidelines in Table 4-32.

Table 4-38:
Shake flask extraction results for heap leach residue.

	Sample Description	CL-01 L Residue (CAP)
	Kinetic Test	**Col 7 & Col 8**
Parameter	**Units**	
pH		7.0
Redox	mV	277
Conductivity	uS/cm	1476
Total Acidity (to pH 8.3)	mg $CaCO_3$/L	6.9
Alkalinity	mg $CaCO_3$/L	33.9
Chloride	mg/L	18
Nitrite	mg/L	0.18
Nitrate	mg/L	7.88
Sulphate	mg/L	726
Total CN	mg/L	0.02
WAD CN	mg/L	<0.01
Free CN	mg/L	<0.01
Dissolved Metals		
Hardness	mg $CaCO_3$/L	717
Ag	mg/L	0.00002
Al	mg/L	0.0294
As	mg/L	0.0067
B	mg/L	0.0164
Ba	mg/L	0.0129
Ca	mg/L	277
Cd	mg/L	0.000131
Co	mg/L	0.0375
Cr	mg/L	<0.0005
Cu	mg/L	0.0099
Fe	mg/L	0.020
Hg	mg/L	<0.00001
K	mg/L	3.53
Mg	mg/L	6.33
Mn	mg/L	0.0059
Mo	mg/L	0.216
Na	mg/L	83.6
Ni	mg/L	0.0035
P	mg/L	0.036
Pb	mg/L	0.00008
Sb	mg/L	0.0038
Se	mg/L	0.0107
Si	mg/L	8.66
Sr	mg/L	0.134
Ti	mg/L	0.0007
Tl	mg/L	0.00006
U	mg/L	0.00547
V	mg/L	0.00073
Zn	mg/L	0.003

Notes: 24 Hour NanoPure Water Leach Extraction Test at 3:1 Liquid to Solid Ratio; Values shaded in blue exceed the maximum CCME guidelines in Table 4-32.

4.6 Tailings Supernatant, Ageing Tests and Process Water

Supernatant and process water (feed water and cleaner circuit) collected during the 2008, 2009, 2010 and 2012 metallurgical tests are presented in Table 4-39 through Table 4-42. The complete set of data is presented in Appendix C. The fresh tailings were allowed to settle for 15 to 30 minutes before supernatant samples were collected using a peristaltic pump and inline filtration (where necessary). Process water from various waste streams and mixed process water samples from the 2012 metallurgical tests are presented in Table 4-41. Mixed samples arecomposed of supernatant from the pyrite rougher concentrate (PyRo-Conc.) and pyrite rougher tailings (PyRo-Tails) streams which were mixed at a ratio of 1:6, respectively. This ratio is consistent with that produced by the 2012 pilot plant program for SUP and HYP ore. These samples were produced to identify any non-conservative behavior that will take place when the tailings streams are mixed. A travel blank, duplicate sample and blank sample were included in the analysis to ensure quality assurance and quality control (QA/QC).

All fresh tailings supernatant and cleaner circuit water samples are strongly alkaline (pH 9 – 12), owing to the addition of lime during the floatation process. Other process reagents are also evident in the tailings supernatant and cleaner circuit water samples, which contain low, but detectable levels of cyanide, ammonia and sulphate. This is particularly evident for the 2008 and 2009 metallurgical products. Parameters which consistently exceed CCME guidelines for aquatic life in fresh tailings supernatant and process water include D-Al, Mo and Se. Additionally, total cyanide and D-As, Cd and Cu are elevated above the guidelines in the 2008 and 2009 metallurgical products and nitrite as N and D-Cu are elevated above the guidelines in the 2012 fresh tailings supernatant. Note that cyanide was not used in preparation of 2010 and 2012 tailings, and the analytical detection limits for many parameters are above the CCME guideline. This is particularly evident for the 2009 tailings supernatant and process waters for which the detection limits were raised due to low sample volume. A comparison of the 2008 supernatant and SFEs (Table 4-37) demonstrate that, with the exception of D-As, dissolved metal concentrations are generally higher in the supernatant.

4.6.1.1 Ageing Tests

Tailings aging tests were carried out on the 2010 and 2012 tailings. Ageing tests involve exposing the tailings and supernatant to air and periodically monitoring the supernatant to determine how it will evolve with time. The 2010 tailings and its supernatant were left to age for up to 34 days before a second sample was collected (Table 4-40). The 2012 tailings and supernatant were left to age for 3 weeks, with samples collected after 7 days and 21 days (Table 4-41 and Table 4-42).

The supernatant from the aged tailings is provides information regarding the chemistry evolution that can be expected from the tailings cover water after placement in the impoundment (without considering dilution from additional water inputs). The 2010 and 2012 metallurgical tailings represent the most up to date metallurgical process planned for the Casino Mine. The tailings are characterized by supernatant with an initially high pH (9.2 – 10.3) that is attributed to the addition of lime during the flotation process. As the process water is aged the pH declines.

Different results were produced by the 2010 and 2012 ageing tests. The 2010 supernatant samples, which were left to age for over a month, show a slight drop in pH and total alkalinity, but maintain alkaline conditions. The 2012 tailings supernatant, for which samples were collected after ageing for one week and then three weeks, show a larger drop in pH and total alkalinity to neutral values of approximately pH 7.5. Consistent with the drop in pH, concentrations of D-Al decrease in each of the aged supernatant samples from the 2010 and 2012 tailings, but remain above CCME guidelines. Concentrations of D-Zn remain below detection in the 2010 tailings supernatant and decrease in the 2012 tailings supernatant.

During the ageing process, sulphate, nitrite (as N) and D-As, Cu, Mo, Pb, Sb and U increase in the 2010 SUP tailings supernatant, consistent with a drop in pH. Concentrations of D-As and U increase above the CCME guidelines in the aged PyRo SUP supernatant. However, supernatant from the SUP Cleaner Tails show a decrease in D-As, Pb, Sb, Se and U, rather than an increase.

Similar increases are not observed for the 2012 aged supernatant samples, which tend to show only minor changes in concentrations, often decreasing over the first week before increasing slightly over the following two weeks to levels below the initial values. Of note for the 2012 tailings supernatant are the higher sulphate values and increases in nitrite (as N) to levels above the CCME guideline.

Table 4-39:
Supernatant and process water chemistry for tailings produced by the 2008 and 2009 metallurgical tests.

	Sample Description (related Kinetic Test ID)	2008 Metallurgical Tests (71% SUP, 22% HYP and 7% CAP)					2009 Metallurgical Tests (HYP and SUS)					
		Rougher Feed	whole tailings			cleaner scavenger tailings of sample 3	whole tailings			cleaner scavenger tailings		
			Sample 1 (T1)	Sample 2 (T2)	Sample 3 (T3)		Comp 1 (Sat Col 1)	Comp 2	Comp 3	Comp 1	Comp 2	Comp 3
Parameter	**Unit**											
pH		7.7	12	11	11	10	11	11	10	11	11	11
Redox	mV	388	41	53	57	134	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Conductivity	uS/cm	108	1493	849	1525	1241	621	568	1570	477	515	454
T-Acidity (to pH 8.3)	mg $CaCO_3$/L	*ND*	*ND*	*ND*	*ND*	*ND*	<1	<1	<1	<1	<1	<1
Alkalinity	mg $CaCO_3$/L	43	150	75	150	100	247	141	83	146	136	122
Chloride	mg/L	3.4	27	26	27	52	34	43	58	8.2	8.7	10
Fluoride	mg/L	0.060	2.8	3.4	3.4	3.2	<0.45	3.9	0.97	0.19	0.24	0.15
Bromide	mg/L	0.10	1.1	1.2	1.2	9.5	<0.5	<0.25	<0.5	<0.25	<0.25	<0.25
Sulphate	mg/L	8.0	450	537	536	546	27	46	702	19	13	31
Nitrite	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.005	<0.01	<0.005	<0.005	0.0079
Nitrate	mg/L	<0.2	0.30	0.20	0.30	0.30	0.052	0.049	<0.05	0.038	0.049	0.050
Ammonia	mg/L	<0.01	0.50	0.50	0.40	0.30	0.62	1.2	0.72	0.12	0.094	0.066
Ortho Phosphate as P	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	0.0051	0.0028	0.0046	0.0053	0.016	0.024
Total Phosphate as P	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	0.32	0.61	0.82	1.3	1.9	2.1
Thiocyanate	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.5	0.58	*ND*	*ND*	*ND*
Thiosulphate	mg/L	<0.2	0.30	0.40	0.40	26	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
WAD Cyanide	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.005	<0.005	*ND*	*ND*	*ND*
Total Cyanide	mg/L	<0.0005	0.0051	0.0038	0.0042	0.011	0.0059	0.0089	<0.005	0.011	0.0069	0.0091
Dissolved Metals												
Hardness	mg $CaCO_3$/L	42	726	705	703	707	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Ag	mg/L	<0.000005	<0.000005	<0.000005	<0.000005	0.000010	<0.00005	<0.001	<0.001	<0.001	<0.001	<0.001
Al	mg/L	0.0058	3.7	3.6	3.4	2.8	36	1.2	0.61	8.5	1.9	1.7
As	mg/L	0.00011	0.0029	0.0031	0.0032	0.013	0.00090	0.026	0.022	<0.01	<0.01	<0.01
B	mg/L	<0.005	0.0060	0.016	0.021	<0.05	<0.05	<1	<1	<1	<1	<1
Ba	mg/L	0.0096	0.023	0.021	0.021	0.030	0.013	0.044	0.075	<0.005	0.074	0.074
Ca	mg/L	14	291	282	281	283	90	75	321	91	87	84
Cd	mg/L	<0.000005	0.00031	0.00033	0.00036	0.00050	<0.000085	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
Co	mg/L	0.000011	0.000075	0.000099	0.000087	0.000061	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
Cr	mg/L	<0.0001	0.00070	0.00070	0.00080	0.00080	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
Cu	mg/L	0.0032	0.025	0.014	0.015	0.00017	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
Fe	mg/L	0.014	0.010	0.0080	0.013	0.036	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Hg	ug/L	<0.01	<0.01	<0.01	<0.01	0.010	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
K	mg/L	0.86	29	26	26	44	55	41	55	13	10	8.9
Mg	mg/L	1.9	<0.05	0.080	0.070	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mn	mg/L	0.0010	0.00073	0.00074	0.00083	0.0012	0.00039	<0.005	<0.005	<0.005	<0.005	<0.005
Mo	mg/L	0.00078	0.71	0.80	0.84	1.2	0.018	0.18	0.17	0.017	0.27	0.16
Na	mg/L	3.2	21	21	21	32	18	24	33	7.9	8.2	8.5
Ni	mg/L	0.00057	0.00081	0.00087	0.00091	0.0017	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
P	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	0.40	0.70	0.96	1.4	2.0	2.2
Pb	mg/L	0.00023	0.0013	0.00055	0.00058	0.00057	<0.00025	<0.005	<0.005	<0.005	<0.005	<0.005
Sb	mg/L	0.000020	0.0023	0.0054	0.0057	0.050	0.00073	<0.01	<0.01	<0.01	<0.01	<0.01
Se	mg/L	0.00020	0.0091	0.0092	0.0093	0.013	0.0032	0.0069	0.0038	0.0043	0.0025	0.0016
Si	mg/L	2.7	2.3	2.2	2.2	3.1	0.71	15	11	1.2	3.6	4.1
Sn	mg/L	0.000010	0.000080	0.000050	0.000060	0.00026	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
Sr	mg/L	0.081	0.72	0.72	0.72	0.74	0.23	0.31	2.0	0.17	0.30	0.48
Ti	mg/L	<0.0005	0.00070	0.00090	0.00070	0.00060	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tl	mg/L	<0.000002	0.000033	0.000039	0.000039	0.000032	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
U	mg/L	0.000069	0.000027	0.000041	0.000039	0.00011	0.00014	<0.001	<0.001	<0.001	<0.001	<0.001
Zn	mg/L	0.0025	0.0019	0.00050	0.0014	0.0070	<0.005	<0.1	<0.1	<0.1	<0.1	<0.1

Note: ND = no data; Values shaded in blue exceed the maximum CCME guidelines outlined in Table 4-32.

Table 4-40:
Fresh and aged tailings supernatant chemistry produced during 2010 bench scale metallurgical testing of SUP ore.

Sample Description and collection date		PyRo whole tailings (T5)			Cleaner scavenger tailings			Pyrite concentrate		
		Fresh	Aged	*Diff*	Fresh	Aged	*Diff*	Fresh	Aged	*Diff*
		08-Dec-10	11-Jan-11		10-Dec-10	11-Jan-11		10-Dec-10	11-Jan-11	
Parameter	**Unit**									
Conductivity	uS/cm	543	632	*1.2*	518	591	*1.1*	433	546	*1.3*
Hardness (as $CaCO_3$)	mg/L	197	245	*1.2*	215	203	*0.9*	152	206	*1.4*
pH		11	8.8	*0.8*	11	10	*1.0*	10	8.9	*0.9*
Acidity (as $CaCO_3$)	mg/L	<1	<1	*NA*	<1	<1	*NA*	<1	<1	*NA*
T-Alkalinity (as $CaCO_3$)	mg/L	213	72	*0.3*	133	92	*0.7*	181	84	*0.5*
Br	mg/L	<0.05	<0.05	*NA*	<0.05	<0.05	*NA*	<0.05	<0.05	*NA*
Cl	mg/L	17	21	*1.2*	9.5	49	*5.2*	15	14	*1.0*
F	mg/L	1.4	0.22	*0.2*	0.62	0.20	*0.3*	1.1	0.39	*0.4*
SO_4	mg/L	60	203	*3.4*	71	110	*1.6*	62	151	*2.4*
Nitrite as N	mg/L	0.0046	0.0066	*1.4*	0.0026	0.0021	*0.8*	0.0057	0.024	*4.2*
Nitrate as N	mg/L	0.094	0.084	*0.9*	0.089	0.090	*1.0*	0.092	0.062	*0.7*
Ammonia as N	mg/L	0.84	0.085	*0.1*	0.049	0.030	*0.6*	0.71	0.084	*0.1*
Ortho Phosphate as P	mg/L	0.0046	0.058	*12.7*	0.0078	<0.001	*0.1*	0.011	<0.001	*0.1*
Total Phosphate as P	mg/L	0.43	0.62	*1.4*	0.056	0.052	*0.9*	0.41	0.38	*0.9*
Total-CN	mg/L	<0.005	*ND*	*NA*	<0.005	*ND*	*NA*	<0.005	*ND*	*NA*
Dissolved Metals										
Hardness (as $CaCO_3$)	mg/L	197	245	*1.2*	215	203	*0.9*	152	206	*1.4*
Ag	mg/L	<0.00002	0.000016	*0.8*	0.000020	0.000039	*2.0*	0.000020	0.000053	*2.7*
Al	mg/L	23	3.4	*0.1*	9.1	8.1	*0.9*	17	8.9	*0.5*
As	mg/L	0.0017	0.0066	*3.8*	0.0032	0.0010	*0.3*	0.0025	0.0031	*1.2*
B	mg/L	0.040	0.085	*2.1*	0.070	0.080	*1.1*	0.027	0.11	*3.9*
Ba	mg/L	0.011	0.017	*1.6*	0.0085	0.020	*2.3*	0.010	0.020	*2.0*
Be	mg/L	<0.001	<0.0005	*NA*	<0.0005	<0.0005	*NA*	<0.001	<0.0005	*NA*
Bi	mg/L	<0.001	<0.0005	*NA*	<0.0005	<0.0005	*NA*	<0.001	<0.0005	*NA*
Ca	mg/L	79	98	*1.2*	86	81	*0.9*	61	82	*1.4*
Cd	mg/L	<0.00015	<0.0017	*NA*	<0.00007	<0.00009	*NA*	<0.00015	<0.0006	*NA*
Co	mg/L	<0.0002	<0.0001	*NA*	<0.0001	<0.0001	*NA*	<0.0002	<0.0001	*NA*
Cr	mg/L	<0.001	0.0017	*1.7*	0.00056	<0.0005	*0.9*	<0.001	<0.0005	*NA*
Cu	mg/L	<0.001	0.013	*13.2*	0.0035	0.0090	*2.6*	<0.001	0.0015	*1.5*
Fe	mg/L	<0.03	<0.03	*NA*	<0.03	<0.03	*NA*	0.085	<0.03	*0.4*
Hg	mg/L	<0.00001	<0.00001	*NA*	<0.00001	<0.00001	*NA*	<0.00001	<0.00001	*NA*
K	mg/L	29	29	*1.0*	12	16	*1.3*	22	29	*1.3*
Li	mg/L	<0.01	<0.005	*NA*	<0.005	<0.005	*NA*	<0.01	<0.005	*NA*
Mg	mg/L	<0.1	<0.1	*NA*	<0.1	<0.1	*NA*	<0.1	<0.1	*NA*

Sample Description and collection date		PyRo whole tailings (T5)			Cleaner scavenger tailings			Pyrite concentrate		
		Fresh	Aged	*Diff*	Fresh	Aged	*Diff*	Fresh	Aged	*Diff*
		08-Dec-10	11-Jan-11		10-Dec-10	11-Jan-11		10-Dec-10	11-Jan-11	
Mn	mg/L	0.00036	0.0012	*3.3*	<0.00005	<0.00005	*NA*	0.0020	0.00018	*0.1*
Mo	mg/L	0.49	1.2	*2.5*	0.19	0.26	*1.4*	0.47	0.68	*1.4*
Na	mg/L	16	20	*1.2*	8.6	27	*3.2*	14	16	*1.1*
Ni	mg/L	<0.001	<0.0005	*NA*	<0.0005	<0.0005	*NA*	<0.001	<0.0005	*NA*
P	mg/L	0.46	0.58	*1.3*	<0.3	<0.3	*NA*	0.46	0.36	*0.8*
Pb	mg/L	0.00010	0.00020	*2.0*	0.000074	0.000071	*1.0*	0.00010	0.00018	*1.8*
Sb	mg/L	0.00039	0.0032	*8.2*	0.0046	0.0040	*0.9*	0.00025	0.0030	*12.0*
Se	mg/L	0.0024	0.0041	*1.7*	0.0026	0.0022	*0.8*	0.0021	0.0032	*1.5*
Sn	mg/L	<0.0002	<0.0001	*NA*	<0.0001	<0.0001	*NA*	<0.0002	<0.0001	*NA*
Sr	mg/L	0.17	0.25	*1.5*	0.17	0.23	*1.3*	0.14	0.24	*1.7*
Ti	mg/L	<0.01	<0.01	*NA*	<0.01	<0.01	*NA*	<0.01	<0.01	*NA*
Tl	mg/L	<0.0002	<0.0001	*NA*	<0.0001	<0.0001	*NA*	<0.0002	<0.0001	*NA*
U	mg/L	0.00039	0.019	*47.4*	0.00019	0.000080	*0.4*	0.00046	0.0029	*6.3*
V	mg/L	0.017	0.016	*1.0*	0.0038	0.010	*2.6*	0.016	0.011	*0.7*
Zn	mg/L	<0.006	<0.003	*NA*	<0.003	<0.003	*NA*	<0.006	<0.003	*NA*

Note: Values shaded in blue exceed the maximum CCME guidelines and values shaded in grey exceed the MMER guidelines according to the limits outlined in Table 4-32.
Diff = difference between aged and fresh sample (aged concentration / fresh concentration), highlighted values represent an increase in aged sample.
NA = not applicable, values below the analytical detection limit.

Table 4-41:
Fresh and aged tailings supernatant chemistry produced by 2012 pilot plant metallurgical testing of SUP ore.

Sample Description and collection date		Pyrite Rougher Feed (rougher whole tailings)				PyRo whole tailings	Pyrite Conc.	1:6 MIX
		Day 0	Day 7	Day 21	*Diff*			
Parameter	**Unit**							
Conductivity	uS/cm	1620	1550	1650	*1.0*	1680	1130	1600
Hardness (as $CaCO_3$)	mg/L	874	821	912	*1.0*	867	557	827
pH		10	7.8	7.6	*0.7*	10	10	10
T-Alkalinity (as $CaCO_3$)	mg/L	74	41	37	*0.5*	74	57	68
Br	mg/L	<1	<0.5	<1	*NA*	<1	<0.5	<1
Cl	mg/L	31	31	29	*0.9*	30	20	29
F	mg/L	2.0	2.4	1.1	*0.6*	2.2	1.4	1.9
SO_4	mg/L	879	844	889	*1.0*	879	518	837
Nitrite as N	mg/L	0.058	1.3	3.8	*65.0*	0.072	0.044	0.066
Nitrate as N	mg/L	4.9	3.3	0.17	*0.0*	4.9	2.9	4.6
Ammonia as N	mg/L	0.32	0.0068	0.071	*0.2*	0.30	0.18	0.27
T-Cyanide	mg/L	<0.005	*ND*	*ND*	*NA*	<0.005	<0.005	<0.005
Dissolved Metals								
Ag	mg/L	<0.00004	<0.00002	0.000052	*1.3*	<0.00004	<0.00004	<0.00004
Al	mg/L	4.5	2.9	0.34	*0.1*	4.8	3.1	4.6
As	mg/L	0.0035	0.0041	0.0044	*1.2*	0.0033	0.0033	0.0033
B	mg/L	<0.1	<0.02	<0.02	*NA*	<0.1	<0.1	<0.1
Ba	mg/L	0.031	0.024	0.028	*0.9*	0.042	0.023	0.038
Be	mg/L	<0.002	<0.0002	<0.0002	*NA*	<0.002	<0.002	<0.002
Ca	mg/L	350	329	364	*1.0*	347	222	331
Cd	mg/L	<0.00008	<0.00009	<0.0001	*NA*	<0.000068	<0.000034	<0.000068
Co	mg/L	<0.0006	<0.0002	<0.0002	*NA*	<0.0006	<0.0006	<0.0006
Cr	mg/L	<0.002	<0.0002	<0.0002	*NA*	<0.002	<0.002	<0.002
Cu	mg/L	0.0023	<0.0004	0.0074	*3.2*	0.0025	<0.002	<0.002
Fe	mg/L	<0.03	<0.01	<0.01	*NA*	<0.03	<0.03	<0.03
Hg	ug/L	<0.01	<0.01	<0.01	*NA*	<0.00001	<0.00001	<0.00001
K	mg/L	55	58	57	*1.0*	86	56	81
Li	mg/L	<0.01	<0.001	<0.001	*NA*	<0.01	<0.01	<0.01
Mg	mg/L	0.22	0.20	0.98	*4.5*	0.24	0.33	0.21
Mn	mg/L	<0.0006	<0.0001	0.0059	*9.8*	<0.0006	<0.0006	<0.0006
Mo	mg/L	0.23	0.23	0.25	*1.1*	0.24	0.15	0.23
Na	mg/L	32	31	32	*1.0*	34	23	32
Ni	mg/L	<0.002	<0.001	<0.001	*NA*	<0.002	<0.002	<0.002
P	mg/L	0.36	0.26	0.20	*0.5*	0.39	0.26	0.42
Pb	mg/L	<0.001	<0.0001	<0.0001	*NA*	<0.001	<0.001	<0.001
Sb	mg/L	0.0019	0.0029	0.0040	*2.1*	0.0013	<0.001	0.0013
Se	mg/L	0.0085	0.0084	0.0072	*0.9*	0.0082	0.0054	0.0078
Sn	mg/L	<0.001	0.00034	0.00030	*0.3*	<0.001	<0.001	<0.001
Ti	mg/L	<0.01	<0.02	<0.02	*NA*	<0.01	<0.01	<0.01
Tl	mg/L	<0.0004	0.000026	0.000032	*0.1*	<0.0004	<0.0004	<0.0004
U	mg/L	<0.0004	0.0011	0.0065	*16.3*	0.00043	<0.0004	0.00056
V	mg/L	0.011	0.010	0.0042	*0.4*	0.016	0.015	0.013
Zn	mg/L	0.0061	<0.002	<0.002	*0.3*	<0.005	<0.005	<0.005

Notes: Values shaded in blue exceed the maximum CCME guidelines and values shaded in grey exceed the MMER guidelines according to the limits outlined in Table 4-32;
1:6 MIX = Supernatant from pyrite concentrate and pyrite rougher (whole) tailings were mixed at a 1 to 6 ratio, which is the approximate ratio produced by the pilot plant;
Diff = difference between aged and fresh sample (aged concentration / fresh concentration), highlighted values represent an increase in aged sample;
ND = no data; NA = not applicable, values below the analytical detection limit.

Table 4-42:
Fresh and aged tailings supernatant chemistry produced by 2012 pilot plant metallurgical testing of HYP ore.

Sample Description and collection date		Pyrite Rougher Feed (rougher whole tailings)				Pyrite rougher whole tailings (Sat Col 16)				Pyrite Concentrate (Sat Col 17)				1:6 MIX
		Day 0	Day 7	Day 21	*Diff*	Day 0	Day 7	Day 21	*Diff*	Day 0	Day 7	Day 21	*Diff*	
Parameter	**Unit**													
Conductivity	uS/cm	1830	1640	1710	*0.9*	2220	1850	1950	*0.9*	766	1050	1110	*1.4*	1870
Hardness (as $CaCO_3$)	mg/L	991	883	989	*1.0*	1240	1000	1120	*0.9*	427	516	589	*1.4*	1080
pH		11	7.5	7.6	*0.7*	11	7.7	7.6	*0.7*	9.2	7.3	7.6	*0.8*	10
T-Alkalinity (as $CaCO_3$)	mg/L	86	32	37	*0.4*	60	31	36	*0.6*	28	28	32	*1.2*	47
Br	mg/L	<1	<1	<1	*NA*	<1	<1	<1	*1.0*	<0.25	<0.5	<0.5	*2.0*	*ND*
Cl	mg/L	34	35	34	*1.0*	36	37	35	*1.0*	17	19	19	*1.1*	*ND*
F	mg/L	1.2	1.3	0.91	*0.7*	1.5	1.3	0.88	*0.6*	0.72	0.99	0.72	*1.0*	*ND*
SO_4	mg/L	911	926	934	*1.0*	1320	1070	1110	*0.8*	592	531	537	*0.9*	*ND*
Nitrite as N	mg/L	0.060	2.6	3.9	*64.5*	0.053	1.0	2.2	*41.7*	0.022	0.61	0.71	*31.6*	*ND*
Nitrate as N	mg/L	5.2	2.3	0.10	*0.0*	5.9	4.6	3.0	*0.5*	2.6	2.2	1.9	*0.7*	*ND*
Ammonia as N	mg/L	0.30	0.062	0.097	*0.3*	0.32	0.071	0.11	*0.3*	0.069	0.014	0.026	*0.4*	0.27
T-Cyanide	mg/L	<0.005	*ND*	*ND*	*NA*	<0.005	*ND*	*ND*	*NA*	<0.005	*ND*	*ND*	*NA*	<0.005
Dissolved Metals														
Ag	mg/L	<0.00004	<0.00002	<0.00002	*NA*	<0.0001	<0.00002	<0.00002	*NA*	<0.00002	<0.00001	<0.00001	*NA*	<0.00004
Al	mg/L	1.4	0.76	0.17	*0.1*	0.64	0.45	0.17	*0.3*	0.49	0.57	0.42	*0.8*	0.70
As	mg/L	0.0033	0.0041	0.0033	*1.0*	0.0038	0.0045	0.0041	*1.1*	0.0041	0.0041	0.0043	*1.1*	0.0037
B	mg/L	<0.1	0.021	0.026	*0.3*	<0.1	<0.02	0.024	*0.2*	<0.1	0.019	0.023	*0.2*	<0.1
Ba	mg/L	0.035	0.034	0.035	*1.0*	0.058	0.044	0.036	*0.6*	<0.02	0.020	0.022	*1.1*	0.047
Be	mg/L	<0.002	<0.0002	<0.0002	*NA*	<0.005	<0.0002	<0.0002	*NA*	<0.001	<0.0001	<0.0001	*NA*	<0.002
Ca	mg/L	397	353	394	*1.0*	497	402	446	*0.9*	169	206	235	*1.4*	432
Cd	mg/L	<0.000068	<0.00014	<0.0001	*NA*	<0.000085	<0.00008	<0.00005	*NA*	0.000018	<0.00004	<0.00003	*1.7*	<0.000051
Co	mg/L	<0.0006	<0.0002	<0.0002	*NA*	<0.0015	<0.0002	<0.0002	*NA*	<0.0003	<0.0001	<0.0001	*NA*	<0.0006
Cr	mg/L	<0.002	0.00036	<0.0002	*NA*	<0.005	0.00064	<0.0002	*NA*	<0.001	0.00024	0.00012	*0.1*	<0.002
Cu	mg/L	0.0035	0.0025	0.0029	*0.8*	<0.005	0.00066	<0.0004	*NA*	<0.001	<0.0002	0.00026	*0.3*	<0.002
Fe	mg/L	<0.03	<0.01	<0.01	*0.3*	<0.03	<0.01	<0.01	*NA*	0.060	<0.01	<0.01	*0.2*	<0.03
Hg	ug/L	<0.01	<0.01	<0.01	*1.0*	<0.01	<0.01	<0.01	*NA*	<0.01	<0.01	<0.01	*NA*	<0.00001
K	mg/L	50	65	57	*1.1*	79	86	76	*1.0*	19	48	40	*2.1*	65
Li	mg/L	<0.01	<0.001	<0.001	*NA*	<0.025	<0.001	<0.001	*NA*	<0.005	0.00092	0.00054	*0.1*	<0.01
Mg	mg/L	0.12	0.19	0.98	*8.2*	0.21	0.20	1.0	*4.9*	1.3	0.51	0.61	*0.5*	0.35
Mn	mg/L	<0.0006	0.00027	0.011	*18.3*	<0.0015	0.00018	0.0061	*4.1*	0.0012	0.00033	0.00052	*0.4*	<0.0006
Mo	mg/L	0.24	0.24	0.24	*1.0*	0.16	0.24	0.24	*1.6*	0.047	0.12	0.14	*2.8*	0.17
Na	mg/L	31	31	33	*1.1*	35	33	35	*1.0*	11	19	19	*1.7*	31
Ni	mg/L	<0.002	0.0013	<0.001	*NA*	<0.005	<0.001	<0.001	*NA*	<0.001	0.00053	<0.0005	*NA*	<0.002
P	mg/L	0.40	0.28	0.28	*0.7*	2.1	1.1	1.1	*0.5*	0.67	0.74	0.79	*1.2*	1.8
Pb	mg/L	<0.001	<0.0001	<0.0001	*NA*	<0.0025	<0.0001	<0.0001	*NA*	<0.0005	<0.00005	<0.00005	*NA*	<0.001
Sb	mg/L	<0.001	0.0020	0.0034	*3.4*	<0.0025	0.0020	0.0035	*1.4*	<0.0005	0.0037	0.0038	*7.5*	0.0010
Se	mg/L	0.0079	0.0071	0.0065	*0.8*	0.0081	0.0073	0.0070	*0.9*	0.0018	0.0033	0.0033	*1.8*	0.0071
Sn	mg/L	<0.001	0.00035	0.00030	*0.3*	<0.0025	0.00029	0.00029	*0.1*	<0.0005	0.00021	0.00018	*0.4*	<0.001
Ti	mg/L	<0.01	<0.02	<0.02	*NA*	<0.01	<0.02	<0.02	*NA*	<0.01	<0.01	<0.01	*NA*	<0.01
Tl	mg/L	<0.0004	0.000027	<0.00002	*NA*	<0.001	<0.00002	0.000030	*0.0*	<0.0002	<0.00001	0.000014	*0.1*	<0.0004
U	mg/L	<0.0004	0.00018	0.0026	*6.4*	<0.001	0.00016	0.0054	*5.4*	0.0031	0.00072	0.0014	*0.5*	0.00052
V	mg/L	0.022	0.022	0.0083	*0.4*	0.050	0.035	0.020	*0.4*	0.0092	0.018	0.016	*1.7*	0.040
Zn	mg/L	<0.005	0.0058	<0.006	*NA*	<0.005	<0.002	<0.002	*NA*	0.0053	<0.001	0.0014	*0.3*	<0.005

Notes:
Values shaded in blue exceed the maximum CCME guidelines and values shaded in grey exceed the MMER guidelines according to the limits outlined in Table 4-32;
1:6 MIX = Supernatant from pyrite concentrate and pyrite rougher (whole) tailings were mixed at a 1 to 6 ratio, which is the approximate ratio produced by the pilot plant;
Diff = difference between aged and fresh sample (aged concentration / fresh concentration), highlighted values represent an increase in aged sample;
ND = no data; NA = not applicable; and anions in 'HYP 1:6 Mix' sample are excluded due to QA/QC concerns.

5. Saturated Column Results

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5. Saturated Column Results

Chapter 5 presents the drainage quality and leaching rates for saturated waste rock and tailings columns. The objective of the saturated kinetic test program is to predict the quality of surface water and groundwater seepage from subaqueously disposed mine waste to provide input regarding management and geochemical source term estimates.

Flow rates have varied over the course of the saturated column experiments. Effluent volumes have been periodically measured to calculate flow rates and determine pore volume flushings. General comments regarding controlled drain downs and variations in flow are discussed in Section 5.2 and in more detail in Appendix D.1. The effects of flow rate on leaching rates are discussed in Section 5.2 The complete saturated waste rock column results are presented in Appendix D.2.

5.1 Leachate Chemistry

5.1.1 Saturated Waste Rock Columns

Eleven saturated columns have been initiated for the Casino waste rock. The sample description and test details for each saturated column are provided in Table 5-1. In summary, the program includes: one column composed of primarily CAP waste rock comprising moderate S concentrations (Sat Col 2), two columns composed of primarily SUP with moderate and high S (Sat Col 15 and Sat Col 5, respectively), three columns composed of HYP with moderate and high S (Sat Col 3, Sat Col 7 and Sat Col 4) and one column composed of equal parts CAP and SUS (Sat Col 6). Sat Col 7 is a duplicate of Sat Col 3, but contains twice the mass of sample. Data provided by duplicate kinetic tests are discussed in more detail in Chapter 8 of this report. Saturated columns 9, 12, 13 and 14 are layered tests. These columns were constructed to assess the effect of neutral HYP waste rock on acidic CAP and SUP waste rock drainage.

Table 5-1:
Sample description and operational procedures for saturated waste rock columns

Kinetic Test ID	Mineralization Zone	Details / Notes	Mass (Kg)	Start Date	End Date
Sat Col 2	95% CAP, 5% SUS	Moderate S (Col 2A duplicate)	5	24-Feb-10	11-Jan-13
Sat Col 3	HYP	Moderate S	5	24-Feb-10	11-Jan-13
Sat Col 4	HYP	High S	5	24-Feb-10	11-Jan-13
Sat Col 5	90% SUS, 5%CAP, 5%HYP	High S	5	24-Feb-10	11-Jan-13
Sat Col 6	50%SUS, 50%CAP	High S	5	24-Feb-10	11-Jan-13
Sat Col 7	HYP	Mod. S (Sat Col 3 duplicate)	10	24-Feb-10	11-Jan-13
Sat Col 9	89% HYP, 11% SUS	Layered CAP and HYP	5	1-Apr-10	25-May-12
	CAP		5		
Sat Col 12	25% HYP	Layered acidic SUP and HYP (upper and lower ports sampled)	3	12-Jul-12	on-going
	75% acidic SUP		9.1	13-Jul-12	
Sat Col 13	25% HYP	Layered neutral SUP and HYP (upper and lower ports sampled)	3.3	17-Jul-12	on-going
	75% neutral SUP		9.8	18-Jul-12	
Sat Col 14	50% HYP	Layered acidic SUP and HYP (upper and lower ports sampled)	5.6	12-Jul-12	on-going
	50% acidic SUP		5.6	13-Jul-12	
Sat Col 15	SUP	Neutral SUP	7.9	17-Jul-12	on-going

5.1.1.1 Single Unit Columns

The pH of the saturated columns remains relatively steady throughout the experiments (Figure 5-1). Only saturated columns containing CAP waste rock (Sat Col 2 and Sat Col 6) are immediately acid generating. The drainage quality of Sat Col 6 (CAP & SUS) remains at pH 3.5 while that of Sat Col 2 (CAP) shows a gradual decrease over time from pH 5.6 to 5.05. Sat Col 5 (high S SUP) and Sat Col 7 (HYP) are initially slightly acidic and then show a gradual increase over time from pH ~6 to ~7.3. The other saturated columns (composed of neutral SUP and HYP) produce neutral drainage during the tests.

Concentrations of sulphate and dissolved metals in leachate from the saturated waste rock columns are generally highest in the first few weeks of the test, consistent with the dissolution and flushing of readily soluble surface oxidation products (secondary sulphates and oxides) (Figure 5-1 and Figure 5-2). Initial sulphate concentrations range from approximately 160 mg/L (Sat Col 2) to 5600 mg/L (Sat Col 6) from Casino waste rock. Following the initial sample, sulphate concentrations consistently decrease by one to two orders of magnitude from all saturated columns. In general, SO_4 from saturated columns

composed of CAP and SUP waste rock decrease rapidly whereas SO_4 loadings from columns composed of HYP waste rock (Sat Col 3, 4 and 7) decrease more gradually, particularly over the first 30 cycles of the test. Consistent with low solid phase sulphur concentrations from the sulphide depleted oxide zone (Table 4-15), the lowest sulphate concentrations are produced by CAP waste rock in Sat Col 2, which appears to stabilize at ~10 mg/L SO_4 by the end of the test The highest sulphate concentrations are produced by the HYP waste rock of Sat Col 7, which appears to stabilize at ~200 mg/L SO_4 by the end of the test. The higher concentrations produced by Sat Col 7, which is a duplicate of Sat Col 3 composed of moderate sulphur concentrations, is likely a result of the larger mass (10 kg) of waste rock used to construct the test. After the first 20 cycles, sulphate concentrations produced by Sat Col 3 are consistently nearly an order of magnitude lower than concentrations produced by Sat Col 7. Sat Col 4, composed of high sulphur (4.33%S) HYP waste rock, also produces high sulphate concentrations that fluctuating around 100 mg/L for the majority of the test.

Metal loadings from the saturated waste rock columns reflect pH and, to lesser extent, solid phase concentrations. In general, Sat Col 6 (SUP/CAP), which has a pH of 3.5, produces the highest metal loadings (D-Al, D-Cu, D-Fe, D-Se and D-Zn in Figure 5-2). This is particularly evident for D-Al, D-Cu and D-Fe, which are three to four orders of magnitude higher than pH-neutral saturated tests composed of SUP and HYP. With the exception of Fe, Sat Col 2 (CAP) also produces higher metal loads compared to the SUP and HYP tests. Conversely, loadings of Mo and U are lowest from the columns composed of CAP (Sat Col 2 and 6), with the highest Mo loadings produced by columns containing predominantly SUP (Sat Col 5 and Sat Col 15; high S and moderate S SUP, respectively).

Most metal loading rates decrease over the duration of the test. In general, metal loadings from pH-neutral saturated SUP and HYP columns are comparable, regardless of the solid phase S and metal content of the test material. Concentrations of Cu and Zn from HYP saturated columns 3, 4 and 7 decrease to levels below detection by the end of the tests. Leaching rates for other metals are presented in Appendix D.2. Metals that were consistently below the analytical detection limit are not presented graphically.

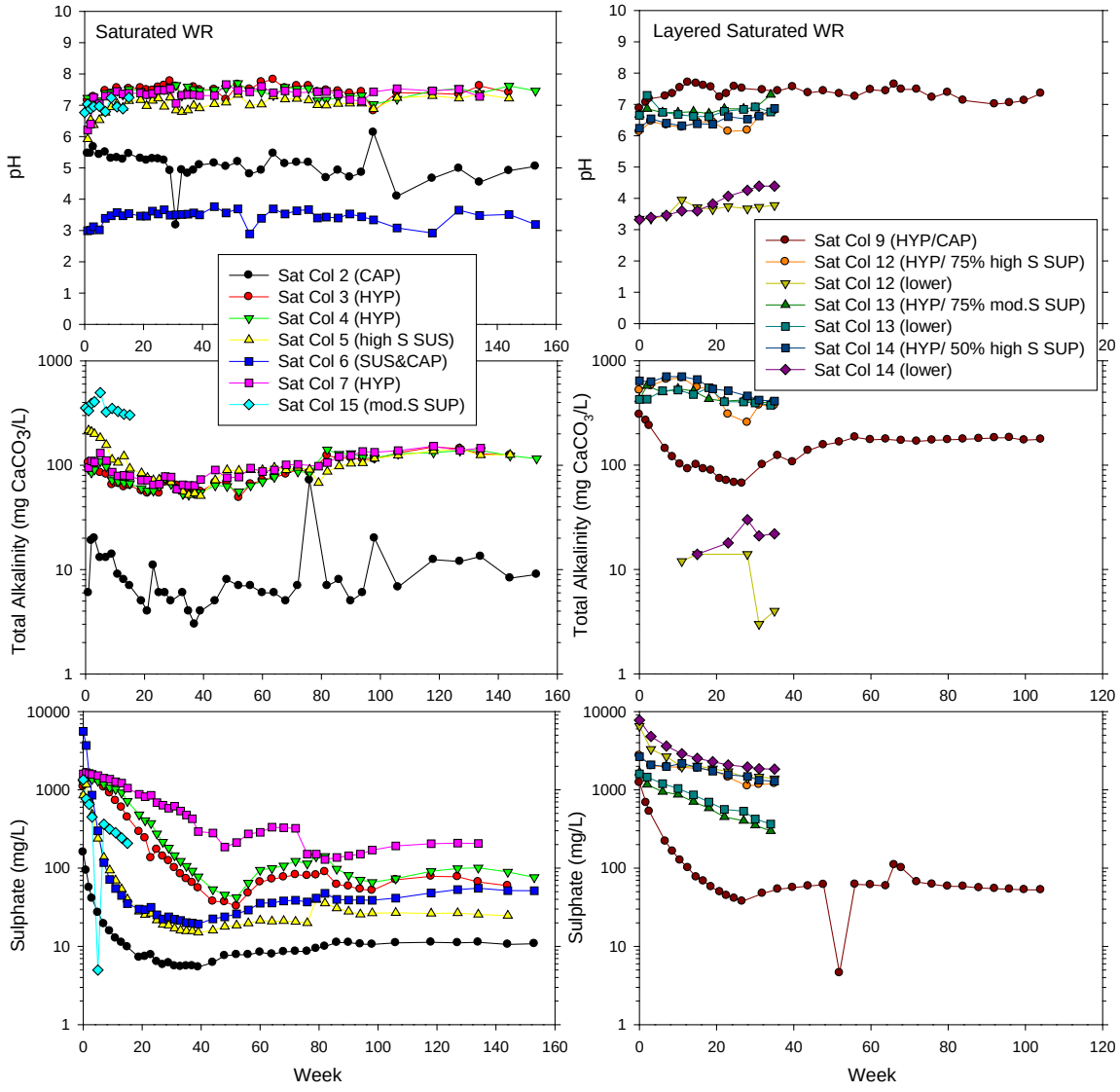


Figure 5-1: pH, alkalinity and sulphate in weekly leachate samples from saturated waste rock column tests.

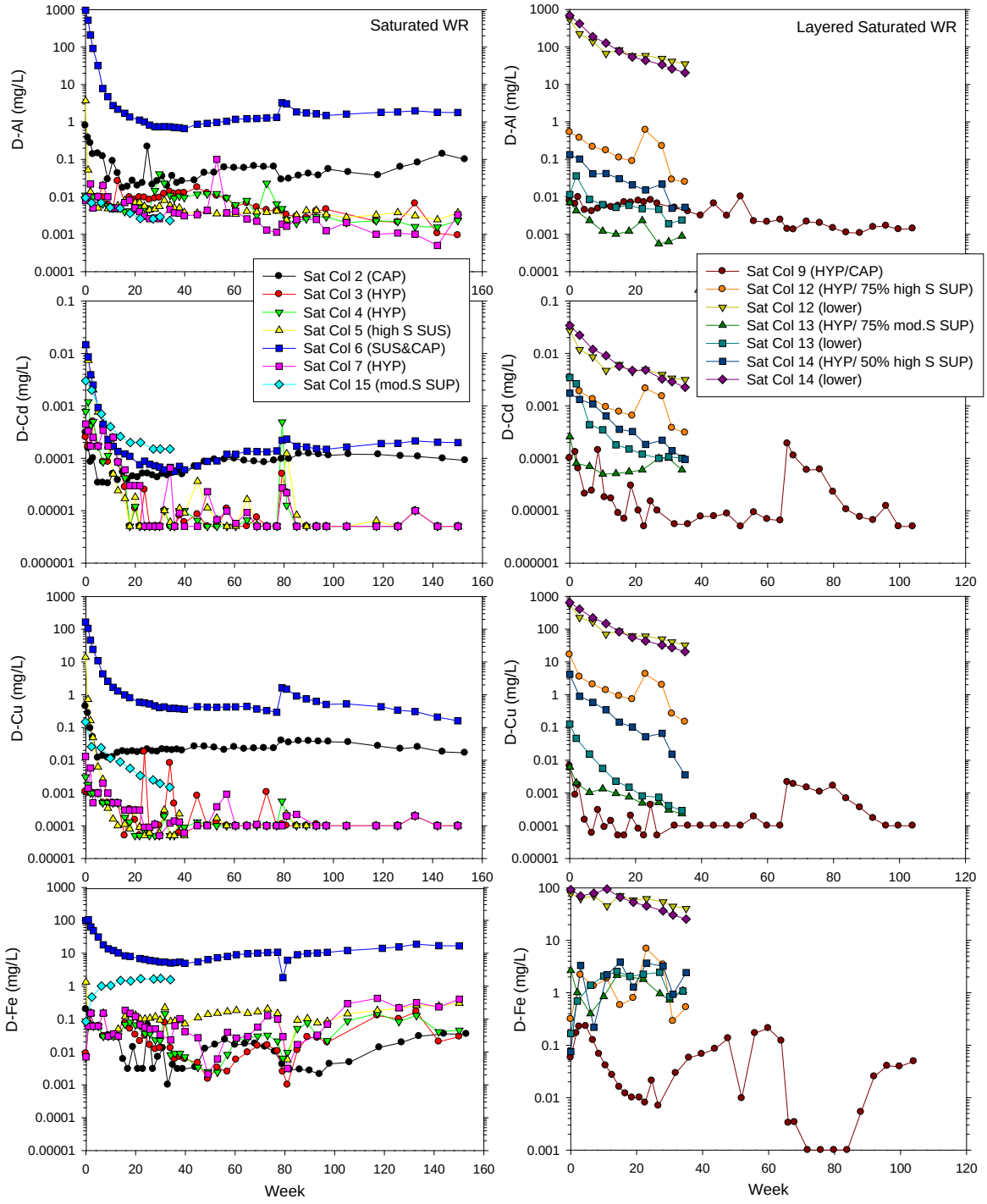


Figure 5-2: Concentrations of potential metals of concern in weekly leachate from saturated waste rock column tests.

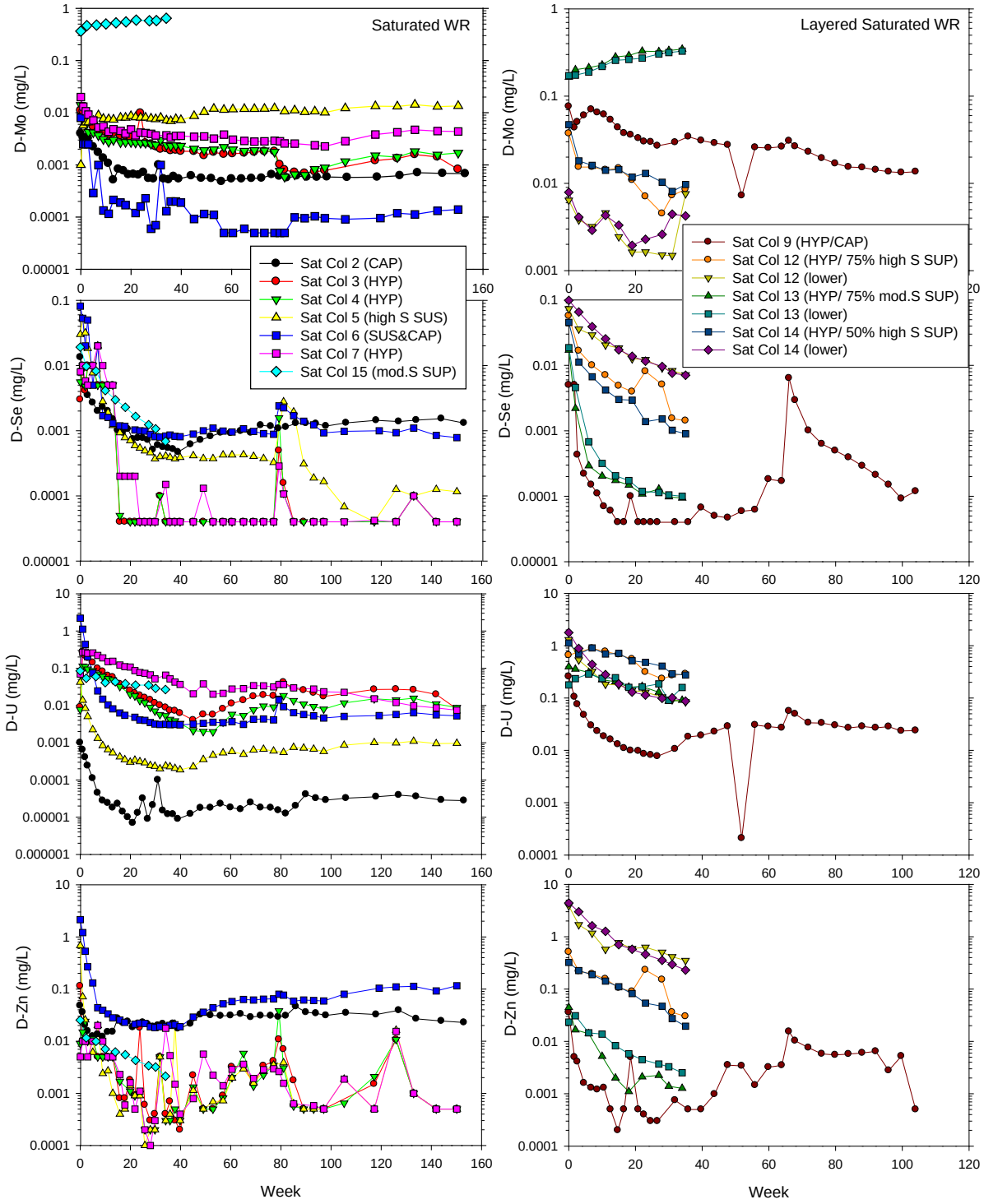


Figure 5-2 (cont.): Concentrations of potential metals of concern in weekly leachate from saturated waste rock column tests

A black precipitate formed in the neutral pH SUP material used in Sat Col 13 and Sat Col 15 (Figure 5-3). This precipitate has not been identified and no attempt has been made to collect a sample for mineralogical analysis as the column experiments are ongoing. It is hypothesized that the black precipitate is a secondary sulphide. Dissolved sulphide has remained below detection limits in all saturated waste rock columns, however this does not preclude sulphate reduction as dissolved sulphide would be highly insoluble in the presence of relatively high Fe and Cu concentrations (Figure 5-2). No precipitates were found in any other rock unit. The neutral SUP material provides relatively favorable conditions for secondary sulphide precipitation compared to the other waste rock columns, in that the neutral pH is favorable to microbial reduction reactions (compared to acidic SUP and CAP samples), and unlike HYP, the SUP mineralization zone contains secondary sulphide minerals that can serve as protonation sites.



Figure 5-3: Photograph of Sat Col 15 (left) and Sat Col 13 (right) showing black precipitate (arrows) along interface between CAP/SUP (bottom) and HYP (top) waste rock.

5.1.1.2 Layered Columns

Sat Col 9 (89% HYP & 11% SUP over CAP)

Sat Col 9 is composed of neutral HYP waste rock overlying acid generating CAP (paste pH 4.2) waste rock. Flow is in an upward direction through the column to assess the influence of HYP waste on CAP pore-water quality under subaqueous conditions. Overall, effluent from Sat Col 9 demonstrates a signature similar to that of saturated HYP waste rock (Sat Col 3, 4 and 7) rather than saturated CAP waste rock (Sat Col 2) in that the

leachate from Sat Col 9 is neutral to slightly alkaline (pH 7 to 8) and metals are leached at values below the MMER guidelines. Sulphate and metal loadings show a gradual decrease over the duration of the test. The initial increase in SO_4 and metal loadings observed for Sat Col 9 is similar to that observed for other columns composed of HYP (Sat Col 3, Sat Col 4 and Sat Col 7) and is likely due to the dissolution of gypsum as identified by XRD (Table 4-3).

Metal concentrations produced by Sat Col 9 are on the same order as that produced by other HYP columns. Of note, is the initially high D-Mo concentrations produced by Sat Col 9 over the first 30 weeks of the experiment, which are higher than concentrations produced by other saturated HYP columns and well above concentrations produced by other saturated CAP columns. Molybdenum is highly mobile under near-neutral pH conditions as the molybdate oxyanion. The notably higher levels of D-Mo in leachate from Sat Col 9 likely reflects the release of Mo from neutralization of CAP material near the HYP interface.

A back precipitate was observed in Sat Col 9 at the interface between the CAP waste and the overlying HYP waste (Figure 5-4). Investigations were conducted to assess whether the precipitate is sequestering D-Cu and other dissolved metals leached from the CAP waste and inhibiting their mobility into the overlying HYP layer and water cover.



Figure 5-4: Photograph of Sat Col 9 (left) and Sat Col 15 (right) showing black precipitate (arrows) along interface between CAP/SUP (bottom) and HYP (top) waste rock.

Concentrations of D-Cu in SFE and in leachate (maximum and cumulative loads after 110 weeks) from Sat Col 9 and Sat Col 2 are provided in Table 5-2 for comparison. Results for Sat Col 2 provide an indication of the behavior of saturated CAP waste rock without the influence of HYP waste. The SFE results provide an indication of the amount of Cu that is readily soluble from the waste at a 3:1 liquid to solid mixture. Both the maximum concentration (0.44 mg/L D-Cu) and cumulative load (0.5 mg/kg Cu) in leachate from Sat Col 2 are higher than concentrations measured in SFE (0.095 mg/L D-Cu and 0.29 mg/kg

Cu). Conversely, Sat Col 9 produced considerably lower maximum concentrations and cumulative loads in pore-water compared to SFE for both the CAP and HYP waste used to construct the column (Table 5-2). The CAP waste in the lower half of Sat Col 9 produced 2.67 mg/kg D-Cu in SFE, however, only 0.01 mg/kg of Cu was released from Sat Col 9 (after 110 weeks). Furthermore, the D-Cu concentration in SFE of CAP waste from the Sat Col 9 sample is an order of magnitude higher than the D-Cu concentration measured in SFE of CAP waste used in Sat Col 2. These results indicate that Cu is being attenuated in Sat Col 9 by the overlying HYP waste.

Table 5-2:
Cu concentrations in SFE and pore-water from Sat Col 9 and Sat Col 2

		Kinetic Test	**Sat Col 2**	**Sat Col 9**	
		Sample Description	**95% CAP 5% SUP**	**100% CAP**	**89% HYP 11% SUP**
Analysis	**Value**	**Unit**			
Shake Flask Extraction	Concentration D-Cu	mg/L	0.095	0.89	0.0098
	Mass Cu release	mg/kg	0.29	2.67	0.0294
Column pore-water *	Max Concentration D-Cu	mg/L	0.44	0.006	
	Cumulative Cu Load	mg/kg	0.5	0.01	

Notes: * Kinetic test data is for 110 weeks of Sat Col 2 and Sat Col 9 testwork.

Potential Cu attenuation mechanisms include sorption to mineral surfaces and/or precipitation as a distinct mineral phase. Once kinetic testing for Sat Col 9 was terminated and the cell was deconstructed, a sample of the black precipitate (Figure 5-4) was collected and submitted for mineralogical investigations by XRD and SEM. Results of these investigations are provided in Appendix B.1 and B.4.

X-ray diffraction of the precipitate was conducted in the Geology Department at UBC. Mineral phases identified by XRD in the black precipitate are consistent with mineral phases identified in samples from the CAP and HYP waste used to construct Sat Col 9 (Table 4-1 and Table 4-3); however, no crystalline Cu-bearing mineral phases were identified. This is not surprising given that the technique has difficulty detecting amorphous or poorly crystalline mineral phases. The lack of secondary phases identified by XRD supports the interpretations of SEM analysis that the metal-bearing secondary phases of the black precipitate are amorphous in nature.

Shavings of the black precipitate were mounted on aluminum stubs using adhesive double sided tape and then sputter coated with carbon before being analyzed by a Philips XL30 electron microscope equipped with a Princeton Gamma-Tech energy-dispersion X-ray

spectrometer (SEM-EDS) at the University of British Columbia. Three shaving fragments of the precipitate were examined in detail. SEM investigations determined that the shavings were composed of Ca, O, Al, Fe and Si, with minor occurrence of Mg, K, Cl, S and Cu. All instances where Cu was identified, Ca, O, Al, Si, S and Fe were also present. The lack of crystalline structure in the locations where Cu was identified indicates that its occurrence is secondary in nature. The mineralogic examination was inconclusive as to whether Cu is present as a distinct mineral precipitate (i.e., sulphide or hydroxide), or if Cu is present as an impurity in another mineral phase.

Sat Col 12, 13 and 14 (HYP over SUP)

The layered saturated columns 12, 13 and 14 have been running for nearly 40 weeks; however, the leaching rates have not yet stabilized. Additional data will provide further information regarding the metal attenuation capacity of the HYP waste rock on the moderate and high S bearing SUP waste rock. A few observations are noted.

- The lower ports for Sat Col 12 and 14 are producing acidic drainage, consistent with high S SUP material placed in the lower portion of the column. The drainage pH from the lower port of Sat Col 14 shows an increase over the last few cycles (Figure 5-1), possibly reflecting the greater volume of HYP (50%) overlying the high S SUP and downward diffusion from the overlying HYP.
- The upper ports of Sat Col 12 and 14 have pH 6 – 6.5, which is somewhat lower of a pH range than observed in HYP-only columns (Sat Col 3, 4 and 7). The leachate from layered and HYP-only columns is being buffered by the same suite of carbonate minerals (i.e., calcite and dolomite). This is because under saturated conditions carbon dioxide degassing is prevented, resulting in accumulation of carbon dioxide and alkalinity when neutralization reactions take place. This lowers the equilibrium pH of carbonate minerals, preventing an alkaline pH from being reached. This is analogous to anoxic limestone drains used in the reclamation of ARD. In a survey of anoxic limestone drains, nine out of the ten sites were producing a pH between 6.2 and 6.7 (Watzlaf *et al.,* 2000).
- The upper and lower ports of Sat Col 13 are producing neutral (pH 6.5 – 7) drainage, consistent with neutral SUP and HYP placed in the column.
- Sulphate loadings from the upper and lower ports of Sat Col 12, 13 and 14 decrease immediately following the initial flush of surface oxidation products.
- Sulphate and metal loadings generally decrease over the nearly 40 weeks of testing (Figures 5-1 and 5-2). The exceptions are D-Fe, which fluctuates, and D-Mo, which shows an increase in concentration from both ports of Sat Col 13.

- Metal loadings reflect the pH of the columns, with the greatest loadings produced from the lower ports of Sat Col 12 and 14 (acidic SUP) and the lowest loadings produced by the upper and lower ports of Sat Col 13 (neutral SUP and HYP). Conversely, the greatest D-Mo loadings are produced by Sat Col 13 and the lowest D-Mo loadings are produced by the lower ports of Sat Col 12 and 14.
- A black precipitate is forming on the boundary between SUP and HYP in Sat Col 12 and 14, similar to that observed in Sat Col 9.

5.1.1.3 CAP and SUP Acidity

One of the objectives of the saturated column experiments was to determine the amount of acidity that may be released from oxidized CAP and SUP waste rock placed subaqueously in the impoundment. Saturated conditions will inhibit the release of sulphide-AP, however AP associated with sulphate minerals (*e.g.*, jarosite and alunite) could still be released into pore water. Total acidity estimates can then be used to estimate the amount of AP released and NP required to neutralize acidic seepage from saturated CAP and SUP waste rock.

Total acidity for Sat Col 2 (95% CAP), Sat Col 5 (90% SUS) and Sat Col 6 (50% CAP & SUS) was calculated using the equation presented in Hedin *et al*. (1994), which incorporates pH values and concentrations of D-Al, Fe and Mn for a sample material. Note that the calculation assumes that all D-Fe is in the oxidized state (Fe^{3+}). To account for acidity that will continue to be released from the saturated CAP and SUS waste rock columns following termination of the kinetic testwork, a linear decay rate was extrapolated using an average of the kinetic test time period producing steady-state acidity. A summary of the Hedin *et al*. (1994) equation and a description of how the acidity values were extrapolated are provided in Appendix D.3.

Acidity estimates for the Casino CAP and SUP waste rock are presented in Table 5-3. The cumulative acidity released at the end of 2010 ranges between 0.00848 $kgCaCO_3$/t and 3.24 $mgCaCO_3$/t. All three columns released a majority of their acidity in the first two months after the kinetic tests were initiated. Because a majority of the acidity was released early on in the experiment, the extrapolated acidity values were similar to the total measured acidity at the end of 2010. This is particularly true for Sat Col 6, which produced 3.24 $mgCaCO_3$/kg measured acidity and 3.52 $mgCaCO_3$/kg extrapolated acidity. Despite the fact that Sat Col 2 has a lower pH, Sat Col 5 produced a larger quantity of acidity. Approximately 75% of the acidity released from Sat Col 5 was during the first 11 weeks before the pH increased above 7.

Sulphate-AP estimated from ABA results in Table 4-15 and 4-16 are presented in Table 5-3 for comparison to measured and extrapolated acidity values. The sulphate-AP is greater than acidity measured in column effluent from all three columns. This could be, in part, due to neutralization taking place from minerals in the column material, as Sat Col 2 and

Sat Col 5 have some ScNP (6.3 and 10.7 kg$CaCO_3$/tonne, respectively). However, no ScNP is present in Sat Col 6, and sulphate-AP values are approximately three times greater than measured or extrapolated acidity. This indicates that a portion of the sulphate-AP in CAP and SUP may be unavailable to infiltrating pore water (*i.e.*, locked in gangue minerals), or that not all sulphate mineralization is associated with acidic oxide minerals. Although, the acidic oxide mineral jarosite is the only sulphate mineral identified by XRD analysis in these samples.

Table 5-3:
Measured and extrapolated total acidity in pore-water from saturated CAP and SUP waste rock columns.

Test ID	Sample Description	Measured Acidity	Extrapolated Acidity	Sulphate Acid Potential1
		kg $CaCO_3$/t	kg $CaCO_3$/t	kg CaCO3/t
Sat Col 2	95% CAP (5% SUS)	0.00848	0.0129	7.03
Sat Col 5	90% SUS (5% CAP & 5% HYP)	0.0250	0.0295	2.34
Sat Col 6	50% CAP, 50% SUS	3.24	3.52	11.2

5.1.2 Saturated Tailings Columns

Four saturated tailings columns have been running for over 40 cycles (Table 5-4). Sat Col 1 and Sat Col 8 were terminated in early January of 2013. Sat Col 10 and Sat Col 11 are on-going. Sat Col 16 and Sat Col 17 were recently initiated; therefore, there was not sufficient data to present graphically at the time of report compilation.

Table 5-4:
Sample description and operational procedures for saturated tailings columns

Kinetic Test ID	Zone	Lithology	Details / Notes	Mass (Kg)	Start Date	End Date
Sat Col 1	60% HYP 40% SUS	66% PP, 34% IX	Rougher whole tailings	4.5	24-Feb-10	11-Jan-13
Sat Col 8	83% HYP 17% SUS	17% WR, 20% PP, 63% IX	Rougher whole tailings	4.5	24-Feb-10	11-Jan-13
Sat Col 10	15% HYP 85% SUS	2% IX, 16% MX, 18% PP, 64% WR	Pyrite rougher (depyritized) whole tailings	5	20-Jul-11	on-going
Sat Col 11	15% HYP 85% SUS	2% IX, 16% MX, 18% PP, 64% WR	Pyrite concentrate with 21% slimes	5	28-Jul-11	on-going

The pH for Sat Col 8, 10 and 11 are slightly alkaline and maintained at a pH of ~ 8 for the length of the tests (Figure 5-5). The pH of Sat Col 8, 10 and 11 is typical of calcite buffered drainage. The pH of Sat Col 1 typically ranges between 9 and nearly 11 and reflects the effects of metallurgical testing and is likely due to incorporation of lime into the feed sample. Sulphate loadings are greatest from Sat Col 1 (60% HYP, 40% SUS whole

tailings), with initially high concentrations of 680 mg/L gradually decreasing and appearing to stabilize at <20 mg/L SO_4 at the end of the test. The high SO_4 leaching rates reflect the higher sulphate S content (0.08%) of the sample (Table 4-18). Sulphate loadings from the other three saturated tailings columns also decrease by an order of magnitude from the initial flush to concentrations near or below 10 mg/L at the end of the test period.

Metal leaching from the saturated tailings columns shows an overall decrease during the test period (Figure 5-6). The exception is D-Mo in leachate from each saturated tailings column except Sat Col 10 (for which there is less data). Following a decrease, concentrations of D-Mo begin a steady gradual increase. Concentrations of D-Mo are particularly high from Sat Col 11, which is composed of 85% SUS tailings concentrate and slimes, with concentrations hovering around 0.4 mg/L for the final 20 cycles of the test.

Sat Col 1 produced D-Al concentrations up to two orders of magnitude higher than that from the other saturated tailings columns, Sat Col 8 produced the highest D-As and Sat Col 10 produced the highest initial D-Cd and D-Cu. The elevated metal concentrations produced by these tailings columns do not reflect solid phase concentrations measured by aqua regia (Table 4-26 and Table 4-27). The elevated Cu release from the depyritized tailings of Sat Col 10 is believed to be associated with the destabilization of secondary Cu hydroxides that may have formed during the high pH mineral processing. Notably Sat Col 11, containing the pyrite concentrate, was observed to have metal leaching rates equal to or less than the corresponding depyritized sample. Leaching rates for other metals are presented in Appendix D.4. Metals that were consistently below the analytical detection limit are not presented graphically.

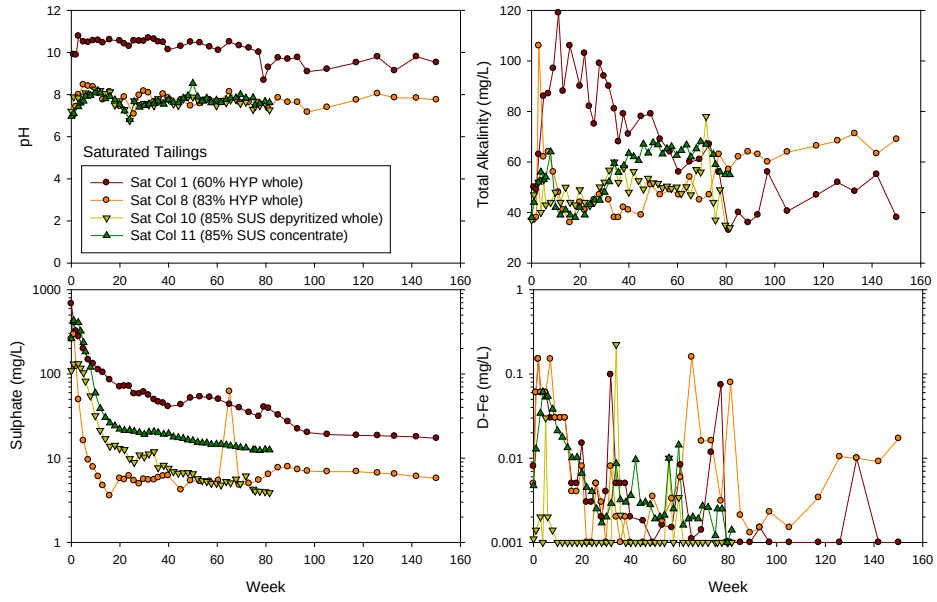


Figure 5-5: pH, alkalinity and sulphate in weekly leachate samples from saturated tailings column tests.

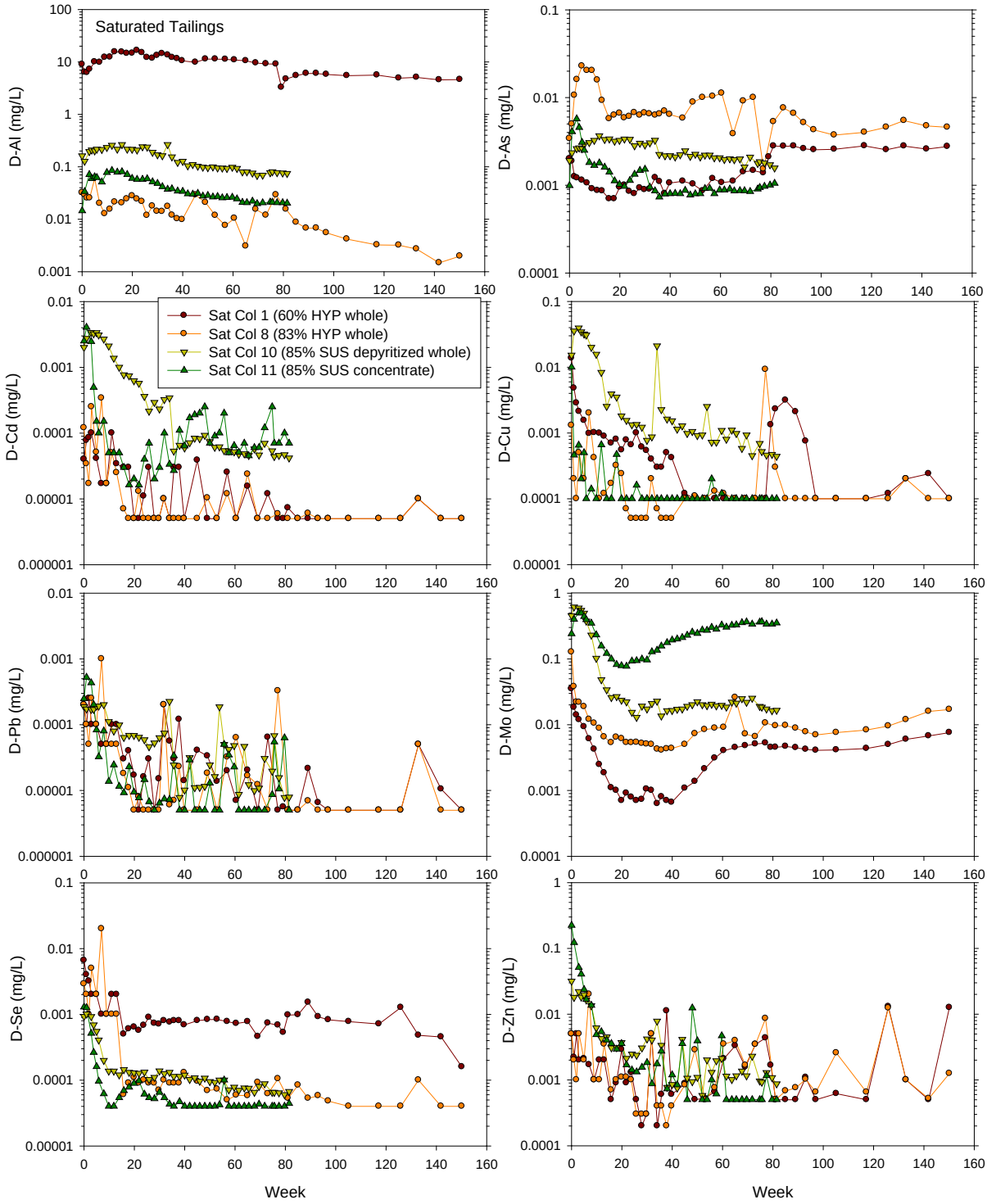


Figure 5-6: Concentrations of potential metals of concern in weekly leachate from saturated tailings column tests

5.2 Effect of Flow Rate

Flow rates for Sat Col 1 through Sat Col 9 vary throughout the experiment. The leachate volume was periodically measured and used to calculate average daily flow rates. A summary of the notable changes in average daily flow rates for the saturated waste rock columns and saturated tailings columns are summarized in Table 5-5 through Table 5-8. Flow rates for the saturated columns were decreased by ~76% to 87% when it became evident that higher flow rates than intended were passing through the columns. High flow rates through flooded wastes can result in large inputs of dissolved oxygen which can in turn result in higher rates of sulphide oxidation than observed under field conditions (Price, 2009). Flow rates were then temporarily increased following week 77 of the experiment (shaded in grey in the table) to assess changes in leachate composition. Small variations in flow rate between columns are due to wear and tear of tubing and material permeability.

Table 5-5:
Average daily flow rates for saturated waste rock columns.

Weeks		Average daily flow rate (mL/day)					
From	To	Sat Col 2	Sat Col 3	Sat Col 4	Sat Col 5	Sat Col 6	Sat Col 7
1	36	208	205	209	209	205	205
36	45	152	193	197	154	152	195
45	53	34	182	182	34	36	190
53	77	26	27	23	32	26	25
77	81	60	106	30	99	97	85
81	97*	41	43	44	35	44	38
97	150	6.4	5.9	5.4	5.3	6.1	5.3

Notes: Blue shaded values represent cycle when flow rates were decreased.
Grey shading highlights where flows were increased temporarily.
*Flow was turned off between sample events after week 97

Table 5-6:
Average daily flow rates for layered saturated waste rock column Sat Col 9

Weeks		Average daily flow rate (mL/day)
From	To	Sat Col 9
1	30	201.0
30	39	150.9
39	73	30.9
73	79	49.7
79	111	31.6

Notes: Blue shaded values represent cycle when flow rates were decreased.
Grey shading highlights where flows were increased temporarily.
Flow was turned off between sample events after week 97.
Presented flow rates do not include the first 5 weeks when the HYP layer was rinsed (prior to the addition of the CAP layer).

Table 5-7:
Average daily flow rates for upper and lower ports from layered saturated waste rock columns and Sat Col 15

Weeks		Average daily flow rate (mL/day)						
From	To	Sat Col 12 (upper)	Sat Col 12 (lower)	Sat Col 13 (upper)	Sat Col 13 (lower)	Sat Col 14 (upper)	Sat Col 14 (lower)	Sat Col 15
0		250	460	415	630	250	475	425
1	35	11[a]	19[b]	9[c]	19[b]	10[c]	18[c]	11

Notes **a.** Weeks 1 through 28 excluded from calculated average daily flow rates due to unknown total output volume and problems with the pump cassette resulting in large volume passing through column.
b. Weeks 7 to 11 and 23 to 28 excluded from calculated average daily flow rates due to unknown total output volume.
c. Weeks 23 to 28 excluded from calculated average daily flow rates due to unknown output volume

Table 5-8:
Average daily flow rates for saturated tailings columns

Week		Average Flow Rates (mL/day)		Week		Average Flow Rates (mL/day)	
From	To	Sat Col 1	Sat Col 8	From	To	Sat Col 10	Sat Col 11
1	36	208	208	1	5	109	105
36	45	153	154	5	30	161	158
45	77	27	34	30	81	35	35
77	81	79	109				
81	97*	39	36				
97	150	8	6				

Notes: Blue shading are cycles when flow rates were decreased. Grey shading highlights when flows were temporarily increased.
*Flow was turned off between sample events after week 97.

Saturated conditions are expected to inhibit oxidation reactions in mine waste. The primary source of metal leaching from saturated columns is flushing of secondary soluble oxide minerals. Concentrations produced by flushing of oxide minerals are not expected to be as sensitive to reaction kinetics as sulphide oxidation. Reaction mechanisms which could alter reaction kinetics over time under subaqueous conditions include reductive dissolution of Fe and Mn oxides and acid leaching.

Average production rates were calculated from the four sets of data prior to, and following, the decrease in flow rate. The calculated averages and difference between the average values are presented for both concentrations (mg/L) and loadings (mg/kg/wk) for waste rock in Tables 5-9 and 5-10 and for tailings in Tables 5-11 and 5-12. The four weeks (two sampling periods) immediately following the reduction in flow rate were excluded from the calculations to allow conditions in the columns to respond to the reduced flow.

Table 5-9:
Average concentrations (mg/L) from saturated waste rock columns before and after the decrease in flow rate

Kinetic Test	Output Vol. (mL/day)	pH	Cond-L	T-Alk	SO_4	D-Al	D-As	D-Cd	D-Cu	D-Fe	D-Pb	D-Mn	D-Mo	D-Ni	D-Se	D-Ag	D-Zn
			uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sat Col 2	152	5.0	20	4.0	5.7	0.028	0.00011	0.000057	0.022	0.0034	0.000072	0.024	0.00057	0.00017	0.00054	0.0000080	0.020
	34	5.1	30	6.0	8.2	0.061	0.00022	0.000092	0.023	0.019	0.00011	0.039	0.00053	0.00030	0.00094	0.0000096	0.031
Diff		1.0	1.5	1.5	1.4	2.2	2.0	1.6	1.0	5.6	1.5	1.6	0.9	1.7	1.8	1.2	1.5
Sat Col 3	182	7.5	206	61	41	0.013	0.0011	0.0000061	0.00028	0.0039	0.000027	0.025	0.0017	0.000043	0.000040	0.0000050	0.00085
	27	7.7	324	84	78	0.0051	0.0017	0.0000056	0.00034	0.013	0.000017	0.059	0.0018	0.000050	0.000040	0.0000051	0.0031
Diff		1.0	1.6	1.4	1.9	0.4	1.5	0.9	1.2	3.3	0.6	2.4	1.0	1.2	1.0	1.0	3.7
Sat Col 4	182	7.6	230	60	55	0.011	0.00038	0.0000066	0.00011	0.0038	0.0000083	0.057	0.0021	0.000043	0.000040	0.0000050	0.00066
	23	7.5	389	85	111	0.010	0.00088	0.0000054	0.00010	0.027	0.0000078	0.12	0.0019	0.000050	0.000040	0.0000051	0.0032
Diff		1.0	1.7	1.4	2.0	0.9	2.3	0.8	0.9	7.1	0.9	2.0	0.9	1.2	1.0	1.0	4.9
Sat Col 5	154	6.9	141	57	16	0.0044	0.00062	0.000015	0.00011	0.089	0.000016	0.16	0.0076	0.000030	0.00039	0.0000050	0.0058
	34	7.1	230	91	21	0.0037	0.0037	0.0000080	0.00010	0.16	0.0000095	0.24	0.012	0.000050	0.00042	0.0000050	0.0018
Diff		1.0	1.6	1.6	1.3	0.8	6.0	0.5	0.9	1.8	0.6	1.5	1.5	1.7	1.1	1.0	0.3
Sat Col 6	152	3.6	93	*ND*	21	0.74	0.00086	0.000064	0.39	5.2	0.0000083	0.0074	0.00017	0.00049	0.00084	0.0000050	0.022
	36	3.4	208	*ND*	35	1.2	0.00052	0.00013	0.41	9.2	0.0000095	0.011	0.000053	0.00067	0.00100	0.0000050	0.059
Diff		0.9	2.2	*NA*	1.7	1.6	0.6	2.0	1.1	1.8	1.1	1.5	0.3	1.4	1.2	1.0	2.6
Sat Col 7	190	7.4	720	76	297	0.028	0.0013	0.0000099	0.00016	0.019	0.000013	0.10	0.0034	0.000087	0.000063	0.0000050	0.0023
	25	7.5	764	95	318	0.0018	0.0016	0.0000061	0.00010	0.078	0.000010	0.20	0.0029	0.000050	0.000040	0.0000050	0.0028
Diff		1.0	1.1	1.3	1.1	0.1	1.3	0.6	0.6	4.1	0.8	1.9	0.8	0.6	0.6	1.0	1.3
Sat Col 9	151	7.5	240	77	43	0.0067	0.0051	0.0000089	0.00016	0.016	0.000016	0.17	0.029	0.00017	0.000040	0.0000050	0.00044
	31	7.3	437	161	47	0.0055	0.0050	0.0000077	0.00012	0.100	0.000023	0.34	0.022	0.00018	0.000055	0.0000050	0.0023
Diff		1.0	1.8	2.1	1.1	0.8	1.0	0.9	0.8	6.1	1.5	2.0	0.8	1.1	1.4	1.0	5.4

Notes: Average concentrations were calculated from the four sample sets prior to and following the flow rate adjustment. The 4 weeks (two sampling periods) immediately following the reduction in flow rate were not included in the averages to allow for the columns to adjust to the reduced flow conditions. Diff = difference between the average values (low flow rate value / high flow rate value); highlighted values represent an increase following the decreased flow rate.
* as $CaCO_3$

Table 5-10:
Average production rates (mg/kg/wk) from saturated waste rock columns before and after the decrease in flow rate

Kinetic Test	Output Vol. (mL/day)	pH	Cond.	T-Alk.*	SO_4	D-Al	D-As	D-Cd	D-Cu	D-Fe	D-Pb	D-Mn	D-Mo	D-Ni	D-Se	D-Zn
			uS/cm	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk
Sat Col 2	152	5	20	2.1	3	0.015	0.000058	0.00003	0.012	0.0018	0.000039	0.013	0.0003	0.000093	0.00028	0.011
	34	5.1	30	0.89	1.2	0.0091	0.000033	0.000014	0.0034	0.0028	0.000016	0.0058	0.000078	0.000043	0.00014	0.0046
Diff		1	1.5	0.4	0.4	0.6	0.6	0.5	0.3	1.6	0.4	0.4	0.3	0.5	0.5	0.4
Sat Col 3	182	7.5	206	62	39	0.014	0.0011	0.0000064	0.00036	0.0036	0.000034	0.024	0.0017	0.000046	0.00004	0.0011
	27	7.7	324	13	12	0.00083	0.00027	0.00000089	0.00005	0.002	0.0000027	0.0095	0.00028	0.0000080	0.0000064	0.00051
Diff		1	1.6	0.2	0.3	0.1	0.2	0.1	0.1	0.6	0.1	0.4	0.2	0.2	0.2	0.5
Sat Col 4	182	7.6	230	61	52	0.012	0.00038	0.0000063	0.00011	0.0034	0.0000092	0.056	0.002	0.000046	0.00004	0.00077
	23	7.5	389	12	15	0.0014	0.00012	0.00000075	0.000014	0.0037	0.0000011	0.016	0.00026	0.0000069	0.0000055	0.00046
Diff		1	1.7	0.2	0.3	0.1	0.3	0.1	0.1	1.1	0.1	0.3	0.1	0.1	0.1	0.6
Sat Col 5	154	6.9	141	31	8.4	0.0023	0.00033	0.0000083	0.00006	0.048	0.0000085	0.086	0.0041	0.000016	0.00021	0.0032
	34	7.1	230	16	3.7	0.00066	0.00067	0.0000015	0.000018	0.029	0.0000018	0.043	0.0021	0.0000088	0.000074	0.00033
Diff		1	1.6	0.5	0.4	0.3	2	0.2	0.3	0.6	0.2	0.5	0.5	0.5	0.4	0.1
Sat Col 6	152	3.6	93	*ND*	11	0.39	0.00045	0.000034	0.21	2.8	0.0000045	0.0039	0.00009	0.00026	0.00045	0.012
	36	3.4	208	*ND*	4.9	0.16	0.000072	0.000018	0.058	1.3	0.0000013	0.0015	0.0000074	0.000095	0.00014	0.0083
Diff		0.9	2.2	*NA*	0.5	0.4	0.2	0.5	0.3	0.5	0.3	0.4	0.1	0.4	0.3	0.7
Sat Col 7	190	7.4	720	39	142	0.012	0.00062	0.0000052	0.000078	0.0087	0.0000066	0.050	0.0017	0.000045	0.000033	0.0012
	25	7.5	764	7.2	24	0.00014	0.00012	0.00000046	0.0000077	0.0058	0.00000078	0.015	0.00022	0.0000038	0.000003	0.00022
Diff		1	1.1	0.2	0.2	0.01	0.2	0.1	0.1	0.7	0.1	0.3	0.1	0.1	0.1	0.2
Sat Col 9	151	7.5	257	19	9.8	0.0014	0.0011	0.0000022	0.000041	0.0053	0.000004	0.042	0.0066	0.000040	0.000009	0.0001
	31	7.4	440	15	4	0.00039	0.00048	0.00000064	0.00001	0.011	0.0000014	0.032	0.0018	0.000016	0.0000075	0.00025
Diff		1	1.7	0.8	0.4	0.3	0.4	0.3	0.3	2.1	0.3	0.8	0.3	0.4	0.8	2.4

Notes: Average production rates were calculated from the four sample sets prior to and following the flow rate adjustment. The 4 weeks (two sampling periods) immediately following the reduction in flow rate were not included in the averages to allow for the columns to adjust to the reduced flow conditions. *Diff* = difference between the average values (low flow rate value / high flow rate value); highlighted values represent an increase following the decreased flow rate. * as $CaCO_3$

Table 5-11:
Average concentrations (mg/L) from saturated tailings columns before and after the decrease in flow rate

Kinetic Test	Output Vol. (mL/day)	pH	Cond-L	T-Alk	SO_4	D-Al	D-Sb	D-As	D-Cd	D-Co	D-Cu	D-Fe	D-Pb	D-Mn	D-Hg	D-Mo	D-Ni	D-Se	D-Ag	D-U	D-Zn
			uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sat Col 1	153	10	261	74	44	11	0.0017	0.0010	0.000026	0.000018	0.00034	0.0035	0.000051	0.00018	0.000039	0.00081	0.00067	0.00077	0.000018	0.000073	0.0033
	27	10	258	60	46	11	0.0020	0.0012	0.000013	0.0000065	0.00010	0.0031	0.000013	0.000050	0.000066	0.0041	0.00012	0.00068	0.0000067	0.000067	0.0019
Diff		1.0	1.0	0.8	1.1	1.0	1.2	1.2	0.5	0.4	0.3	0.9	0.3	0.3	1.7	5.1	0.2	0.9	0.4	0.9	0.6
Sat Col 8	154	7.8	87	40	5.6	0.015	0.0011	0.0064	0.0000050	0.0000052	0.000063	0.0013	0.000010	0.011	0.000013	0.0044	0.00029	0.00010	0.0000050	0.00042	0.00046
	34	7.8	107	49	19	0.0091	0.0013	0.0086	0.000011	0.00015	0.00011	0.046	0.000031	0.15	0.000055	0.013	0.000091	0.000065	0.0000050	0.0071	0.0025
Diff		1.0	1.2	1.2	3.5	0.6	1.1	1.3	2.3	28.9	1.8	36.8	3.1	13.5	4.4	2.9	0.3	0.6	1.0	16.9	5.4
Sat Col 10	161	7.4	106	47	10.0	0.21	0.0013	0.0030	0.00027	0.00012	0.0012	0.0010	0.000055	0.0021	0.000010	0.016	0.000050	0.00012	0.0000050	0.0010	0.0030
	35	7.7	105	53	7.6	0.13	0.00088	0.0022	0.000062	0.000034	0.0016	0.0013	0.000018	0.0070	0.000010	0.016	0.000050	0.00011	0.0000051	0.00085	0.0014
Diff		1.0	1.0	1.1	0.8	0.6	0.7	0.7	0.2	0.3	1.4	1.3	0.3	3.4	1.0	1.0	1.0	0.9	1.0	0.8	0.5
Sat Col 11	158	7.3	127	45	20	0.054	0.0034	0.0014	0.000040	0.000026	0.00012	0.0026	0.0000082	0.0052	0.000010	0.095	0.000056	0.000058	0.0000050	0.000038	0.0015
	35	7.7	152	60	19	0.034	0.0028	0.00078	0.000093	0.000017	0.00010	0.0049	0.000018	0.0090	0.000010	0.18	0.0035	0.000042	0.0000075	0.000046	0.0014
Diff		1.0	1.2	1.3	0.9	0.6	0.8	0.6	2.3	0.7	0.9	1.9	2.2	1.7	1.0	1.9	63.5	0.7	1.5	1.2	0.9

Notes: Average production rates were calculated from the four sample sets prior to and following the flow rate adjustment. The 4 weeks (two sampling periods) immediately following the reduction in flow rate were not included in the averages to allow for the columns to adjust to the reduced flow conditions. *Diff* = difference between the average values (low flow rate value / high flow rate value); highlighted values represent an increase following the decreased flow rate.
* as $CaCO_3$

Table 5-12:
Average production rates (mg/kg/wk) from saturated tailings columns before and after the decrease in flow rate

Kinetic Test	Output Vol. (mL/day)	pH	Cond	T-Alk.*	SO_4	D-Al	D-As	D-Cd	D-Cu	D-Fe	D-Pb	D-Mn	D-Mo	D-Ni	D-Se	D-Zn
			uS/cm	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk
Sat Col 1	153	10.4	261	44	26	6.5	0.0006	0.000015	0.0002	0.002	0.00003	0.00010	0.00048	0.00040	0.00046	0.002
	27	10.3	258	8.8	6.7	1.5	0.00017	0.0000019	0.000015	0.00041	0.000002	0.0000073	0.0006	0.000018	0.0001	0.00028
Diff		1	1	0.2	0.3	0.2	0.3	0.1	0.1	0.2	0.1	0.1	1.2	0.0	0.2	0.1
Sat Col 8	154	7.8	87	24	3.3	0.0091	0.0038	0.000003	0.000037	0.00075	0.000006	0.0068	0.0026	0.00018	0.00006	0.00027
	34	7.8	107	10	4.7	0.0018	0.0017	0.0000025	0.000023	0.011	0.0000061	0.038	0.0029	0.000021	0.000014	0.00054
Diff		1	1.2	0.4	1.4	0.2	0.4	0.9	0.6	15.4	1	5.7	1.1	0.1	0.2	2
Sat Col 10	161	7.4	106	27	5.8	0.1214	0.0018	0.0001621	0.000681	0.00058	0.0000321	0.0012	0.0094	0.00003	0.00007	0.00175
	35	7.7	105	5	0.7	0.0114	0.0002	0.0000056	0.000147	0.00011	0.0000016	0.0006	0.0014	0.00000	0.00001	0.00012
Diff		1	1	0.2	0.1	0.1	0.1	0.03	0.2	0.2	0.1	0.5	0.2	0.2	0.1	0.1
Sat Col 11	158	7.3	127	25	11	0.03	0.00076	0.000022	0.000064	0.0014	0.0000047	0.0029	0.054	0.000031	0.000033	0.00086
	35	7.7	152	5.8	1.9	0.0033	0.000076	0.0000092	0.0000097	0.00047	0.0000017	0.00087	0.018	0.00035	0.0000041	0.00013
Diff		1	1.2	0.2	0.2	0.1	0.1	0.4	0.2	0.3	0.4	0.3	0.3	11.3	0.1	0.2

Notes: Average production rates were calculated from the four sample sets prior to and following the flow rate adjustment. The 4 weeks (two sampling periods) immediately following the reduction in flow rate were not included in the averages to allow for the columns to adjust to the reduced flow conditions. *Diff* = difference between the average values (low flow rate value / high flow rate value); highlighted values represent an increase following the decreased flow rate. * as $CaCO_3$

Loading rates for nearly all parameters decrease following the reduced flow conditions in the saturated waste rock and tailings columns (Tables 5-10 and 5-12), with the majority of parameters decreasing by more than 50% (*i.e., Diff* of 0.5 or lower) from the waste rock and by more than 70% from the tailings. Conversely, concentrations increase when the flow rate is decreased, however not to the extent required to prevent a drop in loading rates. Concentrations increase by generally less than 25% when the pore water residence time is increased by 450% to 800%. The largest concentration increases occur in Fe, Mn, Zn and Mo.

5.3 Pore Volume Concentrations and Guideline Exceedances

Concentrations of parameters in effluent from the saturated waste rock and tailings columns were calculated for pore volumes (*Pvc*) flushed through the column according to:

$$Pvc = (1 - Pv1)/(Pv2 - Pv1)) * [C2] + (Pv2 - 1)/(Pv2 - Pv1) * [C1]$$

Where *Pv* is the calculated pore volumes based on measured weekly column output volumes (mL) and [*C*] is the weekly measured concentration of a parameter. Pore volumes were calculated according to:

$$Pv\ (\mathrm{L}) = n * \left(h * \pi * \left(\frac{d}{2}\right)^2\right)$$

Where, *n* is the assumed pore space in the column (30%), *h* is the height of the sample solids in the column and *d* is the diameter of the column.

Concentrations of potential parameters of concern in pore volumes flushed through each saturated column are presented for CAP and SUP waste rock in Table 5-13, HYP waste rock in Table 5-14, layered waste rock columns in Table 5-15 and the tailings columns in Table 5-17. Column pore volume concentrations are presented for the first 10 pore volumes, the decreased flow rates (Tables 5-5 to 5-7) and the final available data. The results are compared to MMER and CCME guidelines (Table 4-22) in order to provide an indication of the parameters which are elevated and which may be of concern from the different Casino waste products. A summary of the guideline exceedances are presented for waste rock in Table 5-16 and tailings in Table 5-18.

5.3.1 Saturated Waste Rock Columns

Dissolved Cu and Zn exceed MMER guidelines in the initial pore volumes flushed through saturated columns composed of CAP and/or acidic (high S) SUP waste rock (Sat Col 2, 6, 5, 12 and 14) (Table 5-16). Additionally, concentrations of D-Ni exceed MMER in the lower ports of Sat Col 12 and 14. Metal concentrations in the initial pore volume flushed through the HYP waste rock columns do not exceed MMER guidelines.

No MMER guidelines are exceeded in the final stabilized pore volumes flushed through the saturated waste rock columns. Concentrations of D-Al, Cd, Cu, Fe, Se and Zn exceed CCME guidelines in the final stable pore volume produced by columns composed of CAP waste rock (Sat Col 2 and 6). Only D-As exceeds the CCME guideline in the final pore volume from the high S SUS waste rock of Sat Col 5 and only D-U exceeds the CCME guideline in final pore volumes from Sat Col 3 and Sat Col 9 which are composed of waste rock from the HYP. Saturated columns 12, 13, 14 and 15 have not yet stabilized.

Initial concentrations of Al, Cd, Cu, Fe, Se, U and Zn are higher in leachate from Sat Col 5 relative to Sat Col 2 (Table 5-13). However, concentrations decrease more rapidly from Sat Col 5 and stabilize at lower concentrations. This behavior can be related to pH conditions in the column and mineralogy of the test samples. It appears that the soluble oxidation products in the CAP and SUP rocks maintain a lower pH, which allows metals to remain mobile in the pore water. Sat Col 5 becomes neutral while Sat Col 2 remains acidic over the course of the experiment.

Leachate chemistry for Sat Col 15, which is composed of neutral SUP waste rock, differs from the more acidic SUP columns in that concentrations of D-Al and As are low while levels of D-Mo are elevated above the CCME limit early in the test.

Dissolved Cd, Cu, Se and U exceed CCME guidelines in leachate from the HYP waste rock columns early in the test, with D-Se and U leaching at higher concentrations from the HYP compared to the CAP and SUP (Table 5-14).

Leachate produced by the upper ports installed in the HYP waste rock of the layered columns (Sat Col 9, 12, 13 and 14) have slightly different leachate chemistry from saturated columns composed exclusively of HYP (Sat Col 3, 4 and 7) in that D-Al, As, Fe and/or Mo are generally higher (Table 5-15). The elevated concentrations of these metals in pore waters of the HYP waste rock layer is likely due to the dissolution of surface oxides and upward mobility from underlying SUP waste. The lower ports of Sat Col 12 and Sat Col 14, which are within the acidic SUP layers, are producing leachate with some of the highest concentrations of metals. In particular, D-Cu is up to 1000 times the MMER MGS guideline.

Table 5-13:
Column pore volume concentrations for saturated CAP and SUP waste rock columns

Column PV Flush	pH	SO_4	D-Al	D-As	D-Cd	D-Cr	D-Cu	D-Fe	D-Hg	D-Mo	D-Ni	D-Se	D-Tl	D-U	D-Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sat Col 2 (95% CAP, 5% SUS)															
0	*ND*	160	0.80	0.0024	0.00031	0.0080	0.44	0.20	0.00023	0.0040	0.0020	0.013	0.00013	0.0010	0.048
0.5	5.5	142	0.68	0.0021	0.00027	0.0069	0.40	0.16	0.00017	0.0038	0.0017	0.012	0.00012	0.00090	0.045
1	5.5	124	0.57	0.0019	0.00022	0.0058	0.35	0.13	0.00011	0.0036	0.0013	0.011	0.00011	0.00081	0.041
2	5.7	89	0.37	0.0014	0.00015	0.0038	0.25	0.088	0.000021	0.0033	0.00096	0.0083	0.00015	0.00062	0.034
3	5.4	66	0.30	0.0012	0.00010	0.0029	0.14	0.13	0.000041	0.0033	0.0020	0.0058	0.00040	0.00047	0.024
4	5.5	51	0.22	0.0011	0.000091	0.0021	0.078	0.12	0.000035	0.0033	0.0019	0.0043	0.00039	0.00035	0.019
5	5.3	41	0.14	0.0010	0.000100	0.0013	0.051	0.060	0.000010	0.0032	0.0010	0.0035	0.00020	0.00024	0.016
6	5.3	37	0.14	0.00093	0.000079	0.0012	0.039	0.060	0.000010	0.0029	0.0010	0.0032	0.00020	0.00020	0.015
7	5.3	32	0.14	0.00084	0.000059	0.0011	0.026	0.060	0.000010	0.0026	0.0010	0.0030	0.00020	0.00016	0.014
8	5.5	28	0.14	0.00075	0.000038	0.0010	0.014	0.060	0.000010	0.0023	0.0010	0.0027	0.00020	0.00012	0.013
9	*ND*	25	0.14	0.00063	0.000034	0.0010	0.012	0.052	0.000010	0.0021	0.0010	0.0025	0.00020	0.000094	0.013
10	5.3	23	0.13	0.00051	0.000034	0.0010	0.013	0.043	0.000010	0.0019	0.0010	0.0023	0.00020	0.000073	0.013
22[ab]	5.0	11	0.036	0.00017	0.000042	0.00040	0.017	0.024	0.000010	0.00059	0.00044	0.0014	0.000083	0.000019	0.018
82	*ND*	11	0.13	0.00030	0.000097	0.00010	0.018	0.035	0.000010	0.00069	0.00027	0.0015	0.000032	0.000029	0.024
Sat Col 6 (50% SUS, 50% CAP)															
0	*ND*	5600	961	0.0078	0.015	0.22	165	98	0.000080	0.0080	0.39	0.082	0.00020	2.2	2.2
0.5	3.0	5124	851	0.0071	0.013	0.19	150	99	0.000062	0.0066	0.35	0.074	0.0014	1.9	1.9
1	3.0	4648	741	0.0064	0.012	0.16	135	101	0.000045	0.0052	0.30	0.067	0.0026	1.7	1.7
2	3.1	3694	522	0.0050	0.0086	0.10	106	104	0.000010	0.0025	0.21	0.053	0.0050	1.1	1.2
3	3.0	2480	342	0.0050	0.0059	0.063	72	81	0.000033	0.0025	0.14	0.034	0.0050	0.73	0.82
4	3.4	1473	192	0.0050	0.0037	0.032	43	61	0.000045	0.0025	0.085	0.024	0.0050	0.40	0.49
5	3.5	1058	125	0.0050	0.0029	0.027	31	53	0.000024	0.0025	0.056	0.042	0.0050	0.27	0.34
6	3.6	775	83	0.0044	0.0023	0.022	22	46	0.000013	0.0022	0.039	0.043	0.0043	0.18	0.25
7	3.5	616	66	0.0032	0.0018	0.016	19	41	0.000012	0.0015	0.032	0.030	0.0030	0.15	0.21
8	3.5	456	49	0.0020	0.0014	0.010	15	36	0.000011	0.00091	0.025	0.018	0.0018	0.11	0.17
9	*ND*	299	32	0.00086	0.00092	0.0045	11	31	0.000010	0.00029	0.018	0.0051	0.00051	0.074	0.13
10	3.5	247	25	0.0012	0.00078	0.0061	9.0	27	0.000024	0.00050	0.016	0.0094	0.00094	0.060	0.11
22[ab]	3.6	47	2.3	0.00021	0.00014	0.00054	1.4	11	0.000010	0.00022	0.0016	0.0013	0.00012	0.0085	0.029
92	*ND*	52	1.8	0.0027	0.00020	0.00032	0.18	17	0.000010	0.00014	0.00083	0.00082	0.000011	0.0055	0.10

Column PV Flush	pH	SO_4 mg/L	D-Al mg/L	D-As mg/L	D-Cd mg/L	D-Cr mg/L	D-Cu mg/L	D-Fe mg/L	D-Hg mg/L	D-Mo mg/L	D-Ni mg/L	D-Se mg/L	D-Tl mg/L	D-U mg/L	D-Zn mg/L
Sat Col 5 (90% SUP, 5% CAP, 5% HYP)															
0	*ND*	850	3.7	0.0011	0.014	0.0010	14	1.3	0.000020	0.0010	0.083	0.030	0.00027	0.042	0.68
0.5	5.9	931	2.8	0.0011	0.013	0.0020	11	1.0	0.000017	0.0022	0.069	0.036	0.00046	0.035	0.52
1	6.5	1012	1.8	0.0010	0.011	0.0030	7.2	0.69	0.000015	0.0034	0.054	0.041	0.00064	0.028	0.37
2	6.4	1163	0.051	0.00099	0.0073	0.0050	0.71	0.088	0.000011	0.0057	0.026	0.052	0.00099	0.014	0.070
3	6.5	909	0.029	0.00070	0.0052	0.0035	0.39	0.12	0.000034	0.0062	0.016	0.040	0.00070	0.011	0.044
4	6.8	688	0.012	0.00050	0.0035	0.0025	0.14	0.13	0.000043	0.0065	0.0083	0.029	0.00050	0.0078	0.023
5	6.9	544	0.0071	0.00050	0.0024	0.0025	0.076	0.082	0.000020	0.0065	0.0052	0.022	0.00050	0.0059	0.014
6	7.0	443	0.0050	0.00050	0.0018	0.0025	0.042	0.060	0.000010	0.0066	0.0037	0.017	0.00050	0.0046	0.0098
7	6.9	372	0.0050	0.00050	0.0014	0.0025	0.029	0.060	0.000010	0.0067	0.0033	0.013	0.00050	0.0038	0.0085
8	7.1	301	0.0050	0.00050	0.0011	0.0025	0.017	0.060	0.000010	0.0069	0.0029	0.010	0.00050	0.0029	0.0072
9	*ND*	235	0.0056	0.00056	0.00075	0.0028	0.0061	0.063	0.000010	0.0071	0.0028	0.0082	0.00056	0.0022	0.0066
10	7.2	206	0.0099	0.00099	0.00066	0.0050	0.0050	0.089	0.000010	0.0076	0.0050	0.012	0.00099	0.0019	0.011
22[ab]	7.1	56	0.0054	0.00033	0.000025	0.00056	0.000099	0.039	0.000010	0.0073	0.00057	0.0012	0.00011	0.00055	0.0011
90	*ND*	25	0.0030	0.011	0.0000050	0.00010	0.00010	0.27	0.000010	0.013	0.000050	0.00012	0.0000020	0.00096	0.00050
***Sat Col 15 (neutral SUP)**															
0	6.8	1350	0.0094	0.0043	0.0030	0.00029	0.15	0.084	0.000010	0.37	0.0088	0.019	0.00016	0.086	0.025
0.5	7.0	883	0.0074	0.0037	0.0022	0.00016	0.051	0.39	0.000010	0.45	0.0055	0.012	0.00013	0.060	0.014
1	6.9	599	0.0065	0.0047	0.00062	0.00015	0.021	1.0	0.000010	0.49	0.0041	0.0072	0.000095	0.055	0.0092
2	7.0	315	0.0026	0.0048	0.00020	0.00010	0.0034	1.7	0.000010	0.60	0.0025	0.0017	0.000016	0.035	0.0043

Notes: PV = pore volumes, calculations are based on an assumed pore volume of 30% (n = 0.3);
a. reduced flow rate for column, see Table 5-7;
b. pore volumes until stabilized concentrations reached;
Values in blue print are below the analytical detection limit;
Values shaded in blue exceed maximum CCME guidelines (Table 4-32); and
Values shaded in grey exceed MMER guidelines (Table 4-32).
* Rates have not yet stabilized for Sat Col 15.

Table 5-14:
Column pore volume concentrations for saturated HYP waste rock columns

Column PV Flush	pH	SO_4	D-Al	D-As	D-Cd	D-Cu	D-Fe	D-Hg	D-Mo	D-Se	D-U	D-Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sat Col 3 (HYP)												
0	*ND*	1100	0.0090	0.00090	0.00025	0.0011	0.0090	0.00013	0.011	0.0030	0.0090	0.11
0.5	7.2	1249	0.0093	0.0012	0.00023	0.0011	0.023	0.000098	0.011	0.0049	0.080	0.086
1	7.2	1398	0.0095	0.0015	0.00021	0.0010	0.037	0.000065	0.011	0.0068	0.15	0.058
2	7.3	1641	0.010	0.0019	0.00017	0.0010	0.069	0.000014	0.010	0.0094	0.27	0.010
3	7.1	1586	0.010	0.0015	0.00017	0.0010	0.12	0.000039	0.0090	0.0058	0.23	0.010
4	7.5	1527	0.010	0.0013	0.00028	0.0010	0.12	0.000037	0.0078	0.0061	0.21	0.010
5	7.4	1465	0.010	0.0013	0.00048	0.0010	0.064	0.000012	0.0066	0.0097	0.19	0.010
6	7.6	1426	0.010	0.0014	0.00041	0.0010	0.060	0.000010	0.0062	0.010	0.17	0.010
7	7.3	1389	0.010	0.0015	0.00030	0.0010	0.060	0.000010	0.0058	0.010	0.16	0.010
8	7.5	1352	0.010	0.0017	0.00020	0.0010	0.060	0.000010	0.0055	0.010	0.15	0.010
9	*ND*	1285	0.0099	0.0017	0.00015	0.00089	0.054	0.000010	0.0052	0.0089	0.13	0.0089
10	7.6	1204	0.0098	0.0017	0.00013	0.00074	0.044	0.000010	0.0050	0.0074	0.12	0.0074
24[ab]	7.5	507	0.014	0.0021	0.000050	0.00023	0.056	0.000010	0.0038	0.0020	0.046	0.0024
99	*ND*	67	0.0011	0.0010	0.0000050	0.00010	0.020	0.000010	0.0014	0.000040	0.020	0.00050
Sat Col 4 (HYP)												
0	*ND*	1200	0.011	0.00010	0.00078	0.0031	0.0070	0.000020	0.014	0.0056	0.0078	0.0090
0.5	7.2	1300	0.011	0.00033	0.00089	0.0028	0.021	0.000017	0.012	0.0067	0.035	0.011
1	7.1	1401	0.010	0.00056	0.00099	0.0024	0.034	0.000015	0.011	0.0079	0.063	0.012
2	7.2	1587	0.010	0.0010	0.0012	0.0018	0.063	0.000011	0.0072	0.0098	0.11	0.015
3	7.2	1534	0.010	0.0010	0.00071	0.0013	0.12	0.000035	0.0064	0.0068	0.11	0.021
4	7.4	1472	0.010	0.0010	0.00044	0.0010	0.13	0.000041	0.0056	0.0059	0.11	0.021
5	7.4	1396	0.010	0.0010	0.00048	0.0010	0.078	0.000018	0.0046	0.0090	0.098	0.013
6	7.5	1356	0.010	0.0010	0.00044	0.0010	0.060	0.000010	0.0042	0.010	0.093	0.010
7	7.3	1336	0.010	0.0010	0.00034	0.0010	0.060	0.000010	0.0042	0.010	0.090	0.010
8	7.5	1315	0.010	0.0010	0.00024	0.0010	0.060	0.000010	0.0042	0.010	0.088	0.011
9	*ND*	1291	0.0097	0.00096	0.00016	0.00096	0.058	0.000010	0.0042	0.0096	0.085	0.011
10	7.5	1255	0.0087	0.00081	0.00014	0.00081	0.049	0.000010	0.0040	0.0081	0.080	0.0088
24[ab]	7.5	850	0.0046	0.00046	0.000070	0.00039	0.044	0.000010	0.0029	0.0033	0.043	0.0038
101		77	0.0022	0.00076	0.0000050	0.00010	0.045	0.000010	0.0017	0.000040	0.0091	0.00050

Column PV Flush	pH	SO_4	D-Al	D-As	D-Cd	D-Cu	D-Fe	D-Hg	D-Mo	D-Se	D-U	D-Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sat Col 7 (HYP)												
0	*ND*	1600	0.0080	0.00080	0.00045	0.013	0.0070	0.000020	0.020	0.0080	0.070	0.0050
0.5	6.2	1630	0.0090	0.0010	0.00039	0.0071	0.034	0.000015	0.017	0.0090	0.17	0.0075
1	6.4	1659	0.010	0.0012	0.00033	0.0015	0.061	0.000011	0.013	0.0099	0.27	0.010
2	7.3	1613	0.019	0.00095	0.00018	0.0049	0.13	0.000043	0.010	0.0057	0.27	0.0092
3	7.1	1570	0.0058	0.00077	0.00024	0.00058	0.060	0.000010	0.0089	0.0058	0.25	0.0058
4	7.3	1536	0.0087	0.00093	0.00019	0.00087	0.060	0.000010	0.0077	0.0087	0.26	0.0087
5	7.3	1485	0.013	0.0013	0.00022	0.0013	0.089	0.000010	0.0065	0.013	0.25	0.013
6	7.4	1421	0.019	0.0019	0.00032	0.0019	0.14	0.000010	0.0054	0.019	0.22	0.019
7	7.4	1391	0.015	0.0016	0.00026	0.0015	0.093	0.000010	0.0053	0.015	0.21	0.015
8	7.4	1365	0.0097	0.0012	0.00017	0.00097	0.030	0.000012	0.0054	0.0097	0.19	0.0097
9	*ND*	1309	0.0070	0.0012	0.00022	0.00070	0.033	0.000034	0.0048	0.0070	0.17	0.0070
10	7.4	1261	0.0050	0.0012	0.00022	0.00050	0.034	0.000043	0.0044	0.0050	0.15	0.0050
23[ab]	7.5	671	0.0026	0.0015	0.0000050	0.000096	0.049	0.000010	0.0040	0.000040	0.071	0.00017
52	*ND*	209	0.00087	0.00069	0.0000050	0.00010	0.25	0.000010	0.0044	0.000040	0.0085	0.00050

Notes: PV = pore volumes, calculations are based on an assumed pore volume of 30% (n = 0.3);
a. reduced flow rate for column, see Table 5-7;
b. pore volumes until stabilized concentrations reached;
Values in blue print are below the analytical detection limit;
Values shaded in blue exceed maximum CCME guidelines (Table 4-32).
*Pore volumes and calculated concentrations for Sat Col 9 do not include the first 5 weeks when the HYP layer was rinsed, prior to the addition of the CAP layer

Table 5-15:
Column pore volume concentrations for layered saturated waste rock columns

Column PV Flush	pH	SO_4	D-Ag	D-Al	D-As	D-Cd	D-Cr	D-Cu	D-Fe	D-Hg	D-Mo	D-Ni	D-Pb	D-Se	D-Tl	D-U	D-Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sat Col 9 (89% HYP, 11% SUS overlying CAP)																	
0	7.3	399	0.000020	0.012	0.00068	0.000053	0.0010	0.0057	0.030	0.00010	0.0060	0.0010	0.00010	0.0020	0.00020	0.0025	0.0020
0.5	6.9	476	0.0000228	0.012	0.00075	0.000057	0.0011	0.0058	0.033	0.000092	0.012	0.0011	0.000128	0.0023	0.00023	0.026	0.0051
1	7.1	553	0.0000255	0.011	0.00082	0.000062	0.0013	0.0058	0.035	0.000083	0.019	0.0013	0.000157	0.0026	0.00026	0.049	0.0082
2	7.2	708	0.000031	0.010	0.00096	0.000071	0.0016	0.0060	0.040	0.000067	0.032	0.0016	0.00021	0.0031	0.00031	0.096	0.014
3	*ND*	862	0.000037	0.0096	0.0011	0.000079	0.0018	0.0062	0.045	0.000050	0.045	0.0018	0.00027	0.0037	0.00037	0.14	0.021
4	7.3	1017	0.000042	0.0088	0.0012	0.000088	0.0021	0.0064	0.051	0.000034	0.058	0.0021	0.00033	0.0042	0.00042	0.19	0.027
5	7.3	1171	0.000048	0.0081	0.0014	0.000097	0.0024	0.0065	0.056	0.000017	0.070	0.0024	0.00038	0.0048	0.00048	0.24	0.033
6	7.5	1121	0.000050	0.0074	0.0019	0.00011	0.0025	0.0054	0.082	0.000010	0.069	0.0025	0.00040	0.0050	0.00050	0.22	0.029
7	7.7	907	0.000050	0.0069	0.0027	0.00012	0.0025	0.0032	0.12	0.000010	0.057	0.0025	0.00037	0.0050	0.00050	0.17	0.017
8	7.7	694	0.000050	0.0064	0.0035	0.00013	0.0025	0.00097	0.17	0.000010	0.044	0.0025	0.00035	0.0050	0.00050	0.11	0.0055
9	7.6	621	0.000032	0.0078	0.0042	0.00010	0.0016	0.0012	0.19	0.000018	0.046	0.0022	0.00038	0.0031	0.00030	0.093	0.0046
10	7.6	554	0.000012	0.0092	0.0048	0.000075	0.00065	0.0016	0.22	0.000027	0.049	0.0019	0.00041	0.0012	0.000089	0.080	0.0042
15[ab]	*ND*	176	0.0000050	0.0046	0.0055	0.00012	0.00010	0.00025	0.080	0.000010	0.066	0.00067	0.000028	0.00012	0.0000098	0.025	0.0012
41	*ND*	53	0.0000068	0.0014	0.0020	0.0000050	0.00010	0.00010	0.043	*ND*	0.013	0.00041	0.000067	0.00010	0.000011	0.024	0.0035
***Sat Col 12 (25% HYP over 75% acidic SUP)**																	
0	6.1	2740	0.000025	0.53	0.0017	0.0035	0.00050	17	0.31	0.00012	0.037	0.096	0.00025	0.057	0.00025	0.66	0.51
0.5	6.5	1827	0.000025	0.096	0.0059	0.00069	0.00050	0.78	0.72	0.000010	0.012	0.020	0.00015	0.0043	0.000072	0.60	0.095
1	6.3	1384	0.000022	0.53	0.0029	0.0020	0.00046	3.8	6.2	0.000010	0.0066	0.024	0.00031	0.0075	0.000098	0.30	0.22
2	6.3	1162	0.000010	0.058	0.0032	0.00055	0.00022	0.52	0.76	0.000010	0.0069	0.0092	0.000053	0.0021	0.000040	0.26	0.053
***Sat Col 12 (lower port)**																	
0	3.3	6530	0.00050	546	0.016	0.027	0.070	553	78	0.000028	0.0064	0.65	0.0011	0.073	0.0011	1.3	3.9
0.5	3.4	3999	0.00019	294	0.0096	0.015	0.034	295	66	0.000020	0.0044	0.35	0.00050	0.044	0.00080	0.70	2.2
1	3.4	2606	0.00023	131	0.0081	0.0082	0.015	154	68	0.000019	0.0033	0.18	0.00046	0.028	0.00061	0.31	1.1
2	4.0	2004	0.000050	79	0.0061	0.0059	0.011	82	69	0.000010	0.0023	0.13	0.000067	0.017	0.00046	0.17	0.74
3	3.7	1688	0.000047	58	0.011	0.0048	0.0085	60	61	0.000010	0.0016	0.096	0.000060	0.012	0.00035	0.13	0.62

Column PV Flush	pH	SO_4	D-Ag	D-Al	D-As	D-Cd	D-Cr	D-Cu	D-Fe	D-Hg	D-Mo	D-Ni	D-Pb	D-Se	D-Tl	D-U	D-Zn
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
4	3.7	1533	0.000035	53	0.0094	0.0043	0.0071	54	57	0.000010	0.0016	0.087	0.000040	0.010	0.00032	0.11	0.55
5	3.7	1443	0.000039	45	0.0076	0.0036	0.0055	45	49	0.000010	0.0015	0.073	0.000039	0.0087	0.00029	0.098	0.46
***Sat Col 13 (25% HYP over 75% neutral SUP)**																	
0	6.7	1670	0.000040	0.0070	0.016	0.00026	0.00050	0.0062	2.7	0.000010	0.17	0.026	0.0039	0.017	0.000048	0.39	0.045
0.5	6.9	801	0.000010	0.00084	0.0068	0.000048	0.00020	0.0011	2.3	0.000010	0.27	0.012	0.000054	0.00019	0.0000040	0.24	0.0027
1	6.7	356	0.00001005	0.0006	0.0040	0.00010	0.0001000	0.00030	0.707	0.000010	0.33	0.0067	0.0000122	0.00010	0.00000200	0.086	0.0014
***Sat Col 13 (lower port)**																	
0	6.7	1600	0.000025	0.011	0.0045	0.0035	0.00050	0.13	0.17	0.000010	0.17	0.017	0.0014	0.019	0.00015	0.18	0.023
0.5	7.3	1501	0.00018	0.029	0.0036	0.0029	0.0037	0.070	0.54	0.000010	0.17	0.021	0.0018	0.0087	0.00015	0.22	0.029
1	6.8	1244	0.000063	0.013	0.0048	0.00081	0.0013	0.021	1.3	0.000010	0.19	0.018	0.0010	0.0013	0.000074	0.28	0.017
2	6.7	775	0.000010	0.0056	0.0050	0.00016	0.00020	0.0019	2.3	0.000010	0.26	0.012	0.00022	0.00019	0.0000040	0.20	0.0070
3	6.6	492	0.0000080	0.0035	0.0037	0.00010	0.00016	0.00061	1.8	0.000010	0.31	0.0095	0.00013	0.00011	0.0000032	0.15	0.0035
***Sat Col 14 (50% HYP over 50% acidic SUP)**																	
0	6.2	2650	0.000048	0.13	0.0037	0.0017	0.00050	4.1	0.075	0.00013	0.047	0.075	0.00027	0.045	0.00019	1.1	0.32
0.5	6.5	2043	0.000025	0.041	0.0076	0.00093	0.00050	0.50	0.88	0.000010	0.015	0.041	0.00019	0.0059	0.000093	0.83	0.17
1	6.4	1660	0.000013	0.018	0.0081	0.00027	0.00026	0.081	2.3	0.000010	0.012	0.020	0.00010	0.0023	0.000018	0.50	0.070
***Sat Col 14 (lower port)**																	
0	3.3	7770	0.00050	688	0.019	0.034	0.088	643	93	0.000028	0.0079	0.79	0.0014	0.098	0.0014	1.8	4.4
0.5	3.4	6474	0.00039	569	0.016	0.029	0.072	539	83	0.000024	0.0062	0.68	0.00087	0.084	0.0012	1.4	3.8
1	3.5	5179	0.00028	449	0.013	0.024	0.055	436	73	0.000021	0.0046	0.57	0.00039	0.069	0.00098	0.99	3.2
2	3.6	3347	0.00019	165	0.0078	0.011	0.021	192	85	0.000012	0.0034	0.25	0.00049	0.034	0.00067	0.38	1.5
3	3.6	2565	0.000055	82	0.017	0.0060	0.012	89	69	0.000010	0.0034	0.13	0.00011	0.018	0.00046	0.20	0.76
4	3.8	2184	0.000037	48	0.0028	0.0048	0.0064	49	49	0.000010	0.0021	0.093	0.000037	0.013	0.00039	0.12	0.52
5	4.1	1934	0.000025	32	0.0023	0.0032	0.0036	31	35	0.000010	0.0031	0.062	0.000025	0.0091	0.00034	0.099	0.34
6	4.3	1843	0.000025	21	0.0020	0.0023	0.0035	21	26	0.000010	0.0043	0.045	0.000028	0.0071	0.00029	0.089	0.24

Notes: PV = pore volumes, calculations are based on an assumed pore volume of 30% (n = 0.3); **a.** reduced flow rate for column, see Table 5-7; **b.** pore volumes until stabilized concentrations reached;
Values in blue print are below the analytical detection limit; values shaded in blue exceed maximum CCME guidelines (Table 4-32) and values shaded in grey exceed MMER guidelines (Table 4-32).
Pore volumes and calculated concentrations for Sat Col 9 do not include the first 5 weeks when the HYP layer was rinsed, prior to the addition of the CAP layer.

* Rates for these columns have not yet stabilized.

Table 5-16:
Summary of guideline exceedances in initial and final stabilized pore volumes flushed through saturated waste rock columns

Saturated Waste Rock Columns	MMER Exceedences in Initial Pore Volume	CCME Exceedences in Final Stabilized Pore Volumes
CAP & SUP		
Sat Col 2 (95% CAP)	Cu	Al, Cd, Cu, Se
Sat Col 6 (50% CAP & 50% SUS)	Cu, Zn	Al, Cd, Cu, Fe, Zn
Sat Col 5 (90% SUS)	Cu	As
Sat Col 15 (neutral SUP)	*NE*	*NS*
HYP		
Sat Col 3 (HYP)	*NE*	U
Sat Col 4 (HYP)	*NE*	*NE*
Sat Col 7 (HYP)	*NE*	*NE*
Layered		
Sat Col 9 (HYP over CAP)	*NE*	U
Sat Col 12 (HYP over acidic SUP)	Cu, Zn	*NS*
Sat Col 12 (lower port)	Cu, Ni, Zn	*NS*
Sat Col 13 (HYP over neutral SUP)	*NE*	*NS*
Sat Col 13 (lower port)	*NE*	*NS*
Sat Col 14 (HYP over acidic SUP)	Cu	*NS*
Sat Col 14 (lower port)	Cu, Ni, Zn	*NS*

Notes: NE = no exceedences; NS = not stabilized

5.3.2 Saturated Tailings Columns

No parameters in leachate from the saturated tailings columns exceed MMER guidelines (Table 5-18). Dissolved Al, Cd and Mo exceed CCME guidelines in the final stabilized pore volume flushed through Sat Col 1, Sat Col 10 and Sat Col 11, respectively.

Table 5-17:
Column pore volume concentrations from saturated tailings columns

Column PV	pH	SO_4	D-Al	D-As	D-Cd	D-Cu	D-Fe	D-Mo	D-Se	D-U	D-Zn
Flush	s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Sat Col 1											
0	*ND*	680	8.9	0.0020	0.000040	0.014	0.0080	0.035	0.0066	0.00030	0.0050
0.5	9.9	611	8.3	0.0020	0.000049	0.011	0.021	0.031	0.0059	0.00025	0.0043
1	9.9	542	7.6	0.0019	0.000059	0.0092	0.034	0.027	0.0053	0.00021	0.0036
2	10.8	404	6.4	0.0019	0.000077	0.0048	0.060	0.018	0.0040	0.00011	0.0022
3	10.5	357	6.3	0.0015	0.000082	0.0037	0.11	0.016	0.0035	0.000097	0.0038
4	10.5	315	6.4	0.0012	0.000087	0.0027	0.14	0.014	0.0030	0.000081	0.0046
5	10.6	290	6.9	0.0012	0.000096	0.0023	0.086	0.012	0.0023	0.000074	0.0029
6	10.6	266	7.6	0.0012	0.000092	0.0020	0.060	0.012	0.0020	0.000072	0.0020
7	10.5	243	8.4	0.0012	0.000075	0.0019	0.060	0.011	0.0020	0.000074	0.0020
8	10.6	221	9.2	0.0012	0.000058	0.0017	0.060	0.010	0.0020	0.000075	0.0021
9	*ND*	198	10.0	0.0011	0.000041	0.0015	0.060	0.0093	0.0020	0.000077	0.0021
10	10.6	183	9.9	0.0011	0.000034	0.0014	0.051	0.0084	0.0017	0.000076	0.0020
22[a]	10.5	106	15	0.00086	0.000054	0.00092	0.030	0.0020	0.0020	0.00012	0.0020
36[b]	9.2	70.6	15	0.00096	0.0000050	0.00061	0.012	0.00075	0.00062	0.000073	0.0024
90	9.8	17.9	4.6	0.0026	0.0000050	0.00024	0.0010	0.0068	0.00045	0.000044	0.00079
Sat Col 8											
0	*ND*	260	0.032	0.0034	0.00012	0.0013	0.0050	0.13	0.0029	0.0048	0.0050
0.5	7.0	269	0.031	0.0038	0.000097	0.0010	0.019	0.10	0.0027	0.0037	0.0042
1	7.4	277	0.031	0.0042	0.000075	0.00072	0.034	0.080	0.0024	0.0026	0.0034
2	8.0	283	0.029	0.0053	0.000033	0.00019	0.065	0.037	0.0019	0.00054	0.0019
3	8.5	181	0.027	0.0087	0.000023	0.00013	0.12	0.027	0.0013	0.00026	0.0013
4	8.4	104	0.025	0.012	0.000078	0.00020	0.13	0.022	0.0020	0.000100	0.0020
5	8.4	59.7	0.025	0.015	0.00022	0.00044	0.073	0.022	0.0044	0.000084	0.0044
6	8.1	41.8	0.033	0.018	0.00020	0.00043	0.060	0.021	0.0043	0.000083	0.0043
7[b]	7.8	31.8	0.044	0.020	0.00014	0.00034	0.060	0.020	0.0034	0.000086	0.0034
8	8.1	21.7	0.054	0.022	0.000084	0.00025	0.060	0.019	0.0025	0.000089	0.0025
9	*ND*	15.2	0.054	0.022	0.000089	0.00044	0.072	0.018	0.0044	0.00011	0.0044
10	7.4	13.3	0.042	0.022	0.00018	0.00098	0.099	0.016	0.0098	0.00014	0.0098
22[a]	7.5	4.7	0.021	0.0091	0.000025	0.00012	0.029	0.0065	0.00098	0.00037	0.0034
88	7.8	5.9	0.0017	0.0047	0.0000050	0.00010	0.013	0.016	0.000040	0.00016	0.00092
Sat Col 10											
0	7.2	109	0.16	0.0019	0.0020	0.015	0.0011	0.45	0.00093	0.0044	0.032
0.5	7.9	122	0.14	0.0022	0.0024	0.027	0.0013	0.54	0.00098	0.0055	0.024
1	7.8	131	0.13	0.0024	0.0028	0.036	0.0015	0.61	0.0010	0.0062	0.018
2	7.6	132	0.18	0.0026	0.0032	0.039	0.0019	0.60	0.00094	0.0054	0.021
3	7.9	118	0.21	0.0027	0.0032	0.035	0.0011	0.55	0.00071	0.0048	0.018

Column PV	pH	SO_4	D-Al	D-As	D-Cd	D-Cu	D-Fe	D-Mo	D-Se	D-U	D-Zn
Flush	s.u.	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
4	8.1	100	0.20	0.0026	0.0033	0.032	0.027	0.48	0.00053	0.0046	0.019
5	8.0	78.6	0.22	0.0029	0.0030	0.029	0.0019	0.36	0.00038	0.0040	0.016
6	8.3	67.3	0.21	0.0030	0.0029	0.025	0.0017	0.30	0.00029	0.0036	0.015
7	8.2	55.9	0.21	0.0031	0.0027	0.021	0.0014	0.24	0.00021	0.0033	0.014
8	8.0	45.9	0.22	0.0031	0.0025	0.018	0.0012	0.18	0.00018	0.0029	0.011
9	8.1	36.1	0.23	0.0032	0.0022	0.016	0.0011	0.13	0.00015	0.0024	0.0075
10	7.5	29.5	0.24	0.0033	0.0019	0.014	0.0010	0.090	0.00014	0.0021	0.0057
17[ab]	7.5	14.2	0.22	0.0032	0.00074	0.0035	0.0010	0.027	0.00013	0.0010	0.0031
44	*ND*	3.9	0.075	0.0016	0.000044	0.00046	0.0010	0.016	0.000063	0.00045	0.00098
Sat Col 11											
0	7.0	261	0.014	0.00099	0.0025	0.010	0.0047	0.24	0.0013	0.0055	0.22
0.5	7.1	388	0.029	0.0033	0.0037	0.0027	0.011	0.36	0.0013	0.0079	0.15
1	7.4	421	0.046	0.0046	0.0035	0.00052	0.020	0.43	0.0010	0.0073	0.099
2	7.6	366	0.065	0.0051	0.0015	0.00043	0.047	0.50	0.00039	0.0034	0.046
3	7.7	233	0.064	0.0031	0.00015	0.00048	0.053	0.44	0.00016	0.00070	0.023
4	7.9	170	0.060	0.0024	0.00011	0.00011	0.051	0.38	0.000089	0.00037	0.016
5	8.0	138	0.054	0.0020	0.00014	0.00013	0.043	0.36	0.000072	0.00027	0.014
6	8.1	105	0.057	0.0018	0.00013	0.00013	0.034	0.32	0.000057	0.00020	0.011
7	8.1	72.1	0.072	0.0017	0.000071	0.00011	0.025	0.26	0.000045	0.00015	0.0067
8	7.8	53.0	0.080	0.0017	0.000050	0.00027	0.020	0.21	0.000040	0.00013	0.0050
9	7.9	42.8	0.083	0.0018	0.000050	0.00055	0.018	0.17	0.000040	0.00011	0.0053
10	7.7	36.1	0.083	0.0017	0.000050	0.00048	0.016	0.15	0.000045	0.000097	0.0049
17[ab]	7.6	21.3	0.057	0.0010	0.000024	0.00010	0.0043	0.082	0.000086	0.000043	0.0016
35	7.8	12.5	0.020	0.0011	0.000070	0.00010	0.0014	0.35	0.000044	0.000070	0.00050

Notes: PV = pore volumes, calculations are based on an assumed pore volume of 30% (n = 0.3);
a. reduced flow rate for column, see Table 5-7; **b.** pore volumes until stabilized concentrations reached;
Values in blue print are below the analytical detection limit;
Samples shaded in blue exceed maximum CCME guidelines (Table 4-32).

Table 5-18:
Summary of guideline exceedances in initial and final stabilized pore volumes flushed through saturated tailings columns

Saturated Column ID	MMER Exceedences in Initial Pore Volume	CCME Exceedences in Final Stabilized Pore Volumes
Sat Col 1	*NE*	Al
Sat Col 8	*NE*	*NE*
Sat Col 10	*NE*	Cd
Sat Col 11	*NE*	Mo

Notes: NE = no exceedences; NS = not stabilized.

5.4 Saturated Column Results Summary

Key observations and results from the saturated column testing program can be summarized as follows.

- Dissolved concentrations in saturated columns peak during the initial flush of pore water through the column and then gradually decline with time. This observation is consistent with the dissolution and flushing of readily soluble surface oxidation products (secondary sulphates and oxides).
- Extrapolated and measured acidity concentrations released from the CAP and SUP indicates that a portion of the sulphate AP does not contribute directly to acidity. This indicates that a portion of the sulphate in CAP and SUP may not be associated with acidic sulphate minerals (i.e., jarosite or alunite), or that not all sulphate AP is available to pore water.
- In general, metal loadings from pH-neutral saturated SUP columns are somewhat greater than from pH-neutral HYP columns, specifically regarding Cd, Cu and Se.
- An improvement in leachate chemistry was observed in neutral SUP waste rock when it was layered with HYP material. This is attributed to a small increase in pH and availability of surface area for metal sorption in the HYP layer.
- Relative to the other mineralization types, HYP saturated columns produce the highest pH drainage and the lowest concentrations of most metals under saturated conditions. The only parameters which were generally higher in HYP material compared to other mineralization types were U and SO_4.
- The highest metal concentrations are associated with SUP and CAP samples which were acidic prior to saturation in the column experiments. Although metal concentrations declined after the initial flush, concentrations of Cu and Zn remained above MMER guidelines for the duration of kinetic testwork.
- A marked improvement in leachate chemistry was observed in acidic CAP and SUP waste rock when it was layered with HYP material in a saturated column. This reduction in metal concentrations is related to increased sorption potential and hydroxide precipitation associated with neutralization by carbonate minerals in HYP waste rock. A black precipitate formed on the interface of CAP/SUP and HYP material indicating that the reduction in concentrations was, at least in part, due to secondary mineral precipitation.
- Metal concentrations produced by saturated columns are generally not sensitive to pore water residence times, with the exception of Fe and Mn. This is due to the

primary source of metal leaching from saturated columns being flushing of secondary soluble oxide minerals. Concentrations produced by flushing of oxide minerals are not expected to be as sensitive to reaction kinetics as sulphide oxidation.

- Reductive dissolution of Fe and Mn oxides was not correlated to release of other elements (*e.g.,* As and Cu).
- Neutralization of acidic CAP/SUP seepage by HYP waste rock results in a neutral to slightly acidic leachate (pH 6 – 6.5), and the highest total alkalinity values of any saturated column (ranging from 307 to 705 mg$CaCO_3$/L). This is a lower pH range and higher alkalinity range than observed in HYP only columns. The difference in pH and alkalinity is attributed to saturated conditions inhibiting carbon dioxide degassing, resulting in accumulation of carbon dioxide and alkalinity when carbonate buffering occurs. This lowers the equilibrium pH of carbonate minerals, preventing an alkaline pH from being reached. This is analogous to anoxic limestone drains used in the reclamation of ARD, which generally produce a neutral to slightly acidic pH with high alkalinity similar to what was observed in column testwork (Watzlaf *et al.,* 2000).
- Tailings composed predominantly of SUP generally produced higher Cd and Cu concentrations than tailings composed predominantly of HYP in saturated column testing. This is attributed to the relative abundance of oxide minerals in the SUP mineralization zone.
- Depyritized rougher tailings are producing relatively high Cu concentrations compared to pyrite concentrate. This result indicates that depyritization may concentrate Cu bearing oxide minerals in the rougher tailings.

6. Unsaturated Kinetic Test Results

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6. Unsaturated Kinetic Test Results

Results for unsaturated kinetic testwork, including unsaturated columns and humidity cell tests, for Casino waste rock, tailings and ore are presented and discussed in this chapter. The objective of this testwork is to evaluate acid generation and metal leaching rates from sub-aerially stockpiled Casino mine waste. Results for the Casino unsaturated columns and humidity cell kinetic tests are provided in Appendix E.

6.1 Waste Rock

A total of 15 unsaturated laboratory kinetic tests have been initiated on Casino waste rock samples selected from drill core. Details of the test material and operational procedures are summarized in Table 6-1.

Table 6-1:
Summary of unsaturated kinetic test samples and operational procedures

Kinetic Test ID	Sample Description				Details of Test		
	Mineralization Zone	Lithology	Details / Notes	Mass (Kg)	Start Date	Terminated	Flushing Rate/ Weekly Input (mL)
Col 1	CAP	WR	low S, duplicate of FB2	5	27-Jan-10	on-going	300
Col 2A	95% CAP, 5% SUS	85% WR, 5%IX, 5%MX, 5%PP	Moderate S	5	27-Jan-10	on-going	300
Col 2B			duplicate of Col 2A (10 kg)	10	27-Jan-10	5-Dec-12	300
Col 3	80% CAP, 20% SUP	20% PP, 10% MX, 70% WR	high S	5	27-Jan-10	5-Dec-12	300
Col 4a	81% CAP, 13% SUP, 6.3% OVB	19% PP, 81%WR	paste pH > 6.0	5	1-Apr-10	5-Dec-12	300
HC3	HYP	PP	Neutral pH, high S	1	29-Nov-12	on-going	500
HC4	HYP	WR	Neutral pH, high S	1	29-Nov-12	on-going	500
HC5	HYP	PP	Neutral pH, moderate S	1	29-Nov-12	on-going	500
HC6	HYP	WR	Neutral pH, moderate S	1	29-Nov-12	on-going	500
HC7	HYP	50% IX, 50% MX	Neutral pH, moderate S	1	29-Nov-12	on-going	500
HC8	HYP	MX	Acidic paste pH	1	29-Nov-12	on-going	500
HC9	HYP	PP	Carbonate depleted	1	29-Nov-12	on-going	500
HC10	HYP	WR	Acidic paste pH	1	29-Nov-12	on-going	500
HC11	SUP	WR	Neutral SUP	1	29-Nov-12	on-going	500
HC12	SUP	WR	Acidic SUP	1	29-Nov-12	on-going	470

Additional Operational Procedures: The CAP unsaturated columns were trickle leached and the SUP and HYP humidity cells were flood leached; temperature for each test was/is maintained between 22°C and 24°C; sampling was/is conducted weekly without sample preparation prior to flushing. No initial flushing was conducted.

6.1.1 Leachate Chemistry from CAP Unsaturated Columns

Five unsaturated columns are composed of >80% CAP waste rock. Col 1 contains low S waste rock, Col 2A contains moderate S waste, Col 3 contains high S waste and Col 4a contains CAP waste with a paste pH > 6. Col 2B is a duplicate of Col 2A but contains twice the mass of sample. Col 2B, Col 3 and Col 4a tests were terminated after more than 140 weeks. Col 1 and Col 2A are still running (Table 6-1).

Loading rates for pH, alkalinity, sulphate and potential metals of concern in CAP waste rock are presented in Figure 6-1 and Figure 6-2. The complete set of results for the unsaturated waste rock columns are presented in Appendix E.1.

6.1.1.1 pH and Sulphate Loading

The drainage pH is highly variable between the CAP unsaturated kinetic tests. Col 3 has a realtively high S content and low pH compared to typical CAP waste rock. Note that Col 3 contains 20% SUP, which likely contributes to the elevated sulphur compared to typical CAP. This sample has produced high sulphate loadings (stabilized at approximately 10 mg/kg) compared to the other unsaturated CAP waste rock columns. Conversely, Col 4a which is composed of a similar mix of CAP and SUP material as Col 3, is producing a pH of 7 to 7.5, the highest alkalinity (2–3 mg $CaCO_3$/L) and lowest sulphate production (<1 mg/kg) relative to the other CAP columns. Col 1 (low S), Col 2A (moderate S) and Col 2B (10 kg duplicate of Col 2A) have similar loading signatures, with weakly acidic pH values and SO_4 loadings of <3 mg/kg. Of note is the increased sulphate load from Col 1 after reaching a low at cycle 60, consistent with a decrease in pH around the same time (Figure 6-1). Similar leaching rates are observed for Col 2A and Col 2B.

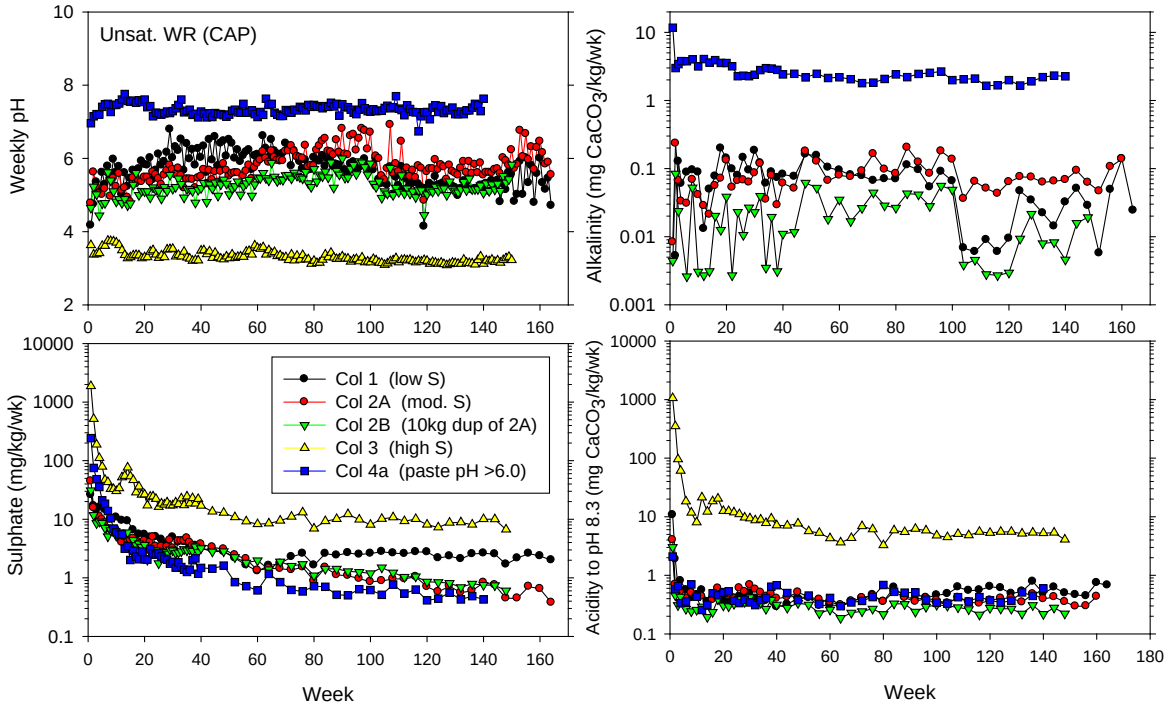


Figure 6-1: Weekly pH and loading rates for total alkalinity, acidity and sulphate from unsaturated CAP waste rock columns

In general, sulphate loadings from the columns are consistent with the presence of sulphate-S as measured by ABA techniques (Table 4-15) that would be in the form of jarosite, a sparingly water-soluble and acid generating secondary sulphate mineral identified by XRD in each CAP waste rock sample (Table 4-1). Acidity and sulphate loadings generated by the CAP waste rock during the test period are likely due to the dissolution of this mineral in the column tests. Also of note, Col 3 is composed of 20% SUP and contains 0.45 wt.% sulphide-S (an order of magnitude higher than the other samples); therefore, acidity is expected to be sustained from this waste rock column via sulphide oxidation in addition to jarosite dissolution.

6.1.1.2 Metal Leaching Trends

Metal loadings from each column are generally initially high due to the flushing of surface oxidation products. The production of metals from the unsaturated CAP waste rock columns is primarily dependent on the pH conditions in the column and, to a lesser extent, the metal content of the test sample. Metal loadings tend to be highest in leachate from Col 3 (Figure 6-2; Appendix E.1), with Al, Cu, Fe and U up to two to three orders of magnitude higher relative to the other CAP columns, despite generally higher solid phase metal content for Col 1 and Col 4a (Table 4-23). The higher metal leaching from Col 3 is consistent with higher solid phase total and sulphide S (Table 4-15) and acidic conditions in the column (Figure 6-1). Metal loadings produced by Col 4a are generally the lowest relative to the other CAP columns, which is consistent with lower solid phase total S (Table 4-15) and neutral pH conditions in the column (Figure 6-1). This is particularly evident for D-Cd, Cu and Zn, which are up to three orders of magnitude lower in leachate produced from Col 4a relative to the other CAP columns, despite the overall highest solid phase Cu and Zn content measured for the Col 4a sample (461 and 44 ppm, respectively, Table 4-23). The low D-Cu and Zn loads from Col 4a are attributed to neutral pH conditions in the column suppressing their solubility.

Where pH conditions for the unsaturated CAP waste rock columns are comparable, as is the case for unsaturated CAP waste rock columns Col 1, Col 2A and Col 2B, then metal content of the waste rock determines the relative loadings. Metal loadings from Col 1 tend to reach a low after the initial flush and then increase to levels greater than that of Col 2A and Col 2B, consistent with higher solid phase metals measured by aqua regia for the Col 1 sample (Table 4-23). This is particularly evident for D-Ag, Al, Cd, Cu, U and Zn (and Co, Ni and Mn) (Figure 6-2 and Table 4-23).

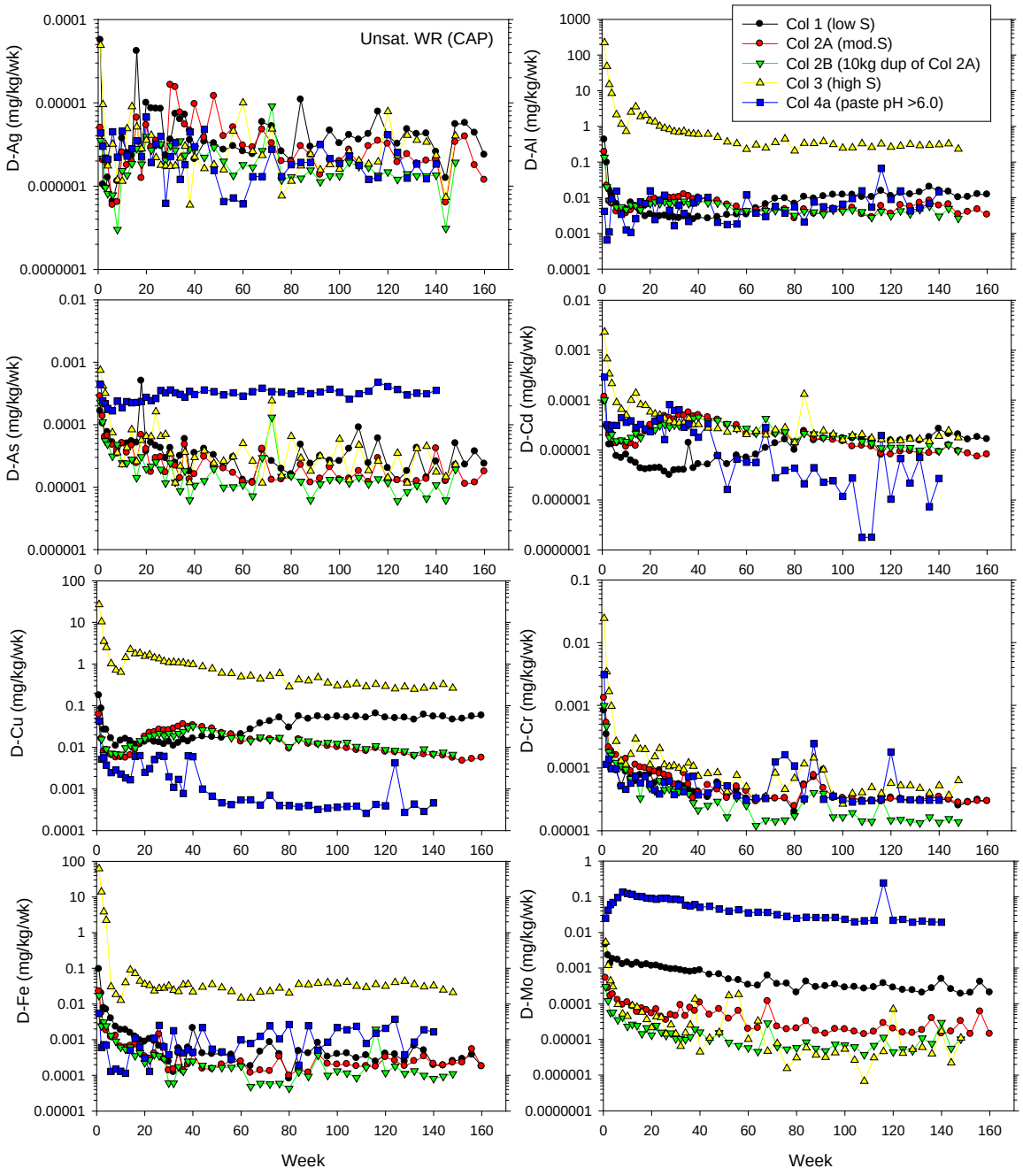


Figure 6-2: Loading rates for potential dissolved metals of concern from unsaturated CAP waste rock column tests

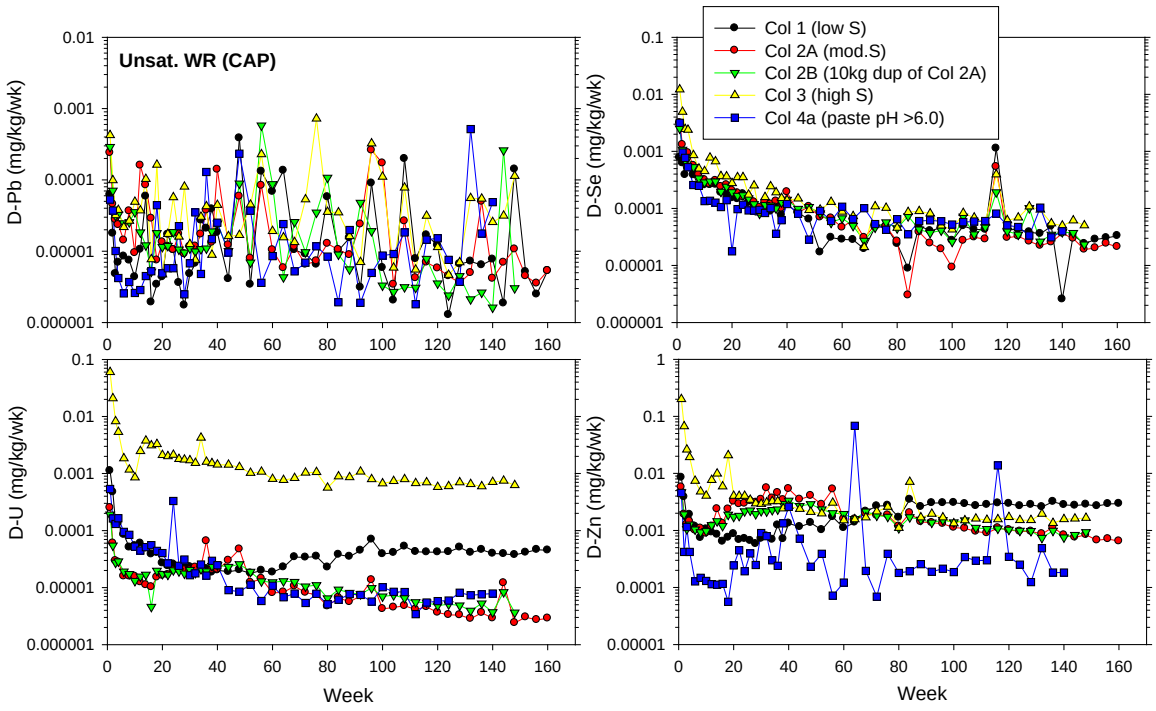


Figure 6-2 cont.: Loading rates for potential dissolved metals of concern from unsaturated CAP waste rock column tests

Of note, is the initial increase in D-Cu and Zn (and Cd) production from Col 1 around week 10-20, at least 40 weeks before the increased production of sulphate and decrease in pH. This kinetic data , together with the lower solid phase total S concentrations (0.19 %S Table 4-15), higher solid phase Fe concentrations (3.0 %Fe, Table 4-23) and lower jarosite content (0.7 wt.%, Table 4-1) for the Col 1 sample, indicates that the source of Cu and Zn in leachate during the first 60 weeks is likely due to desorption from secondary Fe-oxide phases rather than dissolution of sulphate and/or sulphide minerals. Copper and Zn were identified in Fe-oxides by SEM as discussed in Section 4.1. Iron oxides are relatively stable under the pH conditions of the column and may therefore desorption may represent a long term source of Cu and Zn release from sulphide depleted CAP material.

Molybdenum loadings from the unsaturated CAP columns are also primarily influenced by pH and, to a lesser extent, by solid phase content. The highest D-Mo (and As and Sb) production is from Col 4a, which has an alkaline pH, but only average solid phase Mo (91 ppm) (Table 4-23). The column with the second highest Mo leaching rate, Col 1, has a neutral to weakly acidic pH and a very high solid phase Mo content (396 ppm). Despite having a pH similar to columns with lower Mo leaching rates (Col 2A and Col 2B), the

high Mo content in Col 1 that is 20 times that of Col 2a appears to be responsible for the higher leaching rate in Col 1.

6.1.2 Leachate Chemistry from SUP and HYP Humidity Cells

Two SUP and eight HYP waste rock humidity cells have been running for nearly 70 weeks and continue to operate. The SUP cells (HC11 and HC12) are composed of neutral and acidic SUP waste rock, respectively. HC3 and HC4 are composed of HYP waste rock with high S and neutral paste pH; HC5, HC6 and HC7 are composed of HYP waste rock with moderate S and neutral paste pH; HC8 and HC10 are composed of HYP waste rock with acidic paste pH and HC9 is composed of HYP waste that is carbonate deplete.

Loading rates for pH, alkalinity, sulphate and potential metals of concern from SUP and HYP waste rock are presented in Figure 6-3 and Figure 6-4. The complete set of unsaturated waste rock column data is presented in Appendix E.1.

6.1.2.1 pH and Sulphate Loading

Consistent with humidity cell sample selection, HC12 (acidic SUP), HC8 and HC10 (acidic HYP) are immediately acid generating. Drainage pH for these cells continues to decrease over the test period to pH of nearly 3. HC9 (carbonate depleted HYP) is initially neutral, but decreases over the test period, becoming acid generating by the week 13. The initial neutral pH conditions may be in response to NP from residual non-carbonate minerals or trace amounts of carbonate which are able to initially buffer acidic drainage, but are not able to sustain net neutral conditions in the cell. All other humidity cells are neutral to slightly alkaline, generating drainage with a pH of 7.0 to 7.5. HC11 shows a slight decrease over the test period, but continues to generate drainage with a pH near 7.0.

Sulphate loadings from the SUP and HYP unsaturated waste rock kinetic tests reflect pH conditions in the cells and, to a lesser extent, solid phase S concentrations of the waste rock (Table 4-16 and Table 4-17). Sulphate concentrations are initially high, with levels greater than 100 mg/kg measured in leachate from all humidity cells except the HYP tests HC4 and HC9 (35 mg/kg and 74 mg/kg SO_4, Figure 6-3). Initial sulphate levels in leachate from the SUP and HYP kinetic tests reflect relative solid phase sulphate proportions in the waste rock and the flushing of water soluble secondary sulphates such as gypsum. The relatively low initial loadings produced by HC4 and HC9 are consistent with lower solid phase sulphate-S concentrations whereas the relatively high initial loadings from HC5 and HC7 are consistent with higher solid phase sulphate S. Consistent with low pH conditions and relatively high solid phase sulphide S concentrations (2.9 % to 4.13 %, Table 4-17), HC12, HC8 and HC10 leach higher levels of sulphate during as the tests progress than the neutral to slightly alkaline pH humidity cells.

Sulphate levels in leachate from the SUP humidity cells (HC11 and HC12) drop nearly an order of magnitude over the first 7 weeks of the test. Leachate from HC11 produces relatively stable levels of <5 mg/kg SO_4 for the remainder of the test period. Sulphate concentration in leachate from the acidic SUP (HC12) shows a gradual steady increase from 14 mg/kg/wk SO_4 after week 7, but remains below 50 mg/kg/wk; however, concentrations are still increasing by the end of the test period.

Sulphate levels from the acidic HYP waste rock have been stable at ~50 mg/kg/wk and ~75 mg/kg/wk SO_4 for the last 15 weeks of the test period. Despite the lower pH of HC9, sulphate loadings from this cell are low due to considerably lower total S concentration (0.92 %S, Table 4-17)) and remains below 5 mg/kg/wk SO_4 after week 13. Sulphide S in HYP waste rock from HC6 is also relatively low (1.81 %) and also remains below 5 mg/kg/wk SO_4 by week 13. Sulphate loadings from the other neutral pH HYP waste rock cells (HC3, HC4, HC5, HC7) decrease over the test period to concentrations of <12 mg/kg/wk SO_4. In general, over the test period, HYP cells containing neutral paste pH waste rock regardless of the sulphur content (*i.e.,* moderate to high S concentrations) produce neutral drainage with relatively low sulphate following the initial dissolution of gypsum.

6.1.2.2 Metal Leaching Trends

Metal leaching from unsaturated SUP and HYP waste rock is primarily dependent on pH, and to a lesser extent, metal content of the waste rock. Metal loadings from the acid generating SUP (HC12) and HYP (HC8 and HC10) cells are higher than loadings from the neutral pH cells (Figure 6-4), despite the lower solid phase metal content of HC12 and HC8. Most metals, notably D-Cu, Se and Zn, in leachate from HC12 (acidic SUP) appear to have stabilized by the end of the test period. On the other hand, concentrations of D-Al and Fe, in particular, are still increasing by the end of the test period, consistent with increasing concentrations of sulphate. Metal leaching from HC11 (neutral SUP) is generally three orders of magnitude lower than HC12 and relatively stable over the test period. An exception is Mo (and As and Sb in Appendix E.1), which is one to two orders of magnitude higher in leachate from HC11 compared to HC12.

Many metals in leachate from the acidic and neutral HYP tests show an overall decrease in loadings and appear to have stabilized by the end of the 70 week test period. Only D-Fe, and, to a lesser extent, D-U in leachate from the acidic HYP tests (HC8 and HC10) continue to increase by the end of the documented test period.

Of note is the delayed, but steady increase in D-Cd, Fe, Se, U, Zn and, most notably, D-Cu loadings from HC9, consistent with a delayed onset of acidic conditions within the cell due to depleted carbonate content of the test sample.

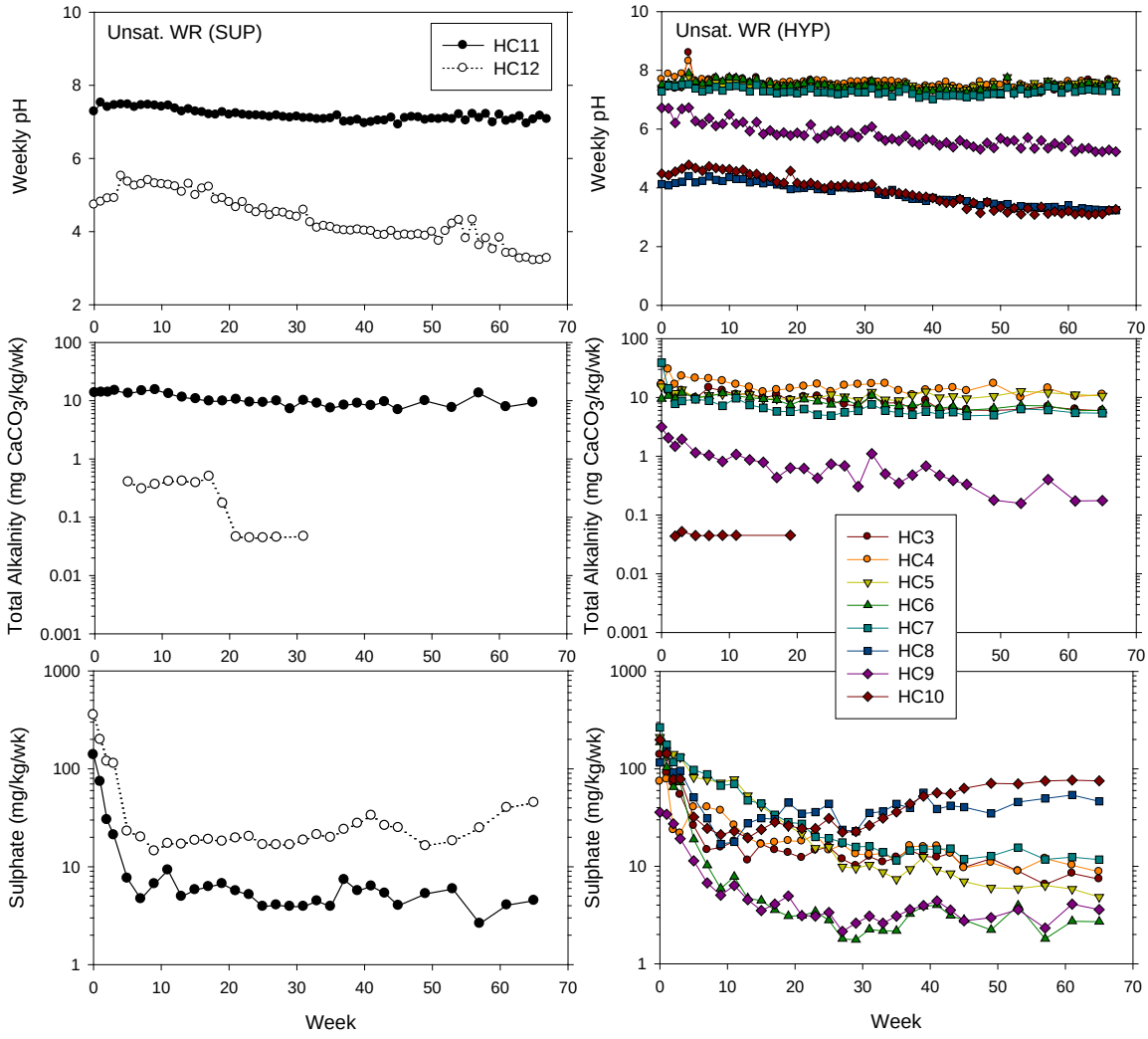


Figure 6-3: Weekly pH and loading rates for total alkalinity and sulphate from unsaturated SUP and HYP waste rock humidity cells

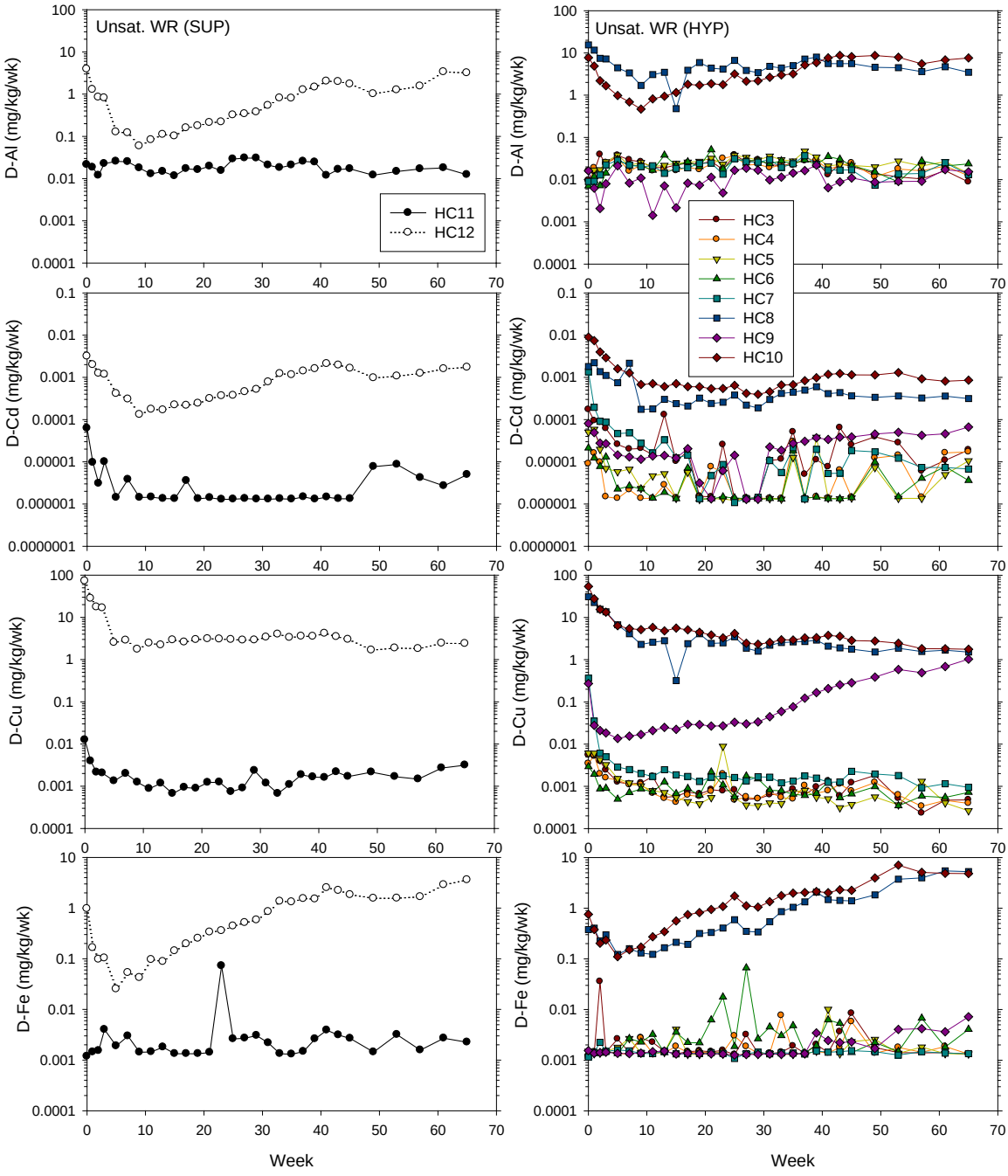


Figure 6-4: Loading rates for potential parameters of concern from unsaturated SUP and HYP waste rock humidity cells

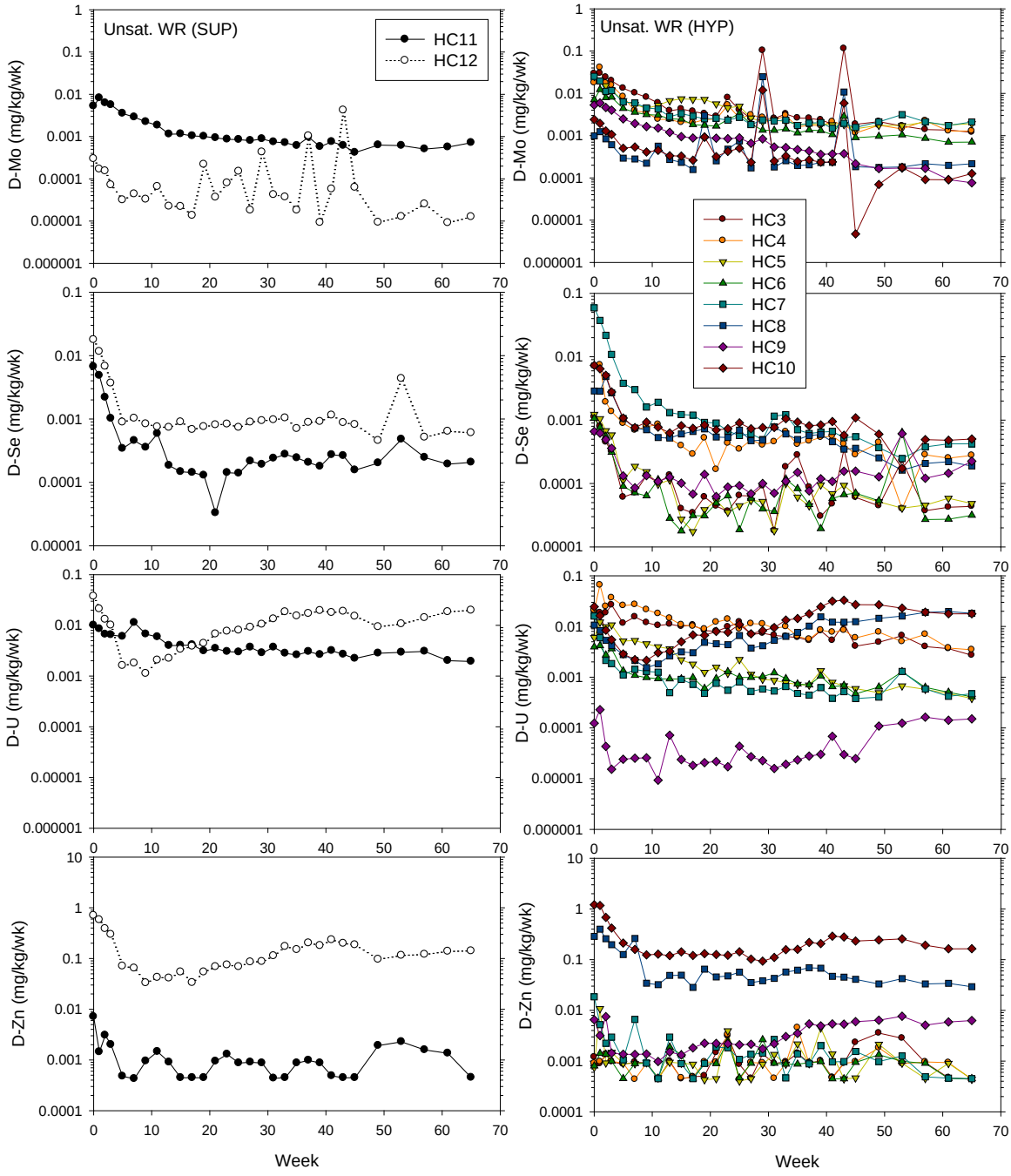


Figure 6-4 (cont.): Loading rates for potential parameters of concern from unsaturated SUP and HYP waste rock humidity cells

6.2 Ore and Tailings

Kinetic test samples have been collected from each round of metallurgical tailings production, as described in Chapter 2. A total of 11 kinetic tests have been initiated on Casino tailings and ore, as outlined in Table 6-2.

Table 6-2:
Sample description and test procedures for unsaturated tailings kinetic tests.

Kinetic Test ID	Mineralization Zone	Operational Procedure						
		Mass (Kg)	Start Date	Terminated	Total Volume of Initial Flushings (mL)	Flushing Rate/ Weekly Input (mL)*	Leach Procedure	Sample Prep for Flushings
Ore								
HC1	HYP	5	3-Dec-09	1-Sep-10	600	500	Flood	None
HC2	81.7% SUP, 18.3% HYP	5	3-Dec-09	1-Sep-10	600	500	Flood	None
Whole Tailings								
T1	71% SUP, 22% HYP, 7% CAP	5	1-May-08	1-May-10	750	500	Flood	Stirred
T2		5	1-May-08	1-May-10	750	500	Flood	Stirred
T3		5	1-May-08	12-Feb-09	750	500	Flood	Stirred
T4	60% HYP, 40% SUP	1	15-Dec-09	on-going	750	500	Flood	Stirred
Depyritized Pyrite Rougher Whole Tailings								
T5	85% SUP, 15% HYP	0.9	3-May-11	4-Dec-12	750	500	Flood	Stirred
T7	HYP	1	5-Mar-13	on-going	750	500	Flood	Stirred
Depyritized Pyrite Rougher Tailings Sands (>75 µm)								
Col 5	85% SUP, 15% HYP	4.96	4-May-11	5-Dec-12	-	500	Trickle	None
Col 6	HYP	1	3-May-11	on-going	-	300	Trickle	None
T6	85% SUP, 15% HYP	1	3-May-11	4-Dec-12	-	500	Flood	Stirred

Additional Operational Procedures: Temperature for each test is maintained between 22°C and 24°C; however, following cycle 37 kinetic test T1 was moved to a cold room operated and maintained at a temperature of 4°C. Sampling is conducted weekly.

6.2.1 Leachate Chemistry from Ore Humidity Cells

Two humidity cell tests composed of HYP ore (HC1) and predominantly SUP ore (HC2) (Table 6-2) were initiated for the Casino project to assess drainage quality from unsaturated stockpiled ore. Both ore tests were terminated after 39 cycles. Loading rates for pH, alkalinity, sulphate and potential metals of concern for HYP and SUP ore are presented in Figure 6-5 and Figure 6-6. The complete set of ore humidity cell data is provided in Appendix E.2.

Drainage pH from the unsaturated ore kinetic tests remains neutral at pH ~7.0 for the duration of the experiment (Figure 6-5). Only the initial flushing of HC2 (SUP ore) produces an acidic drainage with pH 5.0. However, by the first cycle, the pH of leachate

from HC2 increases to >6.0. The initially low pH of HC2 corresponds to elevated loads of D-Fe, D-Al, D-Cd, D-Cu and D-Zn in the initial leachate from HC2 (Figure 6-5 and Figure 6-6) and the flushing of acidic oxides associated with the SUP zone.

Sulphate and metal concentrations in leachate from the unsaturated ore kinetic tests decrease from the initial flush and continue to decrease over the test period. Only D-Al loadings from HC1 are stable at 0.01 mg/kg immediately upon placement in the cell. Concentration of D-Mo in leachate from HC2 shows a rapid increase over the test period from levels below the analytical limit to 0.12 mg/kg Mo and concentration of D-As in leachate from HC2 shows a gradual increase after reaching a low by cycle 2. Concentrations of sulphate, D-Al, D-As, D-Se and D-U (and D-Sb in Appendix E.2) are consistently higher in leachate from HC1 relative to HC2; while concentrations of D-Cd, D-Cu and D-Zn (and D-Co and D-Mn in Appendix E.2) are consistently higher in leachate from HC2. The relative proportion of sulphate and metals in leachate from the unsaturated ore is related to the solid phase content of the kinetic test samples (Table 4-21 and Table 4-29). Total S for the ore test samples is similar (1.53 %S in HC1 and 1.23 %S in HC2); however, the sulphate-S and gypsum content of HC1 (0.25 %S, Table 4-21; 1.4 wt. % gypsum, Table 4-8) is higher than that of HC2 (0.04 %S, no gypsum identified) which supports the higher sulphate loadings and lower metal loadings in leachate from HC1.

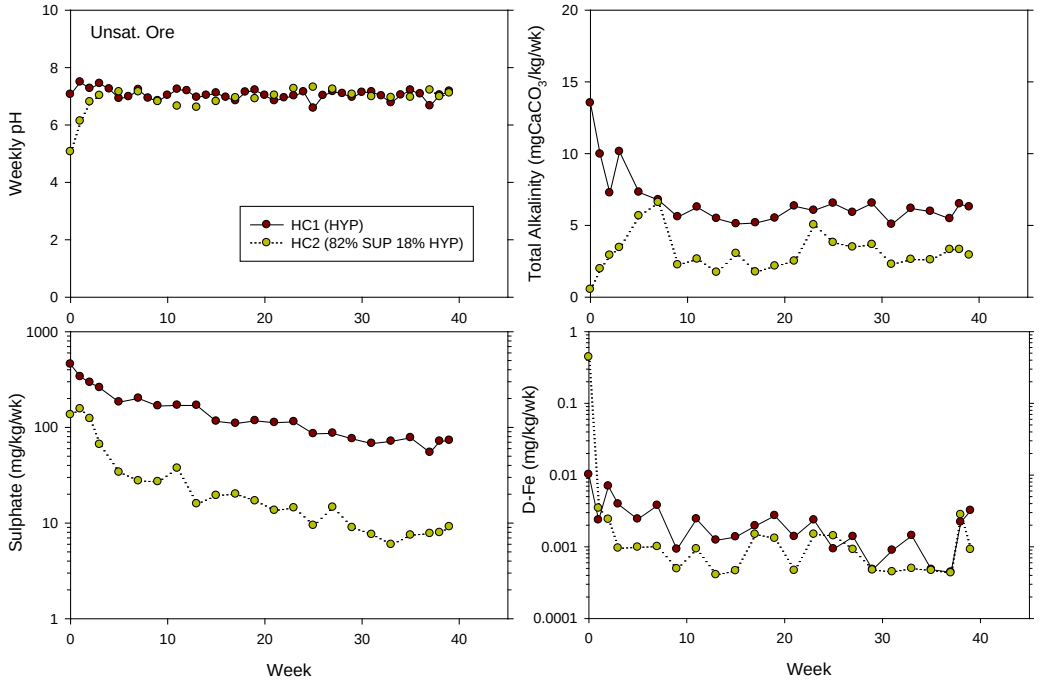


Figure 6-5: Weekly pH and loading rates for alkalinity, sulphate and D-Fe from ore humidity cells

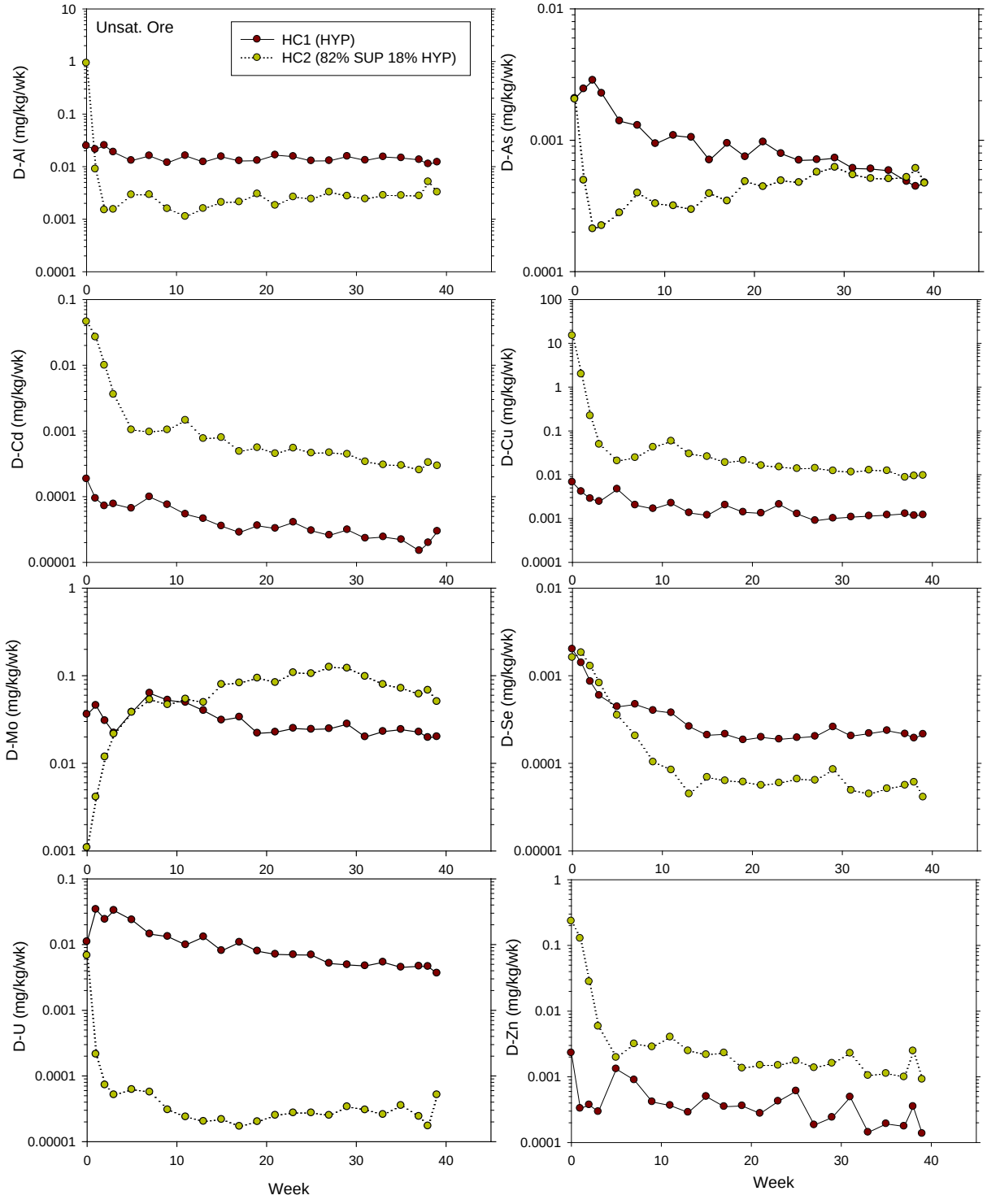


Figure 6-6: Loading rates of potential parameters of concern from ore humidity cells.

6.2.2 Leachate Chemistry from Unsaturated Whole Tailings and Tailings Sands

Nine unsaturated kinetic tests were initiated for the Casino tailings, including four humidity cells composed of whole tailings (T1 through T4), two humidity cells composed of depyritized pyrite rougher whole tailings (T5 and T7), one humidity cell composed of depyritized pyrite rougher tailings sands (T6) and two unsaturated columns composed of depyritized rougher tailings sands (Col 5 and Col 6). The kinetic tests composed of whole tailings provides an assessment of drainage quality produced by unsaturated tailings placed within the impoundment while the kinetic tests composed of tailings sands (>75 µm) provides an assessment of drainage quality produced by unsaturated tailings placed in the beach of the impoundment.

Proportions of SUP and HYP ore feed used to produce the tailings during metallurgical testwork are summarized in Table 6-2 along with variations in test procedures. Note that Col 5 and T6 are composed of the same sample material subjected to different test procedures. All tests were maintained at a temperature of 22°C to 24°C except T1, which was moved on cycle 37 to a cold room maintained at 4°C. Only T4, T7 and Col 6 are still running. All other unsaturated tailings kinetic tests have been terminated. Tests T7 and Col 6 were initiated recently; therefore fewer cycles of data are available for interpretation from these tests. Leachate results were normalized by mass.

Loading rates for pH, alkalinity, SO_4 and potential metals of concern for whole tailings and tailings sands are presented in Figure 6-7 and Figure 6-8. The complete set of unsaturated tailings kinetic test leachate results are presented in Appendix E.3.

6.2.2.1 pH and Sulphate Loading

Drainage quality from the rougher and pyrite rougher (*i.e.*, depyritized) whole tailings and tailings sands remains neutral to slightly alkaline for the duration of the experiment, with pH values generally maintained between 7.5 and 8.0. During tailings processing ore material is mixed with lime which will neutralize any acidic oxides prior to discharge as tailings. This will not remove the oxide load, but will ameliorate the initial flush of low pH drainage. The whole tailings show a consistent gradual decrease in pH and alkalinity over the test period. This is particularly evident for T4, which has been running for nearly 175 weeks. The potential and timing for acid generation from unsaturated whole tailings and tailings sands is estimated and discussed in Section 6.4.

Larger fluctuations in pH are observed for T1 relative to the other rougher whole tailings tests following the decrease in temperature after week 37. Despite the similar pH produced by the unsaturated tailings sands kinetic tests, T6 produces higher alkalinity concentrations

compared to the columns, possibly owing to different operating procedures (*i.e.*, stirring) and increased dissolution of carbonates.

Sulphate concentrations from the rougher whole tailings (T1 through T4) are initially high (210 to 518 mg/kg/wk) and gradually decrease by one to two orders of magnitude to concentrations of <10 mg/kg/wk by week 65. Although sulphate loadings from the whole tailings appear to stabilize at this point, additional data from T4 indicates that sulphate loadings from the whole tailings may gradually increase following a period of nearly 80 weeks of low steady state loading rates, which is consistent with lower pH during the latter portion of the test. Sulphate loadings from the pyrite rougher (*i.e.*, depyritized) whole tailings (T5) and tailings sands (Col 5, Col 6 and T6) are initially lower (50 to 95 mg/kg) and show a consistent decrease to loads of < 2.5 mg/kg/wk over the 80 weeks of testwork. Sulphate loading rates in leachate from pyrite rougher whole tailings and tailings sands show a more rapid decrease and stabilize more quickly at loads of < 5 mg/kg by week 15. This response is favorable in comparison to the rougher whole tailings samples, which require more time to reach stabilized rates.

Following the initial sulphate load, the highest loadings are from T3. This is consistent with higher solid phase sulphate-S concentrations of 0.07 %S measured for the T3 sample. Overall, sulphate concentrations in leachate from the tailings are correlated to the solid phase sulphate-S content of the kinetic test samples. The other rougher whole tailings (T1, T2 and T4) have sulphate-S contents of 0.04 and 0.05 %S, while the pyrite rougher whole tailings (T5 and T7) have lower sulphate-S contents of 0.03 %S and the tailings sands (Col 5, Col 6 and T6) have even lower sulphate-S contents of 0.01 to 0.02 %S. A notable decrease in sulphate release is observed for T1 following the decrease in temperature after week 37 (from 17.5 to 6.5 mg/kg).

6.2.2.2 Metal Leaching Trends

Metal leaching from the tailings kinetic tests is primarily influenced by solid phase content (given the similarity in pH conditions in the tests) and, for the tailings sands, variations in operational procedures for the kinetic tests (Figure 6-8). Consistent with sulphate loads, metal loads from the unsaturated tailings kinetic tests are initially high and decrease, likely due to the dissolution of secondary oxidation products. In general, metal rates from the whole tailings and tailings sands stabilize early on during the test work or continue to show a very gradual decrease over the test period. An exception is D-Cu loadings from T1 and T2, which increase following week 8 before stabilizing at higher loads (0.0045 and 0.003 mg/kg, respectively) relative to the depyritized whole tailings and tailings sands.

The lowest D-Cu (and D-Cd and D-Mo) leaching rates are from kinetic tests T4, T7 and Col 6, which were produced by ore feed composed of 60% HYP and 100% HYP.

Additionally, T4 and T7 test samples have lower solid phase Cu content (216 ppm and 195 ppm, respectively, Table 4-26) compared to all other tailings kinetic test samples which were produced from ore composed primarily of SUP. Conversely, Col 5 and T6 have lower solid phase Cu than Col 6, but higher D-Cu leaching rates by nearly two orders of magnitude. The higher D-Cu leaching rates are believed to reflect the highly soluble forms of metals in the SUP waste and ore. The metal leaching potential of the SUP is believed to be related to highly reactive secondary sulphide phases and soluble oxide phases found in the SUP zone.

The leaching rates of D-Mo are highly variable between the tailings kinetic tests compared to the behavior of other elements. This is likely due to a combination of factors, including:

- Minor variations in pH resulting in sorption of Mo where leachate pH is non-alkaline;
- Decreases in sulphide oxidation (expressed as sulphate leaching rates), which reduces the leaching and mobility of Mo; and
- Relative solid phase Mo content of test samples, which correlates positively with Mo leaching rates.

Similar to D-Mo, variations in D-Se leaching rates can be related to the combined effect of sulphide oxidation rates and solid phase Se content of the kinetic test samples. Selenium typically occurs in the solid phase as a replacement for S. This replacement can take place in both primary sulphide minerals and secondary sulphate minerals. The highest Se leaching rates are from whole tailings kinetic tests T1 through T4, consistent with higher solid phase Se concentrations (1.7 to 2.2 ppm).

The influence of the different test methods is evident for metal loading rates from unsaturated column Col 5 and humidity cell T6, which are composed of the same tailings sample. Loading rates of D-Al, As, Cd and Zn are generally an order of magnitude higher from T6 relative to Col 5. The difference between the two test methods is most evident for D-Mo. The tests produce similar loadings up until week 12 (0.01 mg/kg Mo), after which, concentrations in leachate from Col 5 show a relatively rapid increase to nearly 0.4 mg/kg Mo while concentrations in leachate from T6 continue to decrease and appear to stabilize at approximately 0.0035 mg/kg/wk by week 60. Only loading rates for D-Cu are similar in leachate from the two tests.

Following the drop in temperature, metal loading rates for D-Al, D-As, D-Mo and D-Se (and D-Sb in Appendix E.3) from T1 show a decrease in concentration consistent with that observed for sulphate (Figure 6-7).

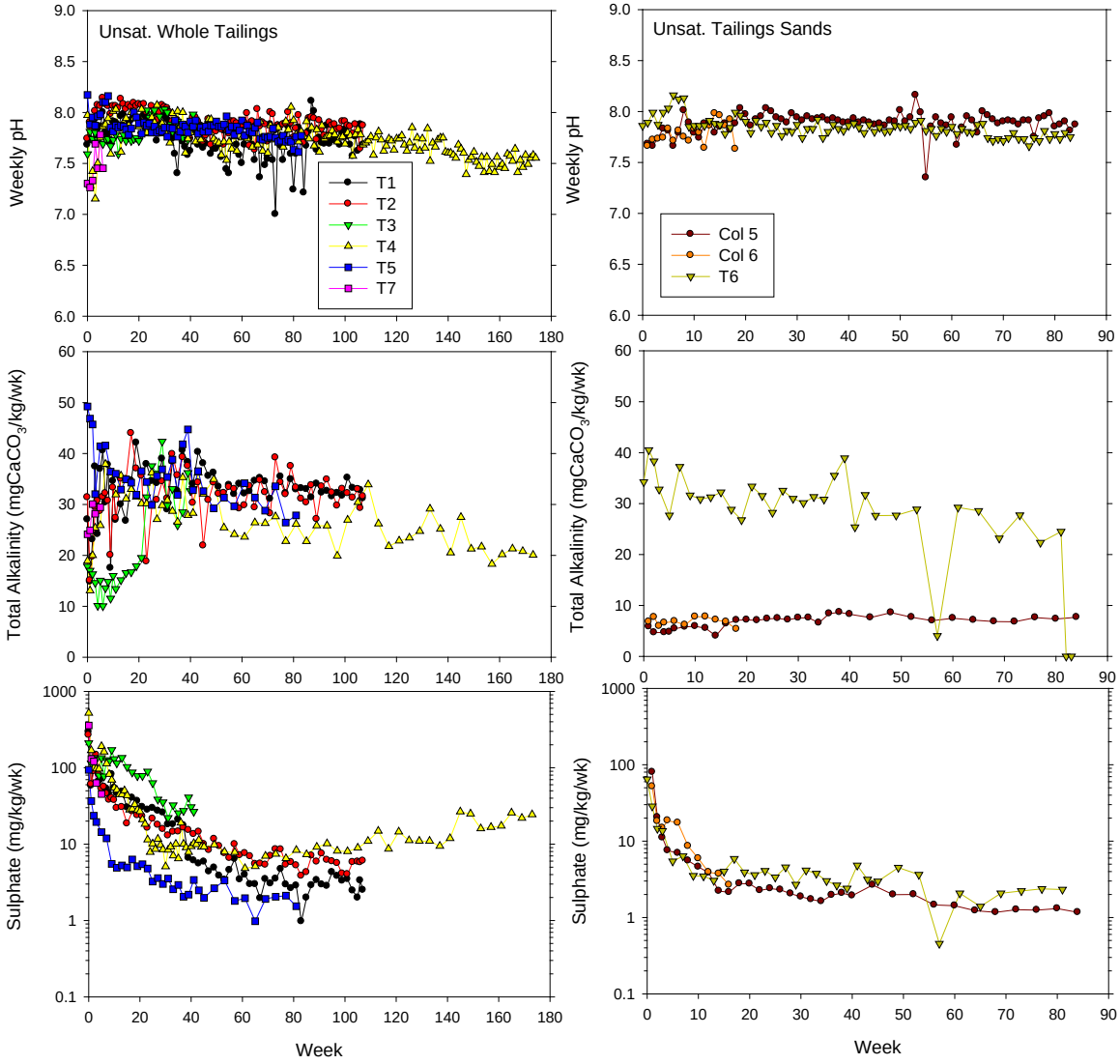


Figure 6-7: pH, alkalinity (as $CaCO_3$) and sulphate in leachate from whole tailings and tailings sands kinetic tests

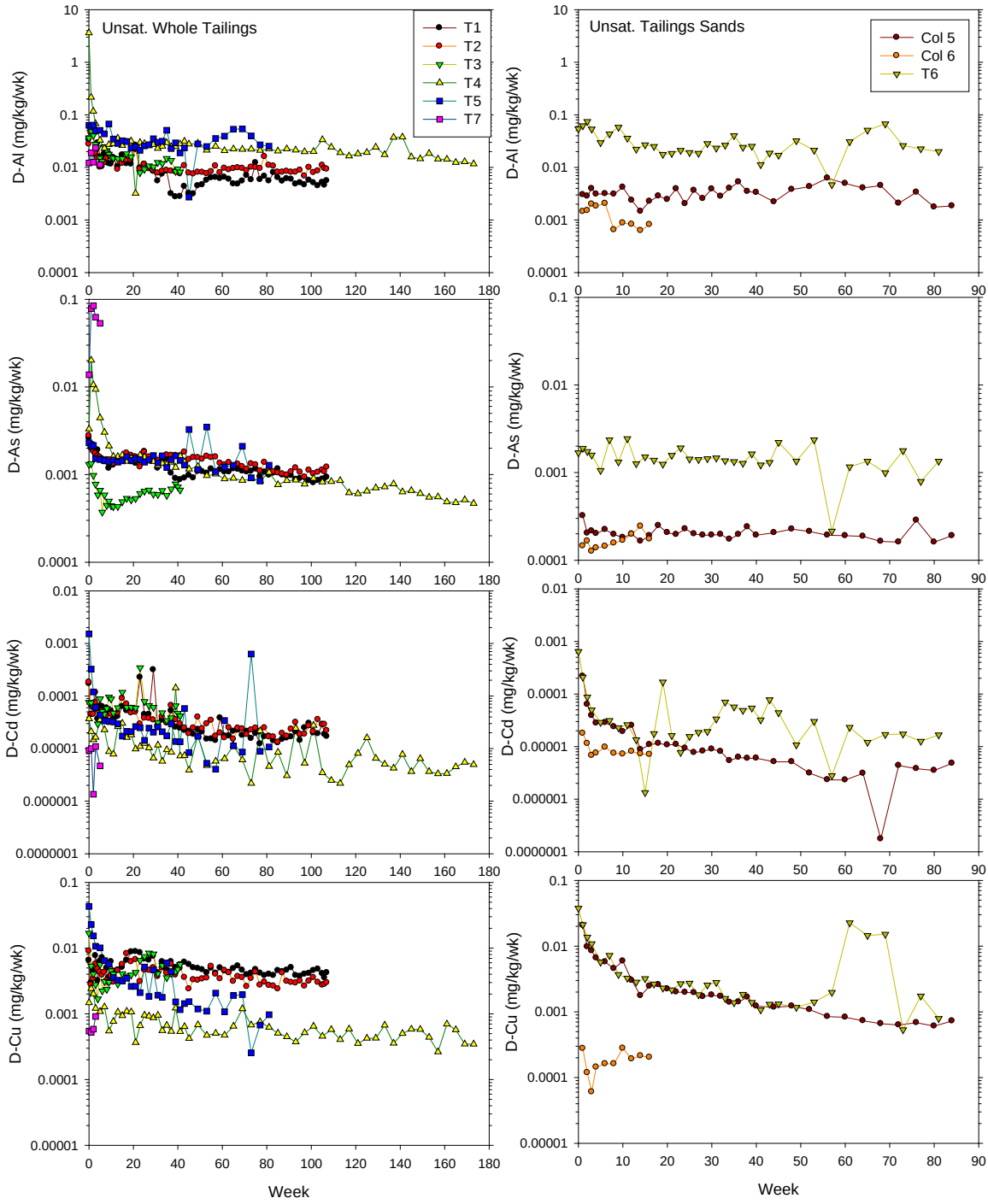


Figure 6-8: Loading rates of potential metals of concern from unsaturated whole tailings and tailings sands kinetic tests

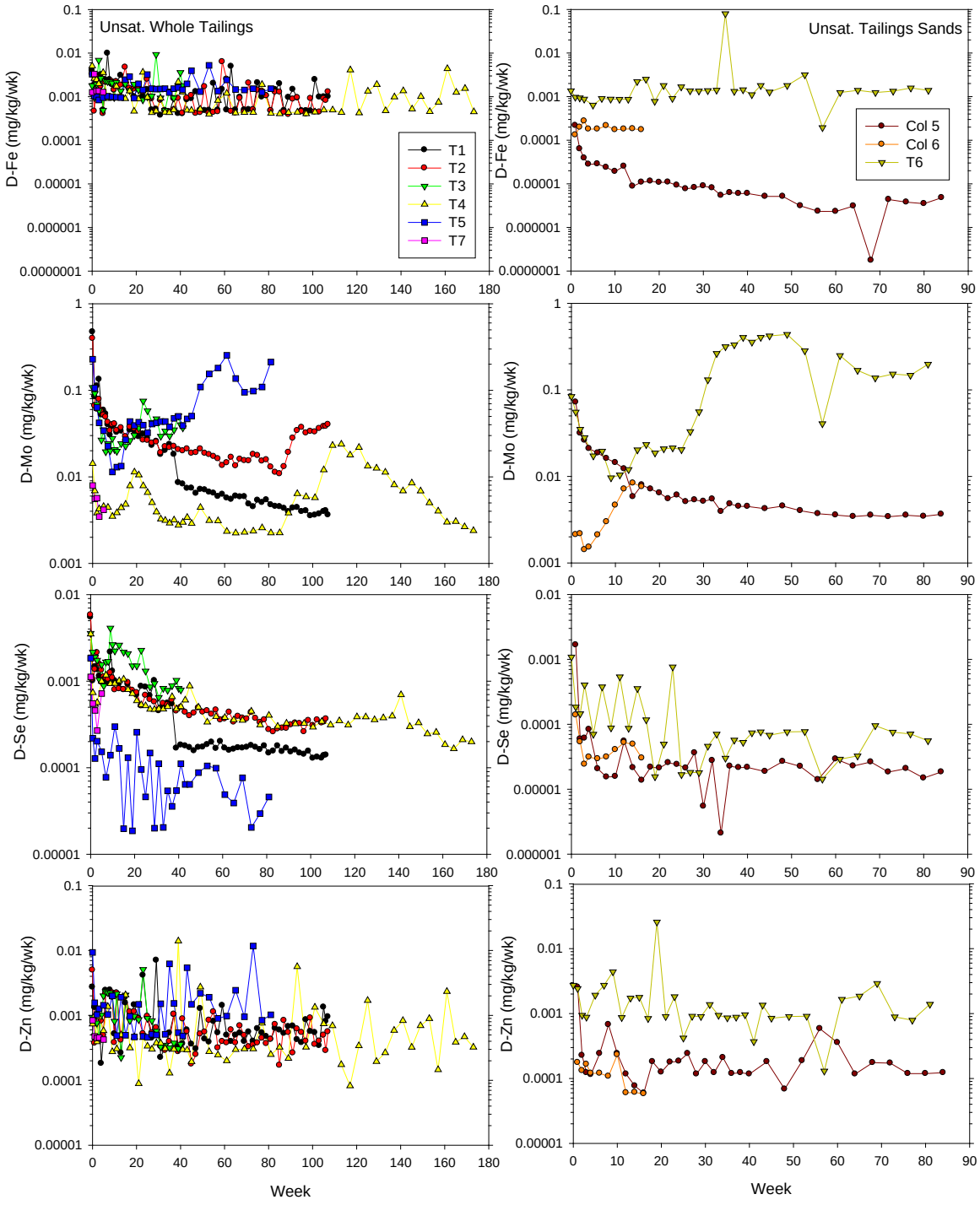


Figure 6-8 (cont.): Loading rates of potential metals of concern from unsaturated whole tailings and tailings sands kinetic tests.

6.3 Temperature Dependence

The oxidation rate of Casino mine waste is influenced by temperature. Laboratory tests are typically conducted at room temperature (~22°C) while the average ambient temperature at the Casino mine site is near 1°C. Therefore, the rate of sulphide oxidation observed in kinetic testwork likely overestimates field conditions. To assess and address the influence of temperature on oxidation rates, humidity cell T1 was moved on week 37 from room temperature to a cold room maintained at 4°C.

Nicholson *et al*. (1988) conducted an experimental study examining pyrite oxidation rates in carbonate buffered systems at a variety of temperatures. They found that the kinetic rate of pyrite oxidation can generally be described by an Arrhenius relationship. The Arrhenius equation can be written as follows:

$$k = Ae^{-Ea/RT}$$

where *k* is the reaction rate, *A* is the pre-exponential factor, *Ea* is the activation energy, *R* is the noble gas constant, and *T* is the temperature in Kelvin. The pre-exponential factor is a constant, with a value of 9.28×10^{-14} mole m^{-2} s^{-1}. The activation energy can be somewhat variable due to chemical differences in pyrite composition.

The oxidation rates before and after the temperature change in sample T1 can be used to calculate the *Ea*. Pyrite oxidation rates were calculated for the different temperatures using averaged sulphate release rates for the four weeks before and four weeks after the temperature decrease. Note that week 38 was excluded from the calculations to allow time for the temperature inside the humidity cell to decrease. Table 6-3 shows the results of the calculation and illustrates that the pyrite oxidation rate at 21°C is approximately one order of magnitude higher than the rate at 4°C. This is similar to results presented by Nicholson *et al* (1988).

Table 6-3:
Parameters used to calculate the activation energy of sulphide oxidation in Casino unsaturated whole tailings humidity cell T1.

Parameter	Unit	T1	
Temperature	°C	21	4
SO_4 release rate	mg/kg/week	18.86	6.28
log k	mol/h	-5.6	-6.1
1000/T	K	3.40	3.61
Activation Energy (Ea)	kJ/mol	43.9	

The *Ea* of a reaction can be derived from the slope of the Arrhenius relationship (1000/T versus log k). The *Ea* calculated for T1 is 43.9 KJ mol^{-1}, which is within the range of *Ea* values reported in the literature (39 KJ mol^{-1} to 88.0 KJ mol^{-1}) (Lowson, 1982). The activation energy of 43.9 KJ mol^{-1} is applied to the Arrhenius equation presented above to determine the pyrite oxidation rate as a function of temperature for Casino mine waste. The relationship normalized to the average temperature of laboratory kinetic experiments (21°C) is presented in Figure 6-9.

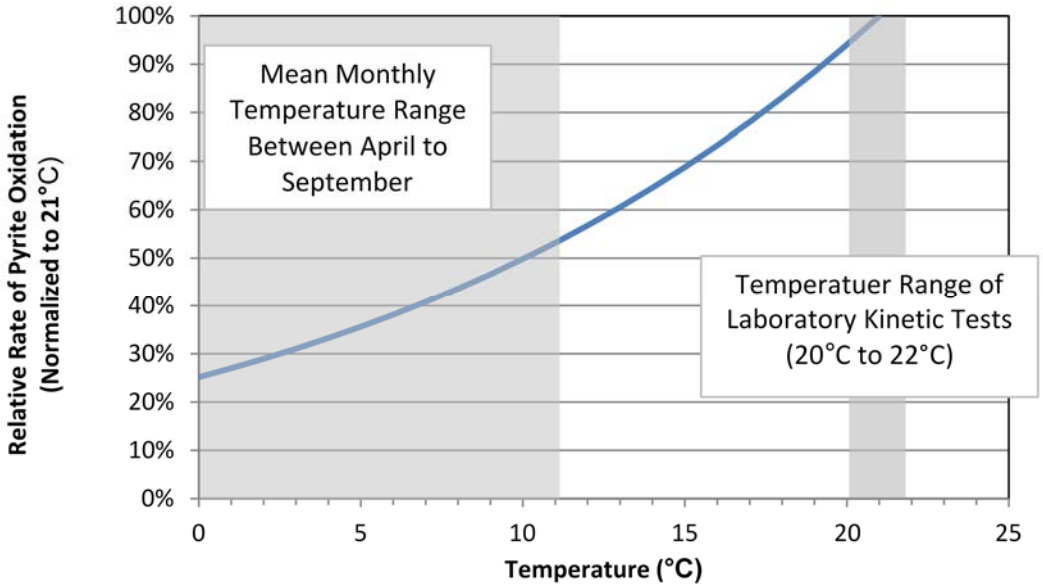


Figure 6-9: Influence of temperature on pyrite oxidation rate in Casino tailings normalized to laboratory weathering rates

The average monthly temperature between April and September ranges from 0.2°C to 10.4°C. Under this temperature range, oxidation rates are 25% to 54% of that measured for the room temperature laboratory experiments. Exposed sections of the pit wall will be largely influenced by these seasonal temperature changes. The interior of waste rock piles and the tailings embankment sands, however, are not expected to be influenced by seasonal temperature variations and will likely reflect mean annual temperature. The mean annual temperature for the Casino project area is -2.7°C (Knight Piesold, 2010). In oxidizing stockpiles of mine waste, the temperature can be expected to be somewhat higher than this due to the exothermic nature of sulphide oxidation reaction.

The change in metal leaching rates cannot be as easily related to reaction kinetics due to solubility controls. The change in metal leaching rates for the four weeks before and four weeks after the humidity cell was moved from room temperature to 4°C is presented in Table 6-4.

Table 6-4:
Leaching rates from humidity cell T1 before and after the temperature decrease

	SO_4	Cd	Cu	Mo	Se	U	Zn
	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk	mg/kg/wk
21°C	19	3.017E-05	0.0050	0.021	0.00051	0.0012	0.00036
4°C	6.3	0.0000249	0.0053	0.0084	0.00018	0.00034	0.00035
rate (4°C) / rate (21°C)	0.33	0.82	1.06	0.41	0.35	0.28	0.95

Notes: Presented values are calculated average values of the two cycles before and after the change in temperature. The first cycle after the temperature change is excluded as it is considered to represent transitional values.

The leaching rate of most metals decreased when humidity cell T1 was moved from 21°C to 4°C. The leaching rates of some metals, D-Ag, D-Co, D-Pb and, most notably D-Cu, actually increased when the temperature was decreased. This observed increase in leaching rates is not believed to be due to sulfide oxidation kinetics, as the oxidation rate of sulfide minerals uniformly decrease with decreasing temperature. The observed increases in these metals are likely do to temperature effects on oxide (hydroxide) solubility and surface sorption. Note that metals which are generally soluble at a neutral pH (Mo and Se), have a similar decline in loading rates as observed for SO_4.

6.4 Potential for Acid Generation

Humidity cell testing may be used to develop two site-specific parameters for waste rock and tailings; (1) the *safe* NPR value, and (2) rate of NP depletion. Recalling that the NPR is defined as NP/AP, a *safe* NPR indicates the ratio above which there is no predicted potential for acid drainage to occur at any point in time. If a sample is deemed to be PAG, a lag time between a rock's exposure and the first appearance of acid generation can be estimated by the rate of NP depletion.

6.4.1 Sulphide Oxidation and NP Depletion Rates

The consumption or loss of NP from waste rock or tailings can occur via two important processes: 1) consumption through neutralization of acidity produced during sulphide (pyrite) oxidation; and 2) consumption through simple carbonate (or aluminosilicate) dissolution from infiltration of meteoric waters, or deionized (DI) water flushing in the case of laboratory experiments. When reactive sulphides are present, the dominant NP consumption reaction is that of acid neutralization. The sulphide oxidation reaction is typically represented as:

$$FeS_2 + {}^{7}\!/\!_{2}\, H_2O + {}^{15}\!/\!_{4}\, O_2 \longrightarrow Fe(OH)_3 + 2SO_4^{2-} + 4H^+$$

Thus, for each mole of sulphide oxidized, 2 moles of acidity are produced. In the most simplistic scenario, when carbonate minerals are present, the oxidation-neutralization reaction is pH-dependent. Assuming no Ca and SO_4 are lost to gypsum precipitation, two carbonate consumption reactions can describe the process, including:

at pH<6.3:

$$FeS_2 + \tfrac{7}{2}H_2O + \tfrac{15}{4}O_2 + 2\left[Ca^{2+}, Mg^{2+}\right]CO_3 \longrightarrow Fe(OH)_3 + 2SO_4^{2-} + 2H_2CO_3^0 + 2\left[Ca^{2+}, Mg^{2+}\right] \quad \textbf{(1)}$$

at 6.3<pH<10.3:

$$FeS_2 + \tfrac{7}{2}H_2O + \tfrac{15}{4}O_2 + 4\left[Ca^{2+}, Mg^{2+}\right]CO_3 \longrightarrow Fe(OH)_3 + 2SO_4^{2-} + 4HCO_3^- + 4\left[Ca^{2+}, Mg^{2+}\right] \quad \textbf{(2)}$$

Equation (1) indicates that, in theory, neutralization of acidity up to a pH of 6.3 will produce one mole of Ca for each mole of SO_4 released, giving a 1:1 carbonate molar ratio (CMR). However, this is a somewhat idealized representation that does not consider the exsolution of CO_2 gas; contribution of non-carbonate minerals releasing Ca and Mg ions; or the dissolution of carbonates by dilute waters in the absence of sulphide oxidation. These processes could affect the relative rate of Ca and Mg release to SO_4 production. In addition, the equation assumes all S is derived from pyrite with an ideal stoichiometry and all released Fe subsequently precipitates as $Fe(OH)_3$. Deviations from these assumptions may alter the CMR.

The range of CMR values for non-acid generating waste rock, tailings and ore are presented in Figure 6-10. Figure 6-11 presents an average CMR value with the average sulphate production rate (calculated from the same cycles) for each non-acid generating kinetic test. CMR values were calculated using the last five complete cycles of data available for each test. At the time that this report was prepared, there was not sufficient kinetic data available for tests Col 6 and T7; therefore, CMR values are not presented for these tests.

A distinct trend is noted between sulphate release rate (sulphide oxidation) and CMR values (Figure 6-11). At low sulphide oxidation rates much of the base cation release is in direct response to the volume of dilute deionized water rather than dissolution related to neutralization of acid generated by the sample. As a result, CMR values from the samples with low sulphide oxidation rates are believed to overestimate the rate of carbonate depletion that would occur in the field. To account for this laboratory artefact, carbonate depletion times for samples with CMR values >2.0 are calculated using a conservative value of 2.0. The lowest CMR values are observed for HYP waste rock tests HC3, HC4 and HC7; tailings test T3 and T4; and the two ore tests HC1 and HC2, all of which have CMR values <2 and SO_4 loading rates >7.5 mg/kg/wk.

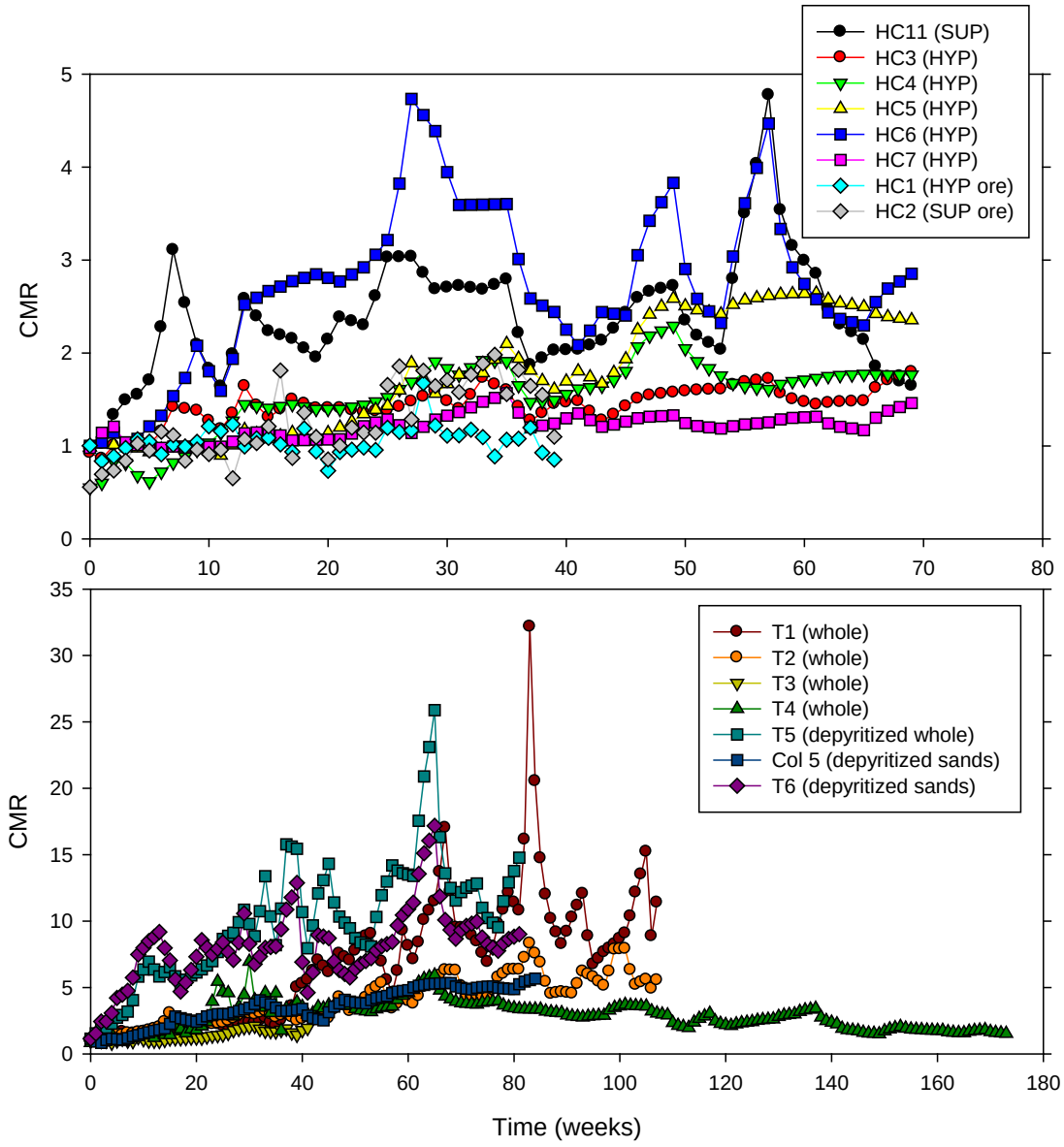


Figure 6-10: Carbonate molar ratios (CMR) for the Casino waste rock, ore and tailings kinetic tests

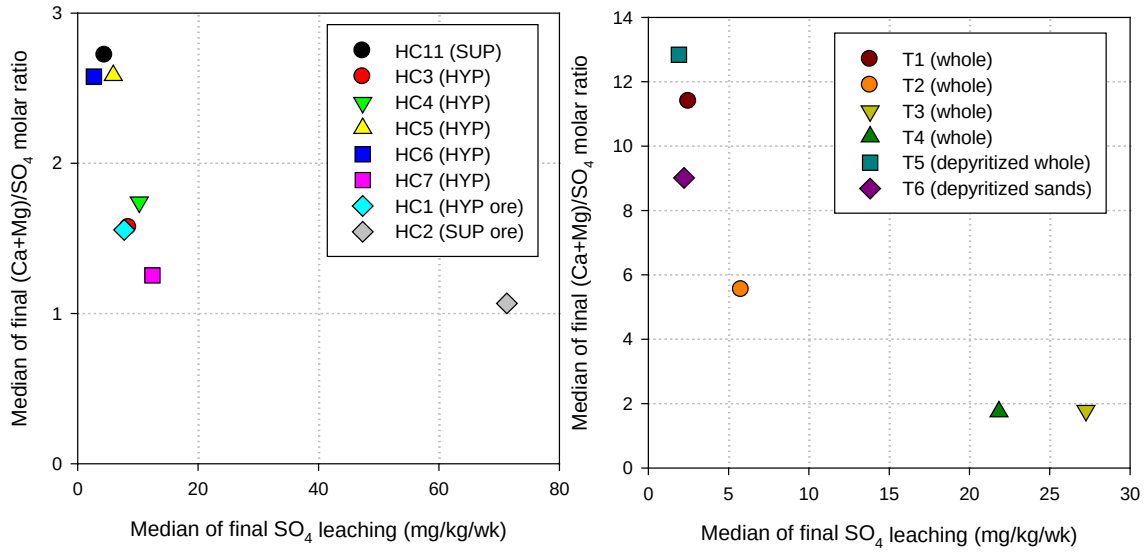


Figure 6-11: Average stabilized CMR values presented with average stabilized SO_4 leaching rates for non-acid generating unsaturated waste rock, ore and tailings kinetic tests

The measured weathering rate for unsaturated waste rock, tailings and ore kinetic test samples can be used to calculate the amount of time required to consume all available CaNP from the kinetic test samples. A summary of the CaNP consumption and sulphate leaching rates (average values calculated for the last five cycles of the available kinetic data) for Casino unsaturated waste rock, ore and tailings humidity cell tests are presented in Table 6-5, Table 6-6 and Table 6-7, respectively. Neutralization potential depletion over the duration of the kinetic experiments is presented in Figure 6-12. Also provided in the tables, are the remaining total S concentrations in each humidity cell test following the complete depletion of CaNP and the time to the onset of acidic conditions. Calculations were completed according to recommendations outlined in Price (2009) and are provided in the tables of Appendix E.4. Note that for the purposes of calculating CaNP consumption rates and the time for complete depletion of CaNP, the initial sulphate production rates, which reflect the flushing of non-acid generating surface oxidation products such as gypsum, were not incorporated in the calculation or presented in Figure 6-12. Rather the CaNP depletion rates more appropriately reflect depletion based on sulphate produced by sulphide oxidation. This will prevent underestimating the amount of available NP and the timing to the onset of acidic conditions. Results of the calculations indicate that it would take 27 to 60 years to deplete the CaNP of the SUP and HYP waste rock humidity cells (Table 6-5); less than 11 years to deplete the CaNP in unsaturated SUP and HYP ore humidity cells (Table 6-67); and 8.5 to 78 years to deplete the CaNP in unsaturated whole tailings humidity cells and columns (Table 6-7).

Table 6-5:
Time until onset of acidic conditions for SUP and HYP waste rock

Mineralization Zone		SUP	HYP				
Lithology		WR	PP	WR	PP	WR	MX/IX
Kinetic		**HC11**	**HC3**	**HC4**	**HC5**	**HC6**	**HC7**
Parameter	**Unit**						
Initial CaNP[1]	$mgCaCO_3/kg$	18.3	22.5	57.5	17.5	15.8	24.2
Initial Total S[1]	%	2.3	4.2	4.3	2.2	1.8	3.3
CaNP consumption rate[2]	$mgCaCO_3/kg/wk$	9.4	12.7	18.4	12.3	5.6	17.0
SO_4 leaching rate[2]	mg/kg/wk	4.5	8.5	10.2	5.9	2.7	12.4
CMR[2]	ratio	2.0	1.6	1.7	2.0	2.0	1.2
Total S remaining upon CaNP depletion	%	2.0	3.8	3.2	1.9	1.6	2.7
Timing to onset of acid generation[3]	years	37.7	33.8	60.0	27.0	54.2	27.2

Notes: 1. Data from Table 4-16 and Table 4-17.
2. Median of last five full cycles of kinetic test data available (Appendix E).
3. Time until complete depletion of CaNP and onset of acidic conditions (includes weeks of kinetic testwork).

Table 6-6:
Time until onset of acidic conditions for SUP and HYP ore

Sample Description		Ore	
Kinetic		**HC2 (SUP)**	**HC1 (HYP)**
Parameter	**Unit**		
Initial CaNP[1]	$mgCaCO_3/kg$	6.7	26.7
Initial Total S[1]	wt. %	1.23	1.53
CaNP Consumption Rate[2]	$mgCaCO_3/kg/wk$	12.1	68.9
SO_4 Leaching Rate[2]	mg/kg/wk	7.74	71.28
CMR[2]	ratio	1.55	1.07
Total S Remaining upon CaNP Depletion	wt. %	1.09	0.62
Time to onset of acid generation[3]	years	10.7	7.5

Notes: 1. Data from Table 4-18;
2. Median of last five full cycles of kinetic test data available (Appendix E); and
3. Time until complete depletion of CaNP and onset of acidic conditions (includes weeks of kinetic testwork).

Table 6-7:
Time until onset of acidic conditions for SUP and HYP rougher and pyrite rougher whole tailings and tailings sands

Kinetic Test ID		**T1**	**T2**	**T3**	**T4**
Mineralization Zone		**71% SUP**	**71% SUP**	**71% SUP**	**60% HYP**
Parameter	**Unit**				
Initial CaNP[1]	$mgCaCO_3/kg$	22.5	21.7	25.8	15.83
Initial Total S[1]	wt. %	1.18	1.09	0.65	1.49
CaNP Consumption Rate[2]	$mgCaCO_3/kg/wk$	5.2	12.1	54.1	38.6
SO_4 Leaching Rate[2]	mg/kg/wk	2.50	5.79	27.26	21.84
CMR[2]	ratio	2.00	2.00	1.78	1.74
Total S Remaining upon CaNP Depletion	wt. %	0.82	0.74	0.21	1.22
Time to onset of acid generation[3]	years	78.3	33.5	9.2	8.5

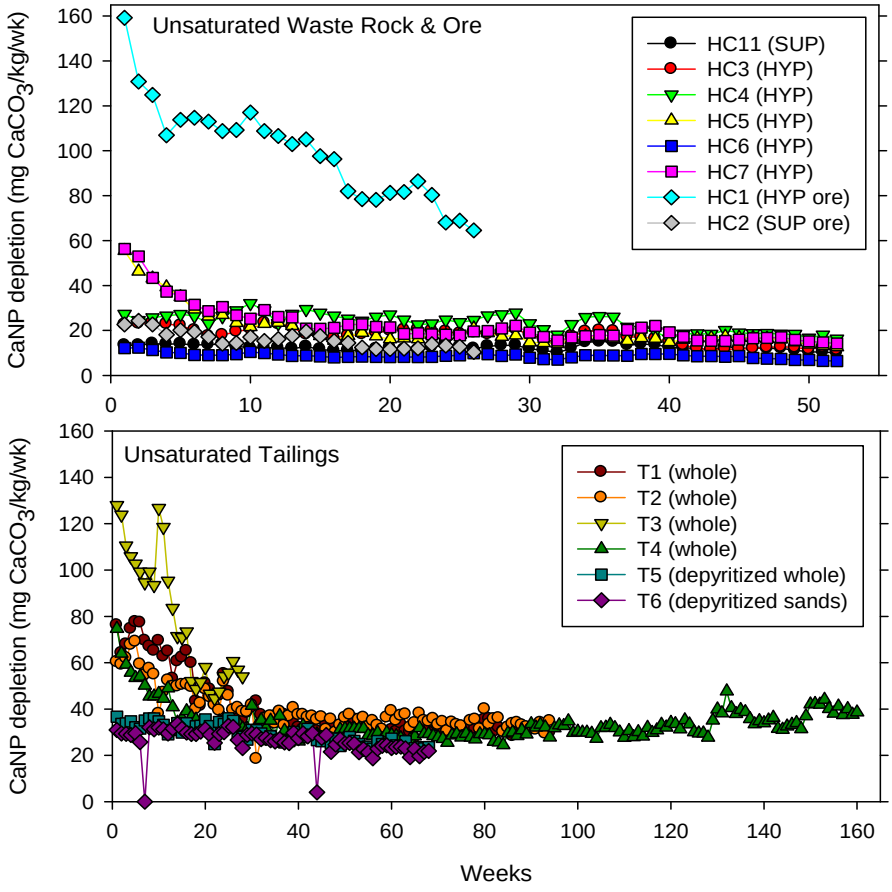


Figure 6-12: Carbonate NP depletion over time for unsaturated kinetic experiments. T1 through T4 are rougher whole tailings, T5 is pyrite rougher whole tailings and T6 is pyrite rougher tailings sands

The oxidation and NP depletion rates calculated in Tables 6-5 to 6-7 have not been scaled to account for temperature effects. As discussed in Section 6.3, lower temperatures affect both sulphide oxidation rates and mineral solubility. Sulphide oxidation rates decrease with decreasing temperature, while mineral solubility can increase or decrease depending on the mineral phase. Therefore, humidity cell loading rates were adjusted using the activation energy (Ea) and Arrheneus relationship to reflect the lower temperatures that are present at the Casino site compared to laboratory temperatures.

Temperatures at the Casino site are below freezing for approximately 50% of the year, therefore, it is assumed that no metal loading or acid generation takes place on the surface of the waste rock and ore stockpiles and the tailings embankments for the 6 months of the year with average temperatures below freezing. The average monthly temperature at the Casino site between April and September ranges from 0.2°C to 10.4°C, with an average of 7.7°C. In this temperature range oxidation rates will be 54% to 25% of those measured at standard laboratory temperatures. To reflect a temperature of 7.7°C, a linear extrapolation between the observed loading rate at 21°C and 4°C is applied. Using this site-specific Arrhenius relationship, SUP and HYP loading rates were adjusted by a factor of 0.47 to reflect a temperature of 7.7°C and to account for the average annual temperatures during the 6 months when the average temperature is above freezing.

The interior of the Casino stockpiles and tailings embankment will remain somewhat warmer than the mean annual temperature at the Casino site (-2.7°C) due to the exothermic nature of sulphide oxidation. A temperature of 4°C was selected to represent the temperatures within the piles based on data from studies conducted at the Aitik Mine in northern Sweden (Linklater *et al.*, 2005; Stromberg and Banwart, 1994). Using the Arrhenius relationship, SUP and HYP loading rates were adjusted by a factor of 0.33 to reflect a temperature of 4°C.

6.5 Metal Leaching Rates

The final stabilized metal leaching rates for unsaturated waste rock kinetic tests are presented in Table 6-11 and for ore and unsaturated tailings kinetic tests in Table 6-12. The stabilized loads are calculated average values of the final five cycles for which there are full sets of data. Kinetic tests for which loads do not appear to have stabilized are marked by an asterisk. Note that metal concentrations in leachate form HC8 and HC10 appear to still be increasing. A green colour scale was used to highlight the kinetic tests that are producing the highest sulphate and metal leaching rates and lowest pH (in the darkest green).

Table 6-8:
Median values for final leaching rates (last 5 cycles of available data) of unsaturated waste rock kinetic tests

Kinetic Test Description	CAP					SUP		HYP							
	Col 1	**Col 2A***	**Col 2B**	**Col 3**	**Col 4a**	**HC11***	**HC12***	**HC3***	**HC4**	**HC5**	**HC6**	**HC7***	**HC8****	**HC9**	**HC10****
cycles	144 - 160	144 - 160	132 - 148	132 - 148	124 - 140	49 - 65	49 - 65	49 - 65	49 - 65	49 - 65	49 - 65	49 - 65	49 - 65	49 - 65	49 - 65
Parameter (mg/kg/wk)															
pH	5.3	6.0	5.2	3.2	7.3	7.1	3.8	7.4	7.5	7.5	7.4	7.3	3.3	5.4	3.2
Sulphate	2.4	0.65	0.74	8.9	0.44	4.5	25	8.5	10	5.9	2.7	12	46	3.6	75
Ca	0.41	0.12	0.14	1.2	0.70	4.4	0.66	3.5	6.3	4.7	3.0	6.3	0.18	0.78	0.46
Mg	0.101	0.022	0.027	0.16	0.092	0.39	0.089	1.0	0.64	0.93	0.24	0.33	0.017	0.076	0.55
Al	0.012	0.0040	0.0046	0.29	0.0070	0.015	1.5	0.012	0.016	0.021	0.021	0.014	4.5	0.009	7.6
Ag	0.0000043	0.0000018	0.0000013	0.0000034	0.0000018	0.0000046	0.0000084	0.0000047	0.0000046	0.0000045	0.0000045	0.0000046	0.000025	0.0000045	0.000014
As	0.000024	0.000013	0.000011	0.000023	0.00032	0.00041	0.00014	0.00013	0.00026	0.00009	0.00018	0.00093	0.00014	0.00009	0.00082
Cd	0.000018	0.0000085	0.000010	0.000018	0.0000027	0.0000050	0.0012	0.000019	0.000014	0.0000050	0.0000041	0.000007	0.00034	0.000046	0.0009
Co	0.00050	0.00017	0.00021	0.0015	0.000008	0.00012	0.0037	0.000063	0.000039	0.000030	0.000026	0.000074	0.0035	0.0020	0.020
Cr	0.000030	0.000030	0.000014	0.000047	0.000031	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.00023	0.0011	0.00023	0.0023
Cu	0.055	0.0055	0.0069	0.26	0.0004	0.0022	1.9	0.00048	0.00047	0.00041	0.00059	0.0012	1.6	0.59	1.8
Fe	0.00025	0.00022	0.00010	0.030	0.0016	0.0023	1.7	0.0014	0.0014	0.0014	0.0022	0.0014	4.0	0.0041	4.9
Hg	0.00059	0.00059	0.00028	0.0006	0.00062	0.0046	0.0043	0.0047	0.0046	0.0045	0.0045	0.0046	0.0046	0.0045	0.0045
Mn	0.012	0.0029	0.0037	0.0091	0.00014	0.00072	0.0072	0.0086	0.00086	0.0027	0.0012	0.0091	0.0072	0.0074	0.080
Mo	0.00020	0.000016	0.000010	0.0000059	0.020	0.00061	0.000013	0.0014	0.0014	0.0018	0.00086	0.0021	0.00020	0.00017	0.00009
Ni	0.00021	0.000030	0.000036	0.00056	0.000018	0.00010	0.0013	0.000047	0.000088	0.000086	0.000046	0.000049	0.0039	0.00055	0.011
Pb	0.000005	0.0000053	0.000003	0.000054	0.00002	0.000014	0.000050	0.000013	0.000013	0.000017	0.000013	0.000013	0.00012	0.000009	0.0001
Sb	0.000012	0.000030	0.000017	0.000012	0.00073	0.00077	0.000085	0.00009	0.00062	0.00009	0.00009	0.00037	0.00014	0.000090	0.00018
Se	0.000030	0.000021	0.000035	0.000054	0.000040	0.00021	0.0006	0.000044	0.00028	0.000048	0.00003	0.00038	0.00021	0.00015	0.00049
Ti	0.000012	0.000012	0.0000099	0.000044	0.000037	0.00014	0.000043	0.000089	0.00009	0.000090	0.00018	0.000092	0.000046	0.000045	0.00009
Tl	0.0000089	0.0000012	0.0000011	0.000015	0.0000012	0.0000091	0.0000085	0.0000093	0.0000091	0.0000090	0.0000090	0.0000092	0.000009	0.0000090	0.000023
U	0.000041	0.0000029	0.0000039	0.00065	0.0000076	0.0028	0.014	0.0040	0.0050	0.00049	0.00063	0.00047	0.018	0.00014	0.019
Zn	0.0029	0.00071	0.00084	0.0016	0.00018	0.0016	0.12	0.0009	0.0009	0.00090	0.00090	0.00049	0.033	0.0063	0.19

Notes: Cycles represent the last 5 complete cycles used to calculate median values; * are kinetic tests that may not have stabilized and loadings may still be decreasing; ** are kinetic tests for which loadings may still be increasing;
Blue print are values for which 4 or 5 of the 5 last cycles used to calculate median values were below the analytical limit; and a green colour scale highlights the highest production rates and lowest pH values in the darkest green.

Table 6-9:
Median values for final leaching rates (last 5 cycles) of unsaturated tailings and ore kinetic tests

Kinetic Test Description	Whole Tailings				Depyritized Whole	Depyritized Tailings Sands			Ore	
	T1	**T2**	**T3**	**T4**	**T5**	**Col 5**	**Col 6**	**T6**	**HC1**	**HC2**
cycles	101 - 107	101 - 107	35 - 41	149 - 173	65 - 81	68 - 84	8 - 16	65 - 81	33 - 39	33 - 39
Parameter (mg/kg/wk)										
pH	7.7	7.8	7.8	7.5	7.8	7.9	7.8	7.7	7.0	7.0
Sulphate	2.5	5.8	27	22	1.9	1.2	3.9	2.2	71	7.7
Ca	11	11	18	8.8	0.0	2.4	3.5	7.9	26	3.2
Mg	0.63	1.4	2.6	4.1	0.00	0.17	0.34	0.51	0.91	0.98
Al	0.0051	0.0093	0.009	0.013	0.005	0.0021	0.00082	0.026	0.013	0.0028
As	0.00089	0.0011	0.00069	0.00049	23.6133	0.00016	0.00017	0.0013	0.00048	0.00051
Cd	0.000019	0.000028	0.000042	0.0000045	0.00001	0.0000038	0.0000073	0.000017	0.000022	0.00030
Co	0.000045	0.000014	0.000069	0.0000099	0.000011	0.0000076	0.000014	0.000049	0.000036	0.00041
Cr	0.000049	0.000045	0.000046	0.000045	0.00129	0.000030	0.000029	0.00022	0.000046	0.000047
Cu	0.0042	0.0030	0.0044	0.00035	8.5867	0.00066	0.00020	0.0017	0.0012	0.010
Fe	0.0010	0.00082	0.0018	0.0013	0.0002	0.00018	0.00018	0.0014	0.0014	0.0005
Hg	0.0049	0.0045	0.0045	0.0045	0.0005	0.00059	0.00058	0.0047	0.0046	0.0047
Mn	0.021	0.00062	0.028	0.0030	0.0000	0.0024	0.0035	0.0012	0.015	0.033
Mo	0.0037	0.038	0.037	0.0030	0.53	0.0036	0.0071	0.15	0.023	0.068
Ni	0.00015	0.00011	0.00015	0.000038	0.00148	0.000023	0.000023	0.00013	0.000086	0.00009
Pb	0.0000050	0.0000065	0.000027	0.000028	0.000040	0.0000034	0.0000081	0.000023	0.0000026	0.0000023
Sb	0.0079	0.016	0.0070	0.00026	0.00489	0.00026	0.0012	0.00085	0.0018	0.0019
Se	0.00013	0.00034	0.00083	0.00020	0.000102	0.000018	0.000041	0.000071	0.00022	0.000051
Tl	0.0000090	0.000017	0.000039	0.0000036	0.0684444	0.0000030	0.0000017	0.000009	0.0000029	0.000013
U	0.00015	0.00056	0.0014	0.00083	0.00001	0.00040	0.0022	0.00039	0.0046	0.000026
Zn	0.00081	0.00040	0.00036	0.00039	0.0001	0.00012	0.00006	0.0014	0.00018	0.0010

Notes: Cycles represent the last 5 complete cycles used to calculate median values;
Blue print are values for which 4 or 5 of the 5 last cycles used to calculate median values were below the analytical limit; and
A green colour scale highlights the highest production rates and lowest pH values in the darkest green.

The highest stabilized metal production rates for D-Al, Ag, Cd, Co, Cr, Cu, Mn, Ni, Pb and Zn are produced by acid generating kinetic tests composed of SUP (HC12) and HYP (HC10, HC8 and, to a lesser extent, HC9). The highest stabilized production rates for D-As, Mo and Sb are from neutral drainage SUP waste rock (HC11).

CAP waste rock tests indicate that the highest stabilized metal production rates for D-Al, Ag, Co, Cu, Fe, Hg, Mn, Ni, Pb and Tl are from acid generating Col 3; however these are one to three orders of magnitude lower than rates produced by acidic SUP (HC12) and acidic HYP (HC10) but on the same order as that from HC9. The greatest concentrations of D-As, Mo and Sb for CAP samples are associated with neutral drainage from Col 4a.

6.5.1.1 Mineralization Zones

Each mineralization zone present at Casino has distinctive metal leaching characteristics. Distinctive traits vary depending on weathering state (e.g., acidic vs. neutral). Under neutral pH conditions, the following differences are observed.

- Major ion leaching rates (SO_4, Ca, Mg) are initially similar between SUP, HYP and CAP at the beginning of kinetic testwork. Stabilized loading rates are considerably higher in the SUP and HYP waste rock then in the CAP waste rock.
- Initial metal loadings from acidic CAP are generally similar to acidic SUP and acidic HYP. However, stabilized loadings of nearly all parameters are lower in acidic CAP than in acidic SUP or HYP samples.
- Neutral HYP humidity cells generally produce greater U and Mo, and lower Co and Cu compared to neutral SUP humidity cell loadings. Stabilized metal loading rates of other parameters are generally similar between neutral SUP and neutral HYP.
- Acidic HYP humidity cells produce somewhat greater loadings of SO_4, Cr, Ni and Pb than acidic SUP, while acidic SUP produces greater concentrations of Se than acidic HYP. Acidic metal loading rates of other parameters are generally similar between these mineralization zones.
- In general, difference between peak and stabilized loading rates in CAP samples is greater than in HYP or SUP samples. This is consistent with an oxide flushing mechanism dominating leaching rates in the CAP material, while sulphide oxidation and associated buffering reactions drive leaching rates in SUP and HYP.
- Tailings and ore samples dominated by SUP produce greater loading rates of Cd, Co, Cu, Mn, Mo, Ni, Sb, Tl and Zn. While tailings and ore samples dominated by HYP produce greater stabilized concentrations of SO4 and U compared to SUP dominated tailings and ore.

6.5.1.2 HYP Lithologies

A number of HYP humidity cells were initiated to examine potential differences in metal leaching characteristics between the various HYP lithologies. In general differences were minor, but some general observations can be made:

- The neutral PP humidity cells have the highest stabilized loading rate of Mg and the lowest stabilized loading rates of As, Se and Sb compared to the other humidity cells.
- The neutral mixed breccia humidity cell (IX/MX) is producing the highest Se loading rate, and stabilized As and Cu loading rates that are more than a factor of two greater than the PP or WR neutral HYP humidity cells. Conversely, this sample has the lowest stabilized Zn loading rates compared to other neutral pH samples.
- The neutral WR humidity cells have somewhat lower Mn concentrations than the other lithologies. The neutral leaching rates from the WR humidity cells are otherwise similar to the other lithologies.
- Acidic WR generally produced higher metal loading rates than acidic MX. Specifically, Zn, Tl, Se, Pb, Ni, Mn, Cr, Co, Cd, As, Mg and Ca were a factor of two or more greater in the acidic WR humidity cell than in the acidic MX humidity cell. The CaNP deplete PP humidity cell (HC9) is producing an intermediate pH, therefore a comparison of acidic weathering rates with this lithology is not possible.

6.6 Unsaturated Kinetic Test Results Summary

The objective of this testwork is to evaluate acid generation and metal leaching rates from sub-aerially stockpiled Casino mine waste. Key observations and results from this testwork are as follows.

- In general, metal leaching rates in CAP kinetic test samples are generally lower than that of SUP or HYP samples in a similar pH range, with the exception of Mo in neutral pH CAP.
- The highest Mo leaching rates are produced from neutral CAP material. However, it is important to note that a majority of CAP at the Casino site has a mildly acidic in-situ pH which would inhibit Mo leaching.
- Depyritization of Casino tailings reduces the leaching rate of SO4 and a number of other parameters, particularly Se and Cu. However, depyritization does not significantly reduce the metal leaching rates of some metals, such as As, Cd and Zn.

- Tailings and ore samples composed primarily of SUP generally have higher metal leaching rates than tailings samples composed of HYP, with the exception of U and SO4.
- In general differences between neutral metal leaching rates in the different HYP lithologies are minor. There is some indication that acidic WR has a higher metal leaching potential than acidic MX.
- Reducing the temperature of a tailings humidity cell from 21C to 4C resulted in a 30% reduction in the sulphate leaching rate. This temperature dependence is similar to literature values regarding temperature effects on the rate of pyrite oxidation.
- The temperature related reduction in sulphide oxidation rates did not uniformly result in a reduction in leaching rates for all metals. Significantly, Cu leaching rates were observed to increase slightly at lower temperatures.

7. Field Bin Results

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7. Field Bin Results

Eight field bin kinetic tests have been running for five years. Four of the field bins (FB1 to FB4) are composed of CAP material; FB5 is composed of 56% SUP and 44% CAP; FB6 is composed of 92% HYP and 8% SUP; and FB7 and FB8 are composed of HYP. CAP waste rock placed in FB1 through FB4 is near or slightly acid generating based on the static testwork discussed in Section 4 (Table 4-15). FB5 through FB8 are slightly alkaline, contain total and sulphide S of > 1.5% and have CaNPR values of < 1 (Table 4- 16 and 4-17). FB5 (composed of SUP and CAP), in particular, has low TIC (0.03 %) and is expected to generate acid early in the test. The HYP field bins have measurable TIC, but not values sufficient to neutralize the sulphide content and are, therefore, these field bins are considered PAG.

The field bins were irrigated with 8L of distilled de-ionized water immediately after construction in 2008 and leachate collected the following day. Subsequent leachate samples were dependent on natural precipitation. As a result, leachate volume was occasionally not sufficient for sample collection. In August 2011, a leak was found in the leachate collection container of FB5. Field bin leachate pH, anions and potential metals of concern are presented in Figure 7-1, Figure 7-2 and Figure 7-3 with CCME and MMER guidelines (Table 7-1). The complete dataset for the field tests are provided in Appendix F.1.

Table 7-1:
Summary of guideline exceedances in leachate from Casino field bins

Field Bin	Sample Description	Dissolved Metal Guideline Exceedances
FB1	CAP	Ag, Al, As, Cd, **Cu**, Cr, Fe, Mo, Pb, Se, (Tl)
FB2	CAP	(Ag), Al, Cd, **Cu**, (Cr), Se
FB3	CAP	(Ag), Al, Cd, **Cu**, Mo, Se, (Tl)
FB4	CAP	Ag, Al, As, Cd, **Cu**, Cr, Fe, Se, (Tl), **Zn**
FB5	56% SUP & CAP	Al, As, Cd, **Cu**, Mo, Pb, Se, U, **Zn**
FB6	92% HYP & SUP	(Al), As, Cd, **Cu**, Mo, Pb, Se, U, Zn
FB7	HYP	As, Cd, Cu, Mo, Pb, Se ,U
FB8	HYP	As, Cd, Cu, Mo, Se ,U

Notes: Parameters in bold print exceed MMER guidelines; and Parameters in parentheses exceed CCME during initial flushing of secondary surface oxides

7.1 CAP Field Bins

The pH produced by CAP field bins is reflective of ABA results. All four field bin samples have CaNP values below detection limits and ScNP values of less than 5 kgCaCO3/tonne. Differences in drainage pH can be correlated to variations in sulphide content. FB2 and FB4 have relatively high sulphide contents for CAP material (0.12% and 0.11%, respectively). The pH in FB2 declined somewhat in the first two years of sampling, stabilizing at a pH near that of FB4. Both field bins are currently producing drainage between generally between pH of 3.8 and 4.5. Samples FB1 and FB3 both have a sulphide content of 0.02 wt. %, which is more typical of CAP waste rock (median of 0.01 wt.%). These field bins are producing circum-neutral producing drainage which is somewhat greater than paste pH values. Sulphate concentrations generally coincide with CAP field bin pH, with the more acidic FB2 and FB4 producing relatively high sulphate concentrations compared to FB1 and FB3.

The CAP waste rock field bins produce leachate with concentrations of D-Ag, Al, As, Cd, Cr, Cu, Fe, Hg, Mo, Pb, Se, Tl and Zn exceeding CCME guidelines (Figure 7-2 and Table 7-1). Note that D-Hg is generally below the analytical limit which is above the CCME guideline. Concentrations of D-Al, Cd, Cu and Se, in particular, exceed the maximum CCME guideline from each CAP field bin and remain above the guideline for the duration of the field tests. Initial concentrations of D-Cu from each field bin also exceed MMER guidelines. Only FB4 leaches D-Zn at concentrations above the CCME and MMER guidelines. In general, the highest metal concentrations are leached from FB4. Exceptions include, D-Ag and Pb (and Sb shown in the Appendix F.1), which are highest in leachate from FB1 by up to two orders of magnitude and remain above CCME guidelines for the duration of the test; and D-Mo, which is highest in leachate from FB3 and remains above CCME guidelines throughout the test. All metals show a gradual decrease over the test period, with concentrations of D-As, Cr, Fe, Tl and Zn from each CAP field bin decreasing to levels below the CCME guideline.

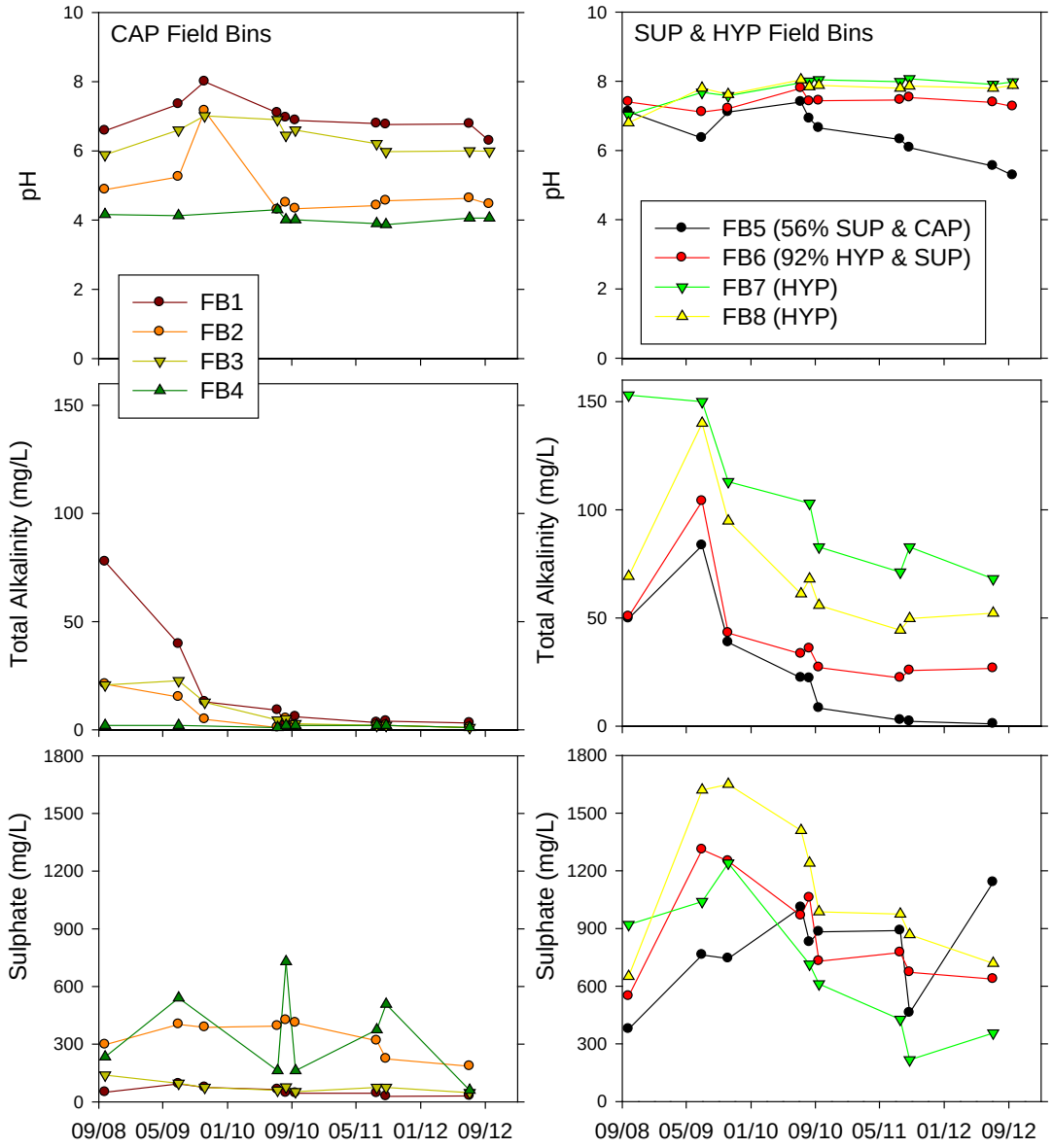


Figure 7-1: pH, total alkalinity (as $CaCO_3$) and sulphate in leachate from CAP waste rock field bins

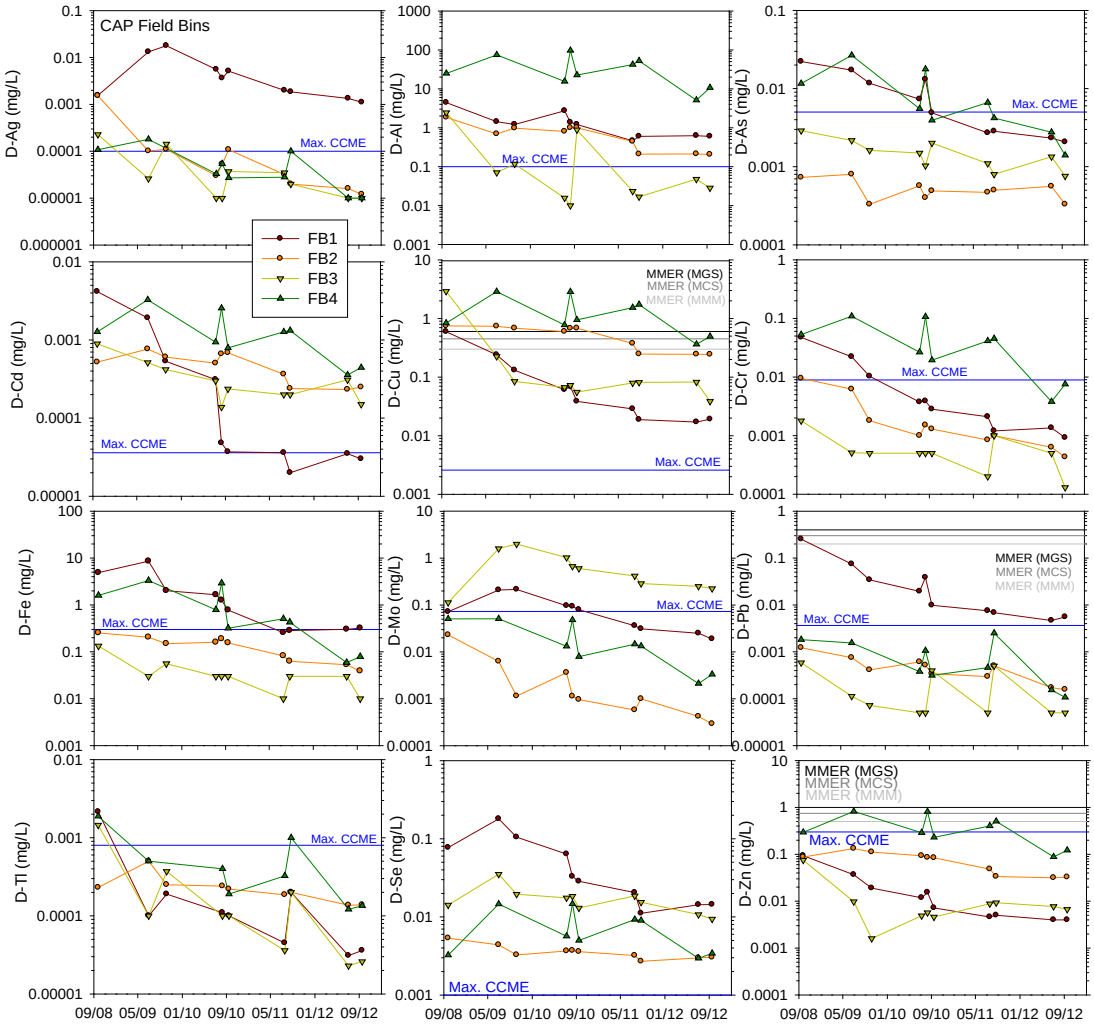


Figure 7-2: Metal concentrations in leachate from CAP waste rock field bins

7.2 SUP and HYP Field Bins

Drainage pH from the HYP waste rock field tests (FB6, FB7 and FB8) are neutral to slightly alkaline and show a slight increase over the test period whereas drainage from FB5 is initially near neutral but becomes acidic during the third season of field tests, producing pH values of < 5.5 (Figure 7-1).

Sulphate concentrations from FB5 through FB8 show an initial increase before decreasing over the test period. Only FB5 shows a second increase in the most recent sample (2012).

The predominantly SUP and HYP waste rock field bins produce leachate with concentrations of D-Al, As, Cd, Cr, Cu, Mo, Pb, Se, U and Zn that exceed CCME guidelines (Figure 7-3). Field bin tests composed of HYP waste rock (FB6, FB7 and FB8) show an overall decrease in metal leaching over the test period with many metals

decreasing in concentration to levels below the CCME guidelines by the third or fourth year of testing. Exceptions include D-Cd, Cu. Mo, Se and U, which are still at concentrations above CCME guidelines in the most recent leachate samples from the HYP field tests, but appear to be continuing to decrease. Initial concentrations of metals are generally higher from FB6 relative to FB7 and FB8 likely owing to oxidation products associated with the minor SUP content (6%) in FB6. ABA results indicate that FB6, FB7 and FB8 test samples are PAG (Table 4-17), therefore, drainage pH from these field tests is expected to decrease in the future and produce increased concentrations of metals in drainage.

Concentrations of D-Al, Cd, Cu and Zn and to a lesser extent D-Pb and Se in FB5 show an initial decrease to levels below CCME guidelines. At later time points the concentration of these metals increase in association with a decline in pH.

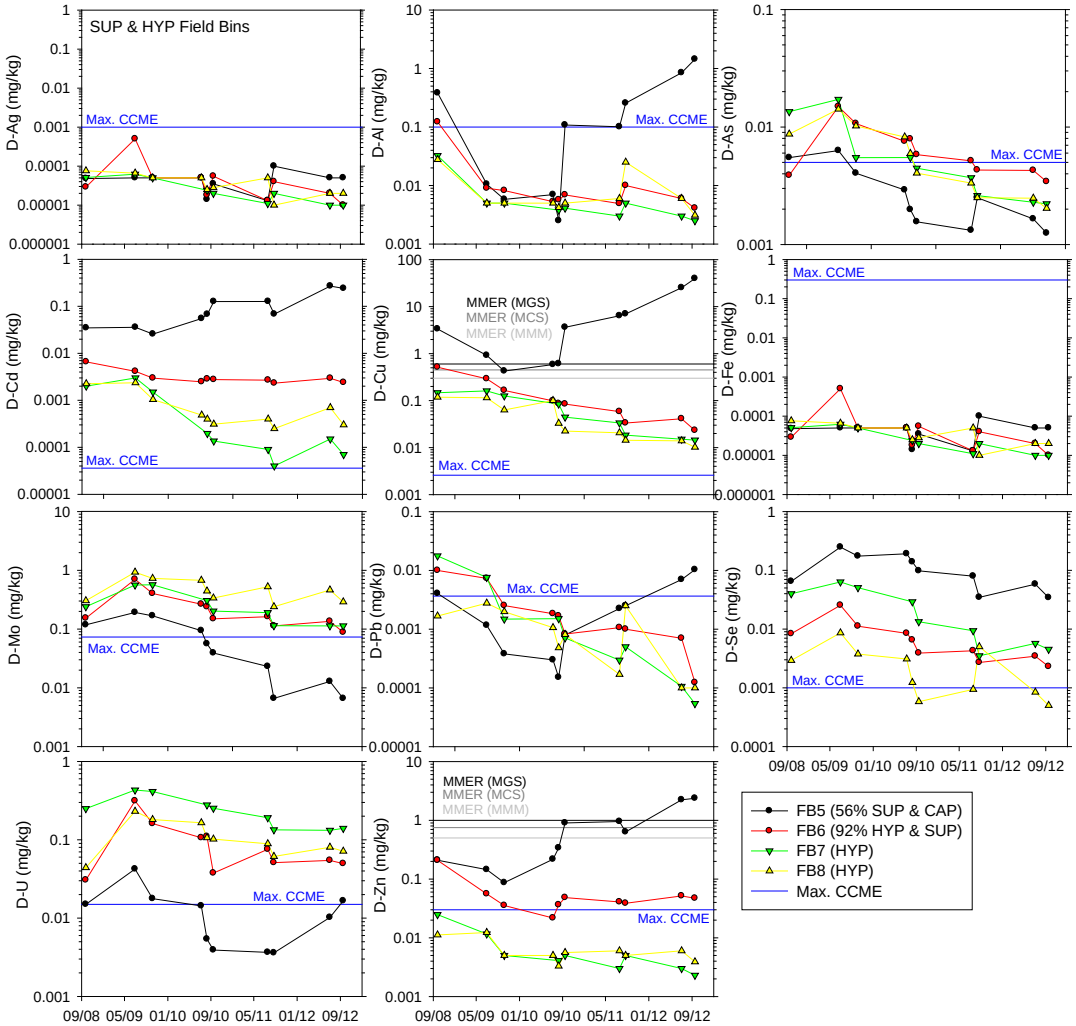


Figure 7-3: Metal concentrations in leachate from SUP and HYP waste rock field bins

7.3 Field Bin Solubility Controls

In this section, the saturation indices (SI) in field bin leachate for minerals identified in the Casino deposit are calculated. Saturation indices are produced using the USGS geochemical modelling program PHREEQC using the Minteq.V4 database (Allison *et al*. 1991; Parkhurst and Apello, 1999). Thermodynamic data for schwertmannite provided by Yu et al., 1999 has been added to the database to calculate schwertmannite SI values. In this section, only carbonate, oxide and sulphate minerals which have been identified in the Casino deposit are considered, in addition to the common secondary Fe minerals schwertmannite [$Fe_8O_8(OH)_{4.4}(SO4)_{1.8}$] and amorphous Fe-hydroxide [$Fe(OH)_3(a)$].

A number of oxide minerals have been identified in the oxide CAP unit in drill core logs and XRD patterns. These oxide minerals include tenorite (CuO), malachite [$Cu_2(CO_3)(OH)_2$], azurite [$Cu_3(CO_3)_2(OH)_2$], and jarosite ($K\text{-}Fe_3(SO_4)_2(OH)_6$. In the HYP zone, XRD patterns have identified the presence of carbonate minerals such as calcite and dolomite in addition to the sulphate mineral gypsum [$CaSO_4{:}2(H_2O)$]. The SUP zone represents a transition between the CAP and HYP zones, containing some secondary oxide minerals similar to CAP, and carbonate and sulphate minerals similar to HYP. Saturation indices for these minerals for the CAP, SUP and HYP field bins are presented in Appendix F.

An SI of 0 indicates that a mineral is in equilibrium with the solution; a mineral may be dissolving or precipitating to achieve equilibrium. A positive SI denotes that a mineral is oversaturated and is therefore likely to precipitate from solution. A negative SI denotes that a mineral is under saturated; if the solid phase is present it will dissolve until equilibrium is reached. However, it should be noted that saturation indices are based on the thermodynamics of mineral formation/dissolution and do not account for kinetic limitations that affect mineral formation. For the purposes of this discussion, SI values <1 or >-1 will be referred to as near equilibrium. For PHREEQC model input files see Appendix F.

In Cap field bin leachate, the carbonate minerals calcite and dolomite are undersaturated in all samples. This is expected, as the CAP oxide unit is deplete in carbonates and has a mildly acidic pH. Gypsum is also undersaturarted at all time-points. The SI values of Fe and Cu minerals vary between field bins. All three Fe minerals considered are oversaturated in FB1, with $Fe(OH)_3(a)$ generally being the least oversaturated. In FB2, K-jarosite is oversaturated in all samples, while schwertmannite and $Fe(OH)_3(a)$ are generally undersaturated. In FB2 field bin $Fe(OH)_3(a)$ is nearest saturation at early time points, while K-jarosite becomes closest to equilibrium at later time points. The Cu minerals malachite and azurite are unsaturated in the CAP field bins with the exception of

the first several samples collected from FB1. Tenorite is near equilibrium in FB1 and FB3 while being undersaturated in FB2 and FB4.

The SUP field bin is near equilibrium with the Cu mineral tenorite and the Fe minerals $Fe(OH)_3$(a) and K-jarosite at most time points. In this field bin Malachite is generally oversaturated while azurite is undersaturated. Similar to CAP field bins, the carbonate minerals calcite and dolomite are undersaturated at all time-points.

In the HYP field bins, calcite and dolomite are near equilibrium in FB7 and FB8, while only calcite is near saturation in FB6. This is supported by XRD results which identified calcite in all three field bins, and identified dolomite in FB7 and FB8 but not FB6. Gypsum is near equilibrium in all three field bins. X-ray diffraction results identified gypsum in FB6 and FB8. Gypsum SI values are generally closer to equilibrium (SI=0) in these two field bins relative to FB7. The Fe-oxide mineral $Fe(OH)_3$(a) and K-jarosite are near equilibrium in all three field bins while schwertmannite is considerably oversaturated. Out of the three copper minerals considered, tenorite is closest to equilibrium in all three field bins. Malachite is also near equilibrium in FB7 and FB8, however the SI values are generally further from equilibrium then that of tenorite.

7.4 Comparison of Mineralization Types

Distinctive geochemical characteristics are evident in the three mineralization types examined in field bin experiments. In order to illustrate the relative differences in the leachate chemistry 90th percentile concentrations are presented in Table 7-2.

The CAP field bins (FB1, FB2, FB3 and FB4) are producing the lowest concentration of major ions (i.e., SO_4, Ca, Mg). Metal leaching within the four CAP field bins is strongly tied to pH. The two circum-neutral pH CAP field bins (FB1 and FB3) are generally producing metal cation concentrations similar to HYP field bins. The relatively acidic CAP field bins (FB2 and FB4) are producing greater metal cation concentrations than HYP field bins, but lower concentrations than the SUP field bin. The two circum-neutral CAP field bins (FB1 and FB3) are producing similar Mo concentrations similar to the HYP field bins, while the two acidic CAP field bins are producing the lowest Mo concentrations. This indicates that Mo leaching in CAP material is inhibited under acidic conditions, but can be released at similar or greater concentrations as HYP under neutral pH conditions.

The SUP field bin (FB5) is producing intermediate SO_4 and Ca concentrations and the highest metal cation concentrations compared any other field bin. Specifically, the 90th percentile concentrations of Al, Cd, Cu, Mn, and Zn are more than a factor of two greater than the 90^{th} percentile values of CAP or HYP field bins. The pH of the SUP field bin has evolved to a similar range as that observed in the CAP field bins (pH 5.5). The difference

in metal leaching potential is attributed to the relative abundance of these metals in the SUP mineralization zone compared to the CAP mineralization zone.

The HYP field bins (FB6, FB7 and FB8) produce the highest concentrations of major ions (i.e., Alkalinity, SO_4, Ca, Mg) and the highest pH range of any mineralization type. The relatively high pH in these field bins is supported by calcite dissolution, as indicated by PHREEQC speciation analysis (Table 7-4) and mineralogy results (Table 4-3). The concentration of most metal cations is relatively low compared to CAP or SUP owing to the high pH range suppressing metal cation solubility. Parameters which leach in relatively high concentrations from HYP field bins are limited to oxyanion forming elements which are generally more soluble at a neutral pH than at an acidic pH. These parametrers include As, Mo and U. If the HYP field bins deplete the available NP and decline in pH, a similar trend in metal leaching as observed in SUP field bin would be expected.

Table 7-2:
Peak concentrations (90th percentile) of parameters in leachate from field bins

Sample Description and Field Bin ID		CAP	CAP	CAP	CAP	56% SUP & CAP	92% HYP & SUP	HYP	HYP
		FB1	**FB2**	**FB3**	**FB4**	**FB5**	**FB6**	**FB7**	**FB8**
Parameter	**Unit**								
pH (lab)[1]	s.u.	6.6	4.3	6.0	3.9	5.5	7.2	7.5	7.5
SO_4	mg/L	79	414	105	597	1036	1262	1100	1626
D-Ca	mg/L	3.1	15	18	12	273	392	232	433
D-Mg	mg/L	0.88	7.6	2.2	9.0	39	25	29	72
D-Ag	mg/L	0.014	0.00025	0.00015	0.00012	0.000055	0.000051	0.000053	0.000067
D-Al	mg/L	2.9	1.1	1.0	79	0.91	0.021	0.010	0.025
D-As	mg/L	0.018	0.00074	0.0022	0.020	0.0056	0.011	0.014	0.011
D-Cd	mg/L	0.0021	0.00069	0.00055	0.0027	0.24	0.0044	0.0022	0.0023
D-Co	mg/L	0.0025	0.016	0.012	0.088	0.33	0.015	0.0086	0.0075
D-Cr	mg/L	0.025	0.0065	0.0011	0.11	0.0053	0.0054	0.0033	0.0052
D-Cu	mg/L	0.28	0.74	0.49	2.9	27	0.31	0.15	0.12
D-Fe	mg/L	5.3	0.21	0.064	3.0	0.052	0.059	0.048	0.041
D-Hg	mg/L	0.00024	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050	0.000050
D-Mn	mg/L	0.058	0.26	0.21	1.4	4.6	0.25	0.014	0.044
D-Mo	mg/L	0.21	0.0080	1.6	0.051	0.17	0.43	0.56	0.75
D-Ni	mg/L	0.0085	0.0094	0.0042	0.056	0.048	0.0100	0.071	0.033
D-Pb	mg/L	0.092	0.00080	0.00051	0.0020	0.0073	0.0076	0.0096	0.0025
D-Sb	mg/L	0.014	0.0015	0.0020	0.0021	0.010	0.012	0.070	0.0071
D-Se	mg/L	0.11	0.0045	0.021	0.015	0.20	0.013	0.053	0.0054
D-Tl	mg/L	0.00059	0.00030	0.00059	0.0013	0.00071	0.00050	0.00050	0.00050
D-U	mg/L	0.0017	0.0040	0.00057	0.0098	0.020	0.18	0.42	0.19
D-Zn	mg/L	0.042	0.11	0.016	0.81	2.2	0.071	0.014	0.011

Notes: Blue print indicates value is below the analytical detection limit; and
green colour scale highlights the highest relative production rates and lowest pH values in the darkest green.
1pH values presented are 10th percentile

7.5 Field Bin Results Summary

Field bin experiments represent the largest scale kinetic test (132 to 172 kg) and are the only field kinetic tests that have been conducted for the Casino project. The field bins provide an indication of metal leaching and acid generation at a relatively large scale compared to other testwork and under site specific climate conditions. In this regard, concentration trends observed in field bin leachate provide the best direct evidence of trends that could be expected in full scale mine facilities. Key conclusions that can be drawn from existing field bin results are as follows;

- Static test results indicate that the SUP and HYP field bins are PAG. All of the field bins initially produced neutral pH drainage. After two years the pH of the SUP field bin began to decline, while the pH of HYP field bins have remained stable in a neutral to alkaline range.
- The HYP field bins (FB6, FB7 and FB8) produce the highest concentrations of major ions (i.e., Alkalinity, SO_4, Ca, Mg) and the highest pH range of any mineralization type. The HYP field bins are also producing relatively high concentration of Mo and U compared to the other field bins.
- Saturation indices calculated in PHREEQC indicate that HYP field bin drainage is near equilibrium with calcite and the secondary copper mineral tenorite (CuO).
- The SUP field bin drainage declined from approximately pH 7.0 to pH 5.3 after four years of exposure. The decline in pH is associated with a rise in metal cation concentrations and decline in Mo concentrations. Similar trends can be expected in the HYP field bins once available NP is depleted.
- Two of the CAP field bins (FB2 and FB4) are producing drainage in a lower pH range than what has been produced from the SUP field bin, however, the SUP field bin is producing much higher concentrations of most metals and major ions. This indicates that the metal leaching potential of SUP is considerably greater than that of CAP under acidic conditions.
- The CAP field bins (FB1, FB2, FB3 and FB4) are producing the lowest concentration of major ions (i.e., SO_4, Ca, Mg). Metal concentrations generally vary with pH. The two circum-neutral pH CAP field bins produce metal cation and Mo concentrations similar to HYP, while the two acidic CAP field bins produce metal cation concentrations greater than the HYP field bins but lower than the SUP field bin.
- Two of the CAP field bins are producing a circum-neutral pH, and two are producing an acidic pH (3.9 to 4.6). This difference can be related to sulphide

content. The two acidic CAP field bins have a sulphide content of approximately 0.1 wt.%, while the neutral pH field bins have a sulphide content of 0.02 wt.%. The two acidic field bins may not be representative of typical CAP waste rock, as their sulphide content is considerably greater than that of typical CAP (median Sulphide-S of 0.01 wt.%).

The CAP field bins FB1 and FB3 have an NPR of <1, with CaNP below detection limits and relatively minor quantities of ScNP (0.15 and 2.74 kg$CaCO_3$/tonne, respectively) (Table 4-15). A majority of the AP is associated with sulphate S, which chiefly occurs as K-karosite as indicated by XRD. These two field bins have consistently produced a circum-neutral pH over the four years of the tests duration. This indicates that AP associated with K-jarosite does not weather quickly enough to overwhelm the minor amounts of NP available in the rock over this time period.

8. Duplicate Kinetic Test Samples

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COPPER AND GOLD

8. Duplicate Kinetic Test Samples

Potential sources of inaccuracy which can arise due to the significant differences between the test conditions and the site conditions include, climate differences; edge effects (*i.e.*, less heat retention in the kinetic test compared to the center of the waste rock dump); scale differences (less particle size segregation in a kinetic test compared to a large waste rock dump face or tailings impoundment); and differences in solid to water ratio.

In order to assess scale issues between the measured kinetic test rates and predictions of full scale waste rock and tailings storage conditions, duplicate samples were submitted in multiple masses for waste rock kinetic tests (Col 2A and Col 2B; and Sat Col 3 and Sat Col 7) and tailings kinetic tests (T6 and Col 5) and tested under different operating conditions (i.e., Sat Col 2 and Col 2A; and Col 1 and FB2) samples (Table 8-1). The number of cycles (weeks) of data included in the duplicate assessment is presented as well as the cumulative volume of leachate for the indicated time.

Table 8-1:
Summary of samples which have been subjected to multiple kinetic tests.

Sample Description	Test ID	Kinetic Test Type	Mass (kg)	Time (weeks)	Leachate (L)
		Waste Rock			
Moderate S, 95% CAP and 5% SUS	Sat Col 2	Saturated Column	5	148*	75
	Col 2A	Unsaturated Column	5	148*	48
	Col 2B	Unsaturated Column	10	148	44
Low S, CAP	Col 1	Unsaturated Column	5	160	51
	FB2	Field Bin	151	160*	~60
Moderate S, HYP	Sat Col 3	Saturated Column 3	5	150	88
	Sat Col 7	Saturated Column 7	10	150	87
		Tailings			
Pyrite Rougher Tailings Sands, 85% SUS and 15% HYP	T6	Humidity Cell	0.9	81	36
	Col 5	Unsaturated Column	5	81*	24

Notes: Time (weeks) represents weeks/cycles included in comparison of data presented in Tables 8-2, 8-3 and 8-4;
* indicates that there are additional cycles for these tests. Leachate is cumulative volume for time indicated.

8.1 Scale Differences

A comparison of the stabilized mass-normalized unit loading rates (average rate for last five complete cycles of data) are presented in Table 8-2 and the maximum (90th percentile) rates are provided in Table 8-3. The difference between the two samples is also provided in the tables, whereby a Diff. value greater than 1.0 indicates higher loading rates from the kinetic test composed of a larger mass (10 kg) compared to the kinetic test composed of a

smaller mass (5 kg). A Diff value of 1.0 indicates that loads produced by metal leaching are directly proportional to the mass of mine waste (i.e. if the mass in a waste rock dump doubles the mass of metal leaching out of the dump will also double).

Unit leaching rates for the unsaturated oxide CAP waste rock columns Col 2A and Col 2B are within the same order of magnitude, with leaching rates from Col 2B only slightly higher than that of Col 2A. This is consistent with data presented in Figure 6-2. The data suggest that at the scale of the column tests, metal loads continue to increase proportionally to increasing quantities of waste rock for the parameters listed in Table 8-2 with the exception of Al, As, Fe and Mo. The lower Diff values for Al and Mo suggest that the concentrations of these metals is being attenuated by secondary mineral controls and that the concentrations measured in the column leachates may be similar to water quality for drainage from larger facilities. Measured concentrations of As and Fe were below analytical detection limits so no definitive behavior can be assigned to these parameters in acidic CAP rock.

Unit loading rates for the saturated HYP waste rock columns show a larger variation between the tests of different masses. For parameters not affected by the analytical detection limit, the loading rates for the smaller mass test (Sat Col 3) are higher than that measured for the larger mass test (Sat Col 7) for As. Higher loading rates of sulphate, D-Fe and D-Mo are observed from Sat Col 7 compared to Sat Col 3, which indicates that the stabilized loading rates are not affected by secondary mineral controls. This is consistent with data in Figure 5-2.

Table 8-2:
Stabilized leaching rates for duplicate kinetic tests of different masses

Kinetic Test (sample mass)	Col 2A (5 kg)	Col 2B (10 kg)	*Diff*	Sat Col 3 (5 kg)	Sat Col 7 (10 kg)	*Diff*
Parameter (mg/kg/wk)						
SO_4	0.65	0.73	*1.1*	5.1	6.9	*1.4*
D-Al	0.0061	0.0041	*0.7*	0.00014	0.000054	*0.4*
D-As	0.000019	0.000010	*0.5*	0.000075	0.000031	*0.4*
D-Cd	0.0000097	0.000011	*1.1*	0.00000042	0.00000019	*0.5*
D-Cu	0.0064	0.0075	*1.2*	0.0000084	0.0000038	*0.5*
D-Fe	0.00023	0.00010	*0.5*	0.0046	0.011	*2.4*
D-Mn	0.0034	0.0038	*1.1*	0.0089	0.0085	*0.9*
D-Mo	0.000023	0.000011	*0.5*	0.000091	0.00015	*1.6*
D-Se	0.000027	0.000043	*1.6*	0.0000035	0.0000016	*0.5*
D-U	0.0000045	0.0000050	*1.1*	0.0014	0.00033	*0.2*
D-Zn	0.00090	0.00087	*1.0*	0.00014	0.000064	*0.5*

Note: Where one kinetic test has been running for more cycles (weeks), the same cycles were used to calculate the average stabilized leaching rates.
Diff = difference between the two columns (larger mass column / smaller mass column); highlighted values are Diff > 1.0 and indicate that the kinetic test comprising a sample of larger mass has a higher concentration.
Blue values indicate that two or more values used in the calculations were below the analytical detection limit.

A comparison of the peak leaching values for the duplicate kinetic tests provides the best indication of possible thermodynamic controls on maximum concentrations. A comparison of the CAP columns (Col 2A and Col 2B) indicates that D-Mo concentrations are most likely to be controlled by thermodynamic constraints, as shown by a 90th percentile value nearly an order of magnitude lower in leachate from Col 2B compared to Col 2A.

A comparison between FB2 and Col 1 reflects the difference of not only upscaling, but also the difference between field and laboratory weathering conditions (*i.e.* leaching under ambient temperatures) for subaerially exposed oxide CAP waste rock. It is important to note that in addition to the larger sample mass of FB2 (30 times that of Col 1), the sample has a larger average grain size than Col 1, which is more representative of waste rock piles. All 90th percentile concentrations from FB2 are higher than that from Col 1, generally by one to two orders of magnitude. The loading rates presented in Table 8-3 suggest that 90th percentile concentrations of As, Cu, Mo and Se in the field bin may be limited by secondary mineral controls.

A comparison of the leaching rates from saturated HYP waste rock tests Sat Col 3 and Sat Col 7 indicate that unit loading rates are lower for the larger column (Sat Col 7), particularly for D-Al, As and Se. This behaviour indicates concentrations of these elements in Sat Col 7 may be limited by secondary mineral controls.

Table 8-3:
Maximum (90th percentile) leaching rates produced by duplicate waste rock kinetic tests of different masses

Parameter (mg/kg/wk)	CAP			CAP			HYP		
	Col 2A (5 kg)	**Col 2B** (10kg)	*Diff*	**Col 1** (5 kg)	**FB2** (151 kg)	*Diff*	**Sat Col 3** (5 kg)	**Sat Col 7** (10 kg)	*Diff*
SO_4	6.7	6.7	*1.0*	11	34	*3.2*	448	382	*0.9*
D-Al	0.010	0.0079	*0.8*	0.015	0.062	*4.0*	0.0087	0.0029	*0.3*
D-As	0.000053	0.000048	*0.9*	0.000062	0.000044	*0.7*	0.0012	0.00063	*0.5*
D-Cd	0.000048	0.000038	*0.8*	0.000020	0.000041	*2.0*	0.000049	0.000047	*1.0*
D-Cu	0.030	0.024	*0.8*	0.055	0.042	*0.8*	0.00030	0.00027	*0.9*
D-Fe	0.0013	0.0014	*1.1*	0.0023	0.011	*5.0*	0.028	0.028	*1.0*
D-Mn	0.020	0.015	*0.7*	0.013	0.016	*1.2*	0.11	0.11	*0.9*
D-Mo	0.00012	0.000036	*0.3*	0.0014	0.00015	*0.1*	0.0026	0.0019	*0.7*
D-Se	0.00054	0.00037	*0.7*	0.00037	0.00030	*0.8*	0.0029	0.0014	*0.5*
D-U	0.000029	0.000025	*0.9*	0.000069	0.00018	*2.5*	0.053	0.045	*0.9*
D-Zn	0.0042	0.0024	*0.6*	0.0030	0.0053	*1.7*	0.0032	0.0029	*0.9*

Note: Where one laboratory kinetic test has been running for more cycles (weeks), the same cycles were used to calculate the 90th percentile values. *Diff* = difference between the two tests (larger mass test / smaller mass test); highlighted values are *Diff* > 1.0 and indicate that the kinetic test comprising a sample of larger mass has a higher concentration

A comparison of the SUP and HYP unsaturated tailings demonstrates that peak unit loading rates are greater from the lower mass test T6 (0.9 kg) relative to Col 5 (5 kg). This finding suggests that the peak concentrations from Col 5 may represent maximum concentrations limited by secondary mineral controls. Sulphate leaching was reduced by 45%, while metal leaching rates were reduced by 66% to 95%. This may be related to lower flushing rates in unsaturated columns compared to humidity cells resulting in incomplete rinsing of mineral surfaces, and presence of mineral solubility controls in the unsaturated column which produces a more concentrated leachate.

Table 8-4:
Peak (90th percentile) leaching rates produced by duplicate tailings kinetic tests of different masses

Kinetic Test (sample mass)	T6 (0.9 kg)	Col 5 (5 kg)	*Ratio Col5 / T6*
Parameter (mg/k/wk)			
SO_4	11	7.5	*0.65*
D-Al	0.057	0.0045	*0.08*
D-As	0.0021	0.00024	*0.11*
D-Cd	0.000085	0.000028	*0.34*
D-Cu	0.015	0.0065	*0.44*
D-Fe	0.0021	0.00023	*0.11*
D-Mn	0.0093	0.0024	*0.26*
D-Mo	0.39	0.021	*0.05*
D-Se	0.00040	0.000059	*0.15*
D-U	0.0020	0.00075	*0.38*
D-Zn	0.0027	0.00035	*0.13*

Note: Where one kinetic test has been running for more cycles (weeks), the same cycles were used to calculate the 90th percentile values.
Diff = difference between the two tests (larger mass test / smaller mass test).

8.2 Storage of Oxide Cap

Subaqueous storage of sulphide-bearing PAG waste rock and tailings is a preferred management option because water limits the rate of oxygen diffusion / sulphide oxidation and hence limits the rate of acidity production and metal release. Limiting oxygen diffusion to oxide waste rock does not have the same obvious benefits because oxide waste rock contains metals as sulphate, oxide and hydroxide minerals whose dissolution kinetics are not controlled by the partial pressure of oxygen. Thus, it is possible if the oxide waste rock is placed under water, metal loading rates from this material could be greater than if it is left on surface and precipitation allowed to infiltrate through the rock.

An assessment of the oxide leaching characteristics demonstrates that a lower metal load would be expected from subaqueous oxide CAP waste rock than from subaerial storage. Duplicate samples of CAP rock were placed in an unsaturated column (Col 2A) and a saturated column (Sat Col 2) to assess the relative loading rates under their respective conditions. Cumulative load released per unit mass are normalized by both time and total output volume in Table 8-5. These results indicate that the release of most parameters is inhibited under saturated conditions. The only parameters which were accentuated in saturated conditions were total alkalinity, Sb, Fe, Hg and Mo. Lower metal release in the saturated columns is presumably due to solubility limits on metal oxides, and the inhibition of sulphide oxidation under sub-aqueous conditions from trace quantities of pyrite present in the CAP sample placed in the columns.

Table 8-5:
Cumulative Load released from unsaturated and saturated oxide waste rock

Parameter	Cumulative Load (mg/kg)			Cumulative Load (mg/kg)		
	Col 2A	Sat Col 2	*Diff*	Col 2A	Sat Col 2	*Diff*
Output Volume (L)	44	75		40	40	
Days	1036	1036		854	189	
Alkalinity	13.4	119	*11.2*	10.6	67.2	*6.3*
sulphate	390	191	*0.49*	366	137	*0.37*
Cl	10.4	20.9	*2.0*	9.86	6.81	*0.69*
F	0.96332	1.27	*1.3*	0.815	0.758	*0.93*
Br	3.12	0.886	*0.28*	2.42	0.515	*0.21*
Ca	56.9	14.4	*0.25*	51.5	6.27	*0.12*
Mg	11.4	3.16	*0.28*	10.4	1.49	*0.14*
Al	1.12	0.979	*0.88*	0.905	0.704	*0.78*
Sb	0.0102	0.0205	*2.0*	0.00896	0.0144	*1.6*
As	0.0039	0.0040	*1.0*	0.00322	0.0029	*0.89*
Cd	0.0034	0.0009	*0.27*	0.00306	0.00040	*0.13*
Cr	0.0097	0.0063	*0.65*	0.00854	0.0050	*0.59*
Co	0.0647	0.0185	*0.29*	0.0580	0.0077	*0.13*
Cu	2.21	0.429	*0.19*	1.98	0.249	*0.13*
Fe	0.0787	0.309	*3.9*	0.0687	0.255	*3.7*
Pb	0.00508	0.0032	*0.63*	0.00470	0.0026	*0.55*
Mn	1.37	0.392	*0.29*	1.24	0.168	*0.14*
Hg	0.00015	0.00023	*1.542*	0.00010	0.00012	*1.194*
Mo	0.00735	0.0142	*1.9*	0.00642	0.0097	*1.5*
Ni	0.0135	0.0069	*0.51*	0.0122	0.0045	*0.37*
Se	0.0212	0.0208	*1.0*	0.0202	0.0150	*0.74*
Ag	0.00056	0.00039	*0.70*	0.00047	0.0003	*0.67*
Sr	0.628	0.00039	*0.00*	0.561	0.0760	*0.14*
Tl	0.00106	0.00099	*0.94*	0.00101	0.0008	*0.75*
U	0.00211	0.00079	*0.37*	0.00196	0.0006	*0.31*
Zn	0.303	0.333	*1.1*	0.271	0.148	*0.55*

Diff. was calculated as the difference between the two columns (Sat Col 2 / Col 2A). Values greater than 1.0 are highlighted and indicate a higher production from Sat Col 2.

8.3 Duplicate Kinetic Test Summary

- Comparison of duplicate unsaturated CAP columns of different masses indicates that metal loads increase proportionally to increasing quantities of waste rock with the exception of Al, As, Fe and Mo. Concentrations of Al and Mo were similar between the two columns, indicating the solubility controls may be affecting these parameters. The concentration of As and Fe on the other hand were below detection limit.
- Loading rates normalized to both time and flow rates indicate that it is geochemically favorable to store CAP waste rock in saturated conditions. Normalized cumulative loadings indicate that Cu leaching is reduced by more than 80%, and leaching of SO4, Br, Ca, Mg, Cd, Co, Mn, Sr and U are reduced by more than 50% under saturated conditions. This is attributed to upper limits on metal concentrations due to secondary mineral solubility and kinetic controls, and the inhibition of sulphide oxidation under sub-aqueous conditions from trace quantities of pyrite present in CAP material.
- A comparison of the leaching rates from saturated HYP waste rock tests Sat Col 3 and Sat Col 7 indicate that unit loading rates are lower for the larger column (Sat Col 7), particularly for D-Al, As and Se. This behavior indicates concentrations of these elements in Sat Col 7 may be limited by secondary mineral controls.
- Comparison of stabilized weathering rates in a depyritized tailings unsaturated column (5kg) and humidity cell (0.9kg) indicates that weathering rates are considerably higher in the humidity cell environment. Sulphate leaching was reduced by 45%, while metal leaching rates were reduced by 66% to 95%. This may be related to lower flushing rates resulting in incomplete rinsing of mineral surfaces, and presence of mineral solubility controls in the unsaturated column.

9. Summary and On-Going Work

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9. Summary and On-Going Work

9.1 Summary of Completed Work

9.1.1 Overview

Laboratory and field kinetic tests were conducted to assess metal leaching potential and rates of NP depletion from the different geologic products that will be generated during the life of the Casino project. The results have aided in the evaluation of disposal and treatment options for acid generating (AG) and potentially acid generating (PAG) waste. Saturated and unsaturated laboratory kinetic tests were evaluated for the CAP, SUP and HYP waste rock and SUP & HYP tailings to evaluate effluent chemistry from the waste products if stockpiled subaerially or submerged in tailings storage facility. The primary objective of this report is to provide an update of the ongoing kinetic test program in order to better constrain Casino source term predictions, and identify specific elements of concern under saturated and unsaturated conditions.

Static test analyses of the waste rock and ore samples used for kinetic testwork demonstrate that the kinetic testwork is representative of the geochemical variations within each mineralization zone of the Casino deposit and the dominant lithologies of the hypogene (HYP) zone. All waste rock and ore kinetic test samples are either AG or PAG. Whole tailings kinetic test samples are PAG but depyritized whole tailings (pyrite rougher) and depyritized embankment sands are non-acid generating (NAG).

Kinetic test results presented throughout this report are compared to freshwater aquatic life guidelines developed by the Canadian Council of Ministers of the Environment (CCME) and water quality guidelines specified in the metal mining effluent regulations (MMER). Although concentrations measured directly from laboratory or field kinetic tests do not accurately reflect drainage concentrations from large scale mine waste storage facilities, a comparison of the laboratory concentrations with water quality guidelines does indicate which parameters could become elevated in mine drainage waters. A list of parameters that exceed CCME and MMER water quality guidelines are listed below for waste rock in Table 9-1 and for ore and tailings in Table 9-2.

9.1.2 Waste Rock and Ore

9.1.2.1 Oxide Zone (CAP)

The majority of CAP waste rock is expected to have immediate ARD potential upon deposition in a subaerial stockpile or submerged in the tailings impoundment produced

from the dissolution of acid generating water- and sparingly-soluble secondary sulphate (*e.g.* jarosite) and metal oxide phases. However, saturated columns indicate that only a portion of the sulphate AP measured by static testing is released to the column leachate. This indicates that a portion of the sulphate in CAP may not be associated with acidic sulphate minerals (i.e., jarosite or alunite), or that not all sulphate AP is available to pore water.

Metal leaching rates from the CAP are shown to vary with pH. In general, unsaturated metal leaching rates are lower than that of SUP or HYP samples within the same pH range, with the exception of Mo in neutral pH CAP. Similar results were observed in the field bins. The two circum-neutral pH CAP field bins produce metal cation and Mo concentrations similar to HYP, while the two acidic CAP field bins produce metal cation concentrations greater than the neutral HYP field bins but lower than the SUP field bin.

Under saturated conditions, the highest metal concentrations are associated with SUP and CAP samples which were acidic prior to saturation in the column experiments. Although metal concentrations declined after the initial flush, concentrations of Cu and Zn remained above MMER guidelines for the duration of kinetic testwork.

A marked improvement in leachate chemistry was observed from acidic CAP waste rock when it was layered with HYP material in a saturated column. This reduction in metal concentrations is related to increased sorption potential and hydroxide precipitation associated with neutralization by carbonate minerals in HYP waste rock. A black precipitate formed on the interface of CAP and HYP material indicating that the reduction in concentrations was, at least in part, due to secondary mineral precipitation.

A comparison of saturated vs. unsaturated loading rates indicate that it is geochemically favorable to store CAP waste rock in saturated conditions. Normalized cumulative loadings indicate that Cu leaching is reduced by more than 80%, and leaching of SO_4, Br, Ca, Mg, Cd, Co, Mn, Sr and U are reduced by more than 50% under saturated conditions.

9.1.2.2 Supergene (SUP) and Hypogene (HYP) Mineralization Zones

SUP and HYP rock are both predominately PAG, however, a greater proportion of SUP is immediately AG. Due to the shorter time to the onset of acidity, SUP rock tends to have a greater immediate metal leaching potential than either HYP or CAP rock. However, metal leaching rates from both HYP and SUP are similar under advanced acidic conditions. The greater metal leaching potential of the SUP is also demonstrated by the SUP field bin, which produced much higher concentrations of most metals and major ions than either of the CAP field bins that had lower pH.

In general there are only minor differences between neutral metal leaching rates from the different HYP lithologies under unsaturated conditions. However, there is some indication that acidic WR has a higher metal leaching potential than acidic MX.

Metal loadings from the saturated waste rock columns reflect pH and, to lesser extent, solid phase concentrations. Under neutral pH conditions, metal concentrations from subaqueously stored SUP and HYP waste rock decrease by two to three orders of magnitude following the initial efflux. Metal loadings from pH-neutral saturated SUP columns are somewhat greater than from pH-neutral HYP columns, specifically regarding Cd, Cu and Se.

A marked improvement in leachate chemistry was observed in acidic SUP waste rock when it was layered with HYP material in a saturated column. This reduction in metal concentrations is related to increased sorption potential and hydroxide precipitation associated with neutralization by carbonate minerals in HYP waste rock. A black precipitate formed on the interface of SUP and HYP material indicating that the reduction in concentrations was, at least in part, due to secondary mineral precipitation. Kinetic testing indicates that subaqueous disposal of Casino SUP and HYP waste rock is favored to limit sulphide oxidation, acid generation and leaching of metals.

9.1.3 Tailings

Humidity cell and unsaturated column data indicates that tailings and ore samples composed primarily of SUP generally have higher metal leaching rates than tailings samples composed of HYP, with the exception of U and SO_4.

Depyritization of Casino tailings reduces the unsaturated leaching rate of SO_4 and a number of other parameters, particularly Se and Cu. However, depyritization does not significantly reduce the unsaturated metal leaching rates of other elements, such as As, Cd and Zn over the relatively short term simulated by the kinetic tests.

Pyrite concentrate has similar or lower metal leaching potential than depyritized rougher tailings under saturated conditions, which indicates that saturation affectively ameliorates metal leaching from pyrite. Overall, kinetic test results indicate that subaqueous disposal of Casino whole tailings is favourable to limit sulphide oxidation, acid generation and leaching of metals.

Reducing the temperature of a tailings humidity cell from 21C to 4C resulted in a 30% reduction in the sulphate leaching rate. This temperature dependence is similar to literature values regarding temperature effects on the rate of pyrite oxidation. The temperature related reduction in sulphide oxidation rates did not uniformly result in a reduction in leaching rates for all metals. Significantly, Cu leaching rates were observed to increase slightly at lower temperatures.

Table 9-1:
Guideline Exceedances for Casino waste rock kinetic tests

Kinetic Test ID	pH	Ag	Al	As	Cd	Cr	Cu	Fe	Hg	Mo	Ni	Pb	Se	Tl	U	Zn
Oxide Gold Zone (CAP)																
Col 1	~ 5.5		10x		10x		MGS		10x				10x			
Sat Col 2	< 5.7						MMM						10x			
Col 2A	~ 5.9		10x		10x		100X						10x			
Col 2B	~ 5.2		10x		10x		100X		10x			10x	10x			
Col 3	< 3.8		**10000x**		**100x**	10x	100x	**1000x**			MCS		**100x**		10x	MGS
Col 4A	~ 7.3		10x		10x		MMM		10x	10x			**100x**			MGS
FB-1	~ 7.2	**100x**	10x		**100x**		MCS	10x				10x	**100x**			
FB-2	< 5.3	10x	10x		10x		MGS									
FB-3	~ 6.5		10x		10x		MGS			10x			10x			
FB-4	< 4.2		100x		10x	10x	MGS	10x					10x			MCS
Supergene Zone (SUP)																
Sat Col 5	~ 6.6		10x		**100x**		MGS						10x			MMM
Sat Col 6	< 3.6		**1000x**		**100x**	10x	MGS	**100x**					10x		**100x**	MGS
*Sat Col 12 (lower)	< 4.0		**1000x**		**100x**		MGS	**100x**			MMM		10x		10x	MGS
*Sat Col 13 (lower)	~ 7.0				10x		10x						10x		10x	
*Sat Col 14 (lower)	< 4.4		**1000x**		**100x**		MGS	100x			MMM		10x		**100x**	MGS
*Sat Col 15	~ 7.1				10x		10x						10x			
HC11	~ 7.2						10x						10x			
HC12	< 5.5		**100x**		**100x**		MGS	10x					10x			MGS
FB-5	~ 6.2				**1000x**		MGS						**100x**			MGS
Hypogene Zone (HYP)																
Sat Col 3	> 7.1														10x	
Sat Col 4	> 7.1				10x											
Sat Col 7	~ 6.9				10x										10x	
*Sat Col 9	> 7.0														10x	
*Sat Col 12 (upper)	~ 6.5				10x		MGS						10x		10x	MMM
*Sat Col 13 (upper)	~ 7.0												10x		10x	
*Sat Col 14 (upper)	~ 6.5				10x		MGS						10x		10x	10x
HC3	> 7.2				10x											
HC4	> 7.4												10x			
HC5	> 7.2															
HC6	> 7.1															
HC7	> 7.0				10x		MGS						**100x**			
HC8	< 4.4		**100x**		**100x**		MGS	10x				10x	10x			MCS
HC9	~ 6.0						MGS									
HC10	< 4.8		**100x**		**100x**		MGS	10x			MMM		10x			MGS
FB-6	> 7.1				**100x**		MCS						10x		10x	
FB-7	> 7.0				10x		10x						10x		10x	
FB-8	~ 7.4				10x		10x			10x					10x	

Notes: Parameters that exceed 10x or more the Canadian Council of Ministers of the Environment (CCME, 2007) guidelines are shaded in light blue, Hardness dependent guidelines (Cd, Cu, Ni, Pb) were calculated based on a mean water hardness of 111.4 mg $CaCO_3$/L. Parameters that exceed the metal mine effluent regulations (MMER, 2002) guidelines are shaded in grey.
MMM = maximum authorized monthly mean (light grey); MCS = maximum authorized concentration in a composite sample (medium grey); and MGS = maximum authorized concentration in a grab sample (dark grey).
*Saturated columns with mixed HYP layered over SUP or CAP.

Table 9-2:
Guideline Exceedances for Casino Tailings and Ore kinetic tests

Kinetic Test ID	Mineralization	Waste Type	pH	Ag	Al	As	Cd	Cr	Cu	Hg	Fe	Mo	Ni	Pb	Se	Tl	U	Zn
Predominantly HYP																		
HC1	HYP	Ore	~7.1				10x											
T7	HYP	Depyritized Whole Tailings	> 7.3			10x												
T4	60% HYP, 40% SUP	Rougher Whole Tailings	> 7.2		10x													
Col 6	HYP	Depyritized Tailings Sands (>0.74 µm)	> 7.6				10x										10x	
Sat Col 8	83% HYP, 17% SUP	Rougher Whole Tailings	~ 7.8															
Sat Col 1	50% HYP, 50% SUP	Rougher Whole Tailings	> 9.2		**100x**													
Predominantly SUP																		
HC2	81.7% SUP, 18.3% HYP	Ore	~6.2	**10000x**		10x	10x	**1000x**	MGS									MMM
T1	71% SUP, 22% HYP, 7% CAP	Rougher Whole Tailings	> 7.0				10x					10x			10x			
T2	71% SUP, 22% HYP, 7% CAP	Rougher Whole Tailings	> 7.6				10x					10x			10x			
T3	71% SUP, 22% HYP, 7% CAP	Rougher Whole Tailings	> 7.6				10x		10x									
T5	85% SUP, 15% HYP	Depyritized Whole Tailings	> 7.6	**1000x**			10x											
T6	85% SUP, 15% HYP	Depyritized Tailings Sands (>0.74 µm)	> 7.7				10x		10x			10x						
Col 5	85% SUP, 15% HYP	Depyritized Tailings Sands (>0.74 µm)	> 7.4				10x		MMM			10x			10x			
Sat Col 10	85% SUP, 15% HYP	Depyritized Whole Tailings	~ 7.8				10x		10x									
Sat Col 11	85% SUP, 15% HYP	Pyrite Rougher Slimes (<74 µm) with pyrite concentrate	~ 7.6				100x											

Notes: Parameters that exceed 10x or more the Canadian Council of Ministers of the Environment (CCME, 2007) guidelines are shaded in light blue, Hardness dependent guidelines (Cd, Cu, Ni, Pb) were calculated based on a mean water hardness of 111.4 mg $CaCO_3$/L. Parameters that exceed the metal mine effluent regulations (MMER, 2002) guidelines are shaded in grey.
MMM = maximum authorized monthly mean (light grey); MCS = maximum authorized concentration in a composite sample (medium grey); and MGS = maximum authorized concentration in a grab sample (dark grey).

9.2 On-Going Kinetic Testwork

A number of the kinetic tests reported on have not yet been terminated and additional data is being collected. In addition to continued data collection, some new tests have been initiated that did not produce data until after cut-off date for data reporting in this report. Ongoing kinetic testwork for waste rock and tailings are outlined in Table 9-3 and Table 9-4, respectively. Testwork which has been initiated but not reported on includes; two unsaturated cyanide leach residue columns; two saturated 2012-tailings columns; and, waste rock humidity cell low temperature (4C) weathering rates. The purpose of this recent testwork is described below.

9.2.1 Cap Heap Leach Residue

Two unsaturated columns have been initiated on CAP heap leach residue. The CAP leach residue is different from CAP ore in that it has been treated with lime and cyanide to recover cold. Testwork on these samples will provide an indication of drainage quality and long term pH that can be expected from the proposed gold heap leach facility after closure.

9.2.2 Temperature Effects on Waste Rock Humidity Cells

In May, 2013, waste rock humidity cells with relatively stable weathering rates were moved from room temperature (approx. 22°C) to a 4°C environment. Humidity cells which were moved to a 4C environment included HC3, HC4, HC5, HC6, HC7, HC10 and HC11. The results of this testwork will provide further indication on how the sub-arctic climate at the Casino minesite will effect rates of metal loading and acid generation from unsaturated mine waste.

9.2.3 Saturated columns on 2012 Pilot Plant Tailings

Two tailings saturated columns were initiated using pyrite rougher tailings and pyrite concentrate from the 2012 pilot plant. These tailings samples were produced exclusively from HYP ore. Most of the existing saturated tailings columns were composed of 50% or more SUP. This testwork will help quantify the subaqueous metal leaching potential from tailings produced when HYP ore is the primary mill feed.

Table 9-3:
Summary of ongoing waste rock kinetic tests for the Casino Project

Kinetic Test Type	Sample ID	Notes	Mineralization Zone	Lithology	Mass (kg)	Start Date
Saturated Columns	Sat Col 12	Layered acidic SUP and HYP	25% HYP	60% WR, 20% MX, 20% IX	3	12-Jul-12
		(upper and lower ports sampled)	75% acidic SUP	88% WR, 12% IX	9.1	13-Jul-12
	Sat Col 13	Layered neutral SUP and HYP	25% HYP	60% WR, 20% MX, 20% IX	3.3	17-Jul-12
		(upper and lower ports sampled)	75% neutral SUP	57% PP, 43% WR	9.8	18-Jul-12
	Sat Col 14	Layered acidic SUP and HYP	50% HYP	60% WR, 20% MX, 20% IX	5.6	12-Jul-12
		(upper and lower ports sampled)	50% acidic SUP	88% WR, 12% IX	5.6	13-Jul-12
	Sat Col 15		neutral SUP	57% PP, 43% WR	7.9	17-Jul-12
Unsaturated Columns	Col 1	Low S CAP (duplicate of FB2)	CAP	WR	5	27-Jan-10
	Col 2A	5 kg Moderate S CAP (duplicate of Sat Col 2 & Col 2B)	95% CAP, 5% SUP	85% WR, 5% IX,5% MX, 5% PP	5	27-Jan-10
Humidity Cells	HC3	Neutral pH, high S (sample: 08-276)	HYP	PP	1	29-Nov-12
	HC4	Neutral pH, high S (sample 08-294)	HYP	WR	1	29-Nov-12
	HC5	Neutral pH, moderate S (sample 08-277)	HYP	PP	1	29-Nov-12
	HC6	Neutral pH, moderate S (sample 08-028)	HYP	WR	1	29-Nov-12
	HC7	Neutral pH, moderate S (50% of 08-043 & 08-225)	HYP	50% IX, 50% MX	1	29-Nov-12
	HC8	Acidic paste pH (sample 08-143)	HYP	MX	1	29-Nov-12
	HC9	Carbonate depleted (sample 08-260)	HYP	PP	1	29-Nov-12
	HC10	Acidic paste pH (50% of 08-059 / 08-178)	HYP	WR	1	29-Nov-12
	HC11	Neutral SUP (sample 08-068)	SUS	WR	1	29-Nov-12
	HC12	Acidic SUP (sample 08-058)	SUS	WR	1	29-Nov-12
Field Bins	FB1	pH>6 Moderate S CAP	CAP	WR	166	01-Sep-08
	FB2	pH > 6 Low S CAP	CAP	WR	151	01-Sep-08
	FB3	pH<6 Low S CAP	CAP	WR	155	01-Sep-08
	FB4	pH<6 High S CAP	CAP	52% PP, 48% MX	150	01-Sep-08
	FB5	Neutral SUP	56% SUP, 44% CAP	WR	169	01-Sep-08
	FB6	Moderate S HYP	92% HYP, 8% SUP	WR	172	01-Sep-08
	FB7	High S HYP	HYP	WR	132	01-Sep-08
	FB8	Moderate S HYP	HYP	PP	163	01-Sep-08

Table 9-4:
Summary of ongoing tailings and heap leach residue kinetic tests for the Casino Project

Kinetic Test Type	Sample ID	Sample Selection Rational	Material Type	Mineralization Zone	Lithology	Mass (kg)	Start Date
Saturated Columns	Sat Col 10	Pyrite rougher whole tailings	2010-Bench	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	5	20-Jul-11
	Sat Col 11	Pyrite concentrate with 21% slimes	2010-Bench	85% SUP, 15% HYP	64% WR, 18% PP, 16% MX, 2% IX	5	28-Jul-11
	Sat Col 16	Pyrite rougher whole tailings	2012-Pilot Plant	100% HYP	87% IXWR, 13% IXPP	5.4	01-Mar-13
	Sat Col 17	Pyrite concentrate	2012-Pilot Plant	100% HYP	87% IXWR, 13% IXPP	6.6	01-Mar-13
Unsaturated Columns	Col 6	Pyrite rougher tailings sands	2012-Pilot Plant	100% HYP	87% IXWR, 13% IXPP	1	03-May-11
	*Col 7	Heap leach residue (sample CL-01 L)	Column leach residue	100% CAP	Mixed	10	20-Mar-13
	*Col 8	Heap leach residue (sample CL-01 L)	Column leach residue	100% CAP	Mixed	25	20-Mar-13
Humidity Cells	T4	Rougher whole tailings	2009-Bench	60% HYP, 40% SUP	59% IX, 22% PP, 20% WR	1	15-Dec-09
	T7	Pyrite rougher whole tailings	2012-Pilot Plant	100% HYP	87% IXWR, 13% IXPP	1	05-Mar-13

10. Report Limitations

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10. Report Limitations

This report was prepared for the exclusive use of Casino Mining Corporation and its consultants in accordance with the rationale and study objectives described in Chapter 1 of this report. The Yukon Environmental and Socio-economic Assessment Board and other government agencies involved with reviewing the application may also rely upon this report; any other use or reliance on this report by any third party is at that party's sole risk. The authors accept no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Respectfully submitted,

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Appendices

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Appendix A
Tailings Metalurgy

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APPENDIX A1 2008 PILOT PLANT TAILINGS PROCESSING_KM2084 REPORT

METALLURGICAL ASSESSMENT OF THE CASINO DEPOSIT

YUKON TERRITORY

KM2084

May 30, 2008

Work Performed on Behalf of Western Copper Corporation

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1.0 Executive Summary

Western Copper Corporation is currently evaluating the Casino project; a copper, molybdenum and gold porphyry deposit located in Yukon Territory. This program of study was initiated to provide critical metallurgical data in support of a pre-feasibility study.

During the initial phase of testing, a flotation process to recover copper, molybdenum and gold into a single concentrate was developed for the sulphide mineralization. The process was relatively simple, using a primary grind size of 150μm K_{80} and regrind sizing of 20μm K_{80}. Flotation conditions were manipulated to selectively recover the target minerals while rejecting pyrite. Overall, 86 percent of the copper was recovered into a concentrate grading 28 percent copper. Molybdenum and gold were 49 and 64 percent recovered into this concentrate.

Other mineralization containing high levels of non-sulphide copper were also examined. However, production of marketable grade concentrates using flotation was difficult. Contamination of the concentrates with pyrite was suspected and further testing would be required to develop a suitable flotation process.

Using the developed process, a large number of discrete sub-samples were tested to determine the metallurgical variability of the deposit. The resulting data indicated the metallurgy for the deposit was highly variable, but copper recovery could be reasonably predicted by measuring the copper feed grade and non-sulphide copper grade.

For successful treatment of this deposit, a thorough understanding and control of the non-sulphide copper content will be required.

1.1 Acknowledgements

We would like to acknowledge the contributions made to this program of metallurgical study by Dr. Paul West-Sells, Senior Metallurgist, to the project for Western Copper Corporation. Dr. West-Sells assumed responsibility for solving logistical problems involving the acquisition and shipment of the samples to the laboratory. In addition, he also contributed to the planning of the test work and ensuring that results were communicated regularly to the Western Copper Corporation management team.

Tom Shouldice, P.Eng.
President

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Director

KM2084
May 30, 2008

Report Distribution:
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2.0 Introduction

Western Copper Corporation is currently conducting a pre-feasibility assessment of the Casino project located 300 kilometers northwest of Whitehorse, Yukon. The deposit reportedly contains 960 million tonnes grading 0.22 percent copper, 0.24 g/tonne gold and 0.02 percent molybdenum.

The deposit is described as porphyry mineralization with geological zones of oxide, supergene and hypogene mineralization. Earlier scoping studies indicated the deposit would be mined as an open pit and the ore would be processed with conventional flotation to produce copper-gold and molybdenum concentrates.

As directed by Dr. Paul West-Sells, Senior Metallurgist with Western Copper Corporation, the principal objectives in support of a pre-feasibility study, were determined to be as follows:

- Develop a suitable process for extracting copper, molybdenum and gold from composites representing the sulphide and oxide mineralized zones of the deposit.

- Determine the variability in ore hardness and metallurgical response for selected sub-samples from the mineralized zones.

- Produce sufficient copper rougher concentrate in the pilot plant to investigate a copper-molybdenum separation stage in the process. In addition, the copper rougher concentrate was processed through the ISA mill to provide critical information to size the regrind mill.

- Assess the distribution of minor elements in the concentrates produced from selected tests conducted on variability samples. The dewatering properties of selected concentrates would also be evaluated.

- Produce tailings samples for preliminary environmental evaluations and dewatering studies.

The initial test work was conducted on two global composites, representing the oxide and sulphide zones. The composites were constructed from split drill core and the chemical assay for copper oxide was the main criteria for interval selection. The test work focused on the development of a suitable flotation process. These studies were supported with mineralogical assessment of the ground feed samples.

The developed process was then applied to 63 sub-composites to assess the variability of ore hardness and metallurgical response across the deposit. The metallurgical response generated by the variability tests was correlated to key chemical and physical properties measured for the feeds of each sub-composite.

To generate sufficient mass for ancillary studies, a large composite was constructed and processed through the pilot plant grinding and rougher flotation equipment. These studies included the power calculation for the regrind mill and dewatering studies on the tailings. Preliminary environmental samples of rougher tailings were captured during the piloting campaign.

The program of test work commenced in October 2007 and was completed by May 2008. The results of the test work are summarized by specific test type or topic in this technical report. All of the data generated by this study are presented in the following six appendices:

Appendix I – Sample Origin
Appendix II – Flotation Test Data
Appendix III – Particle Sizing Data
Appendix IV – Special Analyses and Figures
Appendix V – Modal and Speciation Data
Appendix VI – Pilot Plant Data

3.0 Flowsheet Development Test Work

To develop a process for recovering the valuable minerals, a thorough understanding of the fundamental properties of the ore are required. Once this data has been obtained and reviewed, process development can logically begin. Based on previous test work, flotation will be the main focus of process development. The following subsections discuss both the ore characteristics and the developmental flotation test work on the global composites in greater detail.

3.1 Ore Characteristics

In this program, three important ore characteristics are discussed. Ore hardness studies define the amount of grinding power that will be required in the process. The composition of minerals contained in an ore provides key information regarding the flowsheet that is selected to produce saleable concentrates. Finally, the fragmentation characteristics establishes the amount of grinding that will be required to liberate the target mineral species from each other and undesirable gangue minerals.

3.1.1 Ore Hardness

The resistance to grinding for the two composites was determined using standard FC Bond procedures and a Bond ball mill. The results of these tests indicated the composites to be moderately hard having work index values averaging 16 kWh/tonne.

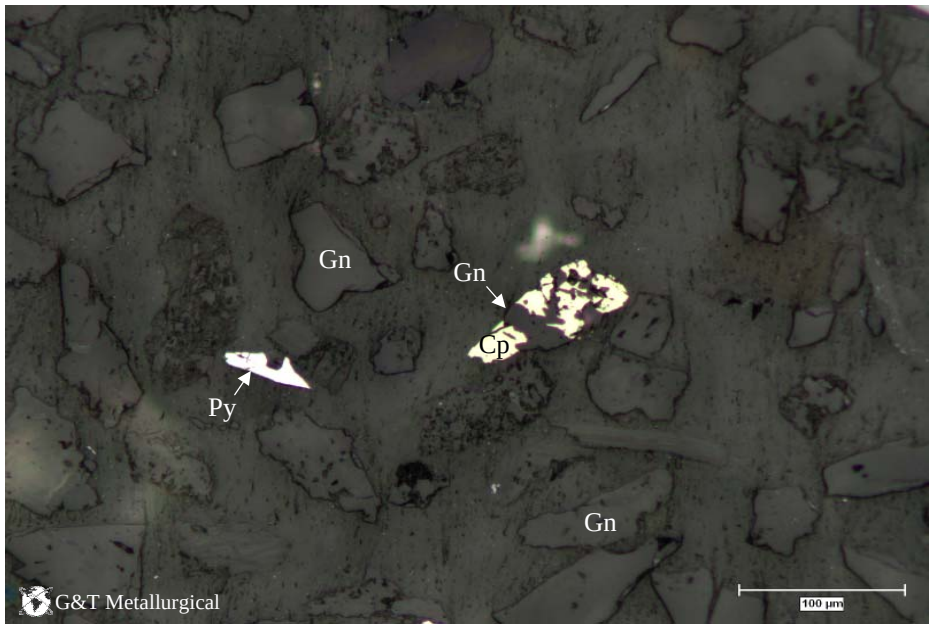
TABLE 1
GRINDABILITY OF THE COMPOSITES

Composite	Ball Mill Work Index	
	kWh/ton	kWh/tonne
Sulphide	14.6	16.1
Oxide	14.3	15.8

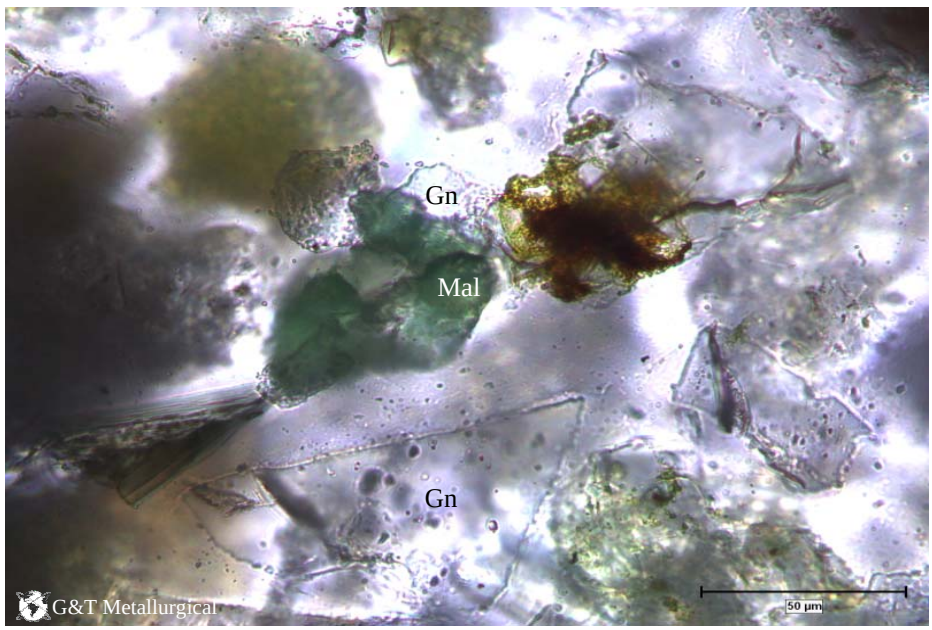
Notes: a) See Appendix III, Tables 1 and 2 for additional FC Bond ball mill test data.

PHOTOMICROGRAPH 1
CASINO PROPERTY
KM2084

Sulphide Composite <75µm>35µm



Oxide Composite <75µm>38µm**



*Cp-Chalcopyrite, Mal-Malachite, Py-Pyrite, Gn-Gangue.
**Photo taken using transmitted light.

3.1.2 Composition

Using standard assay and mineralogical techniques, the compositions of elements and minerals in the composites were determined. The results of these analyses are summarized and displayed in Table 2.

The sulphide and oxide composites contained 0.26 and 0.28 percent copper by weight, respectively. The oxide composite contained almost half of the copper in non-sulphide form. The sulphide composite contained about 10 percent of the copper as non-sulphide*.

The sulphide composite contained 6.6 percent by weight sulphide, about 85 percent of the sulphide mass consisted of pyrite. Most of the remaining mass was present as chalcopyrite with minor concentrations of chalcocite group minerals.

The oxide composite contained about 3 percent sulphide minerals, again dominated by pyrite. A chemical analysis of the oxide composite has indicated that about 45 percent of the copper metal in this composite is present as a non-sulphide. The mineralogical assessment has indicated the presence of malachite and cuprite in the oxide composite.

Both composites contained sufficient levels of molybdenite to warrant investigating a copper-molybdenum separation circuit in the flotation process.

Gold was present in both samples, there was 0.40 and 0.26 g/tonne in the oxide and sulphide composites, respectively. Gold in this type of deposit is typically recovered as a byproduct into the copper concentrate.

* Copper measured by this non-sulphide technique does not readily respond to copper sulphide flotation.

TABLE 2
COMPOSITION OF ELEMENTS AND MINERALS IN THE COMPOSITES

Element or Mineral	Symbol	Units	Composite	
			Oxide	Sulphide
Element				
Copper	Cu	%	0.28	0.26
Copper (oxide)	Cu(ox)	%	0.13	0.016
Iron	Fe	%	3.4	3.5
Molybdenum	Mo	%	0.019	0.021
Gold	Au	g/t	0.40	0.26
Mineral				
Chalcopyrite	Cp	%	0.49	0.72
Chalcocite	Ch	%	0.15	0.02
Molybdenite	Md	%	0.02	0.03
Pyrite	Py	%	2.5	5.8
Gangue	Gn	%	96.9	93.4
XRF-Whole Rock Analysis				
ME-XRF06	SiO_2	%	65.95	62.67
ME-XRF06	Al_2O_3	%	14.83	15.39
ME-XRF06	Fe_2O_3	%	5.53	5.43
ME-XRF06	CaO	%	0.89	1.98
ME-XRF06	MgO	%	1.19	1.97
ME-XRF06	Na_2O	%	0.8	1.02
ME-XRF06	K_2O	%	5.47	4.69
ME-XRF06	$Cr2O_3$	%	0.01	0.01
ME-XRF06	TiO_2	%	0.39	0.52
ME-XRF06	MnO	%	0.02	0.03
ME-XRF06	P_2O_5	%	0.126	0.17
ME-XRF06	SrO	%	0.02	0.02
ME-XRF06	BaO	%	0.19	0.22
ME-XRF06	LOl	%	4.45	4.88

Notes: a) About 45 percent of the copper and 30 percent of the molybdenum in the oxide composite was estimated to be present as a non-sulphide.
b) See Appendix I and V for additional composition data.
c) XRF analysis was performed by ALS Chemex Labs.

3.1.3 Mineral Fragmentation

Following grinding of the composites to a nominal 150μm K_{80}, the mineral fragmentation characteristics were determined using standard point counting techniques. The results of this assessment are displayed in Table 3 and Figures 1 and 2.

TABLE 3
MINERAL FRAGMENTATION CHARACTERISTICS

Composite	K_{80} μm	Liberation – percent			
		Cs	Md	Py	Gn
Sulphide	147	51	56	65	98
Oxide	154	57	79	51	98

Notes: a) See Appendix V, Tables 1A and 2A for additional mineral distribution by class of association by size range data.

On average, about 55 percent of the copper sulphides in both samples are liberated from the other mineral species. Most of the remaining copper sulphides are in binary form with non-sulphide gangue. These binary structures are moderately rich containing about 20 percent by weight copper sulphides.

Typically, with ores of this type, copper sulphide liberation levels of about 50 percent are adequate to successfully recover the copper sulphides into a rougher concentrate. Based on this assessment, a nominal primary grind size of 150μm K_{80} should be adequate*.

The limiting sulphide mineral grade-recovery chart displayed in Figure 2 indicates the theoretical limits to rougher circuit performance. The ability to achieve these limits is dependant upon a number of factors. A significant body of test work is required to develop a process to approximate these metallurgical limits.

* However, as shown in Figure 2, there is some indication that an even coarser primary grind may be possible without significantly sacrificing rougher circuit performance.

FIGURE 1
EFFECT OF PRIMARY GRIND SIZE ON MINERAL LIBERATION

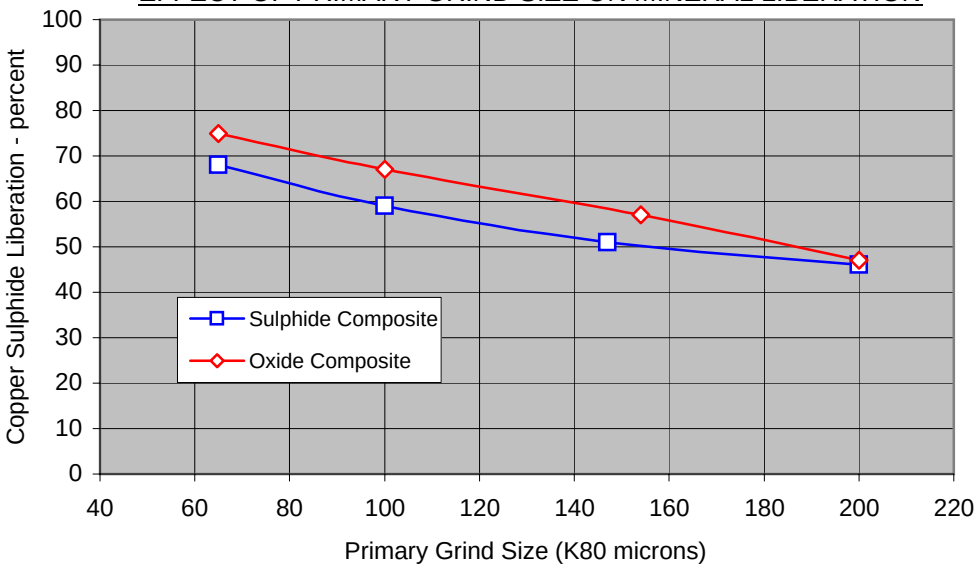
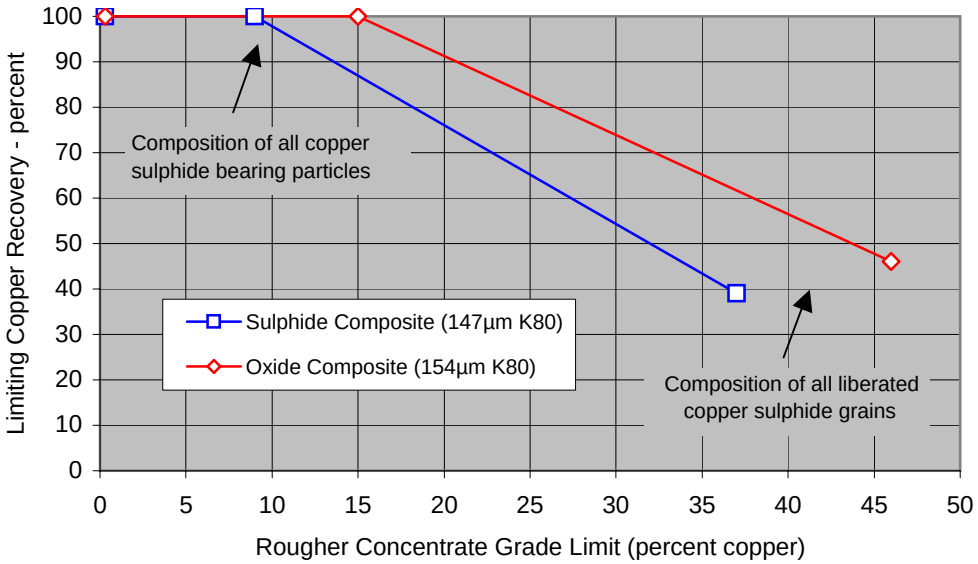


FIGURE 2
MINERALOGICALLY LIMITING GRADE RECOVERY CHART



3.2 The Flowsheet Used in the Test Program

Based on the suite of minerals present in the sulphide and oxide composites, development of a flotation process will focus on recovering a copper concentrate* containing byproduct values of gold and molybdenum. Once a suitable bulk concentrate is produced, the inclusion of a copper molybdenum separation stage in the process will be investigated.

Development of a flotation process begins with simple rougher kinetic tests followed by batch cleaner tests to establish baseline test conditions. Once a suitable process has been developed, locked cycle tests are performed**.

Batch rougher and cleaner tests were conducted on the composites to provide baseline test conditions for primary grind, regrind and reagent requirements. The rougher tests involved recovering timed rougher concentrates following grinding of the composite to maximize metal recoveries.

The cleaner tests investigated regrinding of the rougher concentrates followed by three stages of dilution cleaning. With both flowsheets, primary grind sizing ranging between 65 and 209μm K_{80} and regrind sizing ranging between 12 and 40μm K_{80} were evaluated. In addition, the effect of a variety of collectors and depressants were investigated.

The flowsheet development test work concluded with a series of locked cycle tests. These tests were performed at primary grind sizings ranging between 121 and 209μm K_{80} and a nominal regrind of 20μm K_{80}. To achieve steady state operation, the second and third cleaner tails were recycled in five stages to simulate plant performance and provide metallurgical balance data.

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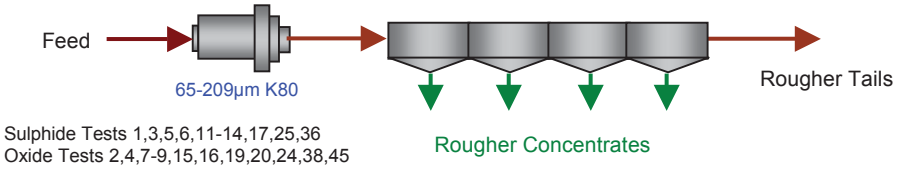
* For this study, copper concentrate refers to combined copper, gold and molybdenum concentrate.

** The locked cycle test is a dynamic test designed to simulate a continuous process. These tests are generally considered the most reliable estimate of metallurgical performance for a given set of test conditions.

FIGURE 3

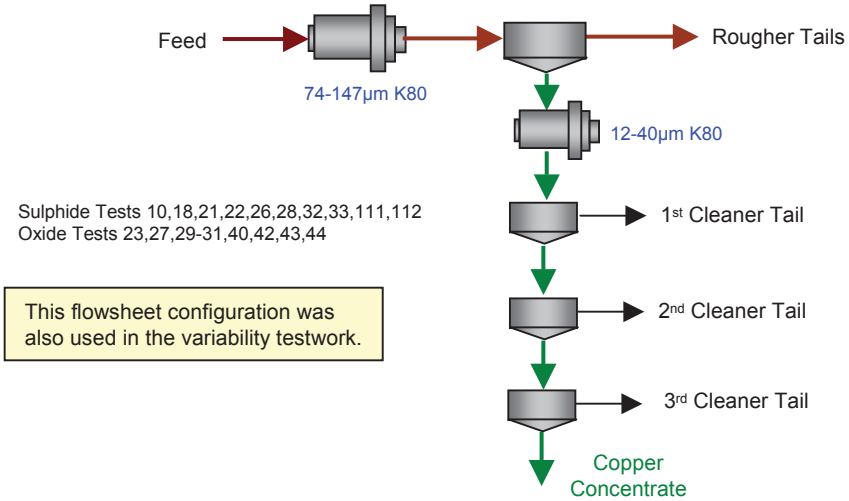
FLOWSHEETS USED IN THE TEST PROGRAM

Rougher Test Flowsheet



Sulphide Tests 1,3,5,6,11-14,17,25,36
Oxide Tests 2,4,7-9,15,16,19,20,24,38,45

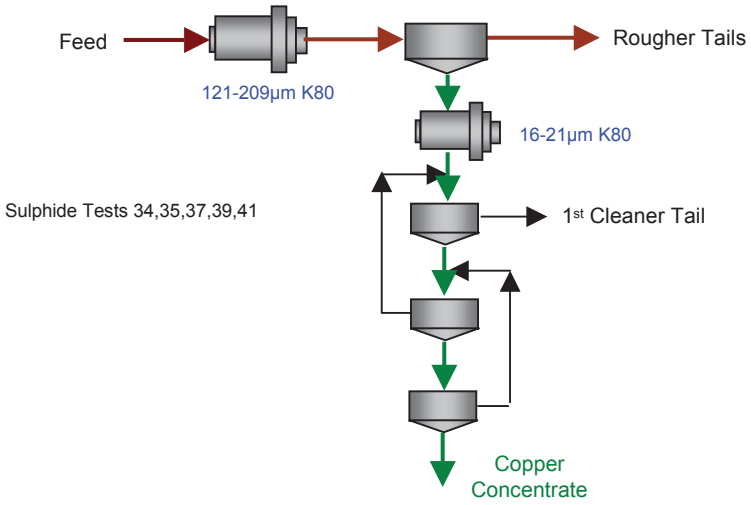
Cleaner Test Flowsheet



Sulphide Tests 10,18,21,22,26,28,32,33,111,112
Oxide Tests 23,27,29-31,40,42,43,44

This flowsheet configuration was also used in the variability testwork.

Locked Cycle Test Flowsheet



Sulphide Tests 34,35,37,39,41

3.3 Rougher Test Results

3.3.1 Sulphide and Oxide Composites

A standard flowsheet, designed to recover the target minerals in four timed concentrates, was employed in this phase of the program. The principal objective of these tests was to assess the effect of primary grind size on rougher circuit performance. The results generated by this study are summarized in Figure 4.

It appears that copper recovery for the sulphide composite reached a maximum 90 percent* for primary grind sizings ranging between 65 and 147μm K_{80}. To achieve 90 percent copper recovery, between 6 and 8 percent of the feed mass was recovered into the rougher concentrate. Maximum recovery of molybdenum and gold occurred at primary grinds ranging between 121 and 147μm K_{80}.

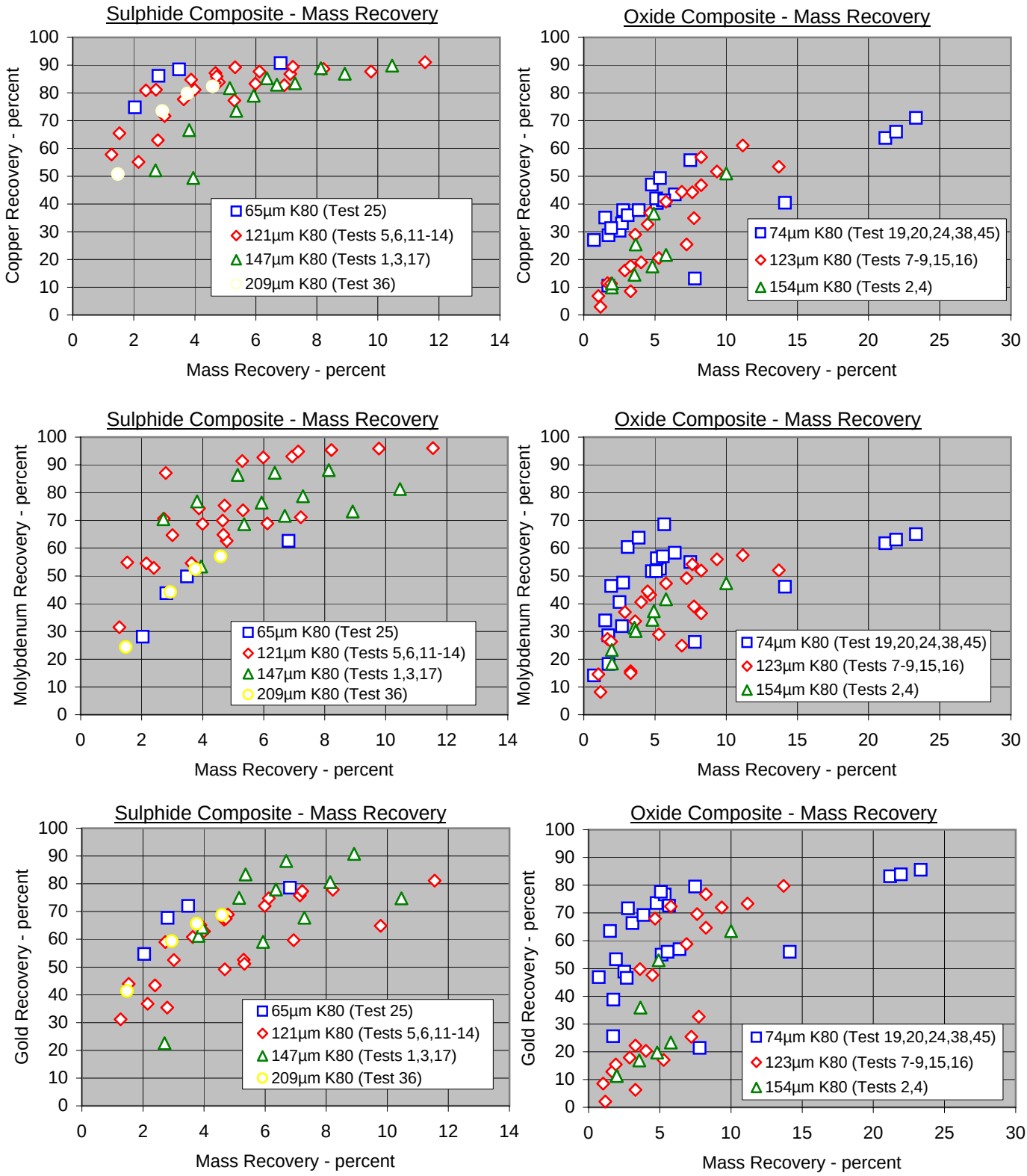
The use of higher pH values of 11 and selective collectors (dithiophosphinate) provide some advantage in controlling pyrite recovery to the concentrate.

The oxide composite had terminal copper recoveries of about 55 percent. Primary grind influenced the mass of rougher concentrate required to achieve the terminal copper recovery; as the grind size increased from 74 to 154μm K_{80}, the mass recovery increased from 6 to 10 percent. The copper recoveries achieved would indicate the sulphide copper was well recovered into the rougher concentrate.

The response of gold and molybdenum in the oxide composite was better than copper, on average, 60 and 85 percent of the molybdenum and gold were recovered into the concentrate.

* The sulphide composite contained about 10 percent non-sulphide copper, which does not readily respond to sulphide flotation.

FIGURE 4
SULPHIDE AND OXIDE COMPOSITE ROUGHER TEST RESULTS



3.4 Cleaner Test Results

3.4.1 Sulphide Composite

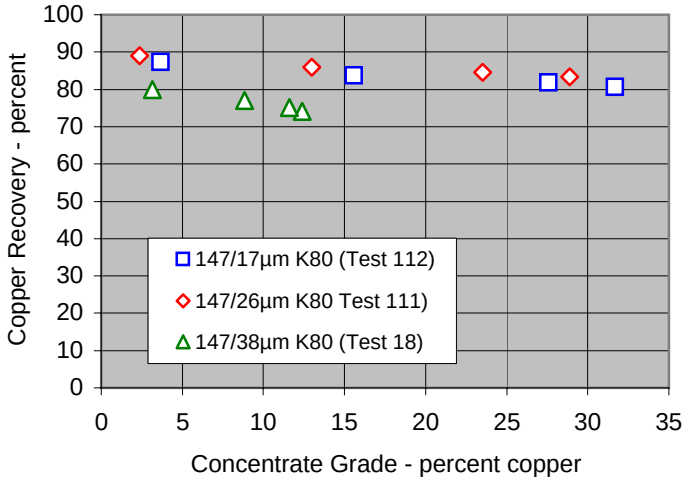
The principal objective of this phase of the flowsheet development studies was to investigate the effect of regrinding on cleaner circuit performance. Regrinding in the range of 15 to 40μm K_{80} was evaluated at two levels of primary grind sizings. The results of these tests are summarized in Figure 5 and in the following comments:

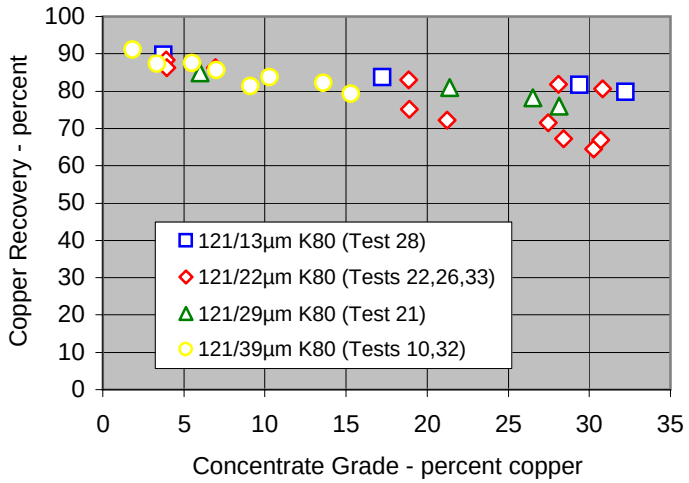
- Regardless of the primary grind sizing selected, regrinding between 15 and 25μm K_{80} produced similar copper grade-recovery profiles. On average, about 80 percent of the copper was recovered into a cleaner concentrate containing 30 percent by weight copper.

- At the coarser primary grind sizing, molybdenum recovery was consistent regardless of the regrind sizing. At 80 percent copper recovery, about 60 percent of the molybdenum was captured into the cleaner concentrate. At the finer grind size, molybdenum recovery was highly variable ranging between 40 and 80 percent.

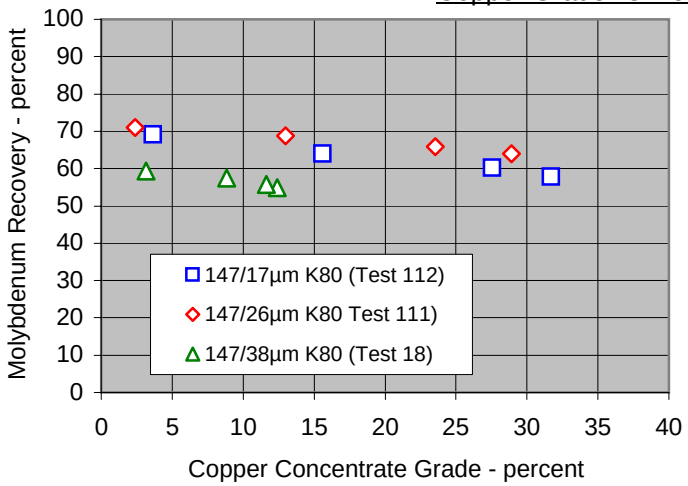
- Gold recovery ranged between 60 and 70 percent, the data suggests that a finer level of regrind may have resulted in slightly higher gold recoveries.

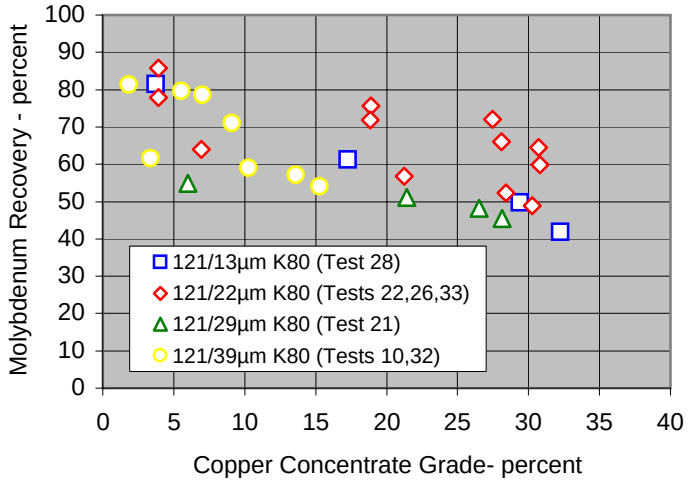
FIGURE 5
SULPHIDE COMPOSITE CLEANER TEST RESULTS
Copper Grade vs Copper Recovery



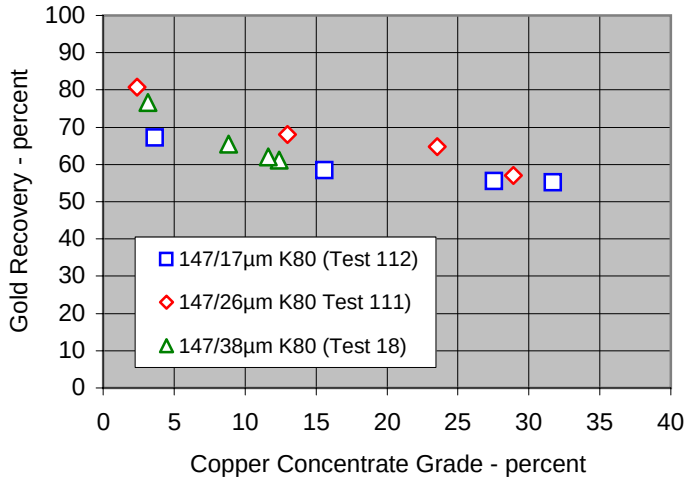


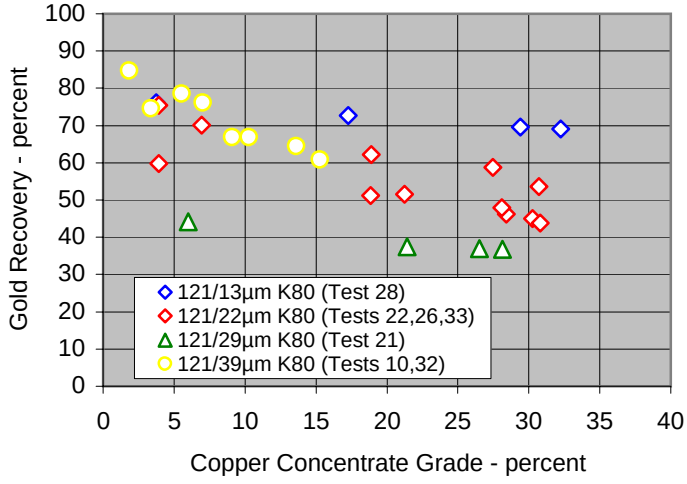
Copper Grade vs Molybdenum Recovery





Copper Grade vs Gold Recovery





3.4.2 Oxide Composite

The effect of regrinding on the oxide composite cleaner circuit performance was conducted at a primary grind sizing of 74μm K_{80}. The results of these tests are summarized in the following comments and in the data shown in Figure 6:

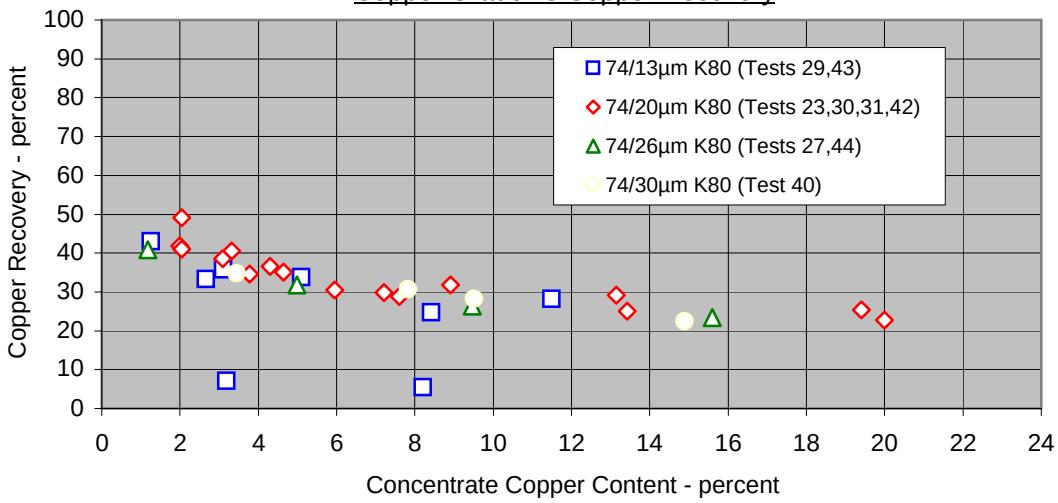
- Regardless of the regrind size tested, grades and recoveries were poor for the oxide composite. On average, about 25 percent of the copper in the feed was recovered into a concentrate containing between 15 and 20 percent by weight copper. Low copper recoveries were attributed to the large proportion of non-sulphide copper in the sample.

- Molybdenum in the feed was between 30 to 45 percent recovered from the feed into a copper concentrate grading 15 to 20 percent copper. There appeared to be a proportional relationship between regrind size and molybdenum recovery. As the molybdenum was reground, losses of molybdenum increased likely as fine “slime” particles.

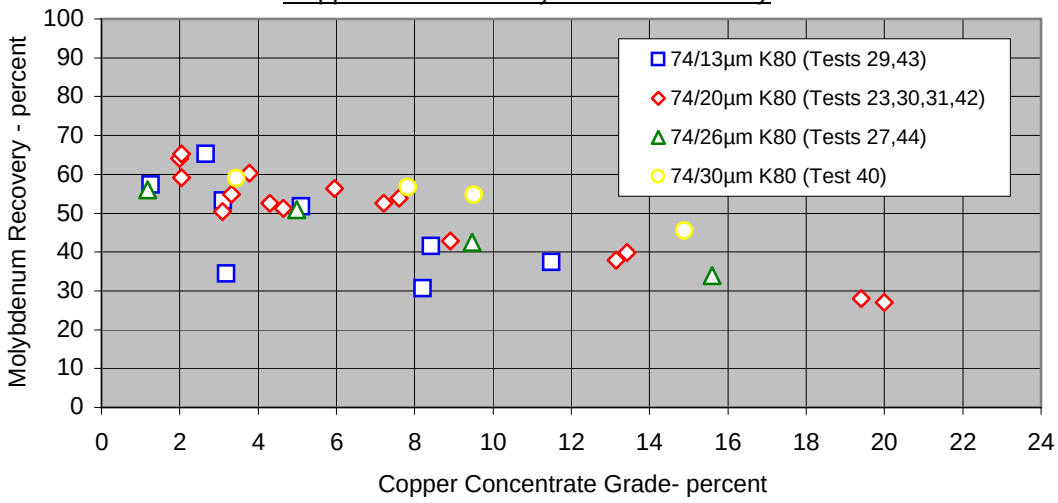
- Gold in the feed was about 40 to 50 percent recovered into a concentrate grading 15 to 20 percent copper. There was no conclusive evidence that regrinding influenced gold recovery to the concentrate.

- The poor concentrate grades were attributed to the recovery of unwanted pyrite into the concentrate. The inferior selectivity against pyrite was probably due to the high levels of chalcocite and covellite in the sample. Further test work would be required to confirm this hypothesis.

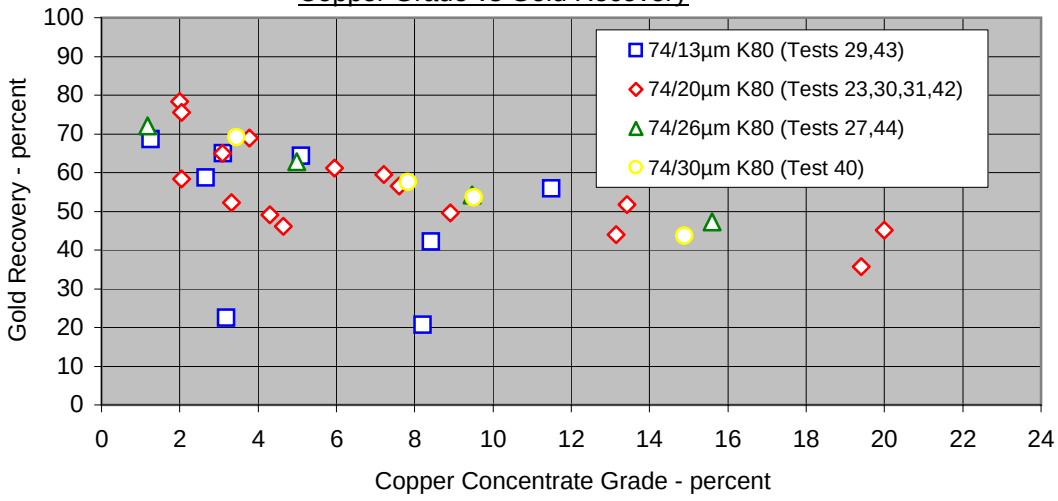
FIGURE 6
OXIDE COMPOSITE CLEANER TEST RESULTS
Copper Grade vs Copper Recovery



Copper Grade vs Molybdenum Recovery



Copper Grade vs Gold Recovery



3.5 Locked Cycle Test Results

To provide metallurgical performance estimates, locked cycle tests were conducted on the sulphide composite only. The principal objective of these tests was to provide metallurgical performance estimates for the composite ground to three levels: 121, 147 and 209μm K_{80}: The flowsheet, nominal test conditions and metallurgical balance data are summarized in Figure 7. Upon review of the data, the following comments are considered:

- The metallurgical results achieved at primary grinds of 121 and 147μm K_{80} were very consistent. At both grinds, about 85 percent of the copper, 48 percent of the molybdenum and 67 percent of the gold were recovered into the cleaner concentrate. This concentrate contained, on average, 29 percent copper, 1.1 percent molybdenum and 26 g/tonne gold.

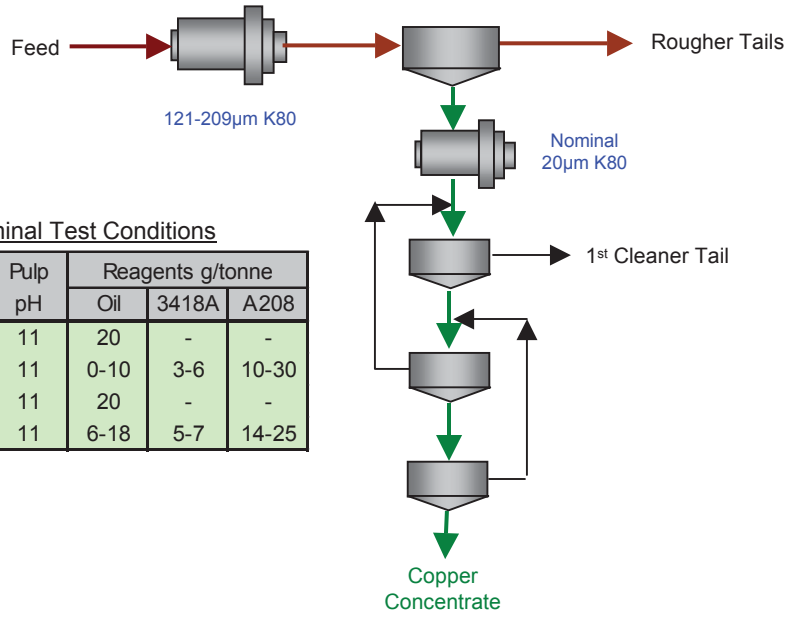
- Based upon the results of a single cycle test conducted at 209μm K_{80}, the performance of copper and gold were inferior compared to the finer primary grind sizings. At this grind, 81 percent of copper and 54 percent of the gold were recovered into a copper concentrate assaying 29 percent copper and 20 g/tonne gold.

- Interestingly, at the coarser primary grind sizing, the molybdenum recovery was markedly higher, at 63 percent, compared to the finer primary grind sizing. The copper concentrate, produced from this single test, contained 1.5 percent by weight molybdenum.

- There may be potential to process this composite at 175μm K_{80} with little or no consequence to metallurgical performance.

FIGURE 7

CYCLE TEST FLOWSHEET AND METALLURGICAL BALANCE DATA



Nominal Test Conditions

Stage	Pulp pH	Reagents g/tonne		
		Oil	3418A	A208
Grind	11	20	-	-
Roughers	11	0-10	3-6	10-30
Regrind	11	20	-	-
Cleaners	11	6-18	5-7	14-25

METALLURGICAL BALANCE DATA

Test Product	Mass percent	Assays - percent or g/tonne				Distribution - percent			
		Cu	Fe	Mo	Au	Cu	Fe	Mo	Au
Grind/Regrind - 121/18µm K80 (Tests 34,35)									
Flotation Feed	100.0	0.27	3.6	0.02	0.31	100	100	100	100
Copper Concentrate	**0.76**	**29.8**	**26.5**	**1.21**	**28.7**	**85**	**6**	**48**	**69**
Copper 1st Cleaner Tail	5.27	0.20	8.4	0.04	0.45	4	12	11	8
Copper Rougher Tail	94.0	0.03	3.1	0.01	0.08	11	82	41	23
Grind/Regrind - 147/20µm K80 (Tests 37,39)									
Flotation Feed	100.0	0.27	3.7	0.02	0.30	100	100	100	100
Copper Concentrate	**0.82**	**28.1**	**28.0**	**1.04**	**23.6**	**86**	**6**	**49**	**64**
Copper 1st Cleaner Tail	4.66	0.21	8.1	0.05	0.60	4	10	13	9
Copper Rougher Tail	94.5	0.03	3.2	0.01	0.09	11	83	37	27
Grind/Regrind - 209/20µm K80 (Test 41)									
Flotation Feed	100.0	0.27	3.7	0.02	0.29	100	100	100	100
Copper Concentrate	**0.77**	**28.7**	**26.7**	**1.53**	**20.2**	**81**	**6**	**63**	**54**
Copper 1st Cleaner Tail	4.00	0.27	9.3	0.04	0.75	4	10	9	10
Copper Rougher Tail	95.2	0.04	3.3	0.01	0.11	15	84	28	36

Note 1) Gold assays are reported in g/tonne.
2) See Appendix II for additional test conditions and metallurgical balance data.

4.0 Ore Variability Test Results

A total of 63 individual samples taken from the Casino deposit were provided for variability studies. To simplify data presentation, the chemical composition, ore hardness and flotation test results are summarized in histograms displayed in the following sub-sections.

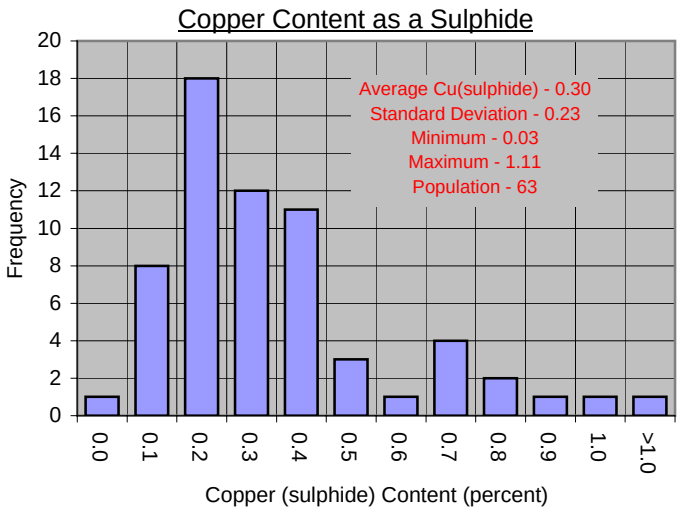
4.1 Composition of the Samples

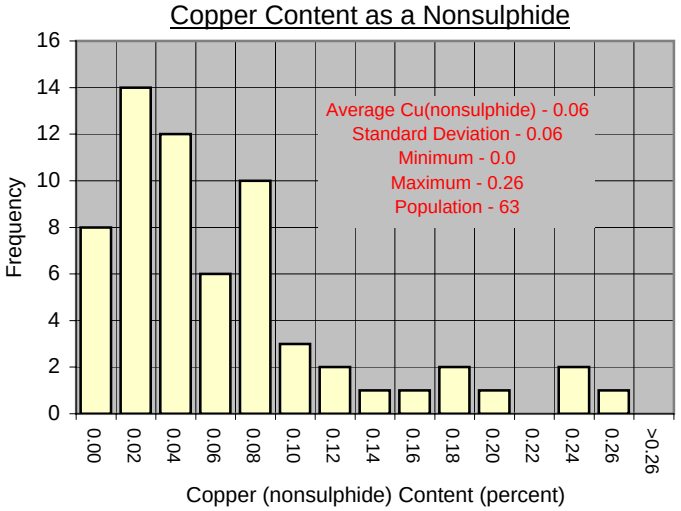
Copper, molybdenum and gold contents in the samples are based on standard chemical assaying techniques, while pyrite content was determined from mineralogical point count procedures. The results of these assessments are summarized in Figure 8.

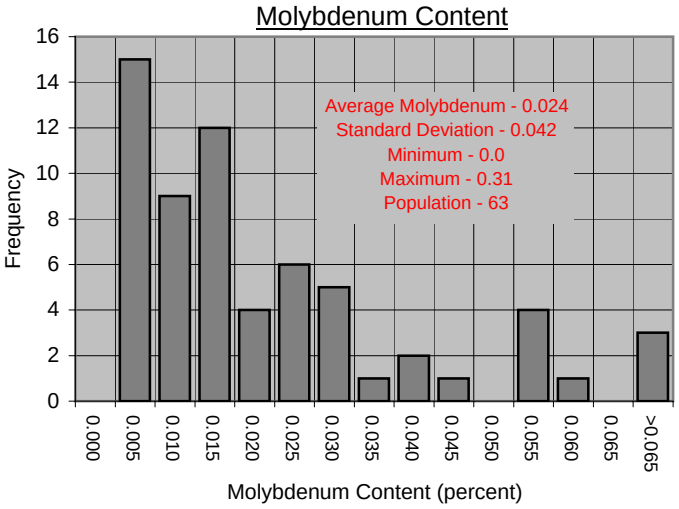
It is apparent from the histogram charts and statistical data, all elements contain relatively high variability in composition. Sulphide copper content ranged between 0.03 to 1.11 percent to average 0.3 percent copper. Non-sulphide copper content in some of the samples is significant and ranged between 0 and 68 percent of the total copper contained in the samples. On average, about 18 percent of the copper is estimated to be present as a non-sulphide.

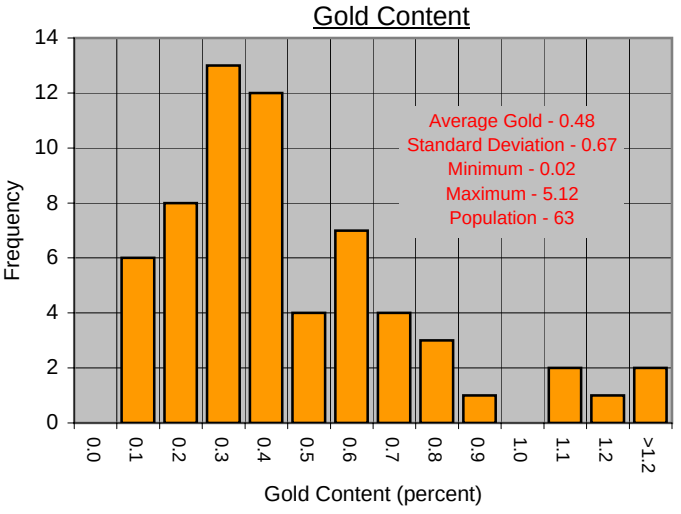
Also of significance is the variability of pyrite content in the samples. Pyrite content ranged between less than 0.1 percent and 16 percent to average 5.4 percent. Of importance to the flotation process is the ratio of pyrite to sulphide copper. With this group of samples, the ratio ranges between 1 and 134 to average 28. At this ratio of pyrite to copper sulphides in the feed, production of high grade bulk concentrate will be difficult.

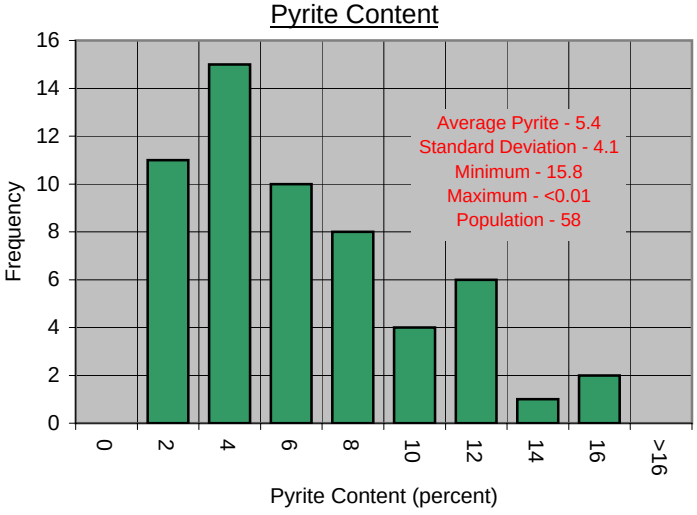
FIGURE 8
HISTOGRAMS DISPLAYING THE FEED GRADE DISTRIBUTIONS

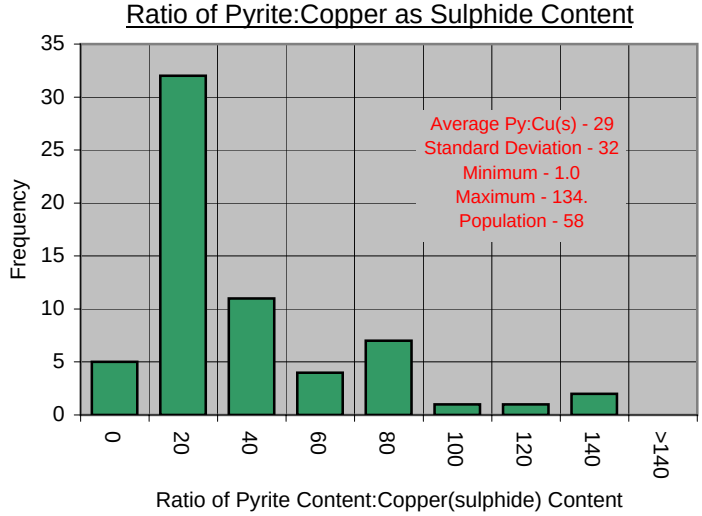












4.2 Sample Hardness

The comparative Bond ball mill work index was determined for each composite. This method is generally less accurate than the standard Bond ball mill procedure, but provides useful data trends of ore hardness. In this study, the global sulphide and oxide samples were used as standards. The results generated by these tests are summarized in Figure 9 and in the following comments:

- The average work index indicates the mineralized samples to be of moderate hardness. On average, the Bond ball mill work index was determined to be 17 kWh/tonne.

- The variability in ore hardness was significant ranging from soft at about 11 kWh/tonne to quite hard at 27 kWh/tonne.

- To confirm the results of these estimates of hardness, it is recommended that standard Bond ball mill work index tests be conducted on approximately one in ten of samples. Particularly standard tests should be conducted on samples displaying high and low estimates of hardness.

FIGURE 9
HISTOGRAM OF COMPARATIVE BOND BALL MILL WORK INDEX VALUES



INDIVIDUAL TEST RESULTS

Comp	kWh/t	Comp	kWh/t	Comp	kWh/t	Comp	kWh/t
528201	17.4	573495	13.1	642872	15.5	644626	15.2
528615	22.2	574241	17.3	642944	19.9	644662	18.2
528659	14.6	574797	20.3	643288	15.8	645064	23.1
528866	26.6	575055	14.6	643311	17.0	645131	13.8
562008	14.3	575753	17.5	643412	23.2	645217	19.5
563176	17.1	575896	19.3	643437	18.2	645346	13.2
563865	14.1	575926	21.6	643678	19.4	645366	12.6
563927	17.8	588005	17.7	643828	20.6	645908	18.9
564106	17.0	588666	10.5	644002	15.0	645972	15.9
565792	18.9	588841	13.0	644171	13.4	647451	15.9
566683	18.8	588893	23.1	644236	17.3	647607	14.8
567708	14.9	589042	15.6	644266	16.5	647769	14.1
567913	15.3	589194	17.2	644329	13.9	647866	14.1
569878	21.3	589606	11.3	644379	17.7	927245	20.3
569898	12.2	642289	12.3	644441	15.5	941533	18.4
571821	17.3	642746	19.1	644546	14.8		

STATISTICAL ANALYSIS

Statistic	kWh/tonne or Population
Average	16.9
Standard Deviation	3.2
Minimum	10.5
Maximum	26.6
Population	63

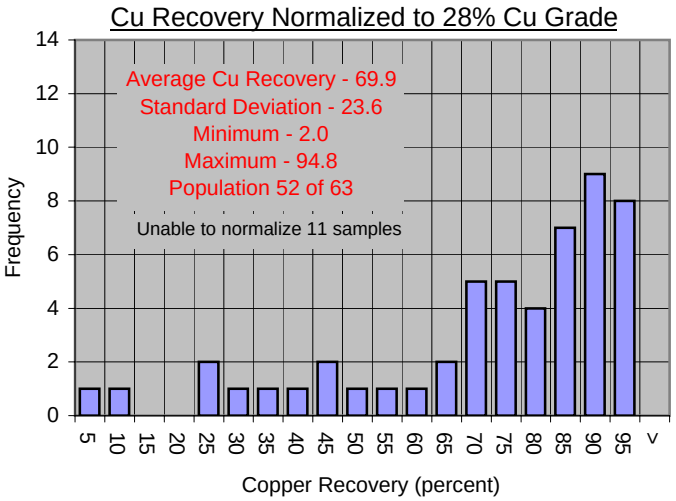
4.3 Metallurgical Performance

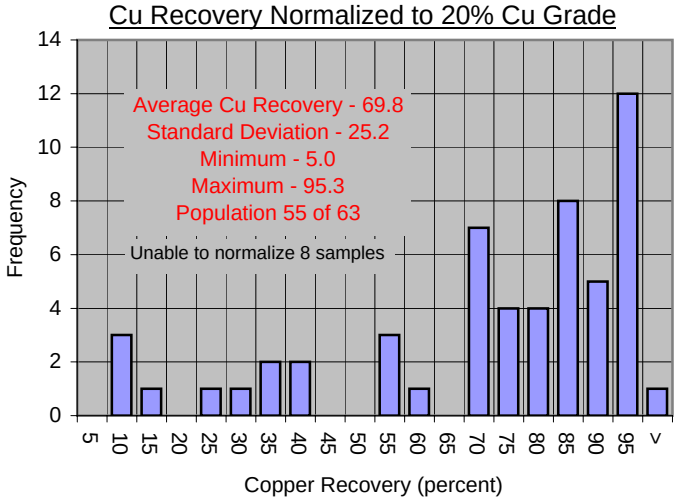
To simplify the presentation of the variability test work, the results are presented as a series of histograms displayed in Figure 10. A complete set of bar charts summarizing the recoveries achieved at normalized copper concentrate grades of 20 and 28 percent copper are presented in detail in Appendix IV, Figures 2A to 2F.

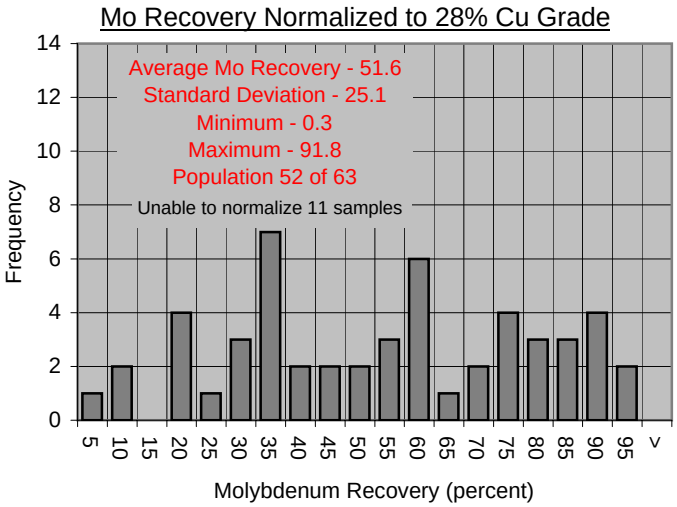
The information shown in Figure 10 is for those samples only that could be normalized to a 28 and 20 percent copper grade in the final concentrate. In summary, about 58 percent of the copper, 43 percent of the molybdenum and 47 percent of the gold contained in these samples were recovered into a copper concentrate assaying 28 percent copper. At a 20 percent copper content in the concentrate, 61, 47 and 52 percent of the copper, molybdenum and gold, respectively were recovered into the cleaner concentrate.

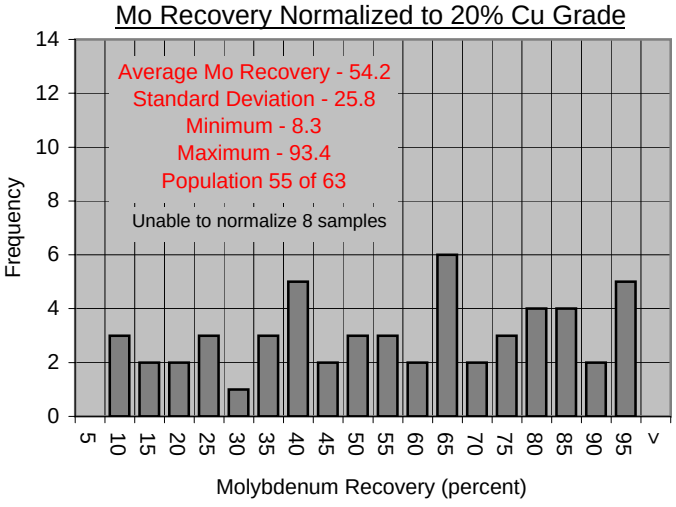
A review of the histograms reveals that a very significant fraction of the samples tested produced substandard recovery profiles. The poor performance of many of these samples can be attributed to a couple of factors: low sulphide copper content and high non-sulphide copper concentrations in the feed samples.

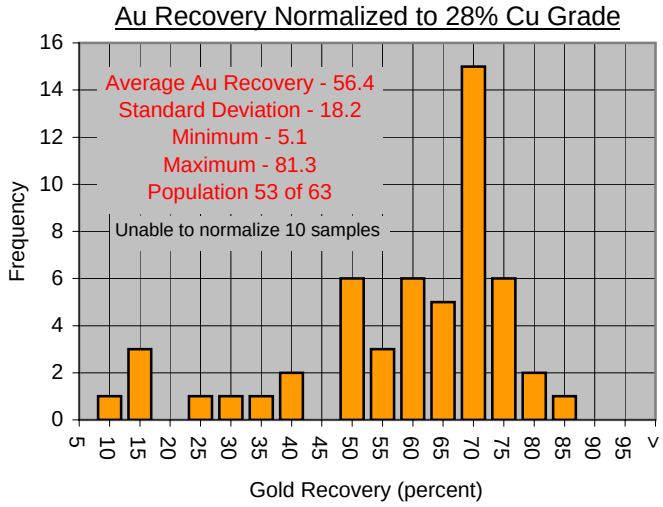
FIGURE 10
HISTOGRAMS DISPLAYING THE FREQUENCY OF RECOVERIES NORMALIZED TO 20 AND 28 PERCENT COPPER CONTENT IN THE CLEANER CONCENTRATE

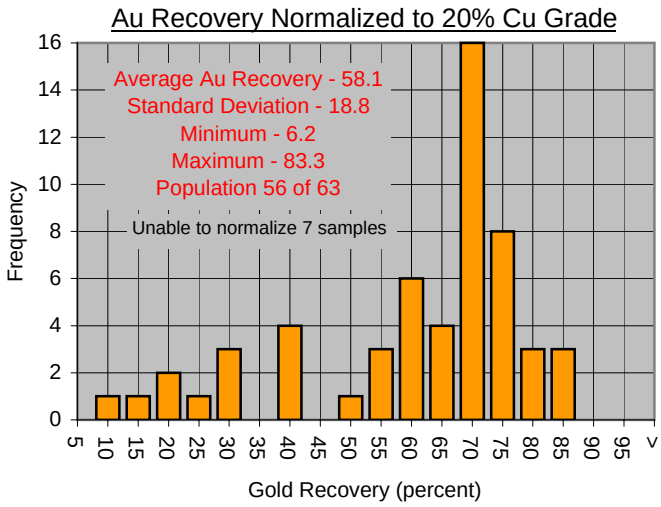












4.4 Concentrate Quality

The concentrations of payable and deleterious elements were determined in selected concentrates produced from flotation tests conducted on the variability samples. The results of these analyses are displayed in Table 4.

TABLE 4
QUALITY OF THE COPPER CONCENTRATE PRODUCED FROM THE VARIABILITY SAMPLES

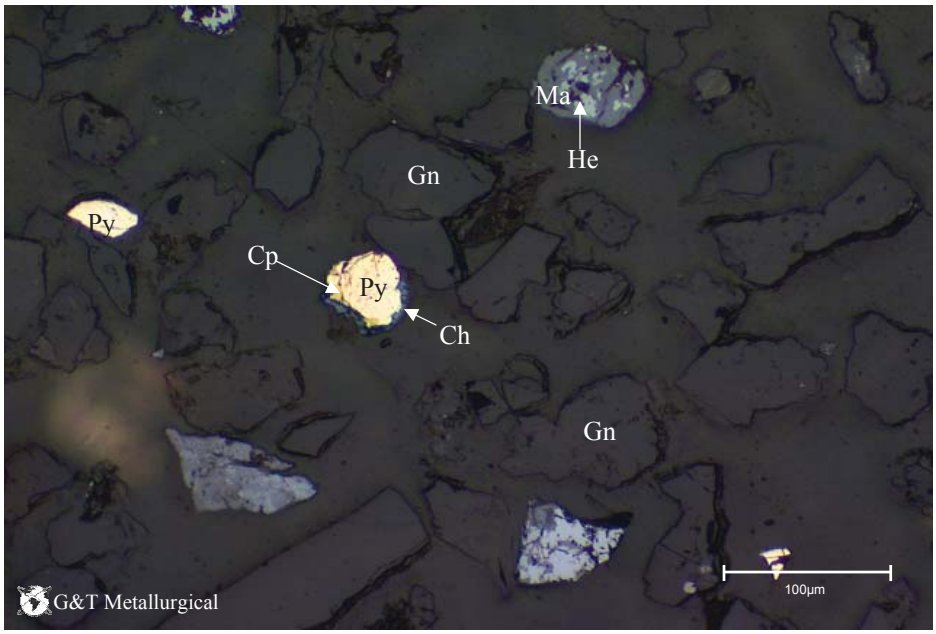
Element	Symbol	Units	Test 58 566683	Test 66 574797	Test 96 644626	Test 104 645972	Test 110 941533
Copper	Cu	%	25.7	18.2	28.5	20.2	25.0
Molybdenum	Mo	%	1.35	0.59	0.85	2.46	1.29
Gold	Au	g/t	20.9	4.56	22.8	27.1	26.2
Silver	Ag	g/t	108	20	172	176	156
Antimony	Sb	g/t	326	282	894	500	220
Arsenic	As	g/t	144	542	1643	11110	142
Bismuth	Bi	g/t	92	100	94	240	60
Cadmium	Cd	g/t	<10	<10	20	10	40
Cobalt	Co	g/t	10	60	60	<10	<10
Fluorine	F	g/t	219	205	76	18	112
Iron	Fe	%	27.3	30.0	25.6	25.7	25.3
Lead	Pb	%	0.028	0.010	0.021	0.032	0.324
Mercury	Hg	g/t	0.5	0.6	1.4	1.1	1.1
Nickel	Ni	g/t	20	20	10	20	<10
Phosphorus	P	g/t	45	305	115	<10	<10
Selenium	Se	g/t	86	52	80	60	80
Silica	SiO2	%	4.22	1.71	3.73	1.60	6.37
Zinc	Zn	%	0.013	0.015	0.172	0.150	0.407
Calcium Oxide	CaO	%	1.31	0.11	0.05	0.14	0.59
Aluminum Oxide	Al2O3	%	1.28	0.62	1.09	0.65	1.09
Magnesium Oxide	MgO	%	0.31	0.02	0.04	0.04	0.17
Manganese Oxide	MnO	%	0.014	0.002	0.008	0.007	0.010

A review of the data indicates that arsenic and antimony are present in sufficient amounts that may result in smelter penalties*. Additional concentrates should be analyzed for arsenic and antimony to further identify zones in the deposit that contains elevated levels of these elements.

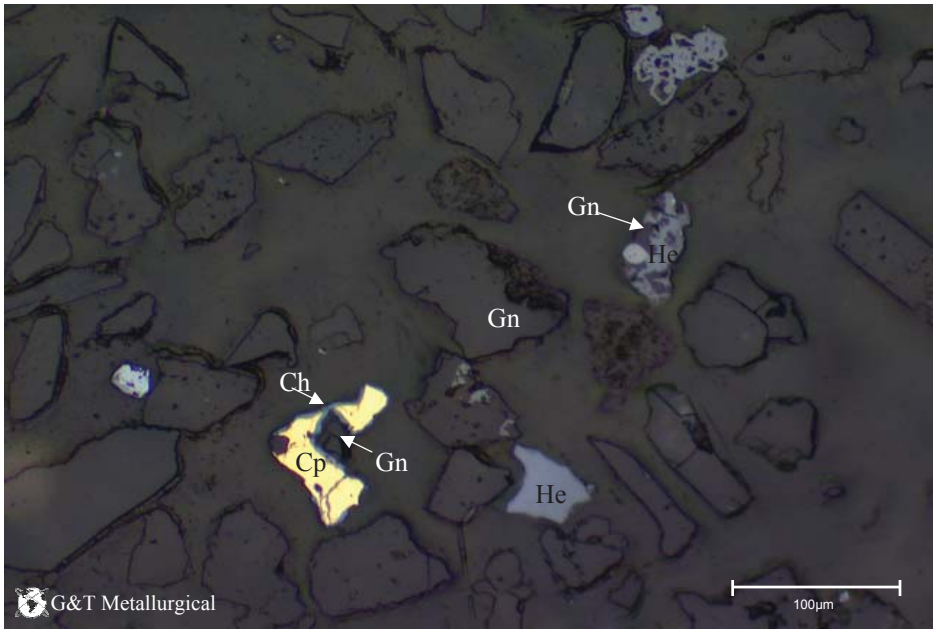
* Arsenic levels at about 1.1 percent are particularly high for sample 645972, which is indicative of zones in the deposit that will contain high arsenic concentrations.

PHOTOMICROGRAPH 2
CASINO PROPERTY-OXIDE COMPOSITE
KM2084

<75µm>35µm



<75µm>38µm



*Cp-Chalcopyrite, Ch-Chalcocite/Covellite, Py-Pyrite, Ma-Magnetite, He-Hematite, Gn-Gangue

5.0 Performance Trends

Using variability data, various feed parameters were analyzed with respect to metal recovery of the concentrate. To simplify this procedure, the recovery values for each test were normalized to a concentrate grade of 28 percent copper. If the concentrate grade did not reach 28 percent for a given sample, the sample was excluded from the analysis.

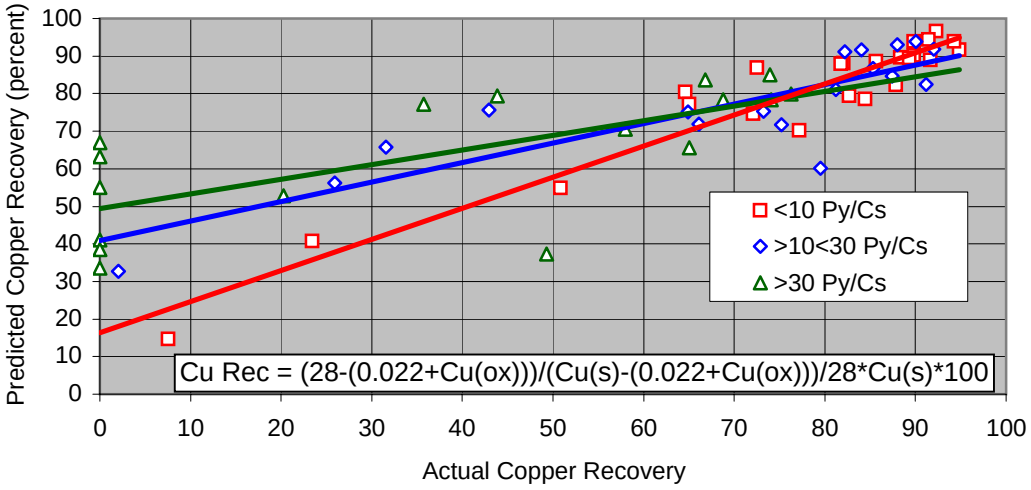
Detailed analysis of the test data revealed that copper metallurgical performance was sensitive to copper oxide content in the feed, total copper feed grade and to a lesser extent, the ratio of pyrite to copper sulphides in the feed. Using these parameters, an equation was developed to predict copper recovery, the equation is shown in the top graph of Figure 11. This equation reasonably predicts copper recovery when copper oxide content is less than 20 percent of the total copper*.

As the percentage of copper oxide exceeds 20 percent of the total copper, copper recovery is over-predicted. The extent of the over-prediction is increased as the pyrite to copper sulphide ratio in the feed increases. Based on this information, creating ore types based on the copper oxide as a percentage of total copper is recommended.

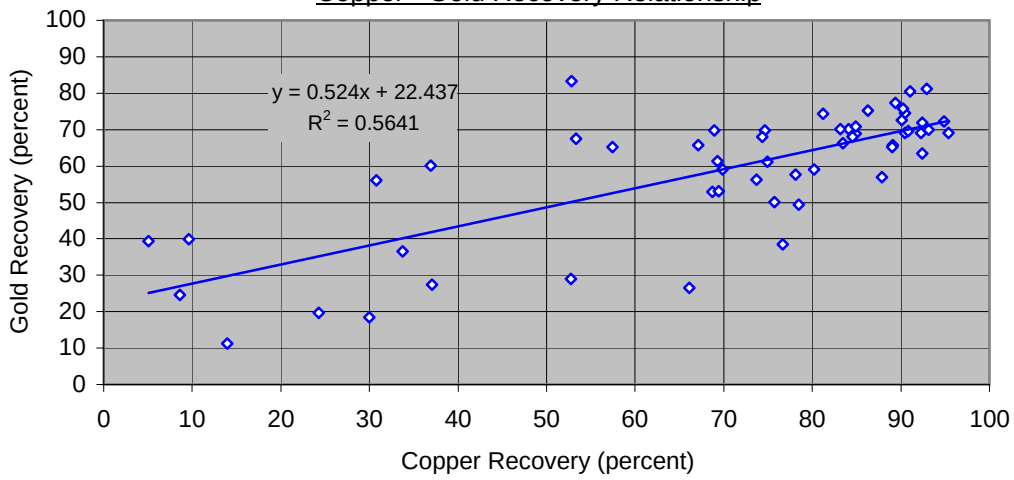
Gold recovery was then plotted relative to copper recovery and a fairly strong trend emerged. As copper recovery improved, generally the gold recovery to the concentrate also improved. There was no specific trend relating any measured variable to molybdenum recovery.

* Figure IV-6 displays the copper recovery versus the proportion of non-sulphide copper in the feed.

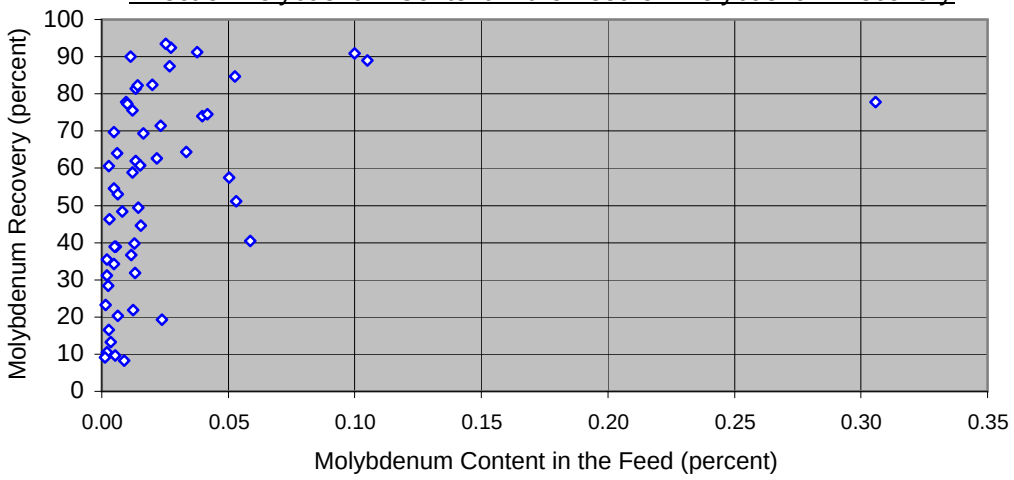
FIGURE 11
METALLURGICAL PERFORMANCE TRENDS
Accuracy of Copper Recovery Prediction Model



Copper - Gold Recovery Relationship



Effect of Molybdenum Content in the Feed on Molybdenum Recovery



6.0 Ancillary Studies

To produce sufficient mass of flotation products for additional studies, a mini pilot plant campaign was conducted to produce a bulk sample of rougher concentrate. The composite used for this portion of the program was constructed with the remaining assay laboratory rejects. To maximize the composite mass, some intervals with higher oxide copper content were used. Figure 12 displays a schematic of the process used to produce the various flotation products.

The primary grinding and rougher flotation stages were conducted utilizing pilot scale equipment. The rougher concentrate was collected and processed with the ISA mill. A final regrind size of 23μm K_{80} was achieved and the power signature for sizing the mill was determined. The rougher tailings stream was sampled during the pilot run and samples were sent for environmental testing*.

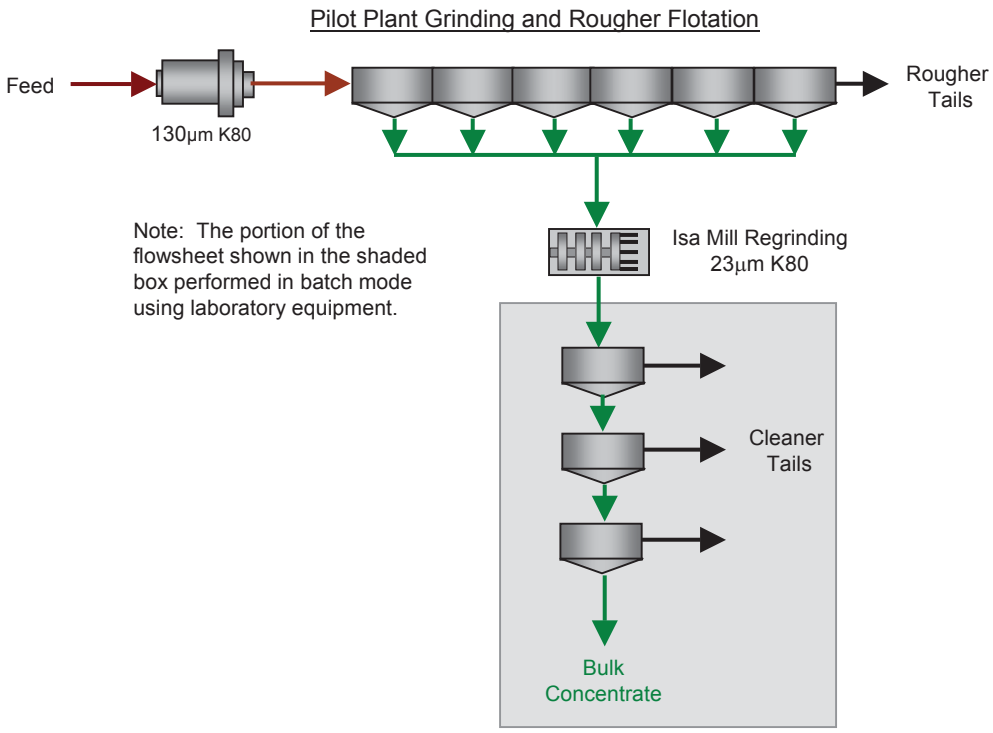
The reground rougher concentrate was cleaned using bench flotation equipment. The concentrate was to be used for development of a copper-molybdenum separation work, however, the concentrate produced from this composite was deemed unsuitable. This test work will have to be repeated, preferably on a sulphide composite of sufficient mass. As shown in the figure, the maximum concentrate grade achieved was 16 percent copper.

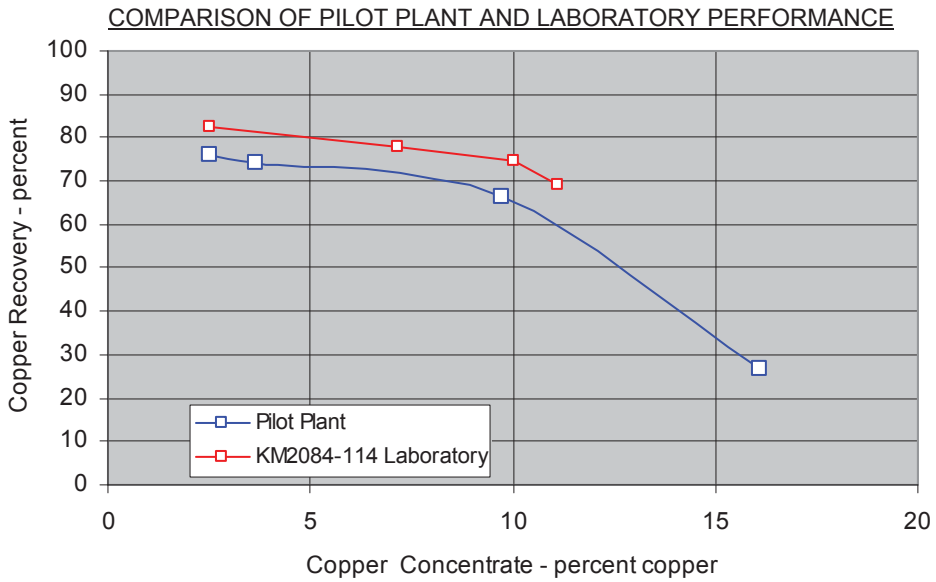
A batch cleaner test was performed on the feed to verify the poor performance observed in the pilot operations. The graph at the bottom of Figure 12 compares the laboratory test to the results of the pilot plant. Although the laboratory data indicates slightly better copper recoveries, the test confirmed that producing high grade concentrates from this sample was unlikely with the developed process. It is hypothesized that the blending of highly oxidized samples with typical sulphide mineralization may result in the activation and subsequent flotation of pyrite.

* The environmental sampling and analyses were performed and reported on by an outside consultant.

FIGURE 12

PILOT PLANT CONCENTRATE AND TAILINGS PRODUCTION





6.1 Thickening Test Results

A series of settling tests were conducted on a sample of rougher tails and bulk copper-molybdenum concentrate produced during the pilot plant campaign*. The tests investigated flocculant type and dosage on settling rates. The results of these tests are summarized in Table 6.

TABLE 6
SUMMARY OF SETTLING TEST RESULTS

Sample	Flocculant Type	Dosage g/tonne	Thickener Area m^2/d/tonne	Final Density percent solids
Rougher Tails	Superfloc A-130	0	0.253	56.8
Rougher Tails	Superfloc A-130	2	0.132	56.8
Rougher Tails	Superfloc A-130	5	0.183	59.0
Rougher Tails	Superfloc C-496	2	0.215	57.9
Rougher Tails	Superfloc C-496	5	0.329	59.0
Copper Concentrate	Superfloc A-130	0	0.121	72.7
Copper Concentrate	Superfloc A-130	2	0.066	69.3
Copper Concentrate	Superfloc A-130	5	0.079	66.2

Notes: a) See Appendix IV, Tables IV-6A to 6H for additional test details.
b) Thickener area is estimated using the Talmadge-Fitch method and is based on 45 percent solids in the thickener underflow for the rougher tails and 55 density for the concentrate.
c) Final density was measured after 24 hours of settling.

As shown in the table, the optimal tailings thickener area was achieved with Superfloc A-130 at a dosage of 2 g/tonne. Similarly, the copper concentrate achieved optimal thickener area at 2 g/tonne of Superfloc A-130.

As the project advances in development, additional concentrate and tailings samples should be provided to equipment vendors for more detailed testing engineering studies.

* Although the concentrate was of poor quality and not representative of type sulphide copper concentrate, it was the only sample available with sufficient mass to conduct the settling test work.

6.2 ISA Regrind Mill Test Results

The rougher concentrate produced in the pilot plant was used to generate the ISA mill power signature plot. As requested, the rougher concentrate was processed through the standard ISA mill with all test parameters being recorded. The data obtained from this test can be used by Xstrata Technologies to size an ISA mill for the regrinding application.

TABLE 7
ISA MILL TEST DATA

Parameter	P98	P80	CS1
Feed Sizing	-	39	0.00
Run 1	103	33	3.1
Run 2	93	30	3.1
Run 3	78	26	3.0
Run 4	62	23	2.7
Target Sizing	20 P_{80}		
Work Index @ Target	47.3 kWh/tonne		
Media Consumption	274 g/kWh		

Notes: a) See Appendix IV for specific test details.

The results of the ISA mill tests are summarized in Table 7. Specific details regarding measured and calculated test results and the ISA signature plot are presented in Appendix IV. As the concentrate produced from this composite sample did not represent typical sulphide composite rougher concentrate, the testing should be repeated on a more representative sample.

6.3 Galvanox and Acid Leach Test Results

Galvanox* leaching is a novel leaching process for primary copper sulphides. Leaching is accomplished utilizing the galvanic coupling of pyrite and chalcopyrite in an acid solution. Figure 13A displays the results of two preliminary tests.

The first test was conducted using the bulk concentrate produced in the pilot plant campaign. This concentrate was blended with a standard pyrite sample. The results indicated that following a 55-hour leaching period, about 84 percent of the copper was leached into solution. The test indicates that low grade concentrates can be leached using this technology. Further optimization test work is required

The second Galvanox test was conducted on concentrate produced from the sulphide global composite**. A flotation test was performed where both pyrite and copper sulphides were recovered together into a single concentrate. This sample, with no additional pyrite was subjected to the Galvanox process. The sample leached to near completion, extracting 97 percent of the copper to solution. The total leach time was long, about 166 hours. Further testing is required to attempt to reduce leaching time.

The oxide composites were subjected to a pair of hybrid acid leach-flotation tests. The results are displayed in Figure 13B. Test 46 was an acid leach conducted on a flotation tailings stream and test 47 was an acid-leaching followed by flotation. As shown, the recovery of copper was about 80 percent, with flotation recovering about half of the copper and leaching recovering the other half. Both methods produce the same final result, however flotation followed by leaching may be a more practical process to avoid high neutralizing costs.

---

* The process was developed by Dave Dixon at UBC and is protected by patent. Dave Dixon also reviewed the results of the Galvanox test work.

** A single flotation test was performed, copper was 77 percent recovered from the feed. Further optimization would be required to improve the recovery. See test KM2084-113 in Appendix II.

FIGURE 13A
GALVANOX LEACH PERFORMANCE
Sulphide and Pilot Plant Composite

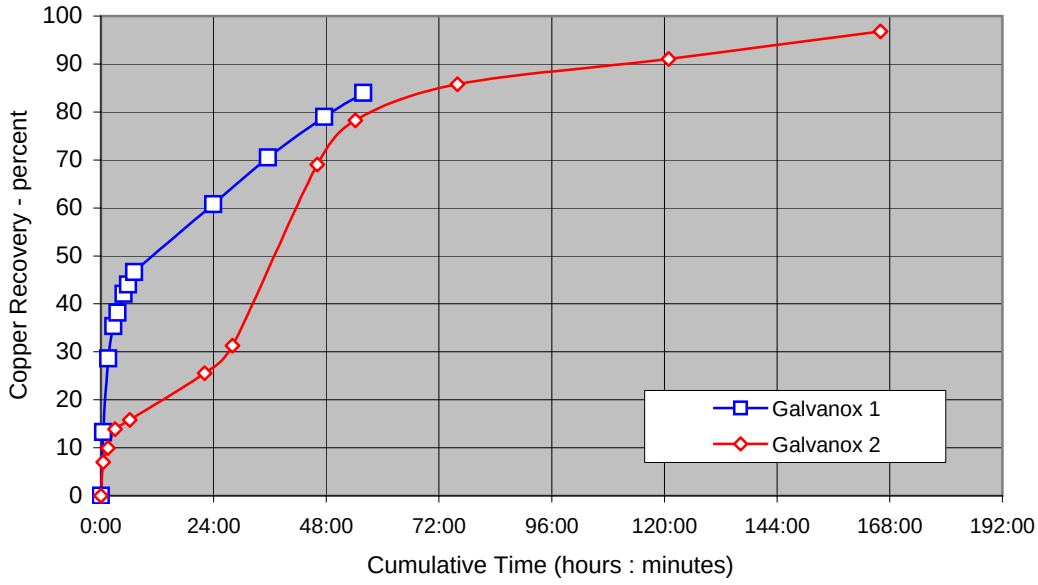
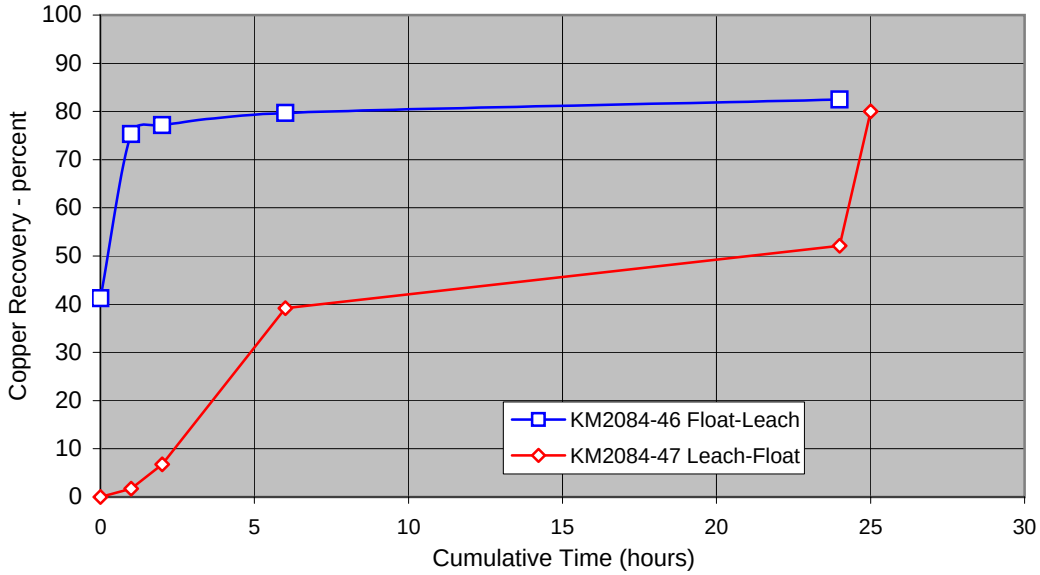


FIGURE 13B
ACID LEACH AND FLOTATION PERFORMANCE
Oxide Composite



7.0 Conclusions

The basic flowsheet parameters were developed on two global composites nominally representing the sulphide and oxide zones. The samples contained, on average, 0.27 percent copper, 0.02 percent molybdenum and about 0.3 g/tonne gold. The key chemical difference between the composites was the oxide composite contained about half of the copper in non-sulphide form.

The sulphide composite contained about 7 percent by weight sulphides, most of which was pyrite. The relatively high levels of pyrite will make production of high copper grade concentrates challenging.

The oxide composite also contained a significant level of sulphide mineralization, about 3 percent of the sample mass. The majority of the sulphide mineralization was pyrite. Copper sulphide content was mixed, with about 75 percent of the copper occurring as chalcopyrite and 25 percent of copper occurring as chalcocite. The presence of chalcocite often reduces the selectivity of the flotation process against pyrite.

For both composites, modal analysis conducted at 150μm K_{80} primary grind size indicated copper sulphide and molybdenite liberations were sufficient for rougher flotation. The liberation levels were, on average, 55 and 60 percent for copper sulphides and molybdenite, respectively. More importantly, the data indicated the economic minerals were not significantly interlocked with pyrite.

Standard Bond ball mill work index tests were conducted on the two composites. The results of these tests revealed the composite to be of moderate hardness having an average ball mill work index value of 16 kWh/tonne, typical of porphyry ores.

For the sulphide composite, a relatively simple reagent strategy was developed. The flotation circuits were operated at pH 11.0 and used a selective dithiophosphinate collector to subdue pyrite flotation. A primary grind sizing of 150μm K_{80} provided effective metallurgical performance and would be recommended for future testing. Regrind sizings of about 20μm appeared to provide relatively good copper and gold metallurgical performance. There were some indications the finer regrind levels were detrimental to molybdenum flotation performance.

Using the developed process, the locked cycle test performance for the sulphide composite was typical of deposits of this classification. Copper in the feed was 86 percent recovered into a concentrate grading 28 percent copper. Molybdenum and gold were 49 and 64 percent recovered into the concentrate, respectively.

For the oxide composite, the test work conducted failed to develop a flotation process that would recovery copper, molybdenum and gold into a marketable concentrate. There were some indications that a hybrid circuit utilizing both flotation and acid leaching would extract more copper from this type of mineralization. More test work would be required to develop this type of process.

To assess ore hardness and metallurgical variability across the Casino deposit, 63 individual samples were subjected to a standard grind test and open circuit cleaner test. The results of these tests revealed significant variations in mineral content, ore hardness and metallurgical response.

Sulphide copper content varied between 0.1 and 1.1 percent copper. The proportion of non-sulphide copper varied between 0 and 68 percent of the total copper content. On average, about 18 percent of the copper was determined to be present as a non-sulphide.

Of importance to the flotation performance is the pyrite content. The average pyrite content in the variability samples was determined to be 5.5 percent. The proportion of pyrite to sulphide copper was very high ranging between 1 and 134 times the sulphide copper content. It is anticipated that the high pyrite contents may result in difficulties in achieving acceptable metallurgy for some of the samples.

The comparative work index estimates, determined on the sample suite, confirms the moderate hardness of the mineralization. The work index values ranged between 10.5 and 26.6 kWh/tonne to average 16.9 kWh/tonne.

Standardized batch cleaner tests conducted on each sample revealed wide variations in metallurgical performance. Normalizing metal recoveries to 28 percent by weight copper in the concentrate produced average recoveries for copper, molybdenum and gold of 70, 52 and 56 percent, respectively. Copper recoveries ranged between 2 percent and 95 percent, molybdenum recoveries between 1 and 92 percent and gold recoveries between 5 and 81 percent.

Minor element concentrations were determined in the cleaner concentrates produced from five of the variability samples. One of the samples contained high levels of arsenic at about 1.1 percent. Arsenic levels in the remaining concentrates ranged between 140 and 1640 g/tonne. There were no other minor element concentrations that would severely reduce the general marketability of the concentrate.

Detailed analysis of the variability test data revealed the metallurgical performance was strongly linked to copper feed grade and the percentage of copper in non-sulphide forms. A subtle relationship between the copper sulphide to pyrite ratio was also observed. Using the data, a model was developed to predict copper recovery and would be, at this point in the project, suitable for block modeling the deposit.

The test work has indicated that as the non-sulphide content of the ore exceeds 20 percent, producing acceptable metallurgical will be difficult. This factor should be carefully considered and used to develop future mine plans. Although not directly investigated, blending of the two mineralized zones may have a detrimental effect on metallurgical performance.

A 300 kg sample was processed through pilot scale grinding and rougher flotation equipment. The goal of this work was to produce sufficient concentrate mass to develop a copper-molybdenum separation. Limitations on available sample caused high non-sulphide copper intervals to be included in the composite. As a result, the bulk concentrate produced was determined to be unsuitable, mainly due to pyrite contamination, for copper molybdenum separation. The concentrate was, however, used to generate engineering data for regrind mill sizing and thickener sizing.

Alternative leaching, both with acid and Galvanox were briefly examined. The results indicated the potential to leach copper into solution. The acid leaching combined with flotation process achieved copper extractions of about 80 percent for the oxide composite. Galvanox process extracted between 84 to 97 of the copper from sulphide concentrates. Significantly more tests are required to optimize these processes.

8.0 Recommendations

As the project development continues, mineralized zones based on non-sulphide copper content should be constructed for testing. Preferably these zones will be utilized to construct a primary plan for the project.

A large sample of sulphide zone material should be provided for completion of the copper-molybdenum separation work. The sample will be processed in the pilot plant to produce concentrate for the separation work. The separate copper and molybdenum concentrates can be further evaluated for dewatering, minor element properties and smelter studies. A sample of 4000 to 5000 kg would be required to properly conduct this test work.

The development of a hybrid-flotation-leach circuit should be pursued. The test work should be conducted on other samples of varying non-sulphide copper content.

APPENDIX A2 2010 (& 2012) TAILINGS PROCESSING_KM2721 REPORT

APPENDIX I – KM2721

SAMPLE ORIGIN

1.0 Sample Origin

Samples for this Casino Project were received at G&T Metallurgical Services Ltd. in three shipments, on August 5, 10, and 13 of 2010. Table I-1 displays the mass and identification of samples received. Upon receipt, samples were checked and certain samples disposed of, based on instructions from Mr. Adam Hesse, metallurgical consultant for Western Copper Corporation. All individual samples were stage crushed to -6 mesh and homogenized. Representative cuts were removed and assayed for elements of interest in this project as shown in Table I-2.

Following Mr. Hesse's instructions, a single global composite was constructed from select samples. Samples for the composite were homogenized and rotary split into 2 kilogram charges. Table I-3 displays the mass and identification of samples, used to construct the global composite, designated Master Composite 1.

Representative duplicate cuts were removed and assayed for elements of interest in this project as shown in Table I-4. Near the end of the program, at the request of Dr. Paul West-Sells, the Master Composite 1 sample name was changed to SUP Composite 2010.

A second SUP Composite 2010 was constructed from the drill core material for environmental test work. This material was constructed based on the same compositing instructions as the initial composite and was designated SUP Composite 2010-2. Head assays were conducted on this composite to confirm uniformity with the original sample. The results are displayed in Table I-5.

TABLE I-1A
MASS AND IDENTIFICATION OF SAMPLES RECEIVED
August 5, 2010

Sample ID	Mass kg	Sample Form
CAS-043 64.17-67.17	3.09	Quarter Core
CAS-043 67.17-69.35	3.09	Quarter Core
CAS-043 69.35-71.45	3.24	Quarter Core
CAS-044 53.65-56.65	4.53	Quarter Core
CAS-044 56.65-59.65	5.64	Quarter Core
CAS-044 59.65-62.65	3.07	Quarter Core
CAS-045 76.95-79.95	3.27	Quarter Core
CAS-045 79.95-82.95	3.21	Quarter Core
CAS-045 82.95-86.95	4.49	Quarter Core
CAS-048 118.50-121.50	3.84	Quarter Core
CAS-048 121.50-124.50	3.98	Quarter Core
CAS-048 124.50-127.50	3.02	Quarter Core
CAS-049 106.40-109.40	3.26	Quarter Core
CAS-049 109.40-111.80	3.4	Quarter Core
CAS-049 111.80-113.80	2.22	Quarter Core
CAS-049 130.00-132.00	2.35	Quarter Core
CAS-049 132.00-134.20	3.31	Quarter Core
CAS-049 134.20-137.20	4.34	Quarter Core
CAS-050 148.30-151.30	3.92	Quarter Core
CAS-050 151.30-154.30	3.83	Quarter Core
CAS-050 154.30-157.30	4.06	Quarter Core
CAS-050 79.90-82.90	3.68	Quarter Core
CAS-050 82.90-85.90	2.98	Quarter Core
CAS-050 85.90-88.90	4.11	Quarter Core
CAS-051 103.37-106.37	4.13	Quarter Core
CAS-051 106.37-109.37	4.65	Quarter Core
CAS-051 109.37-112.37	4.06	Quarter Core
CAS-051 57.80-60.80	2.75	Quarter Core
CAS-051 60.80-63.80	2.81	Quarter Core
CAS-051 63.80-65.28	1.44	Quarter Core
CAS-051 79.07-82.07	3.45	Quarter Core
CAS-051 82.07-85.07	2.85	Quarter Core
CAS-051 85.07-86.72	2.61	Quarter Core
CAS-052 62.60-64.25	2.49	Quarter Core
CAS-052 64.25-66.75	3.13	Quarter Core
CAS-052 66.75-69.75	4.47	Quarter Core
CAS-053 63.80-66.80	3.48	Quarter Core
CAS-053 66.80-69.00	3.27	Quarter Core
CAS-053 69.00-71.25	2.85	Quarter Core
CAS-054 69.70-72.70	3.3	Quarter Core
CAS-054 72.70-75.70	3.18	Quarter Core
CAS-054 75.70-78.70	3.29	Quarter Core
CAS-055 76.30-79.30	3.91	Quarter Core
CAS-055 79.30-82.30	3.15	Quarter Core
CAS-055 82.30-85.30	4.68	Quarter Core

Sample ID	Mass kg	Sample Form
CAS-057 154.00-156.85	4	Quarter Core
CAS-057 156.85-159.15	3.16	Quarter Core
CAS-059 104.00-106.30	1.42	Quarter Core
CAS-059 106.30-109.30	3.62	Quarter Core
CAS-059 109.30-111.35	5.43	Quarter Core
CAS-059 50.60-53.60	3.09	Quarter Core
CAS-059 53.60-56.60	2.97	Quarter Core
CAS-059 56.60-59.60	2.56	Quarter Core
CAS-060 84.57-87.57	5.03	Quarter Core
CAS-060 87.57-90.57	3.87	Quarter Core
CAS-060 90.57-92.30	2.87	Quarter Core
CAS-061 110.77-113.77	6.75	Quarter Core
CAS-061 113.77-115.82	3.66	Quarter Core
CAS-061 115.82-118.82	5.88	Quarter Core
CAS-061 62.48-65.48	4.4	Quarter Core
CAS-061 65.48-68.48	3.39	Quarter Core
CAS-061 68.48-70.48	1.85	Quarter Core
CAS-062 132.30-135.30	4.72	Quarter Core
CAS-062 135.30-138.30	3.88	Quarter Core
CAS-062 138.30-140.10	2.73	Quarter Core
CAS-062 173.65-176.65	5.86	Quarter Core
CAS-062 176.65-179.65	3.55	Quarter Core
CAS-062 179.65-182.65	3.95	Quarter Core
CAS-062 92.90-95.90	3.68	Quarter Core
CAS-062 95.90-98.90	3.27	Quarter Core
CAS-062 98.90-101.90	4.87	Quarter Core
CAS-063 109.30-112.30	4.5	Quarter Core
CAS-063 112.30-115.30	3.54	Quarter Core
CAS-063 115.30-118.30	3.92	Quarter Core
CAS-063 70.50-73.50	3.51	Quarter Core
CAS-063 73.50-75.50	1.57	Quarter Core
CAS-063 75.50-77.10	2.25	Quarter Core
CAS-066 107.30-110.30	4.55	Quarter Core
CAS-066 110.30-113.30	4.83	Quarter Core
CAS-066 113.30-116.30	5.18	Quarter Core
CAS-066 125.30-128.30	4.57	Quarter Core
CAS-066 128.30-131.30	3.86	Quarter Core
CAS-066 131.30-134.30	4.37	Quarter Core
CAS-066 146.30-149.30	3.18	Quarter Core
CAS-066 149.30-151.90	3.95	Quarter Core
CAS-066 151.90-154.25	2.56	Quarter Core
CAS-067 169.60-172.60	4.85	Quarter Core
CAS-067 172.60-175.60	4.95	Quarter Core
CAS-067 175.60-178.60	4	Quarter Core
CAS-067 184.60-187.60	4.63	Quarter Core

TABLE I-1A Continued
MASS AND IDENTIFICATION OF SAMPLES RECEIVED
August 5, 2010

Sample ID	Mass kg	Sample Form
CAS-056 58.10-61.10	3.66	Quarter Core
CAS-056 61.10-64.10	3.39	Quarter Core
CAS-056 64.10-67.08	3.29	Quarter Core
CAS-056 86.70-89.70	4.35	Quarter Core
CAS-056 89.70-91.70	2.48	Quarter Core
CAS-056 91.70-93.00	2.46	Quarter Core
CAS-057 151.00-154.00	4.43	Quarter Core
CAS-069 172.90-175.90	2.17	Quarter Core
CAS-070 140.0-143.0	5.11	Quarter Core
CAS-070 143.0-146.0	4.49	Quarter Core
CAS-070 146.0-149.0	3.43	Quarter Core
CAS-070 168.30-171.10	3.34	Quarter Core
CAS-070 171.10-174.10	4.28	Quarter Core
CAS-070 174.10-177.10	3.23	Quarter Core
CAS-070 183.10-186.10	4.67	Quarter Core
CAS-070 186.10-188.25	4.01	Quarter Core
CAS-070 188.25-190.70	3	Quarter Core
CAS-071 72.60-75.60	3.25	Quarter Core
CAS-071 75.60-78.60	1.96	Quarter Core
CAS-071 78.60-81.60	2.63	Quarter Core
CAS-073 109.70-112.70	3.93	Quarter Core
CAS-073 112.70-115.70	4.67	Quarter Core

Sample ID	Mass kg	Sample Form
CAS-067 187.60-189.60	2.76	Quarter Core
CAS-067 189.60-191.10	3.17	Quarter Core
CAS-069 135.25-138.25	3.02	Quarter Core
CAS-069 138.25-141.25	4.67	Quarter Core
CAS-069 141.25-142.85	2.5	Quarter Core
CAS-069 167.30-169.90	3.82	Quarter Core
CAS-069 169.90-172.90	3.13	Quarter Core
CAS-073 115.70-118.65	1.7	Quarter Core
CAS-073 138.70-141.70	3.36	Quarter Core
CAS-073 141.70-144.70	3.14	Quarter Core
CAS-073 144.70-147.70	3.2	Quarter Core
CAS-073 168.30-171.30	3.92	Quarter Core
CAS-073 171.30-174.30	3.98	Quarter Core
CAS-073 174.30-177.30	4.09	Quarter Core
CAS-074 163.15-166.15	4.13	Quarter Core
CAS-074 166.15-169.15	2.49	Quarter Core
CAS-074 169.15-171.15	4.07	Quarter Core
CAS-074 186.70-189.70	2.55	Quarter Core
CAS-074 189.70-192.70	4.84	Quarter Core
CAS-074 192.70-194.20	2.4	Quarter Core
CAS-074 201.50-203.64	3.02	Quarter Core
CAS-074 203.64-206.64	2.85	Quarter Core

TABLE I-1B
MASS AND IDENTIFICATION OF SAMPLES RECEIVED
August 10, 2010

Sample ID	Mass kg	Sample Form
CAS-043 61.17-64.17	3	Quarter Core
CAS-044 59.65-62.65	2.1	Quarter Core
CAS-045 73.95-76.95	4.1	Quarter Core
CAS-049 113.80-115.80	2.9	Quarter Core
CAS-049 137.20-140.20	3.5	Quarter Core
CAS-050 157.30-160.30	3.5	Quarter Core
CAS-050 88.90-91.00	2	Quarter Core
CAS-051 100.37-103.37	2.2	Quarter Core
CAS-051 54.80-57.80	2.4	Quarter Core
CAS-051 78.34-79.07	2.1	Quarter Core
CAS-052 69.75-72.75	4.2	Quarter Core
CAS-053 60.80-63.80	3.4	Quarter Core
CAS-054 78.70-81.70	2.6	Quarter Core
CAS-055 75.30-76.30	2.3	Quarter Core
CAS-056 67.08-70.08	4.7	Quarter Core
CAS-056 84.20-86.70	1.6	Quarter Core
CAS-057 148.00-151.00	4.9	Quarter Core
CAS-059 102.00-104.00	2.4	Quarter Core
CAS-059 59.60-61.60	1.9	Quarter Core
CAS-060 92.30-93.85	1.1	Quarter Core
CAS-061 118.82-120.82	2.5	Quarter Core
CAS-061 70.48-72.63	2.5	Quarter Core
CAS-062 101.90-104.90	4.5	Quarter Core
CAS-062 130.60-132.30	2.9	Quarter Core

Sample ID	Mass kg	Sample Form
CAS-062 170.65-173.65	3	Quarter Core
CAS-063 118.30-121.30	4.4	Quarter Core
CAS-063 154.25-157.25	4.1	Quarter Core
CAS-063 157.25-159.25	3	Quarter Core
CAS-063 159.25-161.90	2.6	Quarter Core
CAS-063 161.90-163.60	2.6	Quarter Core
CAS-063 67.50-70.50	3.1	Quarter Core
CAS-066 104.30-107.30	3.4	Quarter Core
CAS-066 134.30-137.30	5.5	Quarter Core
CAS-066 143.30-146.30	5.5	Quarter Core
CAS-067 166.60-169.60	3.4	Quarter Core
CAS-067 191.10-193.70	3.4	Quarter Core
CAS-069 142.85-144.45	2.2	Quarter Core
CAS-069 175.90-178.90	5.2	Quarter Core
CAS-070 137.00-140.00	3.5	Quarter Core
CAS-070 177.10-180.10	5.8	Quarter Core
CAS-070 190.70-193.70	4.2	Quarter Core
CAS-071 81.60-54.60	3.2	Quarter Core
CAS-073 118.65-121.65	2.5	Quarter Core
CAS-073 147.70-150.70	2.1	Quarter Core
CAS-073 177.30-180.30	3.7	Quarter Core
CAS-074 171.15-173.00	2.3	Quarter Core
CAS-074 183.70-186.70	4.2	Quarter Core
CAS-074 208.79-211.79	4	Quarter Core

TABLE I-1C
MASS AND IDENTIFICATION OF SAMPLES RECEIVED
August 13, 2010

Sample ID	Mass kg	Sample Form
CAS-002 114.30-117.35	6.8	Quarter Core
CAS-002 117.35-120.40	7.6	Quarter Core
CAS-002 120.40-123.44	7.2	Quarter Core
CAS-002 123.44-126.49	6.8	Quarter Core
CAS-002 138.98-141.73	6.3	Quarter Core
CAS-002 141.73-144.78	6.6	Quarter Core
CAS-002 144.78-147.83	7.3	Quarter Core
CAS-002 147.83-150.88	3	Quarter Core
CAS-002 176.78-179.83	6.8	Quarter Core
CAS-002 179.83-181.36	2.7	Quarter Core
CAS-002 181.36-183.18	2.7	Quarter Core
CAS-002 183.18-185.62	4	Quarter Core
CAS-003 155.45-157.10	3.8	Quarter Core
CAS-003 157.10-158.50	3.4	Quarter Core
CAS-003 158.50-160.88	5.4	Quarter Core
CAS-003 160.88-163.07	6.6	Quarter Core
CAS-005 54.50-57.50	3.8	Quarter Core
CAS-005 57.50-60.50	4.3	Quarter Core
CAS-005 60.50-63.45	4.2	Quarter Core
CAS-005 63.45-66.00	2.5	Quarter Core
CAS-005 89.10-92.10	3.8	Quarter Core
CAS-005 92.10-94.30	2.6	Quarter Core
CAS-005 94.30-95.40	1.2	Quarter Core
CAS-005 95.40-97.00	1.5	Quarter Core
CAS-006 66.40-69.80	4.2	Quarter Core
CAS-006 69.80-72.80	3.1	Quarter Core
CAS-006 72.80-75.00	3.5	Quarter Core
CAS-019 36.05-39.05	3.4	Quarter Core
CAS-019 39.05-41.15	2.6	Quarter Core
CAS-019 41.15-44.15	3.2	Quarter Core
CAS-019 44.15-47.15	3.4	Quarter Core
CAS-022 49.50-52.50	2.9	Quarter Core
CAS-022 52.50-55.00	2	Quarter Core
CAS-022 55.00-58.00	2.8	Quarter Core
CAS-022 58.00-60.60	2.8	Quarter Core
CAS-025 145.00-148.00	4.3	Quarter Core
CAS-025 148.00-151.00	5.4	Quarter Core
CAS-025 151.00-152.41	2.2	Quarter Core
CAS-025 152.41-155.00	3.2	Quarter Core
CAS-025 62.50-63.20	1.1	Quarter Core
CAS-025 63.20-65.55	3.1	Quarter Core
CAS-025 65.55-68.00	3.7	Quarter Core
CAS-025 68.00-70.00	2.2	Quarter Core
CAS-025 82.29-85.00	4.4	Quarter Core
CAS-025 85.00-87.00	2.6	Quarter Core

Sample ID	Mass kg	Sample Form
CAS-025 87.00-88.56	1.9	Quarter Core
CAS-025 88.56-91.22	3.6	Quarter Core
CAS-026 100.00-102.00	3	Quarter Core
CAS-026 102.00-104.30	3.2	Quarter Core
CAS-026 97.00-100.00	3.1	Quarter Core
CAS-028 160.00-163.00	2.5	Quarter Core
CAS-028 163.00-166.00	3.1	Quarter Core
CAS-028 166.00-169.00	3.4	Quarter Core
CAS-028 169.00-172.00	3.1	Quarter Core
CAS-028 184.55-187.00	3.1	Quarter Core
CAS-028 187.00-189.00	2.6	Quarter Core
CAS-028 189.00-191.00	2.6	Quarter Core
CAS-028 191.00-194.00	4.1	Quarter Core
CAS-030 190.75-193.75	3.1	Quarter Core
CAS-030 193.75-196.75	3.6	Quarter Core
CAS-030 196.75-199.75	2.8	Quarter Core
CAS-030 199.75-201.17	1.7	Quarter Core
CAS-030 222.00-224.00	3.4	Quarter Core
CAS-030 224.00-227.00	3.7	Quarter Core
CAS-030 227.00-229.00	1.9	Quarter Core
CAS-030 229.00-230.90	2	Quarter Core
CAS-032 156.35-159.35	4.4	Quarter Core
CAS-032 159.35-162.35	3.8	Quarter Core
CAS-032 162.35-165.35	4.4	Quarter Core
CAS-032 165.35-167.30	2.6	Quarter Core
CAS-032 176.30-178.30	2.9	Quarter Core
CAS-032 178.30-179.60	1.8	Quarter Core
CAS-032 179.60-182.60	4.3	Quarter Core
CAS-032 182.60-185.00	3.8	Quarter Core
CAS-033 141.60-143.60	2.2	Quarter Core
CAS-033 143.60-145.90	3.6	Quarter Core
CAS-033 145.90-148.90	4.1	Quarter Core
CAS-033 148.90-151.90	3.6	Quarter Core
CAS-033 69.00-72.00	3.4	Quarter Core
CAS-033 72.00-75.00	4.5	Quarter Core
CAS-033 75.00-78.00	3.3	Quarter Core
CAS-033 78.00-81.00	2.8	Quarter Core
CAS-040 106.15-109.15	3.1	Quarter Core
CAS-040 109.15-112.15	3.4	Quarter Core
CAS-040 112.15-115.15	2.9	Quarter Core
CAS-040 115.15-117.35	1.9	Quarter Core
CAS-040 156.30-159.30	2.7	Quarter Core
CAS-040 159.30-162.30	3.2	Quarter Core
CAS-040 162.30-164.30	2.1	Quarter Core
CAS-040 164.30-166.50	2.1	Quarter Core

TABLE I-2

VARIABILITY HEAD ASSAYS

Sample	Assay - percent or g/tonne								
	Cu	Fe	Ag	Mo	S	Au	As	Cu(ox)	$Cu_{(CN)}$
Sample 1	0.29	1.9	4	0.031	2.22	0.34	0.004	0.01	0.05
Sample 2	0.40	2.7	4	0.019	3.61	0.34	0.003	0.03	0.19
Sample 3	0.38	1.8	5	0.035	1.70	0.47	0.003	0.02	0.05
Sample 4	0.30	2.4	3	0.063	2.39	0.38	0.002	0.02	0.17
Sample 5	0.56	1.5	3	0.073	2.09	0.54	0.002	0.04	0.33
Sample 6	0.24	1.6	2	0.086	1.97	0.25	<0.001	0.02	0.09
Sample 7	0.35	3.7	2	0.045	3.37	0.18	0.002	0.04	0.21
Sample 8	0.34	7.4	3	0.018	6.39	0.16	0.002	0.05	0.20
Sample 9	0.33	5.2	4	0.024	5.95	0.27	0.002	0.03	0.13
Sample 10	0.18	5.8	4	0.039	5.39	0.21	0.005	0.02	0.04
Sample 11	0.15	4.9	3	0.010	2.56	0.16	0.003	0.01	0.02
Sample 12	0.15	7.2	2	0.010	6.77	0.06	0.003	0.02	0.05
Sample 13	0.21	4.3	3	0.004	3.80	0.48	0.004	0.01	0.02
Sample 14	0.10	4.5	2	0.004	3.93	0.15	0.004	0.00	0.01
Sample 15	0.18	5.7	3	0.052	6.15	0.18	0.004	0.01	0.02
Sample 16	0.15	4.6	4	0.021	4.27	0.44	0.004	0.01	0.01
Sample 17	0.20	4.6	4	0.012	5.37	0.47	0.004	0.01	0.02
Sample 18	0.36	3.4	2	0.018	2.35	0.37	0.003	0.03	0.25
Sample 19	0.50	2.8	4	0.020	2.54	0.57	0.002	0.04	0.17
Sample 20	0.31	2.8	2	0.029	3.28	0.23	0.002	0.03	0.14
Sample 21	0.26	2.0	3	0.016	2.60	0.19	0.002	0.03	0.15
Sample 22	0.32	3.6	3	0.012	3.43	0.33	0.002	0.03	0.10
Sample 23	0.31	2.9	3	0.013	2.90	0.34	0.002	0.02	0.08
Sample 24	0.38	3.3	4	0.002	2.12	0.28	0.003	0.03	0.18
Sample 25	0.21	3.2	2	0.002	1.74	0.27	0.003	0.00	0.00
Sample 26	0.25	2.7	2	0.008	3.11	0.22	0.002	0.01	0.03
Sample 27	0.53	3.6	2	0.004	1.09	0.41	0.001	0.04	0.32
Sample 28	0.15	2.8	2	0.024	1.02	0.20	0.005	0.01	0.01
Sample 29	0.16	2.3	1	0.003	2.50	0.21	0.004	0.01	0.03
Sample 30	0.28	1.4	2	0.017	0.93	0.24	0.002	0.04	0.17
Sample 31	0.17	2.5	3	0.012	1.68	0.16	0.003	0.01	0.01
Sample 32	0.37	4.5	3	0.005	1.99	0.65	0.004	0.02	0.05
Sample 33	0.23	3.6	1	0.004	1.78	0.25	0.003	0.03	0.08
Sample 34	0.19	1.7	1	0.004	1.36	0.15	0.002	0.02	0.05

TABLE I-2 Continued
VARIABILITY HEAD ASSAYS

Sample	Assay - percent or g/tonne								
	Cu	Fe	Ag	Mo	S	Au	As	Cu(ox)	Cu(CN)
Sample 35	0.22	3.3	2	0.016	1.60	0.18	0.003	0.05	0.06
Sample 36	0.38	2.9	2	0.011	1.62	0.30	0.002	0.04	0.21
Sample 37	0.34	3.4	2	0.042	1.67	0.26	0.003	0.02	0.11
Sample 38	0.20	4.8	4	0.007	4.17	0.15	0.006	0.00	0.00
Sample 39	0.26	1.7	2	0.019	1.77	0.22	0.002	0.04	0.15
Sample 40	0.18	1.6	2	0.032	1.44	0.27	0.002	0.01	0.02
Sample 41	0.16	1.7	1	0.024	1.43	0.15	0.002	0.01	0.04
Sample 42	0.15	2.7	2	0.014	2.08	0.16	0.002	0.01	0.01
Sample 44	0.14	4.5	2	0.008	2.26	0.25	0.007	0.02	0.03
Sample 46	0.39	4.5	2	0.012	3.92	0.22	0.009	0.08	0.19
Sample 47	0.30	0.8	1	0.042	0.64	0.15	0.004	0.03	0.10
Sample 48	0.32	1.0	1	0.038	0.87	0.25	0.003	0.03	0.11
Sample 49	0.32	1.1	1	0.029	0.76	0.19	0.003	0.03	0.05
Sample 50	0.10	3.0	2	0.002	3.49	0.21	0.002	0.01	0.05
Sample 51	0.32	1.9	2	0.022	1.91	0.12	0.003	0.06	0.07
Sample 52	0.21	4.3	2	0.021	0.87	0.25	0.004	0.01	0.00
Sample 53	0.21	2.3	1	0.023	1.09	0.15	0.005	0.02	0.03
Sample 54	0.26	4.0	2	0.013	1.02	0.19	0.002	0.04	0.09
Sample 55	0.26	3.0	2	0.002	1.22	0.26	0.003	0.03	0.12
Sample 56	0.32	3.6	3	0.550	4.31	0.10	0.003	0.06	0.16
Sample 57	0.62	5.6	2	0.176	6.12	0.09	0.001	0.08	0.46
Sample 58	0.17	3.9	3	0.070	2.85	0.15	0.002	0.01	0.01
Sample 59	0.64	3.6	5	0.084	3.82	0.27	0.003	0.07	0.14
Sample 60	0.30	4.0	3	0.027	4.30	0.13	0.001	0.03	0.14
Sample 61	0.22	3.5	2	0.031	2.16	0.20	0.001	0.01	0.05
Sample 62	0.32	1.6	2	0.042	2.17	0.22	0.002	0.03	0.16
Sample 63	0.46	2.6	2	0.078	3.53	0.10	0.003	0.07	0.30
Sample 64	0.34	5.2	3	0.011	6.51	0.25	0.003	0.04	0.22
Sample 65	0.44	3.8	4	0.068	5.04	0.29	0.002	0.04	0.23
Sample 66	0.41	1.8	4	0.040	2.13	0.26	0.001	0.03	0.18
Sample 67	0.16	4.1	2	0.024	2.36	0.16	0.002	0.01	0.01
Sample 68	0.30	4.1	2	0.015	3.61	0.07	0.001	0.04	0.20
Sample 69	0.25	3.9	2	0.006	3.96	0.30	0.001	0.04	0.12

TABLE I-3
MASTER COMPOSITE 1 CONSTRUCTION

Sample Identification	Mass in Composite kg
Sample 01	2.18
Sample 02	2.18
Sample 03	2.18
Sample 04	2.18
Sample 05	2.18
Sample 06	2.18
Sample 07	2.18
Sample 08	2.18
Sample 09	2.18
Sample 10	2.18
Sample 11	2.18
Sample 12	2.18
Sample 13	2.18
Sample 14	2.18
Sample 15	2.18
Sample 16	2.18
Sample 17	2.18
Sample 18	2.18
Sample 19	2.18
Sample 20	2.18
Sample 21	2.18
Sample 22	2.18
Sample 23	2.18
Sample 24	2.18
Sample 25	2.18
Sample 26	2.18
Sample 27	2.18
Sample 28	2.18
Sample 29	2.18
Sample 30	2.18
Sample 31	2.18
Sample 32	2.18

Sample Identification	Mass in Composite kg
Sample 33	2.18
Sample 34	2.18
Sample 35	2.18
Sample 36	2.18
Sample 37	2.18
Sample 38	2.18
Sample 39	2.18
Sample 40	2.18
Sample 41	2.18
Sample 42	2.18
Sample 44	2.18
Sample 45	2.18
Sample 46	2.18
Sample 53	2.18
Sample 54	2.18
Sample 55	2.18
Sample 56	2.18
Sample 57	2.18
Sample 58	2.18
Sample 59	2.18
Sample 60	2.18
Sample 61	2.18
Sample 62	2.18
Sample 63	2.18
Sample 64	2.18
Sample 65	2.18
Sample 66	2.18
Sample 67	2.18
Sample 68	2.18
Sample 69	2.18
Total	135.16

TABLE I-4
REPLICATE HEAD ASSAY DATA

Sample	Assay - percent or g/tonne								
	Cu	Fe	Ag	Mo	S	Au	As	CuOx	CuCN
SUP Composite 2010 Head 3	0.31	3.44	2	0.037	2.88	0.26	0.001	0.03	0.11
SUP Composite 2010 Head 4	0.29	3.49	3	0.035	2.87	0.24	0.001	0.03	0.10
Average	**0.30**	**3.47**	**2**	**0.036**	**2.88**	**0.25**	**0.001**	**0.03**	**0.11**

TABLE I-5
REPLICATE HEAD ASSAY DATA

Sample	Assay - percent or g/tonne								
	Cu	Fe	Ag	Mo	S	Au	As	CuOx	CuCN
SUP Composite 2010-2 Head 1	0.29	3.50	2	0.032	2.81	0.18	0.001	0.03	0.11
SUP Composite 2010-2 Head 2	0.28	3.50	3	0.032	2.94	0.20	0.001	0.03	0.11
Average	**0.29**	**3.50**	**2**	**0.032**	**2.88**	**0.19**	**0.001**	**0.03**	**0.11**

Note: Ag and Au assays in g/tonne, all other assays in percent.

APPENDIX A3 COLUMN LEACH STUDY ON GOLD COMPOSITE

CASINO PROJECT

COLUMN LEACH STUDY ON GOLD COMPOSITE SAMPLE

Prepared For:

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Prepared By:

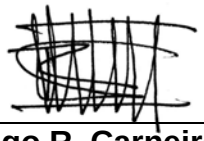
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4.0 ATTACHMENTS

Attachment 1 - Bottle Roll Testing
Attachment 2 - Column Leach Testing

1.0 INTRODUCTION

In October 2008, drill core samples from el Casino Project were received at METCON Research (METCON). These samples were air dried and prepared for a preliminary column leach study conducted at the METCON facility in Tucson, Arizona. The scope of the metallurgical study conducted included;

- Sample Preparation
- Head Assay Screen Analysis
- Bottle Roll Testing
- One Open Cycle Column Leach Test

The main objective of the column leach study was to determine the amenability of this composite sample to gold and silver extraction by heap leach type of leaching process. A secondary objective was to produce pregnant solutions and residues to be evaluated in an environmental impact study. The first 15 days of pregnant solution and the final leach residue were sent to a different laboratory per client's request.

The testing procedures utilized in the Casino project column leach test program are standard leach procedures and are common and acceptable in industrial practice. The metallurgical study was directed by Francisco A. Garcia and supervised by METCON personnel.

2.0 SUMMARY

A bottle roll test and one open cycle column leach test were conducted on a composite identified as Gold Composite No. 2. The primary objective of this test program was to generate gold and silver extraction, cyanide and calcium oxide consumption data on composite sample from the Casino Project. The data developed and metallurgical results obtained on this study are summarized in the following paragraphs.

2.1 Sample Preparation and Head Assay

On 30 October, 2009, approximately 137 kilograms of drill core samples were received at METCON facilities from EL Casino project. The drill core samples received were weighted and classified according to the identification on samples. Log in data was sent to the client to verify weights and samples identification. Table 1 summarizes the log in samples received.

Table 1
Summary of Samples Received at METCON

Sample ID	Interval (m)		Weight (kg)
	From	To	
HOLE: CAS-002	4.20	24.38	42.40
HOLE: CAS-003	1.40	24.38	37.00
HOLE: CAS-009	16.76	37.70	14.32
HOLE: CAS-011	23.00	44.00	38.84
HOLE: CAS-019	21.05	27.05	4.54
		Total	**137.10**

All samples received were screened to obtain as received particle size distribution (PSD). Each screen fraction was weighed and kept segregated in plastic bags previously identified with METCON project number, screen size and weight. Table 2 summarizes the as received particle size distribution of all samples combine.

Table 2
Summary of As Received Particle Size Distribution on Gold Composite No.2

NOMINAL OPENINGS			Sample Weights (kg)	Weight Distribution (%)	Retained (%)	Passing (%)
Millimeters	Inches	Tyler Mesh				
50.00	2		4.42	3.25	3.25	96.75
37.50	1.5		58.53	43.00	43.00	57.00
25.00	0.984	1	43.66	32.07	78.31	21.69
19.00	0.748	3/4	7.57	5.56	83.88	16.12
12.50	0.492	1/2	6.03	4.43	88.31	11.69
9.50	0.374	3/8	2.56	1.88	90.19	9.81
6.30	0.248	1/4	2.84	2.09	92.27	7.73
1.70	0.067	10	4.77	3.50	95.78	4.22
M I N U S		10	5.75	4.22	100.00	
TOTALS			**136.13**	**100.00**		

Base on the as received PSD, the sample was stage crush to 100 percent minus 37.5 mm (1.5 inch). Table 3 summarizes the final PSD on Gold Composite 2.

Table 3
Summary of Final Particle Size Distribution on Gold Composite 2

NOMINAL OPENINGS			Sample Weights (kg)	Weight Distribution (%)	Retained (%)	Passing (%)
Millimeters	Inches	Tyler Mesh				
37.50	1.500		0.00	100.00	0.00	0.00
25.00	0.984	1	85.68	63.03	63.03	36.97
19.00	0.748	3/4	15.57	11.45	74.48	25.52
12.50	0.492	1/2	11.05	8.13	82.61	17.39
9.50	0.374	3/8	4.16	3.06	85.67	14.33
6.30	0.248	1/4	4.66	3.43	89.10	10.90
1.70	0.067	10	7.14	5.25	94.35	5.65
M I N U S10			7.68	5.65	100.00	
		Total	**135.94**			

Two test charges of approximately 45 kilograms were split for column testing and head screen assay based on the above particle size distribution. The screen fractions from the head sample test charge was stage crushed to 100 percent minus 1.7 mm and approximately 1,000 grams were split from each screen fraction, pulverized to 100 percent minus 150 microns and approximately 150 grams were split and submitted for gold assay by fire assay/AA finish and silver by Geochem method. The gold, silver and copper analyses on the head sample are summarized in Table 4 below.

Table 4
Summary of Head Screen Assay Analysis

NOMINAL OPENINGS			Sample Weights (kg)	Weight Distribution (%)	Cumulative Weight Retained (%)	Gold			Silver			Copper		
Millimeters	Inches	Tyler Mesh				Assay (g/t)	Content	Distribution (%)	Assay (%)	Content	Distribution (%)	Assay (%)	Content	Distribution (%)
25.0	0.984	1	28.3	62.94	62.94	0.42	0.264	65.20	3.0	1.888	64.84	0.055	345.57	65.68
19.0	0.748	3/4	5.15	11.45	74.40	0.32	0.037	9.04	3.0	0.344	11.80	0.050	56.93	10.82
12.5	0.492	1/2	3.64	8.10	82.50	0.33	0.027	6.59	3.0	0.243	8.34	0.037	30.12	5.72
9.5	0.374	3/8	1.39	3.09	85.59	0.30	0.009	2.29	2.0	0.062	2.12	0.046	14.13	2.69
6.3	0.248	1/4	1.57	3.49	89.08	0.24	0.008	2.07	3.0	0.105	3.60	0.047	16.55	3.15
1.7	0.067	10	2.36	5.25	94.33	0.28	0.015	3.62	3.0	0.157	5.41	0.049	25.72	4.89
M I N U S		10	2.55	5.67	100.00	0.80	0.045	11.19	2.0	0.113	3.89	0.066	37.15	7.06
	TOTALS		44.96	100.00				100.00			100.00			100.00
CALCULATED ASSAY						0.41			2.9			0.053		
COMPOSITE ASSAY (Pulv.)						0.48			3.0			0.053		

The following comments relate to calculated gold, silver and copper analyses conducted on the head composite sample.

- Gold content in the head was 0.41 g/t and approximately 65 percent of the gold contained in the head sample reported to the 1 inch screen fraction.

- Silver content was low with 2.5 g/t and approximately 65 percent of this silver contained in the sample reported to the 1 inch fraction.

2.2 Bottle Roll Test

A minus 10 mesh composite sample was reconstituted based on the final PSD for bottle roll testing. The bottle roll testing was conducted under the following leaching conditions.

- Leach cycle of 48 hours.
- Test charge of 500 grams.
- 33 percent solids.
- 1 g/l of free sodium cyanide in solution.
- pH range of 10.5 to 11.
- Sampling at 3, 6, 24 hours.
- Pregnant solutions submitted for Au, Ag, Cu, pH, free calcium Oxide and sodium cyanide.

The following table summarizes the results obtained in the bottle roll leach test conducted on the gold Composite No. 2.

Table 5
Ambient 48 hr. Bottle Roll Leach Tests

Leach Test No.	NaCN Consumption (kg/tonne)	CaO Consumption (kg/tonne)	Leach Time (hr)	CUMULATIVE EXTRACTION				
				Au %	Ag %	Cu %	Au (g/t)	Ag (g/t)
BR-01	0.71	2.64	**48**	82.35	16.97	54.09	0.32	0.51

The following comments relate to bottle roll testing conducted on gold composite sample No. 2.

- Gold extraction of approximately 82 percent was achieved on the Gold Composite No. 2.

- A low Silver extraction of approximately 17 percent was obtained after 48 hours of leach cycle.

- A low cyanide consumption of 0.71 kg/tonne was observed.

- A high calcium oxide consumption of 2.64 kg/tonne was observed.

- The metallurgical developed on the bottle roll test are included in this report.

2.3 Open Cycle Column Leach Test

One 45 kilograms open cycle column leach tests was conducted at a crush size of approximately 100 percent passing 1.5 inches, Test charge for column test was reconstituted from individual screen fractions in accordance with the particle size distribution and loaded into 6 inch in diameter by 3 meter tall PVC columns. Prior to loading the columns, the calcium oxide consumed (kg/t) in 48 hour bottle roll was added to each test charge. The leaching parameters used in this column leach test are summarized below:

- Approximately 2.64 kg/tonne of calcium oxide was blended into test charge.
- The initial feed solution was prepared by adding reagent grade calcium oxide to Tucson tap water to obtain a solution pH of 11.00 followed by the addition of 1 gram of sodium cyanide per liter of solution. The column was irrigated at a flow rate of 12 liters per hour per square meter.
- Column test was conducted under open cycle type of leaching regime.
- Leach Cycle of 38 days.
- First 15 days of pregnant solution were sent to a Laboratory per client's request.
- All solution samples were assayed for gold, silver, copper, pH and free sodium cyanide and calcium oxide.
- Leach residue was shipped to a different laboratory per client's request.
- Metals extractions obtained in the column leach test are labeled as "Indicated Extraction" since the leached residue sample was not assayed.

The metallurgical data developed after 38 days of leaching are attached to this report. The following table summarizes the metallurgical results obtained in column leach test CL-01.

Table 6
Summary of Column Leach Test Conducted on Gold Composite No. 2

Test No.	Leach Day	Head Assay Screen (g/t)			Indicated Extraction (%)			Reagent Consumption (kg/t)	
		Au (g/t)	Ag (g/t)	Cu (g/t)	Au	Ag	Cu	NaCN	CaO
CL-01	38	0.41	2.9	526	50.45	17.90	18.75	0.40	3.59

The following comments relate to the column leach test conducted on the gold composite No.2.

- Indicated gold extraction of approximately 50 percent was obtained on this column test after 38 days of leach cycle.
- Indicated silver extraction of approximately 18 percent of the total silver contained in the head.
- Indicated copper extraction of approximately 19 percent of the total copper contained in the head.
- Low sodium cyanide consumption of 0.41 kg/t was observed in this composite sample.
- A high calcium oxide consumption of 2.9 kg/t was obtained after 38 days of leach cycle bottle roll test.

3.0 CONCLUSIONS AND RECOMMENDATIONS

The following conclusions and recommendations are based on the metallurgical data developed under open cycle cyanide column leach testing conducted on gold Composite Sample No. 2.

- Indicated gold extraction of approximately 50 percent was obtained on gold Composite Sample No. 2 after 38 days of leach cycle.
- Indicated silver extraction of approximately 18 percent was obtained.
- Indicated copper extraction of approximately 19 percent was obtained.
- Low sodium cyanide consumption of 0.41 kg/t was observed on this composite sample.
- High calcium oxide consumption of 2.9 kg/t was obtained in the bottle roll test.

4.0 ATTACHMENTS

Attachment 1 - Bottle Roll Testing
Attachment 2 - Column Leach Testing

ATTACHMENT 1

Bottle Roll Data

METCON Research

Standard Cyanide Bottle Leach Test Data Log

OBJECTIVE : **Cyanidation to make a preliminary assessment of gold, silver, and copper extraction**

CLIENT : **Western Copper Corporation**
SAMPLE I.D : **Gold Composite #2**
FEED WEIGHT : **500.00** grams
FEED SIZE : **P_{100} = 10 Mesh**

PROJECT NO : **M-709-02**
DATE BEGIN : **11/23/09**
DATE END : **11/25/09**
TEST No. : **BR-01**

CONDITION AND REAGENTS

OPERATION	SLURRY CONDITIONS						REAGENT ADDITION				PREGNANT SOLUTION ASSAY								
	Volume (liter)	Percent Solids	Leach Period(hr)	pHi/pHf				NaCN (g)	CaO (g)		NaCN (g/l)	CaO (g/l)	pH						
Conditioning	1.000	33.33	0	3.95/10.83					0.98										
Pregnant Solution	1.000	33.33	3	11.01				1.00	0.11		0.76	0.05	10.98						
Pregnant Solution	1.000	33.33	6	10.75				0.24	0.05		0.92	0.03	10.80						
Pregnant Solution	1.000	33.33	24	10.82				0.08	0.22		0.92	0.03	10.82						
Pregnant Solution	0.830		48	10.93							0.84	0.03	10.93						
Wash Solution (2)	0.640										0.24	0.02	10.71						
Cyanide and Lime Consumption (kg/tonne)								0.71	2.64										

REMARKS:
(1) 40 ml Aliquot sample was removed after 3, 6, and 24 hours of leaching
(2) The leach residue was water wash three times (3x200ml)

METALLURGICAL RESULTS

PRODUCT	VOLUME (ml)	WEIGHT (g)	ASSAYS Au (ppm)	Ag (ppm)	Cu (ppm)			CUMULATIVE CONTENT Au (mg)	Ag (mg)	Cu (mg)			CUMULATIVE EXTRACTION (3) Au (%)	Ag (%)	Cu (%)	Au (g/t)	Ag (g/t)	Cu (g/t)
3 hr. Pregnant Leach	1000		0.06	0.16	113			0.0600	0.1600	113.0			30.46	10.70	43.90	0.12	0.32	226.0
6 hr. Pregnant Leach	1000		0.10	0.19	123			0.1000	0.1964	127.5			50.77	13.14	49.55	0.20	0.39	255.0
24 hr. Pregnant Leach	1000		0.14	0.21	129			0.1440	0.2240	138.4			73.11	14.99	53.79	0.29	0.45	276.9
48 hr. Pregnant Leach (4)	830		0.18	0.24	127			0.1622	0.2536	139.2			82.35	16.97	54.09	0.32	0.51	278.4
Wash Solution	640		0.01	0.05	30													
Leach Residue		496.49	0.07	2.50	238			0.0348	1.2412	118.2			17.65	83.03	45.91			
Calc. Head			0.39	2.99	515			0.1970	1.4948	257.4			100.00	100.00	100.00			
Assay Head (5)		500.00	0.41	2.90	526			0.2050	1.4500	263.0								

REMARKS:
(3) Percent extraction based on calculated head (solutions plus leach residue contents)
(4) The 48 hr. pregnant solution metal content includes wash solutions and aliquot samples contents
(5) Composite assay head

ATTACHMENT 2

Column Leach Study

Summary of Results Current Date: 05/15/12

METCON Project No.: M-709-02

Western Copper Corporation

TEST No.: CL-01 CRUSH SIZE : 100% Passing 1-1/2 inch

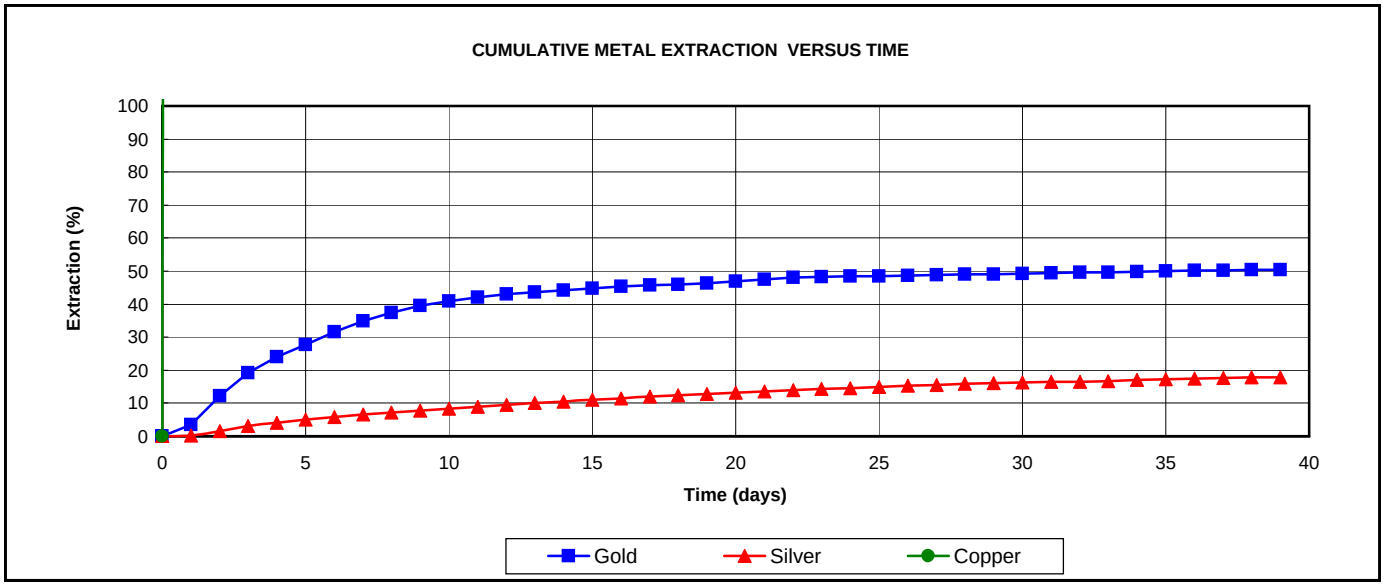
SAMPLE : Gold Composite # 2 CURE DOSAGE : 2.64 kg of CaO/tonne of sample

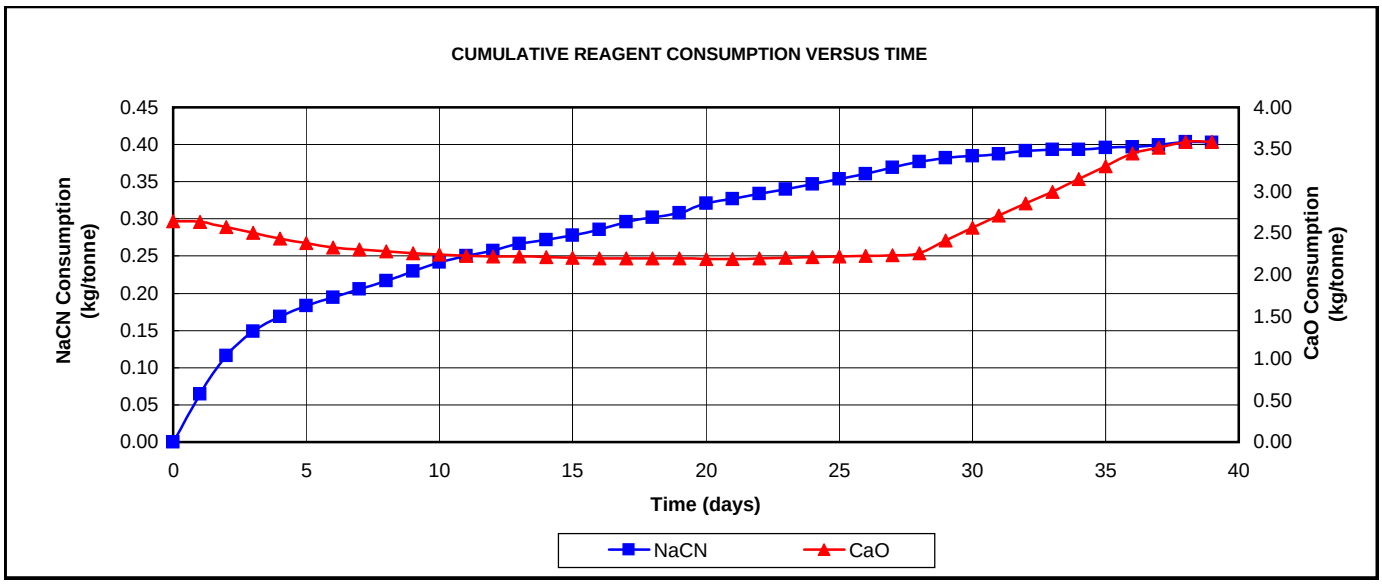
Preliminary Precious Metal Recovery and Reagent Consumption under Open Cycle Leaching

0

Cure Days	None
Leach Days	38
Wash Days	0
Drain Days	1
Total Cycle Days	39

PRODUCTS	Volume (liters)	Weight (kg)	Cumulative									Consumption	
			Assay (g/tonne)			Contents (mg)			Percent Extraction			NaCN	CaO
			Au	Ag	Cu	Au	Ag	Cu	Au	Ag	Cu	(kg/tonne)	(kg/tonne)
Feed Solution	206.40		0.00	0.00	0.00	0.00	0.00	0.00	50.45	17.90	18.75	0.40	3.59
Pregnant Solution	202.02		0.05	0.12	21.96	9.20	23.43	4435.99					
Leach Residue		44.90	0.00	0.00	0	0.00	0.00	0.00					
CALCULATIONS													
Metal Extracted			0.20	0.52	98.67	9.20	23.43	4435.99					
Calculated Head			0.20	0.52	0.010	9.20	23.43	4435.99					
Assay Head		44.96	0.41	2.91	0.053	18.23	130.94	23656.4					





METCON Research

TEST No. CL-01

PHYSICAL CHARACTERISTICS SHEET

CLIENT	Western Copper Corporation METCON Project No.: M-709-02	**TEST CONDITIONS**	
		TEST START	12/02/09
SAMPLE	Gold Composite # 2	**COLUMN SIZE**	6 inch diameter by 10 feet tall
		CRUSH SIZE	100% Passing 1-1/2 inch
		LEACH SOLUTION	500 ppm NaCN
OBJECTIVE	Preliminary Precious Metal Recovery and Reagent Consumption under Open Cycle Leaching	**CURE DOSAGE**	2.64 kg CaO/tonne of ore
		CURE CYCLE	0 days
		FLOWRATE	0.005 gpm/sq. ft - 12.22 lph/sq.m

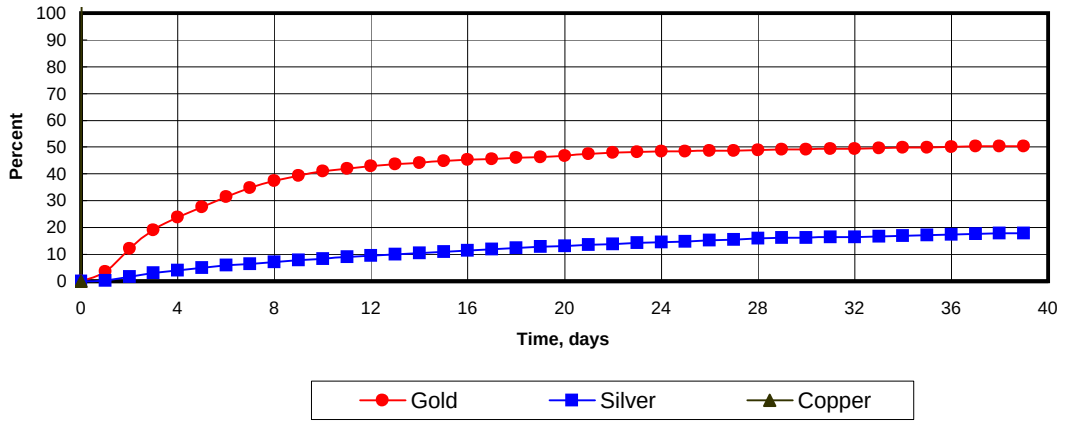
FLOWRATE (lph/sq m)			12.22	
CURE STAGE (days)			None	
COLUMN DIAMETER (mm)			152.40	
ELEMENTS ANALYZED	Au	Ag	Cu	
HEAD ASSAYS (grams per tonne)	0.41	2.9	0	
LEACH RESIDUE ASSAYS (grams per tonne)	0.00	0.0	0	
SAMPLE PERCENT MOISTURE AS RECEIVED (Dry Basis)			0.00	
SAMPLE WEIGHT BEFORE AGGLOMERATION (kg)			44.96	
AGGLOMERATED SAMPLE WEIGHT (kg)			44.96	
INITIAL SAMPLE PERCENT MOISTURE (including agglomeration water)			0.00	(Dry Basis)
INITIAL SAMPLE DRY WEIGHT (kg)			44.96	
INITIAL SAMPLE HEIGHT (m)			1.64	
INITIAL SAMPLE BULK DENSITY (kg/cu m)			1505	(Dry Basis)
FINAL SAMPLE HEIGHT (m)			1.61	
RESIDUE WET WEIGHT (kg)			48.34	
RESIDUE DRY WEIGHT (kg)			44.90	
VOLUME DRAINED (l)			0.72	
SUBSIDENCE (%)			1.94	
MOISTURE UNDER LEACH (%)			9.27	(Dry Basis)
MOISTURE RETAINED (%)			7.66	(Dry Basis)
FINAL SAMPLE BULK DENSITY (kg/cu m)			1532.26	(Dry Basis)

METCON Research

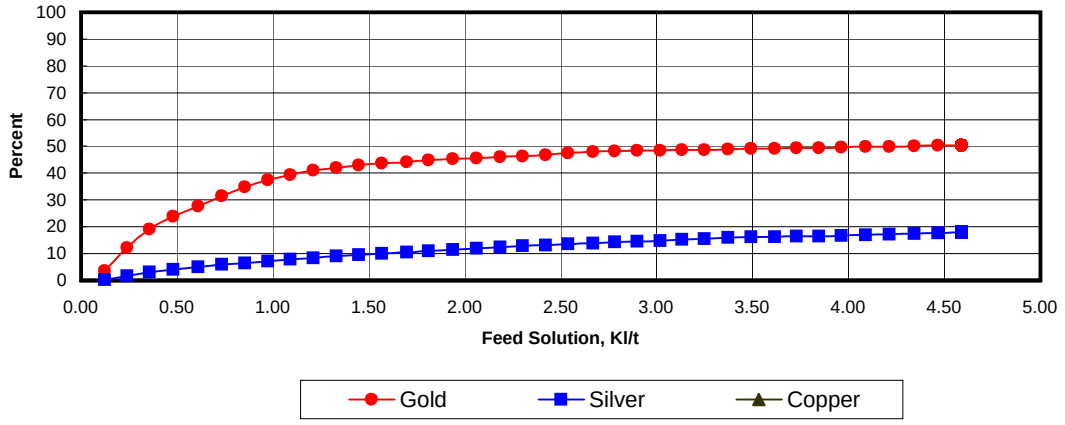
Test: CL-01 — Western Copper Corporation

Sample: Gold Composite # 2 — METCON Project No.: M-709-02

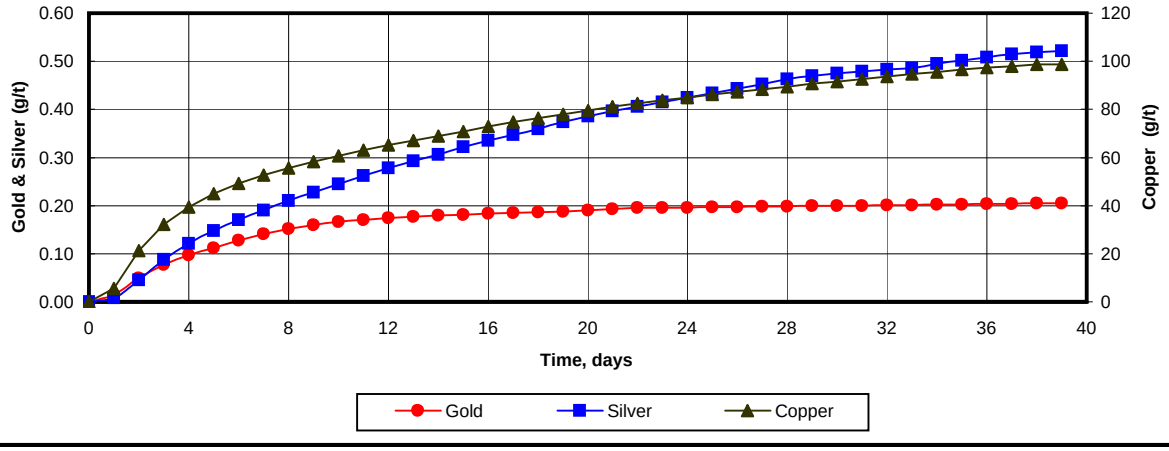
CUMULATIVE METAL EXTRACTION VERSUS TIME



CUMULATIVE METAL EXTRACTION VERSUS FEED SOLUTION (Kl/t)



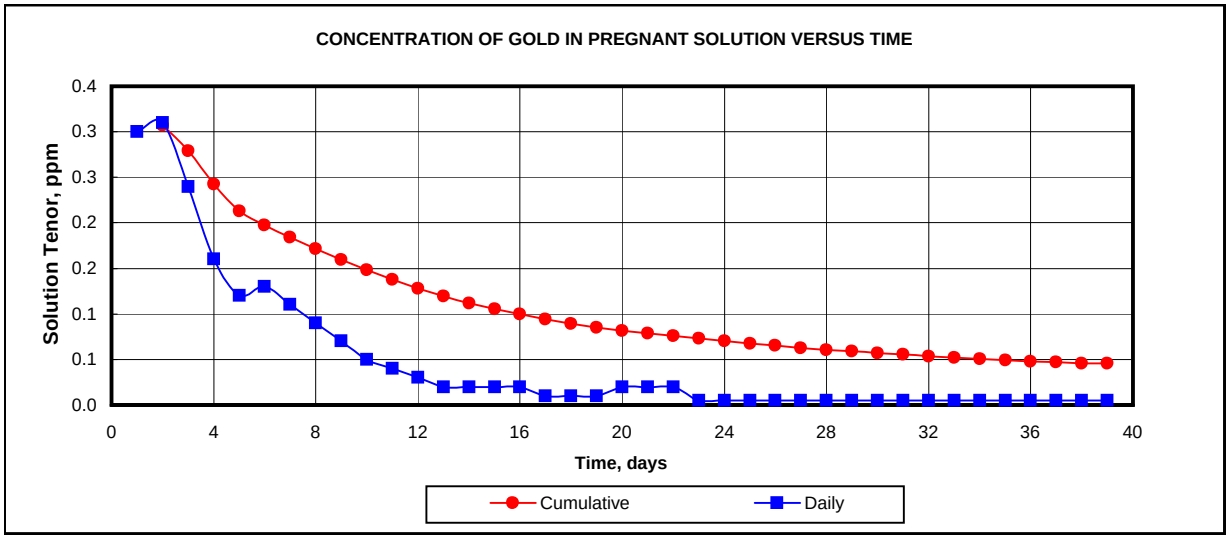
CUMULATIVE GOLD EXTRACTION VERSUS TIME

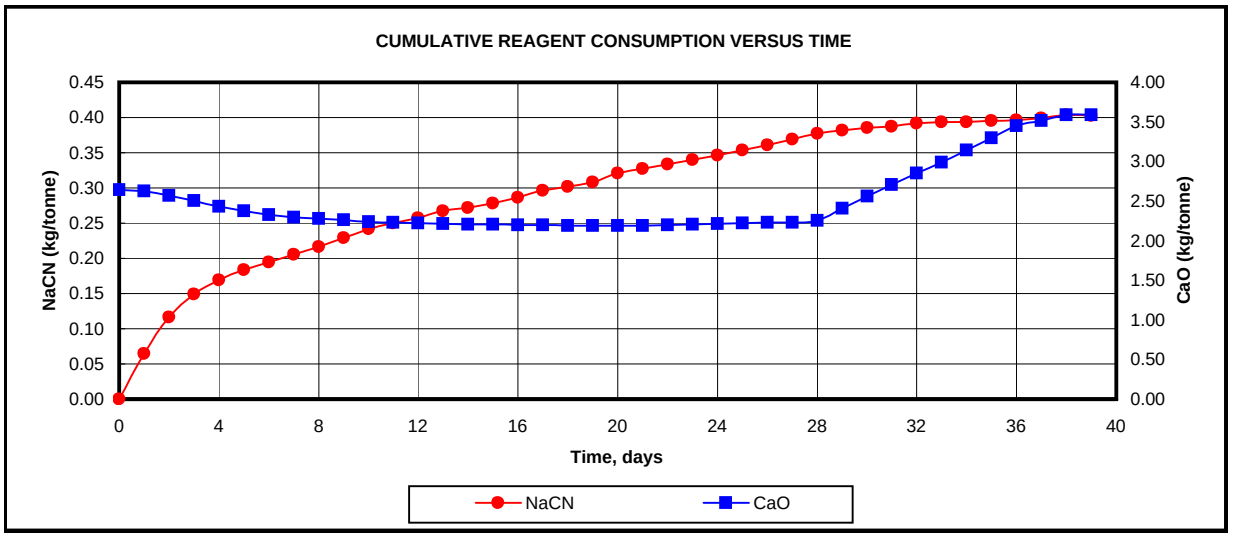


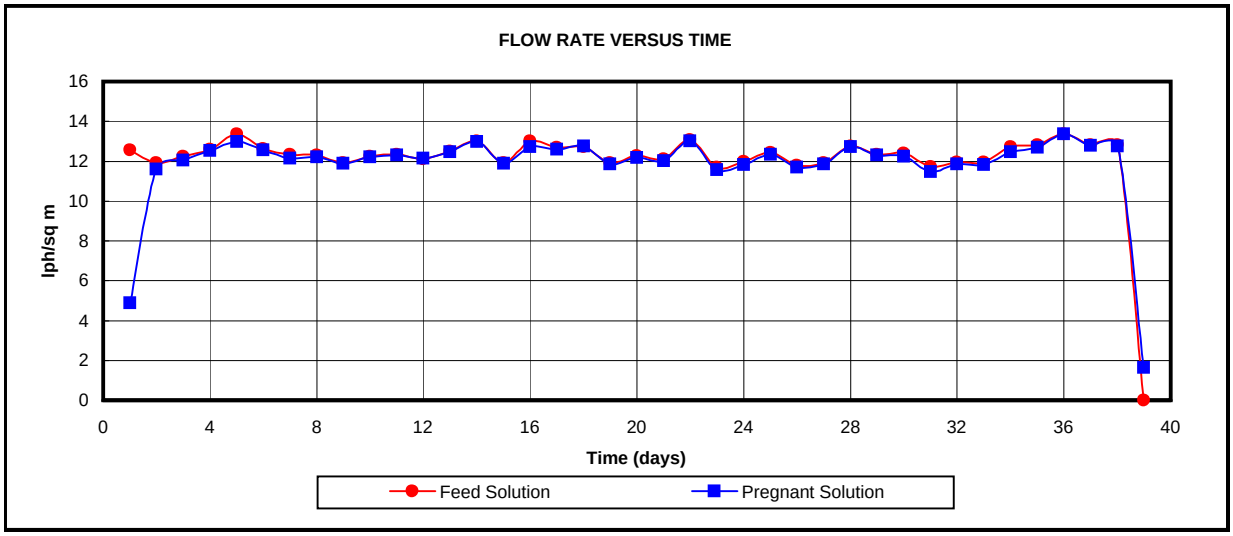
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Test: CL-01 — Western Copper Corporation

Sample: Gold Composite # 2 — METCON Project No.: M-709-02



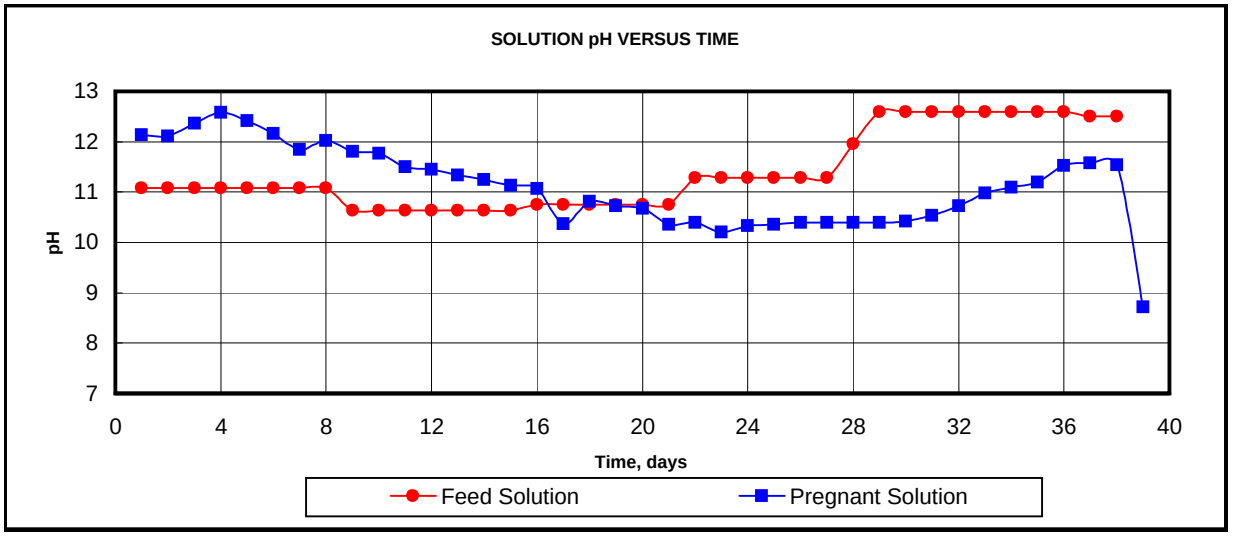


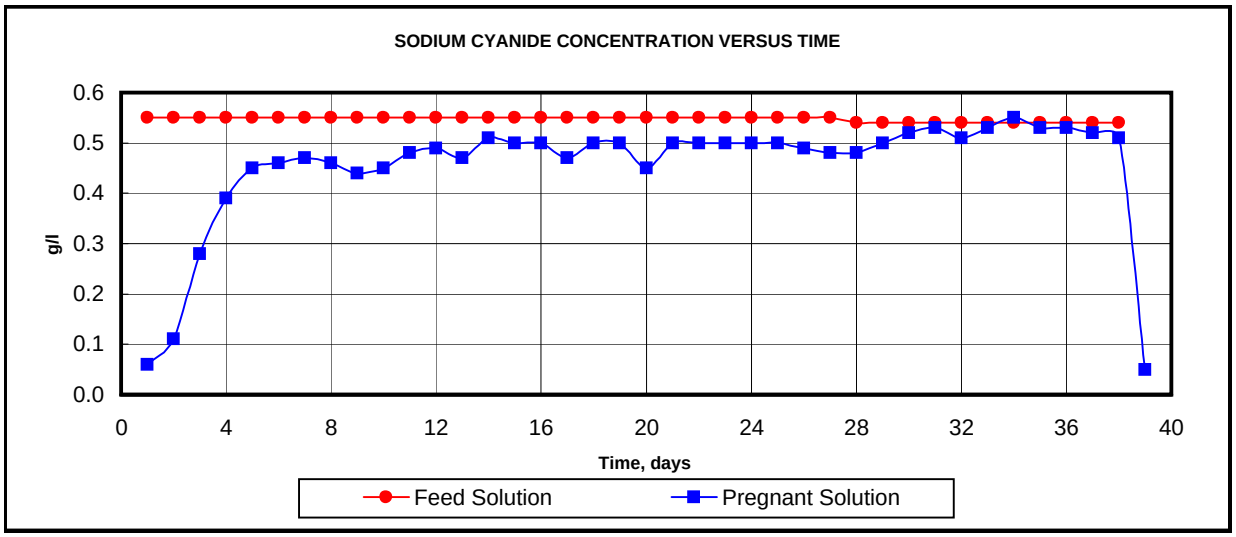


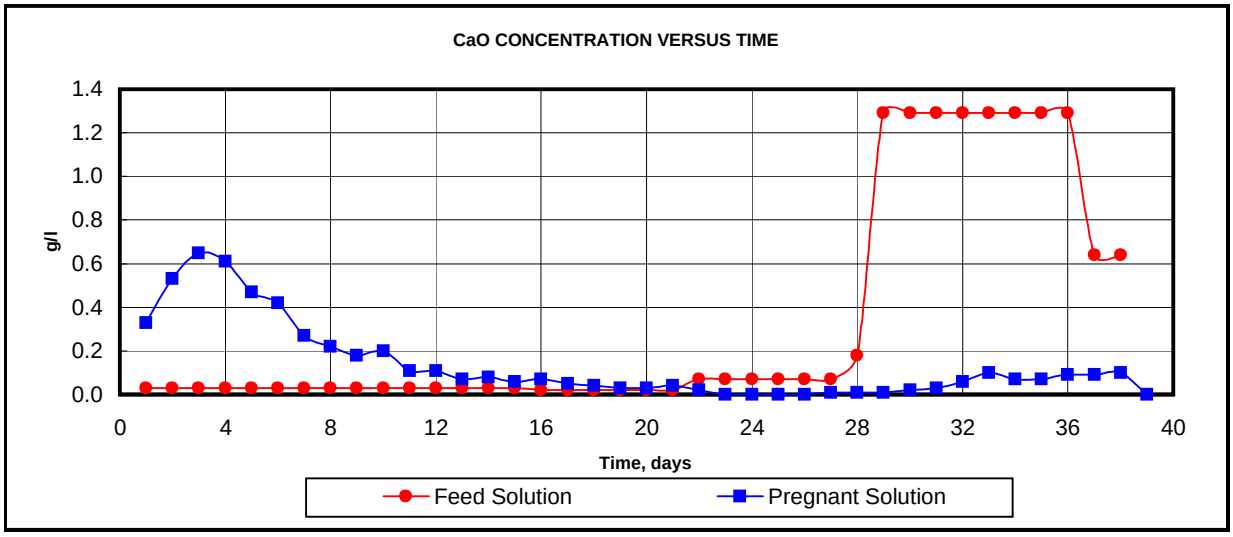
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Test: CL-01 — Western Copper Corporation

Sample: Gold Composite # 2 — METCON Project No.: M-709-02







METCON Research
7701 BUSINESS PARK DRIVE
TUCSON , ARIZONA 85743

SCREEN ANALYSIS RESULTS
Western Copper Corporation
METCON Project No.: M-709-02

SCREEN ANALYSIS			Sample: **Column Leach Head CL-01 Gold Composite # 2 100% Passing 1-1/2 inch**											
NOMINAL OPENINGS						Gold			Silver			Copper		
Millimeters	Inches	Tyler Mesh	Sample Weights (kg)	Weight Distribution (%)	Cumulative Weight Retained (%)	Assay (g/t)	Content	Distribution (%)	Assay (g/t)	Content	Distribution (%)	Assay (%)	Content	Distribution (%)
25.0	0.984	1	28.3	62.94	62.94	0.42	0.264	65.20	3.00	1.888	64.84	0.055	0.03	65.68
19.0	0.748	3/4	5.15	11.45	74.40	0.32	0.037	9.04	3.00	0.344	11.80	0.050	0.01	10.82
12.5	0.492	1/2	3.64	8.10	82.50	0.33	0.027	6.59	3.00	0.243	8.34	0.037	0.00	5.72
9.5	0.374	3/8	1.39	3.09	85.59	0.30	0.009	2.29	2.00	0.062	2.12	0.046	0.00	2.69
6.3	0.248	1/4	1.57	3.49	89.08	0.24	0.008	2.07	3.00	0.105	3.60	0.047	0.00	3.15
1.7	0.067	10	2.36	5.25	94.33	0.28	0.015	3.62	3.00	0.157	5.41	0.049	0.00	4.89
M I N U S		10	2.55	5.67	100.00	0.80	0.045	11.19	2.00	0.113	3.89	0.066	0.00	7.06
TOTALS			44.96	100.00				100.00	19.00		100.00			100.00
CALCULATED ASSAY						0.41			2.91			0.053		
COMPOSITE ASSAY (Pulv.)						0.48			3.00			0.053		
COMPOSITE ASSAY (<10 mesh)														

METCON Research

TEST No. CL-01

Data Sheet

CLIENT	Western Copper Corporation	**TEST CONDITIONS**	
	METCON Project No.: M-709-02	**TEST START**	12/02/09
SAMPLE	Gold Composite # 2	**COLUMN SIZE**	6 inch diameter by 10 feet tall
		CRUSH SIZE	100% Passing 1-1/2 inch
		LEACH SOLUTION	500 ppm NaCN
OBJECTIVE	Preliminary Precious Metal Recovery	**CURE DOSAGE**	2.64 kg CaO/tonne of ore
	and Reagent Consumption under Open Cycle Leaching	**CURE CYCLE**	None Days
	0	**FLOWRATE**	12.22 lph/sq m (0.005 gpm/sq ft)

	Pregnant Leach Solution							**Feed Solution**							
		Free			Assays				Free			NaCN	Assays		
Time	Volume	NaCN	CaO	pH	Au	Ag	Cu	Volume	NaCN	CaO	pH	Add/Rem.	Au	Ag	Cu
(Days)	(l)	(g/l)	(g/l)		(ppm)	(ppm)	(ppm)	(l)	(g/l)	(g/l)		(grams)	(ppm)	(ppm)	(ppm)
Agglom.	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.000	0.000	0.00
1	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.000	0.000	0.00
2	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.000	0.000	0.00
3	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00	0.00	0.00	0	0.00	0.000	0.000	0.00
Leach 1	2.15	0.06	0.33	12.13	0.30	0.17	118.00	5.52	0.55	0.03	11.08	0.00	0.00	0.00	0.00
2	5.10	0.11	0.53	12.11	0.31	0.33	138.00	5.24	0.55	0.03	11.08	0.00	0.00	0.00	0.00
3	5.24	0.28	0.65	12.37	0.24	0.36	93.00	5.33	0.55	0.03	11.08	0.00	0.00	0.00	0.00
4	5.54	0.39	0.61	12.58	0.16	0.27	59.00	5.57	0.55	0.03	11.08	0.00	0.00	0.00	0.00
5	5.63	0.45	0.47	12.42	0.12	0.21	44.00	5.79	0.55	0.03	11.08	0.00	0.00	0.00	0.00
6	5.51	0.46	0.42	12.16	0.13	0.19	36.00	5.54	0.55	0.03	11.08	0.00	0.00	0.00	0.00
7	5.34	0.47	0.27	11.84	0.11	0.17	29.00	5.43	0.55	0.03	11.08	0.00	0.00	0.00	0.00
8	5.36	0.46	0.22	12.02	0.09	0.16	24.00	5.40	0.55	0.03	11.08	0.00	0.00	0.00	0.00
9	5.18	0.44	0.18	11.80	0.07	0.15	22.00	5.20	0.55	0.03	10.64	0.00	0.00	0.00	0.00
10	5.36	0.45	0.20	11.77	0.05	0.15	21.00	5.38	0.55	0.03	10.64	0.00	0.00	0.00	0.00
11	5.40	0.48	0.11	11.50	0.04	0.14	19.00	5.42	0.55	0.03	10.64	0.00	0.00	0.00	0.00
12	5.32	0.49	0.11	11.45	0.03	0.14	18.00	5.30	0.55	0.03	10.64	0.00	0.00	0.00	0.00
13	5.38	0.47	0.07	11.34	0.02	0.12	17.00	5.40	0.55	0.03	10.64	0.00	0.00	0.00	0.00
14	5.74	0.51	0.08	11.25	0.02	0.11	15.00	5.75	0.55	0.03	10.64	0.00	0.00	0.00	0.00
15	5.18	0.50	0.06	11.13	0.02	0.13	16.00	5.20	0.55	0.03	10.64	0.00	0.00	0.00	0.00
16	5.57	0.50	0.07	11.07	0.02	0.11	16.00	5.70	0.55	0.02	10.75	0.00	0.00	0.00	0.00
17	5.52	0.47	0.05	10.37	0.01	0.10	14.60	5.55	0.55	0.02	10.75	0.00	0.00	0.00	0.00
18	5.56	0.50	0.04	10.81	0.01	0.10	13.70	5.55	0.55	0.02	10.75	0.00	0.00	0.00	0.00
19	5.23	0.50	0.03	10.73	0.01	0.12	13.60	5.26	0.55	0.02	10.75	0.00	0.00	0.00	0.00
20	5.30	0.45	0.03	10.67	0.02	0.10	13.50	5.33	0.55	0.02	10.75	0.00	0.00	0.00	0.00
21	5.26	0.50	0.04	10.36	0.02	0.09	14.00	5.30	0.55	0.02	10.75	0.00	0.00	0.00	0.00
22	5.72	0.50	0.02	10.39	0.02	0.08	11.00	5.75	0.55	0.07	11.29	0.00	0.00	0.00	0.00
23	5.08	0.50	0.00	10.20	0.01	0.08	11.00	5.14	0.55	0.07	11.29	0.00	0.00	0.00	0.00
24	5.18	0.50	0.00	10.33	0.01	0.08	10.30	5.24	0.55	0.07	11.29	0.00	0.00	0.00	0.00
25	5.40	0.50	0.00	10.36	0.01	0.08	9.40	5.45	0.55	0.07	11.29	0.00	0.00	0.00	0.00
26	5.08	0.49	0.00	10.39	0.01	0.08	9.30	5.13	0.55	0.07	11.29	0.00	0.00	0.00	0.00
27	5.22	0.48	0.01	10.39	0.01	0.08	10.20	5.26	0.55	0.07	11.29	0.00	0.00	0.00	0.00
28	5.53	0.48	0.01	10.40	0.01	0.09	9.50	5.55	0.54	0.18	11.96	0.00	0.00	0.00	0.00
29	5.40	0.50	0.01	10.40	0.01	0.05	9.30	5.42	0.54	1.29	12.59	0.00	0.00	0.00	0.00
30	5.42	0.52	0.02	10.42	0.01	0.05	8.30	5.48	0.54	1.29	12.59	0.00	0.00	0.00	0.00

METCON Research

TEST No. CL-01

Data Sheet

CLIENT	Western Copper Corporation	**TEST CONDITIONS**	
	METCON Project No.: M-709-02	**TEST START**	12/02/09
SAMPLE	Gold Composite # 2	**COLUMN SIZE**	6 inch diameter by 10 feet tall
		CRUSH SIZE	100% Passing 1-1/2 inch
		LEACH SOLUTION	500 ppm NaCN
OBJECTIVE	Preliminary Precious Metal Recovery	**CURE DOSAGE**	2.64 kg CaO/tonne of ore
	and Reagent Consumption under Open Cycle Leaching	**CURE CYCLE**	None Days
	0	**FLOWRATE**	12.22 lph/sq m (0.005 gpm/sq ft)

	Pregnant Leach Solution							**Feed Solution**							
		Free			Assays				Free			NaCN	Assays		
Time (Days)	Volume (l)	NaCN (g/l)	CaO (g/l)	pH	Au (ppm)	Ag (ppm)	Cu (ppm)	Volume (l)	NaCN (g/l)	CaO (g/l)	pH	Add/Rem. (grams)	Au (ppm)	Ag (ppm)	Cu (ppm)
31	4.99	0.53	0.03	10.53	0.01	0.03	9.60	5.10	0.54	1.29	12.59	0.00	0.00	0.00	0.00
32	5.22	0.51	0.06	10.72	0.01	0.03	7.80	5.28	0.54	1.29	12.59	0.00	0.00	0.00	0.00
33	5.14	0.53	0.10	10.98	0.01	0.03	9.30	5.20	0.54	1.29	12.59	0.00	0.00	0.00	0.00
34	5.54	0.55	0.07	11.09	0.01	0.07	7.70	5.65	0.54	1.29	12.59	0.00	0.00	0.00	0.00
35	5.50	0.53	0.07	11.20	0.01	0.06	7.00	5.55	0.54	1.29	12.59	0.00	0.00	0.00	0.00
36	5.86	0.53	0.09	11.53	0.01	0.05	6.00	5.85	0.54	1.29	12.59	0.00	0.00	0.00	0.00
37	5.54	0.52	0.09	11.57	0.01	0.05	6.00	5.55	0.54	0.64	12.50	0.00	0.00	0.00	0.00
38	5.62	0.51	0.10	11.54	0.01	0.04	5.00	5.65	0.54	0.64	12.50	0.00	0.00	0.00	0.00
39	0.72	0.05	0.00	8.71	0.01	0.11	2.75								
40															
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METCON Research

TEST No. CL-01

METALLURGICAL RESULTS

CLIENT	Western Copper Corporation	**TEST CONDITIONS**		
	METCON Project No.: M-709-02	**TEST START**	12/02/09	
SAMPLE	Gold Composite # 2	**COLUMN SIZE**	6 inch diameter by 10 feet tall	
		CRUSH SIZE	100% Passing 1-1/2 inch	
		LEACH SOLUTION	500 ppm NaCN	
OBJECTIVE	Preliminary Precious Metal Recovery	**CURE DOSAGE**	2.64	kg CaO/tonne of ore
	and Reagent Consumption under Open Cycle Leaching	**CURE CYCLE**	None	Days
	0	**FLOWRATE**	12.22	lph/sq m (0.005 gpm/sq ft)

Time		Feed Solution Application Flow Rate		Cumulative									Consumption	
				Extraction (g/tonne)			Solution Grade (ppm)			Extraction (%)				
(Days)		(lph/sq m)	(Kl/t)	Au	Ag	Cu	Au	Ag	Cu	Au	Ag	Cu	NaCN (kg/tonne)	CaO (kg/tonne)
Agglom.													0.00	2.64
Rest	1			0.00	0.00	0.00				0.00	0.00	0.00	0.00	2.64
Rest	2			0.00	0.00	0.00				0.00	0.00	0.00	0.00	2.64
Rest	3			0.00	0.00	0.00				0.00	0.00	0.00	0.00	2.64
Leach	1	12.57	0.12	0.01	0.01	5.65				3.54	0.28	10734.35	0.06	2.63
	2	11.93	0.24	0.05	0.05	21.30				12.21	1.56	40485.30	0.12	2.57
	3	12.25	0.36	0.08	0.09	32.14	0.28	0.32	115.68	19.11	3.01	61085.23	0.15	2.50
	4	12.59	0.48	0.10	0.12	39.41	0.24	0.30	98.26	23.98	4.15	74907.20	0.17	2.43
	5	13.36	0.61	0.11	0.15	44.92	0.21	0.28	85.36	27.68	5.05	85369.49	0.18	2.37
	6	12.63	0.73	0.13	0.17	49.33	0.20	0.26	76.04	31.61	5.85	93754.54	0.19	2.33
	7	12.33	0.85	0.14	0.19	52.77	0.18	0.25	68.76	34.83	6.54	100300.76	0.21	2.30
	8	12.29	0.97	0.15	0.21	55.64	0.17	0.24	62.74	37.48	7.20	105738.62	0.22	2.28
	9	11.92	1.09	0.16	0.23	58.17	0.16	0.23	58.06	39.47	7.79	110555.92	0.23	2.26
	10	12.25	1.21	0.17	0.24	60.67	0.15	0.22	54.12	40.94	8.41	115314.04	0.24	2.24
	11	12.34	1.33	0.17	0.26	62.96	0.14	0.21	50.72	42.12	8.98	119651.14	0.25	2.23
	12	12.11	1.45	0.17	0.28	65.09	0.13	0.20	47.87	43.00	9.55	123699.09	0.26	2.22
	13	12.51	1.57	0.18	0.29	67.12	0.12	0.20	45.37	43.59	10.04	127565.28	0.27	2.21
	14	13.00	1.70	0.18	0.31	69.04	0.11	0.19	42.96	44.22	10.53	131204.89	0.27	2.21
	15	11.92	1.81	0.18	0.32	70.88	0.11	0.19	41.16	44.79	11.04	134708.38	0.28	2.20
	16	13.02	1.94	0.18	0.34	72.86	0.10	0.18	39.47	45.40	11.51	138475.65	0.29	2.20
	17	12.68	2.06	0.19	0.35	74.65	0.09	0.18	37.92	45.70	11.93	141882.43	0.30	2.20
	18	12.72	2.19	0.19	0.36	76.35	0.09	0.17	36.49	46.00	12.36	145102.36	0.30	2.19
	19	11.93	2.30	0.19	0.37	77.93	0.08	0.17	35.28	46.29	12.83	148106.20	0.31	2.19
	20	12.26	2.42	0.19	0.39	79.52	0.08	0.17	34.18	46.87	13.24	151127.90	0.32	2.19
	21	12.11	2.54	0.19	0.40	81.16	0.08	0.16	33.21	47.45	13.60	154240.80	0.33	2.19
	22	13.09	2.67	0.19	0.41	82.56	0.08	0.16	32.11	48.08	13.95	156900.55	0.33	2.19
	23	11.70	2.78	0.20	0.42	83.80	0.07	0.15	31.23	48.22	14.26	159262.70	0.34	2.20
	24	11.97	2.90	0.20	0.42	84.99	0.07	0.15	30.36	48.36	14.58	161518.07	0.35	2.21
	25	12.45	3.02	0.20	0.43	86.11	0.07	0.15	29.50	48.51	14.91	163663.79	0.35	2.22
	26	11.80	3.13	0.20	0.44	87.17	0.07	0.15	28.75	48.64	15.22	165660.88	0.36	2.23
	27	11.93	3.25	0.20	0.45	88.35	0.06	0.14	28.06	48.79	15.54	167911.61	0.37	2.23
	28	12.77	3.37	0.20	0.46	89.52	0.06	0.14	27.37	48.94	15.92	170132.36	0.38	2.26
	29	12.34	3.49	0.20	0.47	90.63	0.06	0.14	26.73	49.09	16.12	172255.26	0.38	2.41
	30	12.39	3.62	0.20	0.48	91.64	0.06	0.14	26.09	49.24	16.33	174156.90	0.39	2.56

METCON Research

TEST No. CL-01

METALLURGICAL RESULTS

CLIENT	Western Copper Corporation	**TEST CONDITIONS**	
	METCON Project No.: M-709-02	**TEST START**	12/02/09
SAMPLE	Gold Composite # 2	**COLUMN SIZE**	6 inch diameter by 10 feet tall
		CRUSH SIZE	100% Passing 1-1/2 inch
		LEACH SOLUTION	500 ppm NaCN
OBJECTIVE	Preliminary Precious Metal Recovery	**CURE DOSAGE**	2.64 kg CaO/tonne of ore
	and Reagent Consumption under Open Cycle Leaching	**CURE CYCLE**	None Days
	0	**FLOWRATE**	12.22 lph/sq m (0.005 gpm/sq ft)

Time		Feed Solution Application Flow Rate		Cumulative Extraction (g/tonne)			Cumulative Solution Grade (ppm)			Cumulative Extraction (%)			Consumption	
	(Days)	(lph/sq m)	(Kl/t)	Au	Ag	Cu	Au	Ag	Cu	Au	Ag	Cu	NaCN (kg/tonne)	CaO (kg/tonne)
	31	11.73	3.73	0.20	0.48	92.70	0.06	0.13	25.59	49.37	16.44	176181.89	0.39	2.71
	32	11.97	3.85	0.20	0.48	93.61	0.05	0.13	25.04	49.52	16.56	177903.03	0.39	2.85
	33	11.96	3.96	0.20	0.49	94.67	0.05	0.13	24.57	49.66	16.68	179923.71	0.39	2.99
	34	12.73	4.09	0.20	0.49	95.62	0.05	0.12	24.05	49.81	16.98	181726.95	0.39	3.14
	35	12.82	4.21	0.20	0.50	96.47	0.05	0.12	23.54	49.96	17.23	183354.41	0.40	3.29
	36	13.35	4.34	0.20	0.51	97.26	0.05	0.12	23.00	50.12	17.45	184840.69	0.40	3.45
	37	12.81	4.46	0.20	0.51	98.00	0.05	0.12	22.52	50.27	17.66	186245.81	0.40	3.52
	38	12.82	4.59	0.20	0.52	98.62	0.05	0.12	22.03	50.43	17.84	187433.65	0.40	3.59
Drain	39	0.00	4.59	0.20	0.52	98.67	0.05	0.12	21.96	50.45	17.90	187517.49	0.40	3.59
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Appendix B
Mineralogy Reports

CASINO
COPPER AND GOLD

APPENDIX B1 XRAY DIFFRACTION REPORTS

X-RAY POWDER DIFFRACTION ANALYSIS OF ONE SAMPLE

Project: J862

John Dockery, M.Sc.
Lorax Environmental Services Ltd.
2289 Burrard Street
Vancouver, BC V6J 3H9

Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
Edith Czech, M.Sc.
Jenny Lai, B.Sc.

Dept. of Earth, Ocean & Atmospheric Sciences
The University of British Columbia
6339 Stores Road
Vancouver, BC V6T 1Z4

June 26, 2012

EXPERIMENTAL METHOD

The sample of **Project J862** was ground into fine powder with an alumina mortar and smeared on to a zero-diffraction quartz plate with ethanol. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

Mineral identification was done using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). The results are shown in Table 1. The X-ray diffractogram is shown in Figure 1.

Table 1. Results of qualitative analysis.

Mineral	**Ideal Formula**	**Sat Col 9**
Quartz	SiO_2	X
Pyrite	FeS_2	X
K-Feldspar	$KAlSi_3O_8$	X
Kaolinite	$Al_2Si_2O_5(OH)_4$	X
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	X
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	X
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	X

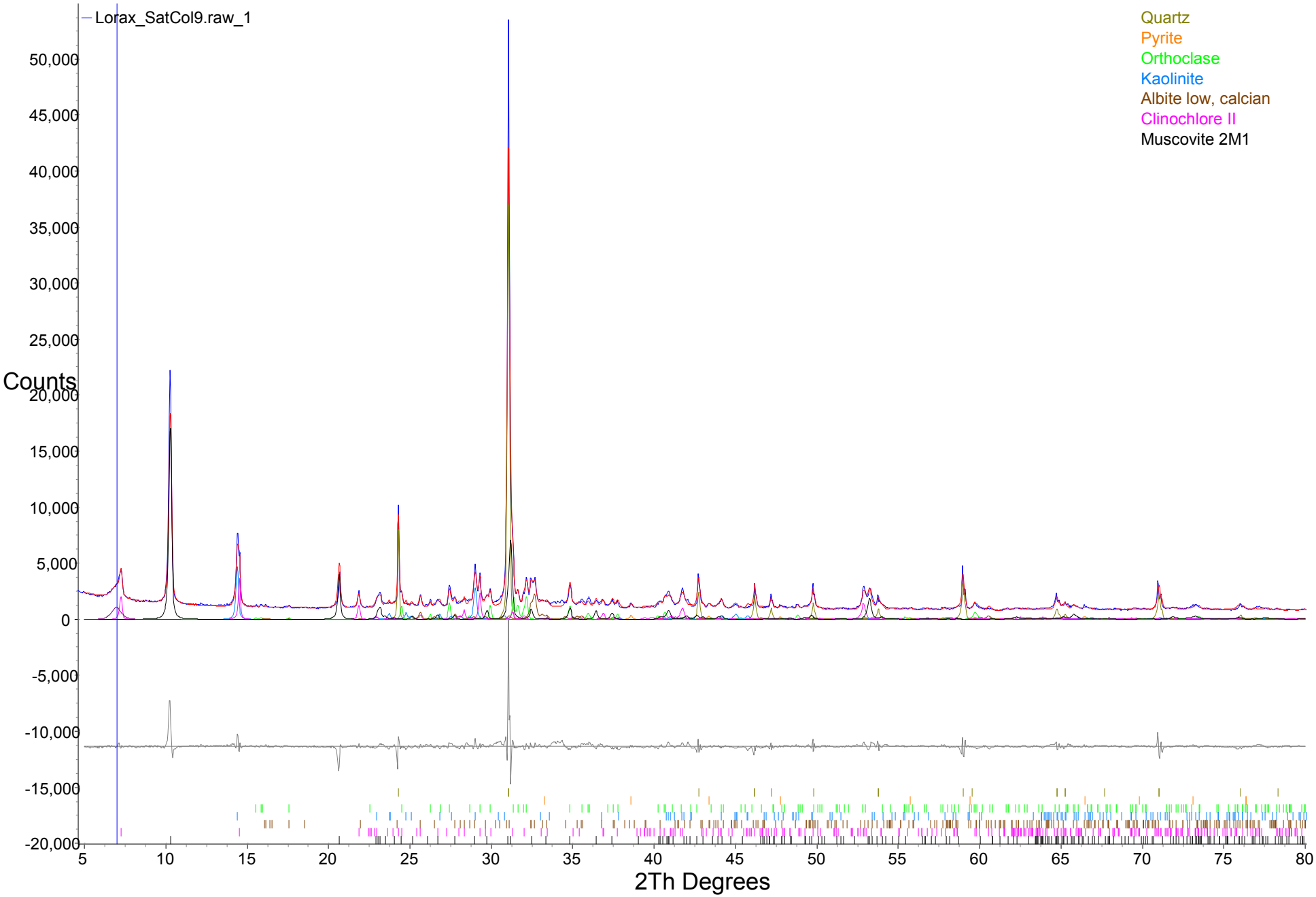


Figure 1. X-ray diffractogram of sample **Lorax " Sat Col 9"**

APPENDIX B2 SEM PETROGRAPHY AND EDS

21 January, 2010

Ms. Stephanie Simpson
Lorax Environmental
2289 Burrard St.
Vancouver, BC
V6J 3H9

Re: Casino Project Samples

Dear Stephanie:

I have examined the polished sections prepared from the samples that you submitted, and the petrographic report is attached.

The polished thin sections were prepared in the polishing lab of the Dept of Geology, UNB. After examination with a petrographic microscope, the polished samples were carbon-coated (to ensure surface conductivity), and examined with a JEOL-6400 Scanning Electron Microscope (SEM). The examination was conducted using backscattered electron imaging (which gives compositional contrast), and the mineral phases present in each sample were identified by Energy-Dispersive X-ray Spectrometry (EDS) using an EDAX Genesis x-ray microanalyser. Backscattered electron images were collected with Digital Micrograph (Gatan Inc.).

If you have any questions, please do not hesitate to contact me.

Best Regards,

Douglas C. Hall, Ph.D.
Senior X-ray Microanalyst

/dch

QUANTITATIVE PHASE ANALYSIS OF TWO POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0833 Western Copper Casino - PO# 42021)

Rik Vos
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December 4, 2009

EXPERIMENTAL METHOD

The two samples of **Project 0833 Western Copper Casino** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 3 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 2.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**HC Ore 1**	**HC Ore 2**
Quartz	SiO_2	30.2	36.9
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.1	1.8
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	12.5	11.5
K-Feldspar	$KAlSi_3O_8$	27.1	33.7
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	17.0	8.0
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.2	5.2
Gypsum	$CaSO_4{\cdot}2H_2O$	1.4	
Calcite	$CaCO_3$	1.4	0.8
Ankerite / Dolomite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$ / $CaMg(CO_3)_2$	2.7	
Pyrite	FeS_2	2.3	2.0
Molybdenite	MoS_2	0.1	trace
Total		100.0	100.0

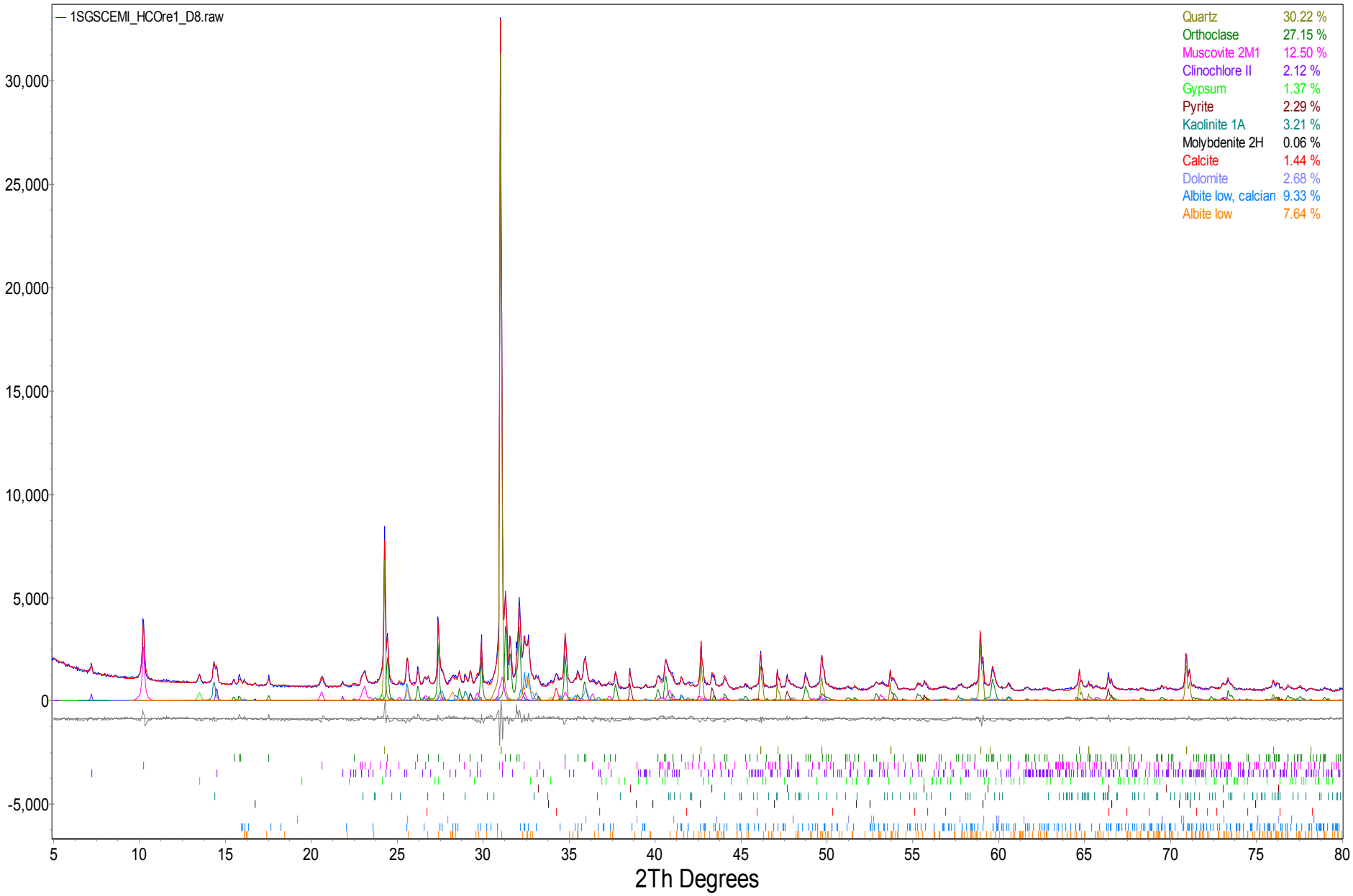


Figure 1. Rietveld refinement plot of sample **SGS CEMI "HC Ore 1"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

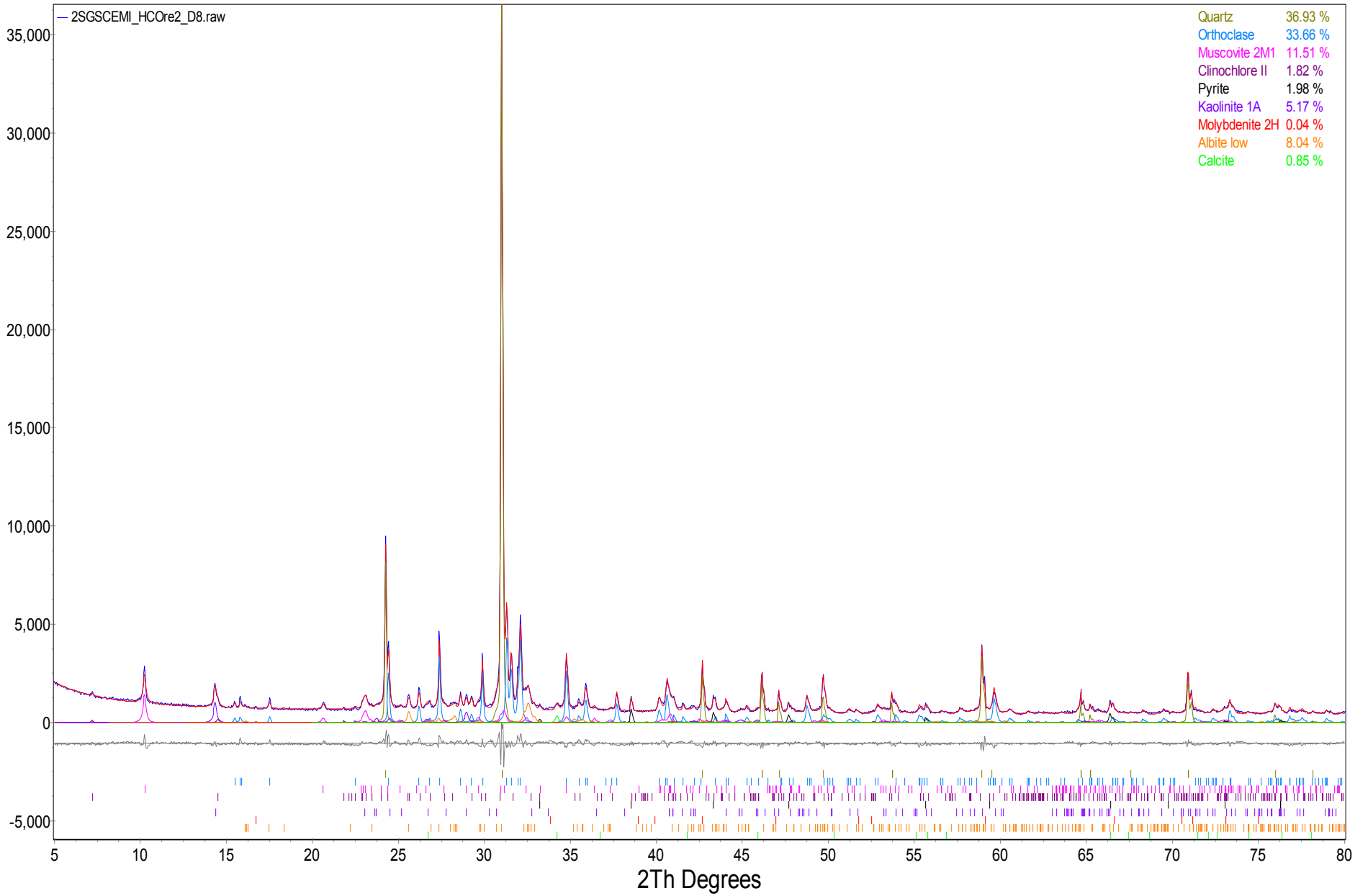


Figure 2. Rietveld refinement plot of sample **SGS CEMI "HC Ore 2"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF THREE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project : 0834 Western Copper – P.O. 41655)

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6927 Antrim Avenue
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Elisabetta Pani, Ph.D.
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6339 Stores Road
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Vancouver, BC V6T 1Z4

May 9, 2008

EXPERIMENTAL METHOD

The three samples were reduced into fine powder to the optimum grain-size range for X-ray analysis (<10μm) grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKα radiation on a standard Siemens (Bruker) D5000 Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a Vantec-1 strip detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS AND DISCUSSION

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 using Search-Match software by Siemens (Bruker). X-ray powder-diffraction data were refined with Rietveld program Topas 3 (Bruker AXS).

The results of quantitative phase analysis by Rietveld refinement are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots for the samples are shown in Figures 1-3.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal formula**	**PP Tail Sample 1**	**PP Tail Sample 2**	**PP Tail Sample 3**
Quartz	SiO_2	38.1	41.1	35.8
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	17.6	17.4	22.2
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	4.7	3.7	6.7
K-feldspar	$KAlSi_3O_8$	22.7	21.7	22.3
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	8.0	7.0	6.6
Kaolinite	$Al_2Si_2O_5(OH)_4$	5.5	5.8	4.1
Calcite	$CaCO_3$	1.5	1.1	1.3
Pyrite	FeS_2	1.5	1.8	0.7
Magnetite	Fe_3O_4	0.4	0.4	0.4
Total		100.0	100.0	100.0

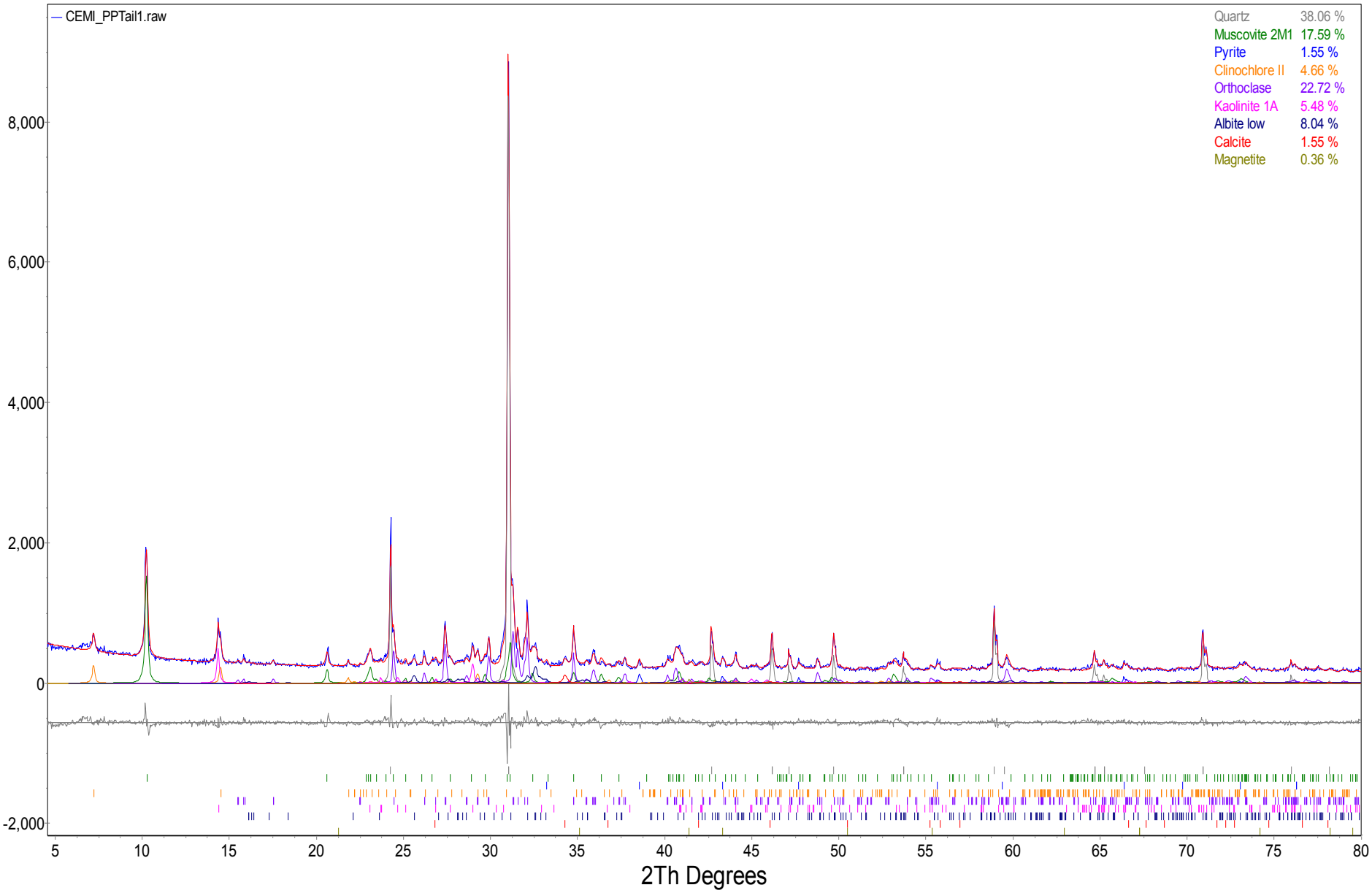


Figure 1. Rietveld refinement plot of sample **CEMI "PP Tail Sample 1"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

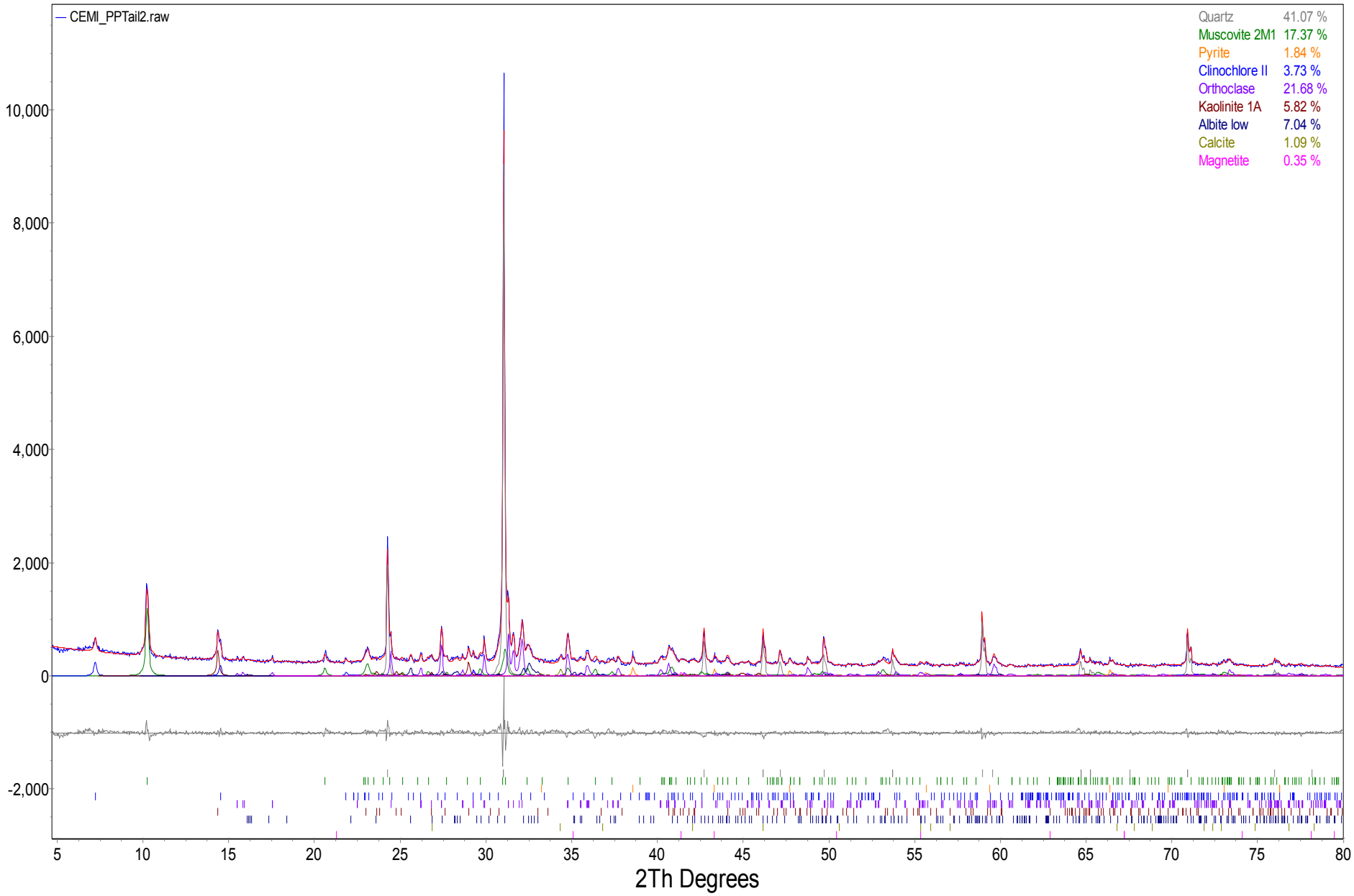


Figure 2. Rietveld refinement plot of sample **CEMI "PP Tail Sample 2"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

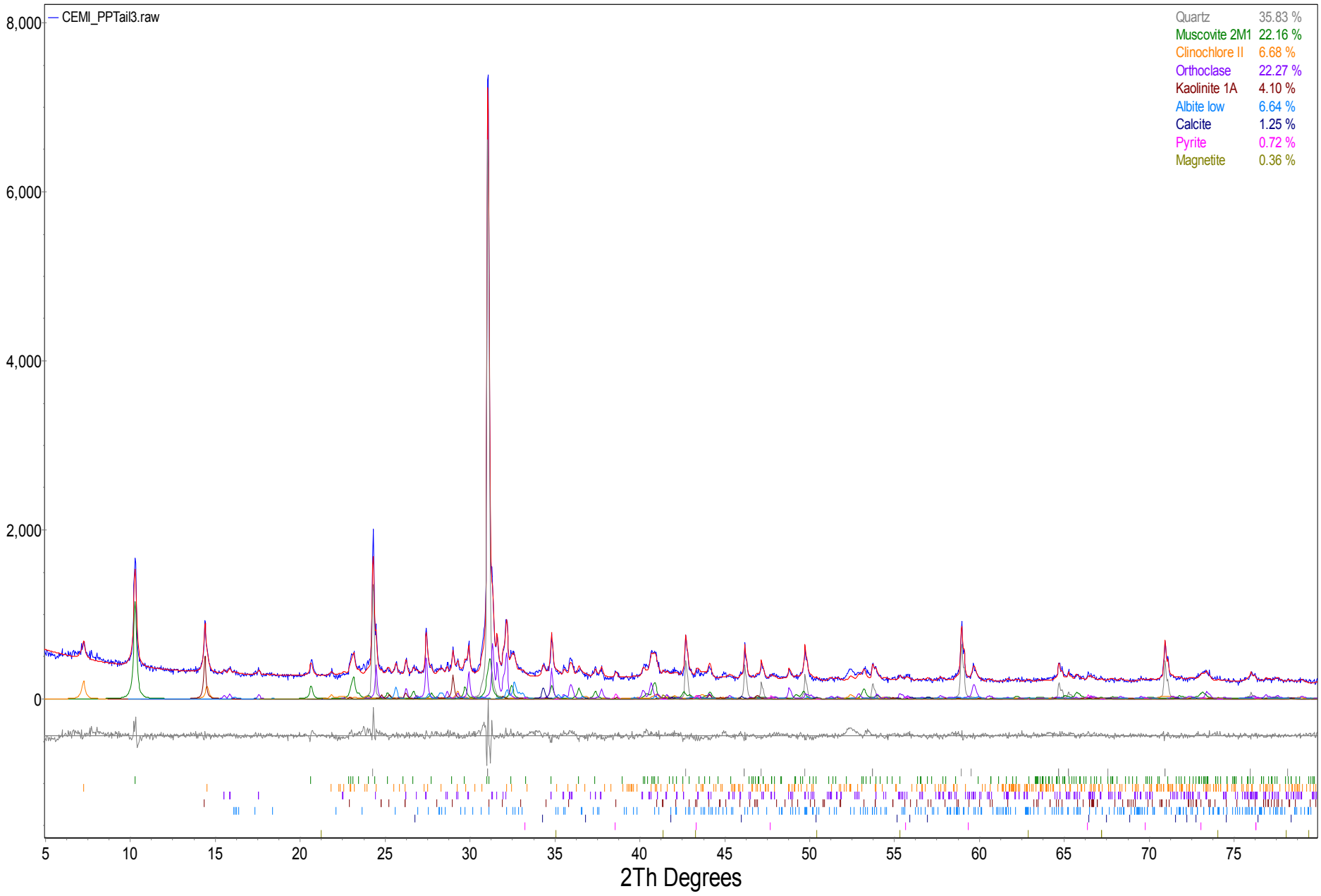


Figure 3. Rietveld refinement plot of sample **CEMI "PP Tail Sample 3"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF THREE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0852 Western Copper, PO# 41990)

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October 15, 2009

EXPERIMENTAL METHOD

The three samples of **Project 0852 Western Copper** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 using Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 3 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 3.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**KM 2459-10 Comp.1**	**KM 2459-09 Comp.2**	**KM 2459-08 Comp.3**
Quartz	SiO_2	47.5	32.9	29.5
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	36.6	4.7	2.4
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$			2.1
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$			
Kaolinite	$Al_2Si_2O_5(OH)_4$	4.6	2.5	2.7
Gypsum	$CaSO_4 \cdot 2H_2O$	0.5		
K-feldspar	$KAlSi_3O_8$	3.5	57.5	60.5
Ankerite – Dolomite	$Ca(Mg,Fe)CO_3$		1.6	2.3
Calcite	$CaCO_3$	0.4		0.4
Siderite	$Fe^{2+}CO_3$		0.4	
Pyrite	FeS_2	6.8	0.4	0.2
Total		100.0	100.0	100.0

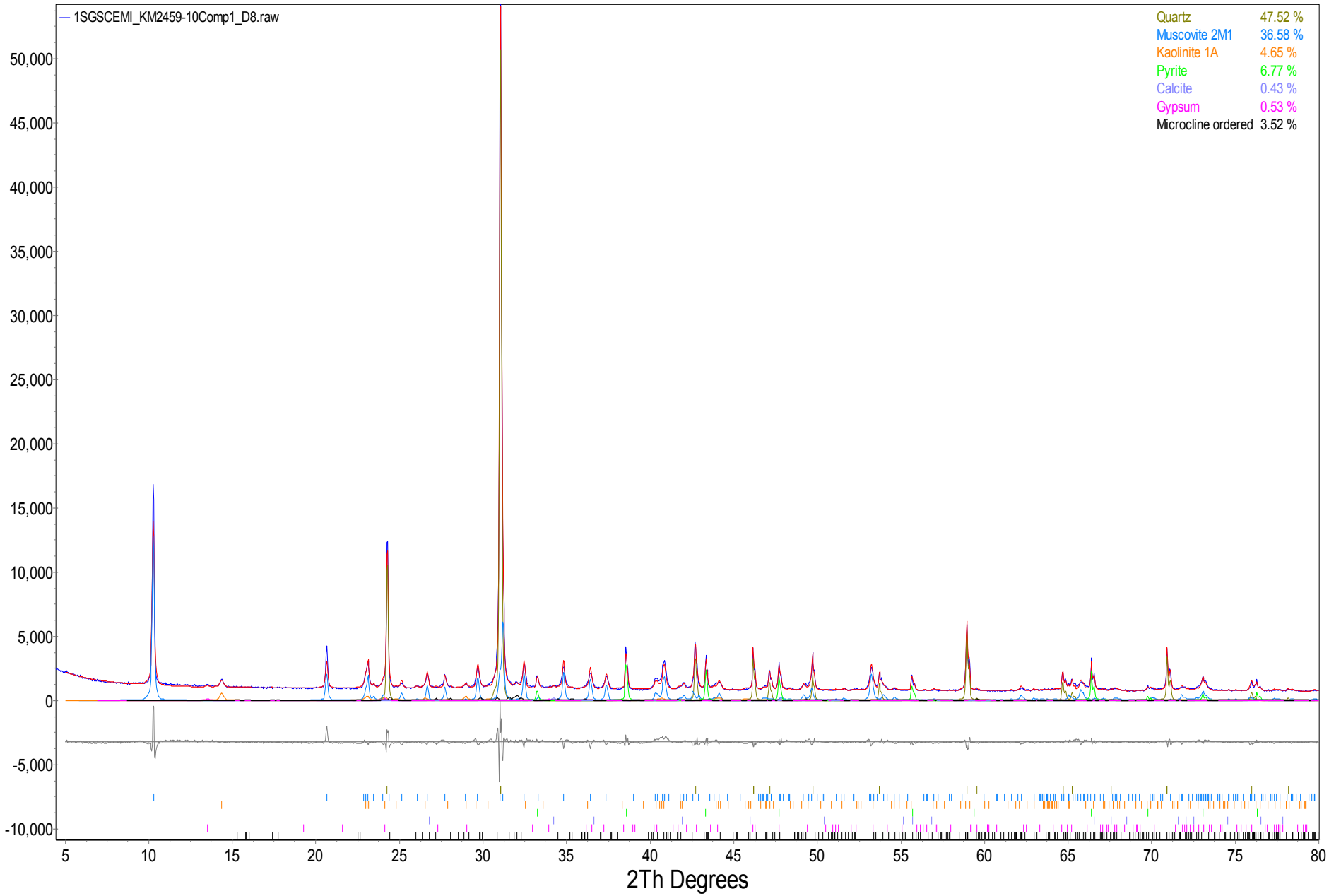


Figure 1. Rietveld refinement plot of sample **SGS CEMI "KM 2459-10 Comp.1"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

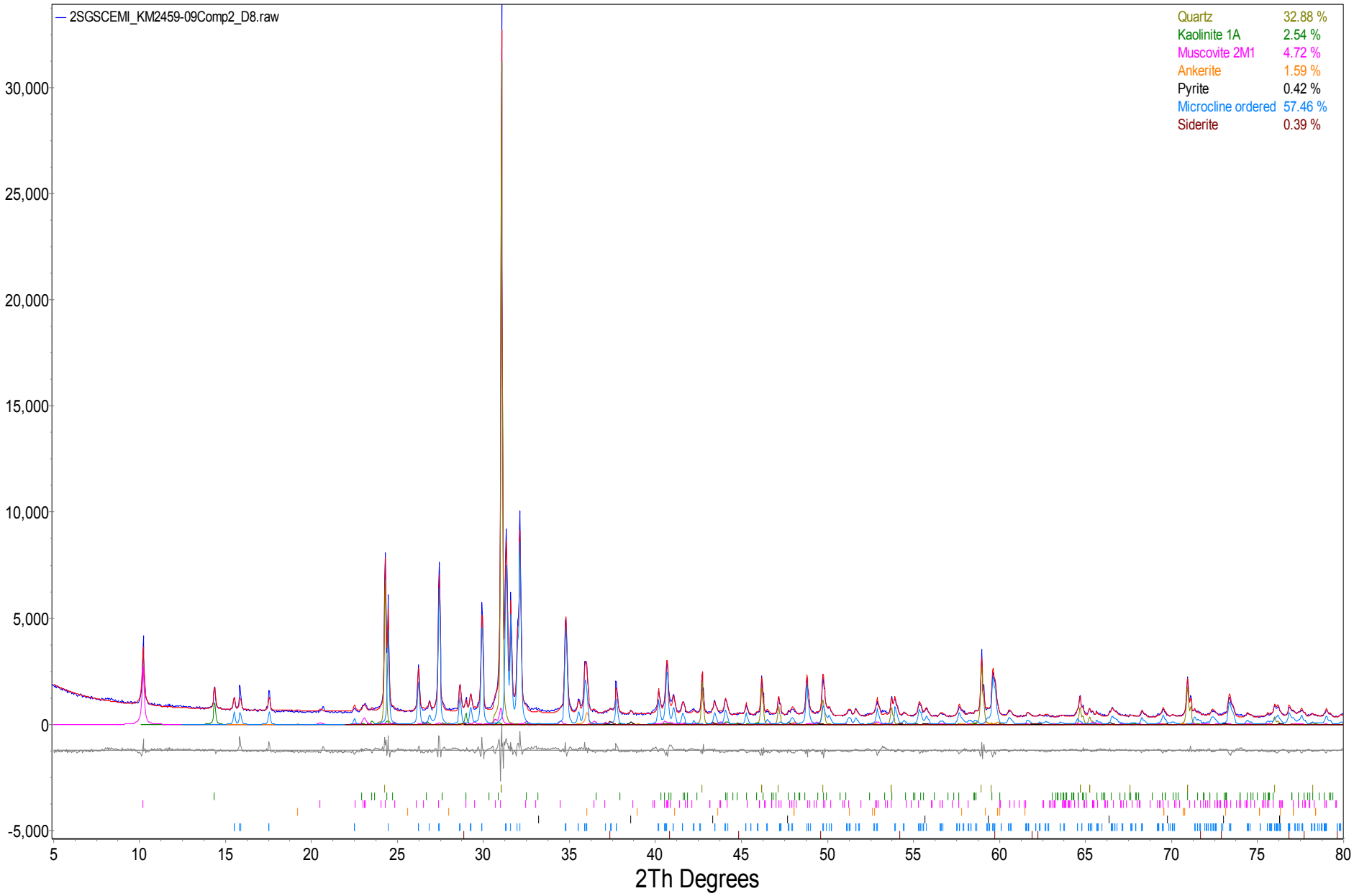


Figure 2. Rietveld refinement plot of sample **SGS CEMI "KM 2459-09 Comp.2"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

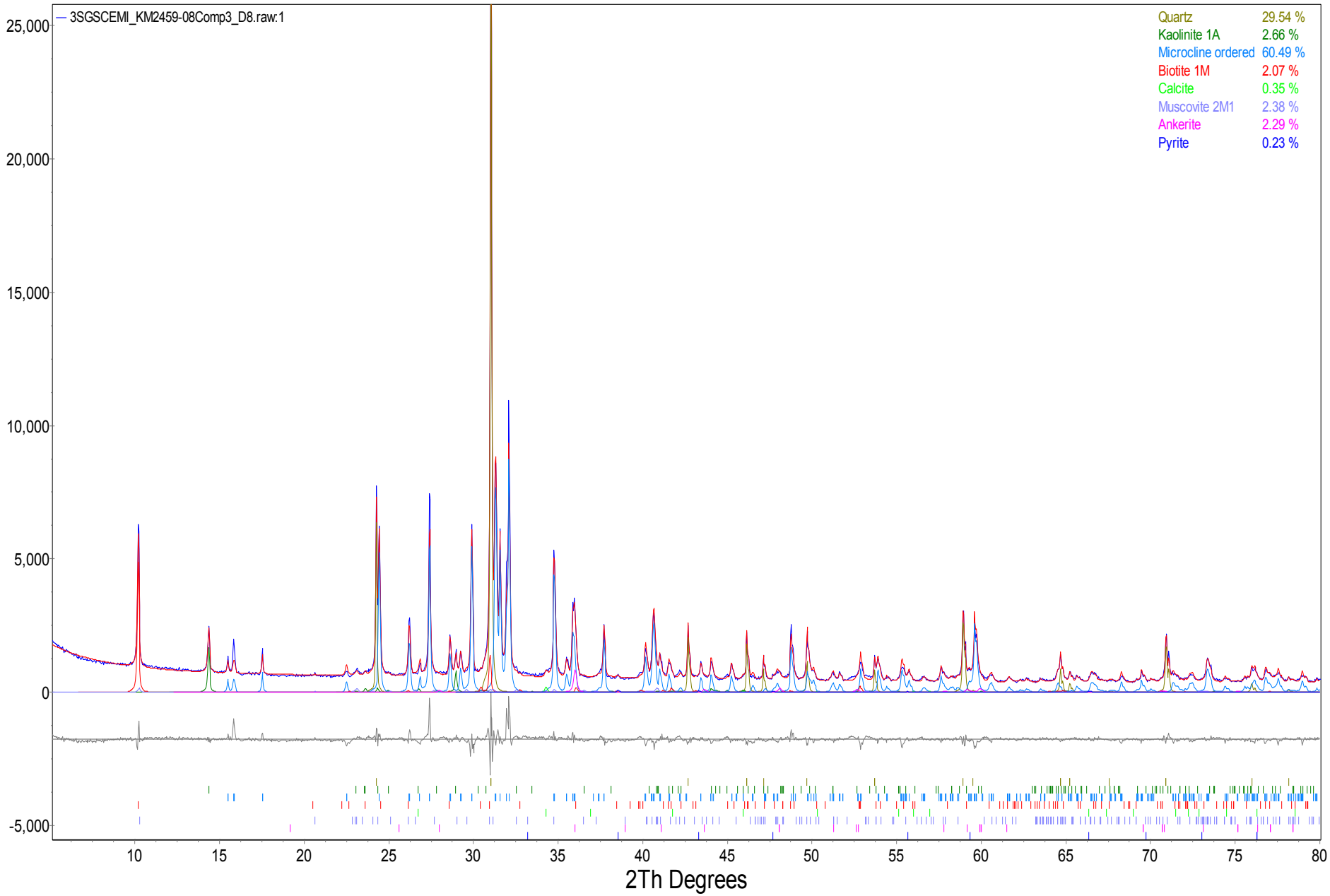


Figure 3. Rietveld refinement plot of sample **SGS CEMI "KM 2459-08 Comp.3"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF FIVE POWDER SAMPLES USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0852 Western Copper Casino – PO# 42320)

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Mati Raudsepp, Ph.D.
Elisabetta Pani, Ph.D.
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Edith Czech, M.Sc.

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The University of British Columbia
6339 Stores Road
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March 30, 2011

EXPERIMENTAL METHOD

The five samples of **Project 0852 Western Copper Casino** were reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractograms were analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the samples were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plots are shown in Figures 1 – 5.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**#1 Py Rougher Tail 1 (whole)**	**#2 Py Rougher Tail 2 (>74μm)**	**#3 Py Rougher Tail 3 (<74μm)**	**#4 Py Rougher Conc**	**#5 Cleaner Tail**
Quartz	SiO_2	44.0	44.3	25.7	26.2	21.9
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	2.3	2.6	3.0	2.2	2.5
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.9	4.1	10.8	5.3	7.0
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	19.3	20.2	28.9	23.6	23.6
Biotite	$K(Mg,Fe)_3(AlSi_3O_{10})(OH)_2$	3.1	2.5	3.3	2.2	2.3
K-Feldspar	$KAlSi_3O_8$	15.0	14.5	16.6	10.3	11.7
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	12.0	11.5	11.2	7.2	7.4
Calcite	$CaCO_3$	0.5	0.3	0.5	0.9	0.6
Pyrite	FeS_2				22.1	22.5
Magnetite	$Fe^{2+}Fe^{3+}{}_2O_4$					0.5
Total		100.0	100.0	100.0	100.0	100.0

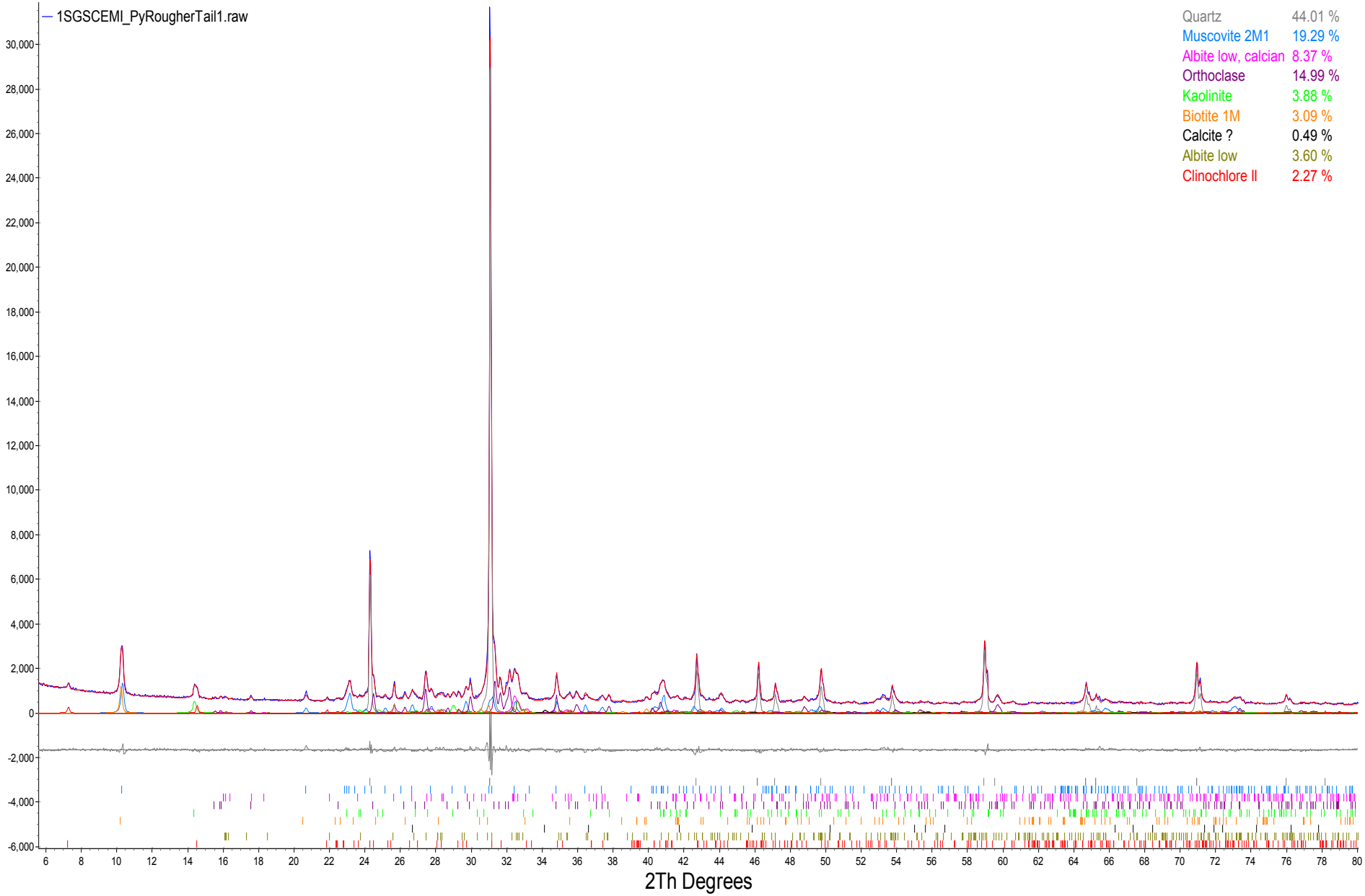


Figure 1. Rietveld refinement plot of sample **SGS CEMI "Py Rougher Tail 1 (whole)"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

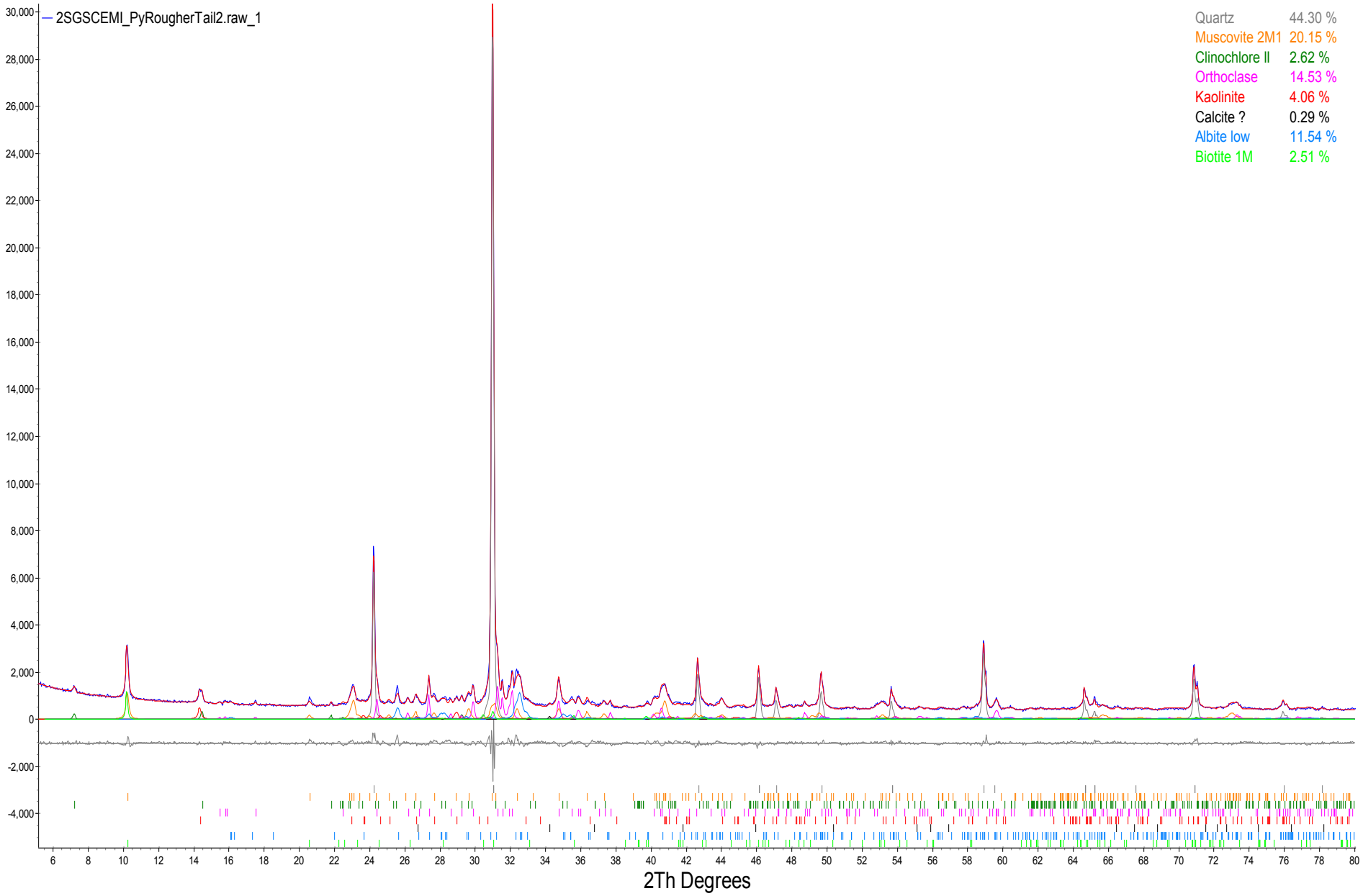


Figure 2. Rietveld refinement plot of sample **SGS CEMI "Py Rougher Tail 2 (>74µm)"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

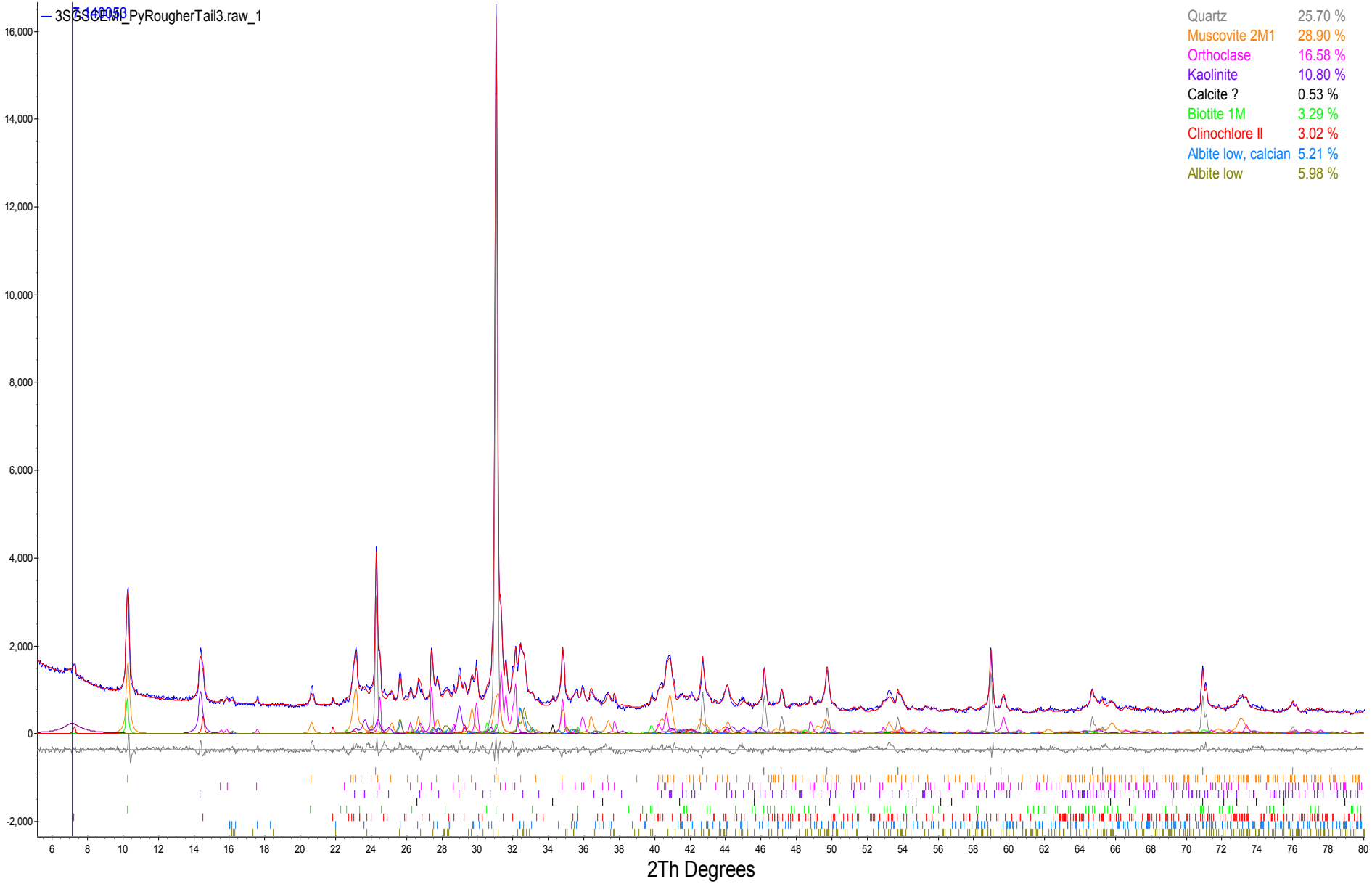


Figure 3. Rietveld refinement plot of sample **SGS CEMI "Py Rougher Tail 3 (<74µm)"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

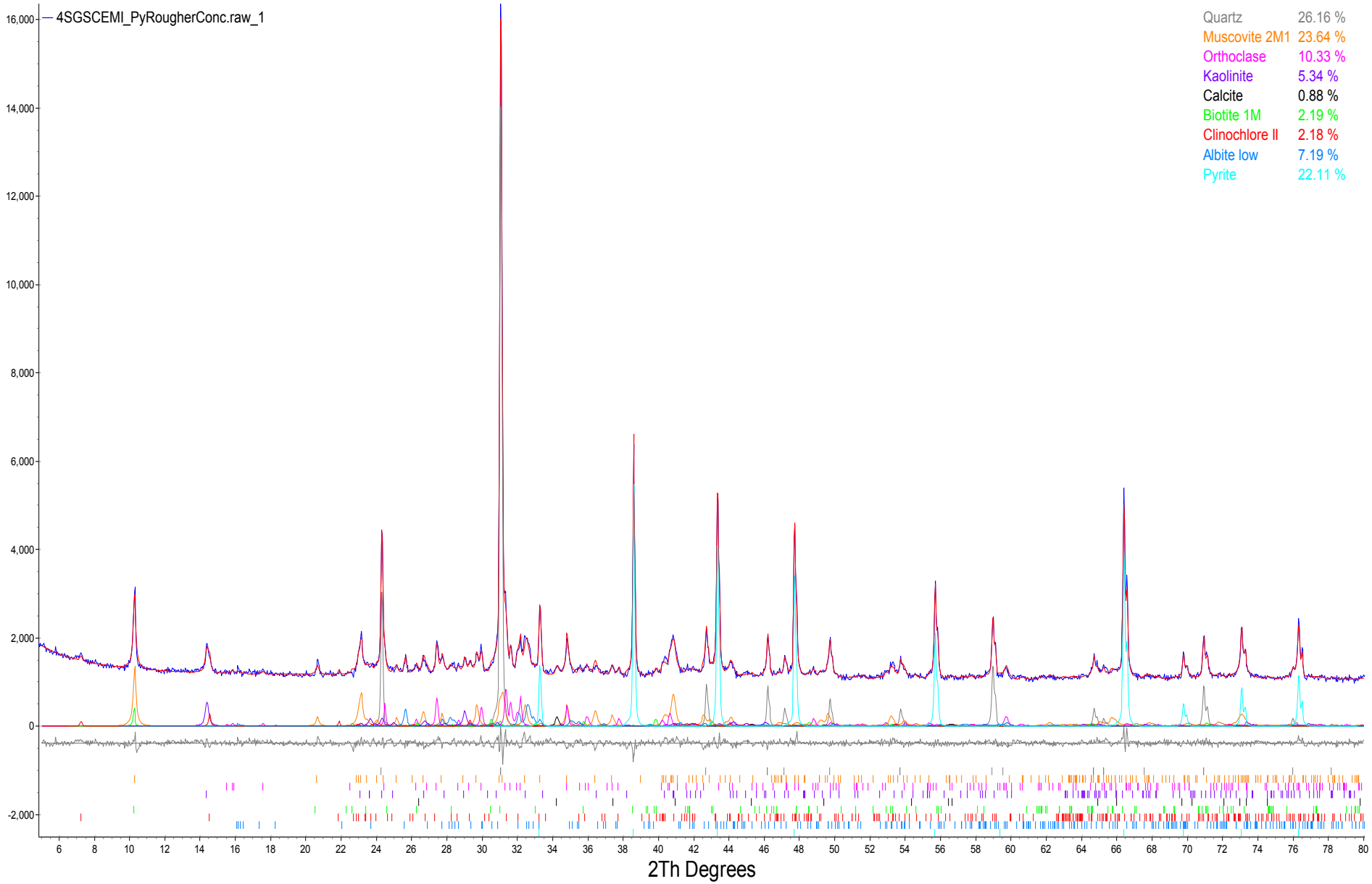


Figure 4. Rietveld refinement plot of sample **SGS CEMI "Py Rougher Conc"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

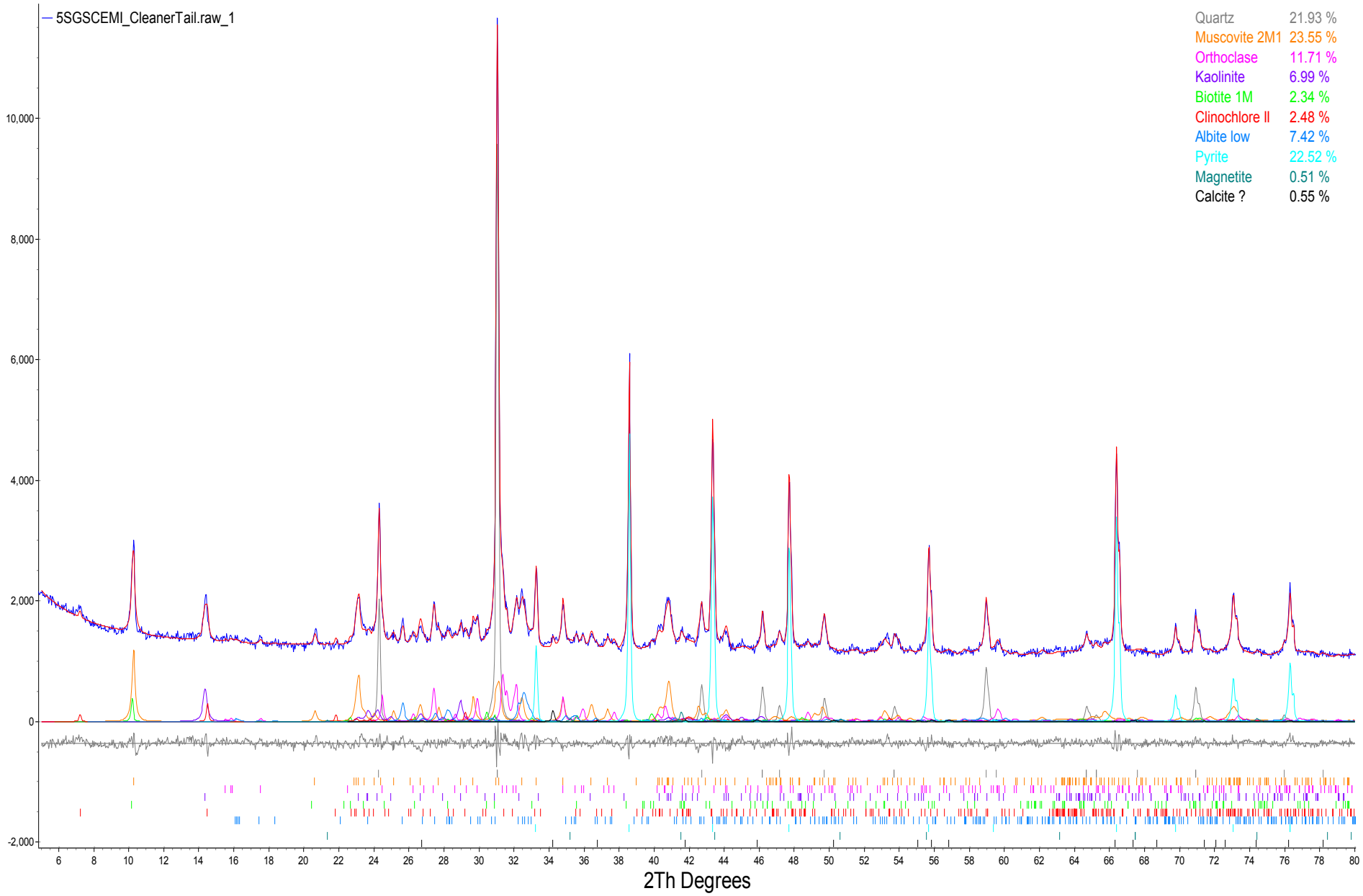


Figure 5. Rietveld refinement plot of sample **SGS CEMI "Cleaner Tail"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF ONE POWDER SAMPLE USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

Project: 0852 Western Copper – PO# 42631

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Elisabetta Pani, Ph.D.
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December 14, 2012

EXPERIMENTAL METHOD

The sample of **Project 0852 Western Copper** was reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Continuous-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractogram was analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Bruker. X-ray powder-diffraction data of the sample were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plot is shown in Figure 1.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**HPY Pyrite Ro Sands**
Quartz	SiO_2	42.1
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	13.3
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$	2.3
Kaolinite	$Al_2Si_2O_5(OH)_4$	1.6
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	7.8
K-feldspar	$KAlSi_3O_8$	29.4
Calcite	$CaCO_3$	0.9
Dolomite	$CaMg(CO_3)_2$	0.9
Hematite	α-Fe_2O_3	0.3
Magnetite	Fe_3O_4	0.5
Rutile	TiO_2	0.9
Total		100.0

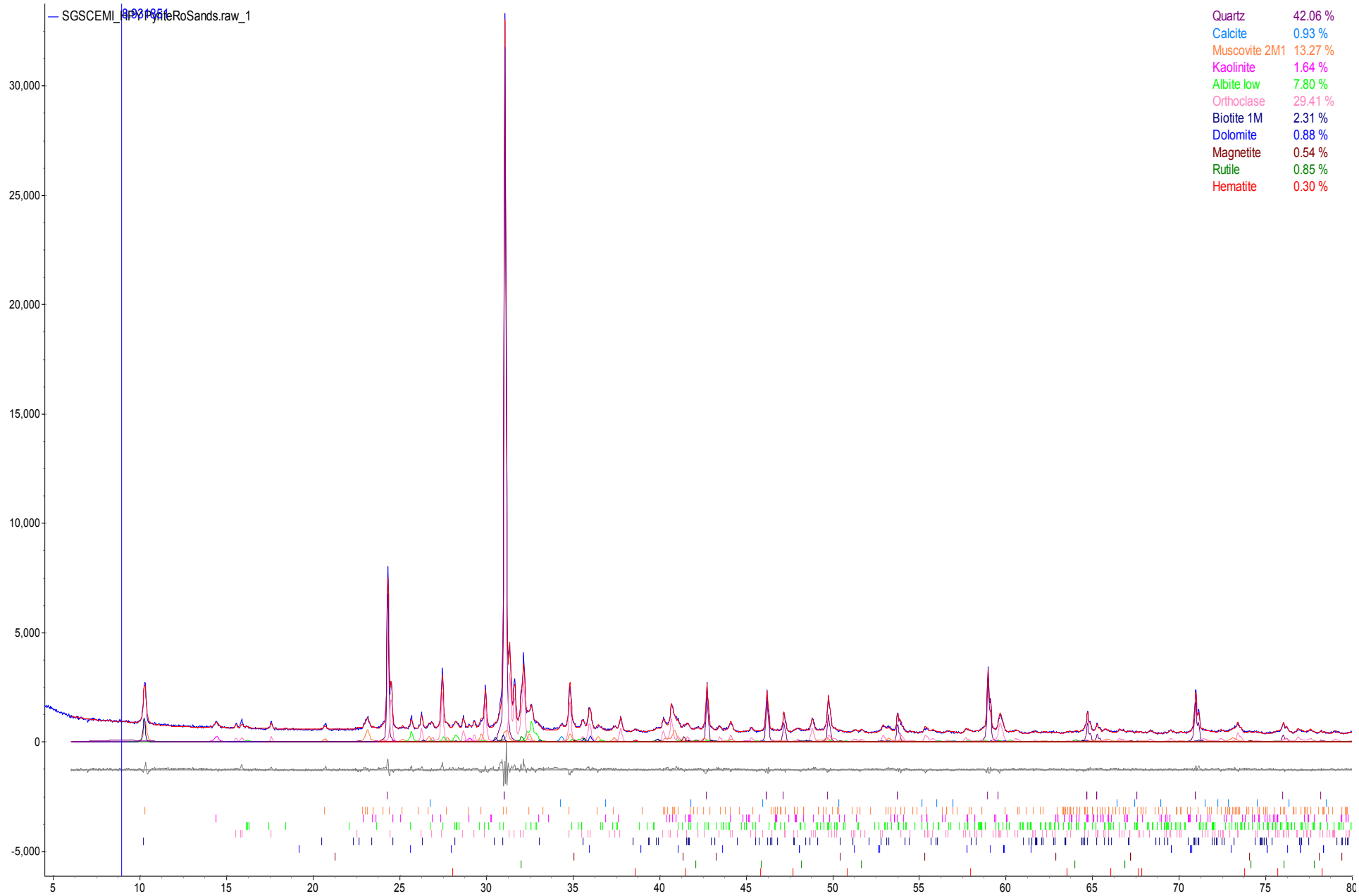


Figure 1. Rietveld refinement plot of sample **SGS CEMI "HPY Pyrite Ro Sands"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF ONE POWDER SAMPLE USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

Project: 0852 Western Copper – PO# 42658

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March 28, 2013

EXPERIMENTAL METHOD

The one sample of **Project 0852 Western Copper** was reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Continuous-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractogram was analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Bruker. X-ray powder-diffraction data of the sample was refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plot is shown in Figure 1.

The pattern shows a small hump between 6 and 8º2θ (vertical line) that was fitted with a calculated peak and that likely corresponds to minor amounts of interstratified chlorite-smectite which cannot be quantified.

A small peak at 42.1º2θ could not be identified.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**HYP-PYRO-CON**
Ankerite	$Ca(Fe^{2+},Mg,Mn)(CO_3)_2$	0.9
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$	2.2
Chalcopyrite	$CuFeS_2$	0.5
Calcite	$CaCO_3$	1.7
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	0.7
Kaolinite	$Al_2Si_2O_5(OH)_4$	3.3
K-feldspar	$KAlSi_3O_8$	25.1
Muscovite	$KAl_2(AlSi_3O_{10})(OH)_2$	18.1
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	3.8
Pyrite	FeS_2	20.4
Quartz	SiO_2	23.3
Total		100.0

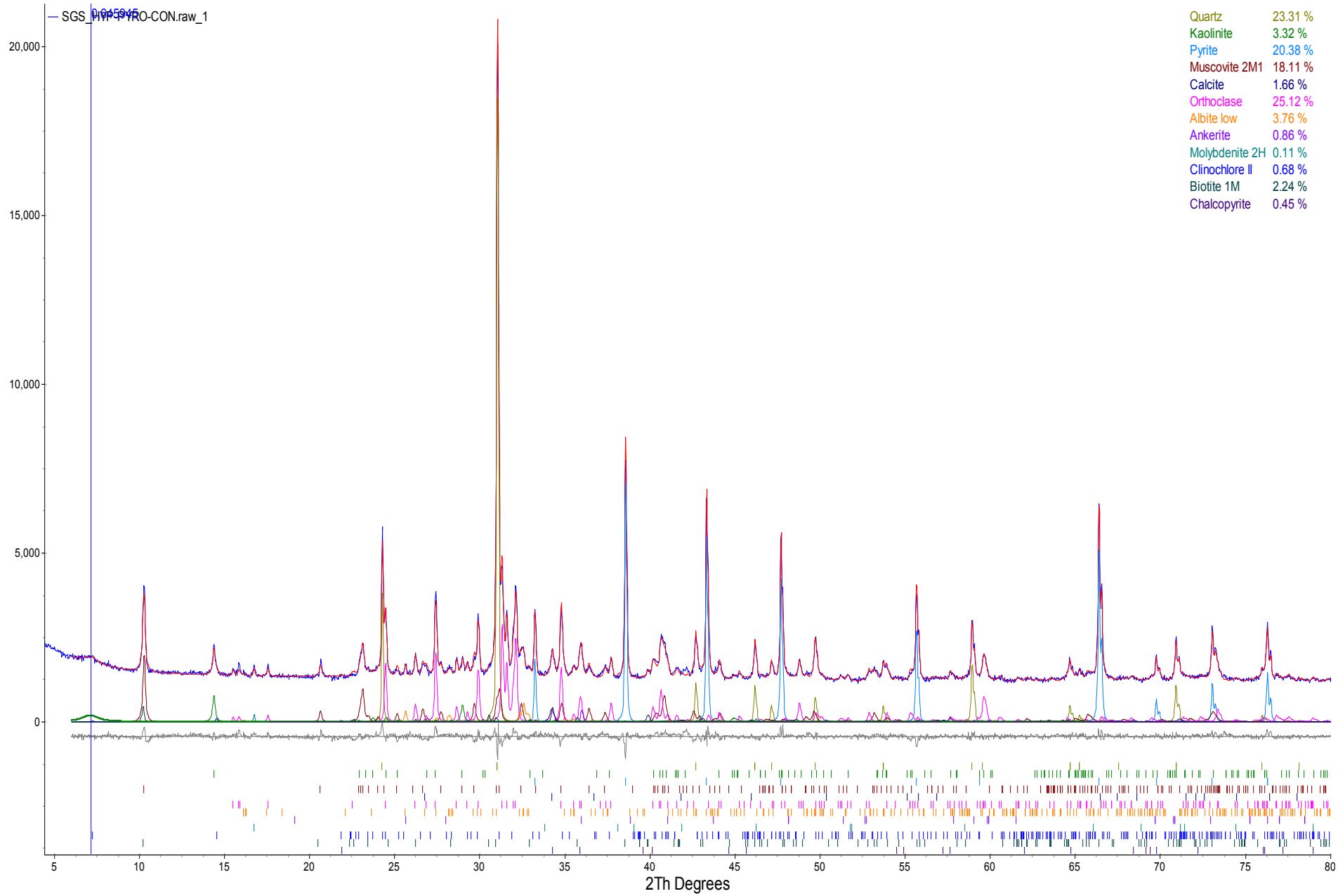


Figure 1. Rietveld refinement plot of sample **SGS Canada "HYP-PYRO-CON"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below - difference between observed and calculated intensities; vertical bars - positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

QUANTITATIVE PHASE ANALYSIS OF ONE POWDER SAMPLE USING THE RIETVELD METHOD AND X-RAY POWDER DIFFRACTION DATA.

(Project: 0852 Western Copper Casino – PO# 42061)

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January 28, 2010

EXPERIMENTAL METHOD

The sample **"CL-02 Composite"** of **Project 0852 Western Copper Casino** was reduced to the optimum grain-size range for quantitative X-ray analysis (<10 μm) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range 3-80°2θ with CoKa radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6°.

RESULTS

The X-ray diffractogram was analyzed using the International Centre for Diffraction Database PDF-4 and Search-Match software by Siemens (Bruker). X-ray powder-diffraction data of the sample were refined with Rietveld program Topas 4.2 (Bruker AXS). The results of quantitative phase analysis by Rietveld refinements are given in Table 1. These amounts represent the relative amounts of crystalline phases normalized to 100%. The Rietveld refinement plot is shown in Figure 1.

Table 1. Results of quantitative phase analysis (wt.%)

Mineral	**Ideal Formula**	**CL-02 Composite**
Quartz	SiO_2	42.4
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$	21.8
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$	4.8
K-feldspar	$KAlSi_3O_8$	21.8
Pyrite	FeS_2	1.1
Hematite	α-Fe_2O_3	1.1
Jarosite	$K_2Fe^{3+}{}_6(SO_4)_4(OH)_{12}$	2.9
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$	1.6
Kaolinite	$Al_2Si_2O_5(OH)_4$	2.5
Total		100.0

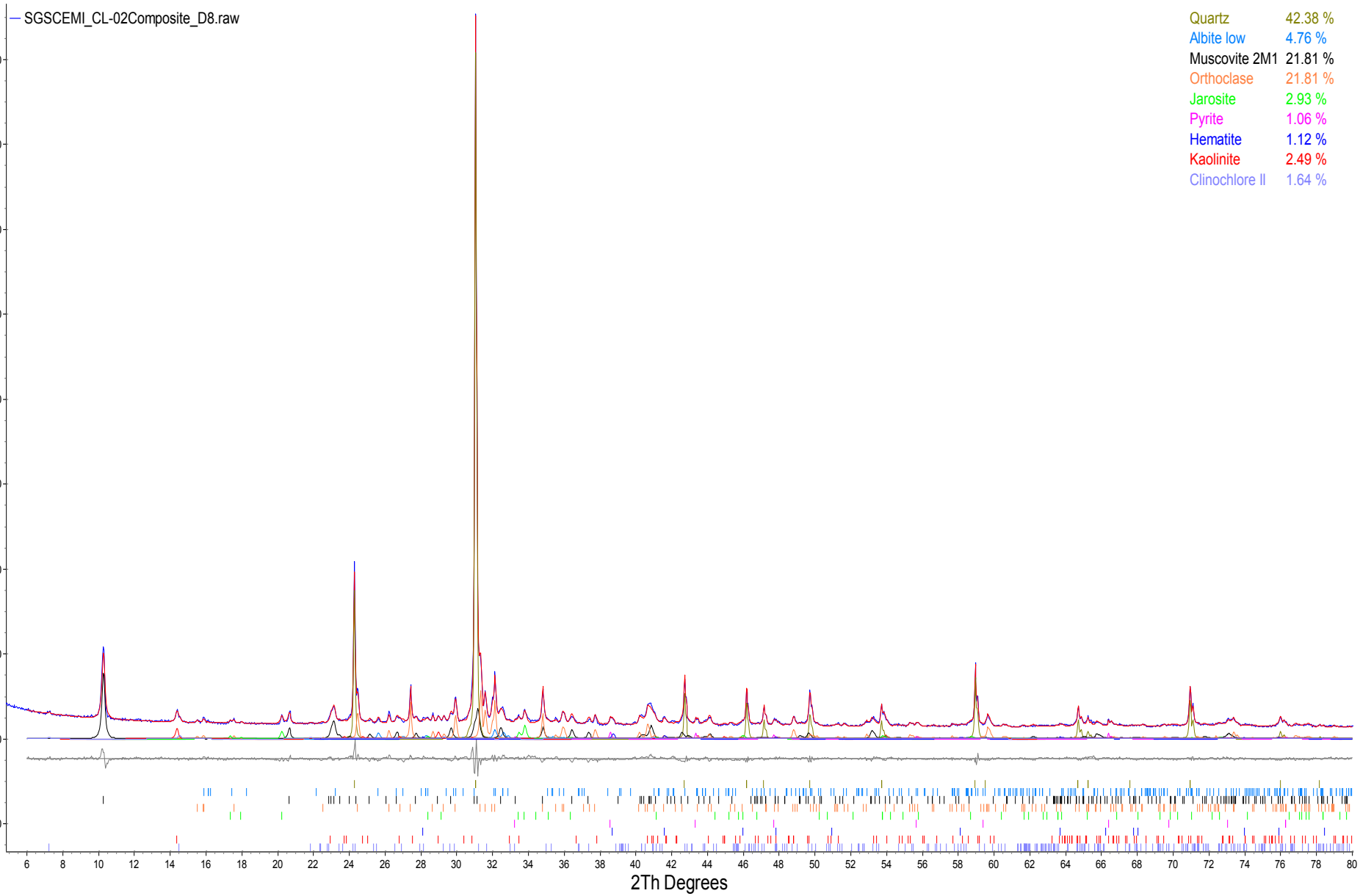


Figure 1. Rietveld refinement plot of sample **SGS CEMI "CL-02 Composite"** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

APPENDIX B3 SATURATED COL 9 PRECIPITATE

21 January, 2010

Ms. Stephanie Simpson
Lorax Environmental
2289 Burrard St.
Vancouver, BC
V6J 3H9

Re: Casino Project Samples

Dear Stephanie:

I have examined the polished sections prepared from the samples that you submitted, and the petrographic report is attached.

The polished thin sections were prepared in the polishing lab of the Dept of Geology, UNB. After examination with a petrographic microscope, the polished samples were carbon-coated (to ensure surface conductivity), and examined with a JEOL-6400 Scanning Electron Microscope (SEM). The examination was conducted using backscattered electron imaging (which gives compositional contrast), and the mineral phases present in each sample were identified by Energy-Dispersive X-ray Spectrometry (EDS) using an EDAX Genesis x-ray microanalyser. Backscattered electron images were collected with Digital Micrograph (Gatan Inc.).

If you have any questions, please do not hesitate to contact me.

Best Regards,

Douglas C. Hall, Ph.D.
Senior X-ray Microanalyst

/dch

08-296:

This sample predominantly consists of granular aggregates of quartz and variably altered feldspar, with minor amounts of sulphide and dolomite. Quartz grains (<1 mm) are strained, with pronounced undulatory extinction. Feldspars range from slightly altered, with a dusty appearance, to comlately replaced by fine-grained muscovite-rich pseudomorphs.

K-feldspar (Or_{85}) does not exhibit twinning, and contain minor beads of albitic plagioclase (<10 um), as well as minor amounts of fine-grained quartz and muscovite (<10 um). Albite exhibits polysynthetic twinning, and contain minor inclusions of calcite and muscovite (<10 um), and small beads of K-feldspar (< 10 um).

Strongly altered feldspars typically consist of fine-grained (20-40 um) blades of muscovite, but may also contain fine-grained (10-20 um) quartz and minor amounts of K-feldspar (Or_{95}) and dolomite (5 wt% FeO). More rarely, apatite and pyrite are also present. Less commonly, the pseudomorphs are optically darker, and consist of fine-grained (10-30 um) blades of biotite, together with quartz, and minor amounts of plagioclase (An_{35}) and kaolinite. The feldspar and kaolinite are typically spatially associated.

Sulphide minerals typically occur as discrete, anhedral grains in feldspar pseudomorphs (20-400 um). Pyrite predominates, but chalcopyrite occurs as fine-grained anhedral inclusions in some coarse grains of pyrite. More rarely, coarse irregular pyrite (0.5-1.5 mm) may contain inclusions of biotite and plagioclase (An_{45}). Pyrite comprises approximately 5% of the sample, and chalcopyrite is present in trace amounts.

Dolomite (9 wt% FeO) also occurs in discrete dolomite-rich fragments, consisting of interlocking grains (100-600 um), which may represent fragments of dolomite veins. These fragments are rare, and comprise less than 1% of the sample. One minor occurrence of baryte was observed, as a crack-filling phase (<5 um wide) in a grain of K-feldspar.

08-234:

This sample predominantly consists of granular aggregates of quartz as well as muscovite-rich feldspar pseudomorphs. Quartz typically occurs in clusters of coarse interlocking grains (0.3-2.0 mm), with highly irregular grain boundaries. These grains exhibit minor undulatory extinction, and contain abundant fine-grained fluid inclusions (10-20 um). The inclusions typically occur in trails, and the inclusion trails may cross grain boundaries.

Feldspar pseudomorphs (<2 mm) consist either of fine-grained intergrowths (30-50 um) of muscovite and quartz, or of muscovite, dolomite ($Mg_{42}Ca_{51}Mn_5Fe_2$), and manganoan dolomite ($Mg_{24}Ca_{45}Mn_{27}Fe_2$). Minor amounts of fine-grained baryte and apatite may also

be present. Dolomite-bearing pseudomorphs may also contain rutile and minor amounts of kaolinite. The rutile is commonly zoned, with W-enriched cores.

Pyrite (10-200 um) occurs in both assemblages, but is more common in the dolomite-bearing pseudomorphs. Pyrite is anhedral to subhedral, and typically occurs as discrete, equant grains in the muscovite-rich matrix. Rare coarse pyrite (0.5-2.0 mm) occurs as discrete fragments. Pyrite comprises approximately 5% of the sample.

Dolomite also occurs in uncommon fragments consisting of medium-grained interlocking rhombs (100-300 um).

08-270:

This sample predominantly consists of lithic fragments containing a fine-grained assemblage of quartz and muscovite, together with lesser amounts of sulphides and chlorite, and minor amounts of apatite, rutile, and kaolinite. Typically, quartz occurs as clusters of equant, anhedral grains (20-100 um), with minor amounts of interstitial muscovite. Muscovite and chlorite (10-30 um) occur in quartz-poor clusters, generally as bundles of muscovite blades, with minor chlorite. Chlorite is locally more abundant, and occurs as radiating bundles of blade-like grains together with blade-like muscovite and anhedral quartz and albite.

More rarely, fragments consist of granular intergrowths of anhedral (20-100 um) quartz and K-feldspar (Or_{93}). These may also contain minor amounts of fine-grained muscovite (<20 um) and kaolinite (<2 um). The kaolinite occurs in clusters (<20 um) which may also contain very fine-grained monazite. Other fragments consist of fine-grained (10-20 um) intergrowths of anhedral K-feldspar (Or_{95}) and blade-like muscovite. These fragments may contain minor amounts of quartz and chlorite.

Sulphides predominantly consist of anhedral to subhedral pyrite grains (10-150 um), but these may contain fine chalcopyrite, and more rarely, pyrrhotite inclusions (< 10 um). Discrete grains of chalcopyrite are rare, and are mantled by thin rims of digenite (10 um). Digenite may also extend into chalcopyrite along narrow cracks. Replacement of chalcopyrite by digenite has in some cases led to the development of small remnant "islands" of chalcopyrite in digenite. Coarse-grained pyrite (1-2 mm) is rare, and occurs as discrete fragments. Sulphides comprise approximately 5% of the sample.

08-285:

Most of this sample is very strongly altered, and therefore much of the primary mineralogy is commonly not identifiable. Discrete grains of strained quartz (<1 mm) typically exhibit undulatory extinction. Quartz grains contain moderate amounts of fluid inclusions (<20 um). The inclusions are randomly dispersed, and do not define trails. Clusters of quartz grains typically display thin (<10 um) mantles of calcite, which may

also extend between grains. Coarse biotite grains are rarely preserved, and have very ragged margins. They have orange-brown to pale-yellow pleochroism, and contain very fine-grained, equant to elongate inclusions of rutile. Cleavage planes in biotite typically exhibit clay alteration, and some grains also have Ca-carbonate and Fe-carbonate along cleavages.

Uncommon coarse grains of relatively unaltered plagioclase exhibit well-developed polysynthetic twinning, and thin discontinuous mantles of K-feldspar. Plagioclase does not exhibit pronounced compositional zonation, but does have minor sodic enrichment toward the rims (An_{50}-An_{44}). Remnants of K-feldspar (Or_{95}) occur together with fine-grained calcite, Fe-bearing dolomite, and quartz in a very fine-grained kaolinite matrix.

Much of the sample consists of very fine-grained subhedral calcite (< 10 um) in a kaolinite matrix, which also contains varied amounts of fine-grained quartz, biotite, and muscovite. Biotite may occur as stubby blades with muscovite mantles. Less commonly, apatite and chlorite are also abundant. In one fragment, calcite grains are mantled by Fe,Mg-carbonate.

Sulphides predominantly consist of anhedral pyrite (<200 um, rarely to 500 um). Relatively coarse grains may contain fine (10-20 um) inclusions of chalcopyrite. Chalcopyrite also occurs uncommonly as discrete anhedral grains (10-30 um, rarely to 100 um). Trace amounts of tennantite occur as rare inclusions together with chalcopyrite in pyrite, and as discrete grains associated with chalcopyrite. Sulphides comprise approximately 2% of the sample.

Fine-grained intergrowths of carbonate and quartz are spatially associated with some pyrite grains. These typically contain calcite with varied FeO contents (2-4 wt% FeO) and minor amounts of a Ca-poor carbonate ($Mg_{18}Ca_2Fe_{78}$).

FB5-43:

Most of this sample consists of lithic fragments comprising quartz, variably altered feldspar, and minor biotite. The quartz (100-1000 um) is strained, and exhibits undulatory extinction. Fluid inclusions are moderately abundant (<30 um). Some quartz-rich patches contain interstitial Fe-hydroxide, as well as thin (<10 um) Fe-hydroxide veins. Coarse-grained biotite (<0.5 mm) is relatively unaltered. It exhibits orange-brown to pale brown pleochroism, and may exhibit minor chlorite alteration. Rarely, green pleochroic chlorite is pseudomorphous after biotite.

Relatively unaltered, coarse-grained feldspar is present. Plagioclase (An_{40}) exhibits polysynthetic twinning. K-feldspar (3 wt% BaO) does not exhibit twinning, and contains fine-grained apatite, baryte, and zircon (20-30 um) inclusions.

Sulphide mineral grains are relatively rare in this sample, and consist mostly of discrete grains of pyrite (0.05-1.0 mm) and chalcopyrite (<50 um). Uncommon fine-grained

inclusions of galena (5 um) or chalcopyrite (10 um) may occur in pyrite. Discrete grains of chalcopyrite are commonly mantle by thin rims of digenite. Sulphides comprise approximately 1% of the sample.

Most of the rest of the sample consists of a fine-grained matrix consisting predominantly of blade-like muscovite (<30 um), together with minor amounts of quartz, apatite, and either barian K-feldspar (8 wt% BaO) or plagioclase (An_{10}). Much of this muscovite-rich matrix represents extensively altered feldspar, but in some cases, the matrix is virtually monomineralic and has a well-developed schistosity. Other fragments consist of a fine-grained kaolinite matrix, with lesser amounts of muscovite and jarosite.

FB5-P4:

This sample contains abundant coarse-grained quartz (<2 mm), which contains numerous fluid inclusions (< 10 um). The quartz is strained, and exhibits undulatory extinction. Mutual grain boundaries are highly irregular, and have a sutured appearance. The sample also contains uncommon, K-feldspar grains (0.5-1.0 mm; 2.4% BaO) with a very dusty appearance, which do not exhibit twinning. These grains may contain euhedral to subhedral inclusions of equant pyrite. Rare dark brown biotite (<1 mm) with altered margins, and plagioclase (An_{54}) with polysynthetic twinning, is also present.

Much of the sample, however, consists predominantly of very fine-grained muscovite, together with varied amounts of equant, anhedral pyrite (<100 um), chalcopyrite (<200 um), quartz, apatite, and somewhat coarser muscovite. Pyrite may contain inclusions of baryte and apatite. This fine-grained assemblage coexists with coarse-grained quartz and feldspar, and also occurs as discrete fragments, and may therefore represent pseudomorphs after feldspar.

Rarely, muscovite-rich fragments are cross-cut by quartz-veins (200-300 um wide). The quartz grains (<100 um) in these veins are relatively clear, and typically contain few fluid inclusions.

Relatively coarse-grained pyrite (100-700 um, rarely to 2 mm) occurs as discrete fragments, and in granular intergrowths with quartz. Chalcopyrite is typically mantled by a thin margin of covellite. These margins are typically <5 um wide. Covellite may also occur along internal fractures in chalcopyrite. Sulphides comprise approximately 2% of the sample.

FB6-43:

This sample contains a moderate amount of inequigranular quartz aggregates, as well as variably altered coarse-grained feldspar (<2.5 mm). Plagioclase exhibits well-developed polysynthetic twinning. Rims compositions (An_{60}) are more calcic than cores (An_{48}). K-feldspar grains (Or_{84}) do not exhibit twinning. Quartz grains (0.05 -2.0 mm) are highly

strained, with pronounced undulatory extinction. Mutual quartz grain boundaries are highly irregular. Some coarse, strained quartz contains inclusions of finer (50-150 um) unstrained quartz, implying some recrystallization. Strained quartz contains a moderate amount of fluid inclusions. Some inclusions are elongate, and are oriented in curvilinear trails.

Much of the sample consists of very fine-grained intergrowths (typically <10 um) of bladelike muscovite, lesser quartz, and minor amounts of irregular apatite. Fine-grained calcite may also be present. Muscovite may be coarser-grained in some fragments, but is mostly <30 um. Small patches of fine-grained kaolinite are only rarely present. Fine patches of remnant feldspar locally occur, implying that at least some of this assemblage represents extensively altered feldspar.

Subhedral pyrite (50-250 um) occurs in this fine-grained matrix. Pyrite may contain fine-grained, anhedral inclusions of chalcopyrite or pyrrhotite (10-20 um). Anhedral chalcopyrite (<100 um) also occurs as less abundant, discrete grains. Relatively coarse-grained pyrite (0.5-1.0 mm) occurs as discrete fragments, and rarely as granular intergrowths with plagioclase. Sulphides comprise approximately 2% of the sample.

There are also uncommon fragments rich in subhedral grains of magnetite (10-50 um), which coexist in a fine-grained chlorite-rich matrix with elongate titanite, as well as anhedral plagioclase, quartz, and K-feldspar.

A single fragment is mineralogically distinct, and consists of coarse rutile and quartz, together with minor amounts of ilmenite needles and epidote. Rutile grains exhibit irregular compositional heterogeneity, defined by varied Nb contents.

FB7-P4:

This sample contains inequigranular (50-500 um) quartz aggregates, variably altered feldspar, and biotite, together with a fine-grained mica-rich matrix. In general, coarse quartz grains are strained and exhibit pronounced undulatory extinction, but finer grains are only moderately strained or apparently unstrained. Coarse feldspars (Or_{92}) are strongly altered. Relatively fresh patches within these grains are rare. Some preserved K-feldspar grains are sieve-textured. The abundant inclusions are exposed as pits in the polished surface of the grains.

Biotite (<2 mm) exhibits dark orange-brown to pale brown pleochroism, and has some patchy alteration. Some grains are almost completely pseudomorphed by pale-green chlorite, and contain elongate inclusions of ilmenite.

The mica-rich matrix typically consists of very fine-grained to medium-grained muscovite blades, with relatively coarse, equant pyrite (50-200 um). Rutile typically occurs as inclusions in pyrite. Locally, however, the matrix consists of fine-grained intergrowths of biotite, chlorite, muscovite, kaolinite, and quartz.

Some fragments consist of medium-grained, interlocking carbonate rhombs (100-200 um). The rhombs consist of alternating bands of calcite and ferroan dolomite, and the fragments may contain minor amounts of interstitial quartz and kaolinite.

Sulphide grains occur throughout, but are not common in quartz aggregates. They consist of discrete grains (50-100 um) or aggregates of equant pyrite and chalcopyrite, with minor amounts of tetrahedrite. Rarely, pyrite is mantled by thin rims (10-20 um) of chalcopyrite. Coarse-grained pyrite (1-2 mm) occurs as discrete fragments. Sulphides comprise approximately 2% of the sample.

FB7-43:

This sample predominantly consists of inequigranular quartz aggregates, together with coarse-grained (0.5-2.0 mm) variably altered K-feldspar in a fine-grained mica-rich matrix. Quartz (0.1-1.0 mm) exhibits undulatory extinction, and contains relatively abundant fluid inclusions (10-30 um). Quartz also occurs as fine-grained (50 um) aggregates with minor interstitial biotite. These aggregates may also contain some coarse, strained quartz grains. Coarse-grained K-feldspar (0.5-2.0 mm; Or_{92}) is sieve-textured, and contains fine-grained (5-20 um) elongate inclusions of kaolinite and quartz.

The matrix typically consists of abundant fine-grained muscovite (20-50 um), together with medium-grained quartz, equant pyrite, and minor amounts of apatite and ferroan dolomite. Quartz in this matrix exhibits minor undulatory extinction, and fluid inclusions are not abundant. Locally, the matrix consists of very fine-grained (5-20 um) intergrowths of muscovite and calcite, with interstitial smectite.

Sulphides consist predominantly of anhedral to subhedral, equant pyrite (50-200 um) in the mica-rich matrix. These contain anhedral inclusions of apatite and K-feldspar (10-30 um), and less common inclusions of fine-grained chalcopyrite (10 um). Chalcopyrite rarely occurs as discrete grains (<20 um) and may occur together with tetrahedrite. Sulphides comprise approximately 2% of the sample.

One muscovite-quartz-rich fragment is transected by a pyrite-rich vein (300 um wide). The vein has uncommon inclusions of chalcopyrite and rutile, and has a ferroan dolomite margin.

FB8-43:

Many fragments in this sample consist of coarse-grained plagioclase feldspar and lesser biotite in a fine-grained matrix. Plagioclase is typically well-preserved, but contains minor amounts of fine-grained muscovite (<10 um). It exhibits well-developed polysynthetic twinning, and does not exhibit pronounced compositional zonation (An_{33} core; An_{30} rim). Coarse-grained biotite (0.5-1.5 mm) exhibits dark orange-brown

pleochroism, and is commonly altered to pale green chlorite along grain margins. Coarse euhedral patches consisting of fine-grained muscovite, chlorite, and lesser biotite are set in the fine-grained quartz and K-feldspar matrix, and may represent pseudomorphs after biotite. Other pseudomorphs consist of fine-grained (5-20 um) muscovite and dolomite with minor biotite and interstitial kaolinite, but the precursor mineral is unidentified.

The fine-grained matrix typically consists of granular intergrowths of quartz and K-feldspar, together with minor amounts of albite, muscovite and patches of very fine-grained smectite. Locally, this matrix lacks K-feldspar but contains more abundant muscovite and smectite, as well as trace amounts of titanite and apatite.

This sample contains a variety of other lithological types, although they are not abundant. Some fragments consist of fine-grained intergrowths of stubby and elongate muscovite blades, biotite, albite (An_6), and very fine-grained patches of kaolinite. Rare fragments are exceptionally muscovite-rich, and the parallel orientation of muscovite blades defines a pronounced foliation. Other fragments consist of granular dolomite (FeO=7%) and K-feldspar (50 um), with minor quartz and kaolinite (<10 um).

A single fragment consists of euhedral dolomite rhombs (100 um) in an interstitial matrix of fine-grained muscovite, kaolinite, and minor siderite. The dolomite exhibits concentric zoning, characterized by varied Fe contents.

Relatively coarse, anhedral pyrite occurs in the fine-grained matrix of many fragments. The pyrite may contain fine-grained inclusions (10 um) of chalcopyrite, as well as biotite, calcite, and apatite. Pyrite may also occur along the cleavages of coarse biotite, together with minor chlorite. Fine-grained pyrite (<50 um) is not common. Sulphides comprise approximately 5% of the sample.

Figure Captions:

08-296:

08-2960001: Muscovite-rich feldspar pseudomorph consisting of muscovite (medium grey), quartz (dark grey) and K-feldspar (light grey).

08-2960005: Biotite-rich fragment consisting of biotite (light grey), quartz (dark grey), plagioclase (medium grey) and kaolinite (very dark grey). Kaolinite is spatially associated with plagioclase.

08-2960006: Poikilitic pyrite (light grey) with fine-grained inclusions of chalcopyrite (white), and plagioclase, biotite, and rutile (dark grey).

08-234:

08-2340001: Muscovite-rich feldspar pseudomorph predominantly consisting of muscovite (medium grey) and quartz (dark grey), together with anhedral pyrite (white).

08-2340004: Carbonate-rich matrix consisting of fine-grained dolomite (dark grey), Mn-dolomite (medium grey), zoned rutile (light grey), and apatite (light grey), together with minor pyrite (white).

08-2340005: Zoned rutile grains in carbonate-rich matrix. The brighter cores are relatively W-rich.

08-270:

08-2700004: Fine-grained intergrowth consisting of K-feldspar, muscovite (darker blades) and minor chlorite (lighter blades).

08-2700006: Irregular chalcopyrite (light grey) with a mantle of digenite (white).

08-2700007: Fine-grained intergrowth of quartz (dark grey), muscovite (darker blades), chlorite (lighter blades), and minor amounts of albite (dark grey).

08-2700008: Irregular grain of pyrite containing anhedral inclusions of pyrrhotite (light grey) and chalcopyrite (white).

08-285:

08-2850003: Anhedral pyrite grain (light grey) containing fine-grained inclusions of chalcopyrite (white).

08-2850005: Fine-grained intergrowth of calcite (medium grey), Fe-rich carbonate (light grey), and quartz (dark grey) adjacent to pyrite (top; light grey). Calcite exhibits subtle variations in grey-scale due to varied FeO contents. The white grains (centre) are chalcopyrite.

08-2850007: Biotite (medium grey) with altered cleavage planes consisting of quartz (dark grey), kaolinite (darker grey), and fine-grained calcite and siderite (light grey).

08-2850009: Fine-grained intergrowth of K-feldspar (medium grey), calcite and Fe-dolomite (light grey) and kaolinite (dark grey).

08-2850011: Subhedral calcite (light grey), together with minor quartz and muscovite (medium grey) in a kaolinite matrix (dark grey).

08-2850012: Mixed sulphides consisting of anhedral pyrite (medium grey), chalcopyrite (light grey) and fine-grained tennantite (white), together with K-feldspar (top), calcite (centre), apatite (lower right), and kaolinite after biotite (lower left).

FB5-43:

FB5-430001: Chalcopyrite (light grey) mantled by digenite (white), set in fine-grained matrix of muscovite and plagioclase.

FB5-430002: Randomly oriented muscovite blades together with quartz (dark grey) and barian K-feldspar (light grey).

FB5-430003: Randomly oriented muscovite blades (light grey; 10-40 um) in plagioclase (medium grey).

FB5-430004: Fragment consisting virtually entirely of fine-grained muscovite. Apatite (white) is at right.

FB5-430005: Kaolinite-rich fragment with fine-grained (<10 um) muscovite (light grey) and jarosite (white).

FB5-P4:

FB5-P40001: Muscovite-rich fragment consisting of fine-grained muscovite (< 20 um; left), coarser muscovite (>50 um; lower right) and fine-grained quartz. Anhedral pyrite (white) is at bottom centre.

FB5-P40003: Coarse pyrite grain with inclusions of baryte (white), as well as K-feldspar, quartz, and apatite (dark grey).

FB5-P40004: Pyrite (medium grey), and chalcopyrite (light grey) set in a matrix of fine-grained muscovite. Chalcopyrite is mantled by a thin rind of covellite (white).

FB5-P40006: Chalcopyrite (light grey) mantled by covellite, set in a matrix of fine-grained muscovite and quartz.

FB6-43:

FB6-430002: Relatively coarse-grained pyrite set in a muscovite-rich matrix. The dark grey patch (upper left) is very fine-grained kaolinite. Pyrite contains fine-grained (<20 um) inclusions of chalcopyrite and pyrrhotite (white).

FB6-430003: Intergrowth of fine-grained quartz (dark grey), randomly oriented muscovite blades (medium grey), and calcite (light grey). Rare apatite occurs in this assemblage, but is not shown in this image.

FB6-430004: Chlorite-rich fragment with fine-grained magnetite (white), titanite (light grey), K-feldspar (medium-grey), and quartz and plagioclase (dark grey).

FB6-430005: Fragment consisting of medium-grained quartz (dark grey), rutile (mottled; light grey), and minor amounts of epidote (medium grey). The rutile contains very fine ilmenite needles (white). Rutile is compositionally inhomogeneous, with varied Nb-contents.

FB7-P4:

FB7-P40001: Banded carbonate rhombs, consisting of alternating ferroan dolomite (medium grey) and calcite (light grey). The interstitial material consists of quartz and kaolinite (dark grey).

FB7-P40002: Sieve-textured K-feldspar, exhibiting abundant elongate inclusions (<20 um). The inclusions are exposed as pits, but also contain very fine-grained clay (dark grey).

FB7-P40004: Sulphide cluster consisting of subhedral pyrite (medium grey), anhedral chalcopyrite (light grey) and tetrahedrite (white).

FB7-P40005: Muscovite-rich matrix consisting of quartz (medium grey) and muscovite (light grey).

FB7-P40007: Muscovite-poor matrix consisting of relatively coarse-grained biotite (50-200 um; white), muscovite (10-50 um; light grey), poikilitic quartz (medium grey), and kaolinite (dark grey).

FB7-P40008: Anhedral pyrite (light grey) mantled by chalcopyrite (white), together with K-feldspar (top) and biotite (bottom).

FB7-43:

FB7-430001: Pyrite vein cross-cutting a fragment composed of muscovite and quartz. The pyrite (light grey) has uncommon inclusions of chalcopyrite (white) and rutile (medium grey). The pyrite vein is bounded by a ferroan dolomite margin (20-40 um; dark grey).

FB7-430002: Muscovite-rich fragment consisting predominantly of fine-grained muscovite (light grey) with minor amounts of quartz (dark grey), apatite (not shown), and Fe-dolomite (bottom-left; medium grey).

FB7-430003: Fragment consisting of stubby muscovite blades (typically <20 um; medium grey) and equant calcite (light grey) in a smectite interstitial matrix.

FB7-430006: Chalcopyrite (light grey) and tetrahedrite (white) in muscovite (right; dark grey), adjacent to pyrite (left; medium grey).

FB8-43:

FB8-430002: Fine-grained matrix consisting of muscovite (light grey), plagioclase (medium grey) and minor interstitial smectite (dark grey).

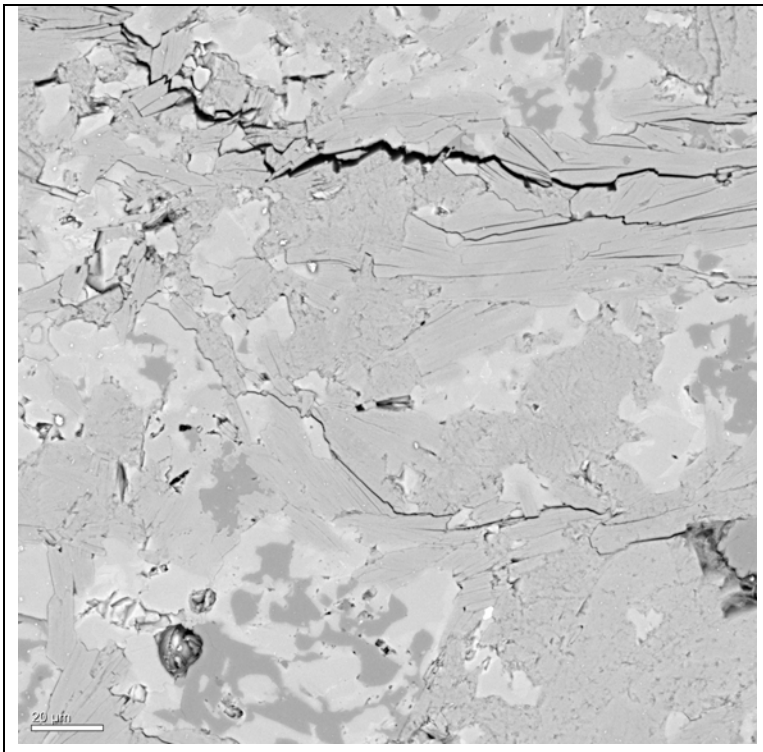
FB8-430003: Muscovite-rich fragment in which the parallel orientation of elongate muscovite defines a strong fabric.

FB8-430007: Coarse pyrite (medium grey) with inclusions of chalcopyrite (white), and calcite, apatite, and K-feldspar (dark grey).

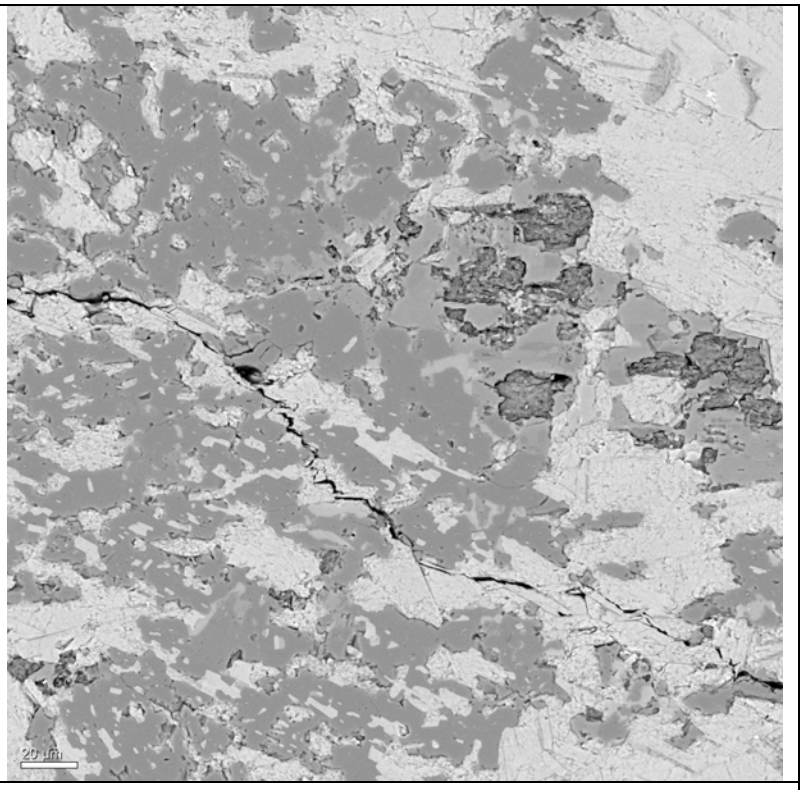
FB8-430009: Coarse-grained muscovite and biotite, with pyrite (white) along cleavage planes, together with fine-grained rutile (light grey) and smectite (dark grey).

FB8-430010: Granular matrix consisting of quartz (medium grey) and K-feldspar (light grey), with albite (medium grey) and smectite (dark grey).

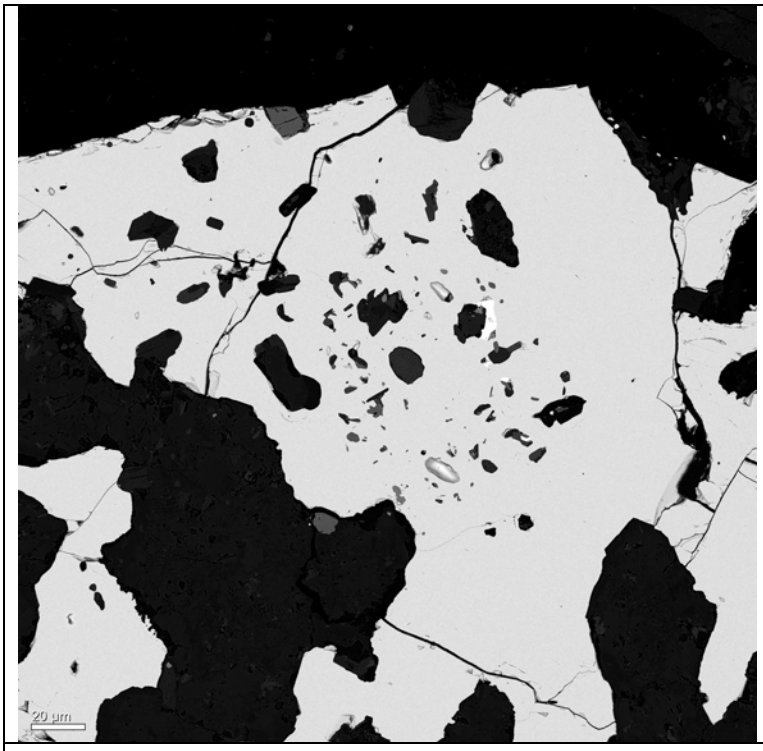
FB8-430011: Euhedral dolomite rhombs with an interstitial matrix of fine-grained muscovite, kaolinite (dark grey), and minor siderite (white). The concentric zoning of dolomite is characterized by varied FeO contents.



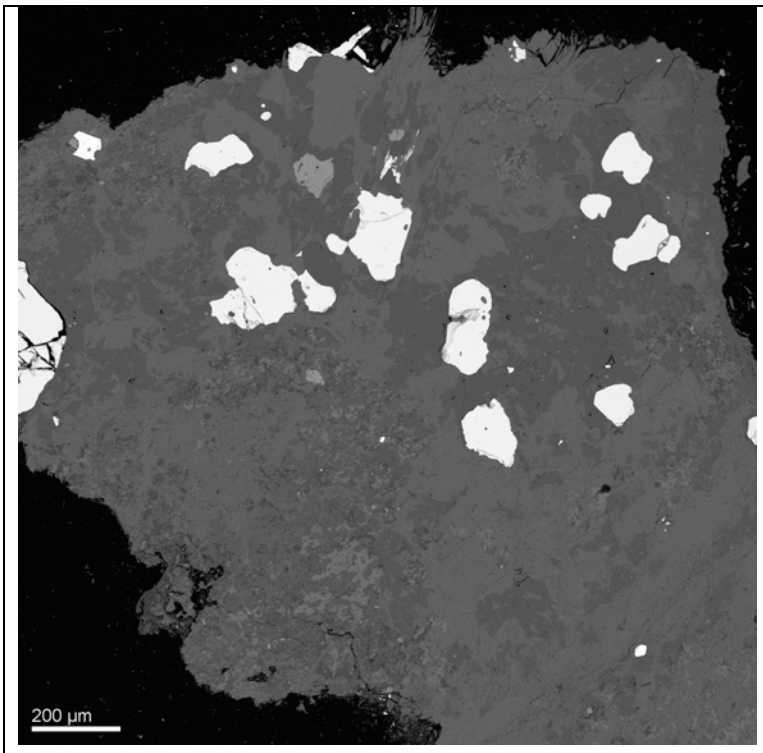
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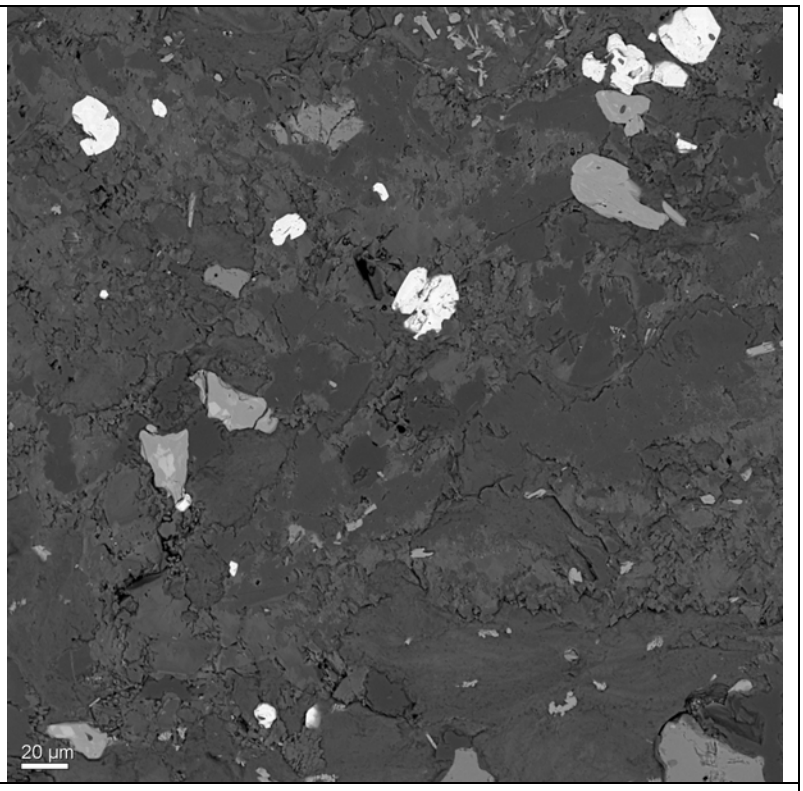
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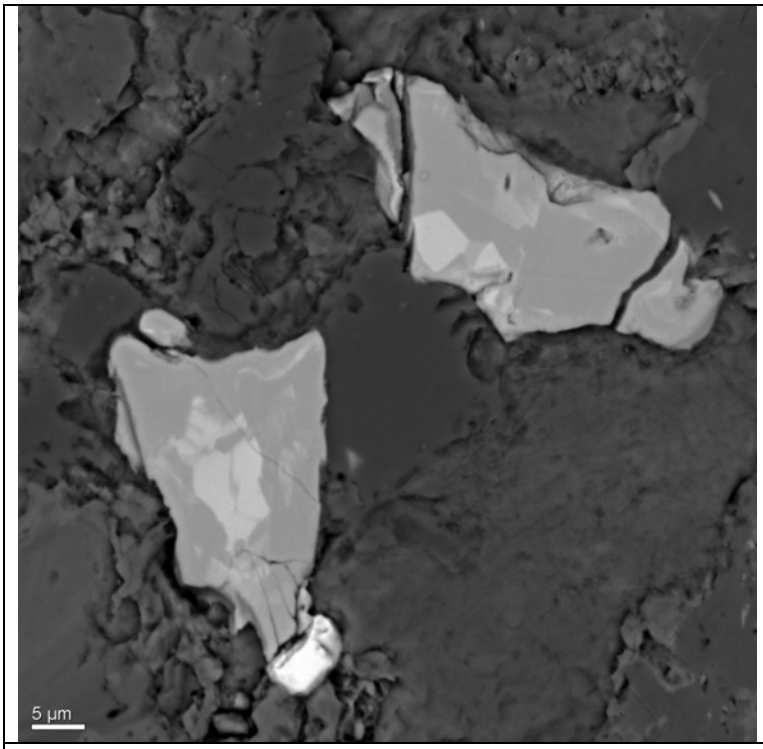
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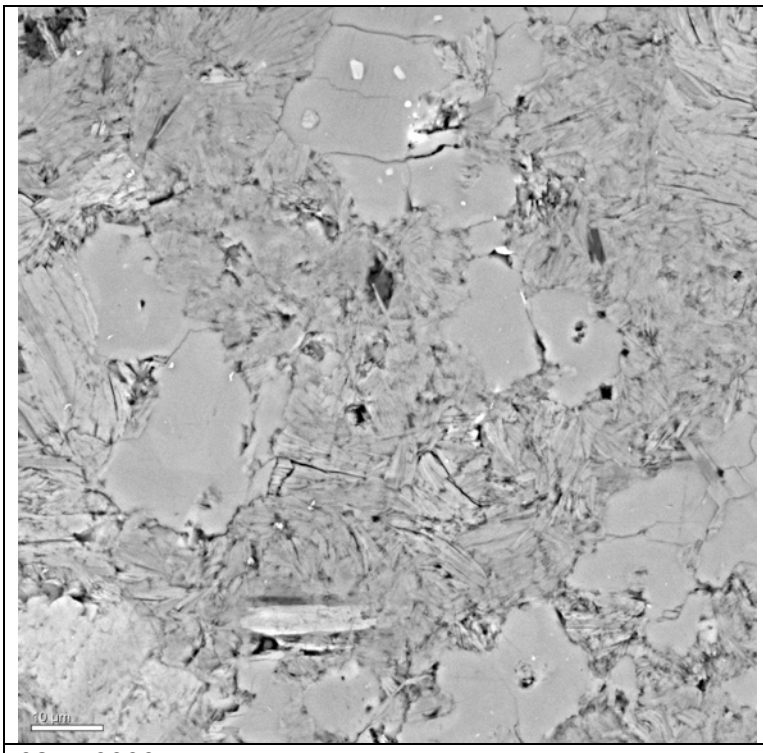
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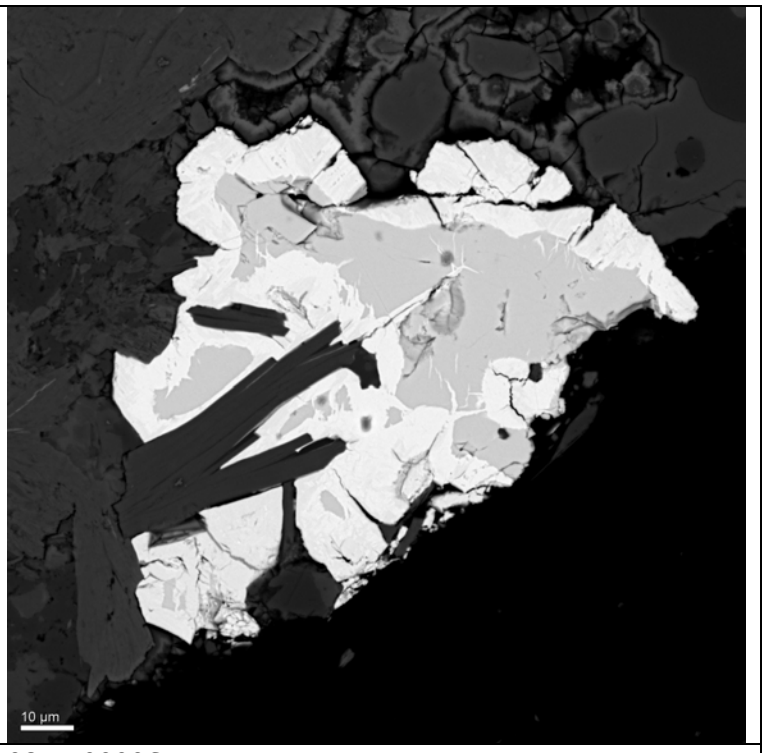
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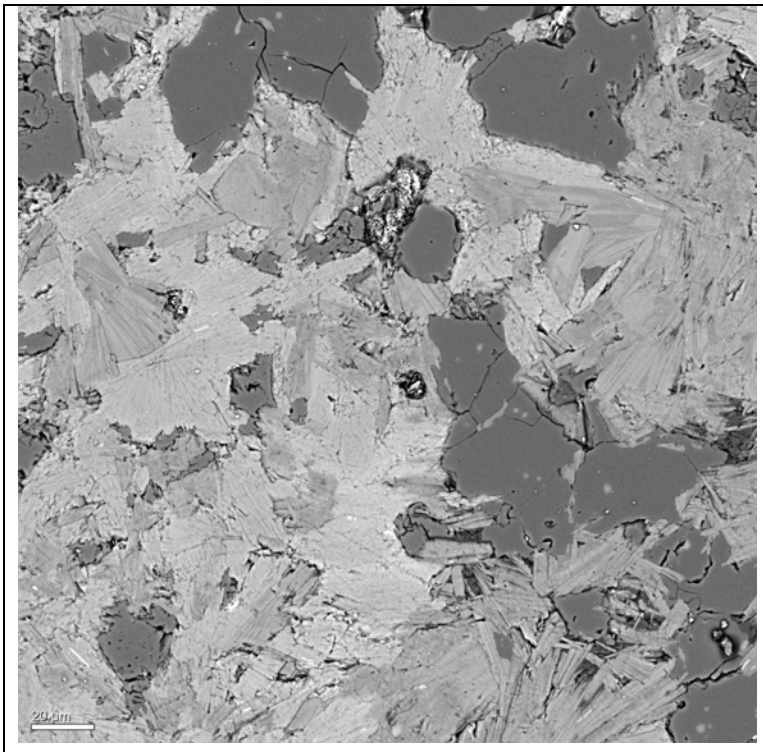
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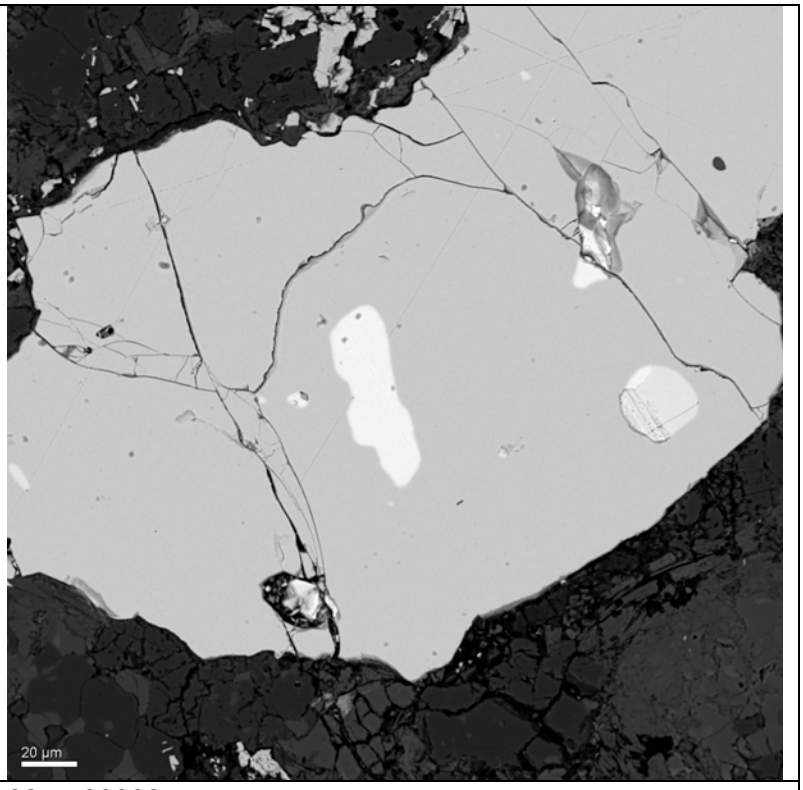
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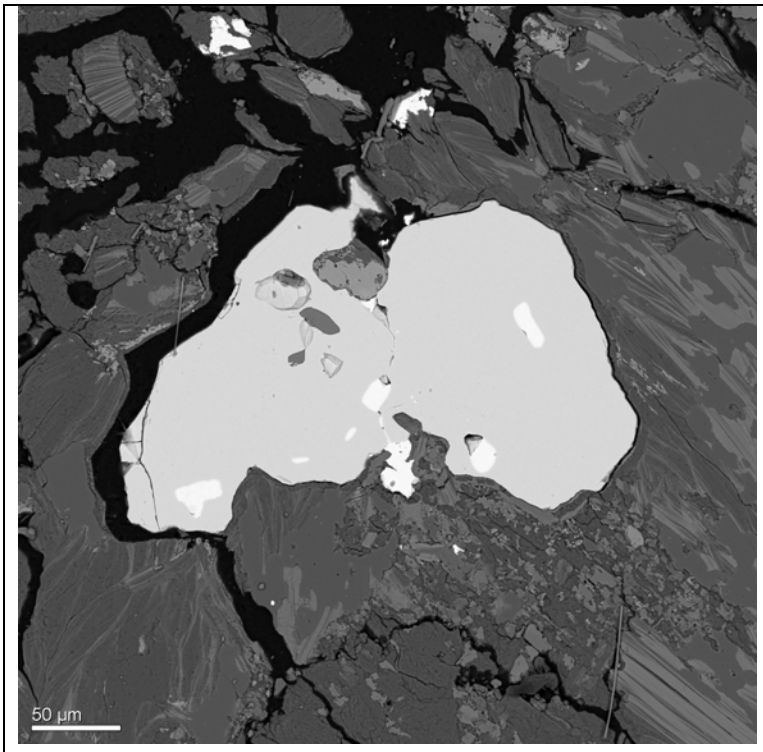
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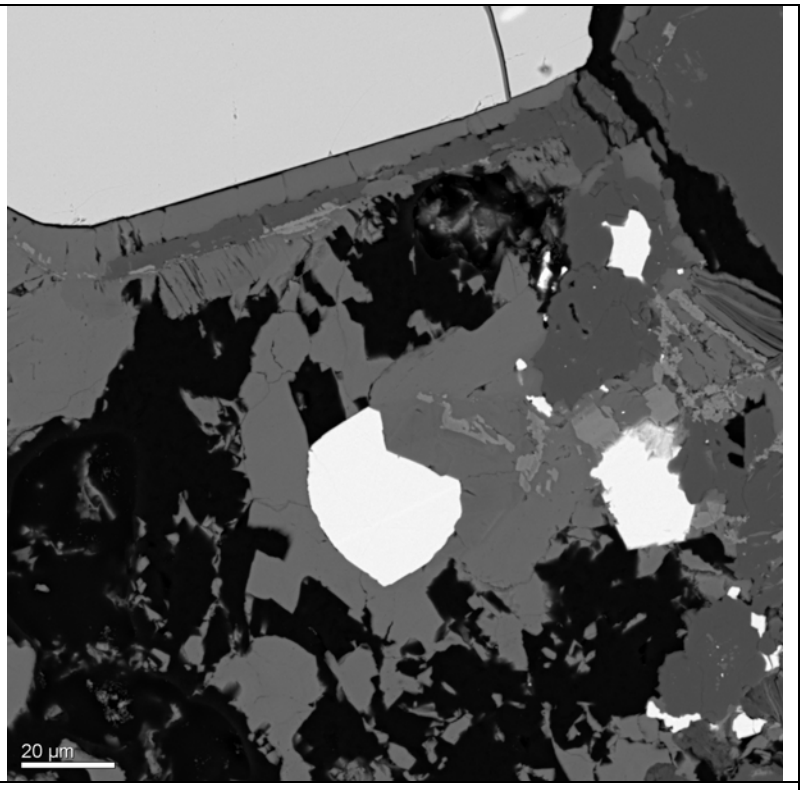
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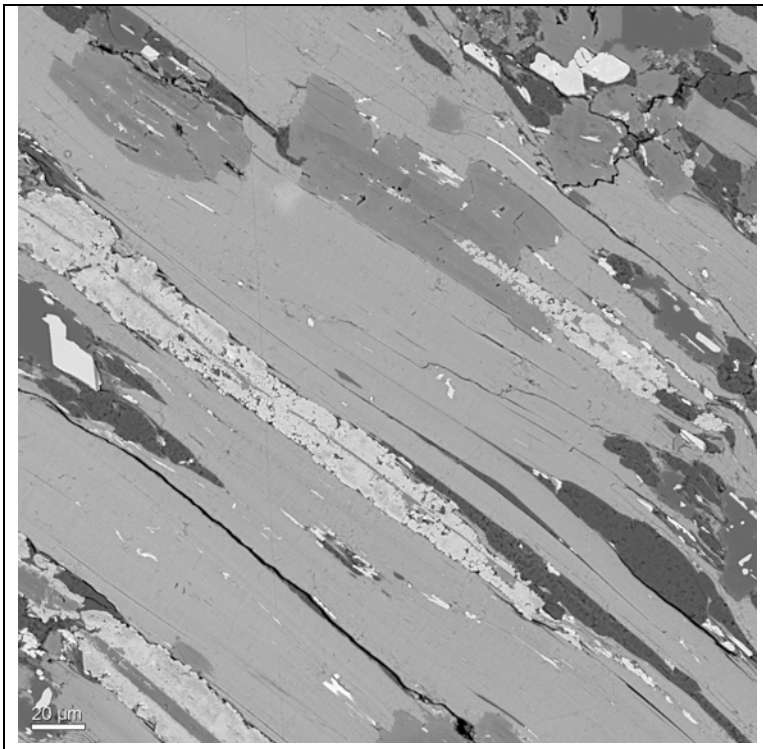
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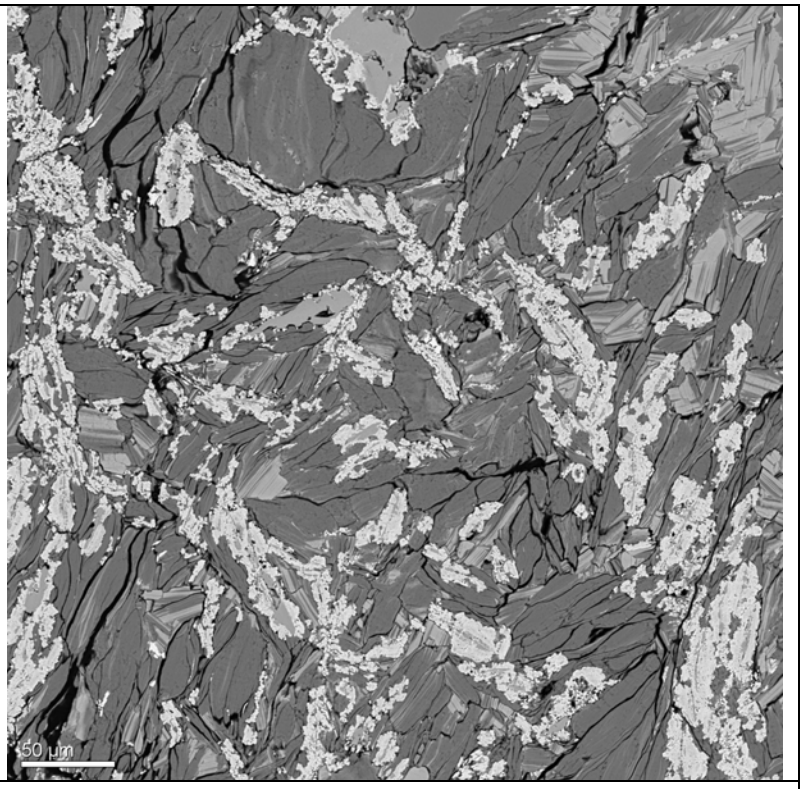
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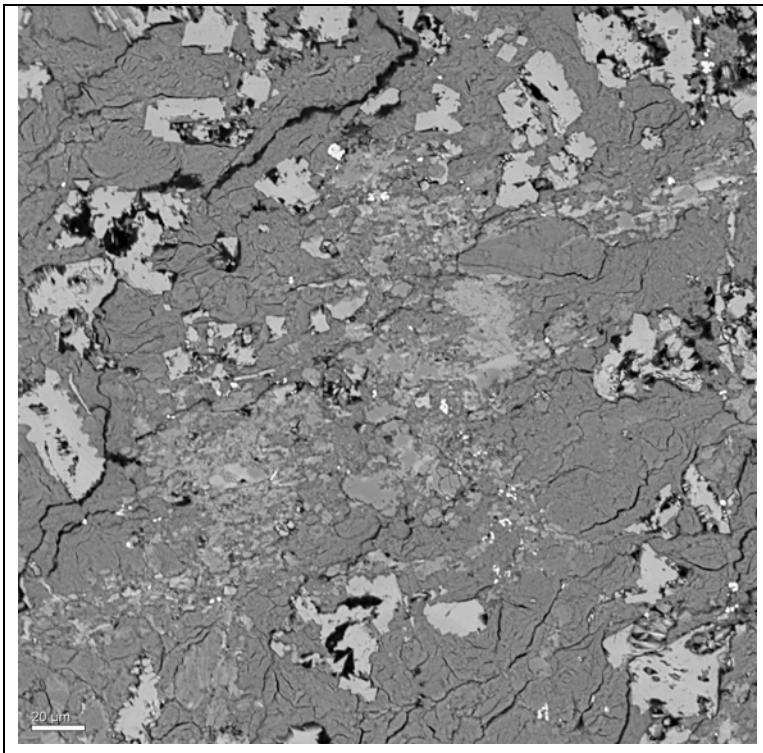
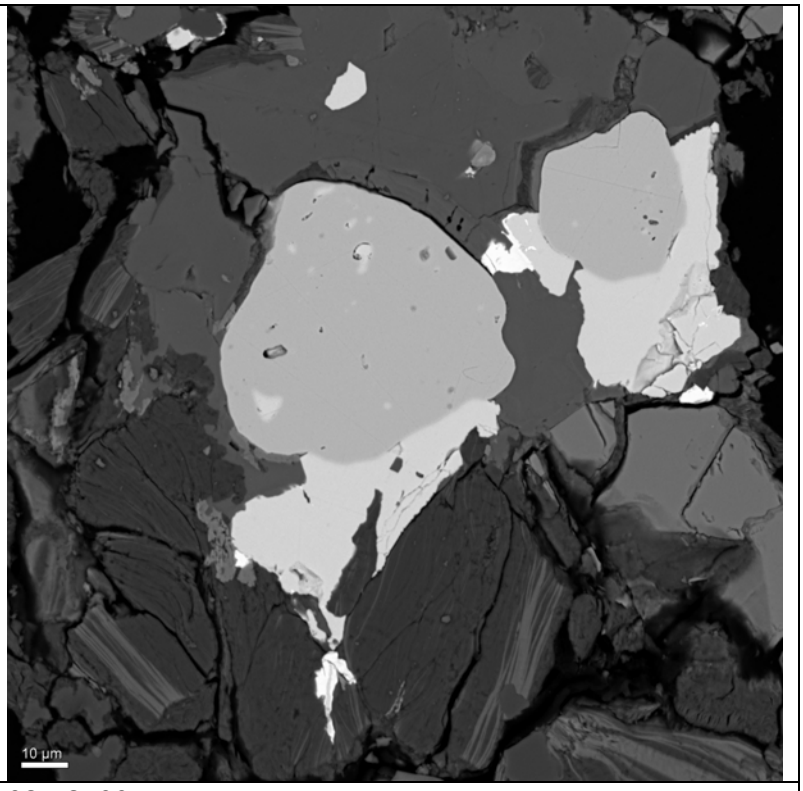
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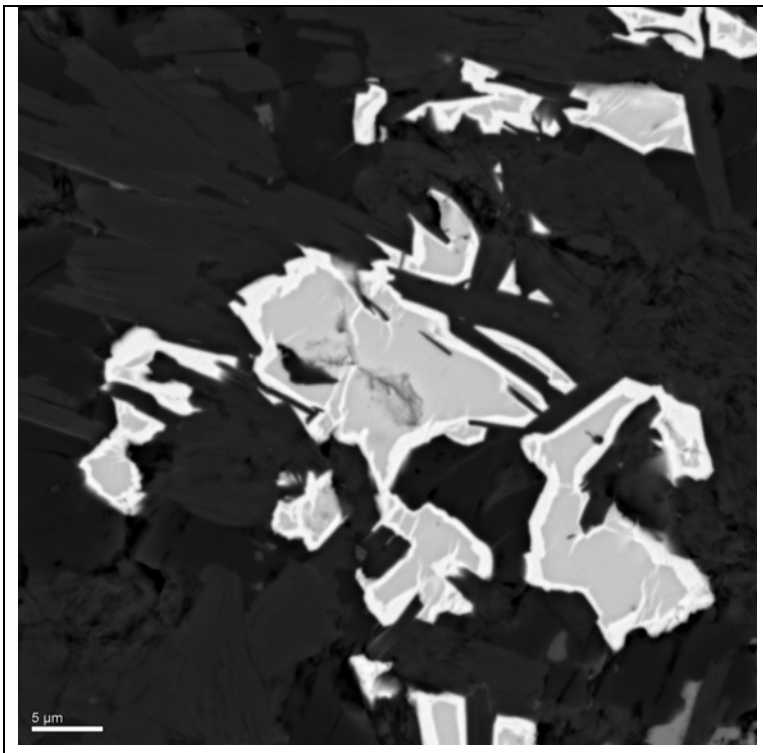


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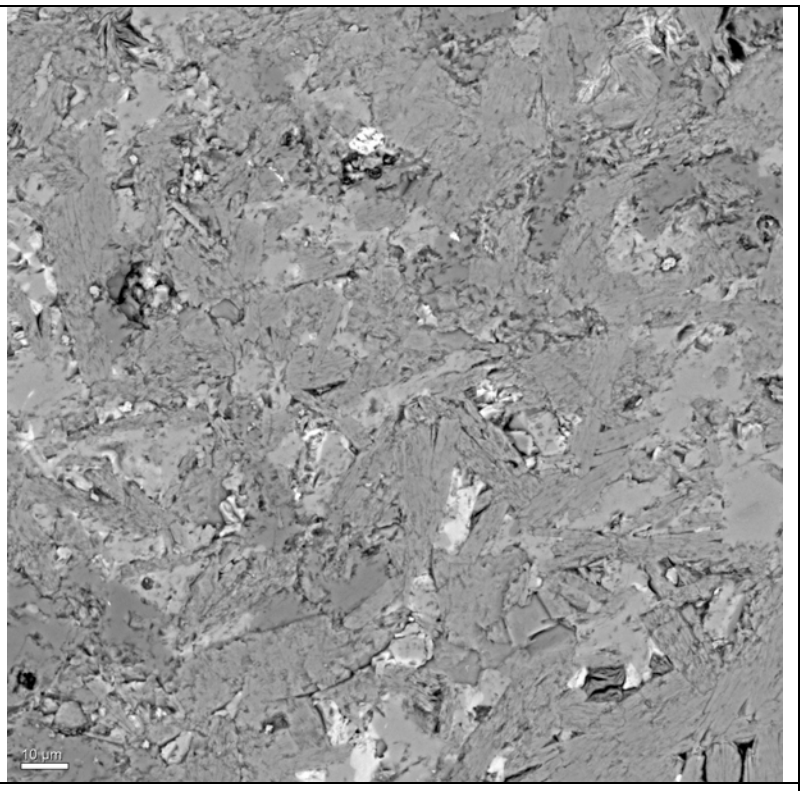


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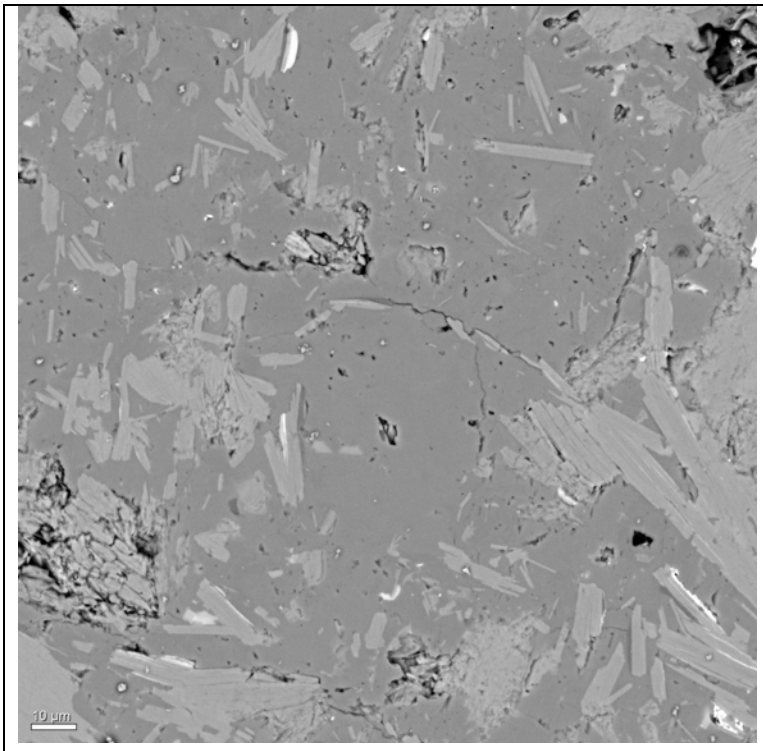
	
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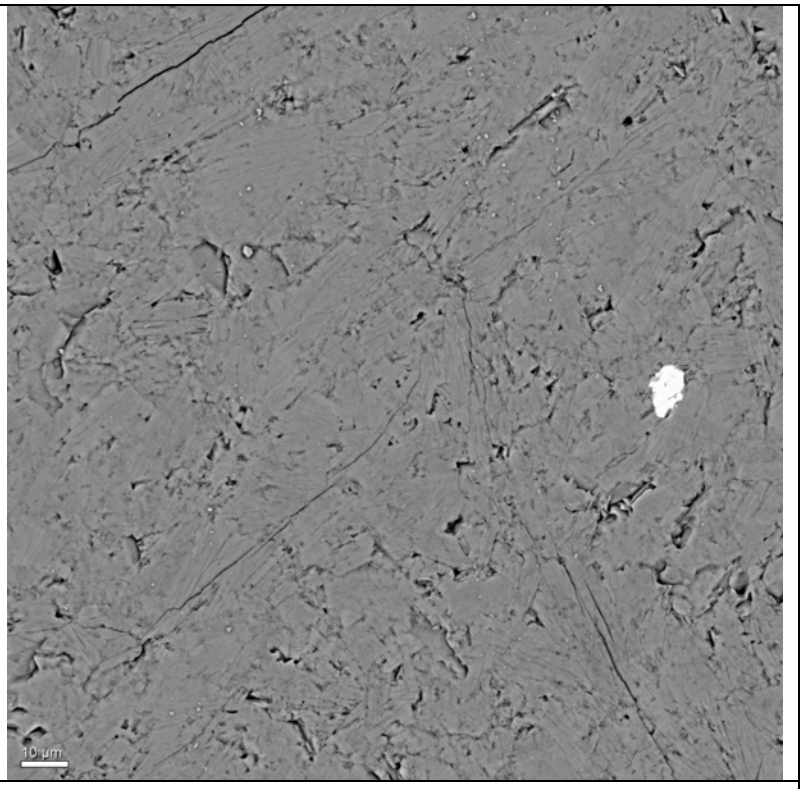
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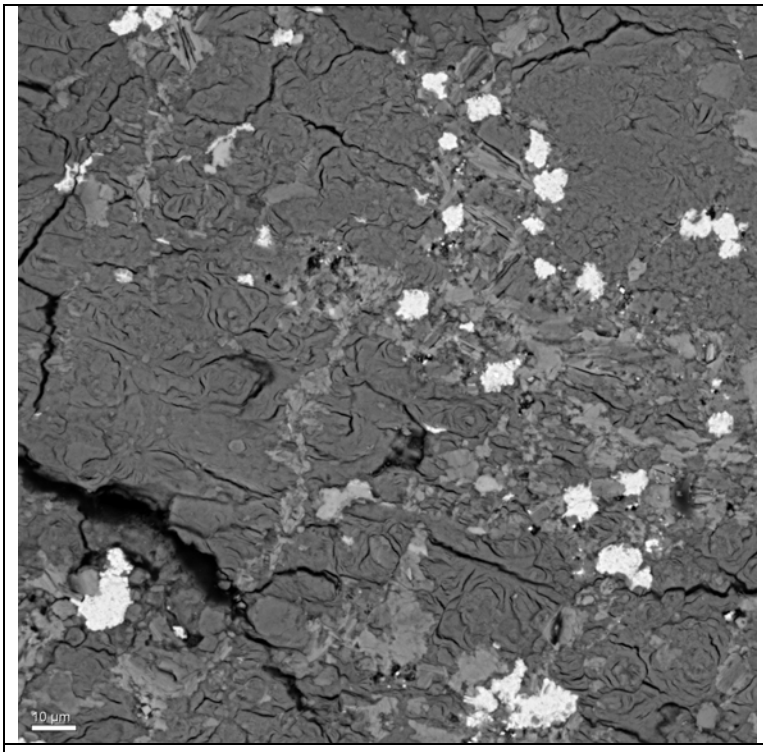
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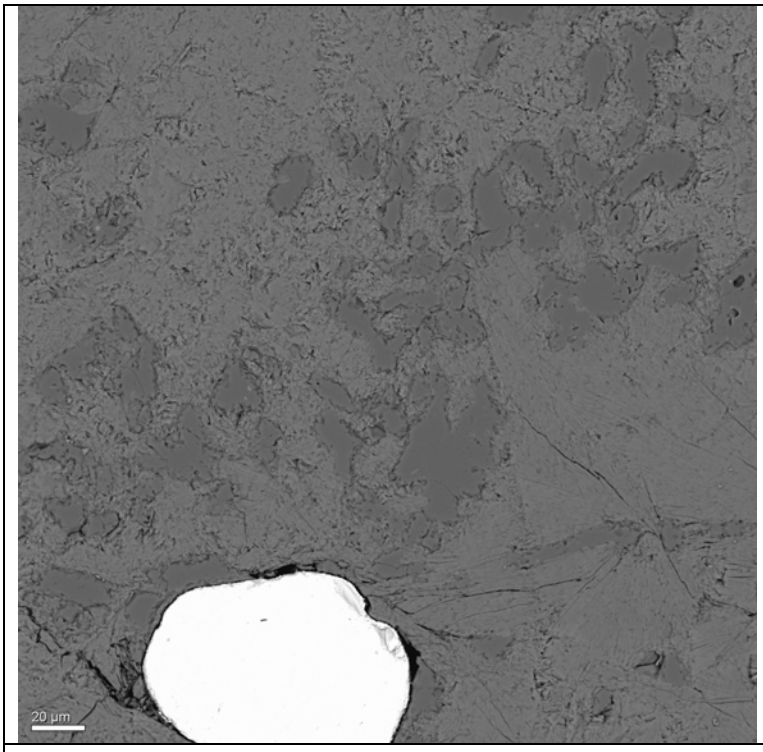


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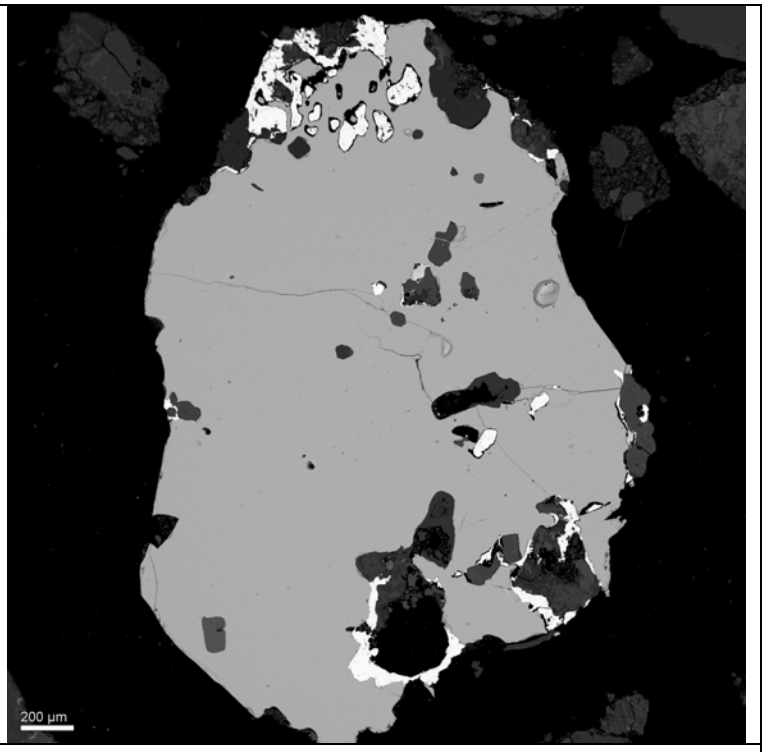


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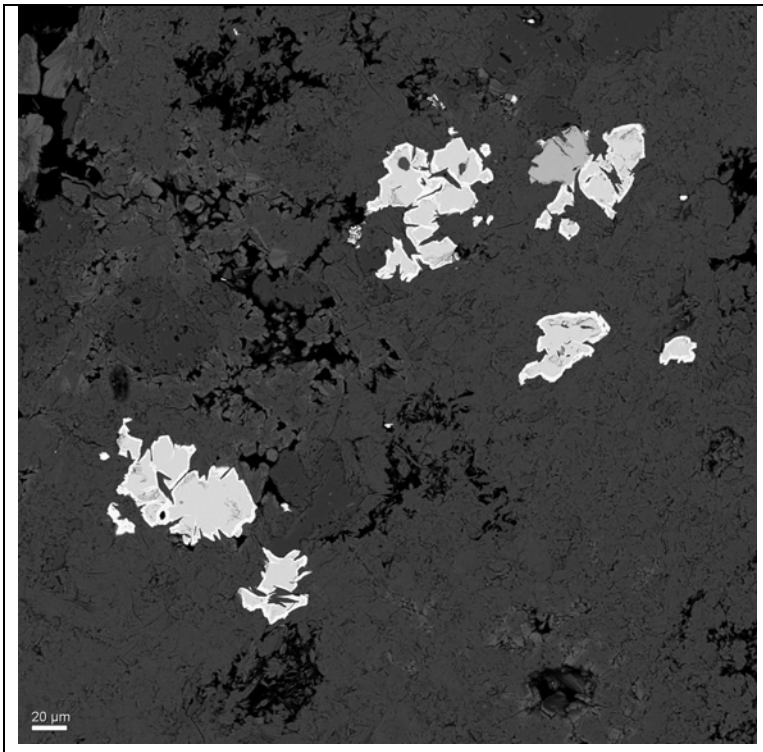
	
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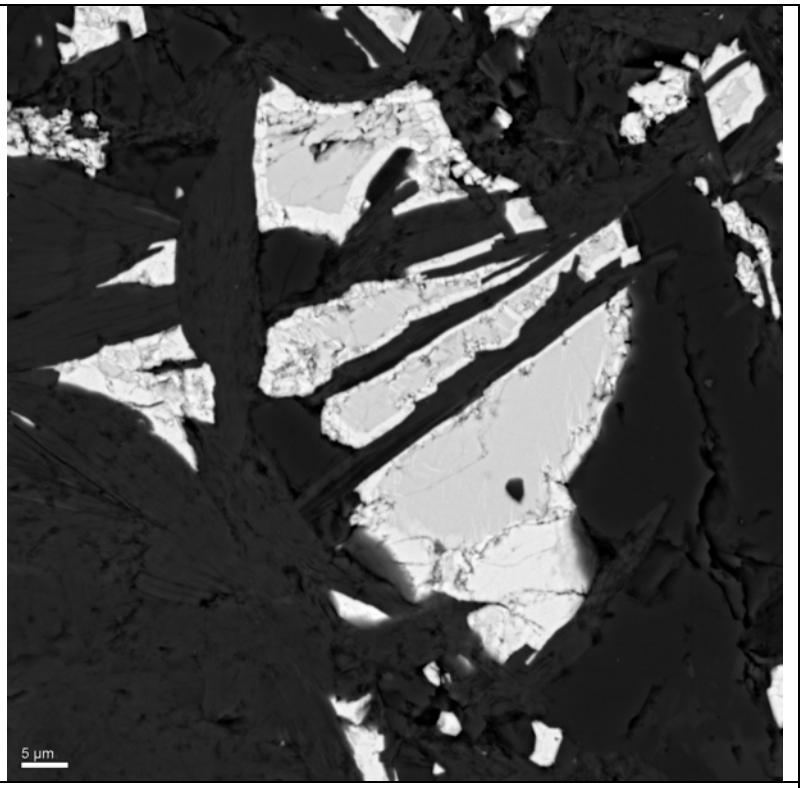
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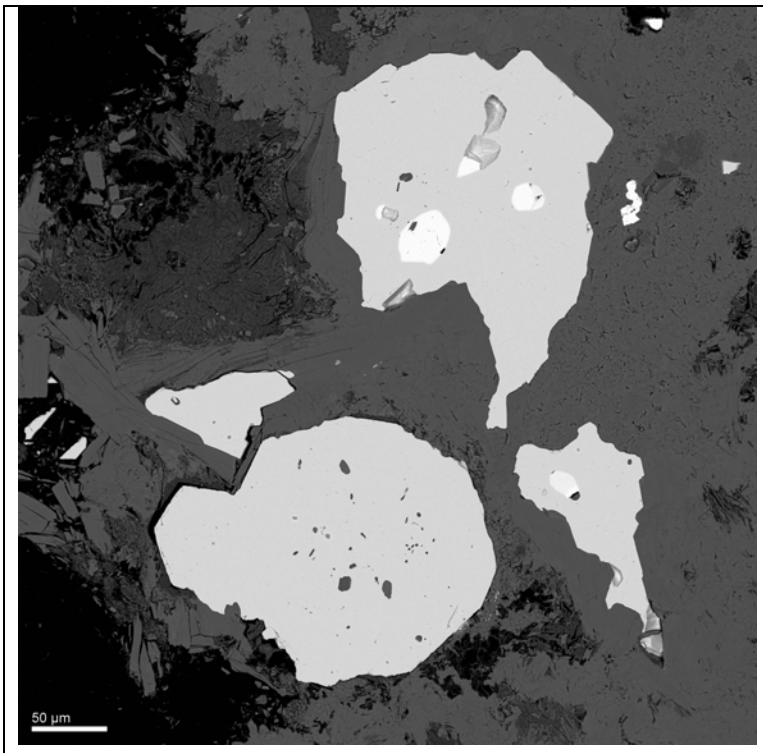
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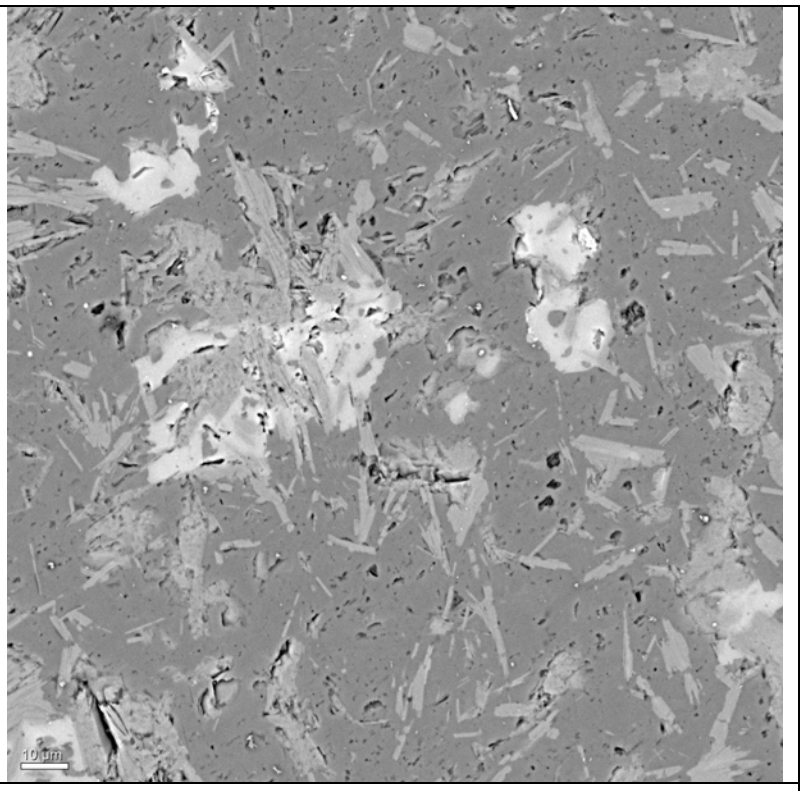
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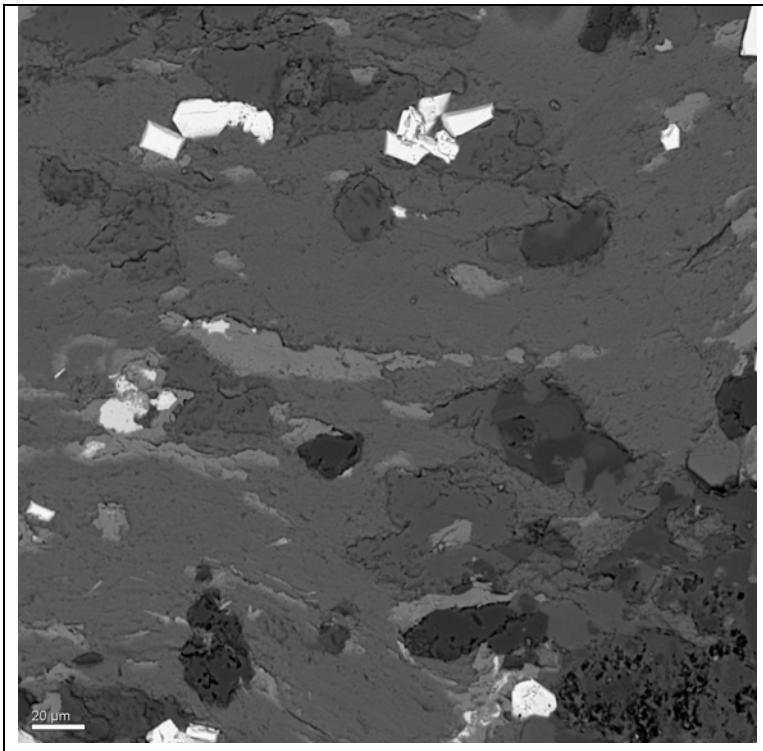
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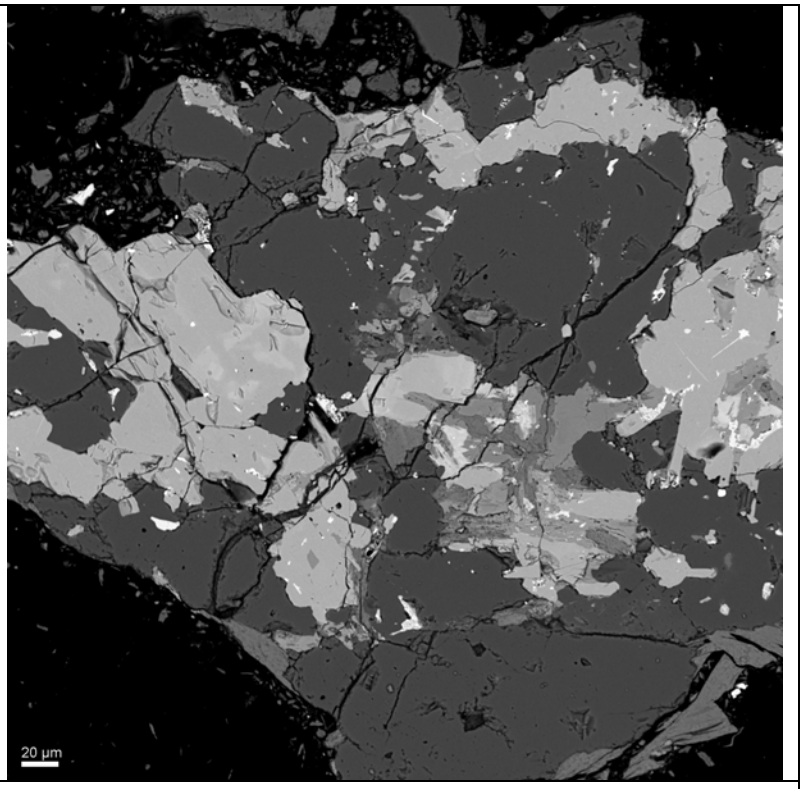
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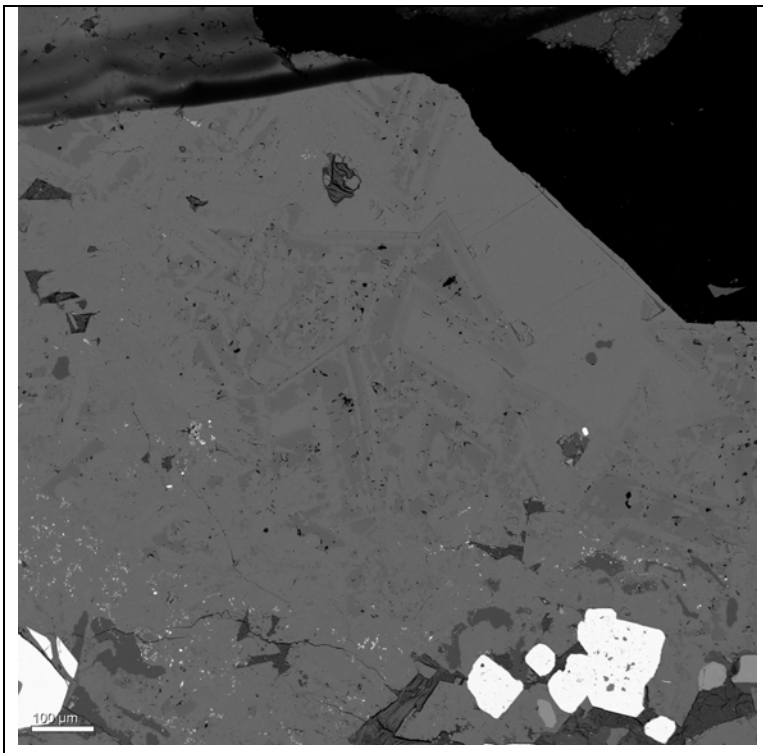
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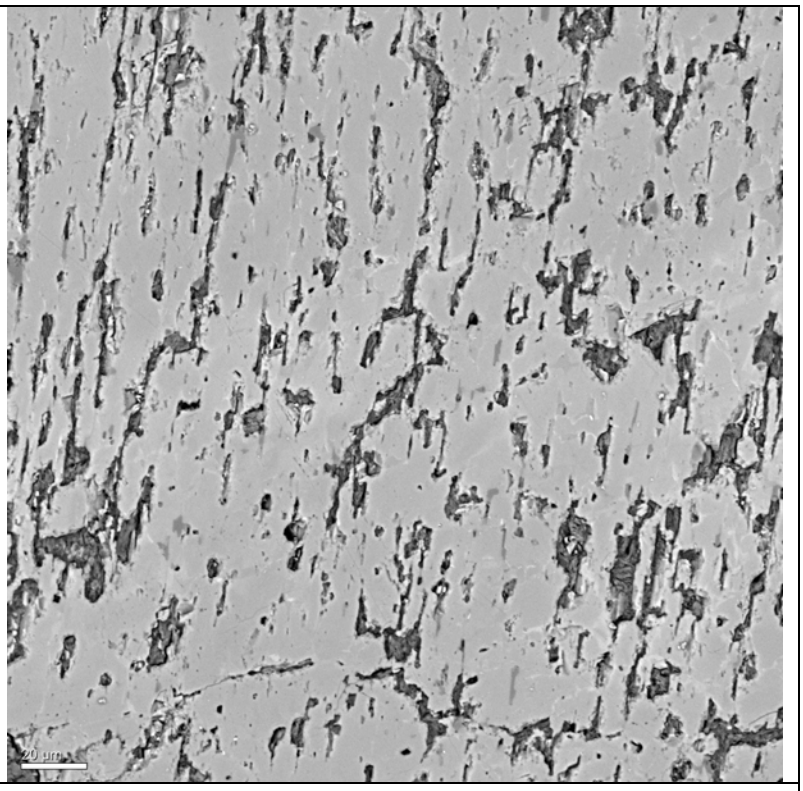
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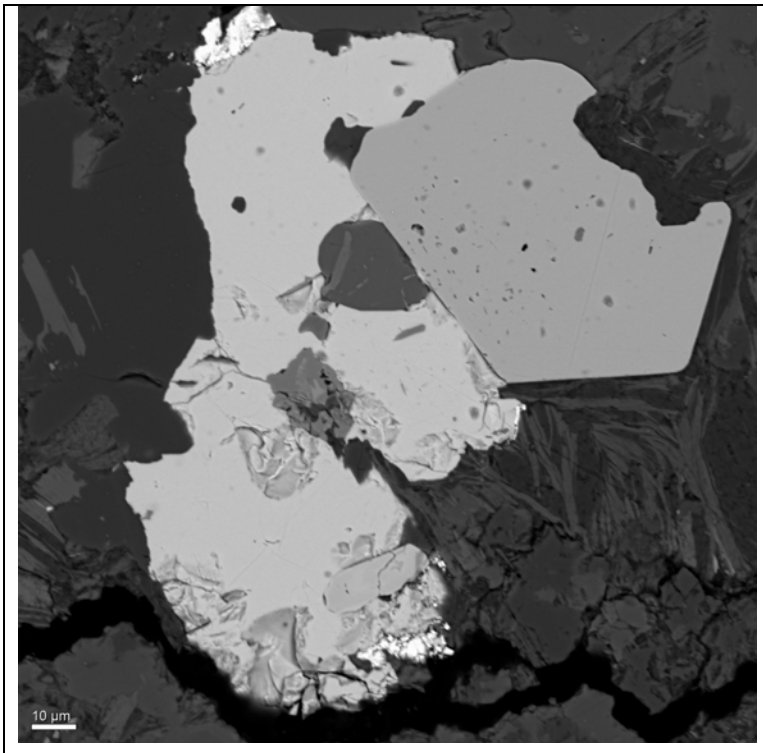
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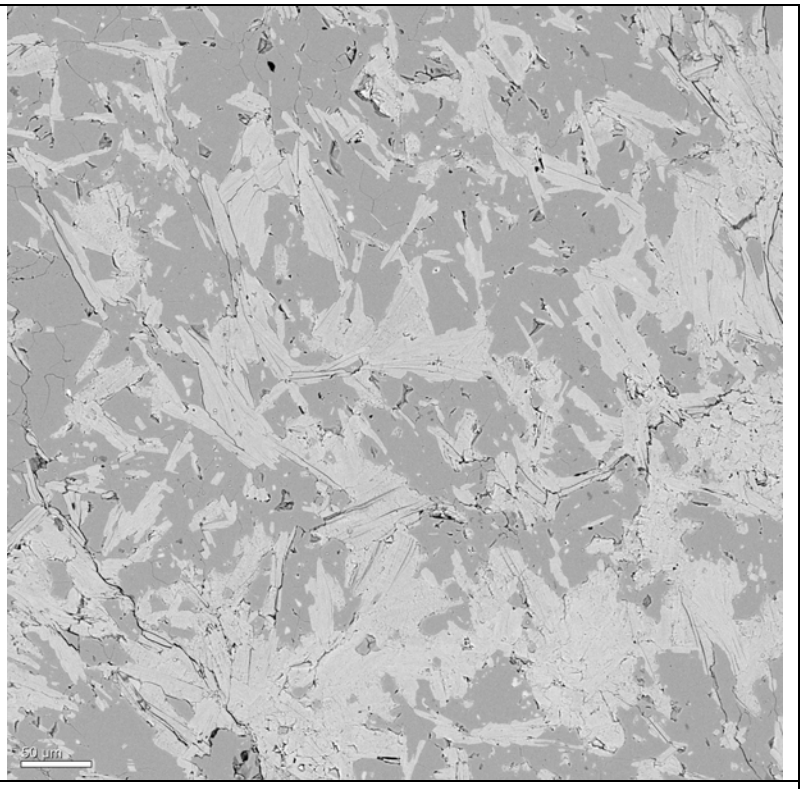
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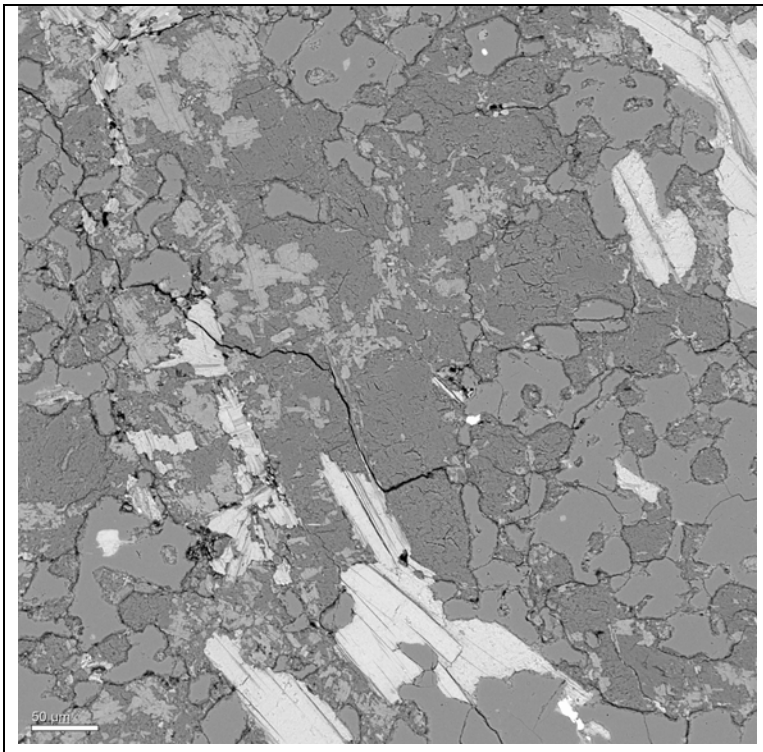
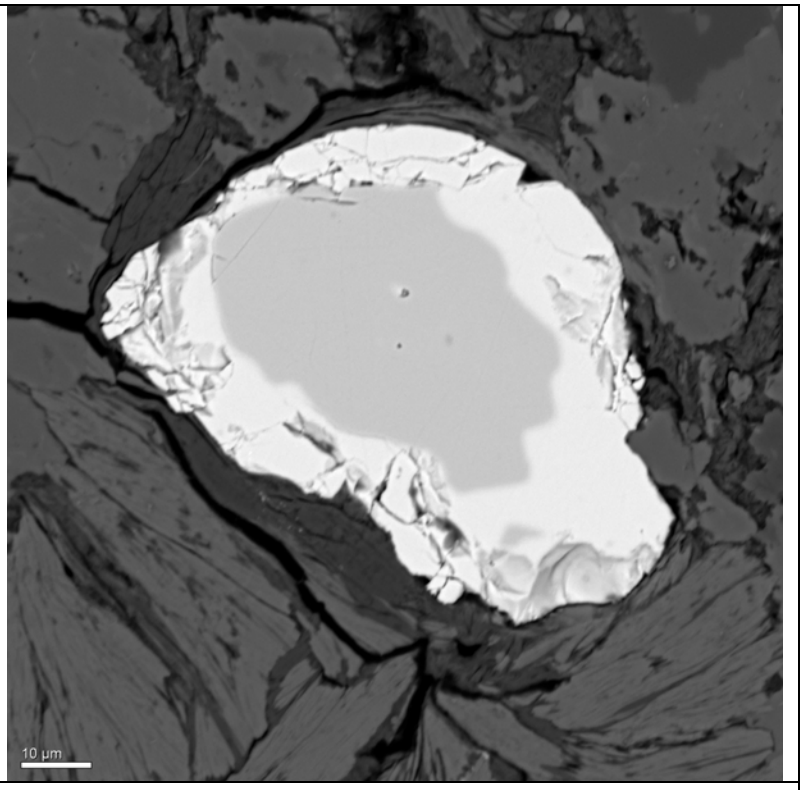
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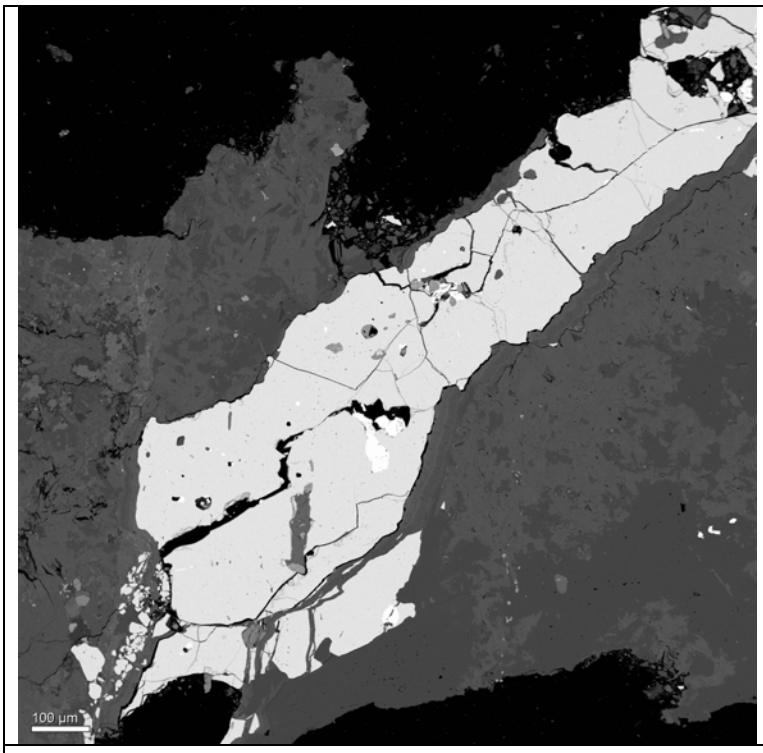


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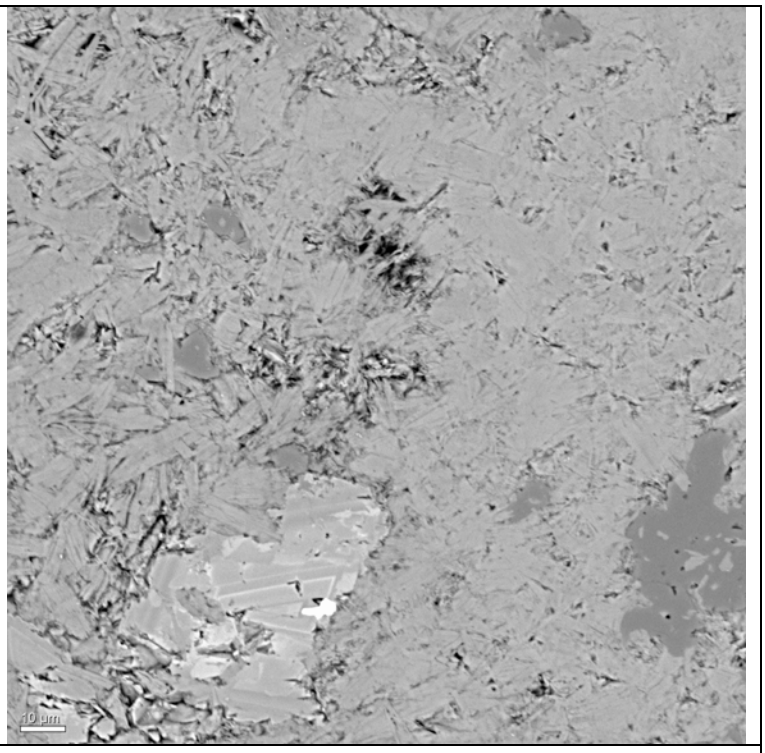


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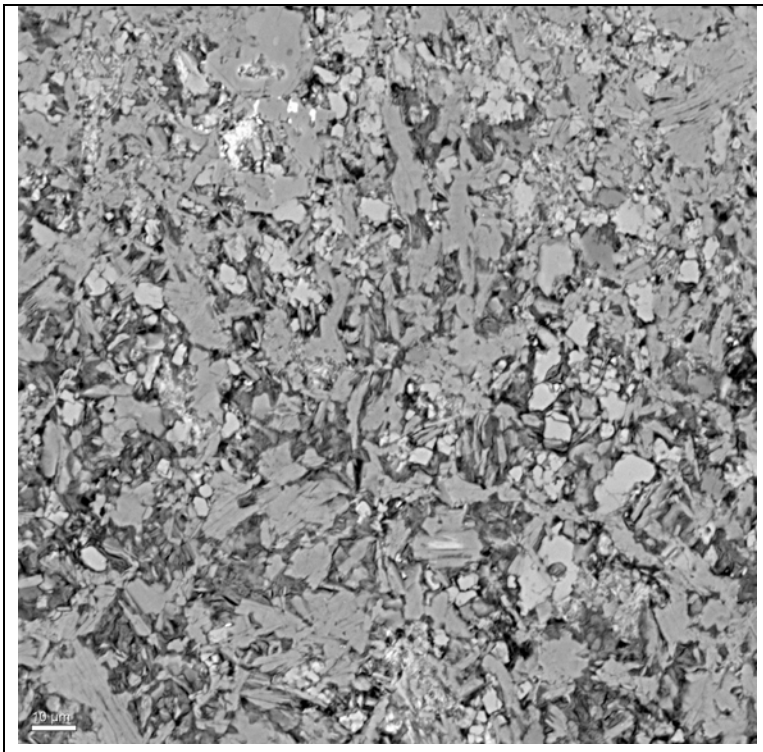
	
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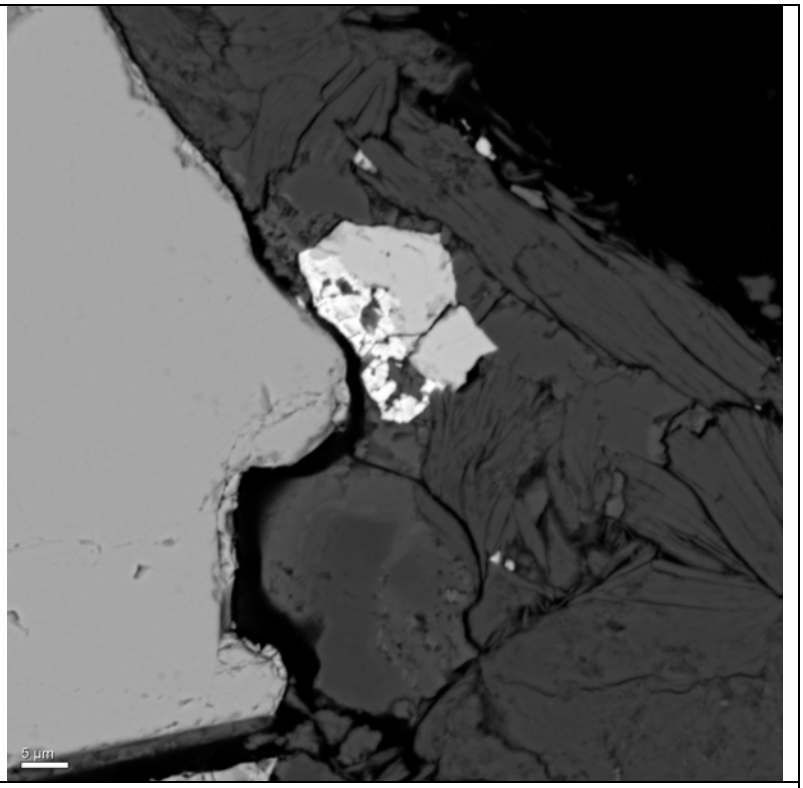
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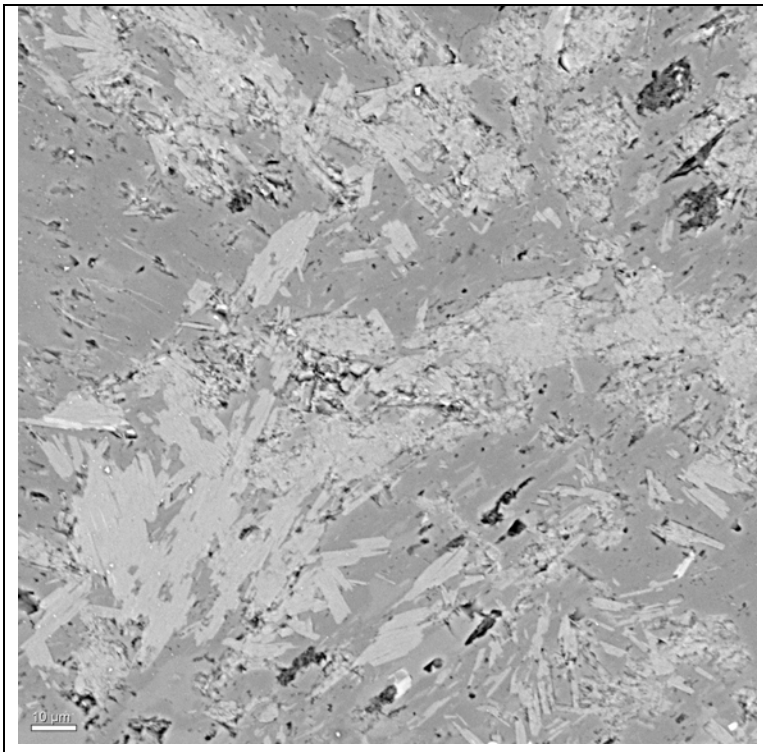
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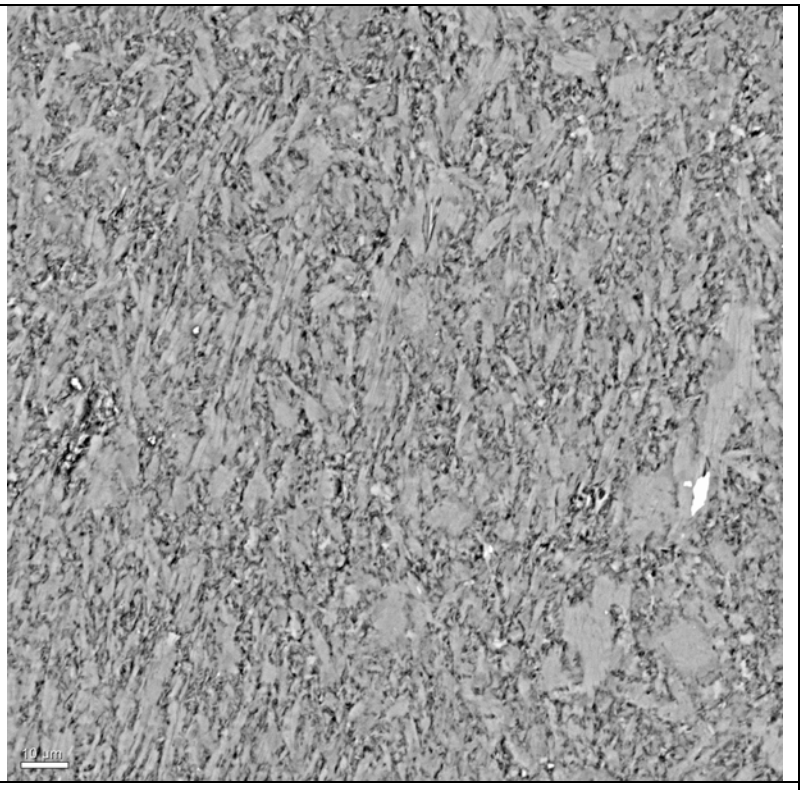
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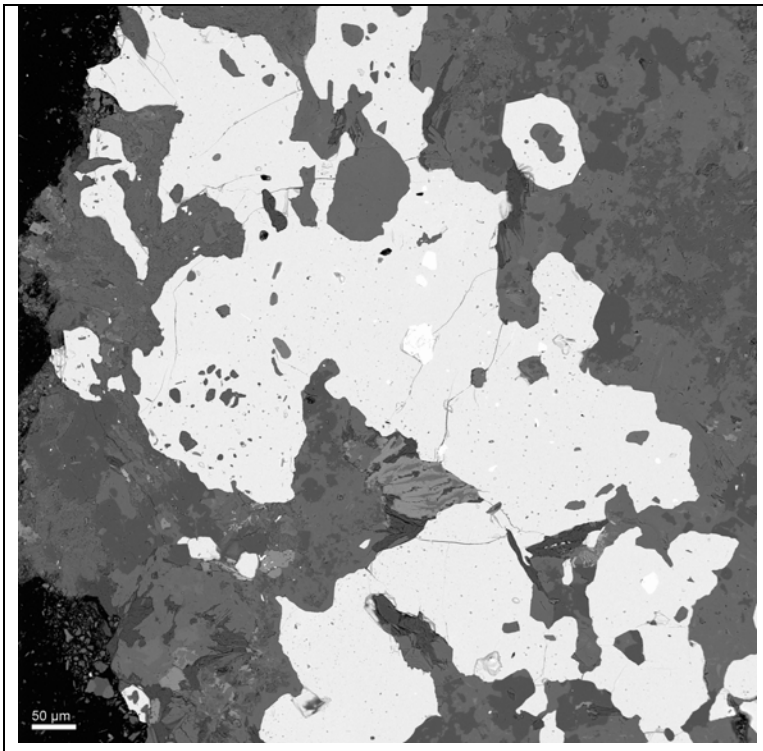
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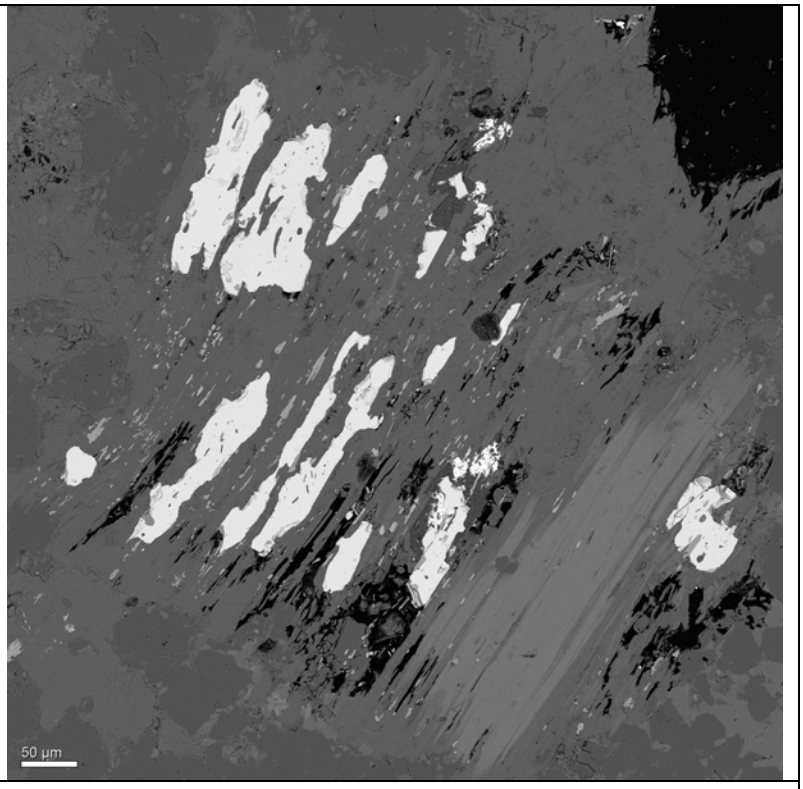
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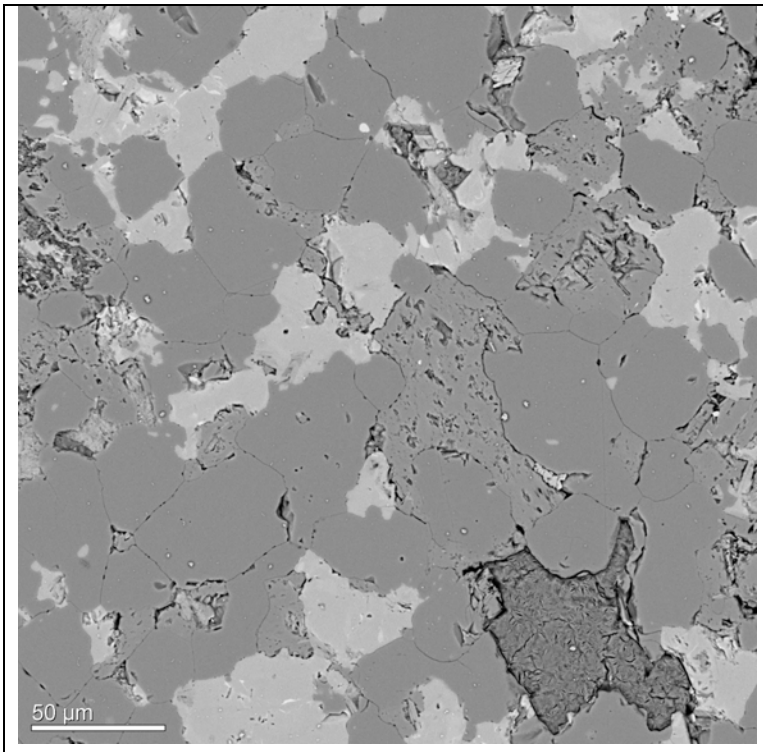
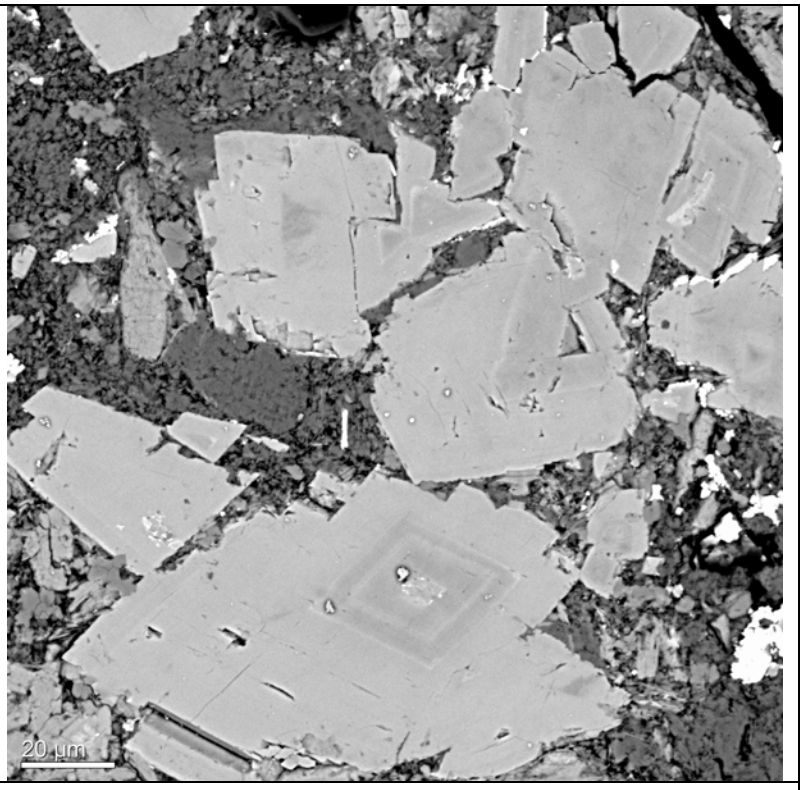
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MINERAL SERVICES

CANADA

REPORT NO. MSC08/042R

PETROGRAPHY OF THREE TAILING SAMPLES

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PETROGRAPHY OF THREE TAILING SAMPLES

1. INTRODUCTION

This report presents the results of petrographic analyses of 3 tailing samples received from Rik Vos of Canadian Environmental & Metallurgical Inc. The samples were submitted as pulp and no description of lithologies, alteration and mineralization were provided.

The aim of the study was to characterize the mineralogy of the samples, focusing on carbonate and sulphides.

2. METHODS

Petrographic descriptions were performed in the office of Mineral Services Canada Inc. using a Nikon Eclipse E400 microscope equipped with transmitted and reflected light. Sample descriptions with representative photomicrographs are presented in Section 3. All modal abundance percentages in the descriptions are approximate.

3. SAMPLE DESCRIPTIONS

3.1. PP Tail Sample #1

Hand sample description:

The dry pulp is beige-coloured, containing trace gold-coloured sulphides. It reacts weakly with cold dilute HCl (presence of calcite) and a few fragments are magnetic. The offcut contains approximately 5-7 % subangular grains that were strongly stained (yellow) by sodium cobaltinitrite indicating they are K-feldspar.

Thin section description:

This tailing sample consists of angular broken grains and shards of quartz, feldspar (variably replaced by sericite or carbonate), sericite, biotite, chlorite, pyrite and carbonate as well as of minor rutile, magnetite, hematite, clay, epidote, possible tourmaline, Fe-oxides/hydroxides and various sulphides. Larger grains are commonly 100 to 200 µm in size. Feldspar and quartz form sporadic monomineralic granular clusters close to 1 mm in size.

Aggregates of minute shards and grains of the above-cited minerals also occur throughout, containing extremely small clusters of possible titanite.

Pyrite is the dominant sulphide present and is mainly fresh or only slightly oxidized. Rare chalcopyrite occurs, locally coated by rims of covellite and / or chalcocite. Chalcopyrite was also observed as sporadic inclusions in pyrite. Fe-oxides / hydroxides form anhedral masses throughout. Very small shards of an undetermined sulphide also occur throughout and one mass of intergrown pyrite and arsenopyrite was observed, associated with chalcopyrite and coated by chalcocite and covellite.

Carbonate is colourless to cloudy (likely calcite). It replaces feldspars or occurs as small monomineralic granular fragments.

Modal composition and characterization of the minerals present in the section are shown in Table 1 and representative photomicrographs are presented in Figure 1. Note that the relative proportions of quartz and plagioclase could not be determined precisely due to the very fine grain size of these minerals and the fact that untwinned colourless feldspar grains could not be confidently distinguished from quartz.

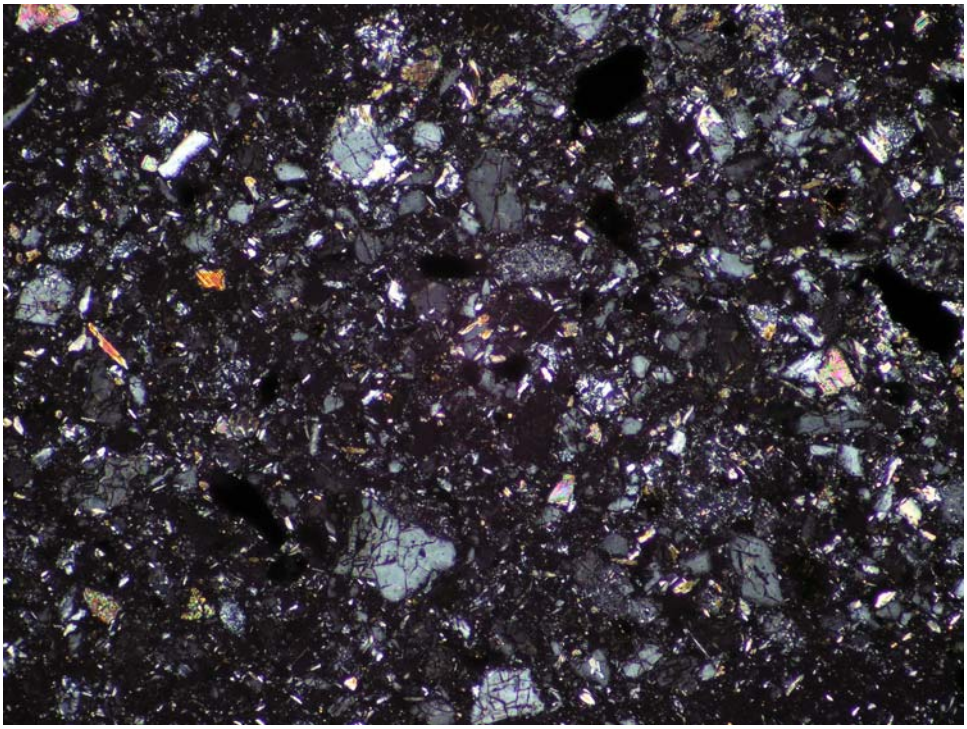


Fig. 1A: *Photomicrograph of sample PP Tail Sample #1, showing disseminated broken grain fragments of quartz, feldspar, mica and carbonate. XPL, FOV = ~ 0.6 mm.*

Table 1: *Modal composition and characterization of minerals in PP Tail Sample #1. Modal abundance estimates in parentheses (%) indicate a high degree of uncertainty (see text for explanation).*

MAJOR MINERALS

Mineral	%	Distribution & Characteristics
Quartz	(50)	Small shards, very fine-grained granular aggregates
Plagioclase	(20)	Small shards and very fine-grained granular clusters, with local polysynthetic twinning, and variably replaced by muscovite/sericite and carbonate
Sericite	8	Fine-grained to extremely fine-grained, typically in clusters variably associated with feldspars
K-feldspar	7	Small subangular grains indicated by stain
Biotite	5	Small acicular to anhedral sheaves, disseminated and in clusters

MINOR MINERALS

Mineral	%	Distribution & Characteristics
Chlorite	2	Small sheaves, commonly in clusters
Pyrite	2	Small fragments (< 180 µm in size), rarely with inclusions of chalcopyrite and with common irregular grain boundaries On one occasion rimmed by Fe-oxides / hydroxides
Carbonate	tr-1	Colourless to cloudy, weakly pleochroic, small monomineralic subangular granular fragments or clusters with feldspars and / or sericite
Kaolinite	tr-1	Microcrystalline clusters
Titanite	tr-1	Disseminated, extremely small clusters in masses, characterized by white internal reflections in reflected light
Clay (possible smectite)	tr-1	Microcrystalline clusters
Magnetite / hematite	tr-1	Small magnetite shards (< 200 µm), variably replaced by hematite
Rutile	tr	Few very small fragments
Epidote	tr	Small to very small anhedral grains
Tourmaline	tr	One possible small fragment
Fe-oxides / hydroxides	tr	Disseminated clusters and local pyrite alteration
Chalcopyrite	tr	Rare very small fragments, less then 50 µm in size, unaltered or displaying rims of covellite and on one occasion chalcocite Also as inclusions in pyrite less then 50 µm in size
Arsenopyrite	tr	Very small grains less then 10 µm in size, clearly anisotropic, occurring in a mass intergrown with pyrite and rimmed by chalcocite and covellite
Chalcocite	tr	Sporadic rims around chalcopyrite
Undetermined	tr	Very small corroded shards, whiter and with higher reflectance than pyrite, isotropic, less than 10-15 µm in size
Covellite	tr	Local rims around chalcopyrite and on one occasion around a mass of pyrite, chalcopyrite and arsenopyrite

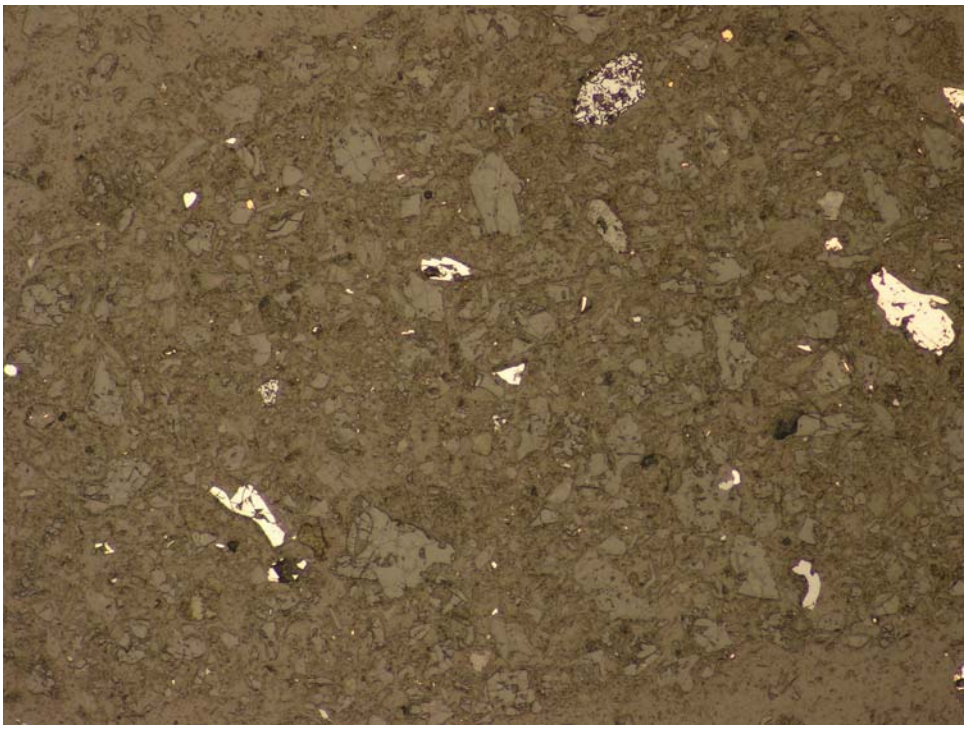


Fig. 1B: *Same view of sample PP Tail Sample #1, showing disseminated shards and grains of whitish pyrite. On the top of the photograph, a mass of Fe-oxides / hydroxides is visible. RL, FOV = ~ 0.6mm.*

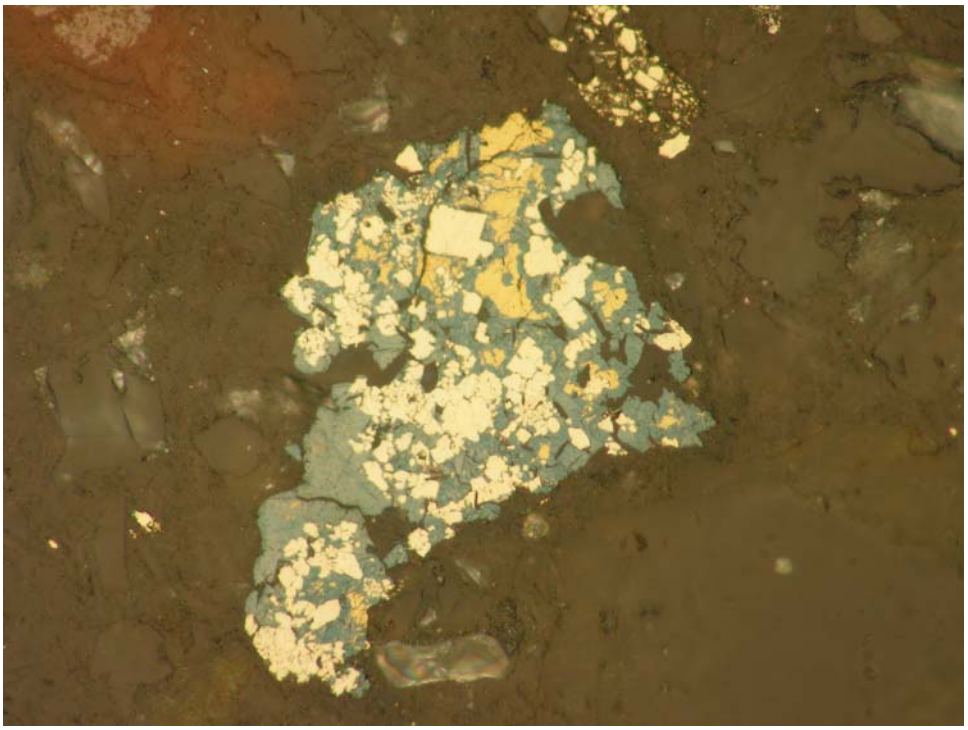


Fig. 1C: *Close-up on a mass of sulphide in sample PP Tail Sample #1, showing intergrown pyrite and arsenopyrite (off-white), chalcopyrite (yellow) and blue (Fe, Cu)-sulphides (chalcocite and covellite). Pyrite and arsenopyrite cannot be distinguished in the micrograph. RL, FOV = ~ 0.25 mm.*

3.2. PP Tail Sample #2

Hand sample description:

The dry pulp is beige-coloured, containing trace gold-coloured sulphides. It reacts moderately with cold dilute HCl (presence of calcite). A few magnetic fragments are present. The offcut contains approximately 10 % subangular grains that were strongly stained (yellow) by sodium cobaltinitrite indicating they are K-feldspar.

Thin section description:

This tailing sample is very similar to PP Tail sample #1 and consists of subangular broken grains of quartz, feldspars, (variably replaced by sericite or carbonate), sericite, biotite, chlorite, pyrite and carbonate as well as of minor rutile, magnetite, hematite, clay, epidote, possible tourmaline, Fe-oxides / hydroxides and various sulphides. Rare aggregates of granular quartz were also observed.

Aggregates of minute shards of the above-cited minerals also occur throughout. These commonly contain numerous very fine masses (characterized by abundant white internal reflections in reflected light) that are interpreted as titanite. The grain size is similar to that of sample PP Tail sample #1, although the proportion of coarser grains appears slightly higher.

Pyrite is the dominant sulphide present but occurs in slightly lower amounts than in PP Tail sample #1 and is mainly fresh and unoxidized. However, a few masses of Fe-oxides / hydroxides with pyrite cores are present. Chalcopyrite only occurs in trace amounts and is typically coarser-grained than in PP Tail sample #1. Grain boundaries are commonly unaltered but rims of blue (Fe, Cu)-sulphides (possibly chalcocite and covellite) locally coat chalcopyrite. On one occasion successive rims of blue (Fe, Cu)-sulphides and Fe-oxides / hydroxides were observed around chalcopyrite.

Carbonate is colourless to cloudy (likely calcite). It occurs associated with the feldspar it replaces or as subangular grains.

Modal composition and characterization of the minerals present in the section are shown in Table 2 and representative photomicrographs are presented in Figure 2. Note that the relative proportions of quartz and feldspars could not be determined precisely due to the very fine grain size of these minerals and the fact that untwinned colourless feldspar grains could not be confidently distinguished from quartz.

***Table 2**: Modal composition and characterization of minerals in PP Tail Sample #2. Modal abundance estimates in parentheses (%) indicate a high degree of uncertainty (see text for explanation).*

MAJOR MINERALS

Mineral	%	Distribution & Characteristics
Quartz	(50)	Small shards, rare very fine-grained granular aggregates
Plagioclase	(20)	Small fragments, recognized by polysynthetic twins or sericite alteration
K-feldspar	10	Disseminated broken grains, locally brownish coloured indicating a secondary origin
Sericite	10	Small sheaves and extremely fine-grained clusters, disseminated or replacing feldspars

MINOR MINERALS

Mineral	%	Distribution & Characteristics
Biotite	3	Small acicular to anhedral sheaves, disseminated and in clusters
Pyrite	1-2	Small fragments (< 400 µm in size), typically unaltered but sporadically as cores within masses of Fe-oxides / hydroxides
Chlorite	1	Small sheaves
Rutile	tr	Few very small granular clusters
Titanite	tr-1	Extremely small granular clusters in masses, characterized by abundant white internal reflections in reflected light
Carbonate	1	Colourless to cloudy, weakly pleochroic, small subangular fragments or clusters replacing feldspars
Clay (possible smectite)	tr	Micro- to cryptocrystalline clusters
Magnetite / hematite	tr	Small magnetite shards (< 200 µm), variably intergrown with (and possibly partially replaced by) hematite
Epidote	tr	Small to very small anhedral grains and granular clusters
Tourmaline	tr	One small fragment
Fe-oxides / hydroxides	tr	Disseminated clusters, anhedral masses and variably thick rims around pyrite and chalcopyrite
Chalcopyrite	tr	Very small fragments, less than 200 µm in size, variably unaltered or displaying thin to thick rims of blue (Fe, Cu)-sulphides, locally with later rim of Fe-oxides / hydroxides
Undetermined	tr	Very small corroded shards, whiter and with higher reflectance than pyrite, isotropic, less than 20 µm in size
Blue (Fe, Cu) sulphides	tr	Local rim around chalcopyrite, locally with successive rim of Fe-oxides / hydroxides Likely including chalcocite and covellite

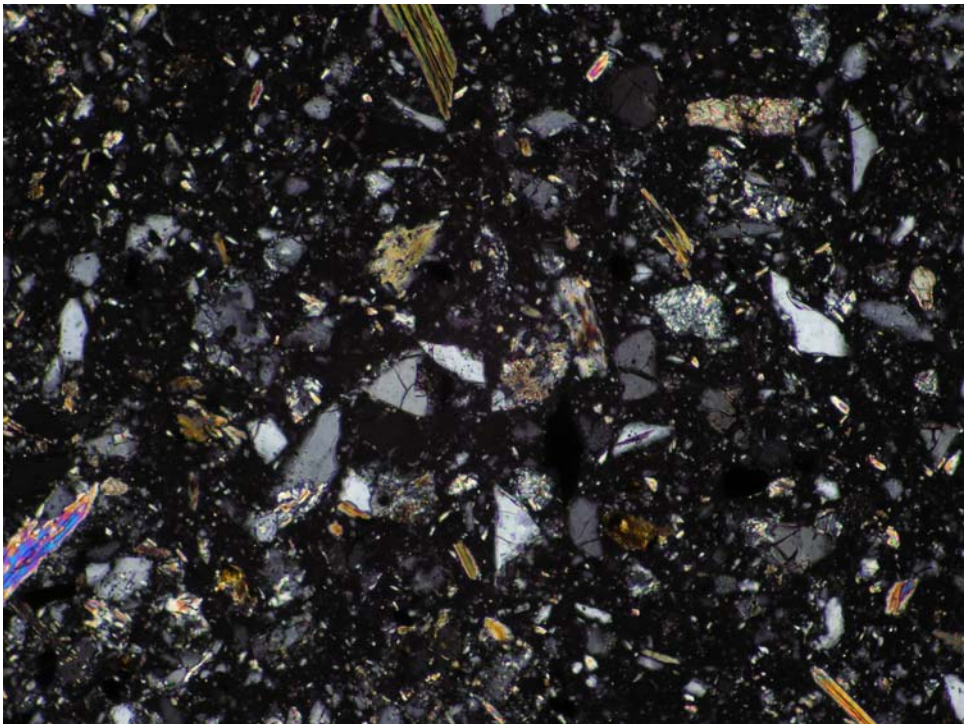


Fig. 2B: *Photomicrograph of sample PP Tail Sample #2, showing disseminated shards and grains of quartz, feldspars, biotite and sericite. XPL, FOV = ~ 1.2mm.*

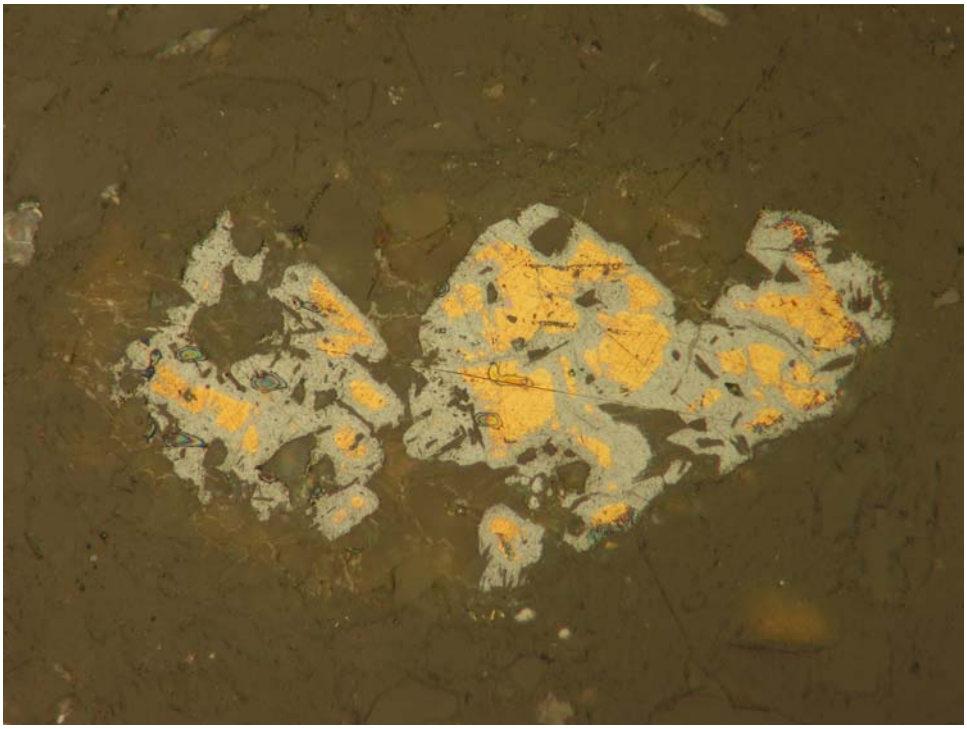


Fig. 2B: *Photomicrograph of sample PP Tail Sample #2, showing yellow chalcopyrite coated by grey-blue chalcocite. RL, FOV = ~ 0.25 mm.*

3.3. PP Tail Sample #3

Hand sample description:

Under the binocular microscope, this pulp appears much finer-grained than the previous samples. No individual grains are recognized, the offcut consisting mostly of microcrystalline, unresolved masses. The dry pulp is beige-coloured, reacts weakly with cold dilute HCl (presence of calcite). Some magnetic material is present. A weak yellow stain produced by reaction with sodium cobaltinitrite is developed throughout the offcut, suggesting K-feldspar is present. However, no discrete K-feldspar grains were recognized due to the extremely fine grain size of pulp.

Thin section description:

The sample is much finer-grained than the previous two samples, with grain and lithic fragments rarely reaching more than 50 µm in size. Individual grains of quartz (or possible feldspar) and sheaves of biotite can be recognized, but most mineral grains occur in brownish and patchy masses that cannot be resolved optically.

Sheaves of sericite and small grains of colourless carbonate are recognized along the thinner edges of the section, sericite occurring as groundmass and carbonate as disseminated grains. Carbonate grains are subangular, typically less then 25 µm in size and occur in masses within sericite, silicates and opaque minerals.

Sulphides consist predominantly of very fine-grained pyrite shards, typically unaltered but sporadically rimmed by Fe-oxides / hydroxides. Chalcopyrite shards are less common than pyrite, variably rimmed by blue (Fe, Cu)-sulphides (mostly chalcocite).

Very small grains of magnetite / hematite, rutile and titanite also occur throughout.

Characterization of the minerals present in the section is shown in Table 3 and representative photomicrographs are presented in Figure 3. Relative proportions of transparent minerals could not be determined due to the extremely fine mineral grain-size.

***Table 3**: Modal composition and characterization of minerals in PP Tail Sample #3. Modal abundances of transparent minerals are not available (na). (see text for explanation).*

MAJOR MINERALS

Mineral	%	Distribution & Characteristics
Quartz	na	Very small broken subangular grains, disseminated and in masses
Feldspar	na	Small broken grains and fragments, recognized by polysynthetic twins, sericite alteration or secondary brownish-coloured K-feldspar alteration
Sericite	na	Very small sheaves and extremely fine-grained aggregates recognized in the thinnest parts of the section

MINOR MINERALS

Mineral	%	Distribution & Characteristics
Biotite	na	Very small acicular sheaves, disseminate and in masses
Carbonate	na	Colourless extremely small subangular grains, recognized in masses in the thinnest parts of the section
Titanite	na	Extremely small granular clusters
Pyrite	tr-1	Disseminated small shards, rarely exceeding 50 µm in size, typically unaltered but sporadically with corroded, irregular grain boundaries
Magnetite / hematite	tr	Small magnetite shards (< 100 µm), variably intergrown with (and possibly partially replaced by) hematite
Rutile	tr	Very small granular fragments
Undetermined	tr	Whiter than pyrite, corroded, occurs as extremely small fragments rarely exceeding 50 µm in size, locally as acicular fragments
Fe-oxides / hydroxides	tr	Disseminated clusters locally enclosing pyrite cores
Chalcopyrite	tr	Extremely small fragments, less than 20 µm in size, typically unaltered but locally with rims of blue (Fe, Cu)-sulphides
Blue (Fe, Cu) sulphides	tr	Sporadic rim around chalcopyrite, dominated by chalcocite

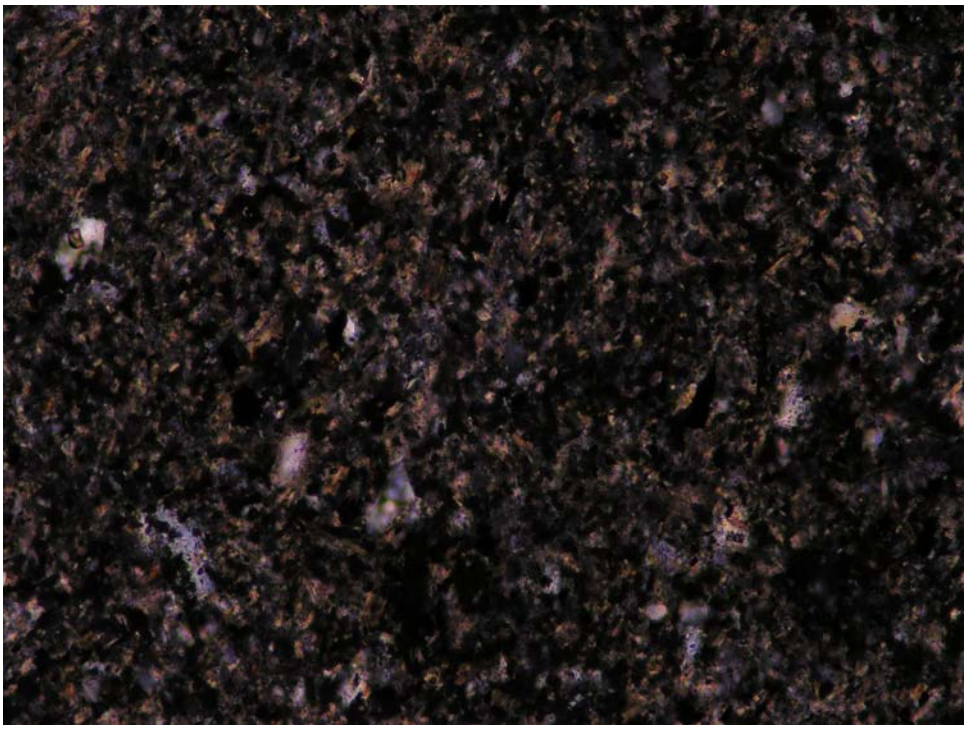


Fig. 3A: *Photomicrograph of sample PP Tail Sample #3 showing part of a very fine-grained mineral aggregate Possible quartz and feldspar grains are recognized in a groundmass containing brownish sheaves of sericite but the other minerals in the field of view cannot be identified. XPL, FOV = ~ 0.6 mm.*

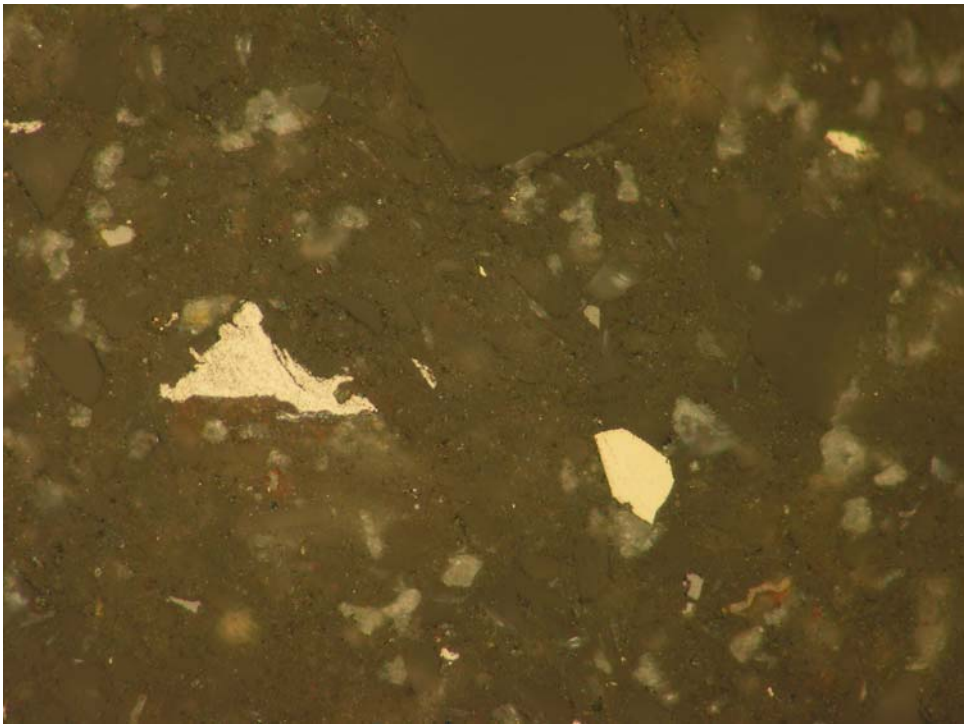


Fig. 3B: *Photomicrograph of sample PP Tail Sample #3 showing an unaltered pyrite grain on the right side of the photomicrograph and a corroded, more whitish grain of an undetermined opaque phase on the left side. RL, FOV = ~ 0.25 mm.*

4. SUMMARY AND CONCLUSION

The results of petrographic analyses of three tailing samples are presented in this report. The purpose of the study was to characterize the mineralogy of the samples with particular emphasis on the carbonates and sulphur-bearing minerals present.

The three samples are characterized by different grain sizes, with sample PP Tail Sample #1 and PP Tail Sample #2 being coarser-grained (typically < 100 µm in size) than sample PP Tail Sample #3 (< 50 µm in size).

Sample PP Tail Sample #1 and PP Tail Sample #2 are similar. Gangue minerals consist of shards, broken grains and aggregates of quartz, feldspars, sericite, biotite, chlorite, clay, epidote and possible tourmaline.

Sample PP Tail Sample #3 contains quartz, feldspars, biotite, sericite and titanite, but their relative amounts as well as the identify of possible additional transparent minerals present could not be determined due to the very fine grain size and to the thickness of the aggregates.

4.1 Carbonate

Carbonate is present in all three samples, occurring in abundances below 1 % in samples PP Tail Sample #1 and PP Tail Sample #2. The relative amount of carbonate in sample PP Tail Sample #3 could not be determined. Carbonate in all sections is colourless and reaction to cold dilute HCl suggests it is mostly calcite. It occurs as disseminated small shards or less commonly as a very fine-grained alteration product of feldspars. Carbonate grains range in size from 20 to 100 µm in sample PP Tail Sample #1 and PP Tail Sample #2. The few carbonate grains recognized in sample PP Tail Sample #3 are less than 50 µm in size.

4.2 Sulphides/Oxides

Pyrite is the dominant sulphide in all the samples and typically occurs in abundances below 2 %. It mostly occurs as small to very small subangular liberated grains, less than 400 µm in size.

Trace amounts of chalcopyrite and of an undetermined, corroded phase (possible galena) occur throughout the sample suite. Like pyrite they typically form very small liberated grains less than 200 µm and 50 µm in size, respectively. Rare grains of arsenopyrite were observed in sample PP Tail Sample #1 in one cluster associated with pyrite and (Fe, Cu)-sulphides. The arsenopyrite grains are all less than 10 µm in size.

Pyrite and chalcopyrite grain boundaries are variably altered with unaltered grain boundaries being most common. However, masses of Fe-oxides / hydroxides also occur, forming subangular clusters locally preserving pyrite cores. Rims of blue (Fe, Cu)-sulphides (dominantly chalcocite) around chalcopyrite are also present. Grain boundaries of possible galena are typically irregular and corroded.

Minor amounts of magnetite and / or hematite occur in some samples, typically finely intergrown in subangular grains. Rutile aggregates are also present.

Petrography reported by: Alexandra Mauler, Ph. D.	Signed and sealed on July 2, 2008 by Tom Nowicki, P. Geo. APEG BC Lic. # 30747
	

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MINERAL SERVICES

CANADA

REPORT NO. MSC09/029R

PETROGRAPHY OF THREE COMPOSITE SAMPLES FROM THE CASINO GOLD-COPPER-MOLYBDENUM PROJECT (YUKON)

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PETROGRAPHY OF THREE COMPOSITE SAMPLES FROM THE CASINO GOLD-COPPER-MOLYBDENUM PROJECT (YUKON)

1. INTRODUCTION

This report presents the results of petrographic investigation of three samples from the Casino gold-copper-molybdenum project in Yukon. The samples were submitted by Carolyn Jones of SGS CEMI in October 2009. Thin sections, offcuts and remnant pulps were submitted.

The aim of the study was to characterize the mineralogy of the samples, focusing on the presence of carbonate and sulphides.

2. METHODOLOGY

Petrographic analysis was performed in the office of Mineral Services Canada Inc. Thin sections were examined using a Nikon eclipse E400 polarising petrographic microscope equipped with transmitted and reflected light. Modal abundances are approximate and were estimated using standard visual comparison charts.

3. PETROGRAPHIC DESCRIPTION AND CLASSIFICATION

The microscopic characteristics of the samples are described in the following sections and illustrated in a series of representative photomicrographs presented in Appendix A.

3.1 SAMPLE KM2459-08 comp.3

The sample consists of mineral (90%) and lithic (10%) fragments, less than 300 microns in size. Mineral fragments include quartz, feldspars, biotite, carbonate, chlorite and various sulphides. Lithic fragments are made up of various amounts of microcrystalline quartz, feldspars, biotite, carbonate and rutile. Alteration in the mineral and lithic fragments consists of local replacement of feldspars by carbonate ± sericite and of biotite by chlorite.

Carbonate is typically colourless and occurs as small liberated grains, microcrystalline clusters and in clasts, associated feldspars or rutile.

Sulphides include chalcopyrite, pyrite and possible galena. They typically occur as liberated and unaltered particles. However, chalcopyrite locally occurs interstitial to gangue minerals in lithic clasts

or attached to pyrite. Galena is sporadically partially preserved in masses of Fe-oxyhydroxides. One mass of hematite also occurs.

Modal composition and characterization of the minerals present in the section are shown in Table 1.

***Table 1**: Modal composition and characterization of minerals in sample KM2459-08 comp.3.*

MAJOR MINERALS

Mineral	%	Distribution & Characteristics
Felsic minerals	65	Small subangular fragments of quartz and less common altered feldspars; rare microcrystalline quartz and / or feldspar aggregates
Biotite	15	Disseminated sheaves
Carbonate	10	Colourless liberated grains (5-150 µm in size) and microcrystalline aggregates (5-100 µm in size) attached to the feldspars they replace or locally to rutile
Sericite	5	Sheaves and microcrystalline clusters replacing feldspars or disseminated

MINOR MINERALS

Mineral	%	Distribution & Characteristics
Chlorite	2	Small sheaves replacing biotite
Pyrite	tr-1	Liberated unaltered grains (2-100 µm in size), locally with chalcopyrite attachments
Fe-oxyhydroxide	tr-1	Small liberated masses, 25 to 100 µm in size, sporadically containing preserved masses of possible galena
Rutile	tr	Very small anhedral grains associated with carbonate aggregates
Chalcopyrite	tr	Liberated unaltered grains, 5 to 50 µm in size or anhedral grains (5-25 µm in size) attached to pyrite or associated with quartz, feldspars or biotite in lithic clasts
Hematite	tr	One liberated mass, 60 µm in size
Galena (?)	tr	Thin liberated sheaves, 10 to 25 µm long and possible masses less than 10 µm in size partially preserved in Fe-oxyhydroxides

3.2 SAMPLE KM2459-09 Comp.2

The sample essentially consists of broken mineral grains (approximately 90%) and of lesser abundant lithic fragments (approximately 10%). Fragments are typically less than 400 microns in size. Mineral fragments are essentially made up of quartz and feldspars, but fragments of biotite, carbonate, sericite, rutile and various sulphides also occur in small amounts. Lithic fragments consist of microcrystalline aggregates of the same minerals. Feldspars are locally replaced by carbonate ± sericite.

Carbonate is typically colourless and occurs as small liberated grains, microcrystalline aggregates and in clasts where it is typically associated the feldspars it replaces.

Sulphides include pyrite, possible galena and chalcopyrite. They typically occur as liberated and unaltered particles. However, pyrite is sporadically rimmed by Fe-oxyhydroxides and chalcopyrite is locally attached to pyrite or quartz.

Modal composition and characterization of the minerals present in the section are shown in Table 2.

***Table 2**: Modal composition and characterization of minerals in sample KM2459-09 Comp.2*

MAJOR MINERALS

Mineral	%	Distribution & Characteristics
Felsic minerals	75	Small subangular fragments of quartz and less common altered feldspars; rare microcrystalline quartz and / or feldspar aggregates
Sericite	10	Sheaves and microcrystalline clusters in clasts or disseminated
Biotite	5	Disseminated small to very small sheaves
Carbonate	5	Colourless liberated grains (5-200 µm in size) and microcrystalline aggregates (5-100 µm in size) attached to feldspars or to rutile

MINOR MINERALS

Mineral	%	Distribution & Characteristics
Chlorite	1	Small sheaves replacing biotite
Rutile	tr-1	Very small anhedral grains disseminated or associated with carbonate
Pyrite	tr-1	Grains (2-200 µm in size) typically unaltered and liberated but on rare occasions enclosed in sericite, intergrown with chalcopyrite or rimmed by Fe-oxyhydroxides
Chalcopyrite	tr	Liberated subhedral unaltered grains, 20 to 75 µm in size or anhedral grains (5-25 µm in size) attached to quartz or pyrite
Galena (?)	tr	Thin liberated sheaves, 10 to 25 µm long
Fe-oxyhydroxide	tr	Sporadic rims around pyrite and gangue minerals

3.3 SAMPLE KM2459-10 Comp.1

The sample essentially consists of mineral and lithic fragments, less than 400 microns in size and containing variable amounts of quartz, sericite, pyrite and rutile. Quartz occurs as broken grains and granular aggregates and sericite as disseminated sheaves and microcrystalline clasts. Rutile is disseminated throughout the quartz and / or sericite aggregates and as broken grains.

Pyrite is the main sulphide and typically occurs as liberated grains. It locally contains inclusions of chalcopyrite and bornite or has attachments of chalcopyrite. Chalcopyrite also occurs as liberated

grains that are coated by variably thick rims of covellite. Liberated sheaves and anhedral grains of possible galena also occur throughout. Masses of hematite and Fe-oxyhydroxides are disseminated.

No carbonate was observed.

Modal composition and characterization of the minerals present in the section are shown in Table 3.

***Table 3**: Modal composition and characterization of minerals in sample KM2459-10 Comp.1*

MAJOR MINERALS

Mineral	%	Distribution & Characteristics
Quartz	50	Small subangular fragments and microcrystalline aggregates associated with sericite; it is unclear whether feldspar is present
Sericite	40	Sheaves and microcrystalline aggregates
Pyrite	7	Liberated unaltered grains (10-150 µm in size) sporadically containing inclusions of chalcopyrite or bornite less than 20 µm in size; rarely as very small grains (< 10 µm in size) intergrown with chalcopyrite

MINOR MINERALS

Mineral	%	Distribution & Characteristics
Rutile	1-2	Small anhedral grains, liberated or in clasts
Fe-oxyhydroxide	tr-1	Rare disseminated masses less than 50 µm in size
Chalcopyrite	tr	Grains, 10 to 40 µm in size, occurring as 1) liberated grains variably rimmed by covellite, 2) attachments or inclusions in pyrite and 3) enclosed with quartz in granular lithic clasts
Galena (?)	tr	Thin liberated sheaves and anhedral grains, 5 to 25 µm in size
Bornite	tr	One inclusion in pyrite, 50 µm in size
Covellite	tr	Rims and pseudomorphs after chalcopyrite
Hematite	tr	Anhedral masses 40 to 60 µm in size

4. SUMMARY AND CONCLUSIONS

The results of petrographic analyses of three samples are presented in this report. The purpose of the study was to characterize the mineralogy of the samples with particular emphasis on the carbonates and sulphides present.

4.1 Gangue minerals

Samples KM2459-08 comp.3 and KM2459-09 comp.2 consist essentially of fragments of quartz, feldspars and biotite and of granular aggregates formed by these minerals. Sericite and chlorite also occur throughout as alteration of feldspars and biotite, respectively.

Sample KM2459-10 comp.1 is dominated by phyllic altered rock and mineral fragments. Gangue minerals essentially consist of quartz and sericite.

4.2 Carbonate

Carbonate occurs in samples KM2459-08 comp.3 and KM2459-09 comp.2, with abundances of approximately 10% in sample KM2459-08 comp.3 and 5% in sample KM2459-09 comp.2.

The carbonate is colourless and fine-grained in both samples. Moderate reaction to cold, dilute HCl suggests the carbonate is dolomite-ankerite. It occurs as broken grains and as very fine-grained aggregates replacing feldspars.

No carbonate was observed in sample KM2459-10 comp.1.

4.3 Sulphides/oxides

Sulphide abundance is close to 1% in samples KM2459-08 comp.3 and KM2459-09 comp.2 In both samples, pyrite is the dominant sulphide and occurs with minor chalcopyrite and possible galena. Sulphides typically occur as liberated and unaltered grains although chalcopyrite locally occurs as inclusions and attachments to pyrite or gangue minerals. Pyrite is on rare occasions partially altered to Fe-oxyhydroxides.

Pyrite abundance is higher (approximately 7%) in sample KM2459-10 comp.1. Chalcopyrite, galena, bornite and covellite occur in trace amounts. Pyrite and galena typically form liberated and unaltered grains. Chalcopyrite occurs as liberated grains variably rimmed by covellite and as inclusions or attachments associated with pyrite or gangue minerals. Bornite occurs as inclusions in pyrite and covellite is present as rims and sporadically as pseudomorphs after chalcopyrite. Grain boundaries of all sulphides other than chalcopyrite are typically unaltered, although pyrite is locally partially altered to Fe-oxyhydroxides.

Rutile, hematite and Fe-oxyhydroxides occur in varying amounts throughout the samples.

5. PROFESSIONAL SEAL

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Report reviewed by:
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APPENDIX A: PHOTOGRAPHS

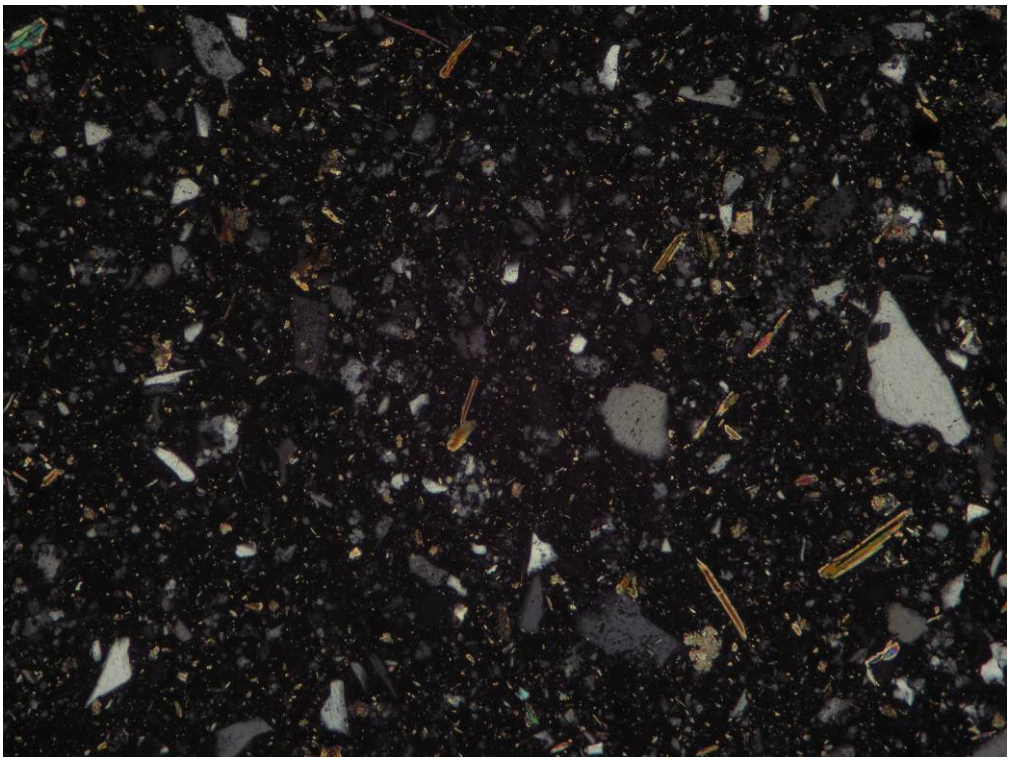


***Figure 1A**: Photomicrograph of sample KM2459-08 comp.3 that it consists essentially of broken grains of felsic minerals and sheaves of biotite. Carbonate is also present (e.g. lower right) XPL, FOV = ~ 2.8 mm.*

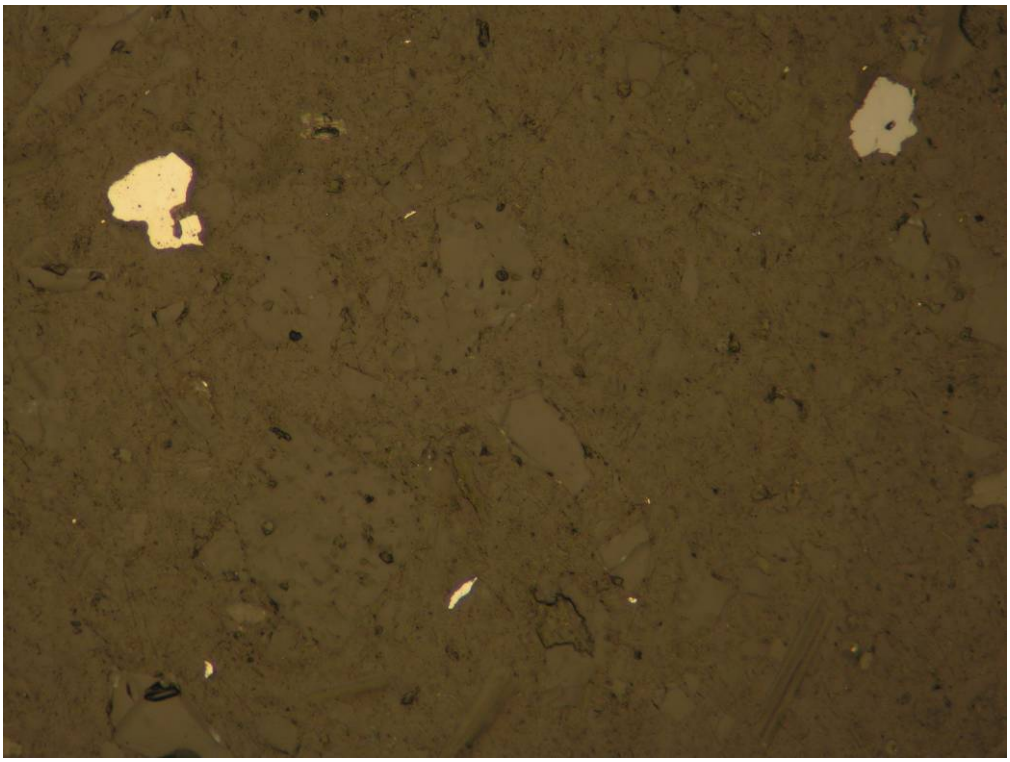


***Figure 1B:** Close-up of the sulphides in sample KM2459-08 comp.3. Sulphides are very rare and include pyrite (pale yellow) and possible galena (off-white). The grey grain at the top right is rutile. RL, FOV = ~ 0.7 mm.*

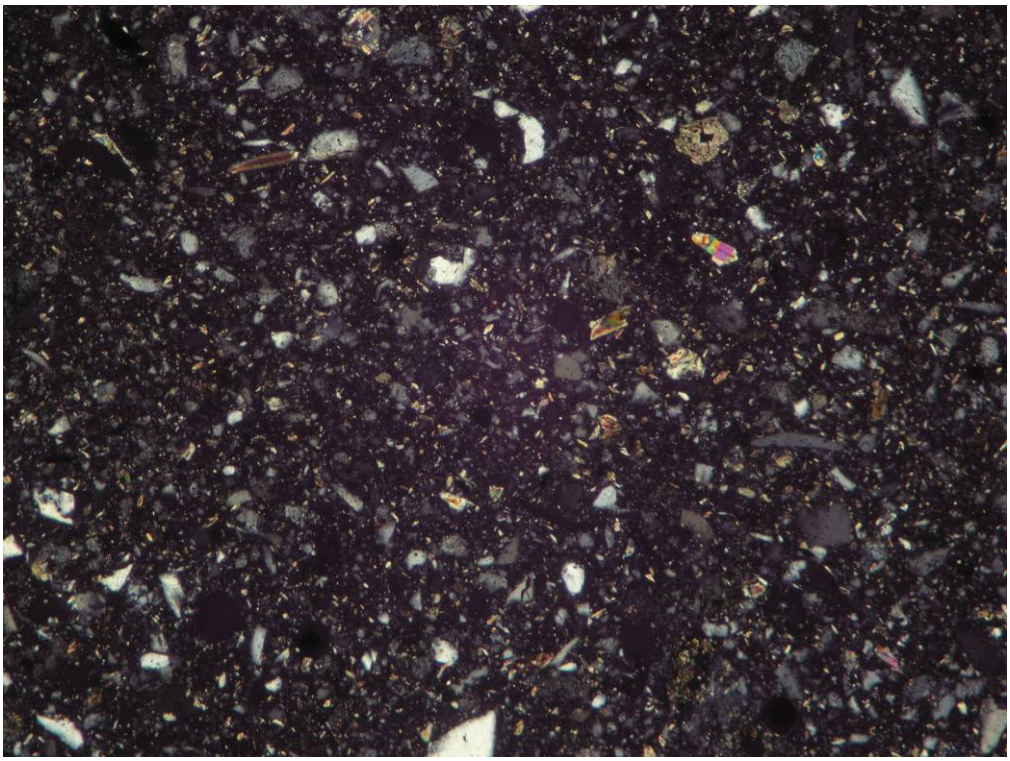


Figure 2A: *Photomicrograph of sample KM2459-09 comp.2 showing that fragments are typically smaller than in sample KM2459-08 comp.3. XPL, FOV = ~ 2.8 mm.*

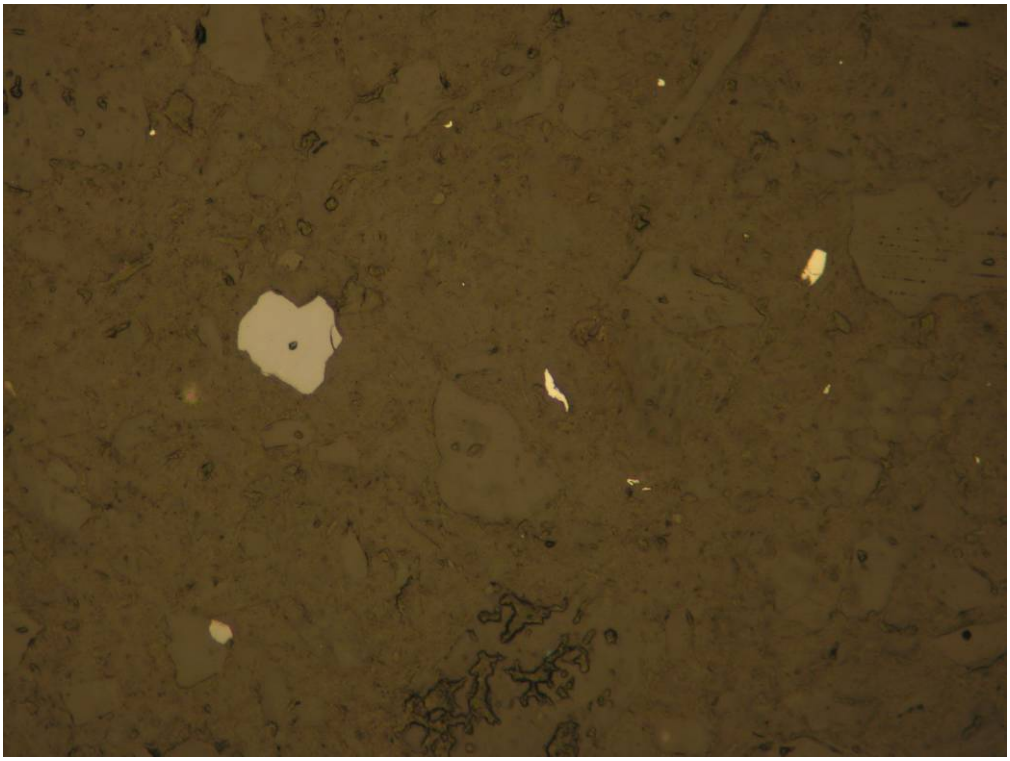


Figure 2B: *Close-up of the sulphides in sample KM2459-09 comp.2. Sulphides are very rare and include pyrite (pale yellow) and possible galena (off-white). The grey grain at centre left is rutile. RL, FOV = ~ 0.7 mm.*

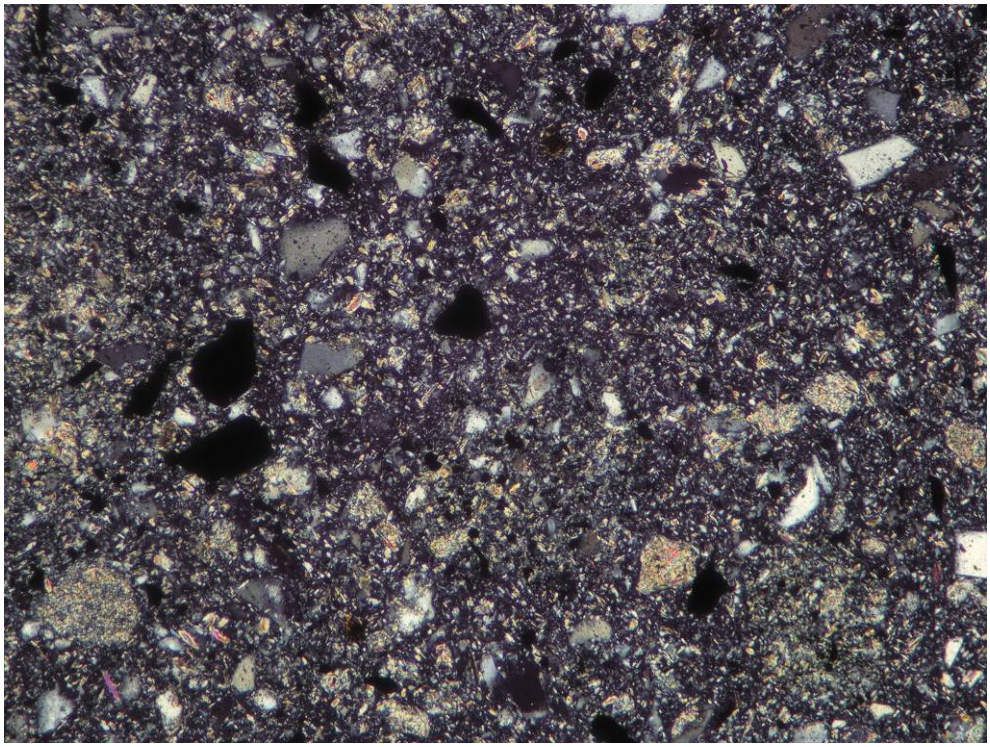


Figure 3A: *Photomicrograph of sample KM2459-10 comp.1 showing that it consists essentially of quartz, sericite and opaque pyrite. PPL, FOV = ~ 2.8 mm.*

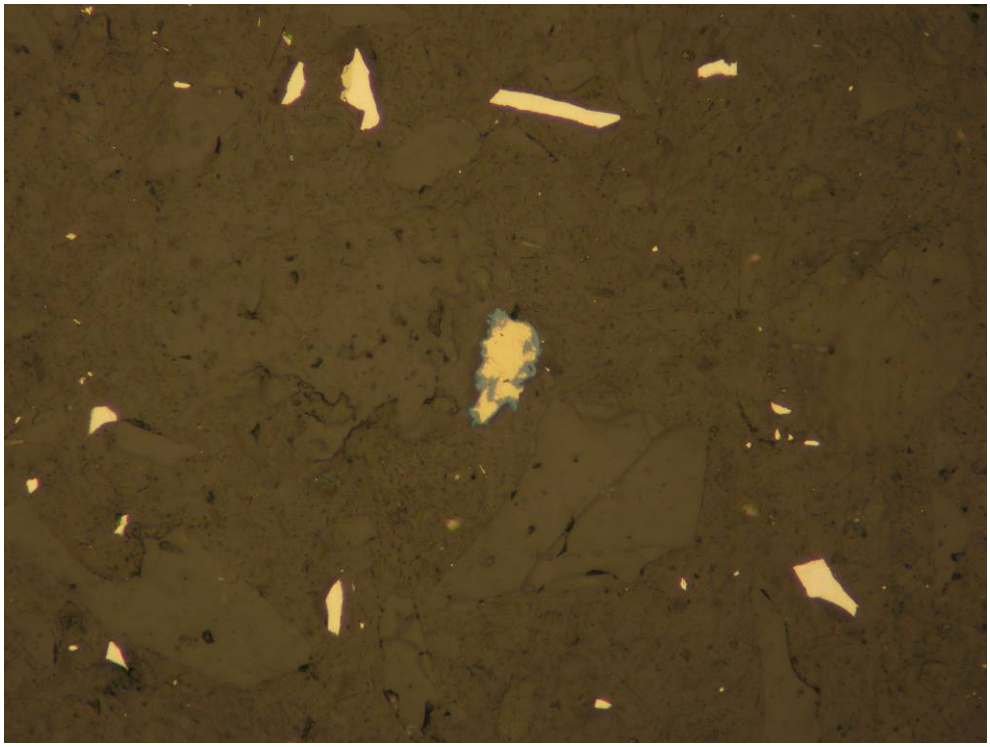


Figure 3B: *Close-up of the sulphides in sample KM2459-10 comp.1. Sulphides are more common than in the previous samples and are dominated by pyrite (pale yellow). Chalcopyrite (yellow) is also present, partially rimmed by covellite (blue). Note the attachment of chalcopyrite to the pyrite grain at the top left. RL, FOV = ~ 0.7 mm.*

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PETROGRAPHY OF FIVE TAILING AND CONCENTRATE SAMPLES FROM THE CASINO (AU, CU, MO) PROJECT

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PETROGRAPHY OF FIVE TAILING AND CONCENTRATE SAMPLES FROM THE CASINO (AU, CU, MO) PROJECT

1. INTRODUCTION

This report presents the results of petrographic analyses of three tailing samples received from Patrick Mueller of Lorax Environmental. Thin sections were submitted as well as offcuts stained for K-feldspar. The aim of the study was to characterize the mineralogy of the samples, focusing on the presence of carbonate and sulphides. Note that MSC numbers 1 – 5 have been assigned to the samples for ease of reference (Table 1).

Table 1: List of samples examined as part of this investigation.

MSC Sample Number	Lorax Sample Name
1	Py Rougher Tail 1 (whole)
2	Py Rougher Tail 2 (>74 µm)
3	Py Rougher Tail 3 (<74 µm)
4	Py Rougher Conc
5	Cleaner Tail

2. METHODS

Petrographic descriptions were performed in the office of Mineral Services Canada Inc. using a Nikon Eclipse E400 microscope equipped with transmitted and reflected light. The microscopic characteristics of the samples are described in Appendix A and illustrated in a series of representative photomicrographs presented in Appendix B. All modal abundance percentages in the descriptions are approximate.

3. RESULTS

The five samples can be classified into two groups based on the nature and size of their constituents: Samples 1, 2 and 4 (Group A) are made up of mineral and lithic fragments ranging in size from 5 to 1,200 µm. Samples 3 and 5 (Group B) are only made up of small mineral fragments that range in size from 2 to 100 µm.

3.1 Samples Group A

3.1.1 Gangue minerals

The three samples 1, 2 and 4 essentially consist of liberated mineral fragments (90-95%) and lesser amounts of lithic clasts (5-10%).

In samples 1 and 2, mineral fragments consist mainly of gangue minerals that include quartz, feldspars, biotite and their respective alteration products (illite-sericite, carbonate and chlorite). Grains of epidote or titanite occur in minor amounts in the two samples and amphibole is additionally recognized in sample 2. The same gangue minerals are observed in sample 4, but mineral fragments are dominated by pyrite (25%) rather than gangue minerals.

The lithic clasts in the three samples are very fine-grained (10-300 µm in size), polygranular and essentially made up by quartz, plagioclase, K-feldspars and biotite. Feldspars are variably pitted by sheaves of sericite, or locally by patches of carbonate. Biotite (and amphibole in samples 2 and 4) is variably replaced by chlorite (± rutile).

3.1.2 Carbonate

The abundance of carbonate in all three samples is very low (less than 1%) with carbonate occurring either in clasts associated with the feldspars it replaces or less commonly as liberated grain fragments. Carbonate is typically colourless to cloudy with varying relief and is likely calcite. In sample 2, a few microcrystalline aggregates of possible reddish Fe-bearing carbonate (possible siderite) occur in lithic clasts. These are not observed in the other samples.

3.1.1 Sulphides/oxides

In samples 1 and 2, the abundance of sulphides is less than 1%. Sulphides present include pyrite, chalcopyrite, covellite and a blue supergene copper sulphide (the lack of anisotropy suggests digenite). In sample 1, trace amount of molybdenite also occur.

In sample 1, pyrite and chalcopyrite are typically 5-75 µm in size while in sample 2 they are 2-50 µm in size. Both pyrite and chalcopyrite occur in lithic clasts, as attachments to mineral fragments or as rare liberated subangular grains. The pyrite grain boundaries are straight and unaltered while chalcopyrite grains are variably coated by rims of secondary copper sulphides such as digenite and covellite. Coating affects both liberated and enclosed chalcopyrite grains. In sample 1, replacement of chalcopyrite by covellite is complete on one occasion. In sample 2, digenite and covellite also occur intergrown in a rim around chalcopyrite. The molybdenite in sample 1 occurs as a liberated elongated sheaf approximately 300 µm long.

Sample 4 is a concentrate sample and as such the abundance of sulphides in the sample is much higher. The pyrite content is close to 25% and the abundance of chalcopyrite is in the range 1-2%. Secondary copper sulphides (digenite and covellite) only occur in trace amounts.

Pyrite mostly occurs as liberated grain fragments, 10 to 100 µm in size and less commonly enclosed in or attached to lithic clasts. It generally contains inclusions of chalcopyrite, magnetite, hematite or rutile. Pyrite grain boundaries are typically unaltered. Chalcopyrite occurs as anhedral grains in lithic clasts and less commonly as liberated grains or as inclusions in pyrite. Both liberated grains and grains enclosed in lithic clasts are in several cases partially to completely rimmed by intergrown digenite/covellite. Total chalcopyrite replacement is also observed in places.

Magnetite, hematite, rutile and Fe-oxyhydroxides occur in all three samples (typically in amounts below 2%) and the (secondary) oxide content of all samples is similar in the tailing and concentrate samples. Magnetite occurs as anhedral grains set in lithic clasts and as liberated grains that are variably coated by hematite. Hematite occurs as rims around magnetite but also as oxidation patches throughout lithic clasts as do Fe-oxyhydroxides. Rutile occurs as microcrystalline clusters that are either liberated or enclosed in clasts, typically associated with chlorite as replacement of mafic phases.

3.2 Sample Group B

Samples 3 and 5 are characterized by a much finer fragment size (2-100 µm in sample 3 and 2-60 µm in sample 5) and hence do not contain lithic clasts. Due to the very fine grain size, mineral fragments commonly aggregate into thick clots (especially in sample 5) that limit the quality of the thin section and the reliability of petrographic observation.

3.2.1 Gangue minerals

Sample 3 consists exclusively of mineral fragments of similar mineralogies to the ones observed in samples 1, 2 and 4. Mineral fragments include subangular plagioclase (30%), quartz (20%), K-feldspar (5%, based on stain), amphibole (1%) and trace epidote and titanite. Sheaves of sericite (20%), biotite (15%) and chlorite (1%) also occur throughout the sample. In sample 5, agglomerated clots are very common and make the determination of the gangue mineralogy and mineral difficult. In the thinner parts of the section, plagioclase, quartz, biotite and sericite are recognized. No K-feldspar stain is observed in the offcut suggesting no K-feldspar is present. However, the staining technique is not reliable for very fine grain sizes. No amphibole, chlorite, epidote or carbonate is observed but could occur in the agglomerated clots.

3.2.2 Carbonate

Rare (<1%) liberated anhedral grains of colourless carbonate (possibly calcite) occur in sample 3. The presence of carbonate in sample 5 is unconfirmed. No carbonate is observed in the thin parts of the section, but carbonate could occur in the unresolved, agglomerated clots.

3.2.3 Sulphides/oxides

In sample 3, sulphides are rare (<1%) and consist of pyrite and chalcopyrite. The sulphides are typically 2-15 µm in size and occur as liberated subangular grains with unaltered grain boundaries.

In sample 5, pyrite is abundant (20-15% of the sample) and chalcopyrite and molybdenite occur in trace amounts. The sulphides are typically 2-20 µm in size although pyrite reaches 75 µm. Pyrite and chalcopyrite occur as liberated subangular grains and molybdenite as liberated sheaves. All sulphides have unaltered grain boundaries.

No secondary copper sulphide is observed in the two samples.

Liberated small magnetite grains, variably coated by hematite, as well as liberated clusters of rutile and patches of Fe-oxyhydroxides occur in both samples.

4. SUMMARY AND CONCLUSION

The results of petrographic analyses of five samples are presented in this report. The purpose of the study was to characterize the mineralogy of the samples with particular emphasis on the carbonates and sulphides present. The main conclusions are summarized below.

- All five samples consist of mineral fragments (as well as lithic clasts in samples 1, 2 and 4) derived from altered felsic rock. The fragments range in size from approximately 5 µm to 1 mm in samples 1, 2 and 4 and from 5 to 100 µm in samples 3 and 5. In all samples, gangue fragments are essentially made up of quartz, feldspars (plagioclase and K-feldspar), biotite and their alteration products (sericite, chlorite, rutile, epidote and titanite). Amphibole occurs as well in samples 2, 3, and 4.
- Due the very fine fragment size in sample 5, minerals agglomerated into unresolved clots during thin section preparation. Quartz, plagioclase, biotite and sericite are recognized in the sample, but their abundance is undetermined. The presence of other gangue minerals such as K-feldspar, amphibole, chlorite, epidote and titanite is unconfirmed.
- The carbonate content is low (<1%) in all samples. Carbonate is colourless to cloudy with varying relief suggesting it is calcite. Few microcrystalline aggregates of possible siderite additionally occur in sample 2.
- In sample 1, 2 and 4, which are characterised by larger fragments, carbonate (colourless to cloudy with varying relief) occurs as liberated grains and as patches replacing feldspars in lithic clasts. In sample 3 the same type of colourless to cloudy carbonate was observed. It occurs as liberated grain fragments. No carbonate is observed in sample 5 although its presence in unresolved agglomerated clots cannot be excluded.
- The sulphide abundance in samples 1, 2 and 3 is low (<1%). Sulphides consist of pyrite and chalcopyrite (samples 1, 2 and 3) with additional covellite and a blue supergene copper sulphide (digenite) in samples 1 and 2. In sample 1, trace amount of molybdenite also occur. Pyrite and chalcopyrite variably occur in lithic clasts, as attachments to mineral fragments or

as rare liberated subangular grains. In all three samples, the pyrite grain boundaries are straight and unaltered. Chalcopyrite fragments are unaltered in sample 3 but chalcopyrite grains in samples 1 and 2 are variably coated by rims secondary copper sulphides such as digenite and covellite. Coating affects both liberated and enclosed chalcopyrite grains. The molybdenite in sample 1 occurs as one liberated elongated sheaf.

- The sulphide abundance in samples 4 and 5 is much higher, characterized by pyrite contents close to 25%. Chalcopyrite, digenite and covellite occur in sample 4 (<2%) and chalcopyrite and molybdenite occur in sample 5 (trace amounts). In sample 4, pyrite and chalcopyrite occur as liberated grain fragments or enclosed in or attached to lithic clasts. Pyrite commonly contains inclusions of chalcopyrite, magnetite, hematite or rutile. Pyrite grain boundaries are typically unaltered. Chalcopyrite is variably rimmed by digenite, covellite or intergrown digenite/covellite and locally completely replaced by covellite. In sample 5, the sulphides are very fine-grained and occur as liberated subangular grains with unaltered grain boundaries.
- Magnetite, hematite, rutile and Fe-oxyhydroxides occur in all samples. In sample 1, 2 and 4, magnetite occurs as anhedral grains set in lithic clasts and as liberated grains that are variably coated by hematite. Hematite also occurs as oxidation patches throughout lithic clasts as do Fe-oxyhydroxides. Rutile is liberated or enclosed in clasts. In samples 3 and 5, magnetite occurs as small liberated grains variably coated by hematite. Liberated clusters of rutile and patches of Fe-oxyhydroxides are also observed.

5. PROFESSIONAL SEAL

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APPENDIX A: SAMPLE DESCRIPTIONS

	Sample	Lithology	Mineralogy	Carbonate	Pyrite	Chalcopyrite	Digenite	Covellite	Molybdenite	Oxides
1	Py Rougher Tail 1 (whole)	Mineral fragments (90-95%) and lithic clasts (5-10%), 5 to 800 µm in size; lithic clasts of altered granular felsic rock, essentially made up by quartz, plagioclase and K-feldspar with feldspars replaced to various extents by sericite or sporadically by carbonate; variably chloritized biotite sheaves set in lithic clasts, as well as rare grains of epidote and titanite; rutile disseminated, commonly associated with chlorite; sulphides and oxides disseminated in lithic clasts or liberated; All clast-forming minerals also occurring as subangular fragments throughout	30% quartz; 25% illite-sericite; 20% plagioclase; 10% K-feldspar; 7% biotite; 2% chlorite; 1% magnetite; tr-1% rutile; tr carbonate; tr epidote; tr titanite; tr pyrite; tr hematite; tr chalcopyrite; tr digenite; tr covellite; tr molybdenite tr Fe-oxyhydroxides	Possible calcite as local feldspar alteration patches in lithic clasts and as rare liberated grains	Anhedral to subhedral grains, 5-75 µm in size; occur in lithic clasts, as attachments to mineral grains or as rare liberated grains; unaltered	Anhedral to subhedral grains, 10-75 µm in size; occur in lithic clasts, as attachments to mineral grains or as rare liberated grains; typically unaltered but on rare occasions rimmed by digenite or covellite or completely replaced by covellite when in lithic clasts	Two rims around chalcopyrite grains in clasts	One rim around chalcopyrite grains in clast and one pseudomorph in clast	One liberated sheave, 300 µm long	Disseminated magnetite in clasts and as liberated grains, variably replaced by hematite along grain boundaries; hematite as rims around magnetite and rare patches in lithic clasts; rutile as liberated clusters and clusters set in lithic clasts
2	Py Rougher Tail 2 (>74 µm)	Mineral fragments (90%) and lithic clasts (10%), 5 to 800 µm in size; lithic clasts of altered granular felsic rock, essentially made up by quartz, plagioclase and K-feldspar with feldspars replaced to various extents by sericite or sporadically by carbonate; variably chloritized biotite sheaves and amphibole grains set in lithic clasts, as well as rare grains and clusters of epidote and titanite; rutile disseminated, commonly associated with chlorite; sulphides and oxides disseminated in lithic clasts or liberated; Fe-oxyhydroxides as orange stain and microcrystalline clusters throughout; All clast-forming minerals also occurring as subangular fragments	30% quartz; 20% illite-sericite; 20% plagioclase; 12% K-feldspar; 10% biotite; 2% chlorite; tr-1% magnetite; tr-1% rutile; tr carbonate; tr titanite; tr amphibole; tr pyrite; tr hematite; tr chalcopyrite; tr digenite; tr covellite; tr Fe-oxyhydroxides	Possible calcite as local feldspar alteration patches in lithic clasts and rare liberated grains; few microcrystalline aggregates of possible siderite in clasts	Anhedral to subhedral grains, 2-50 µm in size; occur in lithic clasts, as attachments to mineral grains, as rare liberated grains or as local intergrowth with chalcopyrite in clasts; unaltered	Anhedral to subhedral grains, 5-50 µm in size; occur in lithic clasts, as attachments to mineral grains, as liberated grains or as intergrowth with pyrite in clasts; liberated grains and grains in clasts unaltered or rimmed by digenite or intergrown digenite/covellite	Rare rims around chalcopyrite (in clasts or liberated), on one occasion intergrown with covellite	Patches intergrown with digenite (likely replacing it) in a rim around chalcopyrite	n/a	Disseminated magnetite in clasts and as liberated grains, variably replaced by hematite along grain boundaries; hematite as rims around magnetite and rare patches in lithic clasts; rutile as liberated clusters and clusters set in lithic clasts; Fe-oxyhydroxides stain and clusters throughout

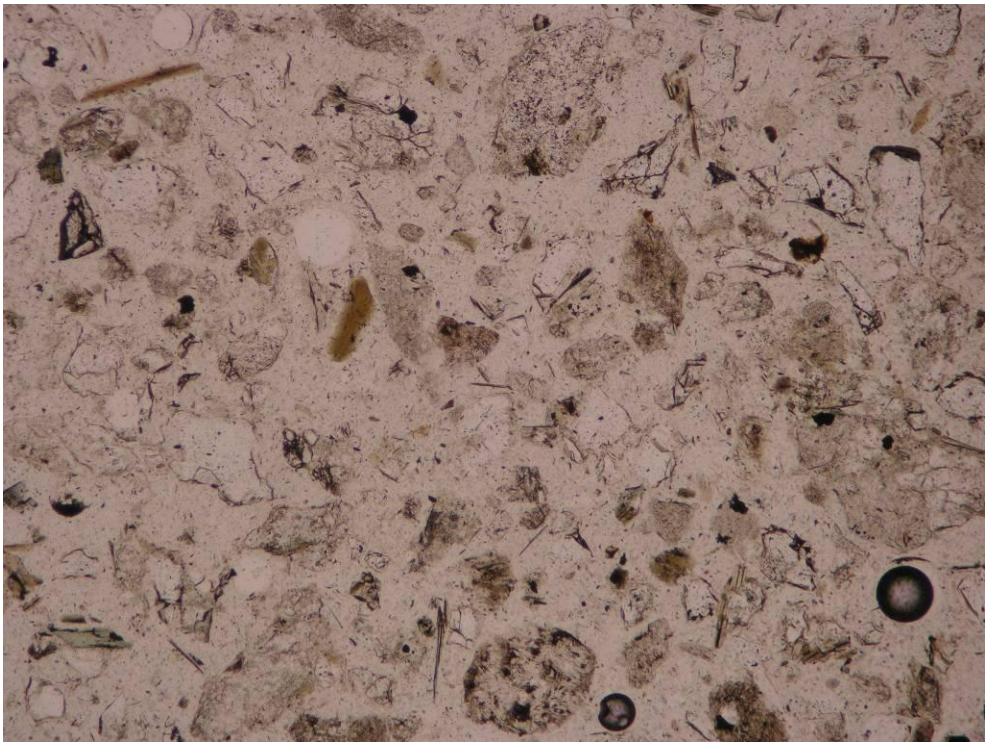
	Sample	Lithology	Mineralogy	Carbonate	Pyrite	Chalcopyrite	Digenite	Covellite	Molybdenite	Oxides
3	Py Rougher Tail 3 (<74 µm)	Mineral fragments, 2 to 100 µm in size occurring either liberated or agglomerated in clots that likely result from thin section preparation; made up by quartz, plagioclase and K-feldspar with feldspars replaced to various extents by sericite or sporadically by carbonate, variably chloritized biotite, amphibole , epidote, titanite, rutile and sulphides/oxides; Fe-oxyhydroxides as orange stain and microcrystalline clusters	30% plagioclase; 20% quartz; 20% illite-sericite; 15% biotite; 5% K-feldspar; 1% chlorite; 1% amphibole; tr-1% magnetite; tr-1% rutile; tr-1% carbonate; tr titanite; tr epidote; tr pyrite; tr hematite; tr chalcopyrite; tr Fe-oxyhydroxides	Liberated grains of possible calcite	Liberated anhedral to lath-like grains, 2-15 µm in size; typically corroded with sutured grain boundaries	Few liberated grains, 2-10 µm in size; unaltered	n/a	n/a	n/a	Liberated magnetite shards and anhedral grains, variably replaced by hematite along grain boundaries; hematite as partial rims around magnetite and patches; rutile as liberated clusters; Fe-oxyhydroxides patches throughout
4	Py Rougher Conc	Mineral fragments (80-85%) and lithic clasts (10-15%), 5 to 1200 µm in size; lithic clasts of altered granular felsic rock, essentially made up by quartz, plagioclase and K-feldspar with feldspars replaced to various extents by sericite or sporadically by carbonate; variably chloritized biotite sheaves and amphibole grains set in lithic clasts, as well as rare grains of epidote and titanite; rutile disseminated, commonly associated with chlorite; sulphides and oxides disseminated in lithic clasts or liberated; Fe-oxyhydroxides as orange stain and microcrystalline clusters throughout; Fragments of most clast-forming minerals present, with pyrite being most abundant (~25%)	25% pyrite; 20% illite-sericite; 15% plagioclase; 15% quartz; 10% biotite; 5% K-feldspar; 1-2% chalcopyrite; 1% chlorite; 1% amphibole; tr-1% rutile; tr-1% carbonate; tr titanite; tr epidote; tr digenite; tr covellite; tr magnetite; tr hematite; tr Fe-oxyhydroxides	Possible calcite as local feldspar alteration patches in lithic clasts and as rare liberated grains	Liberated subangular to subrounded grains, 10-100 µm in size; contains few chalcopyrite, magnetite, hematite or rutile inclusions; also as rare attachments to lithic clasts or enclosed in lithic clasts; unaltered	Anhedral grains in clasts, inclusions in pyrite and rare liberated grains, 10-300 µm in size; variably altered by digenite/covellite from faint boundary alteration to total replacement	Patches of digenite/covellite along chalcopyrite boundaries	Patches of digenite/covellite along chalcopyrite boundaries to complete chalcopyrite replacement by covellite	n/a	Liberated magnetite grains variably replaced by hematite along grain boundaries; hematite as partial rims around magnetite and patches; rutile as clusters in lithic clasts; magnetite, hematite and rutile also as inclusions in pyrite; Fe-oxyhydroxides patches throughout

	Sample	Lithology	Mineralogy	Carbonate	Pyrite	Chalcopyrite	Digenite	Covellite	Molybdenite	Oxides
5	Cleaner Tail	Mineral fragments, 2 to 75 µm in size occurring either liberated or agglomerated in clots that likely result from thin section preparation; illite-sericite, plagioclase, quartz and biotite recognized but abundance undetermined due to the agglomeration in dark clots; presence of K-feldspar, amphibole, chlorite, epidote, titanite and carbonate unconfirmed; fragments of pyrite, chalcopyrite and various oxides also present	20-25% pyrite; illite-sericite, plagioclase, quartz and biotite recognized but abundance undetermined; presence of K-feldspar, amphibole, chlorite, epidote, titanite and carbonate unconfirmed; tr-1% rutile; tr chalcopyrite; tr magnetite; tr hematite; tr Fe-oxyhydroxides	Presence unconfirmed	Liberated subangular unaltered grain fragments, 2-75 µm in size	One liberated unaltered grain, 15 µm in size	n/a	n/a	Liberated sheave fragments of possible corroded molybdenite, 5-20 µm in size	Liberated magnetite grains variably replaced by hematite along grain boundaries; hematite as partial rims around magnetite; rutile as liberated grains and clusters; Fe-oxyhydroxides patches throughout

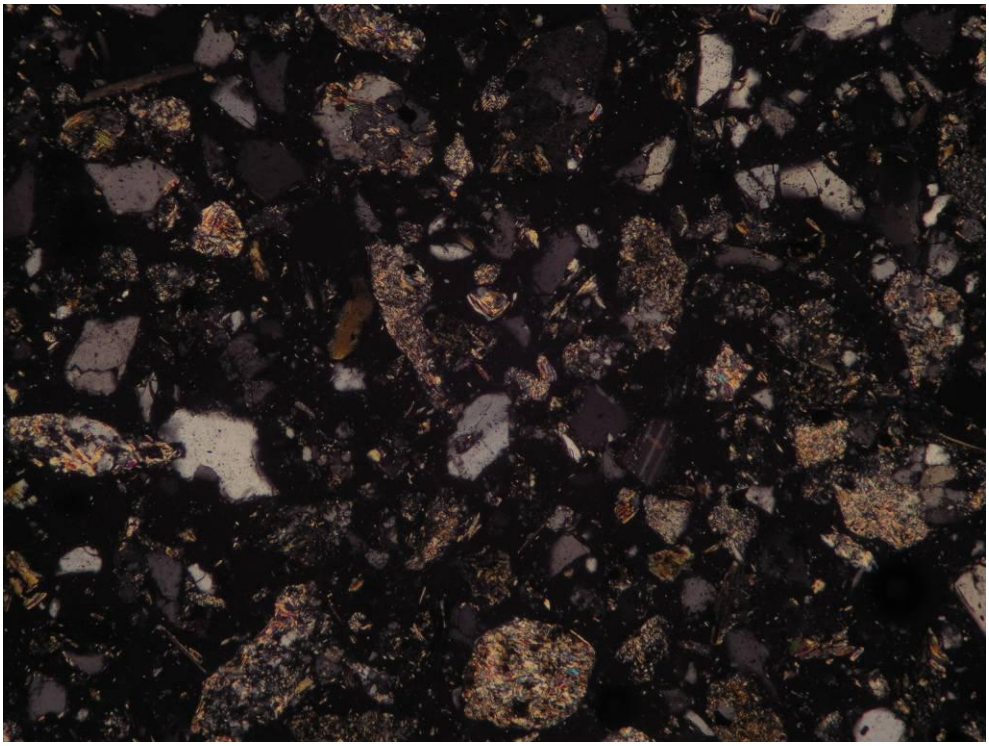
APPENDIX B: PHOTOMICROGRAPHS

List of abbreviations used in the description of photomicrographs:

FOV: Field of view – defined for the long dimension of photomicrographs
PPL: Plane polarized light
XPL: Crossed polars
RL: Reflected light



A)



B)

Figure 1: *Photomicrograph of sample 2 showing that it essentially consists of variably altered lithic clasts and liberated mineral fragments. A) PPL, B) XPL, FOV = ~ 2.7 mm.*

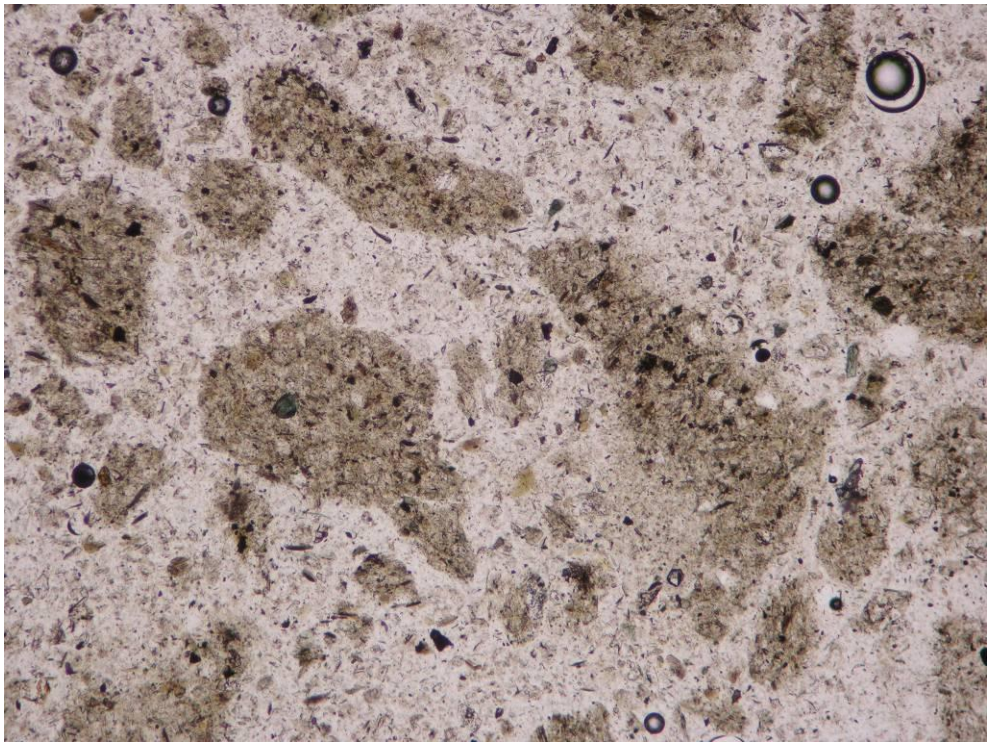


Figure 2: *Photomicrograph of sample 3 at the same magnification as Figure 1, showing that it consists of much smaller fragments, made up by liberated mineral fragments and agglomerated clots of mineral fragments. PPL, FOV = ~ 0.7 mm.*

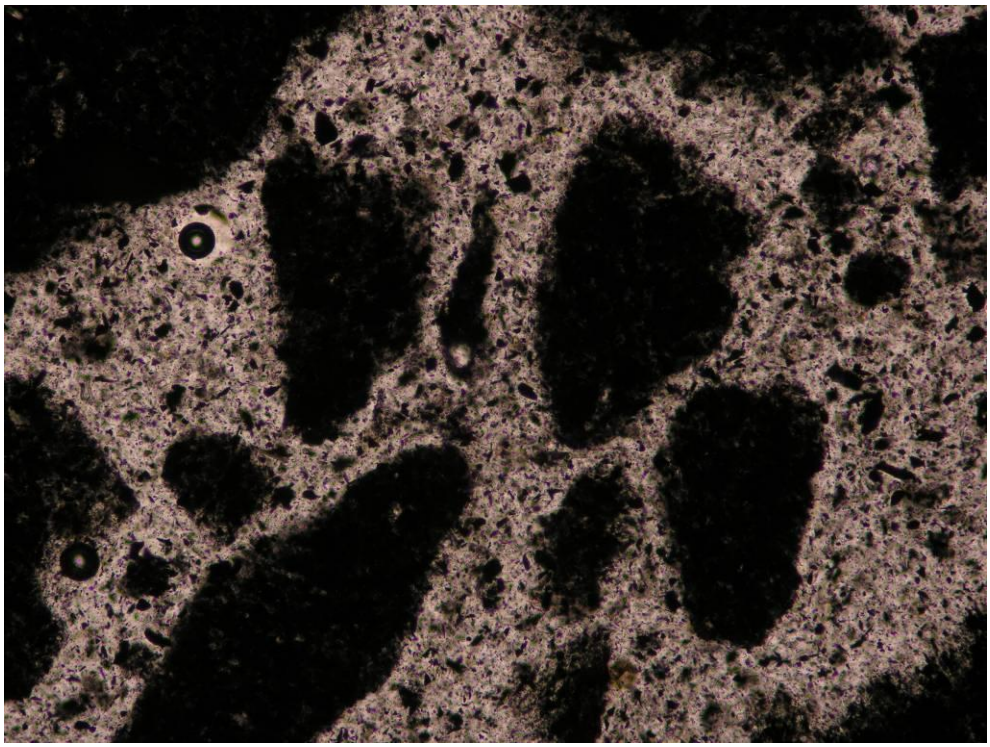
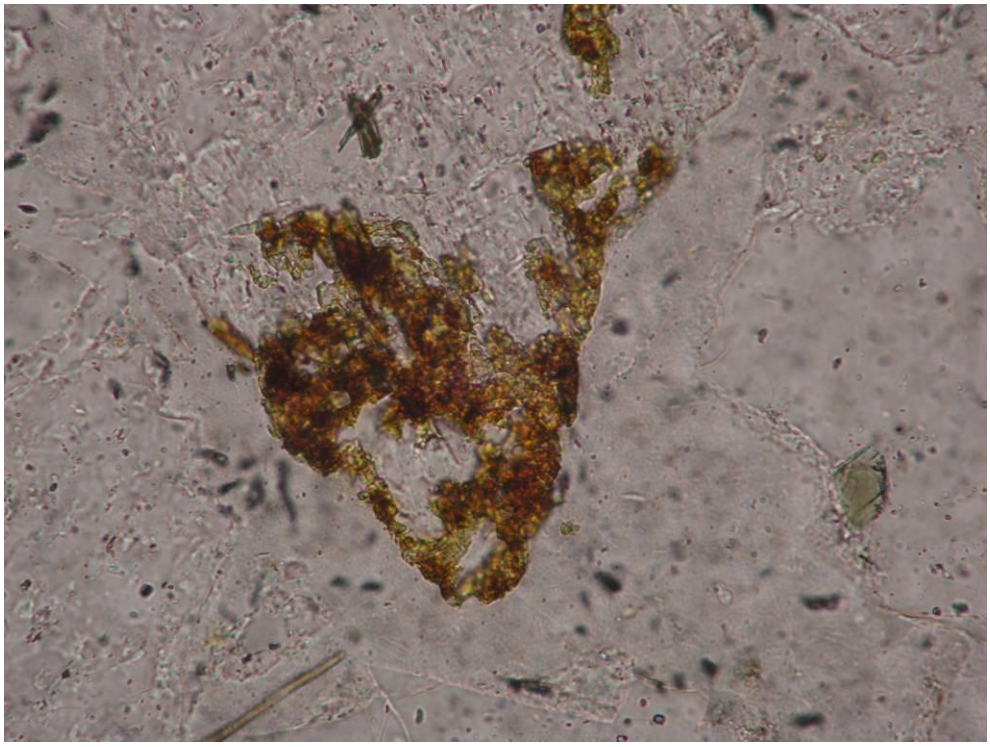
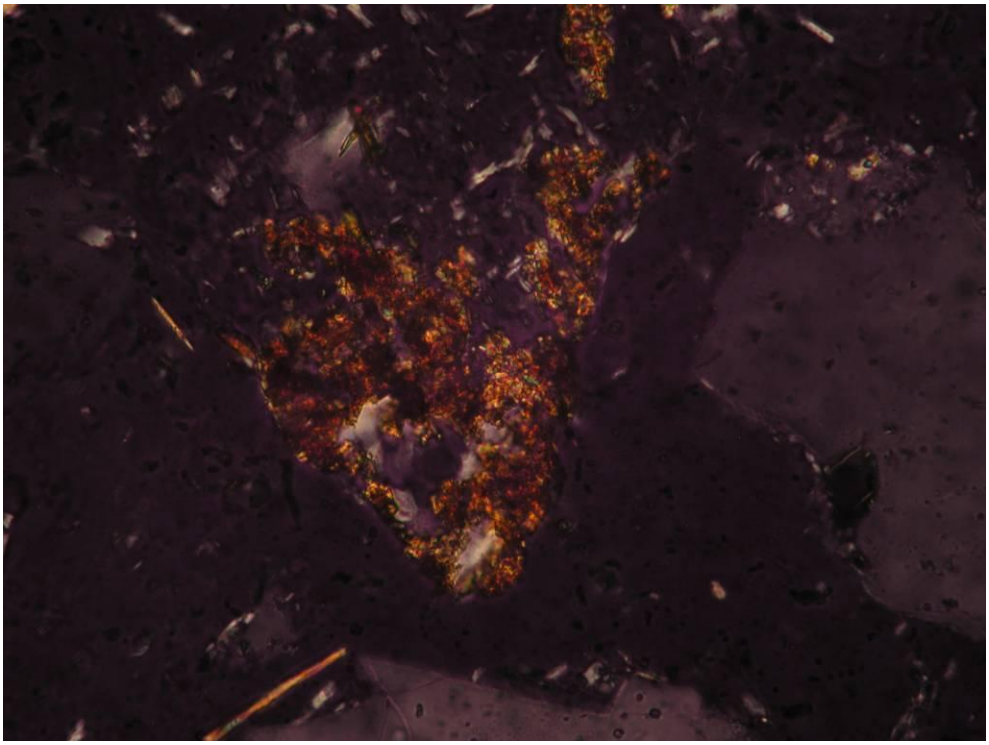


Figure 3: *Photomicrograph of sample 5 showing that it essentially consists of very fine-grained mineral fragments and dark, unresolved clots of mineral fragments. PPL, FOV = ~ 1.4 mm.*



A)



B)

Figure 4: *Photomicrographs of sample 2 showing the occurrence of microcrystalline clusters of brown-reddish possible siderite in clast. A) PPL, B) XPL, FOV = ~ 0.28 mm.*

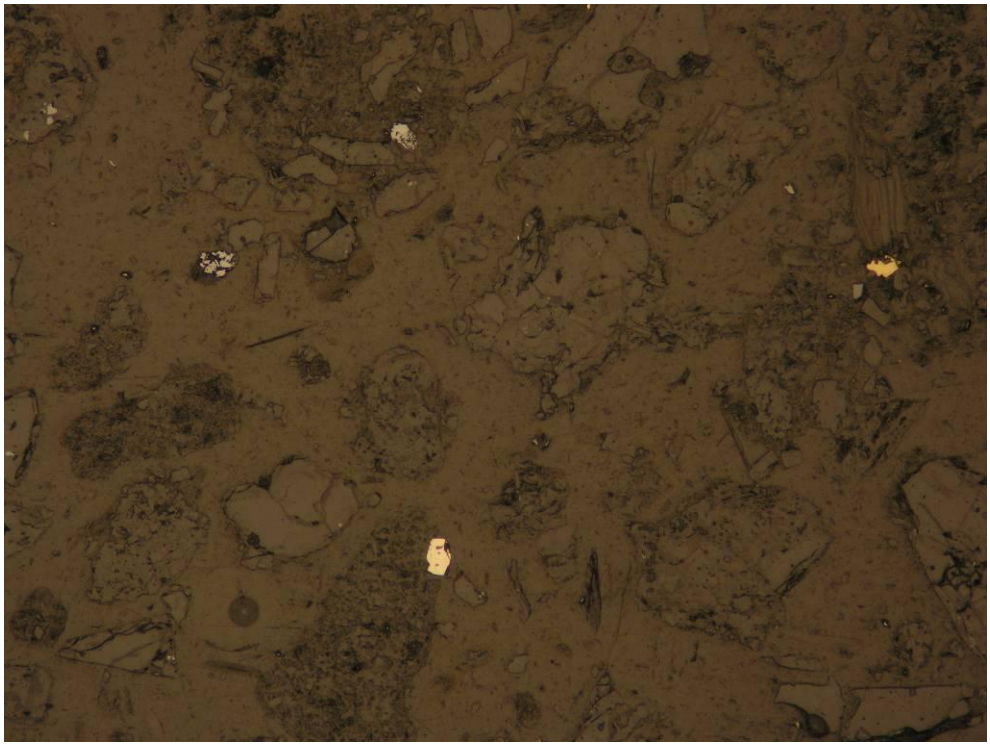


Figure 5: *Photomicrograph of sample 2 showing scarce pyrite (pinkish), chalcopyrite (yellow) and magnetite/ilmenite. Pyrite is attached to a lithic clast and chalcopyrite occurs enclosed in a lithic clast. RL, FOV = ~1.4 mm.*

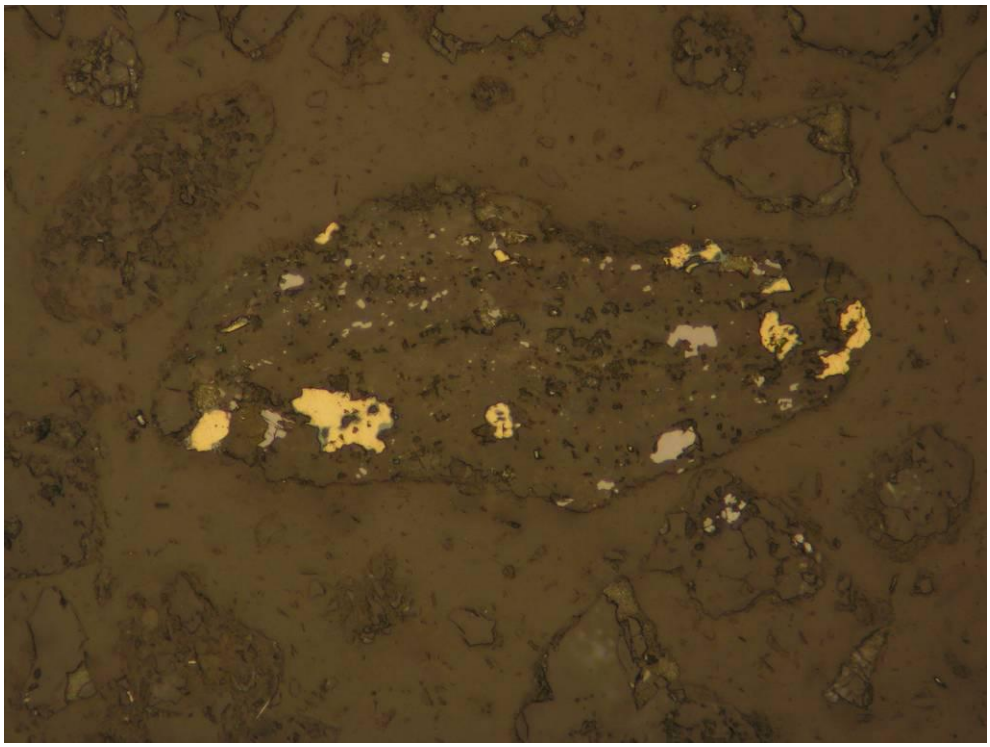


Figure 6: *Photomicrograph of sample 1 showing a lithic clast containing anhedral grains of chalcopyrite and clusters of rutile. Note the local partial rims of secondary blue Cu-sulphides around chalcopyrite RL, FOV = ~ 0.7 mm.*

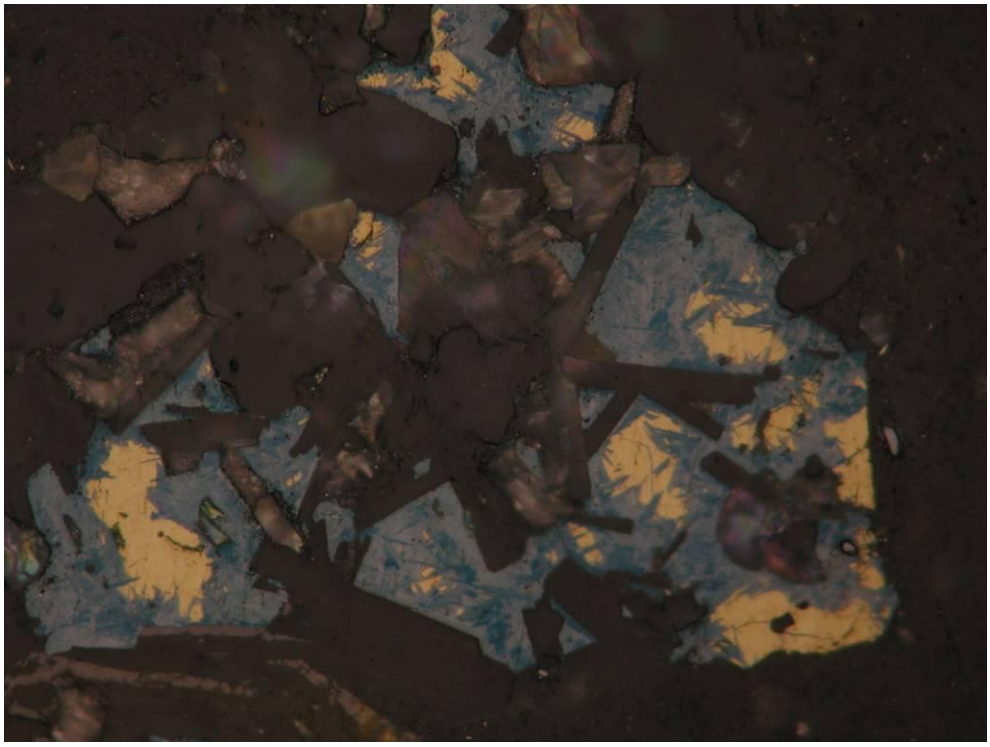


Figure 7: *Photomicrograph of sample 4 showing the occurrence of chalcopyrite in a lithic clast. The chalcopyrite is variably rimmed and replaced by grey-blue possible digenite and dark blue covellite. RL, FOV = ~ 0.27 mm.*

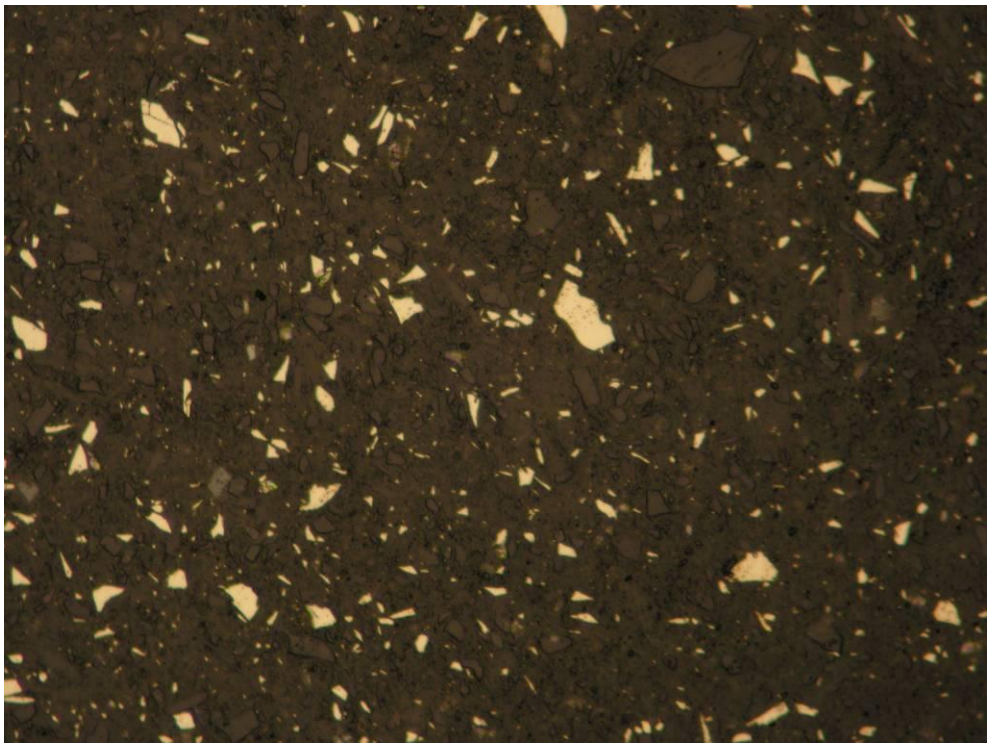


Figure 8: *Photomicrograph of sample 5 showing the abundance of liberated pyrite fragments. RL, FOV = ~ 0.7 mm.*

Appendix C
Static Testwork

CASiNO
COPPER AND GOLD

APPENDIX C1 ACID BASE ACCOUNTING RESULTS

Appendix C.1 Acid Base Accounting Results

		Parameters	Paste pH	TIC	Total C	Total S	Sulphate S	Sulphide S	Insoluble S	non-sulphate S	TAP	Non-SO_4 AP	SAP	CaNP	ScNP	CaNP / non-SO_4 AP	CaNP / TAP	ScNP / non-SO_4 AP	ScNP / TAP	Net NP
		Units	s.u.	%	%	%	%	%	%	%	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	$mgCaCO_3/kg$	ratio
Kinetic Test ID	*Sample ID / Lab ID*	*Dry Wt (kg)*																		
Sat Col 3			7.6	0.33	0.38	3.1	0.24	2.9	<0.01	2.8	96	89	91	28	25	0.31	0.29	0.28	0.25	-66
Sat Col 4			7.5	0.28	0.33	4.3	0.27	4.2	<0.01	4.1	135	127	131	23	21	0.18	0.17	0.17	0.16	-110
Sat Col 5			6.3	0.090	0.11	2.4	0.10	2.3	<0.01	2.3	74	71	72	7.5	11	0.11	0.10	0.15	0.15	-61
Sat Col 6			3.8	<0.01	0.030	1.6	0.48	1.2	<0.01	1.1	51	36	37	0.80	-4.1	0.022	0.016	-0.12	-0.081	-41
Sat Col 7			7.6	0.34	0.39	3.0	0.24	2.8	<0.01	2.8	95	88	88	28	23	0.32	0.30	0.27	0.25	-64
Sat Col 9 (CAP)	Oxide Composite		4.2	<0.01	0.030	0.49	0.20	0.020	0.27	0.29	15	9.1	0.63	0.80	3.3	0.088	0.052	0.36	0.22	2.7
Sat Col 9 (HYP)	Hypogene Composite		8.0	0.50	0.54	2.2	0.41	1.9	<0.01	1.8	69	57	58	42	40	0.74	0.60	0.70	0.57	-18
Sat Col 12 & 14 (acidic SUP)	upper layers		4.0	<0.01	0.020	1.4	0.35	0.83	0.24	1.1	44	33	26	0.80	3.8	0.024	0.018	0.11	0.086	-22
Sat Col 13 & 15 (neutral SUP)	Sat Col 13 (upper), Sat Col 15 (full)		7.7	0.080	0.10	1.0	0.020	0.88	0.10	0.98	31	31	28	6.7	17	0.22	0.21	0.54	0.53	-11
Sat Col 12, 13 & 14 (HYP)	lower layers		8.2	0.77	0.78	2.7	0.030	2.5	0.13	2.6	83	82	78	64	62	0.78	0.77	0.75	0.74	-16
Col 1			4.4	<0.01	0.070	0.19	0.15	0.050	<0.01	0.040	5.9	1.3	1.6	0.80	5.8	0.64	0.13	4.6	0.98	4.2
Col 2A, Sat Col 2			5.3	<0.01	0.030	0.32	0.31	0.020	<0.01	0.010	10	0.31	0.63	0.80	6.3	2.6	0.080	20	0.63	5.7
Col 2B			5.3	<0.01	0.030	0.31	0.31	0.010	<0.01	<0.01	9.7	0.31	0.31	0.80	5.2	2.6	0.083	17	0.54	4.9
	Col 2B kinetic test residue	8.0	5.5	<0.01	0.020	0.28	0.29	<0.01	<0.01	<0.01	8.8	0.31	0.30	0.80	11	2.6	0.091	34	1.2	11
Col 3			3.9	0.010	0.040	1.2	0.77	0.45	0.0100	0.46	38	14	14	0.83	0.60	0.058	0.022	0.042	0.016	-13
	Col 3 kinetic test residue	4.1	4.4	<0.01	0.020	0.93	0.67	0.28	<0.01	0.26	29	8.1	8.8	0.80	8.9	0.098	0.028	1.1	0.31	0.12
Col 4a	Oxide pH >6.0		6.5	0.020	0.050	0.16	0.10	0.050	0.010	0.060	5.0	1.9	1.6	1.7	12	0.89	0.33	6.3	2.4	10
	Col 4a kinetic test residue	4.2	7.7	0.020	0.050	0.14	0.070	0.060	0.010	0.070	4.4	2.2	1.9	1.7	18	0.76	0.38	8.3	4.1	16
HC3	08-276		8.4	0.27	0.28	4.2	0.030	4.0	0.23	4.2	132	131	124	23	32	0.17	0.17	0.24	0.24	-92
HC4	08-294		8.3	0.69	0.72	4.3	0.030	4.2	0.040	4.3	134	133	132	58	68	0.43	0.43	0.51	0.50	-64
HC5	08-277		8.1	0.21	0.21	2.2	0.070	2.1	0.030	2.1	69	67	66	18	27	0.26	0.25	0.40	0.39	-39
HC6	08-028		8.1	0.19	0.20	1.8	0.020	1.7	0.14	1.8	57	56	52	16	27	0.28	0.28	0.48	0.48	-25
HC7	08-043		7.9	0.48	0.51	2.9	0.12	2.7	0.040	2.8	90	87	85	40	48	0.46	0.44	0.56	0.53	-37
HC7	08-225		6.3	0.10	0.10	3.6	0.030	3.6	0.010	3.6	113	112	112	8.3	9.2	0.074	0.074	0.082	0.081	-103
HC8	08-143		5.1	<0.01	0.010	4.3	0.030	4.1	0.12	4.3	134	133	129	0.80	3.2	0.0060	0.0015	0.024	0.024	-126
HC9	08-260		7.9	<0.01	0.010	0.92	0.020	0.86	0.040	0.90	29	28	27	0.80	14	0.028	0.0070	0.51	0.50	-13
HC10	08-059		4.7	<0.01	0.010	2.0	0.060	1.7	0.24	1.9	62	60	53	0.80	4.1	0.013	0.0032	0.068	0.066	-49
HC10	08-178		5.4	<0.01	0.020	5.1	0.030	4.2	0.85	5.1	160	159	133	0.80	1.5	0.0050	0.0013	0.0095	0.0094	-131
HC11	08-068		8.2	0.22	0.23	2.3	0.030	2.0	0.29	2.2	71	70	61	18	33	0.26	0.26	0.47	0.47	-28
HC12	08-058		5.4	<0.01	<0.01	3.1	0.040	2.9	0.13	3.1	97	96	92	0.80	3.7	0.0083	0.0021	0.039	0.038	-88
	Gravel		5.9	<0.01	*ND*	0.42	0.45	<0.01	<0.01	<0.01	13	0.16	0.15	0.80	0.10	5.1	0.030	0.64	0.0076	0.10
FB-1	Sand & Fines		7.8	<0.01	*ND*	0.30	0.22	0.10	<0.01	0.080	9.4	2.5	3.1	0.80	0.60	0.32	0.043	0.24	0.064	-2.5
	Adjusted Average		*6.1*	*<0.01*	*ND*	*0.41*	*0.43*	*0.013*	*<0.01*	*0.011*	*13*	*0.36*	*0.40*	*0.80*	*0.14*	*2.3*	*0.031*	*0.40*	*0.011*	*-0.12*
	Gravel		6.2	<0.01	*ND*	0.34	0.12	0.22	<0.01	0.22	11	6.9	6.9	0.80	5.9	0.12	0.038	0.86	0.56	-0.98
FB-2	Sand & Fines		5.9	<0.01	*ND*	0.26	0.23	0.030	<0.01	0.030	8.1	0.94	0.94	0.80	3.3	0.85	0.049	3.5	0.41	2.4
	Adjusted Average		*6.1*	*<0.01*	*ND*	*0.31*	*0.16*	*0.14*	*<0.01*	*0.14*	*9.6*	*4.5*	*4.5*	*0.80*	*4.9*	*0.18*	*0.042*	*1.1*	*0.50*	*0.36*
	Gravel		5.8	<0.01	*ND*	0.19	0.18	0.020	<0.01	0.010	5.9	0.31	0.63	0.80	2.8	2.6	0.067	9.0	0.47	2.2
FB-3	Sand & Fines		5.9	<0.01	*ND*	0.36	0.37	0.020	<0.01	<0.01	11	0.16	0.63	0.80	1.7	5.1	0.036	11	0.15	1.1
	Adjusted Average		*5.8*	*<0.01*	*ND*	*0.20*	*0.19*	*0.020*	*<0.01*	*0.0097*	*6.2*	*0.30*	*0.63*	*0.80*	*2.7*	*2.6*	*0.064*	*9.0*	*0.44*	*2.1*
	Gravel		5.3	<0.01	*ND*	1.6	1.4	0.10	0.050	0.15	48	4.7	3.1	0.80	-0.40	0.17	0.0083	-0.085	-0.0083	-3.5
FB-4	Sand & Fines		5.7	<0.01	*ND*	1.4	1.1	0.38	<0.01	0.33	45	10	12	0.80	0.50	0.078	0.0090	0.048	0.011	-11
	Adjusted Average		*5.3*	*<0.01*	*ND*	*1.5*	*1.4*	*0.11*	*0.048*	*0.16*	*48*	*4.9*	*3.5*	*0.80*	*-0.36*	*0.16*	*0.0083*	*-0.074*	*-0.0075*	*-3.8*
	Gravel		8.1	0.030	*ND*	1.4	0.11	1.2	0.050	1.3	43	40	38	2.5	13	0.063	0.058	0.32	0.30	-25
FB-5	Sand & Fines		7.3	<0.01	*ND*	2.8	0.29	2.6	<0.01	2.5	87	78	82	0.80	10	0.010	0.0046	0.13	0.12	-72
	Adjusted Average		*8.0*	*0.027*	*ND*	*1.5*	*0.13*	*1.4*	*0.045*	*1.4*	*48*	*44*	*43*	*2.3*	*13*	*0.052*	*0.048*	*0.29*	*0.26*	*-30*
	Gravel		8.4	0.24	*ND*	1.5	0.18	1.3	0.060	1.3	47	41	39	20	26	0.48	0.43	0.63	0.55	-13
FB-6	Sand & Fines		8.0	0.35	*ND*	6.7	0.62	5.9	0.15	6.0	208	188	184	29	34	0.15	0.14	0.18	0.16	-150
	Adjusted Average		*8.4*	*0.24*	*ND*	*1.6*	*0.19*	*1.4*	*0.062*	*1.4*	*51*	*45*	*43*	*20*	*26*	*0.45*	*0.40*	*0.58*	*0.51*	*-17*
	Gravel		8.5	0.44	*ND*	3.0	0.060	3.0	<0.01	3.0	94	93	93	37	38	0.40	0.39	0.41	0.40	-55
FB-7	Sand & Fines		8.2	0.51	*ND*	1.8	0.060	1.6	0.12	1.7	55	53	49	43	55	0.80	0.78	1.0	1.0	6.0
	Adjusted Average		*8.5*	*0.45*	*ND*	*2.9*	*0.060*	*2.8*	*0.020*	*2.8*	*89*	*87*	*87*	*37*	*40*	*0.43*	*0.42*	*0.46*	*0.45*	*-47*
	Gravel		8.4	0.34	*ND*	1.8	0.10	1.7	0.00	1.7	55	52	52	28	34	0.55	0.52	0.66	0.62	-18
FB-8	Sand & Fines		8.3	0.52	*ND*	5.7	0.51	4.9	0.38	5.2	179	163	152	43	41	0.27	0.24	0.25	0.23	-111
	Adjusted Average		*8.4*	*0.34*	*ND*	*1.9*	*0.11*	*1.7*	*0.010*	*1.8*	*58*	*55*	*55*	*29*	*34*	*0.52*	*0.49*	*0.62*	*0.59*	*-20*
HC1	HC Ore 1		7.9	0.32	0.34	1.5	0.25	1.1	0.19	1.3	34	40	40	27	35	0.55	0.78	0.88	1.0	0.94
HC2	HC Ore 2		5.4	0.080	0.11	1.2	0.040	0.99	0.20	1.2	31	37	37	6.7	10	0.18	0.22	0.27	0.32	-21
Pilot Plant Tailings (2008)																				
T1	PP Sample #1		8.7	0.27	*ND*	1.2	0.050	1.1	*ND*	1.1	35	35	35	23	19	0.64	0.64	0.55	0.55	-16
	T1 kinetic test residue	988.0	8.1	0.22		1.1	0.040	0.99	0.020	1.0	33	32	31	18	28	0.58	0.56	0.87	0.84	-3.4
T2	PP Sample #2		8.6	0.26	*ND*	1.1	0.050	1.0	*ND*	1.0	33	33	33	22	17	0.67	0.67	0.53	0.53	-15
	T2 kinetic test residue	988.0	8.0	0.19		0.93	0.030	0.80	0.10	0.90	29	28	25	16	24	0.56	0.54	0.85	0.83	-1.0
T3	PP Sample #3		8.5	0.31	*ND*	0.65	0.070	0.65	*ND*	0.58	20	18	20	26	22	1.4	1.3	1.2	1.1	1.4
KM Bench Scale Tailings (2009)																				
Sat Col 1	KM Comp #1		8.5	0.050	0.060	3.5	0.080	3.2	0.21	3.4	108	106	99	4.2	11	0.039	0.038	0.10	0.10	-88
	KM Comp #2		8.6	0.22	0.24	0.19	<0.01	0.16	0.030	0.18	5.9	5.6	5.0	18	19	3.3	3.1	3.4	3.2	14
	KM Comp #3		8.6	0.41	0.43	0.14	0.020	0.11	0.010	0.12	4.4	3.8	3.4	34	32	9.1	7.8	8.6	7.4	29
T4			8.6	0.19	0.21	1.5	0.040	1.4	0.098	1.5	47	45	42	16	18	0.35	0.34	0.41	0.40	-24
Sat Col 8			8.6	0.19	0.21	0.75	0.022	0.67	0.061	0.73	23	23	21	16	18	0.70	0.68	0.77	0.75	-3.5
PyRo Bench Scale Tailings (2010)																				
T5, Sat Col 10	Whole #1		8.5	0.080	0.090	0.010	0.030	0.070	<0.01	<0.01	0.31	0.31	2.2	6.7	14	21	21	45	45	12
	T5 kinetic test residue	0.75	8.2	0.070	0.090	0.070	<0.01	0.030	0.040	0.060	2.2	1.9	0.94	5.8	20	3.1	2.7	11	9.1	19
Col 5 and T6	>74um #2		8.6	0.060	0.090	0.090	0.020	0.020	0.050	0.070	2.8	2.2	0.63	5.0	16	2.3	1.8	7.2	5.6	15
	Col 5 kinetic test residue	4.0	8.3	0.080	0.10	0.090	0.010	0.040	0.040	0.080	2.8	2.5	1.3	6.7	18	2.7	2.4	7.1	6.3	16
	T6 kinetic test residue	0.75	8.3	0.060	0.080	0.080	<0.01	0.040	0.040	0.070	2.5	2.2	1.3	5.0	18	2.3	2.0	8.4	7.4	17
	<74 um #3		8.5	0.15	0.18	0.070	0.040	0.020	0.010	0.030	2.2	0.94	0.63	13	21	13	5.7	23	9.8	21
	Pyrite Rougher Concentrate		8.6	0.090	0.13	12	0.080	11	1.5	12	388	385	338	7.5	16	0.019	0.019	0.042	0.042	-321
	Cleaner Tail		8.2	0.12	0.19	11	0.62	12	<0.01	11	353	334	359	10	21	0.030	0.028	0.062	0.059	-339
Sat Col 11			8.3	0.12	0.17	9.2	0.37	8.9	0.36	8.8	287	276	279	10.0	20	0.036	0.035	0.072	0.069	-259
PyRo Pilot Plant Tailings (2012)																				
	SUP-Head		7.2	0.21	0.24	2.4	0.070	1.9	0.51	2.4	76	74	58	18	24	0.24	0.23	0.33	0.32	
	HYP-Head		8.0	0.33	0.35	1.4	0.080	1.1	0.23	1.3	44	42	34	28	35	0.66	0.62	0.83	0.78	
	SUP-PyRo-Feed		8.1	0.31	0.32	0.96	0.10	0.79	0.070	0.86	30	27	25	26	33	0.96	0.86	1.2	1.1	
	HYP-PyRo-Feed		7.9	0.36	0.36	1.1	0.050	0.92	0.10	1.0	33	32	29	30	31	0.94	0.90	0.99	0.94	
T7, Sat Col 16	HYP-PyRo-Tails-Whole		8.3	0.34	0.35	0.11	0.030	0.050	0.030	0.080	3.4	2.5	1.6	28	34	11	8.2	14	9.9	33
Sat Col 17	HYP-PyRo-Con		7.7	0.30	0.33	11	0.10	9.9	0.78	11	338	334	310	25	30	0.075	0.074	0.090	0.089	-280
Col 6	Casino HYP-RO-Tails-Sands		8.4	0.21	0.27	0.13	0.010	0.080	0.040	0.12	4.1	3.8	2.5	18	28	4.7	4.3	7.3	6.8	25
Oxide Column Leach Residue																				
Col 7, Col 8	CL-01 L residue		7.51	0.03	0.06	0.46	0.51	0.02	<0.01	<0.01	14	0.31	0.63	2.5	7.2	8.0	0.17	23	0.50	6.6

APPENDIX C2 SOLID PHASE METAL RESULTS

Appendix C.2 Solid Phase Metals Results

Parameter		Ag	Al	As	Au	B	Ba	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Se	Sr	Th	Ti	Tl	U	V	W	Zn
Units		ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm
Kinetic Test ID	*Sample ID / Lab ID*																																				
Sat Col 3		1.1	0.94	23	273	<20	48	10	0.98	1.2	19	85	760	3.9	3.0	<0.01	0.40	16	0.45	249	75	0.014	7.6	0.059	11	3.1	0.70	2.6	2.3	56	14	0.034	0.20	9.1	25	1.2	102
Sat Col 4		0.90	0.81	21	287	<20	27	4.2	0.87	0.50	22	83	895	4.2	2.0	0.020	0.33	15	0.32	297	37	0.016	7.4	0.051	8.2	4.2	0.50	1.9	3.0	42	13	0.014	0.20	7.7	18	3.0	36
Sat Col 5		0.80	1.1	8.1	95	<20	111	2.0	0.25	<0.1	18	80	773	2.6	2.0	<0.01	0.36	17	0.29	103	48	0.015	7.7	0.042	4.6	2.4	0.60	1.6	1.8	11	14	0.0070	0.20	5.8	14	1.5	15
Sat Col 6		1.2	0.70	29	167	<20	85	6.4	0.020	<0.1	11	92	438	2.6	2.0	<0.01	0.38	18	0.10	45	39	0.013	3.3	0.031	7.6	1.7	0.40	0.90	2.6	12	15	0.0020	0.20	4.6	9.0	1.7	13
Sat Col 7		0.90	0.94	23	616	<20	80	9.7	1.0	0.60	19	77	744	3.6	3.0	<0.01	0.39	20	0.44	277	40	0.014	6.7	0.060	17	3.0	0.90	2.6	2.6	48	15	0.035	0.20	9.5	23	0.80	54
Sat Col 9 (CAP)	Oxide Composite	1.0	0.81	15	66	<20	321	2.4	0.030	<0.1	1.5	50	165	2.4	2.0	<0.01	0.42	18	0.18	41	124	0.036	2.8	0.040	15	0.47	1.3	1.7	2.9	27	7.1	0.013	0.30	2.5	16	1.5	30
Sat Col 9 (HYP)	Hypogene Composite	0.50	1.4	8.6	35	<20	58	1.0	1.8	0.20	16	72	671	3.3	4.0	<0.01	0.47	14	0.92	281	25	0.068	7.6	0.055	6.0	2.0	0.70	5.9	1.6	44	10	0.066	0.40	3.9	55	0.40	37
Sat Col 12 & 14 (acidic SUP)	upper layers	0.96	0.86	8.0	40	267	0.30	1.7	0.090	0.090	10	76	813	2.5	2.0	0.020	0.33	21	0.26	46	120	0.020	7.7	370	5.5	1.6	1.3	2.4	1.0	11	16	0.010	0.22	4.3	13	1.2	14
Sat Col 13 & 15 (neutral SUP)	Col 13 (upper), Col 15 (fu	0.46	1.2	5.0	40	147	0.50	1.0	0.30	0.19	9.4	83	455	2.9	5.1	0.030	0.32	14	0.76	222	60	0.040	12	590	4.1	1.1	0.30	4.5	<1	18	13	0.060	0.20	3.3	33	3.0	48
Sat Col 12, 13 & 14 (HYP)	lower layers	0.45	0.82	10	40	143	0.50	2.5	1.8	0.10	19	83	495	3.9	2.8	0.020	0.37	17	0.72	175	30	0.020	10	600	6.9	3.0	0.73	3.5	2.0	63	12	0.020	0.23	3.9	26	1.0	19
Col 1		1.2	2.8	17	73	<20	498	0.90	0.060	<0.1	3.1	45	318	3.0	6.0	<0.01	0.53	15	0.96	93	396	0.033	6.0	0.064	9.1	0.18	0.90	6.1	1.2	74	8.9	0.091	0.30	7.2	62	0.50	22
Col 2A		0.80	0.85	8.7	49	<20	302	1.8	0.12	<0.1	1.9	72	164	1.6	3.0	<0.01	0.31	16	0.16	39	17	0.045	2.6	0.021	23	0.32	1.1	1.5	1.8	20	9.1	0.012	0.10	1.4	12	1.0	16
Col 2B		0.80	0.82	8.6	48	<20	328	2.1	0.11	<0.1	1.3	72	124	1.5	3.0	<0.01	0.31	16	0.15	33	16	0.044	2.8	0.020	23	0.32	1.2	1.5	1.7	21	8.6	0.012	0.20	1.3	11	1.0	12
Col 3		1.0	0.94	12	49	<20	181	1.4	0.080	<0.1	3.5	59	308	2.6	2.0	<0.01	0.52	16	0.20	34	77	0.020	3.8	0.021	19	1.3	0.10	1.4	3.7	22	8.9	0.0030	0.20	1.2	10	2.2	9.0
Col 4a	Oxide pH >6.0	0.70	1.7	12	81	<20	389	1.2	0.33	<0.2	6.1	60	461	2.5	4.0	<0.03	0.33	17	0.65	118	91	0.057	6.4	0.049	15	0.15	2.2	4.8	1.2	29	8.4	0.060	0.30	3.0	42	0.80	44
HC3	08-276	0.80	1.4	1.8	120	<20	37	0.50	0.98	0.20	22	78	845	4.7	5.0	<0.01	0.54	20	0.95	188	71	0.022	20	0.069	2.7	3.8	0.20	2.1	1.9	25	6.8	0.025	0.30	18	25	2.3	31
HC4	08-294	0.30	2.3	<0.5	33	<20	13	0.20	2.6	0.10	63	44	809	5.3	5.0	<0.01	0.72	12	1.3	155	14	0.062	7.2	0.095	5.8	4.2	0.40	7.8	8.4	57	6.0	0.078	0.60	5.7	76	0.20	23
HC5	08-277	0.60	1.8	3.0	159	<20	93	0.70	0.88	<0.1	22	80	580	4.2	6.0	<0.01	0.78	32	1.3	205	73	0.039	19	0.081	1.8	2.2	0.20	3.1	1.6	49	7.1	0.055	0.40	4.6	31	2.2	23
HC6	08-028	0.70	1.3	14	87	<20	87	1.6	0.86	<0.1	12	107	557	2.5	4.0	<0.01	0.58	28	0.91	110	11	0.017	14	0.071	3.4	1.9	0.20	1.8	1.7	16	8.0	0.034	0.60	2.6	21	5.7	13
HC7	08-043	0.40	0.75	33	241	<20	102	1.3	2.0	0.20	39	101	455	2.9	2.0	<0.01	0.20	13	0.56	268	13	0.0090	5.1	0.055	11	2.9	0.50	1.2	2.0	111	12	0.0020	0.10	7.2	9.0	1.6	26
HC7	08-225	1.1	0.35	23	27	<20	107	3.1	0.22	0.30	12	35	645	3.5	1.0	<0.01	0.21	25	0.10	122	70	0.0060	8.9	0.047	22	3.5	0.60	1.3	2.7	13	13	0.0010	0.20	2.9	<2	0.30	21
HC8	08-143	0.60	0.37	6.3	28	<20	53	2.8	0.030	0.10	9.1	40	373	3.7	<1	<0.01	0.22	15	0.050	16	26	0.0060	9.9	0.066	11	3.8	0.30	0.70	1.9	57	9.5	<0.001	0.10	4.7	<2	0.20	14
HC9	08-260	0.50	1.2	3.9	25	<20	242	0.40	0.33	0.20	7.9	66	604	2.7	5.0	<0.01	0.43	12	0.79	174	14	0.092	8.1	0.082	2.4	0.90	<0.1	3.3	2.2	53	7.5	0.17	0.10	3.9	40	2.8	33
HC10	08-059	2.0	0.42	44	36	<20	103	0.40	0.050	0.50	20	104	607	1.9	<1	0.10	0.12	18	0.050	28	84	0.013	7.3	0.018	6.6	2.0	30	1.2	2.8	17	27	<0.001	0.30	4.8	6.0	0.80	71
HC10	08-178	0.60	0.28	16	63	<20	42	5.4	0.030	<0.1	21	62	428	4.5	<1	<0.01	0.17	13	0.020	13	223	0.0060	5.8	0.038	7.0	4.7	0.30	0.80	1.5	86	21	<0.001	<0.1	5.0	2.0	5.0	4.0
HC11	08-068	0.40	2.2	8.0	75	<20	102	0.60	1.2	<0.1	27	92	840	4.1	8.0	<0.01	0.67	17	1.6	163	4.3	0.050	4.8	0.098	3.9	2.3	0.30	10	4.3	31	7.2	0.071	0.50	5.0	89	0.40	29
HC12	08-058	0.50	0.33	7.7	17	<20	45	0.90	0.070	0.20	12	123	635	2.7	<1	0.010	0.13	19	0.020	11	4.4	0.013	3.3	0.029	6.8	3.1	13	0.50	4.3	23	16	<0.001	<0.1	4.1	<2	0.70	28
	Gravel	0.70	0.24	10	62	*ND*	205	1.5	<0.1	<0.1	0.30	104	31	1.3	2.0	0.020	0.33	8.0	0.020	12	14	0.0080	1.8	0.015	15	0.41	1.2	0.80	2.8	5.0	14	0.0020	0.20	0.50	4.0	2.0	3.0
FB-1	Sand & Fines	0.70	0.20	8.4	112	*ND*	339	2.0	0.040	<0.1	0.40	91	18	0.94	1.0	<0.01	0.26	10	0.020	21	17	0.010	2.1	0.0090	15	0.26	1.5	0.50	5.8	5.0	5.6	0.0040	0.10	0.60	4.0	4.4	5.0
	Adjusted Average	*0.70*	*0.24*	*10.0*	*66*	*ND*	*216*	*1.5*	*0.0080*	*<0.1*	*0.31*	*103*	*30*	*1.3*	*1.9*	*0.019*	*0.32*	*8.2*	*0.020*	*13*	*14*	*0.0082*	*1.8*	*0.014*	*15*	*0.40*	*1.2*	*0.77*	*3.1*	*5.0*	*13*	*0.0022*	*0.19*	*0.51*	*4.0*	*2.2*	*3.2*
	Gravel	1.3	1.8	16	72	*ND*	432	0.80	0.040	0.40	3.7	69	313	2.7	5.0	<0.01	0.55	8.0	0.87	84	400	0.030	5.1	0.054	7.4	0.29	2.1	5.7	1.7	59	5.8	0.086	0.50	5.2	56	0.80	19
FB-2	Sand & Fines	1.2	1.9	23	144	*ND*	443	1.2	0.080	0.80	2.7	64	381	2.9	4.0	0.010	0.44	19	0.68	84	495	0.057	5.2	0.075	12	0.22	3.8	5.1	1.9	88	7.9	0.057	0.30	8.1	45	0.90	23
	Adjusted Average	*1.3*	*1.9*	*19*	*101*	*ND*	*436*	*0.96*	*0.056*	*0.56*	*3.3*	*67*	*340*	*2.8*	*4.6*	*0.0070*	*0.51*	*12*	*0.79*	*84*	*438*	*0.041*	*5.1*	*0.062*	*9.0*	*0.26*	*2.8*	*5.5*	*1.8*	*71*	*6.6*	*0.074*	*0.42*	*6.4*	*52*	*0.84*	*21*
	Gravel	0.80	0.51	83	57	*ND*	102	2.4	0.030	0.20	1.4	119	302	1.3	1.0	0.040	0.30	25	0.20	25	212	0.013	3.5	0.034	8.3	0.18	3.6	2.4	1.7	16	9.7	0.010	0.20	2.0	17	0.60	16
FB-3	Sand & Fines	1.3	1.0	127	188	*ND*	163	5.1	0.10	0.80	3.5	99	724	3.2	2.0	0.070	0.45	40	0.32	70	474	0.029	6.0	0.094	24	0.36	15	4.1	3.9	59	19	0.015	0.30	7.9	30	1.4	44
	Adjusted Average	*0.83*	*0.54*	*85*	*64*	*ND*	*105*	*2.5*	*0.034*	*0.23*	*1.5*	*118*	*324*	*1.4*	*1.1*	*0.042*	*0.31*	*26*	*0.21*	*27*	*225*	*0.014*	*3.6*	*0.037*	*9.1*	*0.19*	*4.2*	*2.5*	*1.8*	*18*	*10*	*0.010*	*0.21*	*2.3*	*18*	*0.64*	*17*
	Gravel	0.80	0.48	18	145	*ND*	208	1.7	0.010	0.20	1.4	89	96	3.5	5.0	<0.01	0.75	18	0.030	58	93	0.044	2.0	0.046	8.3	1.3	0.70	1.5	2.0	46	13	0.0060	0.50	0.80	9.0	9.0	24
FB-4	Sand & Fines	1.6	0.38	26	330	*ND*	202	3.3	0.030	0.20	1.5	95	95	3.9	5.0	0.020	0.72	19	0.030	67	149	0.063	2.6	0.037	21	1.3	1.5	1.1	2.9	40	15	0.0040	0.80	1.0	9.0	7.3	37
	Adjusted Average	*0.83*	*0.48*	*19*	*152*	*ND*	*208*	*1.8*	*0.011*	*0.20*	*1.4*	*89*	*96*	*3.5*	*5.0*	*0.0056*	*0.75*	*18*	*0.030*	*58*	*96*	*0.045*	*2.0*	*0.046*	*8.8*	*1.3*	*0.73*	*1.5*	*2.0*	*46*	*13*	*0.0059*	*0.51*	*0.81*	*9.0*	*8.9*	*25*
	Gravel	0.50	0.78	14	54	*ND*	256	1.4	0.27	0.60	15	111	1583	2.2	3.0	0.020	0.22	13	0.37	77	20	0.058	4.3	0.044	12	1.3	2.9	2.1	3.2	54	16	0.011	0.20	2.8	20	0.90	39
FB-5	Sand & Fines	0.50	0.82	21	64	*ND*	130	1.6	0.23	1.1	26	100	1435	3.8	3.0	0.030	0.25	17	0.34	120	30	0.050	4.9	0.056	37	2.6	3.0	3.4	5.4	87	23	0.0080	0.20	4.1	17	1.4	60
	Adjusted Average	*0.50*	*0.78*	*14*	*55*	*ND*	*243*	*1.4*	*0.27*	*0.65*	*16*	*110*	*1567*	*2.3*	*3.0*	*0.021*	*0.22*	*13*	*0.37*	*82*	*21*	*0.057*	*4.4*	*0.045*	*15*	*1.4*	*2.9*	*2.2*	*3.4*	*58*	*17*	*0.011*	*0.20*	*2.9*	*20*	*0.95*	*41*
	Gravel	0.60	0.50	8.7	30	*ND*	119	1.7	1.2	0.10	17	119	413	3.2	2.0	<0.01	0.25	8.0	0.34	144	47	0.016	8.4	0.045	9.4	2.9	5.5	1.9	2.5	26	11	0.012	0.20	3.0	14	1.1	14
FB-6	Sand & Fines	1.5	1.2	22	162	*ND*	69	3.1	2.0	0.60	40	107	1593	6.1	3.0	0.030	0.20	17	0.47	180	79	0.084	7.1	0.057	39	6.0	1.9	3.5	6.4	122	11	0.015	0.20	9.3	23	1.5	62
	Adjusted Average	*0.62*	*0.89*	*5.9*	*88*	*ND*	*97*	*0.57*	*1.2*	*0.21*	*13*	*113*	*683*	*2.0*	*3.0*	*0.0056*	*0.22*	*15*	*0.47*	*120*	*40*	*0.067*	*4.3*	*0.046*	*7.2*	*1.5*	*1.0*	*2.8*	*1.8*	*59*	*8.7*	*0.020*	*0.10*	*4.3*	*21*	*0.72*	*22*
	Gravel	0.50	0.50	8.7	30	*ND*	119	1.7	1.2	0.10	17	119	413	3.2	2.0	<0.01	0.25	8.0	0.34	144	47	0.016	8.4	0.045	9.4	2.9	5.5	1.9	2.5	26	11	0.012	0.20	3.0	14	1.1	14
FB-7	Sand & Fines	1.0	1.3	15	49	*ND*	167	0.70	1.7	0.50	20	68	683	2.8	4.0	0.020	0.55	12	0.87	177	44	0.034	9.1	0.073	24	1.5	9.7	6.0	2.9	45	11	0.060	0.50	3.5	45	0.80	39
	Adjusted Average	*0.56*	*0.60*	*9.5*	*33*	*ND*	*125*	*1.6*	*1.3*	*0.15*	*18*	*112*	*448*	*3.1*	*2.3*	*0.0069*	*0.29*	*8.5*	*0.41*	*148*	*47*	*0.018*	*8.5*	*0.049*	*11*	*2.7*	*6.0*	*2.4*	*2.6*	*28*	*11*	*0.018*	*0.24*	*3.1*	*18*	*1.1*	*17*
	Gravel	0.40	1.0	3.8	28	*ND*	112	0.80	1.1	1.0	11	98	507	2.8	4.0	<0.01	0.37	17	0.97	173	52	0.031	15	0.078	7.4	1.7	0.30	2.4	1.4	55	6.3	0.053	0.20	3.1	26	25	49
FB-8	Sand & Fines	0.70	1.1	15	39	*ND*	75	2.5	2.0	2.6	31	110	639	5.5	4.0	<0.01	0.43	23	0.85	280	170	0.031	22	0.083	20	5.2	0.70	2.7	4.0	118	7.7	0.041	0.30	5.5	26	>100	87
	Adjusted Average	*0.41*	*1.0*	*4.1*	*28*	*ND*	*111*	*0.85*	*1.1*	*1.0*	*11*	*98*	*511*	*2.8*	*4.0*	*0.0050*	*0.37*	*17*	*0.97*	*176*	*55*	*0.031*	*15*	*0.078*	*7.7*	*1.8*	*0.31*	*2.4*	*1.5*	*57*	*6.3*	*0.053*	*0.20*	*3.2*	*26*	*27*	*50*
HC1	HC Ore 1	1.1	0.94	11	143	<20	52	1.0	1.2	0.10	14	78	1656	1.9	3.0	0.020	0.26	16	0.62	148	160	0.063	7.9	0.041	5.7	1.5	1.4	3.2	2.3	57	12	0.022	0.10	4.2	23	0.60	23
	HC1 kinetic test residue	1.2	0.96	10	124	<20	171	0.80	0.99	<0.1	13	62	1525	1.9	3.0	<0.01	0.26	17	0.61	146	208	0.060	7.6	0.041	5.1	1.4	1.2	3.1	1.4	44	10	0.023	0.20	3.4	23	0.40	23
HC2	HC Ore 2	0.80	0.81	10	258	<20	92	1.0	0.24	1.0	11	77	2496	1.7	2.0	0.020	0.17	26	0.21	100	161	0.024	7.8	0.040	20	1.2	2.8	2.0	1.7	21	13	0.0030	<0.1	6.7	13	0.90	42
	HC2 kinetic test residue	1.0	0.74	8.4	65	<20	85	0.70	0.21	0.80	10	65	2371	1.6	1.0	0.010	0.16	20	0.21	87	128	0.017	6.5	0.037	15	1.3	2.2	2.0	1.1	17	11	0.0030	<0.1	5.5	12	0.50	38
Pilot Plant Tailings (2008)																																					
T1	PP Sample #1	1.4	0.72	42	162	*ND*	121	1.8	0.81	1.1	14	14	1424	2.5	3.0	0.050	0.27	21	0.49	325	52	0.011	11	0.060	62	1.0	24	3.3	2.0	39	11	0.026	0.30	8.2	28	2.0	77
	T1 kinetic test residue	1.9	0.67	39	164	<20	125	1.4	0.60	0.90	14	10	1409	2.5	2.0	0.040	0.23	20	0.46	280	43	0.0050	10	0.058	61	0.96	19	2.9	1.3	29	9.6	0.023	0.20	6.5	26	1.5	64
T2	PP Sample #2	1.5	0.70	44	178	*ND*	114	1.7	0.74	0.90	13	10	1436	2.4	2.0	0.050	0.25	20	0.49	295	59	0.010	9.9	0.060	67	1.0	26	3.1	1.7	37	10	0.025	0.30	9.4	28	2.0	65
	T2 kinetic test residue	1.7	0.67	36	209	<20	127	1.4	0.58	0.80	12	9.0	1302	2.4	2.0	0.060	0.23	19	0.47	279	92	0.0050	9.1	0.060	65	0.87	18	2.8	1.2	28	9.2	0.023	0.30	6.8	26	1.4	59
T3	PP Sample #3	2.0	0.88	43	172	*ND*	201	2.7	0.92	1.7	11	21	1853	3.2	3.0	0.070	0.31	26	0.54	411	91	0.015	20	0.071	109	0.62	28	3.6	1.7	52	13	0.021	0.30	11	30	2.3	85
KM Bench Scale Tailings (2009)																																					
Sat Col 1		0.38	0.42	16	75	*ND*	57	3.3	0.38	0.20	30	19	353	3.1	1.1	0.010	0.14	8.3	0.13	50	15	0.0034	11	0.036	5.9	3.0	0.83	0.95	4.0	12	20	0.0027	0.10	5.6	5.8	1.0	15
	KM Comp #1	0.40	0.42	18	80	*ND*	37	3.7	0.37	0.20	33	17	388	3.4	<1	<0.01	0.12	7.0	0.090	38	15	0.0030	10	0.039	6.1	3.4	0.90	0.70	4.5	12	21	0.0010	0.10	5.6	4.0	1.1	14
	KM Comp #2	0.20	0.42	3.1	32	*ND*	206	0.40	0.44	0.20	6.3	34	102	0.84	2.0	<0.01	0.27	18	0.41	139	16	0.0060	12	0.016	4.5	0.19	0.30	2.8	0.60	13	9.9	0.015	0.10	5.5	19	0.30	24
	KM Comp #3	0.20	0.48	4.1	38	*ND*	237	0.50	0.76	0.10	4.7	46	102	1.2	2.0	<0.01	0.34	13	0.63	101	14	0.0080	17	0.022	2.9	0.13	0.10	3.5	0.70	23	8.4	0.048	0.10	2.6	29	0.30	22
T4		0.28	0.43	9.1	53	*ND*	145	1.7	0.48	0.18	17	30	216	1.9	1.6	0.010	0.22	13	0.33	91	15	0.0052	12	0.026	4.8	1.4	0.50	2.1	2.2	15	14	0.016	0.10	5.0	15	0.62	20
Sat Col 8		0.23	0.42	5.5	40	*ND*	177	0.96	0.43	0.20	11	31	150	1.3	1.8	0.010	0.24	16	0.36	122	16	0.0055	12	0.020	4.8	0.73	0.40	2.4	1.3	13	12	0.013	0.10	5.5	16	0.44	22
PyRo Bench Scale Tailings (2010)																																					
T5, Sat Col 10	Whole #1	0.30	0.97	3.6	20	*ND*	227	0.80	0.36	0.30	3.5	9.0	283	1.2	3.0	<0.01	0.38	18	0.60	156	137	0.0080	3.8	0.068	4.4	0.070	0.50	3.3	0.50	37	8.0	0.046	0.30	*ND*	32	9.4	31
Col 5 and T6	>74um #2	0.20	1.0	3.3	33	*ND*	216	0.80	0.35	0.30	3.7	8.0	283	1.2	3.0	<0.01	0.40	18	0.62	159	96	0.0080	4.2	0.062	3.7	0.070	0.30	3.5	<0.5	35	9.4	0.052	0.30	*ND*	35	8.3	31
	<74 um #3	0.20	1.6	5.4	15	*ND*	350	1.8	0.69	0.80	5.7	17	339	1.7	4.0	<0.01	0.50	39	0.77	246	20	0.012	8.4	0.12	8.4	<0.05	0.30	4.8	<0.5	81	18	0.037	0.30	*ND*	41	15	48
	Py Rougher Concentrate	2.2	1.0	45	233	*ND*	32	6.5	0.40	0.50	75	10	1146	11	3.0	0.030	0.33	20	0.53	164	228	0.0080	28	0.062	13	>10	1.3	3.1	7.5	45	13	0.035	0.40	*ND*	30	7.7	48
	Cleaner Tail	1.9	1.3	47	151	*ND*	33	5.6	0.66	0.80	72	165	906	11	3.0	0.030	0.41	27	0.61	197	657	0.018	146	0.078	20	>10	1.4	4.0	7.6	74	16	0.036	0.40	*ND*	36	12	62
Sat Col 11		1.6	1.3	38	141	*ND*	99	5.0	0.61	0.73	59	98	842	8.9	3.2	0.026	0.41	28	0.63	200	425	0.014	90	0.083	16	7.9	1.1	4.0	6.1	69	16	0.036	0.38	*ND*	36	11	56
PyRo Pilot Plant Tailings (2012)																																					
	SUP-Head	2.2	1.4	37	*ND*	20	135	3.9	0.47	0.77	21	74	3600	3.7	3.9	0.050	0.60	25	0.71	230	330	<0.01	8.4	680	12	2.5	3.8	4.5	1.0	28	11	0.060	0.53	6.5	41	2.7	67
	HYP-Head	1.3	0.85	6.0	*ND*	30	159	1.5	0.88	0.32	12	83	2020	2.3	3.1	0.020	0.42	28	0.63	159	350	<0.01	6.8	450	8.3	1.5	0.76	3.7	<1	21	12	0.030	0.28	4.3	30	3.2	36
	SUP-PyRo-Feed	0.65	2.2	15	*ND*	40	310	3.1	0.90	1.1	15	101	533	3.6	5.7	0.050	0.84	40	0.92	321	25	0.020	39	1030	11	1.1	1.2	8.8	1.0

APPENDIX C3 SFE RESULTS

Appendix C3: SFE Results

Parameter	Units	CAP Unsaturated Column Samples					SUP and HYP Saturated Columns							FB-1		FB-2		FB-3		FB-4		FB-5		FB-6		FB-7		FB-8		Ore		2008 Pilot Plant Tails			HL Residue
		Col 1	Col 2A	Col 2B	Col 3	Col 4a	Sat Col 3	Sat Col 4	Sat Col 5	Sat Col 6	Sat Col 7	Sat Col 9	Sat Col 9	gravel	sand & fines	gravel	sand & fines	gravel	sand & fines	gravel	sand & fines	gravel	sand & fines	gravel	sand & fines	gravel	sand & fines	gravel	sand & fines	HYP Head	SUP Head	Sample 1	Sample 2	Sample 3	CL-01 L
Volume Nanopure water	mL	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	450	750	750	750	300	750	750	750	300	750	750	*ND*	*ND*	*ND*	750
Sample Weight	g	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	150	250	250	250	100	250	250	250	100	250	250	*ND*	*ND*	*ND*	250
pH		5.98	5.94	5.87	3.65	7.62	7.05	7.47	5.29	3.39	7.00	4.03	7.30	5.95	7.63	5.58	5.09	5.06	5.40	4.06	4.92	7.13	7.08	7.47	7.46	7.95	8.03	7.74	7.72	7.5	7.6	7.8	7.9	7.9	8.95
Redox	mV	370	348	357	382	366	289	300	360	442	330	402	273	275	334	289	328	278	234	432	251	133	224	242	264	235	240	259	270	398	380	387	356	341	300
Conductivity	uS/cm	155	74	76	1491	396	1528	1634	499	1266	1408	492	1518	37	151	118	218	182	312	170	312	95	234	1223	2482	237	484	709	2615	892	785	292	280	360	119
Acidity (to pH 4.5)														#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	8.51	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Total Acidity (to pH 8.3)	mg CaCO3/L	7.0	6.5	6.7	725	2.8	11.1	8.6	20.7	725	11.2	92.5	6.5	5.0	3.4	6.5	15.1	14.1	16.2	36.7	39.1	3.6	4.3	5.5	7.5	2.9	3.2	3.7	7.0	9.5	10.6	2.3	2.2	2.5	#N/A
Alkalinity	mg CaCO3/L	4.7	2.3	2.2	#N/A	39.1	42.2	40.8	1.1	#N/A	45.2	#N/A	44.0	1.9	61.1	3.2	2.1	0.6	2.7	#N/A	0.6	9.9	8.9	42.1	49.3	76.7	84.5	51.5	60.4	36.7	56.7	42.0	39.6	48.1	37.0
Chloride	mg/L	4.8	2.4	2.4	***3***	3.5	2.7	3.0	2.4	***3***	2.7	2.2	3.1	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	2.9	1.9	7.2	*ND*
Fluoride	mg/L	***0.06***	0.33	0.34	0.68	0.34	0.31	0.35	0.48	0.94	0.30	0.51	0.60	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.77	0.85	0.91	*ND*
Bromide	mg/L	***0.3***	***0.3***	***0.3***	***0.3***	***0.3***	***0.3***	***0.3***	***0.3***	***0.3***	***0.3***	***0.3***	***0.3***	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.8	0.2	1.8	*ND*
Sulphate	mg/L	40	20	17	1080	146	910	903	243	950	793	265	990	11	12	39	67	73	127	51	125	28	67	673	1663	45	129	331	1820	360	291	84	75	108	164
Nitrite	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	<0.5	<0.5	<0.5	*ND*
Nitrate	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	<2	<2	<2	*ND*
Ammonia	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.057	<0.005	<0.005	*ND*
Iodide	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	<0.1	<0.1	<0.1	*ND*
Thiocyanate	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	<0.2	<0.2	<0.2	*ND*
Thiosulphate	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	1	<0.2	<0.2	*ND*
WAD Cyanide	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	<0.0005	<0.0005	<0.0005	*ND*
Total Cyanide	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.0029	0.002	0.0031	*ND*
TSS	mg/L	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
Ion Balance																																			
Major Anions	meq/L	1.06	0.55	0.48	22.50	3.94	19.88	19.71	5.15	19.79	17.50	5.61	21.62	0.27	1.47	0.88	1.44	1.53	2.70		2.62	0.78	1.57	14.86	35.63	2.47	4.38	7.93	39.12	8.23	7.20	1.83	1.62	2.42	4.16
Major Cations	meq/L	1.21	0.68	0.67	21.59	4.24	17.28	18.21	4.63	18.89	15.99	5.26	19.96	0.31	1.63	1.00	1.92	1.47	2.78	0.72	2.34	0.84	2.03	15.85	35.01	2.56	5.07	8.23	38.75	0.50	0.74	*ND*	*ND*	*ND*	0.16
Difference	meq/L	-0.15	-0.14	-0.19	0.91	-0.30	2.59	1.50	0.52	0.91	1.51	0.35	1.66	-0.04	-0.16	-0.12	-0.48	0.06	-0.08		0.27	-0.06	-0.45	-0.99	0.62	-0.09	-0.69	-0.30	0.37	7.73	6.45	*ND*	*ND*	*ND*	3.99
Balance (%)	%	-6.4%	-11.0%	-16.5%	2.1%	-3.7%	7.0%	4.0%	5.3%	2.3%	4.5%	3.3%	4.0%	-7.3%	-5.2%	-6.6%	-14.4%	2.1%	-1.4%		5.5%	-3.6%	-12.6%	-3.2%	0.9%	-1.8%	-7.3%	-1.9%	0.5%	88.5%	81.2%	*ND*	*ND*	*ND*	92.4%
Dissolved Metals																																			
Hardness $CaCO_3$	mg/L	3.9	1.2	1.7	290	127	835	871	202	107	769	123	938	1.2	43	5	7.5	40.6	57.5	8	21	11.1	9.3	763	1590	99.1	120	371	1770	406	343	115	110	137	191
Ag	mg/L	0.00003	0.00003	0.00004	0.00005	0.00006	0.00001	0.00003	***0.00001***	0.00003	***0.00001***	0.00005	***0.00001***	0.000042	0.000076	0.000035	0.000017	0.000026	0.000016	0.000025	0.000024	0.00001	0.000011	0.000007	0.00004	8E-06	0.000017	0.000006	0.00009	<0.00001	0.00002	<0.000005	0.000007	4.5E-05	0.00025
Al	mg/L	0.147	0.241	0.322	103	0.0145	0.0083	0.0201	0.862	133	0.0071	13.0	0.0064	0.157	0.0626	0.109	0.617	0.809	1.1	3.71	3.58	0.052	0.0928	0.0492	0.096	0.0465	0.0747	0.0287	0.065	0.0248	0.0093	0.14	0.137	0.121	0.0398
As	mg/L	0.0005	0.0006	0.0007	0.0008	0.0009	0.0009	0.0009	0.0006	0.0012	0.0007	0.0005	0.0011	0.00074	0.00168	0.00039	0.00092	0.0015	0.00279	0.00139	0.00454	0.00135	0.0042	0.00082	0.0032	0.00095	0.00499	0.0006	0.0021	0.0027	0.0027	0.00732	0.00738	0.00602	0.0038
B	mg/L	0.008	0.008	0.009	0.013	0.009	0.007	0.009	0.006	0.006	0.011	0.009	0.009	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.189	<0.05	<0.05	<0.05	<0.3	<0.05	<0.05	<0.05	0.541	0.0106	0.0104	<0.05	<0.05	<0.05	0.020
Ba	mg/L	0.0410	0.0101	0.0136	0.0285	0.0767	0.0247	0.0233	0.0200	0.0116	0.0234	0.0380	0.0256	0.0486	0.058	0.0579	0.0411	0.0706	0.0605	0.026	0.024	0.0327	0.00883	0.0279	0.0582	0.0424	0.0168	0.0323	0.0646	0.0295	0.0225	0.018	0.0214	0.021	0.0279
Be	mg/L	0.00004	***0.00002***	0.00002	0.00160	***0.00002***	***0.00002***	***0.00002***	0.00038	0.00849	0.00003	0.00128	***0.00002***	0.00001	<0.00001	0.00007	0.00007	0.00013	0.00006	0.00065	0.0002	<0.00001	0.00002	<0.00001	<0.00005	<0.00001	<0.00001	<0.00001	<0.00005	<0.00002	0.00003	<0.00001	<0.00001	<1E-05	<0.00002
Bi	mg/L	***0.00001***	0.00002	0.00004	***1E-05***	0.00006	***0.00001***	***0.00001***	***0.00001***	0.00002	***0.00001***	***0.00001***	***0.00001***	0.000012	0.000063	<0.000005	<0.000005	<0.000005	0.000006	<0.000005	<0.000005	0.000028	0.000014	<0.000005	<0.00003	6E-06	0.000005	<0.000005	<0.00003	<0.00001	0.00002	<0.000005	<5E-06	<5E-06	<0.00001
Ca	mg/L	1.12	0.34	0.49	75.0	39.7	316	334	66.1	18.3	290	36.7	347	0.35	15.6	1.32	2.21	12	19	1.39	6.46	3.78	2.97	294	609	32.8	40.7	131	635	142	105	44.1	42	52.3	74.0
Cd	mg/L	0.000057	0.000035	0.000039	0.00145	0.00026	0.000184	0.000676	0.00317	0.00189	0.000186	0.000298	***3E-06***	0.000034	0.00005	0.000052	0.000782	0.00152	0.00112	0.000264	0.000851	0.000709	0.000484	0.000263	0.00113	0.00013	0.00228	0.000212	0.00078	0.000305	0.00426	0.000063	0.000057	5.1E-05	######
Co	mg/L	0.000831	0.000380	0.000565	0.0681	0.0010	0.00163	0.00587	0.0812	0.363	0.00156	0.0190	0.00186	0.000149	0.000307	0.000729	0.00102	0.0434	0.0156	0.0127	0.0342	0.00113	0.00143	0.002	0.0039	0.00061	0.000711	0.000483	0.00284	0.000613	0.00521	0.000023	0.000036	4.5E-05	0.00344
Cr	mg/L	0.0008	0.0014	0.0013	0.0107	0.0024	***0.0005***	***0.0005***	***0.0005***	0.0329	***0.0005***	0.0057	0.0008	0.002	0.0019	0.0005	0.0023	0.0006	0.0017	0.0059	0.0188	0.0001	0.0004	0.0002	0.001	0.0001	0.0005	0.0002	0.0006	<0.0005	<0.0005	<0.0001	0.0004	0.0012	0.0013
Cu	mg/L	0.248	0.0950	0.114	21.4	0.0242	0.0044	0.0070	3.25	21.3	0.0022	0.893	0.0098	0.0363	0.0204	0.208	0.566	2	1.46	0.28	0.465	0.274	0.491	0.01	0.0475	0.00637	0.0259	0.0172	0.0368	0.0032	0.0279	0.00593	0.00711	0.018	0.119
Fe	mg/L	0.04	0.03	0.07	38.8	***0.01***	***0.01***	***0.01***	1.02	14.5	***0.01***	0.76	***0.01***	0.115	0.084	0.027	0.127	0.149	1.03	0.622	4.76	0.031	0.048	0.006	0.018	0.009	0.04	0.002	0.013	<0.003	<0.003	0.001	0.013	0.002	<0.01
Hg	mg/L	***0.00001***	***0.00001***	***0.00001***	***1E-05***	0.08	***0.00001***	***0.00001***	***0.00001***	***0.00001***	***0.00001***	0.03	***0.01***	0.04	0.04	0.03	0.08	0.08	0.14	0.02	0.02	0.04	0.04	<0.01	<0.05	<0.01	0.02	<0.01	<0.05	<0.01	<0.01	<0.00001	0.00001	0.00005	0.02
K	mg/L	2.42	2.31	2.46	26.3	4.14	11.6	12.5	5.69	0.46	11.4	8.36	14.9	2.58	3.41	2.26	2.69	8.83	8.02	4.17	12.6	2.08	2.47	4.12	11.4	5.58	10.6	5.99	29.4	13.6	16.5	12.2	13	17.2	15.0
Li	mg/L	0.002	***0.001***	***0.001***	0.003	***0.001***	***0.001***	***0.001***	0.004	0.028	***0.001***	0.005	0.003	0.004	<0.0005	0.0025	0.0051	0.0064	0.0067	0.0101	0.0144	0.0017	0.0024	0.0018	0.004	0.0012	0.0021	0.0018	0.006	0.002	0.003	0.0007	0.0008	0.001	0.002
Mg	mg/L	0.267	0.086	0.103	24.9	6.8	10.9	9.15	8.85	14.9	11.0	7.69	17.2	0.08	0.99	0.41	0.47	2.58	2.42	1.11	1.18	0.4	0.45	6.79	17.7	4.2	4.54	10.5	45.4	12.6	19.5	1.05	1.16	1.44	1.42
Mn	mg/L	0.026	0.008	0.009	0.713	0.125	0.381	0.934	1.89	0.946	0.433	0.750	0.192	0.00823	0.0372	0.0176	0.0565	0.2	0.538	0.0794	0.391	0.0255	0.0272	0.145	0.701	0.0222	0.0136	0.0363	0.41	0.0682	0.565	0.00467	0.00589	0.00843	0.007
Mo	mg/L	0.0201	0.00503	0.00514	0.00416	0.146	0.00386	0.00322	0.00020	0.00069	0.00324	0.00302	0.0207	0.00106	0.03	0.00937	0.0388	0.0126	0.102	0.0195	0.00908	0.017	0.0557	0.0474	0.337	0.019	0.102	0.0287	0.229	0.0230	0.0126	0.169	0.17	0.0924	0.579
Na	mg/L	24.0	13.2	12.4	15.2	36.2	6.38	10.00	3.02	1.33	6.45	21.3	18.8	5.03	15.8	19.4	39.2	9.97	32.8	10.5	36.8	13	40.9	11.9	66.1	10.1	55.1	15.5	59.2	5.23	7.19	4.64	5.31	5.76	14.9
Ni	mg/L	0.0010	0.0005	0.0005	0.0461	0.0013	0.0018	0.0037	0.0165	0.0505	0.0017	0.0127	0.0021	0.00084	0.0046	0.00078	0.00105	0.00826	0.0115	0.00609	0.0109	0.00337	0.00157	0.00356	0.0089	0.00393	0.00574	0.00231	0.0218	0.0005	0.0009	0.0005	0.00038	0.00055	0.0008
P	mg/L	0.03	***0.01***	***0.01***	***0.01***	0.04	***0.01***	***0.01***	***0.01***	***0.01***	***0.01***	0.01	0.01	0.004	0.022	0.028	0.05	0.015	0.038	0.007	0.01	0.012	0.074	0.005	0.014	<0.002	0.022	0.004	0.023	0.010	0.009	0.045	0.067	0.21	0.07
Pb	mg/L	0.00014	0.00028	0.00033	0.00116	0.00004	***0.00002***	0.00002	0.00031	0.00066	***0.00002***	0.00207	0.00006	0.00028	0.00281	0.000165	0.00843	0.000452	0.000311	0.127	0.00213	0.000333	0.000745	0.0006	0.00098	0.00054	0.00318	0.000151	0.00043	0.00003	0.00009	0.000037	0.000063	4.9E-05	0.00002
S	mg/L	13.5	7.33	7.12	312	56	276	297	75.2	284	252	78.0	297	4	4	13	26	25	45	18	43	10	**28**	273	609	17	56	127	669	140	112	31	28	39	59.9
Sb	mg/L	0.0005	0.0026	0.0026	0.0003	0.0021	0.0008	0.0009	0.0011	0.0002	0.0007	0.0005	0.0020	0.00101	0.00124	0.00019	0.00106	0.00165	0.00151	0.00033	0.00172	0.00554	0.00859	0.00152	0.0045	0.00778	0.0292	0.0004	0.0016	0.0011	0.0028	0.0201	0.0179	0.0355	0.0092
Se	mg/L	0.00115	0.00150	0.00158	0.00568	0.00139	0.00151	0.00185	0.00777	0.0113	0.00151	0.00382	0.00103	0.00373	0.0149	0.00086	0.00212	0.00644	0.0151	0.00228	0.00522	0.00688	0.0198	0.00106	0.0062	0.00185	0.00501	0.00046	0.0026	0.00187	0.00299	0.00224	0.00244	0.00381	0.00747
Si	mg/L	6.05	3.51	3.37	2.85	2.59	1.04	0.93	0.67	1.11	0.98	2.18	1.10	2.01	4.78	8.1	8.11	2.99	3.86	1.52	4.62	1.89	3.56	1.01	1.95	1.05	2.06	1.22	2.15	1.84	1.48	1.25	1.4	1.3	5.33
Sn	mg/L	0.00011	0.00013	0.00007	0.00014	0.00024	0.00008	0.00009	0.00009	0.00014	0.00007	0.00004	0.00004	<0.00001	0.00002	<0.00001	<0.00001	<0.00001	<0.00001	0.00001	<0.00001	<0.00001	0.00003	<0.00001	<0.00005	<0.00001	0.00002	<0.00001	<0.00005	0.00036	0.00016	0.00005	0.00005	0.00005	0.00017
Sr	mg/L	0.0101	0.0037	0.0044	0.370	0.189	1.36	1.56	0.181	0.0101	1.29	0.158	1.14	0.00311	0.0391	0.0153	0.0167	0.0508	0.0769	0.0217	0.0366	0.0223	0.00957	0.79	1.81	0.237	0.351	0.951	3.98	0.440	0.108	0.13	0.135	0.157	0.150
Ti	mg/L	0.0006	0.0008	0.0009	0.0007	0.0002	0.0001	0.0001	0.0001	0.0008	0.0001	0.0003	0.0002	<0.0005	0.0028	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.001	0.0011	<0.0005	<0.0005	0.011	<0.0005	0.001	<0.0005	0.006	<0.0001	0.0001	<0.0005	<0.0005	<0.0005	0.0003
Tl	mg/L	***0.0002***	***0.0002***	***0.0002***	0.0009	***0.0002***	***0.0002***	***0.0002***	***0.0002***	***0.0002***	***0.0002***	***0.0002***	***0.0002***	0.000053	0.000025	0.000097	0.000091	0.000199	0.000138	0.000269	0.000224	0.000036	0.000028	0.000033	0.00004	2.1E-05	0.000036	0.00002	0.00005	0.00005	0.00017	0.000064	0.00008	7.1E-05	<0.0002
U	mg/L	0.00112	0.000310	0.000541	0.0321	0.00049	0.0337	0.0231	0.00788	0.330	0.0333	0.00939	0.0329	0.0004	0.000371	0.000761	0.00322	0.00075	0.00128	0.0014	0.00135	0.000171	0.000254	0.0229	0.0722	0.0154	0.0359	0.0103	0.074	0.0199	0.00395	0.00184	0.00219	0.0032	0.00672
V	mg/L	0.00011	0.00011	0.00011	0.00011	0.00027	0.00015	0.00021	0.00013	0.00293	0.00012	0.00003	0.00033	<0.0002	0.0003	0.0002	0.0002	<0.0002	<0.0002	0.0004	<0.0002	0.0006	0.0005	0.0004	0.001	0.0004	0.0009	<0.0002	<0.001	0.00097	0.00101	0.0007	0.0007	0.0004	0.00034
Zn	mg/L	0.009	0.004	0.003	0.107	0.001	0.002	0.002	0.109	0.240	0.002	0.473	0.003	0.0035	0.0026	0.005	0.0322	0.0522	0.0664	0.0568	0.125	0.0113	0.015	0.0022	0.0092	0.0013	0.0227	0.0019	0.0055	0.002	0.005	0.0007	0.0006	0.0007	<0.001
Zr	mg/L	0.00007	0.00150	0.00181	0.00451	0.00029	0.00006	0.00003	0.00001	0.00003	0.00002	0.00174	0.00034	0.0032	0.0049	<0.0001	0.0002	<0.0001	0.0007	0.0068	0.0081	0.0002	0.0003	<0.0001	0.0006	0.0002	0.0009	0.0004	0.0013	<0.00001	0.00001	<0.0001	<0.0001	<0.0001	0.00008

APPENDIX C4 SUPERNATANT RESULTS

Appendix C4: Supernatant Results

RESULTS OF ANALYSIS	Fresh	Fresh	Fresh	Aged	Fresh	Aged	Fresh	Aged	Fresh	Aged
Sample ID	PYRROUGHSUP1-2	PYRROUGHSUP3-5	PYRROUGHSUP7-8	PYRROUGHSUP	CLEANERSUP	CLEANERSUP	PYRCON	PYRCON	FINALCON	FINAL CON
Date Sampled	08-DEC-10	08-DEC-10	08-DEC-10	11-JAN-11	10-DEC-10	11-JAN-11	10-DEC-10	11-JAN-11	10-DEC-10	11-JAN-11
Physical Tests										
Conductivity	488	638	504	632	518	591	433	546	487	567
Hardness (as CaCO3)	199	197	195	245	215	203	152	206	196	203
pH	10.78	11.01	10.40	8.76	10.60	10.33	10.31	8.85	10.49	9.88
Anions and Nutrients										
Acidity (as CaCO3)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Alkalinity, Total (as CaCO3)	205	233	200	71.6	133	91.7	181	83.8	158	84.3
Ammonia as N	0.797	0.896	0.820	0.0850	0.0485	0.0304	0.707	0.0838	0.233	0.0988
Bromide (Br)	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chloride (Cl)	16.0	14.8	19.9	20.7	9.46	49.4	14.5	13.8	10.9	36.4
Fluoride (F)	1.43	1.29	1.43	0.221	0.622	0.204	1.08	0.389	0.669	0.311
Nitrate (as N)	0.0973	0.0921	0.0917	0.0842	0.0887	0.0889	0.0920	0.0618	0.0906	0.0837
Nitrite (as N)	0.0067	0.0033	0.0037	0.0066	0.0026	0.0021	0.0057	0.0238	0.0036	0.0098
Ortho Phosphate as P	0.0042	0.0034	0.0062	0.0584	0.0078	<0.0010	0.0107	<0.0010	0.0089	<0.0010
Total Phosphate as P	0.437	0.400	0.446	0.619	0.0556	0.0521	0.406	0.376	0.149	0.168
Sulfate (SO4)	60.6	37.6	81.2	203	70.8	110	61.9	151	67.2	126
Cyanides										
Cyanide, Total	-	<0.0050	<0.0050		<0.0050		<0.0050		<0.0050	
Total Metals										
Sulfur (S)-Total	24.5	16.0	30.5	77.9	52.9	58.8	33.6	73.1	46.4	66.3
Dissolved Metals										
Aluminum (Al)-Dissolved	23.0	22.1	22.7	3.36	9.05	8.14	17.4	8.85	11.7	8.73
Antimony (Sb)-Dissolved	<0.00020	0.00020	0.00057	0.00318	0.00458	0.00350	0.00025	0.00299	0.00359	0.00351
Arsenic (As)-Dissolved	0.00159	0.00146	0.00217	0.00660	0.00315	0.00122	0.00245	0.00305	0.00303	0.00199
Barium (Ba)-Dissolved	0.0126	0.0102	0.0102	0.0174	0.00853	0.0185	0.0101	0.0203	0.00836	0.0201
Beryllium (Be)-Dissolved	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050
Bismuth (Bi)-Dissolved	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050
Boron (B)-Dissolved	0.049	<0.020	0.052	0.085	0.070	0.075	0.027	0.105	0.057	0.089
Cadmium (Cd)-Dissolved	<0.00015	<0.00015	<0.00020	<0.0017	<0.000070	<0.000090	<0.00015	<0.00060	<0.000080	<0.00030
Calcium (Ca)-Dissolved	79.5	78.7	77.9	98.2	86.2	81.1	60.9	82.4	78.6	81.3
Chromium (Cr)-Dissolved	<0.0010	<0.0010	<0.0010	0.00174	0.00056	<0.00050	<0.0010	<0.00050	0.00060	<0.00050
Cobalt (Co)-Dissolved	<0.00020	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010
Copper (Cu)-Dissolved	<0.0010	<0.0010	<0.0010	0.0132	0.00346	0.00935	<0.0010	0.00152	<0.00050	0.00707
Iron (Fe)-Dissolved	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	0.085	<0.030	<0.030	<0.030
Lead (Pb)-Dissolved	<0.00010	0.00010	0.00010	0.000203	0.000074	0.000071	0.00010	0.000180	0.000086	0.000099
Lithium (Li)-Dissolved	<0.010	<0.010	<0.010	<0.0050	<0.0050	<0.0050	<0.010	<0.0050	<0.0050	<0.0050
Magnesium (Mg)-Dissolved	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Manganese (Mn)-Dissolved	0.00029	0.00040	0.00038	0.00119	<0.000050	<0.000050	0.00201	0.000183	<0.000050	0.000100
Mercury (Hg)-Dissolved	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010	<0.000010
Molybdenum (Mo)-Dissolved	0.486	0.459	0.514	1.23	0.188	0.259	0.472	0.683	0.271	0.437
Nickel (Ni)-Dissolved	<0.0010	<0.0010	<0.0010	<0.00050	<0.00050	<0.00050	<0.0010	<0.00050	0.00050	<0.00050
Phosphorus (P)-Dissolved	0.48	0.44	0.46	0.58	<0.30	<0.30	0.46	0.36	<0.30	<0.30
Potassium (K)-Dissolved	35.8	25.9	25.4	29.1	12.2	15.9	22.4	29.1	15.1	21.7
Selenium (Se)-Dissolved	0.0023	0.0022	0.0026	0.00410	0.00262	0.00217	0.0021	0.00323	0.00207	0.00255
Silicon (Si)-Dissolved	1.85	1.87	1.13	0.453	1.32	1.54	1.05	0.389	1.22	1.12
Silver (Ag)-Dissolved	<0.000020	<0.000020	<0.000020	0.000016	0.000020	0.000039	<0.000020	0.000053	<0.000010	0.000073
Sodium (Na)-Dissolved	16.1	14.6	17.6	20.1	8.6	27.4	13.9	15.7	10.1	24.7
Strontium (Sr)-Dissolved	0.172	0.182	0.157	0.248	0.172	0.229	0.140	0.238	0.164	0.245
Thallium (Tl)-Dissolved	<0.00020	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010
Tin (Sn)-Dissolved	<0.00020	<0.00020	<0.00020	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010
Titanium (Ti)-Dissolved	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Dissolved	0.000250	0.000240	0.000687	0.0186	0.000191	0.000075	0.000463	0.00294	0.000276	0.00123
Vanadium (V)-Dissolved	0.0171	0.0150	0.0181	0.0163	0.0038	0.0070	0.0155	0.0114	0.0075	0.0091
Zinc (Zn)-Dissolved	<0.0060	<0.0060	<0.0060	<0.0030	<0.0030	<0.0030	<0.0060	<0.0030	<0.0030	<0.0030

Appendix C4: Supernatant Results													
Parameter	**Method**	**Units**	**Feed Water**	**PP Tailings Supernatant (2008)**				**KM Tailings Supernatant (9/24/2009)**					
				PP Tailings			**Cleaner Circuit**	**KM Tailings**			**Cleaner Circuit**		
				Sample #1	**Sample #2**	**Sample #3**	**Sample #3**	**Comp #1**	**Comp #2**	**Comp #3**	**Comp #1**	**Comp #2**	**Comp #3**
pH	meter		7.7	12.0	11.4	11.2	10.3	11.0	10.8	10.4	11.0	11.1	11.0
Redox	meter	mV	388	41	53	57	134						
Conductivity	meter	uS/cm	108	1493	849	1525	1241	621	568	1570	477	515	454
Total Acidity (to pH 8.3)	titration	mg CaCO3/L	3.3	#N/A	#N/A	#N/A	#N/A	<1	<1	<1	<1	<1	<1
Alkalinity	titration	mg CaCO3/L	42.9	150	75	150	100	247	141	82.7	146	136	122
Chloride		mg/L	3.4	26.5	26	26.6	51.7	33.6	43	57.5	8.2	8.7	10
Fluoride		mg/L	0.06	2.77	3.39	3.44	3.23	<0.45	3.93	0.97	0.19	0.24	0.15
Bromide		mg/L	0.1	1.1	1.2	1.2	9.5	<0.5	<0.25	<0.5	<0.25	<0.25	<0.25
Nitrite		mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.01	<0.005	<0.01	<0.005	<0.005	0.0079
Nitrate		mg/L	<0.2	0.3	0.2	0.3	0.3	0.052	0.049	<0.05	0.038	0.049	0.05
Ammonia		mg/L	<0.01	0.5	0.5	0.4	0.3	0.616	1.21	0.721	0.115	0.094	0.066
Ortho Phosphate as P								0.0051	0.0028	0.0046	0.0053	0.0162	0.0236
Total Phosphate as P								0.323	0.614	0.822	1.32	1.88	2.09
Iodide		mg/L	<0.1	<0.1	<0.1	<0.1	<0.1						
Thiocyanate		mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	<0.5	<0.5	0.58	-	-	-
Thiosulphate		mg/L	<0.2	0.3	0.4	0.4	26						
WAD Cyanide		mg/L	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.005	<0.005	<0.005	-	-	-
Total Cyanide		mg/L	<0.0005	0.0051	0.0038	0.0042	0.0109	0.0059	0.0089	<0.005	0.0113	0.0069	0.0091
TSS		mg/L					19						
Sulphate	Turbidity	mg/L	8	450	537	536	546	26.8	46.2	702	19.3	12.9	30.7

Parameter	**Method**	**Units**	**Feed Water**	**PP Tailings Supernatant (2008)**				**KM Tailings Supernatant (9/24/2009)**					
				PP Tailings			**Cleaner Circuit**	**KM Tailings**			**Cleaner Circuit**		
				Sample #1	**Sample #2**	**Sample #3**	**Sample #3**	**Comp #1**	**Comp #2**	**Comp #3**	**Comp #1**	**Comp #2**	**Comp #3**
Dissolved Metals													
Hardness CaCO3		mg/L	42.3	726	705	703	707						
Ag	ICP-MS	mg/L	<0.000005	<0.000005	<0.000005	<0.000005	0.00001	<0.00005	<0.001	<0.001	<0.001	<0.001	<0.001
Al	ICP-MS	mg/L	0.0058	3.67	3.56	3.43	2.79	36.1	1.24	0.61	8.53	1.92	1.69
As	ICP-MS	mg/L	0.00011	0.00292	0.00311	0.00321	0.0131	0.0009	0.026	0.022	<0.01	<0.01	<0.01
B	ICP-MS	mg/L	<0.005	0.006	0.016	0.021	<0.05	<0.05	<1	<1	<1	<1	<1
Ba	ICP-MS	mg/L	0.00964	0.0229	0.0209	0.0207	0.03	0.0131	0.0443	0.075	<0.005	0.0736	0.0739
Be	ICP-MS	mg/L	<0.00001	<0.00001	<0.00001	<0.00001	<0.00001	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
Bi	ICP-MS	mg/L	<0.000005	<0.000005	<0.000005	<0.000005	<0.000005	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
Ca	ICP-MS	mg/L	13.8	291	282	281	283	89.8	75	321	91.2	86.7	83.8
Cd	ICP-MS	mg/L	<0.000005	0.000305	0.000332	0.000364	0.000498	<0.000085	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
Co	ICP-MS	mg/L	0.000011	0.000075	0.000099	0.000087	0.000061	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
Cr	ICP-MS	mg/L	<0.0001	0.0007	0.0007	0.0008	0.0008	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
Cu	ICP-MS	mg/L	0.00316	0.0245	0.0141	0.0154	0.00017	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
Fe	ICP-MS	mg/L	0.014	0.01	0.008	0.013	0.036	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030
Hg	CVAA	ug/L	<0.01	<0.01	<0.01	<0.01	0.01						
K	ICP-MS	mg/L	0.86	28.7	26.4	26.4	43.8	55	41.2	54.8	12.7	10	8.9
Li	ICP-MS	mg/L	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.025	<0.5	<0.5	<0.5	<0.5	<0.5
Mg	ICP-MS	mg/L	1.9	<0.05	0.08	0.07	0.13	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Mn	ICP-MS	mg/L	0.00101	0.00073	0.00074	0.00083	0.00116	0.00039	<0.005	<0.005	<0.005	<0.005	<0.005
Mo	ICP-MS	mg/L	0.00078	0.708	0.8	0.837	1.17	0.0182	0.176	0.17	0.0172	0.271	0.155
Na	ICP-MS	mg/L	3.15	21.4	21.3	21	32.1	18	23.8	32.9	7.9	8.2	8.5
Ni	ICP-MS	mg/L	0.00057	0.00081	0.00087	0.00091	0.00172	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
P	ICP-MS	mg/L	<0.002	0.112	0.094	0.093	1.16	0.4	0.7	0.96	1.41	2	2.2
Pb	ICP-MS	mg/L	0.000227	0.00131	0.000549	0.000575	0.000568	<0.00025	<0.005	<0.005	<0.005	<0.005	<0.005
S	ICP-MS	mg/L	3	169	189	191	221						
Sb	ICP-MS	mg/L	0.00002	0.00226	0.00543	0.00566	0.0504	0.00073	<0.01	<0.01	<0.01	<0.01	<0.01
Se	ICP-MS	mg/L	0.0002	0.00914	0.00922	0.00926	0.0125	0.00324	0.00692	0.00381	0.00431	0.00254	0.00161
Si	ICP-MS	mg/L	2.65	2.25	2.15	2.15	3.11	0.712	14.6	10.5	1.2	3.58	4.11
Sn	ICP-MS	mg/L	0.00001	0.00008	0.00005	0.00006	0.00026	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
Sr	ICP-MS	mg/L	0.0811	0.722	0.717	0.723	0.744	0.233	0.306	1.96	0.172	0.301	0.48
Ti	ICP-MS	mg/L	<0.0005	0.0007	0.0009	0.0007	0.0006	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Tl	ICP-MS	mg/L	<0.000002	0.000033	0.000039	0.000039	0.000032	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
U	ICP-MS	mg/L	0.000069	0.000027	0.000041	0.000039	0.00011	0.000137	<0.001	<0.001	<0.001	<0.001	<0.001
V	ICP-MS	mg/L	0.0003	0.002	0.0024	0.0024	0.0046	<0.005	<0.1	<0.1	<0.1	<0.1	<0.1
Zn	ICP-MS	mg/L	0.0025	0.0019	0.0005	0.0014	0.007	<0.005	<0.1	<0.1	<0.1	<0.1	<0.1
Zr	ICP-MS	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001						

Appendix C4: Supernatant Results														
Parameter	**Method**	**Units**	**Feed Water**	**PP Tailings Supernatant (2008)**				**KM Tailings Supernatant (9/24/2009)**						
				PP Tailings			**Cleaner Circuit**	**KM Tailings**			**Cleaner Circuit**			
				Sample #1	**Sample #2**	**Sample #3**	**Sample #3**	**Comp #1**	**Comp #2**	**Comp #3**	**Comp #1**	**Comp #2**	**Comp #3**
Total Metals														
Hardness CaCO3		mg/L	47.9	768	749	762	611	224	187	803	228	216	209
Ag	ICP-MS	mg/L	<0.000005	0.000034	0.000013	0.000046	0.000008	<0.00005	<0.001	<0.001	<0.001	<0.001	<0.001
Al	ICP-MS	mg/L	0.0084	4.28	4.24	4.34	2.66	35.8	1.32	0.66	11.8	2.91	3.01
As	ICP-MS	mg/L	0.00013	0.00367	0.00406	0.00449	0.0121	0.00097	0.03	0.024	<0.01	<0.01	<0.01
B	ICP-MS	mg/L	<0.005	<0.005	0.009	0.008	<0.05	<0.05	<1	<1	<1	<1	<1
Ba	ICP-MS	mg/L	0.00966	0.0277	0.0268	0.0293	0.033	0.0142	0.0487	0.082	0.0362	0.163	0.172
Be	ICP-MS	mg/L	<0.00001	<0.00001	0.00002	0.00002	<0.00001	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
Bi	ICP-MS	mg/L	<0.000005	0.00003	<0.000005	0.000049	<0.000005	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
Ca	ICP-MS	mg/L	15.6	307	300	305	244	91.7	78	323	94.5	89.5	88.2
Cd	ICP-MS	mg/L	0.000006	0.000553	0.000624	0.00066	0.000652	<0.000085	<0.0017	<0.0017	<0.0017	<0.0017	<0.0017
Co	ICP-MS	mg/L	0.000014	0.000201	0.000226	0.00031	0.000124	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
Cr	ICP-MS	mg/L	<0.0001	0.0011	0.0011	0.0012	0.001	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
Cu	ICP-MS	mg/L	0.00346	0.0592	0.0494	0.0708	0.00007	0.00202	<0.01	<0.01	1.18	0.48	0.53
Fe	ICP-MS	mg/L	0.024	0.467	0.341	0.513	0.267	0.052	0.078	0.085	8.52	5.59	5.49
Hg	CVAA	ug/L	0.01	0.05	0.04	0.03	0.01						
K	ICP-MS	mg/L	1	31.3	30.1	30.5	37.9	56.3	41.7	57.7	12.9	11.4	11
Li	ICP-MS	mg/L	0.0007	<0.0005	<0.0005	<0.0005	0.0006	<0.025	<0.5	<0.5	<0.5	<0.5	<0.5
Mg	ICP-MS	mg/L	2.19	0.1	0.13	0.17	0.18	<0.1	<0.1	0.13	0.42	0.94	1.49
Mn	ICP-MS	mg/L	0.00172	0.00844	0.00769	0.0109	0.00522	0.00056	<0.005	<0.005	0.011	0.0611	0.0385
Mo	ICP-MS	mg/L	0.00069	0.767	0.876	0.895	1.1	0.0176	0.17	0.159	0.0263	0.263	0.169
Na	ICP-MS	mg/L	3.77	24.9	26	26.2	27.2	18.4	23.9	34.6	7.7	8.2	8.6
Ni	ICP-MS	mg/L	0.00056	0.00135	0.00137	0.00182	0.00188	<0.0025	<0.05	<0.05	<0.05	<0.05	<0.05
P	ICP-MS	mg/L	0.002	0.102	0.132	0.121	0.984	0.42	0.72	0.97	0.96	1.22	1.53
Pb	ICP-MS	mg/L	0.000402	0.00363	0.00267	0.00364	0.0032	<0.00025	<0.005	<0.005	<0.005	<0.005	<0.005
S	ICP-MS	mg/L	<3	174	204	206	200						
Sb	ICP-MS	mg/L	0.00003	0.00291	0.00631	0.00658	0.0499	0.00081	<0.01	<0.01	<0.01	<0.01	<0.01
Se	ICP-MS	mg/L	0.00012	0.00938	0.00929	0.00999	0.0119	0.00327	0.00704	0.00396	0.00495	0.00578	0.00199
Si	ICP-MS	mg/L	3.07	2.58	2.35	2.73	3.12	1.01	15.5	11	4.59	7.89	10.1
Sn	ICP-MS	mg/L	0.00002	0.00011	0.0001	0.00011	0.00028	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
Sr	ICP-MS	mg/L	0.0862	0.734	0.728	0.741	0.705	0.232	0.303	1.85	0.226	0.295	0.469
Ti	ICP-MS	mg/L	<0.0005	0.0022	0.0022	0.0045	0.002	<0.01	<0.01	<0.01	0.035	0.038	0.051
Tl	ICP-MS	mg/L	<0.000002	0.000041	0.000046	0.000049	0.000036	<0.0005	<0.01	<0.01	<0.01	<0.01	<0.01
U	ICP-MS	mg/L	0.000077	0.000269	0.000292	0.000415	0.000235	0.000177	<0.001	<0.001	0.0012	0.0044	0.0015
V	ICP-MS	mg/L	0.0004	0.0019	0.0024	0.0027	0.0041	<0.005	<0.1	<0.1	<0.1	<0.1	<0.1
Zn	ICP-MS	mg/L	0.0036	0.0024	0.0027	0.0042	0.0089	<0.005	<0.1	<0.1	<0.1	<0.1	<0.1
Zr	ICP-MS	mg/L	<0.0001	0.0001	0.0002	0.0003	0.0002						

Appendix D
Sat Column Kinetic Test Results

CASiNO
COPPER AND GOLD

APPENDIX D1 FLOW RATES FOR SATURATED COLUMNS

Appendix D1: Flow Rates for Saturated Columns

General comments regarding flow rates for Casino saturated waste rock and tailings columns:

Flow rates for Sat Col 1 through Sat Col 9 vary throughout the experiment. Flow rates for saturated waste rock columns Sat Col 2 through Sat Col 7 are presented in Table D.1-1. Flow rates for layered Sat Col 9 are provided in Table D.1-2 and for the other layered waste rock columns and Sat Col 15 in Table D.1-3. Flow rates for saturated tailings columns Sat Col 1, 8, 10 and 11 are provided in Table D.1-4. Leachate output volumes were periodically measured and do not necessarily coincide with sample collection dates. Flow rates were therefore calculated by averaging the weekly, biweekly or monthly output volumes to a daily rate. The flow rates presented in the tables are averages for the indicated weeks and highlight notable changes in rates for the columns.

Pumping rates were decreased in Sat Col 9 on week 39; in Sat Col 1, 2, 4, 5, 6 and 8 on week 45 and in Sat Col 3, 4 and 7 on week 53 of the respective experiments. The flow rates were then temporarily increased on week 77 for many of the experiments (shaded in grey in tables), before being permanently decreased again. Small variations in flow rates between columns are due to wear and tear of tubing and material permeability.

Flow rates were reduced in Sat Col 1 through Sat Col 8 when it became evident that higher flow rates then intended were passing through the column. High flow rates through flooded wastes can result in large inputs of dissolved oxygen which can in turn result in higher rates of sulphide oxidation than observed under field conditions (where oxygen inputs are limited by diffusion from the overlying water cover) (Price, 2009).

Table D.1-1:
Average daily flow rates for saturated waste rock columns.

Weeks		Average daily flow rate (mL/day)					
From	To	Sat Col 2	Sat Col 3	Sat Col 4	Sat Col 5	Sat Col 6	Sat Col 7
1	36	208	205	209	209	205	205
36	45	152	193	197	154	152	195
45	53	34	182	182	34	36	190
53	77	26	27	23	32	26	25
77	81	60	106	30	99	97	85
81	97*	41	43	44	35	44	38
97	150	6.4	5.9	5.4	5.3	6.1	5.3

Notes: Blue shaded values represent cycle when flow rates were decreased.
Grey shading highlights where flows were increased temporarily.
*Flow was turned off between sample events after week 97.

Table D.1-2:
Average daily flow rates for layered saturated waste rock column Sat Col 9.

Weeks		Average daily flow rate (mL/day)
From	**To**	**Sat Col 9**
1	30	201.0
30	39	150.9
39	73	30.9
73	79	49.7
79	111	31.6

Notes: Blue shaded values represent cycle when flow rates were decreased.
Grey shading highlights where flows were increased temporarily.

Table D.1-3:
Average daily flow rates for upper and lower ports from layered saturated waste rock columns and Sat Col 15.

Weeks		Average daily flow rate (mL/day)						
From	**To**	**Sat Col 12 (upper)**	**Sat Col 12 (lower)**	**Sat Col 13 (upper)**	**Sat Col 13 (lower)**	**Sat Col 14 (upper)**	**Sat Col 14 (lower)**	**Sat Col 15**
0		250	460	415	630	250	475	425
1	35	11[a]	19[b]	9[c]	19[b]	10[c]	18[c]	11

Notes: **a.** Weeks 1 through 28 excluded from calculated average daily flow rates due to unknown total output volume and problems with the pump cassette resulting in large volume passing through column.
b. Weeks 7 to 11 and 23 to 28 excluded from calculated average daily flow rates due to unknown total output volume.
c. Weeks 23 to 28 excluded from calculated average daily flow rates due to unknown output volume.

Table D.1-4:
Average daily flow rates for saturated tailings columns.

Week		Average Flow Rates (mL/day)		Week		Average Flow Rates (mL/day)	
From	**To**	**Sat Col 1**	**Sat Col 8**	**From**	**To**	**Sat Col 10**	**Sat Col 11**
1	36	208	208	1	5	109	105
36	45	153	154	5	30	161	158
45	77	27	34	30	81	35	35
77	81	79	109				
81	97*	39	36				
97	150	8	6				

Notes: Blue shaded values represent cycle when flow rates were decreased.
Grey shading highlights where flows were increased temporarily.
*Flow was turned off between sample events after week 97.

Notes on controlled flow rate variations for saturated column experiments:

1. Each saturated columns was rinsed and then saturated prior to start up.
2. The HYP layer placed in Sat Col 9 was rinsed with distilled deionized water for 5 weeks at a rate of 1.5 L per day in a 40 cm column in order to flush out the oxide minerals. On May 18, 2010 (following the 5 weeks) CAP waste rock was added to the bottom of the column and the flow rate reduced to 201 mL/day. Flow is in an upward direction passing through the CAP and subsequently the HYP before being sampled from the top of the column. Note that it took 4 weeks for the output volume to reflect the lower input rate. Weekly cycles for leachate concentrations plotted in Figures 5-1 and 5-2 were adjusted to reflect when oxide material was added to the column (*i.e.*, cycle 0).
3. Between August 22 and 24, 2011 a "dry event" occurred for Sat Col 1 to Sat Col 7 and Sat Col 9. The water was effectively drained from each of the columns, after which, flows went through an adjustment period to allow for re-saturation of the mine waste.
4. Input water volumes ranged from 130-140 mL for Sat Col 1 through Sat Col 8 until January 5, 2012 (week 97 for many of the saturated columns). After this date, flow to these columns was turned off between sample collection dates. The flow is only turned on during sampling to replace the volume (approximately 200 mL/day) removed for analysis.
5. On the two most recent sample collection dates for Sat Col 1 to Sat Col 8 presented in Appendix D.2 (November 14, 2012 and January 11, 2013), the headspace was purged (375 to 600 mL) prior to sample collection.
6. Sat Col 12 through Sat Col 17 are saturated; however, flow is turned off between sample collection dates. Prior to sampling water is cleared from the headspace. Output volumes and sampling notes for Sat Col 12 through Sat Col 15 are provided in Table D.1-4. Only a few samples were available for Sat Col 16 and Sat Col 17 during the preparation of this report; therefore, the data for these experiments is not presented.
7. Output volumes for the lower ports of layered saturated columns Sat Col 12 to Sat Col 14 includes the volume that is passed through the column and collected from the upper ports. Beginning on December 18, 2012, sample collection and output volumes for the lower ports of each layered column were collected the day following the collection of data from the upper ports.

APPENDIX D2 LEACHATE RESULTS FOR SATURATED WASTE ROCK COLUMNS

Leachate Data for Sat Col 2

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	TD-PO_4	T-P	D-S	D-Sulphide	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
25-Feb-10	0	208	*ND*	*ND*	*ND*	26.2	45.8	160	21	*ND*	*ND*	0.30	0.05	<0.005	<0.005	*ND*	57	*ND*	0.797	0.0092	0.0024	0.048	<0.0001	<0.001	<0.05	0.00031	7.83	0.008	0.0068	0.444	0.197	0.0084	*ND*	1.62	0.181	0.00023	0.004	0.002	*ND*	9.86	0.0134	24.8	0.00012	76.0	0.068	0.00013	<0.005	<0.005	0.0010	<0.005	0.048	0.0067
4-Mar-10	1	1456	5.5	*ND*	6.0	10.8	22.1	94	7.06	0.464	<0.05	0.164	<0.005	<0.001	0.0026	*ND*	*ND*	*ND*	0.379	0.00595	0.00147	0.0291	<0.0005	<0.0005	0.035	0.000155	3.17	0.00401	0.00341	0.274	0.08	0.00102	<0.005	0.7	0.0769	0.000017	0.00331	0.00076	<0.6	6.5	0.0087	23.3	0.000024	48.3	0.032	<0.0001	<0.0001	<0.02	0.000647	<0.001	0.0359	*ND*
11-Mar-10	2	1456	5.5	*ND*	19	3.8	9.88	56	2.12	0.237	<0.3	0.078	<0.005	<0.001	0.0023	*ND*	*ND*	*ND*	0.271	0.00473	0.0011	0.0308	<0.0025	<0.0025	<0.05	<0.000085	1.52	<0.0025	0.00172	0.0939	<0.15	0.00065	<0.025	<0.5	0.0375	<0.00005	0.00329	<0.0025	<1.5	<10	0.0048	20.4	0.000064	27	0.0159	<0.0005	<0.0005	<0.05	0.000408	<0.005	0.0204	*ND*
18-Mar-10	3	1456	5.7	*ND*	20	3.2	5.92	41	0.82	0.123	<0.2	0.05	<0.005	<0.001	<0.002	*ND*	*ND*	*ND*	0.137	0.00419	0.00102	0.034	<0.001	<0.001	<0.02	<0.0001	0.95	0.0013	0.00116	0.0507	<0.06	0.00041	<0.01	0.21	0.0247	<0.00001	0.00323	<0.001	<0.6	<4	0.0035	17.6	0.000075	19.7	0.0108	<0.0002	<0.0002	<0.02	0.000241	<0.002	0.0157	*ND*
1-Apr-10	5	2912	5.4	58	13	1.6	2.33	27	<0.5	0.115	<0.14	0.042	<0.005	<0.001	<0.002	*ND*	*ND*	*ND*	0.144	0.00292	0.00073	0.0399	<0.001	<0.001	<0.02	<0.000034	0.63	<0.001	0.00078	0.0118	<0.06	0.00032	<0.01	<0.2	0.0177	<0.00001	0.00222	<0.001	<0.6	<4	0.0027	14.9	<0.00002	13.6	0.00783	<0.0002	<0.0002	<0.02	0.000111	<0.002	0.0124	*ND*
15-Apr-10	7	2912	5.5	42	13	1.8	2.00	19	<0.5	0.111	<0.05	0.038	<0.005	<0.001	0.0037	*ND*	*ND*	*ND*	0.121	0.00234	0.00035	0.0471	<0.001	<0.001	<0.02	<0.000034	0.537	<0.001	0.00063	0.0134	<0.03	0.00031	<0.01	0.12	0.0144	<0.00001	0.00173	<0.001	<0.3	2.5	<0.002	12.8	<0.00002	8.6	0.00660	<0.0002	<0.0002	<0.01	0.000045	<0.002	0.0135	*ND*
29-Apr-10	9	2912	5.3	48	14	<3.1	1.00	16	<0.5	0.103	<0.05	0.060	0.0319	<0.001	0.0041	*ND*	*ND*	*ND*	0.029	0.00179	0.00026	0.0521	<0.0005	<0.0005	<0.01	0.000033	0.558	<0.0005	0.00064	0.0119	0.032	0.000199	<0.005	0.13	0.0143	<0.00001	0.00135	<0.0005	<0.3	3.1	0.0023	13.0	<0.00003	7.2	0.00661	<0.0001	<0.0001	<0.01	0.000028	<0.001	0.0121	*ND*
13-May-10	11	3042	5.3	40	9.0	2.0	1.11	13	<0.5	0.090	<0.05	0.031	<0.005	<0.001	0.0038		*ND*	*ND*	0.0898	0.00150	0.00027	0.0578	<0.0005	<0.0005	<0.01	<0.00005	0.582	<0.0005	0.00064	0.0124	<0.03	0.000203	<0.005	0.13	0.0139	<0.00005	0.00107	0.00113	<0.3	2.6	0.0020	12.1	<0.00001	4.7	0.00642	<0.0001	<0.0001	<0.01	0.000024	<0.001	0.0150	*ND*
27-May-10	13	2782	5.3	35	8.0	2.1	0.61	11	<0.5	0.092	<0.05	0.0457	<0.005	<0.001	0.0059	*ND*	*ND*	*ND*	0.0426	0.00098	0.00017	0.0741	<0.0005	<0.0005	<0.01	0.000038	0.615	<0.0005	0.00083	0.0167	<0.03	0.000608	<0.005	0.13	0.0167	<0.00001	0.000516	<0.0005	<0.3	2.3	0.0015	10.5	0.000076	3.6	0.00783	<0.0001	<0.0001	<0.01	0.000018	<0.001	0.0151	*ND*
15-Jun-10	15	4086	5.5	33	7.0	2.2	0.6	9.8	<0.5	0.074	<0.05	2.6	<0.005	<0.001	0.0043	*ND*	<10	0.01	0.0171	0.00125	0.00015	0.0889	0.00001	<0.0005	<0.05	0.0004054	0.64	<0.0001	0.000805	0.0188	0.006	0.000153	0.0006	0.14	0.0182	<0.00001	0.00083	0.00027	*ND*	2.18	0.00101	10.4	0.0000005	2.44	0.00836	0.000028	0.00002	<0.0005	0.00023	<0.0002	0.0273	<0.0001
29-Jun-10	17	2899	*ND*	*ND*	*ND*	2.2	<0.5	*ND*	*ND*	*ND*	<0.05	*ND*	*ND*	*ND*	*ND*	*ND*	<10	<0.01	0.0186	0.00115	0.00013	0.0863	<0.00001	<0.00005	<0.05	0.000039	0.65	<0.0001	0.000891	0.0177	0.003	0.000070	0.0005	0.15	0.0192	<0.00001	0.00077	0.00015	*ND*	2.24	0.00093	10.2	0.000038	1.98	0.00874	0.000028	0.00003	<0.0005	0.000014	0.0003	0.0225	<0.0001
14-Jul-10	19	3137	5.3	25	5.0	2.4	1.2	7.2	<0.5	0.057	<0.05	0.0519	<0.005	<0.001	0.0032	*ND*	<10	0.005	0.0267	0.00109	0.00018	0.102	0.00002	<0.0005	<0.05	0.000045	0.68	<0.0001	0.000978	0.0188	0.014	0.000062	0.0006	0.16	0.0208	<0.00001	0.00065	0.00023	*ND*	2.44	0.00106	8.98	0.000009	1.60	0.00980	0.000030	0.00001	<0.0005	0.000010	0.0004	0.0237	<0.0001
27-Jul-10	21	2695	5.2	25	4.0	2.4	<0.5	7.4	<0.5	0.075	<0.05	0.040	<0.005	<0.001	0.0034	*ND*	<10	0.006	0.0197	0.00097	0.00016	0.103	<0.00001	<0.00005	<0.05	0.000043	0.68	<0.0001	0.000954	0.0176	0.003	0.000058	0.0006	0.16	0.0199	<0.00001	0.00066	0.00014	*ND*	2.23	0.00074	7.99	0.000015	1.21	0.00984	0.000031	<0.00001	<0.0005	0.000007	0.0003	0.0184	<0.0001
10-Aug-10	23	2877	5.3	27	11	2.7	0.6	7.8	<0.5	0.081	<0.05	0.053	<0.005	<0.001	0.0031	*ND*	<10	0.01	0.0231	0.00101	0.00025	0.112	0.00002	<0.00005	<0.05	0.000051	0.78	<0.0001	0.00102	0.0188	0.003	0.000067	0.0005	0.17	0.0214	<0.00001	0.00064	0.00016	*ND*	2.32	0.00077	8.63	0.000009	1.11	0.0103	0.000030	<0.00001	<0.0005	0.000013	<0.0002	0.0216	<0.0001
24-Aug-10	25	2912	5.3	23	6.0	2.7	1.1	6.4	<0.5	0.064	<0.05	0.0491	<0.005	<0.001	0.0089	*ND*	<10	<0.03	0.218	0.00103	0.00023	0.125	0.00002	0.000018	<0.05	0.000051	0.78	<0.0001	0.00104	0.0214	0.065	0.000740	0.0006	0.19	0.0218	<0.00001	0.00072	0.00021	*ND*	2.12	0.00077	8.68	0.000225	0.90	0.0108	0.000040	0.00002	0.0011	0.000032	<0.0002	0.0228	0.0003
8-Sep-10	27	3155	5.2	21	6.0	2.4	0.8	5.8	<0.5	0.066	<0.05	0.0458	<0.005	<0.001	0.0085	*ND*	<10	<0.005	0.0209	0.00085	0.00013	0.119	0.00001	<0.00005	<0.05	0.000047	0.72	<0.0001	0.00100	0.0187	0.003	0.000022	0.0005	0.15	0.0198	<0.00001	0.00055	0.00007	*ND*	1.88	0.00072	6.31	0.000008	0.65	0.0101	0.000028	0.00003	<0.0005	0.000009	<0.0002	0.0210	<0.0001
21-Sep-10	29	2695	4.9	21	5.0	2.5	*ND*	6.2	<0.5	0.067	<0.05	0.0558	<0.005	<0.001	0.0038	*ND*	<10	*ND*	0.0260	0.00084	0.00011	0.112	<0.00001	<0.00005	<0.05	0.000043	0.73	<0.0001	0.00101	0.0182	0.007	0.000055	0.0005	0.17	0.0205	<0.00001	0.00054	0.00017	*ND*	1.83	0.00051	6.3	0.000013	0.65	0.0102	0.000027	<0.00001	<0.0005	0.000021	<0.0002	0.0190	<0.0001
5-Oct-10	31	2895	3.2	232	0.00	2.9	<0.5	5.6	18.3	0.070	<0.05	0.0540	<0.005	<0.001	0.0041	*ND*	*ND*	0.04	0.035	0.0008	0.0002	0.135	<0.0001	<0.001	<0.05	0.00005	0.84	<0.001	0.0011	0.0215	0.013	<0.0002	<0.005	0.19	0.022	<0.00002	<0.001	<0.001	<0.01	2.02	0.0006	7.02	<0.00002	0.67	0.011	<0.00005	<0.005	<0.005	<0.001	<0.005	0.02	<0.0005
21-Oct-10	33	3345	4.9	20	6.0	2.7	0.6	5.5	<0.5	0.068	<0.05	0.0375	<0.005	<0.001	0.0027	*ND*	<10	<0.03	0.0195	0.00083	0.00011	0.131	0.00001	<0.00005	<0.05	0.000047	0.78	<0.0001	0.00107	0.0208	0.001	0.000046	<0.0005	0.18	0.0212	<0.00001	0.00054	0.00066	*ND*	1.78	0.00056	6.5	<0.0000005	0.52	0.0107	0.000029	<0.00001	<0.0005	0.000015	<0.0002	0.0215	<0.0001
2-Nov-10	35	2483	4.8	19	4.0	2.7	<0.5	5.6	<0.5	0.072	<0.05	0.0415	<0.005	<0.001	0.0033	*ND*	<10	<0.03	0.0359	0.00078	0.00009	0.136	0.00001	<0.00005	<0.05	0.000052	0.79	<0.0001	0.00108	0.0202	0.004	0.000067	<0.0005	0.19	0.0219	<0.00001	0.00052	0.00014	*ND*	1.90	0.00054	6.72	<0.0000005	0.52	0.0110	0.000027	<0.00001	<0.0005	0.000012	<0.0002	0.0191	<0.0001
16-Nov-10	37	2724	4.9	19	3.0	3.0	<0.5	5.6	<0.5	0.068	<0.05	0.0491	<0.005	<0.001	0.0028	*ND*	<10	0.006	0.0231	0.00085	0.00012	0.145	0.00001	<0.00005	<0.05	0.000057	0.90	<0.0001	0.00110	0.0211	0.003	0.000073	0.0006	0.18	0.0232	<0.00001	0.00060	0.00020	*ND*	1.76	0.00052	7.07	<0.0000005	0.48	0.0120	0.000026	<0.00001	<0.0005	0.000012	<0.0002	0.0217	<0.0001
30-Nov-10	39	2692	5.1	18	4.0	2.7	<0.5	5.4	<0.5	0.063	<0.05	0.0376	<0.005	<0.001	0.0024	*ND*	<10	<0.01	0.0261	0.00074	0.00011	0.133	0.00001	<0.00005	<0.05	0.000049	0.78	<0.0001	0.00108	0.0198	0.003	0.000064	<0.0005	0.17	0.0222	<0.00001	0.00054	0.00015	*ND*	1.62	0.00047	5.69	0.000009	0.42	0.0111	0.000022	<0.00001	<0.0005	0.000009	0.0003	0.0174	<0.0001
6-Jan-11	44	2723	5.2	22	5.0	*ND*	0.70	6.2	<0.5	0.056	<0.05	0.0509	<0.005	<0.001	0.0034	*ND*	<10	<0.005	0.0273	0.00071	0.00013	0.192	0.00016	<0.00005	<0.01	0.0000701	1.26	<0.0001	0.00142	0.0262	0.0034	0.0000857	0.00055	0.216	0.0297	<0.00002	0.00617	0.00206	*ND*	1.82	0.00615	7.60	0.0000130	0.553	0.0144	0.0000256	<0.00001	<0.0005	0.0000122	<0.0002	0.0215	<0.0001
3-Feb-11	48	990	5.0	26	8.0	*ND*	0.83	7.6	<0.5	0.031	<0.05	0.0575	<0.005	<0.001	0.0051	*ND*	*ND*	<0.005	0.0435	0.00081	0.00016	0.180	0.00014	0.000225	0.00018	<0.00005	<0.005	0.00008855	1.28	<0.0001	0.00183	0.0243	0.0165	0.000110	0.00065	0.256	0.0387	<0.00002	0.00548	0.00370	<0.3	2.17	0.000818	10.4	<0.0000005	0.828	0.0189	0.0000329	<0.00001	<0.0005	0.0000179	<0.00005	0.0313	<0.0001
30-Mar-11	56	672	4.8	33	7.0	*ND*	1.58	7.8	<0.5	0.051	<0.05	0.0652	<0.005	<0.001	0.0051	*ND*	*ND*	<0.005	0.0611	0.00079	0.00024	0.218	0.00026	0.0000155	0.0056	0.0000950	1.62	<0.0001	0.00183	0.0206	0.0235	0.000117	0.00056	0.266	0.0390	<0.00002	0.000480	0.000265	<0.3	2.31	0.000929	12.6	0.0000085	0.949	0.0182	0.0000352	<0.00001	<0.0005	0.000229	<0.00005	0.0305	0.00010
24-Apr-11	60	664	4.9	28	6.0	*ND*	1.45	8.4	<0.5	0.058	<0.05	0.0642	<0.005	<0.001	0.0053	0.0053	*ND*	<0.005	0.0589	0.000844	0.000157	0.222	0.00023	<0.000005	0.006	0.0000980	1.34	<0.0001	0.00196	0.0253	0.0162	0.000121	0.00071	0.277	0.0396	<0.00002	0.000538	0.000393	<0.3	2.28	0.000919	12.2	0.000005	1.03	0.0184	0.0000345	<0.00001	<0.0005	0.0000182	<0.00005	0.0311	0.00011
26-May-11	64	886	5.5	29	6.0	*ND*	1.54	8.0	<0.5	0.069	<0.05	0.0747	<0.005	<0.001	0.0052	*ND*	*ND*	<0.005	0.0587	0.000880	0.000179	0.258	0.00022	<0.000005	0.0061	0.0000898	1.36	<0.0001	0.00183	0.0221	0.0174	0.0000894	<0.0005	0.274	0.0394	<0.00002	0.000539	0.000270	<0.3	2.19	0.000984	14.3	0.0000100	1.08	0.0177	0.0000330	<0.00001	<0.0005	0.0000163	<0.00005	0.0331	<0.0001
23-Jun-11	68	746	5.1	29	5.0	*ND*	1.53	8.5	<0.5	0.077	<0.05	0.0737	<0.005	<0.001	0.0054	*ND*	*ND*	<0.005	0.0658	0.000878	0.000303	0.219	0.00022	<0.000005	0.0062	0.0000869	1.37	<0.0001	0.00185	0.0229	0.0178	0.000112	0.00075	0.272	0.0380	<0.00002	0.000551	0.000255	<0.3	2.17	0.000927	12.3	0.0000147	1.16	0.0190	0.0000346	<0.00001	<0.0005	0.0000247	<0.00005	0.0288	0.00011
21-Jul-11	72	701	5.2	30	7.0	*ND*	1.74	8.7	<0.5	0.084	<0.05	0.0718	<0.005	<0.001	0.0079	*ND*	*ND*	<0.005	0.0624	0.000881	0.000334	0.207	0.00019	<0.000005	0.0071	0.0000837	1.38	<0.0001	0.00188	0.0234	0.0142	0.0000691	0.00053	0.270	0.0390	<0.00002	0.000558	0.000232	<0.3	2.14	0.00121	13.1	<0.0000005	1.26	0.0187	0.0000343	<0.00001	<0.0005	0.0000181	<0.00005	0.0308	<0.0001
18-Aug-11	76	769	5.2	40	72	*ND*	1.72	8.6	<0.5	0.082	<0.05	0.056	<0.005	<0.001	0.0063	*ND*	*ND*	<0.005	0.0638	0.000987	0.000226	0.207	0.00030	<0.000005	0.0078	0.0000905	1.46	<0.0001	0.00186	0.0230	0.0101	0.0000815	0.00076	0.272	0.0394	<0.00002	0.000651	0.000265	<0.3	2.18	0.00117	13.8	<0.0000005	1.30	0.0193	0.0000376	<0.00001	<0.0005	0.0000179	<0.00005	0.0306	0.00012
2-Sep-11	79	1008	*ND*	*ND*	*ND*	*ND*	*ND*	9.4	<0.5	0.068	<0.05	0.0695	<0.005	<0.001	0.0061	0.0061	*ND*	<0.005	0.0288	0.000913	0.000182	0.192	0.00021	<0.000005	0.0063	0.0000971	1.30	<0.0001	0.00178	0.0398	0.0042	0.0000600	<0.0005	0.254	0.0368	<0.00005	0.000607	0.000239	<0.3	2.06	0.00108	13.9	<0.0000005	1.34	0.0169	0.0000310	0.000143	<0.0005	0.0000153	<0.00005	0.0293	<0.0001
15-Sep-11	82	682	4.7	34	7.0	*ND*	1.55	10.0	0.71	0.073	<0.05	0.0780	<0.005	<0.001	0.0058	0.0058	*ND*	<0.005	0.0302	0.000810	0.000213	0.221	0.00023	<0.000005	0.0062	0.0000965	1.45	<0.0001	0.00201	0.0347	0.0029	0.0000410	0.00122	0.291	0.0434	<0.00002	0.000567	0.000299	<0.3	2.32	0.00114	13.8	<0.0000005	1.46	0.0195	0.0000335	<0.00001	<0.0005	0.0000125	<0.00005	0.0307	<0.0001
13-Oct-11	86	721	4.9	36	8.0	*ND*	1.21	11	<0.5	0.075	<0.05	0.0659	<0.005	<0.001	0.0061	0.0061	*ND*	<0.005	0.0366	0.000863	0.000206	0.232	0.00028	<0.000005	0.0071	0.0000121	1.72	<0.0001	0.00226	0.0385	0.0029	0.0000709	0.00058	0.337	0.0485	<0.00002	0.000615	0.000316	<0.3	2.40	0.00130	14.1	<0.0000005	1.60	0.0226	0.0000387	<0.00001	<0.0005	0.0000201	<0.00005	0.0464	<0.0001
10-Nov-11	90	932	4.7	35	5.0	*ND*	1.04	11	<0.5	0.082	<0.05	0.0746	<0.005	<0.001	0.0053	0.0053	*ND*	<0.005	0.0413	0.000853	0.000205	0.242	0.00030	<0.000005	0.0058	0.0000122	1.70	<0.0001	0.00232	0.0386	0.0027	0.0000738	0.00066	0.333	0.0484	<0.00001	0.000582	0.000300	<0.3	2.35	0.00130	13.6	<0.0000005	1.58	0.0223	0.0000358	<0.00001	<0.0005	0.0000413	<0.00005	0.0359	<0.0001
8-Dec-11	94	1506	4.9	34	6.0	*ND*	0.86	11	<0.5	0.079	<0.05	0.0662	<0.005	<0.001	0.0069	*ND*	*ND*	<0.005	0.0370	0.000794	0.000174	0.226	0.00027	<0.000005	0.0056	0.0000118	1.63	<0.0001	0.00231	0.0373	0.0021	0.0000763	0.00052	0.327	0.0467	<0.00001	0.000581	0.000335	<0.3	2.20	0.00128	14.3	<0.0000005	1.60	0.0218	0.0000347	<0.00001	<0.0005	0.0000323	<0.00005	0.0343	<0.0001
5-Jan-12	98	1491	6.1	108	20	*ND*	1.18	11	<0.5	0.079	<0.05	0.0667	<0.005	<0.001	0.0054	*ND*	*ND*	<0.005	0.0548	0.000816	0.000180	0.208	0.00025	<0.000005	0.0052	0.0000113	1.58	<0.0001	0.00226	0.0367	0.0043	0.0000706	0.00066	0.334	0.0474	<0.00001	0.000587	0.000324	<0.3	2.20	0.00118	13.7	0.0000058	1.62	0.0207	0.0000361	<0.00001	<0.0005	0.0000288	<0.00005	0.0312	<0.0001
2-Mar-12	106	225	4.1	37	12	*ND*	1.05	11	<0.5	<0.2	<0.05	0.0825	<0.005	<0.001	0.0071	*ND*	*ND*	<0.005	0.0454	0.000789	0.000205	0.225	0.00027	<0.000005	0.0057	0.0000119	1.77	<0.0001	0.00243	0.0356	0.0048	0.0000487	0.00073	0.344	0.0504	<0.00001	0.000575	0.000335	<0.3	2.22	0.00132	14.5	0.0000073	1.78	0.0233	0.0000352	<0.00001	<0.0005	0.0000326	<0.00005	0.0349	<0.0001
25-May-12	118	225	4.7	38	12	*ND*	1.58	11	<0.5	0.084	<0.05	0.0743	<0.005	<0.001	0.0093	*ND*	*ND*	<0.005	0.0374	0.000861	0.000250	0.216	0.00029	<0.000005	0.0073	0.0000118	1.78	<0.0001	0.00238	0.0272	0.0136	0.0000402	0.00081	0.341	0.0484	<0.00001	0.000583	0.000339	<0.3	2.31	0.00144	17.6	<0.0000005	2.07	0.0224	0.0000355	<0.00001	<0.0005	0.0000354	0.000075	0.0325	<0.0001
25-Jul-12	127	240	5.0	37	12	*ND*	2.04	11	<0.5	0.094	<0.05	0.0657	<0.005	<0.001	0.0097	*ND*	*ND*	<0.005	0.0626	0.000906	0.000243	0.203	0.00029	<0.000005	0.0075	0.0000110	1.64	<0.0001	0.00234	0.0223	0.0193	0.0000670	0.00069	0.336	0.0481	<0.00001	0.000623	0.000298	<0.3	2.20	0.00138	17.0	0.0000125	2.28	0.0215	0.0000339	<0.00001	<0.0005	0.0000394	<0.00005	0.0392	<0.0001
12-Sep-12	134	275	4.5	38	13	6.14	1.43	11	<0.5	0.076	<0.05	0.0625	<0.005	<0.001	0.0105	0.0105	*ND*	<0.005	0.0818	0.00101	0.00027	0.200	<0.0001	<0.0005	<0.01	0.000108	1.85	<0.0001	0.00228	0.0252	0.030	0.000079	0.00094	0.37	0.0470	<0.00001	0.000709	<0.0005	<0.05	2.61	0.00145	17.9	0.000031	2.36	0.0216	0.000037	<0.0001	<0.01	0.000036	<0.001	0.0268	*ND*
14-Nov-12	144	785	4.9	36	8.3	5.15	1.87	11	<0.5	0.072	<0.05	0.0571	<0.005	<0.001	0.0114	0.0114	*ND*	<0.01	0.140	0.00101	0.000307	0.178	0.00029	0.0000054	0.0078	0.0000990	1.56	<0.0001	0.00205	0.0180	0.0350	0.000115	0.00073	0.303	0.0431	<0.00001	0.000689	0.000271	<0.05	2.07	0.00153	17.0	0.0000506	2.35	0.0196	0.0000322	<0.00001	<0.0005	0.0000290	0.000056	0.0244	0.00017
11-Jan-13	153	575	5.1	37	9.0	*ND*	1.80	11	<0.5	0.057	<0.05	0.0605	<0.005	<0.001	0.0133	*ND*	*ND*	<0.01	0.100	0.000947	0.000254	0.167	0.00025	<0.000005	0.0081	0.0000912	1.51	<0.0001	0.00204	0.0168	0.0348	0.0000743	0.00055	0.288	0.0401	<0.00001	0.000680	0.000273	<0.3	1.91	0.00131	16.9	0.0000131	2.50	0.0192	0.0000315	<0.00001	<0.0005	0.0000280	0.000073	0.0228	0.00011

Calculated Production Rates for Sat Col 2 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	TD-PO_4	T-P	D-S	D-Sulphide	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
25-Feb-10	0	208	*ND*	*ND*	*ND*	1.1	1.9	6.7	0.87	*ND*	*ND*	0.012	0.0021	0.00021	0.00021	*ND*	2.4	*ND*	0.033	0

Leachate Data for Sat Col 4

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk. ($CaCO_3$)	Hard. ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2/25/2010	0	209	*ND*	*ND*	*ND*	1350	2.8	1200	17	*ND*	*ND*	1.4	0.06	<0.005	<0.005	490	*ND*	0.011	0.0005	0.0001	0.029	<0.0001	<0.001	<0.05	0.00078	495	<0.001	0.0034	0.0031	0.007	<0.0002	*ND*	27.9	0.971	<0.00002	0.014	0.011	*ND*	17.8	0.0056	0.566	<0.00002	21.6	1.45	0.00023	<0.005	<0.005	0.0078	<0.005	0.009	<0.0005
3/4/2010	1	1463	7.23	*ND*	92	1630	2.72	1590	13	0.59	<1	2.04	<0.1	<0.02	<0.01	*ND*	*ND*	<0.01	0.0018	<0.001	0.0232	<0.005	<0.005	<0.1	0.00119	572	<0.005	0.0051	0.0018	<0.06	<0.0005	<0.05	49.4	2.02	<0.00001	0.00724	<0.005	<0.6	24.1	<0.01	2.91	<0.0001	36.9	5.02	<0.001	<0.001	<0.02	0.114	<0.01	0.015	*ND*
3/11/2010	2	1463	7.11	*ND*	85	1570	1.85	1500	6.8	0.62	<7.8	1.48	<0.05	<0.01	<0.002	*ND*	*ND*	<0.01	0.0016	<0.001	0.02	<0.005	<0.005	<0.1	0.00042	564	<0.005	0.0031	<0.001	<0.15	<0.0005	<0.05	39.5	1.49	<0.00005	0.0059	<0.005	<1.5	19	0.0048	2.97	<0.0001	24	4.59	<0.001	<0.001	<0.05	0.111	<0.01	0.024	*ND*
3/18/2010	3	1463	7.24	*ND*	91	1410	0.97	1370	6.7	0.41	<6.9	0.627	<0.05	<0.01	<0.01	*ND*	*ND*	<0.01	<0.001	<0.001	0.0182	<0.005	<0.005	<0.1	<0.0005	520	<0.005	0.0018	<0.001	<0.06	<0.0005	<0.05	37.5	1.07	<0.00001	0.00426	<0.005	<0.6	13.5	<0.01	2.69	<0.0001	13	3.95	<0.001	<0.001	<0.02	0.0949	<0.01	<0.01	*ND*
4/1/2010	4	2926	7.15	1530	109	1440	0.61	1300	<5	0.61	<6.5	0.573	<0.05	<0.01	<0.002	*ND*	*ND*	<0.01	<0.001	<0.001	0.0182	<0.005	<0.005	<0.1	<0.00017	545	<0.005	0.0013	<0.001	<0.06	<0.0005	<0.05	18.0	0.797	<0.00001	0.00420	<0.005	<0.6	9.3	<0.01	2.52	<0.0001	6.0	3.50	<0.001	<0.001	<0.02	0.0858	<0.01	0.011	*ND*
4/15/2010	5	2926	7.39	1528	97	1240	1.65	1180	<5	0.56	<0.5	0.319	<0.05	<0.01	<0.01	*ND*	*ND*	0.0064	0.00066	<0.0005	0.0169	<0.0025	<0.0025	<0.05	<0.000085	478	<0.0025	0.00086	<0.0005	<0.03	<0.00025	<0.025	12.2	0.546	<0.00001	0.00370	<0.0025	<0.3	5.9	<0.005	2.24	<0.00005	2.3	2.81	<0.0005	<0.0005	<0.01	0.0697	<0.005	<0.005	*ND*
4/29/2010	6	2926	7.41	1798	72	1200	<0.5	1070	<5	0.52	<0.5	0.216	<0.05	<0.01	<0.002	*ND*	*ND*	0.0057	0.00056	<0.0005	0.0168	<0.0025	<0.0025	<0.05	0.000113	478	<0.0025	0.00075	<0.0005	<0.03	<0.00025	<0.025	9.49	0.464	<0.00001	0.00312	<0.0025	<0.3	4.3	<0.005	2.04	<0.00005	<2	2.36	<0.0005	<0.0005	0.010	0.0604	<0.005	<0.005	*ND*
5/13/2010	7	3057	7.47	1729	70	1120	0.56	1020	<5	0.46	<0.5	0.107	<0.05	<0.01	<0.002	*ND*	*ND*	<0.005	<0.0005	<0.0005	0.0143	<0.0025	<0.0025	<0.05	<0.00025	433	<0.0025	0.00057	<0.0005	<0.03	<0.00025	<0.025	8.40	0.366	<0.00005	0.00278	0.0026	<0.3	3.5	<0.005	1.92	<0.00005	<2	1.85	<0.0005	<0.0005	<0.01	0.0527	<0.005	<0.005	*ND*
5/27/2010	8	2795	7.34	1605	68	1020	<0.5	923	<2.5	0.52	<0.25	0.0892	<0.025	<0.005	<0.002	*ND*	*ND*	<0.005	<0.0005	<0.0005	0.0174	<0.0025	<0.0025	<0.05	<0.000085	395	<0.0025	0.00053	<0.0005	<0.03	<0.00025	<0.025	7.57	0.397	<0.00001	0.00301	<0.0025	<0.3	2.7	<0.005	1.87	<0.00005	<2	1.90	<0.0005	<0.0005	0.017	0.0489	<0.005	<0.005	*ND*
6/15/2010	9	4106	7.51	1315	67	780	1.6	717	<5	0.42	<0.5	0.06	<0.05	<0.01	<0.002	255	0.01	0.0040	0.00032	0.00038	0.0159	<0.0001	<0.0005	<0.05	0.000042	302	<0.0001	0.000411	0.00018	0.069	0.000022	0.0012	6.06	0.304	<0.00001	0.00272	0.00024	*ND*	1.92	0.00005	1.83	<0.00005	0.34	1.61	0.000014	<0.00001	<0.0005	0.0322	<0.0002	0.0017	<0.0001
6/29/2010	10	2913	*ND*	*ND*	*ND*	683	0.6	*ND*	*ND*	*ND*	*ND*	0.05	*ND*	*ND*	*ND*	201	<0.01	0.0042	0.00030	0.00061	0.0165	<0.00001	<0.000005	<0.05	<0.0000005	264	<0.0001	0.000295	0.00013	0.079	0.000007	0.0009	5.52	0.263	<0.00001	0.00274	0.00019	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
7/14/2010	11	3152	7.45	997	60	626	1.0	482	<5	0.39	<0.5	0.0105	<0.05	<0.01	<0.002	200	<0.005	0.0048	0.00025	0.00042	0.0181	<0.00001	<0.000005	<0.05	0.000012	241	<0.0001	0.000253	<0.00005	0.066	0.000010	0.0009	6.00	0.25	<0.00001	0.00274	0.00014	*ND*	1.56	<0.00004	1.5	<0.000005	0.30	1.22	0.000004	<0.00001	<0.0005	0.0202	<0.0002	0.0011	<0.0001
7/27/2010	12	2708	7.36	876	57	501	0.7	407	<2.5	0.47	<0.25	<0.01	<0.025	<0.005	<0.002	157	<0.005	0.0053	0.00017	0.00040	0.0184	<0.00001	0.000009	<0.05	<0.0000005	192	<0.0001	0.000168	<0.00005	0.062	<0.0000005	0.0009	5.32	0.208	<0.00001	0.00268	0.00014	*ND*	1.39	<0.00004	1.52	<0.000005	0.31	1.09	0.000002	<0.00001	<0.0005	0.0181	<0.0002	0.0009	<0.0001
8/10/2010	13	2891	7.39	749	57	406	<0.5	374	<2.5	0.47	<0.25	<0.005	0.030	<0.005	<0.002	124	<0.01	0.0051	0.00016	0.00030	0.0175	<0.00001	<0.000005	<0.05	<0.0000005	155	<0.0001	0.000129	0.00007	0.036	0.000010	0.0008	4.79	0.174	<0.00001	0.00266	0.00008	*ND*	1.16	<0.00004	1.34	<0.000005	0.23	0.965	<0.00002	<0.00001	<0.0005	0.0136	<0.0002	0.0010	<0.0001
8/24/2010	14	2926	7.53	657	63	348	0.7	275	<0.5	0.419	<0.05	<0.005	<0.005	<0.001	<0.002	102	<0.03	0.0047	0.00013	0.00031	0.0183	<0.00001	<0.000005	<0.05	<0.0000005	132	<0.0001	0.000104	0.00005	0.036	<0.0000005	0.0008	4.57	0.155	<0.00001	0.00265	0.00009	*ND*	1.00	<0.00004	1.42	<0.000005	0.21	0.827	<0.00002	<0.00001	<0.0005	0.0118	<0.0002	0.0002	<0.0001
9/8/2010	15	3170	7.51	558	75	266	0.6	216	<0.5	0.398	<0.05	<0.005	<0.005	<0.001	<0.002	70	<0.005	0.0146	0.00014	0.00027	0.0198	<0.00001	<0.000005	<0.05	<0.0000005	101	<0.0001	0.000061	<0.00005	0.023	<0.0000005	0.0007	3.68	0.117	<0.00001	0.00253	<0.00002	*ND*	0.82	<0.00004	1.05	<0.000005	0.16	0.751	<0.00002	0.00003	<0.0005	0.00897	<0.0002	0.0002	<0.0001
9/21/2010	16	2708	7.59	481	66	232	<0.5	182	<0.5	0.435	<0.05	<0.005	<0.005	<0.001	<0.002	60	<0.03	0.0047	0.00012	0.00029	0.0205	<0.00001	<0.000005	<0.05	<0.0000005	87.2	<0.0001	0.000046	0.00005	0.022	<0.0000005	0.0006	3.58	0.102	<0.00001	0.00243	0.00265	*ND*	0.74	<0.00004	1.04	<0.000005	0.15	0.635	<0.00002	<0.00001	<0.0005	0.00711	<0.0002	0.0002	<0.0001
10/5/2010	17	2909	7.64	423	61	203	<0.5	145	0.68	0.399	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.03	0.023	<0.0005	0.0003	0.024	<0.0001	<0.001	<0.05	<0.00001	75.2	<0.001	<0.0005	0.0002	0.144	<0.0002	<0.0005	3.72	0.092	<0.00002	0.003	<0.001	<0.01	0.73	<0.0001	1.08	<0.00002	0.16	0.626	<0.00005	<0.005	<0.005	0.0057	<0.005	<0.005	<0.0005
10/21/2010	18	3361	7.31	374	53	176	<0.5	123	<0.5	0.353	<0.05	<0.005	<0.005	<0.001	<0.002	49	<0.03	0.0109	0.00012	0.00032	0.0251	<0.00001	<0.000005	<0.05	<0.0000005	64.4	<0.0001	0.000032	0.00005	0.008	0.000009	<0.0005	3.79	0.0910	<0.00001	0.00239	0.00046	*ND*	0.68	<0.00004	0.961	<0.000005	0.15	0.557	<0.00002	<0.00001	<0.0005	0.00530	<0.0002	0.0003	<0.0001
11/2/2010	19	2495	7.59	342	52	163	<0.5	106	<0.5	0.380	<0.05	<0.005	<0.005	<0.001	<0.002	43	0.03	0.0091	0.00011	0.00027	0.0275	<0.00001	<0.000005	<0.05	<0.0000005	59.7	<0.0001	0.000028	<0.00005	0.009	<0.0000005	0.0006	3.49	0.0815	<0.00001	0.00230	0.00003	*ND*	0.66	<0.00004	0.961	<0.000005	0.13	0.501	<0.00002	<0.00001	<0.0005	0.00424	<0.0002	0.0003	<0.0001
11/16/2010	20	2785	7.51	306	54	139	<0.5	92.5	<0.5	0.372	<0.05	<0.005	<0.005	<0.001	<0.002	35	<0.005	0.0103	0.00012	0.00031	0.0293	<0.00001	<0.000005	<0.05	0.000010	49.9	<0.0001	0.000034	0.00011	0.009	0.000023	0.0005	3.42	0.0778	0.00002	0.00237	0.00009	*ND*	0.60	<0.00004	0.854	<0.000005	0.13	0.497	<0.00002	<0.00001	<0.0005	0.00386	<0.0002	0.0005	<0.0001
11/30/2010	21	2762	7.47	273.1	55	127	<0.5	77.7	<0.5	0.354	<0.05	<0.005	<0.005	<0.001	<0.002	27	<0.01	0.0095	0.00013	0.00032	0.0317	<0.00001	<0.000005	<0.05	0.000010	45.5	<0.0001	0.000024	0.00009	0.007	<0.0000005	<0.0005	3.22	0.0671	<0.00001	0.00231	<0.00002	*ND*	0.55	<0.00004	0.832	<0.000005	0.12	0.45	<0.00002	<0.00001	<0.0005	0.00330	<0.0002	0.0003	<0.0001
1/6/2011	22	7304	7.49	221.6	64	*ND*	0.60	53.4	<0.5	0.275	<0.05	0.0166	<0.005	<0.001	<0.002	*ND*	<0.005	0.0117	0.000114	0.000366	0.0420	<0.00001	<0.000005	<0.01	0.00000665	38.0	<0.0001	0.0000191	0.00013	0.0034	0.000136	<0.0005	2.93	0.0578	<0.00002	0.00204	<0.00005	*ND*	0.482	<0.00004	0.75	<0.000005	0.124	0.388	<0.00002	<0.00001	<0.0005	0.00210	<0.0002	0.00132	<0.0001
2/3/2011	23	5600	7.54	201.1	63	*ND*	0.58	45.6	<0.5	0.264	<0.05	<0.005	<0.005	<0.001	0.0025	*ND*	<0.005	0.0119	0.000114	0.000405	0.0486	<0.00001	<0.000005	<0.05	<0.0000005	33.3	<0.0001	0.0000232	0.00011	0.0025	<0.0000005	<0.0005	2.98	0.0526	<0.00002	0.00191	<0.00005	*ND*	0.441	<0.00004	0.73	<0.000005	0.116	0.363	<0.00002	<0.00001	<0.0005	0.00201	<0.00005	<0.0005	<0.0001
3/2/2011	24	4426	7.7	225.6	56	*ND*	1.82	42.2	<0.5	0.280	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.0121	0.000056	0.000416	0.0536	<0.00001	0.0000100	<0.05	<0.0000005	30.5	<0.0001	0.0000139	<0.0001	0.0024	0.0000097	<0.0005	2.71	0.0494	<0.0001	0.00198	<0.00005	<0.3	0.429	<0.00004	0.751	<0.000005	0.116	0.365	<0.00002	0.000018	<0.0005	0.00197	<0.00005	0.00050	<0.0001
3/30/2011	25	663	7.47	296	64	*ND*	1.90	64.7	<0.5	0.306	<0.05	0.0060	<0.005	<0.001	0.0024	*ND*	<0.005	0.00938	0.000034	0.000696	0.0642	<0.00001	0.0000201	<0.05	<0.0000005	43.1	<0.0001	0.0000162	<0.0001	0.0083	0.0000122	<0.0005	3.76	0.0670	<0.00002	0.00220	<0.00005	<0.3	0.587	<0.00004	1.05	<0.000005	0.175	0.515	<0.00002	<0.00001	<0.0005	0.00359	<0.00005	0.00081	<0.0001
4/24/2011	*ND*	559	7.42	328	70	*ND*	2.08	94.5	0.69	0.375	<0.05	<0.005	<0.005	<0.001	0.0031	*ND*	<0.005	0.00607	0.000025	0.000836	0.0586	<0.00001	<0.000005	<0.05	<0.0000005	53.2	<0.0001	0.0000100	<0.0001	0.0234	0.0000090	0.0006	5.20	0.0869	<0.0001	0.00198	<0.00005	<0.3	0.626	<0.00004	1.21	<0.000005	0.223	0.629	<0.00002	<0.00001	<0.0005	0.00579	<0.00005	0.00201	<0.0001
5/26/2011	26	745	7.32	376	77	*ND*	2.16	99.8	0.64	0.358	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00796	0.000028	0.000934	0.0511	<0.00001	<0.000005	<0.05	0.0000066	63.6	<0.0001	0.0000057	<0.0001	0.0258	0.0000109	<0.0005	6.20	0.102	<0.00002	0.00186	<0.00005	<0.3	0.665	<0.00004	1.35	<0.000005	0.269	0.653	<0.00002	<0.00001	<0.0005	0.00534	<0.00005	0.00584	<0.0001
6/23/2011	27	631	7.58	370	92	*ND*	2.79	107	0.79	0.418	<0.05	0.0066	<0.005	<0.001	<0.002	*ND*	<0.005	0.00321	0.000027	0.000848	0.0478	<0.00001	<0.000005	<0.05	<0.0000005	61.6	<0.0001	0.0000059	<0.0001	0.0302	0.0000102	<0.0005	7.03	0.105	<0.00002	0.00191	<0.00005	<0.3	0.703	<0.00004	1.42	0.0000055	0.310	0.733	<0.00002	<0.00001	<0.0005	0.00764	<0.00005	0.00137	<0.0001
7/21/2011	28	701	7.52	412	87	*ND*	3.29	123	1.27	0.426	<0.05	0.0066	<0.005	<0.001	0.0023	*ND*	<0.005	0.0229	0.000046	0.000982	0.0460	<0.00001	<0.000005	0.0057	<0.0000005	68.9	<0.0001	0.0000056	<0.0001	0.0318	<0.0000005	<0.0005	6.47	0.123	<0.00002	0.00189	<0.00005	<0.3	0.740	<0.00004	1.56	<0.000005	0.371	0.824	<0.00002	<0.00001	<0.0005	0.00965	<0.00005	0.00225	<0.0001
8/18/2011	29	676	7.54	396	85	*ND*	3.07	114	0.91	0.433	<0.05	<0.025	<0.005	<0.001	<0.002	*ND*	<0.005	0.00644	0.000031	0.000775	0.0424	<0.00001	<0.000005	0.0063	<0.0000005	69.4	<0.0001	0.0000063	<0.0001	0.0213	<0.0000005	<0.0005	6.26	0.133	<0.00002	0.00178	<0.00005	<0.3	0.772	<0.00004	1.62	<0.000005	0.388	0.804	<0.00002	<0.00001	<0.0005	0.00910	<0.00005	0.00346	<0.0001
9/2/2011	30	315	7.15	523	*ND*	*ND*	1.56	141	1.24	0.263	<0.05	0.0200	<0.005	<0.001	<0.002	*ND*	<0.02	0.00480	0.000925	0.000244	0.0462	<0.00001	<0.000005	<0.005	0.000491	90.0	<0.0001	0.00101	0.00056	0.0064	<0.0000005	0.00085	11.3	0.338	<0.00005	0.000770	0.000531	<0.3	1.01	0.00157	1.25	<0.000005	0.274	0.950	0.000107	<0.00001	<0.0005	0.0157	<0.00005	0.0382	<0.0001
9/15/2011	31	506	7.17	544	141	*ND*	1.48	142	1.57	0.286	<0.05	0.0056	<0.005	<0.001	<0.002	*ND*	<0.005	0.00247	0.000547	0.000439	0.0451	<0.00001	<0.000005	<0.005	0.0000126	90.3	<0.0001	0.000500	0.00020	0.0096	0.0000143	0.00134	11.7	0.324	<0.00002	0.000592	0.000313	<0.3	1.06	0.000110	1.63	<0.000005	0.326	0.957	0.0000218	<0.00001	<0.0005	0.0184	0.000069	0.00306	<0.0001
10/13/2011	32	1560	7.24	442	128	*ND*	1.33	97.7	0.87	0.339	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00193	0.000100	0.000703	0.0423	<0.00001	<0.000005	0.0052	<0.0000005	73.9	<0.0001	0.000151	0.00010	0.0509	0.0000136	0.00067	9.38	0.216	<0.00002	0.000657	0.000121	<0.3	0.911	<0.00004	1.56	<0.000005	0.303	0.812	<0.00002	<0.00001	<0.0005	0.0135	<0.00005	0.00057	<0.0001
11/10/2011	33	959	7.28	392	130	*ND*	0.98	81.3	<0.5	0.357	<0.05	0.0064	<0.005	<0.001	<0.002	*ND*	<0.005	0.00258	0.000073	0.000748	0.0431	<0.00001	<0.000005	<0.005	<0.0000005	64.0	<0.0001	0.0000582	<0.0001	0.0763	0.0000060	0.00071	8.41	0.200	<0.00001	0.000641	<0.00005	<0.3	0.800	<0.00004	1.60	<0.000005	0.293	0.718	<0.00002	<0.00001	<0.0005	0.0109	<0.00005	<0.0005	<0.0001
12/8/2011	34	1052	7.31	364	119	*ND*	1.04	70.6	2.11	0.375	<0.05	0.0056	<0.005	<0.001	<0.002	*ND*	<0.005	0.00294	0.000036	0.000612	0.0433	<0.00001	<0.000005	0.0051	<0.0000005	61.3	<0.0001	0.0000284	<0.0001	0.0306	<0.0000005	0.00087	7.84	0.174	<0.00001	0.000833	<0.00005	<0.3	0.735	<0.00004	1.60	<0.000005	0.297	0.717	<0.00002	<0.00001	<0.0005	0.00938	<0.00005	<0.0005	<0.0001
1/5/2012	35	1306	7.03	407	118	*ND*	1.42	66.0	0.51	0.387	<0.05	<0.005	0.0056	0.0014	<0.002	*ND*	<0.0057	0.00290	0.000026	0.000538	0.0458	<0.00001	<0.000005	<0.005	<0.0000005	57.8	<0.0001	0.0000172	<0.0001	0.0217	<0.0000005	0.00068	7.51	0.172	<0.00001	0.000888	<0.00005	<0.3	0.721	<0.00004	1.49	<0.000005	0.293	0.635	<0.00002	<0.00001	<0.0005	0.00798	<0.00005	<0.0005	<0.0001
3/2/2012	36	175	7.2	383	129	*ND*	1.10	73.5	0.66	0.460	<0.05	0.0067	<0.005	<0.001	0.0023	*ND*	0.0056	0.00203	0.000026	0.000823	0.0474	<0.00001	<0.000005	0.0051	<0.0000005	62.7	<0.0001	0.0000114	<0.0001	0.0870	<0.0000005	0.00077	8.11	0.184	<0.00001	0.00117	<0.00005	<0.3	0.766	<0.00004	1.69	<0.000005	0.348	0.750	<0.00002	<0.00001	<0.0005	0.0117	<0.00005	0.00065	<0.0001
5/25/2012	37	200	7.46	439	132	*ND*	1.87	91.1	1.01	0.503	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00228	<0.00002	0.00144	0.0492	<0.00001	<0.000005	0.0063	<0.0000005	73.7	<0.0001	0.0000079	<0.0001	0.148	0.0000134	0.00098	9.15	0.198	<0.00001	0.00152	<0.00005	<0.3	0.897	<0.00004	2.22	<0.000005	0.486	0.928	<0.00002	<0.00001	<0.0005	0.0151	<0.00005	0.00209	<0.0001
7/25/2012	38	200	7.54	445	138	*ND*	1.23	99.0	1.17	0.480	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00218	<0.00002	0.00106	0.0426	<0.00001	<0.000005	0.0066	<0.0000005	69.9	<0.0001	0.0000088	<0.0001	0.0829	0.0000055	0.00098	9.51	0.199	<0.00001	0.00141	<0.00005	<0.3	0.872	<0.00004	2.04	<0.000005	0.553	0.936	<0.00002	<0.00001	<0.0005	0.0141	<0.00005	0.0108	<0.0001
9/12/2012	39	210	7.38	451	139	267	1.30	101	1.29	0.523	<0.05	<0.005	<0.005	0.0026	<0.002	*ND*	0.0069	0.0016	<0.0001	0.00124	0.0441	<0.0001	<0.0005	<0.01	<0.0001	88.3	<0.0001	<0.0001	<0.0002	0.127	<0.0005	0.00118	11.2	0.198	<0.00001	0.00182	<0.0005	<0.05	1.14	<0.0001	2.35	<0.00001	0.597	1.00	<0.00001	<0.01	0.0157	<0.001	<0.001	*ND*
11/14/2012	40	590	7.62	412	123	217	1.27	89.3	1.23	0.507	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.01	0.00155	<0.00002	0.000695	0.0375	<0.00001	<0.000005	0.0076	<0.0000005	72.1	<0.0001	<0.0000005	<0.0001	0.0408	0.0000070	0.00105	9.08	0.184	<0.00001	0.00157	<0.0005	<0.05	0.898	<0.00004	2.16	<0.000005	0.588	0.936	0.0000037	<0.00001	<0.0005	0.0110	<0.00005	<0.0005	<0.0001
1/11/2013	41	565	7.46	374	116	*ND*	1.09	76.2	1.07	0.491	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.01	0.00231	0.000032	0.000768	0.0348	<0.00001	<0.000005	0.0079	<0.0000005	63.1	<0.0001	0.0000057	<0.0001	0.0454	<0.0000005	0.00086	7.76	0.154	<0.00001	0.00170	<0.00005	<0.3	0.787	<0.00004	2.07	<0.000005	0.580	0.839	<0.00002	<0.00001	<0.0005	0.00887	<0.00005	<0.0005	<0.0001

Calculated Production Rates for Sat Col 4 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk. ($CaCO_3$)	Hard. ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
25-Feb-10	0	209	ND	ND	ND	56	0.12	50	0.71	ND	ND	0.059	0.0025	0.00021	0.00021	20	ND	0.00046	0.000021	0.0000042	0.0012	0.0000042	0.000042	0.0021	0.000033	21	0.000042	0.00014	0.00013	0.00029	0.0000084	ND	1.2	0.041	0.0000008	0.00059	0.00046	ND	0.74	0.00023	0.024	0.0000008	0.90	0.061	0.0000096	0.00021	0.00021	0.00033	0.00021	0.00038	0.000021
4-Mar-10	1	1463	7.2	ND	27	477	0.80	465	3

Leachate Data for Sat Col 3

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mV	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
25-Feb-10	0	205	*ND*	*ND*	*ND*	1240	3.7	1100	7.9	*ND*	*ND*	0.93	0.04	<0.005	<0.005	429	*ND*	0.009	0.0006	0.0009	0.024	<0.0001	<0.001	<0.05	0.00025	469	<0.001	0.0008	0.0011	0.009	0.0003	*ND*	17.6	0.303	0.00013	0.011	0.008	*ND*	15.4	0.0030	0.624	<0.00002	11.1	1.4	0.00007	<0.005	<0.005	0.0090	<0.005	0.114	<0.0005
4-Mar-10	1	1435	7.2	*ND*	106	1700	4.34	1650	15	0.75	<1	1.61	<0.1	<0.01	<0.01	*ND*	*ND*	<0.01	0.0022	0.002	0.0215	<0.005	<0.005	<0.1	<0.00017	594	<0.005	0.0012	<0.001	<0.06	<0.0005	<0.05	27.3	0.745	<0.00001	0.0106	<0.005	<0.6	27.9	<0.01	3.7	<0.00001	22.4	5.56	<0.001	<0.005	<0.002	0.273	<0.01	<0.01	*ND*
11-Mar-10	2	1435	7.2	*ND*	89	1650	2.59	1560	6.7	0.89	<7.8	1.35	<0.05	<0.01	<0.01	*ND*	*ND*	<0.01	0.0019	0.0013	0.0191	<0.005	<0.005	<0.1	<0.00017	600	<0.005	<0.001	<0.001	<0.15	<0.0005	<0.05	37.5	0.521	<0.00005	0.00841	<0.005	<1.5	20	0.0041	3.69	<0.0001	12	4.4	<0.001	<0.005	<0.002	0.216	<0.01	<0.01	*ND*
18-Mar-10	3	1435	7.3	*ND*	91	1520	1.66	1460	<5	0.51	<7.3	0.7	<0.05	<0.01	<0.002	*ND*	*ND*	<0.01	0.0011	0.0013	0.018	<0.005	<0.005	<0.1	<0.0005	564	<0.005	<0.001	<0.001	<0.06	<0.0005	<0.05	26.6	0.408	<0.00001	0.00651	<0.005	<0.6	15.4	<0.01	3.35	<0.0001	7.3	3.9	<0.001	<0.005	<0.002	0.188	<0.01	<0.01	*ND*
1-Apr-10	5	2870	7.1	1431	85	1460	0.88	1340	<10	<0.4	<6.7	0.423	<0.1	<0.02	<0.002	*ND*	*ND*	<0.01	<0.001	0.0017	0.0186	<0.005	<0.005	<0.1	<0.00017	558	<0.005	<0.001	<0.001	<0.06	<0.0005	<0.05	16.0	0.298	<0.00001	0.00538	<0.005	<0.6	9.7	<0.01	3.08	<0.0001	<4	3.26	<0.001	<0.001	<0.002	0.142	<0.01	<0.01	*ND*
15-Apr-10	7	2870	7.5	1427	82	1170	1.51	1080	<5	0.58	<0.5	0.229	<0.05	<0.01	<0.002	*ND*	*ND*	0.0096	<0.0005	0.00164	0.0172	<0.0025	<0.0025	<0.05	<0.0000885	451	<0.0025	<0.0005	<0.0005	<0.03	<0.00025	<0.025	10.8	0.199	<0.00001	0.00457	<0.0025	<0.3	6.4	<0.005	2.76	<0.00005	<2	2.57	<0.0005	<0.0005	<0.001	0.010	0.0982	<0.005	<0.005	*ND*
29-Apr-10	9	2870	7.4	1583	65	1020	0.65	909	<5	0.56	<0.5	0.166	<0.05	<0.01	<0.002	*ND*	*ND*	0.0061	<0.0005	0.00158	0.0172	<0.0025	<0.0025	<0.05	<0.0000885	404	<0.0025	<0.0005	<0.0005	<0.03	<0.00025	<0.025	8.17	0.167	<0.00001	0.00430	<0.0025	<0.3	5.2	<0.005	2.62	<0.00005	<2	2.22	<0.0005	<0.005	<0.001	0.0815	<0.005	<0.005	*ND*
13-May-10	11	2998	7.6	1331	67	893	0.57	726	<2.5	0.47	<0.25	0.117	<0.025	<0.005	<0.002	*ND*	*ND*	0.0050	<0.0005	0.00156	0.0153	<0.0025	<0.0025	<0.05	<0.00025	346	<0.0025	<0.0005	<0.0005	<0.03	<0.00025	<0.025	6.97	0.122	<0.00001	0.00369	<0.0025	<0.3	4.2	<0.005	2.54	<0.00005	<2	1.68	<0.0005	<0.0005	<0.001	0.0627	<0.005	<0.005	*ND*
27-May-10	13	2742	7.3	1173	62	692	0.56	599	<0.5	0.541	<0.05	0.0778	<0.005	<0.001	0.00291	*ND*	*ND*	0.0262	<0.0005	0.00213	0.0196	<0.0025	<0.0025	<0.05	<0.0000885	268	<0.0025	<0.0005	<0.0005	<0.03	<0.00025	<0.025	5.54	0.129	<0.00001	0.00402	<0.0025	<0.3	3.3	<0.005	2.41	<0.00005	<2	1.80	<0.0005	<0.0005	0.016	0.0577	<0.005	<0.005	*ND*
15-Jun-10	16	4027	7.5	920	64	537	1.2	448	<5	0.39	<0.5	0.05	<0.05	<0.01	<0.002	167	<0.01	0.0067	0.00012	0.00211	0.0181	<0.00001	<0.000005	<0.05	0.000028	208	<0.00001	0.000072	<0.00005	0.073	0.000008	0.0009	4.32	0.0965	<0.00001	0.00363	0.000088	0.00008	2.56	0.00004	2.47	<0.000005	0.29	1.46	0.000003	<0.00001	<0.0005	0.0377	<0.0002	0.0038	<0.0001
29-Jun-10	18	2857	*ND*	*ND*	*ND*	441	<0.5	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	125	0.01	0.0097	0.00014	0.00214	0.0198	<0.00001	<0.000005	<0.05	<0.0000085	170	<0.00001	0.000055	0.00032	0.05	0.000021	0.0007	3.91	0.0812	<0.00001	0.00362	0.00058	*ND*	2.05	<0.00004	2.22	<0.000005	0.25	1.3	0.000003	0.00004	<0.0005	0.0327	<0.0002	0.0008	<0.0001
14-Jul-10	20	3092	7.6	671	57	363	1.2	292	<0.5	0.333	<0.05	0.0117	<0.005	<0.001	<0.002	118	<0.005	0.0084	0.00013	0.00223	0.0211	<0.00001	<0.000005	<0.05	0.0000111	139	<0.00001	0.000044	0.00015	0.033	0.000023	0.0007	3.82	0.0733	<0.00001	0.00335	0.00011	*ND*	2.03	<0.00004	2	<0.000005	0.25	1.18	0.000003	<0.00001	<0.0005	0.0251	<0.0002	0.0018	<0.0001
27-Jul-10	22	2656	7.5	596	54	*ND*	0.6	242	<0.5	0.360	<0.05	<0.01	<0.005	<0.001	<0.002	90	<0.005	0.0097	0.00013	0.00184	0.0215	<0.00001	<0.000005	<0.05	0.000005	114	<0.00001	0.000031	<0.00005	0.021	<0.000005	0.0007	3.40	0.0618	<0.00001	0.00293	0.00005	*ND*	1.79	<0.00004	1.74	<0.000005	0.24	1.02	<0.000002	0.00001	<0.0005	0.0213	<0.0002	0.0009	<0.0001
10-Aug-10	24	2836	7.5	529	57	269	<0.5	135	<0.5	0.217	<0.05	0.0080	<0.005	<0.001	<0.002	76	<0.01	0.0095	0.00015	0.00151	0.0214	<0.00001	<0.000005	<0.05	0.0000025	102	<0.00001	0.000039	0.0180	0.031	0.000262	0.0131	3.17	0.0561	<0.00001	0.00981	0.00008	*ND*	1.56	<0.00004	1.72	<0.000005	0.20	0.969	<0.000002	0.00002	<0.0005	0.0186	<0.0002	0.0181	<0.0001
24-Aug-10	26	2870	7.6	463	54	235	0.7	173	<0.5	0.293	<0.05	<0.005	<0.005	<0.001	<0.002	62	<0.03	0.0083	0.00012	0.00142	0.0232	<0.00001	<0.000005	<0.05	<0.0000085	88.7	<0.00001	0.000034	<0.00005	0.016	<0.000005	0.0005	3.17	0.0515	<0.00001	0.00262	0.00004	*ND*	1.37	<0.00004	1.82	0.000012	0.18	0.853	0.000002	<0.00001	<0.0005	0.0161	<0.0002	0.0006	<0.0001
8-Sep-10	28	3109	7.6	417	69	192	0.8	142	<0.5	0.266	<0.05	<0.005	<0.005	<0.001	0.0057	48	<0.005	0.0090	0.00011	0.00126	0.0250	<0.00001	<0.000005	<0.05	<0.0000055	72.4	<0.00001	0.000015	0.00010	0.012	<0.000005	0.0005	2.74	0.0443	<0.00001	0.00249	<0.00002	*ND*	1.20	<0.00004	1.36	<0.000005	0.15	0.815	<0.000002	0.00002	<0.0005	0.0141	<0.0002	0.0003	<0.0001
21-Sep-10	30	2656	7.8	373	68	171	<0.5	124	<0.5	0.310	<0.05	<0.005	<0.005	<0.001	<0.002	40	0.04	0.0094	0.00010	0.00116	0.0262	<0.00001	<0.000005	<0.05	<0.0000055	64.7	<0.00001	0.000019	0.00010	0.013	0.000029	0.0005	2.40	0.0387	<0.00001	0.00225	0.00010	*ND*	1.09	<0.00004	1.44	<0.000005	0.15	0.721	<0.000002	<0.00001	<0.0005	0.0116	<0.0002	0.0004	<0.0001
5-Oct-10	32	2853	7.6	334	64	160	<0.5	101	<0.5	0.292	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.03	0.012	<0.0005	0.0015	0.032	<0.00001	<0.001	<0.05	<0.00001	60.1	<0.001	<0.0005	0.0002	0.077	<0.0002	<0.005	2.39	0.035	<0.00002	0.002	<0.001	<0.01	1.11	<0.0001	1.56	<0.00002	0.16	0.745	<0.00005	<0.005	<0.005	0.0101	<0.005	<0.005	<0.0005
21-Oct-10	34	3297	7.3	297	57	137	<0.5	84.1	<0.5	0.248	<0.05	<0.005	<0.005	<0.001	<0.002	31	<0.03	0.0135	0.00015	0.00105	0.0333	<0.00001	<0.000005	<0.05	<0.0000055	50.9	<0.001	0.000017	0.00817	0.013	0.000020	<0.0005	2.34	0.0328	<0.00001	0.00205	0.00292	*ND*	0.99	<0.00004	1.35	<0.000005	0.13	0.649	0.000003	<0.00001	<0.0005	0.00881	<0.0002	0.0004	<0.0001
2-Nov-10	36	2447	7.4	274	54	128	<0.5	73.2	<0.5	0.248	<0.05	<0.005	<0.005	<0.001	<0.002	29	<0.03	0.0120	0.00013	0.00101	0.0354	<0.00001	<0.000005	<0.05	<0.0000055	47.2	<0.001	0.000011	0.00047	0.006	0.000009	<0.0005	2.38	0.0320	<0.00001	0.00188	0.00006	*ND*	0.99	<0.00004	1.33	<0.000005	0.13	0.609	<0.000002	<0.00001	<0.0005	0.00732	<0.0002	0.0007	<0.0001
16-Nov-10	38	2717	7.6	254	58	129	<0.5	65.4	<0.5	0.244	<0.05	<0.005	<0.005	<0.001	*ND*	25	0.006	0.0125	0.00014	0.00113	0.0399	<0.00001	<0.000005	<0.05	0.000008	48.0	<0.001	0.000017	0.00006	0.007	0.000026	<0.0005	2.30	0.0321	<0.00001	0.00192	0.00003	*ND*	0.93	<0.00004	1.38	<0.000005	0.13	0.615	<0.000002	<0.00001	<0.0005	0.00718	<0.0002	0.0003	<0.0001
30-Nov-10	40	2692	7.5	232	56	105	<0.5	55.8	<0.5	0.235	<0.05	<0.005	<0.005	<0.001	<0.002	21	<0.01	0.0126	0.00016	0.00102	0.0431	<0.00001	<0.000005	<0.05	0.000006	38.2	<0.001	0.000015	0.00005	0.006	0.000018	<0.0005	2.26	0.0286	<0.00001	0.00183	0.00002	*ND*	0.85	<0.00004	1.17	<0.000005	0.12	0.565	<0.000002	<0.00001	<0.0005	0.00622	<0.0002	0.0002	<0.0001
6-Jan-11	45	7258	7.5	192	68	*ND*	0.68	37.7	<0.5	0.181	<0.05	0.0130	<0.005	<0.001	<0.002	*ND*	<0.005	0.0179	0.00014	0.00111	0.0597	<0.00001	<0.000005	<0.01	0.0000085	35.2	<0.001	0.000190	0.00082	0.046	0.000745	0.00070	1.98	0.0246	<0.00002	0.00182	<0.00005	*ND*	0.772	<0.00004	1.09	<0.000003	0.131	0.496	<0.000002	0.00002	<0.0002	0.00221	<0.0001
13-Feb-11	47	5600	7.2	193	69	*ND*	0.52	37.0	<0.5	0.163	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.0123	0.00013	0.00110	0.0562	<0.00001	<0.000005	<0.05	<0.0000055	34.7	<0.001	0.000015	0.00010	0.013	0.000029	0.0005	2.72	0.0339	<0.00002	0.00160	<0.00005	*ND*	0.776	<0.00004	1.11	<0.000003	0.113	0.525	0.000055	<0.00001	<0.0002	0.0145	<0.0002	0.0004	<0.0001
2-Mar-11	53	4431	7.7	207	49	*ND*	2.14	32.7	<0.5	0.162	<0.05	<0.005	0.0094	<0.001	<0.002	*ND*	<0.005	0.0106	0.00009	0.00094	0.0619	<0.00001	<0.000005	<0.05	<0.0000055	29.9	<0.001	0.000199	0.00013	0.003	0.0000107	0.00073	2.00	0.0235	<0.00002	0.00175	<0.00005	*ND*	0.701	<0.00004	1.07	<0.000003	0.362	0.597	0.0000347	0.0000016	<0.0005	0.00565	<0.0005	<0.0005	<0.0001
30-Mar-11	57	694	7.5	294	66	*ND*	1.89	47.9	<0.5	0.167	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00897	0.00058	0.00139	0.0768	<0.00001	<0.000005	<0.05	0.0000109	41.3	<0.001	0.000194	<0.00001	0.0025	0.000350	<0.0005	2.72	0.0339	<0.00002	0.00160	<0.00005	<0.3	0.866	<0.00004	1.36	<0.000005	0.14	0.660	<0.000002	<0.00001	<0.0005	0.00806	<0.0005	0.00090	<0.0001
24-Apr-11	60	676	7.7	274	72	*ND*	2.19	66.4	0.53	0.223	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00562	0.00032	0.00148	0.0751	<0.00001	<0.000005	<0.05	<0.0000055	45.9	<0.001	0.000129	<0.00001	0.0058	0.0000100	0.00063	3.53	0.0431	<0.00002	0.00164	<0.00005	<0.3	0.918	<0.00004	1.55	<0.000005	0.179	0.783	<0.000002	<0.00001	<0.0005	0.0113	<0.00005	0.00321	<0.0001
26-May-11	65	901	7.8	306	77	*ND*	2.53	72.3	<0.5	0.202	<0.05	0.0064	<0.005	<0.001	<0.002	*ND*	<0.005	0.00672	0.00039	0.00155	0.0670	<0.00001	<0.000005	<0.05	<0.0000055	55.2	<0.001	0.0000098	<0.00001	0.0096	0.0000208	<0.0005	4.70	0.0515	<0.00002	0.00169	<0.00005	<0.3	0.996	<0.00004	1.72	<0.000005	0.225	0.833	<0.000002	<0.00001	<0.0005	0.0138	<0.00005	0.00343	<0.0001
23-Jun-11	69	758	7.6	318	82	*ND*	2.28	76.7	0.89	0.244	<0.05	0.0128	<0.005	<0.001	<0.002	*ND*	<0.005	0.00522	0.00045	0.00142	0.0619	<0.00001	<0.000005	<0.05	0.0000074	53.8	<0.001	0.0000108	<0.00001	0.0152	0.0000381	<0.0005	4.41	0.0570	<0.00002	0.00175	<0.00005	<0.3	1.03	<0.00004	1.81	0.0000055	0.225	0.936	<0.000002	<0.00001	<0.0005	0.0175	<0.00005	0.00151	<0.0001
21-Jul-11	73	701	7.6	338	92	*ND*	2.70	82.2	0.77	0.249	<0.05	0.0087	<0.005	<0.001	0.0081	*ND*	<0.005	0.00442	0.00057	0.00176	0.0598	<0.00001	<0.000005	<0.05	<0.0000055	56.2	<0.001	<0.0000005	0.00106	0.0159	0.0000352	0.00051	4.84	0.0622	<0.00002	0.00181	<0.00005	<0.3	1.13	<0.00004	1.90	<0.000003	0.304	0.997	<0.000002	<0.00001	<0.0005	0.0197	<0.00005	0.00337	<0.0001
18-Aug-11	77	854	7.6	334	85	*ND*	3.17	80.2	1.28	0.260	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00415	0.00036	0.00192	0.0586	<0.00001	<0.000005	<0.05	<0.0000055	58.7	<0.001	<0.0000005	0.00069	0.0105	<0.0000005	0.00069	4.97	0.0672	<0.00002	0.00181	<0.00005	<0.3	1.13	<0.00004	2.07	<0.000003	0.322	1.00	<0.000002	<0.00001	<0.0005	0.0181	<0.00005	0.00415	<0.0001
2-Sep-11	79	1644	7.4	368	103	*ND*	1.42	81.4	1.10	0.216	<0.05	0.0098	<0.005	<0.001	<0.002	*ND*	<0.005	0.00424	0.00068	0.00241	0.0584	<0.00001	<0.000005	<0.05	<0.0000055	61.9	<0.001	0.000220	0.00010	0.0077	0.000125	0.00072	6.10	0.125	<0.00002	0.00181	<0.00005	<0.3	1.41	0.000495	2.26	<0.000003	0.211	1.01	0.0000347	<0.00001	<0.0005	0.0355	<0.00005	0.0105	<0.0001
15-Sep-11	81	1327	7.5	412	124	*ND*	1.27	89.6	<0.5	0.231	<0.05	0.0070	<0.005	<0.001	<0.002	*ND*	<0.005	0.00332	0.00039	0.00366	0.0651	<0.00001	<0.000005	<0.05	0.0000224	69.4	<0.001	0.000199	0.00010	<0.001	<0.0000005	0.00131	7.01	0.131	<0.00002	0.00804	0.000141	<0.3	1.63	0.000157	1.67	<0.000003	0.246	1.08	0.0000292	<0.00001	<0.0005	0.0420	<0.00005	0.00701	<0.0001
13-Oct-11	85	1470	7.5	341	117	*ND*	1.25	61.8	<0.5	0.219	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00297	0.00052	0.00627	0.0610	<0.00001	<0.000005	<0.05	0.0000055	57.8	<0.001	0.0000693	<0.00001	0.0112	0.0000086	0.00069	5.72	0.0892	<0.00002	0.00721	0.000064	<0.3	1.40	<0.00004	1.68	<0.000003	0.221	0.918	0.0000067	<0.00001	<0.0005	0.0290	<0.00005	0.00177	<0.0001
10-Nov-11	89	858	7.4	327	117	*ND*	1.38	58.7	<0.5	0.211	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00275	0.00035	0.00937	0.0671	<0.00001	<0.000005	<0.05	<0.0000055	55.5	<0.001	0.0000613	<0.00001	0.0282	<0.0000005	0.00075	6.11	0.0944	<0.00001	0.00691	<0.00005	<0.3	1.42	<0.00004	1.77	<0.000003	0.243	0.894	<0.000002	<0.00001	<0.0005	0.0257	<0.00005	<0.0005	<0.0001
8-Dec-11	93	1073	7.4	317	114	*ND*	1.36	53.7	<0.5	0.207	<0.05	0.0054	<0.005	<0.001	<0.002	*ND*	0.0056	0.00414	<0.00002	0.00086	0.0592	<0.00001	<0.000005	<0.05	<0.0000055	54.5	<0.001	0.0000452	0.00011	0.0266	0.0000055	0.00087	5.53	0.0876	<0.00001	0.000740	0.000090	<0.3	1.22	<0.00004	1.87	<0.000003	0.253	0.903	<0.000002	<0.00001	<0.0005	0.0219	0.000054	<0.0005	<0.0001
5-Jan-12	97	1398	6.8	366	114	*ND*	1.80	51.8	<0.5	0.211	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	0.0059	0.00213	<0.00002	0.00089	0.0578	<0.00001	<0.000005	<0.05	<0.0000055	54.4	<0.001	0.0000141	<0.00001	0.0194	<0.0000005	0.00077	5.36	0.0894	<0.00001	0.000780	<0.00005	<0.3	1.16	<0.00004	1.84	<0.000003	0.244	0.832	<0.000002	<0.00001	<0.0005	0.0174	<0.00005	<0.0005	<0.0001
25-May-12	117	225	7.4	392	131	*ND*	2.56	70.9	0.76	0.275	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	0.0109	0.00223	<0.00002	0.00119	0.0638	<0.00001	<0.000005	<0.05	<0.0000055	68.2	<0.001	0.0000152	<0.00001	0.127	<0.0000005	0.00112	6.72	0.127	<0.00001	0.00121	<0.00005	<0.3	1.43	<0.00004	2.68	<0.000003	0.405	1.25	<0.000002	<0.00001	<0.0005	0.0270	<0.00005	0.00151	<0.0001
25-Jul-12	126	210	7.4	410	150	*ND*	3.00	78.5	1.25	0.279	<0.05	0.0051	<0.005	<0.001	<0.002	*ND*	0.0059	0.00211	<0.00002	0.00132	0.0584	<0.00001	<0.000005	<0.05	<0.0000055	75.1	<0.001	0.0000163	<0.00001	0.100	0.0000070	0.00119	7.19	0.146	<0.00001	0.00133	<0.00005	<0.3	1.44	<0.00004	3.75	<0.000003	0.498	1.43	<0.000002	<0.00001	<0.0005	0.0275	<0.00005	0.00197	<0.0001
12-Sep-12	133	220	7.4	411	6.3	11	0.077	3.4	0.044	0.013	0.0022	0.00022	0.00022	0.00044	0.00088	*ND*	0.00041	0.00029	0.0000044	0.00061	0.0025	0.0000044	0.00022	0.00044	0.0000044	3.6	0.0000044	0.0000044	0.0000088	0.0073	0.0000022	0.00061	0.35	0.0065	0.0000044	0.000070	0.00022	0.0022	0.073	0.0000044	0.12	0.0000044	0.023	0.060	0.0000044	0.0000044	0.0000044	0.0012	0.0000044	0.0000044	*ND*
14-Nov-12	142	650	7.6	376	129	205	1.40	66.6	0.97	0.318	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	*ND*	0.00105	<0.00002	0.00104	0.0526	<0.00001	<0.000005	<0.05	<0.0000055	70.3	<0.001	0.0000053	<0.00001	0.0204	0.0000428	0.00093	7.03	0.150	<0.00001	0.00142	<0.00005	<0.05	1.46	<0.00004	2.71	<0.000005	0.553	1.16	<0.000002	<0.00001	<0.0005	0.0198	<0.00005	<0.0005	<0.0001
11-Jan-13	150	565	7.4	359	125	*ND*	1.25	59.5	0.90	0.318	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.01	0.00093	<0.00002	0.000600	0.0245	<0.00001	<0.000005	<0.05	<0.0000055	30.0	<0.001	<0.0000005	<0.00001	0.0289	<0.0000005	<0.0005	3.02	0.0612	<0.00001	0.000822	<0.00005	<0.3	0.638	<0.00004	1.32	<0.000005	0.264	0.573	<0.000002	<0.00001	<0.0005	0.00809	<0.0005	<0.0005	<0.0001

Calculated Production Rates for Sat Col 3 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
25-Feb-10	0	205	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
4-Mar-10	1	1435	7.2	*ND*	30	488	1.2	474	4.3	0.22	0.29	0.46	0.029	0.0057	0.0029	*ND*	*ND*	0.0029	0.00063	0.00057	0.0062	0.0014	0.0014	0.029	0.0000449	170	0.0014	0.0034	0.0029	0.017	0.00014	0.014	15	0.21	0.0000029	0.0030	0.0014	0.17	8.0	0.0029	1.1	0.000029	6.4	1.6	0.00029	0.00029	0.0057	0.078	0.0029	0.029	*ND*
11-Mar-10	2	1435	7.2	*ND*	26	474	0.74	448	1.9	0.26	2.2	0.39	0.014

Leachate Data for Sat Col 5

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk. ($CaCO_3$)	Hard. ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
25-Feb-10	0	209	*ND*	*ND*	*ND*	878	3.8	850	8.4	*ND*	*ND*	0.82	0.03	<0.005	<0.005	322	*ND*	3.67	0.0016	0.0011	0.028	0.0013	<0.001	<0.05	0.0143	296	<0.001	0.334	13.9	1.32	0.0004	*ND*	33.9	7.02	<0.00002	0.001	0.083	*ND*	11.6	0.0300	1.26	<0.00002	9.24	0.476	0.00027	<0.005	<0.005	0.0421	<0.005	0.678	<0.0005
4-Mar-10	1	1463	5.92	*ND*	216	1370	3.19	1170	15	<0.4	<1	0.786	<0.1	<0.02	<0.02	*ND*	*ND*	0.052	0.0069	<0.001	0.0112	<0.005	<0.005	<0.1	0.00735	450	<0.005	0.0885	0.718	0.087	<0.0005	<0.05	60.3	8.12	<0.00001	0.00573	0.0261	<0.6	11	0.052	2.87	<0.0001	11.4	0.521	<0.001	<0.001	<0.02	0.0138	<0.01	0.071	*ND*
11-Mar-10	2	1463	6.53	*ND*	209	951	*ND*	732	5.36	0.166	<3.7	0.385	<0.005	<0.001	*ND*	*ND*	*ND*	0.0135	0.00675	<0.0005	0.0108	<0.0025	<0.0025	<0.05	0.00381	318	<0.0025	0.0283	0.161	<0.15	<0.00025	<0.025	38.2	4.59	<0.00005	0.00652	0.0093	<1.5	<10	0.0317	2.6	<0.00005	<10	0.316	<0.0005	<0.0005	<0.05	0.00841	<0.005	0.0257	*ND*
18-Mar-10	3	1463	6.37	*ND*	200	628	1.37	484	<5	<0.2	<2.4	0.342	<0.05	<0.01	<0.01	*ND*	*ND*	<0.005	0.00656	<0.0005	0.0114	<0.0025	<0.0025	<0.05	0.00201	210	<0.0025	0.00975	0.487	<0.06	<0.00025	<0.025	25.3	2.76	<0.00001	0.00653	0.0039	<0.6	5.6	0.0183	2.26	<0.00005	<4	0.212	<0.0005	<0.0005	<0.02	0.00503	<0.005	0.0106	*ND*
1-Apr-10	5	2926	6.53	514	183	392	<0.5	239	0.94	0.198	<1.2	0.167	<0.005	<0.001	<0.002	*ND*	*ND*	<0.005	0.00553	<0.0005	0.0146	<0.0025	<0.0025	<0.05	0.000761	133	<0.0025	0.00178	0.00621	<0.06	<0.00025	<0.025	14.5	1.24	<0.00001	0.00698	<0.0025	<0.6	<4	0.0077	2.12	<0.00005	<4	0.117	<0.0005	<0.0005	<0.02	0.00224	<0.005	0.0061	*ND*
15-Apr-10	7	2926	6.77	380	157	245	2.89	137	<0.5	0.246	<0.05	0.994	<0.005	<0.001	<0.01	*ND*	*ND*	<0.02	0.0051	<0.002	0.0215	<0.01	<0.01	<0.2	0.00046	82.3	<0.01	<0.002	0.0026	<0.15	<0.001	<0.1	9.66	0.732	<0.00001	0.0089	0.010	<1.5	<10	<0.02	1.88	<0.0002	<10	0.0826	<0.002	<0.002	<0.05	0.00131	<0.02	<0.02	*ND*
29-Apr-10	9	2926	6.94	405	113	195	0.54	93.8	<0.5	0.285	<0.05	0.057	0.0058	<0.001	<0.001	*ND*	*ND*	0.0048	0.00463	0.00029	0.0236	<0.0005	<0.0005	<0.01	0.000173	75.9	<0.0005	0.00334	<0.03	<0.0005	<0.005	<0.05	7.82	0.464	<0.00001	0.00764	<0.0005	<0.3	2.1	0.0028	1.81	<0.00001	<2	0.0668	<0.0001	<0.0001	<0.01	0.0008936	<0.001	0.0024	*ND*
13-May-10	11	3057	7.04	339	106	183	*ND*	69.8	<0.5	0.290	<0.05	0.027	<0.005	<0.001	0.0035	*ND*	*ND*	0.0045	0.00392	0.00039	0.0251	<0.0005	<0.0005	<0.01	<0.000005	61.2	0.00079	0.00018	0.00016	0.033	<0.00005	<0.005	7.32	0.325	<0.00005	0.00753	0.00052	<0.3	<2	0.0019	1.70	<0.00001	<2	0.0550	<0.0001	<0.0001	<0.01	0.000653	<0.001	0.0027	*ND*
27-May-10	13	2795	6.92	198.3	122	152	<0.5	53.8	<0.5	0.286	<0.05	0.0090	<0.005	<0.001	0.0056	*ND*	*ND*	0.0057	0.00397	0.00036	0.0325	<0.0005	<0.0005	<0.01	0.000024	50.6	<0.0005	0.00015	<0.001	0.049	<0.00005	<0.005	6.18	0.289	<0.00001	0.00736	<0.0005	<0.3	<2	0.0012	1.61	<0.00001	<2	0.0543	<0.0001	<0.0001	<0.01	0.000535	<0.001	<0.001	*ND*
15-Jun-10	16	4106	7.14	264	93	118	1.6	40.0	<0.5	0.270	<0.05	0.08	<0.005	<0.001	0.0168	15	0.01	0.0079	0.00375	0.00056	0.0381	<0.00001	<0.000005	<0.05	0.000017	38.9	<0.0001	0.000158	0.00011	0.119	0.000013	<0.0005	5.08	0.254	<0.00001	0.00803	0.00002	*ND*	1.21	0.00093	1.59	<0.000005	0.21	0.0505	<0.000002	<0.00001	<0.0005	0.000418	<0.0002	0.0004	<0.0001
29-Jun-10	18	2913	*ND*	*ND*	*ND*	111	<0.5	*ND*	*ND*	*ND*	*ND*	0.06	*ND*	*ND*	*ND*	12	<0.01	0.0078	0.00359	0.00052	0.0405	<0.00001	<0.000005	<0.05	<0.000005	36.5	<0.0001	0.000151	0.00008	0.135	<0.000005	<0.005	4.78	0.233	<0.00001	0.00804	0.00003	*ND*	1.10	0.00078	1.57	0.000010	0.20	0.0485	0.000002	0.00002	<0.0005	0.000350	<0.0002	0.0003	<0.0001
14-Jul-10	20	3152	7.17	214.4	84	110	0.9	28.0	<0.5	0.287	<0.05	<0.005	<0.005	<0.001	0.0125	12	0.006	0.0070	0.00355	0.00053	0.0462	<0.00001	<0.000005	<0.05	0.000018	36.0	<0.0001	0.000148	0.00029	0.13	0.000043	<0.0005	4.97	0.225	<0.00001	0.00862	0.00006	*ND*	1.15	0.00070	1.58	<0.000005	0.20	0.0487	<0.000002	0.00002	<0.0005	0.000302	<0.0002	0.0014	<0.0001
27-Jul-10	22	2708	6.98	203.8	76	93.3	1.1	25.4	<0.5	0.309	<0.05	<0.01	<0.005	<0.001	0.0133	<10	<0.01	0.0070	0.00313	0.00051	0.0465	<0.00001	<0.000005	<0.05	<0.000005	29.9	<0.0001	0.000124	0.00009	0.101	<0.000005	<0.005	4.55	0.203	<0.00001	0.00816	<0.00002	*ND*	1.03	0.00059	1.31	<0.000005	0.20	0.0434	<0.000002	<0.00001	<0.0005	0.000340	<0.0002	0.0009	<0.0001
10-Aug-10	24	2891	7.15	192.2	72	91.2	0.6	26.4	<0.5	0.357	<0.05	<0.005	<0.005	<0.001	0.0137	<10	<0.01	0.0056	0.00307	0.00052	0.0425	<0.00001	<0.000005	<0.05	<0.000005	29.3	<0.0001	0.000128	0.00005	0.1	<0.000005	<0.005	4.37	0.188	<0.00001	0.00804	0.00003	*ND*	0.95	0.00054	1.27	<0.000005	0.18	0.0430	<0.000002	<0.00001	<0.0005	0.000311	<0.0002	0.0009	<0.0001
24-Aug-10	26	2926	7.22	180.8	73	87.5	<0.5	21.6	<0.5	0.290	<0.05	<0.005	<0.005	<0.001	0.0163	<10	<0.01	0.0044	0.00291	0.00050	0.0423	<0.00001	<0.000005	<0.05	<0.000005	28.3	<0.0001	0.000119	0.00006	0.105	0.000009	<0.0005	4.11	0.177	<0.00001	0.00809	0.00002	*ND*	0.81	0.00049	1.36	<0.000005	0.16	0.0398	<0.000002	<0.00001	<0.0005	0.000289	<0.0002	0.0001	<0.0001
8-Sep-10	28	3170	6.96	167.1	76	*ND*	<0.5	19.0	<0.5	0.271	<0.05	0.0053	<0.005	<0.001	0.0171	<10	<0.01	0.0047	0.00258	0.00051	0.0444	<0.00001	<0.000005	<0.05	<0.000005	23.4	<0.0001	0.000091	0.00011	0.116	<0.000005	<0.005	3.39	0.154	<0.00001	0.00775	<0.00002	*ND*	0.73	0.00046	1.04	<0.000005	0.12	0.0394	<0.000002	0.00002	<0.0005	0.000244	<0.0002	0.0002	<0.0001
21-Sep-10	30	2708	7.25	158.3	69	68.7	<0.5	18.6	<0.5	0.309	<0.05	<0.005	<0.005	<0.001	0.0178	<10	0.04	0.0055	0.00259	0.00049	0.0404	<0.00001	<0.000005	<0.05	<0.000005	21.9	<0.0001	0.000083	0.00006	0.093	<0.000005	<0.005	3.44	0.153	<0.00001	0.00751	0.00003	*ND*	0.70	0.00037	0.991	<0.000005	0.13	0.0362	<0.000002	<0.00001	<0.0005	0.000234	<0.0002	0.0002	<0.0001
5-Oct-10	32	2909	6.84	158.6	59	72.6	<0.5	16.4	17.0	5.37	0.307	<0.05	0.0091	<0.005	<0.001	0.0217	*ND*	0.03	0.008	0.0023	0.0007	0.043	<0.0001	<0.001	<0.05	<0.00001	23.1	<0.001	<0.0005	0.0003	0.218	<0.0002	<0.005	3.63	0.153	<0.00002	0.008	<0.001	0.021	0.73	0.0004	1.2	<0.00002	0.15	0.038	<0.00005	<0.005	<0.005	0.0002	<0.005	<0.005	<0.0005
21-Oct-10	34	3361	6.79	144.5	56	64.9	<0.5	16.0	<0.5	0.282	<0.05	<0.005	<0.005	<0.001	0.0195	<10	<0.03	0.0059	0.00238	0.00133	0.0425	<0.00001	<0.000005	<0.05	0.0000106	20.2	<0.0001	0.000076	<0.00005	0.084	<0.000005	<0.005	3.48	0.153	<0.00001	0.00712	<0.00002	*ND*	0.67	0.00041	1.07	<0.000005	0.12	0.0356	<0.000002	<0.00001	<0.0005	0.000239	<0.0002	0.0003	<0.0001
2-Nov-10	36	2495	6.84	138.9	52	65.7	<0.5	15.7	<0.5	0.298	<0.05	<0.005	<0.005	<0.001	0.0195	<10	<0.03	0.0051	0.00225	0.00052	0.0415	<0.00001	<0.000005	<0.05	<0.000005	20.7	<0.0001	0.000082	<0.00005	0.086	<0.000005	<0.005	3.41	0.151	<0.00001	0.00693	<0.00002	*ND*	0.66	0.00039	1.13	<0.000005	0.12	0.0341	<0.000002	<0.00001	<0.0005	0.000227	<0.0002	0.0004	<0.0001
16-Nov-10	38	2750	6.99	138.2	54	68.2	<0.5	15.7	<0.5	0.308	<0.05	<0.005	<0.005	<0.001	0.0189	<10	<0.03	0.0050	0.00242	0.00055	0.0415	<0.00001	<0.000005	<0.05	0.0000111	21.7	<0.0001	0.000077	0.00023	0.09	0.0000032	<0.0005	3.43	0.159	<0.00001	0.00756	0.00003	*ND*	0.64	0.00037	1.17	<0.000005	0.13	0.0361	<0.000002	<0.00001	<0.0005	0.000206	<0.0002	0.0212	<0.0001
30-Nov-10	40	2720	6.91	131.1	51	61.3	<0.5	15.1	<0.5	0.305	<0.05	<0.005	<0.005	<0.001	0.0231	<10	<0.01	0.0038	0.00221	0.00066	0.0397	<0.00001	<0.000005	<0.05	0.0000093	19.2	<0.0001	0.000063	<0.00005	0.071	0.0000065	<0.0005	3.23	0.147	<0.00001	0.00725	<0.00002	*ND*	0.60	0.00039	1.06	<0.000005	0.11	0.0337	<0.000002	<0.00001	<0.0005	0.000187	<0.0002	0.0003	<0.0001
6-Jan-11	45	2735	7.04	155.8	72	*ND*	1.19	16.0	<0.5	0.273	<0.05	<0.005	<0.005	<0.001	0.0244	*ND*	*ND*	0.00365	0.00236	0.000755	0.0496	<0.00001	<0.000005	<0.01	0.0000361	21.6	<0.0001	0.0000610	0.00011	0.109	0.0000208	<0.0005	3.79	0.188	<0.00002	0.00865	<0.00005	*ND*	0.689	0.000414	1.23	<0.000005	0.148	0.0431	<0.000002	<0.00001	<0.0005	0.000227	<0.0002	0.00114	<0.0001
3-Feb-11	49	983	7.09	186.9	90	*ND*	1.73	17.9	<0.5	0.319	<0.05	<0.005	<0.005	<0.001	0.0215	*ND*	<0.005	0.00408	0.00290	0.00110	0.0501	<0.00001	<0.000005	<0.05	0.0000113	27.9	<0.0001	0.000338	<0.00001	0.138	0.0000092	<0.0005	4.81	0.214	<0.00002	0.0103	<0.00005	*ND*	1.03	0.0003375	1.52	<0.000005	0.197	0.0477	<0.000002	<0.00001	<0.0005	0.000354	<0.0005	0.00050	<0.0001
2-Mar-11	53	906	7.34	234.5	89	*ND*	3.11	18.6	<0.5	0.272	<0.05	<0.005	<0.005	<0.001	0.0230	*ND*	<0.005	0.00350	0.00310	0.00113	0.0521	<0.00001	<0.000005	<0.05	0.0000067	27.3	<0.0001	0.0000129	0.00017	0.149	0.0000187	<0.0005	4.75	0.226	<0.00002	0.0119	0.000097	<0.3	0.812	0.0003373	1.61	<0.000005	0.208	0.0523	<0.000002	<0.00001	<0.0005	0.000422	<0.0005	0.00069	<0.0001
30-Mar-11	57	763	7.7	248.6	90	*ND*	2.46	19.8	<0.5	0.242	<0.05	0.0071	<0.005	<0.001	0.0303	*ND*	<0.005	0.00346	0.00984	0.00303	0.0578	<0.00001	<0.000005	<0.05	<0.000005	32.1	<0.0001	0.0000255	<0.00001	0.165	0.0000074	<0.0005	5.31	0.246	<0.00002	0.0114	<0.00005	*ND*	0.882	0.0004424	1.77	<0.000005	0.251	0.0555	<0.000002	<0.00001	<0.0005	0.000535	<0.0005	0.00072	<0.0001
24-Apr-11	61	803	7.03	222.4	90	*ND*	2.20	21.5	0.91	0.294	<0.05	<0.005	<0.005	<0.001	0.0369	*ND*	<0.005	0.00341	0.00137	0.00321	0.0571	<0.00001	<0.000005	<0.05	<0.000005	30.5	<0.0001	0.0000229	<0.00001	0.181	0.0000050	<0.0005	5.75	0.277	<0.00002	0.0116	<0.00005	<0.3	0.877	0.0004424	1.84	<0.000005	0.261	0.0563	<0.000002	<0.00001	<0.0005	0.000422	<0.0005	0.00197	<0.0001
26-May-11	65	1067	7.29	225.7	95	*ND*	2.37	20.9	<0.5	0.322	<0.05	0.0119	<0.005	<0.001	0.0346	*ND*	<0.005	0.00410	0.00119	0.00416	0.0567	<0.00001	<0.000005	<0.05	0.0000164	36.7	<0.0001	0.0000273	<0.00001	0.148	0.0000204	<0.0005	6.26	0.247	<0.00002	0.0118	<0.00005	<0.3	0.899	0.0004427	1.88	<0.000005	0.276	0.0541	<0.000002	<0.00001	<0.0005	0.000427	<0.0005	0.00491	<0.0001
23-Jun-11	69	899	7.19	224	90	*ND*	2.13	21.2	1.18	0.351	<0.05	0.0076	<0.005	<0.001	0.0372	*ND*	<0.005	0.00393	0.000967	0.00454	0.0552	<0.00001	<0.000005	<0.05	0.0000054	34.2	<0.0001	0.0000205	<0.00001	0.164	<0.0000045	<0.0005	5.60	0.236	<0.00002	0.0118	<0.00005	<0.3	0.878	0.0004404	1.84	<0.000005	0.282	0.0567	<0.000002	<0.00001	<0.0005	0.000635	<0.0005	0.00157	<0.0001
21-Jul-11	73	841	7.21	221.4	95	*ND*	2.38	20.7	<0.5	0.371	<0.05	0.0102	<0.005	<0.001	0.0445	*ND*	<0.005	0.00382	0.000762	0.00515	0.0560	<0.00001	<0.000005	<0.05	<0.000005	33.2	<0.0001	0.0000147	<0.00001	0.202	<0.0000045	<0.0005	5.55	0.234	<0.00002	0.0119	<0.00005	<0.3	0.863	0.0003374	1.89	<0.000005	0.295	0.0534	<0.000002	<0.00001	<0.0005	0.000669	<0.0005	0.00262	<0.0001
18-Aug-11	77	981	7.16	230.2	91	*ND*	2.41	19.9	0.89	0.349	<0.05	0.0076	<0.005	<0.001	0.0376	*ND*	<0.005	0.00414	0.000662	0.00507	0.0535	<0.00001	<0.000005	<0.05	<0.000005	33.3	<0.0001	0.0000255	<0.00001	0.147	0.0000045	<0.0005	5.53	0.232	<0.00002	0.0122	<0.00005	<0.3	0.887	0.0003261	1.94	<0.000005	0.286	0.0528	<0.000002	<0.00001	<0.0005	0.000601	<0.0005	0.00350	<0.0001
15-Sep-11	81	2776	7.01	223.7	68	*ND*	1.47	39.6	2.36	0.302	<0.05	<0.005	<0.005	<0.001	0.0153	*ND*	<0.005	0.00241	0.00331	0.00474	0.0598	<0.00001	<0.000005	<0.05	0.000122	33.5	<0.0001	0.000200	0.00023	0.058	0.0000076	0.00054	5.10	0.209	<0.00002	0.0106	<0.00005	<0.3	1.01	0.00278	1.81	<0.000005	0.245	0.0529	0.0000210	<0.00001	<0.0005	0.000549	0.000710	0.00387	<0.0001
13-Oct-11	85	813	7	245.9	87	*ND*	0.89	35.6	0.61	0.314	<0.05	<0.005	<0.005	<0.001	0.0263	*ND*	<0.005	0.00319	0.000719	0.00110	0.0600	<0.00001	<0.000005	<0.05	0.0000082	37.6	<0.0001	0.000134	<0.00001	0.0917	0.0000096	<0.0005	5.76	0.233	<0.00002	0.0111	<0.00005	<0.3	1.04	0.00194	1.86	<0.000005	0.269	0.0593	<0.000002	<0.00001	<0.0005	0.000755	0.000335	0.00063	<0.0001
10-Nov-11	89	856	7.05	244.1	98	*ND*	1.85	30.8	<0.5	0.308	<0.05	0.0072	<0.005	<0.001	0.0282	*ND*	<0.005	0.00427	0.000421	0.00254	0.0631	<0.00001	<0.000005	<0.05	0.0000065	38.6	<0.0001	0.000113	<0.00001	0.103	<0.0000045	<0.0005	6.09	0.248	<0.00001	0.0103	<0.00005	<0.3	0.960	0.000309	1.81	<0.000005	0.258	0.0604	<0.000002	<0.00001	<0.0005	0.000718	0.000156	<0.0005	<0.0001
8-Dec-11	93	975	7.06	246.1	104	*ND*	1.94	28.0	<0.5	0.311	<0.05	<0.005	<0.005	<0.001	0.0271	*ND*	<0.005	0.00430	0.000270	0.00316	0.0591	<0.00001	<0.000005	<0.05	<0.000005	39.1	0.00021	0.0000859	<0.00001	0.0763	0.0000057	<0.0005	6.27	0.243	<0.00001	0.0106	0.000779	<0.3	0.915	0.000188	1.89	<0.000005	0.278	0.0620	<0.000002	<0.00001	<0.0005	0.000673	0.000112	<0.0005	<0.0001
5-Jan-12	97	1245	7.06	238.9	105	*ND*	2.30	25.7	<0.5	0.312	<0.05	<0.005	<0.005	<0.001	0.0266	*ND*	<0.005	0.00333	0.000231	0.00317	0.0562	<0.00001	<0.000005	<0.05	<0.000005	38.4	<0.0001	0.0000508	<0.00001	0.0841	<0.0000045	<0.0005	6.12	0.251	<0.00001	0.0101	<0.00005	<0.3	0.878	0.000166	1.82	<0.000005	0.264	0.0564	<0.000002	<0.00001	<0.0005	0.000583	0.000065	<0.0005	<0.0001
2-Mar-12	105	175	6.88	269.7	116	*ND*	2.64	26.6	0.59	0.345	<0.05	0.0054	<0.005	<0.001	0.0378	*ND*	<0.005	0.00283	0.000155	0.00446	0.0590	<0.00001	<0.000005	<0.05	0.0000064	41.9	<0.0001	0.0000260	<0.00001	0.143	<0.0000045	<0.0005	6.87	0.267	<0.00001	0.0122	<0.00005	<0.3	0.905	0.000068	1.92	<0.000005	0.315	0.0620	<0.000002	<0.00001	<0.0005	0.000858	0.000065	0.00187	<0.0001
25-May-12	117	225	7.24	296	124	*ND*	4.57	26.9	0.88	0.360	<0.05	<0.005	<0.005	<0.001	0.0413	*ND*	<0.005	0.00325	0.000094	0.00693	0.0618	<0.00001	<0.000005	<0.05	0.0000064	46.9	<0.0001	0.0000144	<0.00001	0.181	<0.0000045	<0.0005	7.50	0.284	<0.00001	0.0134	<0.00005	<0.3	1.02	<0.00004	2.37	<0.000005	0.391	0.0695	<0.000002	<0.00001	<0.0005	0.00101	0.000055	<0.0005	<0.0001
25-Jul-12	126	200	7.3	300	137	*ND*	4.33	26.4	2.31	0.338	<0.05	<0.005	<0.005	<0.001	0.0326	*ND*	<0.005	0.00377	0.000177	0.00726	0.0643	<0.00001	<0.000005	<0.05	<0.000005	47.6	<0.0001	0.0000260	<0.00001	0.211	0.0000052	<0.0005	7.74	0.296	<0.00001	0.0132	<0.00005	<0.3	0.963	0.000126	2.36	<0.000005	0.708	0.0751	<0.000002	<0.00001	<0.0005	0.000988	<0.0005	0.0163	<0.0001
12-Sep-12	133	200	7.22	311	143	183	4.74	26.7	1.20	0.349	<0.05	<0.005	<0.005	<0.001	0.0380	*ND*	<0.005	0.0031	0.00014	0.0107	0.0653	<0.00001	<0.000005	<0.05	<0.000005	58.1	<0.0001	<0.0001	<0.00001	0.257	<0.000005	<0.0005	9.08	0.311	<0.00001	0.0143	<0.00005	<0.05	1.19	<0.0001	2.42	<0.00001	0.447	0.0731	<0.00001	<0.00001	<0.0005	0.00110	<0.001	<0.001	*ND*
14-Nov-12	142	620	7.36	296.2	125	158	4.24	25.6	1.43	0.337	<0.05	<0.005	<0.005	<0.001	0.0375	*ND*	<0.01	0.00244	0.000170	0.00777	0.0610	<0.00001	<0.000005	<0.05	<0.000005	50.2	<0.0001	0.0000502	<0.00001	0.247	<0.000005	<0.0005	7.91	0.302	<0.00001	0.0131	<0.00005	<0.05	0.599	0.000196	2.33	<0.00001	0.442	0.0712	<0.00001	<0.00001	<0.0005	0.000951	<0.0005	0.0096	<0.0001
11-Jan-13	150	520	7.22	291.8	126	*ND*	3.93	24.8	1.41	0.290	<0.05	<0.005	<0.005	<0.001	0.0423	*ND*	<0.01	0.00371	0.000184	0.0118	0.0613	<0.00001	<0.000005	<0.05	<0.000005	49.4	<0.0001	0.000300	<0.00001	0.300	<0.000005	<0.0005	7.34	0.287	<0.00001	0.0135	<0.00005	<0.3	0.926	0.000116	2.44	<0.000005	0.480	0.0680	<0.000002	<0.00001	<0.0005	0.000966	<0.0005	0.0021	<0.0001

Calculated Production Rates for Sat Col 5 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk. ($CaCO_3$)	Hard. ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
25-Feb-10	0	209	*ND*	*ND*	*ND*	37	0.16	36	0.35	*ND*	*ND*	0.034	0.0013	0.00021	0.00021	13	*ND*	0.15	0.000067	0.000046	0.0012	0.000054	0.00042	0.0021	0.00060	12	0.000042	0.014	0.58	0.055	0.000017	*ND*	1.4	0.29	0.0000008	0.00042	0.0035	*ND*	0.48	0.0013	0.053	0.0000008	0.39	0.020	0.000011	0.00021	0.00021	0.0018	0.00021	0.028	0.000021
4-Mar-10	1	1463	5.9	*ND*	61	278	0.53	401	0.93	342	4.4	0.12	0.12	0.29	0.23	0.029	0.0059	0.0027	0.0011	0.0015	0.026	0.0021	0.0015	0.026	0.21	0.025	0.0015	0.015	18	2.4	0.00000028	0.00029

Leachate Data for Sat Col 6

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
25-Feb-10	0	205	*ND*	*ND*	*ND*	679	10.5	5600	19	*ND*	*ND*	0.60	0.07	<0.005	<0.005	2120	*ND*	961	<0.002	0.0078	0.008	0.0616	<0.004	<0.2	0.0147	105	0.217	2.8	165	97.7	<0.0008	*ND*	101	6.65	<0.00008	0.008	0.394	*ND*	<0.2	0.0815	6.42	0.00008	2.2	0.037	<0.0002	<0.02	<0.02	2.22	0.071	2.15	<0.002
4-Mar-10	1	1435	2.99	*ND*	*ND*	490	4.5	3700	<100	16.8	<10	0.229	<1	<0.2	2.49	*ND*	*ND*	523	<0.005	<0.005	0.011	0.034	<0.025	<5	0.00861	94	0.104	1.62	106	104	<0.025	<0.25	62.1	3.81	<0.00001	<0.0025	0.214	2.99	<4	0.053	12.9	<0.0005	<4	0.036	<0.005	<0.005	<0.02	1.12	<0.05	1.21	*ND*
11-Mar-10	2	1435	3.01	*ND*	*ND*	224	2.24	1580	6.8	6.82	<7.9	0.195	<0.05	<0.01	0.954	*ND*	*ND*	209	<0.005	<0.005	0.0095	<0.025	<0.025	<0.5	0.00392	45.5	0.033	0.695	46.7	63.2	<0.0025	<0.25	26.9	1.66	<0.00005	<0.0025	0.093	<1.5	<10	0.02	10.6	<0.0005	<10	0.0206	<0.005	<0.005	<0.05	0.438	<0.05	0.532	*ND*
18-Mar-10	3	1435	3.12	*ND*	*ND*	129	1.77	857	6.2	3.38	<4.3	0.127	<0.05	<0.01	0.0337	*ND*	*ND*	91.9	<0.005	<0.005	0.0098	<0.025	<0.025	<0.5	<0.0025	27.2	<0.025	0.342	24.3	48.5	<0.0025	<0.25	14.9	0.808	0.000014	<0.0025	0.042	0.61	<4	<0.05	10.1	<0.0005	<4	0.0211	<0.005	<0.005	<0.02	0.204	<0.05	0.268	*ND*
1-Apr-10	5	2870	3.02	457	*ND*	53.8	0.80	300	1.00	1.35	<1.5	0.149	<0.005	<0.001	0.135	*ND*	*ND*	32.1	<0.0005	0.00085	0.0162	0.0044	<0.0025	<0.5	0.000926	12.1	0.0045	0.137	11.0	31.2	<0.0025	<0.25	5.73	0.345	<0.00001	0.00029	0.183	<0.6	<4	<0.005	9.33	<0.00005	<4	0.0197	<0.0005	<0.0005	<0.02	0.0741	<0.005	0.131	*ND*
15-Apr-10	7	2870	3.39	262	*ND*	21.1	1.17	118	<0.5	0.681	<0.05	0.139	0.0091	<0.001	0.0477	*ND*	*ND*	7.82	<0.002	<0.002	0.0264	<0.01	<0.01	<0.2	0.00044	5.05	<0.01	0.0456	4.31	17.9	<0.001	<0.1	2.1	0.129	0.000058	<0.001	0.011	<3	<20	<0.02	7.59	<0.0002	<20	0.0174	<0.002	<0.002	<0.1	0.0247	<0.02	0.044	*ND*
29-Apr-10	9	2870	3.47	247	*ND*	6.9	0.61	71.6	<0.5	0.411	<0.05	0.126	0.0063	<0.001	0.0275	*ND*	*ND*	4.75	0.00012	0.00047	0.0327	0.00161	<0.0005	<0.01	0.000228	2.93	0.00083	0.0240	2.59	13.6	<0.00005	<0.05	1.08	0.0653	0.0000046	0.000134	0.00337	<0.3	<2	0.0017	7.60	<0.00001	<2	0.0177	<0.0001	<0.0001	<0.01	0.0148	<0.001	0.0393	*ND*
13-May-10	11	2598	3.57	207	*ND*	26.9	1.18	55.1	<0.5	0.294	<0.05	0.091	<0.001	<0.001	0.0310	*ND*	*ND*	2.74	0.00013	0.00049	0.0348	0.00107	<0.0005	<0.01	0.000160	2.15	0.00057	0.0146	1.68	12.1	<0.00005	<0.05	0.78	0.0414	<0.00005	0.000116	0.00249	<0.3	<2	0.0016	7.67	<0.00001	<2	0.0160	<0.0001	<0.0001	<0.01	0.0104	<0.001	0.0334	*ND*
27-May-10	13	2742	3.47	177.4	*ND*	5.8	<0.5	44.8	<0.5	0.219	<0.05	0.102	0.0055	<0.001	0.0063	*ND*	*ND*	2.18	0.00012	0.00034	0.0454	0.00095	<0.0005	<0.01	0.000135	1.51	<0.0005	0.0111	1.30	10.2	<0.00005	<0.05	0.48	0.0330	<0.00001	0.000214	0.00152	<0.3	<2	0.0013	7.07	<0.00001	<2	0.0176	<0.0001	<0.0002	<0.01	0.00815	<0.001	0.0281	*ND*
15-Jun-10	16	4027	3.54	148	*ND*	3.9	1.4	35.3	<0.5	0.156	<0.05	0.17	0.0054	<0.001	0.163	13	<0.01	1.7	0.00013	0.00100	0.0522	0.00077	<0.00005	<0.05	0.000121	1.03	0.0003	0.00772	0.989	8.32	0.000057	0.0026	0.32	0.0231	<0.00001	0.00019	0.00110	*ND*	0.17	0.00119	6.55	<0.00005	0.15	0.0170	0.000011	<0.00001	<0.0005	0.00632	0.0004	0.0255	<0.0001
29-Jun-10	18	2857	*ND*	*ND*	*ND*	3.3	0.7	*ND*	*ND*	*ND*	*ND*	0.11	*ND*	*ND*	*ND*	12	<0.01	1.36	0.00013	0.00103	0.0550	0.00067	<0.00005	<0.05	0.000109	0.89	0.0002	0.00654	0.813	7.92	0.000091	0.0022	0.26	0.0189	<0.00001	0.00017	0.00091	*ND*	0.17	0.00117	6.48	<0.00005	0.13	0.0168	0.000011	0.00001	<0.0005	0.00547	0.0003	0.0230	<0.0001
14-Jul-10	20	3092	3.46	126.1	*ND*	2.8	1.0	30.0	<0.5	0.120	<0.05	0.0517	<0.005	<0.001	0.162	12	<0.005	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
27-Jul-10	22	2656	3.46	122.2	*ND*	2.4	0.9	29.5	<0.5	0.146	<0.05	0.056	<0.005	<0.001	0.152	<10	0.007	1.12	0.00013	0.00095	0.0618	0.00056	<0.0005	<0.05	0.000075	0.65	0.0003	0.00501	0.589	6.87	0.000032	0.0022	0.20	0.0137	<0.00001	0.00012	0.00059	*ND*	0.19	0.00103	5.51	<0.00005	0.11	0.0164	0.000011	<0.00001	<0.0005	0.00485	0.0005	0.0212	<0.0001
10-Aug-10	24	2836	3.62	116.6	*ND*	2.2	0.6	31.6	<0.5	0.156	<0.05	0.0520	<0.005	<0.001	0.105	<10	<0.01	1	0.00012	0.00084	0.0628	0.00059	<0.0005	<0.05	0.000088	0.60	0.0002	0.00466	0.565	6.47	0.000010	0.0022	0.17	0.0121	<0.00001	0.00016	0.00061	*ND*	0.19	0.00100	5.35	<0.00005	0.10	0.0162	0.000011	<0.00001	<0.0005	0.00410	0.0003	0.0222	<0.0001
24-Aug-10	26	2870	3.53	108.3	*ND*	2.1	0.5	25.3	<0.5	0.107	<0.05	0.0482	<0.005	<0.001	0.114	<10	<0.03	0.824	0.00012	0.00081	0.0646	0.00059	<0.0005	<0.05	0.000077	0.57	0.0002	0.00442	0.523	5.97	<0.00005	0.0020	0.16	0.0109	<0.00001	0.00023	0.00060	*ND*	0.18	0.00099	5.53	<0.00005	0.09	0.0157	0.000010	<0.00001	<0.0005	0.00399	0.0003	0.0219	<0.0001
8-Sep-10	28	3109	3.66	104.7	*ND*	1.8	<0.5	22.4	<0.5	0.090	<0.05	0.0328	<0.005	<0.001	0.0864	<10	<0.005	0.745	0.00011	0.00069	0.0701	0.00047	<0.0005	<0.05	0.000072	0.50	<0.0001	0.00412	0.461	5.74	<0.00005	0.0017	0.12	0.00939	<0.00001	0.00006	0.00045	*ND*	0.19	0.00088	4.4	<0.00005	0.07	0.0152	0.000008	0.00002	<0.0005	0.00349	<0.0002	0.0189	<0.0001
21-Sep-10	30	2656	3.49	101.4	*ND*	1.7	<0.5	23.9	<0.5	0.104	<0.05	0.0453	<0.005	<0.001	0.0708	<10	0.03	0.737	0.00011	0.00058	0.0682	0.00045	<0.0005	<0.05	0.000068	0.48	0.0002	0.00370	0.404	5.39	<0.00005	0.0015	0.12	0.00864	<0.00001	0.00007	0.00061	*ND*	0.19	0.00081	4.52	<0.00005	0.07	0.0146	0.000010	<0.00001	<0.0005	0.00319	<0.0002	0.0183	<0.0001
5-Oct-10	32	2853	3.5	102.4	*ND*	1.5	<0.5	22.3	<0.5	0.096	<0.05	0.0426	<0.005	<0.001	0.0352	*ND*	<0.03	0.751	0.00005	0.00065	0.076	0.0004	<0.001	<0.05	0.00006	0.50	<0.001	0.0037	0.426	5.38	<0.0002	<0.005	0.11	0.008	0.00003	<0.001	<0.001	0.035	0.21	0.0008	4.69	<0.0002	0.08	0.014	<0.0005	<0.005	<0.005	0.0031	<0.005	0.0189	<0.0005
21-Oct-10	34	3297	3.51	98.2	*ND*	1.5	<0.5	21.5	<0.5	0.087	<0.05	0.0380	<0.005	<0.001	0.0402	<10	0.04	0.741	0.00011	0.00052	0.0754	0.00043	<0.0005	<0.05	0.000067	0.42	0.0002	0.00360	0.38	5	0.000008	0.0014	0.11	0.00762	<0.00001	0.00013	0.00040	*ND*	0.21	0.00083	4.06	<0.00005	0.07	0.0149	0.000010	<0.00001	<0.0005	0.00315	<0.0002	0.0190	<0.0001
2-Nov-10	36	2447	3.52	92.2	*ND*	1.5	0.5	20.2	<0.5	0.094	<0.05	0.0370	<0.005	<0.001	0.172	<10	<0.03	0.71	0.00011	0.00092	0.0766	0.00042	<0.0005	<0.05	0.000067	0.43	0.0002	0.00367	0.386	5.17	<0.00005	0.0015	0.11	0.00772	<0.00001	0.00020	0.00047	*ND*	0.24	0.00086	4.46	<0.00005	0.07	0.0147	0.000009	<0.00001	<0.0005	0.00306	<0.0002	0.0202	<0.0001
16-Nov-10	38	2705	3.56	92.9	*ND*	1.6	<0.5	19.9	<0.5	0.094	<0.05	0.0332	<0.005	<0.001	0.161	<10	0.005	0.701	0.00011	0.00092	0.0792	0.00043	<0.0005	<0.05	0.000070	0.46	0.0002	0.00366	0.373	5.38	0.000017	0.0015	0.10	0.00733	0.00001	0.00020	0.00046	*ND*	0.22	0.00082	4.35	<0.00005	0.07	0.0153	0.000009	<0.00001	<0.0005	0.00312	<0.0002	0.0207	<0.0001
30-Nov-10	40	2677	3.5	88.6	*ND*	1.4	<0.5	19.4	<0.5	0.089	<0.05	0.0329	<0.005	<0.001	0.150	<10	0.01	0.666	0.00011	0.00087	0.0806	0.00043	<0.0005	<0.05	0.000060	0.39	0.0002	0.00358	0.362	4.91	<0.00005	0.0014	0.09	0.00654	<0.00001	0.00019	0.00047	*ND*	0.22	0.00081	3.78	<0.00005	0.06	0.0149	0.000008	<0.00001	<0.0005	0.00303	0.0004	0.0190	<0.0001
6-Jan-11	45	2792	3.76	96.6	*ND*	*ND*	1.40	22.5	<0.5	0.084	<0.05	0.0394	<0.005	<0.001	0.0817	*ND*	<0.03	0.867	0.00010	0.00075	0.0766	0.00428	<0.0005	<0.05	0.000118	0.43	0.0002	0.00418	0.433	5.45	0.000063	0.0035	0.103	0.00784	<0.00001	0.00022	0.00092	0.00577	*ND*	0.264	0.00088	6.51	<0.00005	0.106	0.0157	0.000085	<0.00001	<0.0005	0.00318	<0.0002	0.0291	<0.0001
3-Feb-11	49	1070	3.56	102.6	*ND*	*ND*	1.24	23.9	<0.5	0.091	<0.05	0.0251	<0.005	<0.001	0.160	*ND*	<0.005	0.915	0.00012	0.00105	0.0704	0.00475	<0.0005	<0.05	0.0063	0.0000871	0.599	0.00022	0.00426	0.419	6.41	<0.00005	0.00301	0.107	0.00810	<0.00002	0.000115	0.00115	*ND*	0.324	0.00100	8.37	<0.00005	0.135	0.0163	0.0000075	<0.00001	<0.0005	0.00332	0.000272	0.0361	<0.0001
2-Mar-11	53	937	3.69	109.2	*ND*	*ND*	1.90	26.0	<0.5	0.080	<0.05	0.0225	<0.005	<0.001	0.192	*ND*	<0.005	0.972	0.00011	0.00105	0.0631	0.00524	<0.0005	0.0068	0.0000890	0.644	0.00021	0.00459	0.413	7.31	0.0000077	0.0037	0.116	0.00939	<0.00002	0.000111	0.000626	<0.3	0.263	0.00110	9.35	<0.00005	0.163	0.0180	0.0000090	<0.00001	<0.0005	0.00356	0.000337	0.0437	<0.0001
30-Mar-11	57	585	2.89	417	*ND*	*ND*	1.55	29.2	<0.5	0.086	<0.05	0.0467	<0.005	<0.001	0.0608	*ND*	<0.005	1.04	0.00011	0.00062	0.0620	0.00589	<0.0005	0.0086	0.000119	0.656	0.00023	0.00478	0.423	8.00	0.0000122	0.0048	0.133	0.0103	<0.00002	<0.00005	0.000607	<0.3	0.301	0.000990	11.9	<0.00005	0.204	0.0185	0.0000101	<0.00001	<0.0005	0.00345	0.000112	0.0524	<0.0001
24-Apr-11	61	642	3.39	136	*ND*	*ND*	0.29	6.1	0.085	0.027	0.085	0.0079	0.0085	0.0017	0.0251	*ND*	<0.005	0.18	0.00067	0.00053	0.0596	0.00047	<0.00005	0.0096	0.000119	0.613	0.00024	0.00504	0.427	9.00	0.0000650	0.0044	0.150	0.0107	<0.00002	<0.00005	0.000694	<0.3	0.313	0.000956	12.6	<0.00005	0.238	0.0187	0.0000114	<0.00001	<0.0005	0.00385	0.000116	0.0578	<0.0001
26-May-11	65	854	3.69	136.4	*ND*	*ND*	1.69	36.0	<0.5	0.160	<0.05	0.0465	<0.005	<0.001	0.0183	*ND*	<0.005	1.23	0.00039	0.00050	0.0556	0.00057	<0.00005	0.0098	0.000136	0.618	0.00023	0.00513	0.439	9.62	0.0000054	0.0060	0.604	0.0155	0.0112	<0.00002	0.000660	0.000675	<0.3	0.320	0.00107	14.7	<0.00005	0.252	0.0186	0.0000107	<0.00001	<0.0005	0.00311	0.000091	0.0633	<0.0001
23-Jun-11	69	720	3.53	151.2	*ND*	*ND*	1.58	38.2	1.16	0.179	<0.05	0.0598	<0.005	<0.001	0.0146	*ND*	<0.005	1.23	0.000040	0.000446	0.0542	0.000663	<0.00005	0.0104	0.000134	0.636	0.00025	0.00510	0.366	9.99	0.0000153	0.00644	0.155	0.0112	<0.00002	<0.00005	0.000722	<0.3	0.327	0.000977	12.8	<0.00005	0.271	0.0199	0.0000107	<0.00001	<0.0005	0.00426	0.000064	0.0618	<0.0001
21-Jul-11	73	701	3.63	144.6	*ND*	*ND*	1.59	38.9	<0.5	0.194	<0.05	0.0499	<0.005	<0.001	0.0069	*ND*	<0.005	1.27	0.000049	0.000444	0.0533	0.000653	<0.00005	0.0098	0.000132	0.611	0.00022	0.00513	0.329	10.5	<0.00005	0.00679	0.158	0.0117	<0.00002	<0.00005	0.000693	<0.3	0.336	0.000904	13.3	<0.00005	0.294	0.0205	0.0000108	<0.00001	<0.0005	0.00437	<0.0005	0.0641	<0.0001
18-Aug-11	77	826	3.67	145.4	*ND*	*ND*	1.45	37.0	<0.5	0.179	<0.05	0.040	<0.005	<0.001	0.0036	*ND*	<0.005	1.32	<0.00002	0.000350	0.0550	0.000694	<0.00005	0.0114	0.000138	0.589	0.00026	0.00495	0.293	10.7	<0.00005	0.00709	0.163	0.0117	<0.00002	<0.00005	0.000698	<0.3	0.362	0.000882	14.0	<0.00005	0.282	0.0182	0.0000116	<0.00001	<0.0005	0.00412	<0.0005	0.0652	<0.0001
2-Sep-11	79	1440	3.4	185.6	*ND*	*ND*	1.62	41.3	1.29	0.293	<0.05	0.0638	<0.005	<0.001	0.0026	*ND*	<0.02	3.23	<0.00002	0.000138	0.0510	0.001272	<0.00005	0.0076	0.000220	0.880	0.00043	0.00513	0.329	11.4	0.0000075	0.00548	0.232	0.0160	<0.00005	<0.00005	0.00135	<0.3	0.458	0.000241	19.5	<0.00005	0.244	0.0265	0.0000156	<0.00001	<0.0005	0.00510	0.000160	0.0244	0.0265	0.00156
15-Sep-11	81	1271	3.43	194.7	*ND*	*ND*	1.37	47.7	<0.5	0.301	<0.05	0.0604	<0.005	<0.001	<0.002	*ND*	<0.005	3.06	<0.00002	0.000127	0.0480	0.00114	<0.00005	0.0079	0.000233	0.843	0.00044	0.00951	1.48	6.10	0.000126	0.00515	0.289	0.0174	<0.00002	<0.00005	0.00133	<0.3	0.507	0.00225	10.2	<0.00005	0.253	0.0253	0.0000153	<0.00001	<0.0005	0.00531	0.000931	0.0766	<0.0001
13-Oct-11	85	1697	3.4	154	*ND*	*ND*	0.33	14	0.17	0.070	0.017	0.016	0.0017	0.0034	0.040	*ND*	0.0017	0.63	0.00036	0.00019	0.017	0.0028	0.00001	0.0026	0.00057	22	0.00013	0.0020	0.31	3.1	0.00000036	0.0012	0.060	0.0042	0.0000068	0.000034	0.00031	0.10	0.14	0.00058	3.0	0.0000017	0.058	0.0066	0.0000040	0.00000054	0.00017	0.0022	0.00079	0.020	0.000034
10-Nov-11	89	856	3.5	148	*ND*	*ND*	0.16	6.7	0.086	0.031	0.0086	0.0071	0.00086	0.00017	0.026	*ND*	0.00086	0.30	0.000019	0.00013	0.0093	0.00013	0.00000086	0.0013	0.000028	0.10	0.0000056	0.00098	0.13	1.7	0.00000086	0.00067	0.029	0.0020	0.0000017	0.000016	0.00013	0.051	0.071	0.00024	1.7	<0.00000086	0.032	0.0032	0.0000020	0.0000017	0.000086	0.00099	0.000063	0.011	0.000017
8-Dec-11	93	1052	3.4	145	*ND*	*ND*	0.17	8.2	0.11	0.037	0.011	0.0071	0.0011	0.00021	0.032	*ND*	0.0011	0.35	0.00023	0.00016	0.010	0.00016	0.0000011	0.0017	0.000032	0.12	0.00063	0.0011	0.13	2.1	0.0000011	0.00094	0.033	0.0023	0.0000021	0.000022	0.00015	0.063	0.080	0.00026	2.4	0.0000011	0.043	0.0037	0.0000025	0.0000021	0.00011	0.0011	0.000087	0.013	0.000021
5-Jan-12	97	1368	3.3	139	*ND*	*ND*	0.31	11	0.14	0.050	0.014	0.0098	0.0014	0.00027	0.040	*ND*	0.0014	0.40	0.000032	0.00021	0.014	0.00019	0.0000014	0.0022	0.000040	0.14	0.000077	0.0014	0.14	2.9	0.0000014	0.0012	0.042	0.0030	0.0000027	0.000026	0.00021	0.082	0.10	0.00025	3.0	0.0000014	0.059	0.0046	0.0000028	0.0000027	0.00014	0.0013	0.00011	0.016	0.000027
2-Mar-12	105	160	3.1	150	*ND*	*ND*	0.033	1.3	0.016	0.0052	0.0016	0.0016	0.00032	0.0047	*ND*	*ND*	0.00018	0.052	0.0000036	0.000024	0.0015	0.0000023	0.00000016	0.00028	0.0000052	0.019	0.0000080	0.00017	0.017	0.39	0.00000016	0.00017	0.0055	0.00038	0.0000032	0.0000029	0.00025	0.0096	0.012	0.00031	0.41	0.00000016	0.0086	0.00058	0.0000031	0.0000032	0.00016	0.00016	0.00015	0.0026	0.0000032
8-Jun-12	119	200	2.9	169	*ND*	*ND*	0.041	1.9	0.020	0.0088	0.0020	0.0018	0.00020	0.00040	0.0070	*ND*	0.00020	0.072	0.0000047	0.00039	0.0018	0.0000033	0.00000020	0.00052	0.0000076	0.027	0.00010	0.00022	0.017	0.56	0.00000020	0.00036	0.0079	0.0054	0.00000040	0.00000038	0.00031	0.012	0.016	0.00040	0.69	0.00000020	0.015	0.00076	0.00000052	0.00000040	0.00020	0.00022	0.00025	0.0042	0.0000040
25-Jul-12	126	220	3.7	178	*ND*	*ND*	0.071	2.3	0.022	0.0091	0.0022	0.0019	0.00022	0.000044	0.0076	*ND*	0.00022	0.081	0.0000053	0.000060	0.0018	0.0000036	0.00000022	0.00053	0.0000084	0.031	0.00016	0.00025	0.015	0.68	0.00000024	0.00044	0.0092	0.00062	0.00000044	0.00000052	0.00037	0.013	0.019	0.00041	0.80	0.00000022	0.021	0.00079	0.00000051	0.00000044	0.00022	0.00025	0.00041	0.0048	0.0000044
12-Sep-12	133	250	3.5	183	*ND*	*ND*	0.16	0.076	2.8	0.025	0.011	0.0025	0.0023	0.00025	0.00050	0.0084	*ND*	0.00025	0.099	0.0000065	0.00093	0.021	0.00045	0.00025	0.00070	0.00011	0.041	0.00017	0.00028	0.015	0.94	0.00000025	0.00058	0.013	0.0075	0.00000050	0.0000057	0.00040	0.0098	0.026	0.00055	0.96	0.00000050	0.026	0.00094	0.00000160	0.00050	0.00050	0.00032	0.00050	0.0057	*ND*
14-Nov-12	142	750	3.5	180	*ND*	0.43	0.21	7.8	0.075	0.027	0.0075	0.0053	0.00075	0.00015	0.023	*ND*	0.0015	0.27	0.000017	0.00037	0.0058	0.00012	0.00000075	0.0019	0.000030	0.11	0.000050	0.00078	0.031	2.5	0.00000075	0.0016	0.035	0.0023	0.00000015	0.000020	0.00013	0.027	0.069	0.00013	2.7	0.00000075	0.077	0.0025	0.00000017	0.00000015	0.00075	0.00085	0.00015	0.014	0.000015
11-Jan-13	150	595	3.2	176	*ND*	*ND*	0.61	0.060	0.021	0.0060	0.0045	0.00060	0.00012	0.021	0.00024	*ND*	0.0012	0.21	0.000014	0.00034	0.0047	0.00091	0.00000060	0.0015	0.000024	0.088	0.00036	0.00060	0.019	2.0	0.00000060	0.0012	0.027	0.0018	0.00000012	0.000017	0.00098	0.036	0.048	0.00093	2.0	0.00000060	0.064	0.0021	0.00000013	0.00000012	0.00060	0.00063	0.00012	0.014	0.000012

Calculated Production Rates for Sat Col 6 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
25-Feb-10	0	205	*ND*	*ND*	*ND*	28	0.43	230	0.78	*ND*	*ND*	0.025	0.0029	0.00021	0.00021	87	*ND*	39	0.000082	0.00032	0.00033	0.0025	0.00016	0.0082	0

Leachate Data for Sat Col 7

Collection Date	Cycle (week)	Output Vol. mL	pH-L	Cond-L uS/cm	T-Alk. ($CaCO_3$) mg/L	Hard. ($CaCO_3$) mg/L	DOC mg/L	SO_4 mg/L	D-Cl mg/L	D-F mg/L	D-Br mg/L	NH_3 mg/L	NO_3-N mg/L	NO_2-N mg/L	Total D-PO_4 mg/L	D-S mg/L	D-S_2 mg/L	D-Al mg/L	D-Sb mg/L	D-As mg/L	D-Ba mg/L	D-Be mg/L	D-Bi mg/L	D-B mg/L	D-Cd mg/L	D-Ca mg/L	D-Cr mg/L	D-Co mg/L	D-Cu mg/L	D-Fe mg/L	D-Pb mg/L	D-Li mg/L	D-Mg mg/L	D-Mn mg/L	D-Hg mg/L	D-Mo mg/L	D-Ni mg/L	D-P mg/L	D-K mg/L	D-Se mg/L	D-Si mg/L	D-Ag mg/L	D-Na mg/L	D-Sr mg/L	D-Ti mg/L	D-Sn mg/L	D-Ti mg/L	D-U mg/L	D-V mg/L	D-Zn mg/L	D-Zr mg/L
25-Feb-10	0	205	*ND*	*ND*	*ND*	1710	3.5	1660	18	*ND*	*ND*	1.8	0.09	<0.005	<0.005	611	*ND*	0.008	0.0016	0.0008	0.029	<0.0001	<0.001	<0.05	0.00045	607	<0.001	0.0028	0.0130	0.007	0.0004	*ND*	46.8	0.646	<0.00002	0.02	0.009	*ND*	29.5	0.0080	2.01	<0.00002	27.0	3.57	0.00014	<0.005	<0.005	0.0701	<0.005	0.005	<0.0005
4-Mar-10	1	1435	6.21	*ND*	95	1750	2.74	1660	19	0.68	<1	1.54	<0.1	0.023	<0.01	*ND*	*ND*	<0.01	0.0022	0.0012	0.023	<0.005	<0.005	<0.1	0.00033	601	<0.005	0.0024	0.0014	<0.06	<0.0005	<0.05	64.1	0.762	<0.00001	0.0131	<0.005	<0.6	31	<0.01	3.8	<0.0001	29.9	5.4	<0.001	<0.001	<0.02	0.268	<0.01	<0.01	*ND*
11-Mar-10	2	1435	6.4	*ND*	110	1690	2.34	1620	10.3	0.76	<0.1	1.43	<0.05	<0.01	<0.002	*ND*	*ND*	0.022	0.0017	<0.001	0.0198	<0.005	<0.005	<0.1	<0.00017	594	<0.005	0.0015	0.0058	<0.15	<0.0005	<0.05	50.9	0.66	<0.00005	0.0107	<0.005	<1.5	27	0.0058	4.03	<0.0001	22	5.05	<0.001	<0.001	<0.05	0.271	<0.01	<0.01	*ND*
18-Mar-10	3	1435	7.25	*ND*	107	1590	1.98	1580	17	<0.4	<7.9	1.28	<0.1	<0.02	<0.01	*ND*	*ND*	<0.005	0.0014	0.00073	0.0194	<0.0025	<0.0025	<0.05	<0.00025	567	<0.0025	0.00078	<0.0005	<0.06	<0.00025	<0.025	43.1	0.523	<0.00001	0.0092	<0.0025	<0.6	23.3	<0.005	4.01	<0.00005	16.7	4.66	<0.0005	<0.0005	<0.02	0.252	<0.005	<0.005	*ND*
1-Apr-10	5	2870	7.05	1734	131	1630	1.12	1520	5.2	0.82	<7.6	0.930	<0.05	<0.01	<0.002	*ND*	*ND*	<0.01	0.0012	<0.001	0.0189	<0.005	<0.005	<0.1	<0.00017	598	<0.005	<0.001	<0.001	<0.06	<0.0005	<0.05	32.7	0.507	<0.00001	0.00712	<0.005	<0.6	18.1	<0.01	3.90	<0.0001	10.3	4.73	<0.001	<0.001	<0.02	0.258	<0.01	<0.01	*ND*
15-Apr-10	7	2870	7.29	1762	111	1500	2.10	1410	<5	0.80	<0.5	0.546	<0.05	<0.01	<0.002	*ND*	*ND*	<0.02	<0.002	<0.002	0.0167	<0.01	<0.01	<0.2	<0.00034	562	<0.01	<0.002	<0.002	<0.15	<0.001	<0.1	24.2	0.370	<0.00001	0.0052	<0.01	<1.5	13	<0.02	3.63	<0.0002	<10	3.86	<0.002	<0.002	<0.05	0.221	<0.02	<0.02	*ND*
29-Apr-10	9	2870	7.31	2127	86	1440	0.66	1370	<5	0.76	<0.5	0.460	<0.05	<0.01	<0.002	*ND*	*ND*	<0.01	<0.001	0.0012	0.0193	<0.005	<0.005	<0.1	<0.00017	554	<0.005	<0.001	<0.001	<0.03	<0.0005	<0.05	18.8	0.375	<0.00001	0.00548	<0.005	<0.3	10.5	<0.01	3.49	<0.0001	3.0	3.93	<0.001	<0.001	0.010	0.190	<0.01	<0.01	*ND*
13-May-10	11	2998	7.44	2074	79	1390	0.63	1270	<5	0.62	<0.5	0.290	<0.05	<0.01	<0.002	*ND*	*ND*	<0.005	<0.0005	0.00112	0.0144	<0.0025	<0.0025	<0.05	<0.00025	530	<0.0025	<0.0005	<0.0005	0.035	<0.00025	<0.025	16.6	0.259	<0.00005	0.00434	<0.0025	<0.3	8.9	<0.005	3.24	<0.00005	2.1	2.69	<0.0005	<0.0005	<0.01	0.151	<0.005	<0.005	*ND*
27-May-10	13	2742	7.36	1970	80	1260	<0.5	1220	<5	0.63	<0.5	0.272	0.056	<0.01	<0.002	*ND*	*ND*	<0.005	<0.0005	0.00178	0.0181	<0.0025	<0.0025	<0.05	<0.0000985	483	<0.0025	<0.0005	<0.0005	<0.03	<0.00025	<0.025	13.7	0.306	<0.00001	0.00483	<0.0025	<0.3	7.5	<0.005	3.33	<0.00005	<2	3.15	<0.0005	<0.0005	0.018	0.154	<0.005	<0.005	*ND*
15-Jun-10	16	4027	7.38	1788	79	1040	<0.5	1050	<5	0.49	<0.5	0.22	<0.05	<0.01	<0.002	366	0.02	0.007	0.0003	0.0022	0.0166	<0.00005	<0.00003	<0.3	0.00006	399	<0.0005	0.00014	<0.0003	0.184	<0.00003	<0.003	10.6	0.259	<0.00005	0.0045	0.0003	*ND*	5.5	<0.0002	3.27	<0.00003	0.9	2.77	<0.00001	<0.00005	<0.003	0.122	<0.001	0.0023	<0.0005
29-Jun-10	18	2857	*ND*	*ND*	*ND*	1020	<0.5	*ND*	*ND*	*ND*	*ND*	0.12	*ND*	*ND*	*ND*	297	<0.01	0.008	0.0003	0.0022	0.0167	<0.00005	<0.00003	<0.3	<0.00003	392	<0.0005	0.00014	0.0003	0.149	0.00020	<0.003	9.5	0.244	<0.00005	0.0040	0.0001	*ND*	4.8	<0.0002	3.08	<0.00003	0.7	2.6	<0.00001	0.00009	<0.003	0.11	<0.001	0.0006	<0.0005
14-Jul-10	20	3092	7.39	1561	72	1150	0.9	876	<0.5	0.524	<0.07	0.108	<0.005	<0.001	<0.002	410	0.005	0.005	0.0003	0.0023	0.0207	<0.00005	<0.00003	<0.3	<0.00003	444	<0.0005	0.00011	<0.0003	0.118	<0.00003	<0.003	10.6	0.282	<0.00005	0.0048	0.0006	*ND*	5.6	<0.0002	3.78	<0.00003	0.8	2.89	<0.00001	<0.00005	<0.003	0.108	<0.001	0.0016	<0.0005
27-Jul-10	22	2656	7.34	1485	72	859	0.9	818	<5	0.52	<0.5	0.075	<0.05	<0.01	<0.002	290	<0.005	0.004	0.0002	0.0016	0.0169	<0.00005	<0.00003	<0.3	<0.00003	331	<0.0005	0.00008	<0.0003	0.066	<0.00003	<0.003	7.9	0.203	<0.00005	0.0037	<0.0001	*ND*	3.9	<0.0002	2.93	<0.00003	0.5	2.21	<0.00001	<0.00005	<0.003	0.0864	<0.001	<0.0005	<0.0005
10-Aug-10	24	2836	7.37	1388	65	832	<0.5	851	<5	0.53	<0.5	0.0689	0.065	<0.01	<0.002	271	<0.01	0.0030	0.00018	0.00158	0.0159	<0.00001	<0.000005	<0.05	<0.000005	322	<0.0001	0.000090	0.00009	0.055	<0.000005	<0.0005	6.60	0.2	<0.00001	0.00416	0.00011	*ND*	3.70	<0.00004	2.56	<0.000005	0.47	2.37	0.000004	0.00004	0.0009	0.0769	<0.0002	0.0011	<0.0001
24-Aug-10	26	2870	7.48	1303	66	813	<0.5	687	<5	0.41	<0.5	0.0529	0.080	<0.01	<0.002	268	<0.03	0.0026	0.00015	0.00149	0.0161	<0.00001	<0.000005	<0.05	<0.000005	314	<0.0001	0.000079	0.00009	0.049	<0.000005	0.0012	6.79	0.198	<0.00001	0.00408	0.00012	*ND*	3.51	<0.00004	2.81	<0.000005	0.47	2.12	0.000002	0.00001	<0.0005	0.0732	<0.0002	0.0002	<0.0001
8-Sep-10	28	3109	7.48	1249	78	718	<0.5	637	<5	0.49	<0.5	0.0423	<0.05	<0.01	<0.002	218	<0.005	0.0027	0.00013	0.00140	0.0167	<0.00001	<0.000005	<0.05	<0.000005	278	<0.0001	0.000046	0.00011	0.05	<0.000005	0.0011	5.49	0.171	<0.00001	0.00394	<0.00002	*ND*	2.86	<0.00004	2.34	<0.000005	0.35	2.03	<0.000002	0.00001	<0.0005	0.0667	<0.0002	0.0001	<0.0001
21-Sep-10	30	2656	7.53	1122	77	651	0.5	582	<10	0.43	<1	0.0376	<0.1	<0.02	<0.002	192	<0.01	0.0026	0.00014	0.00117	0.0161	<0.00001	<0.000005	<0.05	<0.000005	253	<0.0001	0.000046	0.00015	0.034	<0.000005	0.0011	4.85	0.152	<0.00001	0.00368	0.00015	*ND*	2.57	<0.00004	2.25	<0.000005	0.32	1.74	<0.000002	0.00001	<0.0005	0.0520	<0.0002	0.0003	<0.0001
21-Oct-10	34	6150	7.06	1222	59	709	<0.5	619	<5	0.41	<0.5	<0.005	0.060	<0.01	<0.002	244	<0.03	0.0046	0.00063	0.00144	0.0170	<0.00001	<0.000005	<0.05	0.0000065	274	<0.0001	0.000422	0.00012	0.023	0.000013	0.0012	6.28	0.177	<0.00001	0.00369	0.00035	*ND*	3.23	0.00015	2.37	<0.000005	0.39	2.19	0.000051	0.00001	<0.0005	0.0653	<0.0002	0.0177	<0.0001
2-Nov-10	36	2447	7.32	1086	65	628	0.6	537	<5	0.46	<0.5	0.0166	<0.05	<0.01	<0.002	207	<0.03	0.0037	0.00021	0.00163	0.0166	<0.00001	<0.000005	<0.05	<0.000005	243	<0.0001	0.000212	0.00014	0.062	0.000012	0.0011	5.52	0.165	<0.00001	0.00335	0.00011	*ND*	2.70	<0.00004	2.29	<0.000005	0.33	1.84	0.000011	<0.00001	<0.0005	0.0520	<0.0002	0.0053	<0.0001
16-Nov-10	38	2740	7.34	988	64	593	<0.5	477	<5	0.47	<0.5	0.0206	<0.05	<0.01	<0.002	189	<0.005	0.0036	0.00015	0.00186	0.0172	<0.00001	<0.000005	<0.05	0.0000099	229	<0.0001	0.000112	0.00013	0.102	0.000037	0.0011	5.23	0.163	0.00002	0.00361	0.00010	*ND*	2.53	<0.00004	2.41	<0.000005	0.31	1.8	0.000004	<0.00001	<0.0005	0.0427	<0.0002	0.0015	<0.0001
30-Nov-10	40	2720	7.34	896	64	495	<0.5	427	<5	0.45	<0.5	0.0105	<0.05	<0.01	<0.002	156	<0.01	0.0031	0.00011	0.00160	0.0167	<0.00001	<0.000005	<0.05	0.0000095	191	<0.0001	0.000051	0.00006	0.041	0.000005	0.0010	4.62	0.139	<0.00001	0.00362	0.00006	*ND*	2.17	<0.00004	2.07	<0.000005	0.27	1.65	0.000002	<0.00001	<0.0005	0.0368	<0.0002	0.0004	<0.0001
6-Jan-11	48	7276	7.31	694	53	*ND*	0.73	293	<0.5	0.426	<0.07	<0.005	<0.005	<0.001	<0.002	73	<0.005	0.00333	0.00071	0.00154	0.0190	<0.00001	<0.000005	<0.05	<0.000005	136	<0.0001	0.000026	0.00006	0.0269	0.000076	<0.0005	3.38	0.102	<0.00001	0.00264	0.00009	*ND*	1.71	<0.00004	1.88	<0.000005	0.200	1.26	<0.000002	<0.00001	<0.0005	0.0206	<0.0002	0.00079	<0.0001
3-Feb-11	49	5600	7.31	683	90	*ND*	0.57	281	<0.5	0.403	<0.05	0.0086	<0.005	<0.001	<0.002	73	<0.005	0.00433	0.00073	0.000731	0.0222	<0.00001	<0.000005	<0.05	0.0000230	138	<0.0001	0.000197	<0.0001	0.0621	0.000062	0.00060	4.29	0.0916	<0.00001	0.00352	0.00016	*ND*	1.89	0.00013	1.78	<0.000005	0.227	1.53	0.0000308	<0.00001	<0.0005	0.0382	0.000084	0.00565	<0.0001
2-Mar-11	53	4426	7.66	605	76	*ND*	1.89	186	<0.5	0.402	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.100	0.000218	0.00115	0.0240	<0.00001	<0.000005	<0.05	0.0000067	94.1	<0.0001	0.0000818	0.00038	0.0061	0.0000287	0.00071	3.21	0.0859	<0.00002	0.00319	0.000066	<0.3	1.55	<0.00004	1.65	<0.000005	0.235	1.10	0.0000040	0.000012	<0.0005	0.0202	<0.00005	0.00223	<0.0001
30-Mar-11	57	666	7.47	669	77	*ND*	1.57	212	<0.5	0.375	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00372	0.00097	0.00151	0.0251	<0.00001	0.0000064	<0.005	0.0000098	109	0.00268	0.000108	0.00092	0.0393	0.000120	0.00069	3.89	0.112	<0.00002	0.00382	0.000153	<0.3	1.79	<0.00004	2.06	<0.000005	0.243	1.25	<0.000002	0.000066	<0.0005	0.0213	0.000687	0.00140	<0.0001
24-Apr-11	61	618	7.43	652	94	*ND*	2.14	274	<0.5	0.461	<0.05	0.0051	<0.005	<0.001	<0.002	*ND*	<0.005	0.00410	0.00052	0.00170	0.0247	<0.00001	<0.000005	<0.05	0.0000057	125	<0.0001	0.0000588	<0.0001	0.0262	0.0000291	0.00090	4.85	0.142	<0.00002	0.00305	<0.00005	<0.3	1.93	<0.00004	2.39	<0.000005	0.304	1.51	<0.000002	<0.00001	<0.0005	0.0278	<0.00005	0.00289	<0.0001
26-May-11	65	823	7.6	714	87	*ND*	2.40	287	<0.5	0.437	<0.05	0.0100	<0.005	<0.001	<0.002	*ND*	<0.005	0.00256	0.00053	0.00176	0.0271	<0.00001	<0.000005	<0.05	0.0000092	148	<0.0001	0.0000341	0.00010	0.0294	0.0000157	<0.0005	5.75	0.171	<0.00002	0.00288	<0.00005	<0.3	2.07	<0.00004	2.67	<0.000005	0.349	1.65	<0.000002	<0.00001	<0.0005	0.0362	<0.00005	0.00362	<0.0001
23-Jun-11	69	695	7.4	766	90	*ND*	2.75	333	<2.5	0.46	<0.25	0.0095	<0.025	<0.005	<0.002	*ND*	<0.005	0.00222	0.00057	0.00159	0.0209	<0.00001	<0.000005	<0.05	<0.000005	149	<0.0001	0.0000215	0.00011	0.0564	0.0000143	<0.0005	5.50	0.190	<0.00002	0.00280	<0.00005	<0.3	2.12	<0.00004	2.79	<0.000005	0.410	1.98	<0.000002	<0.00001	<0.0005	0.0342	<0.00005	0.00193	<0.0001
21-Jul-11	73	701	7.46	797	101	*ND*	2.68	328	0.67	0.473	<0.05	0.0061	<0.005	<0.001	<0.002	*ND*	<0.005	0.00129	0.000054	0.00165	0.0203	<0.00001	<0.000005	<0.05	<0.000005	156	<0.0001	0.0000097	<0.0001	0.126	0.0000062	0.00081	5.73	0.218	<0.00002	0.00283	<0.00005	<0.3	2.14	<0.00004	2.98	<0.000005	0.464	2.10	<0.000002	<0.00001	<0.0005	0.0337	<0.00005	0.00284	<0.0001
18-Aug-11	77	807	7.4	778	102	*ND*	2.66	323	<2.5	0.49	<0.25	<0.025	<0.025	<0.005	<0.002	*ND*	<0.005	0.00113	<0.00002	0.00155	0.0201	<0.00001	<0.000005	0.0052	<0.000005	157	<0.0001	0.0000122	<0.0001	0.0987	<0.000005	0.00100	5.74	0.231	<0.00002	0.00291	<0.00005	<0.3	2.24	<0.00004	3.11	<0.000005	0.505	2.13	<0.000002	<0.00001	<0.0005	0.0316	<0.00005	0.00296	<0.0001
2-Sep-11	79	1296	*ND*	*ND*	*ND*	*ND*	*ND*	151	3.52	0.526	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00185	0.000471	0.000368	0.0254	<0.00001	<0.000005	<0.05	0.0000271	87.8	<0.0001	0.000149	<0.0001	0.0289	<0.000005	<0.0005	3.71	0.0931	<0.00005	0.00285	0.000119	<0.3	1.68	0.0002387	1.67	<0.000005	0.296	1.31	0.0000273	<0.00001	<0.0005	0.0368	<0.00005	0.00262	<0.0001
15-Sep-11	81	1083	7.43	494	98	*ND*	1.19	151	1.24	0.555	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00162	0.00014	0.000491	0.0256	<0.00001	<0.000005	<0.05	0.0000219	89.7	<0.0001	0.000190	<0.0001	0.0294	0.000107	0.00094	4.51	0.121	<0.00002	0.00258	0.000080	<0.3	1.96	0.0001107	1.88	<0.000005	0.360	1.38	0.0000288	<0.00001	<0.0005	0.0393	<0.00005	0.00155	<0.0001
13-Oct-11	85	1320	7.44	457	106	*ND*	1.49	129	<0.5	0.557	<0.05	0.0071	0.0106	<0.001	<0.002	*ND*	<0.005	0.00244	0.00023	0.00104	0.0318	<0.00001	<0.000005	<0.05	<0.000005	85.6	<0.0001	0.0000947	0.00022	0.0167	0.0000116	<0.0005	4.22	0.103	<0.00002	0.00257	0.000076	<0.3	1.83	<0.00004	2.15	<0.000005	0.327	1.27	0.0000067	<0.00001	<0.0005	0.0298	<0.00005	0.00063	<0.0001
8-Dec-11	93	1372	7.36	490	121	*ND*	1.40	137	<0.5	0.527	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00248	<0.00002	0.00155	0.0325	<0.00001	<0.000005	<0.05	<0.000005	93.7	<0.0001	0.0000539	<0.0001	0.0321	0.0000054	0.00096	4.56	0.143	<0.00001	0.00239	0.000099	<0.3	1.75	<0.00004	2.54	<0.000005	0.386	1.54	0.0000028	<0.00001	<0.0005	0.0277	<0.00005	0.00058	<0.0001
5-Jan-12	97	1153	7.18	507	124	*ND*	1.85	144	1.33	0.519	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00124	<0.00002	0.00172	0.0317	<0.00001	<0.000005	<0.05	<0.000005	98.9	<0.0001	0.0000192	<0.0001	0.0691	<0.000005	0.00072	4.92	0.169	<0.00001	0.00227	<0.00005	<0.3	1.78	<0.00004	2.52	0.0000060	0.403	1.52	<0.000002	<0.00001	<0.0005	0.0234	<0.00005	<0.0005	<0.0001
2-Mar-12	105	200	7.13	542	136	*ND*	1.52	151	<0.5	0.536	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00204	<0.00002	0.00177	0.0306	<0.00001	<0.000005	<0.05	<0.000005	100	<0.0001	0.0000102	<0.0001	0.291	<0.000005	0.00091	5.15	0.199	<0.00001	0.00286	<0.00005	<0.3	1.79	<0.00004	2.87	<0.000005	0.454	1.68	<0.000002	<0.00001	<0.0005	0.0227	<0.00005	0.00187	<0.0001
25-May-12	117	225	7.43	586	133	*ND*	2.81	170	0.53	0.554	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	0.0070	0.00100	<0.00002	0.00204	0.0335	0.00061	0.0000202	<0.0001	0.0000102	111	<0.0001	0.0000126	<0.0001	0.423	0.0000060	0.00147	5.61	0.230	<0.00001	0.00384	<0.00005	<0.3	2.05	0.0000242	3.41	<0.000005	0.554	1.92	0.0000402	<0.00001	<0.0005	0.0152	<0.00005	0.00202	<0.0001
25-Jul-12	126	150	7.53	629	138	*ND*	1.93	192	0.70	0.559	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.005	0.00107	<0.00002	0.00145	0.0286	<0.00001	<0.000005	<0.05	0.0000150	122	<0.0001	0.0000097	<0.0001	0.217	0.0000055	0.00130	6.06	0.242	<0.00001	0.00424	<0.00005	<0.3	2.09	<0.00004	3.47	<0.000005	0.899	2.33	<0.000002	<0.00001	<0.0005	0.0120	<0.00005	0.0154	<0.0001
12-Sep-12	133	180	7.46	653	152	388	1.84	205	0.77	0.568	<0.05	<0.005	0.0060	<0.001	<0.002	*ND*	<0.005	<0.001	<0.0001	0.00117	0.0276	<0.0001	<0.0005	<0.01	<0.00001	143	<0.0001	<0.0001	<0.0002	0.315	<0.00005	0.00172	7.35	0.255	<0.00001	0.00472	<0.0005	<0.05	2.73	<0.0001	3.73	<0.00001	0.689	2.37	<0.00001	<0.0001	<0.01	0.00980	<0.001	<0.001	*ND*
14-Nov-12	142	600	7.51	661	139	355	1.97	209	0.97	0.541	<0.05	<0.005	<0.005	<0.001	<0.002	*ND*	<0.01	<0.0005	<0.00002	0.000711	0.0251	<0.00001	<0.000005	0.0056	<0.000005	132	<0.0001	0.0000071	<0.0001	0.231	0.0000095	0.00161	6.51	0.255	<0.00001	0.00445	<0.0005	<0.05	2.25	<0.0004	3.58	<0.00005	0.738	2.47	<0.000002	<0.00001	<0.0005	0.00865	<0.00005	<0.0005	<0.0001
11-Jan-13	150	560	7.28	650	146	*ND*	1.90	207	<2.5	0.49	<0.25	<0.005	<0.025	<0.005	<0.002	*ND*	<0.01	0.00329	<0.00002	0.000538	0.0239	<0.00001	<0.000005	0.0061	<0.000005	127	<0.0001	0.0000071	<0.0001	0.400	<0.000005	0.00143	6.36	0.245	<0.00001	0.00437	<0.0005	<0.3	2.11	<0.00004	3.75	<0.000005	0.829	2.47	<0.000002	<0.00001	<0.0005	0.00748	<0.00005	<0.0005	<0.0001

Calculated Production Rates for Sat Col 7 (mg/kg/wk)

Collection Date	Cycle	Output Vol. mL	pH-L	Cond-L uS/cm	T-Alk. ($CaCO_3$) mg/kg	Hard. ($CaCO_3$) mg/kg	DOC mg/kg	SO_4 mg/kg	D-Cl mg/kg	D-F mg/kg	D-Br mg/kg	NH_3 mg/kg	NO_3-N mg/kg	NO_2-N mg/kg	Total D-PO_4 mg/kg	D-S mg/kg	D-S_2 mg/kg	D-Al mg/kg	D-Sb mg/kg	D-As mg/kg	D-Ba mg/kg	D-Be mg/kg	D-Bi mg/kg	D-B mg/kg	D-Cd mg/kg	D-Ca mg/kg	D-Cr mg/kg	D-Co mg/kg	D-Cu mg/kg	D-Fe mg/kg	D-Pb mg/kg	D-Li mg/kg	D-Mg mg/kg	D-Mn mg/kg	D-Hg mg/kg	D-Mo mg/kg	D-Ni mg/kg	D-P mg/kg	D-K mg/kg	D-Se mg/kg	D-Si mg/kg	D-Ag mg/kg	D-Na mg/kg	D-Sr mg/kg	D-Ti mg/kg	D-Sn mg/kg	D-Ti mg/kg	D-U mg/kg	D-V mg/kg	D-Zn mg/kg	D-Zr mg/kg
25-Feb-10	0	205	ND	ND	ND	35	0.072	33.9	0.37	ND	ND	0.037	0.0018	0.00010	0.00010	13	ND	0.00016	0.000032	0.00016	0.00059	0.0000021	0.00010	0.0000019	0.0000092	12	0.000002	0.000057	0.00027	0.00014	0.0000082	ND	0.96	0.013	0.0000004	0.00041	0.00018	ND	0.60	0.00003	0.041	0.0000004	0.55	0.073	0.00000029	0.0000010	0.0000010	0.0014	0.0000010	0.0000010	0.0000010
4-Mar-10	1	1435	6.2	ND	14	251	0.39	238	2.7	0.095	0.14	0.22	0.014	0.0033	0.0014	ND	ND	0.0014	0.00032	0.00017	0.0033	0.00072	0.00072	0.014	0.0000047	86	0.00072	0.00034	0.00020	0.0086	0.0000072	0.0072	8.8	0.11	0.0000014	0.0019	0.00072	0.086	4.4	0.0014	0.55	0.000014	4.3	0.77	0.00014	0.00014	0.0029	0.038	0.0014	0.0014	ND
11-Mar-10	2	1435	6.4	ND	16	243	0.34	232	1.5	0.11	1.2	0.21	0.0072	0.0014	0.00029	ND	ND	0.0032	0.00024	0.00014	0.0028	0.00072	0.00072	0.014	0.000024	85	0.00072	0.00022	0.00083	0.022	0.0000072	0.0072	7.3	0.095	0.0000072	0.0015	0.00072	0.22	3.9	0.00083	0.58	0.000014	3.2	0.72	0.00014	0.00014	0.0072	0.039	0.0014	0.0014	ND
18-Mar-10	3	1435	7.3	ND	15	228	0.28	227	2.4	0.057	1.1	0.18	0.014	0.0029	0.0014	ND	ND	0.00072	0.00020	0.00010	0.0028	0.00036	0.00036	0.072	0.000036	81	0.00036	0.00011	0.00072	0.0086	0.0000036	0.0036	6.2	0.075	0.0000014	0.0013	0.00036	0.086	3.3	0.00072	0.58	0.0

Leachate Data for Sat Col 9

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
9-Apr-10	0	*ND*	7.30	791	15.1	415	*ND*	399	1.48	0.223	<0.05	0.031	<0.005	<0.001	0.0172	*ND*	*ND*	<0.012	0.00108	0.00068	0.0259	<0.001	<0.001	<0.02	0.000053	158	<0.001	0.00045	0.00568	<0.03	<0.0001	<0.01	4.69	0.0481	<0.0001	0.00600	<0.001	<0.3	5.8	<0.002	3.90	<0.00002	10.9	0.327	<0.0002	<0.0002	<0.01	0.00251	<0.002	<0.002	*ND*
9-Apr-10	0	1850	7.36	920	18.3	493	*ND*	474	2.22	0.323	<0.05	0.039	0.0456	0.0105	0.0095	*ND*	*ND*	<0.012	0.00136	0.00086	0.0267	<0.001	<0.001	<0.02	0.000070	186	<0.001	0.00083	0.00621	<0.03	<0.0001	<0.01	2.47	0.0348	<0.00005	0.00217	0.00064	<0.3	<2	<0.001	1.14	<0.00001	<2	0.195	<0.0001	<0.0001	<0.01	0.00872	<0.001	0.0025	*ND*
13-May-10	1	51938	7.83	338	39	164	<0.5	123	<0.5	0.208	<0.05	<0.02	<0.005	<0.001	<0.002	*ND*	*ND*	0.0438	0.00206	0.00063	0.0259	<0.0005	<0.0005	<0.01	<0.00005	61.4	<0.0005	<0.0001	0.00047	<0.03	<0.00005	<0.005	2.47	0.0348	<0.00005	0.00217	0.00064	<0.3	<2	<0.001	1.14	<0.00001	<2	0.195	<0.0001	<0.0001	<0.01	0.00872	<0.001	0.0025	*ND*
27-May-10	6	9251	6.87	2325	305	1320	36.0	1240	9.3	0.30	<0.5	0.484	0.892	<0.01	0.0027	*ND*	*ND*	0.0077	0.00173	0.00143	0.0437	<0.0025	<0.0025	<0.05	0.000101	475	<0.0025	0.00588	0.00660	0.058	0.00041	<0.025	32.3	2.37	<0.00001	0.0761	0.0025	<0.3	11.4	<0.005	4.67	<0.00005	85.6	1.44	<0.0005	<0.0005	0.016	0.257	<0.005	0.0359	*ND*
9-Jun-10	8	4422	7.06	1579	268	861	20.1	684	<5	0.53	<0.5	0.876	0.054	<0.01	<0.002	*ND*	*ND*	0.0064	<0.0005	0.00354	0.0243	<0.0025	<0.0025	<0.05	0.000131	308	<0.0025	0.00590	0.00087	0.169	0.00035	<0.025	22.5	1.87	<0.00001	0.0435	<0.0025	<0.3	13.0	<0.005	6.81	<0.00005	49.9	0.753	<0.0005	<0.0005	<0.01	0.105	<0.005	0.0035	*ND*
15-Jun-10	9	3949	7.18	1319	239	679	16.1	530	<5	0.54	<0.5	0.81	<0.05	<0.01	0.0036	197	<0.03	0.0097	0.00031	0.00506	0.0258	0.00002	<0.000005	<0.05	0.000064	244	0.0003	0.00481	0.00174	0.226	0.00427	0.0014	16.8	1.78	0.00003	0.0505	0.00181	*ND*	11.2	0.00043	6.76	<0.000005	31.7	0.74	0.000012	0.00002	<0.0005	0.0757	0.0003	0.0041	0.0002
29-Jun-10	11	2801	*ND*	*ND*	*ND*	452	8.1	*ND*	*ND*	*ND*	*ND*	0.51	*ND*	*ND*	*ND*	115	<0.01	0.0044	0.00019	0.00694	0.0287	0.00001	<0.000005	<0.05	0.000021	163	0.0001	0.00278	0.00015	0.231	0.000122	0.0012	10.8	1.12	0.00002	0.0609	0.00109	*ND*	7.93	0.00022	5.22	0.0000010	14.7	0.495	0.000007	0.00003	<0.0005	0.0474	0.0003	0.0016	0.0001
14-Jul-10	13	3032	7.26	698	144	351	4.4	220	0.65	0.523	<0.05	0.418	<0.005	<0.001	<0.02	91	<0.005	0.0048	0.00008	0.00520	0.0368	<0.00001	<0.000005	<0.05	0.000143	92.4	0.0001	0.000996	0.00030	0.068	0.000022	0.0010	5.77	0.5	<0.00001	0.0649	0.00064	*ND*	5.42	0.00011	5.13	<0.000005	4.11	0.308	0.000012	<0.00001	0.0008	0.0233	<0.0002	0.0012	<0.0001
10-Aug-10	17	2781	7.53	459	102	227	2.7	126	<0.5	0.594	<0.05	0.284	<0.005	<0.001	0.0026	47	<0.01	0.0057	0.00007	0.00523	0.0406	<0.00001	<0.000005	<0.05	0.000018	83.0	<0.0001	0.000671	0.00009	0.041	0.000024	0.0010	4.84	0.394	<0.00001	0.0615	0.00036	*ND*	4.89	0.00007	5.51	<0.000005	2.89	0.266	<0.000002	<0.00001	<0.0005	0.0185	<0.0002	0.0013	<0.0001
24-Aug-10	19	2814	7.7	392	92	185	1.9	101	<0.5	0.513	<0.05	0.237	<0.005	<0.001	0.0058	36	<0.03	0.0053	0.00005	0.00532	0.0422	<0.00001	<0.000005	<0.05	0.000017	67.4	<0.0001	0.000515	0.00014	0.027	0.000018	0.0008	4.01	0.311	<0.00001	0.0534	0.00031	*ND*	3.96	0.00006	5.42	<0.000005	1.98	0.226	<0.000002	<0.00001	<0.0005	0.0161	<0.0002	0.0005	<0.0001
8-Sep-10	21	3048	7.67	335	101	147	1.1	76.8	<0.5	0.424	<0.05	0.200	<0.005	<0.001	0.0055	27	<0.01	0.0057	0.00005	0.00525	0.0486	<0.00001	<0.000005	<0.05	0.000009	53.5	<0.0001	0.000403	<0.00005	0.016	0.000009	0.0008	3.17	0.247	<0.00001	0.0437	0.00016	*ND*	3.52	<0.00004	4.55	<0.000005	1.30	0.206	<0.000002	<0.00001	<0.0005	0.0130	<0.0002	0.0002	<0.0001
21-Sep-10	23	2605	7.6	303	92	132	1.0	68.3	<0.5	0.393	<0.05	0.182	<0.005	<0.001	0.0046	22	<0.03	0.0071	0.00005	0.00486	0.0503	<0.00001	<0.000005	<0.05	0.000007	48.4	<0.0001	0.000336	<0.00005	0.012	0.000009	0.0006	2.78	0.208	<0.00001	0.0376	0.00028	*ND*	2.99	<0.00004	4.55	<0.000005	1.04	0.183	<0.000002	<0.00001	<0.0005	0.0110	<0.0002	0.0005	<0.0001
5-Oct-10	25	2797	7.55	282.2	89	123	0.5	57.6	<0.5	0.373	<0.05	0.162	<0.005	<0.001	0.0062	20	<0.03	0.007	<0.0005	0.0050	0.056	<0.0001	<0.001	<0.05	0.00003	45.0	<0.001	<0.0005	<0.0002	0.01	<0.0002	<0.005	2.63	0.192	<0.00002	0.036	<0.001	<0.01	3.09	<0.0001	4.87	<0.00002	0.99	0.186	<0.00005	<0.005	<0.005	0.0099	<0.005	<0.005	<0.0005
21-Oct-10	27	3233	7.23	258.7	74	116	0.7	49.6	<0.5	0.349	<0.05	0.105	<0.005	<0.001	0.0062	18	0.04	0.0078	0.00003	0.00525	0.0572	<0.00001	<0.000005	<0.05	0.000010	42.3	<0.0001	0.000266	0.00008	0.01	0.000013	0.0006	2.56	0.181	<0.00001	0.0329	0.00018	*ND*	2.90	0.00004	4.8	<0.000005	0.86	0.17	<0.000002	<0.00001	<0.0005	0.00971	<0.0002	0.0005	<0.0001
2-Nov-10	29	2399	7.34	243	71	110	5.4	44.6	<0.5	0.350	<0.05	0.130	<0.005	<0.001	0.0083	18	<0.03	0.0071	0.00004	0.00513	0.0591	<0.00001	<0.000005	<0.05	<0.000005	39.9	<0.0001	0.000235	<0.00005	0.008	0.000006	0.0007	2.48	0.174	<0.00001	0.0301	0.00014	*ND*	2.89	<0.00004	4.87	<0.000005	0.80	0.16	<0.000002	<0.00001	<0.0005	0.00852	<0.0002	0.0004	<0.0001
16-Nov-10	31	2684	7.57	231.5	68	106	<0.5	41.0	1.57	0.342	<0.05	0.132	<0.005	<0.001	0.0084	15	<0.03	0.0081	0.00005	0.00495	0.0606	<0.00001	<0.000005	<0.05	0.000015	38.7	<0.0001	0.000221	0.00043	0.021	0.000043	0.0007	2.21	0.163	<0.00001	0.0298	0.00025	*ND*	2.60	<0.00004	4.97	<0.000005	0.70	0.162	<0.000002	<0.00001	<0.0005	0.00815	<0.0002	0.0003	<0.0001
30-Nov-10	33	2663	7.51	213.1	67	93.3	<0.5	37.6	<0.5	0.320	<0.05	0.109	<0.005	<0.001	0.0085	13	<0.03	0.0066	0.00005	0.00475	0.0608	<0.00001	<0.000005	<0.05	0.000010	33.9	<0.0001	0.000207	0.00006	0.007	0.000007	0.0006	2.13	0.147	<0.00001	0.0269	0.00012	*ND*	2.40	<0.00004	4.36	<0.000005	0.63	0.152	<0.000002	<0.00001	<0.0005	0.00772	<0.0002	0.0003	<0.0001
6-Jan-11	35	2698	7.46	273.8	101	*ND*	1.21	47.5	<0.5	0.271	<0.05	0.115	<0.005	<0.001	0.0055	*ND*	<0.005	0.00508	0.00036	0.00559	0.0893	<0.00001	<0.000005	<0.05	<0.01	0.0000055	47.2	<0.0001	0.000218	<0.0001	0.0293	0.0000065	0.00051	2.68	0.214	<0.00002	0.0295	0.000160	*ND*	2.81	0.000040	5.52	<0.000005	0.721	0.214	<0.000002	<0.00001	<0.0005	0.0106	<0.0002	0.00075	<0.0001
3-Feb-11	39	983	7.43	308	123	*ND*	1.18	53.8	<0.5	0.304	<0.05	0.123	<0.005	<0.001	0.0052	*ND*	<0.005	0.00407	0.00029	0.00483	0.0924	<0.00001	<0.000005	<0.05	0.000016	37.3	<0.0001	0.000267	<0.0001	0.0574	0.0000092	0.00078	3.08	0.268	<0.00002	0.0343	0.000167	*ND*	2.97	<0.00004	4.96	<0.000005	0.803	0.185	<0.000002	<0.00001	<0.0005	0.0181	0.000061	<0.0005	<0.0001
2-Mar-11	43	895	7.56	410	97	*ND*	3.36	56.3	0.93	0.289	<0.05	0.125	<0.005	<0.001	0.0023	*ND*	<0.005	0.00315	0.00003	0.00405	0.0957	<0.00001	<0.000005	<0.05	0.0088	0.0000077	55.6	<0.0001	0.000340	<0.0001	0.0677	0.0000487	0.00092	3.30	0.327	<0.00002	0.0309	0.000192	<0.3	3.02	0.000067	6.12	<0.000005	0.867	0.282	<0.000002	<0.00001	<0.0005	0.0192	0.000078	<0.0005	<0.0001
30-Mar-11	47	705	7.37	438	138	*ND*	1.74	59.0	<0.5	0.303	<0.05	0.154	<0.005	<0.001	0.0028	*ND*	<0.005	0.00660	0.00029	0.00366	0.0982	<0.00001	<0.000005	<0.05	0.0102	0.0000078	65.7	<0.0001	0.000401	<0.0001	0.0851	0.0000312	0.00111	3.92	0.387	<0.00002	0.0289	0.000210	<0.3	3.42	0.000050	5.67	<0.000005	1.04	0.329	<0.000002	<0.00001	<0.0005	0.0227	0.000082	0.00098	<0.0001
27-Apr-11	51	842	7.43	425	156	*ND*	2.07	61.6	<0.5	0.298	<0.05	0.142	<0.005	<0.001	0.0027	*ND*	<0.005	0.00310	0.00025	0.00373	0.108	<0.00001	<0.000005	<0.05	0.0022	0.0000088	83.2	<0.0001	0.000531	<0.0001	0.135	0.0000081	0.00125	4.84	0.454	<0.00002	0.0275	0.000216	<0.3	3.59	0.000047	6.18	<0.000005	1.12	0.363	<0.000002	<0.00001	<0.0005	0.0288	0.000093	0.00052	<0.0001
26-May-11	55	906	7.34	439	166	*ND*	2.90	4.58	0.87	0.697	<0.05	<0.005	<0.005	<0.001	0.0126	*ND*	<0.005	0.0101	0.00162	0.00903	0.433	<0.00001	<0.000005	<0.05	<0.005	<0.000005	15.9	<0.0001	0.0000555	<0.0001	0.0097	<0.000005	0.00100	1.46	0.0171	<0.00002	0.00725	0.000060	<0.3	3.71	0.000059	2.36	<0.000005	0.139	0.150	<0.000002	<0.00001	<0.0005	0.000210	<0.00005	0.00341	<0.0001
23-Jun-11	59	843	7.25	446	185	*ND*	1.97	61.9	<0.5	0.351	<0.05	0.162	<0.005	<0.001	0.0022	*ND*	<0.005	0.00221	0.00024	0.00366	0.106	<0.00001	<0.000005	<0.05	0.0000114	0.0127	0.0000093	78.5	0.00010	0.00613	0.00019	0.169	0.0000340	0.00098	4.91	0.519	<0.00002	0.0258	0.000249	<0.3	3.62	0.000062	6.43	<0.000005	1.32	0.394	<0.000002	<0.00001	<0.0005	0.0305	0.000116	0.00146	<0.0001
21-Jul-11	63	841	7.47	448	175	*ND*	2.19	61.1	<0.5	0.362	<0.05	0.159	<0.005	<0.001	<0.002	*ND*	<0.005	0.00213	0.000611	0.00592	0.0995	<0.00001	<0.000005	<0.05	0.0127	0.0000069	79.5	<0.0001	0.000641	<0.0001	0.211	<0.0000035	0.00137	4.98	0.540	<0.00002	0.0255	0.000232	<0.3	3.57	0.000182	7.20	<0.000005	1.27	0.390	<0.000002	<0.00001	<0.0005	0.0284	0.000106	0.00322	<0.0001
18-Aug-11	67	828	7.4	448	177	*ND*	2.36	59.2	<0.5	0.364	<0.05	0.126	<0.005	<0.001	<0.002	*ND*	<0.005	0.00243	0.000122	0.00460	0.0954	<0.00001	<0.000005	<0.05	0.0115	0.0000065	82.4	<0.0001	0.000627	0.00010	0.121	0.0000123	0.00232	4.98	0.552	<0.00002	0.0263	0.000263	<0.3	3.67	0.000170	7.20	<0.000005	1.24	0.388	<0.000002	<0.00001	<0.0005	0.0269	0.000170	0.00349	<0.0001
2-Sep-11	69	504	7.64	534	*ND*	*ND*	*ND*	110	<0.5	0.311	<0.05	0.0945	<0.005	<0.001	0.0048	*ND*	*ND*	0.00137	0.00357	0.00140	0.0613	<0.00001	<0.000005	<0.05	0.0142	0.000191	95.2	<0.0001	0.00117	0.00214	0.0033	0.0000248	0.00165	6.58	0.486	<0.00005	0.0307	0.00118	<0.3	3.89	0.00639	4.29	<0.000005	1.22	0.476	0.0000949	<0.00001	<0.0005	0.0563	0.000320	0.0154	<0.0001
15-Sep-11	71	626	7.48	520	172	*ND*	2.07	101	1.67	0.344	<0.05	0.102	<0.005	<0.001	<0.002	*ND*	<0.005	0.00133	0.00311	0.00150	0.0640	<0.00001	<0.000005	<0.05	0.0138	0.000112	93.0	<0.0001	0.000875	0.00187	0.0034	<0.0000035	0.00214	6.69	0.546	<0.00002	0.0265	0.000919	<0.3	4.26	0.00293	4.59	<0.000005	1.28	0.430	0.0000726	<0.00001	<0.0005	0.0495	0.000287	0.0103	<0.0001
13-Oct-11	75	1428	7.48	426	169	*ND*	1.41	66.6	<0.5	0.383	<0.05	0.0842	<0.005	<0.001	<0.002	*ND*	<0.005	0.00215	0.00183	0.00108	0.0655	<0.00001	<0.000005	<0.05	0.0125	0.0000596	75.8	<0.0001	0.000140	0.00146	<0.001	0.0000996	0.00117	5.49	0.0794	<0.00002	0.0230	0.000379	<0.3	3.48	0.00101	4.35	<0.000005	0.994	0.341	0.0000496	<0.00001	<0.0005	0.0337	0.000351	0.00760	<0.0001
10-Nov-11	79	724	7.22	425	173	*ND*	1.31	62.2	<0.5	0.384	<0.05	0.102	<0.005	<0.001	<0.002	*ND*	<0.005	0.00200	0.00147	0.000988	0.0715	<0.00001	<0.000005	<0.05	0.0115	0.0000612	76.9	<0.0001	0.000221	0.00108	<0.001	0.0000113	0.00093	5.72	0.220	<0.00001	0.0194	0.000347	<0.3	3.28	0.000631	4.23	<0.000005	1.02	0.344	0.0000417	<0.00001	<0.0005	0.0332	0.000260	0.00578	<0.0001
8-Dec-11	83	906	7.38	425	175	*ND*	1.33	58.6	<0.5	0.365	<0.05	0.0896	0.0054	<0.001	<0.002	*ND*	<0.005	0.00138	0.00128	0.00495	0.0699	<0.00001	<0.000005	<0.05	0.0122	0.0000229	77.3	<0.0001	0.000900	0.00165	<0.001	0.0000093	0.00128	5.55	0.526	<0.00001	0.0169	0.000412	<0.3	3.21	0.000497	5.13	<0.000005	0.945	0.353	0.0000337	<0.00001	<0.0005	0.0330	0.000233	0.00553	<0.0001
5-Jan-12	87	927	7.13	430	177	*ND*	1.94	58.4	0.53	0.361	<0.05	0.0973	<0.005	<0.001	<0.002	*ND*	<0.005	0.00111	0.00131	0.00144	0.0670	<0.00001	<0.000005	<0.05	0.0114	0.0000106	79.7	<0.0001	0.00148	0.00068	<0.001	0.0000196	0.00105	5.72	0.659	<0.00001	0.0154	0.000485	<0.3	3.31	0.000392	4.59	<0.000005	0.947	0.337	0.0000267	<0.00001	<0.0005	0.0268	0.000170	0.00573	<0.0001
3-Feb-12	91	930	*ND*	441	179	*ND*	1.69	56.0	<0.5	0.342	<0.05	0.0863	<0.005	<0.001	<0.02	*ND*	<0.005	0.00107	0.00123	0.00167	0.0713	<0.00001	<0.000005	<0.05	0.0118	0.0000076	80.8	<0.0001	0.00178	0.00036	0.0053	0.0000464	0.00130	5.33	0.709	<0.00001	0.0152	0.000423	<0.3	3.19	0.000291	5.64	<0.000005	0.945	0.360	0.0000247	<0.00001	<0.0005	0.0286	0.000154	0.00602	<0.0001
2-Mar-12	95	908	7.01	435	183	*ND*	1.30	54.7	<0.5	0.337	<0.05	0.104	<0.005	<0.001	<0.002	*ND*	<0.005	0.00115	0.000917	0.00177	0.0723	<0.00001	<0.000005	<0.05	0.0108	0.0000066	78.2	<0.0001	0.00170	0.00017	0.0253	0.0000535	0.00126	5.39	0.637	<0.00001	0.0143	0.000464	<0.3	3.12	0.000211	5.42	<0.000005	0.959	0.341	0.0000183	<0.00001	<0.0005	0.0269	0.000144	0.00645	<0.0001
30-Mar-12	99	890	7.05	438	183	*ND*	1.41	53.8	<0.5	0.335	<0.05	0.0989	<0.005	<0.001	<0.002	*ND*	<0.005	0.00167	0.000685	0.00189	0.0751	<0.00001	<0.000005	<0.05	0.0109	0.0000123	78.5	<0.0001	0.00147	<0.0001	0.0402	0.0000799	0.00112	5.14	0.650	<0.00001	0.0136	0.000412	<0.3	2.94	0.000150	5.55	<0.000005	0.911	0.349	0.0000155	<0.00001	<0.0005	0.0284	0.000128	0.00279	<0.0001
25-Apr-12	103	868	7.12	433	174	*ND*	1.86	52.9	<0.5	0.331	<0.05	0.0976	<0.005	<0.001	<0.002	*ND*	<0.005	0.00135	0.000745	0.00197	0.0767	<0.00001	<0.000005	<0.05	0.0111	0.0000092	77.9	<0.0001	0.000956	0.00120	0.0292	0.0000596	0.00120	5.26	0.628	<0.00001	0.0133	0.000298	<0.3	3.02	0.000092	6.08	0.0000078	0.897	0.337	0.0000134	<0.00001	<0.0005	0.0235	0.000103	0.00523	<0.0001
25-May-12	107	953	7.35	442	177	*ND*	1.94	52.8	<0.5	0.331	<0.05	0.0996	<0.005	<0.001	<0.002	*ND*	<0.005	0.00141	0.000219	0.00209	0.0752	<0.00001	<0.000005	<0.05	0.0118	<0.0000095	80.1	<0.0001	0.00127	<0.0001	0.0491	0.0000176	0.00160	5.04	0.605	<0.00001	0.0136	0.000445	<0.3	3.03	0.000119	6.34	<0.000005	0.916	0.342	0.0000071	<0.00001	<0.0005	0.0239	0.000080	<0.0005	<0.0001

Calculated Production Rates for Sat Col 9 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk	Hardness	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL	pH	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
9-Apr-10	0	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
9-Apr-10	0	1850	7.4	920	3.4	91	*ND*	88	0.41	0.060	0.0093	0.0072	0.0084	0.0019	0.0018	*ND*	*ND*	0.0022	0.00025	0.00016	0.0049	0.00019	0.00019	0.0037	0.000013	34	0.00019	0.00015	0.0011	0.00056	0.00019	0.0019	1.3	0.011	0.00010	0.0020	0.00019	0.056	1.5	0.00037	0.66	0.0000037	2.6	0.087	0.000037	0.00037	0.0019	0.0013	0.00037	0.00037	*ND*
13-May-10	1	51938	7.8	338	203	852	2.6	639	2.6	1.1	0.26	0.10	0.026	0.0052	0.010	*ND*	*ND*	0.23	0.011	0.0033	0.13	0.0026	0.0026	0.052	0.00026	319	0.0026	0.00052	0.0024	0.16	0.00026	0.026	13	0.18	0.00026	0.011	0.0033	1.6	10	0.0052	5.9	0.000052	10	1.0	0.0052	0.00052	0.052	0.045	0.0052	0.013	*ND*
27-May-10	6	9251	6.9	2325	282	1221	32	1147	8.6	0.45	0.23	0.363	0.0025	*ND*	*ND*	*ND*	*ND*	0.0071	0.0016	0.040	0.023	0.0025	0.0025	0.046	0.00093	439	0.0025	0.0054	0.0061	0.054	0.0033	0.028	11	1.2	0.00093	0.070	0.023	0.28	11	0.0046	4.3	0.00046	79	1.3	0.0046	0.046	0.013	0.24	0.046	0.013	*ND*
9-Jun-10	8	4422	7.1	1579	119	381	8.9	302	2.2	0.23	0.22	0.39	0.024	0.0044	0.00888	*ND*	*ND*	0.028	0.00022	0.0016	0.011	0.0011	0.0011	0.022	0.000058	136	0.0011	0.0026	0.00038	0.075	0.00015	0.011	9.9	0.83	0.00004	0.019	0.0011	0.13	5.7	0.0022	3.0	0.000022	22	0.33	0.00022	0.00022	0.0044	0.046	0.0022	0.0022	*ND*
15-Jun-10	9	3949	7.2	1319	94	268	6.4	209	2.0	0.21	0.20	0.32	0.020	0.0039	0.0014	78	0.012	0.0038	0.00012	0.0020	0.010	0.0000079	0.0000020	0.020	0.0000025	96	0.00012	0.0019	0.00069	0.089	0.00017	0.00055	6.6	0.70	0.000012	0.020	0.00071	*ND*	4.4	0.00017	2.7	0.0000020	13	0.29	0.0000047	0.0000079	0.00020	0.030	0.00012	0.0016	0.000079
29-Jun-10	11	2801	*ND*	*ND*	*ND*	127	2.3	*ND*	*ND*	*ND*	*ND*	0.14	*ND*	*ND*	*ND*	32	0.0028	0.0012	0.0000053	0.0019	0.010	0.0000030	0.0000015	0.015	0.0000073	38	0.0000030	0.00053	0.00018	0.038	0.000015	0.0006	3.0	0.31	0.0000056	0.017	0.00031	*ND*	2.2	0.000062	1.7	0.0000028	4.1	0.14	0.0000020	0.0000084	0.00

Leachate Data for Sat Col 12 (upper port)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	$D-S_2$	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-Jul-12	0	250	6.13	4530	522	*ND*	81.8	2740	44	2.49	<1	0.96	0.14	<0.02	0.0027	*ND*	<0.005	0.527	0.00530	0.00173	0.0259	0.000679	<0.000025	0.051	0.00349	846	<0.0005	0.339	16.6	0.314	0.000245	0.0519	195	3.32	0.000122	0.0373	0.0963	<1.5	51.5	0.0570	11.0	<0.000025	124	5.36	0.000254	<0.00005	<0.0025	0.655	<0.00025	0.509	<0.0005
3-Aug-12	3	150	6.46	3640	577	*ND*	30.6	2030	26	3.01	<1	1.39	<0.1	0.021	<0.02	*ND*	<0.005	0.373	0.00476	0.00351	0.0207	0.00129	0.000056	0.045	0.00189	723	<0.0005	0.226	3.50	2.18	0.00101	0.0226	151	3.54	<0.00001	0.0154	0.0461	<1.5	39.3	0.0167	10.5	0.000033	77.9	3.86	0.000189	<0.00005	<0.0025	0.763	<0.00025	0.219	0.00082
30-Aug-12	7	180	6.34	3700	663	*ND*	27.1	1980	24	2.96	<1	1.37	<0.1	<0.02	<0.002	*ND*	<0.005	0.214	0.00310	0.00591	0.0209	0.00102	<0.000025	0.056	0.00134	714	<0.0005	0.188	2.05	1.34	0.000141	0.0261	161	3.41	<0.00001	0.0154	0.0340	<1.5	40.8	0.0100	11.2	<0.000025	84.5	4.10	0.000135	<0.00005	<0.0025	0.885	<0.00025	0.194	0.00083
25-Sep-12	11	200	6.27	3590	685	*ND*	16.6	1940	18	2.92	<1	1.45	<0.1	<0.02	<0.002	*ND*	<0.005	0.172	0.00231	0.00780	0.0188	0.000767	0.000070	0.042	0.000944	664	<0.0005	0.152	1.36	1.84	0.000028	0.0193	145	3.12	<0.00001	0.0143	0.0294	<1.5	39.2	0.00707	10.4	<0.000025	69.1	3.60	0.000088	0.000138	<0.0025	0.770	<0.00025	0.156	0.00117
23-Oct-12	15	200	6.44	3290	556	*ND*	20.3	1880	15	2.64	<1	1.39	<0.1	<0.02	<0.002	*ND*	<0.0057	0.110	0.00172	0.00620	0.0182	0.000661	<0.000025	0.040	0.000770	683	<0.0005	0.120	0.900	0.578	0.000094	0.0199	144	2.91	<0.00001	0.0149	0.0222	<1.5	38.8	0.00486	9.34	<0.000025	64.4	3.54	0.000094	<0.00005	<0.0025	0.678	<0.00025	0.105	0.00052
20-Nov-12	19	200	6.44	3250	538	*ND*	16.9	1800	14	2.43	<1	1.49	<0.1	<0.02	<0.002	*ND*	<0.01	0.0889	0.00133	0.00572	0.0157	0.000519	<0.000025	0.032	0.000646	554	<0.0005	0.104	0.715	0.792	0.000173	0.0130	119	2.68	<0.00001	0.0109	0.0187	<1.5	32.2	0.00396	8.02	<0.000025	50.5	2.86	0.000061	<0.00005	<0.0025	0.554	<0.00025	0.0898	<0.0005
17-Dec-12	23	550	6.14	2547	307	*ND*	12.1	1450	<10	2.95	<1	1.62	<0.1	<0.02	<0.002	*ND*	<0.01	0.604	0.00169	0.00316	0.0158	0.00129	<0.000025	0.026	0.00214	502	<0.0005	0.198	4.25	6.90	0.000362	0.0195	100	3.03	<0.00001	0.00707	0.0248	<1.5	23.9	0.00809	9.98	<0.000025	32.5	2.11	0.000105	<0.00005	<0.0025	0.313	<0.00025	0.232	<0.0005
24-Jan-13	28	2500	6.17	2102	256	*ND*	7.4	1120	<10	3.19	<1	1.20	<0.1	<0.02	<0.002	*ND*	<0.01	0.224	0.00106	0.00186	0.0196	0.000806	<0.00001	0.018	0.00152	379	0.00031	0.147	1.97	3.43	0.000117	0.0143	73.1	2.34	<0.00001	0.00451	0.0190	<0.6	17.7	0.00508	7.16	<0.00001	18.1	1.50	0.0000686	<0.00002	<0.001	0.233	<0.0001	0.151	<0.0002
12-Feb-13	31	263	6.62	2323	375	*ND*	6.1	1170	<10	2.54	<1	1.11	<0.1	<0.02	<0.002	*ND*	<0.005	0.0286	0.000783	0.00348	0.0187	0.000233	<0.00001	0.022	0.000379	465	<0.0002	0.0497	0.261	0.288	0.000041	0.0089	74.5	1.77	<0.00001	0.00727	0.00747	<0.6	22.7	0.00154	7.14	<0.00001	21.6	1.90	0.0000350	<0.00002	<0.001	0.269	<0.0001	0.0359	<0.0002
12-Mar-13	35	255	6.79	2366	371	*ND*	7.7	1200	<10	2.46	<1	1.11	<0.1	<0.02	<0.002	*ND*	<0.005	0.0247	0.000694	0.00441	0.0184	0.000209	<0.00001	0.024	0.000306	467	<0.0002	0.0429	0.148	0.528	0.000050	0.0074	75.9	1.69	<0.00001	0.00854	0.00661	<0.6	22.9	0.00143	7.50	<0.00001	19.5	2.03	0.0000291	<0.00002	<0.001	0.289	<0.0001	0.0301	<0.0002

Calculated Production Rates for the upper port of Sat Col 12 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO4	D-Cl	D-F	D-Br	NH3	NO3-N	NO2-N	Total D-PO_4	D-S	$D-S_2$	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL	pH	uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
12-Jul-12	0	250	6.1	4530	44	*ND*	6.8	228	3.7	0.21	0.083	0.080	0.012	0.0017	0.00023	*ND*	0.00042	0.044	0.00044	0.00014	0.0022	0.000057	0.0000021	0.0043	0.00029	71	0.000042	0.028	1.4	0.026	0.000020	0.0043	16	0.28	0.000010	0.0031	0.0080	0.13	4.3	0.0048	0.92	0.0000021	10	0.45	0.0000021	0.0000042	0.00021	0.055	0.0000021	0.042	0.000042
3-Aug-12	3	150	6.5	3640	29	*ND*	1.5	102	1.3	0.15	0.050	0.070	0.0050	0.0011	0.0010	*ND*	0.00025	0.019	0.00024	0.00018	0.0010	0.000065	0.0000028	0.0023	0.0000095	36	0.0000025	0.011	0.18	0.11	0.000051	0.0011	7.6	0.18	0.00000050	0.00077	0.0023	0.075	2.0	0.00084	0.53	0.0000017	3.9	0.19	0.0000095	0.0000025	0.00013	0.038	0.00000013	0.011	0.000041
30-Aug-12	7	180	6.3	3700	40	*ND*	1.6	119	1.4	0.18	0.060	0.082	0.0060	0.0012	0.00012	*ND*	0.00030	0.013	0.00019	0.00035	0.0013	0.000061	0.0000015	0.0034	0.0000080	43	0.0000030	0.011	0.12	0.080	0.0000085	0.0016	9.7	0.20	0.00000060	0.00092	0.0020	0.090	2.4	0.00060	0.67	0.0000015	5.1	0.25	0.0000081	0.0000030	0.00015	0.053	0.00000015	0.012	0.000050
25-Sep-12	11	200	6.3	3590	46	*ND*	1.1	129	1.2	0.19	0.067	0.097	0.0067	0.0013	0.00013	*ND*	0.00033	0.011	0.00015	0.00052	0.0013	0.000051	0.0000047	0.0028	0.0000063	44	0.0000033	0.010	0.091	0.12	0.0000019	0.0013	9.7	0.21	0.00000067	0.00095	0.0020	0.10	2.6	0.00047	0.69	0.0000017	4.6	0.24	0.0000059	0.0000092	0.00017	0.051	0.00000017	0.010	0.000078
23-Oct-12	15	200	6.4	3290	37	*ND*	1.4	125	1.0	0.18	0.067	0.093	0.0067	0.0013	0.00013	*ND*	0.00038	0.0073	0.00011	0.00041	0.0012	0.000044	0.0000017	0.0027	0.0000051	46	0.0000033	0.0080	0.060	0.039	0.0000063	0.0013	9.6	0.19	0.00000067	0.00099	0.0015	0.10	2.6	0.00032	0.62	0.0000017	4.3	0.24	0.0000063	0.0000033	0.00017	0.045	0.00000017	0.0070	0.00035
20-Nov-12	19	200	6.4	3250	36	*ND*	1.1	120	0.93	0.16	0.067	0.099	0.0067	0.0013	0.00013	*ND*	0.00067	0.0059	0.000089	0.00038	0.0010	0.000035	0.0000017	0.0021	0.0000043	37	0.0000033	0.0069	0.048	0.053	0.000012	0.00087	7.9	0.18	0.00000067	0.00073	0.0012	0.10	2.1	0.00026	0.53	0.0000017	3.4	0.19	0.0000041	0.0000033	0.00017	0.037	0.00000017	0.0060	0.00033
17-Dec-12	23	550	6.1	2547	56	*ND*	2.2	266	1.8	0.54	0.18	0.30	0.018	0.0037	0.00037	*ND*	0.0018	0.11	0.00031	0.00058	0.0029	0.00024	0.0000046	0.0048	0.0000039	92	0.0000092	0.036	0.78	1.3	0.0000066	0.0036	18	0.56	0.0000018	0.0013	0.0045	0.28	4.4	0.0015	1.8	0.0000046	6.0	0.39	0.0000019	0.0000092	0.00046	0.057	0.0000046	0.043	0.000092
24-Jan-13	28	2500	6.2	2102	213	*ND*	6.2	933	8.3	2.7	0.83	1.0	0.083	0.017	0.017	*ND*	0.0083	0.19	0.00088	0.0016	0.016	0.00067	0.0000083	0.015	0.0013	316	0.00026	0.12	1.6	2.9	0.000098	0.012	61	2.0	0.0000083	0.0038	0.016	0.50	15	0.0042	6.0	0.0000083	15	1.3	0.000057	0.0000017	0.00083	0.19	0.0000083	0.13	0.00017
12-Feb-13	31	263	6.6	2323	33	*ND*	0.53	103	0.88	0.22	0.088	0.097	0.0088	0.0018	0.0018	*ND*	0.00044	0.0025	0.000069	0.00031	0.0016	0.000020	0.0000088	0.0019	0.0000033	41	0.0000018	0.0044	0.023	0.025	0.0000036	0.00078	6.5	0.16	0.0000088	0.00064	0.0065	0.053	2.0	0.00014	0.63	0.0000088	1.9	0.17	0.0000031	0.0000018	0.0000088	0.024	0.0000088	0.0031	0.0000018
12-Mar-13	35	255	6.8	2366	32	*ND*	0.65	102	0.85	0.21	0.085	0.094	0.0085	0.0017	0.00017	*ND*	0.00043	0.0021	0.00005	0.00037	0.0016	0.000018	0.0000008	0.0020	0.0000026	40	0.0000017	0.0036	0.013	0.045	0.0000043	0.00063	6.5	0.14	0.0000085	0.00073	0.00056	0.051	1.9	0.00012	0.64	0.0000085	1.7	0.17	0.0000025	0.0000017	0.0000085	0.025	0.0000085	0.0026	0.0000017

Leachate Data for Sat Col 12 (lower port)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	$D-S_2$	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL	pH	uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
13-Jul-12	0	460	3.34	6490	0	*ND*	66.1	6530	39	43.8	<2.5	8.03	0.60	<0.05	1.06	*ND*	<0.005	546	0.0075	0.0156	0.0110	0.0468	0.00156	<0.5	0.0271	419	0.070	2.36	553	78.0	0.00109	0.150	263	11.2	0.000028	0.0064	0.649	<30	24.8	0.0733	27.8	<0.0005	137	0.359	0.00107	0.0011	<0.05	1.30	<0.005	3.89	<0.01
3-Aug-12	3	400	3.35	3880	0	*ND*	35.3	3310	16	18.0	<1	4.20	0.17	<0.02	0.718	*ND*	<0.005	225	0.00446	0.00798	0.00887	0.0221	<0.0001	<0.1	0.0118	416	0.0247	1.06	225	62.3	0.00034	0.073	137	5.69	0.000018	0.0038	0.273	<6	16.5	0.0359	21.8	<0.0001	63.7	0.397	0.000728	<0.00002	<0.01	0.534	0.0041	1.69	<0.002
31-Aug-12	7	405	3.44	3450	0	*ND*	32.5	2670	17	12.3	<1	3.55	<0.1	<0.02	0.567	*ND*	<0.005	138	0.00392	0.00719	0.00901	0.0146	<0.0001	<0.1	0.00856	398	0.0157	0.760	162	70.2	0.00049	0.062	119	4.70	0.000020	0.0032	0.193	<6	15.4	0.0292	24.7	0.00025	56.0	0.421	0.000624	<0.00002	<0.01	0.322	0.0051	1.17	<0.002
27-Sep-12	11	950	3.95	3210	12	1430	21.1	1970	14	5.07	<1	2.63	<0.1	<0.02	0.227	*ND*	<0.005	66.5	0.00544	0.0176	0.00898	0.00719	<0.00005	0.414	0.00472	390	0.0087	0.409	69.9	45.3	0.000119	0.0277	111	3.65	<0.00001	0.00460	0.102	0.297	17.2	0.0205	13.9	<0.00005	47.4	0.771	0.000429	<0.00001	<0.005	0.183	0.00322	0.575	<0.001
24-Oct-12	15	425	3.71	2730	14	*ND*	16.2	1860	<10	7.10	<1	2.31	<0.1	0.040	0.231	*ND*	<0.005	82.8	0.00340	0.00472	0.00716	0.00973	<0.00005	<0.05	0.00612	419	0.0121	0.567	86.2	70.8	0.000070	0.0365	131	4.51	<0.00001	0.00244	0.138	<3	17.3	0.0184	22.2	<0.00005	50.3	0.455	0.000484	<0.00001	<0.005	0.177	0.00515	0.770	<0.001
21-Nov-12	19	410	3.65	2580	0	*ND*	16.2	1860	<10	6.13	<1	2.42	<0.1	<0.02	0.227	*ND*	<0.01	58.0	0.00295	0.0138	0.00792	0.00697	<0.00005	<0.05	0.00451	292	0.0081	0.401	61.9	58.5	<0.00005	0.0323	79.1	3.15	<0.00001	0.00163	0.0975	<3	11.9	0.0126	18.4	<0.00005	30.4	0.369	0.000357	<0.00001	<0.005	0.140	0.00428	0.594	<0.001
19-Dec-12	23	730	3.74	2437	0	*ND*	10.4	1720	<10	6.25	<1	2.35	0.13	<0.02	0.227	*ND*	<0.01	58.5	0.00274	0.0118	0.00902	0.00669	<0.00005	<0.05	0.00488	315	0.0088	0.402	60.9	62.0	0.000064	0.0298	75.5	2.84	<0.00001	0.00164	0.0979	<3	11.5	0.0123	18.9	<0.00005	25.7	0.360	0.000352	<0.00001	<0.005	0.129	0.00420	0.629	<0.001
25-Jan-13	28	2700	3.67	2090	14	*ND*	10.1	1410	<10	5.15	<1	1.68	<0.1	<0.02	0.176	*ND*	<0.01	49.0	0.00232	0.00790	0.0113	0.00561	<0.000025	<0.025	0.00395	260	0.00593	0.333	49.6	53.9	<0.000025	0.0245	58.4	2.39	<0.00001	0.00163	0.0801	<1.5	9.31	0.00917	15.7	<0.000025	15.4	0.279	0.000301	<0.00005	<0.0025	0.105	0.00314	0.506	<0.0005
13-Feb-13	31	515	3.72	2196	0	*ND*	10.3	1470	<10	4.82	<1	1.64	<0.1	<0.02	0.181	*ND*	<0.005	41.1	0.00239	0.00729	0.00870	0.00506	<0.000025	<0.025	0.00336	303	0.0051	0.284	40.3	44.4	<0.000005	0.0203	56.9	2.17	<0.00001	0.00149	0.0667	<3	8.44	0.00831	16.0	<0.000025	14.1	0.319	0.000276	<0.00005	<0.0025	0.0926	0.00237	0.414	<0.001
13-Mar-13	35	480	3.78	2081	4	*ND*	1.90	1390	<10	4.04	<1	1.59	<0.1	<0.02	0.124	*ND*	<0.005	35.3	0.00239	0.00654	0.00884	0.00443	<0.000025	<0.025	0.00317	290	0.00454	0.249	32.5	40.3	<0.000025	0.0167	53.4	2.18	<0.00001	0.00761	0.0591	<1.5	8.71	0.00718	17.1	<0.000025	13.1	0.314	0.000292	<0.00005	<0.0025	0.0843	0.00184	0.352	<0.0005

Calculated Production Rates for the lower port of Sat Col 12 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	$D-S_2$	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL	pH	uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
13-Jul-12	0	460	3.3	6490	0.00	*ND*	3.3	330	2.0	2.2	0.13	0.41	0.030	0.0025	0.054	*ND*	0.00025	28	0.00038	0.00079	0.00056	0.0024	0.000079	0.025	0.0014	21	0.0035	0.12	28	3.9	0.000055	0.0076	13	0.57	0.0000014	0.00032	0.033	1.5	1.3	0.0037	1.4	0.000025	6.9	0.018	0.0000054	0.0000056	0.0025	0.066	0.00025	0.20	0.00051
3-Aug-12	3	400	3.4	3880	0.00	*ND*	1.6	145	0.70	0.79	0.044	0.18	0.0075	0.00088	0.032	*ND*	0.00022	9.9	0.00020	0.00035	0.00039	0.00097	0.0000044	0.0044	0.00052	18	0.0011	0.047	9.9	2.7	0.0000015	0.0032	6.0	0.25	0.00000079	0.00017	0.012	0.26	0.73	0.0016	0.96	0.0000044	2.8	0.017	0.0000032	0.0000088	0.00044	0.023	0.00018	0.074	0.000088
31-Aug-12	7	405	3.4	3450	0.00	*ND*	1.5	119	0.76	0.55	0.045	0.16	0.0045	0.00089	0.025	*ND*	0.00022	6.1	0.00017	0.00032	0.00040	0.00065	0.0000045	0.0045	0.00038	18	0.00070	0.034	7.2	3.1	0.0000022	0.0028	5.3	0.21	0.00000089	0.00014	0.0086	0.27	0.69	0.0013	1.1	0.0000011	2.5	0.019	0.0000028	0.0000089	0.00045	0.014	0.00023	0.052	0.0000089
27-Sep-12	11	950	4.0	3210	1.3	149	2.2	206	1.5	0.53	0.10	0.27	0.010	0.0021	0.024	*ND*	0.00052	6.9	0.00057	0.0018	0.00094	0.00075	0.0000052	0.043	0.00049	41	0.00091	0.043	7.3	4.7	0.0000112	0.0029	12	0.38	0.0000010	0.00048	0.011	0.031	1.8	0.0021	1.5	0.0000052	4.9	0.080	0.0000045	0.0000010	0.00052	0.019	0.00034	0.060	0.00010
24-Oct-12	15	425	3.7	2730	0.65	*ND*	0.16	95	0.65	0.33	0.047	0.11	0.0047	0.0019	0.011	*ND*	0.00023	3.9	0.00016	0.00022	0.00033	0.00045	0.0000023	0.0023	0.00029	20	0.00057	0.026	4.0	3.3	0.0000033	0.0017	6.1	0.21	0.00000047	0.00011	0.0064	0.14	0.81	0.00086	1.0	0.0000023	2.3	0.021	0.0000023	0.0000047	0.00023	0.0083	0.00024	0.036	0.000047
21-Nov-12	19	410	3.7	2580	0.00	*ND*	0.73	84	0.45	0.28	0.045	0.11	0.0045	0.00090	0.010	*ND*	0.00045	2.6	0.00013	0.00062	0.00036	0.00031	0.0000023	0.0023	0.00020	13	0.00036	0.018	2.8	2.6	0.0000023	0.0015	3.6	0.14	0.00000045	0.00073	0.0044	0.14	0.54	0.00057	0.83	0.0000023	1.4	0.017	0.0000016	0.0000045	0.00023	0.0063	0.00019	0.027	0.000045
19-Dec-12	23	730	3.7	2437	0.00	*ND*	1.3	138	0.80	0.50	0.080	0.19	0.010	0.0016	0.018	*ND*	0.00080	4.7	0.00022	0.00095	0.00072	0.00054	0.0000040	0.0040	0.00039	25	0.00071	0.032	4.9	5.0	0.0000051	0.0024	6.1	0.23	0.00000080	0.00013	0.0079	0.24	0.92	0.00099	1.5	0.0000040	2.1	0.029	0.0000028	0.0000080	0.00040	0.010	0.00034	0.050	0.000080
25-Jan-13	28	2700	3.7	2090	0.49	*ND*	3.0	418	3.0	1.5	0.30	0.50	0.030	0.0059	0.052	*ND*	0.0030	15	0.00069	0.0023	0.0034	0.0017	0.0000074	0.0074	0.0012	77	0.0018	0.099	15	16	0.0000074	0.0073	17	0.71	0.0000030	0.00045	0.024	0.45	2.8	0.0027	4.7	0.0000074	4.6	0.083	0.0000089	0.0000015	0.00074	0.031	0.00093	0.15	0.00015
13-Feb-13	31	513	3.7	2166	0.17	*ND*	0.58	83	0.56	0.27	0.056	0.092	0.0056	0.0011	0.010	*ND*	0.00028	2.3	0.00013	0.00041	0.00049	0.00029	0.0000028	0.0028	0.00019	17	0.00029	0.016	2.3	2.5	0.0000028	0.0011	3.2	0.12	0.00000056	0.000084	0.0038	0.17	0.48	0.00047	0.90	0.0000028	0.79	0.018	0.0000016	0.0000056	0.00028	0.0052	0.00013	0.023	0.000056
13-Mar-13	35	480	3.8	2081	0.21	*ND*	0.10	73	0.53	0.21	0.053	0.084	0.0053	0.0011	0.0065	*ND*	0.00026	1.9	0.00013	0.00034	0.00047	0.00023	0.0000013	0.0013	0.00017	15	0.00024	0.013	1.7	2.1	0.0000013	0.00088	2.8	0.11	0.00000053	0.00040	0.0031	0.079	0.46	0.00038	0.90	0.0000013	0.69	0.017	0.0000015

Leachate Data for Sat Col 13 (upper port)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
17-Jul-12	0	415	6.67	3410	428	*ND*	64.9	1670	76	1.11	<1	0.797	<0.1	<0.02	0.0065	*ND*	<0.005	0.0070	0.00542	0.0164	0.0252	0.000082	0.000117	0.099	0.000257	541	<0.0005	0.0186	0.00616	2.65	0.00392	0.0166	94.3	2.98	<0.00001	0.165	0.0257	<1.5	42.7	0.0171	12.7	0.000040	216	3.24	0.000048	0.000073	<0.0025	0.394	0.00090	0.0446	0.00130
3-Aug-12	2	195	6.86	2673	576	*ND*	42.5	1170	48	1.24	<1	0.841	<0.1	<0.02	<0.002	*ND*	<0.005	0.0042	0.000966	0.00911	0.0238	0.000069	<0.00001	0.094	<0.00008	392	<0.0002	0.0102	0.00203	1.01	0.000903	0.0153	73.6	2.06	<0.00001	0.201	0.0164	<0.6	39.4	0.00220	10.6	<0.00001	183	2.77	<0.000004	<0.00002	<0.001	0.356	0.00032	0.0166	0.00046
30-Aug-12	6	220	6.74	2392	499	*ND*	27.4	945	39	1.10	<1	1.01	<0.1	<0.02	0.034	*ND*	<0.005	0.0023	0.000460	0.00818	0.0238	0.000064	<0.00001	0.084	<0.00007	335	<0.0002	0.00835	0.00103	0.397	0.000104	0.0123	62.8	2.03	<0.00001	0.212	0.0140	<0.6	34.7	0.000292	13.0	<0.00001	147	2.06	0.0000077	<0.00002	<0.001	0.308	0.00017	0.0141	0.00021
25-Sep-12	10	220	6.74	2255	539	*ND*	25.4	872	32	1.15	<1	0.976	<0.1	<0.02	0.0021	*ND*	<0.005	0.0012	0.000280	0.00682	0.0209	0.000061	<0.00001	0.071	<0.00005	305	<0.0002	0.00646	0.00133	0.841	0.000018	0.0107	59.1	1.84	<0.00001	0.228	0.0131	<0.6	33.2	0.000203	14.0	<0.00001	124	1.93	<0.000004	<0.00002	<0.001	0.223	0.00012	0.0052	<0.0002
23-Oct-12	14	260	6.77	1913	513	*ND*	21.8	705	25	1.31	<1	0.899	<0.1	<0.02	0.0035	*ND*	<0.005	0.0010	0.000181	0.00681	0.0223	0.000062	<0.00001	0.068	<0.000051	258	<0.0002	0.00412	0.00096	2.15	0.000051	0.0096	50.6	1.53	<0.00001	0.281	0.0108	<0.6	31.2	0.000174	13.2	<0.00001	109	1.61	<0.000004	0.000033	<0.001	0.205	0.00029	0.0020	0.00021
20-Nov-12	18	245	6.71	1745	430	*ND*	19.0	585	21	1.30	<1	0.874	<0.1	<0.02	0.0075	*ND*	<0.01	0.0012	0.000127	0.00678	0.0213	0.000057	<0.00001	0.057	<0.000055	230	<0.0002	0.00274	0.00075	2.02	0.000047	0.0080	43.4	1.31	<0.00001	0.292	0.00903	<0.6	28.9	0.000148	13.9	<0.00001	92.6	1.37	<0.000004	0.000023	<0.001	0.161	0.00030	0.0011	0.00028
18-Dec-12	22	258	6.86	1512	411	*ND*	14.8	451	15.0	1.38	<0.5	0.845	<0.05	<0.01	0.0071	*ND*	<0.01	0.0023	0.000103	0.00571	0.0247	0.000054	<0.00001	0.050	<0.00006	213	<0.0002	0.00221	0.00049	1.80	0.000079	0.0061	37.5	1.18	<0.00001	0.328	0.00756	<0.6	25.6	0.000108	12.0	<0.00001	77.8	1.23	<0.000004	0.000030	<0.001	0.167	0.00025	0.0021	0.00032
24-Jan-13	27	200	6.86	1433	421	*ND*	11.9	404	12.5	1.55	<0.5	0.750	<0.05	<0.01	0.0030	*ND*	<0.01	0.0005	0.000127	0.00390	0.0229	0.000049	<0.000009	0.043	<0.00001	186	<0.0001	0.00174	0.00051	0.960	0.0000380	0.0017	35.2	0.955	<0.00001	0.324	0.00711	<0.3	24.7	0.000129	11.9	<0.000005	68.2	1.16	<0.000002	0.000033	<0.0005	0.129	0.00013	0.00225	0.00016
12-Feb-13	30	226	6.89	1333	406	*ND*	10.3	353	10.7	1.59	<0.5	0.742	<0.05	<0.01	0.0050	*ND*	<0.005	0.00063	0.000085	0.00403	0.0276	0.000046	<0.000005	0.0436	<0.0001	176	<0.0001	0.00161	0.00030	0.726	0.0000130	0.00625	32.3	0.846	<0.00001	0.334	0.00663	<0.3	24.2	0.000098	11.3	0.0000098	70.8	1.10	<0.000002	0.000021	<0.0005	0.0866	0.000109	0.00139	<0.0001
12-Mar-13	34	227	7.31	1225	393	*ND*	12.6	298	8.7	1.75	<0.5	0.738	<0.05	<0.01	<0.002	*ND*	<0.005	0.00089	0.000072	0.00497	0.0304	0.000046	<0.000005	0.0438	0.0000600	159	<0.0001	0.00135	0.00023	1.09	0.0000292	0.00571	29.0	0.755	<0.00001	0.345	0.00581	<0.3	23.3	0.000094	11.8	<0.000005	61.3	1.03	<0.000002	0.000034	<0.0005	0.0904	0.000156	0.00127	0.00013

Calculated Production Rates for the upper port of Sat Col 13 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
17-Jul-12	0	415	6.7	3410	54	*ND*	8.2	210	9.6	0.14	0.13	0.10	0.013	0.0025	0.00082	*ND*	0.00063	0.00088	0.00068	0.0021	0.0032	0.000010	0.000015	0.012	0.000032	68	0.0000063	0.0023	0.00077	0.33	0.00049	0.0021	12	0.37	0.0000013	0.021	0.0032	0.19	5.4	0.0022	1.6	0.0000050	27	0.41	0.0000060	0.0000092	0.00031	0.050	0.00011	0.0056	0.00016
3-Aug-12	2	195	6.9	2673	34	*ND*	2.5	69	2.8	0.073	0.059	0.050	0.0059	0.0012	0.00012	*ND*	0.00030	0.00025	0.000057	0.00054	0.0014	0.0000041	0.00000059	0.0056	0.0000047	23	0.0000012	0.00060	0.00012	0.060	0.000053	0.00090	4.3	0.12	0.00000059	0.012	0.00097	0.035	2.3	0.00013	0.63	0.00000059	11	0.16	0.00000024	0.0000012	0.000059	0.021	0.000019	0.00098	0.000027
30-Aug-12	6	220	6.7	2392	33	*ND*	1.8	63	2.6	0.073	0.067	0.067	0.0067	0.0013	0.0023	*ND*	0.00033	0.00015	0.000031	0.00055	0.0016	0.0000043	0.00000067	0.0056	0.0000047	22	0.0000013	0.00056	0.000069	0.026	0.0000069	0.0008	4.2	0.14	0.00000067	0.014	0.00093	0.040	2.3	0.000019	0.87	0.00000067	9.8	0.14	0.00000051	0.0000013	0.000067	0.021	0.000011	0.00094	0.000014
25-Sep-12	10	220	6.7	2255	36	*ND*	1.7	58	2.1	0.077	0.067	0.065	0.0067	0.0013	0.00014	*ND*	0.00033	0.000080	0.000019	0.00045	0.0014	0.0000041	0.00000067	0.0047	0.0000033	20	0.0000013	0.00043	0.0000089	0.056	0.0000012	0.00071	3.9	0.12	0.00000067	0.015	0.00087	0.040	2.2	0.000014	0.93	0.00000067	8.3	0.13	0.00000027	0.0000013	0.000067	0.015	0.0000080	0.00035	0.000013
23-Oct-12	14	260	6.8	1913	40	*ND*	1.7	56	2.0	0.10	0.079	0.071	0.0079	0.0016	0.00028	*ND*	0.00039	0.000079	0.000014	0.00054	0.0018	0.0000049	0.00000079	0.0054	0.0000040	20	0.0000016	0.00032	0.000076	0.17	0.0000040	0.00076	4.0	0.12	0.00000079	0.022	0.00085	0.047	2.5	0.000014	1.0	0.00000079	8.6	0.13	0.00000032	0.0000026	0.000079	0.016	0.0000023	0.00016	0.0000017
20-Nov-12	18	245	6.7	1745	32	*ND*	1.4	43	1.6	0.097	0.074	0.065	0.0074	0.0015	0.00056	*ND*	0.00074	0.000089	0.0000094	0.00050	0.0016	0.0000042	0.00000074	0.0042	0.0000041	17	0.0000015	0.00020	0.0000056	0.15	0.0000035	0.00059	3.2	0.097	0.00000074	0.022	0.00067	0.045	2.1	0.00001	1.0	0.00000074	6.9	0.10	0.00000030	0.0000017	0.000074	0.012	0.0000022	0.0000082	0.0000021
18-Dec-12	22	258	6.9	1512	32	*ND*	1.2	35	1.2	0.11	0.079	0.065	0.0039	0.00078	0.00055	*ND*	0.00078	0.00018	0.0000080	0.00045	0.0019	0.0000042	0.00000078	0.0039	0.0000047	17	0.0000016	0.00017	0.000038	0.14	0.0000062	0.00048	2.9	0.092	0.00000078	0.026	0.00059	0.047	2.0	0.0000084	0.94	0.00000078	5.1	0.096	0.00000031	0.0000023	0.000078	0.013	0.0000020	0.00016	0.0000025
24-Jan-13	27	200	6.9	1433	26	*ND*	0.72	24	0.76	0.094	0.048	0.045	0.0030	0.00061	0.00018	*ND*	0.00061	0.00033	0.0000083	0.00024	0.0014	0.0000030	0.00000056	0.0033	0.0000034	13	0.0000061	0.00011	0.000031	0.058	0.0000023	0.00037	2.1	0.058	0.00000061	0.020	0.00043	0.018	1.5	0.0000078	0.72	0.00000030	4.1	0.070	0.00000012	0.0000020	0.000030	0.0078	0.00008081	0.00014	0.0000097
12-Feb-13	30	226	6.9	1333	28	*ND*	0.71	24	0.73	0.11	0.034	0.051	0.0034	0.00068	0.00034	*ND*	0.00034	0.0000043	0.0000058	0.00028	0.0019	0.0000032	0.00000034	0.0030	0.0000068	12	0.0000068	0.00011	0.0000021	0.050	0.00000089	0.00043	2.2	0.058	0.00000068	0.023	0.00045	0.021	1.7	0.0000067	0.77	0.00000067	4.8	0.075	0.00000014	0.0000014	0.000034	0.0059	0.0000075	0.000095	0.0000068
12-Mar-13	34	227	7.3	1225	27	*ND*	0.87	20	0.60	0.12	0.034	0.051	0.0034	0.00069	0.00014	*ND*	0.00034	0.0000061	0.0000050	0.00034	0.0021	0.0000032	0.00000034	0.0030	0.0000041	11	0.0000069	0.000093	0.0000016	0.075	0.0000020	0.00039	2.0	0.052	0.00000069	0.024	0.00040	0.021	1.6	0.0000065	0.81	0.00000034	4.2	0.071	0.00000014	0.0000023	0.000034	0.0062	0.000011	0.000087	0.0000089

Leachate Data for Sat Col 13 (lower port)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
18-Jul-12	0	630	6.65	3270	426	*ND*	57.5	1600	72	1.28	<1	1.65	<0.1	<0.02	0.0225	*ND*	<0.005	0.0114	0.00160	0.00449	0.0243	0.000091	0.000099	0.103	0.00347	420	<0.0005	0.0311	0.126	0.167	0.00141	0.0088	88.2	6.27	<0.00001	0.172	0.0171	<1.5	36.9	0.0187	11.6	<0.000025	240	1.74	0.000152	<0.00005	<0.0025	0.178	<0.00025	0.0234	<0.0005
3-Aug-12	2	305	7.29	3030	428	*ND*	49.6	1460	54	1.37	<1	1.65	<0.1	<0.02	0.0183	*ND*	<0.0067	0.036	<0.001	0.0032	0.0233	<0.0010	<0.00025	<0.25	0.00264	418	<0.005	0.0263	0.0464	0.694	0.00194	<0.025	86.0	5.62	<0.00001	0.174	0.0232	<15	36.4	0.00486	12.3	<0.000025	221	1.97	0.000015	<0.00005	<0.0025	0.235	<0.00025	0.031	<0.0005
31-Aug-12	6	470	6.75	2733	516	*ND*	38.1	1200	41	1.22	<1	1.55	<0.1	<0.02	0.0212	*ND*	<0.005	0.0085	0.00052	0.00516	0.0229	0.000070	<0.000025	0.094	0.000437	404	<0.0005	0.0173	0.0153	1.39	0.000830	0.0090	82.2	4.33	<0.00001	0.189	0.0171	<1.5	34.0	0.00068	13.2	<0.000025	182	1.95	0.000058	<0.00005	<0.0025	0.289	<0.00025	0.0146	<0.0005
26-Sep-12	10	470	6.68	2521	525	*ND*	33.9	1040	34	1.23	<1	1.59	<0.1	0.030	0.0114	*ND*	<0.005	0.0062	0.000362	0.00562	0.0219	0.000071	0.000013	0.086	<0.00035	341	<0.0002	0.0129	0.00560	2.08	0.000042	0.0085	69.9	3.56	<0.00001	0.219	0.0163	<0.6	33.6	0.000318	14.2	<0.00001	156	1.65	<0.000004	0.000022	<0.001	0.237	0.00024	0.0138	0.00025
24-Oct-12	14	510	6.62	2162	475	*ND*	5.61	864	27	1.29	<1	1.02	<0.1	<0.02	0.0192	*ND*	<0.005	0.0052	0.000221	0.00525	0.0222	0.000060	<0.00001	0.078	<0.00018	303	<0.0002	0.00971	0.00228	2.55	0.000324	0.0070	63.8	3.36	<0.00001	0.257	0.0135	<0.6	32.7	0.000206	14.8	<0.00001	141	1.51	<0.000004	<0.00002	<0.001	0.242	0.00022	0.0083	<0.0002
21-Nov-12	18	495	6.61	1890	551	*ND*	20.8	698	21	1.24	<1	1.22	<0.1	0.033	0.0207	*ND*	<0.01	0.0059	0.000157	0.00473	0.0216	0.000060	<0.00001	0.062	<0.00015	247	<0.0002	0.00760	0.00150	2.05	0.000132	0.0055	52.0	2.61	<0.00001	0.263	0.0116	<0.6	30.1	0.000174	13.4	<0.00001	114	1.24	<0.000004	<0.00002	<0.001	0.160	0.00017	0.0058	<0.0002
19-Dec-12	22	508	6.78	1689	406	*ND*	16.5	564	15	1.24	<1	1.06	<0.1	<0.02	0.0176	*ND*	<0.01	0.0048	0.000098	0.00419	0.0216	0.000048	<0.00001	0.055	<0.00012	202	<0.0002	0.00608	0.00081	2.26	0.000192	0.0045	44.4	2.03	<0.00001	0.273	0.00987	<0.6	24.0	0.000119	13.0	<0.00001	94.3	1.06	<0.000004	<0.00002	<0.001	0.163	0.00014	0.0045	<0.0002
25-Jan-13	27	410	6.84	1658	404	*ND*	16.7	535	13	1.32	<1	1.08	<0.1	<0.02	0.0165	*ND*	<0.01	0.0046	0.000092	0.00395	0.0220	0.000049	<0.00001	0.059	<0.0001	213	<0.0002	0.00559	0.00074	2.45	0.000192	0.0055	41.4	2.02	<0.00001	0.304	0.0102	<0.6	25.2	0.000114	13.2	<0.00001	88.4	1.10	<0.000004	<0.00002	<0.001	0.186	0.00018	0.0037	<0.0002
13-Feb-13	30	456	6.92	1454	395	*ND*	14.5	424	10.0	1.57	<0.5	0.97	0.065	<0.01	0.0141	*ND*	<0.005	0.00191	0.000067	0.00342	0.0251	0.000039	<0.000005	0.0492	0.000107	188	<0.0001	0.00452	0.00041	0.837	0.0000351	0.00417	36.3	1.71	<0.00001	0.316	0.00851	<0.3	24.6	0.000105	12.0	<0.000005	82.0	0.968	<0.000002	<0.00001	<0.0005	0.0905	0.000060	0.00329	<0.0001
13-Mar-13	34	452	6.76	1342	375	*ND*	2.66	366	8.2	1.77	<0.5	1.01	<0.05	<0.01	0.0166	*ND*	<0.005	0.00239	0.000073	0.00345	0.0239	0.000038	0.0000066	0.0512	<0.0001	163	<0.0001	0.00387	0.00029	1.08	0.0000599	0.00391	32.6	1.47	<0.00001	0.328	0.00761	<0.3	21.8	0.000100	12.8	0.0000077	66.6	0.919	0.0000023	<0.00001	<0.0005	0.159	0.000108	0.00252	<0.0001

Calculated Production Rates for the lower port of Sat Col 13 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
18-Jul-12	0	630	6.7	3270	27	*ND*	3.7	103	4.6	0.082	0.064	0.11	0.0064	0.0013	0.0014	*ND*	0.00032	0.00073	0.00010	0.00029	0.0016	0.0000059	0.0000064	0.0066	0.00022	27	0.0000032	0.0020	0.0081	0.011	0.000091	0.00057	5.7	0.40	0.00000064	0.011	0.0011	0.096	2.4	0.0012	0.75	0.0000016	15	0.11	0.0000098	0.0000032	0.00016	0.011	0.000016	0.0015	0.000032
3-Aug-12	2	305	7.3	3030	13	*ND*	1.5	45	1.7	0.045	0.031	0.051	0.0031	0.0002	0.00078	*ND*	0.021	0.0011	0.0000104	0.00016	0.0007	0.0000016	0.00000027	0.0078	0.0000082	13	0.0000016	0.0082	0.0042	0.047	0.000060	0.00078	2.7	0.17	0.00000027	0.054	0.00072	0.47	1.1	0.0004	0.38	0.00000078	6.9	0.061	0.0000047	0.0000016	0.00078	0.0078	0.000016	0.00078	0.000016
31-Aug-12	6	470	6.8	2733	25	*ND*	1.8	58	2.0	0.059	0.048	0.074	0.0048	0.0096	0.0010	*ND*	0.00024	0.00041	0.000025	0.00025	0.0011	0.0000034	0.0000012	0.0045	0.0000021	19	0.0000024	0.00083	0.00073	0.067	0.0000040	0.0043	3.9	0.21	0.00000048	0.0091	0.00082	0.072	1.6	0.000033	0.63	0.00000012	8.7	0.094	0.0000028	0.0000024	0.00012	0.014	0.00012	0.00070	0.000024
26-Sep-12	10	470	6.7	2521	25	*ND*	1.6	50	1.6	0.059	0.048	0.076	0.0048	0.0014	0.00055	*ND*	0.00024	0.00030	0.000017	0.00027	0.0011	0.0000034	0.0000062	0.0041	0.0000017	16	0.0000096	0.00062	0.00027	0.100	0.0000020	0.00041	3.4	0.17	0.00000048	0.011	0.00078	0.029	1.6	0.000015	0.68	0.00000048	7.5	0.079	0.0000019	0.0000011	0.0000048	0.011	0.000012	0.00066	0.000012
24-Oct-12	14	510	6.6	2162	25	*ND*	0.29	45	1.4	0.067	0.052	0.053	0.0052	0.0015	0.00100	*ND*	0.00026	0.00027	0.000012	0.00027	0.0012	0.0000031	0.0000052	0.0041	0.0000094	16	0.0000010	0.00051	0.00012	0.13	0.0000017	0.00036	3.3	0.17	0.00000052	0.013	0.00070	0.031	1.7	0.0000011	0.77	0.00000052	7.3	0.079	0.0000021	0.0000010	0.0000052	0.013	0.0000011	0.00043	0.0000010
21-Nov-12	18	495	6.6	1890	28	*ND*	1.1	35	1.1	0.063	0.051	0.062	0.0051	0.0017	0.0010	*ND*	0.00051	0.00030	0.0000079	0.00024	0.0011	0.0000030	0.0000051	0.0031	0.0000076	12	0.0000010	0.00038	0.000076	0.10	0.0000067	0.00028	2.6	0.13	0.00000051	0.013	0.00059	0.030	1.5	0.0000088	0.68	0.00000051	5.8	0.063	0.0000020	0.0000010	0.0000051	0.0081	0.0000086	0.00029	0.0000010
19-Dec-12	22	508	6.8	1689	21	*ND*	0.85	29	0.78	0.064	0.052	0.065	0.0052	0.0013	0.00091	*ND*	0.00052	0.00025	0.0000051	0.00022	0.0011	0.0000025	0.0000052	0.0028	0.0000062	10	0.0000010	0.00031	0.000042	0.12	0.0000099	0.00023	2.3	0.11	0.00000052	0.014	0.00051	0.031	1.2	0.0000062	0.67	0.00000052	4.9	0.055	0.0000021	0.0000010	0.0000052	0.0084	0.0000073	0.00025	0.0000010
25-Jan-13	27	410	6.8	1658	17	*ND*	0.70	22	0.54	0.055	0.042	0.045	0.0042	0.00084	0.00069	*ND*	0.00042	0.00019	0.0000038	0.00017	0.00092	0.0000021	0.0000042	0.0025	0.0000042	8.9	0.0000084	0.00023	0.0000031	0.10	0.0000080	0.00023	1.7	0.085	0.00000042	0.013	0.00043	0.025	1.1	0.0000048	0.55	0.00000042	3.7	0.046	0.0000017	0.0000084	0.0000042	0.078	0.00000075	0.00015	0.0000084
13-Feb-13	30	456	6.9	1454	18	*ND*	0.67	20	0.47	0.073	0.023	0.045	0.0030	0.00047	0.00066	*ND*	0.00023	0.0000089	0.0000031	0.00016	0.0012	0.0000018	0.0000023	0.0023	0.0000050	8.7	0.0000047	0.00021	0.0000019	0.039	0.0000016	0.00019	1.7	0.080	0.00000047	0.015	0.00040	0.014	1.1	0.0000049	0.56	0.00000023	3.8	0.045	0.00000093	0.00000047	0.0000023	0.0042	0.0000028	0.00015	0.0

Leachate Data for Sat Col 14 (upper port)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_2-N	NO_3-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
12-Jul-12	0	250	6.24	4640	641	*ND*	97.0	2650	50	1.77	<1	0.636	<0.1	<0.02	0.0032	*ND*	<0.005	0.133	0.00745	0.00366	0.0282	0.000671	0.000035	0.054	0.00174	891	<0.0005	0.181	4.14	0.0751	0.000266	0.0434	191	2.31	0.000129	0.0471	0.0748	<1.5	57.0	0.0454	12.6	0.000048	125	5.91	0.000194	<0.00005	<0.0025	1.12	0.00068	0.323	0.00424
3-Aug-12	3	238	6.54	3820	631	*ND*	32.5	2690	37	2.15	<1	0.955	<0.1	0.022	<0.002	*ND*	<0.005	0.101	0.00271	0.0124	0.0220	0.000658	0.000096	0.042	0.00132	678	0.00091	0.169	0.885	3.31	0.00142	0.0285	149	2.95	<0.00001	0.0181	0.0616	<1.5	41.2	0.0112	12.6	0.000038	79.6	4.18	0.000116	0.000236	<0.0025	0.696	0.00049	0.225	0.00217
30-Aug-12	7	255	6.4	3740	704	*ND*	27.4	1980	28	1.69	<1	0.95	<0.1	<0.02	<0.002	*ND*	<0.005	0.0410	0.00248	0.00665	0.0199	0.000573	<0.000025	0.047	0.00108	706	<0.0005	0.127	0.580	0.219	0.000147	0.0300	169	2.72	<0.00001	0.0161	0.0427	<1.5	45.7	0.00670	11.8	<0.000025	92.4	4.31	0.000109	<0.00005	<0.0025	0.903	0.00057	0.189	0.00200
25-Sep-12	11	260	6.32	3610	705	*ND*	23.2	2170	24	1.95	<1	1.20	<0.1	<0.02	<0.002	*ND*	<0.005	0.0415	0.00148	0.00959	0.0189	0.000499	0.000130	0.039	0.000639	656	<0.0005	0.118	0.343	2.21	0.000274	0.0270	141	2.68	<0.00001	0.0141	0.0378	<1.5	40.8	0.00420	11.3	<0.000025	69.1	3.65	0.000062	0.000238	<0.0025	0.691	0.00038	0.142	0.00153
23-Oct-12	15	280	6.38	3470	660	*ND*	20.3	1940	19	1.80	<1	1.22	<0.1	<0.02	<0.002	*ND*	<0.005	0.0302	0.00119	0.0111	0.0181	0.000411	<0.000025	0.040	0.000356	703	<0.0005	0.114	0.144	3.82	0.000280	0.0280	151	2.75	<0.00001	0.0144	0.0304	<1.5	42.0	0.00301	12.1	<0.000025	68.8	3.78	0.000036	0.000056	<0.0025	0.713	0.00029	0.111	0.00133
20-Nov-12	19	280	6.37	3220	537	*ND*	15.7	1730	15	1.79	<1	1.23	<0.1	0.040	0.0053	*ND*	<0.01	0.0207	0.000899	0.00792	0.0167	0.000360	<0.000005	0.0327	0.000323	626	<0.0001	0.0954	0.102	1.28	0.0000771	0.0245	122	2.56	<0.00001	0.0118	0.0225	<0.3	37.6	0.00294	11.9	<0.000005	49.8	3.09	0.0000237	<0.00001	<0.0005	0.515	0.000121	0.0819	0.00047
18-Dec-12	23	215	6.61	2990	516	*ND*	12.6	1560	13	1.69	<1	1.14	<0.1	<0.02	<0.002	*ND*	<0.01	0.0151	0.00063	0.00842	0.0167	0.000285	<0.000025	0.027	0.000183	598	<0.0001	0.0730	0.0514	3.67	0.000139	0.0192	115	2.12	<0.00001	0.0130	0.0175	<1.5	33.3	0.00138	9.96	<0.000025	41.5	3.02	<0.00001	<0.00005	<0.0025	0.479	0.00037	0.0539	0.00076
24-Jan-13	28	200	6.53	2857	460	*ND*	9.3	1480	<10	2.00	<1	1.07	<0.1	<0.02	<0.002	*ND*	<0.01	0.0216	0.00067	0.00695	0.0162	0.000268	<0.000025	0.026	0.000220	566	<0.0005	0.0693	0.0659	3.20	0.000150	0.0173	102	2.07	<0.00001	0.0103	0.0152	<1.5	29.1	0.00152	10.2	<0.000025	34.4	2.59	0.000013	<0.00005	<0.0025	0.407	<0.00025	0.0470	0.00056
12-Feb-13	31	237	6.63	2597	420	*ND*	6.9	1330	<10	2.01	<1	1.00	<0.1	<0.02	<0.002	*ND*	<0.005	0.0049	0.000437	0.00406	0.0189	0.000191	<0.00001	0.023	0.000139	517	<0.0002	0.0490	0.0152	0.934	0.000019	0.0150	88.0	1.80	<0.00001	0.00808	0.0102	<0.6	27.6	0.00102	9.22	<0.00001	27.9	2.24	0.0000057	<0.00002	<0.001	0.290	<0.0001	0.0273	<0.0002
12-Mar-13	35	235	6.87	2512	411	*ND*	8.3	1290	<10	2.08	<1	0.979	<0.1	<0.02	<0.002	*ND*	<0.005	0.0052	0.000425	0.00538	0.0182	0.000164	0.000019	0.022	0.000095	482	<0.0002	0.0398	0.00356	2.42	0.000058	0.0139	80.5	1.63	<0.00001	0.00972	0.00827	<0.6	25.4	0.000901	8.93	<0.00001	22.9	2.14	<0.000004	<0.00002	<0.001	0.275	0.00013	0.0195	0.00026

Calculated Production Rates for the upper port of Sat Col 14 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_2-N	NO_3-N	TD-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
12-Jul-12	0	250	6.2	4640	29	*ND*	4.3	118	2.2	0.079	0.045	0.028	0.0045	0.00089	0.00014	*ND*	0.00022	0.0059	0.00033	0.00016	0.0013	0.00030	0.00016	0.0024	0.00008	40	0.000022	0.0081	0.18	0.0034	0.000012	0.0019	8.5	0.10	0.0000058	0.0021	0.0033	0.067	2.5	0.0020	0.56	0.00000521	5.6	0.26	0.0000087	0.0000022	0.00011	0.050	0.000030	0.014	0.00019
3-Aug-12	3	230	6.5	3820	26	*ND*	1.3	86	1.5	0.088	0.041	0.039	0.0041	0.00090	0.000082	*ND*	0.00021	0.0041	0.00011	0.00051	0.00090	0.000027	0.0000039	0.0017	0.000054	28	0.000037	0.0069	0.036	0.14	0.000058	0.0012	6.1	0.12	0.00000041	0.00074	0.0025	0.062	1.7	0.00046	0.52	0.00000516	3.3	0.17	0.0000048	0.0000097	0.00010	0.029	0.000020	0.0092	0.0000089
30-Aug-12	7	255	6.4	3740	32	*ND*	1.2	90	1.3	0.077	0.046	0.043	0.0046	0.00091	0.0000991	*ND*	0.00023	0.0019	0.00011	0.00030	0.00091	0.00026	0.0000011	0.0021	0.0000449	32	0.0000023	0.0058	0.026	0.0100	0.0000067	0.0014	7.7	0.12	0.00000046	0.00073	0.0019	0.068	2.1	0.00031	0.54	0.00000511	4.2	0.10	0.0000050	0.0000023	0.00011	0.041	0.000026	0.0086	0.0000091
25-Sep-12	11	260	6.3	3610	33	*ND*	1.1	101	1.1	0.091	0.046	0.056	0.0046	0.00093	0.0000993	*ND*	0.00023	0.0019	0.00006	0.00045	0.00088	0.00023	0.0000060	0.0018	0.0000030	30	0.0000023	0.0055	0.016	0.10	0.0000013	0.0013	6.5	0.12	0.00000046	0.00065	0.0018	0.070	1.9	0.00020	0.52	0.00000512	3.2	0.17	0.0000029	0.0000011	0.00012	0.032	0.000018	0.0066	0.0000071
23-Oct-12	15	280	6.4	3470	33	*ND*	1.0	97	0.95	0.090	0.050	0.061	0.0050	0.0010	0.00010	*ND*	0.00025	0.0015	0.000060	0.00056	0.00091	0.00021	0.0000013	0.0020	0.0000018	35	0.0000025	0.0057	0.0072	0.19	0.0000014	0.0014	7.6	0.14	0.00000050	0.00072	0.0015	0.075	2.1	0.00015	0.61	0.00000513	3.4	0.19	0.0000018	0.0000028	0.00013	0.036	0.000015	0.0056	0.0000067
20-Nov-12	19	280	6.4	3220	27	*ND*	0.79	87	0.75	0.090	0.050	0.062	0.0050	0.0020	0.00027	*ND*	0.00050	0.0016	0.00045	0.00040	0.0084	0.00018	0.0000025	0.0016	0.0000116	23	0.0000050	0.0048	0.0051	0.064	0.0000039	0.0012	6.1	0.13	0.00000050	0.00059	0.0011	0.015	1.9	0.00015	0.60	0.00000525	2.5	0.15	0.0000012	0.0000050	0.00025	0.026	0.0000061	0.0041	0.0000024
18-Dec-12	23	215	6.6	2990	20	*ND*	0.48	60	0.50	0.065	0.038	0.044	0.0038	0.00077	0.000077	*ND*	0.00038	0.00058	0.00024	0.00032	0.00064	0.000011	0.00000096	0.0010	0.0000070	23	0.0000019	0.0028	0.0020	0.14	0.0000053	0.00074	4.4	0.081	0.00000038	0.00050	0.00067	0.058	1.3	0.00053	0.38	0.00000096	1.6	0.12	0.00000038	0.0000019	0.000096	0.018	0.000014	0.0021	0.0000029
24-Jan-13	28	200	6.5	2857	16	*ND*	0.33	53	0.36	0.071	0.036	0.038	0.0036	0.00071	0.0000771	*ND*	0.00036	0.00077	0.000024	0.00025	0.00058	0.0000096	0.00000089	0.00093	0.0000079	20	0.0000018	0.0025	0.0024	0.11	0.0000054	0.00062	3.6	0.074	0.00000036	0.00037	0.00054	0.054	1.0	0.000054	0.36	0.00000089	1.2	0.093	0.00000046	0.0000018	0.00089	0.015	0.0000089	0.0017	0.0000020
12-Feb-13	31	237	6.6	2597	18	*ND*	0.29	56	0.42	0.085	0.042	0.042	0.0042	0.00085	0.0000885	*ND*	0.00021	0.00021	0.00018	0.00017	0.00080	0.00000881	0.00000442	0.00097	0.0000059	22	0.0000085	0.0021	0.00064	0.040	0.00000080	0.00063	3.7	0.076	0.00000042	0.00034	0.00043	0.025	1.2	0.00043	0.39	0.00000442	1.2	0.095	0.00000024	0.00000885	0.0000042	0.012	0.0000042	0.0012	0.0000085
12-Mar-13	35	235	6.9	2512	17	*ND*	0.35	54	0.42	0.087	0.042	0.041	0.0042	0.00084	0.0000884	*ND*	0.00021	0.00022	0.00018	0.00023	0.00076	0.00000869	0.00000080	0.00092	0.0000440	20	0.0000084	0.0017	0.00015	0.10	0.0000024	0.00058	3.4	0.068	0.00000042	0.00041	0.00035	0.025	1.1	0.00038	0.37	0.00000442	0.96	0.090	0.00000017	0.0000084	0.0000042	0.012	0.0000055	0.00082	0.0000011

Leachate Data for Sat Col 14 (lower port)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_2-N	NO_3-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
13-Jul-12	0	475	3.32	7520	NA	*ND*	82.4	7770	48	54.2	<2.5	8.16	0.64	<0.05	3.33	*ND*	<0.005	688	0.0092	0.0185	0.0123	0.0673	0.00159	<0.5	0.0340	486	0.088	2.87	643	92.6	0.00136	0.205	345	14.9	0.000028	0.0079	0.790	<30	26.0	0.0984	31.4	<0.00005	166	0.538	0.00136	0.0014	<0.05	1.78	0.0080	4.41	<0.01
3-Aug-12	3	370	3.39	2418	NA	*ND*	57.0	4820	31	29.5	<2.5	5.34	0.36	<0.05	1.06	*ND*	<0.0067	416	0.0060	0.0119	0.0093	0.0343	<0.00025	<0.25	0.0222	443	0.0508	2.06	407	70.1	<0.00025	0.116	306	12.2	0.000020	0.0041	0.541	<15	29.7	0.0654	30.3	<0.00025	147	0.664	0.00093	<0.0005	<0.025	0.886	0.0061	3.01	<0.005
31-Aug-12	7	465	3.46	4340	NA	*ND*	38.1	3620	23	19.4	<1	3.92	0.18	<0.02	0.723	*ND*	<0.005	188	0.00489	0.00817	0.00800	0.0200	<0.0001	<0.1	0.0119	439	0.0223	1.09	220	79.2	0.00040	0.072	199	7.09	0.000013	0.0029	0.276	<6	21.3	0.0391	26.8	0.00024	86.5	0.716	0.000718	<0.0002	<0.01	0.439	0.0068	1.62	<0.002
26-Sep-12	11	460	3.6	3770	NA	*ND*	29.0	2900	16	13.9	<1	3.37	0.16	0.033	0.620	*ND*	<0.0057	127	0.00399	0.00719	0.00893	0.0154	0.00029	<0.1	0.00906	403	0.0183	0.817	147	95.0	0.000065	0.062	145	5.27	<0.00001	0.0043	0.212	<6	17.2	0.0255	25.8	<0.00001	55.0	0.562	0.000583	0.00041	<0.01	0.280	0.0106	1.27	<0.002
24-Oct-12	15	505	3.6	3370	14	*ND*	4.81	2530	22	8.46	<1	2.53	<0.1	0.024	0.400	*ND*	<0.005	76.7	0.00362	0.0183	0.00908	0.00845	<0.00005	<0.05	0.00568	360	0.0117	0.490	82.8	66.0	<0.00005	0.0388	101	3.86	<0.00001	0.00332	0.119	<3	14.5	0.0173	21.8	<0.00005	41.3	0.487	0.000446	<0.0001	<0.005	0.187	0.00453	0.707	<0.001
21-Nov-12	19	480	3.82	3070	NA	*ND*	18.1	2290	13	5.47	<1	2.48	<0.1	0.023	0.250	*ND*	<0.01	53.6	0.00317	0.00231	0.00645	0.00670	<0.00005	<0.05	0.00471	384	0.0069	0.421	55.3	53.2	<0.00005	0.0223	110	3.94	<0.00001	0.00195	0.101	<3	15.8	0.0138	19.2	<0.00005	39.2	0.674	0.000400	<0.0001	<0.005	0.130	0.00324	0.576	<0.001
19-Dec-12	23	425	4.07	2934	18	*ND*	14.3	2080	<10	4.16	<1	1.97	<0.1	0.021	0.172	*ND*	<0.01	43.4	0.00337	0.00321	0.00697	0.00448	<0.00025	<0.25	0.00281	348	43.2	45.2	<0.00025	0.0140	109	3.39	<0.00001	0.00229	0.0849	<1.5	16.1	0.0116	18.6	<0.00025	35.1	0.819	0.000372	<0.00005	<0.025	0.114	0.00224	0.462	<0.0005
25-Jan-13	28	410	4.26	2809	30	*ND*	13.4	1960	<10	3.58	<1	1.86	<0.1	<0.02	0.118	*ND*	<0.01	33.6	0.00345	0.00239	0.00691	0.00440	<0.00025	0.033	0.00326	470	0.00393	0.277	32.5	36.4	<0.00025	0.0149	106	3.33	<0.00001	0.00260	0.0644	<1.5	15.5	0.00961	18.5	<0.00025	29.3	0.847	0.000348	0.000092	<0.00025	0.0988	0.00141	0.355	<0.0005
13-Feb-13	31	467	4.39	2705	22	*ND*	12.3	1860	<10	3.30	<1	1.70	<0.1	<0.02	0.0582	*ND*	<0.005	26.0	0.00339	0.00212	0.00735	0.00351	<0.00025	0.031	0.00289	475	0.00268	0.224	27.0	30.4	<0.00025	0.0127	94.6	2.95	<0.00001	0.00444	0.0533	<1.5	15.4	0.00760	17.4	<0.00005	27.1	0.834	0.000303	<0.00005	<0.025	0.101	0.00094	0.296	<0.0005
13-Mar-13	35	460	4.39	2677	22	*ND*	2.38	1840	<10	2.84	<1	1.58	<0.1	<0.02	0.0395	*ND*	<0.005	20.5	0.00368	0.00202	0.00714	0.00306	0.000035	0.031	0.00260	465	0.00360	0.182	20.5	25.4	0.000028	0.0117	85.8	2.60	<0.00001	0.00424	0.0431	<1.5	14.3	0.00707	16.8	<0.00005	22.6	0.816	0.000286	<0.00005	<0.025	0.0874	0.00081	0.231	<0.0005

Calculated Production Rates for the lower port of Sat Col 14 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_2-N	NO_3-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
13-Jul-12	0	475	3.3	7520	*ND*	*ND*	7.0	659	4.1	4.6	0.21	0.69	0.054	0.0042	0.282	*ND*	0.00042	58	0.00078	0.00157	0.00104	0.0057	0.000135	0.042	0.0029	41	0.0075	0.24	55	7.9	0.000115	0.0174	29	1.26	0.0000024	0.00067	0.067	2.54	2.2	0.0083	2.7	0.000042	14.1	0.046	0.000115	0.000119	0.0042	0.151	0.00068	0.37	0.00085
3-Aug-12	3	370	3.4	2418	*ND*	*ND*	3.8	318	2.0	1.9	0.17	0.35	0.024	0.0033	0.070	*ND*	0.00044	27	0.00040	0.00079	0.00061	0.0023	0.000017	0.017	0.0015	29	0.0034	0.14	27	4.6	0.000017	0.0077	20	0.81	0.0000013	0.00027	0.036	0.99	2.0	0.0043	2.0	0.000017	9.7	0.044	0.000061	0.000033	0.0017	0.059	0.00040	0.20	0.00033
31-Aug-12	7	465	3.5	4340	*ND*	*ND*	3.2	301	1.9	1.6	0.083	0.33	0.015	0.0017	0.060	*ND*	0.00042	16	0.00041	0.00068	0.00066	0.0017	0.0000083	0.0083	0.00099	36	0.0019	0.091	18	6.6	0.0000033	0.0060	17	0.59	0.0000011	0.00024	0.023	0.50	1.8	0.0032	2.2	0.0000020	7.2	0.059	0.0000060	0.0000017	0.00083	0.036	0.00056	0.13	0.00017
26-Sep-12	11	460	3.6	3770	*ND*	*ND*	2.4	238	1.3	1.1	0.082	0.28	0.013	0.0027	0.051	*ND*	0.00047	10	0.00033	0.00059	0.00073	0.0013	0.0000024	0.0082	0.00074	33	0.0015	0.067	12	7.8	0.000053	0.0051	12	0.43	0.00000082	0.00035	0.017	0.49	1.4	0.0021	2.1	0.0000082	4.5	0.046	0.000048	0.0000034	0.00082	0.023	0.00087	0.10	0.00016
24-Oct-12	15	505	3.6	3370	1.3	*ND*	0.43	228	2.0	0.76	0.090	0.23	0.0090	0.0022	0.036	*ND*	0.00045	6.9	0.00033	0.0017	0.00082	0.00076	0.0000045	0.0045	0.00051	32	0.0011	0.044	7.5	6.0	0.0000045	0.0035	9.1	0.35	0.00000090	0.00030	0.011	0.27	1.3	0.0016	2.0	0.0000045	3.7	0.044	0.0000040	0.0000090	0.00045	0.017	0.00041	0.064	0.0000090
21-Nov-12	19	480	3.8	3070	*ND*	*ND*	1.6	196	1.1	0.47	0.086	0.21	0.0086	0.0020	0.021	*ND*	0.00086	4.6	0.00027	0.00020	0.00055	0.00057	0.0000043	0.0043	0.00040	33	0.00059	0.036	4.7	4.6	0.0000043	0.0019	9.4	0.34	0.00000086	0.00017	0.0087	0.26	1.4	0.0012	1.6	0.0000043	3.4	0.058	0.0000034	0.0000086	0.00043	0.011	0.00028	0.049	0.0000086
19-Dec-12	23	425	4.1	2934	1.4	*ND*	1.1	158	0.76	0.32	0.076	0.15	0.0076	0.0016	0.013	*ND*	0.00076	3.3	0.00026	0.00024	0.00053	0.00034	0.0000019	0.0019	0.00037	31	0.00044	0.026	3.3	3.4	0.0000019	0.0011	8.3	0.26	0.00000076	0.00017	0.0064	0.11	1.2	0.00088	1.4	0.0000019	2.7	0.062	0.0000028	0.0000038	0.00019	0.0087	0.00017	0.035	0.0000038
25-Jan-13	28	410	4.3	2809	2.2	*ND*	0.98	144	0.73	0.26	0.073	0.14	0.0073	0.0015	0.0086	*ND*	0.00073	2.5	0.00025	0.00017	0.0051	0.00032	0.0000018	0.0024	0.00024	34	0.00029	0.020	2.4	2.7	0.0000018	0.0011	7.8	0.24	0.00000073	0.00019	0.0047	0.11	1.1	0.00070	1.4	0.0000018	2.1	0.062	0.0000025	0.0000067	0.00018	0.0072	0.00010	0.026	0.0000037
13-Feb-13	31	467	4.4	2705	1.8	*ND*	1.0	155	0.83	0.28	0.083	0.14	0.0083	0.0017	0.0049	*ND*	0.00042	2.2	0.00028	0.00018	0.00061	0.00029	0.0000021	0.0026	0.00024	39	0.00022	0.019	2.3	2.5	0.0000021	0.0011	7.9	0.25	0.00000083	0.00037	0.0044	0.13	1.3	0.00063	1.5	0.0000021	2.3	0.070	0.0000025	0.0000042	0.00021	0.0084	0.00078	0.025	0.0000042
13-Mar-13	35	460	4.4	2677	1.8	*ND*	0.20	151	0.82	0.23	0.082	0.13	0.0082	0.0016	0.0032	*ND*	0.00041	1.7	0.00030	0.00017	0.00059	0.00025	0.0000029	0.0025	0.00019	38	0.00030	0.015	1.7	2.1	0.0000023	0.00096	7.0	0.21	0.00000082	0.00035	0.0035	0.12	1

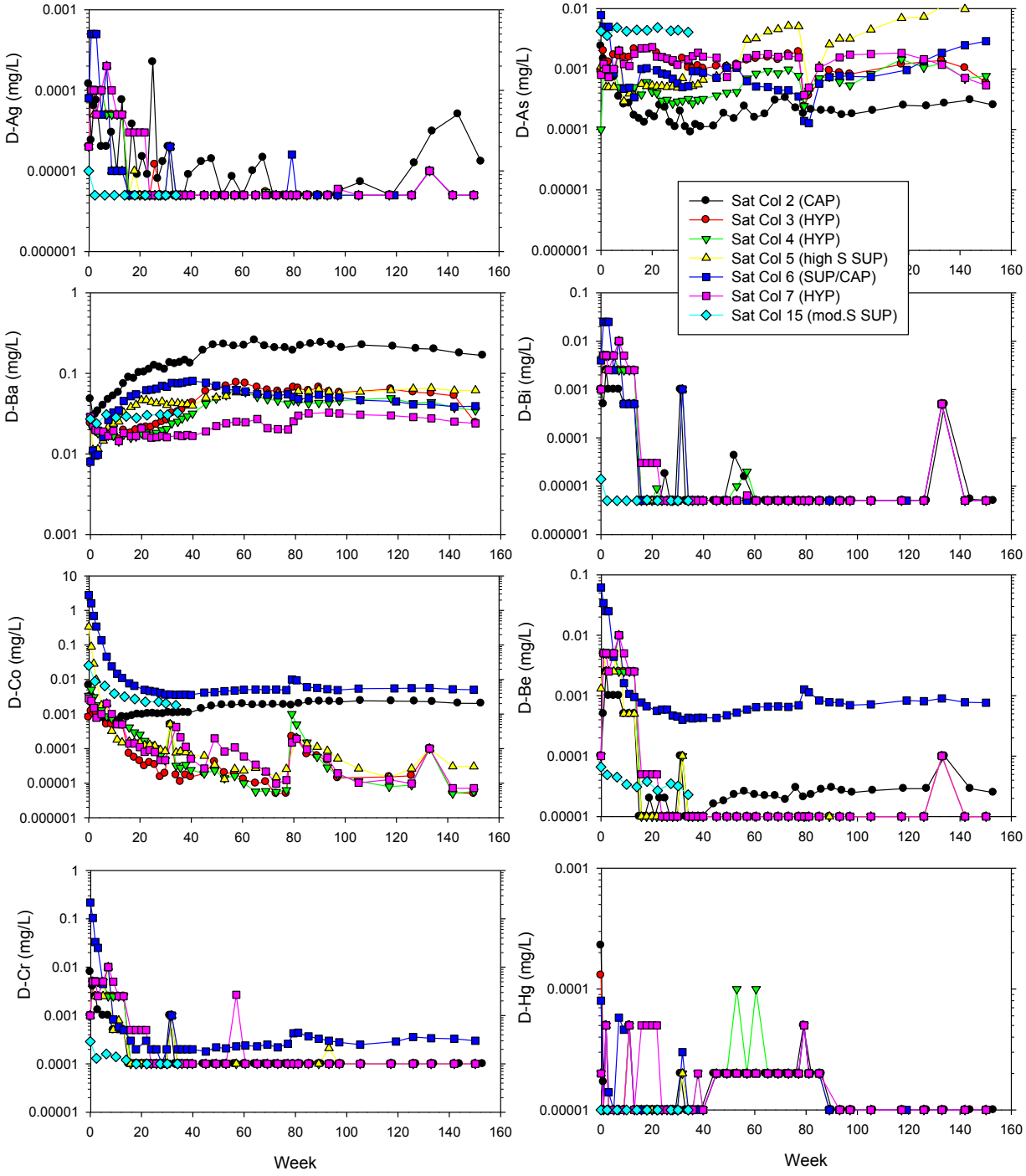
Leachate Data for Sat Col 15

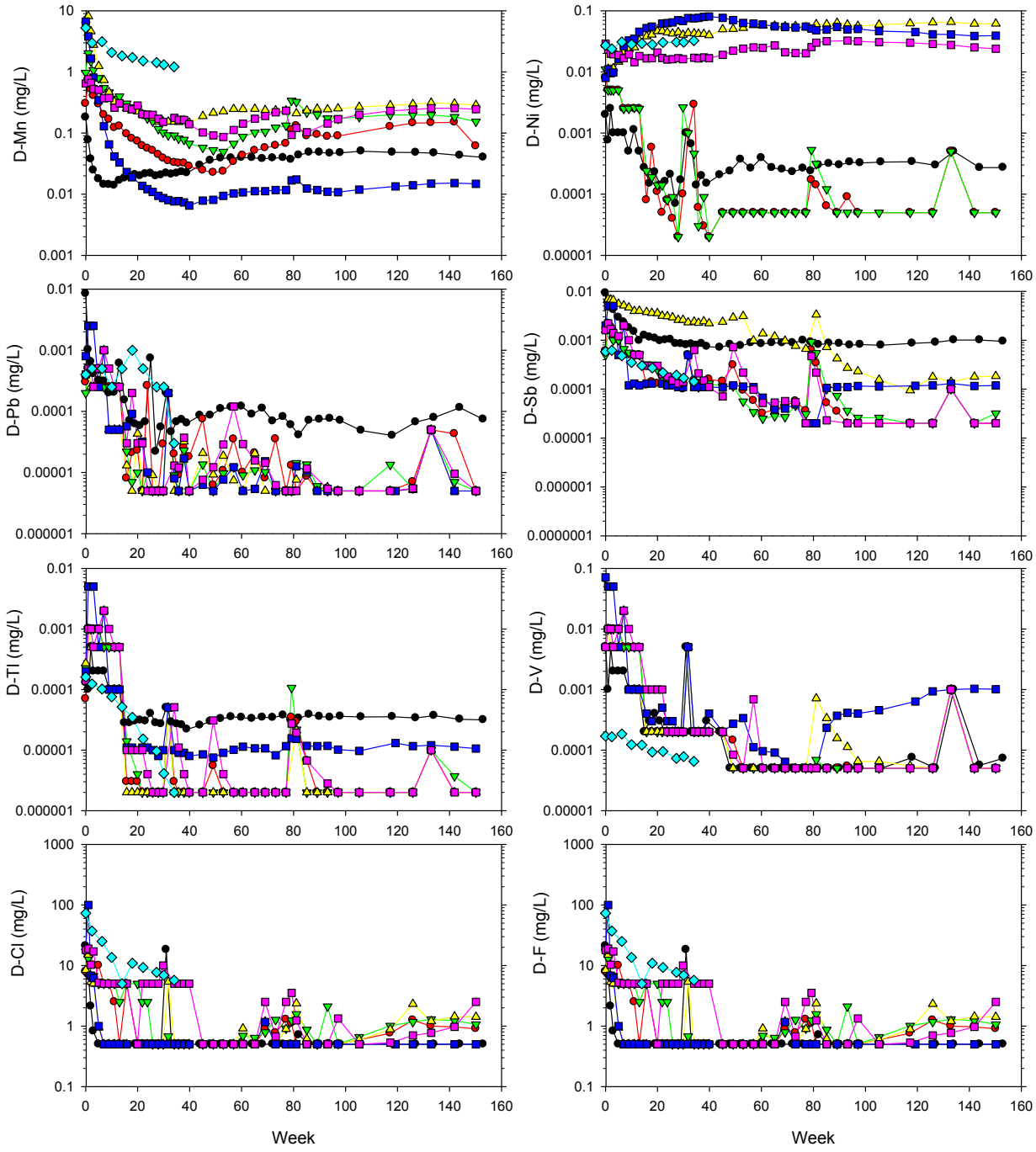
Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
17-Jul-12	0	425	6.77	2976	355	*ND*	60	1350	73	1.37	<1	1.73	<0.1	<0.02	0.0100	*ND*	<0.005	0.0094	0.000586	0.00425	0.0272	0.000066	0.000014	0.136	<0.003	372	0.00029	0.0256	0.148	0.0840	0.000054	0.0099	62.1	5.25	<0.00001	0.366	0.00875	<0.6	33.6	0.0192	13.1	<0.00001	263	1.20	0.000161	0.000023	<0.001	0.0855	0.00017	0.0254	0.00030
3-Aug-12	2	283	7.04	1966	334	*ND*	30.2	765	37	1.69	<1	1.53	<0.1	0.020	<0.002	*ND*	<0.005	0.00690	0.000620	0.00356	0.0238	0.000049	<0.000005	0.110	<0.002	236	0.00013	0.00882	0.0260	0.465	0.0000764	0.00687	36.1	2.98	<0.00001	0.468	0.00465	<0.3	25.9	0.00971	13.6	<0.000005	161	0.898	0.000124	<0.00001	<0.0005	0.0541	0.000166	0.0116	0.00016
30-Aug-12	6	333	6.89	1818	392	*ND*	23.9	653	25	1.56	<1	1.55	<0.1	<0.02	0.0050	*ND*	<0.005	0.00695	0.000479	0.00485	0.0308	0.000045	<0.000005	0.101	<0.0007	229	0.00016	0.00653	0.0241	1.01	0.000112	0.00486	40.7	3.13	<0.00001	0.480	0.00447	<0.3	28.7	0.00827	16.7	<0.000005	152	0.787	0.000102	0.000068	<0.0005	0.0600	0.000184	0.0100	0.00016
25-Sep-12	10	333	6.96	1439	407	*ND*	18.8	450	13.6	1.92	<0.5	1.21	<0.05	<0.01	<0.002	*ND*	<0.005	0.00516	0.000351	0.00421	0.0283	0.000034	<0.000005	0.0807	<0.0004	162	0.00014	0.00392	0.0114	1.04	0.000116	0.00342	27.2	2.08	<0.00001	0.505	0.00312	<0.3	21.3	0.00414	14.3	<0.000005	100	0.578	0.0000759	0.000069	<0.0005	0.0413	0.000123	0.00709	0.00012
23-Oct-12	14	358	6.97	1309	497	*ND*	18.5	<5	<5	<0.2	<0.5	1.19	<0.05	<0.01	0.0042	*ND*	<0.005	0.00491	0.000302	0.00442	0.0292	0.000031	<0.000005	0.0783	<0.00026	146	0.00012	0.00318	0.00889	1.48	0.000145	0.00301	25.3	1.83	<0.00001	0.530	0.00286	<0.3	20.2	0.00299	13.2	<0.000005	82.2	0.528	0.0000516	0.000060	<0.0005	0.0435	0.000121	0.00622	0.00012
20-Nov-12	18	353	6.80	1229	325	*ND*	17.0	364	10.9	2.08	<0.5	1.14	<0.05	<0.01	0.0061	*ND*	<0.01	0.00362	0.000271	0.00437	0.0280	0.000038	0.0000052	0.0726	<0.0002	147	<0.0001	0.00274	0.00565	1.43	0.0000782	0.00294	24.6	1.72	<0.00001	0.552	0.00271	<0.3	21.1	0.00229	14.2	<0.000005	82.6	0.517	0.0000348	0.000093	0.00069	0.0387	0.000093	0.00552	0.00011
18-Dec-12	22	177	7.24	1152	351	*ND*	14.6	314	9.3	1.90	<0.5	1.07	<0.05	<0.01	0.0093	*ND*	<0.01	0.00261	0.000218	0.00485	0.0303	0.000027	<0.000005	0.0590	<0.0002	146	<0.0001	0.00225	0.00340	1.67	0.0000570	0.00258	22.6	1.51	<0.00001	0.597	0.00250	<0.3	18.5	0.00166	14.0	<0.000005	74.1	0.501	0.0000153	0.000095	<0.0005	0.0353	0.000095	0.00430	<0.0001
24-Jan-13	27	210	6.95	1107	329	*ND*	12.9	284	7.7	2.02	<0.5	1.01	<0.05	<0.01	0.0102	*ND*	<0.01	0.00258	0.000194	0.00427	0.0307	0.000035	<0.000005	0.0657	<0.00015	133	<0.0001	0.00227	0.00251	1.64	0.0000444	0.00246	20.6	1.42	<0.00001	0.580	0.00243	<0.3	18.2	0.00124	14.4	<0.000005	67.0	0.461	0.0000096	0.000065	0.00057	0.0354	0.000073	0.00340	<0.0001
12-Feb-13	30	250	6.89	1020	309	*ND*	11.5	244	6.9	2.08	<0.5	0.950	<0.05	<0.01	0.0151	*ND*	<0.005	0.00293	0.000168	0.00439	0.0306	0.000032	<0.000005	0.0620	<0.00015	123	<0.0001	0.00205	0.00195	1.71	0.0000426	0.00224	20.4	1.31	<0.00001	0.585	0.00226	<0.3	17.9	0.00107	13.5	<0.000005	65.5	0.430	0.0000041	0.000040	<0.0005	0.0291	0.000078	0.00321	<0.0001
12-Mar-13	34	238	7.25	945	303	*ND*	12.9	208	5.7	2.23	<0.5	0.934	<0.05	<0.01	0.0057	*ND*	<0.005	0.00231	0.000143	0.00407	0.0325	0.000023	<0.000005	0.0611	<0.00015	111	<0.0001	0.00180	0.00150	1.57	0.0000290	0.00179	18.2	1.21	<0.00001	0.648	0.00220	<0.3	16.4	0.000689	13.9	<0.000005	56.9	0.412	<0.000002	0.000047	<0.0005	0.0270	0.000065	0.00214	<0.0001

Calculated Production Rates for Sat Col 15 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
17-Jul-12	0	425	6.8	2976	19	*ND*	3.2	73	3.9	0.074	0.054	0.093	0.0054	0.0011	0.00054	*ND*	0.00027	0.00051	0.000032	0.00023	0.0015	0.0000036	0.00000075	0.0073	0.00016	20	0.0000016	0.0014	0.0080	0.0045	0.0000029	0.00053	3.3	0.28	0.00000054	0.020	0.00047	0.032	1.8	0.0010	0.70	0.00000054	14	0.065	0.0000087	0.0000012	0.000054	0.0046	0.0000091	0.0014	0.000016
3-Aug-12	2	283	7.0	1966	12	*ND*	1.1	27	1.3	0.061	0.036	0.055	0.0036	0.00072	0.000072	*ND*	0.00018	0.00025	0.000022	0.00013	0.00085	0.0000018	0.00000018	0.0039	0.000072	8.5	0.0000047	0.00032	0.00093	0.017	0.0000027	0.00025	1.3	0.11	0.00000036	0.017	0.00017	0.011	0.93	0.00035	0.49	0.00000018	5.8	0.032	0.0000044	0.00000036	0.000018	0.0019	0.0000059	0.00042	0.0000057
30-Aug-12	6	333	6.9	1818	17	*ND*	1.0	28	1.1	0.066	0.042	0.065	0.0042	0.00084	0.00021	*ND*	0.00021	0.00029	0.000020	0.00020	0.0013	0.0000019	0.00000021	0.0043	0.000030	9.7	0.0000067	0.00028	0.0010	0.043	0.0000047	0.00020	1.7	0.13	0.00000042	0.020	0.00019	0.013	1.2	0.00043	0.70	0.00000021	6.4	0.033	0.0000043	0.0000029	0.000021	0.0025	0.0000078	0.00042	0.0000067
25-Sep-12	10	333	7.0	1439	17	*ND*	0.79	19	0.57	0.081	0.021	0.051	0.0021	0.00042	0.000084	*ND*	0.00021	0.00022	0.000015	0.00018	0.0012	0.0000014	0.00000021	0.0034	0.000017	6.8	0.0000059	0.00017	0.00048	0.044	0.0000049	0.00014	1.1	0.088	0.00000042	0.021	0.00013	0.013	0.90	0.00017	0.60	0.00000021	4.2	0.024	0.0000032	0.0000029	0.000021	0.0017	0.0000052	0.00030	0.0000051
23-Oct-12	14	358	7.0	1309	23	*ND*	0.84	0.23	0.23	0.0091	0.023	0.054	0.0023	0.00045	0.00019	*ND*	0.00023	0.00022	0.000014	0.00020	0.0013	0.0000014	0.00000023	0.0035	0.000012	6.6	0.0000054	0.00014	0.00040	0.067	0.0000066	0.00014	1.1	0.083	0.00000045	0.024	0.00013	0.014	0.92	0.00014	0.60	0.00000023	3.7	0.024	0.0000023	0.0000027	0.000023	0.0020	0.0000055	0.00028	0.0000054
20-Nov-12	18	353	6.8	1229	15	*ND*	0.76	16	0.49	0.093	0.022	0.051	0.0022	0.00045	0.00027	*ND*	0.00045	0.00016	0.000012	0.00020	0.0013	0.0000017	0.00000023	0.0032	0.0000089	6.6	0.0000045	0.00012	0.00025	0.064	0.0000035	0.00013	1.1	0.077	0.00000045	0.025	0.00012	0.013	0.94	0.00010	0.63	0.00000022	3.7	0.023	0.0000016	0.0000042	0.000031	0.0017	0.0000042	0.00025	0.0000049
18-Dec-12	22	177	7.2	1152	7.9	*ND*	0.33	7.0	0.21	0.043	0.011	0.024	0.0011	0.00022	0.00021	*ND*	0.00022	0.00058	0.0000049	0.00011	0.00068	0.0000060	0.00000011	0.0013	0.0000045	3.3	0.0000022	0.000050	0.000076	0.037	0.0000013	0.000058	0.51	0.034	0.00000022	0.013	0.000056	0.0067	0.41	0.000037	0.31	0.00000011	1.7	0.011	0.0000034	0.0000021	0.000011	0.00079	0.0000021	0.000096	0.0000022
24-Jan-13	27	210	7.0	1107	8.7	*ND*	0.34	7.5	0.20	0.054	0.013	0.027	0.0013	0.00027	0.00027	*ND*	0.00027	0.00069	0.0000052	0.00011	0.00082	0.0000093	0.00000013	0.0017	0.0000040	3.5	0.0000027	0.000060	0.000067	0.044	0.0000012	0.000065	0.55	0.038	0.00000027	0.015	0.000065	0.0080	0.48	0.000033	0.38	0.00000013	1.8	0.012	0.0000026	0.0000017	0.000015	0.00094	0.0000019	0.000090	0.0000027
12-Feb-13	30	250	6.9	1020	9.8	*ND*	0.36	7.7	0.22	0.066	0.016	0.030	0.0016	0.00032	0.00048	*ND*	0.00016	0.000093	0.0000053	0.00014	0.00097	0.0000010	0.00000016	0.0020	0.0000047	3.9	0.0000032	0.000065	0.000062	0.054	0.0000013	0.000071	0.65	0.041	0.00000032	0.019	0.000072	0.0095	0.57	0.000034	0.43	0.00000016	2.1	0.014	0.00000013	0.0000013	0.000016	0.00092	0.0000025	0.00010	0.0000032
12-Mar-13	34	238	7.3	945	9.1	*ND*	0.39	6.3	0.17	0.067	0.015	0.028	0.0015	0.00030	0.00017	*ND*	0.00015	0.000070	0.0000043	0.00012	0.00098	0.00000069	0.00000015	0.0018	0.0000045	3.3	0.0000030	0.000054	0.000045	0.047	0.00000087	0.000054	0.55	0.036	0.00000030	0.020	0.000066	0.0090	0.49	0.000021	0.42	0.00000015	1.7	0.012	0.000000060	0.0000014	0.000015	0.00081	0.0000020	0.000064	0.0000030

Appendix D.2: Concentrations of Metals in Leachate from Saturated Waste Rock Columns




D-Mn (mg/L)
D-Ni (mg/L)
D-Pb (mg/L)
D-Sb (mg/L)
D-Tl (mg/L)
D-V (mg/L)
D-Cl (mg/L)
D-F (mg/L)
Week
Week

APPENDIX D3 CALCULATIONS FOR EXTRAPOLATION OF CAP & SUP ACIDITY

Appendix D.3: Extrapolation of Acidity from SUP and CAP Saturated Columns

One of the objectives of the saturated column experiments was to determine the amount of acidity that would be released from oxidized CAP and SUP material when it is subaqueously disposed. This estimate can then be used to provide an estimate of how much NP will need to be placed in the saturated impoundment downgradient of the CAP waste rock to ensure neutral drainage. In this Appendix the calculations used to extrapolate acidity from Sat Col 2, Sat Col 5 and Sat Col 6 are discussed. Total acidity is predominately a function of the activity of hydrogen, iron, manganese and aluminum. A relationship is presented in Hedin *et al*. (1994) by the following equation:

$$Total\ Acidity = 50 \times (1000(10^{-pH}) + (3 \times [Fe^{3+}]) + (2 \times [Fe^{2+}]) + (2 \times [Mn]) + (3 \times [Al])$$

Where total acidity is in units of mg$CaCO_3$/L and elemental concentrations are in milimoles per liter. When calculating acidity, it is assumed that all dissolved Fe is in the +3 oxidation state as Fe speciation was not conducted. The majority of acidity being released from the saturated columns is from dissolved Al, therefore the uncertainty in Fe speciation will not significantly affect the results.

At the end of the data collection period, some acidity was still being released from the three CAP and SUP columns. Therefore to determine the total acidity that could be released from these saturated columns the data must be extrapolated. Acidity production rates had stabilized prior to the decrease in flow rate which occurred at the beginning of 2011. The measured acidity is presented in Figures D-1 for Sat Col 2, Sat Col 5 and Sat Col 6. A linear regression is developed from the final time points of these three experiments. The equation for the linear regressions, and the data used to generate it are presented in Figures D-1. This linear regression is used to determine future decay in acidity release, and the amount of water required to flush all acidity. The decay of future acidity is determined by the linear regressions slope, while the volume of water required to flush all acidity is determined by the point at which the function equals zero. The cumulative amount of acidity which has been released, along with the extrapolated acidity based on linear regressions are presented in Figures D-2.

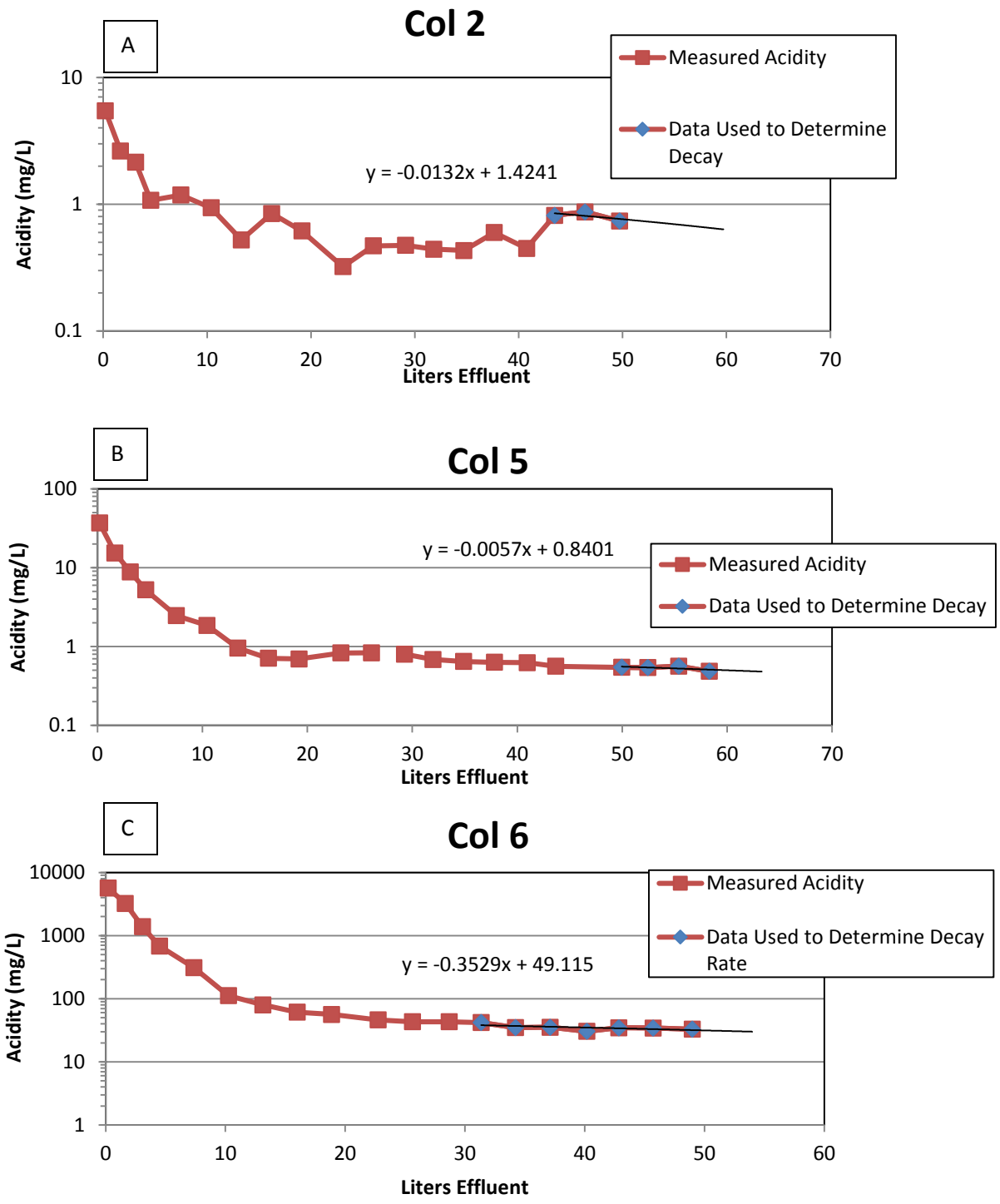


Figure D3-1: Acidity measured in column effluent for Sat Col 2 (a), Sat Col 5 (b) and Sat Col 6 (c). The data used to determine the decay rate is in blue. The line and equation of the linear equation used to determine decay rate and end point of acidity flushing is presented in these figures as well.

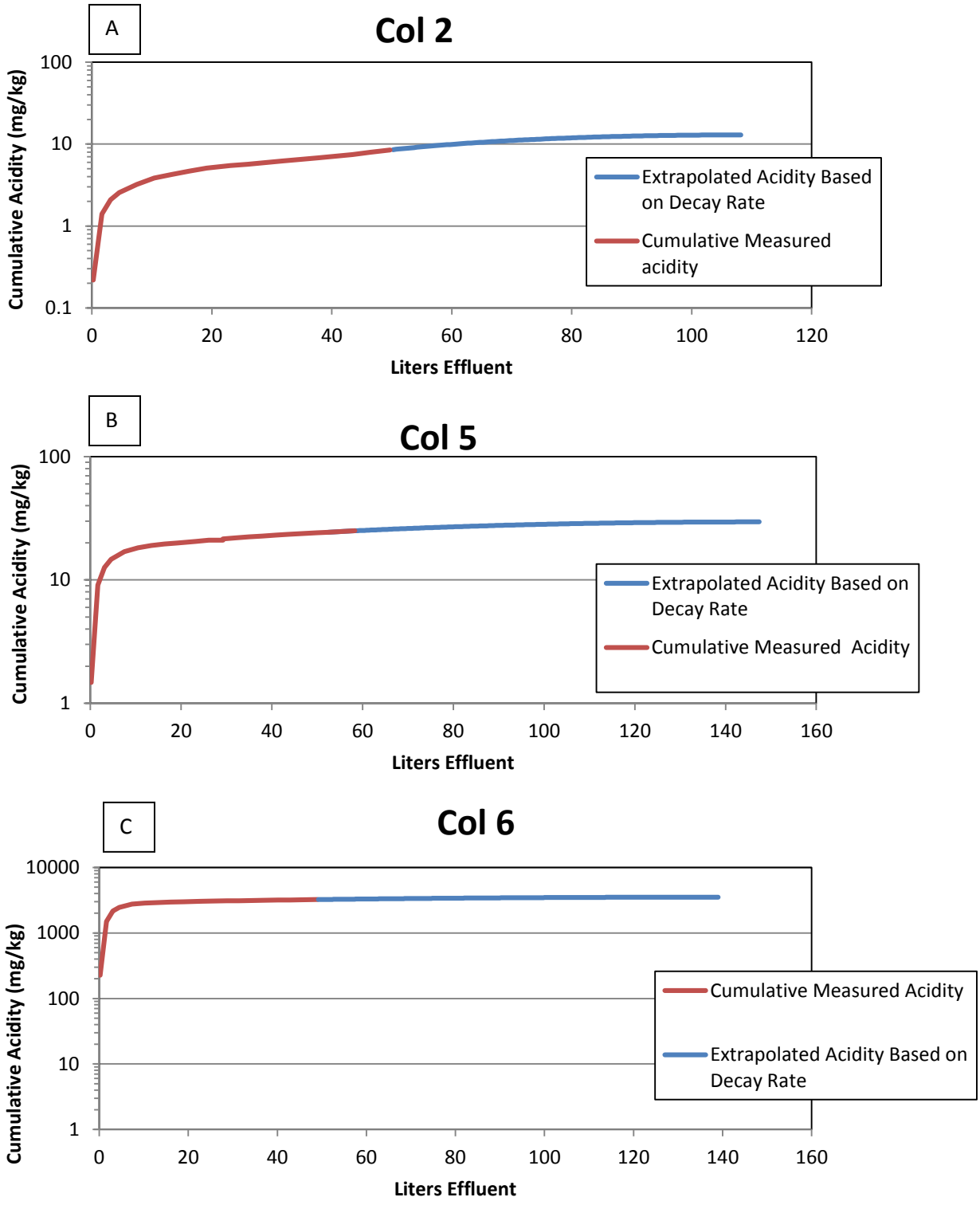


Figure D3-2: Cumulative acidity which is measured and extrapolated from Sat Col 2 (a), Sat Col 5 (b) and Sat Col 6 (c). Extrapolated values are based on linear regressions of data.

APPENDIX D4 LEACHATE RESULTS FOR SATURATED TAILINGS COLUMNS

Leachate Data for Sat Col 1

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
25-Feb-10	0	208	*ND*	*ND*	*ND*	768	5.7	680	32	*ND*	*ND*	0.14	<0.02	0.013	<0.005	281	*ND*	8.94	0.0024	0.0020	0.034	<0.0001	<0.001	<0.05	0.00004	307	<0.001	<0.0005	0.0137	0.008	<0.0002	*ND*	0.32	<0.001	0.00002	0.035	0.009	*ND*	64.9	0.0066	0.34	<0.00002	19.4	0.93	<0.00005	<0.005	<0.005	0.0003	<0.005	<0.005	<0.0005
4-Mar-10	1	1456	9.9	*ND*	50	418	3.09	404	15.6	<0.1	<0.25	0.093	<0.025	0.0152	0.148	*ND*	*ND*	6.36	0.00153	0.00188	0.0245	<0.001	<0.001	0.028	0.000077	167	<0.001	<0.0002	0.0048	<0.06	<0.0001	<0.01	<0.2	0.00099	0.00002	0.0183	<0.001	<0.6	39.4	0.004	0.24	<0.00002	10.6	0.474	<0.0002	<0.0002	<0.02	0.000115	<0.002	0.0022	*ND*
11-Mar-10	2	1456	9.88	*ND*	49	336	2.6	321	10.2	<0.12	<1.6	0.086	<0.005	0.004	0.113	*ND*	*ND*	6.26	0.00123	0.00125	0.0219	<0.0025	<0.0025	<0.05	<0.000085	134	<0.0025	<0.0005	0.00285	<0.15	<0.00025	<0.025	<0.5	<0.00025	<0.00005	0.014	<0.0025	<1.5	31	0.0032	<0.25	<0.00005	<10	0.372	<0.0005	<0.0005	<0.05	0.000083	<0.005	<0.005	*ND*
18-Mar-10	3	1456	10.77	*ND*	63	296	2.4	277	6.26	<0.02	<1.4	0.077	<0.005	<0.001	0.0039	*ND*	*ND*	7.2	0.00121	0.00121	0.0208	<0.001	<0.001	<0.02	<0.0001	119	<0.001	<0.0002	0.00212	<0.06	<0.0001	<0.01	<0.2	<0.0001	<0.00005	0.0119	<0.001	<0.6	26	<0.002	0.28	<0.00027	5.6	0.33	<0.0002	<0.0002	<0.02	0.000071	<0.002	<0.002	*ND*
1-Apr-10	5	2912	10.5	415	86	249	1.90	198	1.88	<0.02	<1	0.087	<0.005	<0.001	0.0562	*ND*	*ND*	10.0	0.00130	0.00114	0.0236	<0.001	<0.001	0.021	0.000041	99.7	<0.001	<0.0002	0.00155	<0.06	<0.0001	<0.01	<0.2	0.00020	<0.00001	0.00928	<0.001	<0.6	18.0	<0.002	0.33	<0.00002	<4	0.273	<0.0002	<0.0002	<0.02	0.000077	0.0020	0.0021	*ND*
15-Apr-10	7	2912	10.48	350	87	192	2.57	147	<0.5	0.036	<0.05	0.054	<0.005	<0.001	0.0404	*ND*	*ND*	9.80	0.00115	0.00106	0.0234	<0.0005	<0.005	0.017	<0.000017	77.0	<0.0005	<0.0001	0.00098	<0.03	<0.00005	<0.005	<0.1	0.000066	<0.00001	0.00608	<0.0005	<0.3	12.1	<0.001	0.358	<0.00001	<2	0.209	<0.0001	<0.0001	<0.01	0.000072	0.0020	0.0017	*ND*
29-Apr-10	9	2912	10.56	450	97	182	1.64	132	<0.5	0.044	0.159	0.076	0.0460	<0.001	0.0361	*ND*	*ND*	12.2	0.00126	0.00091	0.0261	<0.0005	0.0465	0.019	<0.000017	85.2	<0.0005	<0.0001	0.00101	<0.03	<0.00005	<0.005	<0.1	<0.0001	<0.00001	0.00423	0.00074	<0.3	11.3	<0.001	0.392	<0.00003	<2	0.202	<0.0001	<0.0001	<0.01	0.000093	0.0022	<0.001	*ND*
13-May-10	11	3042	10.57	422	119	189	1.74	112	<0.5	0.029	<0.05	<0.02	<0.005	<0.001	0.0327	*ND*	*ND*	12.3	0.00116	0.00087	0.0264	<0.001	<0.001	<0.02	<0.0001	75.6	<0.001	<0.0002	0.00099	<0.03	<0.0001	<0.01	<0.1	<0.0001	<0.00005	0.00247	<0.001	<0.3	8.4	<0.002	0.397	<0.00002	<2	0.181	<0.0002	<0.0002	<0.01	0.000072	0.0027	<0.002	*ND*
27-May-10	13	2782	10.46	421	88	173	1.55	104	<0.5	0.041	<0.05	0.0231	<0.005	<0.001	0.0316	*ND*	*ND*	15.5	0.00127	0.00086	0.0303	<0.001	<0.001	0.023	<0.0000334	69.4	<0.001	<0.0002	0.00089	<0.03	<0.0001	<0.01	<0.1	0.00043	<0.00001	0.00185	<0.001	<0.3	6.4	<0.002	0.414	<0.00002	<2	0.192	<0.0002	<0.0002	<0.01	0.000142	0.0024	<0.002	*ND*
15-Jun-10	16	4086	10.6	379	106	128	1.4	85.0	<0.5	0.289	<0.05	<0.05	0.0058	<0.001	0.0249	<50	0.01	15.4	0.0011	0.0007	0.0305	<0.00005	<0.00003	<0.3	0.00003	51.4	<0.0005	<0.00003	0.0007	<0.005	<0.00003	<0.003	<0.3	<0.0003	<0.00005	0.0011	0.0001	*ND*	4.2	0.0005	<0.5	<0.00003	<0.3	0.174	<0.00001	<0.00005	<0.003	0.00007	0.002	<0.0005	<0.0005
29-Jun-10	18	2899	*ND*	*ND*	*ND*	138	2.1	*ND*	*ND*	*ND*	0.05	*ND*	*ND*	*ND*	<50	0.01	14.5	0.0013	0.0007	0.0336	<0.0005	<0.00003	<0.3	<0.00003	55.2	<0.0005	<0.00003	0.0008	<0.05	<0.00005	<0.005	<0.3	<0.0003	<0.00005	0.0010	0.0001	*ND*	3.5	0.0006	<0.5	<0.00003	<0.3	0.174	<0.00001	<0.00005	<0.003	0.00021	0.003	0.0009	<0.0005
14-Jul-10	20	3137	10.55	352	90	132	2.6	70.2	<0.5	<0.02	<0.05	0.0070	<0.005	<0.001	0.0167	29	<0.005	14.6	0.00130	0.00095	0.0341	<0.00001	<0.00005	<0.05	<0.000005	52.7	<0.0001	0.000013	0.00055	0.015	0.000017	<0.0005	<0.05	<0.00005	<0.00002	0.00070	0.00008	*ND*	2.95	0.00064	0.473	0.000017	0.09	0.16	0.000009	0.00002	0.0009	0.000069	0.0020	0.0029	<0.0001
27-Jul-10	22	2695	10.41	347	103	*ND*	2.6	71.6	<0.5	0.029	<0.05	<0.01	<0.005	<0.001	0.0151	31	0.009	16.5	0.00125	0.00100	0.0340	<0.00001	<0.00005	<0.05	<0.000005	55.9	<0.0001	<0.00005	0.00078	0.003	<0.00003	<0.005	0.06	<0.00005	<0.00001	0.00091	0.00009	*ND*	3.02	0.00057	0.501	<0.00005	0.18	0.171	<0.00002	0.00001	<0.005	0.000086	0.0027	0.0009	<0.0001
10-Aug-10	24	2877	10.29	330	82	134	2.0	67.1	1.76	0.031	<0.05	0.0075	<0.005	0.0023	0.0129	27	<0.01	15	0.00133	0.00085	0.0355	<0.00001	<0.00005	<0.05	0.00001	53.7	<0.001	<0.00005	0.00066	0.003	0.00006	<0.005	<0.05	<0.00005	0.00001	0.00079	0.00025	*ND*	2.52	0.00068	0.531	<0.00005	0.10	0.16	<0.00002	0.00001	<0.005	0.000079	0.0023	0.0013	<0.0001
24-Aug-10	26	2912	10.55	299	75	116	1.6	58.1	<0.5	0.029	<0.05	0.0056	<0.005	<0.001	0.0125	<50	<0.03	12.1	0.0012	0.0008	0.0388	<0.00005	<0.00003	<0.3	<0.00003	46.4	<0.0005	<0.00003	0.0010	<0.005	0.00003	<0.003	<0.3	<0.0003	<0.00005	0.0007	0.0001	*ND*	2.0	0.0009	0.523	<0.00003	<0.3	0.144	<0.00001	<0.00005	<0.003	0.00004	0.003	<0.0005	<0.0005
8-Sep-10	28	3155	10.54	308	99	112	1.9	57.9	<0.5	0.266	<0.05	<0.005	<0.005	<0.001	0.0119	22	<0.005	11.7	0.00133	0.00093	0.0410	<0.00001	<0.00005	<0.05	0.00001	44.9	<0.001	<0.00005	0.00061	0.002	<0.00005	<0.005	<0.05	<0.00005	<0.00001	0.00073	<0.00002	*ND*	1.73	0.00073	0.465	<0.00005	0.06	0.142	<0.00002	0.00001	<0.005	0.000110	0.0023	0.0002	<0.0001
21-Sep-10	30	2695	10.53	320	94	118	1.8	60.9	<0.5	0.330	<0.05	0.0053	<0.005	<0.001	0.0116	23	<0.03	13.2	0.00144	0.00089	0.0373	<0.00001	<0.00005	<0.05	<0.00005	47.3	<0.001	<0.00005	0.00054	0.004	0.00015	<0.005	<0.05	0.00009	<0.00001	0.00105	0.00009	*ND*	1.68	0.00071	0.487	<0.00005	0.07	0.144	<0.00002	<0.00001	<0.005	0.000136	0.0022	0.0003	<0.0001
5-Oct-10	32	2895	10.68	309	90	123	1.3	55.9	3.19	0.039	<0.05	0.0052	<0.005	<0.001	0.0106	*ND*	0.04	14.4	0.0014	0.0009	0.043	<0.001	<0.001	<0.05	<0.00001	49.4	<0.001	<0.0005	0.0004	0.098	<0.0002	<0.005	<0.05	<0.001	0.00002	<0.001	<0.001	<0.01	1.72	0.0008	0.609	<0.00002	0.10	0.155	<0.00005	<0.005	<0.005	0.0001	<0.005	<0.005	<0.0005
21-Oct-10	34	3345	10.63	305	81	109	1.7	49.5	<0.5	0.371	<0.05	<0.005	<0.005	<0.001	0.0088	21	<0.03	13.5	0.00160	0.00122	0.0429	<0.00001	<0.00005	<0.05	<0.00005	43.8	<0.001	<0.00005	0.00030	0.005	0.000056	<0.005	<0.05	0.00009	<0.00002	0.00063	0.00005	*ND*	1.61	0.00076	0.607	<0.00005	0.07	0.139	0.000007	0.00006	<0.005	0.000125	0.0026	0.0002	<0.0001
2-Nov-10	36	2483	10.5	281.1	68	105	1.1	46.4	<0.5	0.030	<0.05	<0.005	<0.005	<0.001	0.0085	<50	<0.03	12.1	0.0015	0.0011	0.0479	<0.00005	<0.00003	<0.3	<0.00003	42.1	<0.0005	<0.00003	0.0003	<0.005	<0.00003	<0.003	<0.3	<0.0003	<0.00005	0.0008	0.0002	*ND*	1.5	0.0008	0.652	<0.00003	<0.3	0.13	<0.00001	<0.00005	<0.003	0.00008	0.002	0.0006	<0.0005
16-Nov-10	38	2724	10.48	274.1	79	106	1.4	45.0	<0.5	0.029	<0.05	<0.005	<0.005	<0.001	0.0076	<50	<0.005	11.5	0.0017	0.0008	0.0468	<0.00005	<0.00003	<0.3	<0.00003	42.6	<0.0005	<0.00003	0.0005	<0.005	0.00012	<0.003	<0.3	<0.0003	<0.00005	0.0007	0.0007	0.0024	*ND*	1.3	0.0008	0.702	<0.00003	<0.3	0.128	<0.00001	0.00030	<0.003	0.00008	0.003	0.0112	<0.0005
30-Nov-10	40	2692	10.13	250.3	71	96.6	*ND*	41.0	<0.5	<0.02	<0.05	<0.005	<0.005	<0.001	0.0066	16	0.01	10.5	0.00175	0.00106	0.0445	<0.00001	<0.00005	<0.05	<0.00005	38.7	<0.0001	<0.00005	0.00042	0.002	0.000014	<0.0005	<0.05	<0.00005	<0.00001	0.00066	0.00004	*ND*	1.21	0.00069	0.688	<0.00005	0.06	0.116	<0.00002	<0.00001	<0.005	0.000074	0.0029	0.0006	<0.0001
6-Jan-11	45	2705	10.29	238.6	78	*ND*	2.96	43.1	<0.5	<0.02	<0.05	<0.005	<0.005	<0.001	0.0135	*ND*	<0.005	9.83	0.00180	0.00111	0.0475	<0.00001	<0.00005	0.016	0.0000387	34.9	<0.0001	<0.00005	0.00012	0.0018	0.0000406	<0.0005	0.0204	<0.00005	0.000027	0.00108	<0.00005	*ND*	1.20	0.000803	0.67	<0.00005	0.059	0.127	<0.00002	<0.00001	<0.005	0.0000586	0.00317	0.00088	<0.0001
3-Feb-11	49	972	10.49	274.4	79	*ND*	4.36	51.6	<0.5	<0.02	<0.05	<0.005	<0.005	<0.001	0.0217	*ND*	<0.005	11.3	0.00181	0.00103	0.0491	<0.00001	<0.00005	0.0185	<0.00005	42.0	<0.0001	<0.00005	0.00054	0.003	0.0000334	<0.0005	0.0099	<0.00005	<0.00002	0.00137	0.000084	*ND*	1.30	0.000833	0.66	<0.00005	0.087	0.131	<0.00002	<0.00001	<0.005	0.0000757	0.00398	<0.0005	<0.0001
2-Mar-11	53	879	10.46	313	69	*ND*	5.35	53.4	<0.5	<0.02	<0.05	<0.005	<0.005	<0.001	0.0241	*ND*	<0.005	11.3	0.00162	0.000860	0.0474	<0.00001	<0.00005	0.0169	<0.00005	37.1	<0.0001	<0.00005	0.0016	0.0000137	<0.0005	0.0082	<0.00005	<0.0001	0.00213	0.000128	<0.0003	1.29	0.000837	0.637	<0.00005	0.094	0.130	<0.00002	<0.00001	<0.005	0.0000727	0.00376	0.00053	<0.0001
30-Mar-11	57	663	10.26	315	64	*ND*	5.63	52.8	<0.5	<0.02	<0.05	0.0150	<0.005	<0.001	0.0268	*ND*	<0.005	11.2	0.00191	0.00119	0.0470	<0.00001	<0.00005	0.0188	0.0000253	41.4	<0.0001	0.0000059	<0.0001	0.0015	0.0000198	<0.0005	0.0090	<0.00005	<0.00005	0.00310	0.000123	<0.0003	1.39	0.000775	0.684	0.0000075	0.123	0.125	<0.00002	0.000020	<0.0005	0.0000907	0.00398	0.00066	<0.0001
24-Apr-11	61	564	10.1	246.5	56	*ND*	5.50	50.0	1.05	<0.02	<0.05	0.0104	<0.005	<0.001	0.0262	*ND*	<0.005	10.9	0.00191	0.00107	0.0449	<0.00001	<0.00005	0.0191	<0.000005	36.8	<0.0001	0.0000100	<0.0001	0.0083	0.0000070	<0.0005	0.0071	<0.00005	<0.0001	0.00402	0.000140	<0.0003	1.33	0.000727	0.683	0.0000091	0.104	0.121	<0.00002	0.000013	<0.0005	0.0000702	0.00403	0.00210	<0.0001
26-May-11	65	751	10.5	247.9	60	*ND*	5.53	43.5	1.29	0.035	<0.05	0.0105	<0.005	<0.001	0.0248	*ND*	<0.005	10.5	0.00201	0.00111	0.0461	<0.00001	<0.00005	0.0187	0.0000155	40.8	<0.0001	<0.00005	<0.0001	0.0011	0.0000203	<0.0005	0.0090	<0.00005	<0.00002	0.00449	0.000115	<0.0003	1.33	0.000774	0.711	<0.00005	0.121	0.111	<0.00002	<0.00001	<0.005	0.0000504	0.00417	0.00331	<0.0001
23-Jun-11	69	637	10.32	224.1	61	*ND*	6.45	39.5	<0.5	0.028	<0.05	0.0204	<0.005	<0.001	0.0268	*ND*	<0.005	9.54	0.00220	0.00142	0.0495	<0.00001	<0.00005	0.0151	<0.000005	33.7	<0.0001	<0.00005	<0.0001	0.0014	<0.0000005	<0.0005	0.0075	<0.00005	<0.00005	0.000092	0.00478	0.000112	<0.0003	1.31	0.000459	0.669	<0.00005	0.126	0.109	<0.00002	0.000015	<0.0005	0.0000558	0.00427	0.00157	<0.0001
21-Jul-11	73	701	10.21	210.3	67	*ND*	6.32	34.8	0.58	0.034	<0.05	0.0151	<0.005	<0.001	0.0269	*ND*	<0.005	9.20	0.00208	0.00147	0.0541	<0.00001	<0.00005	0.0160	0.0000119	31.4	<0.0001	<0.00005	<0.0001	0.0117	0.0000642	<0.0005	0.0050	0.000138	<0.00002	0.00508	0.000101	<0.0003	1.27	0.000735	0.689	0.0000073	0.139	0.104	<0.00002	0.000010	<0.0005	0.0000663	0.00417	0.00347	<0.0001
18-Aug-11	77	809	10.01	225.9	56	*ND*	6.78	31.2	<0.5	0.035	<0.05	<0.005	<0.005	<0.001	0.0242	*ND*	<0.005	9.07	0.00224	0.00138	0.0569	<0.00001	<0.00005	0.0153	<0.000005	29.5	<0.0001	0.0000599	<0.0001	0.0740	0.0000605	<0.0005	0.0218	0.00162	<0.00002	0.00525	0.000241	<0.0003	1.32	0.000686	0.745	0.0000128	0.133	0.0998	<0.00002	0.000032	<0.0005	0.0000464	0.00450	0.00435	<0.0001
2-Sep-11	79	1308	8.67	182	*ND*	*ND*	1.4	12	0.52	0.0058	0.015	0.0027	0.0015	0.0029	0.0074	*ND*	0.058	0.95	0.00083	0.00061	0.017	0.0000229	0.0000515	0.0026	0.0000015	8.9	0.00029	0.0000515	0.0039	0.00029	0.0000016	0.00015	0.012	0.000016	0.00015	0.0013	0.000015	0.087	35	0.00015	0.094	0.0000017	0.035	0.033	0.0000034	0.000029	0.00015	0.0000313	0.00049	0.00029
15-Sep-11	81	910	9.29	172.6	33	*ND*	3.65	39.0	<0.5	<0.02	<0.05	0.0059	<0.005	<0.001	0.0214	*ND*	<0.005	4.71	0.00252	0.00280	0.0532	<0.00001	<0.00005	0.0096	0.0000073	28.4	<0.0001	<0.00005	0.0023	<0.0005	0.0243	<0.00005	<0.00005	0.00231	<0.00001	0.00454	<0.00005	<0.0003	1.29	0.000976	0.370	0.0000080	0.128	0.0930	0.0000105	<0.00001	<0.0005	0.0000611	0.00179	<0.0005	<0.0001
13-Oct-11	85	881	9.74	161.2	40	*ND*	3.89	32.5	0.52	<0.02	<0.05	0.0086	<0.005	<0.001	0.0224	*ND*	<0.005	5.47	0.00275	0.00278	0.0512	<0.00001	<0.00005	0.0108	<0.000005	26.5	<0.0001	<0.00005	0.0034	<0.0001	0.0026	<0.00005	0.0158	<0.00005	<0.00002	0.00467	<0.00005	<0.0003	1.28	0.000988	0.445	0.0000063	0.124	0.0818	0.0000107	<0.00001	<0.0005	0.0000489	0.00294	<0.0005	<0.0001
10-Nov-11	89	984	9.68	151.5	36	*ND*	3.66	27.1	0.96	<0.02	<0.05	0.0101	<0.005	<0.001	0.0188	*ND*	<0.005	6.03	0.00293	0.00280	0.0573	<0.00001	<0.00005	0.0102	<0.000005	24.5	<0.0001	0.0000135	0.00210	<0.001	0.0000215	<0.0005	0.0136	<0.00005	<0.00001	0.00447	<0.00005	<0.0003	1.17	0.00152	0.782	0.0000091	0.117	0.0821	0.0000048	<0.00001	<0.0005	0.0000629	0.00381	<0.0005	<0.0001
8-Dec-11	93	1094	9.76	139.5	39	*ND*	3.49	22.2	0.85	0.020	<0.05	0.0144	<0.005	<0.001	0.0196	*ND*	<0.005	6.03	0.00281	0.00261	0.0573	<0.00001	<0.00005	0.0104	<0.000005	21.8	0.00016	0.0000128	0.00075	0.0015	0.0000065	<0.0005	0.0123	0.000079	<0.00001	0.00421	0.000328	<0.0003	1.11	0.000921	0.560	<0.00005	0.118	0.0816	0.0000027	<0.00001	<0.0005	0.0000529	0.00413	0.00109	<0.0001
5-Jan-12	97	1358	9.09	137.7	56	*ND*	3.82	20.1	<0.5	<0.02	<0.05	0.0071	<0.005	<0.001	0.0183	*ND*	<0.0057	5.78	0.00279	0.00254	0.0588	<0.00001	<0.00005	0.0097	<0.000005	21.7	<0.0001	<0.00005	<0.0001	<0.001	<0.0000135	<0.0005	0.0109	<0.00005	<0.00001	0.00407	<0.00005	<0.0003	1.08	0.000828	0.606	<0.00005	0.109	0.0746	<0.00002	<0.00001	<0.0005	0.0000514	0.00430	<0.0005	<0.0001
2-Mar-12	105	389	9.2	128.4	41	*ND*	3.80	19.1	<0.5	<0.02	<0.05	0.0168	<0.005	<0.001	0.0259	*ND*	<0.005	5.47	0.00271	0.00257	0.0632	<0.00001	<0.00005	0.0086	<0.000005	20.4	<0.0001	<0.00005	<0.0001	<0.001	<0.0000135	<0.0005	0.0093	<0.00005	<0.00001	0.00413	0.000360	<0.0003	1.02	0.000777	0.577	<0.00005	0.109	0.0754	<0.00002	<0.00001	<0.0005	0.0000473	0.00462	0.00062	<0.0001
25-Mar-12	117	250	9.51	127	26	*ND*	5.78	18.6	0.43	<0.02	<0.05	0.0126	0.0059	<0.001	0.0424	*ND*	<0.005	5.63	0.00267	0.00281	0.0669	<0.00001	<0.00005	0.0088	<0.000005	20.0	<0.0001	<0.00005	<0.0001	<0.001	0.0000135	<0.0005	0.0106	<0.00005	<0.00001	0.00454	0.000070	<0.0003	1.08	0.000713	0.685	<0.00005	0.125	0.0769	<0.00002	<0.00001	<0.0005	0.0000433	0.00472	<0.0005	<0.0001
25-Jul-12	126	220	9.79	126.5	52	*ND*	8.29	18.5	<2.5	<0.02	<0.05	0.0082	0.0058	<0.001	0.0560	*ND*	<0.005	4.91	0.00271	0.00254	0.0640	<0.00001	<0.00005	0.0084	<0.000005	19.3	<0.0001	0.0000057	0.00012	<0.001	<0.0000135	<0.0005	0.0145	<0.00005	<0.00001	0.00498	0.000057	<0.0003	1.03	0.00127	0.670	<0.00005	0.151	0.0833	<0.00002	<0.00001	<0.0005	0.0000506	0.00475	0.0130	<0.0001
12-Sep-12	133	230	9.13	118.8	48	55.2	8.49	18.2	<2.5	<0.02	<0.05	0.0133	<0.005	<0.001	0.081	*ND*	<0.005	5.07	0.00248	0.00280	0.0639	<0.001	<0.005	<0.01	<0.0001	22.1	<0.001	<0.0001	<0.0002	<0.01	<0.0001	<0.005	<0.1	<0.0005	<0.0001	0.00599	<0.005	0.103	1.23	0.00048	0.694	<0.00001	0.135	0.0794	<0.00001	<0.0001	<0.01	0.000047	0.0048	<0.001	*ND*
14-Nov-12	142	850	9.8	121.5	55	48.0	8.77	17.9	<2.5	<0.02	<0.05	0.0061	<0.005	<0.001	0.135	*ND*	0.010	4.55	0.00248	0.00258	0.0597	<0.00001	<0.00005	0.0080	<0.000005	19.2	<0.0001	<0.00005	0.00024	<0.001	0.0000105	<0.0005	<0.03	<0.00005	<0.00001	0.00674	0.000060	0.159	0.979	0.000454	0.702	<0.00005	0.133	0.0774	<0.00002	<0.00001	<0.0005	0.0000442	0.00478	<0.0005	<0.0001
11-Jan-13	150	885	9.52	126.1	38	*ND*	7.65	17.2	<2.5	<0.02	<0.05	0.0083	<0.005	<0.001	0.182	*ND*	<0.01	4.61	0.00223	0.00276	0.0572	<0.00001	<0.00005	0.0085	<0.000005	19.6	<0.0001	<0.00005	<0.0001	<0.001	<0.0000005	<0.0005	0.0093	<0.00005	<0.00001	0.00757	<0.00005	<0.0003	0.878	0.000159	0.729	<0.00005	0.139	0.0713	<0.00002	<0.00001	<0.0005	0.0000456	0.00485	0.0126	<0.0001

Calculated Production Rates for Sat Col 1 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
25-Feb-10	0	208	*ND*	*ND*	*ND*	35	0.26	31	1.5	*ND*	*ND*	0.0065	0.00092	0.00060	0.00023	13	*ND*	0.41	0.00011	0.000092	0.0016	0.0000046	0.000046	0.0023	0.0000018	14	0.000046	0.000023

Leachate Data for Sat Col 8

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
25-Feb-10	0	208	*ND*	*ND*	*ND*	286	4.3	260	33	*ND*	*ND*	0.20	0.02	0.015	<0.005	0.032	0.0066	0.0034	0.062	<0.001	<0.001	<0.05	0.00012	104	<0.001	<0.0002	0.0013	<0.005	<0.0002	*ND*	6.70	0.026	0.00006	0.127	0.007	*ND*	46.7	0.0029	2.02	<0.00002	24.2	0.595	<0.00005	<0.005	<0.005	0.0048	<0.005	<0.005	<0.0005
4-Mar-10	1	1456	6.99	*ND*	37	285	*ND*	293	37.2	3.08	<0.05	0.07	0.0069	<0.001	0.333	0.0293	0.00378	0.00497	0.0431	<0.001	<0.001	0.044	<0.000034	103	<0.001	<0.0002	<0.0002	<0.06	<0.0001	<0.01	6.82	0.0224	<0.00001	0.0379	<0.001	<0.6	50.8	<0.002	2.06	<0.00002	26.5	0.571	<0.0002	<0.0002	<0.02	0.000565	<0.002	<0.002	*ND*
11-Mar-10	2	1456	7.42	*ND*	38	109	1.55	123	11.6	3.82	<0.6	<0.02	<0.005	<0.001	0.195	0.0252	0.00361	0.0106	0.038	<0.005	<0.005	0.044	<0.000017	38.8	<0.0005	<0.0001	<0.001	<0.15	<0.0005	<0.05	2.98	0.00639	<0.00005	0.022	<0.0005	<1.5	34	<0.001	1.98	<0.00001	14	0.235	<0.0001	<0.001	<0.05	0.000107	<0.001	<0.001	*ND*
18-Mar-10	3	1456	7.99	*ND*	106	46.8	1.06	49.5	3.06	2.66	<0.25	<0.02	<0.005	<0.001	0.0042	0.0254	0.0044	0.016	0.0542	<0.0025	<0.0025	<0.05	<0.00025	16.6	<0.0025	<0.0005	<0.0005	<0.06	<0.00025	<0.025	1.3	0.00278	<0.00001	0.0218	<0.0025	<0.6	25.3	<0.005	2.08	<0.00005	7.3	0.129	<0.0005	<0.0005	<0.02	0.00008	<0.005	<0.005	*ND*
1-Apr-10	5	2912	8.46	101	62	27.5	0.61	16.1	<0.5	1.27	<0.08	<0.02	<0.005	<0.001	0.0500	0.0596	0.00507	0.0228	0.110	<0.001	<0.001	0.027	0.000551	9.67	<0.001	<0.0002	<0.0002	<0.06	<0.0001	<0.01	0.82	0.00243	<0.00001	0.0188	<0.001	<0.6	15.0	<0.002	2.41	<0.00002	<4	0.0921	<0.0002	<0.0002	<0.02	0.000091	<0.002	0.0020	*ND*
15-Apr-10	7	2912	8.4	98	64	26.7	2.44	9.52	<0.5	0.913	<0.05	0.040	<0.005	<0.001	0.0251	<0.02	0.0038	0.0203	0.102	<0.01	<0.01	<0.2	<0.00034	9.43	<0.01	<0.002	<0.002	<0.15	<0.001	<0.1	0.77	0.0028	<0.00001	0.0120	<0.01	<1.5	22	<0.02	2.53	<0.0002	<10	0.0932	<0.002	<0.002	<0.05	<0.0002	<0.02	<0.02	*ND*
29-Apr-10	9	2911	8.36	128	56	24.4	0.64	7.83	<0.5	0.788	<0.05	<0.02	0.0060	<0.001	0.0213	0.0127	0.00375	0.0203	0.204	<0.0005	<0.0005	<0.01	<0.000017	10.2	<0.0005	<0.0001	0.00042	<0.03	<0.00005	<0.005	0.84	0.00410	<0.00001	0.0105	0.00051	<0.3	23.8	<0.001	2.74	<0.00001	<2	0.107	<0.0001	<0.0001	<0.01	0.000037	<0.001	<0.001	*ND*
13-May-10	11	3042	8.07	103	48	26.9	*ND*	6.04	<0.5	0.619	<0.05	<0.02	<0.005	<0.001	0.0132	0.0154	0.00263	0.0158	0.192	<0.0005	<0.0005	<0.01	<0.000005	9.43	0.00087	<0.0001	<0.0001	<0.03	<0.00005	<0.005	0.82	0.00362	<0.00001	0.00878	<0.0005	<0.3	15.2	<0.001	2.23	<0.00001	<2	0.0942	<0.0001	<0.0001	<0.01	0.000197	<0.001	<0.001	*ND*
27-May-10	13	2782	7.75	86.4	41	32.4	<0.5	4.71	<0.5	0.444	<0.05	0.0088	0.0087	<0.001	0.0194	0.0212	0.00184	0.00924	0.241	<0.0005	<0.0005	<0.01	0.000225	11.4	<0.0005	<0.0001	0.00012	<0.03	<0.00005	<0.005	0.98	0.00550	<0.00001	0.00651	<0.0005	<0.3	9.6	<0.001	1.86	<0.00001	<2	0.0935	<0.0001	<0.0001	<0.01	0.000375	<0.001	0.0035	*ND*
15-Jun-10	16	4086	8.13	76.2	36	25.6	0.9	3.58	<0.5	0.410	<0.05	0.06	<0.005	<0.001	0.0114	0.0204	0.00132	0.00572	0.25	<0.0005	<0.0005	<0.01	<0.000005	8.78	<0.0001	0.000013	0.00017	0.004	0.000018	0.0009	0.88	0.00652	<0.00001	0.00533	0.00002	*ND*	5.84	0.00006	1.58	<0.000005	0.11	0.0882	<0.00002	<0.00001	<0.0005	0.000364	<0.0002	0.0007	<0.0001
29-Jun-10	18	2899	*ND*	*ND*	*ND*	33.7	0.8	*ND*	*ND*	*ND*	<0.05	*ND*	*ND*	*ND*	*ND*	0.0243	0.00165	0.00627	0.293	<0.0001	<0.0001	<0.005	0.00013	11.4	<0.0001	0.000007	0.00032	0.004	0.000011	0.0010	1.30	0.00926	<0.00001	0.00643	0.00005	*ND*	5.60	0.00009	1.96	<0.000005	0.13	0.111	0.000002	0.00002	<0.0005	0.000828	<0.0002	0.0010	<0.0001
14-Jul-10	20	3137	7.44	92.4	44	39.0	1.4	5.73	<0.5	0.489	<0.05	<0.005	<0.005	<0.001	0.0102	0.0278	0.00159	0.00662	0.304	<0.00001	<0.00005	<0.05	<0.000005	13.0	<0.0001	0.000009	0.00024	0.008	<0.000005	0.0011	1.56	0.0101	<0.00001	0.00612	0.00003	*ND*	5.75	0.00011	2.12	<0.000005	0.13	0.119	<0.000002	0.00001	<0.0005	0.000725	<0.0002	0.0011	<0.0001
27-Jul-10	22	2695	7.88	92.2	41	34.4	1.2	5.55	<0.5	0.516	<0.05	<0.01	<0.005	<0.001	0.0097	0.0242	0.00135	0.00585	0.293	<0.00001	<0.00005	<0.05	0.000013	11.2	<0.0001	<0.00005	0.00007	0.001	0.000008	0.0012	1.59	0.00978	<0.00001	0.00534	<0.00002	*ND*	4.63	0.00009	1.7	<0.000005	0.13	0.113	<0.000002	<0.00001	<0.0005	0.000669	<0.0002	0.0011	<0.0001
10-Aug-10	24	2877	*ND*	95.6	*ND*	37.8	1.1	6.14	<0.5	0.596	<0.05	<0.005	<0.005	<0.001	0.0095	0.0217	0.00146	0.00607	0.283	<0.00001	<0.00005	<0.05	<0.000005	12.5	<0.0001	<0.00005	<0.00005	<0.001	<0.000005	0.0012	1.60	0.00977	<0.00001	0.00532	0.00003	*ND*	4.57	0.00010	1.91	<0.000005	0.11	0.114	<0.000002	<0.00001	<0.0005	0.000520	<0.0002	0.0010	<0.0001
24-Aug-10	26	2912	7.07	116	45	37.9	*ND*	5.39	<0.5	0.499	<0.05	<0.005	<0.005	<0.001	0.0140	0.0118	0.00144	0.00671	0.273	<0.00001	<0.00005	<0.05	<0.000005	12.6	<0.0001	<0.00005	<0.00005	0.005	<0.000005	0.0012	1.59	0.0102	<0.00001	0.00537	0.00009	*ND*	4.24	0.00009	1.94	<0.000005	0.10	0.115	<0.000002	<0.00001	<0.0005	0.000405	<0.0002	0.0003	<0.0001
8-Sep-10	28	3155	7.96	89.1	47	33.5	0.8	4.95	<0.5	0.445	<0.05	<0.005	<0.005	<0.001	0.0106	0.0178	0.00134	0.00628	0.273	<0.00001	<0.00005	<0.05	<0.000005	11.2	<0.0001	<0.00005	<0.00005	0.003	<0.000005	0.0011	1.36	0.00910	<0.00001	0.00519	0.00012	*ND*	3.73	0.00009	1.63	<0.000005	0.07	0.113	<0.000002	0.00003	0.0009	0.000616	<0.0002	0.0003	<0.0001
21-Sep-10	30	2695	8.16	92	48	34.8	1.6	5.60	<0.5	0.500	<0.05	<0.005	<0.005	<0.001	0.0110	0.0141	0.00142	0.00666	0.264	<0.00001	<0.00005	<0.05	<0.000005	11.5	<0.0001	<0.00005	<0.00005	0.001	<0.000005	0.0011	1.45	0.00954	<0.00001	0.00507	0.00002	*ND*	3.57	0.00007	1.68	<0.000005	0.08	0.114	<0.000002	<0.00001	<0.0005	0.000525	<0.0002	0.0003	<0.0001
5-Oct-10	32	2895	8.08	92.4	45	37.0	<0.5	5.49	<0.5	0.476	<0.05	<0.005	<0.005	<0.001	0.0099	0.014	0.0012	0.0065	0.301	<0.001	<0.001	<0.05	<0.00001	12.3	<0.001	<0.0005	0.0002	0.008	<0.0002	<0.005	1.53	0.01	<0.00002	0.005	<0.001	*ND*	3.70	0.0001	1.94	<0.00002	0.08	0.122	<0.0005	<0.0005	<0.005	0.0004	<0.005	<0.005	<0.005
21-Oct-10	34	3345	7.65	90.6	38	36.1	0.7	5.52	<0.5	0.450	<0.05	<0.005	<0.005	<0.001	0.0082	0.0175	0.00122	0.00628	0.277	<0.00001	<0.00005	<0.05	<0.000005	12.1	<0.0001	<0.00005	0.00007	0.002	<0.000005	0.0009	1.81	0.0108	<0.00001	0.00424	0.00068	*ND*	3.35	0.00009	1.65	<0.000005	0.07	0.115	<0.000002	<0.00001	<0.0005	0.000561	<0.0002	0.0004	<0.0001
2-Nov-10	36	2483	7.59	91.9	38	39.0	<0.5	5.85	<0.5	0.467	<0.05	<0.005	<0.005	<0.001	0.0082	0.0119	0.00115	0.00648	0.273	<0.00001	<0.00005	<0.05	<0.000005	12.8	<0.0001	<0.00005	<0.00005	0.001	0.000007	0.0011	1.72	0.0111	<0.00001	0.00409	<0.00002	*ND*	3.33	0.00009	1.84	<0.000005	0.07	0.117	<0.000002	<0.00001	<0.0005	0.000330	<0.0002	0.0004	<0.0001
16-Nov-10	38	2736	8.02	92.3	42	37.8	2.7	6.12	<0.5	0.479	<0.05	<0.005	<0.005	<0.001	0.0083	0.0102	0.00123	0.00699	0.276	<0.00001	<0.00005	<0.05	<0.000005	12.2	<0.0001	<0.00005	<0.00005	0.002	0.000023	0.0012	1.75	0.0118	<0.00001	0.00428	<0.00002	*ND*	3.05	0.00009	1.78	<0.000005	0.06	0.123	<0.000002	<0.00001	<0.0005	0.000265	<0.0002	0.0002	<0.0001
30-Nov-10	40	2706	7.84	90.2	41	39.0	0.9	6.20	<0.5	0.451	<0.05	<0.005	<0.005	<0.001	0.0065	0.0098	0.00111	0.00641	0.268	<0.00001	<0.00005	<0.05	<0.000005	12.8	<0.0001	<0.00005	<0.00005	<0.001	<0.000005	0.0010	1.74	0.0114	<0.00001	0.00434	<0.00002	*ND*	2.72	0.00013	1.8	<0.000005	0.06	0.119	<0.000002	<0.00001	<0.0005	0.000294	<0.0002	0.0004	<0.0001
6-Jan-11	45	2758	7.73	73	39	*ND*	1.34	4.20	<0.5	0.369	<0.05	<0.005	<0.005	<0.001	0.0053	0.0290	0.00101	0.00581	0.313	<0.00001	<0.00005	<0.01	<0.000005	14.6	<0.0001	<0.00005	0.00063	0.001	<0.000005	0.0063	1.46	0.0114	<0.00002	0.00499	0.00111	*ND*	3.00	0.00096	1.28	<0.000005	0.067	0.0998	<0.000002	<0.00001	<0.0005	0.000776	<0.0002	0.0008	<0.0001
3-Feb-11	47	1016	7.46	95	51	*ND*	2.63	5.38	<0.5	0.517	<0.05	<0.005	<0.005	<0.001	0.0121	0.0208	0.00159	0.00885	0.345	<0.00001	<0.00005	<0.05	<0.000005	14.6	<0.0001	<0.00005	0.00182	0.001	<0.000005	0.0118	1.39	0.0138	<0.00002	0.00728	0.00117	*ND*	3.68	0.00069	2.17	<0.000005	0.100	0.142	<0.000002	<0.00001	<0.0005	0.000241	0.000057	0.00286	<0.0001
24-Mar-11	53	930	7.57	107.8	47	*ND*	4.22	5.30	<0.5	0.596	<0.05	<0.005	<0.005	<0.001	0.0132	0.0118	0.00161	0.0100	0.343	<0.00001	<0.00005	<0.05	<0.000005	13.5	<0.0001	<0.00005	0.0000668	<0.0001	0.0018	<0.000005	0.00172	1.31	0.0152	<0.00001	0.00842	0.000097	<0.3	3.74	0.00073	2.27	<0.000005	0.098	0.176	<0.000002	<0.00001	<0.0005	0.0000717	<0.0005	0.00206	<0.0001
30-Mar-11	57	758	7.74	113.8	49	*ND*	4.23	5.31	<0.5	0.613	<0.05	0.0066	<0.005	<0.001	0.0154	0.00758	0.00173	0.0103	0.369	<0.00001	0.0000664	<0.005	0.0000119	15.5	<0.0001	0.0000858	0.00013	0.0033	0.0000322	0.00187	1.49	0.0175	<0.00005	0.00885	<0.0005	<0.3	4.31	0.00050	2.57	<0.000005	0.155	0.168	<0.000002	<0.00001	<0.0005	0.000100	<0.0005	0.00076	<0.0001
24-Apr-11	61	864	7.65	111.4	47	*ND*	0.0052	5.41	1.06	0.823	<0.05	<0.005	<0.005	<0.001	*ND*	0.0153	0.0104	0.00176	0.0112	0.414	<0.00001	<0.00005	<0.005	17.7	<0.0001	0.0000881	0.00012	0.0059	0.0000632	0.00193	1.57	0.0193	<0.0001	0.00908	<0.00005	<0.3	4.33	0.00059	2.73	<0.000005	0.164	0.183	<0.000002	<0.00001	<0.0005	0.0000823	<0.00005	0.00350	<0.0001
26-May-11	65	1152	8.13	102	54	*ND*	1.81	61.8	<0.5	0.317	<0.05	0.154	<0.005	<0.001	<0.002	0.00306	0.00025	0.00385	0.155	<0.00001	<0.00005	<0.005	0.0126	0.000237	82.5	<0.0001	0.000584	<0.0001	0.159	0.0000167	0.00072	5.36	0.561	<0.00002	0.0259	0.000214	<0.3	3.63	0.00058	7.47	<0.000005	1.20	0.354	<0.000002	<0.00001	<0.0005	0.0276	0.000119	0.00395	<0.0001
23-Jun-11	69	968	7.64	100.2	48	*ND*	2.89	4.79	<0.5	0.699	<0.05	<0.005	<0.005	<0.001	0.0104	0.0154	0.0160	0.0112	0.442	<0.00001	<0.00005	<0.005	0.0145	14.9	<0.0001	0.0000558	<0.0001	0.159	0.0000122	0.00128	1.38	0.0154	<0.00002	0.00720	<0.0005	<0.3	3.49	0.00062	3.27	<0.000005	0.147	0.160	<0.000002	<0.00001	<0.0005	0.000430	0.000093	0.00167	<0.0001
21-Jul-11	73	841	7.63	101.3	47	*ND*	3.03	4.99	0.50	0.700	<0.05	<0.005	<0.005	<0.001	0.0109	0.0119	0.00151	0.0100	0.330	<0.00001	<0.00005	<0.005	0.0126	15.2	<0.0001	<0.00005	<0.0001	0.0161	<0.000005	0.00130	1.42	0.0171	<0.00002	0.00656	<0.0005	<0.3	3.38	0.00062	2.38	<0.000005	0.130	0.161	<0.000002	<0.00001	<0.0005	0.000217	<0.00005	0.00346	<0.0001
18-Aug-11	77	1001	7.61	134.8	63	*ND*	2.23	5.46	0.64	0.825	<0.05	<0.025	<0.005	<0.001	0.0096	0.0291	0.00145	0.00153	0.376	<0.00001	<0.00005	<0.05	0.0000559	20.6	<0.0001	0.0000290	0.00922	0.0031	0.000326	0.00276	2.16	0.0403	<0.00002	0.0106	0.000076	<0.3	3.83	0.000105	1.90	<0.000005	0.147	0.199	0.0000039	0.000018	<0.0005	0.00285	0.000104	0.00857	<0.0001
15-Sep-11	81	3032	7.33	139.6	57	*ND*	2.43	6.40	2.31	0.872	1.04	<0.005	<0.005	<0.001	0.0109	0.0155	0.000131	0.00530	0.392	<0.00001	<0.00005	<0.005	<0.000005	21.2	<0.0001	0.0000173	0.00030	0.0791	<0.000005	0.00263	2.19	0.0364	<0.00002	0.00961	0.000072	<0.3	3.98	0.000053	2.51	<0.000005	0.180	0.210	<0.000002	<0.00001	<0.0005	0.000629	0.000071	<0.0005	<0.0001
13-Oct-11	85	834	7.84	145.6	62	*ND*	3.90	7.67	0.84	0.881	1.87	<0.005	<0.005	<0.001	0.0108	0.00873	0.000048	0.00760	0.414	<0.00001	<0.00005	<0.005	0.0000555	22.5	<0.0001	0.0000184	<0.0001	0.0021	<0.000005	0.00240	2.32	0.0369	<0.00002	0.00971	0.000059	<0.3	4.03	0.000084	2.53	<0.000005	0.211	0.229	<0.000002	<0.00001	<0.0005	0.000317	0.000051	0.00068	<0.0001
10-Nov-11	89	828	7.61	141.5	64	*ND*	3.75	7.89	1.24	0.859	1.47	<0.005	<0.005	<0.001	0.0095	0.0072	0.000048	0.00753	0.433	<0.00001	<0.00005	<0.005	0.0000669	23.1	<0.0001	0.0000184	<0.0001	0.0016	<0.000005	0.00243	2.36	0.0383	<0.00002	0.00883	<0.0005	<0.3	3.81	0.000053	2.58	<0.000005	0.205	0.224	<0.000002	<0.00001	<0.0005	0.000219	<0.00005	0.00076	<0.0001
8-Dec-11	93	1042	7.63	133.6	63	*ND*	3.26	7.29	<0.5	0.821	0.860	<0.005	<0.005	<0.001	0.0091	0.00675	0.000050	0.00517	0.433	<0.00001	<0.00005	0.0154	<0.000005	20.7	<0.0001	0.0000160	<0.0001	0.0015	<0.000005	0.00251	2.12	0.0338	<0.00001	0.00777	<0.0005	<0.3	3.55	0.000058	2.64	<0.000005	0.206	0.218	<0.000002	<0.00001	<0.0005	0.000313	<0.00005	0.00102	<0.0001
5-Jan-12	97	1368	7.16	126.9	60	*ND*	3.24	7.01	<0.5	0.803	0.534	<0.005	<0.005	<0.001	0.0071	0.00550	0.000048	0.00428	0.375	<0.00001	<0.00005	0.018	<0.000005	20.7	<0.0001	0.0000187	<0.0001	0.0023	<0.000005	0.00227	2.10	0.0331	<0.00001	0.00698	<0.0005	<0.3	3.56	0.000048	2.44	<0.000005	0.184	0.198	<0.000002	<0.00001	<0.0005	0.000246	<0.00005	0.00065	<0.0001
2-Mar-12	105	175	7.39	132.2	64	*ND*	4.33	6.90	<0.5	0.821	0.412	<0.005	<0.005	<0.001	0.0101	0.00418	0.000043	0.00373	0.410	<0.00001	<0.00005	0.0127	<0.000005	20.6	<0.0001	0.0000156	<0.0001	0.0015	<0.000005	0.00235	2.18	0.0347	<0.00001	0.00759	0.000055	<0.3	3.45	<0.00004	2.64	<0.000005	0.190	0.218	<0.000002	<0.00001	<0.0005	0.000218	<0.00005	0.00257	<0.0001
25-May-12	117	200	7.74	142.1	66	*ND*	6.28	6.92	<0.5	0.846	0.356	<0.005	<0.005	<0.001	0.0114	0.00324	0.000030	0.00401	0.442	<0.00001	<0.00005	0.0134	<0.000005	21.6	<0.0001	0.0000167	<0.0001	0.0034	<0.000005	0.00280	2.18	0.0373	<0.00001	0.00829	<0.0005	<0.3	3.49	<0.00004	2.94	<0.000005	0.210	0.232	<0.000002	<0.00001	<0.0005	0.000224	<0.00005	0.00065	<0.0001
25-Jul-12	126	240	8.04	145	68	*ND*	7.87	6.65	<0.5	0.904	0.305	<0.005	<0.005	<0.001	0.0125	0.00319	0.000073	0.00458	0.529	<0.00001	<0.00005	0.0134	<0.000005	22.1	<0.0001	0.0000080	<0.0001	0.0021	<0.000005	0.00324	2.30	0.0414	<0.00002	0.00923	<0.0005	<0.3	3.41	<0.00004	2.92	<0.000005	0.248	0.253	<0.000002	<0.00001	<0.0005	0.000124	<0.00005	0.00124	<0.0001
12-Sep-12	133	240	7.85	147	71	73.3	7.81	6.47	<2.5	0.917	0.244	<0.005	<0.005	<0.001	0.0138	0.0027	<0.0001	0.00546	0.515	<0.0001	<0.0005	0.011	<0.00001	25.2	<0.0001	<0.0001	<0.0002	<0.01	<0.00005	0.00288	2.55	0.0381	<0.00001	0.0119	<0.0005	<0.05	3.96	<0.0001	2.95	<0.00001	0.242	0.248	<0.00001	<0.00001	<0.001	0.000185	<0.001	<0.001	*ND*
14-Nov-12	142	665	7.83	143.2	63	67.6	6.87	6.06	<2.5	0.945	0.187	<0.005	<0.005	<0.001	0.0112	0.00147	0.000050	0.00474	0.505	<0.00001	<0.00005	0.0101	<0.000005	23.2	<0.0001	0.0000164	<0.0001	0.0091	<0.000005	0.00310	2.37	0.0365	<0.00001	0.0159	<0.0005	<0.05	3.50	<0.00004	3.03	<0.000005	0.254	0.247	<0.000002	<0.00001	<0.0005	0.000168	<0.00005	0.00052	<0.0001
11-Jan-13	150	565	7.75	142	69	*ND*	6.39	5.73	0.91	0.924	0.093	<0.005	<0.005	<0.001	0.0132	0.00197	0.000040	0.00458	0.467	<0.00001	<0.00005	0.0093	<0.000005	21.8	<0.0001	0.0000174	<0.0001	0.0171	<0.000005	0.00252	2.32	0.0346	<0.00001	0.0170	<0.0005	<0.3	3.10	<0.00004	3.10	<0.000005	0.264	0.228	<0.000002	<0.00001	<0.0005	0.000154	<0.00005	0.00125	<0.0001

Calculated Production Rates for Sat Col 8 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
25-Feb-10	0	208	*ND*	*ND*	*ND*	12	0.22	12	1.5	*ND*	*ND*	0.0092	0.00092	0.00069	0.00023	0.0015	0.00031	0.00016	0.0029	0.0000046	0.0000046	0.0023	0.0000055	4.8	0.000046	0.000023	0.0000060	0.00023	0.0000092	*ND*	0.31	0.0012	0.00000028	0.0059	0.00032	*ND*	2.2	0.00013	0.093	0.00000092	1.1	0.028	0.0000023	0.00023	0.00023	0.00022	0.00023	0.00023	0.00023
4-Mar-10	1	1456	7.0	*ND*	12	92	*ND*	95	12	1.00	0.016	0.023	0.0022	0.00032	0.11	0.0095	0.0012	0.0016	0.014	0.00032	0.00032	0.014	0.000011	33	0.00032	0.000065	0.000065	0.019	0.000032	0.012	0.00032	0.19	16	0.00065	0.67	0.0000065	8.6	0.18	0.000065	0.000065	0.0065	0.00018	0.00065	0.00065	*ND*
11-Mar-10	2	1456	7.4	*ND*	12	35	0.50	40	3.8	1.2	0.19	0.0065	0.0016	0.00032	0.063	0.0082	0.0012	0.0034	0.012	0.00016	0.00016	0.014	0.000055	13	0.00016	0.00032	0.00032	0.049	0.000016	0.0016	0.96	0.0021	0.00016	0.0071	0.00016	0.49	11	0.00032	0.64	0.00032	4.5	0.076	0.00032	0.00032	0.016	0.000335	0.00032	0.00032	*ND*
18-Mar-10	3	1456	8.0	*ND*	34	15	0.34	16	0.99	0.86	0.081	0.0

Leachate Data for Sat Col 10

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
19-Aug-11	0	110	7.21	384	37	*ND*	4.69	109	18.7	0.021	<0.05	<0.13	<0.005	<0.001	0.134	<0.005	0.161	0.00120	0.00191	0.0390	<0.00001	<0.000005	0.0410	<0.002	50.0	<0.00001	0.000684	0.0152	0.0011	0.000187	0.00064	1.29	0.0141	<0.00002	0.453	0.000262	<0.3	17.9	0.000930	0.904	<0.000005	9.97	0.208	0.0000576	<0.00001	<0.00005	0.00443	0.00143	0.0317	<0.0001
26-Aug-11	1	775	7.89	468	47	*ND*	4.51	131	24.8	0.021	2.61	<0.05	<0.005	<0.001	0.117	<0.005	0.127	0.00131	0.00234	0.0449	<0.00001	<0.000005	0.0462	0.00275	61.9	<0.00001	0.00109	0.0354	0.0014	0.000173	<0.0005	1.68	0.0218	<0.00002	0.613	0.000421	<0.3	21.1	0.00101	1.05	<0.000005	12.1	0.262	0.0000584	<0.00001	0.00078	0.00634	0.00106	0.0179	<0.0001
8-Sep-11	3	1431	7.84	434	52	*ND*	5.83	132	19.0	0.021	1.16	<0.005	<0.005	<0.001	0.137	<0.005	0.195	0.00139	0.00261	0.0397	<0.00001	<0.000005	0.0624	0.00338	58.2	<0.00001	0.00138	0.0394	<0.002	0.000170	<0.0005	1.56	0.0213	<0.00005	0.591	0.000144	<0.3	20.5	0.000923	1.06	<0.000005	12.0	0.218	0.0000496	<0.00001	<0.00005	0.00516	0.00135	0.0220	<0.0001
15-Sep-11	4	760	7.63	380	40	*ND*	4.18	117	11.3	0.021	0.980	<0.005	<0.005	<0.001	0.0804	<0.005	0.208	0.00145	0.00266	0.0361	<0.00001	<0.000005	0.0459	0.00322	47.3	<0.00001	0.00130	0.0343	<0.001	0.000170	<0.0005	1.31	0.0185	<0.00002	0.546	0.000316	<0.3	17.2	0.000691	0.976	<0.000005	9.91	0.193	0.0000428	<0.00001	0.00056	0.00480	0.00154	0.0181	<0.0001
23-Sep-11	5	853	7.93	335	53	118	*ND*	103	5.94	<0.02	0.477	<0.005	<0.005	<0.001	0.0611	<0.005	0.200	0.00152	0.00261	0.0335	<0.0001	<0.0005	0.049	0.00335	45.4	<0.0001	0.00129	0.0319	<0.03	0.000191	<0.0005	1.22	0.0174	*ND*	0.494	<0.0005	<0.3	16.0	0.00055	0.997	<0.00001	9.88	0.173	0.000044	<0.0001	<0.01	0.00469	0.0016	0.0197	*ND*
29-Sep-11	6	804	8.08	279.1	43	*ND*	2.90	82.0	3.38	0.023	0.199	0.0053	<0.005	<0.001	0.0495	<0.005	0.216	0.00158	0.00291	0.0352	<0.00001	<0.000005	0.0409	0.00310	33.2	<0.0001	0.00117	0.0308	0.0020	0.000191	<0.0005	0.985	0.0150	<0.00002	0.375	0.000235	<0.3	14.9	0.000406	0.941	<0.000005	7.20	0.143	0.0000406	0.000054	<0.00005	0.00408	0.00183	0.0164	<0.0001
13-Oct-11	8	2438	8.01	216.7	44	*ND*	2.08	54.6	1.17	0.024	<0.05	<0.005	<0.005	<0.001	0.0472	<0.005	0.213	0.00158	0.00306	0.0451	<0.00001	<0.000005	0.0426	0.00268	26.9	<0.0001	0.000949	0.0200	0.0014	0.000201	<0.0005	0.751	0.0109	<0.00002	0.229	0.000176	<0.3	12.4	0.000198	0.911	<0.000005	4.84	0.122	0.0000348	0.000017	<0.00005	0.00324	0.00179	0.0134	<0.0001
27-Oct-11	10	2326	8.26	161.8	48	*ND*	1.41	31.9	<0.5	0.025	<0.05	<0.005	<0.005	<0.001	0.0438	<0.005	0.233	0.00167	0.00324	0.0576	<0.00001	<0.000005	0.0407	0.00210	20.7	<0.0001	0.000755	0.0157	<0.001	0.000111	<0.0005	0.592	0.00777	<0.00001	0.102	0.000131	<0.3	11.0	0.000137	0.877	<0.000005	2.69	0.107	0.0000275	0.000023	<0.00005	0.00227	0.00188	0.00617	<0.0001
10-Nov-11	12	2521	8.15	132.5	44	*ND*	1.31	21.3	<0.5	0.030	<0.05	<0.005	<0.005	<0.001	0.0437	<0.005	0.256	0.00171	0.00366	0.0734	<0.00001	<0.000005	0.0293	0.00137	17.1	<0.0001	0.000540	0.00833	<0.001	0.000797	<0.0005	0.492	0.00462	<0.00001	0.0481	<0.00005	<0.3	9.63	0.000137	0.816	<0.000005	1.32	0.078	0.0000223	<0.00001	<0.00005	0.00161	0.00216	0.00424	<0.0001
25-Nov-11	14	2388	8.04	123.5	50	*ND*	0.91	17.0	<0.5	0.028	<0.05	<0.005	<0.005	<0.001	0.0473	<0.005	0.216	0.00156	0.00332	0.0885	<0.00001	<0.000005	0.0379	0.00253	<0.001	0.000379	0.00253	<0.001	0.000298	<0.0005	0.485	0.00417	<0.00001	0.0338	<0.00005	<0.3	8.29	0.000120	0.769	<0.000005	0.849	0.0917	0.0000205	0.000026	<0.00005	0.00134	0.00188	0.00450	<0.0001
8-Dec-11	16	1298	8.13	113.1	44	*ND*	0.75	13.8	<0.5	0.028	<0.05	<0.005	0.0052	<0.001	0.0473	<0.005	0.264	0.00146	0.00337	0.0930	<0.00001	<0.000005	0.0217	0.000768	15.4	<0.0001	0.000311	0.00391	<0.001	0.000637	<0.0005	0.469	0.00286	<0.00001	0.0258	<0.00005	<0.3	7.78	0.000144	0.785	<0.000005	0.613	0.0887	0.0000185	<0.00001	<0.00005	0.00112	0.00191	0.00307	<0.0001
23-Dec-11	18	1441	7.5	115	49	*ND*	0.56	14.2	<0.5	0.025	<0.05	<0.005	<0.005	<0.001	0.0490	<0.005	0.216	0.00146	0.00317	0.0963	<0.00001	<0.000005	0.0207	0.000739	15.8	<0.0001	0.000297	0.00350	<0.001	0.000685	<0.0005	0.524	0.00323	<0.00001	0.0267	<0.00005	<0.3	7.86	0.000131	0.841	<0.000005	0.604	0.0860	0.0000181	<0.00001	<0.00005	0.00105	0.00175	0.00308	<0.0001
5-Jan-12	20	1371	7.7	115.3	49	*ND*	1.14	13.0	<0.5	0.024	<0.05	<0.005	<0.005	<0.001	0.0468	<0.005	0.215	0.00148	0.00324	0.105	<0.00001	<0.000005	0.0192	0.000622	17.2	<0.0001	0.000240	0.00181	<0.001	0.0000684	<0.0005	0.513	0.00261	<0.00001	0.0235	<0.00005	<0.3	7.45	0.000129	0.825	<0.000005	0.453	0.0892	0.0000165	<0.00001	<0.00005	0.00111	0.00166	0.00369	<0.0001
19-Jan-12	22	2213	7.29	114.5	44	*ND*	1.72	12.6	0.70	0.025	<0.05	<0.005	<0.005	<0.001	0.0485	<0.005	0.208	0.00145	0.00336	0.113	<0.00001	<0.000005	0.0190	0.000570	16.5	<0.0001	0.000217	0.00155	<0.001	0.0000641	<0.0005	0.523	0.00263	<0.00001	0.0222	<0.00005	<0.3	7.10	0.000127	0.802	<0.000005	0.417	0.0943	0.0000145	<0.00001	<0.00005	0.00127	0.00168	0.00212	<0.0001
3-Feb-12	24	3167	6.76	102.8	43	*ND*	0.79	9.85	<0.5	0.029	<0.05	<0.005	<0.005	<0.001	0.0431	<0.005	0.240	0.00131	0.00333	0.106	<0.00001	<0.000005	0.0132	0.000360	14.7	<0.0001	0.000151	0.00133	<0.001	0.0000588	<0.0005	0.475	0.00189	<0.00001	0.0154	<0.00005	<0.3	6.61	0.000132	0.753	<0.000005	0.281	0.0848	0.0000210	<0.00001	<0.00005	0.00090	0.00175	0.00247	<0.0001
16-Feb-12	26	2641	7.7	97	44	*ND*	1.15	8.87	<0.5	0.026	<0.05	<0.005	<0.005	<0.001	0.0374	<0.005	0.237	0.00106	0.00281	0.114	<0.00001	<0.000005	0.0097	0.000215	13.8	<0.0001	0.0000959	0.00134	<0.001	0.0000461	<0.0005	0.447	0.00155	<0.00001	0.0129	<0.00005	<0.3	5.47	0.000102	0.690	<0.000005	0.207	0.0805	0.0000141	<0.00001	<0.00005	0.00821	0.00166	0.00237	<0.0001
2-Mar-12	28	3076	7.52	113.1	50	*ND*	0.66	10.9	<0.5	0.023	<0.05	<0.005	<0.005	<0.001	0.0503	<0.005	0.188	0.00148	0.00301	0.134	<0.00001	<0.000005	0.0129	0.000292	17.1	<0.0001	0.000130	0.00122	<0.001	0.0000525	<0.0005	0.573	0.00303	<0.00001	0.0191	<0.00005	<0.3	6.32	0.000110	0.760	<0.000005	0.283	0.0956	0.0000162	<0.00001	<0.00005	0.00120	0.00161	0.00306	<0.0001
16-Mar-12	30	2739	7.58	112	52	*ND*	1.31	10.0	<0.5	0.023	<0.05	<0.005	<0.005	<0.001	0.0470	<0.005	0.189	0.00138	0.00277	0.116	<0.00001	<0.000005	0.0113	0.000238	16.5	<0.0001	0.000128	0.00077	<0.001	0.0000532	<0.0005	0.503	0.00183	<0.00001	0.0127	<0.00005	<0.3	5.43	0.000138	0.786	<0.000005	0.510	0.0854	0.0000191	<0.00001	<0.00005	0.00127	0.00178	0.00418	<0.0001
30-Mar-12	32	427	7.52	123.9	57	*ND*	0.87	11.2	<0.5	0.022	<0.05	0.0095	<0.005	<0.001	0.0507	<0.005	0.162	0.00142	0.00304	0.148	<0.00001	<0.000005	0.0140	0.000323	18.2	<0.0001	0.000120	0.00087	<0.001	0.0000741	<0.0005	0.623	0.00200	<0.00001	0.0209	0.000081	<0.3	6.61	0.000125	0.845	<0.000005	0.331	0.108	0.0000151	<0.00001	<0.00005	0.00135	0.00152	0.00403	<0.0001
13-Apr-12	34	461	7.47	130.1	60	*ND*	1.35	11.9	<0.5	0.023	<0.05	<0.005	<0.005	<0.001	0.114	<0.005	0.264	0.00146	0.00325	0.165	0.000013	0.0000360	0.0166	0.000343	19.6	0.00013	0.000321	0.0210	0.223	0.000225	<0.0005	0.719	0.0212	<0.00001	0.0227	0.000172	<0.3	7.21	0.000131	0.988	<0.000005	0.395	0.110	0.0000183	<0.00001	0.00069	0.00196	0.00175	0.00780	<0.0001
25-Apr-12	36	416	7.8	96.6	52	*ND*	1.37	7.67	0.50	0.025	<0.05	<0.005	<0.005	<0.001	0.0564	<0.005	0.154	0.00866	0.00224	0.124	<0.00001	<0.000005	0.0076	0.0000531	15.2	<0.0001	0.0000455	0.00226	0.0021	0.0000243	<0.0005	0.641	0.00263	*ND*	0.0135	<0.00005	<0.3	4.60	0.000114	0.730	0.0000053	0.226	0.0838	0.0000189	<0.00001	<0.00005	0.00865	0.00124	0.00335	<0.0001
11-May-12	38	487	7.65	109	58	*ND*	0.72	8.21	0.53	0.023	<0.05	0.0074	<0.005	<0.001	0.0626	<0.005	0.121	0.000908	0.00216	0.158	<0.00001	<0.000005	0.0087	<0.0000665	17.3	<0.0001	0.0000333	0.00162	<0.001	0.0000078	<0.0005	0.771	0.00796	<0.00001	0.0163	<0.00005	<0.3	4.62	0.000114	0.764	<0.000005	0.247	0.0967	0.0000168	<0.00001	<0.00005	0.00840	0.00119	0.00077	<0.0001
25-May-12	40	453	7.77	109.1	48	*ND*	1.08	7.58	0.51	0.025	<0.05	0.0059	<0.005	<0.001	0.0613	<0.005	0.127	0.000856	0.00217	0.142	<0.00001	<0.000005	0.0085	0.0000343	16.6	<0.0001	0.0000284	0.00153	<0.001	0.0000101	<0.0005	0.762	0.00805	<0.00001	0.0164	<0.00005	<0.3	4.72	0.000119	0.813	<0.000005	0.268	0.0923	0.0000207	<0.00001	<0.00005	0.00874	0.00114	0.00085	<0.0001
8-Jun-12	42	452	7.55	104.8	56	*ND*	<0.5	6.90	0.54	0.023	<0.05	<0.005	<0.005	<0.001	0.0621	<0.005	0.104	0.000874	0.00210	0.152	<0.00001	<0.000005	0.0089	0.0000711	16.4	<0.0001	0.0000278	0.00114	<0.001	0.0000314	<0.0005	0.769	0.00923	<0.00001	0.0171	<0.00005	<0.3	4.21	0.000102	0.790	<0.000005	0.262	0.0926	0.0000186	<0.00001	<0.00005	0.00805	0.00110	0.00075	<0.0001
22-Jun-12	44	427	7.48	101	53	*ND*	1.42	6.61	0.55	0.023	<0.05	0.0072	0.0056	<0.001	0.0642	<0.005	0.110	0.000899	0.00222	0.147	<0.00001	<0.000005	0.0077	0.0000835	16.5	<0.0001	0.0000228	0.00128	<0.001	0.0000110	<0.0005	0.772	0.00916	<0.00001	0.0173	<0.00005	<0.3	4.38	0.000108	0.797	<0.000005	0.277	0.0925	0.0000216	<0.00001	<0.00005	0.00798	0.00114	0.00412	<0.0001
6-Jul-12	46	452	7.79	109.4	49	*ND*	1.47	6.68	0.61	0.024	<0.05	<0.005	<0.005	<0.001	0.0647	<0.005	0.102	0.000951	0.00246	0.171	<0.00001	<0.000005	0.0091	0.0000822	16.5	<0.0001	0.0000243	0.00098	<0.001	0.0000111	<0.0005	0.830	0.0101	<0.00001	0.0190	<0.00005	<0.3	4.26	0.000096	0.846	<0.000005	0.328	0.0958	0.0000202	<0.00001	<0.00005	0.00732	0.00115	0.00106	<0.0001
20-Jul-12	48	442	7.88	110.8	54	*ND*	0.99	6.73	0.69	0.022	<0.05	<0.005	<0.005	<0.001	0.0644	<0.005	0.0981	0.00102	0.00213	0.169	<0.00001	<0.000005	0.0083	0.0000922	17.7	<0.0001	0.0000289	0.00105	<0.001	0.0000115	<0.0005	0.832	0.0107	<0.00001	0.0201	<0.00005	<0.3	4.54	0.000107	0.855	<0.000005	0.342	0.0991	0.0000209	<0.00001	<0.00005	0.00869	0.00112	0.00094	<0.0001
3-Aug-12	50	402	7.88	110.8	52	*ND*	2.6	6.52	0.67	0.025	<0.05	<0.005	<0.005	<0.001	0.0651	<0.0080	0.0961	0.000981	0.00225	0.159	<0.00001	<0.000005	0.0080	0.0000738	15.7	<0.0001	0.0000274	0.00091	<0.001	0.0000243	<0.0005	0.825	0.00992	<0.00001	0.0223	<0.00005	<0.3	4.27	0.000095	0.842	<0.000005	0.354	0.101	0.0000217	<0.00001	<0.00005	0.00932	0.00116	0.00109	<0.0001
17-Aug-12	52	480	7.75	102.2	51	*ND*	0.67	5.69	0.52	0.025	<0.05	<0.005	<0.005	<0.001	0.0703	<0.005	0.0992	0.000882	0.00210	0.155	<0.00001	<0.000005	0.0072	0.0000606	15.1	<0.0001	0.0000169	0.00093	<0.001	0.0000162	<0.0005	0.774	0.00935	<0.00001	0.0201	0.000072	<0.3	3.87	0.000092	0.819	<0.000005	0.327	0.0894	0.0000178	<0.00001	<0.00005	0.00746	0.00108	0.00058	<0.0001
30-Aug-12	54	495	7.69	98.2	50	*ND*	0.84	5.40	0.52	0.023	<0.05	<0.005	<0.005	<0.001	0.0697	<0.005	0.0949	0.000831	0.00220	0.159	<0.00001	<0.000005	0.0074	0.0000685	15.9	<0.0001	0.0000179	0.00252	<0.001	0.0000186	<0.0005	0.782	0.00933	<0.00001	0.0194	0.000085	<0.3	3.77	0.000100	0.799	<0.000005	0.327	0.0940	0.0000170	<0.00001	<0.00005	0.00692	0.00111	0.00201	<0.0001
12-Sep-12	56	512	7.79	97.4	50	45.3	0.92	5.28	<0.5	0.022	<0.05	<0.005	<0.005	<0.001	0.0673	<0.005	0.0942	0.00090	0.00220	0.160	<0.00001	<0.000005	<0.01	0.0000534	16.7	<0.0001	<0.00001	0.00072	<0.01	<0.00005	<0.0005	0.90	0.00958	<0.00001	0.0204	<0.00005	0.071	4.20	<0.00001	0.792	<0.00001	0.332	0.0889	0.000019	<0.00001	<0.01	0.00703	0.0010	0.0013	*ND*
25-Sep-12	58	516	7.7	95.5	50	*ND*	2.01	5.02	<0.5	0.028	<0.05	<0.005	<0.005	<0.001	0.0698	<0.005	0.0926	0.000803	0.00205	0.165	<0.00001	<0.000005	0.0076	0.0000534	14.7	<0.0001	0.0000199	0.00072	<0.001	0.0000148	<0.0005	0.783	0.00985	<0.00001	0.0193	0.000064	<0.3	3.42	0.000071	0.808	<0.000005	0.335	0.0856	0.0000181	<0.00001	<0.00005	0.00588	0.00111	0.00195	<0.0001
10-Oct-12	60	570	7.47	93.9	53	*ND*	0.83	5.01	<0.5	0.022	<0.05	<0.005	<0.005	<0.001	0.0674	<0.005	0.0974	0.000792	0.00205	0.174	<0.00001	<0.000005	0.0074	0.0000518	14.5	<0.0001	0.0000318	0.00109	0.0034	0.0000478	<0.0005	0.791	0.00963	<0.00001	0.0196	0.000105	<0.3	3.59	0.000078	0.793	<0.000005	0.326	0.0853	0.0000171	<0.00001	<0.00005	0.00686	0.00110	0.00211	<0.0001
23-Oct-12	62	536	7.72	90	47	*ND*	0.79	4.80	<0.5	0.023	<0.05	<0.005	<0.005	<0.001	0.0680	<0.005	0.0926	0.000752	0.00196	0.163	<0.00001	<0.000005	0.0066	0.0000475	13.7	<0.0001	0.0000246	0.00080	<0.001	0.0000087	<0.0005	0.770	0.00954	<0.00001	0.0185	0.000171	<0.3	3.22	0.000070	0.719	<0.000005	0.315	0.0803	0.0000163	<0.00001	<0.00005	0.00631	0.00102	0.00114	<0.0001
7-Nov-12	64	532	7.61	99.4	50	*ND*	0.91	5.27	0.51	0.020	<0.05	<0.005	<0.005	<0.001	0.0683	<0.01	0.0799	0.000853	0.00200	0.195	<0.00001	<0.000005	0.0073	0.0000483	15.8	<0.0001	0.0000222	0.00110	<0.001	0.0000466	<0.0005	0.748	0.0107	<0.00001	0.0220	0.000097	<0.3	3.40	0.000076	0.772	<0.000005	0.355	0.0943	0.0000172	<0.00001	<0.00005	0.00700	0.00101	0.00101	<0.0001
20-Nov-12	66	475	7.74	97.5	47	*ND*	0.90	5.08	<0.5	0.022	<0.05	<0.005	<0.005	<0.001	0.0667	<0.01	0.0797	0.000770	0.00195	0.186	<0.00001	<0.000005	0.0069	0.0000455	15.5	<0.0001	0.0000172	0.00098	<0.001	0.0000122	<0.0005	0.855	0.0102	<0.00001	0.0212	0.000073	<0.3	3.41	0.000075	0.783	<0.000005	0.381	0.0882	0.0000166	<0.00001	<0.00005	0.00658	0.00102	0.00115	<0.0001
5-Dec-12	68	383	7.76	107.1	57	*ND*	0.94	5.64	<0.5	0.020	<0.05	<0.005	<0.005	<0.001	0.0689	<0.01	0.0756	0.000842	0.00199	0.192	<0.00001	<0.000005	0.0086	0.0000572	17.7	<0.0001	0.0000219	0.00058	<0.001	0.0000099	<0.0005	0.935	0.0108	<0.00001	0.0248	<0.00005	<0.3	3.40	0.000065	0.812	<0.000005	0.400	0.103	0.0000156	<0.00001	<0.00005	0.00821	0.000904	0.00136	<0.0001
18-Dec-12	70	380	7.58	97.8	56	*ND*	0.96	4.97	<0.5	0.021	<0.05	<0.005	<0.005	<0.001	0.0658	<0.01	0.0681	0.000805	0.00161	0.164	<0.00001	<0.000005	0.0064	0.0000462	14.9	<0.0001	0.0000243	0.00093	<0.001	0.0000108	<0.0005	0.772	0.00940	<0.00001	0.0218	<0.00005	<0.3	2.83	0.000080	0.748	<0.000005	0.326	0.0882	0.0000148	<0.00001	<0.00005	0.00691	0.000843	0.00115	<0.0001
1-Jan-13	72	485	7.64	119	78	*ND*	1.30	6.13	0.53	<0.02	<0.05	0.0055	<0.005	<0.001	0.0686	<0.01	0.0698	0.000897	0.00209	0.202	<0.00001	<0.000005	0.0088	0.0000698	18.5	<0.0001	0.0000366	0.00045	<0.001	0.0000305	<0.0005	0.984	0.0133	<0.00001	0.0252	0.000161	<0.3	3.89	0.000088	0.853	<0.000005	0.464	0.106	0.0000161	<0.00001	<0.00005	0.00900	0.000884	0.00229	<0.0001
24-Jan-13	75	500	7.3	92	44	*ND*	0.085	4.27	<0.5	<0.02	<0.05	0.0059	<0.005	<0.001	0.0643	<0.01	0.0767	0.000717	0.00177	0.166	<0.00001	<0.000005	0.0051	0.0000536	14.1	<0.0001	0.0000194	0.00069	<0.001	0.0000196	<0.0005	0.773	0.00969	<0.00001	0.0189	0.000093	<0.3	2.74	0.000065	0.737	<0.000005	0.330	0.0852	0.0000125	<0.00001	<0.00005	0.00584	0.000918	0.00096	<0.0001
30-Jan-13	76	355	7.44	88	37	*ND*	5.41	4.07	<0.5	<0.02	<0.05	<0.005	<0.005	<0.001	0.0653	<0.005	0.0802	0.000662	0.00185	0.155	<0.00001	<0.000005	0.0060	0.0000466	14.3	<0.0001	0.0000236	0.00052	<0.001	0.0000677	<0.0005	0.779	0.00967	<0.00001	0.0184	<0.00005	<0.3	2.75	0.000065	0.689	<0.000005	0.330	0.0853	0.0000122	<0.00001	<0.00005	0.00517	0.000850	0.00092	<0.0001
12-Feb-13	78	500	7.47	84.7	49	*ND*	<0.5	4.03	<0.5	0.020	<0.05	0.0068	<0.005	<0.001	0.0654	<0.005	0.0772	0.000660	0.00179	0.153	<0.00001	<0.000005	0.0057	0.0000456	13.2	<0.0001	0.0000204	0.00046	<0.001	0.0000156	<0.0005	0.777	0.0101	<0.00001	0.0173	0.000076	<0.3	2.71	0.000064	0.690	<0.000005	0.327	0.0757	0.0000120	<0.00001	<0.00005	0.00526	0.000826	0.00129	<0.0001
27-Feb-13	80	545	7.58	83.3	35	*ND*	1.38	3.98	<0.5	0.021	<0.05	<0.005	<0.005	<0.001	0.0659	<0.005	0.0758	0.000663	0.00171	0.149	<0.00001	<0.000005	0.0060	0.0000468	12.8	<0.0001	0.0000165	0.00047	<0.001	0.0000078	<0.0005	0.751	0.00939	<0.00001	0.0163	<0.00005	<0.3	2.58	0.000060	0.675	<0.000005	0.300	0.0743	0.0000113	0.000015	<0.00005	0.00503	0.000846	0.00108	<0.0001
12-Mar-13	82	585	7.27	79.8	34	*ND*	0.81	3.89	<0.5	0.021	<0.05	<0.005	<0.005	<0.001	0.0639	<0.005	0.0743	0.000599	0.00157	0.153	<0.00001	<0.000005	0.0064	0.0000417	12.6	<0.0001	<0.000005	0.00044	<0.001	0.0000079	<0.0005	0.724	0.00889	<0.00001	0.0165	<0.00005	<0.3	2.55	0.000067	0.660	<0.000005	0.321	0.0785	0.0000104	<0.00001	<0.00005	0.00399	0.000777	0.00087	<0.0001

Calculated Production Rates for Sat Col 10 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg

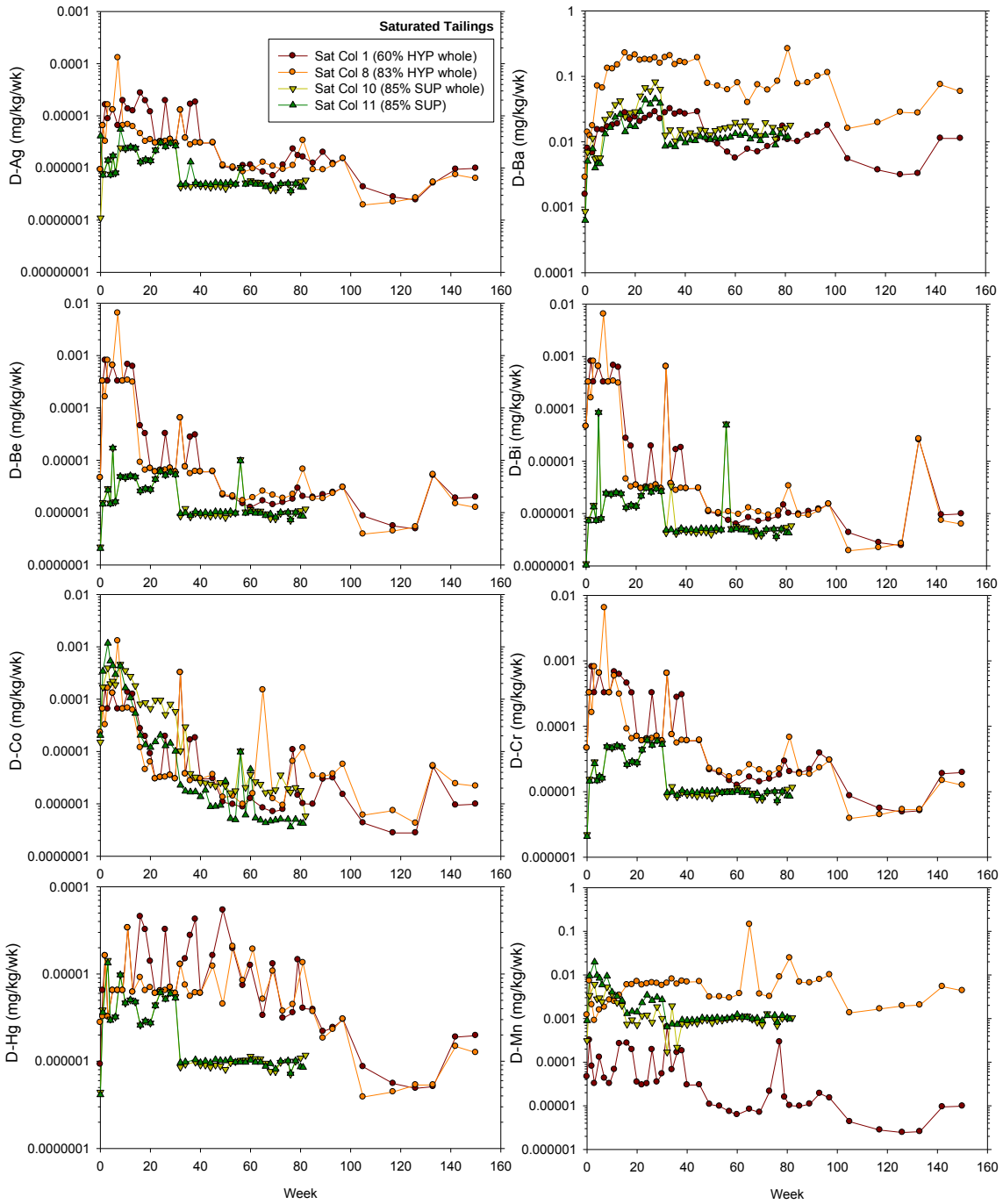
Leachate Data for Sat Col 11

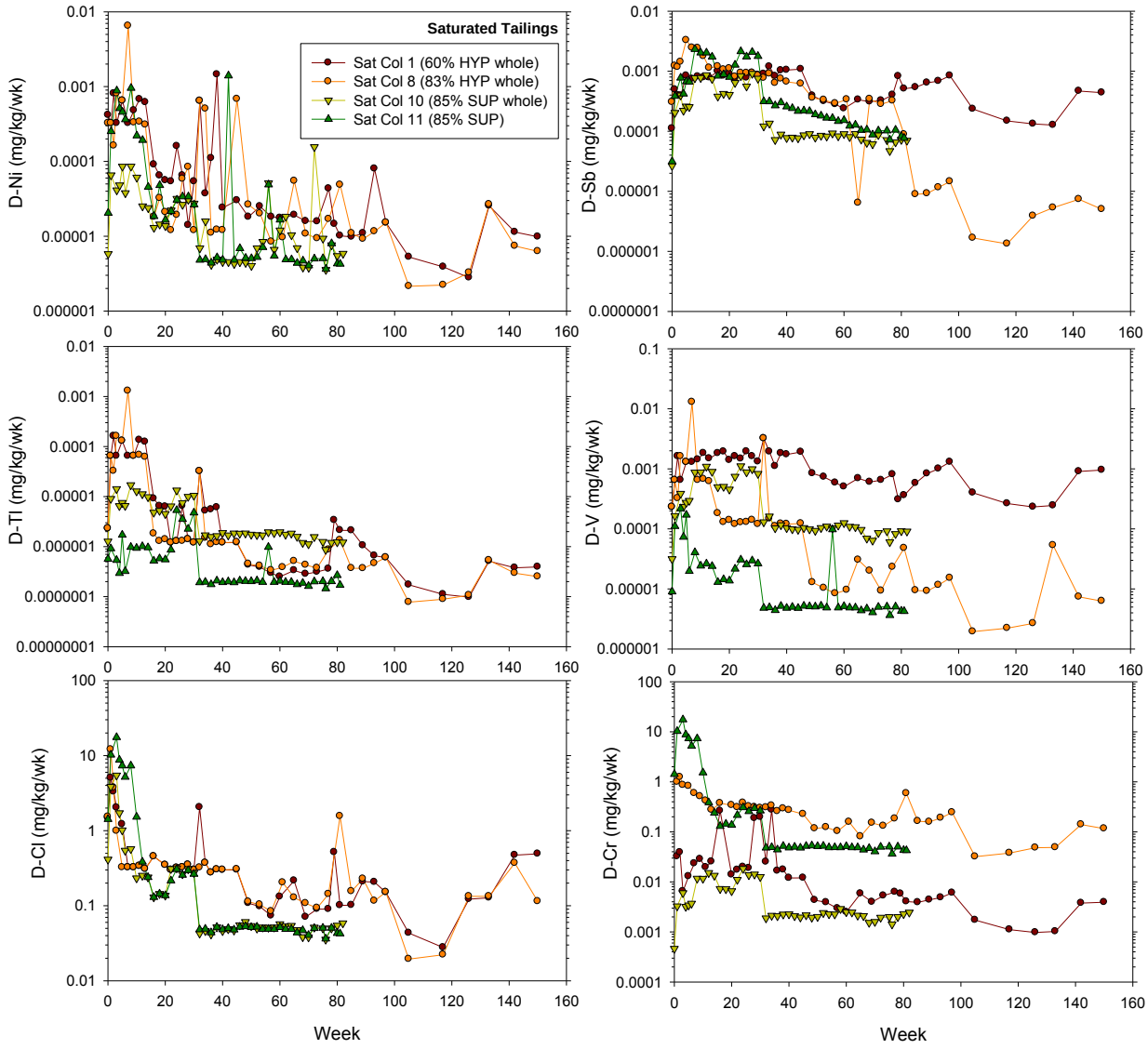
Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
19-Aug-11	0	103	6.97	804.0	38	*ND*	4.23	261	68.8	<0.1	<0.25	0.204	<0.025	<0.005	0.0692	0.0107	0.0144	0.00152	0.00987	0.0305	<0.00001	<0.000005	0.0619	<0.025	123	<0.0001	0.000980	0.0100	0.0047	0.000248	<0.0005	8.91	0.0435	<0.00002	0.240	0.000989	<0.3	17.6	0.00129	1.25	0.000199	13.3	0.434	0.0000273	<0.00001	<0.00005	0.00554	0.000436	0.223	<0.0001
26-Aug-11	1	725	7.10	1063.0	44	*ND*	4.48	428	70.5	<0.2	<0.5	0.0500	<0.05	<0.01	0.102	0.0054	0.0336	0.00265	0.00407	0.0347	<0.00001	<0.000005	0.0781	0.00404	172	<0.0001	0.00235	0.00046	0.0128	0.000523	<0.0005	11.4	0.0659	<0.000025	0.399	0.00174	<0.3	21.1	0.00126	2.51	<0.000005	17.5	0.648	0.0000063	<0.00001	<0.00005	0.00858	0.000763	0.122	<0.0001
8-Sep-11	3	1337	7.42	1076.0	52	*ND*	6.75	407	65.5	<0.2	<0.5	<0.005	0.099	<0.01	0.140	*ND*	0.0707	0.00289	0.00569	0.0291	<0.00001	<0.000005	0.108	0.00246	183	<0.0001	0.00437	0.00065	0.0341	0.000431	<0.0005	10.1	0.0737	<0.00005	0.501	0.00329	<0.3	22.8	0.000513	2.89	0.0000052	21.7	0.620	<0.0000002	<0.00001	<0.00005	0.00458	0.000814	0.0511	<0.0001
15-Sep-11	4	735	7.60	929.0	56	*ND*	6.07	322	59.5	<0.2	<0.5	<0.005	<0.05	<0.01	0.092	*ND*	0.0592	0.00285	0.00454	0.0271	<0.00001	<0.000005	0.0970	0.000495	143	<0.0001	0.00363	0.00020	0.0612	0.000201	<0.0005	8.14	0.0663	<0.00002	0.495	0.00347	<0.3	19.2	0.000263	2.85	<0.000005	19.5	0.532	<0.0000002	<0.00001	<0.00005	0.00299	0.000498	0.0405	<0.0001
23-Sep-11	5	853	7.69	722.0	53	322	5.10	235	43	<0.40	<1	0.0127	<0.1	<0.02	0.0827	<0.005	0.0643	0.00394	0.00308	0.0272	<0.001	<0.00005	0.085	<0.00015	118	<0.0001	0.00255	<0.0005	0.053	0.000383	<0.0005	6.39	0.0491	*ND*	0.440	0.00268	<0.3	16.3	0.00016	2.72	<0.000001	16.6	0.413	<0.00001	<0.00001	<0.01	0.000715	<0.001	0.0236	*ND*
29-Sep-11	6	804	7.92	596.0	54	*ND*	4.55	183	32.2	0.031	<0.05	0.0152	<0.005	<0.001	0.0777	<0.005	0.0620	0.00413	0.00250	0.0288	<0.00001	<0.000005	0.0787	<0.0001	85.9	<0.0001	0.00183	<0.0001	0.0542	0.0000324	<0.0005	4.65	0.0367	<0.00002	0.393	0.00226	<0.3	14.7	0.000096	2.54	0.00343	13.4	0.342	<0.0000002	<0.00001	<0.00005	0.000405	0.000123	0.0167	<0.0001
13-Oct-11	8	2440	7.95	408.0	64	*ND*	2.89	120	15.0	0.034	<0.05	<0.005	<0.05	<0.001	0.0695	<0.005	0.0510	0.00476	0.00181	0.0270	<0.00001	<0.000005	0.0730	<0.00015	56.3	<0.0001	0.000882	0.00014	0.0381	0.0000800	<0.0005	2.68	0.0193	<0.00002	0.348	0.00196	<0.3	11.6	0.000062	2.19	0.0000113	9.69	0.240	<0.0000002	<0.00001	<0.00005	0.000215	0.000083	0.0136	<0.0001
27-Oct-11	10	2328	8.07	225.2	42	*ND*	1.81	59.2	3.27	0.037	<0.05	<0.005	<0.05	<0.001	0.0659	<0.005	0.0774	0.00435	0.00168	0.0356	<0.00001	<0.000005	0.0530	<0.00005	30.8	<0.0001	0.000352	<0.0001	0.0211	0.0000137	<0.0005	1.21	0.00865	<0.00001	0.231	0.000473	<0.3	8.12	<0.000004	1.80	<0.000005	5.25	0.159	<0.0000002	<0.00001	<0.00005	0.000136	0.000052	0.00487	<0.0001
10-Nov-11	12	2523	8.07	166.3	39	*ND*	1.93	38.8	0.76	0.037	<0.05	0.0086	<0.05	<0.001	0.0686	<0.005	0.0846	0.00402	0.00179	0.0468	<0.00001	<0.000005	0.0422	<0.00005	22.8	<0.0001	0.000210	0.00066	0.0177	0.0000244	<0.0005	0.776	0.00640	<0.00001	0.155	0.000381	<0.3	6.69	<0.000004	1.56	<0.000005	3.02	0.120	<0.0000002	<0.00001	<0.00005	0.000105	0.0000052	0.00539	<0.0001
25-Nov-11	14	2389	7.80	143.0	41	*ND*	0.86	30.3	<0.5	0.036	<0.05	0.0173	<0.05	<0.001	0.0692	<0.002	0.0786	0.00362	0.00160	0.0547	<0.00001	<0.000005	0.0384	<0.00005	19.3	<0.0001	0.000112	<0.0001	0.0133	0.0000115	<0.0005	0.630	0.00541	<0.00001	0.121	0.000095	<0.3	5.79	0.000054	1.39	<0.000005	2.27	0.113	<0.0000002	<0.00001	<0.00005	0.0000816	<0.00005	0.00402	<0.0001
8-Dec-11	16	1298	7.90	131.8	39	*ND*	0.87	26.1	<0.5	0.032	<0.05	<0.005	<0.05	<0.001	0.0705	<0.005	0.0802	0.00322	0.00141	0.0549	<0.00001	<0.000005	0.0369	<0.00003	18.3	<0.0001	0.0000787	<0.0001	0.0101	0.0000092	<0.0005	0.580	0.00500	<0.00001	0.0994	0.000071	<0.3	5.45	0.000069	1.40	<0.000005	1.94	0.107	<0.0000002	<0.00001	<0.00005	0.0000633	<0.00005	0.00357	<0.0001
23-Dec-11	18	1441	7.74	127.3	38	*ND*	0.93	24.1	<0.5	0.031	<0.05	<0.005	<0.05	<0.001	0.0717	<0.005	0.0710	0.00306	0.00112	0.0609	<0.00001	<0.000005	0.0348	0.0000163	17.4	<0.0001	0.0000464	0.00047	0.0102	0.0000228	<0.0005	0.574	0.00505	<0.00001	0.0817	0.000166	<0.3	5.18	0.000078	1.42	<0.000005	1.64	0.0958	<0.0000002	<0.00001	<0.00005	0.0000462	<0.00005	0.00293	<0.0001
5-Jan-12	20	1371	7.53	121.3	42	*ND*	1.09	22.1	<0.5	0.030	<0.05	0.0055	<0.05	<0.001	0.0726	<0.005	0.0598	0.00291	0.00102	0.0620	<0.00001	<0.000005	0.0328	0.0000201	18.5	<0.0001	0.0000436	<0.0001	0.0066	0.0000094	<0.0005	0.555	0.00514	<0.00001	0.0786	0.000060	<0.3	5.04	0.000089	1.36	<0.000005	1.43	0.0970	<0.0000002	<0.00001	<0.00005	0.0000459	<0.00005	0.00355	<0.0001
19-Jan-12	22	2154	7.22	118.7	39	*ND*	1.57	21.3	<0.5	0.030	<0.05	<0.005	<0.05	<0.001	0.0720	<0.005	0.0574	0.00295	0.00969	0.0673	<0.00001	<0.000005	0.0328	0.0000162	17.3	<0.0001	0.0000356	<0.0001	0.0045	0.0000077	<0.0005	0.543	0.00534	<0.00001	0.0771	<0.00005	<0.3	4.76	0.000097	1.33	<0.000005	1.29	0.102	<0.0000002	<0.00001	<0.00005	0.0000436	<0.00005	0.00169	<0.0001
3-Feb-12	24	3061	6.82	128.9	43	*ND*	0.90	21.3	<0.5	0.031	<0.05	<0.005	<0.05	<0.001	0.0731	<0.005	0.0574	0.00348	0.00113	0.0710	<0.00001	<0.000005	0.0340	<0.00004	18.4	<0.0001	0.0000335	<0.0001	0.0040	0.0000146	<0.0005	0.546	0.00562	<0.00001	0.0925	<0.00005	<0.3	5.42	0.000061	1.41	<0.000005	1.34	0.110	<0.0000087	<0.00001	<0.00005	0.0000427	<0.00005	0.00141	<0.0001
16-Feb-12	26	2562	7.66	128.8	45	*ND*	1.35	20.8	<0.5	0.029	<0.05	0.0193	0.0058	<0.001	0.0704	<0.005	0.0587	0.00340	0.00133	0.0733	<0.00001	<0.000005	0.0310	<0.00007	18.1	<0.0001	0.0000251	0.00016	0.0025	0.0000067	<0.0005	0.486	0.00504	<0.00001	0.0938	0.000066	<0.3	5.37	0.000054	1.47	<0.000005	1.19	0.111	<0.0000069	<0.00001	<0.00005	0.0000402	<0.00005	0.00132	<0.0001
2-Mar-12	28	2960	7.4	125	45	*ND*	0.76	20.1	<0.5	0.029	<0.05	0.0054	<0.05	<0.001	0.0739	<0.005	0.0514	0.00352	0.00147	0.0764	<0.00001	<0.000005	0.0304	<0.00002	18.7	<0.0001	0.0000243	<0.0001	0.0017	<0.0000005	<0.0005	0.496	0.00518	<0.00001	0.0993	0.000057	<0.3	5.50	0.000052	1.35	<0.000005	1.19	0.112	<0.0000038	<0.00001	<0.00005	0.0000375	<0.00005	0.00155	<0.0001
16-Mar-12	30	2638	7.48	126.8	48	*ND*	1.40	19.1	<0.5	0.029	<0.05	<0.005	<0.05	<0.001	0.0734	<0.0057	0.0478	0.00336	0.00152	0.0735	<0.00001	<0.000005	0.0272	<0.00004	18.5	<0.0001	0.0000192	<0.0001	0.0020	0.0000064	<0.0005	0.441	0.00512	<0.00001	0.0960	<0.00005	<0.3	4.87	0.000065	1.40	<0.000005	1.11	0.114	0.0000090	<0.00001	<0.00005	0.0000328	<0.00005	0.00183	<0.0001
30-Mar-12	32	480	7.55	140.6	52	*ND*	0.90	20.3	<0.5	0.028	<0.05	<0.005	<0.05	<0.001	0.0837	<0.005	0.0415	0.00326	0.00950	0.0891	<0.00001	<0.000005	0.0330	<0.0001	20.6	<0.0001	0.0000236	<0.0001	0.0029	0.0000074	<0.0005	0.566	0.00670	<0.00001	0.128	<0.00005	<0.3	5.89	0.000054	1.56	<0.000005	1.36	0.130	<0.0000002	<0.00001	<0.00005	0.0000412	<0.00005	0.00087	<0.0001
13-Apr-12	34	490	7.58	143.5	59	*ND*	0.92	20.6	<0.5	0.027	<0.05	<0.005	<0.05	<0.001	0.0885	<0.005	0.0371	0.00318	0.000862	0.0914	<0.00001	<0.000005	0.0372	0.0000335	21.3	<0.0001	0.0000178	<0.0001	0.0086	0.0000073	<0.0005	0.596	0.00763	<0.00001	0.135	<0.00005	<0.3	6.21	0.000043	1.65	<0.000005	1.51	0.131	<0.0000002	<0.00001	<0.00005	0.0000422	<0.00005	0.00175	<0.0001
25-Apr-12	36	440	7.69	147.4	56	*ND*	1.71	20.0	<0.5	0.025	<0.05	<0.005	<0.05	<0.001	0.0842	<0.0057	0.0379	0.00304	0.000731	0.0957	<0.00001	<0.000005	0.0384	0.0000269	22.8	<0.0001	0.0000191	<0.0001	0.0032	0.0000336	<0.0005	0.625	0.00828	*ND*	0.156	<0.00005	<0.3	6.63	<0.000004	1.70	0.0000148	1.62	0.143	<0.0000002	<0.00001	<0.00005	0.0000487	<0.00005	0.00273	<0.0001
11-May-12	38	519	7.54	153.4	59	*ND*	1.16	19.2	<0.5	0.023	<0.05	<0.005	<0.05	<0.001	0.0943	<0.005	0.0343	0.00289	0.000792	0.108	<0.00001	<0.000005	0.0410	<0.00011	22.8	<0.0001	0.0000163	<0.0001	0.0030	<0.0000005	<0.0005	0.641	0.00892	<0.00001	0.176	<0.00005	<0.3	6.82	0.000047	1.74	<0.000005	1.80	0.148	<0.0000002	<0.00001	<0.00005	0.0000391	<0.00005	0.00373	<0.0001
25-May-12	40	481	7.75	158	63	*ND*	1.35	19.2	<0.5	0.025	<0.05	<0.005	<0.05	<0.001	0.0938	<0.005	0.0338	0.00267	0.000798	0.100	<0.00001	<0.000005	0.0417	0.0000635	22.7	<0.0001	0.0000142	<0.0001	0.0036	<0.0000005	<0.0005	0.650	0.00949	<0.00001	0.193	<0.00005	<0.3	6.91	<0.000004	1.87	<0.000005	1.95	0.148	<0.0000002	<0.00001	<0.00005	0.0000464	<0.00005	0.00119	<0.0001
8-Jun-12	42	500	7.63	151.1	62	*ND*	0.83	17.8	<0.5	0.024	<0.05	0.0068	<0.05	<0.001	0.0982	<0.005	0.0303	0.00241	0.000805	0.106	<0.00001	<0.000005	0.0402	<0.00017	22.4	<0.0001	0.0000182	<0.0001	0.0096	0.0000290	<0.0005	0.630	0.00922	<0.00001	0.200	0.00140	<0.3	6.48	<0.000004	1.82	<0.000005	1.88	0.144	<0.0000002	<0.00001	<0.00005	0.0000482	<0.00005	0.00084	<0.0001
22-Jun-12	44	480	7.61	152.7	61	*ND*	1.72	17.5	<0.5	0.025	<0.05	0.0056	<0.05	<0.001	0.092	<0.005	0.0298	0.00225	0.000799	0.108	<0.00001	<0.000005	0.0362	0.000189	22.5	<0.0001	0.0000092	<0.0001	0.0029	<0.0000005	<0.0005	0.660	0.00951	<0.00001	0.210	<0.00005	<0.3	6.75	<0.000004	1.86	<0.000005	1.97	0.148	<0.0000002	<0.00001	<0.00005	0.0000451	<0.00005	0.00356	<0.0001
6-Jul-12	46	520	7.82	155	67	*ND*	1.27	17.1	<0.5	0.022	<0.05	<0.005	<0.05	<0.001	0.101	<0.005	0.0310	0.00211	0.000871	0.115	<0.00001	<0.000005	0.0416	<0.0002	22.6	<0.0001	0.0000086	<0.0001	0.0030	<0.0000005	<0.0005	0.660	0.00992	<0.00001	0.228	0.000066	<0.3	6.45	<0.000004	1.95	<0.000005	2.12	0.146	<0.0000002	<0.00001	<0.00005	0.0000422	<0.00005	0.00126	<0.0001
20-Jul-12	48	510	7.94	154.3	64	*ND*	1.27	16.4	0.52	0.022	<0.05	0.0062	<0.05	<0.001	0.076	<0.005	0.0274	0.00211	0.000771	0.114	<0.00001	<0.000005	0.0384	<0.00025	24.4	<0.0001	0.0000092	<0.0001	0.0028	<0.0000005	<0.0005	0.664	0.00988	<0.00001	0.254	<0.00005	<0.3	6.88	<0.000004	1.94	<0.000005	2.27	0.159	<0.0000002	<0.00001	<0.00005	0.0000508	<0.00005	0.0124	<0.0001
3-Aug-12	50	505	8.53	153.7	64	*ND*	1.09	16.1	0.51	0.021	<0.05	<0.005	<0.05	<0.001	0.095	<0.005	0.0265	0.00188	0.000796	0.107	<0.00001	<0.000005	0.0358	<0.00005	22.0	<0.0001	0.0000129	<0.0001	0.0029	<0.0000005	<0.0005	0.670	0.00931	<0.00001	0.243	<0.00005	<0.3	6.93	<0.000004	1.99	<0.000005	2.26	0.148	<0.0000002	<0.00001	<0.00005	0.0000413	<0.00005	0.00391	<0.0001
17-Aug-12	52	523	7.89	152.7	67	*ND*	0.88	15.4	<0.5	0.022	<0.05	<0.005	<0.05	<0.001	0.104	<0.005	0.0264	0.00173	0.000799	0.109	<0.00001	<0.000005	0.0339	<0.00009	21.4	<0.0001	0.0000091	<0.0001	0.0020	<0.0000005	<0.0005	0.647	0.00998	<0.00001	0.274	<0.00005	<0.3	6.95	<0.000004	1.97	<0.000005	2.23	0.145	<0.0000002	<0.00001	<0.00005	0.0000473	<0.00005	0.00405	<0.0001
30-Aug-12	54	486	7.69	152.2	63	*ND*	1.30	15.1	<0.5	0.024	<0.05	<0.005	<0.05	<0.001	0.097	<0.005	0.0270	0.00172	0.000915	0.114	<0.00001	<0.000005	0.0350	<0.0001	22.1	<0.0001	0.0000051	<0.0001	0.0021	<0.0000005	<0.0005	0.672	0.0101	<0.00001	0.271	0.000073	<0.3	6.82	0.000042	2.04	<0.000005	2.22	0.159	<0.0000002	<0.00001	<0.00005	0.0000456	<0.00005	<0.005	<0.0001
12-Sep-12	56	488	7.83	153.6	65	66.0	1.38	15.1	<0.5	0.022	<0.05	<0.005	<0.05	<0.001	0.092	<0.005	0.0255	0.00169	0.00092	0.116	<0.00001	<0.000005	0.035	<0.0002	25.1	<0.0001	<0.0001	<0.0002	<0.01	<0.0000005	<0.0005	0.79	0.0104	<0.00001	0.300	<0.0005	0.106	8.38	<0.0001	2.11	<0.000001	2.24	0.155	<0.0000001	<0.00001	<0.01	0.000047	<0.001	<0.001	*ND*
25-Sep-12	58	487	7.61	153.3	66	*ND*	2.45	14.5	<0.5	0.023	<0.05	0.0053	<0.05	<0.001	0.086	<0.005	0.0258	0.00151	0.000799	0.121	<0.00001	<0.000005	0.0341	<0.00005	21.5	<0.0001	0.0000063	<0.0001	0.0025	0.0000345	<0.0005	0.686	0.0108	<0.00001	0.282	0.000056	<0.3	6.55	<0.000004	2.24	<0.000005	2.29	0.151	<0.0000002	<0.00001	<0.00005	0.0000419	<0.00005	0.00061	<0.0001
10-Oct-12	60	515	7.73	152.1	68	*ND*	1.27	14.4	<0.5	0.021	<0.05	<0.005	<0.05	<0.001	0.0982	<0.005	0.0261	0.00148	0.000889	0.129	<0.00001	<0.000005	0.0375	0.0000604	23.3	<0.0001	0.0000446	<0.0001	0.0143	0.0000227	<0.0005	0.712	0.0108	<0.00001	0.161	<0.00005	<0.3	6.94	<0.000004	2.11	<0.000005	2.26	0.161	<0.0000002	<0.00001	<0.00005	0.0000534	<0.00005	0.00468	<0.0001
23-Oct-12	62	487	7.62	153.1	65	*ND*	1.18	14.6	<0.5	0.022	<0.05	<0.005	<0.05	<0.001	0.086	<0.005	0.0243	0.00126	0.000881	0.129	<0.00001	<0.000005	0.0309	<0.00051	20.9	<0.0001	0.0000055	<0.0001	0.0016	<0.0000005	<0.0005	0.701	0.0111	<0.00001	0.302	<0.00005	<0.3	6.98	<0.000004	2.09	<0.000005	2.19	0.143	<0.0000002	<0.00001	<0.00005	0.0000534	<0.00005	0.00405	<0.0001
7-Nov-12	64	487	7.76	154	67	*ND*	1.28	14.3	<0.5	0.02	<0.05	<0.005	<0.05	<0.001	0.0965	<0.01	0.0208	0.00131	0.000903	0.137	<0.00001	<0.000005	0.0329	<0.00007	21.4	<0.0001	<0.0000005	<0.0001	0.0019	<0.0000005	<0.0005	0.610	0.0109	<0.00001	0.323	<0.00005	<0.3	6.49	<0.000004	2.16	<0.000005	2.09	0.159	<0.0000002	<0.00001	<0.00005	0.0000526	<0.00005	<0.005	<0.0001
20-Nov-12	66	438	7.83	153.1	62	*ND*	1.26	13.9	<0.5	0.021	<0.05	<0.005	<0.05	<0.001	0.0959	<0.01	0.0206	0.00119	0.000858	0.126	<0.00001	<0.000005	0.0316	<0.00045	22.4	<0.0001	<0.0000005	<0.0001	0.0020	<0.0000005	<0.0005	0.701	0.0112	<0.00001	0.328	<0.00005	<0.3	6.91	<0.000004	2.21	<0.000005	2.18	0.154	<0.0000002	<0.00001	<0.00005	0.0000505	<0.00005	<0.005	<0.0001
5-Dec-12	68	469	7.84	153.1	65.2	*ND*	1.13	13.7	<0.5	<0.02	<0.05	<0.005	<0.05	0.0014	0.0979	<0.01	0.0220	0.00113	0.000865	0.132	<0.00001	<0.000005	0.0349	<0.00006	23.4	<0.0001	<0.0000005	<0.0001	0.0019	<0.0000005	<0.0005	0.720	0.0109	<0.00001	0.354	<0.00005	<0.3	6.49	<0.000004	2.03	<0.000005	2.10	0.161	<0.0000002	<0.00001	<0.00005	0.0000624	<0.00005	<0.005	<0.0001
18-Dec-12	70	405	8	152.9	68	*ND*	1.35	13.5	<0.5	0.02	<0.05	0.0099	<0.05	<0.001	0.0994	<0.01	0.0197	0.00108	0.000864	0.128	<0.00001	<0.000005	0.0282	<0.00005	23.3	<0.0001	0.0000060	<0.0001	0.0027	<0.0000005	<0.0005	0.704	0.0110	<0.00001	0.363	<0.00005	<0.3	6.14	0.000043	2.08	<0.000005	2.07	0.164	<0.0000002	<0.00001	<0.00005	0.0000646	<0.00005	<0.005	<0.0001
3-Jan-13	72	500	7.83	154.9	67	*ND*	1.35	13.2	<0.5	<0.02	<0.05	<0.005	<0.05	<0.001	0.0943	<0.01	0.0205	0.00102	0.000847	0.126	<0.00001	<0.000005	0.0311	<0.00012	23.1	<0.0001	0.0000051	<0.0001	0.0026	<0.0000005	<0.0005	0.727	0.0116	<0.00001	0.337	<0.00005	<0.3	6.21	<0.000004	2.04	<0.000005	2.10	0.158	<0.0000002	<0.00001	<0.00005	0.0000661	<0.00005	<0.005	<0.0001
24-Jan-13	75	505	7.85	151	63	*ND*	1.54	12.5	<0.5	<0.02	<0.05	<0.005	<0.05	<0.001	0.0966	<0.01	0.0211	0.00101	0.000902	0.137	<0.00001	<0.000005	0.0275	<0.00025	22.7	<0.0001	<0.0000005	<0.0001	0.0012	0.0000086	<0.0005	0.714	0.0117	<0.00001	0.361	<0.00005	<0.3	6.33	<0.000004	2.18	<0.000005	2.00	0.158	<0.0000002	<0.00001	<0.00005	0.0000679	<0.00005	<0.005	<0.0001
30-Jan-13	76	363	7.5	149.5	59	*ND*	4.13	12.5	<0.5	0.022	<0.05	0.0051	<0.05	<0.001	0.0967	<0.005	0.0210	0.000989	0.000939	0.123	<0.00001	<0.000005	0.0301	<0.00007	23.9	<0.0001	<0.0000005	<0.0001	0.0025	0.0000545	<0.0005	0.740	0.0112	<0.00001	0.366	<0.00005	<0.3	6.29	<0.000004	2.05	<0.000005	2.04	0.164	<0.0000002	<0.00001	<0.00005	0.0000643	<0.00005	<0.005	<0.0001
12-Feb-13	78	505	7.57	147.7	56	*ND*	0.78	12.3	<0.5	<0.02	<0.05	<0.005	<0.05	<0.001	0.0945	<0.005	0.0206	0.00104	0.000968	1.30	<0.00001	<0.000005	0.0287	<0.00007	22.5	<0.0001	0.0000050	<0.0001	0.0015	0.0000105	<0.0005	0.724	0.0109	<0.00001	0.379	<0.00005	<0.3	6.12	<0.000004	2.12	<0.000005	1.93	0.156	<0.0000002	<0.00001	<0.00005	0.0000716	<0.00005	0.00116	<0.0001
27-Feb-13	80	430	7.67	149.8	55	*ND*	1.57	12.6	<0.5	0.02	<0.05	<0.005	<0.05	<0.001	0.0960	<0.005	0.0206	0.000961	0.00100	0.134	<0.00001	<0.000005	0.0289	<0.0001	22.6	<0.0001	<0.0000005	<0.0001	0.0014	0.0000628	<0.0005	0.739	0.0122	<0.00001	0.337	<0.00005	<0.3	6.21	<0.000004	2.15	<0.000005	1.93	0.165	0.0000031	<0.00001	<0.00005	0.0000760	<0.00005	<0.005	<0.0001
12-Mar-13	81	425	7.62	149.5	55	*ND*	1.19	12.5	<0.5	0.02	<0.05	0.0068	<0.05	<0.001	0.0944	<0.005	0.0201	0.000904	0.00105	0.140	<0.00001	<0.000005	0.0276	<0.00007	22.4	<0.0001	<0.0000005	<0.0001	0.0014	<0.0000005	<0.0005	0.715	0.0114	<0.00001	0.350	<0.00005	<0.3	6.05	0.000044	2.19	<0.000005	1.87	0.172	<0.0000002	<0.00001	<0.00005	0.0000700	<0.00005	<0.005	<0.0001

Calculated Production Rates for Sat Col 11 (mg/kg/wk)

Collection Date	Cycle	Output Vol.	pH-L	Cond-L	T-Alk ($CaCO_3$)	Hardness ($CaCO_3$)	DOC	SO_4	D-Cl	D-F	D-Br	NH_3	NO_3-N	NO_2-N	Total D-PO_4	D-S_2	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn	D-Zr
	(week)	mL		uS/cm	mg/L	mg/L	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg

Appendix D.4: Concentrations of Metals in Leachate from Saturated Tailings Columns




Saturated Tailings
Sat Col 1 (60% HYP whole)
Sat Col 8 (83% HYP whole)
Sat Col 10 (85% SUP whole)
Sat Col 11 (85% SUP)
D-Ni (mg/kg/wk)
D-Sb (mg/kg/wk)
D-Tl (mg/kg/wk)
D-V (mg/kg/wk)
D-Cl (mg/kg/wk)
D-Cr (mg/kg/wk)
Week
Week

Appendix E
Unsaturated Kinetic Test Results

CASiNO
COPPER AND GOLD

APPENDIX E1 LEACHATE RESULTS FOR UNSATURATED WASTE ROCK KINETIC TESTS

Leachate Results for Col 1

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hard.	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L*	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
27-Jan-10	1	0.5	1334	315	4.2	1541	36	170	#N/A	414	190	0.59	1.9	119	6.7	0.0023	0.0026	0.073	0.0010	0.000010	0.056	0.0015	33	0.013	0.021	2.8	1.5	0.00098	0.019	8.6	0.75	0.44	0.073	0.011	0.14	17	0.012	42	0.00090	250	0.25	132	0.00040	0.000030	0.0038	0.018	0.0011	0.13	0.0010
3-Feb-10	2	0.5	300	260	4.7	874	#N/A	36	0.10	326	46	0.37	0.30	47	1.8	0.0013	0.0020	0.023	0.00036	0.000010	0.032	0.00060	13	0.0066	0.013	1.6	0.38	0.00034	0.0090	3.2	0.34	0.38	0.043	0.0056	0.020	9.6	0.012	35	0.000020	171	0.096	104	0.00030	0.00060	0.0019	0.0091	0.00053	0.074	0.00043
10-Feb-10	3	0.5	300	240	5.4	728	#N/A	13	2.6	303	18	0.10	0.30	25	0.35	0.00070	0.0013	0.022	0.00015	0.000010	0.028	0.00027	7.0	0.0023	0.0060	0.55	0.16	0.00010	0.0060	1.7	0.19	0.010	0.027	0.0027	0.030	7.6	0.0081	28	0.000020	122	0.055	97	0.00020	0.00024	0.0018	0.0028	0.00029	0.035	0.00011
17-Feb-10	4	0.5	300	315	5.1	557	#N/A	13	0.95	251	10	0.070	0.30	18	0.21	0.00060	0.0012	0.021	0.00011	0.000010	0.028	0.00021	5.2	0.0015	0.0049	0.42	0.11	0.00011	0.0040	1.2	0.14	0.010	0.028	0.0024	0.030	6.9	0.0080	27	0.000020	101	0.039	83	0.00020	0.000090	0.0018	0.0021	0.00021	0.030	0.000090
24-Feb-10	5	0.5	300	150	5.6	553				228																																								
3-Mar-10	6	0.5	300	325	5.3	488	#N/A	8.6	1.4	224	4.2	0.060	0.30	11	0.10	0.00050	0.00080	0.021	0.000070	0.000010	0.033	0.00012	3.1	0.0014	0.0028	0.25	0.060	0.00013	0.0030	0.74	0.088	0.010	0.026	0.0019	0.020	5.1	0.0059	24	0.000010	88	0.025	67	0.00020	0.00070	0.00080	0.0013	0.00015	0.018	0.000070
10-Mar-10	7	0.5	300	295	5.8	450				169																																							
17-Mar-10	8	0.5	300	285	5.5	437	#N/A	7.2	1.7	174	2.9	0.060	0.30	9.8	0.079	0.00040	0.00060	0.020	0.000070	0.000010	0.023	0.00012	2.8	0.00090	0.0022	0.19	0.040	0.00013	0.0030	0.67	0.080	0.070	0.022	0.0011	0.020	4.6	0.0042	24	0.000020	75	0.023	60	0.00020	0.000010	0.00080	0.00089	0.000090	0.013	0.000040
24-Mar-10	9	0.5	300	285	6.0	406				195																																							
31-Mar-10	10	0.5	300	310	5.6	364	#N/A	7.5	1.4	174	2.1	0.060	0.30	8.9	0.077	0.00030	0.00080	0.025	0.000070	0.000010	0.023	0.00013	2.6	0.0014	0.0023	0.23	0.030	0.000070	0.0020	0.62	0.070	0.070	0.023	0.0012	0.040	4.4	0.0042	21	0.000060	96	0.021	55	0.00020	0.00016	0.00090	0.00087	0.000080	0.017	0.000050
7-Apr-10	11	0.5	300	295	5.8	375				184																																							
14-Apr-10	12	0.5	300	310	5.0	342	#N/A	9.0	0.21	153	1.4	0.060	0.30	8.2	0.12	0.00040	0.00080	0.031	0.000080	0.000080	0.023	0.000099	2.4	0.0011	0.0023	0.26	0.030	0.00017	0.0020	0.56	0.064	0.010	0.020	0.0011	0.040	4.6	0.0042	21	0.000040	58	0.020	48	0.00020	0.00017	0.00040	0.00096	0.00013	0.015	0.000060
21-Apr-10	13	0.5	300	335	5.6	324				145																																							
28-Apr-10	14	0.5	300	385	5.2	271	#N/A	4.6	0.64	121	0.90	0.060	0.30	6.6	0.073	0.00020	0.00070	0.097	0.000050	0.000010	0.019	0.000071	1.9	0.00080	0.0018	0.18	0.020	0.00076	0.0010	0.45	0.052	0.030	0.018	0.00080	0.030	3.2	0.0034	16	0.000030	44	0.017	35	0.00020	0.00015	0.00040	0.00064	0.000070	0.011	0.000020
5-May-10	15	0.5	300	300	5.5	291				131																																							
12-May-10	16	0.5	300	320	5.7	287	#N/A	6.2	1.2	102	0.90	0.060	0.30	6.6	0.064	0.00040	0.00080	0.048	0.000040	0.000010	0.022	0.000067	1.9	0.0012	0.0018	0.18	0.019	0.000030	0.0010	0.45	0.050	0.020	0.018	0.0012	0.041	3.6	0.0030	20	0.00065	49	0.016	39	0.00020	0.00022	0.00040	0.00060	0.000050	0.010	0.000060
19-May-10	17	0.5	300	300	5.5	290				91																																							
26-May-10	18	0.5	300	340	5.7	243	#N/A	7.9	2.9	81	0.80	0.060	0.30	5.8	0.044	0.00040	0.0074	0.052	0.000050	0.000010	0.024	0.000060	1.7	0.0011	0.0021	0.17	0.014	0.000050	0.0020	0.40	0.045	0.030	0.019	0.00070	0.040	3.1	0.0026	17	0.000040	39	0.014	32	0.00020	0.00033	0.00030	0.00060	0.000070	0.011	0.000020
2-Jun-10	19	0.5	300	340	5.9	242				76																																							
9-Jun-10	20	0.5	300	310	5.8	246	#N/A	6.1	2.3	88	0.70	0.060	0.30	6.9	0.055	0.00020	0.00060	0.058	0.000040	0.000010	0.023	0.000068	2.0	0.0013	0.0019	0.22	0.014	0.000070	0.0010	0.45	0.046	0.010	0.018	0.00080	0.014	3.2	0.0025	19	0.00016	40	0.017	33	0.00020	0.00051	0.00030	0.00043	0.00010	0.014	0.000040
16-Jun-10	21	0.5	300	290	5.8	253				75																																							
23-Jun-10	22	0.5	300	285	6.0	254	#N/A	6.0	1.7	86	0.70	0.060	0.30	6.7	0.052	0.00050	0.00090	0.033	0.000050	0.000020	0.024	0.000076	1.9	0.0010	0.0019	0.27	0.018	0.00030	0.0020	0.45	0.052	0.010	0.021	0.0012	0.022	3.8	0.0026	21	0.00015	41	0.016	34	0.00020	0.0011	0.00040	0.00042	0.000070	0.012	0.000030
30-Jun-10	23	0.5	300	320	5.4	220				85																																							
7-Jul-10	24	0.5	300	325	5.7	217	#N/A	6.2	1.2	77	0.50	0.060	0.30	5.5	0.046	0.00030	0.00070	0.038	0.000040	0.000010	0.019	0.000067	1.5	0.0014	0.0018	0.21	0.014	0.00016	0.0020	0.42	0.049	0.010	0.016	0.0021	0.038	3.6	0.0028	18	0.00013	33	0.016	29	0.00020	0.00055	0.00040	0.00040	0.000040	0.011	0.000020
14-Jul-10	25	0.5	300	305	6.1	207				42																																							
21-Jul-10	26	0.5	300	300	5.8	217	#N/A	7.2	2.4	75	0.50	0.060	0.30	6.0	0.052	0.00020	0.00070	0.033	0.000040	0.000010	0.020	0.000061	1.7	0.0010	0.0019	0.22	0.011	0.000060	0.0010	0.43	0.049	0.010	0.016	0.0010	0.031	3.8	0.0021	20	0.00014	32	0.016	27	0.00020	0.0015	0.00030	0.00036	0.000040	0.011	0.000020
28-Jul-10	27	0.5	300	290	5.9	211				77																																							
4-Aug-10	28	0.5	300	290	6.2	195	#N/A	6.9	1.6	66	0.50	0.060	0.30	6.5	0.048	0.00020	0.00050	0.032	0.000040	0.000010	0.052	0.000054	1.9	0.0012	0.0018	0.20	0.011	0.000030	0.0020	0.44	0.048	0.020	0.016	0.00070	0.027	3.4	0.0017	19	0.000040	31	0.016	25	0.00020	0.0015	0.00030	0.00038	0.00011	0.010	0.000010
11-Aug-10	29	0.5	300	295	6.8	201				78																																							
18-Aug-10	30	0.5	300	300	6.0	188	#N/A	8.2	3.1	82	0.50	0.060	0.30	6.3	0.047	0.00020	0.00070	0.033	0.000050	0.000010	0.024	0.000065	1.8	0.00090	0.0019	0.22	0.0040	0.000080	0.0020	0.42	0.046	0.010	0.015	0.00080	0.014	3.6	0.0016	20	0.000060	29	0.015	34	0.00020	0.0012	0.00030	0.00038	0.00010	0.012	0.000010
25-Aug-10	31	0.5	300	315	6.3	174				67																																							
1-Sep-10	32	0.5	300	305	6.2	161	#N/A	6.6	2.0	66	0.40	0.060	0.30	6.4	0.044	0.00030	0.00040	0.034	0.000040	0.000010	0.017	0.000065	1.9	0.00090	0.0017	0.18	0.0020	0.00011	0.0010	0.40	0.038	0.010	0.014	0.00080	0.026	3.5	0.0015	19	0.00012	22	0.014	23	0.00020	0.0013	0.00040	0.00034	0.000070	0.013	0.000010
8-Sep-10	33	0.5	300	305	6.5	176				62																																							
15-Sep-10	34	0.5	300	315	5.7	150	#N/A	5.7	0.96	65	0.40	0.060	0.30	6.6	0.047	0.00070	0.00050	0.032	0.000050	0.000030	0.017	0.000063	1.9	0.00080	0.0018	0.20	0.0090	0.00043	0.0020	0.45	0.051	0.010	0.013	0.00070	0.0090	3.2	0.0014	18	0.00010	21	0.016	21	0.00020	0.0013	0.00030	0.00033	0.000030	0.011	0.000030
22-Sep-10	35	0.5	300	285	6.4	134				72																																							
29-Sep-10	36	0.5	300	325	6.0	125	#N/A	5.6	1.4	57	0.40	0.060	0.30	6.5	0.045	0.0084	0.00090	0.035	0.000040	0.000010	0.019	0.00021	1.9	0.00070	0.0027	0.23	0.0020	0.00032	0.0020	0.45	0.050	0.020	0.012	0.0012	0.030	3.6	0.0019	20	0.00011	22	0.016	24	0.00020	0.0021	0.0012	0.00033	0.000040	0.019	0.000030
6-Oct-10	37	0.5	300	300	6.2	160				64																																							
13-Oct-10	38	0.5	300	295	5.8	157	#N/A	6.7	1.2	60	0.40	0.060	0.30	11	0.041	0.00060	0.00030	0.038	0.000050	0.000050	0.020	0.000073	3.3	0.00070	0.0020	0.23	0.010	0.00066	0.0010	0.56	0.066	0.010	0.014	0.00090	0.037	3.8	0.0013	22	0.000060	21	0.019	21	0.00020	0.0016	0.0038	0.00031	0.000060	0.012	0.000080
20-Oct-10	39	0.5	300	275	6.3	153				61																																							
27-Oct-10	40	0.5	300	350	6.0	136	#N/A	4.1	1.2	45	0.30	0.060	0.30	6.1	0.041	0.00020	0.00050	0.036	0.000040	0.000010	0.017	0.000074	1.8	0.00060	0.0022	0.23	0.030	0.00026	0.0010	0.41	0.048	0.010	0.012	0.0014	0.026	3.1	0.0017	17	0.000030	17	0.015	17	0.00020	0.0012	0.0041	0.00029	0.000030	0.019	0.000010
3-Nov-10	41	0.5	300	270	6.3	151																																										
10-Nov-10	42	0.5	300	360	5.6	136																																									
17-Nov-10	43	0.5	300	355	6.5	147																																									
24-Nov-10	44	0.5	300	340	6.0	119	#N/A	4.7	1.1	44	0.40	0.060	0.30	6.5	0.038	0.00020	0.00060	0.041	0.000050	0.000010	0.013	0.000075	1.9	0.00050	0.0022	0.27	0.0060	0.000060	0.0010	0.44	0.053	0.010	0.0095	0.00070	0.0090	3.1	0.0012	16	0.000050	14	0.017	14	0.00020	0.00078	0.00060	0.00028	0.000030	0.017	0.000010
1-Dec-10	45	0.5	300	320	6.6	121																																										
8-Dec-10	46	0.5	300	335	5.8	108																																									
15-Dec-10	47	0.5	300	315	6.4	111																																									
22-Dec-10	48	0.5	300	325	6.5	108	#N/A	6.3	2.5	43	0.30	0.060	0.30	8.0	0.044	0.0019	0.00050	0.044	0.000050	0.000010	0.016	0.00012	2.3	0.00090	0.0025	0.27	0.0060	0.0059	0.0020	0.53	0.061	0.010	0.010	0.0010	0.043	3.7	0.00099	20	0.000050	12	0.020	18	0.00020	0.0014	0.00050	0.00031	0.000060	0.021	0.000010
29-Dec-10	49	0.5	300	345	6.1	89																																									
5-Jan-11	50	0.5	300	325	6.5	88																																									
12-Jan-11	51	0.5	300	310	6.4	97																																									
19-Jan-11	52	0.5	300	340	6.0	85	#N/A	6.1	2.3	32	0.30	0.060	0.30	8.0	0.048	0.00040	0.00030	0.050	0.000050	0.000010	0.012	0.000076	2.3	0.00050	0.0023	0.25	0.0060	0.000050	0.0020	0.54	0.063	0.010	0.0070	0.0010	0.020	3.3	0.00025	16	0.000040	8.0	0.020	11	0.00020	0.00064	0.00020	0.00026	0.000050	0.015	0.000010
26-Jan-11	53	0.5	300	330	6.2	84																																									
2-Feb-11	54	0.5	300	385	5.9	69																																								
9-Feb-11	55	0.5	300	360	6.1	75																																								
16-Feb-11	56	0.5	300	375	6.2	73	#N/A	4.1	1.4	22	0.20	0.060	0.30	8.3	0.045	0.00020	0.00040	0.048	0.000060	0.000010	0.024	0.00010	2.4	0.00060	0.0025	0.27	0.0050	0.0018	0.0020	0.57	0.064	0.010	0.0061	0.0010	0.0090	3.0	0.00041	15	0.000040	5.8	0.021	8.8	0.00020	0.00047	0.00020	0.00027	0.000030	0.023	0.000010
23-Feb-11	57	0.5	300	430	6.2	85																																								
2-Mar-11	58	0.5	300	415	5.7	79																																								
9-Mar-11	59	0.5	300	300	6.1	76																																								
16-Mar-11	60	0.5	300	325	6.1	74	#N/A	4.8	1.5	20	0.20	0.060	0.30	9.8	0.052	0.00070	0.00020	0.073	0.000070	0.000010	0.0083	0.00011	2.9	0.00050	0.0028	0.32	0.0030	0.0011	0.0020	0.64	0.072	0.010	0.0052	0.0016	0.019	3.3	0.00044	15	0.000040	3.4	0.024	8.9	0.00020	0.00066	0.00020	0.00029	0.000030	0.017	0.000010
23-Mar-11	61	0.5	300	405	6.0	79																																								
30-Mar-11	62	0.5	300	385	6.6	79																																								
6-Apr-11	63	0.5	300	360	6.3	77																																								
13-Apr-11	64	0.5	300	300	6.0	87	#N/A	5.1	1.3	27	0.20	0.060	0.30	13	0.084	0.00020	0.00020	0.082	0.000080	0.000010	0.010	0.00013	3.7	0.00050	0.0042	0.45	0.0030	0.0023	0.0020	0.87	0.10	0.010	0.0053	0.0020	0.025	4.0	0.00047	16	0.000040	2.8	0.032	9.6	0.00020	0.00029	0.0018	0.00038	0.000030	0.023	0.000010
20-Apr-11	65	0.5	300	300	6.5	92																																								
27-Apr-11	66	0.5	300	340	6.2	87																																								
4-May-11	67	0.5	300	305	6.1	94																																								
11-May-11	68	0.5	300	325	5.9	95	#N/A	5.5	1.2	27	0.20	0.060	0.30	16	0.100	0.00020	0.00060	0.077	0.00012	0.000010	0.011	0.00017	4.7	0.00050	0.0057	0.57	0.0070	0.00016	0.0020	1.1	0.13	0.010	0.0094	0.0021	0.0090	4.5	0.00030	16	0.000090	2.2	0.041	11	0.00020	0.00051	0.00040	0.00053	0.000030	0.033	0.000020
18-May-11	69	0.5	300	300	6.1	107																																								
25-May-11	70	0.5	300	320	6.4	98																																								
1-Jun-11	71	0.5	300	295	6.2	104																																								
8-Jun-11	72	0.5	300	325	5.8	106	#N/A	6.3	1.0	35	0.20	0.060	0.30	19	0.14	0.00030	0.00040	0.069	0.00013	0.000050	0.010	0.00021	5.4	0.00050	0.0062	0.64	0.013	0.00014	0.0030	1.3	0.15	0.010	0.0054	0.0028	0.058	4.8	0.00072	18	0.000080	1.8	0.047	11	0.00019	0.00040	0.00030	0.00052	0.000070	0.041	0.000030
15-Jun-11	73	0.5	300	305	6.2	103																																								
22-Jun-11	74	0.5	300	345	6.1	104																																								
29-Jun-11	75	0.5	300	310	5.9	107																																								
6-Jul-11	76	0.5	300	325	5.7	110	#N/A	7.1	1.1	40	0.20	0.060	0.30	23	0.15	0.00020	0.00030	0.072	0.00013	0.000010	0.011	0.00025	6.5	0.00050	0.0075	0.79	0.0060	0.00010	0.0030	1.6	0.18	0.010	0.0056	0.0028	0.0090	5.3	0.00074	19	0.000040	1.5	0.057	13	0.00018	0.00023	0.00020	0.00054	0.000030	0.042	0.000010
13-Jul-11	77	0.5	300	295	6.0	112																																								
20-Jul-11	78	0.5	300	335	5.7	114																																								
27-Jul-11	79	0.5	300	320	5.7	115																																								
3-Aug-11	80	0.5	300	200	6.0	112	#N/A	8.9	1.8	41	0.20	0.070	0.30	24	0.17	0.00020	0.00040	0.061	0.00014	0.000010	0.010	0.00025	6.8	0.00050	0.0076	0.74	0.0020	0.0014	0.0030	1.6	0.19	0.010	0.0051	0.0032	0.0090	5.0	0.00060	15	0.000050	1.1	0.059	12	0.00016	0.00018	0.00030	0.00057	0.000030	0.042	0.000010
10-Aug-11	81	0.5	300	330	6.0	110																																								
17-Aug-11	82	0.5	300	315	5.9	113																																								
24-Aug-11	83	0.5	300	300	6.1	115																																								
31-Aug-11	84	0.5	300	340	5.8	107	#N/A	9.1	1.7	38	0.20	0.060	0.30	23	0.15	0.00030	0.00070	0.054	0.00014	0.000010	0.012	0.00035	6.5	0.00080	0.0089	0.81	0.0070	0.00015	0.0030	1.6	0.18	0.010	0.0061	0.0035	0.0090	5.2	0.00013	15	0.00016	1.1	0.060	14	0.00019	0.00033	0.00050	0.00056	0.000030	0.051	0.000010
7-Sep-11	85	0.5	300	335	6.0	107																																								
14-Sep-11	86	0.5	300	315	5.9	109																																								
21-Sep-11	87	0.5	300	315	5.8	114																																								
28-Sep-11	88	0.5	300	295	5.8	117	#N/A	7.3	1.6	41	0.30	0.70	0.30	25	0.16	0.00020	0.00040	0.051	0.00015	0.00010	0.0084	0.00026	7.1	0.0012	0.0081	0.81	0.0070	0.00026	0.0030	1.7	0.20	0.010	0.0049	0.0033	0.0090	5.0	0.00085	15	0.000050	0.94	0.062	13	0.00018	0.00032	0.00030	0.00059	0.000030	0.044	0.000040
5-Oct-11	89	0.5	300	350	5.8	101																																								
12-Oct-11	90	0.5	300	300	6.1	119																																								
19-Oct-11	91	0.5	300	305	5.7	116																																								
26-Oct-11	92	0.5	300	310	5.6	118	#N/A	6.3	0.86	43	0.40	0.090	0.30	26	0.18	0.00020	0.00050	0.056	0.00016	0.000050	0.010	0.00028	7.5	0.0015	0.0082	0.89	0.013	0.000050	0.0030	1.8	0.20	0.010	0.0050	0.0033	0.0090	5.4	0

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Calculated Production Rates for Col 1

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hard.	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg*	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
27-Jan-10	1	0.5	1334	315	4.2	1541	2.3	11	#N/A	26	12	0.037	0.12	7.5	0.42	0.00014	0.00016	0.0046	0.000063	0.00000063	0.0035	0.000093	2.1	0.00082	0.0013	0.18	0.095	0.000062	0.0012	0.54	0.047	0.028	0.0046	0.00066	0.0088	1.1	0.00077	2.6	0.000057	16	0.015	8.3	0.000025	0.0000019	0.00024	0.0011	0.000069	0.0084	0.000066
3-Feb-10	2	0.5	300	260	4.7	874	#N/A	1.9	0.0052	17	2.4	0.019	0.016	2.4	0.096	0.000068	0.00010	0.0012	0.000019	0.00000052	0.0017	0.000031	0.69	0.00034	0.00067	0.084	0.020	0.00018	0.00047	0.17	0.018	0.020	0.0023	0.00029	0.0010	0.50	0.00062	1.8	0.0000010	8.9	0.0050	5.4	0.00016	0.0000031	0.000099	0.00047	0.000028	0.0038	0.000022
10-Feb-10	3	0.5	300	240	5.4	728	#N/A	0.63	0.13	15	0.86	0.0048	0.014	1.2	0.017	0.000034	0.000062	0.0010	0.0000072	0.00000048	0.0013	0.000013	0.34	0.00011	0.00029	0.026	0.0077	0.0000048	0.00029	0.081	0.0089	0.00048	0.0013	0.00013	0.0014	0.37	0.00039	1.3	0.00000096	5.9	0.0026	4.7	0.0000096	0.0000012	0.000086	0.00013	0.000014	0.0017	0.0000053
17-Feb-10	4	0.5	300	315	5.1	557	#N/A	0.80	0.060	16	0.63	0.0044	0.019	1.1	0.013	0.000038	0.000076	0.0013	0.0000069	0.00000063	0.0018	0.000013	0.33	0.000095	0.00031	0.026	0.0069	0.0000069	0.00025	0.074	0.0088	0.00063	0.0018	0.00015	0.0019	0.43	0.00051	1.7	0.0000013	6.4	0.0025	5.2	0.00013	0.0000057	0.00011	0.00013	0.000013	0.0019	0.0000057
24-Feb-10	5	0.5	300	150	5.6	553																																													
3-Mar-10	6	0.5	300	325	5.3	488	#N/A	0.56	0.088	15	0.27	0.0039	0.020	0.71	0.0066	0.000033	0.000052	0.0014	0.0000046	0.00000065	0.0021	0.0000075	0.20	0.000091	0.00018	0.016	0.0039	0.0000085	0.00020	0.048	0.0057	0.00065	0.0017	0.00012	0.0013	0.33	0.00038	1.5	0.00000065	5.7	0.0016	4.3	0.000013	0.000046	0.000052	0.000085	0.0000098	0.0012	0.0000046
10-Mar-10	7	0.5	300	295	5.8	450																																												
17-Mar-10	8	0.5	300	285	5.5	437	#N/A	0.41	0.095	9.9	0.17	0.0034	0.017	0.56	0.0045	0.000023	0.000034	0.0011	0.0000040	0.00000057	0.0013	0.0000069	0.16	0.000051	0.00013	0.011	0.0023	0.0000074	0.00017	0.038	0.0046	0.0040	0.0013	0.000063	0.0011	0.26	0.00024	1.4	0.0000011	4.3	0.0013	3.4	0.000011	0.00000057	0.000046	0.000051	0.0000051	0.00074	0.0000023
24-Mar-10	9	0.5	300	285	6.0	406																																												
31-Mar-10	10	0.5	300	310	5.6	364	#N/A	0.46	0.088	11	0.13	0.0037	0.019	0.55	0.0048	0.000019	0.000050	0.0016	0.0000043	0.00000062	0.0014	0.0000081	0.16	0.000087	0.00014	0.014	0.0019	0.0000043	0.00012	0.038	0.0043	0.0043	0.0014	0.000074	0.0025	0.27	0.00026	1.3	0.0000037	6.0	0.0013	3.4	0.00012	0.0000099	0.000056	0.000054	0.0000050	0.0011	0.0000031
7-Apr-10	11	0.5	300	295	5.8	375																																												
14-Apr-10	12	0.5	300	310	5.0	342	#N/A	0.56	0.013	9.5	0.087	0.0037	0.019	0.51	0.0073	0.000025	0.000050	0.0019	0.0000050	0.0000050	0.0014	0.0000061	0.15	0.000068	0.00015	0.016	0.0019	0.0000011	0.00012	0.034	0.0040	0.00062	0.0012	0.000068	0.0025	0.28	0.00026	1.3	0.0000025	3.6	0.0012	2.9	0.00012	0.000011	0.000025	0.000059	0.0000081	0.00093	0.0000037
21-Apr-10	13	0.5	300	335	5.6	324																																											
28-Apr-10	14	0.5	300	385	5.2	271	#N/A	0.35	0.049	9.3	0.069	0.0046	0.023	0.51	0.0056	0.000015	0.000054	0.0075	0.0000039	0.00000077	0.0015	0.0000055	0.15	0.000062	0.00014	0.014	0.0015	0.0000059	0.000077	0.035	0.0040	0.0023	0.0014	0.000062	0.0023	0.25	0.00026	1.2	0.0000023	3.4	0.0013	2.7	0.00015	0.000012	0.000031	0.000049	0.0000054	0.00085	0.0000015
5-May-10	15	0.5	300	300	5.5	291																																											
12-May-10	16	0.5	300	320	5.7	287	#N/A	0.39	0.077	6.5	0.058	0.0038	0.019	0.42	0.0041	0.000026	0.000051	0.0030	0.0000026	0.00000064	0.0014	0.0000043	0.12	0.000077	0.00011	0.012	0.0012	0.0000019	0.000064	0.029	0.0032	0.0013	0.0012	0.000077	0.0026	0.23	0.00019	1.3	0.000042	3.1	0.00099	2.5	0.00013	0.000014	0.000026	0.000038	0.0000032	0.00064	0.0000038
19-May-10	17	0.5	300	300	5.5	290																																											
26-May-10	18	0.5	300	340	5.7	243	#N/A	0.54	0.20	5.5	0.054	0.0041	0.020	0.39	0.0030	0.000027	0.00050	0.0035	0.0000034	0.00000068	0.0016	0.0000041	0.11	0.000075	0.00014	0.012	0.00095	0.0000034	0.00014	0.027	0.0031	0.0020	0.0013	0.000048	0.0027	0.21	0.00018	1.2	0.0000027	2.6	0.00095	2.1	0.000014	0.000022	0.000020	0.000041	0.0000048	0.00075	0.0000014
2-Jun-10	19	0.5	300	340	5.9	242																																										
9-Jun-10	20	0.5	300	310	5.8	246	#N/A	0.38	0.14	5.5	0.043	0.0037	0.019	0.43	0.0034	0.000012	0.00037	0.0036	0.0000025	0.00000062	0.0014	0.0000042	0.12	0.000081	0.00012	0.013	0.00087	0.0000043	0.000062	0.028	0.0028	0.00062	0.0011	0.000050	0.00087	0.20	0.00015	1.1	0.0000099	2.5	0.0011	2.0	0.00012	0.000032	0.000019	0.000027	0.0000062	0.00087	0.0000025
16-Jun-10	21	0.5	300	290	5.8	253																																										
23-Jun-10	22	0.5	300	285	6.0	254	#N/A	0.34	0.098	4.9	0.040	0.0034	0.017	0.38	0.0030	0.000029	0.00051	0.0019	0.0000029	0.0000011	0.0014	0.0000043	0.11	0.000057	0.00011	0.015	0.0010	0.0000017	0.00011	0.026	0.0030	0.00057	0.0012	0.000068	0.0013	0.22	0.00015	1.2	0.0000086	2.3	0.00093	1.9	0.00011	0.000063	0.000023	0.000024	0.0000040	0.00068	0.0000017
30-Jun-10	23	0.5	300	320	5.4	220																																										
7-Jul-10	24	0.5	300	325	5.7	217	#N/A	0.41	0.079	5.0	0.033	0.0039	0.020	0.36	0.0030	0.000020	0.000046	0.0025	0.0000026	0.00000065	0.0012	0.0000044	0.098	0.000091	0.00012	0.013	0.00091	0.0000010	0.00013	0.027	0.0032	0.00065	0.0011	0.00014	0.0025	0.23	0.00018	1.2	0.0000085	2.2	0.0010	1.9	0.00013	0.000036	0.000026	0.000026	0.0000026	0.00072	0.0000013
14-Jul-10	25	0.5	300	305	6.1	207																																										
21-Jul-10	26	0.5	300	300	5.8	217	#N/A	0.43	0.14	4.5	0.030	0.0036	0.018	0.36	0.0031	0.000012	0.000042	0.0020	0.0000024	0.00000060	0.0012	0.0000037	0.10	0.000060	0.00011	0.013	0.00066	0.0000036	0.000060	0.026	0.0029	0.00060	0.00098	0.000060	0.0019	0.23	0.00013	1.2	0.0000084	1.9	0.00095	1.6	0.00012	0.000089	0.000018	0.000022	0.0000024	0.00066	0.0000012
28-Jul-10	27	0.5	300	290	5.9	211																																										
4-Aug-10	28	0.5	300	290	6.2	195	#N/A	0.40	0.095	3.8	0.029	0.0035	0.017	0.38	0.0028	0.000012	0.000029	0.0019	0.0000023	0.00000058	0.0030	0.0000031	0.11	0.000070	0.00011	0.012	0.00064	0.0000017	0.00012	0.025	0.0028	0.0012	0.00092	0.000041	0.0016	0.20	0.000100	1.1	0.0000023	1.8	0.00092	1.5	0.00012	0.000087	0.000017	0.000022	0.0000064	0.00058	0.00000058
11-Aug-10	29	0.5	300	295	6.8	201																																										
18-Aug-10	30	0.5	300	300	6.0	188	#N/A	0.49	0.18	4.9	0.030	0.0036	0.018	0.38	0.0028	0.000012	0.000042	0.0020	0.0000030	0.00000060	0.0014	0.0000039	0.11	0.000054	0.00011	0.013	0.00024	0.0000048	0.00012	0.025	0.0028	0.00060	0.00092	0.000048	0.00084	0.21	0.000098	1.2	0.0000036	1.7	0.00089	2.0	0.00012	0.000074	0.000018	0.000023	0.0000060	0.00072	0.00000060
25-Aug-10	31	0.5	300	315	6.3	174																																										
1-Sep-10	32	0.5	300	305	6.2	161	#N/A	0.40	0.12	4.0	0.024	0.0037	0.018	0.39	0.0027	0.000018	0.000024	0.0021	0.0000024	0.00000061	0.0010	0.0000040	0.11	0.000055	0.00010	0.011	0.00012	0.0000067	0.000061	0.024	0.0023	0.00061	0.00087	0.000049	0.0016	0.22	0.000091	1.2	0.0000073	1.3	0.00082	1.4	0.00012	0.000081	0.000024	0.000021	0.0000043	0.00079	0.00000061
8-Sep-10	33	0.5	300	305	6.5	176																																										
15-Sep-10	34	0.5	300	315	5.7	150	#N/A	0.36	0.060	4.1	0.025	0.0038	0.019	0.42	0.0030	0.000044	0.000032	0.0020	0.0000032	0.0000019	0.0011	0.0000040	0.12	0.000050	0.00012	0.013	0.00057	0.0000027	0.00013	0.028	0.0032	0.00063	0.00081	0.000044	0.00057	0.20	0.000088	1.1	0.0000063	1.3	0.00098	1.3	0.00013	0.000081	0.000019	0.000021	0.0000019	0.00069	0.0000019
22-Sep-10	35	0.5	300	285	6.4	134																																										
29-Sep-10	36	0.5	300	325	6.0	125	#N/A	0.37	0.088	3.7	0.026	0.0039	0.020	0.42	0.0029	0.00055	0.000059	0.0023	0.0000026	0.00000065	0.0012	0.0000014	0.12	0.000046	0.00018	0.015	0.00013	0.0000021	0.00013	0.029	0.0033	0.0013	0.00077	0.000078	0.0020	0.24	0.00012	1.3	0.0000072	1.4	0.0010	1.5	0.00013	0.00013	0.000078	0.000021	0.0000026	0.0012	0.0000020
6-Oct-10	37	0.5	300	300	6.2	160																																										
13-Oct-10	38	0.5	300	295	5.8	157	#N/A	0.39	0.073	3.5	0.024	0.0035	0.018	0.62	0.0024	0.000035	0.000018	0.0022	0.0000030	0.0000030	0.0012	0.0000043	0.19	0.000041	0.00012	0.014	0.00059	0.0000039	0.000059	0.033	0.0039	0.00059	0.00081	0.000053	0.0022	0.23	0.000076	1.3	0.0000035	1.2	0.0011	1.2	0.00012	0.0000093	0.00022	0.000018	0.0000035	0.00071	0.0000047
20-Oct-10	39	0.5	300	275	6.3	153																																										
27-Oct-10	40	0.5	300	350	6.0	136	#N/A	0.29	0.082	3.2	0.021	0.0042	0.021	0.43	0.0029	0.000014	0.000035	0.0025	0.0000028	0.00000070	0.0012	0.0000052	0.12	0.000042	0.00015	0.016	0.0021	0.0000018	0.000070	0.029	0.0033	0.00070	0.00086	0.000098	0.0018	0.22	0.00012	1.2	0.0000021	1.2	0.0011	1.2	0.00014	0.000084	0.00029	0.000020	0.0000021	0.0013	0.00000070
3-Nov-10	41	0.5	300	270	6.3	151																																										
10-Nov-10	42	0.5	300	360	5.6	136																																										
17-Nov-10	43	0.5	300	355	6.5	147																																										
24-Nov-10	44	0.5	300	340	6.0	119	#N/A	0.32	0.076	3.0	0.027	0.0041	0.020	0.44	0.0026	0.000014	0.000041	0.0028	0.0000034	0.00000068	0.00089	0.0000051	0.13	0.000034	0.00015	0.018	0.00041	0.0000041	0.000068	0.030	0.0036	0.00068	0.00065	0.000048	0.00061	0.21	0.000084	1.1	0.0000034	0.97	0.0011	0.92	0.00014	0.000053	0.000041	0.000019	0.0000020	0.0012	0.00000068
1-Dec-10	45	0.5	300	320	6.6	121																																										
8-Dec-10	46	0.5	300	335	5.8	108																																										
15-Dec-10	47	0.5	300	315	6.4	111																																										
22-Dec-10	48	0.5	300	325	6.5	108	#N/A	0.41	0.16	2.8	0.020	0.0039	0.020	0.52	0.0028	0.00012	0.000033	0.0029	0.0000033	0.00000065	0.0010	0.0000076	0.15	0.000059	0.00016	0.018	0.00039	0.00039	0.00013	0.035	0.0039	0.00065	0.00066	0.000065	0.0028	0.24	0.000064	1.3	0.0000033	0.80	0.0013	1.2	0.00013	0.000092	0.000033	0.000020	0.0000039	0.0014	0.00000065
29-Dec-10	49	0.5	300	345	6.1	89																																										
5-Jan-11	50	0.5	300	325	6.5	88																																										
12-Jan-11	51	0.5	300	310	6.4	97																																										
19-Jan-11	52	0.5	300	340	6.0	85	#N/A	0.41	0.15	2.2	0.020	0.0041	0.020	0.54	0.0033	0.000027	0.000020	0.0034	0.0000034	0.00000068	0.00083	0.0000052	0.16	0.000034	0.00016	0.017	0.00041	0.0000034	0.00014	0.037	0.0043	0.00068	0.00048	0.000068	0.0014	0.23	0.000017	1.1	0.0000027	0.54	0.0014	0.73	0.00014	0.000044	0.00014	0.000018	0.0000034	0.0010	0.00000068
26-Jan-11	53	0.5	300	330	6.2	84																																										
2-Feb-11	54	0.5	300	385	5.9	69																																										
9-Feb-11	55	0.5	300	360	6.1	75																																										
16-Feb-11	56	0.5	300	375	6.2	73	#N/A	0.30	0.10	1.7	0.015	0.0045	0.023	0.62	0.0034	0.000015	0.000030	0.0036	0.0000045	0.00000075	0.0018	0.0000077	0.18	0.000045	0.00019	0.020	0.00038	0.00013	0.00015	0.042	0.0048	0.00075	0.00046	0.000075	0.00068	0.23	0.000031	1.1	0.0000030	0.44	0.0016	0.66	0.00015	0.000035	0.00015	0.000020	0.0000023	0.0017	0.00000075
23-Feb-11	57	0.5	300	430	6.2	85																																										
2-Mar-11	58	0.5	300	415	5.7	79																																										
9-Mar-11	59	0.5	300	425	6.1	76																																										
16-Mar-11	60	0.5	300	325	6.1	74	#N/A	0.31	0.094	1.3	0.013	0.0039	0.020	0.64	0.0034	0.000046	0.000013	0.0047	0.0000046	0.00000065	0.00054	0.0000070	0.19	0.000033	0.00018	0.020	0.00020	0.0000068	0.00013	0.042	0.0046	0.00065	0.00034	0.00010	0.0012	0.21	0.000029	0.98	0.0000026	0.22	0.0016	0.58	0.00013	0.000043	0.00013	0.000019	0.0000020	0.0011	0.00000065
23-Mar-11	61	0.5	300	405	6.0	79																																										
30-Mar-11	62	0.5	300	385	6.6	79																																										
6-Apr-11	63	0.5	300	360	6.3	77																																										
13-Apr-11	64	0.5	300	300	6.0	87	#N/A	0.30	0.080	1.6	0.012	0.0036	0.018	0.77	0.0050	0.000012	0.000012	0.0049	0.0000048	0.00000060	0.00062	0.0000080	0.22	0.000030	0.00025	0.027	0.00018	0.00014	0.00012	0.052	0.0061	0.00060	0.00032	0.00012	0.0015	0.24	0.000028	0.95	0.0000024	0.17	0.0019	0.57	0.000012	0.000017	0.00011	0.000023	0.0000018	0.0014	0.00000060
20-Apr-11	65	0.5	300	300	6.5	92																																										
27-Apr-11	66	0.5	300	340	6.2	87																																										
4-May-11	67	0.5	300	305	6.1	94																																										
11-May-11	68	0.5	300	325	5.9	95	#N/A	0.36	0.078	1.8	0.013	0.0039	0.020	1.1	0.0065	0.000013	0.000039	0.0050	0.0000078	0.00000065	0.00068	0.000011	0.30	0.000033	0.00037	0.037	0.00046	0.0000010	0.00013	0.072	0.0083	0.00065	0.00061	0.00014	0.00059	0.29	0.000020	1.1	0.0000059	0.14	0.0027	0.70	0.00013	0.000033	0.000026	0.000034	0.0000020	0.0021	0.0000013
18-May-11	69	0.5	300	300	6.1	107																																										
25-May-11	70	0.5	300	320	6.4	98																																										
1-Jun-11	71	0.5	300	295	6.2	104																																										
8-Jun-11	72	0.5	300	325	5.8	106	#N/A	0.41	0.066	2.3	0.013	0.0039	0.020	1.2	0.0093	0.000020	0.000026	0.0045	0.0000085	0.0000033	0.00065	0.000014	0.35	0.000033	0.00040	0.042	0.00085	0.0000091	0.00020	0.083	0.0097	0.00065	0.00035	0.00018	0.0038	0.31	0.000047	1.2	0.0000052	0.12	0.0030	0.74	0.00012	0.000026	0.000020	0.000034	0.0000046	0.0027	0.0000020
15-Jun-11	73	0.5	300	305	6.2	103																																										
22-Jun-11	74	0.5	300	345	6.1	104																																										
29-Jun-11	75	0.5	300	310	5.9	107																																										
6-Jul-11	76	0.5	300	325	5.7	110	#N/A	0.46	0.070	2.6	0.013	0.0039	0.020	1.5	0.0096	0.000013	0.000020	0.0047	0.0000085	0.00000065	0.00073	0.000016	0.42	0.000033	0.00049	0.051	0.00039	0.0000065	0.00020	0.10	0.011	0.00065	0.00036	0.00018	0.00059	0.35	0.000048	1.2	0.0000026	0.098	0.0037	0.84	0.000012	0.000015	0.000013	0.000035	0.0000020	0.0027	0.00000065
13-Jul-11	77	0.5	300	295	6.0	112																																										
20-Jul-11	78	0.5	300	335	5.7	114																																										
27-Jul-11	79	0.5	300	320	5.7	115																																										
3-Aug-11	80	0.5	300	200	6.0	112	#N/A	0.36	0.070	1.6	0.0080	0.0028	0.012	0.94	0.0067	0.0000080	0.000016	0.0024	0.0000056	0.00000040	0.00042	0.000010	0.27	0.000020	0.00030	0.030	0.000080	0.0000058	0.00012	0.064	0.0074	0.00040	0.00020	0.00013	0.00036	0.20	0.000024	0.62	0.0000020	0.045	0.0024	0.50	0.0000064	0.0000072	0.000012	0.000023	0.0000012	0.0017	0.00000040
10-Aug-11	81	0.5	300	330	6.0	110																																										
17-Aug-11	82	0.5	300	315	5.9	113																																										
24-Aug-11	83	0.5	300	300	6.1	115																																										
31-Aug-11	84	0.5	300	340	5.8	107	#N/A	0.62	0.11	2.6	0.014	0.0041	0.020	1.6	0.010	0.000020	0.000048	0.0037	0.0000095	0.00000068	0.00083	0.000024	0.44	0.000054	0.00061	0.055	0.00048	0.000010	0.00020	0.11	0.012	0.00068	0.00041	0.00024	0.00061	0.36	0.0000088	1.0	0.000011	0.072	0.0041	0.94	0.000013	0.000022	0.000034	0.000038	0.0000020	0.0035	0.00000068
7-Sep-11	85	0.5	300	335	6.0	107																																										
14-Sep-11	86	0.5	300	315	5.9	109																																										

Calculated Production Rates for Col 1

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hard.	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg*	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4-Apr-12	115	0.5	300	295	5.3	115																																											
11-Apr-12	116	0.5	300	300	5.0	114	#N/A	0.56	0.0060	2.8	0.012	0.0048	0.018	1.5	0.015	0.000012	0.000060	0.0028	0.0000090	0.00000060	0.00057	0.0000079	0.45	0.000030	0.00058	0.064	0.00024	0.000017	0.00024	0.11	0.012	0.0012	0.00037	0.00026	0.00054	0.30	0.0011	0.89	0.0000078	0.050	0.0039	0.81	0.000011	0.000020	0.000054	0.000042	0.000016	0.0030	0.00000060
18-Apr-12	117	0.5	300	305	5.3	114																																											
25-Apr-12	118	0.5	300	300	5.2	117																																											
2-May-12	119	0.5	300	295	4.1	126																																											
9-May-12	120	0.5	300	335	5.2	107	#N/A	0.64	0.0094	2.7	0.013	0.0047	0.020	1.6	0.011	0.000013	0.000020	0.0029	0.000011	0.00000067	0.00062	0.000015	0.47	0.000034	0.00051	0.051	0.00040	0.000012	0.00020	0.11	0.013	0.00067	0.00028	0.00021	0.00060	0.29	0.000042	0.78	0.0000040	0.044	0.0042	0.80	0.000011	0.000031	0.000020	0.000042	0.000023	0.0029	0.00000067
16-May-12	121	0.5	300	350	5.3	116																																											
23-May-12	122	0.5	300	335	5.2	100																																											
30-May-12	123	0.5	300	360	5.5	99																																										
6-Jun-12	124	0.5	300	320	5.3	110	#N/A	0.61	0.047	2.2	0.026	0.0045	0.019	1.6	0.014	0.000013	0.000013	0.0032	0.000012	0.00000064	0.00089	0.000015	0.47	0.000032	0.00049	0.050	0.00038	0.0000013	0.00019	0.11	0.013	0.00064	0.00024	0.00020	0.00058	0.30	0.000043	0.88	0.0000032	0.045	0.0042	0.84	0.000010	0.0000070	0.000019	0.000042	0.000027	0.0027	0.00000064
13-Jun-12	125	0.5	300	320	5.3	108																																											
20-Jun-12	126	0.5	300	315	5.3	111																																											
27-Jun-12	127	0.5	300	305	5.3	113																																											
4-Jul-12	128	0.5	300	300	5.3	112	#N/A	0.49	0.034	2.3	0.018	0.0054	0.018	1.5	0.012	0.000012	0.000018	0.0030	0.000011	0.00000060	0.00053	0.000017	0.43	0.000030	0.00048	0.051	0.00024	0.0000066	0.00018	0.098	0.012	0.00060	0.00024	0.00020	0.00054	0.28	0.000038	0.87	0.0000048	0.043	0.0039	0.75	0.000011	0.000036	0.000012	0.000051	0.000020	0.0028	0.00000060
11-Jul-12	129	0.5	300	300	5.2	112																																											
18-Jul-12	130	0.5	300	335	5.2	100																																											
25-Jul-12	131	0.5	300	300	5.0	114																																											
1-Aug-12	132	0.5	300	300	5.2	113	#N/A	0.53	0.022	2.1	0.012	0.0042	0.018	1.5	0.014	0.000012	0.000042	0.0035	0.0000096	0.00000060	0.00047	0.000015	0.44	0.000030	0.00048	0.046	0.00066	0.0000072	0.00018	0.10	0.012	0.00060	0.00020	0.00022	0.00054	0.28	0.000036	1.0	0.0000042	0.044	0.0040	0.85	0.0000096	0.000019	0.000018	0.000041	0.000031	0.0026	0.00000060
8-Aug-12	133	0.5	300	295	5.4	111																																											
15-Aug-12	134	0.5	300	325	5.2	105																																											
22-Aug-12	135	0.5	300	295	5.5	97																																											
29-Aug-12	136	0.5	300	355	5.1	102	#N/A	0.78	0.014	2.6	0.014	0.0057	0.021	1.7	0.020	0.000014	0.000014	0.0038	0.000011	0.00000071	0.00045	0.000018	0.49	0.000036	0.00058	0.060	0.00050	0.0000064	0.00021	0.11	0.014	0.0021	0.00027	0.00023	0.00064	0.29	0.000048	0.92	0.0000043	0.048	0.0044	0.84	0.000011	0.000023	0.000014	0.000046	0.000025	0.0032	0.0000028
5-Sep-12	137	0.5	300	355	5.2	139																																											
12-Sep-12	138	0.5	300	340	5.2	100																																											
19-Sep-12	139	0.5	300	335	5.3	101																																											
26-Sep-12	140	0.5	300	320	5.2	104	#N/A	0.49	0.032	2.6	0.013	0.0051	0.019	1.6	0.016	0.000013	0.000026	0.0030	0.0000038	0.00000064	0.00045	0.000026	0.45	0.000032	0.00052	0.054	0.00019	0.0000077	0.00019	0.11	0.012	0.00064	0.00049	0.00028	0.00058	0.25	0.0000026	0.83	0.0000026	0.051	0.0040	0.79	0.0000019	0.000035	0.000013	0.000040	0.000033	0.0028	0.0000019
3-Oct-12	141	0.5	300	355	5.3	103																																											
10-Oct-12	142	0.5	300	335	5.1	95																																											
17-Oct-12	143	0.5	300	315	5.4	117																																											
24-Oct-12	144	0.5	300	310	5.2	108	#N/A	0.63	0.051	2.5	0.012	0.0043	0.019	1.5	0.015	0.000012	0.000012	0.0029	0.000011	0.00000062	0.00056	0.000021	0.44	0.000031	0.00049	0.055	0.00019	0.0000019	0.00019	0.10	0.012	0.00062	0.00025	0.00026	0.00056	0.26	0.000034	0.90	0.0000012	0.047	0.0039	0.78	0.0000081	0.000023	0.000031	0.000039	0.000030	0.0027	0.00000062
31-Oct-12	145	0.5	300	340	5.4	123																																											
7-Nov-12	146	0.5	300	360	4.8	87																																											
14-Nov-12	147	0.5	300	300	5.3	107																																											
21-Nov-12	148	0.5	300	250	5.1	108	#N/A	0.50	0.029	1.7	0.010	0.0060	0.015	1.4	0.010	0.000010	0.000050	0.0026	0.0000095	0.00000050	0.00031	0.000020	0.40	0.000025	0.00046	0.046	0.00025	0.00014	0.00015	0.093	0.011	0.00050	0.00019	0.00020	0.00045	0.20	0.000024	0.65	0.0000055	0.041	0.0036	0.64	0.0000075	0.000029	0.000040	0.000038	0.000027	0.0029	0.00000050
28-Nov-12	149	0.5	300	285	5.6	130																																											
5-Dec-12	150	0.5	300	315	5.6	111																																											
12-Dec-12	151	0.5	300	275	4.8	111																																											
19-Dec-12	152	0.5	300	285	5.0	102	#N/A	0.47	0.0057	2.2	0.011	0.0051	0.017	1.4	0.010	0.000011	0.000023	0.0029	0.000010	0.00000057	0.00041	0.000016	0.41	0.000029	0.00050	0.048	0.00029	0.0000051	0.00017	0.096	0.012	0.00057	0.00020	0.00021	0.00051	0.22	0.000029	0.60	0.0000057	0.045	0.0037	0.69	0.0000091	0.000015	0.000011	0.000041	0.0000068	0.0027	0.00000057
26-Dec-12	153	0.5	300	305	5.9	108																																											
2-Jan-13	154	0.5	300	300	5.0	104																																											
9-Jan-13	155	0.5	300	270	6.0	106																																											
16-Jan-13	156	0.5	300	310	5.3	106	#N/A	0.44	0.049	2.6	0.012	0.0043	0.019	1.6	0.012	0.000012	0.000037	0.0031	0.000012	0.00000062	0.00051	0.000018	0.45	0.000031	0.00052	0.055	0.00037	0.0000025	0.00019	0.10	0.012	0.00062	0.00041	0.00022	0.00056	0.24	0.000030	0.76	0.0000043	0.041	0.0040	0.82	0.0000093	0.000079	0.000012	0.000046	0.000023	0.0029	0.000022
23-Jan-13	157	0.5	300	305	5.8	106																																											
30-Jan-13	158	0.5	300	290	4.8	104																																											
6-Feb-13	159	0.5	300	300	5.6	108																																											
13-Feb-13	160	0.5	300	295	6.0	103	#N/A	0.74	0.14	2.4	0.012	0.0047	0.018	1.4	0.012	0.000012	0.000024	0.0027	0.000012	0.00000059	0.00051	0.000016	0.41	0.000030	0.00052	0.057	0.00018	0.0000053	0.00018	0.10	0.012	0.00059	0.00020	0.00021	0.00053	0.24	0.000033	0.82	0.0000024	0.047	0.0039	0.69	0.0000089	0.0000077	0.0000059	0.000045	0.0000059	0.0030	0.00000059
20-Feb-13	161	0.5	300	265	5.3	108																																											
27-Feb-13	162	0.5	300	335	5.2	104																																											
6-Mar-13	163	0.5	300	290	5.5	106																																											
13-Mar-13	164	0.5	300	295	4.7	102	#N/A	0.68	0.024	2.0																																								
Median (last 5)					5.3	107	#N/A	0.50	0.049	2.4	0.012	0.0047	0.018	1.4	0.012	0.000012	0.000024	0.0029	0.000011	0.00000059	0.00051	0.000018	0.41	0.000030	0.00050	0.055	0.00025	0.0000051	0.00018	0.10	0.012	0.00059	0.00020	0.00021	0.00053	0.24	0.000030	0.76	0.0000043	0.045	0.0039	0.69	0.0000089	0.000023	0.000012	0.000041	0.000023	0.0029	0.00000059

Leachate Results for Col 2A

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hard.	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L*	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
27-Jan-10	1	0.5	960	415	4.8	1137	#N/A	48.2	0.10	537	68	1.1	0.80	133	2.3	0.015	0.0034	0.043	0.00019	0.000080	0.085	0.0014	39	0.016	0.021	0.74	0.27	0.0029	0.0080	8.7	0.68	0.040	0.0063	0.0062	0.050	24	0.038	27	0.000060	180	0.33	145	0.00020	0.00010	0.0027	0.0030	0.00051	0.069	0.018
3-Feb-10	2	0.5	300	340	5.6	488	#N/A	10.2	3.4	230	18	0.29	0.30	29	0.32	0.0083	0.0020	0.028	0.000050	0.000020	0.057	0.00044	8.5	0.0077	0.0070	0.23	0.080	0.00067	0.0040	1.8	0.17	0.13	0.0040	0.0022	0.010	10	0.019	25	0.000030	90	0.079	59	0.00020	0.00064	0.0017	0.00088	0.00014	0.028	0.0054
10-Feb-10	3	0.5	300	265	5.2	530	#N/A	9.1	1.3	215	7.4	0.17	0.30	29	0.15	0.0058	0.0012	0.029	0.000060	0.000010	0.067	0.00039	8.5	0.0040	0.0072	0.15	0.050	0.00052	0.0040	1.8	0.19	0.010	0.0031	0.0016	0.010	11	0.017	27	0.000040	87	0.086	72	0.00020	0.00015	0.0017	0.00056	0.00010	0.024	0.0025
17-Feb-10	4	0.5	300	300	5.0	424	#N/A	8.6	0.6	188	3.2	0.15	0.30	24	0.11	0.0048	0.0011	0.027	0.000020	0.000020	0.064	0.00036	7.2	0.0031	0.0070	0.14	0.030	0.00039	0.0030	1.5	0.17	0.010	0.0030	0.0017	0.010	11	0.016	29	0.000030	73	0.073	64	0.00020	0.00012	0.0019	0.00046	0.00015	0.024	0.0016
24-Feb-10	5	0.5	300	300	5.0	384				163																																								
3-Mar-10	6	0.5	300	295	5.2	331	#N/A	6.9	0.5	147	1.3	0.12	0.30	17	0.069	0.0032	0.00080	0.025	0.000050	0.000010	0.049	0.00023	4.9	0.0027	0.0051	0.11	0.020	0.00024	0.0030	1.0	0.12	0.010	0.0021	0.0011	0.010	8.3	0.0095	25	0.000010	53	0.052	46	0.00020	0.00082	0.00060	0.00027	0.000060	0.017	0.00082
10-Mar-10	7	0.5	300	295	5.6	289				117																																							
17-Mar-10	8	0.5	300	320	5.0	270	#N/A	7.8	1.1	103	1.2	0.10	0.30	14	0.069	0.0024	0.00060	0.028	0.000050	0.000010	0.040	0.00023	4.2	0.0019	0.0039	0.088	0.020	0.00057	0.0030	0.90	0.11	0.010	0.0014	0.0017	0.010	6.9	0.0061	26	0.000010	39	0.045	36	0.00020	0.000080	0.00050	0.00025	0.000030	0.017	0.00045
24-Mar-10	9	0.5	300	310	5.5	226				100																																							
31-Mar-10	10	0.5	300	315	5.2	205	#N/A	6.9	0.7	103	0.60	0.10	0.30	12	0.057	0.0022	0.00080	0.031	0.000040	0.000010	0.028	0.00018	3.4	0.0022	0.0032	0.091	0.010	0.00015	0.0020	0.73	0.090	0.020	0.0017	0.00080	0.010	6.0	0.0050	22	0.000040	33	0.037	30	0.00020	0.00030	0.00090	0.00025	0.000030	0.014	0.00034
7-Apr-10	11	0.5	300	310	5.6	194				78																																							
14-Apr-10	12	0.5	300	295	5.1	173	#N/A	7.4	0.5	68	0.50	0.090	0.30	10	0.075	0.0020	0.00060	0.037	0.000050	0.000030	0.027	0.00023	3.0	0.0015	0.0031	0.094	0.010	0.0027	0.0020	0.64	0.075	0.010	0.0014	0.0010	0.010	5.9	0.0045	21	0.000030	22	0.033	23	0.00020	0.00037	0.00030	0.00021	0.000030	0.020	0.00029
21-Apr-10	13	0.5	300	335	5.2	178				76																																							
28-Apr-10	14	0.5	300	330	4.9	166	#N/A	4.4	0.3	68	0.50	0.080	0.30	12	0.087	0.0017	0.00070	0.041	0.000040	0.000010	0.025	0.00018	3.5	0.0017	0.0036	0.096	0.010	0.0013	0.0020	0.75	0.088	0.010	0.00088	0.0016	0.010	5.5	0.0046	19	0.000030	21	0.038	21	0.00020	0.00065	0.00040	0.00017	0.000030	0.036	0.00025
5-May-10	15	0.5	300	275	4.8	186				81																																							
12-May-10	16	0.5	300	300	5.5	203	#N/A	6.4	0.9	78	0.50	0.11	0.30	20	0.077	0.0017	0.00040	0.046	0.000060	0.000010	0.029	0.00030	5.8	0.0017	0.0056	0.14	0.012	0.00048	0.0030	1.2	0.14	0.010	0.0012	0.0013	0.0090	7.6	0.0040	27	0.00011	23	0.064	24	0.00020	0.00069	0.00030	0.00017	0.000030	0.022	0.00026
19-May-10	17	0.5	300	280	5.3	204				65																																							
26-May-10	18	0.5	300	310	5.4	194	#N/A	9.6	1.2	65	0.50	0.11	0.30	24	0.097	0.0014	0.0011	0.051	0.000080	0.000010	0.027	0.00038	7.1	0.0016	0.0078	0.19	0.0090	0.00012	0.0040	1.5	0.18	0.010	0.0011	0.0017	0.0090	7.5	0.0042	23	0.000020	19	0.079	25	0.00020	0.0012	0.00020	0.00024	0.000030	0.038	0.00023
2-Jun-10	19	0.5	300	345	5.4	181				56																																							
9-Jun-10	20	0.5	300	335	5.5	186	#N/A	7.5	2.0	64	0.40	0.13	0.30	28	0.13	0.0011	0.00060	0.056	0.00010	0.000010	0.023	0.00047	8.4	0.0014	0.0091	0.27	0.0050	0.00020	0.0030	1.7	0.22	0.010	0.00079	0.0022	0.0090	7.1	0.0031	22	0.000080	16	0.093	24	0.00020	0.0014	0.00030	0.00024	0.000040	0.048	0.00022
16-Jun-10	21	0.5	300	350	5.5	181				49																																							
23-Jun-10	22	0.5	300	290	5.4	205	#N/A	8.1	0.9	69	0.50	0.060	0.30	38	0.16	0.0015	0.00030	0.049	0.00015	0.000010	0.024	0.00064	11	0.0015	0.012	0.38	0.0050	0.00020	0.0050	2.4	0.30	0.010	0.0012	0.0022	0.0090	9.3	0.0032	25	0.000050	15	0.12	27	0.00020	0.0017	0.00030	0.00029	0.000030	0.050	0.00019
30-Jun-10	23	0.5	300	365	5.6	173				68																																							
7-Jul-10	24	0.5	300	290	5.6	187	#N/A	6.9	1.1	59	0.40	0.14	0.30	35	0.14	0.0011	0.00050	0.046	0.00016	0.000010	0.021	0.00068	9.9	0.0014	0.013	0.39	0.0070	0.00018	0.0050	2.4	0.31	0.010	0.00073	0.0027	0.026	9.2	0.0027	23	0.000060	11	0.13	25	0.00020	0.0015	0.00030	0.00034	0.000030	0.051	0.00019
14-Jul-10	25	0.5	300	275	5.4	185				51																																							
21-Jul-10	26	0.5	300	300	5.3	182	#N/A	10.1	1.1	57	0.40	0.14	0.30	41	0.18	0.00080	0.00050	0.043	0.00018	0.000010	0.018	0.00079	12	0.0013	0.015	0.44	0.023	0.00029	0.0040	2.6	0.33	0.020	0.00058	0.0024	0.0090	9.2	0.0027	24	0.000050	7.8	0.13	24	0.00020	0.0015	0.00030	0.00034	0.000030	0.055	0.00014
28-Jul-10	27	0.5	300	285	5.5	178				47																																							
4-Aug-10	28	0.5	300	285	5.7	174	#N/A	9.2	1.1	59	0.40	0.16	0.30	44	0.17	0.00090	0.00030	0.043	0.00017	0.000010	0.039	0.00076	13	0.0013	0.015	0.45	0.0050	0.00016	0.0040	2.7	0.35	0.020	0.00085	0.0022	0.012	8.3	0.0023	24	0.000030	6.6	0.14	23	0.00020	0.0013	0.00020	0.00036	0.000030	0.054	0.00012
11-Aug-10	29	0.5	300	360	5.8	156				61																																							
18-Aug-10	30	0.5	300	340	5.7	136	#N/A	10.0	1.3	47	0.30	0.11	0.30	34	0.15	0.00080	0.00050	0.047	0.00016	0.000010	0.017	0.00060	10	0.00080	0.012	0.38	0.0020	0.00017	0.0040	2.1	0.26	0.010	0.00066	0.0022	0.0090	7.3	0.0015	18	0.00024	4.1	0.11	24	0.00020	0.00068	0.00020	0.00030	0.000030	0.051	0.00010
25-Aug-10	31	0.5	300	370	5.6	130				38																																							
1-Sep-10	32	0.5	300	365	5.7	131	#N/A	7.9	1.6	58	0.40	0.11	0.30	36	0.14	0.00070	0.00030	0.055	0.00016	0.000010	0.015	0.00068	11	0.00060	0.013	0.38	0.0020	0.00016	0.0040	2.2	0.27	0.010	0.0013	0.0032	0.0090	6.9	0.0018	19	0.00021	3.9	0.11	19	0.00020	0.00045	0.00030	0.00031	0.000030	0.076	0.000080
8-Sep-10	33	0.5	300	360	5.5	149				59																																							
15-Sep-10	34	0.5	300	345	5.2	139	#N/A	7.4	0.5	62	0.40	0.14	0.30	41	0.18	0.0010	0.00020	0.059	0.00017	0.000020	0.015	0.00071	12	0.0012	0.014	0.45	0.0060	0.00025	0.0040	2.5	0.32	0.010	0.00065	0.0023	0.0090	6.7	0.0017	19	0.00011	2.8	0.13	20	0.00020	0.00099	0.00030	0.00034	0.000030	0.053	0.00012
22-Sep-10	35	0.5	300	365	5.4	127				65																																							
29-Sep-10	36	0.5	300	340	5.4	117	#N/A	6.4	1.2	59	0.40	0.15	0.30	41	0.16	0.0038	0.00070	0.054	0.00019	0.000010	0.016	0.00083	12	0.00080	0.016	0.52	0.0020	0.00055	0.0040	2.6	0.33	0.010	0.0011	0.0033	0.016	7.3	0.0020	21	0.000080	2.9	0.13	22	0.00020	0.0017	0.00070	0.00096	0.000030	0.067	0.00010
6-Oct-10	37	0.5	300	305	5.4	152				57																																							
13-Oct-10	38	0.5	300	330	5.2	137	#N/A	7.3	0.4	50	0.30	0.13	0.30	40	0.14	0.00090	0.00020	0.060	0.00020	0.000010	0.017	0.00071	12	0.00050	0.014	0.46	0.0030	0.00020	0.0040	2.5	0.32	0.010	0.00094	0.0024	0.0090	6.7	0.0015	22	0.000070	2.4	0.13	18	0.00020	0.00054	0.0034	0.00031	0.000030	0.052	0.000090
20-Oct-10	39	0.5	300	300	5.5	139				53																																							
27-Oct-10	40	0.5	300	400	5.5	121	#N/A	5.0	0.8	47	0.20	0.13	0.30	31	0.13	0.00060	0.00020	0.049	0.00015	0.000010	0.015	0.00062	9.2	0.00050	0.013	0.42	0.0050	0.0018	0.0030	1.9	0.23	0.010	0.0013	0.0030	0.017	5.1	0.0024	17	0.00012	2.3	0.100	16	0.00020	0.00021	0.0037	0.00026	0.000030	0.067	0.000050
3-Nov-10	41	0.5	300	300	5.7	149																																										
10-Nov-10	42	0.5	300	375	5.3	131																																									
17-Nov-10	43	0.5	300	400	5.7	153																																									
24-Nov-10	44	0.5	300	380	5.4	113	#N/A	5.6	0.7	44	0.20	0.11	0.30	29	0.12	0.00060	0.00040	0.064	0.00015	0.000010	0.013	0.00059	8.9	0.00070	0.011	0.40	0.0020	0.00016	0.0030	1.8	0.22	0.010	0.00064	0.0016	0.0090	4.6	0.0011	16	0.000050	1.5	0.098	13	0.00020	0.00038	0.00060	0.00039	0.000030	0.046	0.000060
1-Dec-10	45	0.5	300	345	5.6	115																																									
8-Dec-10	46	0.5	300	370	5.3	112																																									
15-Dec-10	47	0.5	300	380	5.6	103																																									
22-Dec-10	48	0.5	300	375	5.9	104	#N/A	6.8	2.4	41	0.20	0.12	0.30	30	0.11	0.0013	0.00030	0.070	0.00014	0.000010	0.013	0.00054	8.9	0.00060	0.010	0.37	0.0020	0.00078	0.0030	1.8	0.22	0.010	0.00093	0.0022	0.024	4.8	0.0014	19	0.00016	1.8	0.100	16	0.00020	0.00061	0.00040	0.00063	0.000030	0.054	0.000050
29-Dec-10	49	0.5	300	380	5.7	78																																									
5-Jan-11	50	0.5	300	400	5.5	93																																									
12-Jan-11	51	0.5	300	360	5.6	89																																									
19-Jan-11	52	0.5	300	330	5.6	93	#N/A	6.5	1.9	37	0.20	0.11	0.30	27	0.097	0.00070	0.00030	0.074	0.00012	0.000010	0.0098	0.00048	8.1	0.00050	0.0093	0.33	0.0030	0.00012	0.0030	1.6	0.19	0.010	0.00057	0.0020	0.024	4.2	0.0011	17	0.000060	1.5	0.090	12	0.00020	0.00040	0.00020	0.00019	0.000030	0.043	0.000040
26-Jan-11	53	0.5	300	285	5.6	99																																									
2-Feb-11	54	0.5	300	315	5.3	88																																									
9-Feb-11	55	0.5	300	370	5.5	78																																									
16-Feb-11	56	0.5	300	420	5.7	73	#N/A	4.6	0.8	25	0.30	0.060	0.30	19	0.066	0.00040	0.00020	0.067	0.00010	0.000010	0.013	0.00037	5.8	0.00060	0.0067	0.24	0.0030	0.00099	0.0020	1.2	0.13	0.010	0.00074	0.0021	0.026	3.1	0.00080	14	0.000060	1.9	0.063	9.1	0.00020	0.00042	0.00020	0.00017	0.000030	0.063	0.000050
23-Feb-11	57	0.5	300	505	5.8	62																																									
2-Mar-11	58	0.5	300	365	5.4	71																																									
9-Mar-11	59	0.5	300	455	5.7	64																																									
16-Mar-11	60	0.5	300	305	5.9	72	#N/A	5.8	1.3	22	0.20	0.080	0.30	18	0.065	0.00080	0.00020	0.18	0.000090	0.000010	0.0069	0.00034	5.4	0.00070	0.0058	0.22	0.0040	0.00017	0.0020	1.1	0.11	0.010	0.00032	0.0011	0.0090	2.9	0.00076	15	0.000050	0.92	0.062	8.3	0.00020	0.00082	0.00020	0.00013	0.000030	0.026	0.000030
23-Mar-11	61	0.5	300	395	6.0	71																																									
30-Mar-11	62	0.5	300	360	6.2	65																																									
6-Apr-11	63	0.5	300	280	6.0	81																																									
13-Apr-11	64	0.5	300	290	5.9	79	#N/A	5.4	1.3	25	0.20	0.090	0.30	20	0.078	0.00050	0.00020	0.10	0.000090	0.000010	0.011	0.00037	6.0	0.00050	0.0069	0.26	0.0020	0.00010	0.0020	1.2	0.14	0.010	0.00036	0.0013	0.0090	3.3	0.0011	16	0.000050	1.0	0.066	9.2	0.00020	0.00041	0.0018	0.00014	0.000030	0.027	0.000010
20-Apr-11	65	0.5	300	325	6.2	79																																									
27-Apr-11	66	0.5	300	355	6.0	73																																									
4-May-11	67	0.5	300	305	5.9	74																																									
11-May-11	68	0.5	300	340	6.0	69	#N/A	5.3	1.4	21	0.20	0.080	0.30	17	0.068	0.00020	0.00060	0.089	0.000090	0.000010	0.0091	0.00032	5.1	0.00050	0.0064	0.23	0.0020	0.00017	0.0020	0.99	0.11	0.010	0.0017	0.0011	0.0090	2.7	0.00045	14	0.000070	0.91	0.058	7.9	0.00020	0.00053	0.00030	0.00016	0.000030	0.029	0.000020
18-May-11	69	0.5	300	330	5.9	89																																									
25-May-11	70	0.5	300	325	6.2	65																																									
1-Jun-11	71	0.5	300	340	6.2	69																																									
8-Jun-11	72	0.5	300	325	6.3	68	#N/A	6.3	2.5	21	0.30	0.080	0.30	16	0.072	0.00060	0.00020	0.100	0.000090	0.000020	0.010	0.00032	5.0	0.00050	0.0060	0.24	0.0020	0.00010	0.0020	0.97	0.11	0.010	0.00035	0.0013	0.034	2.7	0.00079	16	0.000050	1.0	0.055	7.6	0.000040	0.00049	0.00020	0.00013	0.000030	0.028	0.000030
15-Jun-11	73	0.5	300	320	6.2	69																																									
22-Jun-11	74	0.5	300	360	6.0	66																																									
29-Jun-11	75	0.5	300	310	6.0	70																																									
6-Jul-11	76	0.5	300	330	6.0	70	#N/A	6.7	1.5	23	0.20	0.070	0.30	18	0.071	0.00040	0.00020	0.081	0.000080	0.000010	0.011	0.00033	5.5	0.00050	0.0065	0.24	0.0050	0.00011	0.0020	1.1	0.13	0.010	0.00029	0.0011	0.0090	2.9	0.00073	17	0.000030	1.1	0.062	8.4	0.000030	0.00035	0.00010	0.00011	0.000030	0.028	0.000010
13-Jul-11	77	0.5	300	180	6.4	69																																									
20-Jul-11	78	0.5	300	340	5.8	64																																									
27-Jul-11	79	0.5	300	340	5.8	62																																									
3-Aug-11	80	0.5	300	245	5.8	58	#N/A	7.2	1.7	18	0.20	0.070	0.30	14	0.053	0.00040	0.00030	0.076	0.000070	0.000010	0.0089	0.00028	4.4	0.00050	0.0053	0.19	0.0020	0.00026	0.0020	0.83	0.10	0.010	0.00041	0.00090	0.0090	2.3	0.00054	13	0.000040	0.87	0.050	6.5	0.000020	0.00034	0.00020	0.000096	0.000030	0.024	0.000030
10-Aug-11	81	0.5	300	350	6.2	54																																									
17-Aug-11	82	0.5	300	355	6.3	53																																									
24-Aug-11	83	0.5	300	290	6.5	57																																									
31-Aug-11	84	0.5	300	375	6.5	54	#N/A	7.1	2.7	20	0.20	0.060	0.30	14	0.062	0.00050	0.00030	0.079	0.000070	0.000010	0.010	0.00029	4.2	0.00070	0.0056	0.21	0.0020	0.00014	0.0020	0.82	0.099	0.010	0.00043	0.0011	0.0090	2.4	0.000040	13	0.000040	0.94	0.049	7.4	0.000030	0.00033	0.00020	0.000089	0.000030	0.027	0.000020
7-Sep-11	85	0.5	300	330	6.2	50																																									
14-Sep-11	86	0.5	300	335	6.2	53																																									
21-Sep-11	87	0.5	300	295	6.1	55																																									
28-Sep-11	88	0.5	300	295	6.5	57	#N/A	7.0	2.1	19	0.20	0.070	0.30	14	0.060	0.00040	0.00020	0.078	0.000090	0.000010	0.0052	0.00029	4.3	0.0013	0.0053	0.20	0.0020	0.00015	0.0020	0.82	0.10	0.010	0.00029	0.0010	0.0090	2.4	0.00065	14	0.000040	1.0	0.049	6.9	0.000030	0.00040	0.00020	0.000095	0.000030	0.024	0.000030
5-Oct-11	89	0.5	300	335	6.2	50																																									
12-Oct-11	90	0.5	300	295	6.8	53																																									
19-Oct-11	91	0.5	300	325	6.1	52																																									
26-Oct-11	92	0.5	300	340	6.1	51	#N/A	5.2	1.2	16	0.20	0.080	0.30	13	0.054	0.00030	0.00020	0.082	0.000080	0.000010	0.0091	0.00025	3.8	0.00070	0.0045	0.17	0.0060	0.00035	0.0

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Calculated Production Rates for Col 2A

Date	Cycle No.	Flow Rate (mL/min)	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mg $CaCO_3$/kg	Acidity (pH 8.3) mg $CaCO_3$/kg	Alkalinity mg $CaCO_3$/kg	SO_4 mg/kg	Cl mg/kg	F mg/kg	Br mg/kg	Hardness mg $CaCO_3$/kg	Al mg/kg	Sb mg/kg	As mg/kg	Ba mg/kg	Be mg/kg	Bi mg/kg	B mg/kg	Cd mg/kg	Ca mg/kg	Cr mg/kg	Co mg/kg	Cu mg/kg	Fe mg/kg	Pb mg/kg	Li mg/kg	Mg mg/kg	Mn mg/kg	Hg mg/kg	Mo mg/kg	Ni mg/kg	P mg/kg	K mg/kg	Se mg/kg	Si mg/kg	Ag mg/kg	Na mg/kg	Sr mg/kg	S mg/kg	Tl mg/kg	Sn mg/kg	Ti mg/kg	U mg/kg	V mg/kg	Zn mg/kg	Zr mg/kg
27-Jan-10	1	0.5	960	415	4.8	1137	#N/A	4.0	0.0083	45	5.6	0.087	0.066	11	0.19	0.0012	0.00028	0.0035	0.000016	0.0000066	0.0071	0.00012	3.2	0.0013	0.0017	0.061	0.022	0.00024	0.00066	0.72	0.056	0.0033	0.00053	0.00051	0.0042	2.0	0.0031	2.2	0.0000050	15	0.027	12	0.000017	0.0000083	0.00022	0.00025	0.000042	0.0057	0.0015
3-Feb-10	2	0.5	300	340	5.6	488	#N/A	0.69	0.23	16	1.2	0.020	0.020	2.0	0.021	0.00056	0.00014	0.0019	0.0000034	0.0000014	0.0039	0.000030	0.58	0.00052	0.00048	0.016	0.0054	0.000046	0.00027	0.12	0.011	0.0088	0.00027	0.00015	0.00068	0.68	0.0013	1.7	0.0000020	6.1	0.0054	4.0	0.000014	0.000044	0.00012	0.000060	0.0000095	0.0019	0.00036
10-Feb-10	3	0.5	300	265	5.2	530	#N/A	0.48	0.066	11	0.39	0.0090	0.016	1.5	0.0078	0.00031	0.000064	0.0016	0.0000032	0.00000053	0.0036	0.000021	0.45	0.00021	0.00038	0.0078	0.0027	0.000028	0.00021	0.096	0.0099	0.00053	0.00016	0.000085	0.00053	0.60	0.00092	1.5	0.0000021	4.6	0.0046	3.8	0.0000011	0.0000080	0.0000090	0.0000029	0.0000053	0.0013	0.00013
17-Feb-10	4	0.5	300	300	5.0	424	#N/A	0.52	0.033	11	0.19	0.0090	0.018	1.5	0.0068	0.00029	0.000066	0.0016	0.0000012	0.0000012	0.0038	0.000021	0.43	0.00019	0.00042	0.0086	0.0018	0.000023	0.00018	0.092	0.010	0.00060	0.00018	0.00010	0.00060	0.64	0.00094	1.7	0.0000018	4.4	0.0044	3.9	0.0000012	0.0000072	0.00011	0.0000028	0.0000090	0.0014	0.000098
24-Feb-10	5	0.5	300	300	5.0	384				9.8																																								
3-Mar-10	6	0.5	300	295	5.2	331	#N/A	0.41	0.031	8.7	0.077	0.0071	0.018	0.97	0.0040	0.00019	0.000047	0.0015	0.0000030	0.00000059	0.0029	0.000014	0.29	0.00016	0.00030	0.0065	0.0012	0.000014	0.00018	0.061	0.0071	0.00059	0.00013	0.000065	0.00059	0.49	0.00056	1.5	0.00000059	3.1	0.0030	2.7	0.000012	0.000048	0.000035	0.000016	0.0000035	0.0010	0.000048
10-Mar-10	7	0.5	300	295	5.6	289				6.9																																								
17-Mar-10	8	0.5	300	320	5.0	270	#N/A	0.50	0.068	6.6	0.077	0.0064	0.019	0.92	0.0044	0.00015	0.000038	0.0018	0.0000032	0.00000064	0.0025	0.000015	0.27	0.00012	0.00025	0.0056	0.0013	0.000036	0.00019	0.058	0.0068	0.00064	0.000092	0.00011	0.00064	0.44	0.00039	1.6	0.00000064	2.5	0.0029	2.3	0.000013	0.0000051	0.000032	0.000016	0.0000019	0.0011	0.000029
24-Mar-10	9	0.5	300	310	5.5	226				6.2																																								
31-Mar-10	10	0.5	300	315	5.2	205	#N/A	0.44	0.041	6.5	0.038	0.0063	0.019	0.72	0.0036	0.00014	0.000050	0.0019	0.0000025	0.00000063	0.0018	0.000012	0.21	0.00014	0.00020	0.0057	0.00063	0.0000095	0.00013	0.046	0.0057	0.0013	0.00011	0.000050	0.00063	0.38	0.00032	1.4	0.0000025	2.1	0.0023	1.9	0.000013	0.000019	0.000057	0.000016	0.0000019	0.00088	0.000021
7-Apr-10	11	0.5	300	310	5.6	194				4.8																																								
14-Apr-10	12	0.5	300	295	5.1	173	#N/A	0.43	0.028	4.0	0.030	0.0053	0.018	0.60	0.0044	0.00012	0.000035	0.0022	0.0000030	0.0000018	0.0016	0.000014	0.18	0.000089	0.00018	0.0056	0.00059	0.00016	0.00012	0.037	0.0044	0.00059	0.000085	0.000059	0.00059	0.35	0.00026	1.2	0.0000018	1.3	0.0019	1.3	0.000012	0.000022	0.000018	0.000013	0.0000018	0.0012	0.000017
21-Apr-10	13	0.5	300	335	5.2	178				5.1																																								
28-Apr-10	14	0.5	300	330	4.9	166	#N/A	0.29	0.021	4.5	0.033	0.0053	0.020	0.78	0.0058	0.00011	0.000046	0.0027	0.0000026	0.00000066	0.0017	0.000012	0.23	0.00011	0.00024	0.0064	0.00066	0.000084	0.00013	0.049	0.0058	0.00066	0.000058	0.00011	0.00066	0.37	0.00031	1.2	0.0000020	1.4	0.0025	1.4	0.000013	0.000043	0.000026	0.000011	0.0000020	0.0024	0.000017
5-May-10	15	0.5	300	275	4.8	186				4.5																																								
12-May-10	16	0.5	300	300	5.5	203	#N/A	0.38	0.056	4.7	0.030	0.0066	0.018	1.2	0.0046	0.00010	0.000024	0.0028	0.0000036	0.00000060	0.0017	0.000018	0.35	0.00010	0.00034	0.0086	0.00072	0.000029	0.00018	0.073	0.0086	0.00060	0.000073	0.000078	0.00054	0.46	0.00024	1.6	0.0000066	1.4	0.0038	1.5	0.000012	0.000041	0.000018	0.000010	0.0000018	0.0013	0.000016
19-May-10	17	0.5	300	280	5.3	204				3.6																																								
26-May-10	18	0.5	300	310	5.4	194	#N/A	0.60	0.071	4.0	0.031	0.0068	0.019	1.5	0.0060	0.000087	0.000068	0.0032	0.0000050	0.00000062	0.0017	0.000023	0.44	0.000099	0.00048	0.012	0.00056	0.0000074	0.00025	0.092	0.011	0.00062	0.000066	0.00011	0.00056	0.47	0.00026	1.4	0.0000012	1.2	0.0049	1.5	0.000012	0.000076	0.000012	0.000015	0.0000019	0.0024	0.000014
2-Jun-10	19	0.5	300	345	5.4	181				3.9																																								
9-Jun-10	20	0.5	300	335	5.5	186	#N/A	0.50	0.13	4.3	0.027	0.0087	0.020	1.9	0.0084	0.000074	0.000040	0.0038	0.0000067	0.00000067	0.0015	0.000031	0.56	0.000094	0.00061	0.018	0.00034	0.0000013	0.00020	0.12	0.015	0.00067	0.000053	0.00015	0.00060	0.47	0.00021	1.4	0.0000054	1.1	0.0062	1.6	0.000013	0.000096	0.000020	0.000016	0.0000027	0.0032	0.000015
16-Jun-10	21	0.5	300	350	5.5	181				3.4																																								
23-Jun-10	22	0.5	300	290	5.4	205	#N/A	0.47	0.053	4.0	0.029	0.0035	0.017	2.2	0.0093	0.000087	0.000017	0.0029	0.0000087	0.00000058	0.0014	0.000037	0.66	0.000087	0.00071	0.022	0.00029	0.000012	0.00029	0.14	0.017	0.00058	0.000069	0.00013	0.00052	0.54	0.00019	1.5	0.0000029	0.84	0.0070	1.6	0.000012	0.000100	0.000017	0.000017	0.0000017	0.0029	0.000011
30-Jun-10	23	0.5	300	365	5.6	173				5.0																																								
7-Jul-10	24	0.5	300	290	5.6	187	#N/A	0.40	0.066	3.4	0.023	0.0081	0.017	2.0	0.0080	0.000064	0.000029	0.0026	0.0000093	0.00000058	0.0012	0.000039	0.57	0.000081	0.00077	0.023	0.00041	0.000010	0.00029	0.14	0.018	0.00058	0.000042	0.00016	0.0015	0.54	0.00016	1.4	0.0000035	0.62	0.0077	1.4	0.000012	0.000088	0.000017	0.000020	0.0000017	0.0030	0.000011
14-Jul-10	25	0.5	300	275	5.4	185				2.8																																								
21-Jul-10	26	0.5	300	300	5.3	182	#N/A	0.61	0.068	3.4	0.024	0.0084	0.018	2.5	0.011	0.000048	0.000030	0.0026	0.000011	0.00000060	0.0011	0.000048	0.72	0.000078	0.00088	0.026	0.0014	0.000017	0.00024	0.16	0.020	0.0012	0.000035	0.00014	0.00054	0.55	0.00016	1.5	0.0000030	0.47	0.0080	1.4	0.000012	0.000088	0.000018	0.000021	0.0000018	0.0033	0.0000084
28-Jul-10	27	0.5	300	285	5.5	178				2.7																																								
4-Aug-10	28	0.5	300	285	5.7	174	#N/A	0.52	0.063	3.4	0.023	0.0091	0.017	2.5	0.0098	0.000051	0.000017	0.0024	0.0000097	0.00000057	0.0022	0.000043	0.75	0.000074	0.00084	0.025	0.00029	0.0000091	0.00023	0.15	0.020	0.0011	0.000048	0.00013	0.00068	0.47	0.00013	1.3	0.0000017	0.38	0.0079	1.3	0.000011	0.000075	0.000011	0.000020	0.0000017	0.0031	0.0000068
11-Aug-10	29	0.5	300	360	5.8	156				4.4																																								
18-Aug-10	30	0.5	300	340	5.7	136	#N/A	0.68	0.086	3.2	0.020	0.0075	0.020	2.3	0.0099	0.000054	0.000034	0.0032	0.000011	0.00000068	0.0011	0.000041	0.69	0.000054	0.00080	0.026	0.00014	0.000012	0.00027	0.14	0.018	0.00068	0.000045	0.00015	0.00061	0.50	0.00010	1.2	0.0000016	0.28	0.0073	1.6	0.000014	0.000046	0.000014	0.000020	0.0000020	0.0035	0.0000068
25-Aug-10	31	0.5	300	370	5.6	130				2.8																																								
1-Sep-10	32	0.5	300	365	5.7	131	#N/A	0.57	0.12	4.2	0.029	0.0080	0.022	2.6	0.010	0.000051	0.000022	0.0040	0.000012	0.00000073	0.0011	0.000050	0.79	0.000044	0.00093	0.028	0.00015	0.000012	0.00029	0.16	0.019	0.00073	0.000091	0.00023	0.00066	0.51	0.00013	1.4	0.0000015	0.28	0.0082	1.4	0.000015	0.000033	0.000022	0.000023	0.0000022	0.0055	0.0000058
8-Sep-10	33	0.5	300	360	5.5	149				4.2																																								
15-Sep-10	34	0.5	300	345	5.2	139	#N/A	0.51	0.035	4.3	0.028	0.0097	0.021	2.8	0.012	0.000069	0.000014	0.0041	0.000012	0.00000014	0.0010	0.000049	0.85	0.000083	0.00095	0.031	0.00041	0.000017	0.00028	0.17	0.022	0.00069	0.000045	0.00016	0.00062	0.46	0.00012	1.3	0.0000076	0.20	0.0090	1.3	0.000014	0.000068	0.000021	0.000024	0.0000021	0.0037	0.0000083
22-Sep-10	35	0.5	300	365	5.4	127				4.7																																								
29-Sep-10	36	0.5	300	340	5.4	117	#N/A	0.43	0.079	4.0	0.027	0.010	0.020	2.8	0.011	0.00026	0.000048	0.0037	0.000013	0.00000068	0.0011	0.000056	0.84	0.000054	0.0011	0.036	0.00014	0.000037	0.00027	0.17	0.022	0.00068	0.000076	0.00022	0.0011	0.50	0.00013	1.4	0.0000054	0.20	0.0089	1.5	0.000014	0.00012	0.000048	0.000065	0.0000020	0.0046	0.0000068
6-Oct-10	37	0.5	300	305	5.4	152				3.5																																								
13-Oct-10	38	0.5	300	330	5.2	137	#N/A	0.48	0.029	3.3	0.020	0.0086	0.020	2.6	0.0090	0.000059	0.000013	0.0040	0.000013	0.00000066	0.0011	0.000047	0.79	0.000033	0.00093	0.030	0.00020	0.000013	0.00026	0.17	0.021	0.00066	0.000062	0.00016	0.00059	0.44	0.000100	1.4	0.0000046	0.16	0.0084	1.2	0.000013	0.000036	0.00022	0.000020	0.0000020	0.0034	0.0000059
20-Oct-10	39	0.5	300	300	5.5	139				3.2																																								
27-Oct-10	40	0.5	300	400	5.5	121	#N/A	0.40	0.061	3.8	0.016	0.010	0.024	2.5	0.010	0.000048	0.000016	0.0039	0.000012	0.00000080	0.0012	0.000050	0.74	0.000040	0.0010	0.034	0.00040	0.00014	0.00024	0.15	0.019	0.00080	0.00011	0.00024	0.0014	0.41	0.00019	1.3	0.0000096	0.18	0.0080	1.3	0.000016	0.000017	0.00030	0.000021	0.0000024	0.0054	0.0000040
3-Nov-10	41	0.5	300	300	5.7	149																																											
10-Nov-10	42	0.5	300	375	5.3	131																																										
17-Nov-10	43	0.5	300	400	5.7	153																																										
24-Nov-10	44	0.5	300	380	5.4	113	#N/A	0.43	0.051	3.3	0.015	0.0084	0.023	2.2	0.0090	0.000046	0.000030	0.0048	0.000011	0.00000076	0.00098	0.000045	0.67	0.000053	0.00083	0.030	0.00015	0.000012	0.00023	0.13	0.017	0.00076	0.000049	0.00012	0.00068	0.35	0.000085	1.2	0.0000038	0.11	0.0074	0.97	0.000015	0.000029	0.000046	0.000030	0.0000023	0.0035	0.0000046
1-Dec-10	45	0.5	300	345	5.6	115																																											
8-Dec-10	46	0.5	300	370	5.3	112																																										
15-Dec-10	47	0.5	300	380	5.6	103																																										
22-Dec-10	48	0.5	300	375	5.9	104	#N/A	0.51	0.18	3.1	0.015	0.0090	0.023	2.2	0.0082	0.000098	0.000023	0.0053	0.000011	0.00000075	0.00100	0.000040	0.67	0.000045	0.00078	0.028	0.00015	0.000059	0.00023	0.14	0.017	0.00075	0.000070	0.00017	0.0018	0.36	0.00011	1.4	0.000012	0.14	0.0075	1.2	0.000015	0.000046	0.000030	0.000047	0.0000023	0.0041	0.0000038
29-Dec-10	49	0.5	300	380	5.7	78																																										
5-Jan-11	50	0.5	300	400	5.5	93																																										
12-Jan-11	51	0.5	300	360	5.6	89																																										
19-Jan-11	52	0.5	300	330	5.6	93	#N/A	0.43	0.13	2.4	0.013	0.0073	0.020	1.8	0.0064	0.000046	0.000020	0.0049	0.0000079	0.00000066	0.00065	0.000032	0.53	0.000033	0.00062	0.022	0.00020	0.0000079	0.00020	0.11	0.013	0.00066	0.000038	0.00013	0.0016	0.28	0.000070	1.1	0.0000040	0.099	0.0059	0.79	0.000013	0.000026	0.000013	0.000012	0.0000020	0.0028	0.0000026
26-Jan-11	53	0.5	300	285	5.6	99																																											
2-Feb-11	54	0.5	300	315	5.3	88																																										
9-Feb-11	55	0.5	300	370	5.5	78																																										
16-Feb-11	56	0.5	300	420	5.7	73	#N/A	0.39	0.066	2.1	0.025	0.0050	0.025	1.6	0.0056	0.000034	0.000017	0.0056	0.0000084	0.00000084	0.0011	0.000031	0.49	0.000050	0.00056	0.020	0.00025	0.000083	0.00017	0.097	0.011	0.00084	0.000062	0.00018	0.0022	0.26	0.000067	1.2	0.0000050	0.16	0.0053	0.77	0.000017	0.000035	0.000017	0.000014	0.0000025	0.0053	0.0000042
23-Feb-11	57	0.5	300	505	5.8	62																																										
2-Mar-11	58	0.5	300	365	5.4	71																																										
9-Mar-11	59	0.5	300	455	5.7	64																																										
16-Mar-11	60	0.5	300	305	5.9	72	#N/A	0.35	0.079	1.3	0.012	0.0049	0.018	1.1	0.0040	0.000049	0.000012	0.011	0.0000055	0.00000061	0.00042	0.000020	0.33	0.000043	0.00035	0.014	0.00024	0.000010	0.00012	0.065	0.0070	0.00061	0.000020	0.000067	0.00055	0.18	0.000046	0.92	0.0000031	0.056	0.0038	0.51	0.000012	0.000050	0.000012	0.0000081	0.0000018	0.0016	0.0000018
23-Mar-11	61	0.5	300	395	6.0	71																																										
30-Mar-11	62	0.5	300	360	6.2	65																																										
6-Apr-11	63	0.5	300	280	6.0	81																																										
13-Apr-11	64	0.5	300	290	5.9	29	#N/A	0.31	0.075	1.5	0.012	0.0052	0.017	1.1	0.0045	0.000029	0.000012	0.0059	0.0000052	0.00000058	0.00061	0.000021	0.35	0.000029	0.00040	0.015	0.00012	0.0000058	0.00012	0.067	0.0082	0.00058	0.000021	0.000075	0.00052	0.19	0.000064	0.92	0.0000029	0.060	0.0038	0.53	0.000012	0.000024	0.00010	0.0000083	0.0000017	0.0016	0.00000058
20-Apr-11	65	0.5	300	325	6.2	79																																										
27-Apr-11	66	0.5	300	355	6.0	73																																										
4-May-11	67	0.5	300	305	5.9	74																																										
11-May-11	68	0.5	300	340	6.0	69	#N/A	0.36	0.092	1.4	0.014	0.0054	0.020	1.1	0.0046	0.000014	0.000041	0.0061	0.0000061	0.00000068	0.00062	0.000022	0.35	0.000034	0.00044	0.016	0.00014	0.000012	0.00014	0.067	0.0073	0.00068	0.00012	0.000075	0.00061	0.18	0.000031	0.94	0.0000048	0.062	0.0039	0.54	0.000014	0.000036	0.000020	0.000011	0.0000020	0.0020	0.0000014
18-May-11	69	0.5	300	330	5.9	89																																										
25-May-11	70	0.5	300	325	6.2	65																																										
1-Jun-11	71	0.5	300	340	6.2	69																																										
8-Jun-11	72	0.5	300	325	6.3	68	#N/A	0.41	0.16	1.4	0.020	0.0052	0.020	1.1	0.0047	0.000039	0.000013	0.0065	0.0000059	0.0000013	0.00066	0.000021	0.32	0.000033	0.00039	0.016	0.00013	0.0000065	0.00013	0.063	0.0073	0.00065	0.000023	0.000085	0.0022	0.18	0.000051	1.0	0.0000033	0.066	0.0036	0.49	0.0000026	0.000032	0.000013	0.0000082	0.0000020	0.0018	0.0000020
15-Jun-11	73	0.5	300	320	6.2	69																																										
22-Jun-11	74	0.5	300	360	6.0	66																																										
29-Jun-11	75	0.5	300	310	6.0	70																																										
6-Jul-11	76	0.5	300	330	6.0	70	#N/A	0.44	0.097	1.5	0.013	0.0046	0.020	1.2	0.0047	0.000026	0.000013	0.0053	0.0000053	0.00000066	0.00071	0.000022	0.36	0.000033	0.00043	0.016	0.00033	0.0000073	0.00013	0.070	0.0084	0.00066	0.000019	0.000073	0.00059	0.19	0.000048	1.1	0.0000020	0.075	0.0041	0.56	0.0000020	0.000023	0.0000066	0.0000075	0.0000020	0.0018	0.00000066
13-Jul-11	77	0.5	300	180	6.4	69																																										
20-Jul-11	78	0.5	300	340	5.8	64																																										
27-Jul-11	79	0.5	300	340	5.8	62																																										
3-Aug-11	80	0.5	300	245	5.8	58	#N/A	0.35	0.084	0.88	0.0098	0.0034	0.015	0.71	0.0026	0.000020	0.000015	0.0037	0.0000034	0.00000049	0.00044	0.000014	0.21	0.000025	0.00026	0.0093	0.000098	0.000013	0.000098	0.041	0.0050	0.00049	0.000020	0.000044	0.00044	0.11	0.000026	0.64	0.0000020	0.043	0.0024	0.32	0.00000098	0.000017	0.0000098	0.0000047	0.0000015	0.0012	0.0000015
10-Aug-11	81	0.5	300	350	6.2	54																																										
17-Aug-11	82	0.5	300	355	6.3	53																																										
24-Aug-11	83	0.5	300	290	6.5	57																																										
31-Aug-11	84	0.5	300	375	6.5	54	#N/A	0.53	0.20	1.5	0.015	0.0045	0.023	1.0	0.0047	0.000038	0.000023	0.0060	0.0000053	0.00000075	0.00077	0.000022	0.32	0.000053	0.00042	0.015	0.00015	0.000011	0.00015	0.061	0.0074	0.00075	0.000032	0.000083	0.00068	0.18	0.0000030	1.00	0.0000030	0.071	0.0037	0.56	0.0000023	0.000025	0.000015	0.0000067	0.0000023	0.0020	0.0000015
7-Sep-11	85	0.5	300	330	6.2	50																																										
14-Sep-11	86	0.5	300	335	6.2	53																	

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Leachate Results for Col 2B

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
27-Jan-10	1	0.5	1448	440	4.7	1596	#N/A	69	0.10	705	110	1.5	1.3	207	3.1	0.020	0.0052	0.051	0.00029	0.00013	0.11	0.0023	60	0.022	0.034	0.98	0.39	0.0066	0.0090	14	1.1	0.15	0.0068	0.0093	0.050	27	0.057	33	0.000080	246	0.52	191	0.00030	0.00012	0.0032	0.0043	0.00080	0.11	0.025
3-Feb-10	2	0.5	300	270	5.2	823	#N/A	17	3.1	436	39	0.50	0.40	73	0.74	0.013	0.0041	0.032	0.000090	0.000020	0.10	0.0010	22	0.017	0.023	0.58	0.090	0.0026	0.0050	4.6	0.46	0.37	0.0045	0.0049	0.10	12	0.040	28	0.000080	137	0.20	104	0.00020	0.0012	0.0025	0.0020	0.00036	0.071	0.011
10-Feb-10	3	0.5	300	240	5.0	830	#N/A	13	0.99	356	18	0.26	0.30	60	0.35	0.0078	0.0023	0.025	0.00012	0.000030	0.087	0.00074	18	0.0075	0.017	0.27	0.13	0.0013	0.0050	3.9	0.39	0.13	0.0024	0.0031	0.010	14	0.029	31	0.000040	129	0.16	113	0.00020	0.00029	0.0020	0.0011	0.00022	0.044	0.0048
17-Feb-10	4	0.5	300	270	4.4	703	1.6	16	#N/A	336	7.5	0.24	0.30	55	0.29	0.0068	0.0018	0.025	0.00010	0.000030	0.090	0.00076	16	0.0059	0.017	0.34	0.090	0.0012	0.0040	3.4	0.37	0.010	0.0021	0.0032	0.010	11	0.029	33	0.000030	116	0.14	111	0.00020	0.00018	0.0021	0.0011	0.00011	0.047	0.0034
24-Feb-10	5	0.5	300	265	4.8	725				326																																								
3-Mar-10	6	0.5	300	260	4.8	640	#N/A	10	0.10	273	2.8	0.20	0.30	44	0.21	0.0042	0.0012	0.022	0.00012	0.000010	0.078	0.00058	13	0.0047	0.015	0.28	0.050	0.00095	0.0040	2.7	0.29	0.010	0.0014	0.0026	0.010	11	0.020	30	0.000030	99	0.12	92	0.00020	0.00084	0.0012	0.00074	0.000070	0.040	0.0019
10-Mar-10	7	0.5	300	220	5.6	572				232																																								
17-Mar-10	8	0.5	300	300	5.4	516	#N/A	8.1	1.8	217	1.4	0.16	0.30	36	0.19	0.0027	0.0016	0.023	0.00011	0.000010	0.071	0.00053	11	0.0036	0.0099	0.23	0.030	0.00085	0.014	2.3	0.25	0.010	0.0014	0.0015	0.010	9.5	0.011	29	0.000010	75	0.100	70	0.00020	0.000010	0.0015	0.00058	0.000030	0.031	0.00095
24-Mar-10	9	0.5	300	275	5.1	533				250																																							
31-Mar-10	10	0.5	300	305	4.8	378	#N/A	8.4	0.10	171	0.80	0.13	0.30	31	0.15	0.0020	0.00080	0.025	0.00010	0.000010	0.047	0.00049	9.2	0.0031	0.0097	0.22	0.020	0.0012	0.0040	2.0	0.23	0.010	0.00076	0.0016	0.010	8.1	0.0094	23	0.000050	82	0.092	58	0.00020	0.00020	0.00090	0.00043	0.000030	0.032	0.00069
7-Apr-10	11	0.5	300	315	4.9	442				189																																							
14-Apr-10	12	0.5	300	270	4.8	441	#N/A	11	0.10	206	0.90	0.18	0.30	42	0.23	0.0022	0.00090	0.026	0.00016	0.000020	0.052	0.00066	12	0.0025	0.014	0.36	0.020	0.00068	0.0050	2.7	0.30	0.010	0.00098	0.0023	0.010	10	0.011	30	0.000050	61	0.12	64	0.00020	0.00023	0.00060	0.00058	0.000030	0.046	0.00089
21-Apr-10	13	0.5	300	280	4.9	452				201																																							
28-Apr-10	14	0.5	300	310	4.7	422	#N/A	6.3	0.10	192	0.90	0.16	0.30	42	0.19	0.0021	0.00090	0.026	0.00016	0.000010	0.051	0.00069	12	0.0025	0.014	0.36	0.020	0.00039	0.0050	2.7	0.31	0.010	0.00078	0.0022	0.010	11	0.0096	30	0.000060	55	0.12	57	0.00020	0.00048	0.00070	0.00054	0.000030	0.047	0.00063
5-May-10	15	0.5	300	235	4.8	393				152																																							
12-May-10	16	0.5	300	235	5.3	369	#N/A	10	0.86	187	0.80	0.16	0.30	45	0.19	0.0019	0.00060	0.025	0.00016	0.000010	0.050	0.00075	13	0.0014	0.015	0.41	0.015	0.00022	0.0070	3.1	0.34	0.010	0.00061	0.0027	0.0090	11	0.0084	37	0.00012	47	0.14	53	0.00020	0.00010	0.00060	0.00020	0.000030	0.051	0.00051
19-May-10	17	0.5	300	285	5.6	336				126																																							
26-May-10	18	0.5	300	305	5.0	351	#N/A	13	0.41	126	0.80	0.19	0.30	51	0.22	0.0017	0.0010	0.029	0.00021	0.000010	0.045	0.00084	15	0.0025	0.018	0.47	0.014	0.00059	0.0070	3.1	0.38	0.010	0.00069	0.0028	0.010	11	0.0079	32	0.000060	36	0.14	49	0.00020	0.00083	0.00050	0.00065	0.000030	0.062	0.00051
2-Jun-10	19	0.5	300	275	5.1	338				123																																							
9-Jun-10	20	0.5	300	280	5.1	320	#N/A	11	1.4	130	1.0	0.18	0.30	47	0.24	0.0015	0.00070	0.029	0.00019	0.000010	0.041	0.00091	13	0.0017	0.018	0.58	0.0080	0.00041	0.0070	3.3	0.40	0.010	0.00047	0.0028	0.0090	11	0.0069	32	0.00014	29	0.15	45	0.00020	0.00094	0.00040	0.00062	0.000030	0.062	0.00046
16-Jun-10	21	0.5	300	250	5.1	307				81																																							
23-Jun-10	22	0.5	300	270	4.9	304	#N/A	11	0.10	104	1.0	0.060	0.30	58	0.28	0.0017	0.00080	0.029	0.00024	0.000010	0.041	0.00094	17	0.0016	0.020	0.68	0.010	0.00044	0.0080	3.7	0.45	0.010	0.00091	0.0028	0.0090	14	0.0062	34	0.00010	22	0.17	41	0.00020	0.0012	0.00040	0.00062	0.000030	0.067	0.00035
30-Jun-10	23	0.5	300	285	5.2	273				93																																							
7-Jul-10	24	0.5	300	315	5.1	267	#N/A	10	0.73	93	0.80	1.0	0.30	51	0.22	0.0013	0.00080	0.031	0.00024	0.000010	0.035	0.00098	14	0.0020	0.019	0.63	0.012	0.00059	0.0080	3.6	0.43	0.010	0.00050	0.0036	1.0	13	0.0054	33	0.00010	16	0.17	37	0.00020	0.0011	0.00040	0.00064	0.000030	0.069	0.00029
14-Jul-10	25	0.5	300	290	5.1	247				61																																							
21-Jul-10	26	0.5	300	320	4.9	247	#N/A	12	0.33	82	0.70	0.17	0.30	54	0.24	0.00090	0.00060	0.033	0.00025	0.000010	0.033	0.0010	16	0.0014	0.020	0.67	0.011	0.00033	0.0070	3.5	0.42	0.010	0.00040	0.0029	0.0090	13	0.0047	33	0.00010	13	0.17	33	0.00020	0.0011	0.00040	0.00061	0.000030	0.070	0.00024
28-Jul-10	27	0.5	300	315	5.2	238				87																																							
4-Aug-10	28	0.5	300	290	5.1	234	#N/A	12	0.92	89	0.70	0.19	0.30	57	0.24	0.0010	0.00040	0.034	0.00023	0.000010	0.042	0.00100	17	0.0016	0.019	0.66	0.010	0.00033	0.0070	3.5	0.44	0.020	0.00052	0.0028	0.0090	12	0.0041	32	0.000070	10	0.17	31	0.00020	0.0012	0.00040	0.00061	0.000030	0.067	0.00021
11-Aug-10	29	0.5	300	330	5.6	230				92																																							
18-Aug-10	30	0.5	300	305	5.2	229	#N/A	14	0.75	96	0.80	#N/A	0.30	58	0.25	0.0011	0.00080	0.036	0.00027	0.000010	0.028	0.0010	17	0.0014	0.020	0.70	0.0020	0.00036	0.0080	3.7	0.45	0.010	0.00034	0.0030	0.017	13	0.0027	33	0.00010	8.1	0.17	42	0.00020	0.0010	0.00040	0.00067	0.000030	0.072	0.00021
25-Aug-10	31	0.5	300	310	5.2	229				85																																							
1-Sep-10	32	0.5	300	300	5.5	212	#N/A	11	1.3	90	0.70	0.15	0.30	54	0.20	0.0010	0.00040	0.035	0.00025	0.000010	0.025	0.0010	16	0.0014	0.020	0.63	0.0020	0.00033	0.0070	3.4	0.42	0.010	0.00035	0.0029	0.0090	12	0.0038	32	0.000090	5.8	0.16	30	0.00020	0.00088	0.00040	0.00060	0.000030	0.072	0.00017
8-Sep-10	33	0.5	300	350	5.3	220				81																																							
15-Sep-10	34	0.5	300	290	4.9	218	#N/A	12	0.12	106	0.70	0.20	0.30	63	0.27	0.0013	0.00030	0.036	0.00028	0.000010	0.023	0.0011	19	0.0016	0.022	0.74	0.0060	0.00037	0.0080	4.0	0.50	0.010	0.00034	0.0031	0.0090	12	0.0039	32	0.00012	5.4	0.19	32	0.00020	0.00098	0.00050	0.00073	0.000030	0.079	0.00021
22-Sep-10	35	0.5	300	245	5.2	205				120																																							
29-Sep-10	36	0.5	300	260	5.2	197	#N/A	10	0.75	116	0.80	0.20	0.30	69	0.26	0.0029	0.00070	0.035	0.00029	0.000010	0.025	0.0012	20	0.0015	0.027	0.92	0.0050	0.00042	0.0080	4.4	0.54	0.010	0.00045	0.0043	0.010	13	0.0039	37	0.000090	5.0	0.21	36	0.00020	0.0027	0.00080	0.00074	0.000030	0.090	0.00021
6-Oct-10	37	0.5	300	260	5.1	258				111																																							
13-Oct-10	38	0.5	300	310	4.8	262	#N/A	12	0.10	110	0.70	0.22	0.30	80	0.24	0.0012	0.00020	0.033	0.00032	0.000030	0.025	0.0014	23	0.00090	0.029	0.94	0.0080	0.00061	0.0070	5.2	0.64	0.010	0.00062	0.0043	0.033	13	0.0041	37	0.000090	4.8	0.24	36	0.00020	0.0010	0.0057	0.00078	0.000030	0.094	0.00022
20-Oct-10	39	0.5	300	235	5.1	254				117																																							
27-Oct-10	40	0.5	300	355	5.2	237	#N/A	8.9	0.31	90	0.50	0.19	0.30	64	0.23	0.00090	0.00030	0.032	0.00028	0.000010	0.022	0.0013	19	0.00060	0.028	0.90	0.0070	0.00069	0.0060	4.0	0.51	0.010	0.00045	0.0042	0.028	11	0.0040	33	0.000080	3.5	0.19	33	0.00020	0.00051	0.0059	0.00070	0.000030	0.094	0.00015
3-Nov-10	41	0.5	300	240	5.3	251																																										
10-Nov-10	42	0.5	300	290	4.8	235																																									
17-Nov-10	43	0.5	300	265	5.3	247																																									
24-Nov-10	44	0.5	300	315	5.2	218	#N/A	8.9	0.37	89	0.60	0.18	0.30	60	0.23	0.00080	0.00040	0.033	0.00027	0.000010	0.019	0.0012	18	0.00080	0.024	0.83	0.0060	0.00032	0.0070	3.8	0.49	0.010	0.00030	0.0030	0.010	10	0.0031	31	0.000070	2.8	0.18	27	0.00020	0.00058	0.0011	0.00073	0.000030	0.085	0.00014
1-Dec-10	45	0.5	300	335	5.3	216																																									
8-Dec-10	46	0.5	300	315	5.0	204																																									
15-Dec-10	47	0.5	300	320	5.3	208																																									
22-Dec-10	48	0.5	300	325	5.4	204	#N/A	10	1.9	87	0.50	0.18	0.30	62	0.22	0.0013	0.00060	0.038	0.00028	0.000010	0.019	0.0012	18	0.00090	0.023	0.76	0.0050	0.0027	0.0080	3.9	0.51	0.010	0.00047	0.0034	0.037	11	0.0033	34	0.000090	2.6	0.19	32	0.00020	0.00060	0.00060	0.00079	0.000030	0.089	0.00011
29-Dec-10	49	0.5	300	355	5.3	189																																									
5-Jan-11	50	0.5	300	330	5.0	172																																									
12-Jan-11	51	0.5	300	320	5.2	175																																									
19-Jan-11	52	0.5	300	330	5.2	174	#N/A	9.6	1.6	68	0.40	0.16	0.30	56	0.18	0.00080	0.00030	0.040	0.00025	0.000010	0.016	0.0010	17	0.00050	0.020	0.66	0.0050	0.00021	0.0060	3.5	0.42	0.010	0.00025	0.0029	0.0090	9.8	0.0025	30	0.000060	2.1	0.16	25	0.00020	0.00058	0.00040	0.00058	0.000030	0.071	0.000090
26-Jan-11	53	0.5	300	350	5.4	153																																									
2-Feb-11	54	0.5	300	355	5.0	133																																								
9-Feb-11	55	0.5	300	305	5.2	134																																								
16-Feb-11	56	0.5	300	335	5.3	139	#N/A	6.7	0.54	54	0.40	0.10	0.30	40	0.12	0.00050	0.00030	0.048	0.00020	0.000010	0.014	0.00080	12	0.0010	0.015	0.50	0.0050	0.017	0.0050	2.5	0.32	0.010	0.00020	0.0020	0.030	7.0	0.0017	23	0.000040	1.7	0.13	18	0.00020	0.00047	0.00040	0.00039	0.000030	0.060	0.000070
23-Feb-11	57	0.5	300	360	5.4	134																																									
2-Mar-11	58	0.5	300	375	5.0	166																																									
9-Mar-11	59	0.5	300	350	5.3	165																																									
16-Mar-11	60	0.5	300	360	5.5	142	#N/A	7.2	0.97	55	0.40	0.12	0.30	36	0.12	0.00080	0.00030	0.053	0.00018	0.000010	0.010	0.00075	11	0.00070	0.014	0.46	0.0050	0.0024	0.0040	2.2	0.29	0.010	0.00016	0.0021	0.0090	6.5	0.0019	19	0.000050	1.5	0.12	17	0.00020	0.00070	0.00040	0.00035	0.000030	0.054	0.000050
23-Mar-11	61	0.5	300	285	5.5	168																																									
30-Mar-11	62	0.5	300	370	5.6	157																																									
6-Apr-11	63	0.5	300	305	5.5	171																																									
13-Apr-11	64	0.5	300	240	5.4	173	#N/A	7.8	0.70	58	0.50	0.15	0.30	43	0.17	0.00060	0.00030	0.046	0.00022	0.000010	0.014	0.00090	13	0.00050	0.018	0.59	0.0020	0.00018	0.0060	2.5	0.35	0.010	0.00019	0.0028	0.0090	8.0	0.0021	29	0.000070	1.8	0.13	20	0.00020	0.00034	0.0031	0.00054	0.000030	0.066	0.000060
20-Apr-11	65	0.5	300	370	5.9	178																																									
27-Apr-11	66	0.5	300	335	5.5	169																																								
4-May-11	67	0.5	300	300	5.4	168																																								
11-May-11	68	0.5	300	295	5.4	165	#N/A	7.8	0.89	64	0.40	0.13	0.30	43	0.15	0.00050	0.0010	0.039	0.00021	0.000010	0.013	0.0015	13	0.00050	0.019	0.59	0.0020	0.00087	0.0060	2.5	0.33	0.010	0.00097	0.0029	0.0090	7.9	0.00092	28	0.000090	1.7	0.13	21	0.00020	0.00049	0.00080	0.00043	0.000030	0.073	0.000060
18-May-11	69	0.5	300	295	5.4	189																																									
25-May-11	70	0.5	300	280	5.5	157																																								
1-Jun-11	71	0.5	300	275	5.6	153																																								
8-Jun-11	72	0.5	300	285	5.5	152	#N/A	8.5	1.6	56	0.40	0.14	0.30	37	0.15	0.00080	0.0046	0.042	0.00018	0.000030	0.012	0.00077	11	0.00050	0.016	0.53	0.0020	0.00034	0.0050	2.2	0.29	0.010	0.00022	0.0034	0.011	7.1	0.0016	28	0.00032	1.6	0.12	17	0.00010	0.00038	0.00050	0.00037	0.000030	0.064	0.00010
15-Jun-11	73	0.5	300	315	5.6	151																																									
22-Jun-11	74	0.5	300	295	5.3	149																																								
29-Jun-11	75	0.5	300	285	5.5	149																																								
6-Jul-11	76	0.5	300	295	5.5	149	#N/A	9.1	0.97	58	0.50	0.11	0.30	37	0.16	0.00060	0.00050	0.043	0.00020	0.000010	0.014	0.00078	11	0.00050	0.016	0.58	0.0020	0.0012	0.0050	2.2	0.29	0.010	0.00018	0.0025	0.0090	7.1	0.0019	29	0.000040	1.7	0.12	18	0.000080	0.00028	0.00030	0.00038	0.000030	0.059	0.000050
13-Jul-11	77	0.5	300	290	5.6	144																																								
20-Jul-11	78	0.5	300	235	5.3	146																																								
27-Jul-11	79	0.5	300	330	5.2	138																																								
3-Aug-11	80	0.5	300	215	5.7	138	#N/A	10	1.2	51	0.30	0.12	0.30	34	0.15	0.00060	0.00070	0.043	0.00017	0.000010	0.011	0.00070	10	0.00080	0.014	0.48	0.0020	0.0050	0.0040	2.0	0.27	0.010	0.00027	0.0022	0.0090	6.4	0.0021	25	0.000060	1.7	0.11	16	0.000070	0.00028	0.00040	0.00030	0.000030	0.051	0.000050
10-Aug-11	81	0.5	300	285	5.4	134																																								
17-Aug-11	82	0.5	300	295	5.6	133																																								
24-Aug-11	83	0.5	300	245	5.5	132																																								
31-Aug-11	84	0.5	300	310	5.6	130	#N/A	11	1.4	46	0.40	0.10	0.30	33	0.13	0.00080	0.00040	0.045	0.00018	0.000010	0.013	0.00070	10.0	0.0010	0.015	0.50	0.0040	0.00029	0.0050	1.9	0.26	0.010	0.00027	0.0024	0.0090	6.4	0.0024	25	0.000040	1.8	0.11	17	0.000080	0.00020	0.00040	0.00030	0.000030	0.055	0.000040
7-Sep-11	85	0.5	300	285	5.5	120																																								
14-Sep-11	86	0.5	300	270	5.9	116																																								
21-Sep-11	87	0.5	300	270	5.2	126																																								
28-Sep-11	88	0.5	300	310	5.7	124	#N/A	10	1.3	46	0.40	0.11	0.30	31	0.13	0.00060	0.00020	0.047	0.00018	0.000010	0.0081	0.00068	9.4	0.0013	0.013	0.46	0.0030	0.00018	0.0040	1.8	0.24	0.010	0.00018	0.0018	0.0090	6.2	0.0014	25	0.000050	1.7	0.10	15	0.000080	0.00025	0.00030	0.00026	0.000030	0.050	0.000050
5-Oct-11	89	0.5	300	315	5.6	116																																								
12-Oct-11	90	0.5	300	280	6.0	123																																								
19-Oct-11	91	0.5	300	285	5.5	123																																								
26-Oct-11	92	0.5	300	280	5.5	122	#N/A	8.5	1.0	46	0.40	0.14	0.30	32	0.12	0.00050	0.00040	0.053	0.00017	0.000010	0.012	0.00063	9.7	0.0014	0.012	0.44	0.013	0.0017	0.0040	1.9	0.25	0.010	0.00017	0.0020	0.0090	6.2	0.0013	24	0.000040	1.9	0.11	16	0.000070	0.00031	0.00040	0.00027	0.000030	0.049	0.000040
2-Nov-11	93	0.5	300	310	5.7	120																																

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Calculated Production Rates for Col 2A

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
27-Jan-10	1	0.5	1448	440	4.7	1596	#N/A	3.0	0.0044	31	4.8	0.064	0.057	9.1	0.14	0.00086	0.00023	0.0023	0.000013	0.0000057	0.0048	0.00010	2.7	0.00099	0.0015	0.043	0.017	0.00029	0.00040	0.60	0.047	0.0066	0.00030	0.00041	0.0022	1.2	0.0025	1.4	0.0000035	11	0.023	8.4	0.000013	0.0000053	0.00014	0.00019	0.000035	0.0047	0.0011
3-Feb-10	2	0.5	300	270	5.2	823	#N/A	0.45	0.084	12	1.1	0.014	0.011	2.0	0.020	0.00034	0.00011	0.00087	0.0000024	0.00000054	0.0028	0.000028	0.58	0.00046	0.00063	0.016	0.0024	0.00007	0.00014	0.12	0.013	0.0100	0.00012	0.00013	0.0027	0.32	0.0011	0.75	0.0000022	3.7	0.0053	2.8	0.0000054	0.0000033	0.000068	0.000055	0.0000097	0.0019	0.00028
10-Feb-10	3	0.5	300	240	5.0	830	#N/A	0.31	0.024	8.5	0.43	0.0062	0.0072	1.4	0.0083	0.00019	0.000055	0.00061	0.0000029	0.00000072	0.0021	0.000018	0.42	0.00018	0.00040	0.0066	0.0031	0.000031	0.00012	0.093	0.0094	0.0031	0.0000056	0.000074	0.00024	0.33	0.00069	0.73	0.00000096	3.1	0.0038	2.7	0.0000048	0.0000070	0.000048	0.000027	0.0000053	0.0011	0.00011
17-Feb-10	4	0.5	300	270	4.4	703	1.6	0.43	#N/A	9.1	0.20	0.0065	0.0081	1.5	0.0079	0.00018	0.000049	0.00067	0.0000027	0.00000081	0.0024	0.000021	0.44	0.00016	0.00046	0.0091	0.0024	0.00003	0.00011	0.093	0.0099	0.00027	0.0000058	0.000086	0.00027	0.30	0.00078	0.90	0.00000081	3.1	0.0038	3.0	0.0000054	0.0000049	0.000057	0.000029	0.0000030	0.0013	0.000091
24-Feb-10	5	0.5	300	265	4.8	725				8.6																																								
3-Mar-10	6	0.5	300	260	4.8	640	#N/A	0.27	0.0026	7.1	0.073	0.0052	0.0078	1.1	0.0055	0.00011	0.000031	0.00057	0.0000031	0.00000026	0.0020	0.000015	0.34	0.00012	0.00038	0.0072	0.0013	0.000025	0.00010	0.070	0.0076	0.00026	0.000035	0.000068	0.00026	0.29	0.00053	0.78	0.00000078	2.6	0.0030	2.4	0.0000052	0.000022	0.000031	0.00019	0.0000018	0.0010	0.000049
10-Mar-10	7	0.5	300	220	5.6	572				5.1																																								
17-Mar-10	8	0.5	300	300	5.4	516	#N/A	0.24	0.053	6.5	0.042	0.0048	0.0090	1.1	0.0056	0.000081	0.000048	0.00070	0.0000033	0.00000030	0.0021	0.000016	0.33	0.00011	0.00030	0.0070	0.00090	0.000026	0.00042	0.068	0.0074	0.00030	0.000042	0.000045	0.00030	0.29	0.00034	0.86	0.00000030	2.2	0.0030	2.1	0.0000060	0.00000030	0.000045	0.000017	0.00000090	0.00093	0.000029
24-Mar-10	9	0.5	300	275	5.1	533				6.9																																								
31-Mar-10	10	0.5	300	305	4.8	378	#N/A	0.26	0.0031	5.2	0.024	0.0040	0.0092	0.96	0.0047	0.000061	0.000024	0.00076	0.0000031	0.00000031	0.0014	0.000015	0.28	0.000095	0.00029	0.0068	0.00061	0.000035	0.00012	0.062	0.0070	0.00031	0.000023	0.000049	0.00031	0.25	0.00029	0.69	0.0000015	2.5	0.0028	1.8	0.0000061	0.0000061	0.000027	0.000013	0.00000092	0.00098	0.000021
7-Apr-10	11	0.5	300	315	4.9	442				6.0																																								
14-Apr-10	12	0.5	300	270	4.8	441	#N/A	0.29	0.0027	5.6	0.024	0.0049	0.0081	1.1	0.0063	0.000059	0.000024	0.00071	0.0000043	0.00000054	0.0014	0.000018	0.33	0.00068	0.00038	0.0097	0.00054	0.000018	0.00014	0.072	0.0081	0.00027	0.000026	0.000062	0.00027	0.27	0.00030	0.80	0.0000014	1.6	0.0032	1.7	0.0000054	0.0000062	0.000016	0.000016	0.00000081	0.0012	0.000024
21-Apr-10	13	0.5	300	280	4.9	452				5.6																																								
28-Apr-10	14	0.5	300	310	4.7	422	#N/A	0.19	0.0031	6.0	0.028	0.0050	0.0093	1.3	0.0060	0.000065	0.000028	0.00081	0.0000050	0.00000031	0.0016	0.000021	0.38	0.000078	0.00044	0.011	0.00062	0.000012	0.00016	0.084	0.0096	0.00031	0.000024	0.000068	0.00031	0.33	0.00030	0.94	0.0000019	1.7	0.0038	1.8	0.0000062	0.0000015	0.000022	0.000017	0.00000093	0.0015	0.000020
5-May-10	15	0.5	300	235	4.8	393				3.6																																								
12-May-10	16	0.5	300	235	5.3	369	#N/A	0.24	0.020	4.4	0.019	0.0038	0.0071	1.0	0.0045	0.000045	0.000014	0.00059	0.0000038	0.00000024	0.0012	0.000018	0.30	0.000033	0.00035	0.0095	0.00035	0.000052	0.00016	0.072	0.0081	0.00024	0.000014	0.000063	0.00021	0.26	0.00020	0.86	0.0000028	1.1	0.0032	1.2	0.0000047	0.0000024	0.000014	0.0000046	0.00000071	0.0012	0.000012
19-May-10	17	0.5	300	285	5.6	336				3.6																																								
26-May-10	18	0.5	300	305	5.0	351	#N/A	0.39	0.013	3.8	0.024	0.0058	0.0092	1.6	0.0068	0.000052	0.000031	0.00089	0.0000064	0.00000031	0.0014	0.000026	0.46	0.000076	0.00054	0.014	0.00043	0.000018	0.00021	0.096	0.011	0.00031	0.000021	0.000085	0.00031	0.34	0.00024	0.96	0.0000018	1.1	0.0044	1.5	0.0000061	0.000025	0.000015	0.000020	0.00000092	0.0019	0.000016
2-Jun-10	19	0.5	300	275	5.1	338				3.4																																								
9-Jun-10	20	0.5	300	280	5.1	320	#N/A	0.30	0.039	3.6	0.028	0.0050	0.0084	1.3	0.0068	0.000042	0.000020	0.00081	0.0000053	0.00000028	0.0011	0.000026	0.38	0.000048	0.00051	0.016	0.00022	0.000011	0.00020	0.093	0.011	0.00028	0.000013	0.000078	0.00025	0.32	0.00019	0.90	0.0000039	0.81	0.0043	1.3	0.0000056	0.000026	0.000011	0.000017	0.00000084	0.0017	0.000013
16-Jun-10	21	0.5	300	250	5.1	307				2.6																																								
23-Jun-10	22	0.5	300	270	4.9	304	#N/A	0.30	0.0027	2.8	0.027	0.0016	0.0081	1.6	0.0076	0.000046	0.000022	0.00079	0.0000065	0.00000027	0.0011	0.000025	0.46	0.000043	0.00053	0.018	0.00027	0.000012	0.00022	0.10	0.012	0.00027	0.000025	0.000076	0.00024	0.38	0.00017	0.91	0.0000027	0.59	0.0047	1.1	0.0000054	0.000031	0.000011	0.000017	0.00000081	0.0018	0.0000095
30-Jun-10	23	0.5	300	285	5.2	273				2.7																																								
7-Jul-10	24	0.5	300	315	5.1	267	#N/A	0.32	0.023	2.9	0.025	0.032	0.0095	1.6	0.0068	0.000041	0.000025	0.00098	0.0000076	0.00000032	0.0011	0.000031	0.45	0.000063	0.00060	0.020	0.00038	0.000019	0.00025	0.11	0.014	0.00032	0.000016	0.00011	0.032	0.41	0.00017	1.0	0.0000032	0.51	0.0054	1.2	0.0000063	0.000036	0.000013	0.000020	0.00000095	0.0022	0.0000091
14-Jul-10	25	0.5	300	290	5.1	247				1.8																																								
21-Jul-10	26	0.5	300	320	4.9	247	#N/A	0.39	0.011	2.6	0.022	0.0054	0.0096	1.7	0.0077	0.000029	0.000019	0.0010	0.0000080	0.00000032	0.0011	0.000033	0.51	0.000045	0.00062	0.021	0.00035	0.000011	0.00022	0.11	0.013	0.00032	0.000013	0.000093	0.00029	0.42	0.00015	1.0	0.0000032	0.41	0.0053	1.0	0.0000064	0.000035	0.000013	0.000019	0.00000096	0.0022	0.0000077
28-Jul-10	27	0.5	300	315	5.2	238				2.7																																								
4-Aug-10	28	0.5	300	290	5.1	234	#N/A	0.35	0.027	2.6	0.020	0.0055	0.0087	1.6	0.0069	0.000029	0.000012	0.00098	0.0000067	0.00000029	0.0012	0.000029	0.49	0.000046	0.00055	0.019	0.00029	0.0000096	0.00020	0.10	0.013	0.00058	0.000015	0.000081	0.00026	0.35	0.00012	0.94	0.0000020	0.29	0.0048	0.90	0.0000058	0.000035	0.000012	0.000018	0.00000087	0.0019	0.0000061
11-Aug-10	29	0.5	300	330	5.6	230				3.0																																								
18-Aug-10	30	0.5	300	305	5.2	229	#N/A	0.42	0.023	2.9	0.024	#N/A	0.0092	1.8	0.0076	0.000034	0.000024	0.0011	0.0000082	0.00000031	0.00084	0.000031	0.52	0.000043	0.00062	0.021	0.000061	0.000011	0.00024	0.11	0.014	0.00031	0.000010	0.000092	0.00052	0.38	0.000081	1.0	0.0000031	0.25	0.0053	1.3	0.0000061	0.000032	0.000012	0.000020	0.00000092	0.0022	0.0000064
25-Aug-10	31	0.5	300	310	5.2	229				2.6																																								
1-Sep-10	32	0.5	300	300	5.5	212	#N/A	0.34	0.040	2.7	0.021	0.0045	0.0090	1.6	0.0061	0.000030	0.000012	0.0011	0.0000075	0.00000030	0.00075	0.000031	0.48	0.000042	0.00059	0.019	0.000060	0.0000099	0.00021	0.10	0.013	0.00030	0.000011	0.000087	0.00027	0.35	0.00012	0.95	0.0000027	0.17	0.0049	0.90	0.0000060	0.000026	0.000012	0.000018	0.00000090	0.0022	0.0000051
8-Sep-10	33	0.5	300	350	5.3	220				2.8																																								
15-Sep-10	34	0.5	300	290	4.9	218	#N/A	0.34	0.0035	3.1	0.020	0.0058	0.0087	1.8	0.0079	0.000038	0.0000087	0.0010	0.0000081	0.00000029	0.00067	0.000032	0.54	0.000046	0.00063	0.021	0.00017	0.000011	0.00023	0.11	0.015	0.00029	0.0000099	0.000090	0.00026	0.34	0.00011	0.94	0.0000035	0.16	0.0055	0.93	0.0000058	0.000028	0.000015	0.000021	0.00000087	0.0023	0.0000061
22-Sep-10	35	0.5	300	245	5.2	205				2.9																																								
29-Sep-10	36	0.5	300	260	5.2	197	#N/A	0.27	0.020	3.0	0.021	0.0052	0.0078	1.8	0.0068	0.000075	0.000018	0.00092	0.0000075	0.00000026	0.00065	0.000032	0.53	0.000039	0.00069	0.024	0.00013	0.000011	0.00021	0.11	0.014	0.00026	0.000012	0.00011	0.00026	0.34	0.00010	0.96	0.0000023	0.13	0.0054	0.94	0.0000052	0.000070	0.000021	0.000019	0.00000078	0.0023	0.0000055
6-Oct-10	37	0.5	300	260	5.1	258				2.9																																								
13-Oct-10	38	0.5	300	310	4.8	262	#N/A	0.38	0.0031	3.4	0.022	0.0068	0.0093	2.5	0.0076	0.000037	0.0000062	0.0010	0.0000099	0.00000093	0.00077	0.000043	0.73	0.000028	0.00090	0.029	0.00025	0.000019	0.00022	0.16	0.020	0.00031	0.000019	0.00013	0.0010	0.41	0.00013	1.2	0.0000028	0.15	0.0075	1.1	0.0000062	0.000032	0.00018	0.000024	0.00000093	0.0029	0.0000068
20-Oct-10	39	0.5	300	235	5.1	254				2.7																																								
27-Oct-10	40	0.5	300	355	5.2	237	#N/A	0.31	0.011	3.2	0.018	0.0067	0.011	2.3	0.0082	0.000032	0.000011	0.0011	0.0000099	0.00000036	0.00077	0.000045	0.67	0.000021	0.00100	0.032	0.00025	0.000024	0.00021	0.14	0.018	0.00036	0.000016	0.00015	0.00099	0.40	0.00014	1.2	0.0000028	0.12	0.0068	1.2	0.0000071	0.000018	0.00021	0.000025	0.0000011	0.0033	0.0000053
3-Nov-10	41	0.5	300	240	5.3	251																																											
10-Nov-10	42	0.5	300	290	4.8	235																																											
17-Nov-10	43	0.5	300	265	5.3	247																																											
24-Nov-10	44	0.5	300	315	5.2	218	#N/A	0.28	0.012	2.8	0.019	0.0057	0.0095	1.9	0.0071	0.000025	0.000013	0.0010	0.0000085	0.00000032	0.00061	0.000037	0.56	0.000025	0.00074	0.026	0.00019	0.000010	0.00022	0.12	0.015	0.00032	0.0000095	0.000095	0.00032	0.32	0.000099	0.98	0.0000022	0.088	0.0057	0.86	0.0000063	0.000018	0.000035	0.000023	0.00000095	0.0027	0.0000044
1-Dec-10	45	0.5	300	335	5.3	216																																											
8-Dec-10	46	0.5	300	315	5.0	204																																											
15-Dec-10	47	0.5	300	320	5.3	208																																											
22-Dec-10	48	0.5	300	325	5.4	204	#N/A	0.34	0.062	2.8	0.016	0.0059	0.0098	2.0	0.0071	0.000042	0.000020	0.0012	0.0000091	0.00000033	0.00062	0.000039	0.60	0.000029	0.00076	0.025	0.00016	0.000089	0.00026	0.13	0.017	0.00033	0.000015	0.00011	0.0012	0.36	0.00011	1.1	0.0000029	0.086	0.0062	1.0	0.0000065	0.000020	0.000020	0.000026	0.00000098	0.0029	0.0000036
29-Dec-10	49	0.5	300	355	5.3	189																																											
5-Jan-11	50	0.5	300	330	5.0	172																																											
12-Jan-11	51	0.5	300	320	5.2	175																																											
19-Jan-11	52	0.5	300	330	5.2	174	#N/A	0.32	0.052	2.2	0.013	0.0053	0.0099	1.9	0.0059	0.000026	0.0000099	0.0013	0.0000083	0.00000033	0.00053	0.000033	0.55	0.000017	0.00066	0.022	0.0017	0.0000069	0.00020	0.12	0.014	0.00033	0.0000083	0.000096	0.00030	0.32	0.000082	0.98	0.0000020	0.070	0.0054	0.83	0.0000066	0.000019	0.000013	0.000019	0.00000099	0.0023	0.0000030
26-Jan-11	53	0.5	300	350	5.4	153																																											
2-Feb-11	54	0.5	300	355	5.0	133																																											
9-Feb-11	55	0.5	300	305	5.2	134																																											
16-Feb-11	56	0.5	300	335	5.3	139	#N/A	0.22	0.018	1.8	0.013	0.0034	0.010	1.4	0.0042	0.000017	0.000010	0.0016	0.0000067	0.00000034	0.00047	0.000027	0.41	0.000034	0.00050	0.017	0.00017	0.00058	0.00017	0.082	0.011	0.00034	0.0000067	0.000067	0.0010	0.23	0.000056	0.77	0.0000013	0.056	0.0042	0.60	0.0000067	0.000016	0.000013	0.000013	0.00000010	0.0020	0.0000023
23-Feb-11	57	0.5	300	360	5.4	134																																											
2-Mar-11	58	0.5	300	375	5.0	166																																											
9-Mar-11	59	0.5	300	350	5.3	165																																											
16-Mar-11	60	0.5	300	360	5.5	142	#N/A	0.26	0.035	2.0	0.014	0.0043	0.011	1.3	0.0044	0.000029	0.000011	0.0019	0.0000065	0.00000036	0.00037	0.000027	0.40	0.000025	0.00051	0.017	0.00018	0.000087	0.00014	0.078	0.010	0.00036	0.0000058	0.000076	0.00032	0.23	0.000067	0.68	0.0000018	0.053	0.0043	0.60	0.0000072	0.000025	0.000014	0.000012	0.0000011	0.0019	0.0000018
23-Mar-11	61	0.5	300	285	5.5	168																																											
30-Mar-11	62	0.5	300	370	5.6	157																																											
6-Apr-11	63	0.5	300	305	5.5	171																																											
13-Apr-11	64	0.5	300	240	5.4	173	#N/A	0.19	0.017	1.4	0.012	0.0036	0.0072	1.0	0.0041	0.000014	0.0000072	0.0011	0.0000053	0.00000024	0.00033	0.000022	0.31	0.000012	0.00043	0.014	0.000048	0.0000043	0.00014	0.061	0.0083	0.00024	0.0000046	0.000067	0.00022	0.19	0.000049	0.70	0.0000017	0.042	0.0031	0.49	0.0000048	0.0000082	0.000074	0.000013	0.00000072	0.0016	0.0000014
20-Apr-11	65	0.5	300	370	5.9	178																																											
27-Apr-11	66	0.5	300	335	5.5	169																																											
4-May-11	67	0.5	300	300	5.4	168																																											
11-May-11	68	0.5	300	295	5.4	165	#N/A	0.23	0.026	1.9	0.012	0.0038	0.0089	1.3	0.0043	0.000015	0.000030	0.0012	0.0000062	0.00000030	0.00037	0.000043	0.39	0.000015	0.00056	0.017	0.000059	0.000026	0.00018	0.072	0.0096	0.00030	0.000029	0.000086	0.00027	0.23	0.000027	0.83	0.0000027	0.051	0.0039	0.61	0.0000059	0.000014	0.000024	0.000013	0.00000089	0.0022	0.0000018
18-May-11	69	0.5	300	295	5.4	189																																											
25-May-11	70	0.5	300	280	5.5	157																																											
1-Jun-11	71	0.5	300	275	5.6	153																																											
8-Jun-11	72	0.5	300	285	5.5	152	#N/A	0.24	0.044	1.6	0.011	0.0040	0.0086	1.1	0.0043	0.000023	0.00013	0.0012	0.0000051	0.00000086	0.00035	0.000022	0.32	0.000014	0.00044	0.015	0.000057	0.0000097	0.00014	0.063	0.0082	0.00029	0.0000063	0.000097	0.00031	0.20	0.000046	0.78	0.0000091	0.047	0.0034	0.49	0.0000029	0.000011	0.000014	0.000010	0.00000086	0.0018	0.0000029
15-Jun-11	73	0.5	300	315	5.6	151																																											
22-Jun-11	74	0.5	300	285	5.5	149																																											
29-Jun-11	75	0.5	300	285	5.5	149																																											
6-Jul-11	76	0.5	300	295	5.5	149	#N/A	0.27	0.029	1.7	0.015	0.0032	0.0089	1.1	0.0046	0.000018	0.000015	0.0013	0.0000059	0.00000030	0.00040	0.000023	0.33	0.000015	0.00047	0.017	0.000059	0.000035	0.00015	0.065	0.0086	0.00030	0.0000053	0.000074	0.00027	0.21	0.000057	0.85	0.0000012	0.051	0.0036	0.52	0.0000024	0.0000083	0.0000089	0.000011	0.00000089	0.0017	0.0000015
13-Jul-11	77	0.5	300	290	5.6	144																																											
20-Jul-11	78	0.5	300	235	5.3	146																																											
27-Jul-11	79	0.5	300	330	5.2	138																																											
3-Aug-11	80	0.5	300	215	5.7	138	#N/A	0.22	0.026	1.1	0.0065	0.0026	0.0065	0.74	0.0032	0.000013	0.000015	0.00093	0.0000037	0.00000022	0.00024	0.000015	0.22	0.000017	0.00031	0.010	0.000043	0.00011	0.000086	0.043	0.0058	0.00022	0.0000058	0.000047	0.00019	0.14	0.000045	0.53	0.0000013	0.035	0.0024	0.34	0.0000015	0.0000060	0.0000086	0.0000065	0.00000065	0.0011	0.0000011
10-Aug-11	81	0.5	300	285	5.4	134																																											
17-Aug-11	82	0.5	300	295	5.6	133																																											
24-Aug-11	83	0.5	300	245	5.5	132																																											
31-Aug-11	84	0.5	300	310	5.6	130	#N/A	0.33	0.043	1.4	0.012	0.0031	0.0093	1.0	0.0041	0.000025	0.000012	0.0014	0.0000056	0.00000031	0.00039	0.000022	0.31	0.000031	0.00046	0.015	0.00012	0.0000090	0.00016	0.060	0.0080	0.00031	0.0000084	0.000074	0.00028	0.20	0.000073	0.78	0.0000012	0.056	0.0034	0.54	0.0000025	0.0000062

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Leachate Results for Col 3

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
27-Jan-10	1	0.5	1230	470	3.6	8110	5900	11250	#N/A	19838	110	0.060	7.5	2710	2340	0.0017	0.0079	0.091	0.023	0.000030	0.13	0.025	368	0.26	1.2	283	654	0.0045	0.089	434	12	0.010	0.056	0.82	3.0	261	0.13	37	0.00052	274	2.8	5100	0.0065	0.000010	0.0091	0.64	0.027	2.1	0.13
3-Feb-10	2	0.5	300	365	3.4	3950	2950	4800	#N/A	7042	34	0.10	3.0	1290	657	0.00070	0.0057	0.033	0.0063	0.000010	0.044	0.0091	330	0.047	0.34	141	189	0.0014	0.027	112	5.1	0.20	0.016	0.23	0.14	137	0.067	36	0.00013	113	1.8	1840	0.0041	0.00053	0.0020	0.28	0.0012	0.91	0.025
10-Feb-10	3	0.5	300	265	3.4	3780	1050	1800	#N/A	3545	18	0.25	3.0	1360	280	0.00020	0.0060	0.022	0.0061	0.000010	0.10	0.0063	385	0.031	0.25	66	72	0.00060	0.018	96	3.8	0.14	0.0082	0.17	0.060	121	0.046	38	0.000060	69	1.5	1130	0.0028	0.00016	0.0030	0.16	0.00078	0.49	0.0080
17-Feb-10	4	0.5	300	290	3.4	3400	650	1050	#N/A	1908	6.4	1.2	3.0	1060	144	0.00020	0.0029	0.022	0.0047	0.000010	0.093	0.0037	301	0.017	0.16	43	38	0.00065	0.015	74	2.5	0.010	0.0051	0.11	0.020	78	0.041	38	0.000030	38	0.99	714	0.0022	0.00025	0.0023	0.092	0.00015	0.33	0.0037
24-Feb-10	5	0.5	300	300	3.6	1951				1311																																								
3-Mar-10	6	0.5	300	265	3.6	1445	149	344	#N/A	884	3.0	1.3	0.30	518	40	0.00020	0.0014	0.019	0.0021	0.000010	0.069	0.0017	152	0.0050	0.059	19	0.57	0.00041	0.011	34	1.2	0.010	0.0018	0.042	0.010	46	0.016	31	0.000060	13	0.53	317	0.0015	0.00096	0.0015	0.035	0.000030	0.14	0.0011
10-Mar-10	7	0.5	300	295	3.8	1205				727																																								
17-Mar-10	8	0.5	300	295	3.7	1046	51	198	#N/A	557	2.0	0.94	0.30	400	19	0.00020	0.00060	0.018	0.0014	0.000010	0.056	0.0011	121	0.0022	0.033	12	0.31	0.00045	0.0090	24	0.91	0.030	0.00087	0.024	0.010	37	0.0084	29	0.000020	7.6	0.39	192	0.0011	0.00093	0.0013	0.020	0.000030	0.081	0.00045
24-Mar-10	9	0.5	300	295	3.7	896				555																																							
31-Mar-10	10	0.5	300	285	3.7	844	38	141	#N/A	530	2.0	0.82	0.30	307	13	0.00020	0.00040	0.021	0.0011	0.000010	0.046	0.00087	93	0.0020	0.033	11	0.22	0.00086	0.0060	19	0.69	0.020	0.00077	0.019	0.010	32	0.0079	26	0.000020	4.5	0.32	160	0.0010	0.0012	0.0011	0.015	0.00012	0.071	0.00031
7-Apr-10	11	0.5	300	305	3.6	966				554																																							
14-Apr-10	12	0.5	300	305	3.5	1337	157	349	#N/A	850	2.0	1.1	0.30	552	41	0.00020	0.00070	0.016	0.0022	0.000010	0.043	0.0016	169	0.0027	0.073	23	0.65	0.00061	0.0070	31	1.2	0.010	0.0014	0.037	0.010	35	0.013	33	0.000080	3.2	0.53	292	0.0011	0.0012	0.0013	0.040	0.000030	0.13	0.00059
21-Apr-10	13	0.5	300	260	3.4	1677				1057																																							
28-Apr-10	14	0.5	300	345	3.3	1564	99	176	#N/A	1107	2.0	0.95	0.30	620	51	0.00020	0.0012	0.013	0.0030	0.000010	0.038	0.0020	191	0.0042	0.098	32	1.3	0.0015	0.0070	35	1.4	0.010	0.0011	0.045	0.010	32	0.0096	34	0.00013	2.1	0.59	331	0.0010	0.0014	0.0014	0.054	0.000030	0.14	0.00078
5-May-10	15	0.5	300	310	3.3	1450				866																																							
12-May-10	16	0.5	300	320	3.4	1215	146	286	#N/A	727	2.0	0.86	0.30	435	29	0.00020	0.00040	0.013	0.0023	0.000010	0.037	0.0013	135	0.0031	0.077	28	1.1	0.00012	0.0060	24	0.92	0.010	0.00090	0.033	0.43	22	0.0057	34	0.000080	1.2	0.40	226	0.00080	0.0011	0.0016	0.049	0.000030	0.092	0.00079
19-May-10	17	0.5	300	295	3.4	1023				486																																							
26-May-10	18	0.5	300	350	3.4	1032	124	291	#N/A	516	2.0	0.74	0.30	355	29	0.00020	0.00080	0.013	0.0022	0.000010	0.036	0.0011	111	0.0028	0.068	26	0.62	0.0023	0.0070	19	0.77	0.010	0.00051	0.029	0.42	16	0.0052	34	0.000040	1.1	0.33	194	0.00070	0.0010	0.0017	0.047	0.000030	0.30	0.00044
2-Jun-10	19	0.5	300	290	3.3	987				451																																							
9-Jun-10	20	0.5	300	295	3.3	920	91	212	#N/A	449	2.0	0.64	0.30	271	24	0.00020	0.0011	0.014	0.0017	0.000010	0.031	0.00098	82	0.0019	0.060	26	0.61	0.000080	0.0060	16	0.67	0.010	0.00036	0.025	0.46	13	0.0047	33	0.000060	1.0	0.28	163	0.00060	0.00089	0.0016	0.036	0.000030	0.068	0.00036
16-Jun-10	21	0.5	300	290	3.3	909				296																																							
23-Jun-10	22	0.5	300	290	3.5	894	68	215	#N/A	417	2.0	0.63	0.30	295	23	0.00020	0.0011	0.014	0.0020	0.000010	0.032	0.00091	94	0.0026	0.057	29	0.57	0.00030	0.0060	15	0.64	0.010	0.00074	0.024	0.43	14	0.0060	35	0.000070	0.87	0.27	155	0.00060	0.00073	0.0015	0.034	0.000030	0.069	0.00031
30-Jun-10	23	0.5	300	315	3.5	863				388																																						
7-Jul-10	24	0.5	300	365	3.4	719	74	162	#N/A	305	2.0	0.47	0.30	193	14	0.00020	0.0022	0.017	0.0016	0.000010	0.035	0.00068	59	0.0028	0.046	19	0.32	0.00078	0.012	11	0.47	0.010	0.00056	0.020	1.9	9.8	0.0048	29	0.000030	0.74	0.21	121	0.00040	0.00061	0.0014	0.029	0.000030	0.055	0.00023
14-Jul-10	25	0.5	300	290	3.3	785				279																																						
21-Jul-10	26	0.5	300	295	3.4	750	64	187	#N/A	313	1.0	0.47	0.30	214	15	0.00020	0.0011	0.013	0.0017	0.000010	0.030	0.00073	68	0.0019	0.052	23	0.46	0.00027	0.0050	11	0.49	0.010	0.00024	0.020	0.0090	11	0.0029	34	0.000030	0.78	0.19	118	0.00040	0.0010	0.0016	0.030	0.000030	0.058	0.00028
28-Jul-10	27	0.5	300	295	3.3	735				300																																						
4-Aug-10	28	0.5	300	290	3.5	724	43	167	#N/A	332	1.0	0.45	0.30	209	14	0.00020	0.0012	0.015	0.0014	0.000010	0.022	0.00065	68	0.0018	0.046	20	0.48	0.0014	0.0050	9.8	0.45	0.030	0.00044	0.017	0.36	9.0	0.0043	33	0.000030	0.68	0.19	110	0.00040	0.00048	0.0012	0.030	0.000030	0.051	0.00019
11-Aug-10	29	0.5	300	300	3.5	721				285																																						
18-Aug-10	30	0.5	300	285	3.5	687	38	164	#N/A	302	1.0	0.40	0.30	193	13	0.00020	0.00060	0.015	0.0014	0.000010	0.027	0.00062	63	0.0019	0.043	19	0.55	0.00022	0.0050	9.1	0.43	0.010	0.00025	0.018	0.26	8.8	0.0015	33	0.000030	0.62	0.18	145	0.00040	0.00052	0.0014	0.030	0.000030	0.051	0.00019
25-Aug-10	31	0.5	300	315	3.3	678				306																																						
1-Sep-10	32	0.5	300	290	3.4	684	47	149	#N/A	312	1.0	0.34	0.30	174	12	0.00020	0.00020	0.015	0.0013	0.000010	0.022	0.00060	57	0.0017	0.047	19	0.42	0.00013	0.0040	7.9	0.38	0.010	0.00011	0.018	0.27	8.2	0.0027	33	0.000030	0.60	0.17	104	0.00040	0.00034	0.0018	0.026	0.000030	0.053	0.00014
8-Sep-10	33	0.5	300	295	3.3	685				383																																						
15-Sep-10	34	0.5	300	360	3.5	532	39	124	#N/A	241	1.0	0.33	0.30	143	10	0.00020	0.00030	0.022	0.0012	0.000010	0.035	0.00048	46	0.0013	0.034	15	0.31	0.00042	0.0040	6.6	0.33	0.020	0.00021	0.015	0.19	6.5	0.0034	27	0.000030	0.58	0.14	82	0.00030	0.00044	0.0013	0.059	0.000030	0.045	0.00014
22-Sep-10	35	0.5	300	340	3.3	517				359																																						
29-Sep-10	36	0.5	300	300	3.3	541	57	130	#N/A	310	1.0	0.37	0.30	168	10	0.00020	0.00060	0.016	0.0013	0.000010	0.020	0.00071	54	0.0020	0.042	18	0.57	0.00071	0.0040	7.8	0.38	0.010	0.00042	0.020	0.22	8.1	0.0032	36	0.000050	0.69	0.16	103	0.00040	0.0014	0.0018	0.027	0.00021	0.054	0.00020
6-Oct-10	37	0.5	300	290	3.2	692				394																																						
13-Oct-10	38	0.5	300	295	3.2	687	59	158	#N/A	313	1.0	0.36	0.30	170	10	0.00020	0.00020	0.016	0.0013	0.000010	0.024	0.00054	55	0.0018	0.043	17	0.60	0.00015	0.0040	8.0	0.40	0.010	0.0023	0.019	0.29	7.7	0.0026	35	0.000010	0.64	0.17	93	0.00040	0.00064	0.0052	0.026	0.000030	0.041	0.00015
20-Oct-10	39	0.5	300	280	3.2	664				395																																						
27-Oct-10	40	0.5	300	370	3.5	532	30	96	#N/A	230	1.0	0.27	0.30	119	8.1	0.00020	0.00040	0.022	0.0011	0.000010	0.021	0.00044	39	0.0010	0.034	13	0.29	0.00060	0.0030	5.4	0.27	0.010	0.000060	0.014	0.15	5.4	0.0019	24	0.000030	0.45	0.11	76	0.00030	0.000080	0.0047	0.019	0.000030	0.036	0.00033
3-Nov-10	41	0.5	300	320	3.5	599																																									
10-Nov-10	42	0.5	300	360	3.4	634																																								
17-Nov-10	43	0.5	300	295	3.5	589																																								
24-Nov-10	44	0.5	300	270	3.3	651	44	131	#N/A	250	1.0	0.32	0.30	141	11	0.00020	0.00070	0.015	0.0014	0.000010	0.017	0.00051	46	0.0015	0.035	16	0.54	0.00030	0.0050	6.2	0.32	0.010	0.00020	0.014	0.25	6.2	0.0027	30	0.000030	0.54	0.13	83	0.00030	0.00031	0.0051	0.026	0.000030	0.044	0.00016
1-Dec-10	45	0.5	300	380	3.4	529																																									
8-Dec-10	46	0.5	300	380	3.3	529																																								
15-Dec-10	47	0.5	300	285	3.3	598																																								
22-Dec-10	48	0.5	300	300	3.2	589	55	128	#N/A	215	1.0	0.27	0.30	129	8.2	0.00020	0.00040	0.018	0.0011	0.000010	0.016	0.00044	42	0.0014	0.035	13	0.58	0.00028	0.0040	5.6	0.00020	0.010	0.00026	0.013	0.30	6.5	0.0016	32	0.000030	0.60	0.13	86	0.00030	0.00034	0.0015	0.022	0.000030	0.035	0.00012
29-Dec-10	49	0.5	300	260	3.3	603																																									
5-Jan-11	50	0.5	300	300	3.3	516																																								
12-Jan-11	51	0.5	300	320	3.4	449																																								
19-Jan-11	52	0.5	300	260	3.3	552	43	109	#N/A	208	1.0	0.25	0.30	122	7.0	0.00030	0.00050	0.017	0.00099	0.000010	0.014	0.00044	40	0.00080	0.034	12	0.55	0.00086	0.0040	5.2	0.27	0.010	0.0032	0.013	0.21	6.4	0.0018	29	0.000030	0.55	0.12	74	0.00030	0.00041	0.0013	0.020	0.000030	0.038	0.00010
26-Jan-11	53	0.5	300	285	3.3	530																																									
2-Feb-11	54	0.5	300	370	3.3	424																																								
9-Feb-11	55	0.5	300	290	3.3	473																																								
16-Feb-11	56	0.5	300	380	3.5	427	29	70	#N/A	121	2.0	0.14	0.30	82	4.3	0.00040	0.00040	0.022	0.00077	0.000010	0.015	0.00034	27	0.0010	0.022	7.8	0.29	0.0030	0.0030	3.5	0.18	0.010	0.0024	0.0088	0.18	4.6	0.0017	22	0.000060	0.80	0.082	48	0.00020	0.000060	0.0018	0.014	0.000030	0.040	0.000070
23-Feb-11	57	0.5	300	430	3.5	440																																								
2-Mar-11	58	0.5	300	350	3.4	439																																								
9-Mar-11	59	0.5	300	405	3.6	321																																								
16-Mar-11	60	0.5	300	415	3.6	387	21	52	#N/A	99	2.0	0.14	0.30	66	2.7	0.00020	0.00060	0.025	0.00059	0.000010	0.0093	0.00025	22	0.00060	0.017	5.9	0.18	0.00023	0.0020	2.7	0.15	0.010	0.00012	0.0066	0.068	3.9	0.0011	19	0.00012	0.33	0.066	38	0.00020	0.00033	0.0010	0.0096	0.000030	0.018	0.000040
23-Mar-11	61	0.5	300	390	3.5	385																																								
30-Mar-11	62	0.5	300	345	3.6	393																																								
6-Apr-11	63	0.5	300	325	3.4	432																																								
13-Apr-11	64	0.5	300	325	3.5	443	22	56	#N/A	130	1.0	0.18	0.30	77	4.6	0.00020	0.00040	0.029	0.00067	0.000010	0.012	0.00037	26	0.00050	0.023	7.9	0.22	0.00024	0.0020	3.2	0.18	0.010	0.00050	0.0099	0.11	4.2	0.0011	20	0.000040	0.39	0.076	49	0.00020	0.00016	0.0026	0.012	0.000030	0.024	0.000050
20-Apr-11	65	0.5	300	310	3.4	457																																								
27-Apr-11	66	0.5	300	285	3.4	510																																								
4-May-11	67	0.5	300	360	3.3	464																																								
11-May-11	68	0.5	300	290	3.4	503	32	74	#N/A	163	1.0	0.17	0.30	83	4.2	0.00020	0.00020	0.020	0.00070	0.000010	0.013	0.00034	28	0.00060	0.025	7.5	0.37	0.00023	0.0030	3.3	0.19	0.010	0.000080	0.0098	0.0090	4.5	0.00036	21	0.000040	0.45	0.080	52	0.00020	0.00035	0.0020	0.014	0.000030	0.029	0.000070
18-May-11	69	0.5	300	305	3.3	461																																								
25-May-11	70	0.5	300	280	3.3	534																																								
1-Jun-11	71	0.5	300	295	3.2	535																																								
8-Jun-11	72	0.5	300	345	3.4	515	41	100	#N/A	160	1.0	0.22	0.30	82	5.1	0.00020	0.0035	0.025	0.00077	0.000010	0.014	0.00037	27	0.0012	0.025	7.3	0.32	0.00077	0.0030	3.3	0.19	0.010	0.00011	0.0099	0.17	4.4	0.0016	22	0.000070	0.67	0.078	51	0.00025	0.00064	0.0023	0.015	0.000030	0.031	0.000070
15-Jun-11	73	0.5	300	310	3.2	406																																								
22-Jun-11	74	0.5	300	330	3.3	521																																								
29-Jun-11	75	0.5	300	350	3.2	500																																								
6-Jul-11	76	0.5	300	380	3.4	496	34	80	#N/A	172	1.0	0.16	0.30	88	5.8	0.00020	0.00020	0.026	0.00080	0.000010	0.012	0.00037	29	0.00060	0.025	7.8	0.37	0.0095	0.0030	3.6	0.20	0.010	0.000020	0.0098	0.0090	4.8	0.0013	23	0.000010	0.53	0.086	57	0.00024	0.00021	0.0011	0.014	0.000030	0.034	0.000060
13-Jul-11	77	0.5	300	330	3.2	514																																								
20-Jul-11	78	0.5	300	385	3.2	509																																								
27-Jul-11	79	0.5	300	290	3.1	562																																								
3-Aug-11	80	0.5	300	190	3.2	553	46	86	#N/A	182	1.0	0.18	0.30	85	5.4	0.00020	0.0017	0.017	0.00076	0.000010	0.0075	0.00037	28	0.0018	0.025	7.4	0.53	0.00093	0.0030	3.5	0.20	0.010	0.000080	0.012	0.0090	4.8	0.0012	22	0.000030	0.57	0.082	56	0.00043	0.00032	0.0015	0.015	0.000030	0.029	0.00010
10-Aug-11	81	0.5	300	285	3.1	555																																								
17-Aug-11	82	0.5	300	295	3.2	546																																								
24-Aug-11	83	0.5	300	340	3.2	501																																								
31-Aug-11	84	0.5	300	290	3.4	579	48	101	#N/A	160	1.0	0.14	0.30	83	5.7	0.00030	0.00050	0.019	0.00084	0.000010	0.011	0.0023	28	0.0020	0.028	7.2	0.61	0.00060	0.0030	3.4	0.19	0.010	0.00010	0.011	0.0090	4.8	0.0015	22	0.000030	0.69	0.081	60	0.00030	0.00018	0.0016	0.015	0.000030	0.12	0.00010
7-Sep-11	85	0.5	300	295	3.3	536																																								
14-Sep-11	86	0.5	300	290	3.4	530																																								
21-Sep-11	87	0.5	300	335	3.3	467																																								
28-Sep-11	88	0.5	300	300	3.3	552	44	91	#N/A	168	1.0	0.16	0.30	78	5.5	0.00020	0.00030	0.018	0.00076	0.000010	0.0052	0.00035	26	0.0024	0.026	6.5	0.57	0.00027	0.0030	3.3	0.18	0.010	0.000060	0.0096	0.012	4.7	0.0015	21	0.000040	0.58	0.077	55	0.00026	0.00019	0.0010	0.014	0.000030	0.028	0.000070
5-Oct-11	89	0.5	300	270	3.3	554																																								
12-Oct-11	90	0.5	300	360	3.3	519																																								
19-Oct-11	91	0.5	300	330	3.3	517																																								
26-Oct-11	92	0.5	300	390	3.3	511	39	80	#N/A	156	0.20	0.20	0.30	73	4.8	0.00020	0.00040	0.028	0.00077	0.000010	0.012	0.00031	24	0.0012	0.023	6.0	0.48	0.000090	0.0030	3.1	0.17	0.010	0.000040	0.0090	0.0090	4.6	0.0010	18	0.000020	0.57	0.073	54	0.00024	0.00015	0.0013	0.014	0.000030	0.025	0.000060
2-Nov-11	93	0.5	300	300	3.2	601																																								
9-Nov-11	94	0.5	300	325	3.2	549																																								
16-Nov-11	95	0.5	300	365	3.3	523																																								
23-Nov-11	96	0.5	300	300	3.2	562	51	97	#N/A	164	0.20	0.21	0.30	72	5.1	0.00020	0.00040	0.018	0.00073	0.00

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Calculated Production Rates for Col 3

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
27-Jan-10	1	0.5	1230	470	3.6	8110	555	1058	#N/A	1865	10	0.0056	0.71	255	220	0.00016	0.00074	0.0085	0.0022	0.0000028	0.012	0.0023	35	0.024	0.12	27	61	0.00042	0.0084	41	1.1	0.00094	0.0053	0.077	0.28	25	0.012	3.4	0.000049	26	0.26	479	0.00061	0.00000094	0.00086	0.060	0.0026	0.20	0.012
3-Feb-10	2	0.5	300	365	3.4	3950	215	350	#N/A	514	2.5	0.0073	0.22	94	48	0.000051	0.00042	0.0024	0.00046	0.00000073	0.0032	0.00067	24	0.0034	0.025	10	14	0.000099	0.0020	8.2	0.37	0.015	0.0012	0.017	0.010	10	0.0049	2.6	0.0000095	8.2	0.13	134	0.00030	0.000039	0.00015	0.021	0.000088	0.067	0.0018
10-Feb-10	3	0.5	300	265	3.4	3780	56	95	#N/A	188	0.95	0.013	0.16	72	15	0.000011	0.00032	0.0012	0.00032	0.00000053	0.0054	0.00033	20	0.0017	0.013	3.5	3.8	0.000032	0.00095	5.1	0.20	0.0074	0.00043	0.0087	0.0032	6.4	0.0024	2.0	0.0000032	3.6	0.080	60	0.00015	0.0000085	0.00016	0.0082	0.000041	0.026	0.00043
17-Feb-10	4	0.5	300	290	3.4	3400	38	61	#N/A	111	0.37	0.071	0.17	61	8.4	0.000012	0.00017	0.0013	0.00027	0.00000058	0.0054	0.00021	17	0.00096	0.0092	2.5	2.2	0.000038	0.00087	4.3	0.14	0.00058	0.00030	0.0062	0.0012	4.5	0.0024	2.2	0.0000017	2.2	0.057	41	0.00013	0.000015	0.00013	0.0053	0.0000087	0.019	0.00021
24-Feb-10	5	0.5	300	300	3.6	1951				79																																								
3-Mar-10	6	0.5	300	265	3.6	1445	7.9	18	#N/A	47	0.16	0.067	0.016	27	2.1	0.000011	0.000074	0.0010	0.00011	0.00000053	0.0037	0.000089	8.1	0.00027	0.0031	1.0	0.030	0.000022	0.00058	1.8	0.064	0.00053	0.000095	0.0022	0.00053	2.4	0.00085	1.6	0.0000032	0.71	0.028	17	0.000080	0.000051	0.000080	0.0018	0.0000016	0.0074	0.000057
10-Mar-10	7	0.5	300	295	3.8	1205				43																																							
17-Mar-10	8	0.5	300	295	3.7	1046	3.0	12	#N/A	33	0.12	0.055	0.018	24	1.1	0.000012	0.000035	0.0010	0.000081	0.00000059	0.0033	0.000065	7.1	0.00013	0.0019	0.71	0.018	0.000027	0.00053	1.4	0.054	0.0018	0.000051	0.0014	0.00059	2.2	0.00050	1.7	0.0000012	0.45	0.023	11	0.000065	0.0000055	0.000077	0.0012	0.0000018	0.0048	0.000027
24-Mar-10	9	0.5	300	295	3.7	896				33																																							
31-Mar-10	10	0.5	300	285	3.7	844	2.2	8.0	#N/A	30	0.11	0.047	0.017	17	0.72	0.000011	0.000023	0.0012	0.000061	0.00000057	0.0026	0.000050	5.3	0.00011	0.0019	0.63	0.013	0.000049	0.00034	1.1	0.039	0.0011	0.000044	0.0011	0.00057	1.8	0.00045	1.5	0.0000011	0.25	0.018	9.1	0.000057	0.000068	0.000063	0.00085	0.0000068	0.0040	0.000018
7-Apr-10	11	0.5	300	305	3.6	966				34																																							
14-Apr-10	12	0.5	300	305	3.5	1337	9.6	21	#N/A	52	0.12	0.065	0.018	34	2.5	0.000012	0.000043	0.0099	0.00013	0.00000061	0.0026	0.000099	10	0.00016	0.0044	1.4	0.040	0.000037	0.00043	1.9	0.074	0.00061	0.000088	0.0023	0.00061	2.1	0.00077	2.0	0.0000049	0.19	0.032	18	0.000067	0.000076	0.000079	0.0025	0.0000018	0.0076	0.000036
21-Apr-10	13	0.5	300	260	3.4	1677				55																																							
28-Apr-10	14	0.5	300	345	3.3	1564	6.8	12	#N/A	76	0.14	0.066	0.021	43	3.5	0.000014	0.000083	0.00088	0.00021	0.00000069	0.0026	0.00014	13	0.00029	0.0067	2.2	0.090	0.00010	0.00048	2.4	0.097	0.00069	0.000079	0.0031	0.00069	2.2	0.00066	2.3	0.0000090	0.15	0.041	23	0.000069	0.000099	0.000097	0.0038	0.0000021	0.0099	0.000054
5-May-10	15	0.5	300	310	3.3	1450				54																																							
12-May-10	16	0.5	300	320	3.4	1215	9.3	18	#N/A	47	0.13	0.055	0.019	28	1.9	0.000013	0.000026	0.00081	0.00014	0.00000064	0.0024	0.000081	8.6	0.00020	0.0049	1.8	0.071	0.0000077	0.00038	1.5	0.059	0.00064	0.000058	0.0021	0.027	1.4	0.00037	2.2	0.0000051	0.079	0.026	14	0.000051	0.000072	0.00010	0.0031	0.0000019	0.0059	0.000051
19-May-10	17	0.5	300	295	3.4	1023				29																																							
26-May-10	18	0.5	300	350	3.4	1032	8.7	20	#N/A	36	0.14	0.052	0.021	25	2.0	0.000014	0.000056	0.00089	0.00016	0.00000070	0.0025	0.000078	7.8	0.00020	0.0047	1.8	0.043	0.00016	0.00049	1.3	0.054	0.00070	0.000036	0.0020	0.030	1.1	0.00036	2.4	0.0000028	0.074	0.023	14	0.000049	0.000071	0.00012	0.0033	0.0000021	0.021	0.000031
2-Jun-10	19	0.5	300	290	3.3	987				26																																							
9-Jun-10	20	0.5	300	295	3.3	920	5.4	13	#N/A	26	0.12	0.038	0.018	16	1.4	0.000012	0.000065	0.00083	0.00010	0.00000059	0.0018	0.000058	4.9	0.00011	0.0036	1.5	0.036	0.0000047	0.00035	0.94	0.040	0.00059	0.000021	0.0015	0.027	0.76	0.00028	1.9	0.0000035	0.060	0.017	9.6	0.000035	0.000053	0.000094	0.0021	0.0000018	0.0040	0.000021
16-Jun-10	21	0.5	300	290	3.3	909				17																																						
23-Jun-10	22	0.5	300	290	3.5	894	4.0	12	#N/A	24	0.12	0.037	0.017	17	1.3	0.000012	0.000064	0.00079	0.00011	0.00000058	0.0019	0.000053	5.4	0.00015	0.0033	1.7	0.033	0.0000017	0.00035	0.86	0.037	0.00058	0.000043	0.0014	0.025	0.79	0.00035	2.0	0.0000041	0.050	0.016	9.0	0.000035	0.000042	0.000087	0.0020	0.0000017	0.0040	0.000018
30-Jun-10	23	0.5	300	315	3.5	863				24																																						
7-Jul-10	24	0.5	300	365	3.4	719	5.4	12	#N/A	22	0.15	0.034	0.022	14	1.0	0.000015	0.00016	0.0013	0.00011	0.00000073	0.0025	0.000050	4.3	0.00020	0.0033	1.4	0.023	0.000057	0.00088	0.80	0.035	0.00073	0.000041	0.0014	0.14	0.71	0.00035	2.1	0.0000022	0.054	0.015	8.8	0.000029	0.000045	0.00010	0.0021	0.0000022	0.0040	0.000017
14-Jul-10	25	0.5	300	290	3.3	785				16																																						
21-Jul-10	26	0.5	300	295	3.4	750	3.8	11	#N/A	18	0.059	0.028	0.018	13	0.89	0.000012	0.000065	0.00076	0.00010	0.00000059	0.0018	0.000043	4.0	0.00011	0.0030	1.3	0.027	0.000016	0.00030	0.64	0.029	0.00059	0.000014	0.0012	0.00053	0.62	0.00017	2.0	0.0000018	0.046	0.011	7.0	0.000024	0.000061	0.000094	0.0018	0.0000018	0.0034	0.000017
28-Jul-10	27	0.5	300	295	3.3	735				18																																						
4-Aug-10	28	0.5	300	290	3.5	724	2.5	9.7	#N/A	19	0.058	0.026	0.017	12	0.81	0.000012	0.000070	0.00084	0.000079	0.00000058	0.0013	0.000038	3.9	0.00010	0.0026	1.2	0.028	0.000080	0.00029	0.57	0.026	0.0017	0.000026	0.00097	0.021	0.52	0.00025	1.9	0.0000017	0.039	0.011	6.4	0.000023	0.000028	0.000070	0.0017	0.0000017	0.0030	0.000011
11-Aug-10	29	0.5	300	300	3.5	721				17																																						
18-Aug-10	30	0.5	300	285	3.5	687	2.2	9.4	#N/A	17	0.057	0.023	0.017	11	0.71	0.000011	0.000034	0.00088	0.000081	0.00000057	0.0015	0.000035	3.6	0.00011	0.0024	1.1	0.032	0.000013	0.00029	0.52	0.025	0.00057	0.000014	0.0010	0.015	0.50	0.000084	1.9	0.0000017	0.035	0.010	8.3	0.000023	0.000030	0.000080	0.0017	0.0000017	0.0029	0.000011
25-Aug-10	31	0.5	300	315	3.3	678				19																																						
1-Sep-10	32	0.5	300	290	3.4	684	2.7	8.7	#N/A	18	0.058	0.020	0.017	10	0.68	0.000012	0.000012	0.00088	0.000075	0.00000058	0.0012	0.000035	3.3	0.000099	0.0027	1.1	0.024	0.0000075	0.00023	0.46	0.022	0.00058	0.0000064	0.0010	0.015	0.47	0.00016	1.9	0.0000017	0.035	0.0097	6.0	0.000023	0.000020	0.00010	0.0015	0.0000017	0.0031	0.0000081
8-Sep-10	33	0.5	300	295	3.3	685				23																																						
15-Sep-10	34	0.5	300	360	3.5	532	2.8	8.9	#N/A	17	0.072	0.024	0.022	10	0.72	0.000014	0.000022	0.0016	0.000086	0.00000072	0.0025	0.000034	3.3	0.000094	0.0024	1.1	0.022	0.000030	0.00029	0.48	0.023	0.0014	0.000015	0.0011	0.014	0.47	0.00024	2.0	0.0000022	0.042	0.010	5.9	0.000022	0.000032	0.000094	0.0042	0.0000022	0.0032	0.000010
22-Sep-10	35	0.5	300	340	3.3	517				24																																						
29-Sep-10	36	0.5	300	300	3.3	541	3.4	7.8	#N/A	19	0.060	0.022	0.018	10	0.62	0.000012	0.000036	0.00095	0.000076	0.00000060	0.0012	0.000043	3.3	0.00012	0.0025	1.1	0.034	0.0000043	0.00024	0.47	0.023	0.00060	0.000025	0.0012	0.013	0.49	0.00019	2.2	0.0000030	0.041	0.0095	6.2	0.000024	0.000084	0.00011	0.0016	0.000013	0.0032	0.000012
6-Oct-10	37	0.5	300	290	3.2	692				23																																						
13-Oct-10	38	0.5	300	295	3.2	687	3.5	9.3	#N/A	18	0.059	0.021	0.018	10	0.61	0.000012	0.000012	0.00093	0.000076	0.00000059	0.0014	0.000032	3.2	0.00011	0.0025	1.00	0.036	0.0000089	0.00024	0.47	0.023	0.00059	0.00013	0.0011	0.017	0.45	0.00015	2.0	0.00000059	0.038	0.0097	5.5	0.000024	0.0000038	0.00031	0.0015	0.0000018	0.0024	0.0000089
20-Oct-10	39	0.5	300	280	3.2	664				22																																						
27-Oct-10	40	0.5	300	370	3.5	532	2.2	7.1	#N/A	17	0.074	0.020	0.022	8.8	0.60	0.000015	0.000030	0.0016	0.000078	0.00000074	0.0016	0.000032	2.9	0.000074	0.0025	0.97	0.022	0.000044	0.00022	0.40	0.020	0.00074	0.0000044	0.0010	0.011	0.40	0.00014	1.8	0.0000022	0.033	0.0084	5.6	0.000022	0.0000059	0.00035	0.0014	0.0000022	0.0027	0.000024
3-Nov-10	41	0.5	300	320	3.5	599																																									
10-Nov-10	42	0.5	300	360	3.4	634																																								
17-Nov-10	43	0.5	300	295	3.5	589																																								
24-Nov-10	44	0.5	300	270	3.3	651	2.4	7.0	#N/A	14	0.054	0.017	0.016	7.6	0.60	0.000011	0.000038	0.00083	0.000073	0.00000054	0.00094	0.000027	2.5	0.000081	0.0019	0.86	0.029	0.000016	0.00027	0.34	0.017	0.00054	0.000011	0.00077	0.014	0.34	0.00015	1.6	0.0000016	0.029	0.0072	4.5	0.000016	0.000017	0.00028	0.0014	0.0000016	0.0024	0.0000086
1-Dec-10	45	0.5	300	380	3.4	529																																									
8-Dec-10	46	0.5	300	380	3.3	529																																								
15-Dec-10	47	0.5	300	285	3.3	598																																								
22-Dec-10	48	0.5	300	300	3.2	589	3.3	7.7	#N/A	13	0.060	0.016	0.018	7.7	0.49	0.000012	0.000024	0.0011	0.000064	0.00000060	0.00095	0.000027	2.5	0.000084	0.0021	0.77	0.035	0.000017	0.00024	0.34	0.000012	0.00060	0.000016	0.00080	0.018	0.39	0.000093	1.9	0.0000018	0.036	0.0075	5.2	0.000018	0.000020	0.000090	0.0013	0.0000018	0.0021	0.0000072
29-Dec-10	49	0.5	300	260	3.3	603																																								
5-Jan-11	50	0.5	300	300	3.3	516																																								
12-Jan-11	51	0.5	300	320	3.4	449																																								
19-Jan-11	52	0.5	300	260	3.3	552	2.2	5.6	#N/A	11	0.052	0.013	0.016	6.3	0.36	0.000016	0.000026	0.00090	0.000051	0.00000052	0.00075	0.000023	2.1	0.000042	0.0018	0.60	0.028	0.000045	0.00021	0.27	0.014	0.00052	0.00017	0.00067	0.011	0.33	0.000095	1.5	0.0000016	0.029	0.0063	3.8	0.000016	0.000021	0.000068	0.0010	0.0000016	0.0020	0.0000052
26-Jan-11	53	0.5	300	285	3.3	530																																								
2-Feb-11	54	0.5	300	370	3.3	424																																								
9-Feb-11	55	0.5	300	290	3.3	473																																								
16-Feb-11	56	0.5	300	380	3.5	427	2.2	5.3	#N/A	9.2	0.15	0.011	0.023	6.2	0.33	0.000030	0.000030	0.0017	0.000059	0.00000076	0.0012	0.000026	2.1	0.000076	0.0017	0.59	0.022	0.00023	0.00023	0.26	0.014	0.00076	0.00018	0.00067	0.014	0.35	0.00013	1.7	0.0000046	0.061	0.0062	3.6	0.000015	0.0000046	0.00014	0.0011	0.0000023	0.0030	0.0000053
23-Feb-11	57	0.5	300	430	3.5	440																																								
2-Mar-11	58	0.5	300	350	3.4	439																																								
9-Mar-11	59	0.5	300	405	3.6	321																																								
16-Mar-11	60	0.5	300	415	3.6	387	1.8	4.3	#N/A	8.2	0.17	0.012	0.025	5.5	0.23	0.000017	0.000050	0.0020	0.000049	0.00000083	0.00077	0.000020	1.8	0.000050	0.0014	0.49	0.015	0.000019	0.00017	0.22	0.012	0.00083	0.0000100	0.00055	0.0056	0.32	0.000087	1.6	0.0000100	0.027	0.0055	3.2	0.000017	0.000027	0.000083	0.00080	0.0000025	0.0015	0.0000033
23-Mar-11	61	0.5	300	390	3.5	385																																								
30-Mar-11	62	0.5	300	345	3.6	393																																								
6-Apr-11	63	0.5	300	325	3.4	432																																								
13-Apr-11	64	0.5	300	325	3.5	443	1.4	3.6	#N/A	8.5	0.065	0.012	0.020	5.0	0.30	0.000013	0.000026	0.0019	0.000044	0.00000065	0.00079	0.000024	1.7	0.000033	0.0015	0.51	0.014	0.000016	0.00013	0.21	0.012	0.00065	0.000033	0.00064	0.0072	0.27	0.000073	1.3	0.0000026	0.025	0.0049	3.2	0.000013	0.000010	0.00017	0.00077	0.0000020	0.0016	0.0000033
20-Apr-11	65	0.5	300	310	3.4	457																																								
27-Apr-11	66	0.5	300	285	3.4	510																																								
4-May-11	67	0.5	300	360	3.3	464																																								
11-May-11	68	0.5	300	290	3.4	503	1.9	4.3	#N/A	9.5	0.058	0.0099	0.017	4.8	0.25	0.000012	0.000012	0.0012	0.000041	0.00000058	0.00074	0.000020	1.6	0.000035	0.0014	0.43	0.021	0.000013	0.00017	0.19	0.011	0.00058	0.0000046	0.00057	0.00052	0.26	0.000021	1.2	0.0000023	0.026	0.0047	3.0	0.000012	0.000020	0.00012	0.00083	0.0000017	0.0017	0.0000041
18-May-11	69	0.5	300	305	3.3	461																																								
25-May-11	70	0.5	300	280	3.3	534																																								
1-Jun-11	71	0.5	300	295	3.2	535																																								
8-Jun-11	72	0.5	300	345	3.4	515	2.8	6.9	#N/A	11	0.069	0.015	0.021	5.6	0.35	0.000014	0.00024	0.0018	0.000053	0.00000069	0.00097	0.000025	1.9	0.000083	0.0017	0.51	0.022	0.000053	0.00021	0.23	0.013	0.00069	0.0000076	0.00068	0.012	0.31	0.00011	1.5	0.0000048	0.046	0.0054	3.5	0.000017	0.000044	0.00016	0.0010	0.0000021	0.0021	0.0000048
15-Jun-11	73	0.5	300	310	3.2	406																																								
22-Jun-11	74	0.5	300	330	3.3	521																																								
29-Jun-11	75	0.5	300	350	3.2	500																																								
6-Jul-11	76	0.5	300	380	3.4	496	2.6	6.1	#N/A	13	0.076	0.012	0.023	6.7	0.44	0.000015	0.000015	0.0020	0.000061	0.00000076	0.00091	0.000028	2.2	0.000046	0.0019	0.59	0.028	0.00072	0.00023	0.27	0.015	0.00076	0.0000015	0.00074	0.00068	0.36	0.00010	1.8	0.0000076	0.040	0.0065	4.3	0.000018	0.000016	0.000084	0.0011	0.0000023	0.0026	0.0000046
13-Jul-11	77	0.5	300	330	3.2	514																																								
20-Jul-11	78	0.5	300	385	3.2	509																																								
27-Jul-11	79	0.5	300	290	3.1	562																																								
3-Aug-11	80	0.5	300	190	3.2	553	1.8	3.3	#N/A	6.9	0.038	0.0068	0.011	3.2	0.20	0.0000076	0.000065	0.00065	0.000029	0.00000038	0.00029	0.000014	1.1	0.000068	0.00096	0.28	0.020	0.000035	0.00011	0.13	0.0074	0.00038	0.0000030	0.00046	0.00034	0.18	0.000046	0.82	0.0000011	0.022	0.0031	2.1	0.000016	0.000012	0.000057	0.00056	0.0000011	0.0011	0.0000038
10-Aug-11	81	0.5	300	285	3.1	555																																								
17-Aug-11	82	0.5	300	295	3.2	546																																								
24-Aug-11	83	0.5	300	340	3.2	501																																								
31-Aug-11	84	0.5	300	290	3.4	579	2.8	5.8	#N/A	9.3	0.058	0.0081	0.017	4.8	0.33	0.000017	0.000029	0.0011	0.000049	0.00000058	0.00061	0.00013	1.6	0.00012	0.0016	0.41	0.035	0.000035	0.00017	0.20	0.011	0.00058	0.0000058	0.00066	0.00052	0.28	0.000086	1.2	0.0000017	0.040	0.0047	3.5	0.000017	0.000010	0.000093	0.00089	0.0000017	0.0071	0.0000058
7-Sep-11	85	0.5	300	295	3.3	536																																								
14-Sep-11	86	0.5	300	290	3.4	530																																								
21-Sep-11	87	0.5	300	335	3.3	467																																								
28-Sep-11	88	0.5	300	300	3.3	552	2.6	5.5	#N/A	10	0.060	0.0096	0.018	4.7	0.33	0.000012	0.000018	0.0011	0.000046	0.00000060	0.00031	0.000021	1.6	0.00014	0.0016	0.39	0.034	0.000016	0.00018	0.20	0.011	0.00060	0.0000036	0.00058	0.00072	0.28	0.000089	1.2	0.0000024	0.035	0.0046	3.3	0.000016	0.000011	0.000060	0.00086	0.0000018	0.0017	0.0000042
5-Oct-11

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Leachate Results for Col 4a

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	T-Alk.	SO_4	Cl	F	Br	Hard.	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Ca	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Ti	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umho/cm	mg/L*		mg/L*	mg/L	mg/L	mg/L	mg/L	mg/L*	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
7-Apr-10	1	0.5	1150	540	7.0	3871	#N/A	19	108	2248	60	0.27	0.30	1400	0.039	0.014	0.0041	0.089	0.00002	0.00003	0.022	0.0027	394	0.029	0.035	0.40	0.050	0.00049	0.002	102	2.4	0.73	0.23	0.020	0.17	31	0.029	9.4	0.00004	796	1.9	754	0.0002	0.00029	0.00090	0.0050	0.00019	0.042	0.004
14-Apr-10	2	0.5	300	300	7.2	2063	#N/A	9.7	50	1252	13	0.48	0.30	878	0.011	0.0087	0.0040	0.035	0.00002	0.00002	0.018	0.00013	277	0.0019	0.0025	0.086	0.010	0.00062	0.001	45	0.55	0.020	0.70	0.0036	0.060	12	0.016	7.0	0.00005	183	0.82	421	0.0002	0.00052	0.00040	0.0027	0.00045	0.0070	0.0006
21-Apr-10	3	0.5	300	360	7.2	1305	#N/A	9.1	48	670	6.7	0.49	0.30	430	0.015	0.0073	0.0030	0.058	0.00002	0.00001	0.018	0.00037	138	0.0019	0.0012	0.077	0.010	0.00014	0.001	21	0.18	0.020	0.83	0.0025	0.060	11	0.011	7.5	0.00003	112	0.46	219	0.0002	0.00076	0.00040	0.0018	0.00043	0.016	0.0003
28-Apr-10	4	0.5	300	350	7.2	960	#N/A	4.8	54	508	4.5	0.44	0.30	299	0.13	0.0073	0.0026	0.050	0.00002	0.00001	0.017	0.00044	96	0.0014	0.0011	0.053	0.010	0.00060	0.001	15	0.14	0.020	0.98	0.0016	0.060	7.4	0.0075	7.7	0.00003	94	0.34	149	0.0002	0.00096	0.00040	0.0024	0.00049	0.0060	0.0003
5-May-10	5	0.5	300	285	7.4	870				368																																								
12-May-10	6	0.5	300	320	7.5	681	#N/A	5.6	59	288	1.6	0.69	0.30	182	0.24	0.0089	0.0026	0.047	0.00002	0.00001	0.020	0.00048	59	0.0015	0.00054	0.038	0.0020	0.00040	0.001	8.7	0.076	0.010	1.5	0.0017	0.091	5.7	0.040	11	0.00007	75	0.22	95	0.0002	0.0015	0.00060	0.0015	0.00062	0.0020	0.0005
19-May-10	7	0.5	300	280	7.5	585				247																																							
26-May-10	8	0.5	300	370	7.3	489	#N/A	9.4	54	141	0.90	0.92	0.30	120	0.046	0.012	0.0032	0.040	0.00002	0.00001	0.019	0.00060	38	0.00070	0.00090	0.038	0.0020	0.00050	0.001	6.0	0.036	0.010	1.8	0.00080	0.15	4.3	0.0034	11	0.00003	53	0.16	64	0.0002	0.0023	0.00080	0.0011	0.00084	0.0020	0.0002
2-Jun-10	9	0.5	300	325	7.5	411				107																																							
9-Jun-10	10	0.5	300	325	7.5	362	#N/A	6.6	49	92	2.0	0.94	0.30	79	0.019	0.013	0.0029	0.042	0.00002	0.00001	0.017	0.00055	25	0.00070	0.00080	0.035	0.0020	0.00040	0.001	4.2	0.041	0.010	1.9	0.00080	0.13	3.2	0.0021	12	0.00007	38	0.12	42	0.0002	0.0030	0.00060	0.00080	0.00071	0.0020	0.0005
16-Jun-10	11	0.5	300	330	7.5	336				82																																							
23-Jun-10	12	0.5	300	285	7.6	347	#N/A	4.5	71	97	1.4	1.2	0.30	90	0.019	0.019	0.0041	0.044	0.00002	0.00001	0.018	0.00067	29	0.0010	0.00036	0.032	0.0020	0.00050	0.001	4.2	0.049	0.010	2.0	0.00050	0.18	3.7	0.0024	14	0.00004	33	0.13	32	0.0002	0.0032	0.00060	0.00078	0.00083	0.0020	0.0001
30-Jun-10	13	0.5	300	305	7.8	273				77																																							
7-Jul-10	14	0.5	300	280	7.6	295	#N/A	5.5	64	62	2.4	1.2	0.30	70	0.046	0.017	0.0040	0.053	0.00002	0.00001	0.017	0.00050	22	0.0013	0.00038	0.030	0.0090	0.000080	0.001	3.8	0.048	0.010	1.8	0.0010	0.25	3.4	0.0023	16	0.00005	27	0.13	27	0.0002	0.0029	0.00060	0.00091	0.00094	0.0020	0.00009
14-Jul-10	15	0.5	300	280	7.6	285				36																																						
21-Jul-10	16	0.5	300	290	7.6	263	#N/A	8.5	67	50	1.8	1.2	0.30	70	0.13	0.016	0.0039	0.051	0.00002	0.00001	0.015	0.00056	22	0.0010	0.00042	0.11	0.019	0.000590	0.001	3.5	0.038	0.010	1.7	0.00050	0.24	3.2	0.0018	17	0.00006	22	0.11	20	0.0002	0.0025	0.00060	0.00096	0.00095	0.0020	0.0001
28-Jul-10	17	0.5	300	295	7.5	244				39																																						
4-Aug-10	18	0.5	300	280	7.6	231	#N/A	8.1	63	37	1.5	1.3	0.30	69	0.12	0.017	0.0042	0.050	0.00002	0.00001	0.013	0.00047	23	0.0013	0.00080	0.11	0.011	0.00079	0.001	3.2	0.041	0.020	1.6	0.00010	0.26	2.8	0.0025	17	0.00004	21	0.10	18	0.0002	0.0023	0.00050	0.00079	0.00093	0.0010	0.0001
11-Aug-10	19	0.5	300	305	7.5	220				46																																						
18-Aug-10	20	0.5	300	305	7.6	208	#N/A	8.3	58	34	1.4	1.3	0.30	60	0.26	0.017	0.0045	0.049	0.00002	0.00001	0.019	0.00038	19	0.00090	0.00021	0.041	0.050	0.000080	0.001	2.8	0.038	0.010	1.5	0.00070	0.24	2.6	0.00029	17	0.0001	16	0.091	21	0.0002	0.0021	0.00060	0.00066	0.0011	0.0040	0.0001
25-Aug-10	21	0.5	300	310	7.4	194				33																																						
1-Sep-10	22	0.5	300	320	7.4	169	#N/A	8.3	50	48	1.1	1.3	0.30	54	0.038	0.018	0.0038	0.047	0.00002	0.00001	0.014	0.00059	18	0.00070	0.00024	0.048	0.020	0.000090	0.001	2.5	0.035	0.010	1.3	0.00070	0.23	2.5	0.0015	18	0.00003	13	0.084	15	0.0002	0.0020	0.00040	0.00041	0.00091	0.0070	0.00006
8-Sep-10	23	0.5	300	335	7.2	161				39																																						
15-Sep-10	24	0.5	300	320	7.3	141	#N/A	5.7	36	39	0.90	1.4	0.30	48	0.13	0.018	0.0041	0.040	0.00002	0.00001	0.017	0.00068	16	0.00060	0.00045	0.079	0.017	0.000090	0.001	2.2	0.036	0.030	1.4	0.00070	0.27	2.2	0.0018	17	0.00005	11	0.079	13	0.0002	0.0027	0.00060	0.0052	0.00092	0.0030	0.0002
22-Sep-10	25	0.5	300	335	7.2	127				39																																						
29-Sep-10	26	0.5	300	330	7.2	113	#N/A	5.1	35	35	1.0	1.5	0.30	46	0.18	0.018	0.0053	0.043	0.00002	0.00001	0.015	0.00025	15	0.00090	0.00073	0.096	0.038	0.00034	0.001	2.0	0.027	0.010	1.4	0.0060	0.35	2.2	0.0014	20	0.00006	9.4	0.074	13	0.0002	0.0038	0.0013	0.00037	0.0016	0.0060	0.0002
6-Oct-10	27	0.5	300	320	7.2	147				33																																						
13-Oct-10	28	0.5	300	310	7.3	145	#N/A	6.2	37	33	1.4	1.6	0.30	50	0.071	0.020	0.0052	0.039	0.00002	0.00001	0.018	0.0013	16	0.0010	0.00054	0.098	0.010	0.000040	0.001	2.3	0.036	0.010	1.4	0.0012	0.36	2.2	0.0015	22	0.00005	8.9	0.081	12	0.0002	0.0056	0.0042	0.00050	0.00094	0.0040	0.0002
20-Oct-10	29	0.5	300	300	7.2	140				29																																						
27-Oct-10	30	0.5	300	375	7.3	130	#N/A	4.6	32	25	0.80	1.4	0.30	41	0.022	0.017	0.0048	0.038	0.00002	0.00001	0.015	0.00038	13	0.00050	0.00024	0.026	0.050	0.000090	0.001	1.8	0.025	0.010	1.1	0.0012	0.31	1.7	0.0013	17	0.00003	6.6	0.065	10	0.0002	0.0067	0.0041	0.00022	0.00084	0.012	0.0001
3-Nov-10	31	0.5	300	300	7.4	130				25																																						
10-Nov-10	32	0.5	300	330	7.5	127	#N/A	4.7	42	28	0.70	0.14	0.30	52	0.095	0.017	0.0049	0.046	0.00002	0.00001	0.011	0.00097	17	0.00080	0.00017	0.017	0.027	0.00053	0.001	2.3	0.022	0.020	1.2	0.00050	0.37	2.2	0.0013	20	0.00005	6.9	0.082	9.0	0.0002	0.0077	0.00060	0.00027	0.00099	0.012	0.0002
17-Nov-10	33	0.5	300	305	7.6	129				25																																						
24-Nov-10	34	0.5	300	300	7.3	146	#N/A	6.3	50	23	0.70	1.5	0.30	53	0.060	0.016	0.0051	0.051	0.00002	0.00001	0.011	0.00048	17	0.00070	0.00024	0.028	0.0080	0.000080	0.001	2.4	0.017	0.010	0.96	0.00010	0.32	2.0	0.0017	20	0.00002	5.8	0.086	7.6	0.0002	0.0092	0.0045	0.00042	0.00086	0.0050	0.0001
1-Dec-10	35	0.5	300	300	7.3	145				21																																						
8-Dec-10	36	0.5	300	300	7.3	143	#N/A	6.9	49	23	0.70	1.5	0.30	56	0.036	0.018	0.0046	0.048	0.00002	0.00007	0.0090	0.00056	18	0.0012	0.00014	0.013	0.0070	0.0022	0.001	2.6	0.015	0.010	0.92	0.00030	0.37	2.1	0.00060	21	0.00003	5.4	0.091	7.6	0.0002	0.010	0.00050	0.00027	0.0010	0.0040	0.00006
15-Dec-10	37	0.5	300	370	7.2	131				27																																						
22-Dec-10	38	0.5	300	370	7.2	126	#N/A	8.7	38	29	0.70	1.5	0.30	50	0.095	0.015	0.0046	0.041	0.00002	0.00001	0.013	0.00030	16	0.0010	0.00045	0.084	0.0070	0.00020	0.001	2.2	0.014	0.010	0.81	0.0011	0.38	2.0	0.00084	22	0.00006	5.3	0.081	11	0.0002	0.0079	0.00030	0.00040	0.00095	0.018	0.00008
29-Dec-10	39	0.5	300	255	7.1	105				23																																						
5-Jan-11	40	0.5	300	370	7.3	99	#N/A	9.1	33	20	0.60	1.3	0.30	41	0.13	0.014	0.0041	0.040	0.00002	0.00001	0.013	0.00024	13	0.00050	0.0013	0.080	0.0060	0.00034	0.001	1.9	0.018	0.010	0.68	0.0020	0.33	1.8	0.0016	18	0.00004	4.6	0.067	11	0.0002	0.0058	0.0014	0.00033	0.00087	0.035	0.00006
12-Jan-11	41	0.5	300	340	7.2	109																																									
19-Jan-11	42	0.5	300	375	7.1	95																																								
26-Jan-11	43	0.5	300	320	7.2	91																																								
2-Feb-11	44	0.5	300	400	7.1	80	#N/A	6.2	31	18	0.40	1.4	0.30	40	0.13	0.015	0.0045	0.038	0.00002	0.00001	0.0096	0.00042	13	0.00050	0.000095	0.012	0.027	0.00012	0.001	1.8	0.0064	0.010	0.67	0.00060	0.39	1.6	0.0010	20	0.00006	2.7	0.063	6.2	0.0002	0.0054	0.00070	0.00011	0.00083	0.0090	0.0002
9-Feb-11	45	0.5	300	325	7.2	92																																									
16-Feb-11	46	0.5	300	350	7.2	90																																								
23-Feb-11	47	0.5	300	450	7.2	95																																								
2-Mar-11	48	0.5	300	385	7.2	89	#N/A	4.9	28	21	0.30	1.3	0.30	38	0.026	0.013	0.0044	0.045	0.00002	0.00001	0.0074	0.00010	12	0.00070	0.00012	0.0087	0.0070	0.0030	0.001	1.8	0.0069	0.010	0.58	0.00020	0.37	1.3	0.00037	17	0.00002	1.9	0.061	5.0	0.0002	0.0047	0.00050	0.00011	0.00067	0.0030	0.00004
9-Mar-11	49	0.5	300	425	7.1	89																																									
16-Mar-11	50	0.5	300	375	7.2	84																																								
23-Mar-11	51	0.5	300	385	7.3	94																																								
30-Mar-11	52	0.5	300	325	7.3	105	#N/A	7.0	38	13	0.40	1.3	0.30	45	0.027	0.014	0.0046	0.055	0.00002	0.00001	0.0086	0.000025	15	0.00080	0.00010	0.0071	0.0070	0.00057	0.001	2.1	0.0038	0.010	0.63	0.00030	0.42	1.6	0.0014	21	0.00003	1.9	0.073	5.5	0.0002	0.0039	0.00030	0.00017	0.00079	0.0060	0.00007
6-Apr-11	53	0.5	300	320	7.3	96																																									
13-Apr-11	54	0.5	300	310	7.3	96																																								
20-Apr-11	55	0.5	300	310	7.5	98																																								
27-Apr-11	56	0.5	300	360	7.3	88	#N/A	4.5	30	10	0.40	1.3	0.30	37	0.025	0.014	0.0045	0.047	0.00002	0.00006	0.0083	0.000091	12	0.00050	0.00	0.0058	0.0040	0.000050	0.001	1.7	0.0056	0.010	0.59	0.00070	0.37	1.3	0.00084	18	0.00001	1.5	0.059	4.8	0.0002	0.0043	0.0042	0.000081	0.00076	0.0010	0.0001
4-May-11	57	0.5	300	305	7.3	95																																									
11-May-11	58	0.5	300	295	7.3	107																																								
18-May-11	59	0.5	300	310	7.2	103																																								
25-May-11	60	0.5	300	305	7.1	107	#N/A	6.7	36	10	0.50	1.3	0.30	47	0.19	0.015	0.0047	0.061	0.00002	0.00002	0.0062	0.000093	15	0.00050	0.00020	0.0089	0.016	0.00034	0.001	2.1	0.0044	0.010	0.58	0.0013	0.41	1.6	0.0018	22	0.00001	1.7	0.075	5.2	0.0002	0.0038	0.0010	0.00018	0.00080	0.0020	0.0002
1-Jun-11	61	0.5	300	285	7.3	108																																								
8-Jun-11	62	0.5	300	305	7.2	108																																								
15-Jun-11	63	0.5	300	335	7.6	94																																								
22-Jun-11	64	0.5	300	325	7.5	89	#N/A	4.6	32	18	0.50	1.4	0.30	39	0.057	0.015	0.0052	0.046	0.00002	0.00002	0.012	0.000087	13	0.00050	0.00020	0.0084	0.012	0.00037	0.001	1.8	0.0053	0.010	0.57	0.00040	0.42	1.4	0.0010	20	0.00002	1.2	0.062	4.9	0.00002	0.0032	0.00040	0.00010	0.00089	1.1	0.0002
29-Jun-11	65	0.5	300	300	7.5	93																																								
6-Jul-11	66	0.5	300	315	7.3	91																																								
13-Jul-11	67	0.5	300	305	7.2	91																																								
20-Jul-11	68	0.5	300	325	7.2	89	#N/A	5.3	28	13	0.40	1.4	0.30	43	0.045	0.015	0.0059	0.049	0.00002	0.00001	0.010	0.00043	14	0.00050	0.00010	0.0063	0.019	0.000080	0.001	1.9	0.0048	0.010	0.56	0.00050	0.49	1.5	0.0016	21	0.00002	1.2	0.068	5.0	0.00002	0.0038	0.00030	0.00012	0.00098	0.0030	0.00007
27-Jul-11	69	0.5	300	335	7.2	83																																								
3-Aug-11	70	0.5	300	240	7.3	82																																								
10-Aug-11	71	0.5	300	345	7.3	84																																								
17-Aug-11	72	0.5	300	345	7.3	78	#N/A	5.3	26	9.0	0.40	1.2	0.30	37	0.081	0.013	0.0049	0.046	0.00002	0.00001	0.0091	0.000040	12	0.0018	0.00030	0.010	0.035	0.00010	0.001	1.7	0.0057	0.010	0.46	0.00050	0.45	1.4	0.00077	18	0.00004	1.4	0.060	4.7	0.00002	0.0039	0.00050	0.000078	0.00074	0.0010	0.0001
24-Aug-11	73	0.5	300	310	7.3	81																																								
31-Aug-11	74	0.5	300	320	7.3	86																																								
7-Sep-11	75	0.5	300	310	7.4	86																																								
14-Sep-11	76	0.5	300	325	7.4	83	#N/A	6.6	32	9.0	0.20	1.3	0.30	37	0.056	0.012	0.0051	0.051	0.00002	0.00001	0.0095	0.000060	12	0.0025	0.00020	0.0061	0.016	0.00018	0.001	1.7	0.0025	0.010	0.43	0.00080	0.40	1.3	0.00065	18	0.00002	0.80	0.060	3.8	0.00002	0.0034	0.00030	0.00012	0.00093	0.0060	0.0002
21-Sep-11	77	0.5	300	320	7.3	84																																								
28-Sep-11	78	0.5	300	310	7.5	88																																								
5-Oct-11	79	0.5	300	315	7.4	95																																								
12-Oct-11	80	0.5	300	300	7.5	95	#N/A	11	40	12	0.30	1.3	0.30	45	0.093	0.014	0.0052	0.062	0.00002	0.00001	0.0090	0.000072	15	0.0018	0.00039	0.0066	0.044	0.00034	0.001	2.0	0.0039	0.010	0.41	0.00040	0.45	1.7	0.0011	22	0.00003	0.95	0.074	4.1	0.00002	0.0033	0.00050	0.000085	0.00085	0.0030	0.0005
19-Oct-11	81	0.5	300	295	7.4	95																																								
26-Oct-11	82	0.5	300	305	7.4	95																																								
2-Nov-11	83	0.5	300	340	7.4	82																																								
9-Nov-11	84	0.5	300	320	7.4	86	#N/A	8.2	34	11	0.40	1.2	0.30	41	0.033	0.013	0.0053	0.053	0.00002	0.00001	0.0079	0.000033	13	0.00050	0.00064	0.0058	0.0030	0.000030	0.001	2.2	0.0066	0.010	0.43	0.00060	0.44	1.5	0.00055	19	0.00003	4.2	0.066	4.1	0.00002	0.0032	0.00030	0.000096	0.00090	0.0030	0.00004
16-Nov-11	85	0.5	300	310	7.4	93																																								
23-Nov-11	86	0.5	300	305	7.5	93																																								
30-Nov-11	87	0.5	300	295	7.4	94																																								
7-Dec-11	88	0.5	300	320	7.5	91	#N/A	7.9	38	8.0	0.20	1.3	0.30	42	0.12	0.013	0.0049	0.058	0.00002	0.00001	0.0059	0.000069	14	0.0038	0.00046	0.0062	0.038	0.00031	0.001	1.9	0.0047	0.010	0.41	0.00020	0.45	1.5	0.00094	20	0.00003	0.78	0.069	3.9	0.00002	0.0035	0.00060	0.00012	0.00081	0.0040	0.0001
14-Dec-11	89	0.5	300	330	7.2	82																																								
21-Dec-11	90	0.5	300	295	7.5	90																																								
28-Dec-11	91	0.5	300	295	7.4	93																																								
4-Jan-12	92	0.5	300	315	7.4	86	#N/A	8.1	40	8.0	0.30	0.060	0.30	40	0.089	0.015	0.0053	0.054	0.00002	0.00001	0.018	0.000036	13	0.00050	0.000057	0.0051	0.0080	0.000030	0.001	1.8	0.0037	0.010	0.40	0.00070	0.40	1.5	0.00098	21	0.00005	0.65	0.067	3.7	0.00002	0.0030	0.00040	0.00012	0.0012	0.0030	0.00007
11-Jan-12	93	0.5	300	330	7.3	80																																								
18-Jan-12	94

Notes: blue print are values below the analytical detection limit * as $CaCO_3$

Calculated Production Rates for Cal 4a

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	T-Alk.	SO_4	Cl	F	Br	Hard.	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg/kg*	mg/kg*	mg/kg*	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg*	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
7-Apr-10	1	0.5	1150	540	7.0	3871	#N/A	2.1	12	243	6.5	0.029	0.032	151	0.0042	0.0015	0.00044	0.0096	0.000002	0.000003	0.0024	0.00029	43	0.0031	0.0038	0.043	0.0054	0.000053	0.0002	11	0.26	0.079	0.025	0.0021	0.018	3.4	0.0032	1.0	0.000004	86	0.21	81	0.000002	0.000031	0.000197	0.00054	0.000021	0.0045	0.0004
14-Apr-10	2	0.5	300	300	7.2	2063	#N/A	0.58	3.0	75	0.78	0.029	0.018	53	0.00065	0.00052	0.00024	0.0021	0.000001	0.000003	0.0011	0.000232	17	0.00011	0.00015	0.0051	0.00060	0.000037	0.00066	2.7	0.033	0.0012	0.042	0.00022	0.0036	0.74	0.00095	0.42	0.000003	11	0.049	25	0.00001	0.000031	0.000124	0.00016	0.000027	0.00042	0.00001
21-Apr-10	3	0.5	300	360	7.2	1305	#N/A	0.66	3.4	48	0.48	0.035	0.022	31	0.0011	0.00053	0.00022	0.0042	0.000001	0.000007	0.0013	0.000327	9.9	0.00014	0.00084	0.0096	0.00072	0.000010	0.00007	1.5	0.013	0.0014	0.060	0.00018	0.0043	0.76	0.00077	0.54	0.000002	8.1	0.033	16	0.00001	0.000055	0.000229	0.00013	0.000031	0.0012	0.00002
28-Apr-10	4	0.5	300	350	7.2	960	#N/A	0.33	3.8	36	0.32	0.031	0.021	21	0.0093	0.00051	0.00018	0.0035	0.000001	0.000007	0.0012	0.000331	6.7	0.00098	0.00076	0.0037	0.00070	0.0000042	0.00027	3.0	0.0098	0.0014	0.069	0.00011	0.0042	0.52	0.00053	0.54	0.000002	6.6	0.024	10	0.00001	0.000067	0.000238	0.00016	0.000034	0.00042	0.00002
5-May-10	5	0.5	300	285	7.4	870				21																																								
12-May-10	6	0.5	300	320	7.5	681	#N/A	0.36	3.8	18	0.10	0.044	0.019	12	0.015	0.00057	0.00017	0.0030	0.000001	0.000006	0.0012	0.000031	3.8	0.00096	0.00034	0.0024	0.00013	0.0000026	0.00006	0.56	0.0049	0.00064	0.093	0.00011	0.0058	0.36	0.00026	0.68	0.000004	4.8	0.014	6.1	0.00001	0.000099	0.000038	0.000095	0.000040	0.00013	0.00003
19-May-10	7	0.5	300	280	7.5	585				14																																								
26-May-10	8	0.5	300	370	7.3	489	#N/A	0.70	4.0	10	0.067	0.068	0.022	8.9	0.0034	0.00086	0.00024	0.0030	0.000001	0.000007	0.0014	0.000044	2.8	0.000052	0.00066	0.0028	0.00015	0.0000037	0.00007	0.44	0.0027	0.00074	0.13	0.00059	0.011	0.32	0.00025	0.84	0.000002	3.9	0.012	4.8	0.00001	0.000017	0.000059	0.000084	0.000062	0.00015	0.00001
2-Jun-10	9	0.5	300	325	7.5	411				7.0																																								
9-Jun-10	10	0.5	300	325	7.5	362	#N/A	0.43	3.2	6.0	0.13	0.061	0.020	5.1	0.0013	0.00082	0.00019	0.0027	0.000001	0.000007	0.0011	0.000036	1.6	0.000046	0.00052	0.0023	0.00013	0.0000026	0.00007	0.27	0.0027	0.00065	0.12	0.00052	0.0086	0.21	0.00013	0.75	0.000005	2.4	0.0079	2.7	0.00001	0.000019	0.000039	0.000052	0.000046	0.00013	0.00003
16-Jun-10	11	0.5	300	330	7.5	336				5.4																																								
23-Jun-10	12	0.5	300	285	7.6	347	#N/A	0.26	4.0	5.5	0.080	0.067	0.017	5.2	0.0011	0.0011	0.00023	0.0025	0.000001	0.000006	0.0010	0.000038	1.7	0.00057	0.00020	0.0018	0.00011	0.0000029	0.00006	0.24	0.0028	0.00057	0.12	0.00029	0.010	0.21	0.00014	0.82	0.000002	1.9	0.0074	1.8	0.00001	0.000018	0.000034	0.000045	0.000047	0.00011	0.000008
30-Jun-10	13	0.5	300	295	7.8	273				3.2																																								
7-Jul-10	14	0.5	300	280	7.6	295	#N/A	0.31	3.6	3.5	0.13	0.067	0.017	3.9	0.0026	0.00094	0.00022	0.0030	0.000001	0.000006	0.00097	0.000028	1.2	0.000073	0.00021	0.0017	0.00050	0.0000045	0.00006	0.21	0.0027	0.00056	0.10	0.00056	0.014	0.19	0.00013	0.88	0.000003	1.5	0.0070	1.5	0.00001	0.000016	0.000034	0.000051	0.000053	0.00011	0.000005
14-Jul-10	15	0.5	300	280	7.6	285				2.0																																								
21-Jul-10	16	0.5	300	290	7.6	263	#N/A	0.49	3.9	2.9	0.10	0.070	0.017	4.1	0.0076	0.00092	0.00023	0.0030	0.000001	0.000006	0.00089	0.000032	1.3	0.000058	0.00024	0.0061	0.0011	0.0000052	0.00006	0.20	0.0022	0.00058	0.099	0.00029	0.014	0.18	0.00011	1.00	0.000003	1.3	0.0066	1.1	0.00001	0.000014	0.000035	0.000056	0.000055	0.00012	0.000008
28-Jul-10	17	0.5	300	295	7.5	244				2.3																																								
4-Aug-10	18	0.5	300	280	7.6	231	#N/A	0.46	3.6	2.1	0.084	0.074	0.017	3.9	0.0069	0.00094	0.00024	0.0028	0.000001	0.000006	0.00075	0.000026	1.3	0.000073	0.000045	0.0063	0.00062	0.0000044	0.00006	0.18	0.0023	0.0011	0.091	0.0000056	0.015	0.16	0.00014	0.97	0.000002	1.2	0.0058	1.00	0.00001	0.000013	0.000028	0.000044	0.000052	0.000056	0.000006
11-Aug-10	19	0.5	300	305	7.5	220				2.8																																								
18-Aug-10	20	0.5	300	305	7.6	208	#N/A	0.51	3.5	2.3	0.085	0.076	0.018	3.6	0.016	0.0011	0.00027	0.0030	0.000001	0.000006	0.0012	0.000023	1.2	0.000055	0.00013	0.0025	0.00031	0.0000049	0.00006	0.17	0.0023	0.00063	0.089	0.00043	0.014	0.16	0.00018	1.1	0.000007	1.0	0.0055	1.3	0.00001	0.000013	0.000037	0.000040	0.000066	0.00024	0.000006
25-Aug-10	21	0.5	300	310	7.4	194				2.0																																								
1-Sep-10	22	0.5	300	320	7.4	169	#N/A	0.53	3.2	1.1	0.070	0.080	0.019	3.5	0.0024	0.0011	0.00023	0.0025	0.000001	0.000006	0.0010	0.000038	1.1	0.000045	0.00016	0.0031	0.00013	0.0000058	0.00006	0.16	0.0022	0.00064	0.084	0.00045	0.015	0.16	0.00097	1.1	0.000002	1.2	0.0054	0.95	0.00001	0.000013	0.000026	0.000036	0.000058	0.00045	0.000004
8-Sep-10	23	0.5	300	335	7.2	161				2.6																																								
15-Sep-10	24	0.5	300	320	7.3	141	#N/A	0.37	2.3	2.5	0.058	0.088	0.019	3.1	0.0084	0.0012	0.00026	0.0026	0.000001	0.000006	0.0011	0.000043	1.0	0.000038	0.000028	0.0050	0.0011	0.0000058	0.00006	0.14	0.0023	0.0019	0.090	0.000045	0.017	0.14	0.00012	1.1	0.000003	0.70	0.0050	0.84	0.00001	0.000018	0.000038	0.00033	0.000059	0.00019	0.000010
22-Sep-10	25	0.5	300	335	7.2	127				2.6																																								
29-Sep-10	26	0.5	300	330	7.2	113	#N/A	0.34	2.3	2.3	0.066	0.10	0.020	3.0	0.012	0.0012	0.00035	0.0028	0.000001	0.000007	0.00098	0.000016	1.00	0.000039	0.00048	0.0063	0.0025	0.0000022	0.00007	0.13	0.0018	0.00066	0.090	0.00040	0.023	0.14	0.00092	1.3	0.000004	0.62	0.0049	0.83	0.00001	0.00025	0.000086	0.000324	0.00010	0.00040	0.00002
6-Oct-10	27	0.5	300	320	7.2	147				2.1																																								
13-Oct-10	28	0.5	300	310	7.3	145	#N/A	0.38	2.3	2.0	0.087	0.096	0.019	3.1	0.0044	0.0012	0.00032	0.0024	0.000001	0.000006	0.0011	0.000081	1.00	0.000062	0.000033	0.0060	0.00062	0.0000025	0.00006	0.15	0.0023	0.00062	0.084	0.000074	0.022	0.14	0.00092	1.3	0.0000006	0.55	0.0050	0.72	0.00001	0.00034	0.00026	0.000031	0.000058	0.00025	0.00001
20-Oct-10	29	0.5	300	300	7.2	140				1.7																																								
27-Oct-10	30	0.5	300	375	7.3	130	#N/A	0.34	2.4	1.9	0.060	0.11	0.023	3.1	0.0016	0.0013	0.00036	0.0028	0.000002	0.000008	0.0011	0.000062	1.0	0.000038	0.000018	0.0020	0.00038	0.0000068	0.00008	0.14	0.0018	0.00075	0.085	0.000090	0.023	0.13	0.00095	1.3	0.000002	0.50	0.0049	0.78	0.00002	0.00050	0.00031	0.000017	0.000063	0.00090	0.000010
3-Nov-10	31	0.5	300	300	7.4	130				1.5																																								
10-Nov-10	32	0.5	300	330	7.5	127	#N/A	0.31	2.8	1.4	0.046	0.0092	0.020	3.4	0.0063	0.0011	0.00032	0.0030	0.000001	0.000007	0.00070	0.000044	1.1	0.000053	0.000011	0.0011	0.0018	0.0000035	0.00007	0.15	0.0014	0.0013	0.083	0.0000033	0.024	0.14	0.000083	1.3	0.000003	0.45	0.0054	0.59	0.00001	0.00051	0.00040	0.000018	0.000065	0.00079	0.000013
17-Nov-10	33	0.5	300	305	7.6	129				1.5																																								
24-Nov-10	34	0.5	300	300	7.3	146	#N/A	0.38	3.0	1.4	0.042	0.090	0.018	3.2	0.0036	0.00098	0.00031	0.0030	0.000001	0.000006	0.00064	0.000029	1.0	0.000042	0.000014	0.0017	0.00048	0.0000048	0.00006	0.15	0.0010	0.00060	0.057	0.0000060	0.019	0.12	0.00010	1.2	0.000001	0.35	0.0052	0.46	0.00001	0.00055	0.00027	0.000025	0.000052	0.00030	0.000008
1-Dec-10	35	0.5	300	300	7.3	145				1.3																																								
8-Dec-10	36	0.5	300	300	7.3	143	#N/A	0.41	2.9	1.4	0.042	0.088	0.018	3.4	0.0021	0.0011	0.00028	0.0029	0.000001	0.000004	0.00054	0.000033	1.1	0.000072	0.0000081	0.00077	0.00042	0.00013	0.00006	0.15	0.00087	0.00060	0.055	0.0000018	0.022	0.13	0.00036	1.3	0.000002	0.32	0.0055	0.45	0.00001	0.00062	0.000030	0.000016	0.000063	0.00024	0.000004
15-Dec-10	37	0.5	300	370	7.2	133				2.0																																								
22-Dec-10	38	0.5	300	370	7.2	126	#N/A	0.64	2.8	2.1	0.052	0.11	0.022	3.7	0.0071	0.0011	0.00034	0.0030	0.000001	0.000007	0.00096	0.000022	1.2	0.000074	0.000033	0.0062	0.00052	0.0000015	0.00007	0.17	0.0011	0.00074	0.060	0.000081	0.028	0.15	0.00062	1.6	0.000004	0.39	0.0060	0.78	0.00001	0.00059	0.000222	0.000030	0.000070	0.0013	0.000006
29-Dec-10	39	0.5	300	250	7.1	105				1.2																																								
5-Jan-11	40	0.5	300	370	7.3	99	#N/A	0.68	2.4	1.5	0.044	0.096	0.022	3.0	0.0094	0.0010	0.00030	0.0030	0.000001	0.000007	0.00093	0.000018	0.99	0.000037	0.000093	0.0059	0.00044	0.0000025	0.00007	0.14	0.0013	0.00074	0.050	0.00015	0.024	0.13	0.00012	1.3	0.000003	0.34	0.0049	0.83	0.00001	0.00043	0.00010	0.000025	0.000064	0.0026	0.000004
12-Jan-11	41	0.5	300	340	7.2	109																																											
19-Jan-11	42	0.5	300	375	7.1	95																																											
26-Jan-11	43	0.5	300	320	7.2	91																																											
2-Feb-11	44	0.5	300	400	7.1	80	#N/A	0.50	2.5	1.4	0.032	0.11	0.024	3.2	0.010	0.0012	0.00036	0.0030	0.000002	0.000008	0.0077	0.000134	1.0	0.000040	0.0000076	0.00099	0.0022	0.0000096	0.00008	0.14	0.00051	0.00080	0.054	0.0000048	0.031	0.13	0.000081	1.6	0.000005	0.21	0.0051	0.49	0.00002	0.00043	0.000056	0.0000090	0.000066	0.00072	0.00001
9-Feb-11	45	0.5	300	325	7.2	92																																											
16-Feb-11	46	0.5	300	350	7.2	90																																										
23-Feb-11	47	0.5	300	450	7.2	95																																										
2-Mar-11	48	0.5	300	385	7.2	89	#N/A	0.38	2.2	1.6	0.023	0.10	0.023	2.9	0.0020	0.00099	0.00034	0.0034	0.000002	0.000008	0.00057	0.0000077	0.93	0.00054	0.0000094	0.00067	0.00054	0.00023	0.00008	0.14	0.00053	0.00077	0.045	0.000015	0.028	0.099	0.000028	1.3	0.000002	0.14	0.0047	0.39	0.00002	0.00036	0.000039	0.0000085	0.000052	0.00023	0.000003
9-Mar-11	49	0.5	300	425	7.1	89																																											
16-Mar-11	50	0.5	300	375	7.2	84																																											
23-Mar-11	51	0.5	300	385	7.3	94																																											
30-Mar-11	52	0.5	300	325	7.3	105	#N/A	0.45	2.5	0.85	0.026	0.085	0.020	2.9	0.0018	0.00092	0.00030	0.0036	0.000001	0.000007	0.00056	0.0000016	0.94	0.00052	0.0000065	0.00046	0.00046	0.00037	0.00007	0.14	0.00025	0.00065	0.039	0.000020	0.027	0.10	0.00090	1.4	0.0000007	0.12	0.0047	0.36	0.00001	0.00025	0.000020	0.0000011	0.0000051	0.00039	0.0000005
6-Apr-11	53	0.5	300	320	7.3	96																																											
13-Apr-11	54	0.5	300	310	7.3	96																																											
20-Apr-11	55	0.5	300	310	7.5	98																																											
27-Apr-11	56	0.5	300	360	7.3	88	#N/A	0.33	2.1	0.72	0.029	0.096	0.022	2.6	0.0018	0.0010	0.00032	0.0033	0.000001	0.000004	0.00060	0.0000066	0.85	0.00036	0.00	0.00042	0.00029	0.0000036	0.00007	0.12	0.00040	0.00072	0.043	0.000050	0.027	0.091	0.000060	1.3	0.0000007	0.11	0.0043	0.35	0.00001	0.00031	0.00030	0.0000058	0.000055	0.000072	0.00003
4-May-11	57	0.5	300	305	7.3	95																																											
11-May-11	58	0.5	300	295	7.3	107																																											
18-May-11	59	0.5	300	310	7.2	103																																											
25-May-11	60	0.5	300	305	7.1	107	#N/A	0.41	2.2	0.61	0.031	0.080	0.018	2.8	0.012	0.00090	0.00029	0.0037	0.000001	0.000001	0.00038	0.0000057	0.93	0.00031	0.000012	0.00054	0.00098	0.0000085	0.00006	0.13	0.00027	0.00061	0.035	0.000079	0.025	0.10	0.00011	1.3	0.0000006	0.10	0.0046	0.32	0.00001	0.00022	0.000061	0.0000011	0.000049	0.00012	0.00001
1-Jun-11	61	0.5	300	295	7.3	108																																											
8-Jun-11	62	0.5	300	305	7.2	108																																											
15-Jun-11	63	0.5	300	335	7.6	94																																											
22-Jun-11	64	0.5	300	325	7.5	89	#N/A	0.30	2.0	1.2	0.013	0.090	0.020	2.5	0.0037	0.00094	0.00034	0.0039	0.000001	0.000001	0.00077	0.0000057	0.82	0.00033	0.000013	0.00055	0.00078	0.0000024	0.00007	0.11	0.00033	0.00065	0.037	0.000026	0.027	0.093	0.000065	1.3	0.0000001	0.080	0.0040	0.32	0.00001	0.00021	0.000026	0.0000068	0.000058	0.068	0.00001
29-Jun-11	65	0.5	300	300	7.5	93																																											
6-Jul-11	66	0.5	300	315	7.3	91																																											
13-Jul-11	67	0.5	300	305	7.2	91																																											
20-Jul-11	68	0.5	300	325	7.2	89	#N/A	0.34	1.8	0.85	0.026	0.088	0.020	2.8	0.0029	0.00097	0.00038	0.0032	0.000001	0.000007	0.00066	0.0000028	0.90	0.00033	0.0000065	0.00041	0.0012	0.0000052	0.00007	0.13	0.00031	0.00065	0.036	0.000033	0.032	0.095	0.000010	1.4	0.0000001	0.077	0.0044	0.33	0.00001	0.00025	0.000020	0.0000079	0.000064	0.00020	0.000005
27-Jul-11	69	0.5	300	335	7.2	83																																											
3-Aug-11	70	0.5	300	240	7.3	82																																											
10-Aug-11	71	0.5	300	345	7.3	84																																											
17-Aug-11	72	0.5	300	345	7.3	78	#N/A	0.37	1.8	0.62	0.028	0.079	0.021	2.6	0.0056	0.00090	0.00034	0.0032	0.000001	0.000007	0.00063	0.0000028	0.83	0.00012	0.000021	0.00070	0.0024	0.0000069	0.00007	0.12	0.00039	0.00069	0.031	0.000035	0.031	0.095	0.000053	1.3	0.0000003	0.099	0.0041	0.33	0.00001	0.00027	0.000035	0.0000054	0.000051	0.000069	0.000007
24-Aug-11	73	0.5	300	310	7.3	81																																											
31-Aug-11	74	0.5	300	320	7.3	86																																											
7-Sep-11	75	0.5	300	310	7.4	86																																											
14-Sep-11	76	0.5	300	325	7.4	83	#N/A	0.43	2.1	0.59	0.013	0.083	0.020	2.4	0.0037	0.00081	0.00033	0.0033	0.000001	0.000007	0.00062	0.0000039	0.78	0.00016	0.0000113	0.00040	0.0010	0.0000012	0.00007	0.11	0.00016	0.00065	0.028	0.000052	0.026	0.083	0.000042	1.2	0.0000001	0.052	0.0039	0.24	0.00001	0.00022	0.000020	0.0000078	0.000060	0.00039	0.00001
21-Sep-11	77	0.5	300	320	7.3	84																																											
28-Sep-11	78	0.5	300	310	7.5	89																																											
5-Oct-11	79	0.5	300	315	7.4	95																																											
12-Oct-11	80	0.5	300	300	7.5	95	#N/A	0.68	2.4	0.72	0.018	0.080	0.018	2.7	0.0056	0.00085	0.00031	0.0037	0.000001	0.000006	0.00054	0.0000043	0.88	0.00011	0.0000023	0.00040	0.0026	0.0000084	0.00006	0.12	0.00023	0.00060	0.025	0.000024	0.027	0.10	0.000065	1.3	0.0000002	0.057	0.0044	0.24	0.00001	0.00020	0.000030	0.0000051	0.000051	0.00018	0.00001
19-Oct-11	81	0.5	300	295	7.4	95																																											
26-Oct-11	82	0.5	300	305	7.4	95																																											
2-Nov-11	83	0.5	300	340	7.4	82																																											
9-Nov-11	84	0.5	300	320	7.4	86	#N/A	0.52	2.2	0.70	0.026	0.075	0.019	2.6	0.0021	0.00086	0.00034	0.0034	0.000001	0.000006	0.00051	0.0000021	0.83	0.00032	0.0000041	0.00037	0.00019	0.0000019	0.00006	0.14	0.00042	0.00064	0.026	0.000038	0.028	0.095	0.000035	1.2	0.0000002	0.27	0.0042	0.26	0.00001	0.00020	0.000019	0.0000061	0.000058	0.00019	0.000003
16-Nov-11	85	0.5	300	310	7.4	93																																											
23-Nov-11	86	0.5	300	305	7.5	93																																											
30-Nov-11	87	0.5	300	295	7.4	94																															

Leachate Results for HC3

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
		Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	500	400	7.3	846	#N/A	8.5	41	349	5.0	1.2	0.30	336	0.024	0.00080	0.00080	0.019	0.000020	0.000010	0.016	0.00043	96	0.00050	0.0014	0.014	0.0030	0.000020	0.0050	24	0.16	0.020	0.073	0.0045	0.0090	15	0.0028	5.1	0.000010	36	0.26	122	0.000040	0.00037	0.00040	0.051	0.00035	0.0030	0.00058
6-Dec-11	1	500	445	7.4	503	#N/A	4.0	29	203	3.4	0.91	0.30	182	0.035	0.00060	0.00060	0.012	0.000020	0.000010	0.0051	0.00021	49	0.00050	0.00063	0.012	0.0030	0.000020	0.0030	15	0.086	0.020	0.067	0.0030	0.0090	9.0	0.0018	0.85	0.000040	25	0.14	72	0.000020	0.000050	0.00030	0.042	0.00034	0.0020	0.00026
13-Dec-11	2	500	450	7.4	414	#N/A	3.8	24	158	1.5	0.97	0.30	165	0.087	0.00040	0.00060	0.011	0.000020	0.000010	0.0044	0.00019	48	0.0018	0.00044	0.0087	0.079	0.00014	0.0020	11	0.068	0.020	0.053	0.0029	0.023	7.0	0.0010	0.98	0.000010	15	0.15	57	0.000020	0.00016	0.0018	0.041	0.00023	0.0030	0.00024
20-Dec-11	3	500	485	7.4	284	#N/A	4.1	27	112	0.40	0.79	0.30	113	0.048	0.00070	0.00050	0.0080	0.000020	0.000010	0.0039	0.00013	32	0.00050	0.00028	0.0050	0.0030	0.000020	0.0020	8.0	0.064	0.010	0.041	0.0019	0.012	5.1	0.00066	1.1	0.000010	7.5	0.094	38	0.000020	0.000010	0.00010	0.055	0.00027	0.0020	0.000090
27-Dec-11	4	500	430	8.6	240																																												
3-Jan-12	5	500	435	7.4	170	#N/A	4.1	23	60	0.20	0.69	0.30	64	0.086	0.00070	0.0011	0.0054	0.000020	0.000010	0.0034	0.000059	19	0.00050	0.00015	0.0029	0.0060	0.000020	0.0010	4.1	0.026	0.010	0.030	0.0015	0.0090	3.2	0.00014	0.75	0.000010	3.6	0.058	20	0.000020	0.00010	0.00040	0.027	0.00067	0.0020	0.000050
10-Jan-12	6	500	415	7.6	166																																											
17-Jan-12	7	500	475	7.7	110	#N/A	2.4	31	31	0.20	0.62	0.30	46	0.062	0.00090	0.00080	0.0059	0.000020	0.000010	0.0036	0.000042	13	0.00050	0.000077	0.0024	0.0030	0.000020	0.0010	3.4	0.023	0.010	0.022	0.00040	0.0090	2.8	0.00015	0.92	0.000010	1.8	0.039	10.0	0.000020	0.000020	0.00030	0.033	0.00040	0.0020	0.000040
24-Jan-12	8	500	505	7.7	120																																											
31-Jan-12	9	500	460	7.6	126	#N/A	3.0	28	34	0.20	0.55	0.30	49	0.057	0.00070	0.00030	0.0082	0.000020	0.000010	0.0026	0.000045	14	0.00050	0.000082	0.0026	0.0060	0.000090	0.0010	3.4	0.025	0.010	0.018	0.00010	0.0090	2.6	0.00029	0.85	0.000010	1.3	0.043	12	0.000020	0.00022	0.00050	0.026	0.00058	0.0020	0.000020
7-Feb-12	10	500	465	7.7	118																																											
14-Feb-12	11	500	450	7.7	116	#N/A	4.7	25	40	0.20	0.46	0.30	49	0.043	0.00040	0.0018	0.0065	0.000020	0.000010	0.0023	0.000033	14	0.00050	0.000065	0.0038	0.0050	0.000020	0.0010	3.4	0.022	0.010	0.013	0.00050	0.0090	2.2	0.00023	0.80	0.000010	0.87	0.044	11	0.000020	0.000030	0.00030	0.023	0.00020	0.0010	0.000020
21-Feb-12	12	500	465	7.7	108																																											
28-Feb-12	13	500	500	7.6	89	#N/A	3.2	23	23	0.20	0.29	0.30	40	0.038	0.00070	0.0037	0.0072	0.000020	0.000010	0.0034	0.00026	11	0.00050	0.000084	0.0011	0.0030	0.000020	0.0010	2.7	0.026	0.010	0.0077	0.00010	0.0090	1.6	0.00027	0.65	0.000010	0.48	0.035	7.5	0.000020	0.000030	0.00020	0.022	0.00031	0.0020	0.000010
6-Mar-12	14	500	495	7.8	97																																											
13-Mar-12	15	500	445	7.5	117	#N/A	2.9	22	38	0.20	0.31	0.30	52	0.050	0.00050	0.00030	0.0077	0.000020	0.000010	0.0020	0.000023	15	0.00050	0.000042	0.0013	0.0030	0.000020	0.0010	3.5	0.020	0.010	0.0096	0.00020	0.0090	1.9	0.000090	0.74	0.000010	0.50	0.045	12	0.000020	0.00021	0.00010	0.023	0.00018	0.0010	0.000020
20-Mar-12	16	500	475	7.6	123																																											
27-Mar-12	17	500	490	7.5	108	#N/A	2.6	23	30	0.20	0.29	0.30	47	0.050	0.00050	0.00020	0.0084	0.000020	0.000010	0.0019	0.000037	14	0.00050	0.000044	0.0015	0.0030	0.000020	0.0010	3.1	0.024	0.010	0.0076	0.00020	0.0090	1.8	0.000070	0.73	0.000010	0.39	0.040	10	0.000020	0.000010	0.00020	0.022	0.00030	0.0010	0.000010
3-Apr-12	18	500	515	7.5	72																																											
10-Apr-12	19	500	510	7.5	94	#N/A	2.1	18	27	0.20	0.20	0.30	40	0.046	0.00040	0.00020	0.0081	0.000020	0.000010	0.0019	0.0000030	11	0.00050	0.000065	0.0013	0.0030	0.000020	0.0010	2.7	0.023	0.020	0.0065	0.00010	0.0090	1.3	0.00012	0.62	0.000010	0.27	0.033	8.6	0.000020	0.000050	0.00010	0.016	0.00029	0.0010	0.000010
17-Apr-12	20	500	460	7.4	114																																											
24-Apr-12	21	500	490	7.5	86	#N/A	2.7	21	25	0.20	0.18	0.30	37	0.055	0.00040	0.00020	0.0092	0.000020	0.000010	0.0016	0.0000030	11	0.00050	0.000060	0.0017	0.0030	0.000030	0.0010	2.5	0.021	0.030	0.0058	0.00030	0.0090	1.2	0.000090	0.55	0.000010	0.25	0.030	7.8	0.000020	0.000070	0.00020	0.016	0.00036	0.0030	0.000010
1-May-12	22	500	510	7.7	88																																											
8-May-12	23	500	520	7.5	92	#N/A	2.7	20	28	0.20	0.16	0.30	40	0.033	0.00050	0.00090	0.0072	0.000020	0.000010	0.0019	0.000049	11	0.00050	0.000059	0.0015	0.0030	0.000028	0.0010	2.9	0.025	0.010	0.015	0.00030	0.0090	1.2	0.000070	0.54	0.000010	0.25	0.030	8.6	0.000020	0.00022	0.00010	0.019	0.00030	0.0060	0.000010
15-May-12	24	500	505	7.5	101																																											
22-May-12	25	500	430	7.5	128	#N/A	3.4	20	37	0.20	0.19	0.30	53	0.089	0.00060	0.00030	0.0081	0.000020	0.000010	0.0017	0.0000030	15	0.00050	0.000053	0.0019	0.0030	0.000020	0.0010	3.9	0.021	0.050	0.0094	0.00030	0.0090	1.7	0.00015	0.71	0.000010	0.31	0.045	13	0.000020	0.00012	0.00040	0.029	0.00056	0.0020	0.000020
29-May-12	26	500	460	7.4	95																																											
5-Jun-12	27	500	455	7.4	95	#N/A	3.2	17	26	0.20	0.13	0.30	40	0.059	0.00090	0.00070	0.0070	0.000020	0.000010	0.0023	0.0000030	12	0.00050	0.000063	0.0011	0.0070	0.000020	0.0010	2.8	0.021	0.010	0.0055	0.00010	0.0090	1.2	0.00014	0.53	0.000010	0.23	0.033	9.4	0.000020	0.00020	0.00030	0.015	0.00054	0.0010	0.000010
12-Jun-12	28	500	465	7.4	91																																											
19-Jun-12	29	500	460	7.4	89	#N/A	2.8	15	22	0.20	0.13	0.30	37	0.064	0.00030	0.00020	0.0058	0.000020	0.000010	0.0012	0.0000030	10	0.00050	0.000044	0.0011	0.0030	0.000020	0.0010	2.6	0.019	0.010	0.23	0.00020	0.0090	1.0	0.00020	0.50	0.000010	0.19	0.029	8.0	0.000020	0.00024	0.00050	0.016	0.00055	0.0030	0.000010
26-Jun-12	30	500	460	7.5	90																																											
3-Jul-12	31	500	450	7.6	97	#N/A	6.4	23	28	0.20	0.13	0.30	41	0.051	0.00030	0.00030	0.0084	0.000020	0.000010	0.0011	0.000024	11	0.00050	0.000065	0.0014	0.0030	0.000030	0.0010	3.0	0.020	0.010	0.0057	0.00010	0.0090	1.1	0.000040	0.48	0.000010	0.21	0.033	9.5	0.000020	0.00031	0.00020	0.015	0.00032	0.0020	0.000010
10-Jul-12	32	500	465	7.4	91																																											
17-Jul-12	33	500	480	7.5	93	#N/A	2.1	17	23	0.20	0.11	0.30	42	0.043	0.00050	0.0042	0.0053	0.000020	0.000010	0.0046	0.000024	12	0.00050	0.000041	0.0014	0.0030	0.000020	0.0030	3.1	0.022	0.070	0.0068	0.00010	0.0090	1.0	0.00038	0.68	0.00012	0.21	0.032	9.5	0.000020	0.00057	0.00030	0.013	0.00031	0.0020	0.000010
24-Jul-12	34	500	480	7.4	103																																											
31-Jul-12	35	500	475	7.5	98	#N/A	2.1	17	26	0.20	0.10	0.30	43	0.053	0.00040	0.00040	0.0063	0.000020	0.000010	0.0026	0.00011	12	0.00050	0.000072	0.0018	0.0040	0.00026	0.0010	3.1	0.024	0.010	0.0055	0.00010	0.0090	0.98	0.00059	0.68	0.000010	0.21	0.034	9.6	0.000020	0.00045	0.00010	0.013	0.00032	0.0030	0.000010
7-Aug-12	36	500	465	7.5	89																																											
14-Aug-12	37	500	460	7.3	98	#N/A	2.8	14	32	0.20	0.11	0.30	43	0.060	0.00030	0.0042	0.0064	0.000020	0.000010	0.0019	0.000011	12	0.00050	0.000035	0.0014	0.0030	0.000020	0.0010	3.2	0.023	0.010	0.0056	0.00040	0.0090	0.95	0.00019	0.52	0.000010	0.21	0.032	11	0.000020	0.00015	0.00040	0.012	0.00062	0.0020	0.000010
21-Aug-12	38	500	465	7.2	95																																											
28-Aug-12	39	500	505	7.4	88	#N/A	3.2	17	25	0.20	0.090	0.30	38	0.053	0.00040	0.00090	0.0045	0.000020	0.000010	0.0019	0.000022	10	0.00050	0.000084	0.0019	0.0040	0.000050	0.0010	3.0	0.028	0.010	0.0047	0.00030	0.0090	0.80	0.000060	0.54	0.000010	0.17	0.027	8.3	0.000020	0.00026	0.00020	0.016	0.00031	0.0020	0.000010
4-Sep-12	40	500	470	7.3	72																																											
11-Sep-12	41	500	475	7.3	86	#N/A	2.8	13	26	0.20	0.090	0.30	40	0.027	0.00030	0.0011	0.0054	0.000020	0.000010	0.0014	0.000016	11	0.00050	0.00043	0.0028	0.0030	0.000020	0.0010	3.0	0.025	0.010	0.0040	0.077	0.0090	0.76	0.00010	0.45	0.000010	0.21	0.029	10	0.000020	0.00010	0.00010	0.011	0.00014	0.0010	0.000020
18-Sep-12	42	500	515	7.3	103																																											
25-Sep-12	43	500	455	7.2	95	#N/A	3.4	14	30	0.20	0.080	0.30	40	0.053	0.00020	0.00020	0.0077	0.000020	0.000010	0.0030	0.00014	11	0.00050	0.00059	0.0013	0.0080	0.000030	0.0010	3.0	0.020	0.010	0.25	0.00020	0.0090	0.71	0.00076	0.38	0.000010	0.17	0.028	10	0.000020	0.00034	0.00010	0.025	0.00033	0.0020	0.000010
2-Oct-12	44	500	460	7.3	80																																											
9-Oct-12	45	500	465	7.3	73	#N/A	3.9	13	21	0.20	0.070	0.30	31	0.044	0.00020	0.00020	0.0035	0.000020	0.000010	0.0011	0.000054	8.7	0.00050	0.0000020	0.0026	0.018	0.00035	0.0010	2.3	0.020	0.010	0.0040	0.00020	0.0090	0.57	0.00013	0.33	0.000010	0.12	0.022	7.4	0.000020	0.00021	0.00020	0.0088	0.00026	0.0050	0.000010
16-Oct-12	46	500	465	7.2	77																																											
23-Oct-12	47	500	475	7.3	67																																											
30-Oct-12	48	500	470	7.4	89																																											
6-Nov-12	49	500	445	7.2	88	#N/A	2.9	14	27	0.20	0.080	0.30	44	0.031	0.00020	0.00030	0.0051	0.000020	0.000010	0.0025	0.000088	12	0.00050	0.00022	0.0041	0.0040	0.000030	0.0010	3.3	0.022	0.010	0.0048	0.00060	0.012	0.67	0.00010	0.36	0.000010	0.20	0.031	11	0.000020	0.0012	0.00020	0.011	0.00024	0.0080	0.000010
13-Nov-12	50	500	450	7.2	88																																											
20-Nov-12	51	500	490	7.6	56																																											
27-Nov-12	52	500	490	7.2	105																																											
4-Dec-12	53	500	470	7.4	69	#N/A	2.1	13	19	0.20	0.070	0.30	32	0.025	0.00050	0.00020	0.0035	0.000020	0.000010	0.0010	0.000060	8.5	0.00050	0.00014	0.0011	0.0030	0.000080	0.0010	2.6	0.018	0.010	0.0036	0.00020	0.0090	0.56	0.00049	0.31	0.000010	0.12	0.021	7.3	0.000020	0.00015	0.00010	0.014	0.00018	0.0060	0.000010
11-Dec-12	54	500	475	7.2	105																																											
18-Dec-12	55	500	450	7.4	76																																											
25-Dec-12	56	500	445	7.2	110																																											
1-Jan-13	57	500	465	7.4	54	#N/A	4.1	15	14	0.20	0.060	0.30	25	0.022	0.00020	0.00030	0.0035	0.000020	0.000010	0.00080	0.000013	6.8	0.00050	0.000066	0.00050	0.0030	0.000020	0.0010	2.0	0.019	0.010	0.0030	0.00010	0.034	0.42	0.000080	0.38	0.000010	0.10	0.017	4.8	0.000020	0.00031	0.00020	0.0087	0.00016	0.0020	0.000010
8-Jan-13	58	500	450	7.3	95																																											
15-Jan-13	59	500	450	7.4	56																																											
22-Jan-13	60	500	465	7.4	80																																										
29-Jan-13	61	500	470	7.4	60	#N/A	2.5	13	18	0.20	0.060	0.30	27	0.035	0.00020	0.00020	0.0029	0.000020	0.000010	0.0010	0.000023	7.5	0.00050	0.000029	0.0010	0.0030	0.000020	0.0010	2.1	0.017	0.010	0.0029	0.00010	0.011	0.39	0.000090	0.43	0.000010	0.11	0.018	6.1	0.000020	0.00025	0.00020	0.0078	0.00022	0.0010	0.000010
5-Feb-13	62	500	470	7.6	60																																											
12-Feb-13	63	500	440	7.7	50																																											
19-Feb-13	64	500	480	7.5	52																																										
26-Feb-13	65	500	435	7.4	70	#N/A	3.4	14	17	0.20	0.060	0.30	26	0.020	0.00020	0.00040	0.0031	0.000020	0.000010	0.0010	0.000044	7.1	0.00050	0.00027	0.0011	0.0030	0.000030	0.0010	2.0	0.016	0.010	0.0028	0.00010	0.010	0.41	0.00010	0.27	0.000010	0.10	0.016	5.9	0.000020	0.00010	0.00010	0.0063	0.000040	0.0010	0.000010
5-Mar-13	66	500	445	7.7	70																																											
12-Mar-13	67	500	455	7.5	70																																										

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC3

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	400	7.3	846	#N/A	3.4	16	140	2.0	0.46	0.12	134	0.0096	0.00032	0.00032	0.0076	0.0000080	0.0000040	0.0062	0.00017	38	0.00020	0.00056	0.0055	0.0012	0.0000080	0.0020	9.4	0.064	0.0080	0.029	0.0018	0.0036	6.0	0.0011	2.0	0.0000040	14	0.11	49	0.000016	0.00015	0.00016	0.020	0.00014	0.0012	0.00023
6-Dec-11	1	500	445	7.4	503	#N/A	1.8	13	90	1.5	0.40	0.13	81	0.016	0.00027	0.00027	0.0053	0.0000089	0.0000045	0.0023	0.000094	22	0.00022	0.00028	0.0052	0.0013	0.0000089	0.0013	6.5	0.038	0.0089	0.030	0.0013	0.0040	4.0	0.00079	0.38	0.0000018	11	0.062	32	0.0000089	0.000022	0.00013	0.019	0.00015	0.00089	0.00012
13-Dec-11	2	500	450	7.4	414	#N/A	1.7	11	71	0.68	0.44	0.14	74	0.039	0.00018	0.00027	0.0050	0.0000090	0.0000045	0.0020	0.000086	21	0.00081	0.00020	0.0039	0.036	0.0000063	0.00090	5.0	0.031	0.0090	0.024	0.0013	0.010	3.2	0.00045	0.44	0.0000045	6.8	0.066	26	0.0000090	0.000072	0.00081	0.018	0.00010	0.0014	0.00011
20-Dec-11	3	500	485	7.4	284	#N/A	2.0	13	54	0.19	0.38	0.15	55	0.023	0.00034	0.00024	0.0039	0.0000097	0.0000049	0.0019	0.000061	16	0.00024	0.00014	0.0024	0.0015	0.0000097	0.00097	3.9	0.031	0.0049	0.020	0.00092	0.0058	2.5	0.00032	0.52	0.0000049	3.7	0.046	18	0.0000097	0.0000049	0.000049	0.026	0.00013	0.00097	0.000044
27-Dec-11	4	500	430	8.6	240																																												
3-Jan-12	5	500	435	7.4	170	#N/A	1.8	9.8	26	0.087	0.30	0.13	28	0.037	0.00030	0.00048	0.0023	0.0000087	0.0000044	0.0015	0.000026	8.1	0.00022	0.000064	0.0013	0.0026	0.0000087	0.00044	1.8	0.011	0.0044	0.013	0.00065	0.0039	1.4	0.000061	0.33	0.0000044	1.5	0.025	8.6	0.0000087	0.000044	0.00017	0.012	0.00029	0.00087	0.000022
10-Jan-12	6	500	415	7.6	166																																												
17-Jan-12	7	500	475	7.7	110	#N/A	1.1	15	15	0.095	0.29	0.14	22	0.029	0.00043	0.00038	0.0028	0.0000095	0.0000048	0.0017	0.000020	6.1	0.00024	0.000037	0.0011	0.0014	0.0000095	0.00048	1.6	0.011	0.0048	0.010	0.00019	0.0043	1.3	0.000071	0.44	0.0000048	0.83	0.018	4.7	0.0000095	0.0000095	0.00014	0.015	0.00019	0.00095	0.000019
24-Jan-12	8	500	505	7.7	120																																											
31-Jan-12	9	500	460	7.6	126	#N/A	1.4	13	16	0.092	0.25	0.14	22	0.026	0.00032	0.00014	0.0038	0.0000092	0.0000046	0.0012	0.000021	6.4	0.00023	0.000038	0.0012	0.0028	0.000041	0.00046	1.6	0.012	0.0046	0.0081	0.000046	0.0041	1.2	0.00013	0.39	0.0000046	0.58	0.020	5.4	0.0000092	0.00010	0.00023	0.012	0.00027	0.00092	0.0000092
7-Feb-12	10	500	465	7.7	118																																											
14-Feb-12	11	500	450	7.7	116	#N/A	2.1	11	18	0.090	0.21	0.14	22	0.020	0.00018	0.00081	0.0029	0.0000090	0.0000045	0.0010	0.000015	6.3	0.00023	0.000029	0.0017	0.0023	0.0000090	0.00045	1.5	0.010	0.0045	0.0059	0.00023	0.0041	1.00	0.00010	0.36	0.0000045	0.39	0.020	4.9	0.0000090	0.000014	0.00014	0.010	0.000090	0.00045	0.0000090
21-Feb-12	12	500	465	7.7	108																																											
28-Feb-12	13	500	500	7.6	89	#N/A	1.6	12	12	0.10	0.15	0.15	20	0.019	0.00035	0.0019	0.0036	0.0000010	0.0000050	0.0017	0.00013	5.7	0.00025	0.000042	0.00055	0.0015	0.0000010	0.00050	1.3	0.013	0.0050	0.0039	0.000050	0.0045	0.82	0.00014	0.33	0.0000050	0.24	0.018	3.7	0.000010	0.000015	0.00010	0.011	0.00016	0.0010	0.0000050
6-Mar-12	14	500	495	7.8	97																																											
13-Mar-12	15	500	445	7.5	117	#N/A	1.3	9.8	17	0.089	0.14	0.13	23	0.022	0.00022	0.00013	0.0034	0.0000089	0.0000045	0.00089	0.000010	6.7	0.00022	0.000019	0.00058	0.0013	0.0000089	0.00045	1.6	0.0090	0.0045	0.0043	0.000089	0.0040	0.83	0.000040	0.33	0.0000045	0.22	0.020	5.3	0.0000089	0.000093	0.000045	0.010	0.000080	0.00045	0.0000089
20-Mar-12	16	500	475	7.6	123																																											
27-Mar-12	17	500	490	7.5	108	#N/A	1.3	11	15	0.098	0.14	0.15	23	0.025	0.00025	0.000098	0.0041	0.0000098	0.0000049	0.00093	0.000018	6.7	0.00025	0.000022	0.00074	0.0015	0.0000098	0.00049	1.5	0.012	0.0049	0.0037	0.000098	0.0044	0.86	0.000034	0.36	0.0000049	0.19	0.020	5.0	0.0000098	0.0000049	0.000098	0.011	0.00015	0.00049	0.0000049
3-Apr-12	18	500	515	7.5	72																																											
10-Apr-12	19	500	510	7.5	94	#N/A	1.1	9.0	14	0.10	0.10	0.15	20	0.024	0.00020	0.00010	0.0041	0.0000010	0.0000051	0.00097	0.0000015	5.8	0.00026	0.000033	0.00066	0.0015	0.0000010	0.00051	1.4	0.012	0.010	0.0033	0.000051	0.0046	0.67	0.000061	0.32	0.0000051	0.14	0.017	4.4	0.000010	0.000026	0.000051	0.0083	0.00015	0.00051	0.0000051
17-Apr-12	20	500	460	7.4	114																																											
24-Apr-12	21	500	490	7.5	86	#N/A	1.3	10	12	0.098	0.088	0.15	18	0.027	0.00020	0.000098	0.0045	0.0000098	0.0000049	0.00078	0.0000015	5.1	0.00025	0.000029	0.00083	0.0015	0.0000015	0.00049	1.2	0.010	0.015	0.0028	0.00015	0.0044	0.60	0.000044	0.27	0.0000049	0.12	0.015	3.8	0.0000098	0.000034	0.000098	0.0080	0.00018	0.0015	0.0000049
1-May-12	22	500	510	7.7	88																																											
8-May-12	23	500	520	7.5	92	#N/A	1.4	10	15	0.10	0.083	0.16	21	0.017	0.00026	0.00047	0.0037	0.0000010	0.0000052	0.00099	0.000025	5.8	0.00026	0.000031	0.00078	0.0016	0.000015	0.00052	1.5	0.013	0.0052	0.0079	0.00016	0.0047	0.63	0.000036	0.28	0.0000052	0.13	0.016	4.5	0.000010	0.00011	0.000052	0.0098	0.00016	0.0031	0.0000052
15-May-12	24	500	505	7.5	101																																											
22-May-12	25	500	430	7.5	128	#N/A	1.5	8.8	16	0.086	0.082	0.13	23	0.038	0.00026	0.00013	0.0035	0.0000086	0.0000043	0.00073	0.0000013	6.4	0.00022	0.000023	0.00082	0.0013	0.0000086	0.00043	1.7	0.0089	0.022	0.0040	0.00013	0.0039	0.72	0.000065	0.31	0.0000043	0.13	0.019	5.7	0.0000086	0.000052	0.00017	0.012	0.00024	0.00086	0.0000086
29-May-12	26	500	460	7.4	95																																											
5-Jun-12	27	500	455	7.4	95	#N/A	1.5	7.6	12	0.091	0.059	0.14	18	0.027	0.00041	0.00032	0.0032	0.0000091	0.0000046	0.0010	0.0000014	5.2	0.00023	0.000029	0.00050	0.0032	0.0000091	0.00046	1.3	0.0096	0.0046	0.0025	0.000046	0.0041	0.56	0.000064	0.24	0.0000046	0.10	0.015	4.3	0.0000091	0.000091	0.00014	0.0070	0.00025	0.00046	0.0000046
12-Jun-12	28	500	465	7.4	91																																											
19-Jun-12	29	500	460	7.4	89	#N/A	1.3	7.1	10	0.092	0.060	0.14	17	0.029	0.00014	0.000092	0.0027	0.0000092	0.0000046	0.00055	0.0000014	4.7	0.00023	0.000020	0.00051	0.0014	0.0000092	0.00046	1.2	0.0088	0.0046	0.10	0.000092	0.0041	0.48	0.000092	0.23	0.0000046	0.087	0.013	3.7	0.0000092	0.00011	0.00023	0.0074	0.00025	0.0014	0.0000046
26-Jun-12	30	500	460	7.5	90																																											
3-Jul-12	31	500	450	7.6	97	#N/A	2.9	11	13	0.090	0.059	0.14	18	0.023	0.00014	0.00014	0.0038	0.0000090	0.0000045	0.00050	0.0000011	5.1	0.00023	0.000029	0.00063	0.0014	0.0000014	0.00045	1.3	0.0090	0.0045	0.0026	0.000045	0.0041	0.51	0.000018	0.22	0.0000045	0.095	0.015	4.3	0.0000090	0.00014	0.000090	0.0067	0.00014	0.00090	0.0000045
10-Jul-12	32	500	465	7.4	91																																											
17-Jul-12	33	500	480	7.5	93	#N/A	1.0	8.0	11	0.096	0.053	0.14	20	0.021	0.00024	0.0020	0.0025	0.0000096	0.0000048	0.0022	0.000012	5.5	0.00024	0.000020	0.00067	0.0014	0.0000096	0.0014	1.5	0.011	0.034	0.0033	0.000048	0.0043	0.49	0.00018	0.33	0.0000058	0.10	0.015	4.6	0.0000096	0.00027	0.00014	0.0063	0.00015	0.00096	0.0000048
24-Jul-12	34	500	480	7.4	103																																											
31-Jul-12	35	500	475	7.5	98	#N/A	1.0	8.1	12	0.095	0.048	0.14	21	0.025	0.00019	0.00019	0.0030	0.0000095	0.0000048	0.0012	0.0000051	5.8	0.00024	0.000034	0.00086	0.0019	0.00012	0.00048	1.5	0.011	0.0048	0.0026	0.000048	0.0043	0.47	0.00028	0.32	0.0000048	0.100	0.016	4.5	0.0000095	0.00021	0.000048	0.0061	0.00015	0.0014	0.0000048
7-Aug-12	36	500	465	7.5	89																																											
14-Aug-12	37	500	460	7.3	98	#N/A	1.3	6.4	15	0.092	0.051	0.14	20	0.028	0.00014	0.0019	0.0029	0.0000092	0.0000046	0.00087	0.0000051	5.4	0.00023	0.000016	0.00064	0.0014	0.0000092	0.00046	1.5	0.011	0.0046	0.0026	0.00018	0.0041	0.44	0.000087	0.24	0.0000046	0.097	0.015	5.1	0.0000092	0.00069	0.00018	0.0053	0.00029	0.00092	0.0000046
21-Aug-12	38	500	465	7.2	95																																											
28-Aug-12	39	500	505	7.4	88	#N/A	1.6	8.8	13	0.10	0.045	0.15	19	0.027	0.00020	0.00045	0.0023	0.0000010	0.0000051	0.00096	0.000011	5.2	0.00025	0.000042	0.00096	0.0020	0.0000025	0.00051	1.5	0.014	0.0051	0.0024	0.00015	0.0045	0.40	0.000030	0.27	0.0000051	0.086	0.014	4.2	0.000010	0.00013	0.00010	0.0082	0.00016	0.0010	0.0000051
4-Sep-12	40	500	470	7.3	72																																											
11-Sep-12	41	500	475	7.3	86	#N/A	1.3	6.3	12	0.095	0.043	0.14	19	0.013	0.00014	0.00052	0.0026	0.0000095	0.0000048	0.00067	0.0000076	5.3	0.00024	0.00021	0.0013	0.0014	0.0000095	0.00048	1.4	0.012	0.0048	0.0019	0.036	0.0043	0.36	0.000048	0.21	0.0000048	0.100	0.014	4.8	0.0000095	0.000048	0.000048	0.0053	0.000067	0.00048	0.0000095
18-Sep-12	42	500	515	7.1	103																																											
25-Sep-12	43	500	455	7.2	95	#N/A	1.5	6.4	14	0.091	0.036	0.14	18	0.024	0.000091	0.000091	0.0035	0.0000091	0.0000046	0.00014	0.000064	5.0	0.00023	0.00027	0.00059	0.0036	0.000014	0.00046	1.4	0.0092	0.0046	0.11	0.000091	0.0041	0.32	0.00035	0.17	0.0000046	0.077	0.013	4.6	0.0000091	0.00015	0.000046	0.011	0.00015	0.00091	0.0000046
2-Oct-12	44	500	460	7.3	80																																											
9-Oct-12	45	500	465	7.3	73	#N/A	1.8	6.1	9.8	0.093	0.033	0.14	15	0.021	0.000093	0.000093	0.0016	0.0000093	0.0000047	0.00051	0.0000025	4.1	0.00023	0.00000093	0.0012	0.0084	0.00016	0.00047	1.1	0.0093	0.0047	0.0018	0.000093	0.0042	0.26	0.000060	0.15	0.0000047	0.056	0.010	3.4	0.0000093	0.000098	0.000093	0.0041	0.00012	0.0023	0.0000047
16-Oct-12	46	500	465	7.2	77																																											
23-Oct-12	47	500	475	7.3	67																																											
30-Oct-12	48	500	470	7.4	89																																											
6-Nov-12	49	500	445	7.2	88	#N/A	1.3	6.0	12	0.089	0.036	0.13	20	0.014	0.000089	0.00013	0.0022	0.0000089	0.0000045	0.0011	0.000039	5.5	0.00022	0.000098	0.0018	0.0018	0.0000013	0.00045	1.5	0.0097	0.0045	0.0021	0.00027	0.0053	0.30	0.000045	0.16	0.0000045	0.089	0.014	4.7	0.0000089	0.00053	0.000089	0.0049	0.00011	0.0036	0.0000045
13-Nov-12	50	500	450	7.2	88																																											
20-Nov-12	51	500	490	7.6	56																																											
27-Nov-12	52	500	490	7.2	105																																											
4-Dec-12	53	500	470	7.4	69	#N/A	1.00	6.3	8.9	0.094	0.033	0.14	15	0.012	0.00024	0.000094	0.0017	0.0000094	0.0000047	0.00047	0.000028	4.0	0.00024	0.000063	0.00052	0.0014	0.0000038	0.00047	1.2	0.0086	0.0047	0.0017	0.000094	0.0042	0.26	0.00023	0.15	0.0000047	0.056	0.0099	3.4	0.0000094	0.000071	0.000047	0.0066	0.000085	0.0028	0.0000047
11-Dec-12	54	500	475	7.2	105																																											
18-Dec-12	55	500	450	7.4	76																																											
25-Dec-12	56	500	445	7.2	110																																											
1-Jan-13	57	500	465	7.4	54	#N/A	1.9	6.9	6.5	0.093	0.028	0.14	12	0.010	0.000093	0.00014	0.0016	0.0000093	0.0000047	0.00037	0.0000060	3.1	0.00023	0.000031	0.00023	0.0014	0.0000093	0.00047	0.93	0.0087	0.0047	0.0014	0.000047	0.016	0.20	0.000037	0.18	0.0000047	0.047	0.0079	2.2	0.0000093	0.00014	0.000093	0.0040	0.000074	0.0093	0.0000047
8-Jan-13	58	500	450	7.3	95																																											
15-Jan-13	59	500	450	7.4	56																																											
22-Jan-13	60	500	465	7.4	80																																										
29-Jan-13	61	500	470	7.4	60	#N/A	1.2	6.3	8.5	0.094	0.028	0.14	13	0.016	0.000094	0.000094	0.0013	0.0000094	0.0000047	0.00047	0.0000011	3.5	0.00024	0.000014	0.00047	0.0014	0.0000094	0.00047	0.96	0.0079	0.0047	0.0014	0.000047	0.0052	0.18	0.000042	0.20	0.0000047	0.052	0.0083	2.8	0.0000094	0.00012	0.000094	0.0037	0.00010	0.00047	0.0000047
5-Feb-13	62	500	470	7.6	60																																											
12-Feb-13	63	500	440	7.7	50																																											
19-Feb-13	64	500	480	7.5	52																																										
26-Feb-13	65	500	435	7.4	70	#N/A	1.5	5.9	7.4	0.087	0.026	0.13	11	0.0088	0.000087	0.00017	0.0014	0.0000087	0.0000044	0.00044	0.000019	3.1	0.00022	0.00012	0.00048	0.0013	0.0000013	0.00044	0.89	0.0069	0.0044	0.0012	0.0000044	0.0044	0.18	0.0000044	0.12	0.0000044	0.044	0.0070	2.6	0.0000087	0.0000044	0.0000044	0.0027	0.000017	0.00044	0.0000044
5-Mar-13	66	500	445	7.7	70																																											
12-Mar-13	67	500	455	7.5	70																																										
Median (last 5)				7.4	70	#N/A	1.3	6.3	8.5	0.093	0.028	0.14	13	0.012	0.000093	0.00013	0.0016	0.0000093	0.0000047	0.00047	0.000019	3.5	0.00023	0.000063	0.00048	0.0014	0.0000013	0.00047	0.96	0.0086	0.0047	0.0014	0.0000047	0.0052	0.20	0.0000044	0.16	0.0000047	0.052	0.0083	2.8	0.0000093	0.00012	0.000089	0.0040	0.0000085	0.00093	0.0000047

Leachate Results for HC4

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	500	300	7.7	662	#N/A	6.7	54	247	5.3	1.4	0.30	141	0.053	0.0029	0.0040	0.024	0.000020	0.000010	0.012	0.000030	48	0.00060	0.00030	0.012	0.0040	0.00010	0.0020	5.1	0.0064	0.020	0.059	0.0017	0.0090	8.7	0.024	3.1	0.000010	70	0.70	79	0.000040	0.00019	0.00060	0.069	0.0019	0.0030	0.00041
6-Dec-11	1	500	485	7.9	513	#N/A	3.5	62	161	2.4	2.4	0.30	101	0.039	0.0037	0.0044	0.016	0.000020	0.000010	0.014	0.000033	35	0.00050	0.00016	0.011	0.0030	0.000020	0.0020	3.5	0.0027	0.020	0.084	0.00070	0.0090	9.0	0.015	1.7	0.000010	66	0.50	62	0.000020	0.000020	0.00030	0.14	0.0018	0.0020	0.00018
13-Dec-11	2	500	445	7.8	207	#N/A	3.0	37	53	0.50	1.4	0.30	46	0.031	0.0020	0.0021	0.011	0.000020	0.000030	0.0069	0.000022	16	0.00070	0.000071	0.0044	0.0030	0.0010	0.0010	1.4	0.0027	0.020	0.039	0.00060	0.0090	4.2	0.0043	0.97	0.000010	24	0.22	20	0.000020	0.00012	0.000020	0.056	0.0011	0.0030	0.000080
20-Dec-11	3	500	495	7.9	179	#N/A	3.4	46	44	0.20	1.3	0.30	37	0.051	0.0028	0.0020	0.0098	0.000020	0.000010	0.0080	0.0000030	13	0.00050	0.000049	0.0032	0.0030	0.000020	0.0010	1.3	0.0027	0.010	0.031	0.00040	0.0090	3.9	0.0028	1.3	0.000010	19	0.18	15	0.000020	0.000030	0.00020	0.074	0.0013	0.0020	0.000050
27-Dec-11	4	500	445	8.3	202																																												
3-Jan-12	5	500	455	7.6	262	#N/A	4.6	46	89	0.20	1.9	0.30	57	0.072	0.0037	0.0020	0.016	0.000020	0.000010	0.0097	0.0000030	20	0.00050	0.000075	0.0031	0.0030	0.000020	0.0010	2.0	0.0024	0.010	0.018	0.0010	0.0090	5.8	0.0020	1.4	0.000010	26	0.29	27	0.000020	0.000050	0.00030	0.057	0.0017	0.0020	0.000040
10-Jan-12	6	500	425	7.7	316																																											
17-Jan-12	7	500	435	7.6	261	#N/A	3.1	47	93	0.20	1.3	0.30	79	0.036	0.0042	0.0014	0.021	0.000020	0.000010	0.0088	0.0000050	27	0.00050	0.000048	0.0025	0.0030	0.000020	0.0010	2.8	0.0019	0.010	0.0090	0.00020	0.0090	7.0	0.0016	1.4	0.000010	15	0.41	28	0.000020	0.000020	0.00040	0.062	0.0013	0.0010	0.000050
24-Jan-12	8	500	435	7.7	245																																											
31-Jan-12	9	500	455	7.6	240	#N/A	3.4	42	82	0.20	0.96	0.30	82	0.049	0.0037	0.0011	0.020	0.000020	0.000010	0.0068	0.0000030	28	0.00050	0.000060	0.0024	0.0060	0.000020	0.0010	3.0	0.0033	0.010	0.0077	0.00010	0.0090	6.3	0.0017	1.2	0.000010	7.9	0.41	25	0.000020	0.000070	0.00030	0.047	0.0012	0.0020	0.000010
7-Feb-12	10	500	450	7.7	185																																											
14-Feb-12	11	500	455	7.7	178	#N/A	4.5	36	58	0.20	0.55	0.30	69	0.035	0.0023	0.0012	0.016	0.000020	0.000010	0.0044	0.0000030	24	0.00050	0.000043	0.0015	0.0030	0.000020	0.0010	2.5	0.0028	0.010	0.0054	0.00070	0.0090	4.3	0.0019	0.88	0.000010	3.1	0.34	17	0.000020	0.000030	0.00020	0.040	0.00069	0.0010	0.000060
21-Feb-12	12	500	455	7.7	174																																											
28-Feb-12	13	500	470	7.6	152	#N/A	3.7	31	42	0.20	0.47	0.30	63	0.036	0.0021	0.0025	0.016	0.000020	0.000010	0.0048	0.0000060	22	0.00050	0.000029	0.0011	0.0030	0.000020	0.0010	2.2	0.0037	0.010	0.0051	0.00010	0.0090	3.7	0.0011	0.76	0.000010	1.8	0.31	14	0.000020	0.000060	0.00020	0.031	0.00067	0.0020	0.000010
6-Mar-12	14	500	470	7.7	168																																											
13-Mar-12	15	500	465	7.5	127	#N/A	2.6	26	36	0.20	0.43	0.30	53	0.035	0.0019	0.00070	0.014	0.000020	0.000010	0.0035	0.0000030	18	0.00050	0.000015	0.00090	0.0040	0.000020	0.0010	1.8	0.0026	0.010	0.0044	0.00010	0.0090	3.3	0.00085	0.71	0.000010	1.1	0.25	12	0.000020	0.00014	0.00020	0.023	0.00046	0.0010	0.000020
20-Mar-12	16	500	475	7.6	128																																											
27-Mar-12	17	500	475	7.5	134	#N/A	2.9	28	37	0.20	0.41	0.30	56	0.042	0.0018	0.00070	0.015	0.000020	0.000010	0.0034	0.000012	19	0.00050	0.000011	0.0013	0.0030	0.000040	0.0010	1.8	0.0027	0.010	0.0042	0.00020	0.0090	3.1	0.00061	0.70	0.000010	0.79	0.25	12	0.000020	0.000010	0.00010	0.021	0.00056	0.0010	0.000010
3-Apr-12	18	500	490	7.6	135																																											
10-Apr-12	19	500	480	7.6	148	#N/A	2.2	29	38	0.20	0.38	0.30	55	0.036	0.0020	0.00080	0.014	0.000020	0.000010	0.0036	0.0000030	19	0.00050	0.000027	0.0012	0.0030	0.000020	0.0010	1.9	0.0020	0.020	0.0050	0.00010	0.0090	3.0	0.0011	0.73	0.000010	0.69	0.26	12	0.000020	0.00016	0.00010	0.019	0.00062	0.0020	0.000010
17-Apr-12	20	500	420	7.5	198																																											
24-Apr-12	21	500	475	7.6	135	#N/A	2.8	32	38	0.20	0.44	0.30	55	0.049	0.0029	0.00080	0.016	0.000020	0.000010	0.0039	0.000016	19	0.00050	0.000033	0.0016	0.0030	0.000020	0.0010	2.0	0.0023	0.030	0.0052	0.00030	0.0090	3.6	0.00035	0.82	0.000010	0.58	0.26	12	0.000020	0.000050	0.00030	0.026	0.00065	0.0020	0.000010
1-May-12	22	500	470	7.6	135																																											
8-May-12	23	500	475	7.7	164	#N/A	3.0	35	45	0.20	0.54	0.30	68	0.067	0.0032	0.00080	0.019	0.000020	0.000010	0.018	0.0000012	23	0.00050	0.00040	0.0041	0.0030	0.00014	0.0010	2.6	0.0019	0.010	0.011	0.0015	0.0090	4.3	0.00091	0.90	0.000010	0.65	0.31	15	0.000020	0.00017	0.00010	0.029	0.00057	0.0070	0.000010
15-May-12	24	500	475	7.6	126																																											
22-May-12	25	500	430	7.5	133	#N/A	3.1	29	34	0.20	0.33	0.30	54	0.085	0.0020	0.00090	0.014	0.000020	0.000010	0.0027	0.0000030	19	0.00050	0.000023	0.0011	0.0070	0.000020	0.0010	1.9	0.0022	0.020	0.0061	0.00020	0.0090	3.0	0.00081	0.74	0.000010	0.39	0.25	12	0.000020	0.00010	0.00060	0.021	0.00073	0.0010	0.000010
29-May-12	26	500	465	7.5	132																																											
5-Jun-12	27	500	465	7.5	148	#N/A	3.3	34	36	0.20	0.39	0.30	63	0.047	0.0030	0.0012	0.017	0.000020	0.000010	0.0046	0.0000030	21	0.00050	0.000039	0.0012	0.0040	0.000020	0.0010	2.4	0.0026	0.010	0.0066	0.00010	0.0090	3.6	0.0011	0.88	0.000010	0.41	0.30	14	0.000020	0.00034	0.00020	0.024	0.00087	0.0020	0.000010
12-Jun-12	28	500	460	7.6	148																																											
19-Jun-12	29	500	460	7.6	139	#N/A	2.9	36	29	0.20	0.42	0.30	58	0.050	0.0027	0.00060	0.017	0.000020	0.000010	0.0035	0.0000030	19	0.00050	0.000038	0.0011	0.0030	0.000020	0.0010	2.2	0.0020	0.010	0.0058	0.0012	0.0090	3.4	0.00088	0.93	0.000010	0.33	0.27	11	0.000020	0.00025	0.00010	0.024	0.00074	0.0020	0.000010
26-Jun-12	30	500	455	7.6	133																																											
3-Jul-12	31	500	455	7.6	130	#N/A	7.4	37	29	0.20	0.38	0.30	53	0.042	0.0030	0.0011	0.017	0.000020	0.000010	0.0031	0.0000030	18	0.00050	0.000023	0.0016	0.0030	0.000020	0.0010	2.1	0.0026	0.010	0.0051	0.00010	0.0090	3.6	0.0010	0.94	0.000010	0.26	0.25	10	0.000020	0.00022	0.00020	0.020	0.00081	0.0010	0.000020
10-Jul-12	32	500	460	7.6	140																																											
17-Jul-12	33	500	450	7.6	141	#N/A	2.7	38	30	0.20	0.31	0.30	60	0.049	0.0038	0.0017	0.018	0.000020	0.000010	0.0039	0.0000030	20	0.00050	0.00017	0.0012	0.017	0.000090	0.0010	2.5	0.0021	0.020	0.0066	0.00010	0.0090	3.9	0.0015	1.2	0.000010	0.42	0.29	12	0.000020	0.00055	0.00020	0.022	0.00077	0.0020	0.000010
24-Jul-12	34	500	450	7.6	148																																											
31-Jul-12	35	500	455	7.6	117	#N/A	2.2	28	25	0.20	0.20	0.30	50	0.048	0.0027	0.00050	0.015	0.000020	0.000010	0.0034	0.000066	17	0.00050	0.000021	0.0011	0.0030	0.00076	0.0010	2.0	0.0020	0.010	0.0035	0.00010	0.0090	2.7	0.00091	0.86	0.000010	0.20	0.24	9.3	0.000020	0.00013	0.00010	0.014	0.00067	0.010	0.000010
7-Aug-12	36	500	440	7.6	103																																											
14-Aug-12	37	500	450	7.4	136	#N/A	3.3	24	36	0.20	0.21	0.30	55	0.071	0.0037	0.0099	0.016	0.000020	0.000010	0.0068	0.0000030	19	0.00050	0.000059	0.0023	0.0030	0.000020	0.0010	2.1	0.0030	0.010	0.0039	0.00040	0.0090	2.7	0.0010	0.75	0.000010	0.20	0.26	13	0.000020	0.00061	0.00050	0.012	0.00095	0.0020	0.000010
21-Aug-12	38	500	450	7.4	114																																											
28-Aug-12	39	500	495	7.5	120	#N/A	3.3	27	32	0.20	0.13	0.30	50	0.059	0.0020	0.00030	0.015	0.000020	0.000010	0.0025	0.0000030	17	0.00050	0.000080	0.0014	0.0030	0.000020	0.0010	2.0	0.0026	0.010	0.0035	0.00070	0.0090	2.2	0.0011	0.67	0.000010	0.14	0.23	11	0.000020	0.00024	0.00020	0.017	0.00055	0.0020	0.000010
4-Sep-12	40	500	490	7.4	99																																											
11-Sep-12	41	500	460	7.5	137	#N/A	2.9	30	35	0.20	0.19	0.30	59	0.038	0.0024	0.00060	0.015	0.000020	0.000010	0.0030	0.0000030	20	0.00050	0.000061	0.0017	0.0030	0.000020	0.0010	2.4	0.0019	0.010	0.0046	0.00030	0.0090	2.9	0.0012	0.83	0.000010	0.21	0.27	13	0.000020	0.00017	0.00090	0.017	0.00081	0.0010	0.000020
18-Sep-12	42	500	505	7.6	134																																											
25-Sep-12	43	500	450	7.5	124	#N/A	3.7	32	30	0.20	0.14	0.30	52	0.048	0.0024	0.0036	0.016	0.000020	0.000010	0.0023	0.000014	17	0.00050	0.00018	0.0025	0.0040	0.000020	0.0010	2.0	0.0019	0.010	0.0041	0.00070	0.0090	2.3	0.00093	0.69	0.000010	0.66	0.23	10	0.000020	0.00018	0.00010	0.019	0.00056	0.0020	0.000010
2-Oct-12	44	500	460	7.4	120																																											
9-Oct-12	45	500	480	7.4	86	#N/A	4.1	27	20	0.20	0.11	0.30	38	0.052	0.0017	0.00040	0.013	0.000020	0.000010	0.0019	0.0000030	13	0.00050	0.000097	0.0016	0.012	0.000020	0.0010	1.4	0.0029	0.010	0.0024	0.00010	0.0090	1.7	0.00059	0.58	0.000010	0.10	0.16	6.6	0.000020	0.00018	0.00020	0.012	0.00044	0.0020	0.000010
16-Oct-12	46	500	480	7.5	112																																											
23-Oct-12	47	500	495	7.6	136																																											
30-Oct-12	48	500	480	7.5	135																																											
6-Nov-12	49	500	455	7.6	114	#N/A	2.7	38	24	0.20	0.12	0.30	57	0.026	0.0027	0.00090	0.016	0.000020	0.000010	0.0029	0.000027	19	0.00050	0.000094	0.0027	0.0030	0.000080	0.0010	2.3	0.0019	0.010	0.0039	0.00030	0.0090	2.3	0.00097	0.84	0.000010	0.22	0.26	9.7	0.000020	0.00074	0.00010	0.017	0.00052	0.0040	0.000010
13-Nov-12	50	500	460	7.5	110																																											
20-Nov-12	51	500	485	7.6	99																																											
27-Nov-12	52	500	500	7.4	120																																											
4-Dec-12	53	500	445	7.5	82	#N/A	2.1	22	20	0.20	0.060	0.30	37	0.040	0.0014	0.00050	0.010	0.000020	0.000010	0.0016	0.000032	13	0.00050	0.000087	0.0014	0.0040	0.00019	0.0010	1.3	0.0017	0.010	0.0032	0.00010	0.0090	1.2	0.000090	0.39	0.000010	0.10	0.16	7.4	0.000020	0.00010	0.00020	0.011	0.00035	0.0020	0.000010
11-Dec-12	54	500	470	7.4	85																																											
18-Dec-12	55	500	460	7.5	84																																											
25-Dec-12	56	500	445	7.4	90																																											
1-Jan-13	57	500	480	7.6	97	#N/A	4.3	30	25	0.20	0.10	0.30	42	0.034	0.0023	0.0015	0.014	0.000020	0.000010	0.0015	0.0000030	14	0.00050	0.000022	0.00070	0.0030	0.000020	0.0010	1.6	0.0018	0.010	0.0047	0.00010	0.0090	1.3	0.00059	0.58	0.000010	0.090	0.18	7.8	0.000020	0.00023	0.00020	0.015	0.00036	0.0020	0.000010
8-Jan-13	58	500	465	7.5	85																																											
15-Jan-13	59	500	465	7.5	85																																											
22-Jan-13	60	500	470	7.6	83																																											
29-Jan-13	61	500	465	7.5	78	#N/A	2.7	22	22	0.20	0.060	0.30	40	0.045	0.0011	0.00040	0.010	0.000020	0.000010	0.0014	0.0000035	14	0.00050	0.0000020	0.0010	0.0040	0.000020	0.0010	1.4	0.0027	0.010	0.0028	0.00030	0.026	1.0	0.00054	0.48	0.000010	0.11	0.16	7.9	0.000020	0.00029	0.00050	0.0081	0.00041	0.0020	0.000010
5-Feb-13	62	500	480	7.6	97																																											
12-Feb-13	63	500	445	7.5	90																																											
19-Feb-13	64	500	485	7.6	88																																											
26-Feb-13	65	500	440	7.5	94	#N/A	3.5	25	20	0.20	0.060	0.30	37	0.028	0.0011	0.00060	0.011	0.000020	0.000010	0.0015	0.0000039	13	0.00050	0.00026	0.00090	0.0030	0.000030	0.0010	1.3	0.0016	0.010	0.0029	0.00020	0.014	1.1	0.00063	0.40	0.000010	0.090	0.15	7.5	0.000020	0.000070	0.00010	0.0079	0.00021	0.0010	0.000010
5-Mar-13	66	500	450	7.6	94																																											
12-Mar-13	67	500	445	7.6	96																																											

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC4

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	300	7.7	662	#N/A	2.0	16	74	1.6	0.42	0.090	42	0.016	0.00087	0.0012	0.0071	0.0000060	0.0000030	0.0035	0.0000090	14	0.00018	0.000090	0.0035	0.0012	0.000030	0.00060	1.5	0.0019	0.0060	0.018	0.00051	0.0027	2.6	0.0071	0.92	0.0000030	21	0.21	24	0.000012	0.000057	0.00018	0.021	0.00056	0.00090	0.00012
6-Dec-11	1	500	485	7.9	513	#N/A	1.7	30	78	1.2	1.2	0.15	49	0.019	0.0018	0.0021	0.0077	0.0000097	0.0000049	0.0065	0.0000016	17	0.00024	0.000075	0.0054	0.0015	0.0000097	0.00097	1.7	0.0013	0.0097	0.041	0.00034	0.0044	4.3	0.0074	0.82	0.0000049	32	0.24	30	0.0000097	0.0000097	0.00015	0.065	0.00086	0.00097	0.000087
13-Dec-11	2	500	445	7.8	207	#N/A	1.4	16	24	0.22	0.62	0.13	20	0.014	0.00089	0.00093	0.0049	0.0000089	0.0000013	0.0031	0.0000098	7.2	0.00031	0.000032	0.0020	0.0013	0.00045	0.00045	0.61	0.0012	0.0089	0.017	0.00027	0.0040	1.9	0.0019	0.43	0.0000045	10	0.097	8.9	0.0000089	0.000053	0.000089	0.025	0.00049	0.0013	0.000036
20-Dec-11	3	500	495	7.9	179	#N/A	1.7	23	22	0.099	0.63	0.15	18	0.025	0.0014	0.00099	0.0049	0.0000099	0.0000050	0.0040	0.0000015	6.4	0.00025	0.000024	0.0016	0.0015	0.0000099	0.00050	0.62	0.0013	0.0050	0.016	0.00020	0.0045	1.9	0.0014	0.62	0.0000050	9.5	0.089	7.5	0.0000099	0.000015	0.000099	0.037	0.00066	0.00099	0.000025
27-Dec-11	4	500	445	8.3	202																																												
3-Jan-12	5	500	455	7.6	262	#N/A	2.1	21	40	0.091	0.87	0.14	26	0.033	0.0017	0.00091	0.0071	0.0000091	0.0000046	0.0044	0.0000014	9.0	0.00023	0.000034	0.0014	0.0014	0.0000091	0.00046	0.89	0.0011	0.0046	0.0083	0.00046	0.0041	2.6	0.00089	0.64	0.0000046	12	0.13	12	0.0000091	0.000023	0.00014	0.026	0.00076	0.00091	0.000018
10-Jan-12	6	500	425	7.7	316																																												
17-Jan-12	7	500	435	7.6	261	#N/A	1.3	21	40	0.087	0.57	0.13	34	0.016	0.0018	0.00061	0.0091	0.0000087	0.0000044	0.0038	0.0000022	12	0.00022	0.000021	0.0011	0.0013	0.0000087	0.00044	1.2	0.00083	0.0044	0.0039	0.000087	0.0039	3.0	0.00070	0.62	0.0000044	6.6	0.18	12	0.0000087	0.0000087	0.00017	0.027	0.00056	0.00044	0.000022
24-Jan-12	8	500	435	7.7	245																																												
31-Jan-12	9	500	455	7.6	240	#N/A	1.6	19	37	0.091	0.44	0.14	37	0.022	0.0017	0.00050	0.0089	0.0000091	0.0000046	0.0031	0.0000014	13	0.00023	0.000027	0.0011	0.0027	0.0000091	0.00046	1.3	0.0015	0.0046	0.0035	0.000046	0.0041	2.9	0.00079	0.54	0.0000046	3.6	0.18	11	0.0000091	0.000032	0.00014	0.021	0.00054	0.00091	0.0000046
7-Feb-12	10	500	450	7.7	185																																											
14-Feb-12	11	500	455	7.7	178	#N/A	2.0	16	26	0.091	0.25	0.14	31	0.016	0.0010	0.00055	0.0071	0.0000091	0.0000046	0.0020	0.0000014	11	0.00023	0.000020	0.00068	0.0014	0.0000091	0.00046	1.1	0.0013	0.0046	0.0024	0.00032	0.0041	2.0	0.00086	0.40	0.0000046	1.4	0.16	7.7	0.0000091	0.000014	0.000091	0.018	0.00031	0.00046	0.000027
21-Feb-12	12	500	500	7.7	174																																											
28-Feb-12	13	500	470	7.6	152	#N/A	1.7	15	20	0.094	0.22	0.14	30	0.017	0.00099	0.0012	0.0074	0.0000094	0.0000047	0.0023	0.0000028	10	0.00024	0.000014	0.00052	0.0014	0.0000094	0.00047	1.0	0.0017	0.0047	0.0024	0.000047	0.0042	1.8	0.00051	0.36	0.0000047	0.82	0.14	6.7	0.0000094	0.000028	0.000094	0.014	0.00031	0.00094	0.0000047
6-Mar-12	14	500	470	7.7	168																																											
13-Mar-12	15	500	465	7.5	127	#N/A	1.2	12	17	0.093	0.20	0.14	25	0.016	0.00088	0.00033	0.0064	0.0000093	0.0000047	0.0016	0.0000014	8.4	0.00023	0.0000070	0.00042	0.0019	0.0000093	0.00047	0.86	0.0012	0.0047	0.0020	0.000047	0.0042	1.5	0.00040	0.33	0.0000047	0.51	0.12	5.5	0.0000093	0.000065	0.000093	0.011	0.00021	0.00047	0.0000093
20-Mar-12	16	500	475	7.6	128																																											
27-Mar-12	17	500	475	7.5	134	#N/A	1.4	13	18	0.095	0.19	0.14	27	0.020	0.00086	0.00033	0.0073	0.0000095	0.0000048	0.0016	0.0000057	9.2	0.00024	0.0000052	0.00062	0.0014	0.0000019	0.00048	0.87	0.0013	0.0048	0.0020	0.000095	0.0043	1.5	0.00029	0.33	0.0000048	0.38	0.12	5.8	0.0000095	0.0000048	0.00048	0.010	0.00027	0.00048	0.0000048
3-Apr-12	18	500	490	7.6	135																																											
10-Apr-12	19	500	480	7.6	135	#N/A	1.0	14	18	0.096	0.18	0.14	27	0.017	0.00096	0.00038	0.0065	0.0000096	0.0000048	0.0017	0.0000014	9.1	0.00024	0.000013	0.00058	0.0014	0.0000096	0.00048	0.91	0.00096	0.0096	0.0024	0.000048	0.0043	1.5	0.00052	0.35	0.0000048	0.33	0.12	6.0	0.0000096	0.000077	0.000048	0.0089	0.00030	0.00096	0.0000048
17-Apr-12	20	500	420	7.5	198																																											
24-Apr-12	21	500	475	7.6	135	#N/A	1.3	15	18	0.095	0.21	0.14	26	0.023	0.0014	0.00038	0.0077	0.0000095	0.0000048	0.0019	0.0000076	8.9	0.00024	0.000016	0.00076	0.0014	0.0000095	0.00048	0.96	0.0011	0.014	0.0025	0.00014	0.0043	1.7	0.00017	0.39	0.0000048	0.28	0.12	5.5	0.0000095	0.000024	0.00014	0.012	0.00031	0.00095	0.0000048
1-May-12	22	500	470	7.6	135																																											
8-May-12	23	500	475	7.7	164	#N/A	1.4	17	21	0.095	0.26	0.14	32	0.032	0.0015	0.00038	0.0089	0.0000095	0.0000048	0.0084	0.0000057	11	0.00024	0.00019	0.0019	0.0014	0.000067	0.00048	1.2	0.00090	0.0048	0.0053	0.00071	0.0043	2.1	0.00043	0.43	0.0000048	0.31	0.15	7.2	0.0000095	0.000081	0.000048	0.014	0.00027	0.0033	0.0000048
15-May-12	24	500	475	7.6	126																																											
22-May-12	25	500	430	7.5	133	#N/A	1.3	12	15	0.086	0.14	0.13	23	0.037	0.00086	0.00039	0.0060	0.0000086	0.0000043	0.0012	0.0000013	8.0	0.00022	0.0000099	0.00047	0.0030	0.0000086	0.00043	0.81	0.00095	0.0086	0.0026	0.000086	0.0039	1.3	0.00035	0.32	0.0000043	0.17	0.11	5.1	0.0000086	0.000043	0.00026	0.0089	0.00031	0.00043	0.0000043
29-May-12	26	500	465	7.5	132																																											
5-Jun-12	27	500	465	7.5	148	#N/A	1.5	16	17	0.093	0.18	0.14	29	0.022	0.0014	0.00056	0.0078	0.0000093	0.0000047	0.0021	0.0000014	10.0	0.00023	0.000018	0.00056	0.0019	0.0000093	0.00047	1.1	0.0012	0.0047	0.0031	0.0000047	0.0042	1.7	0.00049	0.41	0.0000047	0.19	0.14	6.3	0.0000093	0.00016	0.000093	0.011	0.00040	0.00093	0.0000047
12-Jun-12	28	500	460	7.6	148																																											
19-Jun-12	29	500	460	7.6	139	#N/A	1.3	17	13	0.092	0.19	0.14	26	0.023	0.0012	0.00028	0.0079	0.0000092	0.0000046	0.0016	0.0000014	8.9	0.00023	0.000017	0.00051	0.0014	0.0000092	0.00046	1.0	0.00092	0.0046	0.0027	0.00055	0.0041	1.6	0.00040	0.43	0.0000046	0.15	0.12	4.9	0.0000092	0.00012	0.000046	0.011	0.00034	0.00092	0.0000046
26-Jun-12	30	500	455	7.6	133																																											
3-Jul-12	31	500	455	7.6	130	#N/A	3.4	17	13	0.091	0.17	0.14	24	0.019	0.0014	0.00050	0.0075	0.0000091	0.0000046	0.0014	0.0000014	8.1	0.00023	0.000010	0.00073	0.0014	0.0000091	0.00046	0.97	0.0012	0.0046	0.0023	0.000046	0.0041	1.6	0.00046	0.43	0.0000046	0.12	0.11	4.6	0.0000091	0.00010	0.000091	0.0092	0.00037	0.00046	0.0000091
10-Jul-12	32	500	460	7.6	140																																											
17-Jul-12	33	500	450	7.6	141	#N/A	1.2	17	14	0.090	0.14	0.14	27	0.022	0.0017	0.00077	0.0082	0.0000090	0.0000045	0.0018	0.0000014	9.0	0.00023	0.000075	0.00054	0.0077	0.0000041	0.00045	1.1	0.00095	0.0090	0.0030	0.000045	0.0041	1.8	0.00065	0.52	0.0000045	0.19	0.13	5.2	0.0000090	0.00025	0.000090	0.0099	0.00035	0.00090	0.0000045
24-Jul-12	34	500	450	7.6	148																																											
31-Jul-12	35	500	455	7.6	117	#N/A	1.00	13	11	0.091	0.091	0.14	23	0.022	0.0012	0.00023	0.0066	0.0000091	0.0000046	0.0015	0.000030	7.6	0.00023	0.0000096	0.00050	0.0014	0.00035	0.00046	0.89	0.00091	0.0046	0.0016	0.0000046	0.0041	1.2	0.00041	0.39	0.0000046	0.091	0.11	4.2	0.0000091	0.000059	0.000046	0.0064	0.00030	0.0046	0.0000046
7-Aug-12	36	500	440	7.6	103																																											
14-Aug-12	37	500	450	7.4	136	#N/A	1.5	11	16	0.090	0.095	0.14	25	0.032	0.0017	0.0045	0.0072	0.0000090	0.0000045	0.0031	0.0000014	8.4	0.00023	0.000027	0.0010	0.0014	0.0000090	0.00045	0.95	0.0014	0.0045	0.0018	0.00018	0.0041	1.2	0.00047	0.34	0.0000045	0.090	0.12	5.9	0.0000090	0.00027	0.00023	0.0056	0.00043	0.00090	0.0000045
21-Aug-12	38	500	450	7.4	114																																											
28-Aug-12	39	500	495	7.5	120	#N/A	1.6	13	16	0.099	0.064	0.15	25	0.029	0.00099	0.00015	0.0072	0.0000099	0.0000050	0.0012	0.0000015	8.3	0.00025	0.000040	0.00069	0.0015	0.0000099	0.00050	0.97	0.0013	0.0050	0.0017	0.00035	0.0045	1.1	0.00053	0.33	0.0000050	0.069	0.11	5.3	0.0000099	0.00012	0.000099	0.0085	0.00027	0.00099	0.0000050
4-Sep-12	40	500	490	7.4	99																																											
11-Sep-12	41	500	460	7.5	137	#N/A	1.3	14	16	0.092	0.087	0.14	27	0.017	0.0011	0.00028	0.0069	0.0000092	0.0000046	0.0014	0.0000014	9.1	0.00023	0.000028	0.00078	0.0014	0.0000092	0.00046	1.1	0.00087	0.0046	0.0021	0.00014	0.0041	1.3	0.00056	0.38	0.0000046	0.097	0.12	6.1	0.0000092	0.000078	0.00041	0.0077	0.00037	0.00046	0.0000092
18-Sep-12	42	500	505	7.6	134																																											
25-Sep-12	43	500	450	7.5	124	#N/A	1.7	15	14	0.090	0.063	0.14	23	0.022	0.0011	0.0016	0.0072	0.0000090	0.0000045	0.0010	0.0000063	7.8	0.00023	0.000080	0.0011	0.0018	0.0000090	0.00045	0.90	0.00086	0.0045	0.0018	0.00032	0.0041	1.0	0.00042	0.31	0.0000045	0.30	0.11	4.7	0.0000090	0.000081	0.000045	0.0084	0.00025	0.00090	0.0000045
2-Oct-12	44	500	460	7.4	120																																											
9-Oct-12	45	500	480	7.4	86	#N/A	1.9	13	9.6	0.096	0.053	0.14	18	0.025	0.00082	0.00019	0.0060	0.0000096	0.0000048	0.00091	0.0000014	6.1	0.00024	0.000047	0.00077	0.0058	0.0000096	0.00048	0.68	0.0014	0.0048	0.0011	0.000048	0.0043	0.81	0.00028	0.28	0.0000048	0.048	0.079	3.2	0.0000096	0.000086	0.000096	0.0060	0.00021	0.00096	0.0000048
16-Oct-12	46	500	480	7.5	112																																											
23-Oct-12	47	500	495	7.6	136																																										
30-Oct-12	48	500	480	7.5	135																																										
6-Nov-12	49	500	455	7.6	114	#N/A	1.2	17	11	0.091	0.055	0.14	26	0.012	0.0012	0.00041	0.0073	0.0000091	0.0000046	0.0013	0.000012	8.7	0.00023	0.000043	0.0012	0.0014	0.0000036	0.00046	1.0	0.00086	0.0046	0.0018	0.00014	0.0041	1.0	0.00044	0.38	0.0000046	0.10	0.12	4.4	0.0000091	0.00034	0.000046	0.0077	0.00024	0.0018	0.0000046
13-Nov-12	50	500	460	7.5	110																																											
20-Nov-12	51	500	485	7.6	99																																										
27-Nov-12	52	500	500	7.4	120																																										
4-Dec-12	53	500	445	7.5	82	#N/A	0.94	9.9	8.9	0.089	0.027	0.13	16	0.018	0.00062	0.00022	0.0046	0.0000089	0.0000045	0.00071	0.0000014	5.6	0.00022	0.000039	0.00062	0.0018	0.0000085	0.00045	0.58	0.00076	0.0045	0.0014	0.000045	0.0040	0.55	0.000040	0.17	0.0000045	0.045	0.070	3.3	0.0000089	0.000045	0.000089	0.0050	0.00016	0.00089	0.0000045
11-Dec-12	54	500	470	7.4	85																																											
18-Dec-12	55	500	460	7.5	84																																										
25-Dec-12	56	500	445	7.4	90																																										
1-Jan-13	57	500	480	7.6	97	#N/A	2.0	14	12	0.096	0.048	0.14	20	0.016	0.0011	0.00072	0.0067	0.0000096	0.0000048	0.00072	0.0000014	6.8	0.00024	0.000011	0.00034	0.0014	0.0000096	0.00048	0.75	0.00086	0.0048	0.0023	0.000048	0.0043	0.64	0.00028	0.28	0.0000048	0.043	0.086	3.8	0.0000096	0.00011	0.000096	0.0070	0.00017	0.00096	0.0000048
8-Jan-13	58	500	465	7.5	85																																										
15-Jan-13	59	500	465	7.5	85																																										
22-Jan-13	60	500	470	7.6	83																																										
29-Jan-13	61	500	465	7.5	78	#N/A	1.2	10	10	0.093	0.028	0.14	18	0.021	0.00051	0.00019	0.0047	0.0000093	0.0000047	0.00065	0.0000016	6.3	0.00023	0.00000093	0.00047	0.0019	0.0000093	0.00047	0.64	0.0013	0.0047	0.0013	0.00014	0.012	0.47	0.00025	0.22	0.0000047	0.051	0.076	3.7	0.0000093	0.00013	0.00023	0.0038	0.00019	0.00093	0.0000047
5-Feb-13	62	500	480	7.6	97																																										
12-Feb-13	63	500	445	7.5	90																																										
19-Feb-13	64	500	485	7.6	88																																										
26-Feb-13	65	500	440	7.5	94	#N/A	1.5	11	8.8	0.088	0.026	0.13	16	0.012	0.00048	0.00026	0.0049	0.0000088	0.0000044	0.00066	0.000017	5.5	0.00022	0.00012	0.00040	0.0013	0.000013	0.00044	0.59	0.00070	0.0044	0.0013	0.000088	0.0062	0.48	0.00028	0.18	0.0000044	0.040	0.064	3.3	0.0000088	0.000031	0.000044	0.0035	0.000092	0.00044	0.0000044
5-Mar-13	66	500	450	7.6	94																																										
12-Mar-13	67	500	445	7.6	96																																										
Median (last 5)				7.5	90	#N/A	1.2	11	10	0.091	0.028	0.14	18	0.016	0.00062	0.00026	0.0049	0.0000091	0.0000046	0.00071	0.0000014	6.3	0.00023	0.000039	0.00047	0.0014	0.000013	0.00046	0.64	0.00086	0.0046	0.0014	0.000088	0.0043	0.55	0.00028	0.22	0.0000046	0.045	0.076	3.7	0.0000091	0.00011	0.000089	0.0050	0.00017	0.00093	0.0000046

Leachate Results for HC5

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	500	375	7.4	1254	#N/A	8.3	41	565	6.2	1.2	0.30	579	0.023	0.00070	0.0016	0.039	0.000020	0.000010	0.0091	0.00014	188	0.00080	0.0015	0.016	0.0040	0.000030	0.0060	27	0.036	0.020	0.067	0.0042	0.0090	18	0.0033	1.7	0.000010	41	2.2	204	0.000050	0.000090	0.00050	0.016	0.00049	0.0020	0.0011
6-Dec-11	1	500	450	7.6	744	#N/A	4.5	29	300	3.9	0.88	0.30	318	0.037	0.00050	0.00070	0.016	0.000020	0.000010	0.0060	0.00013	99	0.00050	0.00087	0.014	0.0030	0.000060	0.0030	17	0.021	0.020	0.045	0.0033	0.0090	9.5	0.0023	0.84	0.000030	26	1.2	119	0.000030	0.000050	0.00030	0.027	0.00039	0.024	0.00038
13-Dec-11	2	500	460	7.5	709	#N/A	3.7	26	309	2.1	1.0	0.30	326	0.037	0.00040	0.00090	0.024	0.000020	0.000010	0.0053	0.000043	104	0.0010	0.00051	0.0093	0.0030	0.000090	0.0030	16	0.012	0.010	0.033	0.0046	0.0090	9.5	0.0015	0.99	0.000010	21	1.4	112	0.000020	0.000010	0.00020	0.022	0.00015	0.0020	0.00018
20-Dec-11	3	500	495	7.5	617	#N/A	5.1	27	266	0.80	0.83	0.30	278	0.054	0.00060	0.00070	0.015	0.000020	0.000010	0.0051	0.000014	88	0.00050	0.00036	0.0066	0.0030	0.000020	0.0030	14	0.0082	0.010	0.024	0.0042	0.0090	7.0	0.0012	1.1	0.000010	12	1.1	97	0.000020	0.000020	0.00030	0.022	0.00034	0.0030	0.000090
27-Dec-11	4	500	450	7.8	470																																												
3-Jan-12	5	500	450	7.5	423	#N/A	4.9	22	182	0.30	0.61	0.30	177	0.085	0.00050	0.00040	0.011	0.000020	0.000010	0.0037	0.000013	56	0.00050	0.00023	0.0034	0.0040	0.000020	0.0020	9.1	0.0081	0.010	0.015	0.0034	0.0090	4.7	0.00025	0.65	0.000010	5.6	0.77	60	0.000020	0.000030	0.00040	0.012	0.00060	0.0020	0.000030
10-Jan-12	6	500	435	7.4	441																																											
17-Jan-12	7	500	445	7.4	404	#N/A	3.2	24	174	0.20	0.64	0.30	179	0.049	0.00060	0.00040	0.011	0.000020	0.000010	0.0038	0.000015	58	0.00050	0.00013	0.0027	0.0060	0.000020	0.0020	8.6	0.0088	0.010	0.012	0.00050	0.0090	4.6	0.00042	0.75	0.000010	3.2	0.83	58	0.000020	0.000030	0.00020	0.012	0.00034	0.0020	0.000030
24-Jan-12	8	500	445	7.6	360																																											
31-Jan-12	9	500	465	7.5	364	#N/A	3.3	24	155	0.20	0.55	0.30	159	0.055	0.00050	0.00040	0.010	0.000020	0.000010	0.0031	0.0000050	52	0.00050	0.00013	0.0022	0.0030	0.000020	0.0010	7.3	0.011	0.010	0.0095	0.00030	0.0090	3.9	0.00033	0.69	0.000010	1.8	0.76	50	0.000020	0.000050	0.00040	0.0098	0.00048	0.0020	0.000010
7-Feb-12	10	500	460	7.6	367																																											
14-Feb-12	11	500	465	7.6	345	#N/A	5.1	25	168	0.20	0.57	0.30	157	0.044	0.00050	0.00050	0.0098	0.000020	0.000010	0.0027	0.000010	52	0.00050	0.00011	0.0017	0.0030	0.000020	0.0010	6.8	0.011	0.010	0.011	0.0014	0.0090	3.6	0.00021	0.77	0.000010	1.3	0.81	45	0.000020	0.000010	0.00010	0.0086	0.00015	0.0010	0.000010
21-Feb-12	12	500	470	7.5	317																																											
28-Feb-12	13	500	475	7.5	289	#N/A	4.1	24	112	0.20	0.47	0.30	137	0.046	0.00070	0.00060	0.0086	0.000020	0.000010	0.0030	0.000011	46	0.00050	0.000096	0.0015	0.0030	0.000020	0.0010	5.6	0.013	0.010	0.014	0.00010	0.0090	3.2	0.00024	0.69	0.000010	0.84	0.75	39	0.000020	0.00010	0.00020	0.0077	0.00028	0.0020	0.000010
6-Mar-12	14	500	465	7.6	255																																											
13-Mar-12	15	500	455	7.4	226	#N/A	3.0	20	91	0.20	0.47	0.30	102	0.054	0.00060	0.00030	0.0077	0.000020	0.000010	0.0023	0.0000030	34	0.00050	0.000057	0.0012	0.0090	0.000030	0.0010	4.0	0.0089	0.010	0.016	0.00030	0.0090	2.6	0.000060	0.70	0.000010	0.61	0.60	29	0.000020	0.00017	0.00050	0.0048	0.00011	0.0020	0.000030
20-Mar-12	16	500	450	7.5	221																																											
27-Mar-12	17	500	435	7.4	209	#N/A	2.9	22	76	0.20	0.47	0.30	90	0.059	0.00050	0.00040	0.0077	0.000020	0.000010	0.0024	0.000013	31	0.00050	0.000043	0.0010	0.0030	0.000030	0.0010	3.3	0.0079	0.010	0.017	0.00030	0.0090	2.2	0.000040	0.65	0.000010	0.55	0.55	25	0.000020	0.000010	0.00010	0.0042	0.00026	0.0020	0.000010
3-Apr-12	18	500	440	7.5	189																																											
10-Apr-12	19	500	430	7.5	164	#N/A	2.4	22	60	0.20	0.44	0.30	68	0.063	0.00050	0.00020	0.0070	0.000020	0.000010	0.0020	0.0000030	23	0.00050	0.000044	0.00090	0.0030	0.000020	0.0010	2.6	0.0057	0.020	0.017	0.00010	0.0090	1.9	0.000090	0.59	0.000010	0.44	0.46	18	0.000020	0.000020	0.00010	0.0029	0.00029	0.0010	0.000010
17-Apr-12	20	500	410	7.5	184																																											
24-Apr-12	21	500	450	7.5	146	#N/A	2.4	23	48	0.20	0.42	0.30	60	0.071	0.00070	0.00020	0.0085	0.000020	0.000010	0.0022	0.0000030	20	0.00050	0.000046	0.0012	0.0030	0.000020	0.0010	2.4	0.0051	0.050	0.013	0.00040	0.0090	2.5	0.00012	0.65	0.000010	0.45	0.43	15	0.000020	0.000030	0.00010	0.0035	0.00031	0.0010	0.000010
1-May-12	22	500	430	7.6	131																																											
8-May-12	23	500	440	7.5	120	#N/A	2.5	22	35	0.20	0.32	0.30	49	0.053	0.00050	0.00050	0.0076	0.000020	0.000010	0.0022	0.0000030	16	0.00050	0.000035	0.020	0.0030	0.00027	0.0010	2.1	0.0047	0.010	0.010	0.00060	0.0090	2.1	0.000080	0.53	0.000010	0.39	0.36	12	0.000020	0.00092	0.00020	0.0027	0.00026	0.0090	0.000010
15-May-12	24	500	430	7.5	119																																											
22-May-12	25	500	405	7.5	142	#N/A	3.3	28	39	0.20	0.36	0.30	58	0.093	0.0010	0.00030	0.0097	0.000020	0.000010	0.0025	0.0000030	19	0.00050	0.000039	0.0013	0.0030	0.000020	0.0010	2.8	0.0053	0.030	0.012	0.00030	0.0090	2.8	0.00011	0.82	0.000010	0.51	0.47	14	0.000020	0.00037	0.00030	0.0055	0.00048	0.0010	0.000010
29-May-12	26	500	435	7.4	99																																											
5-Jun-12	27	500	450	7.4	100	#N/A	3.1	23	22	0.20	0.29	0.30	43	0.075	0.00040	0.00040	0.0073	0.000020	0.000010	0.0028	0.0000030	14	0.00050	0.000039	0.00080	0.0030	0.000030	0.0010	1.9	0.0064	0.010	0.0058	0.00010	0.0090	1.9	0.00012	0.56	0.000010	0.35	0.35	9.4	0.000020	0.00027	0.00020	0.0025	0.00049	0.0010	0.000010
12-Jun-12	28	500	445	7.5	94																																											
19-Jun-12	29	500	435	7.4	89	#N/A	2.6	20	22	0.20	0.27	0.30	36	0.067	0.00040	0.00020	0.0062	0.000020	0.000010	0.0015	0.0000030	12	0.00050	0.000043	0.00080	0.0030	0.000020	0.0010	1.7	0.0055	0.010	0.0049	0.00050	0.0090	1.6	0.00012	0.44	0.000010	0.29	0.29	7.7	0.000020	0.00015	0.00040	0.0021	0.00064	0.0020	0.000010
26-Jun-12	30	500	450	7.5	95																																											
3-Jul-12	31	500	450	7.7	102	#N/A	7.1	27	23	0.20	0.31	0.30	42	0.080	0.00040	0.00040	0.0079	0.000020	0.000010	0.0011	0.0000030	14	0.00050	0.000029	0.00090	0.0030	0.000030	0.0010	2.0	0.0066	0.010	0.0052	0.00010	0.0090	1.8	0.000040	0.53	0.000010	0.35	0.34	8.9	0.000020	0.00027	0.00030	0.0019	0.00031	0.0030	0.000010
10-Jul-12	32	500	440	7.5	106																																											
17-Jul-12	33	500	435	7.5	91	#N/A	2.4	21	20	0.20	0.27	0.30	37	0.068	0.00040	0.0016	0.0071	0.000020	0.000010	0.0016	0.0000030	12	0.00050	0.00017	0.00090	0.0030	0.00063	0.0010	1.8	0.0060	0.010	0.0050	0.00010	0.0090	1.6	0.00023	0.49	0.000010	0.42	0.30	7.8	0.000020	0.00021	0.00010	0.0018	0.00037	0.0020	0.000010
24-Jul-12	34	500	445	7.4	95																																											
31-Jul-12	35	500	435	7.5	85	#N/A	2.0	20	17	0.20	0.27	0.30	37	0.063	0.00040	0.00030	0.0063	0.000020	0.000010	0.0022	0.0000029	12	0.00050	0.000042	0.0017	0.0030	0.00017	0.0010	1.9	0.0062	0.010	0.0042	0.00010	0.0090	1.5	0.00014	0.51	0.000010	0.33	0.31	7.1	0.000020	0.00019	0.00010	0.0017	0.00033	0.0050	0.000010
7-Aug-12	36	500	470	7.6	88																																											
14-Aug-12	37	500	445	7.5	94	#N/A	2.8	25	21	0.20	0.26	0.30	40	0.11	0.00070	0.0030	0.0069	0.000020	0.000010	0.0046	0.0000039	12	0.00050	0.0000020	0.0018	0.0030	0.000020	0.0010	2.1	0.0063	0.010	0.0042	0.00020	0.0090	1.6	0.00010	0.51	0.000010	0.35	0.31	8.2	0.000020	0.00031	0.00040	0.0016	0.00065	0.0020	0.000010
21-Aug-12	38	500	445	7.3	91																																											
28-Aug-12	39	500	500	7.5	101	#N/A	3.5	25	25	0.20	0.29	0.30	42	0.068	0.00030	0.00020	0.0076	0.000020	0.000010	0.0021	0.000076	13	0.00050	0.00013	0.0011	0.0030	0.000020	0.0010	2.3	0.0089	0.010	0.0038	0.00090	0.0090	1.4	0.00019	0.47	0.000010	0.32	0.33	8.3	0.000020	0.00021	0.00020	0.0027	0.00036	0.0090	0.000010
4-Sep-12	40	500	475	7.4	78																																											
11-Sep-12	41	500	460	7.4	84	#N/A	2.6	22	20	0.20	0.30	0.30	38	0.046	0.00030	0.00020	0.0061	0.000020	0.000010	0.0021	0.0000030	12	0.00050	0.000054	0.0011	0.022	0.000020	0.0010	2.1	0.0078	0.040	0.0039	0.00010	0.0090	1.3	0.00015	0.38	0.000010	0.31	0.29	7.8	0.000020	0.00020	0.00020	0.0017	0.00024	0.0030	0.000040
18-Sep-12	42	500	505	7.5	89																																											
25-Sep-12	43	500	445	7.4	82	#N/A	3.2	23	19	0.20	0.24	0.30	33	0.051	0.00020	0.00080	0.0059	0.000020	0.000010	0.0042	0.0000030	10	0.00050	0.000051	0.00070	0.0030	0.000020	0.0010	1.9	0.0054	0.010	0.0041	0.00020	0.0090	1.1	0.00021	0.32	0.000010	0.27	0.26	6.4	0.000020	0.00013	0.00010	0.0015	0.00026	0.0010	0.000020
2-Oct-12	44	500	455	7.3	80																																											
9-Oct-12	45	500	465	7.4	70	#N/A	4.0	21	15	0.20	0.21	0.30	30	0.046	0.00020	0.00020	0.0054	0.000020	0.000010	0.0014	0.0000030	9.2	0.00050	0.000080	0.00080	0.0050	0.000020	0.0010	1.8	0.0066	0.010	0.0031	0.00060	0.0090	0.98	0.00014	0.29	0.000010	0.22	0.23	5.5	0.000020	0.00014	0.00020	0.0013	0.00021	0.0010	0.000010
16-Oct-12	46	500	465	7.4	81																																											
23-Oct-12	47	500	485	7.5	89																																										
30-Oct-12	48	500	460	7.3	85																																										
6-Nov-12	49	500	430	7.6	74	#N/A	2.6	24	14	0.20	0.24	0.30	38	0.047	0.00020	0.00020	0.0061	0.000020	0.000010	0.0020	0.000017	12	0.00050	0.000069	0.0013	0.0060	0.000040	0.0010	2.1	0.0071	0.010	0.0041	0.00020	0.0090	0.97	0.00012	0.32	0.000010	0.26	0.28	6.0	0.000020	0.00045	0.00010	0.0012	0.00019	0.0050	0.000010
13-Nov-12	50	500	435	7.3	85																																											
20-Nov-12	51	500	490	7.8	80																																										
27-Nov-12	52	500	490	7.2	95																																										
4-Dec-12	53	500	455	7.5	73	#N/A	1.9	28	13	0.20	0.21	0.30	33	0.061	0.00030	0.00020	0.0053	0.000020	0.000010	0.0014	0.0000030	9.7	0.00050	0.000090	0.00080	0.0030	0.000020	0.0010	2.0	0.0041	0.010	0.0038	0.00010	0.0090	0.87	0.000090	0.30	0.000010	0.19	0.22	4.8	0.000020	0.00011	0.00030	0.0015	0.00019	0.0020	0.000010
11-Dec-12	54	500	450	7.2	75																																											
18-Dec-12	55	500	450	7.6	73																																										
25-Dec-12	56	500	445	7.3	85																																										
1-Jan-13	57	500	455	7.7	69	#N/A	3.9	26	14	0.20	0.20	0.30	38	0.046	0.00030	0.00030	0.0056	0.000020	0.000010	0.0010	0.0000030	11	0.00050	0.000028	0.0029	0.0040	0.000020	0.0010	2.5	0.0060	0.010	0.0046	0.00010	0.010	0.94	0.00010	0.40	0.000010	0.23	0.28	5.7	0.000020	0.00022	0.00030	0.0013	0.00015	0.0010	0.000010
8-Jan-13	58	500	455	7.5	75																																											
15-Jan-13	59	500	460	7.5	69																																										
22-Jan-13	60	500	455	7.5	72																																										
29-Jan-13	61	500	450	7.6	68	#N/A	2.5	25	13	0.20	0.19	0.30	36	0.059	0.00020	0.00020	0.0053	0.000020	0.000010	0.0014	0.000011	10	0.00050	0.0000030	0.00090	0.0030	0.00011	0.0010	2.4	0.0064	0.010	0.0040	0.00020	0.015	0.86	0.00013	0.36	0.000010	0.24	0.25	5.5	0.000020	0.00021	0.00020	0.0011	0.00021	0.0020	0.000010
5-Feb-13	62	500	460	7.6	68																																											
12-Feb-13	63	500	455	7.6	69																																										
19-Feb-13	64	500	445	7.6	68																																										
26-Feb-13	65	500	440	7.5	71	#N/A	3.5	24	11	0.20	0.17	0.30	29	0.032	0.00020	0.00030	0.0052	0.000020	0.000010	0.0012	0.000024	8.2	0.00050	0.00026	0.00060	0.0030	0.000050	0.0010	2.0	0.0038	0.010	0.0044	0.00020	0.0090	0.75	0.00011	0.24	0.000010	0.18	0.20	4.7	0.000020	0.000080	0.00010	0.00087	0.000030	0.0010	0.000010
5-Mar-13	66	500	440	7.7	65																																											
12-Mar-13	67	500	450	7.6	69																																										

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC5

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	375	7.4	1254	#N/A	3.1	15	212	2.3	0.44	0.11	217	0.0085	0.00026	0.00060	0.015	0.0000075	0.0000038	0.0034	0.000051	71	0.00030	0.00056	0.0061	0.0015	0.000011	0.0023	10.0	0.014	0.0075	0.025	0.0016	0.0034	6.6	0.0012	0.62	0.0000038	15	0.81	77	0.000019	0.000034	0.00019	0.0061	0.00018	0.00075	0.00040
6-Dec-11	1	500	450	7.6	744	#N/A	2.0	13	135	1.8	0.40	0.14	143	0.017	0.00023	0.00032	0.0072	0.0000090	0.0000045	0.0027	0.000059	45	0.00023	0.00039	0.0061	0.0014	0.000027	0.0014	7.7	0.0093	0.0090	0.020	0.0015	0.0041	4.3	0.0011	0.38	0.000014	12	0.54	54	0.000014	0.000023	0.00014	0.012	0.00018	0.011	0.00017
13-Dec-11	2	500	460	7.5	709	#N/A	1.7	12	142	0.97	0.48	0.14	150	0.017	0.00018	0.00041	0.011	0.0000092	0.0000046	0.0024	0.000020	48	0.00046	0.00024	0.0043	0.0014	0.000041	0.0014	7.4	0.0053	0.0046	0.015	0.0021	0.0041	4.4	0.00058	0.46	0.0000046	9.5	0.64	52	0.0000092	0.000046	0.000092	0.0099	0.000069	0.00092	0.000083
20-Dec-11	3	500	495	7.5	617	#N/A	2.5	14	132	0.40	0.41	0.15	138	0.026	0.00030	0.00035	0.0075	0.0000099	0.0000050	0.0025	0.0000069	44	0.00025	0.00018	0.0033	0.0015	0.0000099	0.0015	6.8	0.0041	0.0050	0.012	0.0021	0.0045	3.4	0.00058	0.53	0.0000050	5.8	0.56	48	0.0000099	0.0000099	0.00015	0.011	0.00017	0.0015	0.000045
27-Dec-11	4	500	450	7.8	470																																												
3-Jan-12	5	500	450	7.5	423	#N/A	2.2	9.8	82	0.14	0.27	0.14	80	0.038	0.00023	0.00018	0.0049	0.0000090	0.0000045	0.0017	0.0000059	25	0.00023	0.00010	0.0015	0.0018	0.0000090	0.00090	4.1	0.0036	0.0045	0.0067	0.0015	0.0041	2.1	0.00011	0.29	0.0000045	2.5	0.35	27	0.0000090	0.000014	0.00018	0.0052	0.00027	0.00090	0.000014
10-Jan-12	6	500	435	7.4	441																																											
17-Jan-12	7	500	445	7.4	404	#N/A	1.4	11	77	0.089	0.28	0.13	80	0.022	0.00027	0.00018	0.0048	0.0000089	0.0000045	0.0017	0.0000067	26	0.00022	0.000058	0.0012	0.0027	0.0000089	0.00089	3.8	0.0039	0.0045	0.0054	0.00022	0.0040	2.1	0.00019	0.33	0.0000045	1.4	0.37	26	0.0000089	0.000013	0.000089	0.0053	0.00015	0.00089	0.000013
24-Jan-12	8	500	445	7.6	360																																											
31-Jan-12	9	500	465	7.5	364	#N/A	1.5	11	72	0.093	0.26	0.14	74	0.025	0.00023	0.00019	0.0048	0.0000093	0.0000047	0.0014	0.0000023	24	0.00023	0.000061	0.0010	0.0014	0.0000093	0.00047	3.4	0.0050	0.0047	0.0044	0.00014	0.0042	1.8	0.00015	0.32	0.0000047	0.84	0.35	23	0.0000093	0.000023	0.00019	0.0046	0.00022	0.00093	0.0000047
7-Feb-12	10	500	460	7.6	367																																											
14-Feb-12	11	500	465	7.6	345	#N/A	2.4	12	78	0.093	0.27	0.14	73	0.020	0.00023	0.00023	0.0046	0.0000093	0.0000047	0.0013	0.0000047	24	0.00023	0.000052	0.00079	0.0014	0.0000093	0.00047	3.2	0.0052	0.0047	0.0052	0.00065	0.0042	1.7	0.000098	0.36	0.0000047	0.62	0.37	21	0.0000093	0.0000047	0.000047	0.0040	0.000070	0.00047	0.0000047
21-Feb-12	12	500	470	7.5	317																																											
28-Feb-12	13	500	475	7.5	289	#N/A	1.9	11	53	0.095	0.22	0.14	65	0.022	0.00033	0.00029	0.0041	0.0000095	0.0000048	0.0014	0.0000052	22	0.00024	0.000046	0.00071	0.0014	0.0000095	0.00048	2.6	0.0064	0.0048	0.0067	0.0000048	0.0043	1.5	0.00011	0.33	0.0000048	0.40	0.36	18	0.0000095	0.0000048	0.0000095	0.0036	0.00013	0.00095	0.0000048
6-Mar-12	14	500	465	7.6	255																																											
13-Mar-12	15	500	455	7.4	226	#N/A	1.4	9.3	41	0.091	0.21	0.14	46	0.025	0.00027	0.00014	0.0035	0.0000091	0.0000046	0.0010	0.0000014	16	0.00023	0.000026	0.00055	0.0041	0.000014	0.00046	1.8	0.0040	0.0046	0.0074	0.00014	0.0041	1.2	0.000027	0.32	0.0000046	0.28	0.27	13	0.0000091	0.0000077	0.00023	0.0022	0.000050	0.00091	0.000014
20-Mar-12	16	500	450	7.5	221																																											
27-Mar-12	17	500	435	7.4	209	#N/A	1.3	9.5	33	0.087	0.20	0.13	39	0.026	0.00022	0.00017	0.0033	0.0000087	0.0000044	0.0010	0.0000057	13	0.00022	0.000019	0.00044	0.0013	0.000013	0.00044	1.4	0.0034	0.0044	0.0072	0.00013	0.0039	0.97	0.000017	0.28	0.0000044	0.24	0.24	11	0.0000087	0.0000044	0.00044	0.0018	0.00011	0.00087	0.0000044
3-Apr-12	18	500	440	7.5	189																																											
10-Apr-12	19	500	430	7.5	164	#N/A	1.0	9.2	26	0.086	0.19	0.13	29	0.027	0.00022	0.000086	0.0030	0.0000086	0.0000043	0.00086	0.0000013	9.9	0.00022	0.000019	0.00039	0.0013	0.0000086	0.00043	1.1	0.0025	0.0086	0.0072	0.000043	0.0039	0.82	0.000039	0.25	0.0000043	0.19	0.20	7.9	0.0000086	0.0000086	0.000043	0.0012	0.00012	0.00043	0.0000043
17-Apr-12	20	500	410	7.5	184																																											
24-Apr-12	21	500	450	7.5	146	#N/A	1.1	10	22	0.090	0.19	0.14	27	0.032	0.00032	0.000090	0.0038	0.0000090	0.0000045	0.00099	0.0000014	9.0	0.00023	0.000021	0.00054	0.0014	0.0000090	0.00045	1.1	0.0023	0.023	0.0056	0.00018	0.0041	1.1	0.000054	0.29	0.0000045	0.20	0.20	6.8	0.0000090	0.000014	0.000045	0.0016	0.00014	0.00045	0.0000045
1-May-12	22	500	430	7.6	131																																											
8-May-12	23	500	440	7.5	120	#N/A	1.1	9.8	15	0.088	0.14	0.13	21	0.023	0.00022	0.00022	0.0033	0.0000088	0.0000044	0.00097	0.0000013	7.1	0.00022	0.000015	0.0089	0.0013	0.00012	0.00044	0.91	0.0021	0.0044	0.0045	0.00026	0.0040	0.93	0.000035	0.23	0.0000044	0.17	0.16	5.1	0.0000088	0.00040	0.000088	0.0012	0.00011	0.0040	0.0000044
15-May-12	24	500	430	7.5	119																																											
22-May-12	25	500	405	7.5	142	#N/A	1.3	11	16	0.081	0.15	0.12	24	0.038	0.00041	0.00012	0.0039	0.0000081	0.0000041	0.0010	0.0000012	7.6	0.00020	0.000016	0.00053	0.0012	0.0000081	0.00041	1.1	0.0021	0.012	0.0049	0.00012	0.0036	1.1	0.000045	0.33	0.0000041	0.21	0.19	5.5	0.0000081	0.00015	0.00012	0.0022	0.00019	0.00041	0.0000041
29-May-12	26	500	435	7.4	99																																											
5-Jun-12	27	500	450	7.4	100	#N/A	1.4	10	9.9	0.090	0.13	0.14	19	0.034	0.00018	0.00018	0.0033	0.0000090	0.0000045	0.0013	0.0000014	6.4	0.00023	0.000018	0.00036	0.0014	0.000014	0.00045	0.86	0.0029	0.0045	0.0026	0.000045	0.0041	0.87	0.000054	0.25	0.0000045	0.16	0.16	4.2	0.0000090	0.00012	0.000090	0.0011	0.00022	0.00045	0.0000045
12-Jun-12	28	500	445	7.5	94																																											
19-Jun-12	29	500	435	7.4	89	#N/A	1.1	8.9	9.6	0.087	0.12	0.13	16	0.029	0.00017	0.000087	0.0027	0.0000087	0.0000044	0.00065	0.0000013	5.0	0.00022	0.000019	0.00035	0.0013	0.0000087	0.00044	0.72	0.0024	0.0044	0.0021	0.00022	0.0039	0.68	0.000052	0.19	0.0000044	0.13	0.13	3.4	0.0000087	0.0000065	0.00017	0.00091	0.00028	0.00087	0.0000044
26-Jun-12	30	500	450	7.5	95																																											
3-Jul-12	31	500	450	7.7	102	#N/A	3.2	12	10	0.090	0.14	0.14	19	0.036	0.00018	0.00018	0.0036	0.0000090	0.0000045	0.00050	0.0000014	6.2	0.00023	0.000013	0.00041	0.0014	0.000014	0.00045	0.88	0.0030	0.0045	0.0023	0.000045	0.0041	0.81	0.000018	0.24	0.0000045	0.16	0.15	4.0	0.0000090	0.00012	0.00014	0.00086	0.00014	0.0014	0.0000045
10-Jul-12	32	500	440	7.5	106																																											
17-Jul-12	33	500	435	7.5	91	#N/A	1.0	9.1	8.7	0.087	0.12	0.13	16	0.030	0.00017	0.00070	0.0031	0.0000087	0.0000044	0.00070	0.0000013	5.2	0.00022	0.000075	0.00039	0.0013	0.00027	0.00044	0.79	0.0026	0.0044	0.0022	0.000044	0.0039	0.68	0.00010	0.21	0.0000044	0.18	0.13	3.4	0.0000087	0.000091	0.000044	0.00078	0.00016	0.00087	0.0000044
24-Jul-12	34	500	445	7.4	95																																											
31-Jul-12	35	500	435	7.5	85	#N/A	0.86	8.9	7.4	0.087	0.12	0.13	16	0.028	0.00017	0.00013	0.0027	0.0000087	0.0000044	0.00096	0.000013	5.1	0.00022	0.000018	0.00074	0.0013	0.000074	0.00044	0.84	0.0027	0.0044	0.0018	0.000044	0.0039	0.65	0.000061	0.22	0.0000044	0.14	0.13	3.1	0.0000087	0.000083	0.000044	0.00072	0.00014	0.0022	0.0000044
7-Aug-12	36	500	470	7.6	88																																											
14-Aug-12	37	500	445	7.5	94	#N/A	1.2	11	9.3	0.089	0.12	0.13	18	0.047	0.00031	0.0013	0.0031	0.0000089	0.0000045	0.0020	0.0000013	5.5	0.00022	0.00000089	0.00080	0.0013	0.0000089	0.00045	0.93	0.0028	0.0045	0.0019	0.000089	0.0040	0.70	0.000045	0.23	0.0000045	0.16	0.14	3.7	0.0000089	0.00014	0.00018	0.00070	0.00029	0.00089	0.0000045
21-Aug-12	38	500	445	7.3	91																																											
28-Aug-12	39	500	500	7.5	101	#N/A	1.7	13	13	0.10	0.15	0.15	21	0.034	0.00015	0.00010	0.0038	0.000010	0.0000050	0.0011	0.000038	6.5	0.00025	0.000063	0.00055	0.0015	0.000010	0.00050	1.2	0.0045	0.0050	0.0019	0.00045	0.0045	0.70	0.000095	0.24	0.0000050	0.16	0.17	4.1	0.000010	0.00011	0.00010	0.0013	0.00018	0.0045	0.0000050
4-Sep-12	40	500	475	7.4	78																																											
11-Sep-12	41	500	460	7.4	84	#N/A	1.2	9.9	9.2	0.092	0.14	0.14	17	0.021	0.00014	0.000092	0.0028	0.0000092	0.0000046	0.00097	0.0000014	5.3	0.00023	0.000025	0.00051	0.010	0.0000092	0.00046	0.96	0.0036	0.018	0.0018	0.000046	0.0041	0.61	0.000069	0.17	0.0000046	0.14	0.13	3.6	0.0000092	0.000092	0.000092	0.00079	0.00011	0.0014	0.000018
18-Sep-12	42	500	505	7.5	89																																											
25-Sep-12	43	500	445	7.4	82	#N/A	1.4	10	8.5	0.089	0.11	0.13	15	0.023	0.000089	0.00036	0.0026	0.0000089	0.0000045	0.0019	0.0000013	4.5	0.00022	0.000023	0.00031	0.0013	0.0000089	0.00045	0.85	0.0024	0.0045	0.0018	0.000089	0.0040	0.49	0.000093	0.14	0.0000045	0.12	0.11	2.8	0.0000089	0.000058	0.000045	0.00068	0.00012	0.00045	0.0000089
2-Oct-12	44	500	455	7.3	80																																											
9-Oct-12	45	500	465	7.4	70	#N/A	1.9	9.6	7.0	0.093	0.098	0.14	14	0.022	0.000093	0.000093	0.0025	0.0000093	0.0000047	0.00065	0.0000014	4.3	0.00023	0.000037	0.00037	0.0023	0.0000093	0.00047	0.82	0.0031	0.0047	0.0015	0.00028	0.0042	0.45	0.000065	0.13	0.0000047	0.10	0.11	2.6	0.0000093	0.000065	0.000093	0.00060	0.000098	0.00047	0.0000047
16-Oct-12	46	500	465	7.4	81																																											
23-Oct-12	47	500	485	7.5	89																																										
30-Oct-12	48	500	460	7.3	85																																										
6-Nov-12	49	500	430	7.6	74	#N/A	1.1	10	6.0	0.086	0.10	0.13	16	0.020	0.000086	0.000086	0.0026	0.0000086	0.0000043	0.00086	0.0000073	5.0	0.00022	0.000030	0.00056	0.0026	0.000017	0.00043	0.91	0.0031	0.0043	0.0018	0.000086	0.0039	0.42	0.000052	0.14	0.0000043	0.11	0.12	2.6	0.0000086	0.00019	0.000043	0.00049	0.000082	0.0022	0.0000043
13-Nov-12	50	500	435	7.3	85																																											
20-Nov-12	51	500	490	7.8	80																																										
27-Nov-12	52	500	490	7.2	95																																										
4-Dec-12	53	500	455	7.5	73	#N/A	0.88	13	5.9	0.091	0.096	0.14	15	0.028	0.00014	0.000091	0.0024	0.0000091	0.0000046	0.00064	0.0000014	4.4	0.00023	0.000041	0.00036	0.0014	0.0000091	0.00046	0.93	0.0019	0.0046	0.0017	0.000046	0.0041	0.40	0.000041	0.14	0.0000046	0.086	0.10	2.2	0.0000091	0.000050	0.00014	0.00067	0.000086	0.00091	0.0000046
11-Dec-12	54	500	450	7.2	75																																										
18-Dec-12	55	500	450	7.6	73																																										
25-Dec-12	56	500	445	7.3	85																																										
1-Jan-13	57	500	455	7.7	69	#N/A	1.8	12	6.4	0.091	0.091	0.14	17	0.021	0.00014	0.00014	0.0025	0.0000091	0.0000046	0.00046	0.0000014	5.1	0.00023	0.000013	0.0013	0.0018	0.0000091	0.00046	1.1	0.0027	0.0046	0.0021	0.000046	0.0046	0.43	0.000046	0.18	0.0000046	0.10	0.13	2.6	0.0000091	0.00010	0.00014	0.00058	0.000068	0.00046	0.0000046
8-Jan-13	58	500	455	7.5	75																																										
15-Jan-13	59	500	460	7.5	69																																										
22-Jan-13	60	500	455	7.5	72																																										
29-Jan-13	61	500	450	7.6	68	#N/A	1.1	11	5.9	0.090	0.086	0.14	16	0.027	0.000090	0.000090	0.0024	0.0000090	0.0000045	0.00063	0.0000050	4.7	0.00023	0.0000014	0.00041	0.0014	0.000050	0.00045	1.1	0.0029	0.0045	0.0018	0.000090	0.0068	0.39	0.000059	0.16	0.0000045	0.11	0.11	2.5	0.0000090	0.000095	0.000090	0.00047	0.000095	0.00090	0.0000045
5-Feb-13	62	500	460	7.6	68																																										
12-Feb-13	63	500	455	7.6	69																																										
19-Feb-13	64	500	445	7.6	68																																										
26-Feb-13	65	500	440	7.5	71	#N/A	1.5	11	4.8	0.088	0.075	0.13	13	0.014	0.000088	0.00013	0.0023	0.0000088	0.0000044	0.00053	0.000011	3.6	0.00022	0.00012	0.00026	0.0013	0.000022	0.00044	0.88	0.0017	0.0044	0.0019	0.000088	0.0040	0.33	0.000048	0.11	0.0000044	0.079	0.087	2.1	0.0000088	0.000035	0.000044	0.00038	0.000013	0.00044	0.0000044
5-Mar-13	66	500	440	7.7	65																																										
12-Mar-13	67	500	450	7.6	69																																										
Median (last 5)				7.5	73	#N/A	1.1	11	5.9	0.090	0.091	0.14	16	0.021	0.000090	0.000091	0.0024	0.0000090	0.0000045	0.00063	0.0000050	4.7	0.00023	0.000030	0.00041	0.0014	0.000017	0.00045	0.93	0.0027	0.0045	0.0018	0.000086	0.0041	0.40	0.000048	0.14	0.0000045	0.10	0.11	2.5	0.0000090	0.000095	0.000090	0.00049	0.000082	0.00090	0.0000045

Leachate Results for HC6

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	500	400	7.5	1000	#N/A	7.5	24	469	2.2	0.96	0.30	489	0.018	0.00050	0.0011	0.010	0.000020	0.000010	0.0089	0.000053	168	0.00050	0.00070	0.0073	0.0030	0.00010	0.0030	17	0.026	0.010	0.018	0.0043	0.013	17	0.0027	1.6	0.000010	10	0.37	172	0.000040	0.000010	0.00020	0.0099	0.00025	0.0020	0.000050
6-Dec-11	1	500	470	7.6	524	#N/A	3.9	23	220	1.1	0.75	0.30	238	0.025	0.00030	0.00090	0.011	0.000020	0.000010	0.0041	0.000026	79	0.00050	0.00023	0.0041	0.0030	0.000020	0.0020	9.8	0.018	0.010	0.026	0.00030	0.0090	10	0.0016	1.2	0.000010	6.5	0.17	82	0.000020	0.000010	0.00020	0.0089	0.00031	0.0030	0.000010
13-Dec-11	2	500	455	7.5	374	#N/A	3.3	21	143	0.40	0.66	0.30	170	0.016	0.00020	0.00080	0.0092	0.000020	0.000010	0.0033	0.000017	57	0.00080	0.00014	0.0019	0.0030	0.00011	0.0010	6.7	0.013	0.010	0.017	0.0016	0.0090	7.9	0.0012	0.99	0.000010	3.8	0.13	53	0.000020	0.000070	0.00010	0.0060	0.00015	0.0030	0.000020
20-Dec-11	3	500	500	7.7	350	#N/A	4.7	24	145	0.20	0.62	0.30	157	0.028	0.00030	0.00080	0.0081	0.000020	0.000010	0.0035	0.000026	53	0.00050	0.00018	0.0018	0.0030	0.000020	0.0010	5.7	0.015	0.010	0.016	0.0018	0.0090	6.3	0.00062	1.2	0.000010	2.3	0.12	51	0.000020	0.000010	0.00020	0.0073	0.00031	0.0020	0.000010
27-Dec-11	4	500	435	7.9	196																																												
3-Jan-12	5	500	450	7.6	133	#N/A	3.9	22	42	0.20	0.43	0.30	53	0.066	0.00030	0.0011	0.0042	0.000020	0.000010	0.0024	0.0000050	18	0.00050	0.000065	0.0011	0.0030	0.000020	0.0010	1.8	0.0059	0.010	0.0097	0.00090	0.0090	3.3	0.00020	0.72	0.000010	0.86	0.040	14	0.000020	0.000050	0.00040	0.0030	0.00062	0.0010	0.000010
10-Jan-12	6	500	450	7.5	120																																												
17-Jan-12	7	500	445	7.6	85	#N/A	2.6	24	23	0.20	0.39	0.30	37	0.048	0.00040	0.00050	0.0045	0.000020	0.000010	0.0027	0.0000060	13	0.00050	0.000044	0.0016	0.0060	0.000050	0.0010	1.2	0.0049	0.010	0.0080	0.00020	0.0090	2.7	0.00016	0.81	0.000010	0.50	0.028	7.8	0.000020	0.000040	0.00050	0.0024	0.00041	0.0020	0.000020
24-Jan-12	8	500	455	7.8	80																																											
31-Jan-12	9	500	455	7.6	73	#N/A	3.0	26	13	0.20	0.34	0.30	28	0.047	0.00020	0.00050	0.0043	0.000020	0.000010	0.0019	0.0000050	9.7	0.00050	0.000034	0.0019	0.0050	0.00010	0.0010	0.96	0.0042	0.010	0.0069	0.00010	0.0090	2.4	0.00014	0.77	0.000010	0.35	0.022	5.0	0.000020	0.000030	0.00040	0.0022	0.00044	0.0020	0.000010
7-Feb-12	10	500	475	7.8	71																																											
14-Feb-12	11	500	460	7.7	67	#N/A	4.0	23	17	0.20	0.31	0.30	28	0.036	0.00020	0.00070	0.0044	0.000020	0.000010	0.0016	0.0000030	9.7	0.00050	0.000032	0.0016	0.0070	0.000020	0.0010	0.95	0.0037	0.010	0.0067	0.00040	0.0090	2.1	0.00025	0.78	0.000010	0.33	0.023	4.6	0.000020	0.000020	0.00050	0.0020	0.00020	0.0010	0.000010
21-Feb-12	12	500	470	7.7	67																																											
28-Feb-12	13	500	470	7.6	60	#N/A	3.2	21	10	0.20	0.24	0.30	26	0.080	0.00030	0.00050	0.0049	0.000020	0.000010	0.0019	0.0000040	9.1	0.00050	0.000029	0.0027	0.0030	0.000020	0.0010	0.85	0.0045	0.010	0.0053	0.00010	0.0090	2.0	0.000060	0.71	0.000010	0.20	0.021	3.8	0.000020	0.000070	0.00070	0.0020	0.00035	0.0040	0.000020
6-Mar-12	14	500	450	7.7	68																																											
13-Mar-12	15	500	445	7.5	64	#N/A	2.6	21	10	0.20	0.26	0.30	28	0.049	0.00030	0.00080	0.0051	0.000020	0.000010	0.0017	0.0000030	9.7	0.00050	0.000016	0.0015	0.0080	0.000020	0.0010	0.89	0.0030	0.010	0.0055	0.00010	0.0090	2.2	0.000040	0.86	0.000010	0.21	0.023	4.5	0.000020	0.00018	0.00030	0.0021	0.00021	0.0030	0.000020
20-Mar-12	16	500	445	7.6	61																																											
27-Mar-12	17	500	445	7.5	53	#N/A	2.5	20	8.0	0.20	0.20	0.30	23	0.059	0.00030	0.00060	0.0047	0.000020	0.000010	0.0017	0.000016	8.0	0.00050	0.000011	0.0020	0.0050	0.00025	0.0010	0.74	0.0035	0.010	0.0041	0.00010	0.0090	1.9	0.000070	0.81	0.000010	0.17	0.018	2.9	0.000020	0.000010	0.00040	0.0022	0.00043	0.0010	0.000010
3-Apr-12	18	500	455	7.5	50																																											
10-Apr-12	19	500	440	7.5	50	#N/A	2.0	17	7.0	0.20	0.17	0.30	21	0.046	0.00020	0.00040	0.0047	0.000020	0.000010	0.0016	0.0000030	7.3	0.00050	0.000021	0.0014	0.0050	0.000030	0.0010	0.65	0.0029	0.020	0.0040	0.00010	0.0090	1.6	0.000070	0.66	0.000010	0.13	0.017	2.9	0.000020	0.000040	0.00030	0.0014	0.00034	0.0020	0.000010
17-Apr-12	20	500	440	7.5	63																																											
24-Apr-12	21	500	445	7.5	49	#N/A	2.2	21	7.0	0.20	0.17	0.30	20	0.11	0.00030	0.00060	0.0059	0.000020	0.000010	0.0012	0.0000030	7.0	0.00050	0.00025	0.0049	0.014	0.000050	0.0010	0.65	0.0035	0.030	0.0038	0.00010	0.0090	2.2	0.00011	0.85	0.000010	0.15	0.017	2.5	0.000020	0.000040	0.0010	0.0021	0.00044	0.0020	0.000030
1-May-12	22	500	455	7.7	51																																											
8-May-12	23	500	490	7.5	51	#N/A	2.4	17	7.0	0.20	0.12	0.30	21	0.036	0.00030	0.00040	0.0058	0.000020	0.000010	0.0050	0.0000030	7.4	0.00050	0.00012	0.0022	0.036	0.000080	0.0010	0.69	0.0031	0.010	0.0049	0.00050	0.0090	2.0	0.00013	0.71	0.000010	0.12	0.017	2.9	0.000020	0.00035	0.00020	0.0026	0.00033	0.0050	0.000010
15-May-12	24	500	480	7.5	50																																											
22-May-12	25	500	465	7.5	50	#N/A	3.1	16	6.0	0.20	0.12	0.30	20	0.065	0.00020	0.0014	0.0050	0.000020	0.000010	0.0017	0.0000030	7.0	0.00050	0.000022	0.0012	0.0040	0.000020	0.0010	0.65	0.0031	0.020	0.0071	0.00030	0.0090	1.8	0.000040	0.68	0.000010	0.12	0.016	2.9	0.000020	0.00069	0.00080	0.0021	0.00054	0.0010	0.000010
29-May-12	26	500	435	7.4	47																																											
5-Jun-12	27	500	450	7.4	46	#N/A	2.7	21	4.0	0.20	0.12	0.30	20	0.063	0.00020	0.00050	0.0052	0.000020	0.000010	0.013	0.0000030	6.9	0.0015	0.00058	0.0039	0.15	0.000020	0.0010	0.62	0.0061	0.010	0.0042	0.0062	0.0090	2.0	0.00013	0.80	0.000010	0.13	0.016	2.3	0.000020	0.00010	0.00060	0.0022	0.00065	0.0020	0.000080
12-Jun-12	28	500	445	7.4	45																																											
19-Jun-12	29	500	440	7.4	44	#N/A	2.4	17	4.0	0.20	0.12	0.30	18	0.064	0.00030	0.00060	0.0051	0.000020	0.000010	0.0023	0.0000030	6.4	0.00050	0.00016	0.0034	0.0060	0.00065	0.0010	0.58	0.0030	0.010	0.0030	0.00020	0.0090	1.9	0.000090	0.78	0.000010	0.11	0.015	2.0	0.000020	0.00034	0.00040	0.0023	0.00048	0.0060	0.000010
26-Jun-12	30	500	445	7.5	48																																											
3-Jul-12	31	500	450	7.6	46	#N/A	6.1	24	5.0	0.20	0.11	0.30	19	0.053	0.00030	0.00060	0.0057	0.000020	0.000010	0.0013	0.0000030	6.5	0.00050	0.000028	0.0018	0.010	0.000040	0.0010	0.59	0.0040	0.010	0.0030	0.00010	0.0090	2.1	0.000080	0.83	0.000010	0.11	0.016	2.0	0.000020	0.00039	0.00040	0.0027	0.00035	0.0020	0.000010
10-Jul-12	32	500	440	7.4	47																																											
17-Jul-12	33	500	435	7.5	45	#N/A	2.1	17	5.0	0.20	0.10	0.30	19	0.064	0.00040	0.0016	0.0056	0.000020	0.000010	0.0034	0.0000030	6.6	0.00050	0.0000070	0.0018	0.0070	0.000070	0.0010	0.58	0.0032	0.010	0.0033	0.00010	0.0090	2.0	0.00027	0.83	0.00012	0.15	0.016	2.3	0.000020	0.00028	0.00060	0.0022	0.00053	0.0020	0.000020
24-Jul-12	34	500	440	7.4	47																																											
31-Jul-12	35	500	435	7.5	44	#N/A	2.1	16	5.0	0.20	0.090	0.30	19	0.055	0.00030	0.00050	0.0057	0.000020	0.000010	0.0018	0.0000042	6.6	0.00050	0.000023	0.0015	0.011	0.00010	0.0010	0.57	0.0030	0.010	0.0027	0.00010	0.0090	1.8	0.00019	0.84	0.000010	0.11	0.016	2.2	0.000020	0.00015	0.00030	0.0017	0.00043	0.0020	0.000010
7-Aug-12	36	500	440	7.5	43																																											
14-Aug-12	37	500	465	7.4	46	#N/A	2.3	16	7.0	0.20	0.090	0.30	19	0.062	0.00020	0.0017	0.0053	0.000020	0.000010	0.0017	0.0000030	6.6	0.00050	0.0000050	0.0013	0.0030	0.000020	0.0010	0.56	0.0030	0.010	0.0029	0.00010	0.0090	1.6	0.00010	0.72	0.000010	0.10	0.015	3.0	0.000020	0.00018	0.00030	0.0015	0.00068	0.0020	0.000010
21-Aug-12	38	500	455	7.3	50																																											
28-Aug-12	39	500	485	7.4	48	#N/A	3.1	16	8.0	0.20	0.080	0.30	20	0.047	0.00020	0.00060	0.0052	0.000020	0.000010	0.0016	0.0000030	7.2	0.00050	0.000028	0.0014	0.0040	0.000020	0.0010	0.59	0.0039	0.020	0.0027	0.00020	0.0090	1.4	0.000040	0.65	0.000010	0.080	0.016	2.9	0.000020	0.00037	0.00020	0.0022	0.00035	0.0020	0.000010
4-Sep-12	40	500	475	7.3	42																																											
11-Sep-12	41	500	445	7.4	43	#N/A	2.4	15	9.0	0.20	0.090	0.30	20	0.079	0.00020	0.00070	0.0062	0.000020	0.000010	0.0014	0.0000030	6.9	0.00050	0.00022	0.0029	0.014	0.000030	0.0010	0.58	0.0027	0.040	0.0024	0.0032	0.0090	1.5	0.00013	0.77	0.000010	0.090	0.016	2.8	0.000020	0.000050	0.0011	0.0015	0.00026	0.0010	0.000020
18-Sep-12	42	500	500	7.3	45																																											
25-Sep-12	43	500	445	7.3	45	#N/A	3.1	16	7.0	0.20	0.080	0.30	18	0.068	0.00020	0.00030	0.0065	0.000020	0.000010	0.0013	0.0000030	6.2	0.00050	0.000020	0.0012	0.012	0.000020	0.0010	0.55	0.0022	0.010	0.0064	0.00010	0.0090	1.3	0.00015	0.63	0.000010	0.080	0.015	2.5	0.000020	0.00010	0.00050	0.0016	0.00035	0.0010	0.000020
2-Oct-12	44	500	440	7.2	43																																											
9-Oct-12	45	500	470	7.2	36	#N/A	3.5	13	6.0	0.20	0.060	0.30	15	0.046	0.00020	0.00040	0.0044	0.000020	0.000010	0.0012	0.0000030	5.3	0.00050	0.0000020	0.0014	0.0030	0.000020	0.0010	0.43	0.0032	0.010	0.0019	0.00020	0.0090	0.99	0.00015	0.47	0.000010	0.070	0.012	2.1	0.000020	0.00014	0.00040	0.0010	0.00034	0.0020	0.000010
16-Oct-12	46	500	460	7.3	40																																											
23-Oct-12	47	500	480	7.3	42																																										
30-Oct-12	48	500	460	7.3	47																																										
6-Nov-12	49	500	445	7.4	39	#N/A	2.7	15	5.0	0.20	0.060	0.30	20	0.034	0.00020	0.00050	0.0056	0.000020	0.000010	0.0020	0.000022	7.1	0.00050	0.000094	0.0022	0.0050	0.000030	0.0010	0.56	0.0027	0.010	0.0022	0.00030	0.0090	1.2	0.00012	0.66	0.000010	0.10	0.016	2.7	0.000020	0.00060	0.00020	0.0014	0.00016	0.0030	0.000010
13-Nov-12	50	500	445	7.1	40																																											
20-Nov-12	51	500	490	7.8	39																																										
27-Nov-12	52	500	490	7.3	45																																										
4-Dec-12	53	500	495	7.4	42	#N/A	1.9	15	8.0	0.20	0.060	0.30	19	0.018	0.00020	0.00020	0.0052	0.000020	0.000010	0.0011	0.0000030	6.8	0.00050	0.000052	0.00070	0.0030	0.000020	0.0010	0.56	0.0025	0.010	0.0021	0.00010	0.0090	1.1	0.0013	0.52	0.000010	0.060	0.015	2.8	0.000020	0.000090	0.00010	0.0026	0.00020	0.0020	0.000010
11-Dec-12	54	500	470	7.3	45																																											
18-Dec-12	55	500	455	7.4	33																																										
25-Dec-12	56	500	460	7.4	50																																										
1-Jan-13	57	500	450	7.6	36	#N/A	3.5	16	4.0	0.20	0.060	0.30	19	0.062	0.00030	0.00090	0.0057	0.000020	0.000010	0.00070	0.0000090	6.6	0.00050	0.000027	0.0013	0.015	0.000040	0.0010	0.54	0.0027	0.010	0.0019	0.00010	0.012	1.1	0.000060	0.70	0.000010	0.060	0.015	2.2	0.000020	0.00016	0.0010	0.0014	0.00029	0.0020	0.000030
8-Jan-13	58	500	495	7.5	45																																											
15-Jan-13	59	500	465	7.4	36																																										
22-Jan-13	60	500	455	7.5	44																																										
29-Jan-13	61	500	455	7.4	32	#N/A	2.4	13	6.0	0.20	0.060	0.30	16	0.046	0.00020	0.00020	0.0039	0.000020	0.000010	0.00090	0.000017	5.7	0.00050	0.0000020	0.0012	0.0040	0.000020	0.0010	0.46	0.0026	0.010	0.0015	0.00010	0.0090	0.82	0.000060	0.49	0.000010	0.090	0.012	2.1	0.000020	0.00014	0.00040	0.0011	0.00031	0.0010	0.000050
5-Feb-13	62	500	455	7.5	31																																											
12-Feb-13	63	500	465	7.6	36																																										
19-Feb-13	64	500	445	7.4	34																																										
26-Feb-13	65	500	450	7.4	36	#N/A	3.5	13	6.0	0.20	0.060	0.30	14	0.052	0.00020	0.00040	0.0047	0.000020	0.000010	0.00080	0.0000080	5.0	0.00050	0.00024	0.0016	0.0090	0.000050	0.0010	0.43	0.0023	0.010	0.0016	0.00010	0.012	0.82	0.000070	0.48	0.000010	0.050	0.011	2.0	0.000020	0.000010	0.00070	0.00091	0.00011	0.0010	0.000010
5-Mar-13	66	500	450	7.6	35																																											
12-Mar-13	67	500	445	7.4	36																																										

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC6

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	400	7.5	1000	#N/A	3.0	9.5	188	0.88	0.38	0.12	196	0.0071	0.00020	0.00044	0.0041	0.0000080	0.0000040	0.0036	0.000021	67	0.00020	0.00028	0.0029	0.0012	0.000040	0.0012	6.8	0.010	0.0040	0.0070	0.0017	0.0052	6.6	0.0011	0.64	0.0000040	4.2	0.15	69	0.000016	0.0000040	0.000080	0.0039	0.00010	0.00080	0.000020
6-Dec-11	1	500	470	7.6	524	#N/A	1.8	11	103	0.52	0.35	0.14	112	0.012	0.00014	0.00042	0.0050	0.0000094	0.0000047	0.0019	0.000012	37	0.00024	0.00011	0.0019	0.0014	0.0000094	0.00094	4.6	0.0083	0.0047	0.012	0.00014	0.0042	4.7	0.00077	0.55	0.0000047	3.1	0.082	39	0.0000094	0.0000047	0.000094	0.0042	0.00015	0.0014	0.0000047
13-Dec-11	2	500	455	7.5	374	#N/A	1.5	9.5	65	0.18	0.30	0.14	77	0.0071	0.000091	0.00036	0.0042	0.0000091	0.0000046	0.0015	0.0000077	26	0.00036	0.0000066	0.00086	0.0014	0.00050	0.00046	3.0	0.0060	0.0046	0.0079	0.00073	0.0041	3.6	0.00056	0.45	0.0000046	1.7	0.059	24	0.0000091	0.000032	0.000046	0.0027	0.000068	0.0014	0.0000091
20-Dec-11	3	500	500	7.7	350	#N/A	2.4	12	73	0.10	0.31	0.15	79	0.014	0.00015	0.00040	0.0041	0.000010	0.0000050	0.0018	0.000013	27	0.00025	0.000092	0.00090	0.0015	0.000010	0.00050	2.8	0.0074	0.0050	0.0081	0.00090	0.0045	3.1	0.00031	0.59	0.0000050	1.2	0.060	25	0.000010	0.0000050	0.00010	0.0036	0.00016	0.0010	0.0000050
27-Dec-11	4	500	435	7.9	196																																												
3-Jan-12	5	500	450	7.6	133	#N/A	1.8	9.8	19	0.090	0.19	0.14	24	0.030	0.00014	0.00050	0.0019	0.0000090	0.0000045	0.0011	0.0000023	8.2	0.00023	0.000029	0.00050	0.0014	0.0000090	0.00045	0.81	0.0027	0.0045	0.0044	0.00041	0.0041	1.5	0.000090	0.32	0.0000045	0.39	0.018	6.5	0.0000090	0.000023	0.00018	0.0013	0.00028	0.00045	0.0000045
10-Jan-12	6	500	450	7.5	120																																												
17-Jan-12	7	500	445	7.6	85	#N/A	1.1	10	10	0.089	0.17	0.13	16	0.021	0.00018	0.00022	0.0020	0.0000089	0.0000045	0.0012	0.0000027	5.7	0.00022	0.000020	0.00071	0.0027	0.0000022	0.00045	0.52	0.0022	0.0045	0.0036	0.000089	0.0040	1.2	0.000071	0.36	0.0000045	0.22	0.012	3.5	0.0000089	0.000018	0.00022	0.0011	0.00018	0.00089	0.0000089
24-Jan-12	8	500	455	7.8	80																																												
31-Jan-12	9	500	455	7.6	73	#N/A	1.4	12	5.9	0.091	0.15	0.14	13	0.021	0.000091	0.00023	0.0020	0.0000091	0.0000046	0.00086	0.0000023	4.4	0.00023	0.000015	0.00086	0.0023	0.000046	0.00046	0.44	0.0019	0.0046	0.0031	0.000046	0.0041	1.1	0.000064	0.35	0.0000046	0.16	0.010	2.3	0.0000091	0.000014	0.00018	0.00098	0.00020	0.00091	0.0000046
7-Feb-12	10	500	475	7.8	71																																												
14-Feb-12	11	500	460	7.7	67	#N/A	1.8	11	7.8	0.092	0.14	0.14	13	0.017	0.000092	0.00032	0.0020	0.0000092	0.0000046	0.00074	0.0000014	4.5	0.00023	0.000015	0.00074	0.0032	0.0000092	0.00046	0.44	0.0017	0.0046	0.0031	0.00018	0.0041	0.96	0.00012	0.36	0.0000046	0.15	0.011	2.1	0.0000092	0.0000092	0.00023	0.00093	0.000092	0.00046	0.0000046
21-Feb-12	12	500	470	7.7	67																																											
28-Feb-12	13	500	470	7.6	60	#N/A	1.5	9.9	4.7	0.094	0.11	0.14	12	0.038	0.00014	0.00024	0.0023	0.0000094	0.0000047	0.00089	0.0000019	4.3	0.00024	0.000014	0.0013	0.0014	0.0000094	0.00047	0.40	0.0021	0.0047	0.0025	0.0000047	0.0042	0.94	0.000028	0.33	0.0000047	0.094	0.010	1.8	0.0000094	0.00033	0.00033	0.00093	0.00016	0.0019	0.0000094
6-Mar-12	14	500	450	7.7	68																																											
13-Mar-12	15	500	445	7.5	64	#N/A	1.2	9.4	4.5	0.089	0.12	0.13	12	0.022	0.00013	0.00036	0.0023	0.0000089	0.0000045	0.00076	0.0000013	4.3	0.00022	0.0000071	0.00067	0.0036	0.0000089	0.00045	0.40	0.0013	0.0045	0.0024	0.0000045	0.0040	0.97	0.000018	0.38	0.0000045	0.093	0.010	2.0	0.0000089	0.000080	0.00013	0.00093	0.000093	0.0013	0.0000089
20-Mar-12	16	500	445	7.6	61																																												
27-Mar-12	17	500	445	7.5	53	#N/A	1.1	9.0	3.6	0.089	0.089	0.13	10	0.026	0.00013	0.00027	0.0021	0.0000089	0.0000045	0.00076	0.0000071	3.6	0.00022	0.0000049	0.00089	0.0022	0.00011	0.00045	0.33	0.0016	0.0045	0.0018	0.0000045	0.0040	0.84	0.0000031	0.36	0.0000045	0.076	0.0080	1.3	0.0000089	0.0000045	0.00018	0.00098	0.00019	0.00045	0.0000045
3-Apr-12	18	500	455	7.5	50																																											
10-Apr-12	19	500	440	7.5	50	#N/A	0.89	7.4	3.1	0.088	0.075	0.13	9.2	0.020	0.000088	0.00018	0.0021	0.0000088	0.0000044	0.00070	0.0000013	3.2	0.00022	0.0000092	0.00062	0.0022	0.0000013	0.00044	0.28	0.0013	0.0088	0.0017	0.0000044	0.0040	0.72	0.0000031	0.29	0.0000044	0.057	0.0073	1.3	0.0000088	0.000018	0.00013	0.00060	0.00015	0.00088	0.0000044
17-Apr-12	20	500	440	7.5	63																																												
24-Apr-12	21	500	445	7.5	49	#N/A	0.97	9.3	3.1	0.089	0.076	0.13	9.0	0.051	0.00013	0.00027	0.0026	0.0000089	0.0000045	0.00053	0.0000013	3.1	0.00022	0.00011	0.0022	0.0062	0.0000022	0.00045	0.29	0.0016	0.013	0.0017	0.0000045	0.0040	0.97	0.0000049	0.38	0.0000045	0.067	0.0074	1.1	0.0000089	0.000018	0.00045	0.00094	0.00020	0.00089	0.000013
1-May-12	22	500	455	7.7	51																																											
8-May-12	23	500	490	7.5	51	#N/A	1.2	8.5	3.4	0.098	0.059	0.15	10	0.018	0.00015	0.00020	0.0028	0.0000098	0.0000049	0.0025	0.0000015	3.6	0.00025	0.000057	0.0011	0.018	0.000039	0.00049	0.34	0.0015	0.0049	0.0024	0.00025	0.0044	0.96	0.000064	0.35	0.0000049	0.059	0.0083	1.4	0.0000098	0.00017	0.000098	0.0013	0.00016	0.0025	0.0000049
15-May-12	24	500	480	7.5	50																																											
22-May-12	25	500	465	7.5	50	#N/A	1.4	7.5	2.8	0.093	0.056	0.14	9.3	0.030	0.000093	0.00065	0.0023	0.0000093	0.0000047	0.00079	0.0000014	3.2	0.00023	0.000010	0.00056	0.0019	0.0000093	0.00047	0.30	0.0014	0.0093	0.0033	0.00014	0.0042	0.81	0.000019	0.32	0.0000047	0.056	0.0075	1.4	0.0000093	0.00032	0.00037	0.00099	0.00025	0.00047	0.0000047
29-May-12	26	500	435	7.4	47																																											
5-Jun-12	27	500	450	7.4	46	#N/A	1.2	9.3	1.8	0.090	0.054	0.14	8.9	0.028	0.000090	0.00023	0.0023	0.0000090	0.0000045	0.0059	0.0000014	3.1	0.00068	0.00026	0.0018	0.066	0.0000090	0.00045	0.28	0.0027	0.0045	0.0019	0.0028	0.0041	0.90	0.0000059	0.36	0.0000045	0.059	0.0074	1.0	0.0000090	0.000045	0.00027	0.00099	0.00029	0.00090	0.000036
12-Jun-12	28	500	445	7.4	45																																											
19-Jun-12	29	500	440	7.4	44	#N/A	1.1	7.4	1.8	0.088	0.053	0.13	8.1	0.028	0.00013	0.00026	0.0022	0.0000088	0.0000044	0.0010	0.0000013	2.8	0.00022	0.000069	0.0015	0.0026	0.00029	0.00044	0.26	0.0013	0.0044	0.0013	0.000088	0.0040	0.84	0.000040	0.34	0.0000044	0.048	0.0066	0.89	0.0000088	0.00015	0.00018	0.0010	0.00021	0.0026	0.0000044
26-Jun-12	30	500	445	7.5	48																																											
3-Jul-12	31	500	450	7.6	46	#N/A	2.8	11	2.3	0.090	0.050	0.14	8.4	0.024	0.00014	0.00027	0.0026	0.0000090	0.0000045	0.00059	0.0000014	2.9	0.00023	0.000013	0.00081	0.0045	0.0000018	0.00045	0.27	0.0018	0.0045	0.0013	0.0000045	0.0041	0.95	0.0000036	0.37	0.0000045	0.050	0.0072	0.90	0.0000090	0.00018	0.00018	0.0012	0.00016	0.00090	0.0000045
10-Jul-12	32	500	440	7.4	47																																											
17-Jul-12	33	500	435	7.5	45	#N/A	0.90	7.4	2.2	0.087	0.044	0.13	8.1	0.028	0.00017	0.00070	0.0024	0.0000087	0.0000044	0.0015	0.0000013	2.8	0.00022	0.0000030	0.00078	0.0030	0.0000030	0.00044	0.25	0.0014	0.0044	0.0014	0.000044	0.0039	0.86	0.00012	0.36	0.0000052	0.065	0.0068	1.0	0.0000087	0.00012	0.00026	0.00094	0.00023	0.00087	0.0000087
24-Jul-12	34	500	440	7.4	47																																											
31-Jul-12	35	500	435	7.5	44	#N/A	0.89	7.1	2.2	0.087	0.039	0.13	8.2	0.024	0.00013	0.00022	0.0025	0.0000087	0.0000044	0.00078	0.000018	2.9	0.00022	0.000010	0.00065	0.0048	0.0000044	0.00044	0.25	0.0013	0.0044	0.0012	0.000044	0.0039	0.77	0.000083	0.37	0.0000044	0.048	0.0067	0.94	0.0000087	0.000065	0.00013	0.00073	0.00019	0.00087	0.0000044
7-Aug-12	36	500	440	7.5	43																																											
14-Aug-12	37	500	465	7.4	46	#N/A	1.1	7.3	3.3	0.093	0.042	0.14	8.8	0.029	0.000093	0.00079	0.0025	0.0000093	0.0000047	0.00079	0.0000014	3.1	0.00023	0.0000023	0.00060	0.0014	0.0000093	0.00047	0.26	0.0014	0.0047	0.0014	0.0000047	0.0042	0.74	0.0000047	0.33	0.0000047	0.047	0.0072	1.4	0.0000093	0.000084	0.00014	0.00070	0.00032	0.00093	0.0000047
21-Aug-12	38	500	455	7.3	50																																											
28-Aug-12	39	500	485	7.4	48	#N/A	1.5	7.8	3.9	0.097	0.039	0.15	9.8	0.023	0.000097	0.00029	0.0025	0.0000097	0.0000049	0.00078	0.0000015	3.5	0.00024	0.000014	0.00068	0.0019	0.0000097	0.00049	0.29	0.0019	0.0097	0.0013	0.000097	0.0044	0.69	0.0000019	0.32	0.0000049	0.039	0.0079	1.4	0.0000097	0.00018	0.000097	0.0011	0.00017	0.00097	0.0000049
4-Sep-12	40	500	475	7.3	42																																											
11-Sep-12	41	500	445	7.4	43	#N/A	1.0	6.6	4.0	0.089	0.040	0.13	8.7	0.035	0.000089	0.00031	0.0028	0.0000089	0.0000045	0.00062	0.0000013	3.1	0.00022	0.000098	0.0013	0.0062	0.0000013	0.00045	0.26	0.0012	0.018	0.0011	0.0014	0.0040	0.65	0.000058	0.34	0.0000045	0.040	0.0073	1.2	0.0000089	0.000022	0.00049	0.00065	0.00012	0.00045	0.0000089
18-Sep-12	42	500	500	7.3	45																																											
25-Sep-12	43	500	445	7.3	45	#N/A	1.4	7.0	3.1	0.089	0.036	0.13	7.9	0.030	0.000089	0.00013	0.0029	0.0000089	0.0000045	0.00058	0.0000013	2.8	0.00022	0.0000089	0.00053	0.0053	0.0000089	0.00045	0.24	0.00098	0.0045	0.0028	0.0000045	0.0040	0.59	0.000067	0.28	0.0000045	0.036	0.0065	1.1	0.0000089	0.0000045	0.00022	0.00069	0.00016	0.00045	0.0000089
2-Oct-12	44	500	440	7.2	43																																											
9-Oct-12	45	500	470	7.2	36	#N/A	1.6	6.1	2.8	0.094	0.028	0.14	7.1	0.021	0.000094	0.00019	0.0021	0.0000094	0.0000047	0.00056	0.0000014	2.5	0.00024	0.00000094	0.00066	0.0014	0.0000094	0.00047	0.20	0.0015	0.0047	0.00089	0.000094	0.0042	0.46	0.000071	0.22	0.0000047	0.033	0.0056	0.96	0.0000094	0.000066	0.00019	0.00047	0.00016	0.00094	0.0000047
16-Oct-12	46	500	460	7.3	40																																											
23-Oct-12	47	500	480	7.3	42																																										
30-Oct-12	48	500	460	7.3	47																																										
6-Nov-12	49	500	445	7.4	39	#N/A	1.2	6.5	2.2	0.089	0.027	0.13	8.9	0.015	0.000089	0.00022	0.0025	0.0000089	0.0000045	0.00089	0.0000098	3.1	0.00022	0.000042	0.00098	0.0022	0.0000013	0.00045	0.25	0.0012	0.0045	0.00096	0.00013	0.0040	0.53	0.000053	0.29	0.0000045	0.045	0.0072	1.2	0.0000089	0.00027	0.000089	0.00064	0.000071	0.0013	0.0000045
13-Nov-12	50	500	445	7.1	40																																											
20-Nov-12	51	500	490	7.8	39																																										
27-Nov-12	52	500	490	7.3	45																																										
4-Dec-12	53	500	495	7.4	42	#N/A	0.96	7.3	4.0	0.099	0.030	0.15	9.6	0.0088	0.000099	0.000099	0.0026	0.0000099	0.0000050	0.00054	0.0000015	3.4	0.00025	0.000026	0.00035	0.0015	0.0000099	0.00050	0.27	0.0012	0.0050	0.0010	0.000050	0.0045	0.54	0.00064	0.26	0.0000050	0.030	0.0076	1.4	0.0000099	0.000045	0.000050	0.0013	0.000099	0.00099	0.0000050
11-Dec-12	54	500	470	7.3	45																																										
18-Dec-12	55	500	455	7.4	33																																										
25-Dec-12	56	500	460	7.4	50																																										
1-Jan-13	57	500	450	7.6	36	#N/A	1.6	7.2	1.8	0.090	0.027	0.14	8.4	0.028	0.00014	0.00041	0.0025	0.0000090	0.0000045	0.00032	0.0000041	3.0	0.00023	0.000012	0.00059	0.0068	0.000018	0.00045	0.24	0.0012	0.0045	0.00086	0.000045	0.0054	0.49	0.000027	0.32	0.0000045	0.027	0.0067	1.0	0.0000090	0.000072	0.00045	0.00063	0.00013	0.00090	0.000014
8-Jan-13	58	500	495	7.5	45																																										
15-Jan-13	59	500	465	7.4	36																																										
22-Jan-13	60	500	455	7.5	44																																										
29-Jan-13	61	500	455	7.4	32	#N/A	1.1	5.9	2.7	0.091	0.027	0.14	7.3	0.021	0.000091	0.000091	0.0018	0.0000091	0.0000046	0.00041	0.0000077	2.6	0.00023	0.00000091	0.00055	0.0018	0.0000091	0.00046	0.21	0.0012	0.0046	0.00070	0.000046	0.0041	0.37	0.000027	0.22	0.0000046	0.041	0.0056	0.95	0.0000091	0.000064	0.00018	0.00051	0.00014	0.00046	0.000023
5-Feb-13	62	500	455	7.5	31																																										
12-Feb-13	63	500	465	7.6	36																																										
19-Feb-13	64	500	445	7.4	34																																										
26-Feb-13	65	500	450	7.4	36	#N/A	1.6	6.0	2.7	0.090	0.027	0.14	6.4	0.023	0.000090	0.00018	0.0021	0.0000090	0.0000045	0.00036	0.0000036	2.3	0.00023	0.00011	0.00072	0.0041	0.000023	0.00045	0.19	0.0010	0.0045	0.00070	0.000045	0.0054	0.37	0.000032	0.22	0.0000045	0.023	0.0050	0.90	0.0000090	0.0000045	0.00032	0.00041	0.000050	0.00045	0.0000045
5-Mar-13	66	500	450	7.6	35																																										
12-Mar-13	67	500	445	7.4	36																																										
Median (last 5)				7.4	39	#N/A	1.2	6.5	2.7	0.090	0.027	0.14	8.4	0.021	0.000091	0.00018	0.0025	0.0000090	0.0000045	0.00041	0.0000041	3.0	0.00023	0.000026	0.00059	0.0022	0.000013	0.00045	0.24	0.0012	0.0045	0.00086	0.000046	0.0045	0.49	0.000032	0.26	0.0000045	0.030	0.0067	1.0	0.0000090	0.000064	0.00018	0.00063	0.000099	0.00090	0.0000050

Leachate Results for HC7

Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mg $CaCO_3$/L	Acidity (pH 8.3) mg $CaCO_3$/L	Alkalinity mg $CaCO_3$/L	SO_4 mg/L	Cl mg/L	F mg/L	Br mg/L	Hardness mg $CaCO_3$/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
29-Nov-11	0	500	385	7.3	1364	#N/A	15	101	693	4.0	0.28	0.30	708	0.024	0.0022	0.0049	0.048	0.000020	0.000020	0.015	0.0035	232	0.00050	0.040	0.94	0.0030	0.00032	0.0050	31	1.6	0.040	0.066	0.020	0.014	19	0.15	0.99	0.000010	13	1.4	220	0.00020	0.000050	0.00050	0.042	0.00074	0.048	0.00067
6-Dec-11	1	500	475	7.5	814	#N/A	4.4	30	371	2.1	0.37	0.30	441	0.019	0.0018	0.0025	0.030	0.000020	0.000010	0.0057	0.00041	145	0.00050	0.0026	0.074	0.0030	0.000060	0.0010	19	0.36	0.030	0.041	0.0012	0.0090	10	0.079	0.48	0.000010	7.1	0.89	144	0.000070	0.000010	0.00010	0.013	0.00017	0.011	0.00010
13-Dec-11	2	500	450	7.5	647	#N/A	3.5	17	261	1.0	0.42	0.30	329	0.029	0.0015	0.0022	0.031	0.000020	0.000010	0.0040	0.00020	109	0.0013	0.00080	0.014	0.0050	0.00026	0.0010	14	0.17	0.020	0.025	0.0032	0.060	7.6	0.048	0.43	0.000010	4.1	0.68	104	0.000040	0.000090	0.00020	0.0048	0.00011	0.0050	0.000080
20-Dec-11	3	500	495	7.5	572	#N/A	4.5	18	265	0.30	0.38	0.30	286	0.045	0.0014	0.0021	0.026	0.000020	0.000010	0.0046	0.00018	97	0.00050	0.00075	0.010	0.0030	0.000020	0.0010	11	0.15	0.010	0.023	0.0035	0.044	5.7	0.022	0.52	0.000010	2.0	0.58	95	0.000040	0.000050	0.00020	0.0038	0.00032	0.0060	0.000040
27-Dec-11	4	500	525	7.5	438																																												
3-Jan-12	5	500	530	7.4	400	#N/A	4.7	18	184	0.20	0.27	0.30	185	0.054	0.0011	0.0014	0.030	0.000020	0.000010	0.0037	0.000088	64	0.00050	0.00038	0.0054	0.0030	0.000020	0.0010	6.0	0.069	0.010	0.012	0.0026	0.038	3.6	0.0072	0.39	0.000010	0.73	0.38	60	0.000020	0.000020	0.00020	0.0021	0.00035	0.0020	0.000010
10-Jan-12	6	500	480	7.3	408																																											
17-Jan-12	7	500	510	7.3	381	#N/A	3.1	17	172	0.20	0.29	0.30	178	0.044	0.0015	0.0017	0.036	0.000020	0.000010	0.0034	0.0000095	63	0.00050	0.00027	0.0049	0.0030	0.000070	0.0010	5.3	0.056	0.010	0.012	0.00030	0.039	3.3	0.0059	0.47	0.000010	0.43	0.36	56	0.000020	0.000020	0.00020	0.0028	0.00028	0.013	0.000020
24-Jan-12	8	500	440	7.4	359																																											
31-Jan-12	9	500	455	7.3	341	#N/A	3.9	16	148	0.20	0.30	0.30	153	0.045	0.0015	0.0016	0.021	0.000020	0.000010	0.0025	0.000060	54	0.00050	0.00025	0.0044	0.0030	0.000020	0.0010	4.5	0.050	0.010	0.0100	0.00010	0.046	2.7	0.0035	0.45	0.000010	0.29	0.31	48	0.000020	0.000020	0.00020	0.0029	0.00043	0.0020	0.000010
7-Feb-12	10	500	480	7.5	343																																											
14-Feb-12	11	500	450	7.5	339	#N/A	4.9	22	156	0.30	0.35	0.30	161	0.047	0.0014	0.0029	0.024	0.000020	0.000010	0.0022	0.000036	58	0.00050	0.00019	0.0038	0.0030	0.000020	0.0010	4.0	0.047	0.010	0.0095	0.0013	0.071	3.2	0.0043	0.51	0.000010	0.29	0.33	46	0.000020	0.000010	0.00020	0.0028	0.00012	0.0010	0.000010
21-Feb-12	12	500	465	7.4	293																																											
28-Feb-12	13	500	495	7.3	243	#N/A	3.8	15	96	0.40	0.23	0.30	113	0.028	0.0014	0.0021	0.033	0.000020	0.000010	0.0021	0.000067	41	0.00050	0.00019	0.0050	0.0030	0.000030	0.0010	2.6	0.046	0.010	0.0057	0.00010	0.053	1.9	0.0027	0.43	0.000010	0.15	0.25	33	0.000020	0.000010	0.00010	0.00100	0.00016	0.0060	0.000010
6-Mar-12	14	500	485	7.5	259																																											
13-Mar-12	15	500	445	7.3	256	#N/A	3.1	15	99	0.60	0.29	0.30	119	0.041	0.0017	0.0025	0.023	0.000020	0.000010	0.0021	0.000028	44	0.00050	0.00012	0.0042	0.0030	0.000030	0.0010	2.4	0.034	0.010	0.0074	0.00030	0.066	1.9	0.0028	0.48	0.000010	0.13	0.25	35	0.000020	0.00017	0.00010	0.0020	0.00010	0.0020	0.000020
20-Mar-12	16	500	430	7.3	199																																											
27-Mar-12	17	500	450	7.2	189	#N/A	2.8	13	75	0.50	0.21	0.30	83	0.042	0.0014	0.0022	0.024	0.000020	0.000010	0.0019	0.000032	30	0.00050	0.00013	0.0038	0.0030	0.000020	0.0010	1.7	0.032	0.010	0.0064	0.00030	0.054	1.3	0.0027	0.39	0.000010	0.12	0.19	24	0.000020	0.000010	0.00010	0.0016	0.00024	0.0010	0.000010
3-Apr-12	18	500	465	7.3	174																																											
10-Apr-12	19	500	450	7.3	165	#N/A	2.2	13	63	0.50	0.20	0.30	70	0.054	0.0014	0.0022	0.023	0.000020	0.000010	0.0021	0.0000030	26	0.00050	0.00012	0.0029	0.0030	0.000020	0.0010	1.5	0.029	0.020	0.0056	0.00010	0.049	1.1	0.0021	0.34	0.000010	0.10	0.18	20	0.000020	0.000030	0.00010	0.0011	0.00026	0.0020	0.000010
17-Apr-12	20	500	425	7.2	183																																											
24-Apr-12	21	500	470	7.3	155	#N/A	2.6	14	58	0.50	0.19	0.30	65	0.052	0.0016	0.0023	0.024	0.000020	0.000010	0.0018	0.0000010	24	0.00050	0.00013	0.0035	0.0030	0.000060	0.0010	1.4	0.028	0.030	0.0055	0.00040	0.048	1.1	0.0019	0.35	0.000010	0.11	0.17	18	0.000020	0.000040	0.00010	0.0016	0.00032	0.0040	0.000010
1-May-12	22	500	445	7.4	146																																											
8-May-12	23	500	455	7.3	133	#N/A	3.1	11	44	0.50	0.14	0.30	56	0.030	0.0013	0.0020	0.020	0.000020	0.000010	0.0019	0.0000019	20	0.00050	0.00012	0.0039	0.0030	0.00026	0.0010	1.2	0.027	0.010	0.0051	0.00010	0.050	1.0	0.0015	0.30	0.000010	0.10	0.15	16	0.000020	0.00017	0.00010	0.0012	0.00019	0.0040	0.000010
15-May-12	24	500	455	7.3	136																																											
22-May-12	25	500	360	7.2	176	#N/A	3.6	14	54	0.40	0.19	0.30	72	0.087	0.0017	0.0028	0.022	0.000020	0.000010	0.0018	0.0000030	27	0.00050	0.00011	0.0045	0.0030	0.000030	0.0010	1.5	0.025	0.020	0.0075	0.00040	0.066	1.2	0.0016	0.39	0.000010	0.12	0.19	21	0.000020	0.00012	0.00020	0.0022	0.00050	0.0030	0.000010
29-May-12	26	500	435	7.2	138																																											
5-Jun-12	27	500	450	7.2	109	#N/A	3.1	12	39	0.40	0.14	0.30	46	0.059	0.0011	0.0023	0.028	0.000020	0.000010	0.0025	0.0000030	17	0.00050	0.00011	0.0030	0.0030	0.000020	0.0010	0.86	0.022	0.020	0.0040	0.00010	0.044	0.78	0.0014	0.30	0.000010	0.10	0.14	12	0.000020	0.000070	0.00020	0.0012	0.00039	0.0030	0.000010
12-Jun-12	28	500	460	7.3	110																																											
19-Jun-12	29	500	480	7.3	106	#N/A	2.8	12	33	0.40	0.13	0.30	44	0.054	0.0010	0.0021	0.028	0.000020	0.000010	0.0015	0.0000030	16	0.00050	0.00012	0.0035	0.0030	0.000060	0.0010	0.89	0.025	0.010	0.0049	0.00030	0.046	0.69	0.0010	0.31	0.000010	0.11	0.13	11	0.000020	0.0010	0.00020	0.0012	0.00035	0.0030	0.000010
26-Jun-12	30	500	475	7.3	103																																											
3-Jul-12	31	500	445	7.4	123	#N/A	6.5	17	36	0.50	0.19	0.30	51	0.067	0.0013	0.0027	0.032	0.000020	0.000010	0.0012	0.000024	19	0.00050	0.00010	0.0037	0.0030	0.00013	0.0010	1.1	0.025	0.010	0.0050	0.00010	0.054	0.91	0.0026	0.35	0.000010	0.10	0.16	13	0.000020	0.00064	0.00020	0.0012	0.00031	0.0060	0.000020
10-Jul-12	32	500	445	7.2	111																																											
17-Jul-12	33	500	465	7.3	108	#N/A	2.1	13	30	0.30	0.17	0.30	46	0.042	0.0015	0.0032	0.026	0.000020	0.000010	0.0019	0.000012	17	0.00050	0.00023	0.0026	0.0030	0.000020	0.0010	0.95	0.023	0.010	0.0050	0.00010	0.052	0.82	0.0026	0.37	0.000010	0.13	0.15	12	0.000020	0.000010	0.00010	0.0014	0.00017	0.0010	0.000010
24-Jul-12	34	500	425	7.1	102																																											
31-Jul-12	35	500	460	7.3	93	#N/A	2.1	12	25	0.30	0.12	0.30	41	0.052	0.0012	0.0021	0.024	0.000020	0.000010	0.0020	0.000047	15	0.00050	0.000099	0.0029	0.0030	0.00014	0.0010	0.82	0.020	0.020	0.0038	0.00010	0.060	0.66	0.0015	0.35	0.000010	0.090	0.14	9.8	0.000020	0.000050	0.00010	0.0010	0.00036	0.0030	0.000010
7-Aug-12	36	500	445	7.4	105																																											
14-Aug-12	37	500	440	7.2	98	#N/A	2.7	12	33	0.40	0.13	0.30	41	0.084	0.0012	0.0036	0.020	0.000020	0.000010	0.0037	0.0000030	15	0.00050	0.00039	0.0040	0.0030	0.000020	0.0010	0.85	0.018	0.010	0.0045	0.00030	0.048	0.72	0.0014	0.31	0.000010	0.10	0.14	11	0.000020	0.00023	0.00040	0.0010	0.00066	0.0020	0.000010
21-Aug-12	38	500	445	7.1	99																																											
28-Aug-12	39	500	505	7.1	96	#N/A	3.3	11	30	0.40	0.11	0.30	39	0.046	0.0010	0.0015	0.020	0.000020	0.000010	0.0020	0.000039	14	0.00050	0.00014	0.0031	0.0030	0.000020	0.0010	0.86	0.024	0.010	0.0040	0.00040	0.032	0.62	0.0013	0.30	0.000010	0.080	0.13	10	0.000020	0.00040	0.00010	0.0012	0.00033	0.0040	0.000010
4-Sep-12	40	500	480	7.0	92																																											
11-Sep-12	41	500	480	7.2	97	#N/A	2.7	11	31	0.20	0.12	0.30	44	0.035	0.0010	0.0019	0.024	0.000020	0.000010	0.0018	0.000011	16	0.00050	0.00012	0.0026	0.0030	0.000020	0.0010	0.82	0.021	0.010	0.0031	0.00030	0.039	0.62	0.0014	0.27	0.000010	0.090	0.15	11	0.000020	0.000020	0.00010	0.00080	0.00011	0.0020	0.000010
18-Sep-12	42	500	535	7.1	96																																											
25-Sep-12	43	500	490	7.2	95	#N/A	3.3	11	31	0.20	0.10	0.30	39	0.034	0.00080	0.0020	0.030	0.000020	0.000010	0.0024	0.000011	14	0.00050	0.00011	0.0026	0.0030	0.000020	0.0010	0.72	0.021	0.010	0.0040	0.00020	0.024	0.50	0.0011	0.25	0.000010	0.11	0.14	10	0.000020	0.00010	0.00010	0.0011	0.00020	0.0020	0.000010
2-Oct-12	44	500	495	7.1	99																																											
9-Oct-12	45	500	515	7.1	73	#N/A	4.1	9.4	23	0.20	0.090	0.30	30	0.033	0.00070	0.0013	0.024	0.000020	0.000010	0.0011	0.000036	11	0.00050	0.00015	0.0044	0.0030	0.000070	0.0010	0.61	0.021	0.010	0.0030	0.00070	0.031	0.43	0.0011	0.22	0.000010	0.060	0.10	7.8	0.000020	0.00012	0.00050	0.00074	0.00033	0.0030	0.000010
16-Oct-12	46	500	510	7.2	86																																											
23-Oct-12	47	500	505	7.1	88																																											
30-Oct-12	48	500	510	7.2	100																																											
6-Nov-12	49	500	490	7.2	75	#N/A	2.8	10	26	0.20	0.080	0.30	36	0.015	0.00070	0.0014	0.027	0.000020	0.000010	0.0016	0.000035	13	0.00050	0.00015	0.0040	0.0030	0.000040	0.0010	0.67	0.025	0.010	0.0043	0.00030	0.038	0.41	0.00075	0.24	0.000010	0.11	0.12	8.8	0.000020	0.00016	0.00010	0.00083	0.000030	0.0020	0.000010
13-Nov-12	50	500	495	7.2	86																																											
20-Nov-12	51	500	490	7.4	77																																											
27-Nov-12	52	500	495	7.2	85																																											
4-Dec-12	53	500	420	7.4	108	#N/A	2.1	15	37	0.20	0.090	0.30	46	0.032	0.0017	0.0026	0.021	0.000020	0.000010	0.0011	0.000029	17	0.00050	0.00020	0.0043	0.0030	0.000030	0.0010	1.1	0.028	0.010	0.0075	0.00010	0.049	0.82	0.00059	0.33	0.000010	0.090	0.16	12	0.000020	0.00012	0.00030	0.0031	0.00019	0.0030	0.000010
11-Dec-12	54	500	445	7.2	105																																											
18-Dec-12	55	500	445	7.3	78																																											
25-Dec-12	56	500	465	7.3	110																																											
1-Jan-13	57	500	490	7.5	75	#N/A	3.8	12	24	0.20	0.090	0.30	31	0.029	0.0010	0.0019	0.023	0.000020	0.000010	0.00080	0.000015	12	0.00050	0.00010	0.0019	0.0030	0.000020	0.0010	0.64	0.019	0.010	0.0043	0.00010	0.038	0.54	0.00077	0.28	0.000010	0.060	0.12	7.7	0.000020	0.00011	0.00020	0.0012	0.00017	0.0010	0.000010
8-Jan-13	58	500	465	7.4	85																																											
15-Jan-13	59	500	465	7.2	80																																											
22-Jan-13	60	500	460	7.4	75																																											
29-Jan-13	61	500	460	7.3	74	#N/A	2.6	12	27	0.20	0.080	0.30	37	0.055	0.00080	0.0019	0.017	0.000020	0.000010	0.00080	0.000016	14	0.00050	0.000069	0.0025	0.0030	0.000020	0.0010	0.73	0.019	0.010	0.0038	0.00020	0.060	0.53	0.00092	0.25	0.000010	0.090	0.15	9.2	0.000020	0.00014	0.00020	0.00091	0.00028	0.0010	0.000010
5-Feb-13	62	500	460	7.3	82																																											
12-Feb-13	63	500	460	7.4	81																																											
19-Feb-13	64	500	455	7.3	83																																											
26-Feb-13	65	500	450	7.3	80	#N/A	4.0	12	26	0.20	0.080	0.30	32	0.029	0.00080	0.0021	0.014	0.000020	0.000010	0.00060	0.000015	12	0.00050	0.00027	0.0021	0.0030	0.000040	0.0010	0.65	0.013	0.010	0.0047	0.00010	0.051	0.53	0.00094	0.19	0.000010	0.070	0.12	8.3	0.000020	0.000020	0.00010	0.0011	0.000040	0.0010	0.000010
5-Mar-13	66	500	440	7.5	69																																											
12-Mar-13	67	500	445	7.3	67																																											

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC7

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	385	7.3	1364	#N/A	5.9	39	267	1.5	0.11	0.12	273	0.0090	0.00085	0.0019	0.018	0.0000077	0.0000077	0.0056	0.0014	89	0.00019	0.015	0.36	0.0012	0.00012	0.0019	12	0.62	0.015	0.025	0.0077	0.0054	7.1	0.059	0.38	0.0000039	5.1	0.53	85	0.000077	0.000019	0.00019	0.016	0.00028	0.018	0.00026
6-Dec-11	1	500	475	7.5	814	#N/A	2.1	14	176	1.00	0.18	0.14	209	0.0091	0.00086	0.0012	0.014	0.0000095	0.0000048	0.0027	0.00020	69	0.00024	0.0012	0.035	0.0014	0.000029	0.00048	9.1	0.17	0.014	0.020	0.00057	0.0043	4.9	0.037	0.23	0.0000048	3.4	0.42	68	0.0000033	0.0000048	0.000048	0.0060	0.000081	0.0052	0.000048
13-Dec-11	2	500	450	7.5	647	#N/A	1.6	7.8	117	0.45	0.19	0.14	148	0.013	0.00068	0.00099	0.014	0.0000090	0.0000045	0.0018	0.000091	49	0.00059	0.00036	0.0061	0.0023	0.00012	0.00045	6.1	0.077	0.0090	0.011	0.0014	0.027	3.4	0.022	0.19	0.0000045	1.8	0.31	47	0.000018	0.000041	0.000090	0.0021	0.000050	0.0023	0.000036
20-Dec-11	3	500	495	7.5	572	#N/A	2.2	8.7	131	0.15	0.19	0.15	142	0.022	0.00069	0.0010	0.013	0.0000099	0.0000050	0.0023	0.000087	48	0.00025	0.00037	0.0050	0.0015	0.0000099	0.00050	5.3	0.072	0.0050	0.012	0.0017	0.022	2.8	0.011	0.26	0.0000050	1.0	0.28	47	0.000020	0.000025	0.000099	0.0019	0.00016	0.0030	0.000020
27-Dec-11	4	500	525	7.5	438																																												
3-Jan-12	5	500	530	7.4	400	#N/A	2.5	9.3	98	0.11	0.14	0.16	98	0.028	0.00058	0.00074	0.016	0.0000011	0.0000053	0.0020	0.000047	34	0.00027	0.00020	0.0029	0.0016	0.000011	0.00053	3.2	0.037	0.0053	0.0063	0.0014	0.020	1.9	0.0038	0.21	0.0000053	0.39	0.20	32	0.000011	0.000011	0.00011	0.0011	0.00019	0.0011	0.0000053
10-Jan-12	6	500	480	7.3	408																																											
17-Jan-12	7	500	510	7.3	381	#N/A	1.6	8.8	88	0.10	0.15	0.15	91	0.022	0.00077	0.00087	0.018	0.0000010	0.0000051	0.0017	0.000048	32	0.00026	0.00014	0.0025	0.0015	0.0000036	0.00051	2.7	0.029	0.0051	0.0059	0.00015	0.020	1.7	0.0030	0.24	0.0000051	0.22	0.19	28	0.000010	0.000010	0.00010	0.0014	0.00014	0.0066	0.000010
24-Jan-12	8	500	440	7.4	359																																											
31-Jan-12	9	500	455	7.3	341	#N/A	1.8	7.2	67	0.091	0.14	0.14	70	0.020	0.00068	0.00073	0.0096	0.0000091	0.0000046	0.0011	0.000027	25	0.00023	0.00012	0.0020	0.0014	0.0000091	0.00046	2.0	0.023	0.0046	0.0045	0.000046	0.021	1.2	0.0016	0.20	0.0000046	0.13	0.14	22	0.0000091	0.0000091	0.000091	0.0013	0.00020	0.00091	0.0000046
7-Feb-12	10	500	480	7.5	343																																											
14-Feb-12	11	500	450	7.5	339	#N/A	2.2	9.7	70	0.14	0.16	0.14	72	0.021	0.00063	0.0013	0.011	0.0000090	0.0000045	0.00099	0.000016	26	0.00023	0.000087	0.0017	0.0014	0.0000090	0.00045	1.8	0.021	0.0045	0.0043	0.00059	0.032	1.5	0.0019	0.23	0.0000045	0.13	0.15	21	0.0000090	0.0000045	0.000090	0.0013	0.00054	0.00045	0.0000045
21-Feb-12	12	500	465	7.4	293																																											
28-Feb-12	13	500	495	7.3	243	#N/A	1.9	7.4	48	0.20	0.11	0.15	56	0.014	0.00069	0.0010	0.016	0.0000099	0.0000050	0.0010	0.000033	20	0.00025	0.000092	0.0025	0.0015	0.000015	0.00050	1.3	0.023	0.0050	0.0028	0.000050	0.026	0.92	0.0013	0.21	0.0000050	0.074	0.12	16	0.0000099	0.0000050	0.000050	0.00049	0.000079	0.0030	0.0000050
6-Mar-12	14	500	485	7.5	259																																											
13-Mar-12	15	500	445	7.3	256	#N/A	1.4	6.6	44	0.27	0.13	0.13	53	0.018	0.00076	0.0011	0.010	0.0000089	0.0000045	0.00093	0.000012	19	0.00022	0.000054	0.0019	0.0013	0.000013	0.00045	1.1	0.015	0.0045	0.0033	0.00013	0.029	0.82	0.0012	0.21	0.0000045	0.058	0.11	15	0.0000089	0.000076	0.000045	0.00091	0.000045	0.00089	0.0000089
20-Mar-12	16	500	430	7.3	199																																											
27-Mar-12	17	500	450	7.2	189	#N/A	1.3	5.8	34	0.23	0.095	0.14	37	0.019	0.00063	0.00099	0.011	0.0000090	0.0000045	0.00086	0.000014	14	0.00023	0.000059	0.0017	0.0014	0.0000090	0.00045	0.77	0.014	0.0045	0.0029	0.00014	0.024	0.58	0.0012	0.18	0.0000045	0.054	0.085	11	0.0000090	0.0000045	0.000045	0.00072	0.00011	0.00045	0.0000045
3-Apr-12	18	500	465	7.3	174																																											
10-Apr-12	19	500	450	7.3	165	#N/A	0.97	5.7	28	0.23	0.090	0.14	32	0.024	0.00063	0.00099	0.010	0.0000090	0.0000045	0.00095	0.0000014	12	0.00023	0.000052	0.0013	0.0014	0.0000090	0.00045	0.66	0.013	0.0090	0.0025	0.000045	0.022	0.51	0.00092	0.15	0.0000045	0.045	0.079	9.0	0.0000090	0.0000014	0.0000045	0.00048	0.00012	0.00090	0.0000045
17-Apr-12	20	500	425	7.2	183																																											
24-Apr-12	21	500	470	7.3	155	#N/A	1.2	6.3	27	0.24	0.089	0.14	30	0.025	0.00075	0.0011	0.011	0.0000094	0.0000047	0.00085	0.0000047	11	0.00024	0.000059	0.0016	0.0014	0.0000028	0.00047	0.63	0.013	0.014	0.0026	0.00019	0.023	0.53	0.00090	0.16	0.0000047	0.052	0.080	8.6	0.0000094	0.000019	0.0000047	0.00076	0.00015	0.0019	0.0000047
1-May-12	22	500	445	7.4	146																																											
8-May-12	23	500	455	7.3	133	#N/A	1.4	5.1	20	0.23	0.064	0.14	25	0.013	0.00059	0.00091	0.0090	0.0000091	0.0000046	0.00086	0.0000086	9.2	0.00023	0.000055	0.0018	0.0014	0.00012	0.00046	0.54	0.012	0.0046	0.0023	0.000046	0.023	0.46	0.00067	0.14	0.0000046	0.046	0.066	7.1	0.0000091	0.0000077	0.000046	0.00055	0.000086	0.0018	0.0000046
15-May-12	24	500	455	7.3	136																																											
22-May-12	25	500	360	7.2	176	#N/A	1.3	4.9	19	0.14	0.068	0.11	26	0.031	0.00061	0.0010	0.0080	0.0000072	0.0000036	0.00065	0.0000011	9.5	0.00018	0.000040	0.0016	0.0011	0.0000011	0.00036	0.53	0.0090	0.0072	0.0027	0.00014	0.024	0.42	0.00057	0.14	0.0000036	0.043	0.069	7.5	0.0000072	0.000043	0.0000072	0.00081	0.00018	0.0011	0.0000036
29-May-12	26	500	435	7.2	138																																											
5-Jun-12	27	500	450	7.2	109	#N/A	1.4	5.6	18	0.18	0.063	0.14	21	0.026	0.00050	0.0010	0.013	0.0000090	0.0000045	0.0011	0.0000014	7.7	0.00023	0.000049	0.0014	0.0014	0.0000090	0.00045	0.39	0.0098	0.0090	0.0018	0.000045	0.020	0.35	0.00061	0.14	0.0000045	0.045	0.065	5.6	0.0000090	0.000032	0.0000090	0.00053	0.00018	0.0014	0.0000045
12-Jun-12	28	500	460	7.3	110																																											
19-Jun-12	29	500	480	7.3	106	#N/A	1.3	5.9	16	0.19	0.062	0.14	21	0.026	0.00048	0.0010	0.014	0.0000096	0.0000048	0.00072	0.0000014	7.8	0.00024	0.000057	0.0017	0.0014	0.000029	0.00048	0.43	0.012	0.0048	0.0024	0.00014	0.022	0.33	0.00049	0.15	0.0000048	0.053	0.064	5.3	0.0000096	0.00050	0.000096	0.00059	0.00017	0.0014	0.0000048
26-Jun-12	30	500	475	7.3	103																																											
3-Jul-12	31	500	445	7.4	123	#N/A	2.9	7.6	16	0.22	0.085	0.13	23	0.030	0.00058	0.0012	0.014	0.0000089	0.0000045	0.00053	0.000011	8.3	0.00022	0.000046	0.0016	0.0013	0.000058	0.00045	0.48	0.011	0.0045	0.0022	0.000045	0.024	0.40	0.0012	0.16	0.0000045	0.045	0.070	6.0	0.0000089	0.00028	0.000089	0.00053	0.00014	0.0027	0.0000089
10-Jul-12	32	500	445	7.2	111																																											
17-Jul-12	33	500	465	7.3	108	#N/A	0.96	6.0	14	0.14	0.079	0.14	21	0.019	0.00070	0.0015	0.012	0.0000093	0.0000047	0.00088	0.0000056	7.9	0.00023	0.00011	0.0012	0.0014	0.0000093	0.00047	0.44	0.011	0.0047	0.0023	0.000047	0.024	0.38	0.0012	0.17	0.0000047	0.060	0.067	5.7	0.0000093	0.0000047	0.000047	0.00066	0.000079	0.00047	0.0000047
24-Jul-12	34	500	425	7.1	102																																											
31-Jul-12	35	500	460	7.3	93	#N/A	0.95	5.5	12	0.14	0.055	0.14	19	0.024	0.00055	0.00097	0.011	0.0000092	0.0000046	0.00092	0.0000046	6.9	0.00023	0.000046	0.0013	0.0014	0.0000064	0.00046	0.37	0.0092	0.0092	0.0017	0.000046	0.028	0.30	0.00070	0.16	0.0000046	0.041	0.064	4.5	0.0000092	0.000023	0.0000046	0.00048	0.00017	0.0014	0.0000046
7-Aug-12	36	500	445	7.4	105																																											
14-Aug-12	37	500	440	7.2	98	#N/A	1.2	5.1	15	0.18	0.057	0.13	18	0.037	0.00053	0.0016	0.0088	0.0000088	0.0000044	0.0016	0.0000013	6.6	0.00022	0.000017	0.0018	0.0013	0.0000088	0.00044	0.37	0.0078	0.0044	0.0020	0.00013	0.021	0.32	0.00062	0.14	0.0000044	0.044	0.062	5.0	0.0000088	0.00010	0.00018	0.00044	0.00029	0.00088	0.0000044
21-Aug-12	38	500	445	7.1	99																																											
28-Aug-12	39	500	505	7.1	96	#N/A	1.7	5.7	15	0.20	0.056	0.15	20	0.023	0.00051	0.00076	0.0100	0.000010	0.0000051	0.0010	0.0000020	7.1	0.00025	0.000072	0.0016	0.0015	0.000010	0.00051	0.43	0.012	0.0051	0.0020	0.00020	0.016	0.31	0.00065	0.15	0.0000051	0.040	0.068	5.2	0.000010	0.00020	0.0000051	0.00062	0.00017	0.0020	0.0000051
4-Sep-12	40	500	480	7.0	92																																											
11-Sep-12	41	500	480	7.2	97	#N/A	1.3	5.2	15	0.096	0.058	0.14	21	0.017	0.00048	0.00091	0.011	0.0000096	0.0000048	0.00086	0.0000053	7.7	0.00024	0.000056	0.0012	0.0014	0.0000096	0.00048	0.39	0.0099	0.0048	0.0015	0.00014	0.019	0.30	0.00066	0.13	0.0000048	0.043	0.071	5.4	0.0000096	0.0000096	0.000048	0.00038	0.000053	0.00096	0.0000048
18-Sep-12	42	500	535	7.1	96																																											
25-Sep-12	43	500	490	7.2	95	#N/A	1.6	5.6	15	0.098	0.049	0.15	19	0.017	0.00039	0.00098	0.015	0.0000098	0.0000049	0.0012	0.0000054	7.1	0.00025	0.000052	0.0013	0.0015	0.0000098	0.00049	0.35	0.010	0.0049	0.0020	0.000098	0.012	0.25	0.00053	0.12	0.0000049	0.054	0.066	5.0	0.0000098	0.00049	0.000049	0.00052	0.000098	0.00098	0.0000049
2-Oct-12	44	500	495	7.1	99																																											
9-Oct-12	45	500	515	7.1	73	#N/A	2.1	4.9	12	0.10	0.046	0.15	16	0.017	0.00036	0.00067	0.012	0.000010	0.0000052	0.00057	0.000019	5.7	0.00026	0.000078	0.0023	0.0015	0.000036	0.00052	0.31	0.011	0.0052	0.0016	0.00036	0.016	0.22	0.00055	0.11	0.0000052	0.031	0.053	4.0	0.000010	0.000062	0.00026	0.00038	0.00017	0.0015	0.0000052
16-Oct-12	46	500	510	7.2	86																																											
23-Oct-12	47	500	505	7.1	88																																										
30-Oct-12	48	500	510	7.2	100																																										
6-Nov-12	49	500	490	7.2	75	#N/A	1.4	5.0	13	0.098	0.039	0.15	18	0.0074	0.00034	0.00069	0.013	0.0000098	0.0000049	0.00078	0.000017	6.5	0.00025	0.000074	0.0020	0.0015	0.000020	0.00049	0.33	0.012	0.0049	0.0021	0.00015	0.019	0.20	0.00037	0.12	0.0000049	0.054	0.061	4.3	0.0000098	0.000078	0.000049	0.00040	0.000015	0.00098	0.0000049
13-Nov-12	50	500	495	7.2	86																																											
20-Nov-12	51	500	490	7.4	77																																										
27-Nov-12	52	500	495	7.2	85																																										
4-Dec-12	53	500	420	7.4	108	#N/A	0.89	6.3	16	0.084	0.038	0.13	19	0.014	0.00071	0.0011	0.0088	0.0000084	0.0000042	0.00046	0.000012	6.9	0.00021	0.000084	0.0018	0.0013	0.000013	0.00042	0.46	0.012	0.0042	0.0031	0.000042	0.021	0.34	0.00025	0.14	0.0000042	0.038	0.066	4.9	0.0000084	0.000050	0.00013	0.0013	0.000080	0.0013	0.0000042
11-Dec-12	54	500	445	7.2	105																																											
18-Dec-12	55	500	445	7.3	78																																										
25-Dec-12	56	500	465	7.3	110																																										
1-Jan-13	57	500	490	7.5	75	#N/A	1.9	6.1	12	0.098	0.044	0.15	15	0.014	0.00049	0.00093	0.011	0.0000098	0.0000049	0.00039	0.0000074	5.6	0.00025	0.000051	0.00093	0.0015	0.0000098	0.00049	0.31	0.0091	0.0049	0.0021	0.000049	0.019	0.26	0.00038	0.14	0.0000049	0.029	0.061	3.8	0.0000098	0.000054	0.000098	0.00059	0.000083	0.00049	0.0000049
8-Jan-13	58	500	465	7.4	85																																										
15-Jan-13	59	500	465	7.2	80																																										
22-Jan-13	60	500	460	7.4	75																																										
29-Jan-13	61	500	460	7.3	74	#N/A	1.2	5.5	12	0.092	0.037	0.14	17	0.025	0.00037	0.00087	0.0080	0.0000092	0.0000046	0.00037	0.0000074	6.3	0.00023	0.000032	0.0012	0.0014	0.0000092	0.00046	0.34	0.0088	0.0046	0.0017	0.000092	0.028	0.24	0.00042	0.12	0.0000046	0.041	0.067	4.2	0.0000092	0.000064	0.000092	0.00042	0.00013	0.00046	0.0000046
5-Feb-13	62	500	460	7.3	82																																										
12-Feb-13	63	500	460	7.4	81																																										
19-Feb-13	64	500	455	7.3	83																																										
26-Feb-13	65	500	450	7.3	80	#N/A	1.8	5.4	12	0.090	0.036	0.14	14	0.013	0.00036	0.00095	0.0065	0.0000090	0.0000045	0.00027	0.0000068	5.2	0.00023	0.00012	0.00095	0.0014	0.000018	0.00045	0.29	0.0060	0.0045	0.0021	0.000045	0.023	0.24	0.00042	0.086	0.0000045	0.032	0.055	3.7	0.0000090	0.0000090	0.000045	0.00047	0.000018	0.00045	0.0000045
5-Mar-13	66	500	440	7.5	69																																										
12-Mar-13	67	500	445	7.3	67																																										
Median (last 5)				7.3	81	#N/A	1.4	5.5	12	0.092	0.038	0.14	17	0.014	0.00037	0.00093	0.0088	0.0000092	0.0000046	0.00039	0.0000074	6.3	0.00023	0.000074	0.0012	0.0014	0.000013	0.00046	0.33	0.0091	0.0046	0.0021	0.000049	0.021	0.24	0.00038	0.12	0.0000046	0.038	0.061	4.2	0.0000092	0.000054	0.000092	0.00047	0.000080	0.00049	0.0000046

Leachate Results for HC8

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	500	340	4.1	735	35	247	#N/A	341	2.2	0.73	0.30	105	45	0.00060	0.0016	0.045	0.0035	0.000010	0.0064	0.0053	32	0.0025	0.085	90	1.1	0.0025	0.0080	6.2	0.48	0.020	0.0029	0.082	0.32	19	0.0084	0.55	0.00010	14	0.095	127	0.00043	0.00013	0.00060	0.031	0.0014	0.84	0.000080
6-Dec-11	1	500	475	4.1	644	28	219	#N/A	318	1.4	0.060	0.30	93	25	0.00050	0.0014	0.0077	0.0036	0.000010	0.0051	0.0047	28	0.0024	0.082	47	0.85	0.0036	0.0090	5.5	0.46	0.020	0.0026	0.077	0.32	14	0.0060	2.3	0.00010	11	0.096	121	0.00031	0.000010	0.00070	0.018	0.0016	0.84	0.000030
13-Dec-11	2	500	455	4.2	462	17	149	#N/A	202	0.80	0.68	0.30	60	16	0.00030	0.0014	0.0040	0.0023	0.000020	0.0048	0.0030	18	0.0029	0.066	34	0.50	0.00051	0.0080	3.4	0.29	0.030	0.0018	0.065	0.29	9.2	0.011	1.7	0.000050	5.5	0.074	76	0.00016	0.00093	0.00070	0.012	0.0010	0.57	0.000030
20-Dec-11	3	500	510	4.2	362	12	122	#N/A	187	0.60	0.67	0.30	42	14	0.00040	0.0014	0.0023	0.0023	0.000010	0.0042	0.0022	13	0.0010	0.032	27	0.58	0.00014	0.0040	2.2	0.19	0.010	0.0012	0.032	0.41	7.4	0.0053	2.6	0.000020	3.2	0.062	60	0.00017	0.000010	0.00060	0.0082	0.00086	0.39	0.000010
27-Dec-11	4	500	420	4.4	271																																												
3-Jan-12	5	500	450	4.2	227	9.5	76	#N/A	113	1.0	0.43	0.30	18	9.9	0.00030	0.00080	0.0016	0.0015	0.000010	0.0031	0.0017	5.9	0.00060	0.018	15	0.27	0.0040	0.0030	0.83	0.075	0.010	0.00065	0.018	0.12	3.6	0.0024	0.78	0.000020	0.92	0.035	31	0.000090	0.00017	0.00070	0.0062	0.00086	0.28	0.000020
10-Jan-12	6	500	420	4.2	175																																											
17-Jan-12	7	500	450	4.4	153	2.7	41	#N/A	69	0.20	0.34	0.30	7.9	7.5	0.00040	0.00060	0.0019	0.0013	0.000010	0.0031	0.0048	2.6	0.00050	0.0081	9.1	0.35	0.027	0.0020	0.34	0.033	0.010	0.00062	0.0084	0.12	2.5	0.0017	0.70	0.000020	0.29	0.021	21	0.000070	0.000090	0.00050	0.0047	0.00064	0.58	0.000010
24-Jan-12	8	500	435	4.3	140																																											
31-Jan-12	9	500	445	4.2	115	4.8	33	#N/A	38	0.20	0.28	0.30	2.9	3.8	0.00020	0.00080	0.0014	0.00092	0.000010	0.0022	0.00039	0.97	0.00050	0.0050	5.2	0.29	0.00022	0.0020	0.12	0.013	0.010	0.00050	0.0052	0.0090	1.3	0.0016	0.57	0.000010	0.13	0.013	14	0.000040	0.000010	0.00040	0.0035	0.00065	0.077	0.000010
7-Feb-12	10	500	460	4.4	99																																											
14-Feb-12	11	500	445	4.3	111	6.3	41	#N/A	40	0.20	0.25	0.30	1.9	6.9	0.00020	0.00060	0.0012	0.00079	0.000010	0.0023	0.00040	0.64	0.00050	0.0039	5.8	0.28	0.00010	0.0010	0.070	0.0082	0.010	0.0013	0.0041	0.11	1.1	0.0012	0.55	0.000010	0.080	0.011	13	0.000030	0.000020	0.00030	0.0041	0.00027	0.072	0.000010
21-Feb-12	12	500	465	4.3	144																																											
28-Feb-12	13	500	460	4.2	146	8.6	52	#N/A	60	1.0	0.28	0.30	1.9	7.5	0.0012	0.0010	0.0020	0.0010	0.000010	0.0034	0.00065	0.64	0.00050	0.0058	6.1	0.36	0.00073	0.0030	0.068	0.0086	0.010	0.00059	0.011	0.10	1.3	0.0011	0.78	0.000040	0.070	0.014	19	0.00047	0.000090	0.00020	0.0057	0.00044	0.11	0.000010
6-Mar-12	14	500	435	4.2	161																																											
13-Mar-12	15	500	465	4.2	155	13	64	#N/A	67	1.0	0.26	0.30	1.4	1.0	0.00040	0.00050	0.0015	0.0010	0.000010	0.0028	0.00051	0.47	0.00050	0.0058	0.69	0.46	0.00015	0.0010	0.050	0.0062	0.010	0.00050	0.0060	0.11	1.1	0.0013	1.0	0.000020	0.060	0.012	21	0.000040	0.00017	0.00020	0.0068	0.00028	0.11	0.000020
20-Mar-12	16	500	430	4.2	147																																											
27-Mar-12	17	500	435	4.1	155	13	61	#N/A	70	1.0	0.23	0.30	1.1	8.9	0.00020	0.00040	0.0010	0.0013	0.000010	0.0030	0.00048	0.40	0.00050	0.0047	5.5	0.44	0.0046	0.0010	0.037	0.0047	0.010	0.00036	0.0051	0.18	1.4	0.0015	0.56	0.00090	0.12	0.010	21	0.000040	0.000010	0.00020	0.0070	0.00032	0.065	0.000010
3-Apr-12	18	500	445	4.1	164																																											
10-Apr-12	19	500	450	4.0	213	32	88	#N/A	100	0.20	0.25	0.30	1.3	13	0.00030	0.00040	0.0013	0.0019	0.000010	0.0030	0.00071	0.45	0.00070	0.0074	9.1	0.70	0.00029	0.0010	0.049	0.0061	0.020	0.0066	0.0080	0.096	1.2	0.0016	0.92	0.000020	0.060	0.014	31	0.000040	0.000050	0.00020	0.011	0.00047	0.14	0.000010
17-Apr-12	20	500	410	4.0	240																																											
24-Apr-12	21	500	450	4.0	174	21	71	#N/A	77	1.0	0.18	0.30	0.91	9.7	0.00040	0.00050	0.0030	0.0015	0.000010	0.0022	0.00053	0.31	0.00060	0.0049	5.4	0.74	0.0016	0.0010	0.033	0.0056	0.030	0.00056	0.0057	0.094	1.0	0.0012	0.91	0.000010	0.060	0.013	23	0.000030	0.000030	0.00010	0.010	0.00046	0.10	0.000010
1-May-12	22	500	455	4.1	178																																											
8-May-12	23	500	455	4.0	188	27	74	#N/A	79	1.0	0.13	0.30	0.83	9.1	0.00030	0.00040	0.0018	0.0015	0.000010	0.0046	0.00056	0.28	0.00060	0.0056	5.5	0.89	0.00019	0.0010	0.033	0.0044	0.010	0.0011	0.0065	0.024	0.94	0.0012	1.1	0.000030	0.060	0.012	26	0.000030	0.00025	0.00010	0.0096	0.00048	0.11	0.000010
15-May-12	24	500	445	4.0	180																																											
22-May-12	25	500	405	3.9	252	46	113	#N/A	108	1.0	0.16	0.30	1.8	16	0.00050	0.00080	0.0039	0.0020	0.000010	0.0026	0.00094	0.64	0.0011	0.0078	8.6	1.5	0.00031	0.0010	0.050	0.0063	0.020	0.0019	0.0090	0.0090	1.3	0.0017	0.65	0.000010	0.070	0.022	38	0.000040	0.00012	0.00020	0.016	0.00063	0.14	0.000020
29-May-12	26	500	415	4.0	160																																											
5-Jun-12	27	500	430	4.0	164	20	71	#N/A	55	1.0	0.12	0.30	1.0	8.9	0.00020	0.00040	0.0012	0.0013	0.000010	0.0062	0.00051	0.37	0.00050	0.0050	4.3	0.81	0.00038	0.0010	0.030	0.0041	0.020	0.00040	0.0089	0.018	0.80	0.0011	0.71	0.000010	0.050	0.013	22	0.000020	0.000040	0.00070	0.0087	0.00084	0.082	0.000010
12-Jun-12	28	500	445	4.0	174																																											
19-Jun-12	29	500	440	4.0	153	20	60	#N/A	52	0.20	0.090	0.30	0.53	7.8	0.00020	0.00050	0.0014	0.0012	0.000010	0.0020	0.00043	0.18	0.00050	0.0045	3.6	0.77	0.000050	0.0010	0.021	0.0033	0.010	0.056	0.0052	0.018	0.58	0.0011	0.74	0.000010	0.060	0.0087	18	0.000020	0.00020	0.00020	0.0095	0.00059	0.087	0.000010
26-Jun-12	30	500	440	4.0	154																																											
3-Jul-12	31	500	440	4.0	192	35	92	#N/A	80	1.0	0.090	0.30	0.80	11	0.00030	0.00050	0.0015	0.0014	0.000010	0.0015	0.00068	0.27	0.00060	0.0060	5.0	1.2	0.00026	0.0010	0.034	0.0046	0.010	0.00041	0.0069	0.0090	0.72	0.0018	0.94	0.000030	0.050	0.011	26	0.000030	0.00015	0.00020	0.012	0.00054	0.097	0.000010
10-Jul-12	32	500	475	3.8	225																																											
17-Jul-12	33	500	445	3.8	204	43	82	#N/A	82	1.0	0.090	0.30	0.66	9.9	0.00040	0.00090	0.0016	0.0018	0.000010	0.0039	0.00093	0.21	0.00060	0.0072	5.7	1.9	0.000090	0.0010	0.035	0.0056	0.010	0.00057	0.0069	0.0090	0.75	0.0014	1.4	0.00016	0.060	0.012	28	0.000030	0.00015	0.00020	0.014	0.00064	0.13	0.000010
24-Jul-12	34	500	440	3.9	204																																											
31-Jul-12	35	500	445	3.8	220	45	88	#N/A	98	0.20	0.090	0.30	0.65	11	0.00030	0.00050	0.0017	0.0017	0.000010	0.0025	0.00100	0.20	0.00090	0.0069	5.9	2.3	0.00044	0.0010	0.036	0.0067	0.010	0.00044	0.0077	0.024	0.67	0.0011	1.4	0.000040	0.040	0.012	29	0.000020	0.000090	0.00020	0.017	0.00095	0.14	0.000010
7-Aug-12	36	500	445	3.7	258																																											
14-Aug-12	37	500	440	3.6	261	58	110	#N/A	90	1.0	0.080	0.30	0.85	16	0.00030	0.00080	0.0020	0.0020	0.000010	0.0024	0.0011	0.26	0.0012	0.0082	6.1	3.0	0.00028	0.0010	0.047	0.0087	0.010	0.00046	0.0093	0.0090	0.80	0.0013	1.8	0.000050	0.070	0.012	37	0.000030	0.00028	0.00060	0.023	0.0014	0.16	0.000010
21-Aug-12	38	500	445	3.6	252																																											
28-Aug-12	39	500	490	3.6	305	62	128	#N/A	116	1.0	0.080	0.30	0.92	16	0.00050	0.00040	0.0024	0.0019	0.000010	0.0031	0.0012	0.28	0.0013	0.0090	5.9	4.2	0.00015	0.0010	0.050	0.011	0.020	0.00047	0.010	0.074	0.86	0.0012	3.3	0.000050	0.050	0.015	40	0.000040	0.00025	0.00030	0.032	0.0014	0.14	0.000010
4-Sep-12	40	500	470	3.7	226																																											
11-Sep-12	41	500	450	3.6	261	49	109	#N/A	86	1.0	0.070	0.30	0.86	12	0.00030	0.00040	0.0024	0.0013	0.000010	0.0018	0.00091	0.28	0.0012	0.0073	4.6	3.3	0.00043	0.0010	0.039	0.0079	0.010	0.00052	0.0094	0.033	0.60	0.0010	1.9	0.000040	0.050	0.012	31	0.000030	0.00014	0.00020	0.027	0.00087	0.10	0.000010
18-Sep-12	42	500	505	3.6	266																																											
25-Sep-12	43	500	450	3.6	260	43	91	#N/A	93	0.20	0.060	0.30	0.87	12	0.00020	0.00020	0.0027	0.0011	0.000010	0.00040	0.00097	0.29	0.0016	0.0074	4.2	3.2	0.00034	0.0010	0.036	0.0071	0.010	0.024	0.0079	0.027	0.52	0.00077	1.6	0.000030	0.13	0.011	31	0.000020	0.00034	0.00010	0.027	0.0010	0.10	0.000020
2-Oct-12	44	500	455	3.6	330																																											
9-Oct-12	45	500	460	3.6	240	39	85	#N/A	88	1.0	0.060	0.30	0.85	12	0.00030	0.00040	0.0022	0.0010	0.000010	0.0014	0.00079	0.28	0.0014	0.0070	3.9	3.0	0.0010	0.0010	0.033	0.0074	0.010	0.00040	0.0078	0.034	0.43	0.00078	1.5	0.000030	0.050	0.0094	29	0.000020	0.00016	0.00020	0.027	0.00089	0.089	0.000010
16-Oct-12	46	500	460	3.5	266																																											
23-Oct-12	47	500	485	3.4	301																																										
30-Oct-12	48	500	460	3.5	271																																										
6-Nov-12	49	500	430	3.5	253	39	91	#N/A	81	1.0	0.060	0.30	1.1	11	0.00030	0.00030	0.0024	0.00086	0.000010	0.0017	0.00078	0.36	0.0021	0.0070	3.5	4.3	0.00011	0.0010	0.038	0.0093	0.010	0.00041	0.0077	0.013	0.39	0.00059	1.3	0.000010	0.060	0.0097	29	0.000020	0.00019	0.00010	0.034	0.00072	0.077	0.000010
13-Nov-12	50	500	435	3.4	260																																											
20-Nov-12	51	500	485	3.5	287																																										
27-Nov-12	52	500	490	3.3	280																																										
4-Dec-12	53	500	490	3.4	307	38	85	#N/A	93	1.0	0.060	0.30	1.0	9.1	0.00040	0.00040	0.0035	0.00067	0.000010	0.0012	0.00074	0.36	0.0016	0.0072	3.8	7.6	0.00024	0.0010	0.032	0.014	0.010	0.00037	0.0078	0.026	0.51	0.00033	2.3	0.000050	0.050	0.011	31	0.000030	0.00014	0.00020	0.033	0.0012	0.086	0.000010
11-Dec-12	54	500	440	3.4	310																																											
18-Dec-12	55	500	435	3.4	300																																										
25-Dec-12	56	500	445	3.3	320																																										
1-Jan-13	57	500	460	3.3	317	50	98	#N/A	108	1.0	0.060	0.30	1.1	7.8	0.00040	0.00020	0.0033	0.00060	0.000010	0.00070	0.00070	0.38	0.0023	0.0077	3.4	8.6	0.0015	0.0010	0.037	0.016	0.010	0.00047	0.0085	0.018	0.37	0.00045	1.7	0.000040	0.050	0.010	33	0.000030	0.00013	0.00010	0.041	0.0012	0.072	0.000010
8-Jan-13	58	500	465	3.4	319																																											
15-Jan-13	59	500	465	3.3	323																																										
22-Jan-13	60	500	455	3.4	317																																										
29-Jan-13	61	500	460	3.2	338	51	95	#N/A	117	1.0	0.060	0.30	1.3	10	0.00030	0.00030	0.0035	0.00057	0.000010	0.00080	0.00078	0.44	0.0030	0.0083	3.7	12	0.00028	0.0010	0.046	0.018	0.010	0.00043	0.0088	0.062	0.35	0.00048	1.5	0.00013	0.10	0.010	39	0.000020	0.00025	0.00020	0.043	0.0014	0.074	0.000010
5-Feb-13	62	500	460	3.3	354																																										
12-Feb-13	63	500	455	3.3	343																																										
19-Feb-13	64	500	460	3.3	355																																										
26-Feb-13	65	500	450	3.2	368	52	89	#N/A	103	1.0	0.060	0.30	1.5	7.7	0.00020	0.00050	0.0033	0.00054	0.000010	0.00060	0.00070	0.53	0.0029	0.0084	3.4	12	0.00016	0.0010	0.039	0.018	0.010	0.00048	0.0086	0.055	0.31	0.00042	1.5	0.000090	0.060	0.0075	34	0.000020	0.000030	0.00010	0.041	0.0011	0.065	0.000010
5-Mar-13	66	500	455	3.2	381																																										
12-Mar-13	67	500	450	3.2	370																																										

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC8

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	340	4.1	735	12	84	#N/A	116	0.75	0.25	0.10	36	15	0.00020	0.00054	0.015	0.0012	0.0000034	0.0022	0.0018	11	0.00085	0.029	31	0.38	0.00084	0.0027	2.1	0.16	0.0068	0.00099	0.028	0.11	6.4	0.0029	0.19	0.000034	4.6	0.032	43	0.00015	0.000044	0.00020	0.011	0.00047	0.29	0.000027
6-Dec-11	1	500	475	4.1	644	13	104	#N/A	151	0.67	0.029	0.14	44	12	0.00024	0.00067	0.0037	0.0017	0.0000048	0.0024	0.0022	13	0.0011	0.039	22	0.40	0.0017	0.0043	2.6	0.22	0.0095	0.0012	0.037	0.15	6.6	0.0029	1.1	0.00048	5.0	0.045	57	0.00015	0.0000048	0.00033	0.0083	0.00077	0.40	0.000014
13-Dec-11	2	500	455	4.2	462	7.7	68	#N/A	92	0.36	0.31	0.14	27	7.4	0.00014	0.00064	0.0018	0.0010	0.0000091	0.0022	0.0014	8.4	0.0013	0.030	16	0.23	0.00023	0.0036	1.5	0.13	0.014	0.00084	0.030	0.13	4.2	0.0049	0.76	0.000023	2.5	0.034	35	0.000073	0.00042	0.00032	0.0053	0.00046	0.26	0.000014
20-Dec-11	3	500	510	4.2	362	5.9	62	#N/A	95	0.31	0.34	0.15	22	7.2	0.00020	0.00071	0.0012	0.0012	0.0000051	0.0021	0.0011	6.8	0.00051	0.016	14	0.30	0.000071	0.0020	1.1	0.096	0.0051	0.00061	0.016	0.21	3.8	0.0027	1.3	0.000010	1.6	0.031	31	0.000087	0.0000051	0.00031	0.0042	0.00044	0.20	0.0000051
27-Dec-11	4	500	420	4.4	271																																												
3-Jan-12	5	500	450	4.2	227	4.3	34	#N/A	51	0.45	0.19	0.14	8.1	4.4	0.00014	0.00036	0.00072	0.00067	0.0000045	0.0014	0.00074	2.6	0.00027	0.0079	6.7	0.12	0.0018	0.0014	0.38	0.034	0.0045	0.00029	0.0081	0.053	1.6	0.0011	0.35	0.0000090	0.41	0.016	14	0.000041	0.000077	0.00032	0.0028	0.00039	0.13	0.0000090
10-Jan-12	6	500	420	4.2	175																																											
17-Jan-12	7	500	450	4.4	153	1.2	19	#N/A	31	0.090	0.15	0.14	3.6	3.4	0.00018	0.00027	0.00085	0.00057	0.0000045	0.0014	0.0022	1.2	0.00023	0.0036	4.1	0.16	0.012	0.00090	0.15	0.015	0.0045	0.00028	0.0038	0.052	1.1	0.00075	0.32	0.0000090	0.13	0.0095	9.5	0.000032	0.000041	0.00023	0.0021	0.00029	0.26	0.0000045
24-Jan-12	8	500	435	4.3	140																																											
31-Jan-12	9	500	445	4.2	115	2.2	15	#N/A	17	0.089	0.12	0.13	1.3	1.7	0.000089	0.00036	0.00062	0.00041	0.0000045	0.00098	0.00017	0.43	0.00022	0.0022	2.3	0.13	0.000098	0.00089	0.052	0.0056	0.0045	0.00022	0.0023	0.0040	0.59	0.00070	0.25	0.0000045	0.058	0.0057	6.0	0.000018	0.0000045	0.00018	0.0015	0.00029	0.034	0.0000045
7-Feb-12	10	500	460	4.4	99																																											
14-Feb-12	11	500	445	4.3	111	2.8	18	#N/A	18	0.089	0.11	0.13	0.83	3.1	0.000089	0.00027	0.00053	0.00035	0.0000045	0.0010	0.00018	0.28	0.00022	0.0017	2.6	0.12	0.0000045	0.00045	0.031	0.0036	0.0045	0.00056	0.0018	0.050	0.47	0.00053	0.24	0.0000045	0.036	0.0051	5.7	0.000013	0.0000089	0.00013	0.0018	0.00012	0.032	0.0000045
21-Feb-12	12	500	465	4.3	144																																											
28-Feb-12	13	500	460	4.2	146	4.0	24	#N/A	28	0.46	0.13	0.14	0.86	3.5	0.00055	0.00046	0.00092	0.00046	0.0000046	0.0016	0.00030	0.29	0.00023	0.0027	2.8	0.17	0.00034	0.0014	0.031	0.0040	0.0046	0.00027	0.0049	0.048	0.58	0.00052	0.36	0.0000018	0.032	0.0065	8.7	0.00022	0.000041	0.000092	0.0026	0.00020	0.049	0.0000046
6-Mar-12	14	500	435	4.2	161																																											
13-Mar-12	15	500	465	4.2	155	5.8	30	#N/A	31	0.47	0.12	0.14	0.64	0.48	0.00019	0.00023	0.00070	0.00047	0.0000047	0.0013	0.00024	0.22	0.00023	0.0027	0.32	0.21	0.000070	0.00047	0.023	0.0029	0.0047	0.00023	0.0028	0.050	0.53	0.00060	0.47	0.0000093	0.028	0.0055	9.8	0.000019	0.000079	0.000093	0.0032	0.00013	0.049	0.0000093
20-Mar-12	16	500	430	4.2	147																																											
27-Mar-12	17	500	435	4.1	155	5.7	26	#N/A	30	0.44	0.10	0.13	0.50	3.9	0.000087	0.00017	0.00044	0.00057	0.0000044	0.0013	0.00021	0.17	0.00022	0.0021	2.4	0.19	0.0020	0.00044	0.016	0.0020	0.0044	0.00016	0.0022	0.077	0.62	0.00066	0.24	0.00039	0.052	0.0044	9.0	0.000017	0.0000044	0.000087	0.0030	0.00014	0.028	0.0000044
3-Apr-12	18	500	445	4.1	164																																											
10-Apr-12	19	500	450	4.0	213	14	40	#N/A	45	0.090	0.11	0.14	0.60	5.9	0.00014	0.00018	0.00059	0.00087	0.0000045	0.0014	0.00032	0.20	0.00032	0.0033	4.1	0.32	0.00013	0.00045	0.022	0.0027	0.0090	0.0030	0.0036	0.043	0.54	0.00072	0.41	0.0000090	0.027	0.0061	14	0.000018	0.000023	0.000090	0.0049	0.00021	0.065	0.0000045
17-Apr-12	20	500	410	4.0	240																																											
24-Apr-12	21	500	450	4.0	174	9.6	32	#N/A	35	0.45	0.081	0.14	0.41	4.4	0.00018	0.00023	0.0014	0.00069	0.0000045	0.00099	0.00024	0.14	0.00027	0.0022	2.4	0.33	0.00073	0.00045	0.015	0.0025	0.014	0.00025	0.0026	0.042	0.47	0.00054	0.41	0.0000045	0.027	0.0058	10	0.000014	0.000014	0.000045	0.0045	0.00021	0.045	0.0000045
1-May-12	22	500	455	4.1	178																																											
8-May-12	23	500	455	4.0	188	12	34	#N/A	36	0.46	0.059	0.14	0.38	4.1	0.00014	0.00018	0.00082	0.00070	0.0000046	0.0021	0.00026	0.13	0.00027	0.0025	2.5	0.41	0.000086	0.00046	0.015	0.0020	0.0046	0.00048	0.0030	0.011	0.43	0.00053	0.48	0.000014	0.027	0.0053	12	0.000014	0.00011	0.000046	0.0044	0.00022	0.048	0.0000046
15-May-12	24	500	445	4.0	180																																											
22-May-12	25	500	405	3.9	252	19	46	#N/A	44	0.41	0.065	0.12	0.73	6.6	0.00020	0.00032	0.0016	0.00080	0.0000041	0.0011	0.00038	0.26	0.00045	0.0032	3.5	0.59	0.00013	0.00041	0.020	0.0026	0.0081	0.00075	0.0036	0.0036	0.53	0.00069	0.26	0.0000041	0.028	0.0090	15	0.000016	0.000049	0.000081	0.0066	0.00026	0.057	0.0000081
29-May-12	26	500	415	4.0	160																																											
5-Jun-12	27	500	430	4.0	164	8.6	31	#N/A	24	0.43	0.052	0.13	0.45	3.8	0.000086	0.00017	0.00052	0.00057	0.0000043	0.0027	0.00022	0.16	0.00022	0.0021	1.9	0.35	0.00016	0.00043	0.013	0.0018	0.0086	0.00017	0.0038	0.0077	0.34	0.00047	0.31	0.0000043	0.022	0.0055	9.4	0.0000086	0.000017	0.00030	0.0037	0.00036	0.035	0.0000043
12-Jun-12	28	500	445	4.0	174																																											
19-Jun-12	29	500	440	4.0	153	8.8	26	#N/A	23	0.088	0.040	0.13	0.23	3.4	0.000088	0.00022	0.00062	0.00051	0.0000044	0.00088	0.00019	0.079	0.00022	0.0020	1.6	0.34	0.000022	0.00044	0.0092	0.0015	0.0044	0.025	0.0023	0.0079	0.26	0.00048	0.33	0.0000044	0.026	0.0038	7.7	0.0000088	0.000088	0.000088	0.0042	0.00026	0.038	0.0000044
26-Jun-12	30	500	440	4.0	154																																											
3-Jul-12	31	500	440	4.0	192	15	40	#N/A	35	0.44	0.040	0.13	0.35	4.8	0.00013	0.00022	0.00066	0.00063	0.0000044	0.00066	0.00030	0.12	0.00026	0.0027	2.2	0.54	0.00011	0.00044	0.015	0.0020	0.0044	0.00018	0.0030	0.0040	0.32	0.00078	0.41	0.0000013	0.022	0.0049	11	0.000013	0.000066	0.000088	0.0053	0.00024	0.043	0.0000044
10-Jul-12	32	500	475	3.8	225																																											
17-Jul-12	33	500	445	3.8	204	19	36	#N/A	36	0.45	0.040	0.13	0.29	4.4	0.00018	0.00040	0.00071	0.00080	0.0000045	0.0017	0.00042	0.093	0.00027	0.0032	2.5	0.85	0.000040	0.00045	0.016	0.0025	0.0045	0.00025	0.0031	0.0040	0.33	0.00061	0.62	0.000071	0.027	0.0053	13	0.000013	0.000067	0.000089	0.0064	0.00028	0.057	0.0000045
24-Jul-12	34	500	440	3.9	204																																											
31-Jul-12	35	500	445	3.8	220	20	39	#N/A	44	0.089	0.040	0.13	0.29	5.0	0.00013	0.00022	0.00076	0.00074	0.0000045	0.0011	0.00044	0.089	0.00040	0.0030	2.6	1.0	0.00020	0.00045	0.016	0.0030	0.0045	0.00020	0.0034	0.011	0.30	0.00049	0.61	0.000018	0.018	0.0052	13	0.0000089	0.000040	0.000089	0.0077	0.00042	0.062	0.0000045
7-Aug-12	36	500	445	3.7	258																																											
14-Aug-12	37	500	440	3.6	261	26	48	#N/A	40	0.44	0.035	0.13	0.37	7.1	0.00013	0.00035	0.00090	0.00086	0.0000044	0.0011	0.00050	0.11	0.00053	0.0036	2.7	1.3	0.00012	0.00044	0.021	0.0038	0.0044	0.00020	0.0041	0.0040	0.35	0.00057	0.80	0.000022	0.031	0.0055	16	0.000013	0.00012	0.00026	0.010	0.00063	0.069	0.0000044
21-Aug-12	38	500	445	3.6	252																																											
28-Aug-12	39	500	490	3.6	305	30	63	#N/A	57	0.49	0.039	0.15	0.45	7.9	0.00025	0.00020	0.0012	0.00091	0.0000049	0.0015	0.00060	0.14	0.00064	0.0044	2.9	2.1	0.000074	0.00049	0.025	0.0051	0.0098	0.00023	0.0049	0.036	0.42	0.00059	1.6	0.000025	0.025	0.0073	20	0.000020	0.00012	0.00015	0.015	0.00067	0.068	0.0000049
4-Sep-12	40	500	470	3.7	226																																											
11-Sep-12	41	500	450	3.6	261	22	49	#N/A	39	0.45	0.032	0.14	0.39	5.6	0.00014	0.00018	0.0011	0.00060	0.0000045	0.00081	0.00041	0.13	0.00054	0.0033	2.1	1.5	0.00019	0.00045	0.018	0.0036	0.0045	0.00023	0.0042	0.015	0.27	0.00045	0.86	0.000018	0.023	0.0052	14	0.000014	0.000063	0.000090	0.012	0.00039	0.047	0.0000045
18-Sep-12	42	500	505	3.6	266																																											
25-Sep-12	43	500	450	3.6	260	19	41	#N/A	42	0.090	0.027	0.14	0.39	5.6	0.000090	0.000090	0.0012	0.00048	0.0000045	0.00018	0.00043	0.13	0.00072	0.0033	1.9	1.4	0.00015	0.00045	0.016	0.0032	0.0045	0.011	0.0036	0.012	0.23	0.00035	0.72	0.000014	0.059	0.0048	14	0.0000090	0.00015	0.0000045	0.012	0.00045	0.045	0.0000090
2-Oct-12	44	500	455	3.6	330																																											
9-Oct-12	45	500	460	3.6	240	18	39	#N/A	40	0.46	0.028	0.14	0.39	5.6	0.00014	0.00018	0.0010	0.00047	0.0000046	0.00064	0.00036	0.13	0.00064	0.0032	1.8	1.4	0.00046	0.00046	0.015	0.0034	0.0046	0.00018	0.0036	0.016	0.20	0.00036	0.68	0.000014	0.023	0.0043	13	0.0000092	0.000074	0.000092	0.012	0.00041	0.041	0.0000046
16-Oct-12	46	500	460	3.5	266																																											
23-Oct-12	47	500	485	3.4	301																																										
30-Oct-12	48	500	460	3.5	271																																										
6-Nov-12	49	500	430	3.5	253	17	39	#N/A	35	0.43	0.026	0.13	0.46	4.6	0.00013	0.00013	0.0010	0.00037	0.0000043	0.00073	0.00034	0.15	0.00090	0.0030	1.5	1.8	0.000047	0.00043	0.016	0.0040	0.0043	0.00018	0.0033	0.0056	0.17	0.00025	0.56	0.0000043	0.026	0.0042	12	0.0000086	0.000082	0.000043	0.014	0.00031	0.033	0.0000043
13-Nov-12	50	500	435	3.4	260																																											
20-Nov-12	51	500	485	3.5	287																																										
27-Nov-12	52	500	490	3.3	280																																										
4-Dec-12	53	500	490	3.4	307	19	42	#N/A	46	0.49	0.029	0.15	0.49	4.5	0.00020	0.00020	0.0017	0.00033	0.0000049	0.00059	0.00036	0.18	0.00078	0.0035	1.9	3.7	0.00012	0.00049	0.016	0.0068	0.0049	0.00018	0.0038	0.013	0.25	0.00016	1.1	0.000025	0.025	0.0055	15	0.000015	0.000069	0.000098	0.016	0.00058	0.042	0.0000049
11-Dec-12	54	500	440	3.4	310																																											
18-Dec-12	55	500	435	3.4	300																																										
25-Dec-12	56	500	445	3.3	320																																										
1-Jan-13	57	500	460	3.3	317	23	45	#N/A	50	0.46	0.028	0.14	0.50	3.6	0.00018	0.000092	0.0015	0.00028	0.0000046	0.00032	0.00032	0.17	0.0011	0.0035	1.6	4.0	0.00069	0.00046	0.017	0.0072	0.0046	0.00022	0.0039	0.0083	0.17	0.00021	0.77	0.000018	0.023	0.0047	15	0.000014	0.000060	0.000046	0.019	0.00057	0.033	0.0000046
8-Jan-13	58	500	465	3.4	319																																											
15-Jan-13	59	500	465	3.3	323																																										
22-Jan-13	60	500	455	3.4	317																																										
29-Jan-13	61	500	460	3.2	338	23	44	#N/A	54	0.46	0.028	0.14	0.59	4.7	0.00014	0.00014	0.0016	0.00026	0.0000046	0.00037	0.00036	0.20	0.0014	0.0038	1.7	5.4	0.00013	0.00046	0.021	0.0083	0.0046	0.00020	0.0040	0.029	0.16	0.00022	0.70	0.000060	0.046	0.0048	18	0.0000092	0.00012	0.000092	0.020	0.00064	0.034	0.0000046
5-Feb-13	62	500	460	3.3	354																																											
12-Feb-13	63	500	455	3.3	343																																										
19-Feb-13	64	500	460	3.3	355																																										
26-Feb-13	65	500	450	3.2	368	23	40	#N/A	46	0.45	0.027	0.14	0.67	3.5	0.000090	0.00023	0.0015	0.00024	0.0000045	0.00027	0.00031	0.24	0.0013	0.0038	1.5	5.3	0.000072	0.00045	0.018	0.0080	0.0045	0.00022	0.0039	0.025	0.14	0.00019	0.68	0.000041	0.027	0.0034	15	0.0000090	0.000014	0.000045	0.018	0.00051	0.029	0.0000045
5-Mar-13	66	500	455	3.2	381																																											
12-Mar-13	67	500	450	3.2	370																																										
Median (last 5)				3.3	317	23	42	#N/A	46	0.46	0.028	0.14	0.50	4.5	0.00014	0.00014	0.0015	0.00028	0.0000046	0.00037	0.00034	0.18	0.0011	0.0035	1.6	4.0	0.00012	0.00046	0.017	0.0072	0.0046	0.00020	0.0039	0.013	0.17	0.00021	0.70	0.000025	0.026	0.0047	15	0.0000092	0.000069	0.000046	0.018	0.00057	0.033	0.0000046

Leachate Results for HC9

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	500	385	6.7	268	#N/A	6.4	8.2	93	3.0	0.090	0.30	59	0.042	0.00030	0.00090	0.028	0.000020	0.000010	0.0084	0.00021	19	0.00050	0.0067	0.71	0.0040	0.0013	0.0020	2.9	0.080	0.020	0.014	0.0029	0.0090	9.3	0.0017	1.1	0.000010	19	0.12	33	0.000040	0.000060	0.00080	0.00032	0.00078	0.017	0.000020
6-Dec-11	1	500	455	6.7	210	#N/A	4.7	4.5	75	2.6	0.060	0.30	53	0.014	0.00020	0.00060	0.010	0.000020	0.000010	0.0073	0.00011	17	0.00070	0.0043	0.061	0.0030	0.000020	0.0010	2.3	0.068	0.020	0.013	0.00060	0.0090	5.8	0.0014	1.3	0.000020	16	0.069	29	0.000020	0.000030	0.00020	0.00050	0.00049	0.0070	0.000010
13-Dec-11	2	500	470	6.2	154	#N/A	4.6	3.1	58	1.4	0.060	0.30	39	0.0044	0.00020	0.00050	0.0073	0.000020	0.000010	0.0052	0.000059	13	0.00080	0.0027	0.044	0.0030	0.00011	0.0010	1.7	0.049	0.020	0.0099	0.00070	0.014	4.3	0.0011	1.2	0.000010	9.9	0.050	20	0.000020	0.000070	0.00020	0.000092	0.00029	0.016	0.000010
20-Dec-11	3	500	480	6.7	98	#N/A	5.0	4.0	40	0.60	0.060	0.30	25	0.017	0.00020	0.00050	0.0045	0.000020	0.000010	0.0051	0.000056	8.4	0.00050	0.0023	0.038	0.0030	0.000020	0.0010	1.0	0.037	0.010	0.0083	0.00040	0.0090	2.9	0.00075	1.6	0.000010	5.1	0.031	13	0.000020	0.000010	0.00020	0.000032	0.00039	0.0030	0.000010
27-Dec-11	4	500	455	6.7	80																																												
3-Jan-12	5	500	455	6.3	63	#N/A	4.8	2.5	25	0.30	0.060	0.30	15	0.047	0.00020	0.00030	0.0034	0.000020	0.000010	0.0038	0.000032	5.1	0.00050	0.0013	0.030	0.0030	0.000020	0.0010	0.64	0.020	0.010	0.0055	0.00050	0.0090	2.0	0.00029	1.0	0.000010	3.1	0.019	7.9	0.000020	0.000040	0.00030	0.000053	0.00058	0.0030	0.000010
10-Jan-12	6	500	435	6.2	55																																											
17-Jan-12	7	500	450	6.4	40	#N/A	3.1	2.3	15	0.20	0.060	0.30	12	0.019	0.00020	0.00020	0.0035	0.000020	0.000010	0.0045	0.000029	4.0	0.00050	0.0012	0.034	0.0030	0.000020	0.0010	0.43	0.016	0.010	0.0043	0.00030	0.0090	1.6	0.00019	1.1	0.000010	1.7	0.014	5.0	0.000020	0.000020	0.00020	0.000056	0.00043	0.0030	0.000010
24-Jan-12	8	500	450	6.1	35																																											
31-Jan-12	9	500	460	6.2	31	#N/A	4.0	1.8	11	0.20	0.060	0.30	8.1	0.024	0.00020	0.00020	0.0034	0.000020	0.000010	0.0028	0.000025	2.7	0.00050	0.0012	0.037	0.0030	0.000020	0.0010	0.34	0.014	0.010	0.0036	0.00010	0.0090	1.3	0.00029	1.2	0.000010	1.2	0.011	3.7	0.000020	0.000030	0.00020	0.000056	0.00051	0.0030	0.000010
7-Feb-12	10	500	450	6.5	29																																											
14-Feb-12	11	500	490	6.2	28	#N/A	4.8	2.2	13	0.20	0.060	0.30	8.9	0.0029	0.00020	0.00030	0.0043	0.000020	0.000010	0.0028	0.000028	3.0	0.00050	0.0014	0.043	0.0030	0.000020	0.0010	0.37	0.017	0.010	0.0031	0.00030	0.0090	1.2	0.00022	1.4	0.000010	1.1	0.013	3.6	0.000020	0.000010	0.00010	0.000019	0.00025	0.0020	0.000010
21-Feb-12	12	500	455	6.2	26																																											
28-Feb-12	13	500	505	5.9	26	#N/A	4.2	1.7	9.0	0.20	0.060	0.30	7.8	0.014	0.00020	0.00030	0.0038	0.000020	0.000010	0.0026	0.000028	2.6	0.00050	0.0013	0.049	0.0030	0.000020	0.0010	0.31	0.016	0.010	0.0024	0.00020	0.0090	1.0	0.00025	1.3	0.000010	0.71	0.012	3.0	0.000020	0.000040	0.00010	0.00014	0.00035	0.0030	0.000010
6-Mar-12	14	500	450	6.2	29																																											
13-Mar-12	15	500	440	5.8	25	#N/A	3.8	1.8	8.0	0.20	0.060	0.30	7.6	0.0049	0.00020	0.00020	0.0039	0.000020	0.000010	0.0021	0.000028	2.5	0.00050	0.0013	0.051	0.0030	0.000020	0.0010	0.30	0.014	0.010	0.0022	0.00020	0.0090	1.0	0.00023	1.2	0.000010	0.66	0.011	3.1	0.000020	0.00020	0.00010	0.000054	0.00016	0.0030	0.000010
20-Mar-12	16	500	470	6.0	26																																											
27-Mar-12	17	500	455	5.8	26	#N/A	3.5	0.95	9.0	0.20	0.060	0.30	8.0	0.018	0.00020	0.00030	0.0041	0.000020	0.000010	0.0021	0.000045	2.7	0.00050	0.0015	0.065	0.0030	0.0012	0.0010	0.31	0.015	0.010	0.0019	0.00030	0.0090	1.0	0.00015	1.2	0.000010	0.63	0.011	3.2	0.000020	0.000010	0.00010	0.000040	0.00030	0.0040	0.000010
3-Apr-12	18	500	455	5.9	28																																											
10-Apr-12	19	500	450	5.8	30	#N/A	3.4	1.4	11	0.20	0.060	0.30	8.6	0.016	0.00020	0.00020	0.0047	0.000020	0.000010	0.0025	0.0000070	2.9	0.00050	0.0019	0.064	0.0030	0.000020	0.0010	0.33	0.017	0.010	0.0020	0.00030	0.0090	1.2	0.00031	1.4	0.000010	0.63	0.013	3.5	0.000020	0.000050	0.00010	0.000046	0.00031	0.0050	0.000010
17-Apr-12	20	500	425	5.9	36																																											
24-Apr-12	21	500	445	5.8	25	#N/A	3.8	1.4	7.0	0.20	0.060	0.30	7.0	0.026	0.00020	0.00020	0.0046	0.000020	0.000010	0.0020	0.0000030	2.4	0.00050	0.0017	0.060	0.0030	0.000030	0.0010	0.27	0.015	0.020	0.0020	0.00050	0.0090	1.2	0.00014	1.3	0.000010	0.56	0.011	3.0	0.000020	0.000030	0.00010	0.000049	0.00042	0.0050	0.000010
1-May-12	22	500	435	6.2	25																																											
8-May-12	23	500	440	5.7	22	#N/A	4.0	0.96	7.0	0.20	0.060	0.30	6.2	0.011	0.00020	0.00020	0.0042	0.000020	0.000010	0.0022	0.000014	2.1	0.00050	0.0016	0.062	0.0030	0.000060	0.0010	0.23	0.014	0.010	0.0019	0.00040	0.0090	1.1	0.00020	1.2	0.000010	0.45	0.010	2.6	0.000020	0.00013	0.00010	0.000039	0.00029	0.0050	0.000010
15-May-12	24	500	450	5.8	23																																											
22-May-12	25	500	420	5.9	27	#N/A	4.5	1.8	8.0	0.20	0.060	0.30	7.6	0.040	0.00020	0.00020	0.0060	0.000020	0.000010	0.0019	0.000034	2.6	0.00050	0.0020	0.078	0.0030	0.000020	0.0010	0.31	0.020	0.010	0.0021	0.00040	0.0090	1.3	0.00022	1.7	0.000010	0.50	0.013	3.2	0.000020	0.000060	0.00040	0.00010	0.00057	0.0050	0.000010
29-May-12	26	500	420	6.0	19																																											
5-Jun-12	27	500	430	5.7	19	#N/A	4.4	1.6	5.0	0.20	0.060	0.30	5.8	0.043	0.00020	0.00060	0.0044	0.000020	0.000010	0.0026	0.0000030	2.0	0.00050	0.0018	0.070	0.0030	0.000020	0.0010	0.22	0.015	0.010	0.0015	0.00010	0.0090	0.95	0.00016	1.2	0.000010	0.38	0.010	2.5	0.000020	0.000060	0.00010	0.000063	0.00051	0.0050	0.000010
12-Jun-12	28	500	445	5.9	19																																											
19-Jun-12	29	500	435	5.7	18	#N/A	3.7	0.70	6.0	0.20	0.060	0.30	5.0	0.038	0.00020	0.00020	0.0041	0.000020	0.000010	0.0014	0.0000030	1.7	0.00050	0.0019	0.077	0.0030	0.000020	0.0010	0.19	0.014	0.010	0.0019	0.00030	0.0090	0.79	0.00023	1.1	0.000010	0.29	0.0093	2.1	0.000020	0.00019	0.00010	0.000052	0.00046	0.0040	0.000010
26-Jun-12	30	500	435	6.0	19																																											
3-Jul-12	31	500	440	6.1	20	#N/A	7.5	2.5	7.0	0.20	0.060	0.30	5.6	0.022	0.00020	0.00020	0.0046	0.000020	0.000010	0.0010	0.000051	1.9	0.00050	0.0023	0.10	0.0030	0.000040	0.0010	0.22	0.017	0.010	0.0012	0.00060	0.0090	0.89	0.00016	1.0	0.000010	0.34	0.011	2.3	0.000020	0.000090	0.0037	0.000036	0.0017	0.0050	0.000010
10-Jul-12	32	500	445	5.8	21																																											
17-Jul-12	33	500	435	5.6	21	#N/A	3.0	1.2	6.0	0.20	0.060	0.30	6.0	0.026	0.00020	0.00040	0.0056	0.000020	0.000010	0.0017	0.000043	2.0	0.00050	0.0027	0.14	0.0030	0.00074	0.0010	0.24	0.019	0.010	0.0012	0.00010	0.0090	0.95	0.00025	1.2	0.000010	0.34	0.012	2.6	0.000020	0.000010	0.00010	0.000044	0.00050	0.0070	0.000010
24-Jul-12	34	500	430	5.7	23																																											
31-Jul-12	35	500	440	5.6	22	#N/A	3.5	0.79	7.0	0.20	0.060	0.30	6.4	0.033	0.00020	0.00020	0.0058	0.000020	0.000010	0.0019	0.000062	2.1	0.00050	0.0033	0.17	0.0030	0.000030	0.0010	0.26	0.022	0.030	0.0011	0.00040	0.0090	0.95	0.00034	1.3	0.000010	0.35	0.013	2.6	0.000020	0.000030	0.00010	0.000053	0.00040	0.0080	0.000010
7-Aug-12	36	500	440	5.8	23																																											
14-Aug-12	37	500	450	5.6	24	#N/A	4.4	1.1	8.0	0.20	0.060	0.30	6.6	0.036	0.00020	0.00070	0.0070	0.000020	0.000010	0.0032	0.000068	2.2	0.00050	0.0040	0.27	0.0030	0.000050	0.0010	0.27	0.024	0.010	0.00096	0.00070	0.0090	1.0	0.00017	1.4	0.000010	0.36	0.014	3.1	0.000020	0.00041	0.00020	0.000062	0.00058	0.012	0.000010
21-Aug-12	38	500	435	5.5	25																																											
28-Aug-12	39	500	495	5.7	23	#N/A	5.1	1.4	8.0	0.20	0.060	0.30	6.1	0.044	0.00020	0.00020	0.0074	0.000020	0.000010	0.0024	0.000075	2.1	0.00050	0.0033	0.34	0.0070	0.00034	0.0010	0.21	0.020	0.010	0.00073	0.00080	0.0090	0.77	0.00024	1.8	0.000010	0.28	0.014	2.6	0.000020	0.00049	0.00010	0.000061	0.00038	0.010	0.000010
4-Sep-12	40	500	475	5.6	22																																											
11-Sep-12	41	500	490	5.5	23	#N/A	4.9	0.96	9.0	0.20	0.060	0.30	6.5	0.013	0.00020	0.00020	0.0083	0.000020	0.000020	0.0020	0.000069	2.2	0.00050	0.0040	0.42	0.0050	0.000050	0.0010	0.23	0.022	0.050	0.00075	0.00080	0.0090	0.87	0.00022	1.3	0.000010	0.30	0.016	2.8	0.000020	0.00015	0.00020	0.00014	0.00023	0.011	0.000010
18-Sep-12	42	500	495	5.5	25																																											
25-Sep-12	43	500	445	5.4	25	#N/A	5.2	0.87	8.0	0.20	0.060	0.30	6.5	0.020	0.00020	0.00030	0.0089	0.000020	0.000010	0.0020	0.000086	2.2	0.00050	0.0047	0.57	0.0050	0.000020	0.0010	0.25	0.023	0.010	0.00084	0.00090	0.0090	0.90	0.00035	1.3	0.000010	0.29	0.016	3.0	0.000020	0.000060	0.00020	0.000067	0.00021	0.012	0.000010
2-Oct-12	44	500	455	5.6	39																																											
9-Oct-12	45	500	460	5.5	21	#N/A	5.3	0.72	6.0	0.20	0.060	0.30	5.1	0.024	0.00020	0.00020	0.0077	0.000020	0.000010	0.0012	0.000084	1.7	0.00050	0.0041	0.62	0.0050	0.000030	0.0010	0.20	0.021	0.010	0.00047	0.0013	0.010	0.76	0.00034	1.0	0.000010	0.23	0.013	2.4	0.000020	0.00019	0.00020	0.000054	0.00024	0.013	0.000010
16-Oct-12	46	500	455	5.4	23																																											
23-Oct-12	47	500	480	5.3	23																																										
30-Oct-12	48	500	465	5.5	37																																										
6-Nov-12	49	500	425	5.4	24	#N/A	4.8	0.42	7.0	0.20	0.060	0.30	6.9	0.020	0.00020	0.00020	0.0100	0.000020	0.000010	0.0018	0.00011	2.4	0.00050	0.0047	0.91	0.0040	0.000060	0.0010	0.22	0.024	0.010	0.00039	0.0011	0.0090	0.81	0.00030	1.2	0.000010	0.27	0.018	3.0	0.000020	0.00056	0.00010	0.00026	0.00022	0.015	0.000010
13-Nov-12	50	500	435	5.7	28																																											
20-Nov-12	51	500	490	5.6	20																																										
27-Nov-12	52	500	495	5.6	30																																										
4-Dec-12	53	500	450	5.4	24	#N/A	4.8	0.35	8.0	0.20	0.060	0.30	5.9	0.020	0.00020	0.00020	0.012	0.000020	0.000010	0.00080	0.00011	2.0	0.00050	0.0054	1.3	0.0090	0.000020	0.0010	0.21	0.023	0.010	0.00038	0.0013	0.010	0.89	0.0014	1.5	0.000010	0.24	0.017	3.0	0.000020	0.00012	0.00010	0.00028	0.00017	0.017	0.000010
11-Dec-12	54	500	450	5.7	35																																											
18-Dec-12	55	500	465	5.3	24																																										
25-Dec-12	56	500	485	5.6	30																																										
1-Jan-13	57	500	465	5.4	18	#N/A	6.5	0.86	5.0	0.20	0.060	0.30	4.7	0.020	0.00020	0.00020	0.012	0.000020	0.000010	0.00070	0.000091	1.7	0.00050	0.0036	1.1	0.0090	0.000020	0.0010	0.14	0.015	0.010	0.00036	0.0010	0.0090	0.60	0.00026	1.5	0.000010	0.17	0.014	2.5	0.000020	0.00023	0.00010	0.00035	0.00014	0.011	0.000010
8-Jan-13	58	500	480	5.5	25																																											
15-Jan-13	59	500	460	5.4	25																																										
22-Jan-13	60	500	460	5.6	27																																										
29-Jan-13	61	500	455	5.2	21	#N/A	5.4	0.38	9.0	0.20	0.060	0.30	4.4	0.038	0.00020	0.00020	0.012	0.000020	0.000010	0.00080	0.00010	1.5	0.00050	0.0041	1.5	0.0080	0.000020	0.0010	0.14	0.016	0.010	0.00020	0.0012	0.0090	0.59	0.00032	1.1	0.000010	0.23	0.014	2.7	0.000020	0.00024	0.00010	0.00031	0.00023	0.013	0.000010
5-Feb-13	62	500	475	5.3	24																																										
12-Feb-13	63	500	480	5.4	25																																										
19-Feb-13	64	500	460	5.2	26																																										
26-Feb-13	65	500	450	5.2	26	#N/A	7.2	0.39	8.0	0.20	0.060	0.30	4.6	0.034	0.00020	0.00040	0.015	0.000040	0.000010	0.00070	0.00015	1.6	0.00050	0.0054	2.3	0.016	0.000030	0.0010	0.17	0.016	0.010	0.00017	0.0016	0.0090	0.77	0.00050	1.3	0.000010	0.23	0.015	3.3	0.000020	0.000050	0.00010	0.00034	0.000030	0.014	0.000010
5-Mar-13	66	500	450	5.3	25																																										
12-Mar-13	67	500	455	5.2	25																																										

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC9

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	385	6.7	268	#N/A	2.5	3.1	36	1.2	0.035	0.12	23	0.016	0.00012	0.00035	0.011	0.0000077	0.0000039	0.0032	0.000081	7.3	0.00019	0.0026	0.27	0.0015	0.00049	0.00077	1.1	0.031	0.0077	0.0053	0.0011	0.0035	3.6	0.00066	0.43	0.0000039	7.1	0.045	13	0.000015	0.000023	0.00031	0.00012	0.00030	0.0065	0.0000077
6-Dec-11	1	500	455	6.7	210	#N/A	2.1	2.1	34	1.2	0.027	0.14	24	0.0063	0.000091	0.00027	0.0047	0.0000091	0.0000046	0.0033	0.000049	7.9	0.00032	0.0020	0.028	0.0014	0.0000091	0.00046	1.0	0.031	0.0091	0.0059	0.00027	0.0041	2.6	0.00062	0.58	0.0000091	7.2	0.031	13	0.0000091	0.000014	0.000091	0.00023	0.00022	0.0032	0.0000046
13-Dec-11	2	500	470	6.2	154	#N/A	2.1	1.5	27	0.66	0.028	0.14	19	0.0021	0.000094	0.00024	0.0034	0.0000094	0.0000047	0.0024	0.000028	6.1	0.00038	0.0013	0.021	0.0014	0.000052	0.00047	0.78	0.023	0.0094	0.0046	0.00033	0.0066	2.0	0.00049	0.57	0.0000047	4.6	0.024	9.4	0.0000094	0.000033	0.000094	0.00043	0.00014	0.0075	0.0000047
20-Dec-11	3	500	480	6.7	98	#N/A	2.4	1.9	19	0.29	0.029	0.14	12	0.0080	0.000096	0.00024	0.0022	0.0000096	0.0000048	0.0024	0.000027	4.0	0.00024	0.0011	0.018	0.0014	0.0000096	0.00048	0.49	0.018	0.0048	0.0040	0.00019	0.0043	1.4	0.00036	0.77	0.0000048	2.5	0.015	6.1	0.0000096	0.0000048	0.000096	0.000015	0.00019	0.0014	0.0000048
27-Dec-11	4	500	455	6.7	80																																												
3-Jan-12	5	500	455	6.3	63	#N/A	2.2	1.1	11	0.14	0.027	0.14	7.0	0.021	0.000091	0.00014	0.0015	0.0000091	0.0000046	0.0017	0.000015	2.3	0.00023	0.00059	0.014	0.0014	0.0000091	0.00046	0.29	0.0093	0.0046	0.0025	0.00023	0.0041	0.91	0.00013	0.46	0.0000046	1.4	0.0086	3.6	0.0000091	0.000018	0.00014	0.000024	0.00026	0.0014	0.0000046
10-Jan-12	6	500	435	6.2	55																																											
17-Jan-12	7	500	450	6.4	40	#N/A	1.4	1.0	6.8	0.090	0.027	0.14	5.2	0.0083	0.000090	0.000090	0.0016	0.0000090	0.0000045	0.0020	0.000013	1.8	0.00023	0.00055	0.015	0.0014	0.0000090	0.00045	0.19	0.0071	0.0045	0.0019	0.00014	0.0041	0.71	0.0000086	0.50	0.0000045	0.78	0.0062	2.2	0.0000090	0.0000090	0.000090	0.000025	0.00019	0.0014	0.0000045
24-Jan-12	8	500	450	6.1	35																																											
31-Jan-12	9	500	460	6.2	31	#N/A	1.8	0.81	5.1	0.092	0.028	0.14	3.7	0.011	0.000092	0.000092	0.0016	0.0000092	0.0000046	0.0013	0.000012	1.2	0.00023	0.00053	0.017	0.0014	0.0000092	0.00046	0.15	0.0063	0.0046	0.0016	0.000046	0.0041	0.58	0.00013	0.53	0.0000046	0.54	0.0049	1.7	0.0000092	0.000014	0.000092	0.000026	0.00023	0.0014	0.0000046
7-Feb-12	10	500	450	6.5	29																																											
14-Feb-12	11	500	490	6.2	28	#N/A	2.3	1.1	6.4	0.098	0.029	0.15	4.3	0.0014	0.000098	0.00015	0.0021	0.0000098	0.0000049	0.0014	0.000014	1.4	0.00025	0.00067	0.021	0.0015	0.0000098	0.00049	0.18	0.0082	0.0049	0.0015	0.00015	0.0044	0.60	0.00011	0.68	0.0000049	0.51	0.0062	1.8	0.0000098	0.0000049	0.000049	0.0000093	0.00012	0.00098	0.0000049
21-Feb-12	12	500	455	6.2	26																																											
28-Feb-12	13	500	505	5.9	26	#N/A	2.1	0.87	4.5	0.10	0.030	0.15	4.0	0.0071	0.00010	0.00015	0.0019	0.000010	0.0000051	0.0013	0.000014	1.3	0.00025	0.00067	0.025	0.0015	0.000010	0.00051	0.16	0.0078	0.0051	0.0012	0.00010	0.0045	0.52	0.00013	0.64	0.0000051	0.36	0.0058	1.5	0.000010	0.000020	0.000051	0.000072	0.00018	0.0015	0.0000051
6-Mar-12	14	500	450	6.2	29																																											
13-Mar-12	15	500	440	5.8	25	#N/A	1.7	0.79	3.5	0.088	0.026	0.13	3.3	0.0022	0.000088	0.000088	0.0017	0.0000088	0.0000044	0.00092	0.000012	1.1	0.00022	0.00059	0.022	0.0013	0.0000088	0.00044	0.13	0.0060	0.0044	0.00095	0.000088	0.0040	0.45	0.00010	0.52	0.0000044	0.29	0.0048	1.3	0.0000088	0.000088	0.000044	0.000024	0.000070	0.0013	0.0000044
20-Mar-12	16	500	470	6.0	26																																											
27-Mar-12	17	500	455	5.8	26	#N/A	1.6	0.43	4.1	0.091	0.027	0.14	3.7	0.0083	0.000091	0.00014	0.0019	0.0000091	0.0000046	0.00096	0.000020	1.2	0.00023	0.00070	0.029	0.0014	0.00054	0.00046	0.14	0.0069	0.0046	0.00088	0.00014	0.0041	0.46	0.000068	0.53	0.0000046	0.29	0.0050	1.5	0.0000091	0.0000046	0.000046	0.000018	0.00014	0.0018	0.0000046
3-Apr-12	18	500	455	5.9	28																																											
10-Apr-12	19	500	450	5.8	30	#N/A	1.5	0.63	5.0	0.090	0.027	0.14	3.8	0.0074	0.000090	0.000090	0.0021	0.0000090	0.0000045	0.0011	0.0000032	1.3	0.00023	0.00084	0.029	0.0014	0.0000090	0.00045	0.15	0.0077	0.0045	0.00092	0.00014	0.0041	0.54	0.00014	0.64	0.0000045	0.28	0.0058	1.6	0.0000090	0.0000023	0.0000045	0.00021	0.00014	0.0023	0.0000045
17-Apr-12	20	500	425	5.9	36																																											
24-Apr-12	21	500	445	5.8	25	#N/A	1.7	0.62	3.1	0.089	0.027	0.13	3.1	0.011	0.000089	0.000089	0.0020	0.0000089	0.0000045	0.00089	0.0000013	1.0	0.00022	0.00076	0.027	0.0013	0.0000013	0.00045	0.12	0.0069	0.0089	0.00087	0.00022	0.0040	0.54	0.000062	0.59	0.0000045	0.25	0.0050	1.3	0.0000089	0.000013	0.0000045	0.000022	0.00019	0.0022	0.0000045
1-May-12	22	500	435	6.2	25																																											
8-May-12	23	500	440	5.7	22	#N/A	1.8	0.42	3.1	0.088	0.026	0.13	2.7	0.0048	0.000088	0.000088	0.0018	0.0000088	0.0000044	0.00097	0.0000062	0.92	0.00022	0.00070	0.027	0.0013	0.0000026	0.00044	0.10	0.0062	0.0044	0.00084	0.00018	0.0040	0.47	0.000088	0.53	0.0000044	0.20	0.0044	1.1	0.0000088	0.000057	0.000044	0.000017	0.00013	0.0022	0.0000044
15-May-12	24	500	450	5.8	23																																											
22-May-12	25	500	420	5.9	27	#N/A	1.9	0.74	3.4	0.084	0.025	0.13	3.2	0.017	0.000084	0.000084	0.0025	0.0000084	0.0000042	0.00080	0.000014	1.1	0.00021	0.00084	0.033	0.0013	0.0000084	0.00042	0.13	0.0082	0.0042	0.00089	0.00017	0.0038	0.55	0.000092	0.72	0.0000042	0.21	0.0055	1.3	0.0000084	0.000025	0.00017	0.000044	0.00024	0.0021	0.0000042
29-May-12	26	500	420	6.0	19																																											
5-Jun-12	27	500	430	5.7	19	#N/A	1.9	0.68	2.2	0.086	0.026	0.13	2.5	0.019	0.000086	0.00026	0.0019	0.0000086	0.0000043	0.0011	0.0000013	0.84	0.00022	0.00077	0.030	0.0013	0.0000086	0.00043	0.095	0.0065	0.0043	0.00066	0.000043	0.0039	0.41	0.000069	0.49	0.0000043	0.16	0.0044	1.1	0.0000086	0.000026	0.000043	0.000027	0.00022	0.0022	0.0000043
12-Jun-12	28	500	445	5.9	19																																											
19-Jun-12	29	500	435	5.7	18	#N/A	1.6	0.30	2.6	0.087	0.026	0.13	2.2	0.017	0.000087	0.000087	0.0018	0.0000087	0.0000044	0.00061	0.0000013	0.74	0.00022	0.00082	0.034	0.0013	0.0000087	0.00044	0.084	0.0061	0.0044	0.00084	0.00013	0.0039	0.34	0.00010	0.46	0.0000044	0.13	0.0040	0.89	0.0000087	0.000083	0.000044	0.000023	0.00020	0.0017	0.0000044
26-Jun-12	30	500	435	6.0	19																																											
3-Jul-12	31	500	440	6.1	20	#N/A	3.3	1.1	3.1	0.088	0.026	0.13	2.5	0.0098	0.000088	0.000088	0.0020	0.0000088	0.0000044	0.00044	0.000022	0.82	0.00022	0.0010	0.044	0.0013	0.000018	0.00044	0.099	0.0074	0.0044	0.00054	0.00026	0.0040	0.39	0.000070	0.45	0.0000044	0.15	0.0046	1.0	0.0000088	0.000040	0.0016	0.000016	0.00074	0.0022	0.0000044
10-Jul-12	32	500	445	5.8	21																																											
17-Jul-12	33	500	435	5.6	21	#N/A	1.3	0.50	2.6	0.087	0.026	0.13	2.6	0.011	0.000087	0.00017	0.0024	0.0000087	0.0000044	0.00074	0.000019	0.88	0.00022	0.0012	0.059	0.0013	0.00032	0.00044	0.10	0.0081	0.0044	0.00052	0.000044	0.0039	0.41	0.00011	0.54	0.0000044	0.15	0.0053	1.1	0.0000087	0.0000044	0.000044	0.000019	0.00022	0.0030	0.0000044
24-Jul-12	34	500	430	5.7	23																																											
31-Jul-12	35	500	440	5.6	22	#N/A	1.5	0.35	3.1	0.088	0.026	0.13	2.8	0.014	0.000088	0.000088	0.0026	0.0000088	0.0000044	0.00084	0.000027	0.94	0.00022	0.0014	0.077	0.0013	0.000013	0.00044	0.11	0.0096	0.013	0.00047	0.00018	0.0040	0.42	0.00015	0.57	0.0000044	0.15	0.0059	1.1	0.0000088	0.000013	0.000044	0.000023	0.00018	0.0035	0.0000044
7-Aug-12	36	500	440	5.8	23																																											
14-Aug-12	37	500	450	5.6	24	#N/A	2.0	0.48	3.6	0.090	0.027	0.14	3.0	0.016	0.000090	0.00032	0.0031	0.0000090	0.0000045	0.0014	0.0000031	0.99	0.00023	0.0018	0.12	0.0014	0.0000023	0.00045	0.12	0.011	0.0045	0.00043	0.00032	0.0041	0.46	0.0000077	0.61	0.0000045	0.16	0.0065	1.4	0.0000090	0.00018	0.000090	0.000028	0.00026	0.0054	0.0000045
21-Aug-12	38	500	435	5.5	25																																											
28-Aug-12	39	500	495	5.7	23	#N/A	2.5	0.68	4.0	0.099	0.030	0.15	3.0	0.022	0.000099	0.000099	0.0037	0.0000099	0.0000050	0.0012	0.0000037	1.0	0.00025	0.0016	0.17	0.0035	0.00017	0.00050	0.11	0.010	0.0050	0.00036	0.00040	0.0045	0.38	0.00012	0.89	0.0000050	0.14	0.0070	1.3	0.0000099	0.00024	0.000050	0.000030	0.00019	0.0050	0.0000050
4-Sep-12	40	500	475	5.6	22																																											
11-Sep-12	41	500	490	5.5	23	#N/A	2.4	0.47	4.4	0.098	0.029	0.15	3.2	0.0064	0.000098	0.000098	0.0041	0.0000098	0.0000049	0.00098	0.0000034	1.1	0.00025	0.0020	0.21	0.0025	0.000025	0.00049	0.11	0.011	0.025	0.00037	0.00039	0.0044	0.42	0.00011	0.63	0.0000049	0.15	0.0076	1.4	0.0000098	0.000074	0.000098	0.000068	0.00011	0.0054	0.0000049
18-Sep-12	42	500	495	5.5	25																																											
25-Sep-12	43	500	445	5.4	25	#N/A	2.3	0.39	3.6	0.089	0.027	0.13	2.9	0.0089	0.000089	0.00013	0.0040	0.0000089	0.0000045	0.00089	0.0000038	0.97	0.00022	0.0021	0.25	0.0022	0.0000089	0.00045	0.11	0.010	0.0045	0.00037	0.00040	0.0040	0.40	0.00016	0.56	0.0000045	0.13	0.0070	1.3	0.0000089	0.000027	0.000089	0.000030	0.000093	0.0053	0.0000045
2-Oct-12	44	500	455	5.6	39																																											
9-Oct-12	45	500	460	5.5	21	#N/A	2.4	0.33	2.8	0.092	0.028	0.14	2.3	0.011	0.000092	0.000092	0.0035	0.0000092	0.0000046	0.00055	0.000039	0.79	0.00023	0.0019	0.28	0.0023	0.000014	0.00046	0.092	0.0095	0.0046	0.00022	0.00060	0.0046	0.35	0.00016	0.47	0.0000046	0.11	0.0059	1.1	0.0000092	0.000087	0.000092	0.000025	0.00011	0.0060	0.0000046
16-Oct-12	46	500	455	5.4	23																																											
23-Oct-12	47	500	480	5.3	23																																										
30-Oct-12	48	500	465	5.5	37																																										
6-Nov-12	49	500	425	5.4	24	#N/A	2.0	0.18	3.0	0.085	0.026	0.13	2.9	0.0087	0.000085	0.000085	0.0042	0.0000085	0.0000043	0.00077	0.000045	1.0	0.00021	0.0020	0.39	0.0017	0.0000026	0.00043	0.094	0.010	0.0043	0.00017	0.00047	0.0038	0.34	0.00013	0.49	0.0000043	0.11	0.0077	1.3	0.0000085	0.00024	0.000043	0.00011	0.0000094	0.0064	0.0000043
13-Nov-12	50	500	435	5.7	28																																											
20-Nov-12	51	500	490	5.6	20																																										
27-Nov-12	52	500	495	5.6	30																																										
4-Dec-12	53	500	450	5.4	24	#N/A	2.2	0.16	3.6	0.090	0.027	0.14	2.7	0.0090	0.000090	0.000090	0.0053	0.0000090	0.0000045	0.00036	0.000050	0.91	0.00023	0.0024	0.59	0.0041	0.0000090	0.00045	0.094	0.010	0.0045	0.00017	0.00059	0.0045	0.40	0.00061	0.65	0.0000045	0.11	0.0076	1.4	0.0000090	0.000054	0.000045	0.00012	0.000077	0.0077	0.0000045
11-Dec-12	54	500	450	5.7	35																																										
18-Dec-12	55	500	465	5.3	24																																										
25-Dec-12	56	500	485	5.6	30																																										
1-Jan-13	57	500	465	5.4	18	#N/A	3.0	0.40	2.3	0.093	0.028	0.14	2.2	0.0091	0.000093	0.000093	0.0054	0.0000093	0.0000047	0.00033	0.000042	0.78	0.00023	0.0017	0.49	0.0042	0.0000093	0.00047	0.063	0.0070	0.0047	0.00017	0.00047	0.0042	0.28	0.00012	0.67	0.0000047	0.079	0.0066	1.2	0.0000093	0.00011	0.000047	0.00016	0.000065	0.0051	0.0000047
8-Jan-13	58	500	480	5.5	25																																										
15-Jan-13	59	500	460	5.4	25																																										
22-Jan-13	60	500	460	5.6	27																																										
29-Jan-13	61	500	455	5.2	21	#N/A	2.5	0.17	4.1	0.091	0.027	0.14	2.0	0.017	0.000091	0.000091	0.0053	0.0000091	0.0000046	0.00036	0.000046	0.69	0.00023	0.0019	0.69	0.0036	0.0000091	0.00046	0.064	0.0071	0.0046	0.000091	0.00055	0.0041	0.27	0.00015	0.52	0.0000046	0.10	0.0062	1.2	0.0000091	0.00011	0.000046	0.00014	0.00010	0.0059	0.0000046
5-Feb-13	62	500	475	5.3	24																																										
12-Feb-13	63	500	480	5.4	25																																										
19-Feb-13	64	500	460	5.2	26																																										
26-Feb-13	65	500	450	5.2	26	#N/A	3.2	0.18	3.6	0.090	0.027	0.14	2.1	0.015	0.000090	0.00018	0.0067	0.000018	0.0000045	0.00032	0.000067	0.71	0.00023	0.0024	1.0	0.0072	0.000014	0.00045	0.076	0.0074	0.0045	0.000077	0.00072	0.0041	0.35	0.00023	0.60	0.0000045	0.10	0.0067	1.5	0.0000090	0.000023	0.000045	0.00015	0.000014	0.0063	0.0000045
5-Mar-13	66	500	450	5.3	25																																										
12-Mar-13	67	500	455	5.2	25																																										
Median (last 5)				5.4	25	#N/A	2.5	0.18	3.6	0.090	0.027	0.14	2.2	0.0091	0.000090	0.000091	0.0053	0.0000091	0.0000045	0.00036	0.000046	0.78	0.00023	0.0020	0.59	0.0041	0.0000093	0.00045	0.076	0.0074	0.0045	0.00017	0.00055	0.0041	0.34	0.00015	0.60	0.0000045	0.10	0.0067	1.3	0.0000090	0.00011	0.000045	0.00014	0.000077	0.0063	0.0000045

Leachate Results for HC10

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	500	385	4.5	1036	3.4	209	#N/A	516	3.7	2.1	0.30	246	20	0.0076	0.0036	0.034	0.0042	0.000010	0.033	0.023	74	0.0072	0.78	141	2.0	0.0011	0.020	15	1.9	0.030	0.0063	0.64	0.054	15	0.019	0.80	0.000050	46	0.22	177	0.0023	0.000060	0.00040	0.064	0.00054	3.1	0.0020
6-Dec-11	1	500	470	4.4	686	2.0	126	#N/A	306	2.1	0.060	0.30	148	10	0.0069	0.0019	0.019	0.0036	0.000010	0.066	0.016	40	0.0065	0.55	59	0.81	0.00047	0.020	12	1.4	0.030	0.0042	0.46	0.058	8.5	0.014	2.3	0.00010	27	0.12	119	0.0016	0.000010	0.00040	0.035	0.00046	2.5	0.0011
13-Dec-11	2	500	435	4.6	421	#N/A	80	0.10	180	1.3	1.1	0.30	88	5.0	0.0045	0.0017	0.018	0.0019	0.000010	0.049	0.0092	25	0.0051	0.42	36	0.47	0.0060	0.014	6.5	0.86	0.020	0.0030	0.37	0.046	5.4	0.012	1.6	0.000020	12	0.076	66	0.00096	0.00051	0.00030	0.019	0.00021	1.6	0.00046
20-Dec-11	3	500	520	4.7	303	#N/A	58	0.10	151	0.60	0.86	0.30	67	3.2	0.0053	0.0015	0.017	0.0016	0.000010	0.039	0.0056	21	0.0026	0.19	26	0.45	0.000080	0.0090	3.6	0.50	0.010	0.0020	0.16	0.21	3.8	0.0053	2.5	0.000010	4.6	0.063	46	0.00083	0.000010	0.00070	0.011	0.00039	0.81	0.00025
27-Dec-11	4	500	435	4.8	221																																													
3-Jan-12	5	500	445	4.7	159	#N/A	30	0.10	72	0.40	0.50	0.30	29	2.2	0.0033	0.0010	0.017	0.00099	0.000010	0.022	0.0036	8.8	0.0012	0.10	14	0.25	0.0023	0.0060	1.6	0.24	0.010	0.0011	0.090	0.024	2.3	0.0024	0.72	0.000010	1.1	0.031	21	0.00043	0.000070	0.00050	0.0065	0.00057	0.48	0.00013
10-Jan-12	6	500	430	4.6	149																																												
17-Jan-12	7	500	445	4.7	117	#N/A	25	0.10	55	0.20	0.40	0.30	21	1.6	0.0035	0.0011	0.021	0.00097	0.000010	0.017	0.0028	6.5	0.0011	0.063	12	0.34	0.0045	0.0050	1.1	0.16	0.010	0.0012	0.057	0.12	2.0	0.0017	0.72	0.000010	0.38	0.025	16	0.00032	0.000030	0.00020	0.0050	0.00028	0.36	0.000090
24-Jan-12	8	500	440	4.7	115																																											
31-Jan-12	9	500	450	4.6	109	#N/A	21	0.10	47	0.20	0.39	0.30	14	1.0	0.0027	0.00090	0.022	0.00092	0.000010	0.013	0.0015	4.4	0.00080	0.049	11	0.38	0.00038	0.0040	0.80	0.13	0.010	0.00091	0.045	0.0090	1.5	0.0021	0.76	0.000010	0.23	0.019	14	0.00022	0.000020	0.00020	0.0048	0.00035	0.28	0.000040
7-Feb-12	10	500	455	4.6	108																																											
14-Feb-12	11	500	450	4.6	119	#N/A	32	0.10	51	0.20	0.42	0.30	14	1.8	0.0020	0.00090	0.018	0.0010	0.000010	0.012	0.0016	4.2	0.00060	0.050	13	0.61	0.000070	0.0030	0.73	0.14	0.010	0.00099	0.046	0.11	1.3	0.0017	0.74	0.000010	0.19	0.020	14	0.00021	0.000010	0.00020	0.0067	0.00019	0.28	0.000020
21-Feb-12	12	500	465	4.6	115																																											
28-Feb-12	13	500	465	4.5	111	1.2	30	#N/A	42	0.20	0.41	0.30	11	2.0	0.0020	0.00080	0.017	0.00096	0.000010	0.011	0.0013	3.2	0.00060	0.038	10	0.74	0.00021	0.0030	0.58	0.13	0.010	0.00072	0.038	0.11	1.3	0.0014	0.77	0.000010	0.16	0.018	13	0.00029	0.000060	0.00020	0.0070	0.00022	0.26	0.000030
6-Mar-12	14	500	445	4.5	136																																											
13-Mar-12	15	500	450	4.3	130	2.6	40	#N/A	53	0.20	0.48	0.30	10	2.6	0.0022	0.00080	0.013	0.0011	0.000010	0.010	0.0016	3.2	0.00080	0.048	12	1.2	0.00013	0.0020	0.53	0.15	0.010	0.00073	0.041	0.065	1.1	0.0018	0.79	0.000020	0.12	0.017	17	0.00019	0.00017	0.00010	0.011	0.000050	0.32	0.000040
20-Mar-12	16	500	445	4.4	128																																											
27-Mar-12	17	500	450	4.2	145	3.9	44	#N/A	63	0.20	0.48	0.30	8.6	4.0	0.0015	0.00060	0.0098	0.0017	0.000010	0.0081	0.0013	2.7	0.00070	0.037	11	1.7	0.0012	0.0030	0.43	0.15	0.010	0.00058	0.033	0.054	0.94	0.0017	0.76	0.000020	0.11	0.014	19	0.00019	0.000010	0.00010	0.015	0.00022	0.27	0.000030
3-Apr-12	18	500	460	4.2	135																																											
10-Apr-12	19	500	450	4.2	120	#N/A	37	0.10	58	0.20	0.44	0.30	6.1	3.8	0.0017	0.00060	0.018	0.0017	0.000010	0.0070	0.0013	2.0	0.00080	0.034	9.8	1.8	0.00038	0.0030	0.31	0.12	0.020	0.0021	0.029	0.049	0.75	0.0019	0.80	0.000020	0.10	0.011	17	0.00014	0.00030	0.00020	0.015	0.00020	0.29	0.000030
17-Apr-12	20	500	455	4.2	157																																											
24-Apr-12	21	500	460	4.1	132	6.6	44	#N/A	53	1.0	0.37	0.30	4.7	4.0	0.0019	0.00080	0.015	0.0017	0.000010	0.0061	0.0012	1.5	0.00090	0.025	8.4	2.1	0.0013	0.0030	0.24	0.10	0.030	0.00069	0.023	0.042	0.66	0.0015	0.90	0.000010	0.10	0.0096	16	0.00013	0.000030	0.00010	0.017	0.00028	0.27	0.000020
1-May-12	22	500	440	4.2	141																																											
8-May-12	23	500	460	4.1	135	8.0	46	#N/A	53	1.0	0.25	0.30	4.4	3.9	0.0017	0.00090	0.017	0.0014	0.000010	0.0068	0.0012	1.4	0.00080	0.024	7.1	2.3	0.0093	0.0020	0.21	0.11	0.010	0.00092	0.021	0.0090	0.58	0.0016	0.78	0.000010	0.090	0.0085	17	0.00011	0.00020	0.00010	0.017	0.00017	0.26	0.000020
15-May-12	24	500	445	4.0	151																																											
22-May-12	25	500	430	4.1	177	12	70	#N/A	72	1.0	0.39	0.30	4.4	7.4	0.0033	0.0015	0.010	0.0020	0.000010	0.0069	0.0015	1.3	0.0019	0.029	9.6	4.0	0.00025	0.0040	0.27	0.14	0.020	0.0012	0.025	0.0090	1.1	0.0021	1.1	0.000010	0.13	0.0089	24	0.00020	0.00012	0.00030	0.026	0.00039	0.33	0.000080
29-May-12	26	500	435	4.1	138																																											
5-Jun-12	27	500	440	4.1	131	7.4	47	#N/A	51	1.0	0.30	0.30	3.7	4.8	0.0014	0.00070	0.0099	0.0016	0.000010	0.0070	0.00095	1.1	0.0010	0.024	5.6	2.5	0.000030	0.0030	0.21	0.10	0.020	0.00053	0.025	0.042	0.60	0.0017	0.76	0.000010	0.12	0.0070	17	0.00011	0.000050	0.00040	0.016	0.00046	0.23	0.000040
12-Jun-12	28	500	455	4.1	127																																											
19-Jun-12	29	500	445	4.0	133	9.2	48	#N/A	51	0.20	0.27	0.30	2.8	4.9	0.0012	0.00080	0.0089	0.0015	0.000010	0.0046	0.00089	0.81	0.0010	0.022	5.2	2.4	0.00022	0.0030	0.18	0.097	0.010	0.027	0.019	0.018	0.46	0.0017	0.80	0.000010	0.090	0.0059	16	0.00010	0.00012	0.00020	0.019	0.00041	0.21	0.000020
26-Jun-12	30	500	445	4.0	139																																											
3-Jul-12	31	500	445	4.1	149	14	62	#N/A	59	1.0	0.28	0.30	2.9	5.9	0.0015	0.00080	0.013	0.0015	0.000010	0.0032	0.0010	0.83	0.0010	0.023	5.7	3.0	0.00013	0.0020	0.19	0.11	0.010	0.00056	0.018	0.0090	0.43	0.0017	0.72	0.000010	0.070	0.0058	19	0.000090	0.00012	0.00010	0.021	0.00030	0.25	0.000060
10-Jul-12	32	500	445	3.9	170																																											
17-Jul-12	33	500	445	3.8	174	23	62	#N/A	70	1.0	0.30	0.30	3.1	6.8	0.0018	0.0015	0.0079	0.0019	0.000010	0.0054	0.0015	0.84	0.0014	0.029	6.6	4.0	0.000070	0.0030	0.24	0.14	0.010	0.00074	0.022	0.0090	0.43	0.0024	0.97	0.00014	0.080	0.0064	23	0.00010	0.00015	0.00010	0.030	0.00031	0.35	0.000030
24-Jul-12	34	500	440	3.9	191																																											
31-Jul-12	35	500	445	3.8	183	25	71	#N/A	81	0.20	0.30	0.30	2.9	7.2	0.0017	0.0010	0.0074	0.0016	0.000010	0.0038	0.0015	0.76	0.0017	0.025	6.6	4.4	0.00014	0.0030	0.25	0.14	0.020	0.00055	0.020	0.0090	0.36	0.0021	1.1	0.000020	0.070	0.0060	23	0.000090	0.00012	0.00020	0.032	0.00043	0.36	0.000020
7-Aug-12	36	500	460	3.8	195																																											
14-Aug-12	37	500	445	3.8	220	39	96	#N/A	98	1.0	0.32	0.30	3.4	12	0.0016	0.0016	0.0068	0.0017	0.000010	0.0032	0.0019	0.84	0.0021	0.030	7.4	4.6	0.0012	0.0030	0.32	0.17	0.010	0.00060	0.024	0.0090	0.35	0.0018	1.2	0.000030	0.080	0.0064	30	0.000090	0.00010	0.00050	0.040	0.00067	0.49	0.000030
21-Aug-12	38	500	450	3.7	230																																											
28-Aug-12	39	500	490	3.7	248	35	96	#N/A	107	1.0	0.31	0.30	3.6	12	0.0018	0.0011	0.0063	0.0016	0.000010	0.0041	0.0020	0.91	0.0026	0.031	6.8	4.3	0.000060	0.0030	0.33	0.18	0.010	0.00048	0.023	0.043	0.34	0.0017	2.8	0.000040	0.070	0.0079	32	0.000090	0.00023	0.0010	0.050	0.00035	0.42	0.000040
4-Sep-12	40	500	480	3.7	259																																											
11-Sep-12	41	500	450	3.6	319	64	143	#N/A	126	1.0	0.35	0.30	4.4	17	0.0015	0.0010	0.0053	0.0015	0.000010	0.0018	0.0026	0.95	0.0041	0.040	8.3	4.5	0.00017	0.0030	0.50	0.20	0.010	0.00053	0.028	0.0090	0.30	0.0021	1.6	0.000040	0.080	0.0072	43	0.000090	0.00014	0.00020	0.070	0.00020	0.65	0.000060
18-Sep-12	42	500	505	3.5	336																																											
25-Sep-12	43	500	450	3.5	354	64	134	#N/A	123	0.20	0.31	0.30	4.9	19	0.00020	0.00080	0.0046	0.0016	0.000010	0.00040	0.0027	0.87	0.0066	0.047	7.9	5.1	0.00013	0.0040	0.66	0.19	0.030	0.013	0.031	0.066	0.26	0.0013	1.8	0.000010	0.080	0.0067	49	0.000020	0.00029	0.00010	0.073	0.00028	0.62	0.000090
2-Oct-12	44	500	460	3.6	260																																											
9-Oct-12	45	500	470	3.3	382	76	145	#N/A	134	1.0	0.30	0.30	4.6	17	0.00040	0.00070	0.0044	0.00085	0.000010	0.0013	0.0024	0.73	0.0062	0.040	6.0	4.8	0.00036	0.0030	0.68	0.17	0.010	0.000010	0.018	0.057	0.23	0.0023	2.0	0.000020	0.060	0.0061	46	0.000070	0.00016	0.00010	0.057	0.000030	0.49	0.000090
16-Oct-12	46	500	455	3.5	433																																											
23-Oct-12	47	500	480	3.1	496																																											
30-Oct-12	48	500	465	3.5	304																																										
6-Nov-12	49	500	435	3.2	438	77	152	#N/A	163	1.0	0.38	0.30	8.5	20	0.00050	0.0011	0.0042	0.0012	0.000010	0.0013	0.0026	1.2	0.0060	0.056	6.3	9.1	0.000090	0.0030	1.3	0.30	0.010	0.00016	0.034	0.083	0.22	0.0014	1.6	0.000010	0.060	0.0076	60	0.000060	0.00018	0.00020	0.062	0.000030	0.56	0.00018
13-Nov-12	50	500	450	3.3	350																																											
20-Nov-12	51	500	490	3.2	482																																										
27-Nov-12	52	500	490	3.3	410																																										
4-Dec-12	53	500	455	3.1	578	97	175	#N/A	154	1.0	0.30	0.30	6.8	17	0.00060	0.0019	0.0073	0.0010	0.000010	0.0015	0.0028	0.94	0.0058	0.053	5.4	16	0.0090	0.0030	1.1	0.25	0.020	0.00039	0.030	0.045	0.22	0.00038	2.6	0.000050	0.070	0.011	65	0.000070	0.00016	0.00020	0.050	0.00039	0.56	0.00012
11-Dec-12	54	500	460	3.3	470																																											
18-Dec-12	55	500	465	3.1	511																																										
25-Dec-12	56	500	455	3.4	460																																										
1-Jan-13	57	500	455	3.1	505	82	147	#N/A	165	1.0	0.36	0.30	6.9	12	0.00040	0.0018	0.0060	0.00083	0.000010	0.00060	0.0020	0.95	0.0051	0.042	4.0	11	0.0092	0.0020	1.1	0.18	0.010	0.00020	0.024	0.013	0.18	0.0011	2.3	0.000050	0.060	0.0088	52	0.000050	0.00020	0.00070	0.042	0.00028	0.42	0.00014
8-Jan-13	58	500	470	3.2	490																																											
15-Jan-13	59	500	480	3.1	436																																										
22-Jan-13	60	500	465	3.2	475																																										
29-Jan-13	61	500	450	3.1	476	81	141	#N/A	170	1.0	0.40	0.30	7.6	15	0.00040	0.0018	0.0051	0.00093	0.000010	0.0010	0.0018	1.0	0.0048	0.044	4.0	11	0.00017	0.0030	1.2	0.14	0.010	0.00020	0.022	0.041	0.17	0.0011	1.9	0.000030	0.10	0.0085	54	0.000050	0.00020	0.00010	0.040	0.00036	0.36	0.00014
5-Feb-13	62	500	435	3.2	495																																										
12-Feb-13	63	500	480	3.1	528																																										
19-Feb-13	64	500	460	3.1	510																																										
26-Feb-13	65	500	450	3.1	494	82	138	#N/A	167	1.0	0.47	0.30	7.9	17	0.00040	0.0027	0.0042	0.00093	0.000010	0.00040	0.0019	1.1	0.0052	0.045	3.9	11	0.00026	0.0030	1.2	0.10	0.010	0.00028	0.023	0.050	0.15	0.0011	1.6	0.000030	0.050	0.0066	51	0.000040	0.000030	0.00010	0.039	0.00061	0.36	0.00012
5-Mar-13	66	500	455	3.2	423																																										
12-Mar-13	67	500	420	3.3	357																																										

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC10

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	385	4.5	1036	1.3	80	#N/A	199	1.4	0.79	0.12	95	7.7	0.0029	0.0014	0.013	0.0016	0.0000039	0.013	0.0090	29	0.0028	0.30	54	0.75	0.00043	0.0077	5.7	0.72	0.012	0.0024	0.25	0.021	5.7	0.0073	0.31	0.000019	18	0.084	68	0.00088	0.000023	0.00015	0.025	0.00021	1.2	0.00077
6-Dec-11	1	500	470	4.4	686	0.92	59	#N/A	144	0.99	0.028	0.14	70	4.9	0.0032	0.00089	0.0091	0.0017	0.0000047	0.031	0.0074	19	0.0031	0.26	27	0.38	0.00022	0.0094	5.4	0.65	0.014	0.0020	0.22	0.027	4.0	0.0064	1.1	0.0000047	13	0.057	56	0.00077	0.0000047	0.00019	0.016	0.00022	1.2	0.00049
13-Dec-11	2	500	435	4.6	421	#N/A	35	0.044	78	0.57	0.49	0.13	38	2.2	0.0020	0.00074	0.0080	0.00084	0.0000044	0.021	0.0040	11	0.0022	0.18	15	0.20	0.0026	0.0061	2.8	0.37	0.0087	0.0013	0.16	0.020	2.4	0.0051	0.70	0.0000087	5.2	0.033	28	0.00042	0.00022	0.00013	0.0084	0.000091	0.68	0.00020
20-Dec-11	3	500	520	4.7	303	#N/A	30	0.052	79	0.31	0.45	0.16	35	1.7	0.0028	0.00078	0.0090	0.00081	0.0000052	0.020	0.0029	11	0.0014	0.10	13	0.24	0.000042	0.0047	1.9	0.26	0.0052	0.0011	0.085	0.11	2.0	0.0028	1.3	0.0000052	2.4	0.033	24	0.00043	0.0000052	0.00036	0.0055	0.00020	0.42	0.00013
27-Dec-11	4	500	435	4.8	221																																												
3-Jan-12	5	500	445	4.7	159	#N/A	13	0.045	32	0.18	0.22	0.13	13	0.98	0.0015	0.00045	0.0076	0.00044	0.0000045	0.0097	0.0016	3.9	0.00053	0.045	6.4	0.11	0.0010	0.0027	0.73	0.11	0.0045	0.00050	0.040	0.011	1.0	0.0011	0.32	0.0000045	0.47	0.014	9.4	0.00019	0.000031	0.00022	0.0029	0.00025	0.21	0.000058
10-Jan-12	6	500	430	4.6	149																																											
17-Jan-12	7	500	445	4.7	117	#N/A	11	0.045	24	0.089	0.18	0.13	9.1	0.69	0.0016	0.00049	0.0095	0.00043	0.0000045	0.0074	0.0013	2.9	0.00049	0.028	5.4	0.15	0.0020	0.0022	0.47	0.070	0.0045	0.00054	0.025	0.053	0.87	0.00076	0.32	0.0000045	0.17	0.011	7.1	0.00014	0.000013	0.0000089	0.0022	0.00012	0.16	0.000040
24-Jan-12	8	500	440	4.7	115																																											
31-Jan-12	9	500	450	4.6	109	#N/A	9.5	0.045	21	0.090	0.18	0.14	6.3	0.47	0.0012	0.00041	0.0099	0.00041	0.0000045	0.0058	0.00068	2.0	0.00036	0.022	5.1	0.17	0.00017	0.0018	0.36	0.060	0.0045	0.00041	0.020	0.0041	0.66	0.00093	0.34	0.0000045	0.10	0.0087	6.1	0.000099	0.0000090	0.000090	0.0022	0.00016	0.12	0.000018
7-Feb-12	10	500	455	4.6	108																																											
14-Feb-12	11	500	450	4.6	119	#N/A	14	0.045	23	0.090	0.19	0.14	6.1	0.81	0.00090	0.00041	0.0083	0.00046	0.0000045	0.0052	0.00071	1.9	0.00027	0.023	5.8	0.27	0.000032	0.0014	0.33	0.063	0.0045	0.00045	0.021	0.049	0.56	0.00077	0.33	0.0000045	0.086	0.0090	6.4	0.000095	0.0000045	0.000090	0.0030	0.000086	0.13	0.0000090
21-Feb-12	12	500	465	4.6	115																																											
28-Feb-12	13	500	465	4.5	111	0.53	14	#N/A	20	0.093	0.19	0.14	4.9	0.94	0.00093	0.00037	0.0078	0.00045	0.0000047	0.0049	0.00060	1.5	0.00028	0.018	4.8	0.34	0.000098	0.0014	0.27	0.061	0.0047	0.00033	0.017	0.051	0.60	0.00063	0.36	0.0000047	0.074	0.0082	5.9	0.00013	0.000028	0.000093	0.0033	0.00010	0.12	0.000014
6-Mar-12	14	500	445	4.5	136																																											
13-Mar-12	15	500	450	4.3	130	1.2	18	#N/A	24	0.090	0.22	0.14	4.6	1.2	0.00099	0.00036	0.0059	0.00050	0.0000045	0.0045	0.00071	1.4	0.00036	0.021	5.6	0.56	0.000059	0.00090	0.24	0.066	0.0045	0.00033	0.018	0.029	0.48	0.00081	0.36	0.0000090	0.054	0.0074	7.5	0.000086	0.000077	0.000045	0.0050	0.000023	0.14	0.000018
20-Mar-12	16	500	445	4.4	128																																											
27-Mar-12	17	500	450	4.2	145	1.8	20	#N/A	28	0.090	0.22	0.14	3.9	1.8	0.00068	0.00027	0.0044	0.00077	0.0000045	0.0036	0.00060	1.2	0.00032	0.017	5.1	0.75	0.00056	0.0014	0.19	0.066	0.0045	0.00026	0.015	0.024	0.42	0.00074	0.34	0.0000090	0.050	0.0063	8.3	0.000086	0.0000045	0.000045	0.0068	0.000099	0.12	0.000014
3-Apr-12	18	500	460	4.2	135																																											
10-Apr-12	19	500	450	4.2	120	#N/A	17	0.045	26	0.090	0.20	0.14	2.8	1.7	0.00077	0.00027	0.0081	0.00077	0.0000045	0.0032	0.00060	0.88	0.00036	0.015	4.4	0.82	0.00017	0.0014	0.14	0.053	0.0090	0.00092	0.013	0.022	0.34	0.00084	0.36	0.0000090	0.045	0.0050	7.7	0.000063	0.000014	0.000090	0.0067	0.000090	0.13	0.000014
17-Apr-12	20	500	455	4.2	157																																											
24-Apr-12	21	500	460	4.1	132	3.0	20	#N/A	24	0.46	0.17	0.14	2.2	1.9	0.00087	0.00037	0.0067	0.00077	0.0000046	0.0028	0.00054	0.68	0.00041	0.011	3.8	0.94	0.00059	0.0014	0.11	0.046	0.014	0.00032	0.010	0.019	0.31	0.00070	0.41	0.0000046	0.046	0.0044	7.2	0.000060	0.000014	0.000046	0.0080	0.00013	0.13	0.0000092
1-May-12	22	500	440	4.2	141																																											
8-May-12	23	500	460	4.1	135	3.7	21	#N/A	24	0.46	0.12	0.14	2.0	1.8	0.00078	0.00041	0.0078	0.00066	0.0000046	0.0031	0.00054	0.64	0.00037	0.011	3.3	1.1	0.0043	0.00092	0.098	0.048	0.0046	0.00042	0.0096	0.0041	0.27	0.00073	0.36	0.0000046	0.041	0.0039	7.6	0.000051	0.000092	0.000046	0.0077	0.000078	0.12	0.0000092
15-May-12	24	500	445	4.0	151																																											
22-May-12	25	500	430	4.1	177	5.0	30	#N/A	31	0.43	0.17	0.13	1.9	3.2	0.0014	0.00065	0.0044	0.00084	0.0000043	0.0030	0.00065	0.57	0.00082	0.013	4.1	1.7	0.00011	0.0017	0.12	0.062	0.0086	0.00050	0.011	0.0039	0.45	0.00090	0.46	0.0000043	0.056	0.0038	10	0.000086	0.000052	0.00013	0.011	0.00017	0.14	0.000034
29-May-12	26	500	435	4.1	138																																										
5-Jun-12	27	500	440	4.1	131	3.3	21	#N/A	22	0.44	0.13	0.13	1.6	2.1	0.00062	0.00031	0.0044	0.00070	0.0000044	0.0031	0.00042	0.49	0.00044	0.011	2.5	1.1	0.000013	0.0013	0.094	0.045	0.0088	0.00023	0.011	0.018	0.26	0.00073	0.33	0.0000044	0.053	0.0031	7.4	0.000048	0.000022	0.00018	0.0072	0.00020	0.10	0.000018
12-Jun-12	28	500	455	4.1	127																																										
19-Jun-12	29	500	445	4.0	133	4.1	21	#N/A	23	0.089	0.12	0.13	1.2	2.2	0.00053	0.00036	0.0040	0.00065	0.0000045	0.0020	0.00039	0.36	0.00045	0.0098	2.3	1.1	0.000098	0.0013	0.081	0.043	0.0045	0.012	0.0085	0.0080	0.21	0.00076	0.36	0.0000045	0.040	0.0026	6.9	0.000045	0.000053	0.000089	0.0083	0.00018	0.093	0.0000089
26-Jun-12	30	500	445	4.0	139																																										
3-Jul-12	31	500	445	4.1	149	6.2	27	#N/A	26	0.45	0.12	0.13	1.3	2.6	0.00067	0.00036	0.0056	0.00066	0.0000045	0.0014	0.00046	0.37	0.00045	0.010	2.6	1.3	0.000058	0.00089	0.085	0.049	0.0045	0.00025	0.0080	0.0040	0.19	0.00077	0.32	0.0000045	0.031	0.0026	8.2	0.000040	0.000053	0.000045	0.0095	0.00013	0.11	0.000027
10-Jul-12	32	500	445	3.9	170																																										
17-Jul-12	33	500	445	3.8	174	10	28	#N/A	31	0.45	0.13	0.13	1.4	3.0	0.00080	0.00067	0.0035	0.00085	0.0000045	0.0024	0.00066	0.37	0.00062	0.013	3.0	1.8	0.000031	0.0013	0.11	0.061	0.0045	0.00033	0.0096	0.0040	0.19	0.0011	0.43	0.000062	0.036	0.0028	10	0.000045	0.000067	0.000045	0.013	0.00014	0.16	0.000013
24-Jul-12	34	500	440	3.9	191																																										
31-Jul-12	35	500	445	3.8	183	11	32	#N/A	36	0.089	0.13	0.13	1.3	3.2	0.00076	0.00045	0.0033	0.00073	0.0000045	0.0017	0.00067	0.34	0.00076	0.011	2.9	2.0	0.000062	0.0013	0.11	0.063	0.0089	0.00024	0.0090	0.0040	0.16	0.00093	0.48	0.0000089	0.031	0.0027	10	0.000040	0.000053	0.000089	0.014	0.00019	0.16	0.0000089
7-Aug-12	36	500	460	3.8	195																																										
14-Aug-12	37	500	445	3.8	220	17	43	#N/A	44	0.45	0.14	0.13	1.5	5.2	0.00071	0.00071	0.0030	0.00076	0.0000045	0.0014	0.00083	0.37	0.00093	0.013	3.3	2.0	0.00055	0.0013	0.14	0.073	0.0045	0.00027	0.011	0.0040	0.15	0.00081	0.54	0.000013	0.036	0.0028	13	0.000040	0.000045	0.000022	0.018	0.00030	0.22	0.000013
21-Aug-12	38	500	450	3.7	230																																										
28-Aug-12	39	500	490	3.7	248	17	47	#N/A	52	0.49	0.15	0.15	1.8	5.9	0.00088	0.00054	0.0031	0.00078	0.0000049	0.0020	0.00098	0.45	0.0013	0.015	3.3	2.1	0.000029	0.0015	0.16	0.086	0.0049	0.00024	0.011	0.021	0.17	0.00084	1.4	0.000020	0.034	0.0039	16	0.000044	0.00011	0.00049	0.024	0.00017	0.21	0.000020
4-Sep-12	40	500	480	3.7	259																																										
11-Sep-12	41	500	450	3.6	319	29	64	#N/A	57	0.45	0.16	0.14	2.0	7.7	0.00068	0.00045	0.0024	0.00069	0.0000045	0.00081	0.0012	0.43	0.0018	0.018	3.7	2.0	0.000077	0.0014	0.23	0.090	0.0045	0.00024	0.013	0.0041	0.13	0.00095	0.73	0.00018	0.036	0.0032	19	0.000041	0.00063	0.000090	0.032	0.000090	0.29	0.000027
18-Sep-12	42	500	505	3.5	336																																										
25-Sep-12	43	500	450	3.5	354	29	61	#N/A	55	0.090	0.14	0.14	2.2	8.7	0.000090	0.00036	0.0020	0.00072	0.0000045	0.00018	0.0012	0.39	0.0030	0.021	3.6	2.3	0.000059	0.0018	0.30	0.086	0.014	0.0059	0.014	0.030	0.12	0.00058	0.79	0.0000045	0.036	0.0030	22	0.0000090	0.00013	0.000045	0.033	0.00013	0.28	0.000041
2-Oct-12	44	500	460	3.6	260																																										
9-Oct-12	45	500	470	3.3	382	36	68	#N/A	63	0.47	0.14	0.14	2.2	8.2	0.00019	0.00033	0.0020	0.00040	0.0000047	0.00061	0.0011	0.34	0.0029	0.019	2.8	2.2	0.00017	0.0014	0.32	0.082	0.0047	0.0000047	0.0085	0.027	0.11	0.0011	0.92	0.0000094	0.028	0.0029	22	0.000033	0.000075	0.000047	0.027	0.000014	0.23	0.000042
16-Oct-12	46	500	455	3.5	433																																										
23-Oct-12	47	500	480	3.1	496																																										
30-Oct-12	48	500	465	3.5	304																																										
6-Nov-12	49	500	435	3.2	438	34	66	#N/A	71	0.44	0.17	0.13	3.7	8.7	0.00022	0.00048	0.0018	0.00051	0.0000044	0.00057	0.0011	0.52	0.0026	0.025	2.8	3.9	0.000039	0.0013	0.58	0.13	0.0044	0.000070	0.015	0.036	0.097	0.00060	0.68	0.0000044	0.026	0.0033	26	0.000026	0.000078	0.000087	0.027	0.000013	0.24	0.000078
13-Nov-12	50	500	450	3.3	350																																										
20-Nov-12	51	500	490	3.2	482																																										
27-Nov-12	52	500	490	3.3	410																																										
4-Dec-12	53	500	455	3.1	578	44	80	#N/A	70	0.46	0.14	0.14	3.1	7.9	0.00027	0.00086	0.0033	0.00046	0.0000046	0.00068	0.0013	0.43	0.0026	0.024	2.5	7.1	0.0041	0.0014	0.49	0.12	0.0091	0.00018	0.014	0.020	0.10	0.00017	1.2	0.000023	0.032	0.0050	30	0.000032	0.000073	0.000091	0.023	0.00018	0.26	0.000055
11-Dec-12	54	500	460	3.3	470																																										
18-Dec-12	55	500	465	3.1	511																																										
25-Dec-12	56	500	455	3.4	460																																										
1-Jan-13	57	500	455	3.1	505	37	67	#N/A	75	0.46	0.16	0.14	3.1	5.5	0.00018	0.00082	0.0027	0.00038	0.0000046	0.00027	0.00092	0.43	0.0023	0.019	1.8	5.1	0.0042	0.00091	0.50	0.080	0.0046	0.000091	0.011	0.0059	0.083	0.00049	1.0	0.000023	0.027	0.0040	24	0.000023	0.000091	0.00032	0.019	0.00013	0.19	0.000064
8-Jan-13	58	500	470	3.2	490																																										
15-Jan-13	59	500	480	3.1	436																																										
22-Jan-13	60	500	465	3.2	475																																										
29-Jan-13	61	500	450	3.1	476	37	63	#N/A	77	0.45	0.18	0.14	3.4	6.8	0.00018	0.00081	0.0023	0.00042	0.0000045	0.00045	0.00081	0.46	0.0022	0.020	1.8	4.9	0.000077	0.0014	0.55	0.064	0.0045	0.000090	0.0099	0.018	0.077	0.00048	0.86	0.000014	0.045	0.0038	24	0.000023	0.000090	0.000045	0.018	0.00016	0.16	0.000063
5-Feb-13	62	500	435	3.2	495																																										
12-Feb-13	63	500	480	3.1	528																																										
19-Feb-13	64	500	460	3.1	510																																										
26-Feb-13	65	500	450	3.1	494	37	62	#N/A	75	0.45	0.21	0.14	3.5	7.6	0.00018	0.0012	0.0019	0.00042	0.0000045	0.00018	0.00086	0.51	0.0023	0.020	1.8	4.8	0.00012	0.0014	0.55	0.046	0.0045	0.00013	0.010	0.023	0.068	0.00050	0.70	0.000014	0.023	0.0030	23	0.000018	0.000014	0.000045	0.018	0.00027	0.16	0.000054
5-Mar-13	66	500	455	3.2	423																																										
12-Mar-13	67	500	420	3.3	357																																										
Median (last 5)				3.2	482	37	66	#N/A	75	0.45	0.17	0.14	3.4	7.6	0.00018	0.00082	0.0023	0.00042	0.0000045	0.00045	0.00092	0.46	0.0023	0.020	1.8	4.9	0.00012	0.0014	0.55	0.080	0.0045	0.000091	0.011	0.020	0.083	0.00049	0.86	0.000014	0.027	0.0038	24	0.000023	0.000078	0.000087	0.019	0.00016	0.19	0.000063

Leachate Results for HC11

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	500	395	7.3	791	#N/A	8.0	34	352	2.1	1.9	0.30	356	0.054	0.0019	0.0018	0.027	0.000020	0.000020	0.0068	0.00016	123	0.00050	0.0046	0.032	0.0030	0.000050	0.0020	12	0.035	0.010	0.013	0.0054	0.0090	7.1	0.017	1.4	0.000010	23	0.52	124	0.000060	0.000060	0.00030	0.025	0.00056	0.018	0.00025
6-Dec-11	1	500	480	7.5	389	#N/A	4.6	29	154	1.2	1.9	0.30	164	0.038	0.0012	0.0013	0.022	0.000020	0.000010	0.0038	0.000020	56	0.0011	0.00042	0.0082	0.0030	0.000020	0.0010	5.8	0.018	0.010	0.017	0.00020	0.0090	4.1	0.010	1.2	0.000010	14	0.24	56	0.000020	0.000010	0.00040	0.018	0.00029	0.0030	0.00013
13-Dec-11	2	500	510	7.4	207	#N/A	4.1	27	59	0.20	1.6	0.30	82	0.023	0.00080	0.00080	0.032	0.000020	0.000020	0.0030	0.0000060	29	0.00070	0.00019	0.0042	0.0030	0.00010	0.0010	2.5	0.0098	0.010	0.012	0.00080	0.010	2.7	0.0043	0.88	0.000010	7.2	0.13	24	0.000020	0.00016	0.00030	0.013	0.00025	0.0060	0.000080
20-Dec-11	3	500	500	7.5	140	#N/A	4.7	30	42	0.20	1.9	0.30	65	0.045	0.0013	0.0012	0.030	0.000020	0.000010	0.0030	0.000020	23	0.00050	0.00016	0.0041	0.0080	0.000020	0.0010	2.0	0.011	0.010	0.011	0.00070	0.0090	2.4	0.0020	1.4	0.000010	6.2	0.096	17	0.000020	0.000010	0.00090	0.013	0.00039	0.0040	0.000070
27-Dec-11	4	500	525	7.5	69																																												
3-Jan-12	5	500	475	7.5	81	#N/A	4.1	28	16	0.20	1.6	0.30	28	0.054	0.0014	0.0011	0.036	0.000020	0.000010	0.0026	0.0000030	9.7	0.00050	0.000085	0.0028	0.0040	0.000020	0.0010	0.99	0.0039	0.010	0.0074	0.00050	0.0090	1.7	0.00072	0.93	0.000010	3.1	0.044	5.3	0.000020	0.000020	0.00060	0.013	0.00057	0.0010	0.000040
10-Jan-12	6	500	445	7.4	83																																											
17-Jan-12	7	500	425	7.5	86	#N/A	3.1	34	11	0.20	1.7	0.30	36	0.059	0.0035	0.0014	0.037	0.000020	0.000010	0.0037	0.0000090	12	0.00050	0.000095	0.0047	0.0070	0.000020	0.0010	1.3	0.0038	0.010	0.0068	0.00020	0.0090	2.0	0.0011	1.4	0.000010	3.0	0.055	5.4	0.000020	0.000010	0.0018	0.027	0.00059	0.0010	0.00013
24-Jan-12	8	500	465	7.5	77																																											
31-Jan-12	9	500	475	7.4	81	#N/A	3.3	32	14	0.20	1.4	0.30	31	0.038	0.0019	0.0012	0.040	0.000020	0.000010	0.0023	0.0000030	10	0.00050	0.000072	0.0026	0.0030	0.000020	0.0010	1.1	0.0032	0.010	0.0047	0.00010	0.0090	1.9	0.00075	1.0	0.000010	2.0	0.049	4.5	0.000020	0.000040	0.00030	0.014	0.00059	0.0020	0.000030
7-Feb-12	10	500	485	7.4	78																																											
14-Feb-12	11	500	485	7.4	78	#N/A	4.6	27	19	0.20	1.2	0.30	32	0.027	0.0015	0.0013	0.037	0.000020	0.000010	0.0018	0.0000030	11	0.00050	0.000060	0.0018	0.0030	0.000020	0.0010	1.2	0.0042	0.010	0.0038	0.00030	0.0090	1.7	0.0012	0.95	0.000010	1.5	0.053	4.8	0.000020	0.000010	0.00040	0.012	0.00052	0.0030	0.000030
21-Feb-12	12	500	475	7.4	79																																											
28-Feb-12	13	500	450	7.3	71	#N/A	3.9	25	11	0.20	0.97	0.30	30	0.033	0.0014	0.0011	0.031	0.000020	0.000010	0.0019	0.0000030	10	0.00050	0.000057	0.0026	0.0040	0.000040	0.0010	1.1	0.0035	0.010	0.0025	0.00010	0.0090	1.9	0.00041	0.87	0.000010	1.2	0.046	4.1	0.000020	0.000020	0.00050	0.0089	0.00044	0.0020	0.000020
6-Mar-12	14	500	450	7.3	73																																										
13-Mar-12	15	500	445	7.3	69	#N/A	3.0	24	13	0.20	0.89	0.30	30	0.026	0.0015	0.0011	0.031	0.000020	0.000010	0.0019	0.0000030	10	0.00050	0.000041	0.0015	0.0030	0.000020	0.0010	1.0	0.0031	0.010	0.0026	0.00010	0.0090	1.6	0.00033	0.96	0.000010	0.89	0.048	4.6	0.000020	0.00016	0.00040	0.0090	0.00029	0.0010	0.000030
20-Mar-12	16	500	460	7.3	74																																										
27-Mar-12	17	500	445	7.2	71	#N/A	3.2	22	14	0.20	0.77	0.30	31	0.038	0.0015	0.0013	0.031	0.000020	0.000010	0.0017	0.0000080	11	0.00050	0.000053	0.0021	0.0030	0.00010	0.0010	1.1	0.0029	0.010	0.0023	0.00010	0.012	1.6	0.00032	0.91	0.000010	0.75	0.047	4.9	0.000020	0.000010	0.00040	0.0092	0.00045	0.0010	0.000030
3-Apr-12	18	500	455	7.2	67																																										
10-Apr-12	19	500	445	7.3	73	#N/A	2.9	22	15	0.20	0.69	0.30	30	0.036	0.0016	0.0010	0.026	0.000020	0.000010	0.0020	0.0000030	11	0.00050	0.000060	0.0020	0.0030	0.000020	0.0010	1.0	0.0028	0.030	0.0023	0.00010	0.0090	1.5	0.00029	0.86	0.000010	0.59	0.048	5.3	0.000020	0.000030	0.00030	0.0070	0.00041	0.0010	0.000020
17-Apr-12	20	500	455	7.2	76																																										
24-Apr-12	21	500	470	7.2	70	#N/A	3.2	22	12	0.20	0.61	0.30	30	0.042	0.0017	0.0010	0.033	0.000020	0.000010	0.0017	0.0000030	10	0.00050	0.000058	0.0026	0.0030	0.000030	0.0010	0.99	0.0031	0.020	0.0020	0.00030	0.0090	1.5	0.000070	0.81	0.000010	0.46	0.047	4.7	0.000020	0.000020	0.00030	0.0074	0.00048	0.0020	0.000010
1-May-12	22	500	440	7.2	70																																										
8-May-12	23	500	430	7.2	67	#N/A	3.3	22	12	1.0	0.49	0.30	29	0.036	0.0017	0.0010	0.025	0.000020	0.000010	0.0018	0.0000030	9.9	0.00050	0.000064	0.0029	0.17	0.00010	0.0010	0.98	0.0040	0.010	0.0020	0.00040	0.0090	1.5	0.00033	0.80	0.000010	0.42	0.045	4.5	0.000020	0.00031	0.00080	0.0071	0.00037	0.0030	0.000010
15-May-12	24	500	430	7.2	67																																										
22-May-12	25	500	435	7.2	67	#N/A	3.9	21	9.0	0.20	0.52	0.30	28	0.067	0.0014	0.00090	0.025	0.000020	0.000010	0.0014	0.0000030	9.8	0.00050	0.000051	0.0017	0.0060	0.000020	0.0010	0.97	0.0026	0.010	0.0019	0.00020	0.0090	1.4	0.00032	0.82	0.000010	0.34	0.045	4.7	0.000020	0.000050	0.00070	0.0068	0.00055	0.0020	0.000020
29-May-12	26	500	420	7.1	65																																										
5-Jun-12	27	500	450	7.2	64	#N/A	4.0	22	9.0	0.20	0.45	0.30	29	0.068	0.0016	0.0012	0.026	0.000020	0.000010	0.0025	0.0000030	9.8	0.00050	0.000087	0.0020	0.0060	0.000030	0.0010	0.97	0.0025	0.030	0.0018	0.00010	0.0090	1.4	0.00048	0.85	0.000010	0.30	0.047	4.4	0.000020	0.000040	0.00060	0.0082	0.00063	0.0020	0.000010
12-Jun-12	28	500	435	7.1	60																																										
19-Jun-12	29	500	435	7.1	59	#N/A	3.2	16	9.0	0.20	0.45	0.30	25	0.070	0.0015	0.00090	0.021	0.000020	0.000010	0.0013	0.0000030	8.7	0.00050	0.000085	0.0054	0.0070	0.000040	0.0010	0.87	0.0023	0.010	0.0020	0.00020	0.0090	1.1	0.00044	0.79	0.000010	0.28	0.041	3.7	0.000020	0.00016	0.0010	0.0066	0.00051	0.0020	0.000020
26-Jun-12	30	500	440	7.1	59																																										
3-Jul-12	31	500	435	7.1	60	#N/A	7.5	23	9.0	0.20	0.45	0.30	26	0.048	0.0021	0.0012	0.029	0.000020	0.000010	0.0012	0.0000030	8.7	0.00050	0.000039	0.0027	0.0050	0.000020	0.0010	0.90	0.0028	0.010	0.0017	0.00010	0.0090	1.4	0.00055	0.90	0.000010	0.24	0.042	3.6	0.000020	0.00012	0.00050	0.0085	0.00046	0.0010	0.000030
10-Jul-12	32	500	440	7.1	63																																										
17-Jul-12	33	500	445	7.1	63	#N/A	3.0	20	10	0.20	0.37	0.30	28	0.041	0.0018	0.0011	0.029	0.000020	0.000010	0.0016	0.0000030	9.6	0.00050	0.00016	0.0015	0.0030	0.000020	0.0010	0.94	0.0024	0.010	0.0016	0.00010	0.0090	1.4	0.00062	0.84	0.000010	0.22	0.046	4.6	0.000020	0.000020	0.00040	0.0063	0.00044	0.0010	0.000010
24-Jul-12	34	500	425	7.1	65																																										
31-Jul-12	35	500	435	7.1	60	#N/A	2.8	17	9.0	0.20	0.36	0.30	26	0.048	0.0018	0.00090	0.028	0.000020	0.000010	0.0020	0.0000030	9.0	0.00050	0.000060	0.0025	0.0030	0.000020	0.0010	0.88	0.0022	0.010	0.0014	0.00010	0.0090	1.4	0.00056	0.85	0.000010	0.21	0.044	3.7	0.000020	0.000040	0.00050	0.0060	0.00055	0.0020	0.000010
7-Aug-12	36	500	455	7.2	60																																										
14-Aug-12	37	500	490	7.0	69	#N/A	3.8	17	15	0.20	0.35	0.30	29	0.052	0.0018	0.0012	0.027	0.000020	0.000010	0.0034	0.0000030	10	0.00050	0.000013	0.0038	0.0030	0.000020	0.0010	0.97	0.0023	0.010	0.0020	0.00020	0.0090	1.4	0.00042	0.92	0.000010	0.21	0.047	5.5	0.000020	0.000015	0.00030	0.0062	0.00078	0.0020	0.000010
21-Aug-12	38	500	445	7.0	67																																										
28-Aug-12	39	500	435	7.1	66	#N/A	4.2	21	13	0.20	0.32	0.30	27	0.056	0.0017	0.00070	0.029	0.000020	0.000010	0.0023	0.0000030	9.5	0.00050	0.000044	0.0038	0.0060	0.000020	0.0010	0.88	0.0024	0.010	0.0013	0.00020	0.0090	1.2	0.00041	0.82	0.000010	0.17	0.045	4.4	0.000020	0.00041	0.00050	0.0061	0.00051	0.0020	0.000010
4-Sep-12	40	500	475	7.0	54																																										
11-Sep-12	41	500	485	7.0	63	#N/A	3.8	17	13	0.20	0.29	0.30	28	0.024	0.0016	0.00080	0.028	0.000020	0.000010	0.0029	0.0000030	9.6	0.00050	0.000071	0.0033	0.0080	0.000020	0.0010	0.89	0.0017	0.020	0.0016	0.00020	0.0090	1.2	0.00056	0.80	0.000010	0.18	0.044	4.5	0.000020	0.00012	0.00020	0.0065	0.00046	0.0010	0.000080
18-Sep-12	42	500	495	7.0	65																																										
25-Sep-12	43	500	445	7.0	64	#N/A	4.5	21	12	0.20	0.26	0.30	27	0.037	0.0015	0.0010	0.024	0.000020	0.000010	0.0021	0.0000030	9.2	0.00050	0.000046	0.0049	0.0070	0.000020	0.0010	0.87	0.0010	0.020	0.0014	0.00020	0.0090	1.2	0.00059	0.76	0.000010	0.17	0.044	4.4	0.000020	0.000070	0.00050	0.0060	0.00046	0.0010	0.000010
2-Oct-12	44	500	450	7.1	60																																										
9-Oct-12	45	500	445	6.9	54	#N/A	4.6	16	9.0	0.20	0.21	0.30	23	0.038	0.0012	0.00060	0.019	0.000020	0.000010	0.0011	0.0000030	7.9	0.00050	0.000071	0.0038	0.0060	0.000020	0.0010	0.74	0.0012	0.010	0.00094	0.00080	0.0090	1.1	0.00035	0.63	0.000010	0.12	0.037	3.7	0.000020	0.00017	0.00070	0.0050	0.00037	0.0010	0.000010
16-Oct-12	46	500	450	7.1	78																																										
23-Oct-12	47	500	510	7.1	75																																										
30-Oct-12	48	500	500	7.1	70																																										
6-Nov-12	49	500	480	7.1	64	#N/A	3.7	21	11	0.20	0.21	0.30	31	0.025	0.0018	0.00080	0.024	0.000020	0.000010	0.0020	0.0000016	11	0.00050	0.00025	0.0045	0.0030	0.000020	0.0010	0.96	0.0014	0.010	0.0013	0.00020	0.0090	1.1	0.00042	0.71	0.000010	0.11	0.048	5.1	0.000020	0.00012	0.00010	0.0059	0.00028	0.0040	0.000010
13-Nov-12	50	500	460	7.1	63																																										
20-Nov-12	51	500	490	7.1	66																																										
27-Nov-12	52	500	490	7.1	65																																										
4-Dec-12	53	500	455	7.1	62	#N/A	3.4	17	13	0.20	0.19	0.30	28	0.032	0.0017	0.00090	0.021	0.000020	0.000010	0.00090	0.000019	9.6	0.00050	0.00062	0.0037	0.0070	0.000040	0.0010	0.85	0.0018	0.010	0.0013	0.00030	0.0090	1.0	0.0011	0.62	0.000010	0.10	0.042	4.6	0.000020	0.00019	0.00040	0.0065	0.00028	0.0050	0.000010
11-Dec-12	54	500	470	7.2	65																																										
18-Dec-12	55	500	470	7.0	58																																										
25-Dec-12	56	500	455	7.2	60																																										
1-Jan-13	57	500	525	7.1	51	#N/A	4.9	25	5.0	0.20	0.20	0.30	25	0.032	0.0020	0.0012	0.031	0.000020	0.000010	0.0017	0.0000080	8.7	0.00050	0.00021	0.0028	0.0030	0.000050	0.0010	0.75	0.0016	0.010	0.00096	0.00020	0.0090	1.0	0.00047	0.81	0.000010	0.090	0.040	2.4	0.000020	0.00018	0.00040	0.0058	0.00039	0.0030	0.000010
8-Jan-13	58	500	465	7.2	65																																										
15-Jan-13	59	500	465	7.0	55																																										
22-Jan-13	60	500	450	7.2	60																																										
29-Jan-13	61	500	450	7.0	54	#N/A	3.4	17	9.0	0.20	0.15	0.30	27	0.040	0.0015	0.00080	0.018	0.000020	0.000010	0.00090	0.0000060	9.4	0.00050	0.00018	0.0060	0.0060	0.000020	0.0010	0.80	0.0016	0.010	0.0013	0.00020	0.014	0.93	0.00043	0.61	0.000010	0.12	0.041	4.1	0.000020	0.00015	0.00030	0.0045	0.00039	0.0030	0.000010
5-Feb-13	62	500	460	7.1	58																																										
12-Feb-13	63	500	450	7.2	59																																										
19-Feb-13	64	500	455	7.0	57																																										
26-Feb-13	65	500	450	7.1	55	#N/A	4.6	21	10	0.20	0.12	0.30	22	0.027	0.0014	0.0011	0.019	0.000020	0.000010	0.00080	0.000011	7.8	0.00050	0.00035	0.0070	0.0050	0.000030	0.0010	0.70	0.00090	0.010	0.0016	0.00020	0.0090	0.89	0.00046	0.57	0.000010	0.090	0.034	3.8	0.000020	0.000070	0.00030	0.0043	0.00019	0.0010	0.000010
5-Mar-13	66	500	460	7.2	54																																										
12-Mar-13	67	500	450	7.1	54																																										

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC11

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	500	395	7.3	791	#N/A	3.1	14	139	0.83	0.77	0.12	141	0.021	0.00075	0.00071	0.011	0.0000079	0.0000079	0.0027	0.000062	49	0.00020	0.0018	0.012	0.0012	0.000020	0.00079	4.8	0.014	0.0040	0.0053	0.0021	0.0036	2.8	0.0067	0.55	0.0000040	9.2	0.20	49	0.000024	0.000024	0.00012	0.010	0.00022	0.0071	0.000099
6-Dec-11	1	500	480	7.5	389	#N/A	2.2	14	74	0.58	0.89	0.14	79	0.018	0.00058	0.00062	0.011	0.0000096	0.0000048	0.0018	0.0000096	27	0.00053	0.00020	0.0039	0.0014	0.0000096	0.00048	2.8	0.0086	0.0048	0.0082	0.000096	0.0043	2.0	0.0048	0.57	0.0000048	6.9	0.11	27	0.0000096	0.0000048	0.00019	0.0085	0.00014	0.0014	0.000062
13-Dec-11	2	500	510	7.4	207	#N/A	2.1	14	30	0.10	0.81	0.15	42	0.012	0.00041	0.00041	0.017	0.000010	0.000010	0.0015	0.0000031	15	0.00036	0.000095	0.0021	0.0015	0.000051	0.00051	1.3	0.0050	0.0051	0.0062	0.00041	0.0051	1.4	0.0022	0.45	0.0000051	3.6	0.064	12	0.000010	0.000082	0.00015	0.0066	0.00013	0.0031	0.000041
20-Dec-11	3	500	500	7.5	140	#N/A	2.4	15	21	0.10	0.93	0.15	33	0.023	0.00065	0.00060	0.015	0.000010	0.0000050	0.0015	0.000010	11	0.00025	0.000080	0.0021	0.0040	0.000010	0.00050	1.0	0.0053	0.0050	0.0056	0.00035	0.0045	1.2	0.0010	0.70	0.0000050	3.1	0.048	8.6	0.000010	0.0000050	0.00045	0.0065	0.00020	0.0020	0.000035
27-Dec-11	4	500	525	7.5	69																																												
3-Jan-12	5	500	475	7.5	81	#N/A	2.0	13	7.6	0.095	0.76	0.14	13	0.026	0.00067	0.00052	0.017	0.0000095	0.0000048	0.0012	0.0000014	4.6	0.00024	0.000040	0.0013	0.0019	0.0000095	0.00048	0.47	0.0019	0.0048	0.0035	0.00024	0.0043	0.79	0.00034	0.44	0.0000048	1.5	0.021	2.5	0.0000095	0.0000095	0.00029	0.0060	0.00027	0.00048	0.000019
10-Jan-12	6	500	445	7.4	83																																												
17-Jan-12	7	500	425	7.5	86	#N/A	1.3	15	4.7	0.085	0.73	0.13	15	0.025	0.0015	0.00060	0.016	0.0000085	0.0000043	0.0016	0.0000038	5.2	0.00021	0.000040	0.0020	0.0030	0.0000085	0.00043	0.53	0.0016	0.0043	0.0029	0.0000085	0.0038	0.86	0.00045	0.58	0.0000043	1.3	0.024	2.3	0.0000085	0.0000043	0.00077	0.011	0.00025	0.00043	0.000055
24-Jan-12	8	500	465	7.5	77																																												
31-Jan-12	9	500	475	7.4	81	#N/A	1.6	15	6.7	0.095	0.67	0.14	14	0.018	0.00090	0.00057	0.019	0.0000095	0.0000048	0.0011	0.0000014	4.9	0.00024	0.000034	0.0012	0.0014	0.0000095	0.00048	0.52	0.0015	0.0048	0.0022	0.000048	0.0043	0.89	0.00036	0.48	0.0000048	0.95	0.023	2.1	0.0000095	0.000019	0.00014	0.0067	0.00028	0.00095	0.000014
7-Feb-12	10	500	485	7.4	78																																												
14-Feb-12	11	500	485	7.4	78	#N/A	2.2	13	9.2	0.097	0.59	0.15	16	0.013	0.00073	0.00063	0.018	0.0000097	0.0000049	0.00087	0.0000015	5.4	0.00024	0.000029	0.00087	0.0015	0.0000097	0.00049	0.56	0.0020	0.0049	0.0018	0.00015	0.0044	0.81	0.00059	0.46	0.0000049	0.74	0.026	2.3	0.0000097	0.0000049	0.00019	0.0059	0.00025	0.0015	0.000015
21-Feb-12	12	500	475	7.4	79																																											
28-Feb-12	13	500	450	7.3	71	#N/A	1.7	11	5.0	0.090	0.44	0.14	13	0.015	0.00063	0.00050	0.014	0.0000090	0.0000045	0.00086	0.0000014	4.5	0.00023	0.000026	0.0012	0.0018	0.000018	0.00045	0.48	0.0016	0.0045	0.0011	0.000045	0.0041	0.86	0.00018	0.39	0.0000045	0.55	0.021	1.9	0.0000090	0.0000090	0.00023	0.0040	0.00020	0.00090	0.0000090
6-Mar-12	14	500	450	7.3	73																																											
13-Mar-12	15	500	445	7.3	69	#N/A	1.3	11	5.8	0.089	0.40	0.13	14	0.012	0.00067	0.00049	0.014	0.0000089	0.0000045	0.00085	0.0000013	4.6	0.00022	0.000018	0.00067	0.0013	0.0000089	0.00045	0.46	0.0014	0.0045	0.0012	0.000045	0.0040	0.73	0.00015	0.43	0.0000045	0.40	0.021	2.0	0.0000089	0.000071	0.00018	0.0040	0.00013	0.00045	0.000013
20-Mar-12	16	500	460	7.3	74																																											
27-Mar-12	17	500	445	7.2	71	#N/A	1.4	9.8	6.2	0.089	0.34	0.13	14	0.017	0.00067	0.00058	0.014	0.0000089	0.0000045	0.00076	0.0000036	4.8	0.00022	0.000024	0.00093	0.0013	0.000045	0.00045	0.48	0.0013	0.0045	0.0010	0.000045	0.0053	0.70	0.00014	0.40	0.0000045	0.33	0.021	2.2	0.0000089	0.0000045	0.00018	0.0041	0.00020	0.00045	0.000013
3-Apr-12	18	500	455	7.2	67																																											
10-Apr-12	19	500	445	7.3	73	#N/A	1.3	9.8	6.7	0.089	0.31	0.13	14	0.016	0.00071	0.00045	0.011	0.0000089	0.0000045	0.00089	0.0000013	4.7	0.00022	0.000027	0.00089	0.0013	0.0000089	0.00045	0.46	0.0012	0.013	0.0010	0.000045	0.0040	0.68	0.00013	0.38	0.0000045	0.26	0.021	2.4	0.0000089	0.0000013	0.00013	0.0031	0.00018	0.00045	0.0000089
17-Apr-12	20	500	455	7.2	76																																											
24-Apr-12	21	500	470	7.2	70	#N/A	1.5	10	5.6	0.094	0.29	0.14	14	0.020	0.00080	0.00047	0.015	0.0000094	0.0000047	0.00080	0.0000014	4.8	0.00024	0.000027	0.0012	0.0014	0.000014	0.00047	0.46	0.0015	0.0094	0.00093	0.00014	0.0042	0.69	0.000033	0.38	0.0000047	0.22	0.022	2.2	0.0000094	0.0000094	0.00014	0.0035	0.00023	0.00094	0.0000047
1-May-12	22	500	440	7.2	70																																											
8-May-12	23	500	430	7.2	67	#N/A	1.4	9.4	5.2	0.43	0.21	0.13	12	0.015	0.00073	0.00043	0.011	0.0000086	0.0000043	0.00077	0.0000013	4.3	0.00022	0.000028	0.0012	0.072	0.000043	0.00043	0.42	0.0017	0.0043	0.00086	0.00017	0.0039	0.65	0.00014	0.34	0.0000043	0.18	0.019	2.0	0.0000086	0.00013	0.00034	0.0030	0.00016	0.0013	0.0000043
15-May-12	24	500	430	7.2	67																																											
22-May-12	25	500	435	7.2	67	#N/A	1.7	9.3	3.9	0.087	0.23	0.13	12	0.029	0.00061	0.00039	0.011	0.0000087	0.0000044	0.00061	0.0000013	4.2	0.00022	0.000022	0.00074	0.0026	0.0000087	0.00044	0.42	0.0011	0.0044	0.00084	0.000087	0.0039	0.60	0.00014	0.36	0.0000044	0.15	0.020	2.1	0.0000087	0.000022	0.00030	0.0030	0.00024	0.00087	0.0000087
29-May-12	26	500	420	7.1	65																																											
5-Jun-12	27	500	450	7.2	64	#N/A	1.8	9.8	4.1	0.090	0.20	0.14	13	0.031	0.00072	0.00054	0.011	0.0000090	0.0000045	0.0011	0.0000014	4.4	0.00023	0.000039	0.00090	0.0027	0.000014	0.00045	0.44	0.0011	0.014	0.00080	0.000045	0.0041	0.63	0.00022	0.38	0.0000045	0.14	0.021	2.0	0.0000090	0.000018	0.00027	0.0037	0.00028	0.00090	0.0000045
12-Jun-12	28	500	435	7.1	60																																											
19-Jun-12	29	500	435	7.1	59	#N/A	1.4	7.2	3.9	0.087	0.20	0.13	11	0.030	0.00065	0.00039	0.0090	0.0000087	0.0000044	0.00057	0.0000013	3.8	0.00022	0.000037	0.0023	0.0030	0.000017	0.00044	0.38	0.0010	0.0044	0.00088	0.000087	0.0039	0.50	0.00019	0.34	0.0000044	0.12	0.018	1.6	0.0000087	0.000070	0.00044	0.0029	0.00022	0.00087	0.0000087
26-Jun-12	30	500	440	7.1	59																																											
3-Jul-12	31	500	435	7.1	60	#N/A	3.2	10	3.9	0.087	0.20	0.13	11	0.021	0.00091	0.00052	0.013	0.0000087	0.0000044	0.00052	0.0000013	3.8	0.00022	0.000017	0.0012	0.0022	0.0000087	0.00044	0.39	0.0012	0.0044	0.00074	0.000044	0.0039	0.60	0.00024	0.39	0.0000044	0.10	0.018	1.6	0.0000087	0.000052	0.00022	0.0037	0.00020	0.00044	0.000013
10-Jul-12	32	500	440	7.1	63																																											
17-Jul-12	33	500	445	7.1	63	#N/A	1.3	8.9	4.5	0.089	0.16	0.13	12	0.018	0.00080	0.00049	0.013	0.0000089	0.0000045	0.00071	0.0000013	4.3	0.00022	0.000069	0.00067	0.0013	0.0000089	0.00045	0.42	0.0011	0.0045	0.00071	0.000045	0.0040	0.64	0.00028	0.37	0.0000045	0.098	0.021	2.0	0.0000089	0.0000089	0.00018	0.0028	0.00020	0.00045	0.0000045
24-Jul-12	34	500	425	7.1	65																																											
31-Jul-12	35	500	435	7.1	60	#N/A	1.2	7.4	3.9	0.087	0.16	0.13	11	0.021	0.00078	0.00039	0.012	0.0000087	0.0000044	0.00087	0.0000013	3.9	0.00022	0.000026	0.0011	0.0013	0.0000087	0.00044	0.38	0.00096	0.0044	0.00061	0.000044	0.0039	0.59	0.00024	0.37	0.0000044	0.091	0.019	1.6	0.0000087	0.000017	0.00022	0.0026	0.00024	0.00087	0.0000044
7-Aug-12	36	500	455	7.2	60																																											
14-Aug-12	37	500	490	7.0	69	#N/A	1.9	8.3	7.4	0.098	0.17	0.15	14	0.026	0.00088	0.00059	0.013	0.0000098	0.0000049	0.0017	0.0000015	4.9	0.00025	0.0000064	0.0019	0.0015	0.0000098	0.00049	0.48	0.0011	0.0049	0.00098	0.000098	0.0044	0.70	0.00021	0.45	0.0000049	0.10	0.023	2.7	0.0000098	0.0000074	0.00015	0.0030	0.00038	0.00098	0.0000049
21-Aug-12	38	500	445	7.0	67																																											
28-Aug-12	39	500	435	7.1	66	#N/A	1.8	8.9	5.7	0.087	0.14	0.13	12	0.025	0.00074	0.00030	0.012	0.0000087	0.0000044	0.0010	0.0000013	4.1	0.00022	0.000019	0.0017	0.0026	0.0000087	0.00044	0.38	0.0010	0.0044	0.00057	0.000087	0.0039	0.54	0.00018	0.36	0.0000044	0.074	0.019	1.9	0.0000087	0.00018	0.00022	0.0026	0.00022	0.00087	0.0000044
4-Sep-12	40	500	475	7.0	54																																											
11-Sep-12	41	500	485	7.1	63	#N/A	1.8	8.2	6.3	0.097	0.14	0.15	13	0.012	0.00078	0.00039	0.014	0.0000097	0.0000049	0.0014	0.0000015	4.6	0.00024	0.000034	0.0016	0.0039	0.0000097	0.00049	0.43	0.00082	0.0097	0.00075	0.000097	0.0044	0.60	0.00027	0.39	0.0000049	0.087	0.022	2.2	0.0000097	0.000058	0.000097	0.0032	0.00022	0.00049	0.000039
18-Sep-12	42	500	495	7.0	65																																											
25-Sep-12	43	500	445	7.0	64	#N/A	2.0	9.5	5.3	0.089	0.12	0.13	12	0.016	0.00067	0.00045	0.010	0.0000089	0.0000045	0.00093	0.0000013	4.1	0.00022	0.000020	0.0022	0.0031	0.0000089	0.00045	0.39	0.00045	0.0089	0.00061	0.000089	0.0040	0.53	0.00026	0.34	0.0000045	0.076	0.019	2.0	0.0000089	0.000031	0.00022	0.0027	0.00020	0.00045	0.0000045
2-Oct-12	44	500	450	7.1	60																																											
9-Oct-12	45	500	445	6.9	54	#N/A	2.0	6.9	4.0	0.089	0.093	0.13	10	0.017	0.00053	0.00027	0.0085	0.0000089	0.0000045	0.00049	0.0000013	3.5	0.00022	0.000032	0.0017	0.0027	0.0000089	0.00045	0.33	0.00053	0.0045	0.00042	0.00036	0.0040	0.47	0.00016	0.28	0.0000045	0.053	0.017	1.7	0.0000089	0.000076	0.00031	0.0022	0.00016	0.00045	0.0000045
16-Oct-12	46	500	450	7.1	78																																											
23-Oct-12	47	500	510	7.1	75																																										
30-Oct-12	48	500	500	7.1	70																																										
6-Nov-12	49	500	480	7.1	64	#N/A	1.8	9.9	5.3	0.096	0.10	0.14	15	0.012	0.00086	0.00038	0.011	0.0000096	0.0000048	0.00096	0.0000077	5.2	0.00024	0.00012	0.0022	0.0014	0.0000096	0.00048	0.46	0.00067	0.0048	0.00063	0.000096	0.0043	0.51	0.00020	0.34	0.0000048	0.053	0.023	2.5	0.0000096	0.0000058	0.000048	0.0028	0.00013	0.0019	0.0000048
13-Nov-12	50	500	460	7.1	63																																											
20-Nov-12	51	500	490	7.1	66																																										
27-Nov-12	52	500	490	7.1	65																																										
4-Dec-12	53	500	455	7.1	62	#N/A	1.5	7.5	5.9	0.091	0.086	0.14	13	0.015	0.00077	0.00041	0.0094	0.0000091	0.0000046	0.00041	0.0000086	4.4	0.00023	0.00028	0.0017	0.0032	0.0000018	0.00046	0.39	0.00082	0.0046	0.00061	0.00014	0.0041	0.46	0.00048	0.28	0.0000046	0.046	0.019	2.1	0.0000091	0.000086	0.00018	0.0029	0.00013	0.0023	0.0000046
11-Dec-12	54	500	470	7.2	65																																										
18-Dec-12	55	500	470	7.0	58																																										
25-Dec-12	56	500	455	7.2	60																																										
1-Jan-13	57	500	525	7.1	51	#N/A	2.6	13	2.6	0.11	0.11	0.16	13	0.017	0.0011	0.00063	0.016	0.000011	0.0000053	0.00089	0.0000042	4.6	0.00026	0.00011	0.0015	0.0016	0.000026	0.00053	0.39	0.00084	0.0053	0.00050	0.000011	0.0047	0.54	0.00025	0.43	0.0000053	0.047	0.021	1.3	0.000011	0.000095	0.00021	0.0031	0.00020	0.0016	0.0000053
8-Jan-13	58	500	465	7.2	65																																										
15-Jan-13	59	500	465	7.0	55																																										
22-Jan-13	60	500	450	7.2	60																																										
29-Jan-13	61	500	450	7.0	54	#N/A	1.5	7.8	4.1	0.090	0.068	0.14	12	0.018	0.00068	0.00036	0.0083	0.0000090	0.0000045	0.00041	0.0000027	4.2	0.00023	0.000080	0.0027	0.0027	0.0000090	0.00045	0.36	0.00072	0.0045	0.00056	0.000090	0.0063	0.42	0.00019	0.27	0.0000045	0.054	0.019	1.8	0.0000090	0.000068	0.00014	0.0020	0.00018	0.0014	0.0000045
5-Feb-13	62	500	460	7.1	58																																										
12-Feb-13	63	500	450	7.2	59																																										
19-Feb-13	64	500	455	7.0	57																																										
26-Feb-13	65	500	450	7.1	55	#N/A	2.1	9.2	4.5	0.090	0.054	0.14	10	0.012	0.00063	0.00050	0.0087	0.0000090	0.0000045	0.00036	0.0000050	3.5	0.00023	0.00016	0.0032	0.0023	0.000014	0.00045	0.31	0.00041	0.0045	0.00072	0.000090	0.0041	0.40	0.00021	0.26	0.0000045	0.041	0.015	1.7	0.0000090	0.000032	0.00014	0.0019	0.000086	0.00045	0.0000045
5-Mar-13	66	500	460	7.2	54																																										
12-Mar-13	67	500	450	7.1	54																																										
Median (last 5)				7.1	60	#N/A	1.8	9.2	4.5	0.091	0.086	0.14	13	0.015	0.00077	0.00041	0.0094	0.0000091	0.0000046	0.00041	0.0000050	4.4	0.00023	0.00012	0.0022	0.0023	0.000014	0.00046	0.39	0.00072	0.0046	0.00061	0.000096	0.0043	0.46	0.00021	0.28	0.0000046	0.047	0.019	1.8	0.0000091	0.000068	0.00014	0.0028	0.00013	0.0016	0.0000046

Leachate Results for HC12

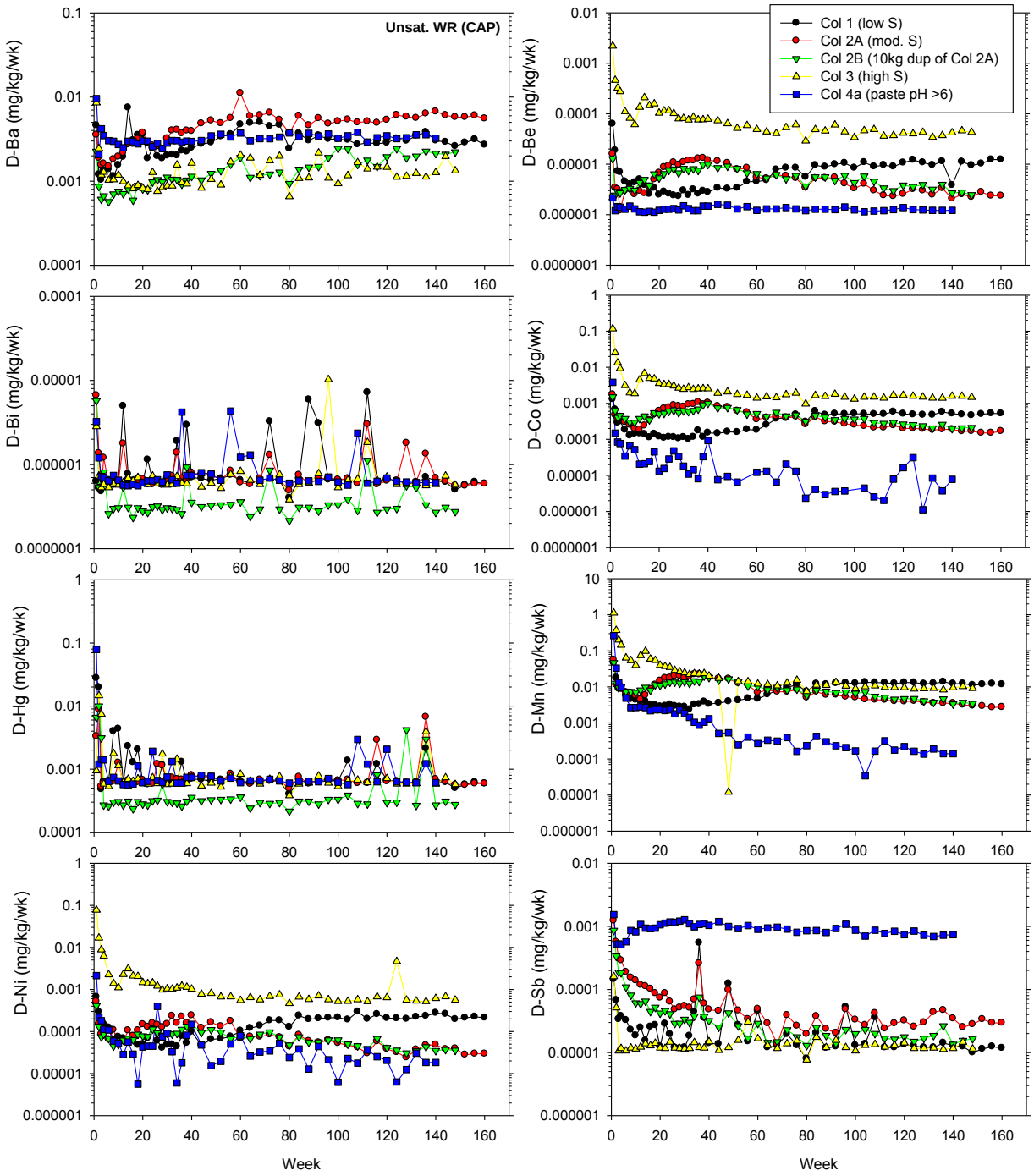
Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
29-Nov-11	0	470	375	4.7	1605	#N/A	198	#N/A	944	4.8	2.0	0.30	444	10	0.0074	0.0022	0.035	0.0013	0.000010	0.0055	0.0084	139	0.00090	0.22	193	2.6	0.0069	0.018	24	1.2	0.030	0.00079	0.059	0.044	13	0.047	0.76	0.000080	99	0.45	283	0.00032	0.000090	0.00030	0.100	0.00039	1.9	0.0011
6-Dec-11	1	500	470	4.8	840	#N/A	100	#N/A	422	2.2	0.060	0.30	205	2.7	0.0057	0.00090	0.013	0.00088	0.000010	0.0068	0.0042	60	0.0016	0.12	59	0.35	0.0018	0.015	14	0.66	0.020	0.00036	0.020	0.015	8.9	0.025	1.5	0.000090	54	0.21	149	0.00019	0.000010	0.00020	0.045	0.00024	1.2	0.00046
13-Dec-11	2	500	435	4.9	599	#N/A	77	#N/A	273	2.0	0.84	0.30	155	1.9	0.0042	0.00050	0.0093	0.00053	0.000050	0.0061	0.0028	46	0.0020	0.11	40	0.22	0.0010	0.011	9.5	0.46	0.020	0.00035	0.034	0.0090	6.7	0.016	0.91	0.000020	29	0.16	95	0.00012	0.00037	0.00030	0.030	0.00012	0.88	0.000026
20-Dec-11	3	500	420	4.9	520	#N/A	75	#N/A	269	0.70	0.96	0.30	137	1.9	0.0066	0.0013	0.0079	0.00057	0.000010	0.0054	0.0028	41	0.00050	0.075	40	0.24	0.00011	0.010	8.4	0.41	0.010	0.00017	0.022	0.0090	6.4	0.0087	0.75	0.000010	15	0.14	83	0.00011	0.000030	0.00030	0.024	0.00040	0.71	0.00027
27-Dec-11	4	500	535	5.5	128																																												
3-Jan-12	5	500	450	5.4	116	#N/A	12	0.89	51	0.20	0.15	0.30	33	0.28	0.0029	0.00030	0.0044	0.00013	0.000010	0.0044	0.00091	11	0.00050	0.010	5.6	0.056	0.0012	0.0040	0.97	0.046	0.010	0.000070	0.0039	0.0090	1.9	0.0020	0.64	0.000010	0.81	0.037	15	0.000030	0.000090	0.00030	0.0036	0.00047	0.16	0.000030
10-Jan-12	6	500	425	5.3	115																																											
17-Jan-12	7	500	435	5.3	106	#N/A	12	0.70	46	0.20	0.15	0.30	30	0.28	0.0080	0.00040	0.0046	0.00019	0.000010	0.0074	0.00070	9.8	0.00050	0.011	6.6	0.12	0.00083	0.0060	1.2	0.058	0.010	0.00010	0.0037	0.026	3.0	0.0024	0.89	0.000010	0.48	0.033	15	0.000030	0.000030	0.00020	0.0041	0.00026	0.15	0.000060
24-Jan-12	8	500	435	5.4	90																																											
31-Jan-12	9	500	465	5.3	75	#N/A	8.4	0.78	31	0.20	0.11	0.30	18	0.13	0.0023	0.00030	0.0034	0.00012	0.000010	0.0037	0.00028	6.1	0.00050	0.0066	3.8	0.091	0.0046	0.0030	0.73	0.036	0.010	0.000070	0.0025	0.0090	1.6	0.0018	0.79	0.000010	0.16	0.022	9.0	0.000020	0.000010	0.00030	0.0024	0.00035	0.071	0.000010
7-Feb-12	10	500	460	5.3	83																																											
14-Feb-12	11	500	465	5.3	88	#N/A	14	0.88	37	0.20	0.14	0.30	22	0.18	0.0012	0.00020	0.0029	0.00014	0.000010	0.0033	0.00038	7.2	0.00050	0.0090	5.2	0.21	0.00024	0.0030	0.97	0.048	0.010	0.00014	0.0029	0.043	1.3	0.0016	0.90	0.000010	0.12	0.028	10	0.000020	0.000010	0.00040	0.0044	0.00024	0.091	0.000010
21-Feb-12	12	500	420	5.2	123																																											
28-Feb-12	13	500	445	5.1	102	#N/A	13	0.93	38	0.20	0.15	0.30	26	0.25	0.0018	0.00020	0.0031	0.00016	0.000010	0.0029	0.00038	8.8	0.00050	0.0089	4.9	0.20	0.000090	0.0030	1.00	0.048	0.010	0.000050	0.0045	0.024	2.0	0.0017	0.67	0.000010	0.12	0.032	12	0.000060	0.000040	0.00010	0.0050	0.00023	0.092	0.000010
6-Mar-12	14	500	440	5.3	97																																											
13-Mar-12	15	500	440	5.0	102	#N/A	15	0.88	42	0.20	0.17	0.30	25	0.23	0.0017	0.00040	0.0023	0.00063	0.000010	0.0024	0.00050	8.2	0.00050	0.012	6.6	0.32	0.000040	0.0060	1.2	0.057	0.010	0.000050	0.0039	0.046	1.6	0.0020	0.74	0.000010	0.070	0.029	13	0.000020	0.00019	0.00010	0.0076	0.000030	0.12	0.000020
20-Mar-12	16	500	465	5.2	88																																											
27-Mar-12	17	500	450	5.2	99	#N/A	14	1.1	42	0.20	0.18	0.30	25	0.35	0.0011	0.00020	0.0030	0.00024	0.000010	0.0030	0.00048	8.3	0.00050	0.011	5.7	0.43	0.0019	0.0030	1.1	0.055	0.010	0.000030	0.0035	0.034	1.3	0.0015	0.75	0.000010	0.070	0.028	13	0.000020	0.000010	0.00010	0.0086	0.00014	0.074	0.000010
3-Apr-12	18	500	440	4.9	89																																											
10-Apr-12	19	500	465	4.9	101	#N/A	15	0.37	39	0.20	0.20	0.30	22	0.38	0.00090	0.00020	0.0023	0.00028	0.000010	0.0025	0.00052	7.0	0.00050	0.012	6.4	0.54	0.00011	0.0030	1.1	0.054	0.020	0.00047	0.0039	0.020	0.99	0.0016	0.90	0.000010	0.050	0.026	12	0.000020	0.000030	0.00010	0.0094	0.00014	0.12	0.000010
17-Apr-12	20	500	450	4.8	122																																											
24-Apr-12	21	500	455	4.7	108	#N/A	19	0.10	43	0.20	0.22	0.30	22	0.46	0.00090	0.00020	0.0017	0.00034	0.000010	0.0018	0.00069	7.1	0.00050	0.012	6.8	0.73	0.00021	0.0030	1.1	0.059	0.030	0.000080	0.0040	0.042	0.90	0.0018	0.76	0.000010	0.060	0.025	13	0.000020	0.000020	0.00010	0.015	0.00012	0.15	0.000010
1-May-12	22	500	450	4.8	116																																											
8-May-12	23	500	440	4.6	119	#N/A	22	0.10	46	0.20	0.20	0.30	24	0.50	0.00080	0.00020	0.0013	0.00036	0.000010	0.0017	0.00083	7.6	0.00050	0.015	6.9	0.81	0.000090	0.0030	1.2	0.064	0.010	0.00018	0.0048	0.016	0.87	0.0019	0.61	0.000010	0.060	0.022	15	0.000020	0.00018	0.00010	0.017	0.00013	0.17	0.000010
15-May-12	24	500	450	4.5	110																																											
22-May-12	25	500	440	4.6	112	#N/A	22	0.10	38	0.20	0.27	0.30	21	0.73	0.00060	0.00030	0.0011	0.00038	0.000010	0.0017	0.00084	6.8	0.00050	0.013	6.7	1.0	0.00010	0.0030	1.1	0.060	0.010	0.00034	0.0047	0.0090	0.64	0.0017	0.64	0.000010	0.050	0.020	14	0.000020	0.000070	0.0016	0.018	0.00069	0.16	0.000010
29-May-12	26	500	440	4.4	119																																										
5-Jun-12	27	500	450	4.5	110	#N/A	22	0.10	37	0.20	0.27	0.30	20	0.75	0.00050	0.00020	0.0010	0.00044	0.000010	0.0029	0.0010	6.4	0.00050	0.014	6.4	1.1	0.000020	0.0030	1.0	0.056	0.010	0.000040	0.0058	0.0090	0.55	0.0020	0.70	0.000010	0.050	0.018	14	0.000020	0.000060	0.00020	0.020	0.00034	0.19	0.000010
12-Jun-12	28	500	455	4.5	103																																											
19-Jun-12	29	500	450	4.4	106	1.6	22	#N/A	37	0.40	0.31	0.30	17	0.84	0.00050	0.00040	0.0050	0.00046	0.000010	0.0022	0.0011	5.3	0.00050	0.014	6.4	1.3	0.00027	0.0030	0.90	0.051	0.010	0.00095	0.0048	0.0090	0.47	0.0021	0.71	0.000010	0.060	0.016	12	0.000020	0.00010	0.00010	0.023	0.00023	0.19	0.000010
26-Jun-12	30	500	450	4.4	107																																											
3-Jul-12	31	500	465	4.6	117	#N/A	34	0.10	40	1.0	0.37	0.30	16	1.2	0.00050	0.00020	0.0010	0.00053	0.000010	0.0011	0.0017	4.9	0.00050	0.015	7.3	1.8	0.00026	0.0030	0.95	0.054	0.010	0.000090	0.0050	0.0090	0.36	0.0021	0.69	0.000010	0.050	0.015	14	0.000020	0.00025	0.00010	0.029	0.00021	0.24	0.000020
10-Jul-12	32	500	450	4.3	126																																											
17-Jul-12	33	500	460	4.1	136	5.0	35	#N/A	46	0.20	0.43	0.30	17	1.8	0.00070	0.00060	0.00080	0.00082	0.000010	0.0034	0.0027	5.0	0.00050	0.020	8.6	3.0	0.000050	0.0040	0.99	0.058	0.010	0.000080	0.0057	0.011	0.35	0.0023	0.99	0.00013	0.060	0.016	17	0.000020	0.00011	0.00020	0.040	0.00023	0.37	0.000010
24-Jul-12	34	500	470	4.2	133																																											
31-Jul-12	35	500	450	4.1	126	4.4	30	#N/A	44	0.20	0.41	0.30	15	1.8	0.00060	0.00020	0.00090	0.00065	0.000010	0.0018	0.0025	4.5	0.00050	0.014	7.4	2.9	0.0015	0.0030	0.80	0.047	0.060	0.000040	0.0050	0.0090	0.27	0.0016	0.87	0.000010	0.050	0.013	15	0.000020	0.000070	0.00010	0.034	0.00029	0.33	0.000010
7-Aug-12	36	500	485	4.1	141																																											
14-Aug-12	37	500	460	4.0	143	7.3	41	#N/A	52	0.20	0.46	0.30	13	2.7	0.00050	0.00040	0.0010	0.00074	0.000010	0.0020	0.0030	4.0	0.00050	0.015	7.7	3.3	0.000090	0.0030	0.76	0.045	0.010	0.0022	0.0057	0.0090	0.24	0.0019	1.0	0.000010	0.070	0.012	17	0.000020	0.00019	0.00030	0.037	0.00049	0.44	0.000010
21-Aug-12	38	500	465	4.0	161																																											
28-Aug-12	39	500	460	4.1	148	8.4	47	#N/A	60	0.20	0.45	0.30	12	3.2	0.00050	0.00050	0.00093	0.00072	0.000010	0.0022	0.0035	3.6	0.00050	0.014	7.7	3.3	0.00023	0.0030	0.65	0.040	0.040	0.000020	0.0053	0.013	0.20	0.0020	0.92	0.000010	0.040	0.011	17	0.000020	0.00015	0.00010	0.042	0.00020	0.39	0.000010
4-Sep-12	40	500	480	4.0	151																																											
11-Sep-12	41	500	475	4.0	189	12	55	#N/A	70	0.20	0.50	0.30	15	4.3	0.00040	0.00030	0.00079	0.00085	0.000010	0.0019	0.0044	4.7	0.00050	0.016	8.7	5.3	0.00011	0.0030	0.67	0.042	0.010	0.00012	0.0063	0.0090	0.22	0.0024	1.7	0.000020	0.070	0.015	22	0.000020	0.000040	0.00010	0.037	0.000060	0.49	0.000010
18-Sep-12	42	500	520	3.9	160																																											
25-Sep-12	43	500	495	3.9	168	11	51	#N/A	53	0.20	0.37	0.30	9.6	4.0	0.00020	0.00020	0.00074	0.00062	0.000010	0.00090	0.0039	3.1	0.00070	0.012	7.0	4.5	0.000070	0.0030	0.45	0.028	0.050	0.0085	0.0049	0.026	0.17	0.0018	1.2	0.000010	0.050	0.011	19	0.000020	0.00042	0.00010	0.038	0.00024	0.40	0.000020
2-Oct-12	44	500	485	4.0	160																																											
9-Oct-12	45	500	480	3.9	154	10.0	45	#N/A	52	0.20	0.32	0.30	7.7	3.6	0.00020	0.00020	0.0010	0.00057	0.000010	0.0015	0.0034	2.5	0.00050	0.011	6.2	3.8	0.00053	0.0030	0.36	0.024	0.010	0.00013	0.0039	0.065	0.16	0.0017	1.1	0.000030	0.040	0.0095	17	0.000020	0.00020	0.00020	0.031	0.00021	0.39	0.000030
16-Oct-12	46	500	465	3.9	172																																											
23-Oct-12	47	500	475	3.9	117																																											
30-Oct-12	48	500	485	3.9	180																																										
6-Nov-12	49	500	465	3.9	113	7.6	31	#N/A	35	0.20	0.21	0.30	5.5	2.2	0.00020	0.00030	0.00077	0.00032	0.000010	0.0018	0.0021	1.9	0.00050	0.0065	3.6	3.3	0.000070	0.0010	0.21	0.015	0.010	0.000020	0.0027	0.0090	0.13	0.00098	0.69	0.000010	0.040	0.0081	12	0.000020	0.00033	0.00010	0.020	0.00011	0.21	0.000010
13-Nov-12	50	500	505	4.0	164																																											
20-Nov-12	51	500	495	3.7	187																																										
27-Nov-12	52	500	455	4.0	210																																										
4-Dec-12	53	500	425	4.2	106	0.10	23	#N/A	43	0.20	0.20	0.30	5.4	2.9	0.00020	0.00020	0.0013	0.00039	0.000010	0.00080	0.0025	1.8	0.00050	0.0083	4.4	3.7	0.00011	0.0020	0.21	0.016	0.010	0.000030	0.0031	0.013	0.15	0.010	0.76	0.000020	0.040	0.0090	15	0.000020	0.00016	0.00010	0.025	0.00011	0.27	0.000010
11-Dec-12	54	500	430	4.3	105																																											
18-Dec-12	55	500	445	3.8	187																																										
25-Dec-12	56	500	405	4.3	105																																										
1-Jan-13	57	500	420	3.6	196	22	59	#N/A	59	0.20	0.23	0.30	3.7	3.7	0.00020	0.00030	0.0014	0.00038	0.000010	0.00060	0.0029	1.2	0.00050	0.0089	4.3	4.0	0.00048	0.0020	0.18	0.015	0.010	0.000060	0.0032	0.0090	0.11	0.0012	0.80	0.000010	0.040	0.0072	17	0.000020	0.00018	0.00010	0.034	0.000080	0.29	0.000010
8-Jan-13	58	500	435	3.8	135																																											
15-Jan-13	59	500	435	3.5	246																																										
22-Jan-13	60	500	415	3.8	160																																										
29-Jan-13	61	500	455	3.4	290	38	81	#N/A	88	1.0	0.24	0.30	4.4	7.4	0.00020	0.00030	0.00076	0.00048	0.000010	0.00060	0.0035	1.5	0.0013	0.012	5.3	6.3	0.00017	0.0020	0.20	0.017	0.010	0.000020	0.0039	0.031	0.12	0.0014	0.89	0.000020	0.080	0.0083	29	0.000020	0.00014	0.00010	0.041	0.00012	0.30	0.000010
5-Feb-13	62	500	430	3.4	323																																										
12-Feb-13	63	500	425	3.3	346																																										
19-Feb-13	64	500	425	3.3	354																																										
26-Feb-13	65	500	420	3.2	378	49	91	#N/A	107	1.0	0.24	0.30	4.4	7.5	0.00020	0.00050	0.00085	0.00051	0.000010	0.00060	0.0041	1.5	0.0018	0.014	5.7	8.5	0.00012	0.0020	0.19	0.019	0.010	0.000030	0.0039	0.073	0.11	0.0014	1.2	0.000020	0.060	0.0075	35	0.000020	0.000050	0.00010	0.047	0.000030	0.34	0.000010
5-Mar-13	66	500	425	3.2	421																																										
12-Mar-13	67	500	425	3.3	345																																										

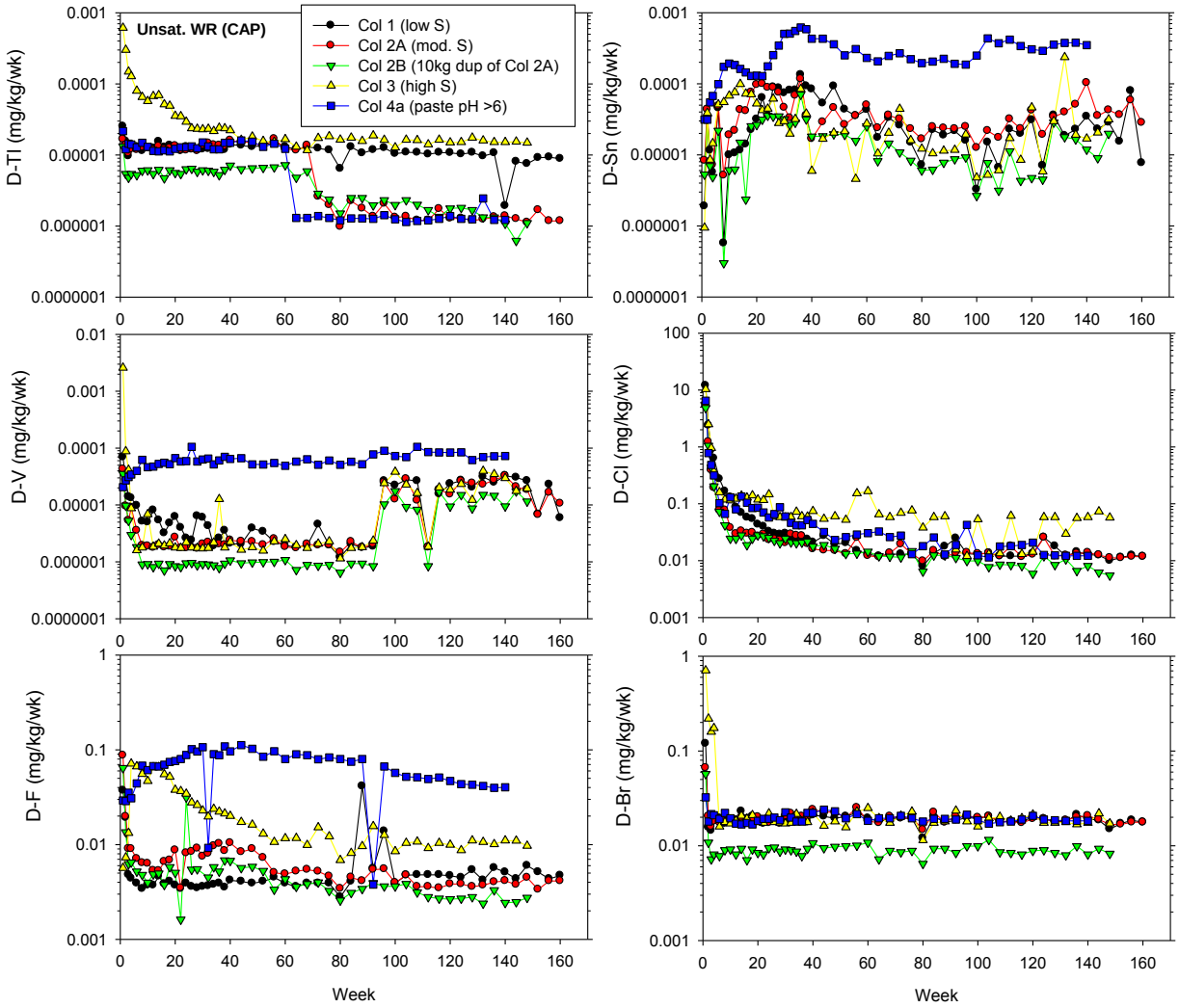
Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC12

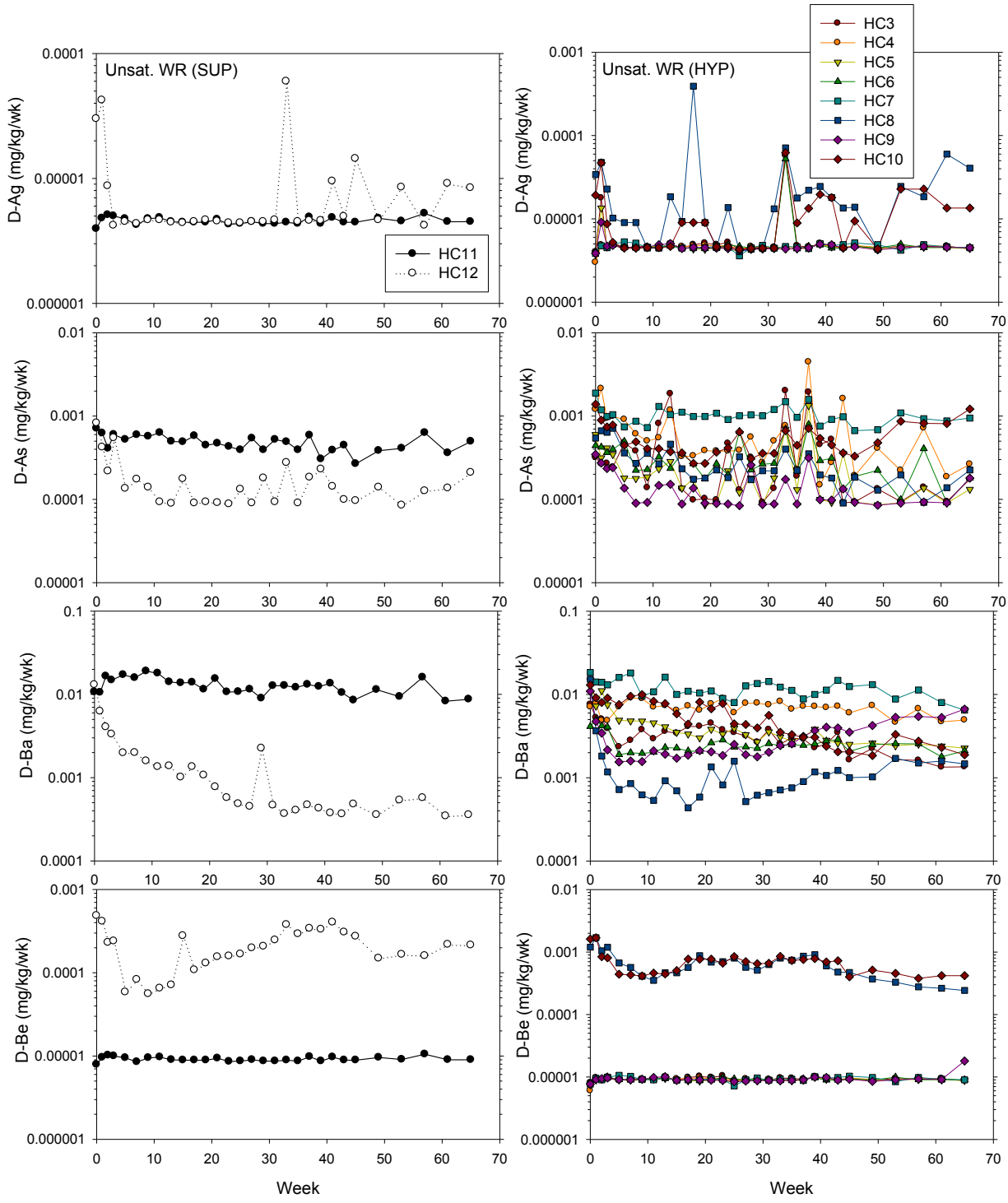
Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
29-Nov-11	0	470	375	4.7	1605	#N/A	74	#N/A	354	1.8	0.73	0.11	167	3.9	0.0028	0.00083	0.013	0.00048	0.0000038	0.0021	0.0032	52	0.00034	0.081	72	0.97	0.0026	0.0068	8.9	0.44	0.011	0.00030	0.022	0.017	4.7	0.018	0.29	0.000030	37	0.17	106	0.00012	0.000034	0.00011	0.037	0.00015	0.70	0.00040
6-Dec-11	1	500	470	4.8	840	#N/A	47	#N/A	198	1.0	0.028	0.14	96	1.3	0.0027	0.00042	0.0063	0.00041	0.0000047	0.0032	0.0020	28	0.00075	0.058	28	0.16	0.00086	0.0071	6.4	0.31	0.0094	0.00017	0.0095	0.0071	4.2	0.012	0.69	0.000042	25	0.100	70	0.0000089	0.0000047	0.000094	0.021	0.00011	0.58	0.00022
13-Dec-11	2	500	435	4.9	599	#N/A	33	#N/A	119	0.87	0.37	0.13	67	0.84	0.0018	0.00022	0.0040	0.00023	0.000022	0.0027	0.0012	20	0.00087	0.047	17	0.097	0.00045	0.0048	4.1	0.20	0.0087	0.00015	0.015	0.0039	2.9	0.0067	0.40	0.0000087	13	0.071	41	0.000052	0.00016	0.00013	0.013	0.000052	0.38	0.00011
20-Dec-11	3	500	420	4.9	520	#N/A	31	#N/A	113	0.29	0.40	0.13	58	0.81	0.0028	0.00055	0.0033	0.00024	0.0000042	0.0023	0.0012	17	0.00021	0.032	17	0.10	0.000046	0.0042	3.5	0.17	0.0042	0.000071	0.0093	0.0038	2.7	0.0037	0.32	0.0000042	6.1	0.057	35	0.000046	0.000013	0.00013	0.010	0.00017	0.30	0.00011
27-Dec-11	4	500	535	5.5	128																																												
3-Jan-12	5	500	450	5.4	116	#N/A	5.2	0.40	23	0.090	0.068	0.14	15	0.13	0.0013	0.00014	0.0020	0.000059	0.0000045	0.0020	0.00041	5.1	0.00023	0.0045	2.5	0.025	0.00052	0.0018	0.44	0.021	0.0045	0.000032	0.0018	0.0041	0.86	0.00089	0.29	0.0000045	0.36	0.017	6.8	0.000014	0.000041	0.00014	0.0016	0.00021	0.071	0.000014
10-Jan-12	6	500	425	5.3	115																																											
17-Jan-12	7	500	435	5.3	106	#N/A	5.2	0.30	20	0.087	0.065	0.13	13	0.12	0.0035	0.00017	0.0020	0.000083	0.0000044	0.0032	0.00030	4.3	0.00022	0.0049	2.9	0.053	0.00036	0.0026	0.54	0.025	0.0044	0.000044	0.0016	0.011	1.3	0.0010	0.39	0.0000044	0.21	0.014	6.5	0.000013	0.000013	0.000087	0.0018	0.00011	0.064	0.000026
24-Jan-12	8	500	435	5.4	90																																											
31-Jan-12	9	500	465	5.3	75	#N/A	3.9	0.36	14	0.093	0.051	0.14	8.5	0.059	0.0011	0.00014	0.0016	0.000056	0.0000047	0.0017	0.00013	2.8	0.00023	0.0031	1.7	0.042	0.0022	0.0014	0.34	0.017	0.0047	0.000033	0.0012	0.0042	0.74	0.00083	0.37	0.0000047	0.074	0.010	4.2	0.0000093	0.0000047	0.00014	0.0011	0.00016	0.033	0.0000047
7-Feb-12	10	500	460	5.3	83																																											
14-Feb-12	11	500	465	5.3	88	#N/A	6.3	0.41	17	0.093	0.065	0.14	10	0.082	0.00056	0.000093	0.0013	0.000065	0.0000047	0.0015	0.00017	3.3	0.00023	0.0042	2.4	0.096	0.00011	0.0014	0.45	0.022	0.0047	0.000065	0.0013	0.020	0.60	0.00075	0.42	0.0000047	0.056	0.013	4.8	0.0000093	0.0000047	0.00019	0.0021	0.00011	0.042	0.0000047
21-Feb-12	12	500	420	5.2	123																																											
28-Feb-12	13	500	445	5.1	102	#N/A	5.8	0.41	17	0.089	0.067	0.13	12	0.11	0.00080	0.000089	0.0014	0.000071	0.0000045	0.0013	0.00017	3.9	0.00022	0.0040	2.2	0.088	0.000040	0.0013	0.44	0.021	0.0045	0.000022	0.0020	0.011	0.88	0.00073	0.30	0.0000045	0.053	0.014	5.2	0.000027	0.000018	0.000045	0.0022	0.00010	0.041	0.0000045
6-Mar-12	14	500	440	5.3	97																																											
13-Mar-12	15	500	440	5.0	102	#N/A	6.7	0.39	18	0.088	0.075	0.13	11	0.10	0.00075	0.00018	0.0010	0.00028	0.0000044	0.0011	0.00022	3.6	0.00022	0.0054	2.9	0.14	0.000018	0.0026	0.51	0.025	0.0044	0.000022	0.0017	0.020	0.70	0.00089	0.33	0.0000044	0.031	0.013	5.7	0.0000088	0.000084	0.000044	0.0033	0.000013	0.054	0.0000088
20-Mar-12	16	500	465	5.2	88																																											
27-Mar-12	17	500	450	5.2	99	#N/A	6.2	0.50	19	0.090	0.081	0.14	11	0.16	0.00050	0.000090	0.0014	0.00011	0.0000045	0.0014	0.00022	3.7	0.00023	0.0047	2.6	0.20	0.00083	0.0014	0.48	0.025	0.0045	0.000014	0.0016	0.015	0.57	0.00068	0.34	0.0000045	0.032	0.013	5.9	0.0000090	0.0000045	0.000045	0.0039	0.000063	0.033	0.0000045
3-Apr-12	18	500	440	4.9	89																																											
10-Apr-12	19	500	465	4.9	101	#N/A	7.1	0.17	18	0.093	0.093	0.14	10	0.18	0.00042	0.000093	0.0011	0.00013	0.0000047	0.0012	0.00024	3.3	0.00023	0.0056	3.0	0.25	0.000051	0.0014	0.49	0.025	0.0093	0.00022	0.0018	0.0093	0.46	0.00075	0.42	0.0000047	0.023	0.012	5.7	0.0000093	0.0000014	0.000047	0.0044	0.000065	0.054	0.0000047
17-Apr-12	20	500	450	4.8	122																																											
24-Apr-12	21	500	455	4.7	108	#N/A	8.6	0.046	20	0.091	0.10	0.14	10	0.21	0.00041	0.000091	0.00077	0.00015	0.0000046	0.00082	0.00031	3.2	0.00023	0.0056	3.1	0.33	0.000096	0.0014	0.50	0.027	0.014	0.000036	0.0018	0.019	0.41	0.00081	0.35	0.0000046	0.027	0.011	6.0	0.0000091	0.0000091	0.000046	0.0067	0.000055	0.069	0.0000046
1-May-12	22	500	450	4.8	116																																											
8-May-12	23	500	440	4.6	119	#N/A	9.7	0.044	20	0.088	0.088	0.13	11	0.22	0.00035	0.000088	0.00057	0.00016	0.0000044	0.00075	0.00036	3.3	0.00022	0.0064	3.0	0.35	0.000040	0.0013	0.52	0.028	0.0044	0.000079	0.0021	0.0070	0.38	0.00083	0.27	0.0000044	0.026	0.0098	6.4	0.0000088	0.0000079	0.000044	0.0076	0.000057	0.074	0.0000044
15-May-12	24	500	450	4.5	110																																											
22-May-12	25	500	440	4.6	112	#N/A	9.8	0.044	17	0.088	0.12	0.13	9.4	0.32	0.00026	0.00013	0.00048	0.00017	0.0000044	0.00075	0.00037	3.0	0.00022	0.0059	3.0	0.44	0.000044	0.0013	0.48	0.026	0.0044	0.00015	0.0021	0.0040	0.28	0.00073	0.28	0.0000044	0.022	0.0086	6.0	0.0000088	0.000031	0.00070	0.0080	0.00030	0.069	0.0000044
29-May-12	26	500	440	4.4	119																																											
5-Jun-12	27	500	450	4.5	110	#N/A	9.9	0.045	17	0.090	0.12	0.14	9.0	0.34	0.00023	0.000090	0.00045	0.00020	0.0000045	0.0013	0.00045	2.9	0.00023	0.0063	2.9	0.51	0.0000090	0.0014	0.46	0.025	0.0045	0.000018	0.0026	0.0041	0.25	0.00089	0.32	0.0000045	0.023	0.0079	6.1	0.0000090	0.000027	0.000090	0.0091	0.00015	0.085	0.0000045
12-Jun-12	28	500	455	4.5	103																																											
19-Jun-12	29	500	450	4.4	106	1.6	10	#N/A	17	0.18	0.14	0.14	7.6	0.38	0.00023	0.00018	0.0023	0.00021	0.0000045	0.00099	0.00051	2.4	0.00023	0.0061	2.9	0.58	0.00012	0.0014	0.40	0.023	0.0045	0.00043	0.0022	0.0041	0.21	0.00094	0.32	0.0000045	0.027	0.0073	5.4	0.0000090	0.000045	0.000045	0.010	0.00010	0.086	0.0000045
26-Jun-12	30	500	450	4.4	107																																											
3-Jul-12	31	500	465	4.6	117	#N/A	16	0.047	19	0.47	0.17	0.14	7.5	0.53	0.00023	0.000093	0.00047	0.00025	0.0000047	0.00051	0.00077	2.3	0.00023	0.0068	3.4	0.85	0.00012	0.0014	0.44	0.025	0.0047	0.000042	0.0023	0.0042	0.17	0.00097	0.32	0.0000047	0.023	0.0069	6.3	0.0000093	0.00012	0.000047	0.013	0.000098	0.11	0.0000093
10-Jul-12	32	500	450	4.3	126																																											
17-Jul-12	33	500	460	4.1	136	5.0	16	#N/A	21	0.092	0.20	0.14	7.6	0.81	0.00032	0.00028	0.00037	0.00038	0.0000046	0.0016	0.0012	2.3	0.00023	0.0090	4.0	1.4	0.000023	0.0018	0.45	0.027	0.0046	0.000037	0.0026	0.0051	0.16	0.0010	0.46	0.000060	0.028	0.0075	7.6	0.0000092	0.000051	0.000092	0.018	0.00011	0.17	0.0000046
24-Jul-12	34	500	470	4.2	133																																											
31-Jul-12	35	500	450	4.1	126	4.4	14	#N/A	20	0.090	0.18	0.14	6.5	0.80	0.00027	0.000090	0.00041	0.00029	0.0000045	0.00081	0.0011	2.0	0.00023	0.0065	3.3	1.3	0.00066	0.0014	0.36	0.021	0.027	0.000018	0.0023	0.0041	0.12	0.00070	0.39	0.0000045	0.023	0.0060	6.5	0.0000090	0.000032	0.000045	0.015	0.00013	0.15	0.0000045
7-Aug-12	36	500	485	4.1	141																																											
14-Aug-12	37	500	460	4.0	143	7.3	19	#N/A	24	0.092	0.21	0.14	6.0	1.3	0.00023	0.00018	0.00047	0.00034	0.0000046	0.00092	0.0014	1.8	0.00023	0.0069	3.5	1.5	0.000041	0.0014	0.35	0.021	0.0046	0.0010	0.0026	0.0041	0.11	0.00088	0.46	0.0000046	0.032	0.0056	7.9	0.0000092	0.000087	0.00014	0.017	0.00023	0.20	0.0000046
21-Aug-12	38	500	465	4.0	161																																											
28-Aug-12	39	500	460	4.1	148	8.4	22	#N/A	28	0.092	0.21	0.14	5.3	1.5	0.00023	0.00023	0.00043	0.00033	0.0000046	0.0010	0.0016	1.6	0.00023	0.0064	3.5	1.5	0.00011	0.0014	0.30	0.018	0.018	0.0000092	0.0024	0.0060	0.094	0.00091	0.42	0.0000046	0.018	0.0051	7.9	0.0000092	0.000069	0.000046	0.019	0.000092	0.18	0.0000046
4-Sep-12	40	500	480	4.0	151																																											
11-Sep-12	41	500	475	4.0	189	12	26	#N/A	33	0.095	0.24	0.14	6.9	2.0	0.00019	0.00014	0.00038	0.00040	0.0000048	0.00090	0.0021	2.2	0.00024	0.0075	4.1	2.5	0.000052	0.0014	0.32	0.020	0.0048	0.000057	0.0030	0.0043	0.11	0.0011	0.81	0.0000095	0.033	0.0070	11	0.0000095	0.000019	0.000048	0.018	0.000029	0.23	0.0000048
18-Sep-12	42	500	520	3.9	160																																											
25-Sep-12	43	500	495	3.9	168	11	25	#N/A	26	0.099	0.18	0.15	4.8	2.0	0.000099	0.000099	0.00037	0.00031	0.0000050	0.00045	0.0019	1.5	0.00035	0.0061	3.5	2.2	0.000035	0.0015	0.22	0.014	0.025	0.0042	0.0024	0.013	0.085	0.00087	0.57	0.0000050	0.025	0.0055	9.3	0.0000099	0.00021	0.000050	0.019	0.00012	0.20	0.0000099
2-Oct-12	44	500	485	4.0	160																																											
9-Oct-12	45	500	480	3.9	154	10.0	21	#N/A	25	0.096	0.15	0.14	3.7	1.7	0.000096	0.000096	0.00048	0.00027	0.0000048	0.00072	0.0016	1.2	0.00024	0.0051	3.0	1.8	0.00025	0.0014	0.17	0.012	0.0048	0.000062	0.0019	0.031	0.074	0.00082	0.51	0.000014	0.019	0.0046	8.0	0.0000096	0.000096	0.000096	0.015	0.00010	0.18	0.000014
16-Oct-12	46	500	465	3.9	172																																											
23-Oct-12	47	500	475	3.9	117																																										
30-Oct-12	48	500	485	3.9	180																																										
6-Nov-12	49	500	465	3.9	113	7.6	14	#N/A	16	0.093	0.098	0.14	2.6	1.0	0.000093	0.00014	0.00036	0.00015	0.0000047	0.00084	0.00097	0.87	0.00023	0.0030	1.7	1.5	0.000033	0.00047	0.096	0.0072	0.0047	0.0000093	0.0013	0.0042	0.062	0.00046	0.32	0.0000047	0.019	0.0038	5.3	0.0000093	0.00015	0.000047	0.0093	0.000051	0.096	0.0000047
13-Nov-12	50	500	505	4.0	164																																											
20-Nov-12	51	500	495	3.7	187																																										
27-Nov-12	52	500	455	4.0	210																																										
4-Dec-12	53	500	425	4.2	106	0.10	9.9	#N/A	18	0.085	0.085	0.13	2.3	1.2	0.000085	0.000085	0.00054	0.00017	0.0000043	0.00034	0.0011	0.78	0.00021	0.0035	1.9	1.6	0.000047	0.00085	0.089	0.0067	0.0043	0.000013	0.0013	0.0055	0.065	0.0043	0.32	0.0000085	0.017	0.0038	6.5	0.0000085	0.000068	0.000043	0.011	0.000047	0.11	0.0000043
11-Dec-12	54	500	430	4.3	105																																											
18-Dec-12	55	500	445	3.8	187																																										
25-Dec-12	56	500	405	4.3	105																																										
1-Jan-13	57	500	420	3.6	196	22	25	#N/A	25	0.084	0.097	0.13	1.6	1.5	0.000084	0.00013	0.00057	0.00016	0.0000042	0.00025	0.0012	0.50	0.00021	0.0037	1.8	1.7	0.00020	0.00084	0.077	0.0063	0.0042	0.000025	0.0013	0.0038	0.047	0.00051	0.34	0.0000042	0.017	0.0030	7.3	0.0000084	0.000076	0.000042	0.014	0.000034	0.12	0.0000042
8-Jan-13	58	500	435	3.8	135																																											
15-Jan-13	59	500	435	3.5	246																																										
22-Jan-13	60	500	415	3.8	160																																										
29-Jan-13	61	500	455	3.4	290	38	37	#N/A	40	0.46	0.11	0.14	2.0	3.3	0.000091	0.00014	0.00035	0.00022	0.0000046	0.00027	0.0016	0.66	0.00059	0.0052	2.4	2.9	0.000077	0.00091	0.091	0.0076	0.0046	0.0000091	0.0018	0.014	0.052	0.00064	0.40	0.0000091	0.036	0.0038	13	0.0000091	0.000064	0.000046	0.018	0.000055	0.14	0.0000046
5-Feb-13	62	500	430	3.4	323																																											
12-Feb-13	63	500	425	3.3	346																																										
19-Feb-13	64	500	425	3.3	354																																										
26-Feb-13	65	500	420	3.2	378	49	38	#N/A	45	0.42	0.10	0.13	1.9	3.2	0.000084	0.00021	0.00036	0.00021	0.0000042	0.00025	0.0017	0.61	0.00076	0.0059	2.4	3.6	0.000050	0.00084	0.081	0.0078	0.0042	0.000013	0.0016	0.031	0.047	0.00060	0.49	0.0000084	0.025	0.0032	15	0.0000084	0.000021	0.000042	0.020	0.000013	0.14	0.0000042
5-Mar-13	66	500	425	3.2	421																																										
12-Mar-13	67	500	425	3.3	345																																										
Median (last 5)				3.8	187	22	25	#N/A	25	0.093	0.098	0.13	2.0	1.5	0.000085	0.00014	0.00036	0.00017	0.0000043	0.00027	0.0012	0.66	0.00023	0.0037	1.9	1.7	0.000050	0.00084	0.089	0.0072	0.0043	0.000013	0.0013	0.0055	0.052	0.00060	0.34	0.0000084	0.019	0.0038	7.3	0.0000085	0.000068	0.000043	0.014	0.000047	0.12	0.0000043

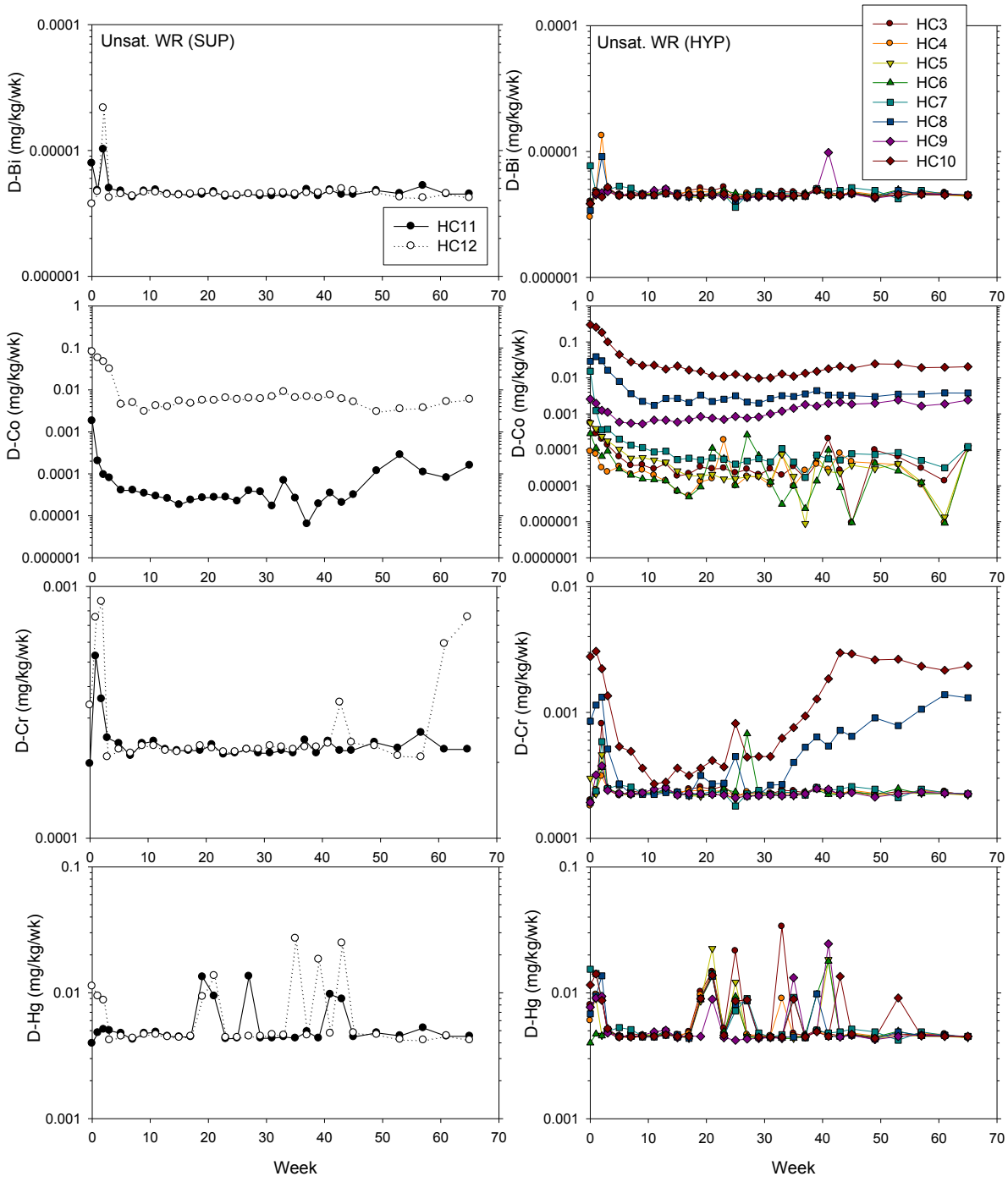
Appendix E.1: Loading Rates for Unsaturated CAP Waste Rock Columns

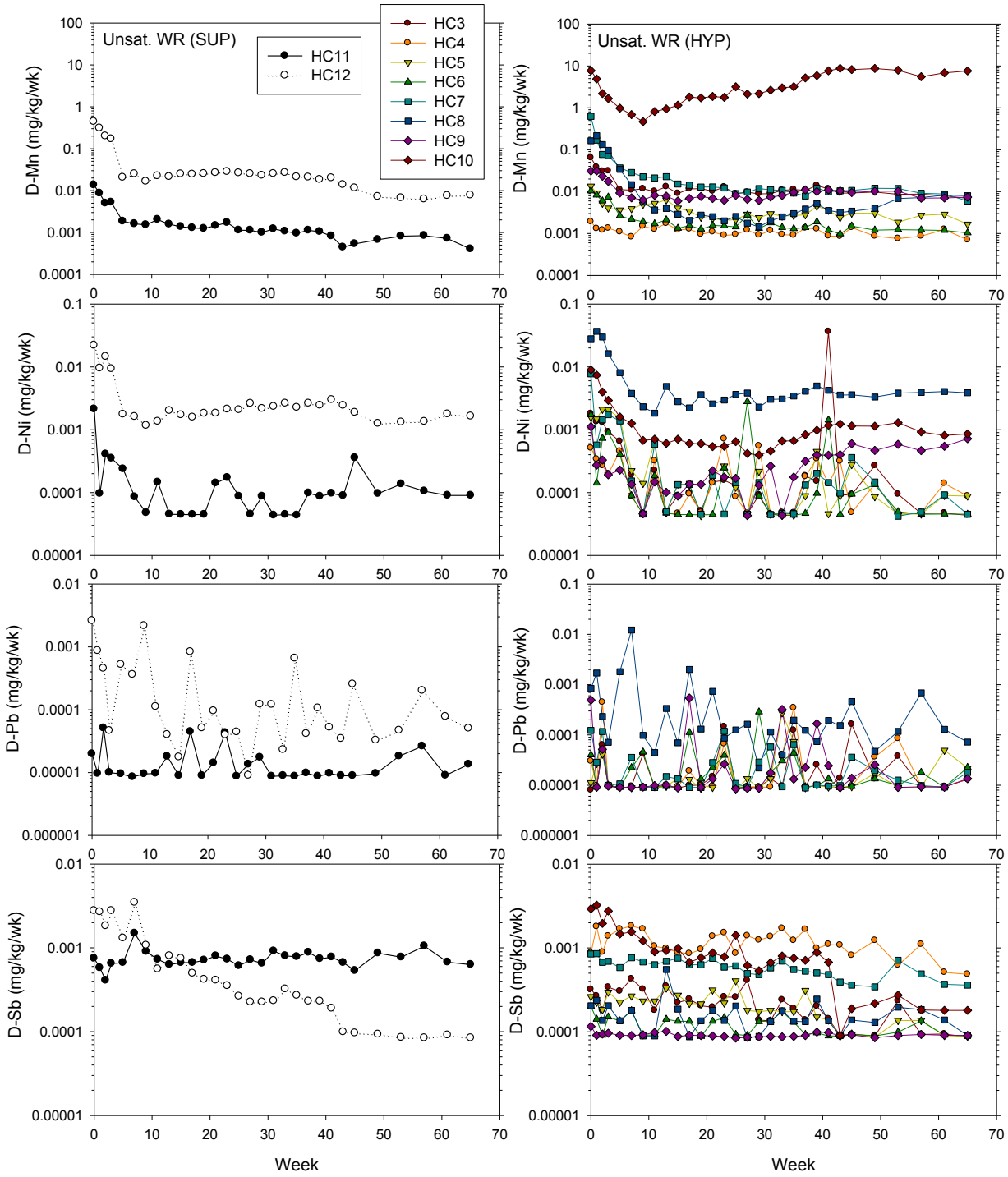


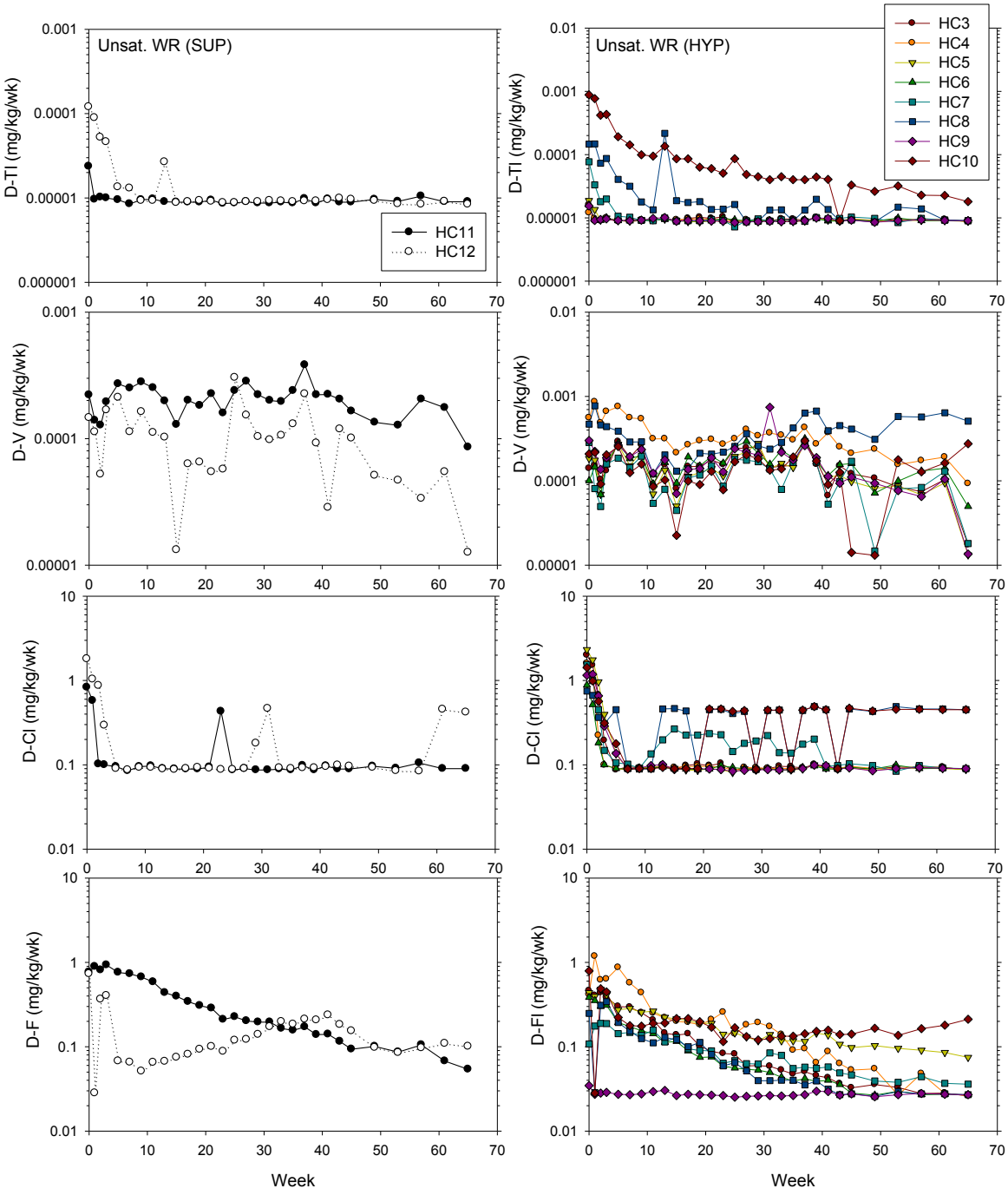

Unsat. WR (CAP)
Col 1 (low S)
Col 2A (mod. S)
Col 2B (10kg dup of Col 2A)
Col 3 (high S)
Col 4a (paste pH >6)
D-Tl (mg/kg/wk)
D-Sn (mg/kg/wk)
D-V (mg/kg/wk)
D-Cl (mg/kg/wk)
D-F (mg/kg/wk)
D-Br (mg/kg/wk)
Week
Week

Loading Rates for Unsaturated SUP and HYP Waste Rock Humidity Cells




Unsat. WR (SUP)
Unsat. WR (HYP)
HC11
HC12
HC3
HC4
HC5
HC6
HC7
HC8
HC9
HC10
D-Bi (mg/kg/wk)
D-Co (mg/kg/wk)
D-Cr (mg/kg/wk)
D-Hg (mg/kg/wk)
Week


Unsat. WR (SUP)
Unsat. WR (HYP)
HC11
HC12
HC3
HC4
HC5
HC6
HC7
HC8
HC9
HC10
D-Mn (mg/kg/wk)
D-Ni (mg/kg/wk)
D-Pb (mg/kg/wk)
D-Sb (mg/kg/wk)
Week


Unsat. WR (SUP)
Unsat. WR (HYP)
HC3
HC4
HC5
HC6
HC7
HC8
HC9
HC10
HC11
HC12
D-Tl (mg/kg/wk)
D-V (mg/kg/wk)
D-Cl (mg/kg/wk)
D-F (mg/kg/wk)
D-Fl (mg/kg/wk)
Week

APPENDIX E2 LEACHATE RESULTS FOR UNSATURATED ORE HUMIDITY CELLS

Cell No.	Zone	Method Reference	Column Dimensions			Column Packing			Total Volume of Initial Flushings (mL)	Flushing Rate/ Weekly Input* (mL)	Temp (°C)	Sampling Frequency	Start-up date	Sampling Day	Operation Procedure	Sample Prep for Flushings
			Inner Diameter (cm)	Length (cm)	Ht. of Sample (cm)	Dry Wt. of Sample (kg)	Other Materials Used	Column Material								
HC1	HYP	ASTM	10.2	25.5	-	1.00	Acrylic perforated disk & nylon mesh	Plexiglas	600	500	20-22 °C	Weekly	3-Dec-09	Thursday	Flood Leach	None
HC2	81.7% SUP, 18.3% HYP	ASTM	10.2	25.5	-	1.00	Acrylic perforated disk & nylon mesh	Plexiglas	600	500	20-22 °C	Weekly	3-Dec-09	Thursday	Flood Leach	None

Leachate Results for HC1

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
3-Dec-09	0	600	460	7.1	1585	#N/A	6.4	29	993	14	0.96	0.60	1040	0.054	0.0035	0.0045	0.038	0.000010	0.0000050	0.050	0.00040	369	0.00080	0.0026	0.015	0.022	0.00018	0.0032	29	0.090	0.020	0.078	0.010	0.013	15	0.0044	0.99	0.0000070	33	1.8	380	0.000067	0.000030	0.00050	0.024	0.00040	0.0050	0.00020
10-Dec-09	1	500	470	7.5	1138	#N/A	5.0	21	719	5.2	0.88	0.40	627	0.045	0.0048	0.0052	0.024	0.000010	0.0000050	0.050	0.00020	220	0.00010	0.00088	0.0087	0.0050	0.000032	0.0014	19	0.052	0.010	0.097	0.0064	0.0050	7.7	0.0030	0.93	0.000010	21	1.4	223	0.000035	0.000010	0.00050	0.073	0.00040	0.00070	0.00010
17-Dec-09	2	500	465	7.3	1004	#N/A	3.8	16	633	2.2	0.81	0.40	586	0.054	0.0051	0.0061	0.022	0.000010	0.0000050	0.050	0.00016	205	0.00010	0.00053	0.0061	0.015	0.000018	0.0011	18	0.052	0.010	0.066	0.0041	0.010	7.3	0.0018	1.1	0.0000050	17	1.3	222	0.000031	0.000020	0.00050	0.052	0.00040	0.00080	0.00010
24-Dec-09	3	500	490	7.4	831	#N/A	3.3	21	529	1.2	0.72	0.40	539	0.038	0.0052	0.0046	0.019	0.000010	0.0000050	0.050	0.00016	193	0.00020	0.00050	0.0050	0.0080	0.000061	0.0012	14	0.065	0.010	0.045	0.0023	0.0070	6.1	0.0012	1.1	0.0000060	9.2	1.2	196	0.000038	0.000020	0.00050	0.067	0.00040	0.00060	0.00010
31-Dec-09	4	500	460	7.3	771				426																																								
7-Jan-10	5	500	485	6.9	751	#N/A	4.3	15	378	0.50	0.50	0.40	411	0.027	0.0062	0.0029	0.014	0.000010	0.0000050	0.050	0.00014	148	0.00010	0.00059	0.0096	0.0050	0.000066	0.0011	10	0.073	0.010	0.079	0.0012	0.0030	4.0	0.00091	1.0	0.0000050	4.3	0.92	138	0.000019	0.00013	0.00050	0.049	0.00020	0.0027	0.00010
14-Jan-10	6	500	500	7.0	857				455																																								
21-Jan-10	7	500	470	7.2	732	#N/A	4.8	14	427	0.50	0.57	0.40	450	0.034	0.0073	0.0028	0.013	0.000010	0.0000050	0.050	0.00021	163	0.00010	0.00052	0.0043	0.0080	0.00048	0.0012	11	0.095	0.010	0.13	0.00078	0.0040	4.1	0.0010	1.0	0.00012	2.7	0.92	153	0.000024	0.000010	0.00050	0.031	0.00020	0.0019	0.00010
28-Jan-10	8	500	470	6.9	612				409																																								
4-Feb-10	9	500	460	6.8	571	#N/A	4.4	12	363	0.50	0.44	0.40	396	0.026	0.0061	0.0020	0.014	0.000010	0.0000050	0.050	0.00016	143	0.00010	0.00038	0.0036	0.0020	0.000024	0.0010	9.2	0.086	0.010	0.11	0.00062	0.0020	3.1	0.00087	0.84	0.0000050	1.5	0.80	133	0.000019	0.00011	0.00050	0.029	0.00020	0.00090	0.00010
11-Feb-10	10	500	440	7.0	642				357																																								
18-Feb-10	11	500	405	7.2	672	#N/A	3.9	15	419	0.90	0.47	0.40	506	0.040	0.0057	0.0027	0.016	0.000010	0.0000090	0.050	0.00013	185	0.00010	0.00028	0.0055	0.0060	0.000018	0.0013	11	0.082	0.010	0.12	0.00084	0.0060	4.0	0.00093	1.0	0.0000050	1.5	0.96	174	0.000018	0.000030	0.00050	0.024	0.00030	0.00090	0.00010
25-Feb-10	12	500	420	7.2	643				364																																								
4-Mar-10	13	500	410	7.0	705	#N/A	3.9	13	413	0.50	0.37	0.40	429	0.030	0.0069	0.0026	0.013	0.000010	0.0000050	0.050	0.00011	158	0.00020	0.00027	0.0033	0.0030	0.000089	0.0011	8.1	0.077	0.010	0.097	0.00042	0.0030	2.7	0.00064	1.0	0.0000050	0.87	0.79	146	0.000015	0.000010	0.00050	0.032	0.00020	0.00070	0.00010
11-Mar-10	14	500	445	7.0	569				318																																								
18-Mar-10	15	500	455	7.1	517	#N/A	4.2	11	254	0.50	0.24	0.40	288	0.034	0.0045	0.0016	0.012	0.000010	0.0000050	0.050	0.000078	107	0.00010	0.00017	0.0026	0.0030	0.000023	0.00070	5.0	0.049	0.010	0.068	0.00066	0.0020	1.9	0.00046	0.75	0.0000050	0.56	0.50	98	0.000016	0.000010	0.00050	0.018	0.00020	0.0011	0.00010
25-Mar-10	16	500	445	7.0	513				265																																								
1-Apr-10	17	500	390	6.8	534	#N/A	4.7	13	281	0.50	0.29	0.40	273	0.033	0.0099	0.0024	0.010	0.000010	0.0000050	0.050	0.00073	101	0.00010	0.00017	0.0052	0.0050	0.000056	0.0010	5.2	0.044	0.010	0.086	0.00036	0.0020	2.3	0.00055	0.83	0.000015	0.58	0.48	88	0.000014	0.00012	0.00050	0.028	0.00020	0.00090	0.00010
8-Apr-10	18	500	430	7.1	491				214																																								
15-Apr-10	19	500	450	7.2	483	#N/A	3.3	12	260	0.50	0.20	0.40	255	0.029	0.0048	0.0017	0.0093	0.000010	0.0000050	0.050	0.000080	95	0.00010	0.00020	0.0031	0.0060	0.000070	0.00070	4.0	0.047	0.010	0.049	0.00081	0.0040	1.9	0.00041	0.77	0.000012	0.58	0.44	84	0.000037	0.000090	0.00050	0.018	0.00020	0.00080	0.00010
22-Apr-10	20	500	460	7.0	562				322																																								
29-Apr-10	21	500	460	6.8	513	#N/A	2.8	14	243	0.50	0.30	0.40	236	0.036	0.0048	0.0021	0.012	0.000010	0.0000050	0.050	0.000071	89	0.00010	0.00013	0.0029	0.0030	0.0000060	0.00060	3.5	0.047	0.010	0.049	0.00028	0.0020	1.6	0.00043	0.66	0.0000050	0.42	0.42	74	0.0000070	0.000020	0.00050	0.015	0.00020	0.00060	0.00010
6-May-10	22	500	450	6.9	483				243																																								
13-May-10	23	500	470	7.0	482	#N/A	4.0	13	243	0.50	0.20	0.40	248	0.033	0.0050	0.0017	0.013	0.000010	0.0000050	0.050	0.000086	94	0.00010	0.00015	0.0044	0.0050	0.0000050	0.00060	3.3	0.050	0.010	0.053	0.00029	0.0020	1.6	0.00040	0.74	0.0000050	0.38	0.45	85	0.0000090	0.000030	0.00050	0.015	0.00020	0.00090	0.00010
20-May-10	24	500	455	7.2	444				240																																								
27-May-10	25	500	465	6.6	427	#N/A	7.6	14	184	0.50	0.19	0.40	229	0.028	0.0045	0.0015	0.0078	0.000010	0.0000090	0.050	0.000065	87	0.00010	0.00012	0.0027	0.0020	0.0000060	0.00070	3.1	0.046	0.010	0.052	0.00028	0.0020	1.4	0.00042	0.76	0.0000050	0.34	0.40	70	0.000012	0.000010	0.00050	0.015	0.00020	0.0013	0.00010
3-Jun-10	26	500	450	7.0	462				191																																								
10-Jun-10	27	500	460	7.2	447	#N/A	5.1	13	188	0.50	0.20	0.40	228	0.028	0.0044	0.0015	0.0069	0.000010	0.0000050	0.050	0.000056	86	0.00020	0.00011	0.0019	0.0030	0.000017	0.00060	3.2	0.044	0.010	0.054	0.00021	0.0020	1.4	0.00044	0.69	0.0000050	0.38	0.40	84	0.0000070	0.000010	0.00050	0.011	0.00020	0.00040	0.00010
17-Jun-10	28	500	455	7.1	394				123																																								
24-Jun-10	29	500	480	7.0	429	#N/A	4.2	14	158	0.50	0.17	0.40	200	0.032	0.0051	0.0015	0.0084	0.000010	0.0000050	0.050	0.000065	76	0.00010	0.00012	0.0021	0.0010	0.0000050	0.00060	2.9	0.044	0.010	0.058	0.00019	0.0020	1.2	0.00054	0.70	0.0000050	0.34	0.38	72	0.0000080	0.000010	0.00050	0.010	0.00020	0.00050	0.00010
1-Jul-10	30	500	435	7.1	397				163																																								
8-Jul-10	31	500	445	7.2	371	#N/A	2.6	11	152	0.50	0.15	0.40	176	0.029	0.0040	0.0014	0.0081	0.000010	0.0000050	0.050	0.000052	67	0.00010	0.000094	0.0024	0.0020	0.00010	0.00050	2.4	0.038	0.010	0.045	0.00023	0.0020	0.98	0.00046	0.59	0.0000050	0.27	0.31	61	0.000018	0.000010	0.00050	0.011	0.00020	0.0011	0.00010
15-Jul-10	32	500	450	7.0	386				142																																								
22-Jul-10	33	500	475	6.8	347	#N/A	4.3	13	150	0.50	0.13	0.40	171	0.032	0.0038	0.0013	0.0081	0.000010	0.0000050	0.050	0.000051	64	0.00010	0.00013	0.0024	0.0030	0.0000050	0.00050	2.4	0.039	0.010	0.048	0.00024	0.0030	0.91	0.00046	0.59	0.0000050	0.28	0.31	61	0.0000070	0.000020	0.00050	0.011	0.00020	0.00030	0.00010
29-Jul-10	34	500	465	7.0	381				190																																								
5-Aug-10	35	500	480	7.2	353	#N/A	3.9	12	162	0.50	0.14	0.40	180	0.030	0.0042	0.0012	0.0070	0.000010	0.0000050	0.050	0.000046	69	0.00010	0.000098	0.0025	0.0010	0.0000050	0.00050	2.1	0.039	0.010	0.051	0.00018	0.0020	0.91	0.00049	0.65	0.0000050	0.23	0.31	65	0.0000060	0.000030	0.00050	0.0094	0.00020	0.00040	0.00010
12-Aug-10	36	500	480	7.1	326				149																																								
19-Aug-10	37	500	440	6.7	298	#N/A	7.1	12	124	0.80	0.18	0.40	154	0.031	0.0037	0.0011	0.0068	0.000010	0.0000050	0.050	0.000034	58	0.00010	0.000058	0.0029	0.0010	0.0000060	0.00050	2.1	0.025	0.010	0.052	0.00017	0.0020	0.80	0.00049	0.53	0.0000050	0.26	0.27	50	0.0000060	0.000010	0.00050	0.011	0.00020	0.00040	0.00010
26-Aug-10	38	500	440	7.0	320	#N/A	3.7	15	162	0.50	0.17	0.40	156	0.025	0.0039	0.0010	0.0076	0.000010	0.0000050	0.050	0.000045	59	0.00010	0.000081	0.0026	0.0050	0.000030	0.00070	2.0	0.035	0.010	0.045	0.00019	0.0030	0.78	0.00044	0.54	0.0000050	0.23	0.30	52	0.0000070	0.000040	0.00050	0.011	0.00020	0.00080	0.00010
2-Sep-10	39	500	455	7.2	292	#N/A	5.3	14	160	0.50	0.14	0.40	142	0.027	0.0039	0.0010	0.0075	0.000010	0.0000050	0.050	0.000065	54	0.00010	0.000067	0.0026	0.0070	0.0000060	0.00050	2.0	0.030	0.010	0.044	0.00026	0.0020	0.75	0.00047	0.57	0.0000050	0.23	0.26	53	0.0000060	0.00013	0.00050	0.0080	0.00020	0.00030	0.00010
Cell Terminated				7.5																																												

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC1

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
3-Dec-09	0	600	460	7.1	1585	#N/A	3.0	14	457	6.4	0.44	0.28	478	0.025	0.0016	0.0021	0.018	0.0000046	0.0000023	0.023	0.00018	170	0.00037	0.0012	0.0067	0.010	0.000082	0.0015	13	0.041	0.0092	0.036	0.0046	0.0060	6.9	0.0020	0.45	0.0000032	15	0.82	175	0.0000031	0.000014	0.00023	0.011	0.00018	0.0023	0.000092
10-Dec-09	1	500	470	7.5	1138	#N/A	2.3	10.0	338	2.4	0.41	0.19	295	0.021	0.0022	0.0025	0.011	0.0000047	0.0000024	0.024	0.000094	103	0.00047	0.00041	0.0041	0.0024	0.000015	0.00066	8.8	0.024	0.0047	0.046	0.0030	0.0024	3.6	0.0014	0.44	0.0000047	10.0	0.66	105	0.0000016	0.0000047	0.00024	0.034	0.00019	0.00033	0.000047
17-Dec-09	2	500	465	7.3	1004	#N/A	1.7	7.3	294	1.0	0.38	0.19	272	0.025	0.0024	0.0029	0.010	0.0000047	0.0000023	0.023	0.000072	95	0.000047	0.00025	0.0028	0.0070	0.0000084	0.00051	8.3	0.024	0.0047	0.031	0.0019	0.0047	3.4	0.00086	0.51	0.0000023	7.8	0.61	103	0.0000014	0.0000093	0.00023	0.024	0.00019	0.00037	0.000047
24-Dec-09	3	500	490	7.4	831	#N/A	1.6	10	259	0.59	0.35	0.20	264	0.019	0.0026	0.0023	0.0092	0.0000049	0.0000025	0.025	0.000077	95	0.000098	0.00025	0.0024	0.0039	0.000030	0.00059	6.8	0.032	0.0049	0.022	0.0011	0.0034	3.0	0.00059	0.54	0.0000029	4.5	0.60	96	0.0000019	0.0000098	0.00025	0.033	0.00020	0.00029	0.000049
31-Dec-09	4	500	460	7.3	771																																												
7-Jan-10	5	500	485	6.9	751	#N/A	2.1	7.3	183	0.24	0.24	0.19	199	0.013	0.0030	0.0014	0.0069	0.0000049	0.0000024	0.024	0.000066	72	0.000049	0.00029	0.0047	0.0024	0.000032	0.00053	4.9	0.036	0.0049	0.038	0.00057	0.0015	1.9	0.00044	0.49	0.0000024	2.1	0.45	67	0.0000092	0.000063	0.00024	0.024	0.000097	0.0013	0.000049
14-Jan-10	6	500	500	7.0	857																																												
21-Jan-10	7	500	470	7.2	732	#N/A	2.3	6.8	201	0.24	0.27	0.19	212	0.016	0.0034	0.0013	0.0062	0.0000047	0.0000024	0.024	0.000099	77	0.000047	0.00024	0.0020	0.0038	0.00023	0.00056	5.0	0.045	0.0047	0.063	0.00037	0.0019	1.9	0.00047	0.48	0.0000056	1.3	0.43	72	0.000011	0.0000047	0.00024	0.014	0.000094	0.00089	0.000047
28-Jan-10	8	500	470	6.9	612																																											
4-Feb-10	9	500	460	6.8	571	#N/A	2.0	5.6	167	0.23	0.20	0.18	182	0.012	0.0028	0.00094	0.0063	0.0000046	0.0000023	0.023	0.000046	66	0.000046	0.00017	0.0017	0.00092	0.000011	0.00046	4.2	0.040	0.0046	0.052	0.00029	0.00092	1.4	0.00040	0.39	0.0000023	0.70	0.37	61	0.0000087	0.000051	0.00023	0.013	0.000092	0.00041	0.000046
11-Feb-10	10	500	440	7.0	642																																											
18-Feb-10	11	500	405	7.2	672	#N/A	1.6	6.3	170	0.36	0.19	0.16	205	0.016	0.0023	0.0011	0.0066	0.0000041	0.0000036	0.020	0.000054	75	0.000041	0.00011	0.0022	0.0024	0.0000073	0.00053	4.3	0.033	0.0041	0.049	0.00034	0.0024	1.6	0.00038	0.41	0.0000020	0.62	0.39	70	0.0000073	0.000012	0.00020	0.0099	0.00012	0.00036	0.000041
25-Feb-10	12	500	420	7.2	643																																											
4-Mar-10	13	500	410	7.0	705	#N/A	1.6	5.5	169	0.21	0.15	0.16	176	0.012	0.0028	0.0010	0.0052	0.0000041	0.0000021	0.021	0.000046	65	0.000082	0.00011	0.0013	0.0012	0.000036	0.00045	3.3	0.031	0.0041	0.040	0.00017	0.0012	1.1	0.00026	0.42	0.0000021	0.36	0.32	60	0.0000062	0.0000041	0.00021	0.013	0.000082	0.00029	0.000041
11-Mar-10	14	500	445	7.0	569																																											
18-Mar-10	15	500	455	7.1	517	#N/A	1.9	5.1	116	0.23	0.11	0.18	131	0.015	0.0020	0.00071	0.0053	0.0000046	0.0000023	0.023	0.000035	49	0.000046	0.000078	0.0012	0.0014	0.000010	0.00032	2.3	0.022	0.0046	0.031	0.00030	0.00091	0.85	0.00021	0.34	0.0000023	0.25	0.23	45	0.0000073	0.0000046	0.00023	0.0081	0.000091	0.00050	0.000046
25-Mar-10	16	500	445	7.0	513																																											
1-Apr-10	17	500	390	6.8	534	#N/A	1.8	5.2	110	0.20	0.11	0.16	106	0.013	0.0039	0.00094	0.0041	0.0000039	0.0000020	0.020	0.000028	39	0.000039	0.000064	0.0020	0.0020	0.000022	0.00039	2.0	0.017	0.0039	0.034	0.00014	0.00078	0.89	0.00021	0.32	0.0000059	0.23	0.19	34	0.0000055	0.000047	0.00020	0.011	0.000078	0.00035	0.000039
8-Apr-10	18	500	430	7.1	491																																											
15-Apr-10	19	500	450	7.2	483	#N/A	1.5	5.5	117	0.23	0.090	0.18	115	0.013	0.0022	0.00075	0.0042	0.0000045	0.0000023	0.023	0.000036	43	0.000045	0.000088	0.0014	0.0027	0.000032	0.00032	1.8	0.021	0.0045	0.022	0.00036	0.0018	0.85	0.00018	0.35	0.0000054	0.26	0.20	38	0.000017	0.000041	0.00023	0.0079	0.000090	0.00036	0.000045
22-Apr-10	20	500	460	7.0	562																																											
29-Apr-10	21	500	460	6.8	513	#N/A	1.3	6.3	112	0.23	0.14	0.18	109	0.016	0.0022	0.00097	0.0053	0.0000046	0.0000023	0.023	0.000033	41	0.000046	0.000058	0.0013	0.0014	0.0000028	0.00028	1.6	0.021	0.0046	0.023	0.00013	0.00092	0.75	0.00020	0.30	0.0000023	0.19	0.20	34	0.0000032	0.0000092	0.00023	0.0071	0.000092	0.00028	0.000046
6-May-10	22	500	450	6.9	483																																											
13-May-10	23	500	470	7.0	482	#N/A	1.9	6.0	114	0.24	0.094	0.19	117	0.016	0.0024	0.00079	0.0061	0.0000047	0.0000024	0.024	0.000040	44	0.000047	0.000068	0.0021	0.0024	0.0000024	0.00028	1.5	0.023	0.0047	0.025	0.00014	0.00094	0.73	0.00019	0.35	0.0000024	0.18	0.21	40	0.0000042	0.000014	0.00024	0.0070	0.000094	0.00042	0.000047
20-May-10	24	500	455	7.2	444																																											
27-May-10	25	500	465	6.6	427	#N/A	3.5	6.5	86	0.23	0.088	0.19	106	0.013	0.0021	0.00070	0.0036	0.0000047	0.0000042	0.023	0.000030	40	0.000047	0.000057	0.0013	0.00093	0.0000028	0.00033	1.4	0.022	0.0047	0.024	0.00013	0.00093	0.63	0.00020	0.35	0.0000023	0.16	0.18	33	0.0000056	0.0000047	0.00023	0.0069	0.000093	0.00060	0.000047
3-Jun-10	26	500	450	7.0	462																																											
10-Jun-10	27	500	460	7.2	447	#N/A	2.4	5.9	86	0.23	0.092	0.18	105	0.013	0.0020	0.00071	0.0032	0.0000046	0.0000023	0.023	0.000026	40	0.000092	0.000049	0.00089	0.0014	0.0000078	0.00028	1.5	0.020	0.0046	0.025	0.000097	0.00092	0.63	0.00020	0.32	0.0000023	0.17	0.18	39	0.0000032	0.0000046	0.00023	0.0052	0.000092	0.00018	0.000046
17-Jun-10	28	500	455	7.1	394																																											
24-Jun-10	29	500	480	7.0	429	#N/A	2.0	6.5	76	0.24	0.082	0.19	96	0.016	0.0024	0.00073	0.0041	0.0000048	0.0000024	0.024	0.000031	36	0.000048	0.000055	0.0010	0.00048	0.0000024	0.00029	1.4	0.021	0.0048	0.028	0.000091	0.00096	0.58	0.00026	0.34	0.0000024	0.16	0.18	35	0.0000038	0.0000048	0.00024	0.0049	0.000096	0.00024	0.000048

Leachate Results for HC2

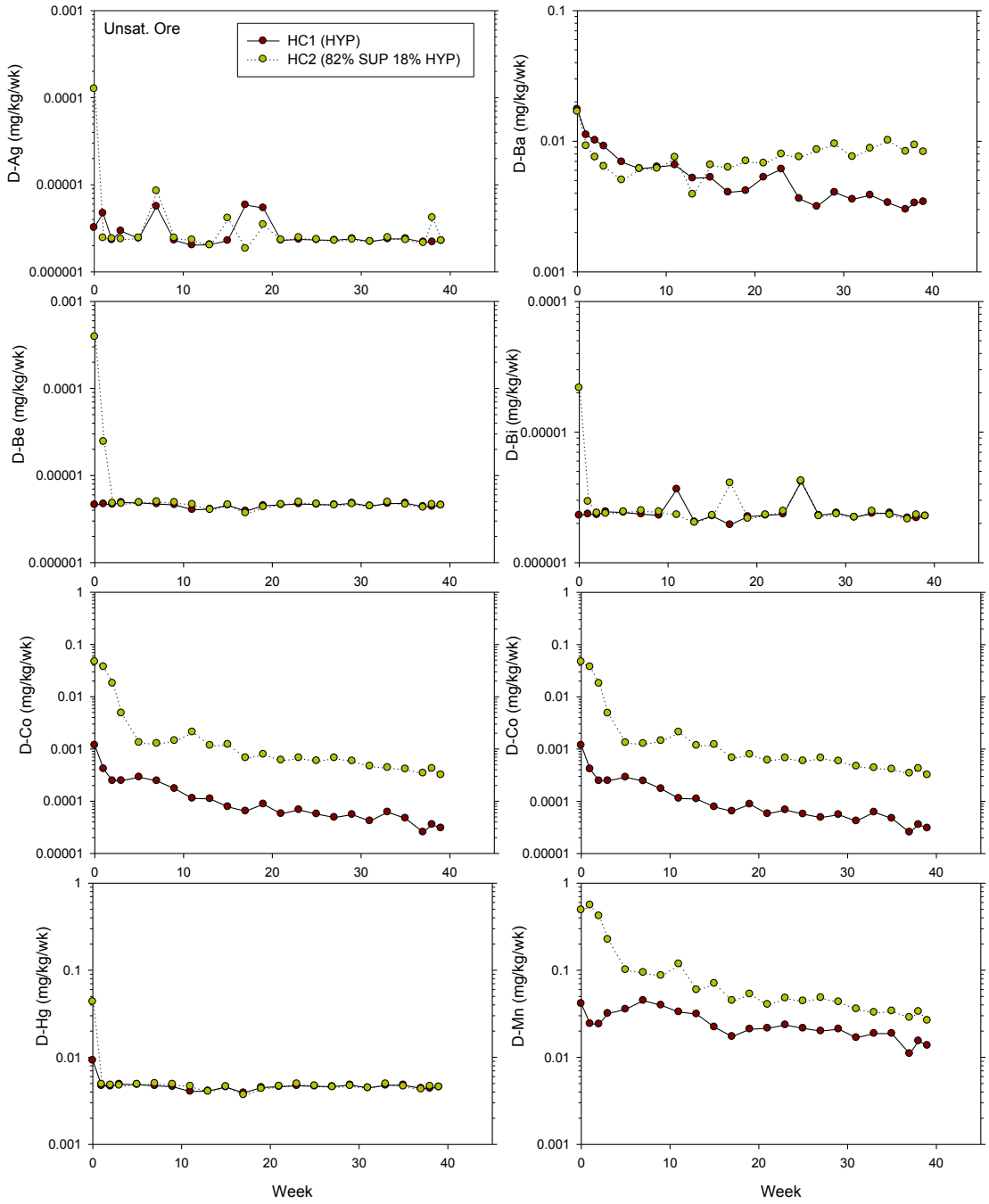
Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
3-Dec-09	0	600	435	5.1	622	#N/A	83	1.2	310	10	0.90	0.40	180	2.1	0.0010	0.0047	0.039	0.00090	0.000050	0.50	0.11	55	0.0010	0.11	34	1.0	0.0020	0.018	11	1.1	0.10	0.0025	0.058	0.020	15	0.0037	1.7	0.00029	32	0.19	117	0.00042	0.00010	0.0050	0.016	0.0020	0.54	0.0010
10-Dec-09	1	500	490	6.1	600	#N/A	13	4.0	317	10	0.28	0.40	229	0.018	0.00071	0.0010	0.019	0.000050	0.0000060	0.050	0.055	66	0.00010	0.076	4.0	0.0070	0.000096	0.0061	15	1.1	0.010	0.0084	0.036	0.0060	10	0.0037	1.4	0.0000050	22	0.17	98	0.00027	0.000010	0.00050	0.00044	0.00020	0.26	0.00010
17-Dec-09	2	500	480	6.8	466	#N/A	4.5	6.1	256	4.8	0.21	0.40	196	0.0031	0.00065	0.00044	0.016	0.000010	0.0000050	0.050	0.021	55	0.00010	0.038	0.46	0.0050	0.000027	0.0026	14	0.88	0.010	0.025	0.012	0.015	8.7	0.0027	1.2	0.0000050	17	0.12	81	0.00019	0.000010	0.00050	0.00015	0.00020	0.058	0.00010
24-Dec-09	3	500	475	7.0	284	#N/A	3.1	7.2	139	2.5	0.28	0.40	122	0.0032	0.00064	0.00047	0.014	0.000010	0.0000050	0.050	0.0075	34	0.00010	0.010	0.10	0.0020	0.000024	0.0014	8.8	0.47	0.010	0.045	0.0017	0.017	6.2	0.0017	1.1	0.0000050	8.8	0.074	50	0.00014	0.000010	0.00050	0.00011	0.00040	0.012	0.00010
31-Dec-09	4	500	480	7.1	220				89																																							
7-Jan-10	5	500	490	7.2	183	#N/A	3.6	12	69	0.50	0.38	0.40	68	0.0059	0.00067	0.00057	0.010	0.000010	0.0000050	0.050	0.0021	19	0.00010	0.0027	0.042	0.0020	0.000043	0.00070	5.3	0.21	0.010	0.078	0.00045	0.027	4.0	0.00072	1.1	0.0000050	3.7	0.041	23	0.000083	0.00012	0.00050	0.00013	0.00040	0.0040	0.00010
14-Jan-10	6	500	485	7.1	147				55																																							
21-Jan-10	7	500	500	7.2	147	#N/A	3.6	13	55	0.50	0.36	0.40	64	0.0058	0.0017	0.00079	0.012	0.000010	0.0000050	0.050	0.0019	17	0.00010	0.0025	0.049	0.0020	0.0015	0.00080	5.0	0.19	0.010	0.11	0.00036	0.033	3.4	0.00041	1.4	0.000017	2.0	0.036	21	0.000075	0.000010	0.00050	0.00011	0.00040	0.0063	0.00010
28-Jan-10	8	500	465	7.1	155				68																																							
4-Feb-10	9	500	490	6.8	165	#N/A	3.0	4.6	55	0.50	0.33	0.40	55	0.0032	0.0024	0.00067	0.013	0.000010	0.0000050	0.050	0.0021	15	0.00010	0.0029	0.086	0.0010	0.000022	0.00080	4.3	0.18	0.010	0.095	0.00044	0.023	2.4	0.00021	1.1	0.0000050	0.82	0.034	18	0.000062	0.00013	0.00050	0.000062	0.00030	0.0058	0.00010
11-Feb-10	10	500	475	6.9	172				71																																							
18-Feb-10	11	500	465	6.7	109	#N/A	4.0	5.7	80	0.60	0.33	0.40	80	0.0024	0.0039	0.00068	0.016	0.000010	0.0000050	0.050	0.0031	22	0.00040	0.0045	0.13	0.0020	0.000015	0.0014	5.9	0.25	0.010	0.12	0.00063	0.024	2.6	0.00018	1.5	0.0000050	0.70	0.048	27	0.000072	0.00017	0.00050	0.000051	0.00030	0.0086	0.00010
25-Feb-10	12	500	470	6.6	179				91																																							
4-Mar-10	13	500	405	6.6	106	#N/A	3.4	4.3	39	0.50	0.38	0.40	44	0.0039	0.0033	0.00073	0.0097	0.000010	0.0000050	0.050	0.0019	12	0.00010	0.0029	0.073	0.0010	0.000025	0.0012	3.5	0.15	0.010	0.12	0.00044	0.024	1.8	0.00011	1.4	0.0000050	0.36	0.027	14	0.000052	0.000010	0.00050	0.000050	0.00040	0.0061	0.00010
11-Mar-10	14	500	470	6.6	120				45																																							
18-Mar-10	15	500	460	6.8	123	#N/A	4.2	6.6	42	0.50	0.47	0.40	53	0.0045	0.0038	0.00085	0.014	0.000010	0.0000050	0.050	0.0017	14	0.00010	0.0026	0.056	0.0010	0.000015	0.0012	4.1	0.15	0.010	0.17	0.00042	0.033	2.2	0.00015	1.9	0.0000090	0.37	0.031	17	0.000059	0.000010	0.00050	0.000047	0.00040	0.0047	0.00010
25-Mar-10	16	500	445	7.0	78				27																																							
1-Apr-10	17	500	370	6.9	118	#N/A	4.5	4.7	54	0.50	0.53	0.40	49	0.0057	0.0042	0.00093	0.017	0.000010	0.000011	0.050	0.0013	13	0.00010	0.0018	0.051	0.0040	0.000047	0.0011	3.8	0.12	0.010	0.22	0.00045	0.034	2.0	0.00017	1.5	0.0000050	0.30	0.030	15	0.000051	0.00012	0.00050	0.000046	0.00040	0.0062	0.00010
8-Apr-10	18	500	430	6.8	98				33																																							
15-Apr-10	19	500	435	6.9	109	#N/A	3.3	5.0	39	0.50	0.52	0.40	45	0.0069	0.0046	0.0011	0.016	0.000010	0.0000050	0.050	0.0013	12	0.00010	0.0018	0.048	0.0030	0.000053	0.0010	3.7	0.12	0.010	0.22	0.00050	0.048	1.9	0.00014	1.8	0.0000080	0.28	0.027	14	0.000061	0.00010	0.00050	0.000046	0.00040	0.0031	0.00010
22-Apr-10	20	500	460	7.2	111				42																																							
29-Apr-10	21	500	465	7.0	79	#N/A	2.6	5.4	29	0.50	0.51	0.40	30	0.0039	0.0040	0.00095	0.015	0.000010	0.0000050	0.050	0.00096	8.1	0.00010	0.0013	0.035	0.0010	0.0000050	0.00070	2.4	0.087	0.010	0.18	0.00028	0.033	1.2	0.00012	1.3	0.0000050	0.15	0.020	10	0.000030	0.000010	0.00050	0.000054	0.00050	0.0032	0.00010
6-May-10	22	500	445	7.1	84				26																																							
13-May-10	23	500	495	7.3	94	#N/A	2.8	10	29	0.50	0.37	0.40	35	0.0053	0.0044	0.00099	0.016	0.000010	0.0000050	0.050	0.0011	9.4	0.00010	0.0014	0.030	0.0030	0.000019	0.00080	2.7	0.097	0.010	0.22	0.00028	0.039	1.3	0.00012	1.6	0.0000050	0.15	0.022	12	0.000041	0.000060	0.00050	0.000055	0.00020	0.0030	0.00010
20-May-10	24	500	445	7.3	84				29																																							
27-May-10	25	500	470	7.3	84	#N/A	6.5	8.1	20	0.50	0.43	0.40	35	0.0051	0.0044	0.0010	0.016	0.000010	0.0000090	0.050	0.00097	9.3	0.00010	0.0013	0.029	0.0030	0.000017	0.0010	2.8	0.094	0.010	0.22	0.00030	0.043	1.2	0.00014	1.7	0.0000050	0.14	0.023	10	0.000045	0.000010	0.00050	0.000058	0.00050	0.0037	0.00010
3-Jun-10	26	500	455	7.0	79				20																																							
10-Jun-10	27	500	455	7.2	98	#N/A	4.2	7.7	32	0.50	0.47	0.40	43	0.0071	0.0051	0.0013	0.019	0.000010	0.0000050	0.050	0.0010	11	0.00010	0.0015	0.031	0.0020	0.000051	0.00090	3.5	0.11	0.010	0.27	0.00027	0.055	1.5	0.00014	1.9	0.0000050	0.21	0.025	14	0.000047	0.00011	0.00050	0.000055	0.00050	0.0030	0.00010
17-Jun-10	28	500	465	7.3	90				20																																							
24-Jun-10	29	500	470	7.1	82	#N/A	3.9	7.8	19	0.50	0.44	0.40	33	0.0058	0.0060	0.0013	0.020	0.000010	0.0000050	0.050	0.00093	8.2	0.00010	0.0013	0.026	0.0010	0.0000050	0.0010	2.9	0.092	0.010	0.26	0.00021	0.056	1.3	0.00018	1.8	0.0000050	0.16	0.021	11	0.000047	0.000010	0.00050	0.000072	0.00060	0.0034	0.00010
1-Jul-10	30	500	480	7.0	69				17																																							
8-Jul-10	31	500	445	7.0	70	#N/A	2.5	5.1	17	0.50	0.40	0.40	28	0.0054	0.0045	0.0012	0.017	0.000010	0.0000050	0.050	0.00076	7.2	0.00010	0.0011	0.026	0.0010	0.00033	0.00060	2.4	0.081	0.010	0.22	0.00021	0.048	1.0	0.00011	1.5	0.0000050	0.12	0.019	10	0.000035	0.00022	0.00050	0.000068	0.00050	0.0051	0.00010
15-Jul-10	32	500	455	7.1	72				14																																							
22-Jul-10	33	500	495	7.0	58	#N/A	3.9	5.3	12	0.50	0.32	0.40	24	0.0057	0.0038	0.0010	0.018	0.000010	0.0000050	0.050	0.00061	6.2	0.00010	0.00088	0.025	0.0010	0.0000050	0.00060	2.0	0.066	0.010	0.16	0.00024	0.045	0.77	0.000090	1.3	0.0000050	0.11	0.016	10	0.000026	0.000010	0.00050	0.000052	0.00050	0.0021	0.00010
29-Jul-10	34	500	480	7.2	54				12																																							
5-Aug-10	35	500	465	7.0	61	#N/A	3.1	5.6	16	0.50	0.33	0.40	26	0.0060	0.0042	0.0011	0.022	0.000010	0.0000050	0.050	0.00064	6.9	0.00020	0.00088	0.026	0.0010	0.0000050	0.00050	2.1	0.073	0.010	0.15	0.00018	0.050	0.79	0.00011	1.4	0.0000050	0.11	0.017	10	0.000029	0.000010	0.00050	0.000076	0.00050	0.0024	0.00010
12-Aug-10	36	500	490	6.9	69				15																																							
19-Aug-10	37	500	430	7.2	61	#N/A	6.1	7.7	18	0.50	0.37	0.40	31	0.0064	0.0048	0.0012	0.019	0.000010	0.0000050	0.050	0.00059	8.6	0.00010	0.00080	0.020	0.0010	0.0000050	0.00060	2.3	0.067	0.010	0.14	0.00021	0.056	0.79	0.00013	1.6	0.0000050	0.13	0.017	10	0.000030	0.000010	0.00050	0.000056	0.00050	0.0023	0.00010
26-Aug-10	38	500	465	7.0	63	#N/A	2.9	7.1	17	0.50	0.41	0.40	27	0.011	0.0049	0.0013	0.020	0.000010	0.0000050	0.050	0.00071	7.5	0.00010	0.00091	0.020	0.0060	0.000038	0.00070	2.1	0.072	0.010	0.15	0.00054	0.051	0.88	0.00013	1.6	0.0000090	0.21	0.018	10	0.000029	0.000050	0.00050	0.000037	0.00030	0.0053	0.00010
2-Sep-10	39	500	455	7.1	47	#N/A	4.5	6.4	20	0.50	0.35	0.40	23	0.0071	0.0039	0.0010	0.018	0.000010	0.0000050	0.050	0.00065	5.9	0.00010	0.00070	0.021	0.0020	0.0000050	0.00050	2.0	0.058	0.010	0.11	0.00019	0.047	0.66	0.000090	1.2	0.0000050	0.10	0.014	10	0.000027	0.000090	0.00050	0.00011	0.00020	0.0020	0.00010
Cell Terminated																																																

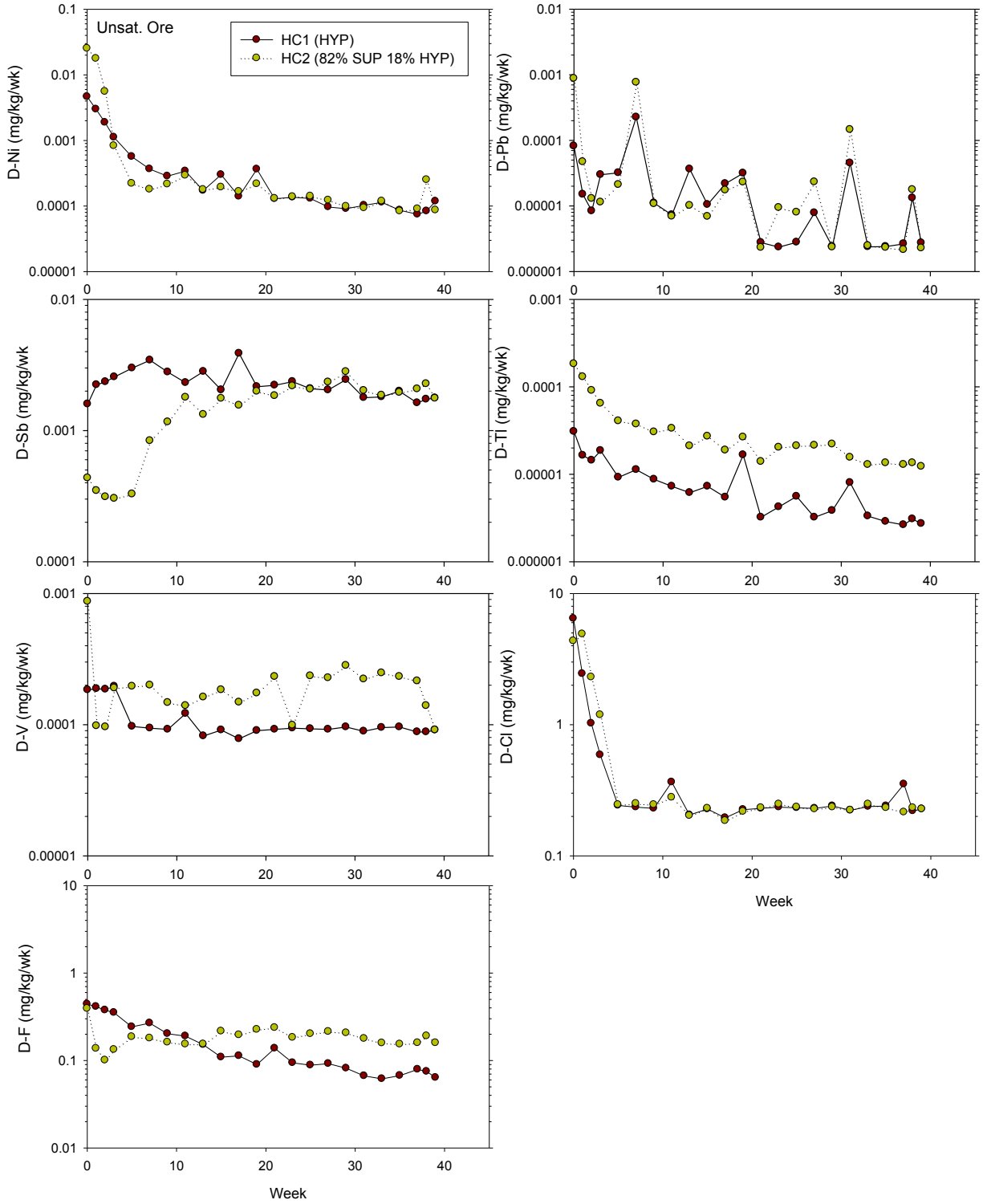
Notes: blue print are values below the analytical detection limit

Calculated Production Rates for HC2

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
3-Dec-09	0	600	435	5.1	622	#N/A	36	0.53	135	4.4	0.39	0.17	78	0.93	0.00044	0.0020	0.017	0.00039	0.000022	0.22	0.046	24	0.00044	0.047	15	0.44	0.00088	0.0078	4.6	0.49	0.044	0.0011	0.025	0.0087	6.4	0.0016	0.74	0.00013	14	0.082	51	0.00018	0.000044	0.0022	0.0068	0.00087	0.23	0.00044
10-Dec-09	1	500	490	6.1	600	#N/A	6.2	2.0	155	4.9	0.14	0.20	112	0.0089	0.00035	0.00049	0.0092	0.000025	0.0000029	0.025	0.027	33	0.000049	0.037	2.0	0.0034	0.000047	0.0030	7.5	0.56	0.0049	0.0041	0.018	0.0029	5.0	0.0018	0.68	0.0000025	11	0.082	48	0.00013	0.0000049	0.00025	0.00021	0.000098	0.13	0.000049
17-Dec-09	2	500	480	6.8	466	#N/A	2.2	2.9	123	2.3	0.10	0.19	94	0.0015	0.00031	0.00021	0.0075	0.0000048	0.0000024	0.024	0.0099	26	0.000048	0.018	0.22	0.0024	0.000013	0.0012	6.8	0.42	0.0048	0.012	0.0056	0.0072	4.2	0.0013	0.57	0.0000024	8.1	0.056	39	0.000091	0.0000048	0.00024	0.000072	0.000096	0.028	0.000048
24-Dec-09	3	500	475	7.0	284	#N/A	1.5	3.4	66	1.2	0.13	0.19	58	0.0015	0.00030	0.00022	0.0064	0.0000048	0.0000024	0.024	0.0036	16	0.0000048	0.0048	0.049	0.00095	0.000011	0.00067	4.2	0.23	0.0048	0.022	0.00083	0.0081	2.9	0.00082	0.54	0.0000024	4.2	0.035	24	0.000065	0.0000048	0.00024	0.000051	0.00019	0.0058	0.000048
31-Dec-09	4																																															
7-Jan-10	5	500	490	7.2	183	#N/A	1.8	5.6	34	0.25	0.19	0.20	33	0.0029	0.00033	0.00028	0.0050	0.0000049	0.0000025	0.025	0.0010	9.1	0.000049	0.0013	0.020	0.00098	0.000021	0.00034	2.6	0.10	0.0049	0.038	0.00022	0.013	1.9	0.00035	0.53	0.0000025	1.8	0.020	11	0.000041	0.000059	0.00025	0.000062	0.00020	0.020	0.000049
14-Jan-10	6																																														
21-Jan-10	7	500	500	7.2	147	#N/A	1.8	6.6	28	0.25	0.18	0.20	32	0.0029	0.00084	0.00040	0.0062	0.0000050	0.0000025	0.025	0.00096	8.7	0.000050	0.0013	0.024	0.0010	0.00077	0.00040	2.5	0.094	0.0050	0.053	0.00018	0.017	1.7	0.00021	0.68	0.0000085	1.00	0.018	11	0.000038	0.0000050	0.00025	0.000057	0.00020	0.0032	0.000050
28-Jan-10	8																																														
4-Feb-10	9	500	490	6.8	165	#N/A	1.5	2.2	27	0.25	0.16	0.20	27	0.0016	0.0012	0.00033	0.0062	0.0000049	0.0000025	0.025	0.0010	7.4	0.000049	0.0014	0.042	0.00049	0.000011	0.00039	2.1	0.087	0.0049	0.047	0.00022	0.011	1.2	0.00010	0.54	0.0000025	0.40	0.016	8.8	0.000030	0.0000064	0.00025	0.000030	0.00015	0.0028	0.000049
11-Feb-10	10																																														
18-Feb-10	11	500	465	6.7	109	#N/A	1.8	2.6	37	0.28	0.15	0.19	37	0.0011	0.0018	0.00032	0.0075	0.0000047	0.0000023	0.023	0.0014	10	0.00019	0.0021	0.058	0.00093	0.0000070	0.00065	2.8	0.12	0.0047	0.054	0.00029	0.011	1.2	0.000084	0.69	0.0000023	0.33	0.022	13	0.000033	0.000079	0.00023	0.000024	0.00014	0.0040	0.000047
25-Feb-10	12																																														
4-Mar-10	13	500	405	6.6	106	#N/A	1.4	1.7	16	0.20	0.15	0.16	18	0.0016	0.0013	0.00030	0.0039	0.0000041	0.0000020	0.020	0.00076	4.7	0.000041	0.0012	0.030	0.00041	0.000010	0.00049	1.4	0.060	0.0041	0.049	0.00018	0.0097	0.73	0.000045	0.58	0.0000020	0.15	0.011	5.7	0.000021	0.0000041	0.00020	0.000020	0.00016	0.0025	0.000041
11-Mar-10	14																																														
18-Mar-10	15	500	460	6.8	123	#N/A	1.9	3.0	19	0.23	0.22	0.18	24	0.0021	0.0018	0.00039	0.0066	0.0000046	0.0000023	0.023	0.00079	6.6	0.000046	0.0012	0.026	0.00046	0.0000069	0.00055	1.9	0.070	0.0046	0.079	0.00019	0.015	1.0	0.000069	0.89	0.0000041	0.17	0.014	7.8	0.000027	0.0000046	0.00023	0.000022	0.00018	0.0022	0.000046
25-Mar-10	16																																														
1-Apr-10	17	500	370	6.9	118	#N/A	1.7	1.7	20	0.19	0.20	0.15	18	0.0021	0.0016	0.00034	0.0063	0.0000037	0.0000041	0.019	0.00048	4.9	0.000037	0.00068	0.019	0.0015	0.000017	0.00041	1.4	0.045	0.0037	0.083	0.00017	0.013	0.75	0.000063	0.56	0.0000019	0.11	0.011	5.6	0.000019	0.000044	0.00019	0.000017	0.00015	0.0023	0.000037
8-Apr-10	18																																														
15-Apr-10	19	500	435	6.9	109	#N/A	1.4	2.2	17	0.22	0.23	0.17	19	0.0030	0.0020	0.00048	0.0070	0.0000044	0.0000022	0.022	0.00055	5.1	0.000044	0.00079	0.021	0.0013	0.000023	0.00044	1.6	0.053	0.0044	0.094	0.00022	0.021	0.81	0.000061	0.80	0.0000035	0.12	0.012	6.1	0.000027	0.000044	0.00022	0.000020	0.00017	0.0013	0.000044
22-Apr-10	20																																														
29-Apr-10	21	500	465	7.0	79	#N/A	1.2	2.5	13	0.23	0.24	0.19	14	0.0018	0.0018	0.00044	0.0068	0.0000047	0.0000023	0.023	0.00045	3.8	0.000047	0.00061	0.016	0.00047	0.0000023	0.00033	1.1	0.040	0.0047	0.083	0.00013	0.015	0.56	0.000056	0.62	0.0000023	0.070	0.0093	4.7	0.000014	0.0000047	0.00023	0.000025	0.00023	0.0015	0.000047
6-May-10	22																																														
13-May-10	23	500	495	7.3	94	#N/A	1.4	5.0	14	0.25	0.18	0.20	17	0.0026	0.0022	0.00049	0.0080	0.0000050	0.0000025	0.025	0.00054	4.6	0.000050	0.00067	0.015	0.0015	0.0000094	0.00040	1.3	0.048	0.0050	0.11	0.00014	0.019	0.64	0.000059	0.77	0.0000025	0.074	0.011	5.9	0.000020	0.000030	0.00025	0.000027	0.000099	0.0015	0.000050
20-May-10	24																																														
27-May-10	25	500	470	7.3	84	#N/A	3.1	3.8	9.4	0.24	0.20	0.19	16	0.0024	0.0021	0.00047	0.0076	0.0000047	0.0000042	0.024	0.00046	4.4	0.000047	0.00059	0.014	0.0014	0.0000080	0.00047	1.3	0.044	0.0047	0.11	0.00014	0.020	0.57	0.000066	0.81	0.0000024	0.066	0.011	4.7	0.000021	0.0000047	0.00024	0.000027	0.00024	0.0017	0.000047
3-Jun-10	26																																														
10-Jun-10	27	500	455	7.2	98	#N/A	1.9	3.5	15	0.23	0.21	0.18	19	0.0032	0.0023	0.00057	0.0086	0.0000046	0.0000023	0.023	0.00046	5.2	0.000046	0.00067	0.014	0.00091	0.000023	0.00041	1.6	0.048	0.0046	0.12	0.00012	0.025	0.67	0.000064	0.87	0.0000023	0.096	0.011	6.4	0.000021	0.0000050	0.00023	0.000025	0.00023	0.0014	0.000046
17-Jun-10	28																																														
24-Jun-10	29	500	470	7.1	82	#N/A	1.8	3.7	8.9	0.24	0.21	0.19	15	0.0027	0.0028	0.00062	0.0095	0.0000047	0.0000024	0.024	0.00044	3.9	0.000047	0.00059	0.012	0.00047	0.0000024	0.00047	1.4	0.043	0.0047	0.12	0.000099	0.026	0.62	0.000085	0.84	0.0000024	0.075	0.010	5.2	0.000022	0.0000047	0.00024	0.000034	0.00028	0.0016	0.000047
1-Jul-10	30																																														
8-Jul-10	31	500	445	7.0	70	#N/A	1.1	2.3	7.6	0.22	0.18	0.18	12	0.0024	0.0020	0.00054	0.0076	0.0000045	0.0000022	0.022	0.00

Appendix E.2: Loading Rates for Unsaturated Ore Humidity Cells




Unsat. Ore
HC1 (HYP)
HC2 (82% SUP 18% HYP)
D-Ni (mg/kg/wk)
D-Pb (mg/kg/wk)
D-Sb (mg/kg/wk
D-Tl (mg/kg/wk)
D-V (mg/kg/wk)
D-Cl (mg/kg/wk)
D-F (mg/kg/wk)
Week
Week

APPENDIX E3 LEACHATE RESULTS FOR UNSATURATED TAILINGS KINETIC TESTS

Cell No.	Type	Zone	Method Reference	Column Inner Diameter (cm)	Length (cm)	Ht. of Sample (cm)	Column Dry Wt. of Sample (kg)	Other Materials Used	Column Material	Total Volume of Initial Flushings (mL)	Flushing Rate/ Weekly Input* (mL)	Temp (°C)	Sampling Frequency	Start-up date	Sampling Day	Operation Procedure	Sample Prep for Flushings
Col 5	Pyrite Rougher Sand	85% SUP, 15% HYP	ASTM	20.00	10.00	-	4.96	Acrylic perforated disk & nylon mesh	Plexiglas	-	500	20-22 °C	Weekly	4-May-11	Tuesday	Trickle Leach	None
Col 6	Pyrite Rougher Sand	HYP	MEND	10.15	60	-	5.00	Acrylic perforated disk & nylon mesh	Acrylic	-	300	20-22 °C	Weekly	19-Dec-12	Wednesday	Trickle Leach	None
T1	Whole Rougher	71% SUP, 22% HYP, 7% CAP	ASTM	21	20.5	-	1.00	Acrylic perforated disk & nylon mesh	Plexiglas	750	500	4 °C	Weekly	1-May-08	Thursday	Flood Leach	Stirred
T2	Whole Rougher	71% SUP, 22% HYP, 7% CAP	ASTM	21	20.5	-	1.00	Acrylic perforated disk & nylon mesh	Plexiglas	750	500	20-22 °C	Weekly	1-May-08	Thursday	Flood Leach	Stirred
T3	Whole Rougher	71% SUP, 22% HYP, 7% CAP	ASTM	21	20.5	-	1.00	Acrylic perforated disk & nylon mesh	Plexiglas	750	500	20-22 °C	Weekly	1-May-08	Thursday	Flood Leach	Stirred
T4	Whole Rougher	60% HYP, 40% SUP	ASTM	20.00	10.00	2.0	1.00	Acrylic perforated disk & nylon mesh	Plexiglas	750	500	20-22 °C	Weekly	15-Dec-09	Tuesday	Flood Leach	Stirred
T5	Whole Pyrite Rougher	85% SUS, 15% HYP	ASTM	20.00	10.00	-	0.90	Acrylic perforated disk & nylon mesh	Plexiglas	750	500	20-22 °C	Weekly	3-May-11	Tuesday	Flood Leach	Stirred
T6	Pyrite Rougher Sand	85% SUS, 15% HYP	ASTM	20.00	10.00	-	1.00	Acrylic perforated disk & nylon mesh	Plexiglas	-	500	20-22 °C	Weekly	3-May-11	Tuesday	Flood Leach	Stirred
T 7	Whole Pyrite Rougher	HYP	MEND	20.00	10.00	-	1.00	Acrylic perforated disk & nylon mesh	Acrylic	750	500	20-22 °C	Weekly	5-Mar-13	Tuesday	Flood Leach	Stirred

Leachate Results for Col 5

Date	Cycle No.	Flow Rate (mL/min)	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mg CaCO3/L	Acidity (pH 8.3) mg CaCO3/L	Alkalinity mg CaCO3/L	SO_4 mg/L	Cl mg/L	F mg/L	Br mg/L	Total CN mg/L	WAD CN mg/L	Hardness mg CaCO3/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
4-May-11	1	0.5	1505	325	7.7	2297	#N/A	8.4	89	1224	62	0.060	0.30	0.010	0.010	1170	0.046	0.0031	0.0049	0.080	0.000020	0.000010	0.074	0.0033	445	0.0011	0.0031	0.32	0.0030	0.0024	0.0010	15	0.11	0.030	1.1	0.018	1.3	70	0.026	2.3	0.00061	90	1.5	458	0.00020	0.0040	0.0021	0.14	0.0013	0.039	0.000050
11-May-11	2	0.5	300	280	7.7	878	#N/A	5.1	83	363	2.5	0.060	0.30	0.010	0.010	313	0.050	0.0030	0.0036	0.029	0.000020	0.000080	0.066	0.0011	118	0.00050	0.0014	0.17	0.0020	0.00028	0.0010	4.3	0.037	0.010	0.56	0.0010	0.20	34	0.0011	1.7	0.000070	36	0.41	129	0.00020	0.0022	0.00070	0.026	0.0013	0.0040	0.000030
18-May-11	3	0.5	300	305	#N/A	#N/A	#N/A	#N/A	#N/A	180	0.80	0.060	0.30	0.010	0.010	195	0.064	0.0033	0.0035	0.027	0.000020	0.000040	0.072	0.00063	72	0.00080	0.00080	0.14	0.0020	0.00017	0.0010	3.7	0.028	0.010	0.43	0.0024	0.28	29	0.00099	1.8	0.00087	32	0.27	77	0.00020	0.0029	0.00060	0.016	0.0016	0.020	0.000010
25-May-11	4	0.5	300	285	7.8	481	#N/A	5.9	82	131	0.60	0.060	0.30	0.010	0.010	157	0.054	0.0033	0.0035	0.030	0.000020	0.000020	0.065	0.00049	59	0.00050	0.00080	0.12	0.0020	0.00010	0.0010	2.4	0.022	0.010	0.37	0.0029	0.28	24	0.0015	1.6	0.000030	20	0.22	56	0.00020	0.0094	0.00080	0.013	0.0014	0.0020	0.000010
1-Jun-11	5	0.5	300	290	7.8	436	#N/A	7.3	82																																												
8-Jun-11	6	0.5	350	300	7.7	418	#N/A	7.7	90	115	0.40	0.060	0.30	0.010	0.010	129	0.052	0.0034	0.0037	0.028	0.000020	0.000020	0.069	0.00047	48	0.00050	0.00060	0.095	0.0020	0.00019	0.0010	2.2	0.021	0.010	0.31	0.0016	0.28	21	0.00034	1.6	0.000040	13	0.19	38	0.000060	0.065	0.00060	0.012	0.0015	0.0040	0.000020
15-Jun-11	7	0.5	300	305	7.8	431																																														
22-Jun-11	8	0.5	300	305	8.0	355	#N/A	3.5	94	90	0.20	0.060	0.30	0.010	0.010	124	0.050	0.0032	0.0032	0.028	0.000020	0.000030	0.067	0.00039	46	0.00050	0.00040	0.074	0.0020	0.00014	0.0010	2.2	0.020	0.010	0.26	0.00010	0.17	20	0.00025	1.5	0.000010	7.9	0.18	31	0.000050	0.20	0.00050	0.010	0.0015	0.011	0.000010
29-Jun-11	9	0.5	300	300	7.9	338																																														
6-Jul-11	10	0.5	300	300	7.8	330	#N/A	5.7	97	76	0.20	0.060	0.30	0.010	0.010	120	0.069	0.0029	0.0030	0.033	0.000020	0.000010	0.067	0.00032	45	0.00050	0.00050	0.098	0.0020	0.00037	0.0010	2.2	0.020	0.010	0.24	0.0011	0.14	20	0.00026	1.6	0.000010	4.6	0.18	25	0.000060	0.39	0.00040	0.0090	0.0014	0.0040	0.000010
13-Jul-11	11	0.5	300	285	7.7	318																																														
20-Jul-11	12	0.5	300	290	7.9	310	#N/A	4.8	95	66	0.20	0.060	0.30	0.010	0.010	120	0.040	0.0033	0.0034	0.038	0.000020	0.000010	0.061	0.00043	44	0.00050	0.00030	0.052	0.0020	0.000080	0.0010	2.2	0.021	0.010	0.21	0.0015	0.13	19	0.00094	1.5	0.000010	3.3	0.19	22	0.000050	0.38	0.00040	0.0092	0.0015	0.0020	0.000010
27-Jul-11	13	0.5	300	290	7.9	306																																													
3-Aug-11	14	0.5	300	190	7.8	299	#N/A	7.9	105	58	0.20	0.060	0.30	0.010	0.010	115	0.038	0.0029	0.0043	0.038	0.000020	0.000010	0.065	0.00023	43	0.0023	0.00040	0.046	0.0020	0.00013	0.0010	2.1	0.021	0.010	0.15	0.00010	0.096	19	0.00056	1.5	0.000010	2.4	0.18	18	0.000060	0.38	0.00030	0.0091	0.0014	0.0020	0.000010
10-Aug-11	15	0.5	300	300	7.9	291																																													
17-Aug-11	16	0.5	300	295	7.9	292	#N/A	5.2	107	36	0.20	0.060	0.30	0.010	0.010	106	0.038	0.0031	0.0032	0.045	0.000020	0.000010	0.062	0.00018	39	0.0018	0.00030	0.041	0.0090	0.000080	0.0010	2.1	0.019	0.010	0.13	0.00020	0.098	18	0.00023	1.3	0.000010	2.2	0.17	17	0.000050	0.47	0.00040	0.0094	0.0013	0.0010	0.000010
24-Aug-11	17	0.5	300	290	7.8	291																																													
31-Aug-11	18	0.5	300	300	7.9	301	#N/A	9.2	117	46	0.20	0.060	0.30	0.010	0.010	124	0.047	0.0036	0.0041	0.052	0.000020	0.000010	0.073	0.00019	46	0.0014	0.00030	0.043	0.0020	0.00019	0.0010	2.4	0.023	0.010	0.12	0.0016	0.070	21	0.00036	1.6	0.000010	1.9	0.20	17	0.000060	0.45	0.00040	0.0087	0.0015	0.0030	0.000010
7-Sep-11	19	0.5	300	295	8.0	290																																													
14-Sep-11	20	0.5	300	310	8.0	282	#N/A	6.6	114	44	0.20	0.060	0.30	0.010	0.010	111	0.039	0.0029	0.0033	0.051	0.000020	0.000010	0.061	0.00017	41	0.0014	0.00030	0.036	0.0020	0.00020	0.0010	2.2	0.020	0.010	0.10	0.00010	0.074	18	0.00034	1.4	0.000010	1.4	0.18	14	0.000050	0.41	0.00040	0.0091	0.0013	0.0020	0.000010
21-Sep-11	21	0.5	300	295	7.9	284																																													
28-Sep-11	22	0.5	300	295	7.9	283	#N/A	7.2	119	38	0.20	0.060	0.30	0.010	0.010	112	0.066	0.0030	0.0033	0.053	0.000020	0.000010	0.051	0.00018	41	0.0016	0.00036	0.034	0.0020	0.00021	0.0010	2.3	0.023	0.010	0.093	0.00010	0.074	19	0.00043	1.4	0.000010	1.2	0.18	13	0.000060	0.42	0.00030	0.0090	0.0013	0.0030	0.000020
5-Oct-11	23	0.5	300	305	8.0	289																																													
12-Oct-11	24	0.5	300	305	8.0	288	#N/A	3.9	119	39	0.20	0.060	0.30	0.010	0.010	122	0.033	0.0032	0.0037	0.059	0.000020	0.000010	0.056	0.00015	45	0.0017	0.00020	0.032	0.0020	0.00015	0.0010	2.5	0.024	0.010	0.099	0.0011	0.086	21	0.00039	1.6	0.000010	1.2	0.20	14	0.000060	0.43	0.00030	0.0091	0.0013	0.0030	0.000030
19-Oct-11	25	0.5	300	300	8.0	296																																													
26-Oct-11	26	0.5	300	300	7.9	292	#N/A	7.7	123	38	0.20	0.060	0.30	0.010	0.010	119	0.060	0.0029	0.0033	0.064	0.000020	0.000010	0.054	0.00013	43	0.0092	0.00031	0.032	0.0080	0.00010	0.0010	2.5	0.025	0.010	0.084	0.0012	0.093	19	0.00035	1.4	0.000010	1.1	0.20	14	0.000060	0.41	0.00030	0.0094	0.0013	0.0040	0.000020
2-Nov-11	27	0.5	300	305	7.9	288																																													
9-Nov-11	28	0.5	300	290	7.9	290	#N/A	7.7	123	35	0.20	0.060	0.30	0.010	0.010	118	0.044	0.0031	0.0033	0.061	0.000020	0.000010	0.043	0.00014	43	0.00050	0.00025	0.029	0.0030	0.000060	0.0010	2.6	0.029	0.010	0.091	0.0018	0.091	18	0.00062	1.4	0.000010	1.1	0.20	12	0.000060	0.40	0.00050	0.0090	0.0015	0.0020	0.000010
16-Nov-11	29	0.5	300	310	8.0	290																																													
23-Nov-11	30	0.5	300	300	7.9	285	#N/A	7.2	125	31	0.20	0.10	0.30	0.010	0.010	112	0.064	0.0031	0.0032	0.061	0.000020	0.000010	0.043	0.00015	41	0.00050	0.00030	0.030	0.0030	0.000060	0.0010	2.5	0.027	0.010	0.085	0.0012	0.076	17	0.000090	1.4	0.000010	0.83	0.19	11	0.000060	0.44	0.00040	0.0082	0.0018	0.0030	0.000010
30-Nov-11	31	0.5	300	285	7.9	289																																													
7-Dec-11	32	0.5	300	305	8.0	282	#N/A	6.4	123	28	0.20	0.060	0.30	0.010	0.010	118	0.046	0.0031	0.0032	0.064	0.000020	0.000010	0.041	0.00013	43	0.00050	0.00020	0.028	0.0030	0.000020	0.0010	2.7	0.028	0.010	0.089	0.00030	0.087	18	0.00045	1.4	0.000050	0.83	0.20	12	0.000060	0.39	0.00030	0.0081	0.0015	0.0020	0.000010
14-Dec-11	33	0.5	300	320	7.9	283																																													
21-Dec-11	34	0.5	300	260	7.9	279	#N/A	7.6	125	31	0.20	0.060	0.30	0.010	0.010	121	0.076	0.0034	0.0033	0.065	0.000020	0.000010	0.037	0.00010	44	0.00050	0.00021	0.027	0.0030	0.000020	0.0010	2.8	0.029	0.010	0.075	0.0012	0.093	19	0.000040	1.4	0.000010	0.84	0.20	12	0.000050	0.42	0.00060	0.0086	0.0017	0.0040	0.000010
28-Dec-11	35	0.5	300	300	7.9	285																																													
4-Jan-12	36	0.5	300	295	7.9	281	#N/A	7.6	141	33	0.20	0.060	0.30	0.010	0.010	111	0.089	0.0036	0.0033	0.065	0.000020	0.000010	0.038	0.00011	40	0.00050	0.00022	0.024	0.0030	0.000030	0.0010	2.6	0.028	0.010	0.081	0.0020	0.071	17	0.00038	1.4	0.000010	0.75	0.19	11	0.000060	0.38	0.00060	0.0083	0.0018	0.0020	0.000010
11-Jan-12	37	0.5	300	270	7.9	283																																												
18-Jan-12	38	0.5	300	305	7.9	282	#N/A	4.0	141	34	0.20	0.060	0.30	0.010	0.010	115	0.057	0.0032	0.0039	0.066	0.000020	0.000010	0.038	0.000097	42	0.00050	0.00030	0.027	0.0030	0.000040	0.0010	2.6	0.029	0.010	0.073	0.00020	0.085	16	0.00035	1.3	0.000010	0.74	0.19	11	0.000070	0.36	0.00050	0.0080	0.0018	0.0020	0.000010
25-Jan-12	39	0.5	300	295	7.9	281																																												
1-Feb-12	40	0.5	300	290	7.9	284	#N/A	4.9	141	33	0.20	0.060	0.30	0.020	0.010	116	0.057	0.0040	0.0033	0.068	0.000020	0.000010	0.031	0.00010	42	0.00050	0.00017	0.021	0.0030	0.000040	0.0010	2.7	0.031	0.010	0.077	0.00080	0.081	17	0.00037	1.5	0.000010	0.70	0.20	11	0.000050	0.36	0.00030	0.0078	0.0018	0.0020	0.000010
8-Feb-12	41	0.5	300	300	7.9	287																																												
15-Feb-12	42	0.5	300	290	7.9	285																																												
22-Feb-12	43	0.5	300	285	7.9	274																																												
29-Feb-12	44	0.5	300	300	7.9	273	#N/A	5.1	126	44	0.20	0.060	0.30	0.010	0.010	116	0.037	0.0037	0.0034	0.068	0.000020	0.000010	0.025	0.000085	42	0.00050	0.00020	0.019	0.0030	0.00035	0.0010	2.8	0.032	0.010	0.070	0.00040	0.079	16	0.00031	2.0	0.000010	0.70	0.20	10	0.000050	0.30	0.00040	0.0078	0.0016	0.0030	0.000010
7-Mar-12	45	0.5	300	300	7.9	275																																													
14-Mar-12	46	0.5	300	305	7.9	279																																													
21-Mar-12	47	0.5	300	315	7.9	282																																													
28-Mar-12	48	0.5	300	340	7.9	289	#N/A	5.0	125	29	1.0	0.060	0.30	0.010	0.010	123	0.056	0.0038	0.0033	0.072	0.000020	0.000010	0.026	0.000075	44	0.0017	0.00014	0.018	0.080	0.00032	0.0010	3.0	0.035	0.010	0.066	0.0010	0.076	16	0.00039	1.6	0.000010	0.90	0.21	11	0.000070	0.39	0.00030	0.0083	0.0016	0.0010	0.000010
4-Apr-12	49	0.5	300	295	7.9	274																																													
11-Apr-12	50	0.5	300	290	8.0	278																																													
18-Apr-12	51	0.5	300	275	7.9	272																																												
25-Apr-12	52	0.5	300	310	7.9	277	#N/A	6.3	123	32	0.20	0.060	0.30	0.010	0.010	127	0.069	0.0045	0.0034	0.078	0.000020	0.000010	0.024	0.000050	46	0.00050	0.00013	0.017	0.0030	0.00013	0.0010	3.1	0.037	0.020	0.064	0.00060	0.077	16	0.00036	1.7	0.000010	0.66	0.22	11	0.000050	0.33	0.00040	0.0073	0.0021	0.0030	0.000010
2-May-12	53	0.5	300	290	8.2	301																																													
9-May-12	54	0.5	300	290	8.0	272																																												
16-May-12	55	0.5	300	285	7.4	91																																												
23-May-12	56	0.5	300	290	7.9	269	#N/A	5.7	120	25	0.30	0.060	0.30	0.010	0.010	113	0.11	0.0039	0.0033	0.071	0.000020	0.000010	0.022	0.000040	41	0.00050	0.00014	0.015	0.0030	0.000040	0.0010	2.9	0.035	0.010	0.063	0.0016	0.083	14	0.00024	1.6	0.000010	0.53	0.20	9.7	0.000060	0.28	0.00040	0.0076	0.0020	0.010	0.000010
30-May-12	57	0.5	300	295	7.9	274																																													
6-Jun-12	58	0.5	300	300	7.9	267																																													
13-Jun-12	59	0.5	300	295	7.9	267																																													
20-Jun-12	60	0.5	300	295	7.9	269	#N/A	6.1	126	24	0.20	0.060	0.30	0.010	0.010	120	0.083	0.0041	0.0032	0.082	0.000020	0.000010	0.025	0.000039	43	0.00050	0.00014	0.014	0.0030	0.000030	0.0010	3.0	0.038	0.010	0.060	0.00090	0.085	13	0.00049	1.7	0.000010	0.57	0.22	9.4	0.000060	0.26	0.00030	0.0076	0.0019	0.0060	0.000010
27-Jun-12	61	0.5	300	295	7.7	273																																													
4-Jul-12	62	0.5	300	290	7.8	275																																													
11-Jul-12	63	0.5	300	290	8.0	268																																													
18-Jul-12	64	0.5	300	290	7.9	254	#N/A	5.3	122	21	0.20	0.060	0.30	0.010	0.010	115	0.070	0.0042	0.0032	0.078	0.000020	0.000010	0.015	0.000053	41	0.00050	0.00017	0.013	0.0030	0.000020	0.0010	2.9	0.038	0.020	0.059	0.00030	0.085	11	0.00039	1.5	0.000010	0.53	0.20	9.2	0.000040	0.25	0.00030	0.0070	0.0018	0.0020	0.000040
25-Jul-12	65	0.5	300	300	7.8	262																																													
1-Aug-12	66	0.5	300	300	8.0	263																																													
8-Aug-12	67	0.5	300	295	8.0	260																																													
15-Aug-12	68	0.5	300	290	7.9	255	#N/A	5.4	117	20	0.20	0.060	0.30	0.010	0.010	111	0.077	0.0044	0.0028	0.082	0.000020	0.000010	0.014	0.0000030	40	0.00050	0.00012	0.011	0.0040	0.0000020	0.0010	2.9	0.038	0.010	0.061	0.00040	0.071	11	0.00045	1.5	0.000010	0.49	0.20	8.6	0.000050	0.21	0.00030	0.0068	0.0017	0.0030	0.000020
22-Aug-12	69	0.5	300	290	7.9	255																																													
29-Aug-12	70	0.5	300	295	7.9	251																																													
5-Sep-12	71	0.5	300	300	7.9	261																																													
12-Sep-12	72	0.5	300	285	7.9	261	#N/A	5.4	118	22	0.20	0.060	0.30	0.010	0.010	111	0.036	0.0043	0.0028	0.081	0.000020	0.000010	0.013	0.000076	40	0.00050	0.00010	0.011	0.0030	0.000060	0.0010	2.9	0.039	0.010	0.060	0.00050	0.066	9.2	0.00032	1.5	0.000010	0.52	0.20	8.5	0.000060	0.20	0.00020	0.0072	0.0013	0.0030	0.00010
19-Sep-12	73	0.5	300	295	7.9	257																																													
26-Sep-12	74	0.5	300	300	7.9	260																																													
3-Oct-12	75	0.5	300	295	7.9	260																																													
10-Oct-12	76	0.5	300	295	7.8	253	#N/A	9.5	128	21	0.20	0.060	0.30	0.010	0.010	111	0.057	0.0048	0.0048	0.087	0.000020	0.000010	0.021	0.000064	40	0.00050	0.00014	0.012	0.0030	0.000020	0.0010	2.9	0.041	0.010	0.060	0.00020	0.070	9.2	0.00035	1.7	0.000010	0.47	0.20	8.2	0.000050	0.19	0.00030	0.0067	0.0016	0.0020	0.000010
17-Oct-12	77	0.5	300	305	7.9	260																																													
24-Oct-12	78	0.5	300	295	8.0	270																																													
31-Oct-12	79	0.5	300	300	8.0	253																																													
7-Nov-12	80	0.5	300	295	7.9	235	#N/A	6.5	123	22	0.20	0.060	0.30	0.010	0.010	112	0.030	0.0044	0.0027	0.080	0.000020	0.000010	0.011	0.000059	40	0.00050	0.00013	0.010	0.0030	0.00037	0.0010	3.0	0.043	0.010	0.058	0.00030	0.076	8.0	0.00025	1.5	0.000010	0.42	0.21	7.9	0.000050	0.16	0.00020	0.0054	0.0014	0.0020	0.000010
14-Nov-12	81	0.5	300	290	7.9	253																																													
21-Nov-12	82	0.5	300	300	7.9	237																																													
28-Nov-12	83	0.5	300	295	7.8	261																																													
5-Dec-12	84	0.5	300	305	7.9	246	#N/A	12	125	19	0.20	0.060	0.30	0.010	0.010	112	0.030	0.0046	0.0031	0.087	0.000020	0.000010	0.012	0.000078	40	0.00050	0.00019	0.012	0.0030	0.000060	0.0010	3.1	0.043	0.010	0.059	0.00040	0.073	8.4	0.00030	1.5	0.000010	0.44	0.21	8.0	0.000050	0.14	0.00020	0.0062	0.0014	0.0020	0.000010
Cell Terminated																																																				

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for Col 1

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Total CN	WAD CN	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
4-May-11	1	0.5	1505	325	7.7	2297	#N/A	0.55	5.8	80	4.1	0.0039	0.020	0.00066	0.00066	77	0.0030	0.00020	0.00032	0.0052	0.0000013	0.00000066	0.0048	0.00022	29	0.000072	0.00020	0.021	0.00020	0.00016	0.000066	0.97	0.0071	0.0020	0.072	0.0012	0.086	4.6	0.0017	0.15	0.0000040	5.9	0.100	30	0.0000013	0.00026	0.00014	0.0089	0.0000084	0.0026	0.0000033
11-May-11	2	0.5	300	280	7.7	878	#N/A	0.29	4.7	20	0.14	0.0034	0.017	0.00056	0.00056	18	0.0028	0.00017	0.00020	0.0016	0.0000011	0.0000045	0.0037	0.000063	6.7	0.000028	0.00079	0.0098	0.00011	0.00016	0.000056	0.24	0.0021	0.00056	0.032	0.000056	0.011	1.9	0.000059	0.094	0.0000040	2.0	0.023	7.3	0.000011	0.00012	0.000040	0.0015	0.000072	0.00023	0.0000017
18-May-11	3	0.5	300	305						11	0.049	0.0037	0.018	0.00061	0.00061	12	0.0039	0.00020	0.00022	0.0016	0.0000012	0.0000025	0.0044	0.000039	4.4	0.000049	0.00049	0.0085	0.00012	0.000010	0.000061	0.23	0.0017	0.00061	0.026	0.00015	0.017	1.8	0.000061	0.11	0.000053	2.0	0.017	4.7	0.000012	0.00018	0.000037	0.00095	0.00010	0.00012	0.0000061
25-May-11	4	0.5	300	285	7.8	481	#N/A	0.34	4.7	7.5	0.034	0.0034	0.017	0.00057	0.00057	9.0	0.0031	0.00019	0.00020	0.0017	0.0000011	0.0000011	0.0038	0.000028	3.4	0.000029	0.000046	0.0066	0.00011	0.0000057	0.000057	0.14	0.0013	0.00057	0.021	0.00017	0.016	1.4	0.000083	0.090	0.0000017	1.1	0.013	3.2	0.000011	0.00054	0.000046	0.00075	0.000083	0.00011	0.00000057
1-Jun-11	5	0.5	300	290	7.8	436	#N/A	0.42	4.8																																													
8-Jun-11	6	0.5	350	300	7.7	418	#N/A	0.46	5.4	7.0	0.024	0.0036	0.018	0.00060	0.00060	7.8	0.0032	0.00021	0.00022	0.0017	0.0000012	0.0000012	0.0042	0.000029	2.9	0.000030	0.000036	0.0057	0.00012	0.000011	0.000060	0.13	0.0013	0.00060	0.019	0.000097	0.017	1.3	0.000021	0.097	0.0000024	0.79	0.011	2.3	0.0000036	0.0039	0.000036	0.00073	0.000089	0.00024	0.0000012
15-Jun-11	7	0.5	300	305	7.8	431																																														
22-Jun-11	8	0.5	300	305	8.0	355	#N/A	0.22	5.8	5.5	0.012	0.0037	0.018	0.00061	0.00061	7.6	0.0031	0.00020	0.00020	0.0017	0.0000012	0.0000018	0.0041	0.000024	2.8	0.000031	0.00025	0.0045	0.00012	0.0000086	0.000061	0.13	0.0012	0.00061	0.016	0.0000061	0.011	1.3	0.000015	0.090	0.0000061	0.49	0.011	1.9	0.0000031	0.012	0.000031	0.00063	0.000090	0.00068	0.00000061
29-Jun-11	9	0.5	300	300	7.9	338																																														
6-Jul-11	10	0.5	300	300	7.8	330	#N/A	0.35	5.9	4.6	0.012	0.0036	0.018	0.00060	0.00060	7.3	0.0042	0.00018	0.00018	0.0020	0.0000012	0.00000060	0.0041	0.000019	2.7	0.000030	0.000030	0.0059	0.00012	0.000022	0.000060	0.13	0.0012	0.00060	0.014	0.000067	0.0085	1.2	0.000016	0.094	0.0000060	0.28	0.011	1.5	0.0000036	0.024	0.000024	0.00055	0.000082	0.00024	0.0000060
13-Jul-11	11	0.5	300	285	7.7	318																																														
20-Jul-11	12	0.5	300	290	7.9	310	#N/A	0.28	5.5	3.9	0.012	0.0035	0.018	0.00058	0.00058	7.0	0.0024	0.00019	0.00020	0.0022	0.0000012	0.00000058	0.0036	0.000025	2.6	0.000029	0.000018	0.0030	0.00012	0.0000047	0.000058	0.13	0.0012	0.00058	0.012	0.000088	0.0073	1.1	0.0000055	0.087	0.00000058	0.19	0.011	1.3	0.0000029	0.022	0.000023	0.00054	0.000088	0.00012	0.00000058
27-Jul-11	13	0.5	300	290	7.9	306																																														
3-Aug-11	14	0.5	300	190	7.8	299	#N/A	0.30	4.0	2.2	0.0077	0.0023	0.011	0.00038	0.00038	4.4	0.0015	0.00011	0.00016	0.0015	0.00000077	0.00000038	0.0025	0.0000088	1.6	0.000088	0.000015	0.0018	0.000077	0.0000050	0.000038	0.082	0.00080	0.00038	0.0058	0.0000038	0.0037	0.72	0.000021	0.056	0.00000038	0.091	0.0069	0.70	0.0000023	0.015	0.0000011	0.00035	0.000052	0.000077	0.00000038
10-Aug-11	15	0.5	300	300	7.9	291																																														
17-Aug-11	16	0.5	300	295	7.9	292	#N/A	0.31	6.4	2.1	0.012	0.0036	0.018	0.00059	0.00059	6.3	0.0023	0.00018	0.00019	0.0027	0.0000012	0.00000059	0.0037	0.000011	2.3	0.00011	0.000018	0.0025	0.00054	0.0000048	0.000059	0.12	0.0011	0.00059	0.0080	0.000012	0.0058	1.1	0.000014	0.075	0.00000059	0.13	0.0099	1.0	0.0000030	0.028	0.000024	0.00056	0.000078	0.000059	0.00000059
24-Aug-11	17	0.5	300	290	7.8	291																																														
31-Aug-11	18	0.5	300	300	7.9	301	#N/A	0.56	7.1	2.8	0.012	0.0036	0.018	0.00060	0.00060	7.5	0.0029	0.00022	0.00025	0.0031	0.0000012	0.00000060	0.0044	0.000011	2.8	0.000085	0.000018	0.0026	0.00012	0.000011	0.000060	0.15	0.0014	0.00060	0.0071	0.000097	0.0042	1.3	0.000022	0.096	0.00000060	0.11	0.012	1.0	0.0000036	0.027	0.000024	0.00053	0.000089	0.00018	0.00000060
7-Sep-11	19	0.5	300	295	8.0	290																																														
14-Sep-11	20	0.5	300	310	8.0	282	#N/A	0.41	7.2	2.8	0.013	0.0038	0.019	0.00063	0.00063	6.9	0.0024	0.00018	0.00021	0.0032	0.0000013	0.00000063	0.0038	0.000011	2.6	0.000088	0.000019	0.0022	0.00013	0.000013	0.000063	0.14	0.0012	0.00063	0.0064	0.0000063	0.0046	1.1	0.000021	0.084	0.00000063	0.087	0.011	0.88	0.0000031	0.026	0.000025	0.00057	0.000083	0.00013	0.00000063
21-Sep-11	21	0.5	300	295	7.9	284																																														
28-Sep-11	22	0.5	300	295	7.9	283	#N/A	0.43	7.1	2.3	0.012	0.0036	0.018	0.00059	0.00059	6.7	0.0039	0.00018	0.00020	0.0032	0.0000012	0.00000059	0.0030	0.000011	2.4	0.000095	0.000021	0.0020	0.00012	0.000012	0.000059	0.14	0.0013	0.00059	0.0055	0.0000059	0.0044	1.1	0.000026	0.083	0.00000059	0.073	0.011	0.78	0.0000036	0.025	0.000018	0.00053	0.000076	0.00018	0.0000012
5-Oct-11	23	0.5	300	305	8.0	289																																														
12-Oct-11	24	0.5	300	305	8.0	288	#N/A	0.24	7.3	2.4	0.012	0.0037	0.018	0.00061	0.00061	7.5	0.0020	0.00020	0.00023	0.0036	0.0000012	0.00000061	0.0034	0.0000093	2.7	0.00010	0.000012	0.0020	0.00012	0.0000092	0.000061	0.16	0.0015	0.00061	0.0061	0.000068	0.0053	1.3	0.000024	0.097	0.00000061	0.076	0.012	0.85	0.0000037	0.026	0.000018	0.00056	0.000081	0.00018	0.0000018
19-Oct-11	25	0.5	300	300	8.0	296																																														
26-Oct-11	26	0.5	300	300	7.9	292	#N/A	0.47	7.5	2.3	0.012	0.0036	0.018	0.00060	0.00060	7.2	0.0036	0.00018	0.00020	0.0038	0.0000012	0.00000060	0.0032	0.0000077	2.6	0.00056	0.000019	0.0020	0.00048	0.0000060	0.000060	0.15	0.0015	0.00060	0.0051	0.000073	0.0056	1.2	0.000021	0.083	0.00000060	0.067	0.012	0.82	0.0000036	0.025	0.000018	0.00057	0.000079	0.00024	0.0000012
2-Nov-11	27	0.5	300	305	7.9	288																																														
9-Nov-11	28	0.5	300	290	7.9	290	#N/A	0.45	7.2	2.0	0.012	0.0035	0.018	0.00058	0.00058	6.9	0.0025	0.00018	0.00019	0.0035	0.0000012	0.00000058	0.0025	0.0000082	2.5	0.000029	0.000015	0.0017	0.00018	0.0000035	0.000058	0.15	0.0017	0.00058	0.0053	0.00011	0.0053	1.1	0.000036	0.081	0.00000058	0.066	0.012	0.70	0.0000035	0.023	0.000029	0.00052	0.000088	0.00012	0.00000058
16-Nov-11	29	0.5	300	310	8.0	290																																														
23-Nov-11	30	0.5	300	300	7.9	285	#N/A	0.43	7.5	1.9	0.012	0.0060	0.018	0.00060	0.00060	6.8	0.0039	0.00019	0.00019	0.0037	0.0000012	0.00000060	0.0026	0.0000090	2.5	0.000030	0.000018	0.0018	0.00018	0.0000036	0.000060	0.15	0.0016	0.00060	0.0052	0.000073	0.0046	1.0	0.0000054	0.084	0.00000060	0.050	0.011	0.68	0.0000036	0.026	0.000024	0.00049	0.00011	0.00018	0.00000060
30-Nov-11	31	0.5	300	285	7.9	289																																														
7-Dec-11	32	0.5	300	305	8.0	282	#N/A	0.39	7.6	1.7	0.012	0.0037	0.018	0.00061	0.00061	7.3	0.0028	0.00019	0.00020	0.0039	0.0000012	0.00000061	0.0025	0.0000081	2.6	0.000031	0.000012	0.0017	0.00018	0.0000012	0.000061	0.16	0.0017	0.00061	0.0055	0.000018	0.0053	1.1	0.000028	0.087	0.00000031	0.051	0.012	0.76	0.0000037	0.024	0.000018	0.00050	0.000090	0.00012	0.00000061
14-Dec-11	33	0.5	300	320	7.9	283																																														
21-Dec-11	34	0.5	300	260	7.9	279	#N/A	0.40	6.6	1.6	0.010	0.0031	0.016	0.00052	0.00052	6.3	0.0040	0.00018	0.00017	0.0034	0.0000010	0.00000052	0.0019	0.0000054	2.3	0.000026	0.000011	0.0014	0.00016	0.0000010	0.000052	0.14	0.0015	0.00052	0.0039	0.000063	0.0049	1.0	0.0000021	0.073	0.00000052	0.044	0.010	0.64	0.0000026	0.022	0.000031	0.00045	0.000091	0.00021	0.0000052
28-Dec-11	35	0.5	300	300	7.9	285																																														
4-Jan-12	36	0.5	300	295	7.9	281	#N/A	0.45	8.4	2.0	0.012	0.0036	0.018	0.00059	0.00059	6.6	0.0053	0.00021	0.00020	0.0039	0.0000012	0.00000059	0.0023	0.0000062	2.4	0.000030	0.000013	0.0014	0.00018	0.0000018	0.000059	0.16	0.0017	0.00059	0.0048	0.00012	0.0042	1.0	0.000023	0.083	0.00000059	0.045	0.011	0.64	0.0000036	0.022	0.000036	0.00049	0.00011	0.00012	0.00000059
11-Jan-12	37	0.5	300	270	7.9	283																																														
18-Jan-12	38	0.5	300	305	7.9	282	#N/A	0.25	8.7	2.1	0.012	0.0037	0.018	0.00061	0.00061	7.1	0.0035	0.00020	0.00024	0.0040	0.0000012	0.00000061	0.0023	0.0000060	2.6	0.000031	0.000019	0.0017	0.00018	0.0000025	0.000061	0.16	0.0018	0.00061	0.0045	0.000012	0.0052	0.95	0.000022	0.082	0.00000061	0.046	0.012	0.68	0.0000043	0.022	0.000031	0.00049	0.00011	0.00012	0.00000061
25-Jan-12	39	0.5	300	295	7.9	281																																														
1-Feb-12	40	0.5	300	290	7.9	284	#N/A	0.29	8.3	1.9	0.012	0.0035	0.018	0.0012	0.00058	6.8	0.0033	0.00023	0.00019	0.0040	0.0000012	0.00000058	0.0018	0.0000060	2.5	0.000029	0.000010	0.0012	0.00018	0.0000023	0.000058	0.16	0.0018	0.00058	0.0045	0.000047	0.0047	1.00	0.000022	0.087	0.00000058	0.041	0.012	0.66	0.0000029	0.021	0.000018	0.00045	0.00010	0.00012	0.00000058
8-Feb-12	41	0.5	300	300	7.9	287																																														
15-Feb-12	42	0.5	300	290	7.9	285																																														
22-Feb-12	43	0.5	300	285	7.9	274																																													
29-Feb-12	44	0.5	300	300	7.9	273	#N/A	0.31	7.6	2.7	0.012	0.0036	0.018	0.00060	0.00060	7.0	0.0022	0.00022	0.00021	0.0041	0.0000012	0.00000060	0.0015	0.0000051	2.5	0.000030	0.000012	0.0012	0.00018	0.0000021	0.000060	0.17	0.0019	0.00060	0.0042	0.000024	0.0048	0.98	0.000019	0.12	0.00000060	0.042	0.012	0.62	0.0000030	0.018	0.000024	0.00047	0.000094	0.00018	0.00000060
7-Mar-12	45	0.5	300	300	7.9	275																																														
14-Mar-12	46	0.5	300	305	7.9	279																																														
21-Mar-12	47	0.5	300	315	7.9	282																																													
28-Mar-12	48	0.5	300	340	7.9	289	#N/A	0.34	8.6	2.0	0.069	0.0041	0.021	0.00069	0.00069	8.4	0.0038	0.00026	0.00023	0.0049	0.0000014	0.00000069	0.0018	0.0000051	3.0	0.00012	0.0000097	0.0012	0.0055	0.000022	0.000069	0.21	0.0024	0.00069	0.0045	0.000069	0.0052	1.1	0.000027	0.11	0.00000069	0.062	0.015	0.73	0.0000048	0.027	0.000021	0.00057	0.00011	0.000069	0.00000069
4-Apr-12	49	0.5	300	295	7.9	274																																														
11-Apr-12	50	0.5	300	290	8.0	278																																														
18-Apr-12	51	0.5	300	275	7.9	272																																													
25-Apr-12	52	0.5	300	310	7.9	277	#N/A	0.39	7.7	2.0	0.013	0.0038	0.019	0.00063	0.00063	7.9	0.0043	0.00028	0.00021	0.0049	0.0000013	0.00000063	0.0015	0.0000031	2.9	0.000031	0.0000084	0.0011	0.00019	0.0000081	0.000063	0.19	0.0023	0.0013	0.0040	0.000038	0.0048	0.99	0.000023	0.11	0.00000063	0.041	0.014	0.66	0.0000031	0.020	0.000025	0.00046	0.00013	0.00019	0.00000063
2-May-12	53	0.5	300	290	8.2	301																																														
9-May-12	54	0.5	300	290	8.0	272																																													
16-May-12	55	0.5	300	285	7.4	91																																												
23-May-12	56	0.5	300	290	7.9	269	#N/A	0.34	7.0	1.5	0.018	0.0035	0.018	0.00058	0.00058	6.6	0.0063	0.00023	0.00019	0.0041	0.0000012	0.00000058	0.0013	0.0000023	2.4	0.000029	0.0000082	0.00085	0.00018	0.0000023	0.000058	0.17	0.0021	0.00058	0.0037	0.000094	0.0049	0.82	0.000014	0.091	0.00000058	0.031	0.012	0.57	0.0000035	0.016	0.000023	0.00045	0.00012	0.00058	0.00000058
30-May-12	57	0.5	300	295	7.9	274																																														
6-Jun-12	58	0.5	300	300	7.9	267																																														
13-Jun-12	59	0.5	300	295	7.9	267																																														
20-Jun-12	60	0.5	300	295	7.9	269	#N/A	0.37	7.5	1.4	0.012	0.0036	0.018	0.00059	0.00059	7.1	0.0050	0.00024	0.00019	0.0049	0.0000012	0.00000059	0.0015	0.0000023	2.6	0.000030	0.0000082	0.00083	0.00018	0.0000018	0.000059	0.18	0.0022	0.00059	0.0036	0.000054	0.0051	0.77	0.000029	0.100	0.00000059	0.034	0.013	0.56	0.0000036	0.015	0.000018	0.00045	0.00011	0.00036	0.00000059
27-Jun-12	61	0.5	300	295	7.7	273																																														
4-Jul-12	62	0.5	300	290	7.8	275																																														
11-Jul-12	63	0.5	300	290	8.0	268																																														
18-Jul-12	64	0.5	300	290	7.9	254	#N/A	0.31	7.1	1.2	0.012	0.0035	0.018	0.00058	0.00058	6.7	0.0041	0.00025	0.00019	0.0045	0.0000012	0.00000058	0.00086	0.0000031	2.4	0.000029	0.0000098	0.00073	0.00018	0.0000012	0.000058	0.17	0.0022	0.0012	0.0034	0.000018	0.0050	0.61	0.000023	0.089	0.00000058	0.031	0.012	0.54	0.0000023	0.015	0.000018	0.00041	0.00010	0.00012	0.0000023
25-Jul-12	65	0.5	300	300	7.8	262																																														
1-Aug-12	66	0.5	300	300	8.0	263																																														
8-Aug-12	67	0.5	300	295	8.0	260																																														
15-Aug-12	68	0.5	300	290	7.9	255	#N/A	0.32	6.8	1.2	0.012	0.0035	0.018	0.00058	0.00058	6.5	0.0045	0.00026	0.00016	0.0048	0.0000012	0.00000058	0.00081	0.00000018	2.3	0.000029	0.0000072	0.00066	0.00023	0.0000012	0.000058	0.17	0.0022	0.00058	0.0036	0.000023	0.0042	0.62	0.000026	0.089	0.00000058	0.029	0.012	0.50	0.0000029	0.012	0.000018	0.00040	0.000099	0.00018	0.0000012
22-Aug-12	69	0.5	300	290	7.9	255																																														
29-Aug-12	70	0.5	300	295	7.9	251																																														
5-Sep-12	71	0.5	300	300	7.9	261																																														
12-Sep-12	72	0.5	300	285	7.9	261	#N/A	0.31	6.8	1.3	0.011	0.0034	0.017	0.00057	0.00057	6.4	0.0021	0.00025	0.00016	0.0046	0.0000011	0.00000057	0.00075	0.0000044	2.3	0.000029	0.0000058	0.00063	0.00017	0.0000034	0.000057	0.16	0.0022	0.00057	0.0034	0.000029	0.0038	0.53	0.000018	0.086	0.00000057	0.030	0.012	0.49	0.0000034	0.011	0.000011	0.00041	0.000074	0.00017	0.0000057
19-Sep-12	73	0.5	300	295	7.9	257																																														
26-Sep-12	74	0.5	300	300	7.9	260																																														
3-Oct-12	75	0.5	300	295	7.9	260																																														
10-Oct-12	76	0.5	300	295	7.8	253	#N/A	0.56	7.6	1.2	0.012	0.0036	0.018	0.00059	0.00059	6.6	0.0034	0.00029	0.00029	0.0052	0.0000012	0.00000059	0.0013	0.0000038	2.4	0.000030	0.0000082	0.00068	0.00018	0.0000012	0.000059	0.17	0.0024	0.00059	0.0036	0.000012	0.0042	0.55	0.000021	0.098	0.00000059	0.028	0.012	0.49	0.0000030	0.012	0.000018	0.00040	0.000095	0.00012	0.00000059
17-Oct-12	77	0.5	300	305	7.9	260																																														
24-Oct-12	78	0.5	300	295	8.0	270																																														
31-Oct-12	79	0.5	300	300	8.0	253																																														
7-Nov-12	80	0.5	300	295	7.9	235	#N/A	0.39	7.3	1.3	0.012	0.0036	0.018	0.00059	0.00059	6.7	0.0018	0.00026	0.00016	0.0048	0.0000012	0.00000059	0.00067	0.0000035	2.4	0.000030	0.0000076	0.00061	0.00018	0.0000022	0.000059	0.18	0.0025	0.00059	0.0034	0.000018	0.0045	0.47	0.000015	0.087	0.00000059	0.025	0.012	0.47	0.0000030	0.0096	0.000012	0.00032	0.000080	0.00012	0.00000059
14-Nov-12	81	0.5	300	290	7.9	253																																														
21-Nov-12	82	0.5	300

Leachate Results for Col 6

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
19-Dec-12	1	1.0	300	220	7.7	2145	#N/A	#N/A	154	1177	42	0.52	0.30	1300	0.033	0.0030	0.0033	0.055	0.000020	0.000010	0.035	0.00041	457	0.00050	0.00048	0.0063	0.0030	0.0016	0.0020	40	0.19	0.010	0.048	0.00070	0.24	39	0.0032	3.1	0.000070	47	1.8	414	0.000050	0.00042	0.00050	0.25	0.00089	0.0040	0.00010
26-Dec-12	2	1.0	300	330	7.7	896	#N/A	9.9	116	276	5.3	0.65	0.30	409	0.023	0.0029	0.0025	0.025	0.000020	0.000010	0.040	0.00017	141	0.00050	0.00022	0.0018	0.0030	0.00047	0.0010	14	0.064	0.010	0.033	0.0014	0.14	20	0.00081	2.7	0.000020	16	0.75	120	0.000030	0.00026	0.00020	0.085	0.00061	0.0020	0.000020
2-Jan-13	3	1.0	300	275	7.7	745	#N/A	8.7	108	270	1.6	0.67	0.30	319	0.036	0.0030	0.0023	0.029	0.000020	0.000010	0.032	0.00012	111	0.00050	0.00019	0.0011	0.0050	0.00028	0.0010	10	0.057	0.010	0.026	0.00090	0.11	18	0.00044	3.0	0.000080	9.8	0.62	92	0.000030	0.00038	0.00050	0.077	0.00085	0.0030	0.000030
9-Jan-13	4	1.0	300	300	7.7	753	#N/A	11	109	309	0.80	0.64	0.30	351	0.031	0.0034	0.0023	0.035	0.000020	0.000010	0.033	0.00013	122	0.00050	0.00023	0.0024	0.0030	0.00020	0.0010	11	0.068	0.010	0.025	0.0018	0.092	19	0.00052	2.7	0.000010	6.8	0.69	83	0.000030	0.00031	0.00030	0.084	0.00081	0.0020	0.000040
16-Jan-13	5	1.0	300	295	7.8	744																																												
23-Jan-13	6	1.0	300	300	7.7	715	#N/A	12	115	288	0.60	0.60	0.30	319	0.034	0.0068	0.0024	0.033	0.000020	0.000010	0.028	0.00016	111	0.00050	0.00031	0.0027	0.0030	0.00018	0.0010	10	0.075	0.010	0.035	0.0032	0.086	17	0.00049	3.0	0.00013	2.9	0.68	87	0.000030	0.00062	0.00050	0.078	0.00076	0.0020	0.000060
30-Jan-13	7	1.0	300	300	7.8	646																																											
6-Feb-13	8	1.0	300	270	7.8	584	#N/A	10	114	159	1.0	0.66	0.30	242	0.012	0.012	0.0029	0.033	0.000020	0.000010	0.030	0.00014	83	0.00050	0.00027	0.0030	0.0040	0.00021	0.0010	8.5	0.071	0.010	0.055	0.00090	0.064	15	0.00058	3.2	0.000010	1.7	0.59	61	0.000030	0.0011	0.00020	0.073	0.00049	0.0020	0.000050
13-Feb-13	9	1.0	300	295	7.7	476																																											
20-Feb-13	10	1.0	300	290	7.8	431	#N/A	7.9	134	102	0.90	0.77	0.30	213	0.015	0.015	0.0029	0.030	0.000020	0.000010	0.023	0.00012	75	0.00050	0.00019	0.0048	0.0030	0.00014	0.0010	6.5	0.060	0.010	0.080	0.00040	0.083	13	0.00070	3.0	0.000010	1.3	0.47	37	0.000030	0.0018	0.00020	0.047	0.00058	0.0040	0.000050
27-Feb-13	11	1.0	300	295	7.8	391																																											
6-Mar-13	12	1.0	300	300	7.6	380	#N/A	8.2	130	65	0.80	0.80	0.30	170	0.014	0.021	0.0033	0.038	0.000020	0.000010	0.020	0.00014	59	0.00050	0.00025	0.0032	0.0030	0.00014	0.0010	5.7	0.059	0.010	0.12	0.00040	0.072	12	0.00087	3.1	0.000010	0.88	0.43	26	0.000030	0.0024	0.00010	0.037	0.00058	0.0010	0.000060
13-Mar-13	13	1.0	300	295	7.9	336																																											
20-Mar-13	14	1.0	300	305	8.0	319	#N/A	8.1	117	61	0.80	0.75	0.30	152	0.010	0.021	0.0040	0.044	0.000020	0.000010	0.015	0.00012	52	0.00050	0.00024	0.0035	0.0030	0.00011	0.0010	5.2	0.056	0.010	0.14	0.00020	0.070	12	0.00081	3.0	0.000010	0.80	0.39	20	0.000030	0.0033	0.00010	0.033	0.00031	0.0010	0.000020
27-Mar-13	15	1.0	300	295	8.0	318																																											
3-Apr-13	16	1.0	300	290	7.9	313	#N/A	9.1	117	46	0.80	0.71	0.30	150	0.014	0.021	0.0030	0.050	0.000020	0.000010	0.014	0.00012	52	0.00050	0.00023	0.0035	0.0030	0.00011	0.0010	5.1	0.055	0.010	0.13	0.00030	0.070	11	0.00052	3.1	0.000010	0.66	0.39	18	0.000030	0.0045	0.00010	0.029	0.00046	0.0010	0.000020
10-Apr-13	17	1.0	300	290	7.9	301																																											
17-Apr-13	18	1.0	300	290	7.6	301	#N/A	#N/A	92																																									

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for Col 6

Date	Cycle	Flow Rate	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	(mL/min)	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
19-Dec-12	1	1	300	220	7.7	2145	#N/A	0.49	6.8	52	1.8	0.023	0.013	57	0.0014	0.00013	0.00015	0.0024	0.00000088	0.00000044	0.0016	0.000018	20	0.000022	0.000021	0.00028	0.00013	0.000071	0.000088	1.8	0.0085	0.00044	0.0021	0.000031	0.010	1.7	0.00014	0.14	0.0000031	2.1	0.077	18	0.0000022	0.000018	0.000022	0.011	0.000039	0.00018	0.0000044
26-Dec-12	2	1	300	330	7.7	896	#N/A	0.65	7.7	18	0.35	0.043	0.020	27	0.0015	0.00019	0.00017	0.0017	0.0000013	0.00000066	0.0026	0.000011	9.3	0.0000033	0.0000014	0.00012	0.00020	0.0000031	0.0000066	0.91	0.0042	0.00066	0.0022	0.000092	0.0089	1.3	0.0000053	0.18	0.0000013	1.1	0.049	7.9	0.0000020	0.0000017	0.0000013	0.0056	0.0000040	0.00013	0.0000013
2-Jan-13	3	1	300	275	7.7	745	#N/A	0.48	5.9	15	0.088	0.037	0.017	18	0.0020	0.00017	0.00013	0.0016	0.0000011	0.00000055	0.0018	0.0000068	6.1	0.0000028	0.0000011	0.000061	0.00028	0.0000015	0.0000055	0.56	0.0032	0.00055	0.0014	0.000050	0.0062	0.97	0.0000024	0.17	0.0000044	0.54	0.034	5.0	0.0000017	0.0000021	0.0000028	0.0043	0.0000047	0.00017	0.0000017
9-Jan-13	4	1	300	300	7.7	753	#N/A	0.68	6.6	19	0.048	0.038	0.018	21	0.0018	0.00020	0.00014	0.0021	0.0000012	0.00000060	0.0020	0.0000075	7.3	0.0000030	0.0000014	0.00014	0.00018	0.0000012	0.0000060	0.66	0.0041	0.00060	0.0015	0.00011	0.0055	1.1	0.0000031	0.16	0.00000060	0.41	0.042	5.0	0.0000018	0.0000019	0.0000018	0.0050	0.0000049	0.00012	0.0000024
16-Jan-13	5	1	300	295	7.8	744																																											
23-Jan-13	6	1	300	300	7.7	715	#N/A	0.73	6.9	17	0.036	0.036	0.018	19	0.0021	0.00041	0.00014	0.0020	0.0000012	0.00000060	0.0017	0.0000097	6.7	0.0000030	0.0000019	0.00016	0.00018	0.0000011	0.0000060	0.61	0.0045	0.00060	0.0021	0.00019	0.0052	1.0	0.0000029	0.18	0.0000078	0.17	0.041	5.2	0.0000018	0.0000037	0.0000030	0.0047	0.0000046	0.00012	0.0000036
30-Jan-13	7	1	300	300	7.8	646																																											
6-Feb-13	8	1	300	270	7.8	584	#N/A	0.54	6.2	8.6	0.054	0.036	0.016	13	0.00065	0.00064	0.00016	0.0018	0.0000011	0.00000054	0.0016	0.0000075	4.5	0.0000027	0.0000015	0.00016	0.00022	0.0000011	0.0000054	0.46	0.0038	0.00054	0.0030	0.000049	0.0035	0.82	0.0000031	0.17	0.00000054	0.092	0.032	3.3	0.0000016	0.0000057	0.0000011	0.0039	0.0000026	0.00011	0.0000027
13-Feb-13	9	1	300	295	7.7	476																																											
20-Feb-13	10	1	300	290	7.8	431	#N/A	0.46	7.7	5.9	0.052	0.045	0.017	12	0.00088	0.00087	0.00017	0.0018	0.0000012	0.00000058	0.0013	0.0000072	4.3	0.000029	0.0000011	0.00028	0.00017	0.0000081	0.0000058	0.38	0.0035	0.00058	0.0046	0.000023	0.0048	0.78	0.0000041	0.18	0.00000058	0.073	0.027	2.1	0.0000017	0.00010	0.0000012	0.0027	0.0000034	0.00023	0.0000029
27-Feb-13	11	1	300	295	7.8	391																																											
6-Mar-13	12	1	300	300	7.6	380	#N/A	0.49	7.8	3.9	0.048	0.048	0.018	10	0.00083	0.0013	0.00020	0.0023	0.0000012	0.00000060	0.0012	0.0000081	3.5	0.000030	0.0000015	0.00019	0.00018	0.0000084	0.0000060	0.34	0.0035	0.00060	0.0071	0.000024	0.0043	0.69	0.0000052	0.19	0.00000060	0.053	0.026	1.5	0.0000018	0.00015	0.0000060	0.0022	0.0000035	0.00060	0.0000036
13-Mar-13	13	1	300	295	7.9	336																																											
20-Mar-13	14	1	300	305	8.0	319	#N/A	0.50	7.1	3.7	0.049	0.046	0.018	9.3	0.00063	0.0013	0.00024	0.0027	0.0000012	0.00000061	0.00089	0.0000073	3.2	0.000031	0.0000014	0.00021	0.00018	0.0000067	0.0000061	0.32	0.0034	0.00061	0.0084	0.000012	0.0043	0.70	0.0000049	0.18	0.00000061	0.049	0.024	1.2	0.0000018	0.00020	0.0000061	0.0020	0.000019	0.000061	0.0000012
27-Mar-13	15	1	300	295	8.0	318																																											
3-Apr-13	16	1	300	290	7.9	313	#N/A	0.53	6.8	2.7	0.046	0.041	0.017	8.7	0.00082	0.0012	0.00017	0.0029	0.0000012	0.00000058	0.00080	0.0000071	3.0	0.000029	0.0000013	0.00020	0.00017	0.0000064	0.0000058	0.30	0.0032	0.00058	0.0076	0.000017	0.0041	0.66	0.0000030	0.18	0.00000058	0.038	0.023	1.0	0.0000017	0.00026	0.0000058	0.0017	0.0000027	0.00058	0.0000012
10-Apr-13	17	1	300	290	7.9	301																																											
17-Apr-13	18	1	300	290	7.6	301	#N/A	#N/A	5.3																																								
Median (last 5)					7.8	380	#N/A	0.50	7.1	3.9	0.049	0.045	0.017	10	0.00082	0.0012	0.00017	0.0023	0.0000012	0.00000058	0.0012	0.0000073	3.5	0.000029	0.0000014	0.00020	0.00018	0.0000081	0.0000058	0.34	0.0035	0.00058	0.0071	0.000023	0.0043	0.70	0.0000041	0.18	0.00000058	0.053	0.026	1.5	0.0000017	0.00015	0.0000061	0.0022	0.0000027	0.000061	0.0000027

Leachate Results for T1

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg CaCO3/L	mg CaCO3/L	mg CaCO3/L	mg/L	mg/L	mg/L	mg/L	mg CaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1-May-08	0	750	400	7.7	1544	#N/A	4.1	67	736	34	1.7	2.8	752	0.084	0.054	0.0065	0.059	0.000050	0.00030	0.30	0.00043	287	0.00050	0.00014	0.016	0.010	0.00034	0.0030	8.8	0.044	0.090	1.2	0.0017	0.16	50	0.014	2.7	0.000030	37	0.87	272	0.00028	0.00043	0.0030	0.054	0.0010	0.0068	0.00050
8-May-08	1	500	455	7.7	378	#N/A	3.6	33	127	1.9	0.72	0.30	160	0.12	0.016	0.0049	0.018	0.000010	0.0000050	0.050	0.000097	60	0.00010	0.000065	0.0065	0.0040	0.00013	0.0011	2.6	0.018	0.010	0.19	0.00056	0.026	13	0.0022	1.3	0.0000090	5.2	0.19	49	0.000091	0.000040	0.0018	0.0074	0.00030	0.0029	0.00010
15-May-08	2	500	510	7.7	553	#N/A	3.3	45	229	0.90	1.0	0.10	267	0.086	0.027	0.0043	0.020	0.000010	0.0000050	0.050	0.00012	98	0.00010	0.00017	0.0089	0.0040	0.00013	0.0017	5.4	0.047	0.010	0.22	0.00059	0.037	19	0.0029	2.1	0.0000050	7.5	0.32	87	0.00013	0.000060	0.00050	0.016	0.00040	0.0019	0.00010
22-May-08	3	500	500	7.9	645	#N/A	3.5	75	260	0.80	1.2	0.10	314	0.035	0.039	0.0034	0.025	0.000010	0.0000050	0.050	0.00023	114	0.00010	0.00036	0.015	0.0060	0.00017	0.0022	7.1	0.090	0.010	0.27	0.00090	0.036	22	0.0027	2.8	0.0000050	7.0	0.40	89	0.00017	0.000080	0.00050	0.021	0.00020	0.0019	0.00010
29-May-08	4	500	455	7.8	343	#N/A	3.3	53	145	0.50	0.90	0.40	164	0.064	0.025	0.0042	0.027	0.000010	0.0000050	0.050	0.000080	59	0.00010	0.00011	0.0070	0.0070	0.00012	0.0014	3.9	0.034	0.030	0.11	0.00030	0.025	13	0.0025	2.2	0.0000010	2.5	0.23	44	0.00012	0.000040	0.00070	0.0091	0.00020	0.00040	0.00010
5-Jun-08	5	500	490	7.9	363	#N/A	4.9	75	145	0.60	1.0	0.10	196	0.032	0.029	0.0032	0.030	0.000010	0.0000050	0.050	0.00013	70	0.00010	0.00031	0.013	0.0010	0.000043	0.0021	5.2	0.072	0.010	0.12	0.00041	0.022	14	0.0020	2.7	0.0000050	2.3	0.28	47	0.00012	0.000050	0.00050	0.012	0.00020	0.0010	0.00010
12-Jun-08	6	500	485	8.0	317	#N/A	3.2	84	115				198	0.028	0.028	0.0030	0.037	0.000010	0.0010	0.050	0.00013	70	0.00010	0.00050	0.015	0.0050	0.00020	#N/A	5.5	0.081	#N/A	0.11	0.00010	0.018	14	0.0019	3.2	0.000020	2.0	0.29	42	0.00012	0.00050	0.00050	0.011	0.00050	0.0050	0.00050
19-Jun-08	7	500	450	7.8	273	#N/A	4.7	67	118				166	0.040	0.025	0.0031	0.041	0.000010	0.0010	0.050	0.000080	59	0.00010	0.00050	0.014	0.022	0.00020	#N/A	4.7	0.044	#N/A	0.089	0.0070	0.019	12	0.0023	2.5	0.000020	1.3	0.24	38	0.00011	0.0050	0.0050	0.0093	0.0050	0.0050	0.00050
26-Jun-08	8	500	490	7.8	339	#N/A	6.2	77	93				149	0.041	0.023	0.0029	0.039	0.000010	0.0010	0.050	0.00012	52	0.00010	0.00050	0.010	0.0050	0.00020	#N/A	4.5	0.060	#N/A	0.062	0.0010	0.014	9.8	0.0020	2.5	0.000020	1.0	0.22	32	0.00010	0.0050	0.0050	0.0079	0.0050	0.0050	0.00050
3-Jul-08	9	500	380	7.7	556	#N/A	3.4	46	215				297	0.031	0.029	0.0031	0.041	0.000010	0.0010	0.050	0.00013	105	0.00010	0.00050	0.0094	0.0050	0.00020	#N/A	8.5	0.072	#N/A	0.10	0.0010	0.035	13	0.0057	2.8	0.000020	1.6	0.38	84	0.00012	0.0050	0.0050	0.014	0.0050	0.0050	0.00050
10-Jul-08	10	500	470	7.9	429	#N/A	4.0	74	115	0.60	0.67	0.10	198	0.025	0.027	0.0027	0.038	0.000010	0.0000050	0.050	0.00011	69	0.00010	0.00028	0.013	0.0030	0.000080	0.0013	6.1	0.079	0.010	0.086	0.00045	0.016	11	0.0028	2.4	0.0000050	1.0	0.29	46	0.00012	0.000030	0.00050	0.011	0.00020	0.0011	0.00010
17-Jul-08	11	500	440	7.9	369	#N/A	3.7	61	105				167	0.035	0.023	0.0029	0.036	0.00010	0.0010	0.050	0.000080	58	0.00010	0.00050	0.010	0.0050	0.00020	#N/A	5.4	0.055	#N/A	0.074	0.0010	0.018	9.1	0.0023	2.4	0.000020	0.77	0.23	39	0.00010	0.0050	0.0050	0.0083	0.0050	0.0050	0.00050
24-Jul-08	12	500	465	7.8	397																																											
31-Jul-08	13	500	440	8.0	347	#N/A	2.8	68	110	0.50	0.74	0.10	171	0.024	0.023	0.0032	0.040	0.000010	0.0000050	0.050	0.000092	60	0.00010	0.00017	0.011	0.0070	0.000028	0.0011	5.4	0.056	0.010	0.077	0.00023	0.014	7.8	0.0021	2.5	0.0000050	0.63	0.23	38	0.00011	0.000020	0.00050	0.0073	0.00020	0.00060	0.00010
7-Aug-08	14	500	495	8.0	358																																											
14-Aug-08	15	500	470	7.9	284	#N/A	3.5	57	64	0.50	0.62	0.20	136	0.037	0.020	0.0032	0.039	0.000010	0.0000050	0.050	0.00013	48	0.00010	0.00013	0.011	0.0040	0.00038	0.0010	4.2	0.050	0.010	0.056	0.00024	0.010	6.1	0.0017	2.1	0.0000050	0.47	0.19	27	0.000093	0.000020	0.00050	0.0055	0.00020	0.0033	0.00010
21-Aug-08	16	500	465	7.9	321																																											
28-Aug-08	17	500	480	7.9	309	#N/A	3.1	72	84	0.80	0.60	0.20	155	0.024	0.023	0.0030	0.042	0.000010	0.0000050	0.050	0.00011	54	0.00010	0.00016	0.014	0.0030	0.000061	0.0011	4.9	0.062	0.010	0.072	0.00026	0.010	6.1	0.0019	2.3	0.0000050	0.52	0.21	31	0.00010	0.000010	0.00050	0.0061	0.00020	0.0019	0.00010
4-Sep-08	18	500	500	8.0	303																																											
11-Sep-08	19	500	500	8.0	311	#N/A	3.9	84	73	1.6	0.72	0.20	155	0.023	0.024	0.0028	0.053	0.000010	0.0000050	0.050	0.00012	53	0.00010	0.00022	0.018	0.0020	0.00010	0.0011	5.2	0.076	0.010	0.068	0.00023	0.0080	6.0	0.0015	2.7	0.0000050	0.50	0.20	27	0.00011	0.000020	0.00050	0.0056	0.00020	0.0029	0.00010
18-Sep-08	20	500	470	7.9	282																																											
25-Sep-08	21	500	475	7.9	294	#N/A	3.9	76	64	0.50	0.59	0.10	141	0.055	0.022	0.0028	0.055	0.000010	0.0000050	0.050	0.00011	49	0.00010	0.00021	0.019	0.0040	0.00013	0.0011	4.8	0.073	0.010	0.061	0.00023	0.0080	5.0	0.0015	2.9	0.0000050	0.56	0.19	23	0.000093	0.000010	0.00050	0.0051	0.00020	0.0019	0.00010
2-Oct-08	22	500	465	8.0	277																																											
9-Oct-08	23	500	500	7.9	278	#N/A	3.9	76	56	0.90	0.55	0.10	139	0.019	0.021	0.0029	0.059	0.000010	0.0000050	0.050	0.00045	48	0.00010	0.00020	0.017	0.0020	0.00037	0.0010	4.7	0.072	0.010	0.063	0.00023	0.0070	4.4	0.0017	2.6	0.0000050	0.43	0.19	23	0.000098	0.000040	0.00050	0.0044	0.00020	0.0083	0.00010
16-Oct-08	24	500	460	7.9	238																																											
23-Oct-08	25	500	485	7.9	258	#N/A	3.0	71	61	1.0	0.47	0.10	133	0.024	0.021	0.0038	0.064	0.000010	0.0000050	0.050	0.000091	46	0.00010	0.00017	0.014	0.0030	0.00012	0.00070	4.6	0.064	0.010	0.058	0.00028	0.0050	4.3	0.0018	2.3	0.0000060	0.82	0.18	22	0.000085	0.000010	0.00050	0.0044	0.00020	0.0019	0.00010
30-Oct-08	26	500	415	7.9	241																																											
6-Nov-08	27	500	495	7.7	228	#N/A	4.5	69	55	0.50	0.46	0.10	122	0.020	0.020	0.0031	0.061	0.000010	0.0000050	0.050	0.000090	42	0.00010	0.00014	0.013	0.0010	0.000049	0.0010	4.1	0.061	0.010	0.047	0.00023	0.0070	4.0	0.0014	2.4	0.0000050	0.36	0.16	18	0.000086	0.000020	0.00060	0.0033	0.00020	0.00090	0.00010
13-Nov-08	28	500	500	7.8	210																																											
20-Nov-08	29	500	515	7.9	202	#N/A	2.8	76	50				126	0.016	0.020	0.0029	0.077	0.000010	0.0000050	0.050	0.00061	44	0.00010	0.00016	0.015	0.0010	0.00058	0.00080	4.1	0.065	0.010	0.050	0.00021	0.0080	3.6	0.0020	2.2	0.0000050	0.35	0.16	19	0.00010	0.000010	0.00080	0.0033	0.00020	0.014	0.00010
27-Nov-08	30	500	495	8.0	212																																											
4-Dec-08	31	500	375	7.9	223	#N/A	2.4	77	48				115	0.015	0.020	0.0032	0.072	0.000010	0.0000050	0.050	0.000067	40	0.00010	0.00013	0.011	0.0010	0.000039	0.00070	3.8	0.051	0.010	0.048	0.00024	0.0070	3.4	0.0012	2.1	0.0000050	0.32	0.15	17	0.000076	0.000020	0.00050	0.0030	0.00020	0.00060	0.00010
11-Dec-08	32	500	370	7.8	210																																											
18-Dec-08	33	500	475	7.7	212	#N/A	4.6	81	38				107	0.016	0.020	0.0030	0.091	0.000010	0.0000050	0.050	0.000073	37	0.00010	0.00012	0.013	0.0010	0.000020	0.00080	3.4	0.052	0.010	0.042	0.00020	0.0060	3.1	0.0011	2.2	0.0000050	0.27	0.14	14	0.000080	0.00011	0.00050	0.0027	0.00020	0.00070	0.00010
25-Dec-08	34	500	460	7.6	210																																											
1-Jan-09	35	500	445	7.4	204	#N/A	#N/A	73	47				103	0.019	0.025	0.0034	0.090	0.000010	0.0000050	0.050	0.000069	36	0.00010	0.000094	0.011	0.0010	0.000048	0.00080	3.5	0.045	0.010	0.053	0.00018	0.0060	3.1	0.0013	2.0	0.0000050	0.29	0.14	15	0.000083	0.000010	0.00050	0.0029	0.00020	0.0012	0.00010
8-Jan-09	36	500	405	7.8	211																																											
15-Jan-09	37	500	450	7.7	225	#N/A	5.2	90	39				122	0.0070	0.016	0.0023	0.086	0.000010	0.0000050	0.050	0.00012	42	0.00010	0.00018	0.014	0.0020	0.000073	0.00060	4.1	0.071	0.010	0.040	0.00033	0.0060	2.3	0.0012	1.5	0.0000050	0.28	0.15	14	0.000054	0.000010	0.00050	0.0025	0.00020	0.0023	0.00010
22-Jan-09	38	500	460	7.7	167																																											
29-Jan-09	39	500	410	7.6	170	#N/A	8.5	93	16				84	0.0067	0.013	0.0022	0.072	0.000010	0.0000050	0.050	0.000062	29	0.00010	0.00013	0.012	0.0010	0.000063	0.00050	2.8	0.050	0.010	0.021	0.00024	0.0040	1.7	0.00041	1.5	0.0000050	0.15	0.11	6.0	0.000032	0.000010	0.00050	0.00084	0.00020	0.00080	0.00010
5-Feb-09	40	500	425	7.6	180																																											
12-Feb-09	41	500	405	7.9	166	#N/A	2.7	84	15				87	0.0069	0.014	0.0022	0.080	0.000010	0.0000050	0.050	0.000060	30	0.00010	0.00015	0.014	0.0010	0.000032	0.00050	2.9	0.054	0.010	0.020	0.00021	0.010	1.7	0.00045	1.3	0.000011	0.14	0.12	6.0	0.000042	0.000030	0.00050	0.00080	0.00020	0.00090	0.00010
19-Feb-09	42	500	420	7.8	174																																											
26-Feb-09	43	500	425	7.7	173	#N/A	6.8	95	13				95	0.010	0.013	0.0021	0.091	0.000010	0.0000050	0.050	0.000052	33	0.00010	0.00016	0.014	0.0020	0.0044	0.00050	3.1	0.059	0.010	0.017	0.00020	0.0050	1.8	0.00042	1.7	0.0000050	0.13	0.12	5.0	0.000038	0.000020	0.00050	0.00068	0.00020	0.0014	0.00010
5-Mar-09	44	500	485	7.9	164																																											
12-Mar-09	45	500	450	7.7	315	#N/A	4.6	85	13				83	0.0071	0.013	0.0022	0.091	0.000010	0.0000050	0.050	0.000047	29	0.00010	0.00013	0.013	0.0020	0.000048	0.00050	2.5	0.050	0.010	0.016	0.00011	0.0030	1.6	0.00038	1.4	0.0000050	0.10	0.11	5.0	0.000038	0.000020	0.00050	0.00054	0.00020	0.00080	0.00010
19-Mar-09	46	500	445	7.7	161																																											
26-Mar-09	47	500	435	7.9	152	#N/A	5.3	82	10				79	0.0072	0.012	0.0021	0.092	0.000010	0.0000050	0.050	0.000043	28	0.00010	0.00014	0.012	0.0030	0.000018	0.00050	2.4	0.047	0.010	0.015	0.00016	0.0040	1.5	0.00036	1.2	0.0000050	0.090	0.10	4.0	0.000029	0.000050	0.00050	0.00051	0.00020	0.00070	0.00010
2-Apr-09	48	500	485	7.6	141																																											
9-Apr-09	49	500	490	7.6	141	#N/A	5.5	74	10				73	0.0091	0.012	0.0022	0.093	0.000010	0.0000060	0.050	0.000047	26	0.00010	0.000092	0.010	0.0010	0.000099	0.00050	2.2	0.040	0.010	0.015	0.00014	0.0050	1.5	0.00035	1.2	0.0000050	0.11	0.092	4.0	0.000031	0.000010	0.00050	0.00051	0.00020	0.0026	0.00010
16-Apr-09	50	500	515	7.6	138																																											
23-Apr-09	51	500	480	7.7	135	#N/A	3.6	70	8.0				72	0.0097	0.012	0.0023	0.10	0.000010	0.0000050	0.050	0.000043	26	0.00010	0.000098	0.0098	0.0010	0.000018	0.00050	2.0	0.038	0.010	0.015	0.00019	0.0040	1.4	0.00036	1.2	0.0000050	0.11	0.089	4.0	0.000027	0.000020	0.00050	0.00053	0.00020	0.00090	0.00010
30-Apr-09	52	500	490	7.6	126																																											
7-May-09	53	500	485	7.8	127	#N/A	3.4	65	7.0				66	0.012	0.011	0.0021	0.10	0.000010	0.0000050	0.050	0.000031	23	0.00010	0.000081	0.0087	0.0010	0.000019	0.00050	1.8	0.033	0.010	0.014	0.00025	0.0050	1.3	0.00038	1.2	0.0000050	0.090	0.083	3.0	0.000026	0.000010	0.00050	0.00048	0.00020	0.00080	0.00010
14-May-09	54	500	475	7.4	122																																											
21-May-09	55	500	505	7.4	126	#N/A	5.2	67	9.0				65	0.013	0.012	0.0023	0.11	0.000010	0.0000050	0.050	0.000030	23	0.00010	0.000075	0.0098	0.0040	0.000026	0.00050	1.8	0.031	0.010	0.013	0.00017	0.0040	1.3	0.00039	1.1	0.0000050	0.10	0.083	4.0	0.000029	0.000010	0.00050	0.00047	0.00020	0.0016	0.00010
28-May-09	56	500	495	7.8	120																																											
4-Jun-09	57	500	490	7.8	101	#N/A	4.2	65	13				62	0.013	0.013	0.0021	0.11	0.000010	0.0000050	0.050	0.000029	22	0.00010	0.000085	0.0084	0.0010	0.000019	0.00050	1.6	0.028	0.010	0.012	0.00015	0.0020	1.2	0.00034	0.96	0.0000050	0.12	0.083	4.0	0.000024	0.000010	0.00050	0.00047	0.00020	0.0011	0.00010
11-Jun-09	58	500	440	7.7	119																																											
18-Jun-09	59	500	490	7.6	113	#N/A	4.7	69	7.0				68	0.013	0.013	0.0023	0.12	0.000010	0.0000050	0.050	0.000078	24	0.00010	0.000081	0.010	0.0030	0.00042	0.00050	1.7	0.032	0.010	0.013	0.00044	0.0070	1.3	0.00041	1.1	0.000010	0.15	0.082	3.0	0.000029	0.000020	0.00050	0.00051	0.00020	0.0029	0.00010
25-Jun-09	60	500	500	7.5	108																																											
2-Jul-09	61	500	495	7.7	126	#N/A	3.2	65	8.0				59	0.013	0.013	0.0022	0.12	0.000010	0.0000050	0.050	0.000035	21	0.00020	0.000065	0.0091	0.0010	0.000052	0.00050	1.5	0.029	0.010	0.012	0.00013	0.0050	1.2	0.00034	0.85	0.0000050	0.13	0.079	3.0	0.000029	0.000010	0.00050	0.00045	0.00020	0.0010	0.00010
9-Jul-09	62	500	495	7.9	119																																											
16-Jul-09	63	500	495	7.7	107	#N/A	3.1	66	6.0				63	0.012	0.012	0.0022	0.13	0.000010	0.0000050	0.050	0.000035	23	0.00010	0.000068	0.0086	0.010	0.000025	0.00050	1.5	0.031	0.010	0.011	0.00016	0.0040	1.2	0.00032	0.92	0.0000050	0.060	0.079	3.0	0.000023	0.000010	0.00050	0.00045	0.00020	0.00080	0.00010
23-Jul-09	64	500	475	7.7	121																																											
30-Jul-09	65	500	495	7.5	126	#N/A	6.4	70	6.0				72	0.0098	0.013	0.0023	0.13	0.000010	0.0000050	0.050	0.000043	26	0.00010	0.000087	0.0098	0.0010	0.000036	0.00050	1.7	0.037	0.010	0.012	0.00014	0.0060	1.3	0.00033	1.0	0.0000050	0.090	0.084	3.0	0.000026	0.000010	0.00050	0.00045	0.00020	0.0010	0.00010
6-Aug-09	66	500	470	7.9	110																																											
13-Aug-09	67	500	485	7.4	132	#N/A	6.0	72	4.0				71	0.0099	0.013	0.0024	0.14	0.000010	0.0000050	0.050	0.000046	25	0.00010	0.000088	0.011	0.0020	0.000095	0.00050	1.8	0.037	0.010	0.012	0.00022	0.0040	1.3	0.00035	1.1	0.0000050	0.12	0.088	3.0	0.000026	0.00010	0.00050	0.00049	0.00020	0.0011	0.00010
20-Aug-09	68	500	480	7.8	121																																											
27-Aug-09	69	500	495	7.5	124	#N/A	4.7	70	7.0				69	0.011	0.014	0.0022	0.14	0.000010	0.0000050	0.050	0.000036	25	0.00010	0.000079	0.0093	0.0010	0.000036	0.00050	1.7	0.034	0.010	0.012	0.00015	0.0050	1.3	0.00034	1.1	0.0000050	0.090	0.085	3.0	0.000026	0.000010	0.00050	0.00044	0.00020	0.00080	0.00010
3-Sep-09	70	500	480	7.5	121																																											
10-Sep-09	71	500	505	7.9	111	#N/A	2.0	61	6.0				59	0.014	0.013	0.0021	0.13	0.000010	0.0000050	0.050	0.000042	21	0.00010	0.000065	0.0078	0.0010	0.0012	0.00050	1.5	0.027	0.010	0.0096	0.00012	0.0020	1.1	0.00034	0.96	0.0000050	0.080	0.074	3.0	0.000025	0.000020	0.00050	0.00032	0.00020	0.0011	0.00010
17-Sep-09	72	500	475	7.5	107																																											
24-Sep-09	73	500	500	7.0	110	#N/A	2.9	67	7.0				62	0.012	0.012	0.0022	0.13	0.000010	0.0000050	0.050	0.000031	22	0.00010	0.000066	0.0083	0.0010	0.000038	0.00050	1.4	0.030	0.010	0.0090	0.00010	0.0050	1.1	0.00036	0.88	0.0000060	0.11	0.071	3.0	0.000021	0.000080	0.00050	0.00031	0.00020	0.00080	0.00010
1-Oct-09	74	500	475	7.9	122																																											
8-Oct-09	75	500	520	7.7	117	#N/A	4.8	68	9.0				65	0.024	0.013	0.0022	0.15	0.000010	0.0000050	0.050	0.000037	24	0.00010	0.000081	0.0091	0.0040	0.000035	0.00050	1.5	0.033	0.010	0.010	0.00014	0.0060	1.3	0.00033	1.0	0.0000050	0.14	0.075	3.0	0.000022	0.000020	0.00050	0.00036	0.00020	0.0012	0.00010
15-Oct-09

Calculated Production Rates for T1

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg CaCO3/kg	mg CaCO3/kg	mg CaCO3/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg CaCO3/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1-May-08	0	750	400	7.7	1544	#N/A	1.7	27	294	14	0.66	1.1	301	0.034	0.022	0.0026	0.024	0.0000020	0.000012	0.12	0.00017	115	0.00020	0.000056	0.0065	0.0040	0.00014	0.0012	3.5	0.018	0.036	0.47	0.00068	0.064	20	0.0055	1.1	0.0000012	15	0.35	109	0.00011	0.00017	0.0012	0.022	0.00040	0.0027	0.00020
8-May-08	1	500	455	7.7	378	#N/A	1.6	15	58	0.86	0.33	0.14	73	0.055	0.0074	0.0022	0.0082	0.0000046	0.0000023	0.023	0.000044	27	0.000046	0.000030	0.0030	0.0018	0.000057	0.00050	1.2	0.0083	0.0046	0.084	0.00025	0.012	5.8	0.0010	0.58	0.0000041	2.4	0.088	22	0.000041	0.00018	0.00082	0.0034	0.00014	0.0013	0.000046
15-May-08	2	500	510	7.7	553	#N/A	1.7	23	117	0.46	0.53	0.051	136	0.044	0.014	0.0022	0.010	0.0000051	0.0000026	0.026	0.000061	50	0.000051	0.000085	0.0045	0.0020	0.000067	0.00087	2.8	0.024	0.0051	0.11	0.00030	0.019	9.5	0.0015	1.1	0.0000026	3.8	0.16	44	0.000067	0.000031	0.00026	0.0080	0.00020	0.00097	0.000051
22-May-08	3	500	500	7.9	645	#N/A	1.8	37	130	0.40	0.60	0.050	157	0.017	0.019	0.0017	0.012	0.0000050	0.0000025	0.025	0.00012	57	0.000050	0.00018	0.0077	0.0030	0.000084	0.0011	3.6	0.045	0.0050	0.13	0.00045	0.018	11	0.0014	1.4	0.0000025	3.5	0.20	45	0.000083	0.000040	0.00025	0.011	0.00010	0.00095	0.000050
29-May-08	4	500	455	7.8	343	#N/A	1.5	24	66	0.23	0.41	0.18	75	0.029	0.011	0.0019	0.012	0.0000046	0.0000023	0.023	0.000036	27	0.000046	0.000051	0.0032	0.0032	0.000055	0.00064	1.8	0.015	0.014	0.052	0.00014	0.011	5.9	0.0011	1.0	0.0000046	1.1	0.10	20	0.000053	0.000018	0.00032	0.0042	0.0000091	0.00018	0.000046
5-Jun-08	5	500	490	7.9	363	#N/A	2.4	37	71	0.29	0.51	0.049	96	0.016	0.014	0.0015	0.015	0.0000049	0.0000025	0.025	0.000064	34	0.000049	0.00015	0.0063	0.00049	0.000021	0.0010	2.5	0.035	0.0049	0.059	0.00020	0.011	6.8	0.00098	1.3	0.0000025	1.1	0.14	23	0.000058	0.000025	0.00025	0.0059	0.000098	0.00049	0.000049
12-Jun-08	6	500	485	8.0	317	#N/A	1.6	41	56				96	0.014	0.014	0.0015	0.018	0.0000049	0.00049	0.024	0.000063	34	0.00049	0.00024	0.0071	0.0024	0.0000997	#N/A	2.7	0.039	#N/A	0.053	0.00049	0.0087	6.7	0.00092	1.5	0.0000097	0.97	0.14	20	0.000058	0.0024	0.0024	0.0051	0.0024	0.0024	0.00024
19-Jun-08	7	500	450	7.8	273	#N/A	2.1	30	53				74	0.018	0.011	0.0014	0.018	0.0000045	0.00045	0.023	0.000036	26	0.00045	0.00023	0.0063	0.0099	0.000090	#N/A	2.1	0.020	#N/A	0.040	0.0032	0.0086	5.5	0.0010	1.1	0.0000090	0.59	0.11	17	0.000050	0.0023	0.0023	0.0042	0.0023	0.0023	0.00023
26-Jun-08	8	500	490	7.8	339	#N/A	3.0	38	46				73	0.020	0.011	0.0014	0.019	0.000049	0.00049	0.025	0.000059	26	0.00049	0.00025	0.0049	0.0025	0.000098	#N/A	2.2	0.029	#N/A	0.030	0.00049	0.0069	4.8	0.00098	1.2	0.0000098	0.50	0.11	16	0.000049	0.0025	0.0025	0.0039	0.0025	0.0025	0.00025
3-Jul-08	9	500	380	7.7	556	#N/A	1.3	17	82				113	0.012	0.011	0.0012	0.016	0.0000038	0.0000038	0.019	0.000049	40	0.00038	0.00019	0.0036	0.0019	0.000076	#N/A	3.2	0.027	#N/A	0.038	0.00038	0.013	5.1	0.0022	1.1	0.0000076	0.59	0.14	32	0.000046	0.0019	0.0019	0.0052	0.0019	0.0019	0.00019
10-Jul-08	10	500	470	7.9	429	#N/A	1.9	35	54	0.28	0.31	0.047	93	0.012	0.013	0.0013	0.018	0.0000047	0.0000024	0.024	0.000052	33	0.000047	0.00013	0.0062	0.0014	0.000038	0.00061	2.9	0.037	0.0047	0.040	0.00021	0.0075	5.1	0.0013	1.1	0.0000024	0.48	0.13	22	0.000057	0.000014	0.00024	0.0051	0.000094	0.00052	0.000047
17-Jul-08	11	500	440	7.9	369	#N/A	1.6	27	46				73	0.015	0.0099	0.0013	0.016	0.000044	0.00044	0.022	0.000035	26	0.00044	0.00022	0.0044	0.0022	0.000088	#N/A	2.4	0.024	#N/A	0.033	0.00044	0.0079	4.0	0.0010	1.0	0.0000088	0.34	0.10	17	0.000044	0.0022	0.0022	0.0037	0.0022	0.0022	0.00022
24-Jul-08	12	500	465	7.8	397																																											
31-Jul-08	13	500	440	8.0	347	#N/A	1.2	30	48	0.22	0.33	0.044	75	0.010	0.010	0.0014	0.018	0.0000044	0.0000022	0.022	0.000040	26	0.000044	0.000073	0.0046	0.0031	0.000012	0.00048	2.4	0.025	0.0044	0.034	0.00010	0.0062	3.4	0.00092	1.1	0.0000022	0.28	0.10	17	0.000048	0.0000088	0.00022	0.0032	0.000088	0.00026	0.000044
7-Aug-08	14	500	495	8.0	358																																											
14-Aug-08	15	500	470	7.9	284	#N/A	1.6	27	30	0.24	0.29	0.094	64	0.017	0.0094	0.0015	0.019	0.0000047	0.0000024	0.024	0.000063	22	0.000047	0.000063	0.0051	0.0019	0.00018	0.00047	2.0	0.023	0.0047	0.026	0.00011	0.0047	2.8	0.00079	0.98	0.0000024	0.22	0.088	13	0.000044	0.0000094	0.00024	0.0026	0.000094	0.0016	0.000047
21-Aug-08	16	500	465	7.9	321																																										
28-Aug-08	17	500	480	7.9	309	#N/A	1.5	35	40	0.38	0.29	0.096	74	0.012	0.011	0.0014	0.020	0.0000048	0.0000024	0.024	0.000052	26	0.000048	0.000077	0.0065	0.0014	0.000029	0.00053	2.4	0.030	0.0048	0.035	0.00012	0.0048	2.9	0.00092	1.1	0.0000024	0.25	0.099	15	0.000048	0.0000048	0.00024	0.0029	0.000096	0.00091	0.000048
4-Sep-08	18	500	500	8.0	303																																										
11-Sep-08	19	500	500	8.0	311	#N/A	1.9	42	37	0.80	0.36	0.10	78	0.012	0.012	0.0014	0.026	0.0000050	0.0000025	0.025	0.000058	27	0.000050	0.00011	0.0088	0.0010	0.000052	0.00055	2.6	0.038	0.0050	0.034	0.00012	0.0040	3.0	0.00076	1.4	0.0000025	0.25	0.10	14	0.000056	0.000010	0.00025	0.0028	0.00010	0.0015	0.000050
18-Sep-08	20	500	470	7.9	282																																										
25-Sep-08	21	500	475	7.9	294	#N/A	1.9	36	30	0.24	0.28	0.048	67	0.026	0.011	0.0013	0.026	0.0000048	0.0000024	0.024	0.000051	23	0.000048	0.000099	0.0088	0.0019	0.0000062	0.00052	2.3	0.034	0.0048	0.029	0.00011	0.0038	2.4	0.00069	1.4	0.0000024	0.27	0.091	11	0.000044	0.0000048	0.00024	0.0024	0.0000095	0.00090	0.000048
2-Oct-08	22	500	465	8.0	277																																										
9-Oct-08	23	500	500	7.9	278	#N/A	2.0	38	28	0.45	0.28	0.050	70	0.0097	0.011	0.0014	0.030	0.0000050	0.0000025	0.025	0.00023	24	0.000050	0.000098	0.0085	0.0010	0.00018	0.00050	2.3	0.036	0.0050	0.031	0.00012	0.0035	2.2	0.00087	1.3	0.0000025	0.22	0.093	12	0.000049	0.000020	0.00025	0.0022	0.00010	0.0042	0.000050
16-Oct-08	24	500	460	7.9	238																																										
23-Oct-08	25	500	485	7.9	258	#N/A	1.5	35	30	0.49	0.23	0.049	65	0.011	0.010	0.0018	0.031	0.0000049	0.0000024	0.024	0.000044	22	0.000049	0.000083	0.0068	0.0015	0.000056	0.00034	2.2	0.031	0.0049	0.028	0.00014	0.0024	2.1	0.00085	1.1	0.0000029	0.40	0.085	11	0.000041	0.0000049	0.00024	0.0021	0.000097	0.00092	0.000049
30-Oct-08	26	500	415	7.9	241																																										
6-Nov-08	27	500	495	7.7	228	#N/A	2.2	34	27	0.25	0.23	0.050	60	0.0099	0.0098	0.0015	0.030	0.0000050	0.0000025	0.025	0.000045	21	0.000050	0.000070	0.0065	0.00050	0.000024	0.00050	2.0	0.030	0.0050	0.023	0.00011	0.0035	2.0	0.00068	1.2	0.0000025	0.18	0.081	8.9	0.000043	0.0000099	0.00030	0.0016	0.000099	0.00045	0.000050
13-Nov-08	28	500	500	7.8	210																																										
20-Nov-08	29	500	515	7.9	202	#N/A	1.5	39	26				65	0.0084	0.010	0.0015	0.040	0.0000052	0.0000026	0.026	0.00031	23	0.000052	0.000081	0.0075	0.00052	0.00030	0.00041	2.1	0.033	0.0052	0.026	0.00011	0.0041	1.9	0.0010	1.1	0.0000026	0.18	0.084	9.8	0.000053	0.0000052	0.00041	0.0017	0.00010	0.0071	0.000052
27-Nov-08	30	500	495	8.0	212																																										
4-Dec-08	31	500	375	7.9	223	#N/A	0.90	29	18				43	0.0055	0.0074	0.0012	0.027	0.0000038	0.0000019	0.019	0.000025	15	0.000038	0.000048	0.0042	0.00038	0.000015	0.00026	1.4	0.019	0.0038	0.018	0.000090	0.0026	1.3	0.00045	0.80	0.0000019	0.12	0.056	6.4	0.000029	0.0000075	0.00019	0.0011	0.0000075	0.00023	0.000038
11-Dec-08	32	500	370	7.8	210																																										
18-Dec-08	33	500	475	7.7	212	#N/A	2.2	38	18				51	0.0074	0.0094	0.0014	0.043	0.0000048	0.0000024	0.024	0.00035	18	0.000048	0.000058	0.0062	0.00048	0.0000095	0.00038	1.6	0.025	0.0048	0.020	0.000095	0.0029	1.5	0.00051	1.0	0.0000024	0.13	0.067	6.7	0.000038	0.000052	0.00024	0.0013	0.0000095	0.00033	0.000048
25-Dec-08	34	500	460	7.6	210																																										
1-Jan-09	35	500	445	7.4	204	#N/A	#N/A	33	21				46	0.0085	0.011	0.0015	0.040	0.0000045	0.0000022	0.022	0.000031	16	0.000045	0.000042	0.0047	0.00045	0.000021	0.00036	1.5	0.020	0.0045	0.024	0.000080	0.0027	1.4	0.00056	0.88	0.0000022	0.13	0.064	6.7	0.000037	0.0000045	0.00022	0.0013	0.000089	0.00053	0.000045
8-Jan-09	36	500	405	7.8	211																																										
15-Jan-09	37	500	450	7.7	225	#N/A	2.3	41	18				55	0.0032	0.0070	0.0010	0.039	0.0000045	0.0000023	0.023	0.000052	19	0.000045	0.000079	0.0062	0.00090	0.000033	0.00027	1.8	0.032	0.0045	0.018	0.00015	0.0027	1.0	0.00054	0.68	0.0000023	0.13	0.069	6.3	0.000024	0.0000045	0.00023	0.0011	0.000090	0.0010	0.000045
22-Jan-09	38	500	460	7.7	167																																										
29-Jan-09	39	500	410	7.6	170	#N/A	3.5	38	6.6				34	0.0027	0.0052	0.00090	0.029	0.0000041	0.0000021	0.021	0.000025	12	0.000041	0.000054	0.0050	0.00041	0.000026	0.00021	1.2	0.020	0.0041	0.0086	0.000098	0.0016	0.71	0.00017	0.60	0.0000021	0.062	0.046	2.5	0.000013	0.0000041	0.00021	0.00034	0.000082	0.00033	0.000041
5-Feb-09	40	500	425	7.6	180																																										
12-Feb-09	41	500	405	7.9	166	#N/A	1.1	34	6.1				35	0.0028	0.0055	0.00087	0.033	0.0000041	0.0000020	0.020	0.000024	12	0.000041	0.000062	0.0055	0.00041	0.000013	0.00020	1.2	0.022	0.0041	0.0083	0.000085	0.0041	0.70	0.00018	0.54	0.0000045	0.057	0.047	2.4	0.000017	0.000012	0.00020	0.00033	0.000081	0.00036	0.000041
19-Feb-09	42	500	420	7.8	174																																										
26-Feb-09	43	500	425	7.7	173	#N/A	2.9	40	5.5				41	0.0043	0.0055	0.00091	0.039	0.0000043	0.0000021	0.021	0.000022	14	0.000043	0.000066	0.0061	0.00085	0.0019	0.00021	1.3	0.025	0.0043	0.0074	0.000085	0.0021	0.78	0.00018	0.72	0.0000021	0.055	0.051	2.1	0.000016	0.0000085	0.00021	0.00029	0.000085	0.00060	0.000043
5-Mar-09	44	500	485	7.9	164																																										
12-Mar-09	45	500	450	7.7	315	#N/A	2.1	38	5.9				37	0.0032	0.0057	0.00098	0.041	0.0000045	0.0000023	0.023	0.000021	13	0.000045	0.000056	0.0056	0.00090	0.000022	0.00023	1.1	0.023	0.0045	0.0074	0.000050	0.0014	0.72	0.00017	0.61	0.0000023	0.045	0.050	2.3	0.000017	0.0000090	0.00023	0.00024	0.000090	0.00036	0.000045
19-Mar-09	46	500	445	7.7	161																																										
26-Mar-09	47	500	435	7.9	152	#N/A	2.3	36	4.4				34	0.0031	0.0052	0.00091	0.040	0.0000044	0.0000022	0.022	0.000019	12	0.000044	0.000059	0.0050	0.0013	0.0000078	0.00022	1.0	0.020	0.0044	0.0064	0.000070	0.0017	0.67	0.00016	0.51	0.0000022	0.039	0.045	1.7	0.000013	0.0000022	0.00022	0.00022	0.000087	0.00030	0.000044
2-Apr-09	48	500	485	7.6	141																																										
9-Apr-09	49	500	490	7.6	141	#N/A	2.7	36	4.9				36	0.0045	0.0057	0.0011	0.046	0.0000049	0.0000029	0.025	0.000023	13	0.000049	0.000045	0.0049	0.00049	0.000049	0.00025	1.1	0.019	0.0049	0.0072	0.000069	0.0025	0.72	0.00017	0.60	0.0000025	0.054	0.045	2.0	0.000015	0.0000049	0.00025	0.00025	0.000098	0.0013	0.000049
16-Apr-09	50	500	515	7.6	138																																										
23-Apr-09	51	500	480	7.7	135	#N/A	1.7	33	3.8				35	0.0047	0.0055	0.0011	0.048	0.0000048	0.0000024	0.024	0.000021	12	0.000048	0.000047	0.0047	0.00048	0.0000086	0.00024	0.98	0.018	0.0048	0.0071	0.000091	0.0019	0.69	0.00017	0.56	0.0000024	0.053	0.043	1.9	0.000013	0.0000096	0.00024	0.00025	0.000096	0.00043	0.000048
30-Apr-09	52	500	490	7.6	126																																										
7-May-09	53	500	485	7.8	127	#N/A	1.7	31	3.4				32	0.0057	0.0055	0.0010	0.050	0.0000049	0.0000024	0.024	0.000015	11	0.000049	0.000039	0.0042	0.00049	0.0000092	0.00024	0.88	0.016	0.0049	0.0066	0.00012	0.0024	0.64	0.00018	0.56	0.0000024	0.044	0.040	1.5	0.000013	0.0000049	0.00024	0.00023	0.000097	0.00039	0.000049
14-May-09	54	500	475	7.4	122																																										
21-May-09	55	500	505	7.4	126	#N/A	2.6	34	4.5				33	0.0063	0.0062	0.0012	0.056	0.0000051	0.0000025	0.025	0.000015	12	0.000051	0.000038	0.0050	0.0020	0.000013	0.00025	0.89	0.016	0.0051	0.0065	0.000086	0.0020	0.67	0.00020	0.58	0.0000025	0.051	0.042	2.0	0.000015	0.0000051	0.00025	0.00024	0.00010	0.00081	0.000051
28-May-09	56	500	495	7.8	120																																										
4-Jun-09	57	500	490	7.8	101	#N/A	2.1	32	6.4				30	0.0064	0.0064	0.0010	0.055	0.0000049	0.0000025	0.025	0.000014	11	0.000049	0.000042	0.0041	0.00049	0.0000093	0.00025	0.79	0.014	0.0049	0.0059	0.000074	0.00098	0.60	0.00017	0.47	0.0000025	0.059	0.040	2.0	0.000012	0.0000049	0.00025	0.00023	0.000098	0.00054	0.000049
11-Jun-09	58	500	440	7.7	119																																										
18-Jun-09	59	500	490	7.6	113	#N/A	2.3	34	3.4				33	0.0061	0.0062	0.0011	0.061	0.0000049	0.0000025	0.025	0.000038	12	0.000049	0.000040	0.0050	0.0015	0.00021	0.00025	0.84	0.016	0.0049	0.0063	0.00022	0.0034	0.63	0.00020	0.52	0.0000049	0.074	0.040	1.5	0.000014	0.0000098	0.00025	0.00025	0.000098	0.0014	0.000049
25-Jun-09	60	500	500	7.5	108																																										
2-Jul-09	61	500	495	7.7	126	#N/A	1.6	32	4.0				29	0.0065	0.0063	0.0011	0.060	0.0000050	0.0000025	0.025	0.000017	11	0.000099	0.000032	0.0045	0.00050	0.000026	0.00025	0.74	0.014	0.0050	0.0057	0.000064	0.0025	0.57	0.00017	0.42	0.0000025	0.064	0.039	1.5	0.000014	0.0000050	0.00025	0.00022	0.000099	0.00050	0.000050
9-Jul-09	62	500	495	7.9	119																																										
16-Jul-09	63	500	495	7.7	107	#N/A	1.5	33	3.0				31	0.0059	0.0060	0.0011	0.062	0.0000050	0.0000025	0.025	0.000017	11	0.000050	0.000034	0.0043	0.0050	0.000012	0.00025	0.76	0.015	0.0050	0.0055	0.000079	0.0020	0.57	0.00016	0.45	0.0000025	0.030	0.039	1.5	0.000011	0.0000050	0.00025	0.00022	0.000099	0.00040	0.000050
23-Jul-09	64	500	475	7.7	121																																										
30-Jul-09	65	500	495	7.5	126	#N/A	3.2	35	3.0				35	0.0049	0.0063	0.0012	0.064	0.0000050	0.0000025	0.025	0.000021	13	0.000050	0.000043	0.0049	0.00050	0.000018	0.00025	0.85	0.018	0.0050	0.0060	0.000069	0.0030	0.63	0.00016	0.51	0.0000025	0.045	0.042	1.5	0.000013	0.0000050	0.00025	0.00022	0.000099	0.00050	0.000050
6-Aug-09	66	500	470	7.9	110																																										
13-Aug-09	67	500	485	7.4	132	#N/A	2.9	35	1.9				34	0.0048	0.0064	0.0011	0.066	0.0000049	0.0000024	0.024	0.000022	12	0.000049	0.000043	0.0053	0.00097	0.000046	0.00024	0.88	0.018	0.0049	0.0059	0.00011	0.0019	0.63	0.00017	0.52	0.0000024	0.058	0.043	1.5	0.000013	0.000049	0.00024	0.00024	0.000097	0.00053	0.000049
20-Aug-09	68	500	480	7.8	121																																										
27-Aug-09	69	500	495	7.5	124	#N/A	2.3	34	3.5				34	0.0055	0.0067	0.0011	0.067	0.0000050	0.0000025	0.025	0.000018	12	0.000050	0.000039	0.0046	0.00050	0.000018	0.00025	0.86	0.017	0.0050	0.0059	0.000074	0.0025	0.63	0.00017	0.53	0.0000025	0.045	0.042	1.5	0.000013	0.0000050	0.00025	0.00022	0.000099	0.00040	0.000050
3-Sep-09	70	500	480	7.5	121																																										
10-Sep-09	71	500	505	7.9	111	#N/A	0.98	31	3.0				30	0.0070	0.0067	0.0011	0.063	0.0000051	0.0000025	0.025	0.000021	11	0.000051	0.000033	0.0039	0.00051	0.00058	0.00025	0.73	0.014	0.0051	0.0048	0.000061	0.0010	0.58	0.00017	0.49	0.0000025	0.040	0.037	1.5	0.000013	0.0000010	0.00025	0.00016	0.00010	0.00056	0.000051
17-Sep-09	72	500	475	7.5	107																																										
24-Sep-09	73	500	500	7.0	110	#N/A	1.5	33	3.5				31	0.0058	0.0058	0.0011	0.067	0.0000050	0.0000025	0.025	0.000016	11	0.000050	0.000033	0.0041	0.00050	0.000019	0.00025	0.71	0.015	0.0050	0.0045	0.000050	0.0025	0.57	0.00018	0.44	0.0000030	0.055	0.035	1.5	0.000011	0.0000040	0.00025	0.00015	0.00010	0.00040	0.000050
1-Oct-09	74	500	475	7.9	122																																										
8-Oct-09	75	500	520

Leachate Results for T2

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg CaCO3/L	mg CaCO3/L	mg CaCO3/L	mg/L	mg/L	mg/L	mg/L	mg CaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1-May-08	0	750	470	7.7	1298	#N/A	4.0	67	570	26	2.0	0.90	594	0.059	0.048	0.0059	0.032	0.000050	0.000030	0.30	0.00039	224	0.00050	0.000018	0.019	0.0070	0.00025	0.0030	8.4	0.046	0.090	0.85	0.0021	0.24	45	0.012	2.7	0.000050	33	0.69	216	0.00028	0.00027	0.0030	0.050	0.0010	0.011	0.00050
8-May-08	1	500	465	7.9	363	#N/A	3.4	32	130	1.7	0.71	0.30	155	0.097	0.015	0.0044	0.020	0.000010	0.0000050	0.050	0.000095	58	0.00010	0.000071	0.0059	0.0010	0.000025	0.00090	2.8	0.019	0.010	0.14	0.00038	0.027	12	0.0023	1.2	0.0000070	3.8	0.19	46	0.000090	0.000030	0.0019	0.0086	0.00040	0.00080	0.00010
15-May-08	2	500	465	7.8	478	#N/A	2.9	42	193	4.9	0.81	0.20	226	0.099	0.020	0.0040	0.019	0.000010	0.0000050	0.050	0.000096	83	0.00010	0.00013	0.0073	0.0060	0.00010	0.0012	4.9	0.039	0.010	0.13	0.00053	0.027	15	0.0029	1.8	0.0000050	4.9	0.27	71	0.00012	0.000040	0.00050	0.016	0.00030	0.0020	0.00010
22-May-08	3	500	450	8.0	691	#N/A	3.1	66	326	4.8	1.2	0.10	345	0.041	0.035	0.0039	0.025	0.000010	0.0000050	0.050	0.00017	125	0.00010	0.00025	0.013	0.0050	0.00014	0.0019	8.1	0.066	0.020	0.18	0.00093	0.030	22	0.0047	2.6	0.000057	6.5	0.43	107	0.00018	0.000060	0.00050	0.025	0.00020	0.0021	0.00010
29-May-08	4	500	430	8.1	475	#N/A	2.8	71	189	7.0	1.4	0.80	251	0.035	0.033	0.0038	0.029	0.000010	0.0000050	0.050	0.00013	90	0.00010	0.00020	0.011	0.0040	0.00013	0.0018	6.5	0.056	0.010	0.14	0.00046	0.023	18	0.0037	3.0	0.000077	3.4	0.32	72	0.00017	0.000090	0.00050	0.017	0.00020	0.0019	0.00010
5-Jun-08	5	500	410	8.1	377	#N/A	3.9	70	130	3.5	1.7	0.60	204	0.025	0.029	0.0038	0.037	0.000010	0.0000050	0.050	0.00010	72	0.00010	0.00019	0.011	0.0010	0.000029	0.0014	5.8	0.052	0.020	0.13	0.00042	0.016	16	0.0033	2.8	0.000068	2.3	0.29	56	0.00014	0.000050	0.00050	0.013	0.00030	0.0012	0.00010
12-Jun-08	6	500	430	8.1	316	#N/A	2.4	73	130				190	0.024	0.028	0.0035	0.042	0.000010	0.0010	0.050	0.00012	67	0.0010	0.00050	0.0090	0.0050	0.00050	#N/A	5.5	0.054	#N/A	0.11	0.0010	0.016	14	0.0026	3.0	0.000050	1.5	0.28	48	0.00013	0.0050	0.0050	0.011	0.0050	0.0050	0.00050
19-Jun-08	7	500	435	8.1	271	#N/A	3.8	74	105				171	0.028	0.030	0.0033	0.050	0.000010	0.0010	0.050	0.00010	60	0.0010	0.00050	0.0098	0.0050	0.00020	#N/A	5.1	0.048	#N/A	0.098	0.0010	0.017	13	0.0025	2.9	0.00014	1.1	0.24	40	0.00013	0.0050	0.0050	0.0093	0.0050	0.0050	0.00050
26-Jun-08	8	500	420	8.1	318	#N/A	5.2	73	90				140	0.035	0.028	0.0035	0.053	0.00010	0.0010	0.050	0.00010	49	0.0010	0.00050	0.0076	0.0050	0.00030	#N/A	4.4	0.041	#N/A	0.081	0.0010	0.010	9.5	0.0025	2.5	0.000070	0.83	0.20	33	0.00013	0.0050	0.0050	0.0072	0.0050	0.0050	0.00050
3-Jul-08	9	500	445	8.0	314	#N/A	2.9	45	90				153	0.041	0.030	0.0033	0.048	0.00010	0.0010	0.050	0.000070	54	0.0010	0.00050	0.0066	0.0050	0.00020	#N/A	4.6	0.038	#N/A	0.090	0.0010	0.019	9.0	0.0028	2.3	0.000030	0.86	0.21	37	0.00010	0.0050	0.0050	0.0069	0.0050	0.0050	0.00050
10-Jul-08	10	500	475	8.1	317	#N/A	3.3	70	79	0.80	0.90	0.10	137	0.034	0.029	0.0028	0.051	0.000010	0.0000050	0.050	0.000095	47	0.00020	0.00021	0.0080	0.0030	0.000040	0.00090	4.4	0.048	0.010	0.086	0.00096	0.010	7.6	0.0023	2.1	0.000014	0.71	0.21	27	0.00011	0.000030	0.00050	0.0082	0.00020	0.00080	0.00010
17-Jul-08	11	500	440	8.1	285	#N/A	2.9	62	67				123	0.033	0.026	0.0030	0.048	0.00010	0.0010	0.050	0.000070	43	0.0010	0.00050	0.0069	0.0050	0.00020	#N/A	3.9	0.038	#N/A	0.078	0.0010	0.013	7.0	0.0018	2.2	0.000020	0.61	0.18	24	0.000090	0.0050	0.0050	0.0062	0.0050	0.0050	0.00050
24-Jul-08	12	500	475	8.0	310																																												
31-Jul-08	13	500	460	8.1	288	#N/A	2.2	76	66	0.50	0.83	0.10	138	0.020	0.027	0.0031	0.064	0.000010	0.0000050	0.050	0.00010	48	0.00010	0.00015	0.0099	0.0040	0.000032	0.00090	4.5	0.048	0.010	0.080	0.00024	0.010	6.9	0.0018	2.5	0.0000050	0.58	0.20	23	0.00010	0.000030	0.00050	0.0062	0.00020	0.00090	0.00010
7-Aug-08	14	500	460	8.1	280																																											
14-Aug-08	15	500	475	8.0	262	#N/A	3.2	74	39	0.50	0.79	0.10	124	0.025	0.026	0.0031	0.067	0.000010	0.0000050	0.050	0.00019	43	0.00020	0.00017	0.012	0.010	0.00035	0.0010	4.1	0.051	0.010	0.061	0.00025	0.0090	5.9	0.0017	2.4	0.0000050	0.46	0.18	18	0.000094	0.000040	0.00050	0.0052	0.00020	0.0040	0.00010
21-Aug-08	16	500	485	8.1	262																																											
28-Aug-08	17	500	515	8.1	259	#N/A	2.9	85	52	0.80	0.61	0.20	131	0.027	0.026	0.0034	0.087	0.000010	0.0000050	0.050	0.00014	45	0.00010	0.00021	0.016	0.0030	0.000088	0.00090	4.5	0.062	0.010	0.073	0.00025	0.0070	5.4	0.0019	2.7	0.0000050	0.47	0.20	19	0.00010	0.000030	0.00050	0.0058	0.00020	0.0022	0.00010
4-Sep-08	18	500	550	8.1	249																																											
11-Sep-08	19	500	495	8.1	246	#N/A	3.3	75	48	0.90	0.66	0.10	120	0.028	0.024	0.0033	0.079	0.000010	0.0000050	0.050	0.000096	41	0.00020	0.00015	0.013	0.0030	0.000094	0.00080	4.1	0.050	0.010	0.073	0.00021	0.0090	4.9	0.0016	2.4	0.0000050	0.43	0.16	18	0.000090	0.000020	0.00050	0.0048	0.00020	0.0023	0.00010
18-Sep-08	20	500	460	8.1	245																																											
25-Sep-08	21	500	490	8.1	249	#N/A	3.8	73	47	0.70	0.58	0.10	117	0.045	0.024	0.0032	0.084	0.000010	0.0000050	0.050	0.00010	40	0.00010	0.00017	0.014	0.0030	0.0018	0.00080	4.1	0.053	0.010	0.068	0.00028	0.0080	4.3	0.0015	2.7	0.0000050	0.43	0.17	17	0.000085	0.000010	0.00050	0.0047	0.00020	0.0018	0.00010
2-Oct-08	22	500	470	8.1	233																																											
9-Oct-08	23	500	325	8.0	236	#N/A	2.8	58	50	1.2	0.65	0.50	116	0.028	0.023	0.0038	0.081	0.000010	0.0000050	0.050	0.000090	40	0.00010	0.00011	0.0095	0.0040	0.000097	0.00070	4.0	0.043	0.010	0.082	0.00020	0.010	3.9	0.0016	2.3	0.0000050	0.41	0.16	20	0.000076	0.000030	0.00050	0.0043	0.00020	0.0016	0.00010
16-Oct-08	24	500	390	7.8	225																																											
23-Oct-08	25	500	420	8.1	228	#N/A	2.4	71	51	0.90	0.48	0.10	124	0.027	0.022	0.0043	0.087	0.000010	0.0000050	0.050	0.000090	43	0.00020	0.00014	0.011	0.0060	0.00015	0.00060	4.1	0.048	0.010	0.063	0.00025	0.0070	4.1	0.0016	2.6	0.0000050	0.42	0.16	17	0.000077	0.000030	0.00050	0.0042	0.00020	0.0023	0.00010
30-Oct-08	26	500	420	8.0	216																																											
6-Nov-08	27	500	445	7.9	207	#N/A	3.8	69	40	0.50	0.44	0.10	112	0.021	0.019	0.0036	0.095	0.000010	0.0000050	0.050	0.000084	38	0.00010	0.00012	0.010	0.0020	0.000074	0.00070	3.9	0.045	0.010	0.055	0.00021	0.0090	3.8	0.0014	2.3	0.0000050	0.38	0.15	14	0.000080	0.000050	0.00070	0.0035	0.00020	0.0012	0.00010
13-Nov-08	28	500	455	8.0	201																																											
20-Nov-08	29	500	460	8.1	177	#N/A	2.4	75	34				110	0.019	0.020	0.0033	0.11	0.000010	0.0000050	0.050	0.000076	38	0.00010	0.00011	0.011	0.0010	0.000035	0.00070	3.8	0.046	0.010	0.055	0.00017	0.011	3.5	0.0013	2.1	0.0000050	0.33	0.15	14	0.000076	0.000040	0.00050	0.0034	0.00020	0.0014	0.00010
27-Nov-08	30	500	480	8.1	187																																											
4-Dec-08	31	500	415	8.0	185	#N/A	2.4	75	31				96	0.019	0.020	0.0035	0.099	0.000010	0.0000050	0.050	0.000065	33	0.00010	0.000090	0.0089	0.0020	0.000060	0.00050	3.4	0.038	0.010	0.046	0.00028	0.0080	3.0	0.0011	1.8	0.0000050	0.29	0.13	12	0.000067	0.000020	0.00050	0.0026	0.00020	0.00080	0.00010
11-Dec-08	32	500	430	8.0	189																																											
18-Dec-08	33	500	480	7.9	195	#N/A	3.9	83	30				101	0.018	0.019	0.0034	0.13	0.000010	0.0000050	0.050	0.000084	35	0.00010	0.00011	0.010	0.0010	0.000036	0.00070	3.4	0.044	0.010	0.046	0.00020	0.0070	3.0	0.0012	2.1	0.0000050	0.27	0.14	11	0.000069	0.000070	0.00070	0.0029	0.00020	0.00060	0.00010
25-Dec-08	34	500	460	7.9	194																																											
1-Jan-09	35	500	440	7.9	187	#N/A	#N/A	81	33				95	0.020	0.025	0.0038	0.13	0.000010	0.0000050	0.050	0.000071	32	0.00010	0.000093	0.0095	0.0010	0.000041	0.00070	3.4	0.040	0.010	0.049	0.00017	0.0060	2.9	0.0012	1.9	0.0000050	0.27	0.14	11	0.000078	0.000010	0.00050	0.0029	0.00020	0.00090	0.00010
8-Jan-09	36	500	395	7.8	187																																											
15-Jan-09	37	500	495	7.8	197	#N/A	5.1	79	33				105	0.017	0.021	0.0033	0.14	0.000010	0.0000050	0.050	0.00013	36	0.00010	0.00011	0.012	0.0010	0.00015	0.00060	3.6	0.049	0.010	0.045	0.00018	0.0070	2.9	0.0012	1.9	0.0000050	0.30	0.13	12	0.000076	0.000010	0.00050	0.0030	0.00020	0.0021	0.00010
22-Jan-09	38	500	480	7.9	186																																											
29-Jan-09	39	500	460	7.8	185	#N/A	9.1	82	33				86	0.018	0.023	0.0036	0.12	0.000010	0.0000050	0.050	0.000077	29	0.00010	0.000086	0.0084	0.0020	0.000026	0.00050	3.0	0.038	0.010	0.045	0.00017	0.0060	2.4	0.00098	1.9	0.0000050	0.25	0.12	11	0.000068	0.000010	0.00050	0.0030	0.00020	0.00060	0.00010
5-Feb-09	40	500	455	7.7	207																																											
12-Feb-09	41	500	420	8.0	188	#N/A	2.6	72	32				92	0.018	0.026	0.0039	0.12	0.000010	0.0000050	0.050	0.000070	32	0.00010	0.000094	0.012	0.0010	0.000045	0.00050	3.2	0.039	0.010	0.047	0.00019	0.0080	2.5	0.0012	2.0	0.0000060	0.26	0.12	11	0.000073	0.000020	0.00050	0.0029	0.00020	0.0021	0.00010
19-Feb-09	42	500	425	8.0	179																																											
26-Feb-09	43	500	465	7.9	177	#N/A	6.5	74	31				90	0.023	0.026	0.0039	0.12	0.000010	0.0000050	0.050	0.000053	31	0.00010	0.000070	0.0077	0.0020	0.000058	0.00060	3.1	0.034	0.010	0.045	0.00014	0.0070	2.4	0.00094	2.0	0.0000050	0.24	0.11	10	0.000067	0.000010	0.00050	0.0025	0.00020	0.0012	0.00010
5-Mar-09	44	500	220	7.8	177																																											
12-Mar-09	45	500	355	7.7	162	#N/A	3.7	62	28				78	0.022	0.027	0.0042	0.11	0.000010	0.0000050	0.050	0.0000054	27	0.00010	0.0000056	0.0067	0.0030	0.000043	0.00050	2.6	0.028	0.010	0.053	0.00015	0.0060	2.5	0.0011	2.1	0.0000050	0.25	0.10	8.0	0.000066	0.000040	0.00050	0.0019	0.00020	0.00050	0.00010
19-Mar-09	46	500	430	7.8	189																																											
26-Mar-09	47	500	415	7.9	175	#N/A	4.3	74	20				89	0.018	0.025	0.0038	0.12	0.000010	0.000056	0.050	0.000059	30	0.00010	0.000068	0.0079	0.0010	0.000030	0.00060	3.2	0.033	0.010	0.046	0.00014	0.0070	2.6	0.0010	1.8	0.0000050	0.29	0.11	9.0	0.000068	0.000010	0.00050	0.0023	0.00020	0.00060	0.00010
2-Apr-09	48	500	375	7.7	179																																											
9-Apr-09	49	500	430	7.8	186	#N/A	5.0	80	27				91	0.019	0.026	0.0036	0.13	0.000010	0.0000050	0.050	0.000092	31	0.00010	0.000082	0.0075	0.0010	0.000070	0.00050	3.3	0.035	0.010	0.049	0.00017	0.0070	2.6	0.0011	2.0	0.0000050	0.27	0.11	9.0	0.000070	0.000010	0.00050	0.0026	0.00020	0.0012	0.00010
16-Apr-09	50	500	370	7.8	175																																											
23-Apr-09	51	500	425	7.9	171	#N/A	3.6	75	22				87	0.019	0.024	0.0035	0.13	0.000010	0.0000050	0.050	0.000056	30	0.00010	0.000079	0.0080	0.0040	0.000032	0.00060	3.2	0.035	0.010	0.044	0.00019	0.0080	2.4	0.0010	2.0	0.0000050	0.26	0.11	8.0	0.000065	0.000010	0.00050	0.0023	0.00020	0.0013	0.00010
30-Apr-09	52	500	460	7.8	171																																											
7-May-09	53	500	420	7.7	177	#N/A	4.1	77	18				89	0.018	0.024	0.0038	0.14	0.000010	0.0000050	0.050	0.000070	30	0.00010	0.000086	0.0083	0.0010	0.000065	0.00060	3.4	0.037	0.010	0.043	0.00017	0.0080	2.3	0.0011	2.1	0.0000050	0.24	0.11	8.0	0.000065	0.000010	0.00050	0.0021	0.00020	0.0020	0.00010
14-May-09	54	500	435	7.8	173																																											
21-May-09	55	500	435	7.8	162	#N/A	5.4	77	15				83	0.019	0.024	0.0036	0.13	0.000010	0.0000050	0.050	0.000079	28	0.00010	0.000069	0.012	0.0010	0.00016	0.00050	3.3	0.033	0.010	0.040	0.000060	0.0050	2.2	0.00095	2.1	0.0000050	0.24	0.10	7.0	0.000066	0.000010	0.00050	0.0019	0.00020	0.0026	0.00010
28-May-09	56	500	455	7.9	163																																											
4-Jun-09	57	500	450	7.9	135	#N/A	4.0	73	22				78	0.024	0.022	0.0035	0.14	0.000010	0.0000050	0.050	0.000038	27	0.00010	0.000053	0.0089	0.0010	0.000032	0.00050	2.9	0.031	0.010	0.036	0.00015	0.010	2.0	0.0010	2.1	0.0000050	0.21	0.096	6.0	0.000062	0.000010	0.00050	0.0018	0.00020	0.00070	0.00010
11-Jun-09	58	500	465	7.9	164																																											
18-Jun-09	59	500	395	7.9	140	#N/A	4.6	74	18				79	0.020	0.020	0.0034	0.16	0.00010	0.0000050	0.50	0.000050	27	0.0010	0.00024	0.0086	0.016	0.00040	0.0050	2.8	0.034	0.10	0.034	0.00040	0.020	1.9	0.00090	2.0	0.0000050	0.20	0.10	8.0	0.000050	0.00010	0.0050	0.0017	0.0020	0.0010	0.0010
25-Jun-09	60	500	475	7.9	166																																											
2-Jul-09	61	500	420	7.9	154	#N/A	2.9	71	18				71	0.023	0.019	0.0031	0.17	0.000010	0.0000060	0.050	0.000038	24	0.00010	0.000064	0.011	0.0060	0.000036	0.00050	2.5	0.031	0.010	0.035	0.00028	0.0070	1.8	0.00087	1.4	0.0000050	0.18	0.090	5.0	0.000057	0.000010	0.00050	0.0016	0.00020	0.00090	0.00010
9-Jul-09	62	500	440	8.0	151																																											
16-Jul-09	63	500	460	7.7	140	#N/A	4.0	73	15				79	0.020	0.019	0.0030	0.20	0.000010	0.0000050	0.050	0.000054	27	0.00010	0.000076	0.0091	0.0010	0.0026	0.00060	2.8	0.036	0.010	0.037	0.00010	0.0070	2.0	0.00095	1.6	0.0000050	0.18	0.093	6.0	0.000056	0.000010	0.00050	0.0016	0.00020	0.0013	0.00010
23-Jul-09	64	500	490	7.9	161																																											
30-Jul-09	65	500	420	7.6	138	#N/A	6.2	70	13				75	0.023	0.019	0.0030	0.19	0.000010	0.0000050	0.050	0.000036	26	0.00010	0.000062	0.0074	0.0010	0.000050	0.00050	2.6	0.033	0.010	0.032	0.00012	0.0070	1.9	0.00080	1.6	0.0000050	0.18	0.086	5.0	0.000055	0.000010	0.00050	0.0013	0.00020	0.00090	0.00010
6-Aug-09	66	500	460	8.0	135																																											
13-Aug-09	67	500	460	7.9	150	#N/A	5.0	75	12				79	0.021	0.019	0.0029	0.21	0.000010	0.0000050	0.050	0.000053	27	0.00010	0.000079	0.0080	0.0020	0.00064	0.00050	2.9	0.035	0.010	0.035	0.00021	0.0070	1.9	0.00085	1.6	0.0000050	0.20	0.090	5.0	0.000049	0.000090	0.00050	0.0016	0.00020	0.0015	0.00010
20-Aug-09	68	500	410	7.9	144																																											
27-Aug-09	69	500	445	7.9	145	#N/A	4.0	73	12				78	0.022	0.018	0.0028	0.21	0.000010	0.0000050	0.050	0.000053	27	0.00010	0.000068	0.0080	0.0010	0.000049	0.00050	2.8	0.033	0.010	0.035	0.00017	0.0070	1.9	0.00084	1.6	0.0000060	0.21	0.088	6.0	0.000046	0.000020	0.00050	0.0015	0.00020	0.0011	0.00010
3-Sep-09	70	500	425	7.7	138																																											
10-Sep-09	71	500	410	8.0	147	#N/A	1.6	69	17				76	0.021	0.019	0.0028	0.22	0.000010	0.0000050	0.050	0.000045	26	0.00010	0.000066	0.0063	0.0050	0.000050	0.00050	2.7	0.030	0.010	0.037	0.00014	0.0070	1.9	0.00089	1.7	0.0000050	0.19	0.087	6.0	0.000054	0.000020	0.00050	0.0016	0.00020	0.00080	0.00010
17-Sep-09	72	500	470	8.0	149																																											
24-Sep-09	73	500	500	7.8	149	#N/A	2.5	78	17				78	0.020	0.019	0.0027	0.22	0.000010	0.0000050	0.050	0.000045	27	0.00010	0.000069	0.0069	0.0010	0.000048	0.00050	2.9	0.030	0.010	0.036	0.00010	0.0060	1.8	0.00087	1.5	0.0000050	0.18	0.085	6.0	0.000050	0.000060	0.00050	0.0016	0.00020	0.00070	0.00010
1-Oct-09	74	500	445	7.9	144																																											
8-Oct-09	75	500	470	7.9	151	#N/A	4.5	73	18				79	0.021	0.019	0.0027	0.22	0.000010	0.0000050	0.050	0.000052	27	0.00010	0.000069	0.0092	0.0030	0.000040	0.00050	3.0	0.025	0.010	0.038	0.00023	0.0070	1.9	0.00079	1.7	0.0000050	0.24	0.082	6.0	0.000051	0.000020	0.00050	0.0017	0.00020	0.00080	0.00010
15-Oct-09	76	500	500	7.9	138	

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1-May-08	0	750	470	7.7	1298	#N/A	1.9	31	268	12	0.95	0.42	279	0.028	0.022	0.0028	0.015	0.000024	0.000014	0.14	0.00018	105	0.00024	0.000085	0.0090	0.0033	0.00012	0.0014	3.9	0.021	0.042	0.40	0.00099	0.11	21	0.0058	1.3	0.000024	16	0.32	102	0.00013	0.00013	0.0014	0.023	0.00047	0.0050	0.00024
8-May-08	1	500	465	7.9	363	#N/A	1.6	15	60	0.79	0.33	0.14	72	0.045	0.0071	0.0020	0.0094	0.0000047	0.0000023	0.023	0.000044	27	0.00047	0.000033	0.0028	0.00047	0.000012	0.00042	1.3	0.0088	0.0047	0.066	0.00018	0.013	5.4	0.0011	0.55	0.0000033	1.8	0.086	21	0.000042	0.000014	0.00088	0.0040	0.00019	0.00037	0.000047
15-May-08	2	500	465	7.8	478	#N/A	1.3	20	90	2.3	0.38	0.093	105	0.046	0.0095	0.0018	0.0088	0.0000047	0.0000023	0.023	0.000045	38	0.00047	0.000062	0.0034	0.0028	0.000048	0.00056	2.3	0.018	0.0047	0.060	0.00025	0.013	7.0	0.0014	0.84	0.0000023	2.3	0.12	33	0.000054	0.000019	0.00023	0.0073	0.00014	0.00093	0.000047
22-May-08	3	500	450	8.0	691	#N/A	1.4	29	147	2.2	0.54	0.045	155	0.018	0.016	0.0017	0.011	0.0000045	0.0000023	0.023	0.000076	56	0.00045	0.00011	0.0057	0.0023	0.000062	0.00086	3.6	0.030	0.0090	0.079	0.00042	0.014	9.8	0.0021	1.2	0.000026	2.9	0.19	48	0.000081	0.000027	0.00023	0.011	0.000090	0.00095	0.000045
29-May-08	4	500	430	8.1	475	#N/A	1.2	31	81	3.0	0.61	0.34	108	0.015	0.014	0.0016	0.013	0.0000043	0.0000022	0.022	0.000058	39	0.00043	0.000087	0.0048	0.0017	0.000055	0.00077	2.8	0.024	0.0043	0.058	0.00020	0.0099	7.8	0.0016	1.3	0.0000033	1.4	0.14	31	0.000074	0.000039	0.00022	0.0071	0.000086	0.00082	0.000043
5-Jun-08	5	500	410	8.1	377	#N/A	1.6	29	53	1.4	0.69	0.25	84	0.010	0.012	0.0016	0.015	0.0000041	0.0000021	0.021	0.000042	30	0.00041	0.000078	0.0043	0.00041	0.000012	0.00057	2.4	0.021	0.0082	0.052	0.00017	0.0066	6.4	0.0013	1.2	0.000028	0.94	0.12	23	0.000056	0.000021	0.00021	0.0052	0.00012	0.00049	0.000041
12-Jun-08	6	500	430	8.1	316	#N/A	1.0	31	56				82	0.010	0.012	0.0015	0.018	0.0000043	0.0000043	0.022	0.000052	29	0.00043	0.00022	0.0039	0.0022	0.00022	#N/A	2.4	0.023	#N/A	0.049	0.00043	0.0069	6.0	0.0011	1.3	0.0000022	0.66	0.12	21	0.000056	0.0022	0.0022	0.0046	0.0022	0.00022	0.000022
19-Jun-08	7	500	435	8.1	271	#N/A	1.7	32	46				74	0.012	0.013	0.0014	0.022	0.0000044	0.0000044	0.022	0.000044	26	0.00044	0.00022	0.0043	0.0022	0.000087	#N/A	2.2	0.021	#N/A	0.043	0.00044	0.0074	5.5	0.0011	1.2	0.0000061	0.47	0.10	17	0.000057	0.0022	0.0022	0.0040	0.0022	0.0022	0.000022
26-Jun-08	8	500	420	8.1	318	#N/A	2.2	31	38				59	0.015	0.012	0.0015	0.022	0.0000042	0.0000042	0.021	0.000042	20	0.00042	0.00021	0.0032	0.0021	0.00013	#N/A	1.8	0.017	#N/A	0.034	0.00042	0.0042	4.0	0.0011	1.1	0.0000029	0.35	0.086	14	0.000055	0.0021	0.0021	0.0030	0.0021	0.0021	0.000021
3-Jul-08	9	500	445	8.0	314	#N/A	1.3	20	40				68	0.018	0.013	0.0015	0.021	0.0000045	0.0000045	0.022	0.000031	24	0.00045	0.00022	0.0029	0.0022	0.000089	#N/A	2.1	0.017	#N/A	0.040	0.00045	0.0085	4.0	0.0012	1.0	0.0000013	0.38	0.094	16	0.000045	0.0022	0.0022	0.0031	0.0022	0.0022	0.000022
10-Jul-08	10	500	475	8.1	317	#N/A	1.6	33	38	0.38	0.43	0.048	65	0.016	0.014	0.0013	0.024	0.0000048	0.0000024	0.024	0.000045	23	0.00095	0.000100	0.0038	0.0014	0.000019	0.00043	2.1	0.023	0.0048	0.041	0.00046	0.0048	3.6	0.0011	1.0	0.0000067	0.34	0.10	13	0.000052	0.000014	0.00024	0.0039	0.000095	0.00038	0.000048
17-Jul-08	11	500	440	8.1	285	#N/A	1.3	27	29				54	0.015	0.012	0.0013	0.021	0.0000044	0.0000044	0.022	0.000031	19	0.00044	0.00022	0.0030	0.0022	0.000088	#N/A	1.7	0.017	#N/A	0.034	0.00044	0.0057	3.1	0.00079	0.96	0.0000088	0.27	0.081	11	0.000040	0.0022	0.0022	0.0027	0.0022	0.0022	0.000022
24-Jul-08	12	500	475	8.0	310																																												
31-Jul-08	13	500	460	8.1	288	#N/A	1.0	35	30	0.23	0.38	0.046	63	0.0092	0.013	0.0014	0.029	0.0000046	0.0000023	0.023	0.000047	22	0.00046	0.00068	0.0046	0.0018	0.000015	0.00041	2.1	0.022	0.0046	0.037	0.00011	0.0046	3.2	0.00081	1.2	0.0000023	0.27	0.090	11	0.000047	0.00014	0.00023	0.0029	0.000092	0.00041	0.000046
7-Aug-08	14	500	460	8.1	280																																											
14-Aug-08	15	500	475	8.0	262	#N/A	1.5	35	19	0.24	0.38	0.048	59	0.012	0.012	0.0015	0.032	0.0000048	0.0000024	0.024	0.000090	20	0.00095	0.00080	0.0056	0.0048	0.00017	0.00048	1.9	0.024	0.0048	0.029	0.00012	0.0043	2.8	0.00080	1.1	0.0000024	0.22	0.086	8.6	0.000045	0.000019	0.00024	0.0025	0.000095	0.0019	0.000048
21-Aug-08	16	500	485	8.1	262																																										
28-Aug-08	17	500	515	8.1	259	#N/A	1.5	44	27	0.41	0.31	0.10	67	0.014	0.013	0.0018	0.045	0.0000052	0.0000026	0.026	0.000070	23	0.00052	0.00011	0.0082	0.0015	0.000045	0.00046	2.3	0.032	0.0052	0.038	0.00013	0.0036	2.8	0.00096	1.4	0.0000026	0.24	0.10	9.8	0.000052	0.000015	0.00026	0.0030	0.00010	0.0011	0.000052
4-Sep-08	18	500	550	8.1	249																																										
11-Sep-08	19	500	495	8.1	246	#N/A	1.6	37	24	0.45	0.33	0.050	59	0.014	0.012	0.0017	0.039	0.0000050	0.0000025	0.025	0.000048	20	0.00099	0.000075	0.0062	0.0015	0.000047	0.00040	2.0	0.025	0.0050	0.036	0.00010	0.0045	2.4	0.00078	1.2	0.0000025	0.21	0.081	8.9	0.000045	0.0000099	0.00025	0.0024	0.000099	0.0011	0.000050
18-Sep-08	20	500	460	8.1	245																																										
25-Sep-08	21	500	490	8.1	249	#N/A	1.9	36	23	0.34	0.28	0.049	57	0.022	0.012	0.0016	0.041	0.0000049	0.0000025	0.025	0.000049	20	0.00049	0.000085	0.0067	0.0015	0.00088	0.00039	2.0	0.026	0.0049	0.033	0.00014	0.0039	2.1	0.00074	1.3	0.0000025	0.21	0.082	8.3	0.000042	0.0000049	0.00025	0.0023	0.000098	0.00088	0.000049
2-Oct-08	22	500	470	8.1	233																																										
9-Oct-08	23	500	325	8.0	236	#N/A	0.92	19	16	0.39	0.21	0.16	38	0.0092	0.0076	0.0012	0.026	0.0000033	0.0000016	0.016	0.000029	13	0.00033	0.00036	0.0031	0.0013	0.000032	0.00023	1.3	0.014	0.0033	0.027	0.000065	0.0033	1.3	0.00052	0.76	0.0000016	0.13	0.052	6.5	0.000025	0.0000098	0.00016	0.0014	0.000065	0.00052	0.000033
16-Oct-08	24	500	390	7.8	225																																										
23-Oct-08	25	500	420	8.1	228	#N/A	1.0	30	21	0.38	0.20	0.042	52	0.011	0.0093	0.0018	0.037	0.0000042	0.0000021	0.021	0.000038	18	0.00084	0.000060	0.0046	0.0025	0.000063	0.00025	1.7	0.020	0.0042	0.026	0.00011	0.0029	1.7	0.00068	1.1	0.0000021	0.18	0.066	7.1	0.000032	0.000013	0.00021	0.0018	0.000084	0.00097	0.000042
30-Oct-08	26	500	420	8.0	216																																										
6-Nov-08	27	500	445	7.9	207	#N/A	1.7	31	18	0.22	0.20	0.045	50	0.0094	0.0086	0.0016	0.042	0.0000045	0.0000022	0.022	0.000037	17	0.00045	0.000051	0.0046	0.00089	0.000033	0.00031	1.7	0.020	0.0045	0.025	0.000093	0.0040	1.7	0.00061	1.0	0.0000022	0.17	0.069	6.2	0.000036	0.000022	0.00031	0.0015	0.000089	0.00053	0.000045
13-Nov-08	28	500	455	8.0	201																																										
20-Nov-08	29	500	460	8.1	177	#N/A	1.1	35	16				51	0.0087	0.0092	0.0015	0.050	0.0000046	0.0000023	0.023	0.000035	17	0.00046	0.00052	0.0050	0.00046	0.000016	0.00032	1.7	0.021	0.0046	0.025	0.000078	0.0051	1.6	0.00058	0.94	0.0000023	0.15	0.069	6.4	0.000035	0.000018	0.00023	0.0016	0.000092	0.00064	0.000046
27-Nov-08	30	500	480	8.1	187																																										
4-Dec-08	31	500	415	8.0	185	#N/A	0.99	31	13				40	0.0078	0.0081	0.0014	0.041	0.0000042	0.0000021	0.021	0.000027	14	0.00042	0.000037	0.0037	0.00083	0.000025	0.00021	1.4	0.016	0.0042	0.019	0.00012	0.0033	1.2	0.00046	0.75	0.0000021	0.12	0.054	5.0	0.000028	0.0000083	0.00021	0.0011	0.000083	0.00033	0.000042
11-Dec-08	32	500	430	8.0	189																																										
18-Dec-08	33	500	480	7.9	195	#N/A	1.9	40	14				48	0.0084	0.0093	0.0016	0.060	0.0000048	0.0000024	0.024	0.000040	17	0.00048	0.000052	0.0050	0.00048	0.000017	0.00034	1.6	0.021	0.0048	0.022	0.00096	0.0034	1.4	0.00055	1.0	0.0000024	0.13	0.065	5.3	0.000033	0.0000034	0.00034	0.0014	0.000096	0.00029	0.000048
25-Dec-08	34	500	460	7.9	194																																										
1-Jan-09	35	500	440	7.9	187	#N/A	#N/A	36	15				42	0.0088	0.011	0.0017	0.056	0.0000044	0.0000022	0.022	0.000031	14	0.00044	0.000041	0.0042	0.00044	0.000018	0.00031	1.5	0.018	0.0044	0.022	0.000075	0.0026	1.3	0.00053	0.84	0.0000022	0.12	0.060	4.8	0.000034	0.0000044	0.00022	0.0013	0.000088	0.00040	0.000044
8-Jan-09	36	500	395	7.8	187																																										
15-Jan-09	37	500	495	7.8	197	#N/A	2.5	39	16				52	0.0085	0.010	0.0017	0.068	0.0000050	0.0000025	0.025	0.000066	18	0.00050	0.00054	0.0057	0.00050	0.00073	0.00030	1.8	0.024	0.0050	0.022	0.000089	0.0035	1.4	0.00060	0.94	0.0000025	0.15	0.066	5.9	0.000038	0.0000050	0.00025	0.0015	0.000099	0.0010	0.000050
22-Jan-09	38	500	480	7.9	186																																										
29-Jan-09	39	500	460	7.8	185	#N/A	4.2	38	15				40	0.0082	0.010	0.0017	0.056	0.0000046	0.0000023	0.023	0.000035	14	0.00046	0.00040	0.0039	0.00092	0.000012	0.00023	1.4	0.017	0.0046	0.021	0.000078	0.0028	1.1	0.00045	0.89	0.0000023	0.12	0.055	5.1	0.000031	0.0000046	0.00023	0.0014	0.000092	0.00028	0.000046
5-Feb-09	40	500	455	7.7	207																																										
12-Feb-09	41	500	420	8.0	188	#N/A	1.1	30	13				39	0.0076	0.011	0.0016	0.050	0.0000042	0.0000021	0.021	0.000029	13	0.00042	0.000039	0.0049	0.00042	0.000019	0.00021	1.3	0.016	0.0042	0.020	0.000080	0.0034	1.1	0.00050	0.82	0.0000025	0.11	0.052	4.6	0.000031	0.0000084	0.00021	0.0012	0.000084	0.00088	0.000042
19-Feb-09	42	500	425	8.0	179																																										
26-Feb-09	43	500	465	7.9	177	#N/A	3.0	34	14				42	0.011	0.012	0.0018	0.054	0.0000047	0.0000023	0.023	0.000025	14	0.00047	0.000033	0.0036	0.00093	0.000027	0.00028	1.5	0.016	0.0047	0.021	0.000065	0.0033	1.1	0.00044	0.94	0.0000023	0.11	0.053	4.7	0.000031	0.0000047	0.00023	0.0012	0.000093	0.00056	0.000047
5-Mar-09	44	500	220	7.8	177																																										
12-Mar-09	45	500	355	7.7	162	#N/A	1.3	22	9.9				28	0.0078	0.0095	0.0015	0.037	0.0000036	0.0000018	0.018	0.000019	9.5	0.00036	0.000020	0.0024	0.0011	0.000015	0.00018	0.92	0.010	0.0036	0.019	0.000053	0.0021	0.88	0.00040	0.74	0.0000018	0.089	0.037	3.6	0.000023	0.0000014	0.00018	0.00067	0.000071	0.00018	0.000036
19-Mar-09	46	500	430	7.8	189																																										
26-Mar-09	47	500	415	7.9	175	#N/A	1.8	31	8.3				37	0.0075	0.010	0.0016	0.051	0.0000042	0.000023	0.021	0.000024	13	0.00042	0.000028	0.0033	0.00042	0.000012	0.00025	1.3	0.014	0.0042	0.019	0.000058	0.0029	1.1	0.00043	0.76	0.0000021	0.12	0.047	3.7	0.000028	0.0000042	0.00021	0.00095	0.000083	0.00025	0.000042
2-Apr-09	48	500	375	7.7	179																																										
9-Apr-09	49	500	430	7.8	186	#N/A	2.1	34	12				39	0.0080	0.011	0.0016	0.055	0.0000043	0.0000022	0.022	0.000040	13	0.00043	0.000035	0.0032	0.00043	0.000030	0.00022	1.4	0.015	0.0043	0.021	0.000073	0.0030	1.1	0.00049	0.85	0.0000022	0.12	0.049	3.9	0.000030	0.0000043	0.00022	0.0011	0.000086	0.00052	0.000043
16-Apr-09	50	500	370	7.8	175																																										
23-Apr-09	51	500	425	7.9	171	#N/A	1.5	32	9.4				37	0.0080	0.010	0.0015	0.055	0.0000043	0.0000021	0.021	0.000024	13	0.00043	0.000034	0.0034	0.0017	0.000014	0.00026	1.3	0.015	0.0043	0.019	0.000081	0.0034	1.0	0.00044	0.85	0.0000021	0.11	0.045	3.4	0.000028	0.0000043	0.00021	0.00096	0.000085	0.00055	0.000043
30-Apr-09	52	500	460	7.8	171																																										
7-May-09	53	500	420	7.7	177	#N/A	1.7	32	7.6				37	0.0076	0.010	0.0016	0.057	0.0000042	0.0000021	0.021	0.000029	13	0.00042	0.000036	0.0035	0.00042	0.000027	0.00025	1.4	0.015	0.0042	0.018	0.000071	0.0034	0.98	0.00045	0.88	0.0000021	0.10	0.045	3.4	0.000027	0.0000042	0.00021	0.00090	0.000084	0.00084	0.000042
14-May-09	54	500	435	7.8	173																																										
21-May-09	55	500	435	7.8	162	#N/A	2.3	33	6.5				36	0.0083	0.010	0.0016	0.057	0.0000044	0.0000022	0.022	0.000034	12	0.00044	0.000030	0.0053	0.00044	0.000070	0.00022	1.4	0.014	0.0044	0.017	0.000026	0.0022	0.97	0.00041	0.92	0.0000022	0.10	0.044	3.0	0.000029	0.0000044	0.00022	0.00081	0.000087	0.0011	0.000044
28-May-09	56	500	455	7.9	163																																										
4-Jun-09	57	500	450	7.9	135	#N/A	1.8	33	9.9				35	0.011	0.0098	0.0016	0.063	0.0000045	0.0000023	0.023	0.000017	12	0.00045	0.000024	0.0040	0.00045	0.000014	0.00023	1.3	0.014	0.0045	0.016	0.000068	0.0045	0.91	0.00046	0.95	0.0000023	0.095	0.043	2.7	0.000028	0.0000045	0.00023	0.00079	0.000090	0.00032	0.000045
11-Jun-09	58	500	465	7.9	164																																										
18-Jun-09	59	500	395	7.9	140	#N/A	1.8	29	7.1				31	0.0079	0.0079	0.0013	0.062	0.000040	0.000020	0.20	0.000020	11	0.00040	0.000095	0.0034	0.0063	0.00016	0.0020	1.1	0.013	0.040	0.014	0.00016	0.0079	0.75	0.00036	0.78	0.000020	0.079	0.041	3.2	0.000020	0.000040	0.0020	0.00068	0.00079	0.00040	0.00040
25-Jun-09	60	500	475	7.9	166																																										
2-Jul-09	61	500	420	7.9	154	#N/A	1.2	30	7.6				30	0.0096	0.0081	0.0013	0.069	0.0000042	0.0000025	0.021	0.000016	10	0.00042	0.000027	0.0046	0.0025	0.000015	0.00021	1.1	0.013	0.0042	0.015	0.00012	0.0029	0.74	0.00037	0.60	0.0000021	0.076	0.038	2.1	0.000024	0.0000042	0.00021	0.00065	0.000084	0.00038	0.000042
9-Jul-09	62	500	440	8.0	151																																										
16-Jul-09	63	500	460	7.7	140	#N/A	1.8	34	6.9				36	0.0090	0.0086	0.0014	0.091	0.0000046	0.0000023	0.023	0.000025	12	0.00046	0.000035	0.0042	0.00046	0.0012	0.00028	1.3	0.017	0.0046	0.017	0.000046	0.0032	0.90	0.00044	0.75	0.0000023	0.083	0.043	2.8	0.000026	0.0000046	0.00023	0.00074	0.000092	0.00060	0.000046
23-Jul-09	64	500	490	7.9	161																																										
30-Jul-09	65	500	420	7.6	138	#N/A	2.6	29	5.5				31	0.0095	0.0078	0.0013	0.078	0.0000042	0.0000021	0.021	0.000015	11	0.00042	0.000026	0.0031	0.00042	0.000021	0.00021	1.1	0.014	0.0042	0.013	0.000050	0.0029	0.79	0.00034	0.66	0.0000021	0.076	0.036	2.1	0.000023	0.0000042	0.00021	0.00056	0.000084	0.00038	0.000042
6-Aug-09	66	500	460	8.0	135																																										
13-Aug-09	67	500	460	7.9	150	#N/A	2.3	35	5.5				36	0.0098	0.0087	0.0013	0.097	0.0000046	0.0000023	0.023	0.000024	12	0.00046	0.000036	0.0037	0.00092	0.00029	0.00023	1.3	0.016	0.0046	0.016	0.000097	0.0032	0.86	0.00039	0.72	0.0000023	0.092	0.041	2.3	0.000023	0.0000041	0.00023	0.00071	0.000092	0.00069	0.000046
20-Aug-09	68	500	410	7.9	144																																										
27-Aug-09	69	500	445	7.9	145	#N/A	1.8	32	5.3				35	0.0096	0.0082	0.0012	0.093	0.0000045	0.0000022	0.022	0.000024	12	0.00045	0.000030	0.0036	0.00045	0.000022	0.00022	1.3	0.015	0.0045	0.015	0.000076	0.0031	0.84	0.00037	0.72	0.0000027	0.093	0.039	2.7	0.000020	0.0000089	0.00022	0.00066	0.000089	0.00049	0.000045
3-Sep-09	70	500	425	7.7	138																																										
10-Sep-09	71	500	410	8.0	147	#N/A	0.65	28	7.0				31	0.0087	0.0079	0.0012	0.088	0.0000041	0.0000021	0.021	0.000018	11	0.00041	0.000027	0.0026	0.0021	0.000021	0.00021	1.1	0.012	0.0041	0.015	0.000057	0.0029	0.80	0.00036	0.68	0.0000021	0.078	0.036	2.5	0.000022	0.0000082	0.00021	0.00066	0.000082	0.00033	0.000041
17-Sep-09	72	500	470	8.0	149																																										
24-Sep-09	73	500	500	7.8	149	#N/A	1.3	39	8.5				39	0.010	0.0094	0.0013	0.11	0.0000050	0.0000025	0.025	0.000023	13	0.00050	0.000035	0.0035	0.00050	0.000024	0.00025	1.4	0.015	0.0050	0.018	0.000050	0.0030	0.92	0.00044	0.76	0.0000025	0.090	0.043	3.0	0.000025	0.000030	0.00025	0.00081	0.00010	0.00035	0.000050
1-Oct-09	74	500	445	7.9	144																																										
8-Oct-09	75	500	470	7.9	151	#N/A	2.1

Leachate Results for T3

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg CaCO3/L	mg CaCO3/L	mg CaCO3/L	mg/L	mg/L	mg/L	mg/L	mg CaCO3/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1-May-08	0	750	360	7.6	1218	#N/A	4.2	49	583	40	1.1	4.4	595	0.10	0.039	0.0036	0.040	0.000010	0.0000050	0.050	0.00021	228	0.00010	0.00014	0.047	0.0050	0.00014	0.0023	6.4	0.044	0.080	0.30	0.0017	0.75	41	0.0099	1.6	0.00024	23	0.67	199	0.00014	0.000021	0.00050	0.020	0.00030	0.0026	0.00010
8-May-08	1	500	480	7.8	651	#N/A	4.2	35	238	13	0.73	1.3	286	0.10	0.025	0.0028	0.020	0.000010	0.0000050	0.050	0.00016	107	0.00010	0.00017	0.011	0.0020	0.000040	0.0015	4.9	0.043	0.020	0.19	0.00079	0.20	22	0.0045	1.3	0.000047	11	0.32	100	0.0000079	0.000040	0.00050	0.011	0.00020	0.0010	0.00010
15-May-08	2	500	480	7.7	603	#N/A	3.2	34	280	3.1	0.88	0.20	283	0.084	0.027	0.0020	0.020	0.000010	0.0000050	0.050	0.00013	103	0.00010	0.00027	0.0084	0.0040	0.000081	0.0014	6.0	0.059	0.010	0.14	0.00070	0.15	21	0.0040	1.4	0.0000060	9.2	0.29	99	0.0000085	0.000030	0.00050	0.0098	0.00020	0.0016	0.00010
22-May-08	3	500	460	7.8	603	#N/A	2.6	32	280	4.6	0.61	0.50	287	0.060	0.027	0.0017	0.017	0.000010	0.0000050	0.050	0.00013	104	0.00010	0.00027	0.0061	0.015	0.000040	0.0014	6.5	0.066	0.010	0.13	0.00053	0.10	19	0.0038	1.2	0.0000070	7.3	0.31	95	0.0000091	0.000040	0.00050	0.0082	0.00020	0.0010	0.00010
29-May-08	4	500	440	7.7	348	#N/A	2.6	23	180	1.2	0.41	0.30	157	0.054	0.015	0.0013	0.025	0.000010	0.0000050	0.050	0.000067	56	0.00010	0.00014	0.0038	0.0060	0.00018	0.00080	3.8	0.037	0.010	0.061	0.00030	0.049	10	0.0024	0.78	0.0000050	3.5	0.18	53	0.0000065	0.000020	0.0013	0.0035	0.00020	0.0023	0.00010
5-Jun-08	5	500	490	7.8	506	#N/A	4.2	31	274	1.9	0.60	0.10	284	0.031	0.020	0.0014	0.020	0.000010	0.0000050	0.050	0.00018	101	0.00030	0.00045	0.012	0.0010	0.000023	0.0011	7.6	0.097	0.010	0.071	0.00069	0.078	16	0.0032	1.3	0.0000050	6.0	0.29	95	0.0000079	0.000020	0.00050	0.0092	0.00020	0.0041	0.00010
12-Jun-08	6	500	465	7.7	341	#N/A	3.1	22	166				196	0.028	0.014	0.00080	0.019	0.000010	0.0010	0.050	0.00011	70	0.0010	0.00050	0.0048	0.0050	0.00020	#N/A	5.4	0.064	#N/A	0.042	0.0010	0.041	11	0.0019	0.87	0.000020	3.8	0.22	66	0.0000060	0.0050	0.0050	0.0047	0.0050	0.0050	0.00050
19-Jun-08	7	500	450	7.7	470	#N/A	4.6	30	281				291	0.055	0.020	0.0013	0.016	0.000010	0.0010	0.050	0.00010	103	0.0010	0.00050	0.0069	0.0050	0.00020	#N/A	8.0	0.081	#N/A	0.054	0.0010	0.054	16	0.0037	1.3	0.000030	5.1	0.31	100	0.0000080	0.0050	0.0050	0.0058	0.0050	0.0050	0.00050
26-Jun-08	8	500	445	7.7	605	#N/A	6.0	33	273				270	0.047	0.017	0.0010	0.016	0.00010	0.0010	0.050	0.00013	95	0.0010	0.00050	0.0053	0.0050	0.00020	#N/A	8.1	0.086	#N/A	0.045	0.0010	0.040	15	0.0038	1.2	0.000020	4.4	0.28	94	0.0000070	0.0050	0.0050	0.0050	0.0050	0.0050	0.00050
3-Jul-08	9	500	415	7.7	915	#N/A	3.4	28	412				541	0.043	0.022	0.0012	0.023	0.00010	0.0010	0.050	0.00023	189	0.0010	0.00050	0.0073	0.0050	0.00020	#N/A	17	0.16	#N/A	0.067	0.0010	0.070	23	0.0099	1.7	0.0000040	6.6	0.51	189	0.0000090	0.0050	0.0050	0.010	0.0050	0.0050	0.00050
10-Jul-08	10	500	480	7.7	659	#N/A	3.7	33	271	1.1	0.51	0.10	308	0.033	0.017	0.00092	0.015	0.000010	0.0000050	0.050	0.00018	108	0.0010	0.00053	0.0095	0.0020	0.000028	0.0011	9.6	0.14	0.010	0.043	0.00065	0.035	15	0.0055	1.1	0.0000060	3.8	0.32	104	0.0000082	0.000010	0.00050	0.0079	0.00020	0.0017	0.00010
17-Jul-08	11	500	430	7.8	596	#N/A	2.9	31	267				274	0.035	0.015	0.0010	0.016	0.000010	0.0010	0.050	0.00011	95	0.0010	0.00050	0.0094	0.0050	0.00020	#N/A	9.0	0.10	#N/A	0.046	0.0010	0.031	15	0.0052	1.2	0.000020	3.2	0.28	91	0.0000080	0.0050	0.0050	0.0055	0.0050	0.0050	0.00050
24-Jul-08	12	500	470	7.6	588																																											
31-Jul-08	13	500	450	7.7	615	#N/A	2.6	34	300	0.50	0.57	0.10	304	0.033	0.014	0.00096	0.020	0.000010	0.0000050	0.050	0.00013	105	0.00010	0.00030	0.0063	0.0030	0.00031	0.0012	10	0.11	0.010	0.054	0.00037	0.032	13	0.0058	1.2	0.0000050	2.6	0.28	99	0.00011	0.000010	0.00050	0.0066	0.00020	0.00050	0.00010
7-Aug-08	14	500	460	7.8	690																																										
14-Aug-08	15	500	490	7.7	502	#N/A	3.5	34	209	0.50	0.49	0.10	253	0.030	0.013	0.0010	0.016	0.000010	0.0000050	0.050	0.00024	87	0.00010	0.00033	0.0084	0.0040	0.00025	0.0011	8.4	0.11	0.010	0.046	0.00039	0.024	11	0.0044	1.2	0.0000050	1.9	0.22	76	0.0000090	0.000020	0.00050	0.0049	0.00020	0.0042	0.00010
21-Aug-08	16	500	460	7.8	425																																									
28-Aug-08	17	500	465	7.7	463	#N/A	2.8	36	187	0.60	0.56	0.20	228	0.039	0.013	0.0012	0.018	0.000010	0.0000050	0.050	0.00013	77	0.00010	0.00025	0.0081	0.0030	0.000055	0.0010	8.4	0.089	0.010	0.057	0.00037	0.024	11	0.0045	1.4	0.0000050	1.8	0.21	71	0.00010	0.000010	0.00050	0.0043	0.00020	0.0018	0.00010
4-Sep-08	18	500	475	7.7	413																																									
11-Sep-08	19	500	485	7.8	429	#N/A	3.3	37	161	0.50	0.67	0.10	204	0.033	0.012	0.0011	0.018	0.000010	0.0000050	0.050	0.00013	69	0.00010	0.00024	0.0080	0.0040	0.00012	0.0010	7.8	0.083	0.010	0.062	0.00031	0.020	9.6	0.0031	1.3	0.0000050	1.6	0.18	61	0.0000099	0.000010	0.00050	0.0040	0.00020	0.0020	0.00010
18-Sep-08	20	500	460	7.7	355																																									
25-Sep-08	21	500	480	7.8	447	#N/A	3.7	41	163	0.60	0.64	0.10	207	0.050	0.013	0.0011	0.021	0.000010	0.0000050	0.050	0.00012	68	0.00010	0.00032	0.0089	0.0030	0.000095	0.0011	8.7	0.100	0.010	0.076	0.00033	0.022	9.3	0.0031	1.7	0.0000050	1.5	0.20	62	0.00011	0.000010	0.00050	0.0052	0.00020	0.0018	0.00010
2-Oct-08	22	500	370	7.9	811																																									
9-Oct-08	23	500	425	8.0	594	#N/A	3.5	74	210	1.1	1.1	0.10	298	0.019	0.019	0.0014	0.023	0.000010	0.0000050	0.050	0.00081	98	0.00010	0.00053	0.015	0.0020	0.00034	0.0018	13	0.16	0.010	0.18	0.00047	0.027	12	0.0054	2.5	0.0000050	2.1	0.30	85	0.00014	0.000040	0.00050	0.0099	0.00020	0.012	0.00010
16-Oct-08	24	500	485	8.0	319																																									
23-Oct-08	25	500	500	8.0	370	#N/A	3.7	38	63	0.35	0.43	0.050	96	0.0092	0.0078	0.00065	0.016	0.0000050	0.0000030	0.025	0.00079	31	0.00050	0.00019	0.0075	0.0010	0.000021	0.00060	4.2	0.060	0.0050	0.058	0.00025	0.0090	4.5	0.0013	1.2	0.0000025	0.65	0.10	22	0.00057	0.000020	0.00025	0.0025	0.00010	0.00090	0.000050
30-Oct-08	26	500	510	8.0	404																																									
6-Nov-08	27	500	520	7.9	260	#N/A	2.5	36	38	0.26	0.38	0.052	71	0.011	0.0061	0.00067	0.023	0.0000052	0.0000026	0.026	0.00066	23	0.00052	0.00015	0.0084	0.0010	0.000025	0.00052	3.2	0.046	0.0052	0.043	0.00018	0.0042	3.6	0.00086	1.0	0.0000026	0.45	0.081	13	0.000045	0.000016	0.00026	0.0014	0.00010	0.00083	0.000052
13-Nov-08	28	500	510	8.0	222																																									
20-Nov-08	29	500	520	8.0	242	#N/A	1.3	42	35				73	0.010	0.0070	0.00060	0.027	0.0000052	0.0000026	0.026	0.00061	24	0.00052	0.00014	0.0082	0.0094	0.00033	0.00057	3.3	0.048	0.0052	0.047	0.00014	0.0057	3.5	0.00094	1.1	0.0000026	0.39	0.088	12	0.000048	0.000010	0.00026	0.0017	0.00010	0.00057	0.000052
27-Nov-08	30	500	425	8.0	239																																									
4-Dec-08	31	500	470	8.0	209	#N/A	1.1	30	22				48	0.012	0.0047	0.00059	0.027	0.0000047	0.0000024	0.024	0.00031	16	0.00094	0.00059	0.0041	0.00094	0.00016	0.00033	2.2	0.021	0.0047	0.029	0.00015	0.0038	2.3	0.00065	0.67	0.0000024	0.26	0.057	8.5	0.000034	0.0000094	0.00024	0.00090	0.00094	0.00033	0.000047
11-Dec-08	32	500	465	7.9	176																																									
18-Dec-08	33	500	490	7.8	240	#N/A	1.9	33	32				58	0.012	0.0057	0.00066	0.023	0.0000049	0.0000025	0.025	0.00048	19	0.00049	0.00091	0.0054	0.00049	0.00011	0.00044	2.5	0.031	0.0049	0.034	0.00011	0.0049	2.4	0.00083	0.85	0.0000025	0.27	0.064	11	0.000037	0.000025	0.00025	0.0014	0.00098	0.00034	0.00049
25-Dec-08	34	500	430	7.8	185																																									
1-Jan-09	35	500	455	7.9	206	#N/A	#N/A	26	25				45	0.015	0.0056	0.00058	0.017	0.0000046	0.0000023	0.023	0.00034	14	0.00046	0.00046	0.0036	0.0014	0.00010	0.00032	2.0	0.018	0.0046	0.030	0.00011	0.0036	2.0	0.00079	0.62	0.0000023	0.24	0.051	9.1	0.000033	0.000077	0.00023	0.0011	0.00091	0.00032	0.00046
8-Jan-09	36	500	445	7.8	277																																									
15-Jan-09	37	500	470	7.8	232	#N/A	2.3	28	27				54	0.014	0.0066	0.00069	0.019	0.0000047	0.0000024	0.024	0.00039	18	0.00047	0.00052	0.0041	0.00094	0.00027	0.00038	2.5	0.023	0.0047	0.035	0.000080	0.0042	2.3	0.00089	0.78	0.0000024	0.29	0.060	11	0.000039	0.0000047	0.00024	0.0014	0.00094	0.00038	0.00047
22-Jan-09	38	500	440	7.9	275																																									
29-Jan-09	39	500	440	7.7	305	#N/A	4.2	36	41				61	0.0084	0.0077	0.00078	0.020	0.0000044	0.0000022	0.022	0.00065	19	0.00044	0.00069	0.0044	0.0018	0.00081	0.00035	3.0	0.028	0.0044	0.051	0.00015	0.0044	2.3	0.0010	1.0	0.0000022	0.37	0.072	14	0.000040	0.0000044	0.00022	0.0022	0.00088	0.00031	0.00044
5-Feb-09	40	500	450	7.8	254	#N/A	1.4	33	31				57	0.0094	0.0076	0.00072	0.019	0.0000045	0.0000023	0.023	0.00047	18	0.00045	0.00069	0.0048	0.0036	0.00069	0.00041	2.7	0.028	0.0045	0.040	0.00016	0.0027	2.3	0.00083	1.0	0.0000023	0.31	0.066	11	0.000041	0.000023	0.00023	0.0015	0.00090	0.00036	0.00045
12-Feb-09	41	500	450	8.0	241	#N/A	1.0	33	27				54	0.0082	0.0070	0.00067	0.020	0.0000045	0.0000023	0.023	0.00042	17	0.00027	0.00078	0.0056	0.0018	0.0000081	0.00032	2.6	0.028	0.0045	0.037	0.00027	0.0036	2.1	0.00079	0.80	0.0000023	0.28	0.064	9.5	0.000038	0.0000090	0.00023	0.0014	0.00090	0.00050	0.00045
Median (last 5)				7.8	241	#N/A	#N/A	33	27				54	0.0094	0.0070	0.00069	0.019	0.0000045	0.0000023	0.023	0.00042	18	0.00046	0.00069	0.0044	0.0018	0.00027	0.00035	2.6	0.028	0.0045	0.037	0.00015	0.0036	2.3	0.00083	0.80	0.0000023	0.29	0.064	11	0.000039	0.0000090	0.00023	0.0014	0.00090	0.00036	0.00045
Cell Terminated																																																

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for T3

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg CaCO3/kg	mg CaCO3/kg	mg CaCO3/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg CaCO3/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
1-May-08	0	750	360	7.6	1218	#N/A	1.5	18	210	14	0.39	1.6	214	0.036	0.014	0.0013	0.014	0.0000036	0.0000018	0.018	0.0000076	82	0.000036	0.000049	0.017	0.0018	0.000051	0.00083	2.3	0.016	0.029	0.11	0.00059	0.27	15	0.0036	0.59	0.0000085	8.3	0.24	72	0.0000049	0.0000076	0.00018	0.0073	0.00011	0.00094	0.0000036
8-May-08	1	500	480	7.8	651	#N/A	2.0	17	114	6.2	0.35	0.62	137	0.049	0.012	0.0013	0.0096	0.0000048	0.0000024	0.024	0.0000074	51	0.0000048	0.0000083	0.0053	0.00096	0.0000019	0.00072	2.4	0.020	0.0096	0.092	0.00038	0.095	10	0.0022	0.61	0.0000023	5.0	0.15	48	0.0000038	0.0000019	0.00024	0.0055	0.0000096	0.00048	0.000048
15-May-08	2	500	480	7.7	603	#N/A	1.5	16	134	1.5	0.42	0.096	136	0.040	0.013	0.00098	0.0097	0.0000048	0.0000024	0.024	0.0000062	49	0.0000048	0.00013	0.0040	0.0019	0.0000039	0.00067	2.9	0.028	0.0048	0.069	0.00034	0.071	9.8	0.0019	0.69	0.0000029	4.4	0.14	48	0.0000041	0.0000014	0.00024	0.0047	0.0000096	0.00077	0.000048
22-May-08	3	500	460	7.8	603	#N/A	1.2	15	129	2.1	0.28	0.23	132	0.028	0.012	0.00078	0.0076	0.0000046	0.0000023	0.023	0.0000059	48	0.0000046	0.00012	0.0028	0.0069	0.0000018	0.00064	3.0	0.030	0.0046	0.058	0.00024	0.047	8.8	0.0017	0.54	0.0000032	3.3	0.14	44	0.0000042	0.0000018	0.00023	0.0038	0.0000092	0.00046	0.0000046
29-May-08	4	500	440	7.7	348	#N/A	1.2	10	79	0.53	0.18	0.13	69	0.024	0.0066	0.00059	0.011	0.0000044	0.0000022	0.022	0.0000029	25	0.0000044	0.0000060	0.0017	0.0026	0.0000077	0.00035	1.7	0.016	0.0044	0.027	0.00013	0.022	4.6	0.0010	0.34	0.0000022	1.6	0.080	23	0.0000029	0.0000088	0.00057	0.0015	0.0000088	0.0010	0.0000044
5-Jun-08	5	500	490	7.8	506	#N/A	2.1	15	134	0.93	0.29	0.049	139	0.015	0.0098	0.00066	0.0098	0.0000049	0.0000025	0.025	0.0000089	49	0.00015	0.00022	0.0056	0.00049	0.000011	0.00054	3.7	0.048	0.0049	0.035	0.00034	0.038	7.7	0.0016	0.63	0.0000025	2.9	0.14	47	0.0000039	0.0000098	0.00025	0.0045	0.0000098	0.0020	0.0000049
12-Jun-08	6	500	465	7.7	341	#N/A	2.1	14	126				131	0.025	0.0088	0.00059	0.0072	0.000045	0.00045	0.023	0.0000045	46	0.00045	0.00023	0.0031	0.0023	0.0000090	#N/A	3.6	0.036	#N/A	0.024	0.00045	0.024	7.3	0.0017	0.56	0.0000014	2.3	0.14	45	0.0000036	0.0023	0.0023	0.0026	0.0023	0.0023	0.00023
19-Jun-08	7	500	450	7.7	470	#N/A	2.7	15	121				120	0.021	0.0076	0.00045	0.0071	0.000045	0.00045	0.022	0.0000058	42	0.00045	0.00022	0.0024	0.0022	0.0000089	#N/A	3.6	0.038	#N/A	0.020	0.00045	0.018	6.6	0.0017	0.52	0.0000089	1.9	0.12	42	0.0000031	0.0022	0.0022	0.0022	0.0022	0.0022	0.00022
26-Jun-08	8	500	445	7.7	605	#N/A	2.7	15	121				120	0.021	0.0076	0.00045	0.0071	0.000045	0.00045	0.022	0.0000058	42	0.00045	0.00022	0.0024	0.0022	0.0000089	#N/A	3.6	0.038	#N/A	0.020	0.00045	0.018	6.6	0.0017	0.52	0.0000089	1.9	0.12	42	0.0000031	0.0022	0.0022	0.0022	0.0022	0.0022	0.00022
3-Jul-08	9	500	415	7.7	915	#N/A	1.4	12	171				225	0.018	0.0090	0.00050	0.0095	0.000042	0.00042	0.021	0.0000095	78	0.00042	0.00021	0.0030	0.0021	0.0000083	#N/A	6.9	0.068	#N/A	0.028	0.00042	0.029	9.4	0.0041	0.69	0.0000017	2.7	0.21	78	0.0000037	0.0021	0.0021	0.0042	0.0021	0.0021	0.00021
10-Jul-08	10	500	480	7.7	659	#N/A	1.8	16	130	0.53	0.24	0.048	148	0.016	0.0081	0.00044	0.0071	0.0000048	0.0000024	0.024	0.0000088	52	0.0000048	0.00025	0.0045	0.00096	0.0000013	0.00053	4.6	0.066	0.0048	0.021	0.00031	0.017	7.3	0.0026	0.55	0.0000029	1.8	0.16	50	0.0000039	0.0000048	0.00024	0.0038	0.0000096	0.00082	0.0000048
17-Jul-08	11	500	430	7.8	596	#N/A	1.3	13	115				118	0.015	0.0064	0.00043	0.0069	0.000043	0.00043	0.022	0.0000047	41	0.00043	0.00022	0.0040	0.0022	0.0000086	#N/A	3.9	0.043	#N/A	0.020	0.00043	0.013	6.2	0.0022	0.53	0.0000086	1.4	0.12	39	0.0000034	0.0022	0.0022	0.0024	0.0022	0.0022	0.00022
24-Jul-08	12	500	470	7.6	588																																											
31-Jul-08	13	500	450	7.7	615	#N/A	1.2	15	135	0.23	0.26	0.045	137	0.015	0.0064	0.00043	0.0088	0.0000045	0.0000023	0.023	0.0000060	47	0.0000045	0.00014	0.0028	0.0014	0.000014	0.00054	4.5	0.047	0.0045	0.024	0.00017	0.014	6.0	0.0026	0.55	0.0000023	1.2	0.13	45	0.0000047	0.0000045	0.00023	0.0030	0.0000090	0.00023	0.0000045
7-Aug-08	14	500	460	7.8	690																																										
14-Aug-08	15	500	490	7.7	502	#N/A	1.7	17	102	0.25	0.24	0.049	124	0.015	0.0062	0.00049	0.0079	0.0000049	0.0000025	0.025	0.00012	43	0.00049	0.00016	0.0041	0.0020	0.00012	0.00054	4.1	0.053	0.0049	0.023	0.00019	0.012	5.6	0.0022	0.57	0.0000025	0.91	0.11	37	0.0000044	0.0000098	0.00025	0.0024	0.0000098	0.0021	0.0000049
21-Aug-08	16	500	460	7.8	425																																									
28-Aug-08	17	500	465	7.7	463	#N/A	1.3	17	87	0.28	0.26	0.093	106	0.018	0.0059	0.00053	0.0081	0.0000047	0.0000023	0.023	0.0000061	36	0.0000047	0.00012	0.0038	0.0014	0.0000026	0.00047	3.9	0.041	0.0047	0.026	0.00017	0.011	4.9	0.0021	0.66	0.0000023	0.83	0.098	33	0.0000047	0.0000047	0.00023	0.0020	0.0000093	0.00084	0.0000047
4-Sep-08	18	500	475	7.7	413																																									
11-Sep-08	19	500	485	7.8	429	#N/A	1.6	18	78	0.24	0.32	0.049	99	0.016	0.0060	0.00051	0.0088	0.0000049	0.0000024	0.024	0.0000061	33	0.0000049	0.00012	0.0039	0.0019	0.0000060	0.00049	3.8	0.040	0.0049	0.030	0.00015	0.0097	4.6	0.0015

Leachate Results for T4

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
15-Dec-09	0	750	460	8.0	1726	#N/A	4.4	41	1127	57		976	7.8	0.0079	0.0072	0.093	0.000050	0.000030	0.30	0.000080	382	0.00050	0.000070	0.0032	0.011	0.00012	0.0030	5.6	0.0096	0.14	0.031	0.00090	0.40	65	0.0076	0.88	0.00014	17	1.1	320	0.00011	0.0078	0.0030	0.0095	0.0010	0.0016	0.00050
22-Dec-09	1	500	525	7.3	553	#N/A	3.5	25	320	19		296	0.41	0.0038	0.038	0.028	0.000050	0.000030	0.30	0.000040	115	0.00050	0.000030	0.0046	0.0050	0.000080	0.0030	2.1	0.012	0.090	0.013	0.0026	0.16	22	0.0014	4.2	0.00010	4.3	0.38	108	0.000060	0.0066	0.0030	0.0028	0.0010	0.0019	0.00050
29-Dec-09	2	500	490	7.4	472	#N/A	4.8	41	201	3.8		198	0.24	0.0050	0.022	0.029	0.000050	0.000030	0.30	0.000030	76	0.00050	0.000030	0.0041	0.0050	0.000030	0.0030	2.3	0.011	0.050	0.0078	0.0013	0.083	15	0.0011	3.0	0.000030	1.8	0.26	65	0.000040	0.0077	0.0030	0.0029	0.0010	0.00080	0.00050
5-Jan-10	3	500	495	7.2	452	#N/A	7.3	51	195	2.6		210	0.14	0.0053	0.019	0.032	0.000010	0.0000050	0.050	0.000033	78	0.00010	0.000048	0.0024	0.0040	0.000057	0.00050	4.0	0.018	0.020	0.0086	0.00025	0.065	13	0.0011	3.5	0.0000090	1.2	0.27	63	0.000045	0.0094	0.00050	0.0041	0.00020	0.0019	0.00010
12-Jan-10	4	500	460	7.5	450				209																																							
19-Jan-10	5	500	445	7.8	810	#N/A	6.0	58	427	2.1		428	0.074	0.0040	0.0100	0.022	0.000010	0.0000050	0.050	0.000079	143	0.00010	0.00021	0.0024	0.0080	0.00011	0.00050	17	0.058	0.010	0.010	0.00034	0.65	11	0.0022	3.2	0.0000070	1.0	0.44	141	0.000037	0.0074	0.00050	0.013	0.00020	0.0013	0.00010
26-Jan-10	6	500	430	7.9	626				275																																							
2-Feb-10	7	500	455	7.9	440	#N/A	3.6	83	248	0.50		279	0.051	0.0042	0.0067	0.025	0.000010	0.0000050	0.050	0.000050	90	0.00010	0.00016	0.0028	0.0020	0.000047	0.00050	13	0.043	0.010	0.0098	0.00029	0.035	7.2	0.0026	3.5	0.0000050	0.46	0.28	71	0.000042	0.0064	0.00050	0.011	0.00020	0.0030	0.00010
9-Feb-10	8	500	450	7.9	456				182																																							
16-Feb-10	9	500	460	7.6	367	#N/A	4.6	79	150	0.50		202	0.059	0.0040	0.0046	0.033	0.000010	0.0000050	0.050	0.000019	65	0.00010	0.00012	0.0012	0.0020	0.000023	0.00050	9.4	0.030	0.010	0.0076	0.00013	0.032	5.3	0.0020	3.2	0.0000050	0.32	0.23	47	0.000026	0.0062	0.00050	0.0084	0.00020	0.00060	0.00010
23-Feb-10	10	500	465	8.0	301				117																																							
2-Mar-10	11	500	435	8.0	337	#N/A	1.9	73	117	0.50		182	0.065	0.0040	0.0037	0.041	0.000010	0.0000050	0.050	0.000018	59	0.00010	0.000089	0.0018	0.0040	0.000031	0.00050	8.3	0.027	0.010	0.0088	0.00019	0.036	4.4	0.0022	3.1	0.0000050	0.24	0.20	42	0.000024	0.0063	0.00050	0.0077	0.00020	0.00070	0.00010
9-Mar-10	12	500	320	7.9	372				139																																							
16-Mar-10	13	500	500	7.6	290	#N/A	4.4	71	89	0.50		169	0.072	0.0034	0.0032	0.041	0.000010	0.0000050	0.050	0.000052	55	0.00010	0.00011	0.0021	0.0020	0.00019	0.00050	7.7	0.033	0.010	0.0088	0.00020	0.033	3.8	0.0020	3.1	0.0000050	0.22	0.18	36	0.000024	0.0049	0.00050	0.0072	0.00020	0.0010	0.00010
23-Mar-10	14	500	480	7.9	296				104																																							
30-Mar-10	15	500	450	7.9	281	#N/A	2.3	69	96	0.50		142	0.058	0.0042	0.0037	0.048	0.000010	0.0000050	0.050	0.000067	46	0.00010	0.00010	0.0021	0.0020	0.00012	0.00050	6.5	0.030	0.010	0.011	0.00032	0.034	3.2	0.0023	3.2	0.0000050	0.20	0.16	31	0.000039	0.0057	0.00050	0.0064	0.00020	0.0046	0.00010
6-Apr-10	16	500	445	7.9	264				63																																							
13-Apr-10	17	500	450	8.0	254	#N/A	3.2	73	64	0.50		124	0.067	0.0048	0.0031	0.057	0.000010	0.0000050	0.050	0.000036	41	0.00010	0.000098	0.0024	0.0030	0.000083	0.00050	5.4	0.028	0.010	0.018	0.00023	0.034	2.9	0.0018	3.1	0.0000050	0.17	0.14	21	0.000022	0.0057	0.00050	0.0050	0.00030	0.00070	0.00010
20-Apr-10	18	500	445	7.9	253				74																																							
27-Apr-10	19	500	465	8.0	227	#N/A	2.9	68	60	0.50		116	0.068	0.0048	0.0033	0.063	0.000010	0.0000050	0.050	0.000039	38	0.00010	0.000069	0.0023	0.0010	0.000018	0.00050	5.1	0.024	0.010	0.024	0.00017	0.039	2.7	0.0015	3.2	0.0000050	0.16	0.13	20	0.000017	0.0049	0.00050	0.0042	0.00020	0.0010	0.00010
4-May-10	20	500	460	7.9	213				58																																							
11-May-10	21	500	445	8.0	221	#N/A	2.2	68	47	5.0		102	0.0072	0.0054	0.0033	0.075	0.000010	0.0000050	0.050	0.000022	34	0.00010	0.000042	0.00082	0.0020	0.0000050	0.00050	4.2	0.021	0.010	0.024	0.000050	0.028	2.5	0.0013	3.3	0.0000050	0.17	0.13	17	0.000021	0.00063	0.00050	0.00035	0.00020	0.00020	0.00010
18-May-10	22	500	445	7.8	206				41																																							
25-May-10	23	500	455	7.8	194	#N/A	4.5	66	25	0.50		102	0.065	0.0047	0.0037	0.076	0.000010	0.0000050	0.050	0.000024	34	0.00010	0.000048	0.0015	0.0080	0.000032	0.00050	4.2	0.020	0.010	0.017	0.00017	0.040	2.5	0.0012	3.1	0.0000050	0.13	0.12	15	0.000019	0.0049	0.00050	0.0034	0.00020	0.0010	0.00010
1-Jun-10	24	500	435	7.9	187				18																																							
8-Jun-10	25	500	480	8.0	197	#N/A	2.9	75	21	0.50		102	0.059	0.0045	0.0033	0.091	0.000010	0.0000050	0.050	0.000026	34	0.00090	0.000062	0.0020	0.0020	0.0013	0.00050	4.3	0.024	0.010	0.014	0.000070	0.039	2.4	0.0011	3.9	0.0000050	0.13	0.12	12	0.000020	0.0074	0.00050	0.0032	0.00020	0.00070	0.00010
15-Jun-10	26	500	450	7.9	180				19																																							
22-Jun-10	27	500	430	8.1	172	#N/A	1.8	63	27	0.50		80	0.060	0.0042	0.0033	0.084	0.000010	0.0000050	0.050	0.000024	26	0.00010	0.000048	0.0022	0.0010	0.000018	0.00050	3.5	0.017	0.010	0.012	0.00015	0.042	2.2	0.0011	3.0	0.0000050	0.13	0.11	13	0.000018	0.0052	0.00050	0.0025	0.00030	0.00070	0.00010
29-Jun-10	28	500	440	7.8	169				22																																							
6-Jul-10	29	500	470	7.9	164	#N/A	2.4	63	18	0.50		83	0.058	0.0033	0.0030	0.087	0.000010	0.0000050	0.050	0.000014	28	0.00010	0.000038	0.0019	0.0010	0.000052	0.00050	3.5	0.017	0.010	0.0084	0.00024	0.040	2.0	0.0010	3.1	0.0000050	0.13	0.099	10	0.000015	0.0048	0.00050	0.0024	0.00030	0.00080	0.00010
13-Jul-10	30	500	460	7.8	162				11																																							
20-Jul-10	31	500	465	7.9	158	#N/A	3.7	66	18	3.0		76	0.049	0.0030	0.0027	0.098	0.000010	0.0000050	0.050	0.000025	26	0.00010	0.000044	0.0020	0.0020	0.000036	0.00050	2.9	0.016	0.010	0.0070	0.00017	0.032	1.6	0.0010	2.5	0.0000050	0.10	0.099	10	0.000016	0.0049	0.00050	0.0024	0.00020	0.00080	0.00010
27-Jul-10	32	500	440	7.7	157				21																																							
3-Aug-10	33	500	440	8.0	155	#N/A	3.1	65	16	0.50		76	0.057	0.0030	0.0031	0.11	0.000010	0.0000050	0.050	0.000013	26	0.00010	0.000029	0.0013	0.0010	0.000020	0.00050	3.1	0.016	0.020	0.0071	0.00012	0.042	1.8	0.0011	2.9	0.0000050	0.13	0.098	10	0.000015	0.0051	0.00050	0.0025	0.00020	0.00070	0.00010
10-Aug-10	34	500	435	7.8	152				23																																							
17-Aug-10	35	500	430	8.0	149	#N/A	2.8	62	15	1.1		71	0.068	0.0030	0.0030	0.11	0.000010	0.0000050	0.050	0.000022	24	0.00010	0.000024	0.0016	0.0010	0.000012	0.00050	3.0	0.014	0.010	0.0068	0.00012	0.040	1.7	0.0012	2.5	0.0000050	0.16	0.094	10	0.000018	0.0047	0.00050	0.0021	0.00020	0.00030	0.00010
24-Aug-10	36	500	485	7.9	156				39																																							
31-Aug-10	37	500	500	8.0	137	#N/A	5.8	71	20	0.50		71	0.049	0.0028	0.0028	0.12	0.000010	0.0000050	0.050	0.000017	24	0.00010	0.000040	0.0011	0.0010	0.000083	0.00050	2.9	0.017	0.010	0.0063	0.00015	0.035	1.5	0.0013	2.7	0.0000050	0.10	0.099	10	0.000021	0.0059	0.00050	0.0018	0.00020	0.00060	0.00010
7-Sep-10	38	500	450	7.6	155				20																																							
14-Sep-10	39	500	435	7.7	135	#N/A	3.2	64	18	0.50		73	0.057	0.0024	0.0028	0.11	0.000010	0.0000050	0.050	0.00033	24	0.00010	0.000036	0.0028	0.0050	0.000020	0.00050	2.9	0.014	0.010	0.0063	0.00014	0.041	1.5	0.0011	2.6	0.0000050	0.14	0.089	10	0.000020	0.0056	0.00090	0.0022	0.00040	0.032	0.00010
21-Sep-10	40	500	465	7.8	133				20																																							
28-Sep-10	41	500	425	7.9	154	#N/A	2.5	66	24	0.80		75	0.066	0.0027	0.0038	0.13	0.000010	0.0000050	0.050	0.000017	25	0.00010	0.000033	0.0013	0.0030	0.000046	0.00050	3.2	0.016	0.010	0.0070	0.00018	0.043	1.7	0.0012	2.8	0.0000050	0.15	0.092	10	0.000018	0.0059	0.00050	0.0023	0.00030	0.00070	0.00010
5-Oct-10	42	500	395	7.7	148				25																																							
12-Oct-10	43	500	490	7.9	167	#N/A	2.8	74	23	0.50		85	0.064	0.0025	0.0028	0.16	0.000010	0.0000050	0.050	0.000015	28	0.00010	0.000029	0.0013	0.0010	0.000015	0.00050	3.5	0.021	0.010	0.0069	0.00015	0.043	1.7	0.0012	3.2	0.0000050	0.12	0.097	10	0.000019	0.0057	0.00050	0.0027	0.00030	0.00060	0.00010
19-Oct-10	44	500	415	7.7	155				22																																							
26-Oct-10	45	500	485	7.8	147	#N/A	2.7	66	19	0.50		73	0.057	0.0018	0.0024	0.15	0.000010	0.0000050	0.050	0.0000080	24	0.00010	0.000041	0.00087	0.0010	0.000028	0.00050	2.9	0.017	0.010	0.0060	0.00013	0.041	1.3	0.0018	2.5	0.0000050	0.10	0.080	10	0.000019	0.0051	0.00050	0.0018	0.00020	0.00040	0.00010
2-Nov-10	46	500	440	7.8	153																																											
9-Nov-10	47	500	485	7.9	177																																										
16-Nov-10	48	500	385	7.9	139																																										
23-Nov-10	49	500	515	7.7	151	#N/A	3.0	68	19	0.50		72	0.056	0.0019	0.0024	0.18	0.000010	0.0000050	0.050	0.000035	24	0.00010	0.000035	0.0013	0.0010	0.000067	0.00050	3.0	0.019	0.010	0.0086	0.00026	0.043	1.3	0.00097	2.5	0.0000050	0.090	0.083	10	0.000015	0.0078	0.00050	0.0023	0.00020	0.0053	0.00010
30-Nov-10	50	500	445	7.7	143																																										
7-Dec-10	51	500	415	7.7	146																																										
14-Dec-10	52	500	425	7.6	143																																										
21-Dec-10	53	500	395	7.7	145	#N/A	5.5	64	20	0.50		66	0.054	0.0017	0.0025	0.19	0.000010	0.0000050	0.050	0.000012	22	0.00010	0.000033	0.0012	0.0010	0.000019	0.00050	2.8	0.017	0.010	0.0079	0.00014	0.045	1.3	0.00085	2.3	0.0000050	0.080	0.076	10	0.000014	0.0062	0.00050	0.0020	0.00020	0.00070	0.00010
28-Dec-10	54	500	480	7.5	124																																										
4-Jan-11	55	500	435	7.7	132																																										
11-Jan-11	56	500	410	7.6	135																																										
18-Jan-11	57	500	410	7.8	144	#N/A	3.3	59	19	0.50		71	0.061	0.0017	0.0025	0.17	0.000010	0.0000050	0.050	0.000014	24	0.00010	0.000054	0.0012	0.0020	0.000023	0.00050	2.9	0.019	0.010	0.0076	0.00017	0.039	1.2	0.00095	2.3	0.0000050	0.090	0.073	10	0.000014	0.0059	0.00050	0.025	0.00020	0.00060	0.00010
25-Jan-11	58	500	390	7.6	136																																										
1-Feb-11	59	500	435	7.8	138																																										
8-Feb-11	60	500	430	7.8	133																																										
15-Feb-11	61	500	400	7.8	137	#N/A	3.1	59	12	1.8		60	0.052	0.0015	0.0022	0.16	0.000010	0.0000050	0.050	0.000016	20	0.00010	0.000046	0.0012	0.0030	0.000013	0.00050	2.7	0.018	0.010	0.0059	0.00017	0.039	1.1	0.00095	2.0	0.0000050	0.070	0.065	10	0.000017	0.0063	0.00050	0.0018	0.00040	0.00050	0.00010
22-Feb-11	62	500	465	7.7	150																																										
1-Mar-11	63	500	445	7.9	151																																										
8-Mar-11	64	500	435	7.7	146																																										
15-Mar-11	65	500	425	7.8	144	#N/A	2.8	62	12	0.50		74	0.053	0.0014	0.0021	0.18	0.000010	0.0000050	0.050	0.000027	24	0.00010	0.000040	0.0015	0.0010	0.000023	0.00050	3.2	0.019	0.010	0.0053	0.00015	0.044	1.1	0.00084	2.4	0.0000050	0.070	0.066	10	0.000010	0.0058	0.00050	0.0020	0.00030	0.00070	0.00010
22-Mar-11	66	500	450	7.7	137																																										
29-Mar-11	67	500	465	7.9	149																																										
5-Apr-11	68	500	430	7.6	147																																										
12-Apr-11	69	500	435	7.7	139	#N/A	3.8	60	16	1.4		66	0.051	0.0012	0.0020	0.17	0.000010	0.0000050	0.050	0.000014	21	0.00010	0.000029	0.0027	0.0010	0.000034	0.00050	3.1	0.021	0.010	0.0053	0.00011	0.042	1.0	0.00081	2.1	0.0000050	0.080	0.063	10	0.0000090	0.0052	0.00050	0.0020	0.00040	0.00070	0.00010
19-Apr-11	70	500	451	7.6	141																																										
26-Apr-11	71	500	410	7.9	145																																										
3-May-11	72	500	450	7.7	141																																										
10-May-11	73	500	435	7.8	142	#N/A	3.6	63	17	0.50		66	0.051	0.0012	0.0021	0.17	0.000010	0.000027	0.050	0.0000050	21	0.00010	0.000022	0.0016	0.0010	0.00018	0.00050	3.0	0.018	0.010	0.0054	0.00012	0.036	0.88	0.0010	2.2	0.0000050	0.070	0.059	10	0.000012	0.0050	0.00050	0.0018	0.00030	0.00070	0.00010
17-May-11	74	500	415	7.9	144																																										
24-May-11	75	500	395	7.8	140																																										
31-May-11	76	500	335	7.7	143																																										
7-Jun-11	77	500	380	7.9	147	#N/A	2.7	60	17	0.60		70	0.055	0.0013	0.0022	0.17	0.000010	0.0000050	0.050	0.000057	23	0.00030	0.000039	0.0020	0.0050	0.00072	0.00050	3.5	0.018	0.010	0.0068	0.00012	0.040	0.98	0.00082	2.3	0.0000050	0.090	0.058	10	0.000012	0.0046	0.00050	0.0022	0.00050	0.0020	0.00010
14-Jun-11	78	500	400	7.8	138																																										
21-Jun-11	79	500	450	8.1	150																																										
28-Jun-11	80	500	415	7.9	150																																										
5-Jul-11	81	500	415	7.8	144	#N/A	4.4	63	20	0.50		70	0.054	0.0012	0.0026	0.18	0.000010	0.0000050	0.050	0.000011	22	0.00010	0.000089	0.0015	0.0010	0.000017	0.00050	3.8	0.018	0.010	0.0054	0.00015	0.043	0.98	0.00097	2.4	0.0000050	0.070	0.057	10	0.000018	0.0048	0.00050	0.0020	0.00030	0.00060	0.00010
12-Jul-11	82	500	425	7.7	142																																										
19-Jul-11	83	500	430	7.8	146																																										
26-Jul-11	84	500	425	7.8	147																																										
2-Aug-11	85	500	405	7.9	130	#N/A	5.6	56	18	1.3	0.11	63	0.051	0.0010	0.0019	0.17	0.000010	0.0000050	0.050	0.000021	20	0.00010	0.000030	0.0013	0.0010	0.000010	0.00050	3.2	0.016	0.010	0.0056	0.000080	0.042	0.84	0.00074	2.2	0.0000050	0.060	0.050	10	0.000010	0.0048	0.00050	0.0016	0.00040	0.00080	0.00010

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Calculated Production Rates for T4

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
15-Dec-09	0	750	460	8.0	1726	#N/A	2.0	19	518	26	0.00	449	3.6	0.0036	0.0033	0.043	0.000023	0.000014	0.14	0.000037	176	0.00023	0.000032	0.0015	0.0051	0.000055	0.0014	2.6	0.0044	0.064	0.014	0.00041	0.18	30	0.0035	0.41	0.000064	8.0	0.52	147	0.000051	0.0036	0.0014	0.0044	0.00046	0.00074	0.00023
22-Dec-09	1	500	525	7.3	553	#N/A	1.8	13	168	10.0	0.00	155	0.22	0.0020	0.020	0.015	0.000026	0.000016	0.16	0.000021	60	0.00026	0.000016	0.0024	0.0026	0.000042	0.0016	1.1	0.0060	0.047	0.0069	0.0014	0.086	11	0.00074	2.2	0.000053	2.3	0.20	57	0.000032	0.0035	0.0016	0.0015	0.00053	0.00100	0.00026
29-Dec-09	2	500	490	7.4	472	#N/A	2.3	20	98	1.9	0.00	97	0.12	0.0025	0.011	0.014	0.000025	0.000015	0.15	0.000015	37	0.00025	0.000015	0.0020	0.0025	0.000015	0.0015	1.1	0.0052	0.025	0.0038	0.00064	0.041	7.2	0.00054	1.5	0.000015	0.88	0.13	32	0.000020	0.0038	0.0015	0.0014	0.00049	0.00039	0.00025
5-Jan-10	3	500	495	7.2	452	#N/A	3.6	25	97	1.3	0.00	104	0.068	0.0026	0.0094	0.016	0.0000050	0.0000025	0.025	0.000016	38	0.00050	0.0000024	0.0012	0.0020	0.000028	0.00025	2.0	0.0087	0.0099	0.0043	0.00012	0.032	6.3	0.00056	1.7	0.0000045	0.61	0.13	31	0.000022	0.0047	0.00025	0.0020	0.000099	0.00094	0.000050
12-Jan-10	4	500	460	7.5	450				96																																							
19-Jan-10	5	500	445	7.8	810	#N/A	2.7	26	190	0.93	0.00	190	0.033	0.0018	0.0044	0.0100	0.0000045	0.0000022	0.022	0.000035	64	0.000045	0.000095	0.0011	0.0036	0.000051	0.00022	7.5	0.026	0.0045	0.0045	0.00015	0.29	5.0	0.00100	1.4	0.0000031	0.45	0.19	63	0.000016	0.0033	0.00022	0.0056	0.000089	0.00058	0.000045
26-Jan-10	6	500	430	7.9	626				161																																							
2-Feb-10	7	500	455	7.9	440	#N/A	1.6	38	113	0.23	0.00	127	0.023	0.0019	0.0030	0.011	0.0000046	0.0000023	0.023	0.000023	41	0.000046	0.000073	0.0013	0.00091	0.000021	0.00023	6.1	0.020	0.0046	0.0044	0.00013	0.016	3.3	0.0012	1.6	0.0000023	0.21	0.13	32	0.000019	0.0029	0.00023	0.0051	0.000091	0.0014	0.000046
9-Feb-10	8	500	450	7.9	456				82																																							
16-Feb-10	9	500	460	7.6	367	#N/A	2.1	36	69	0.23	0.00	93	0.027	0.0018	0.0021	0.015	0.0000046	0.0000023	0.023	0.0000087	30	0.000046	0.000053	0.00055	0.00092	0.000011	0.00023	4.3	0.014	0.0046	0.0035	0.000060	0.015	2.4	0.00093	1.5	0.0000023	0.15	0.10	22	0.000012	0.0028	0.00023	0.0039	0.000092	0.00028	0.000046
23-Feb-10	10	500	465	8.0	301				54																																							
2-Mar-10	11	500	435	8.0	337	#N/A	0.80	32	51	0.22	0.00	79	0.028	0.0018	0.0016	0.018	0.0000044	0.0000022	0.022	0.0000078	26	0.000044	0.000039	0.00077	0.0017	0.000013	0.00022	3.6	0.012	0.0044	0.0038	0.000083	0.016	1.9	0.00094	1.4	0.0000022	0.10	0.087	18	0.000010	0.0027	0.00022	0.0034	0.000087	0.00030	0.000044
9-Mar-10	12	500	320	7.9	372				44																																							
16-Mar-10	13	500	500	7.6	290	#N/A	2.2	36	45	0.25	0.00	85	0.036	0.0017	0.0016	0.021	0.0000050	0.0000025	0.025	0.000026	28	0.000050	0.000056	0.0011	0.0010	0.000094	0.00025	3.8	0.016	0.0050	0.0044	0.00010	0.017	1.9	0.0010	1.6	0.0000025	0.11	0.089	18	0.000012	0.0024	0.00025	0.0036	0.00010	0.00050	0.000050
23-Mar-10	14	500	480	7.9	296				50																																							
30-Mar-10	15	500	450	7.9	281	#N/A	1.0	31	43	0.23	0.00	64	0.026	0.0019	0.0017	0.022	0.0000045	0.0000023	0.023	0.000030	21	0.000045	0.000045	0.00094	0.00090	0.000052	0.00023	2.9	0.013	0.0045	0.0048	0.00014	0.015	1.4	0.0011	1.4	0.0000023	0.090	0.071	14	0.000018	0.0026	0.00023	0.0029	0.000090	0.0021	0.000045
6-Apr-10	16	500	445	7.9	264				28																																							
13-Apr-10	17	500	450	8.0	254	#N/A	1.5	33	29	0.23	0.00	56	0.030	0.0021	0.0014	0.025	0.0000045	0.0000023	0.023	0.000016	18	0.000045	0.000044	0.0011	0.0014	0.000037	0.00023	2.4	0.012	0.0045	0.0079	0.00010	0.015	1.3	0.0080	1.4	0.0000023	0.077	0.063	9.5	0.0000099	0.0026	0.00023	0.0023	0.00014	0.00032	0.000045
20-Apr-10	18	500	445	7.9	253				33																																							
27-Apr-10	19	500	465	8.0	227	#N/A	1.4	31	28	0.23	0.00	54	0.032	0.0022	0.0015	0.029	0.0000047	0.0000023	0.023	0.000018	18	0.000047	0.000032	0.0011	0.0047	0.0000084	0.00023	2.4	0.011	0.0047	0.011	0.000079	0.018	1.3	0.00072	1.5	0.0000023	0.074	0.059	9.3	0.0000079	0.0023	0.00023	0.0019	0.000093	0.00047	0.000047
4-May-10	20	500	460	7.9	213				27																																							
11-May-10	21	500	445	8.0	221	#N/A	0.96	30	21	2.2	0.00	45	0.0032	0.0024	0.0015	0.033	0.0000045	0.0000022	0.022	0.0000098	15	0.000045	0.000019	0.00036	0.00089	0.0000022	0.00022	1.9	0.0093	0.0045	0.011	0.000022	0.012	1.1	0.00059	1.5	0.0000022	0.076	0.057	7.6	0.0000093	0.00028	0.00022	0.00016	0.000089	0.000089	0.000045
18-May-10	22	500	445	7.8	206				18																																							
25-May-10	23	500	455	7.8	194	#N/A	2.0	30	11	0.23	0.00	46	0.030	0.0021	0.0017	0.035	0.0000046	0.0000023	0.023	0.0000011	15	0.000046	0.000022	0.00066	0.0036	0.000015	0.00023	1.9	0.0090	0.0046	0.0079	0.000077	0.018	1.1	0.00053	1.4	0.0000023	0.059	0.056	6.8	0.0000086	0.0022	0.00023	0.0016	0.000091	0.00046	0.000046
1-Jun-10	24	500	435	7.9	187				7.8																																							
8-Jun-10	25	500	480	8.0	197	#N/A	1.4	36	10	0.24	0.00	49	0.028	0.0022	0.0016	0.044	0.0000048	0.0000024	0.024	0.0000012	16	0.00043	0.000030	0.00095	0.00096	0.00063	0.00024	2.0	0.011	0.0048	0.0066	0.0000034	0.019	1.2	0.00052	1.9	0.0000024	0.062	0.057	5.8	0.0000096	0.0036	0.00024	0.0015	0.000096	0.00034	0.000048
15-Jun-10	26	500	450	7.9	180				8.6																																							
22-Jun-10	27	500	430	8.1	172	#N/A	0.79	27	12	0.22	0.00	34	0.026	0.0018	0.0014	0.036	0.0000043	0.0000022	0.022	0.000010	11	0.000043	0.000021	0.00092	0.00043	0.0000077	0.00022	1.5	0.0071	0.0043	0.0050	0.000065	0.018	0.92	0.00047	1.3	0.0000022	0.056	0.045	5.6	0.0000077	0.0022	0.00022	0.0011	0.00013	0.00030	0.000043
29-Jun-10	28	500	440	7.8	169				9.7																																							
6-Jul-10	29	500	470	7.9	164	#N/A	1.1	30	8.5	0.24	0.00	39	0.027	0.0016	0.0014	0.041	0.0000047	0.0000024	0.024	0.0000066	13	0.000047	0.000018	0.00087	0.00047	0.000024	0.00024	1.6	0.0078	0.0047	0.0039	0.00011	0.019	0.92	0.00047	1.4	0.0000024	0.061	0.047	4.7	0.0000071	0.0022	0.00024	0.0011	0.00014	0.00038	0.000047
13-Jul-10	30	500	460	7.8	162				5.1																																							
20-Jul-10	31	500	465	7.9	158	#N/A	1.7	31	8.4	1.4	0.00	35	0.023	0.0014	0.0013	0.045	0.0000047	0.0000023	0.023	0.000012	12	0.000047	0.000020	0.00095	0.00093	0.000017	0.00023	1.3	0.0075	0.0047	0.0033	0.000079	0.015	0.74	0.00048	1.2	0.0000023	0.047	0.046	4.7	0.0000074	0.0023	0.00023	0.0011	0.000093	0.00037	0.000047
27-Jul-10	32	500	440	7.7	157				9.2																																							
3-Aug-10	33	500	440	8.0	155	#N/A	1.4	29	7.0	0.22	0.00	34	0.025	0.0013	0.0013	0.048	0.0000044	0.0000022	0.022	0.0000057	11	0.000044	0.000013	0.00055	0.00044	0.0000088	0.00022	1.4	0.0069	0.0088	0.0031	0.000053	0.018	0.77	0.00048	1.3	0.0000022	0.057	0.043	4.4	0.0000066	0.0023	0.00022	0.0011	0.000088	0.00031	0.000044
10-Aug-10	34	500	435	7.8	152				10																																							
17-Aug-10	35	500	430	8.0	149	#N/A	1.2	27	6.5	0.47	0.00	31	0.029	0.0013	0.0013	0.045	0.0000043	0.0000022	0.022	0.0000095	10	0.000043	0.000010	0.00067	0.00043	0.0000052	0.00022	1.3	0.0058	0.0043	0.0029	0.000052	0.017	0.74	0.00051	1.1	0.0000022	0.069	0.040	4.3	0.0000077	0.0020	0.00022	0.00089	0.000086	0.00013	0.000043
24-Aug-10	36	500	485	7.9	156				19																																							
31-Aug-10	37	500	500	8.0	137	#N/A	2.9	35	10	0.25	0.00	36	0.025	0.0014	0.0014	0.058	0.0000050	0.0000025	0.025	0.0000085	12	0.000050	0.000020	0.00054	0.00050	0.000042	0.00025	1.4	0.0086	0.0050	0.0032	0.000075	0.018	0.75	0.00066	1.3	0.0000025	0.050	0.049	5.0	0.000011	0.0029	0.00025	0.00092	0.00010	0.00030	0.000050
7-Sep-10	38	500	450	7.6	155				9.0																																							
14-Sep-10	39	500	435	7.7	135	#N/A	1.4	28	7.8	0.22	0.00	32	0.025	0.0010	0.0012	0.048	0.0000044	0.0000022	0.022	0.00014	11	0.000044	0.000016	0.0012	0.0022	0.0000087	0.00022	1.3	0.0063	0.0044	0.0028	0.000061	0.018	0.64	0.00048	1.1	0.0000022	0.061	0.039	4.4	0.0000087	0.0024	0.00039	0.00094	0.00017	0.014	0.000044
21-Sep-10	40	500	465	7.8	133				9.3																																							
28-Sep-10	41	500	425	7.9	154	#N/A	1.1	28	10	0.34	0.00	32	0.028	0.0012	0.0016	0.053	0.0000043	0.0000021	0.021	0.0000072	10	0.000043	0.000014	0.00054	0.0013	0.000020	0.00021	1.4	0.0067	0.0043	0.0030	0.000077	0.018	0.74	0.00051	1.2	0.0000021	0.064	0.039	4.3	0.0000077	0.0025	0.00021	0.00099	0.00013	0.00030	0.000043
5-Oct-10	42	500	395	7.7	148				9.9																																							
12-Oct-10	43	500	490	7.9	167	#N/A	1.4	36	11	0.25	0.00	41	0.031	0.0012	0.0014	0.079	0.0000049	0.0000025	0.025	0.0000074	14	0.000049	0.000014	0.00064	0.00049	0.0000074	0.00025	1.7	0.010	0.0049	0.0034	0.000074	0.021	0.82	0.00060	1.5	0.0000025	0.059	0.048	4.9	0.0000093	0.0028	0.00025	0.0013	0.00015	0.00029	0.000049
19-Oct-10	44	500	415	7.7	155				9.1																																							
26-Oct-10	45	500	485	7.8	147	#N/A	1.3	32	9.2	0.24	0.00	35	0.028	0.00089	0.0012	0.073	0.0000049	0.0000024	0.024	0.0000039	12	0.000049	0.000020	0.00042	0.00049	0.000014	0.00024	1.4	0.0081	0.0049	0.0029	0.000063	0.020	0.63	0.00088	1.2	0.0000024	0.049	0.039	4.9	0.0000092	0.0025	0.00024	0.00089	0.000097	0.00019	0.000049
2-Nov-10	46	500	440	7.8	153																																										
9-Nov-10	47	500	485	7.9	177																																										
16-Nov-10	48	500	385	7.9	139																																										
23-Nov-10	49	500	515	7.7	151	#N/A	1.5	35	9.8	0.26	0.00	37	0.029	0.00096	0.0012	0.093	0.0000052	0.0000026	0.026	0.000018	12	0.000052	0.000018	0.00068	0.00052	0.000035	0.00026	1.6	0.0098	0.0052	0.0044	0.00013	0.022	0.69	0.00050	1.3	0.0000026	0.046	0.043	5.2	0.0000077	0.0040	0.00026	0.0012	0.00010	0.0027	0.000052
30-Nov-10	50	500	445	7.7	143																																										
7-Dec-10	51	500	415	7.7	146																																										
14-Dec-10	52	500	425	7.6	143																																										
21-Dec-10	53	500	395	7.7	145	#N/A	2.2	25	7.9	0.20	0.00	26	0.021	0.00067	0.00097	0.073	0.0000040	0.0000020	0.020	0.0000047	8.6	0.000040	0.000013	0.00047	0.00040	0.0000075	0.00020	1.1	0.0068	0.0040	0.0031	0.000055	0.018	0.53	0.00034	0.92	0.0000020	0.032	0.030	4.0	0.0000055	0.0025	0.00020	0.00078	0.000079	0.00028	0.000040
28-Dec-10	54	500	480	7.5	124																																										
4-Jan-11	55	500	435	7.7	132																																										
11-Jan-11	56	500	410	7.6	135																																										
18-Jan-11	57	500	410	7.8	144	#N/A	1.4	24	7.8	0.21	0.00	29	0.025	0.00071	0.0010	0.071	0.0000041	0.0000021	0.021	0.0000057	9.7	0.000041	0.000022	0.00050	0.00082	0.0000094	0.00021	1.2	0.0080	0.0041	0.0031	0.000070	0.016	0.48	0.00039	0.96	0.0000021	0.037	0.030	4.1	0.0000057	0.0024	0.00021	0.010	0.000082	0.00025	0.000041
25-Jan-11	58	500	390	7.6	136																																										
1-Feb-11	59	500	435	7.8	138																																										
8-Feb-11	60	500	430	7.8	133																																										
15-Feb-11	61	500	400	7.8	137	#N/A	1.2	24	4.8	0.72	0.00	24	0.021	0.00058	0.00089	0.065	0.0000040	0.0000020	0.020	0.0000064	7.9	0.000040	0.000018	0.00047	0.0012	0.0000052	0.00020	1.1	0.0071	0.0040	0.0023	0.000068	0.016	0.43	0.00038	0.80	0.0000020	0.028	0.026	4.0	0.0000068	0.0025	0.00020	0.00072	0.00016	0.00020	0.000040
22-Feb-11	62	500	465	7.7	150																																										
1-Mar-11	63	500	445	7.9	151																																										
8-Mar-11	64	500	435	7.7	146																																										
15-Mar-11	65	500	425	7.8	144	#N/A	1.2	26	5.1	0.21	0.00	31	0.022	0.00060	0.00091	0.074	0.0000043	0.0000021	0.021	0.000011	10	0.000043	0.000017	0.00065	0.00043	0.0000098	0.00021	1.3	0.0082	0.0043	0.0022	0.000064	0.019	0.46	0.00036	1.0	0.0000021	0.030	0.028	4.3	0.0000043	0.0025	0.00021	0.00087	0.00013	0.00030	0.000043
22-Mar-11	66	500	450	7.7	137																																										
29-Mar-11	67	500	465	7.9	149																																										
5-Apr-11	68	500	430	7.6	147																																										
12-Apr-11	69	500	435	7.7	139	#N/A	1.7	26	7.0	0.61	0.00	29	0.022	0.00054	0.00086	0.076	0.0000044	0.0000022	0.022	0.0000061	9.2	0.000044	0.000013	0.0012	0.00044	0.000015	0.00022	1.3	0.0092	0.0044	0.0023	0.000048	0.018	0.44	0.00035	0.92	0.0000022	0.035	0.028	4.4	0.0000039	0.0022	0.00022	0.00085	0.00017	0.00030	0.000044
19-Apr-11	70	500	451	7.6	141																																										
26-Apr-11	71	500	410	7.9	145																																										
3-May-11	72	500	450	7.7	141																																										
10-May-11	73	500	435	7.8	142	#N/A	1.5	28	7.4	0.22	0.00	29	0.022	0.00053	0.00089	0.073	0.0000044	0.0000012	0.022	0.0000022	9.3	0.000044	0.0000096	0.00067	0.00044	0.000076	0.00022	1.3	0.0077	0.0044	0.0024	0.000052	0.016	0.38	0.00045	0.96	0.0000022	0.030	0.026	4.4	0.0000052	0.0022	0.00022	0.00079	0.00013	0.00030	0.000044
17-May-11	74	500	415	7.9	144																																										
24-May-11	75	500	395	7.8	140																																										
31-May-11	76	500	335	7.7	143																																										
7-Jun-11	77	500	380	7.9	147	#N/A	1.0	23	6.5	0.23	0.00	27	0.021	0.00048	0.00085	0.066	0.0000038	0.0000019	0.019	0.000022	8.6	0.00011	0.000015	0.00075	0.0019	0.00027	0.00019	1.3	0.0067	0.0038	0.0026	0.000046	0.015	0.37	0.00031	0.89	0.0000019	0.034	0.022	3.8	0.0000046	0.0018	0.00019	0.00084	0.00019	0.00076	0.000038
14-Jun-11	78	500	400	7.8	138																																										
21-Jun-11	79	500	450	8.1	150																																										
28-Jun-11	80	500	415	7.9	150																																										
5-Jul-11	81	500	415	7.8	144	#N/A	1.8	26	8.3	0.21	0.00	29	0.022	0.00048	0.0011	0.074	0.0000042	0.0000021	0.021	0.0000046	9.1	0.000042	0.000037	0.00062	0.00042	0.0000071	0.00021	1.6	0.0076	0.0042	0.0022	0.000062	0.018	0.41	0.00040	0.98	0.0000021	0.029	0.024	4.2	0.0000075	0.0020	0.00021	0.00084	0.00012	0.00025	0.000042
12-Jul-11	82	500	425	7.7	142																																										
19-Jul-11	83	500	430	7.8	146																																										
26-Jul-11	84	500	425	7.8	147																																										
2-Aug-11	85	500	405	7.9	130	#N/A	2.2	23	7.3	0.53	0.045	25	0.020	0.00042	0.00077	0.067	0.0000041	0.0000020	0.020	0.0000085	8.0	0.000041	0.000012	0.00051	0.00041	0.0000041	0.00020	1.3	0.0064	0.0041	0.0023	0.000032	0.017	0.34	0.00030	0.90	0.0000020	0.024	0.020	4.1	0.0000041	0.0020	0.00020	0.00066	0.00016	0.00032	0.000041
9-Aug-11	86	500	440	7.7	141																																										
16-Aug-11	87	500	440	7.9	138																																										
23-Aug-11	88	500	415	7.7	143																																										
30-Aug-11	89	500	435	7.8	141	#N/A	2.7	26	9.1	0.22	0.052	29	0.022	0.00048	0.00085	0.079	0.0000044	0.0000022	0.022	0.0000030	9.1	0.000044	0.000018	0.00045	0.00044	0.0000070	0.00022	1.6	0.0067	0.0044	0.0038	0.000030	0.018	0.38	0.00033	0.94	0.0000022	0.026	0.023	4.4	0.0000074	0.0018	0.00022	0.00091	0.00017	0.00022	0.000044
6-Sep-11	90	500	415	7.6	142																																										
13-Sep-11	91	500	405	7.9	132						

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Leachate Results for T5

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Total CN	WAD CN	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
3-May-11	0	750	495	8.2	572	#N/A	4.0	89	170	7.9	0.060	0.30	0.010	0.010	202	0.12	0.0027	0.0042	0.028	0.000020	0.000010	0.071	0.0028	77	0.00080	0.00090	0.078	0.0060	0.00080	0.0010	2.4	0.024	0.010	0.42	0.00050	0.31	23	0.0034	1.6	0.000010	16	0.27	60	0.00020	0.011	0.0021	0.018	0.0023	0.017	0.000020
10-May-11	1	500	470	7.9	320	#N/A	4.4	90	70	1.7	0.060	0.30	0.010	0.010	113	0.11	0.0027	0.0040	0.026	0.000020	0.000010	0.064	0.00062	42	0.00060	0.00050	0.044	0.0020	0.000090	0.0010	1.7	0.014	0.010	0.20	0.0021	0.16	16	0.00042	1.4	0.000030	6.1	0.17	26	0.00020	0.0024	0.00050	0.0086	0.0022	0.0030	0.000020
17-May-11	2	500	460	8.0	267	#N/A	4.3	89	46	0.50	0.060	0.30	0.010	0.010	99	0.12	0.0024	0.0042	0.039	0.000020	0.000010	0.052	0.00023	37	0.00080	0.00030	0.030	0.0020	0.000030	0.0010	1.7	0.012	0.010	0.12	0.0011	0.15	14	0.00025	1.6	0.000080	4.5	0.15	29	0.00020	0.0045	0.00050	0.0072	0.0024	0.0020	0.000010
24-May-11	3	500	380	7.9	247	#N/A	5.4	76	46	0.30	0.060	0.30	0.010	0.010	95	0.12	0.0025	0.0036	0.055	0.000020	0.000010	0.044	0.00014	36	0.00050	0.00030	0.025	0.0020	0.000020	0.0010	1.6	0.011	0.010	0.100	0.0017	0.16	12	0.00048	1.5	0.000020	2.3	0.15	31	0.00020	0.0047	0.00050	0.0070	0.0022	0.0030	0.000010
31-May-11	4	500	400	8.0	242																																															
7-Jun-11	5	500	430	8.0	225	#N/A	3.3	87	30	0.20	0.060	0.30	0.010	0.010	85	0.11	0.0026	0.0031	0.055	0.000020	0.000010	0.037	0.000091	32	0.00050	0.00020	0.021	0.0020	0.000030	0.0010	1.6	0.012	0.010	0.072	0.0010	0.15	10	0.00032	1.5	0.000010	1.2	0.15	12	0.000040	0.0024	0.00040	0.0060	0.0020	0.0030	0.000020
14-Jun-11	6	500	445	8.1	189																																														
21-Jun-11	7	500	465	8.1	179	#N/A	2.0	80	23	0.20	0.060	0.30	0.010	0.010	76	0.084	0.0021	0.0028	0.063	0.000020	0.000010	0.024	0.000065	28	0.00050	0.00010	0.013	0.0020	0.000020	0.0010	1.5	0.011	0.010	0.044	0.00010	0.078	7.9	0.00015	1.3	0.000010	0.66	0.14	7.8	0.000020	0.029	0.00020	0.0040	0.0018	0.0020	0.000010
28-Jun-11	8	500	490	8.2	193																																														
5-Jul-11	9	500	450	7.9	148	#N/A	4.3	73	11	0.20	0.060	0.30	0.010	0.010	67	0.13	0.0018	0.0028	0.069	0.000020	0.000010	0.018	0.000067	25	0.00050	0.00020	0.011	0.0020	0.000020	0.0010	1.3	0.010	0.010	0.023	0.00050	0.091	6.1	0.00028	1.4	0.000010	0.40	0.12	4.8	0.000020	0.0059	0.00010	0.0027	0.0019	0.0040	0.00020
12-Jul-11	10	500	445	7.8	165																																													
19-Jul-11	11	500	440	7.9	154	#N/A	5.7	74	10	0.50	0.060	0.30	0.010	0.010	72	0.071	0.0021	0.0030	0.090	0.000020	0.000010	0.014	0.000066	27	0.00050	0.00010	0.0073	0.0020	0.000020	0.0010	1.4	0.013	0.010	0.027	0.00080	0.081	5.6	0.00061	1.3	0.000010	0.37	0.13	4.5	0.000020	0.0051	0.00010	0.0026	0.0017	0.0010	0.000010
26-Jul-11	12	500	405	7.9	151																																													
2-Aug-11	13	500	430	7.9	150	#N/A	5.8	69	11	1.6	0.060	0.30	0.010	0.010	67	0.060	0.0028	0.0029	0.090	0.000020	0.000010	0.014	0.000062	25	0.0020	0.00010	0.0068	0.0020	0.000040	0.0010	1.4	0.013	0.010	0.028	0.00010	0.079	5.1	0.00035	1.3	0.000010	0.32	0.13	4.3	0.000020	0.0061	0.00010	0.0024	0.0016	0.0040	0.0011
9-Aug-11	14	500	490	7.9	156																																													
16-Aug-11	15	500	445	7.8	149	#N/A	6.1	71	10	1.5	0.060	0.30	0.010	0.010	68	0.065	0.0039	0.0029	0.10	0.000020	0.000010	0.012	0.000035	25	0.0022	0.00010	0.0064	0.0050	0.000060	0.0010	1.5	0.014	0.010	0.054	0.00010	0.093	4.7	0.000040	1.3	0.000010	0.41	0.13	5.3	0.000020	0.014	0.00020	0.0028	0.0016	0.0010	0.000010
23-Aug-11	16	500	435	7.8	139																																													
30-Aug-11	17	500	435	7.8	153	#N/A	5.1	71	13	1.5	0.060	0.30	0.010	0.010	72	0.064	0.0045	0.0033	0.10	0.000020	0.000010	0.014	0.000044	26	0.0016	0.00010	0.0072	0.0060	0.000030	0.0010	1.5	0.015	0.010	0.090	0.00090	0.088	4.7	0.00027	1.4	0.000010	0.31	0.14	5.4	0.000030	0.0088	0.00020	0.0026	0.0017	0.0020	0.000010
6-Sep-11	18	500	415	8.0	154																																													
13-Sep-11	19	500	420	8.0	142	#N/A	4.5	68	11	1.0	0.060	0.30	0.010	0.010	68	0.050	0.0042	0.0031	0.10	0.000020	0.000010	0.012	0.000045	25	0.0012	0.00010	0.0056	0.0020	0.000030	0.0010	1.5	0.014	0.010	0.084	0.00010	0.066	4.2	0.000040	1.3	0.000010	0.26	0.13	4.3	0.000020	0.0070	0.00010	0.0024	0.0016	0.0010	0.000010
20-Sep-11	20	500	450	7.9	155																																												
27-Sep-11	21	500	445	7.8	149	#N/A	6.7	74	11	0.90	0.060	0.30	0.010	0.010	73	0.050	0.0044	0.0031	0.12	0.000020	0.000010	0.0073	0.000053	27	0.00090	0.000090	0.0053	0.0040	0.000030	0.0010	1.6	0.017	0.010	0.087	0.00010	0.082	4.2	0.00052	1.4	0.000010	0.25	0.13	4.2	0.000020	0.0056	0.00010	0.0025	0.0016	0.0030	0.000010
4-Oct-11	22	500	445	7.9	152																																												
11-Oct-11	23	500	430	7.9	140	#N/A	6.8	72	10	0.80	0.060	0.30	0.010	0.010	73	0.044	0.0045	0.0031	0.13	0.000020	0.000010	0.0096	0.000052	27	0.00050	0.000061	0.0044	0.0030	0.000080	0.0010	1.6	0.016	0.010	0.083	0.00060	0.090	4.1	0.00020	1.4	0.000010	0.26	0.14	3.7	0.000020	0.013	0.00010	0.0021	0.0015	0.0010	0.000010
18-Oct-11	24	500	440	7.9	144																																												
25-Oct-11	25	500	415	7.8	129	#N/A	3.9	65	7.0	0.60	0.060	0.30	0.010	0.010	63	0.056	0.0034	0.0030	0.13	0.000020	0.000010	0.0086	0.000031	23	0.0017	0.000087	0.011	0.0070	0.000020	0.0010	1.4	0.013	0.010	0.070	0.00060	0.091	3.4	0.00010	1.2	0.000010	0.18	0.12	3.2	0.000020	0.012	0.00010	0.0019	0.0015	0.0010	0.000010
1-Nov-11	26	500	430	7.9	131																																												
8-Nov-11	27	500	460	7.8	134	#N/A	5.5	70	7.0	0.70	0.060	0.30	0.010	0.010	67	0.053	0.0036	0.0029	0.14	0.000020	0.000010	0.0063	0.000048	24	0.00050	0.000087	0.0036	0.0030	0.000020	0.0010	1.5	0.019	0.010	0.080	0.00090	0.065	3.1	0.00029	1.3	0.000010	0.23	0.13	2.9	0.000020	0.011	0.00010	0.0019	0.0016	0.0010	0.000010
15-Nov-11	28	500	400	7.8	139																																												
22-Nov-11	29	500	450	7.8	136	#N/A	5.8	74	6.0	0.60	0.060	0.30	0.010	0.010	68	0.070	0.0039	0.0033	0.15	0.000020	0.000010	0.0079	0.000041	25	0.00050	0.000093	0.0093	0.0030	0.000020	0.0010	1.5	0.017	0.010	0.084	0.00070	0.082	3.0	0.000040	1.3	0.000010	0.18	0.12	2.9	0.000020	0.013	0.00010	0.0019	0.0018	0.0010	0.000010
29-Nov-11	30	500	410	7.9	142																																												
6-Dec-11	31	500	455	7.8	134	#N/A	5.5	70	7.0	0.60	0.060	0.30	0.010	0.010	65	0.059	0.0034	0.0027	0.15	0.000020	0.000010	0.0064	0.000051	24	0.00050	0.000058	0.0038	0.0030	0.000020	0.0010	1.4	0.016	0.010	0.086	0.00010	0.074	2.8	0.00022	1.2	0.000080	0.14	0.12	2.8	0.000020	0.0054	0.00020	0.0017	0.0017	0.0030	0.000010
13-Dec-11	32	500	440	7.9	134																																												
20-Dec-11	33	500	460	7.8	137	#N/A	5.5	76	5.0	0.40	0.060	0.30	0.010	0.010	70	0.062	0.0052	0.0032	0.17	0.000020	0.000010	0.0072	0.000041	25	0.00050	0.000073	0.0035	0.0030	0.00053	0.0010	1.5	0.017	0.010	0.085	0.00090	0.078	2.8	0.000040	1.3	0.000010	0.17	0.13	2.9	0.000020	0.0067	0.00020	0.0015	0.0016	0.0010	0.000010
27-Dec-11	34	500	455	7.9	134																																												
3-Jan-12	35	500	375	7.8	127	#N/A	4.9	76	7.0	0.50	0.060	0.30	0.010	0.010	60	0.12	0.0037	0.0029	0.15	0.000020	0.000010	0.0063	0.000042	22	0.00050	0.000075	0.014	0.0030	0.00023	0.0010	1.3	0.015	0.020	0.091	0.0010	0.066	2.5	0.00013	1.2	0.000010	0.19	0.11	2.4	0.000020	0.0081	0.00060	0.0016	0.0021	0.015	0.000010
10-Jan-12	36	500	495	7.8	134																																												
17-Jan-12	37	500	460	7.9	130	#N/A	2.7	82	4.0	0.40	0.060	0.30	0.010	0.010	66	0.045	0.0031	0.0029	0.17	0.000020	0.000010	0.0049	0.000058	24	0.00050	0.00013	0.0086	0.0030	0.0021	0.0010	1.4	0.016	0.010	0.093	0.00010	0.079	2.3	0.000070	1.1	0.000010	0.16	0.11	2.4	0.000020	0.0041	0.00010	0.0014	0.0015	0.0030	0.000010
24-Jan-12	38	500	500	7.9	130																																												
31-Jan-12	39	500	490	7.8	133	#N/A	3.9	82	4.0	0.40	0.060	0.30	0.010	0.010	65	0.054	0.0040	0.0030	0.18	0.000020	0.000010	0.0045	0.000025	24	0.00050	0.000059	0.0028	0.0030	0.00012	0.0010	1.4	0.017	0.010	0.092	0.00050	0.089	2.6	0.00010	1.2	0.000010	0.16	0.11	2.4	0.000020	0.011	0.00010	0.0014	0.0017	0.0010	0.000010
7-Feb-12	40	500	420	7.9	136																																												
14-Feb-12	41	500	435	7.9	118	#N/A	5.2	68	7.0	0.40	0.060	0.30	0.010	0.010	58	0.039	0.0031	0.0030	0.17	0.000020	0.000010	0.0039	0.000028	21	0.00050	0.00015	0.0024	0.0030	0.000020	0.0010	1.2	0.013	0.010	0.081	0.00050	0.074	2.3	0.00023	1.3	0.000010	0.14	0.10	1.9	0.000020	0.0034	0.00010	0.0013	0.0014	0.0010	0.000010
21-Feb-12	42	500	400	7.9	137																																												
28-Feb-12	43	500	445	7.8	132	#N/A	4.3	74	5.0	0.40	0.060	0.30	0.010	0.010	63	0.048	0.0034	0.0026	0.18	0.000020	0.000010	0.0038	0.00012	23	0.00050	0.00010	0.0029	0.0040	0.00039	0.0010	1.4	0.016	0.010	0.095	0.00010	0.072	2.3	0.00013	1.4	0.000010	0.19	0.11	2.1	0.000020	0.0024	0.00020	0.0014	0.0015	0.011	0.000010
6-Mar-12	44	500	455	7.9	133																																												
13-Mar-12	45	500	445	7.8	120	#N/A	3.8	66	4.0	0.40	0.060	0.30	0.020	0.010	60	0.0055	0.0031	0.0066	0.18	0.000020	0.000010	0.015	0.000017	22	0.00050	0.00033	0.0031	0.0080	0.000040	0.0010	1.3	0.014	0.010	0.10	0.00090	0.078	2.2	0.00013	1.2	0.000010	0.14	0.11	2.0	0.000020	0.0053	0.00010	0.0012	0.0014	0.0030	0.000010
20-Mar-12	46	500	410	7.9	138																																												
27-Mar-12	47	500	430	7.8	136																																												
3-Apr-12	48	500	405	7.9	132																																												
10-Apr-12	49	500	395	7.9	125	#N/A	2.9	67	6.0	0.40	0.060	0.30	0.010	0.010	59	0.064	0.0029	0.0026	0.18	0.000020	0.000010	0.0040	0.000039	22	0.00050	0.000043	0.0027	0.0030	0.00040	0.0010	1.3	0.012	0.050	0.25	0.00040	0.067	2.1	0.00020	1.3	0.000010	0.17	0.10	2.2	0.000020	0.0088	0.00020	0.0012	0.0016	0.0050	0.000010
17-Apr-12	50	500	390	7.9	133																																												
24-Apr-12	51	500	400	7.9	125																																												
1-May-12	52	500	460	7.9	132																																												
8-May-12	53	500	430	7.9	124	#N/A	3.0	66	7.0	0.40	0.060	0.30	0.010	0.010	59	0.052	0.0035	0.0073	0.19	0.000020	0.000010	0.0032	0.000011	22	0.00050	0.000036	0.0023	0.011	0.00021	0.0010	1.2	0.0083	0.010	0.32	0.00030	0.081	2.2	0.00022	1.2	0.000020	0.14	0.098	1.9	0.000020	0.0051	0.00010	0.0011	0.0016	0.0040	0.000010
15-May-12	54	500	425	8.0	122																																												
22-May-12	55	500	480	7.8	119																																												
29-May-12	56	500	440	7.9	130																																												
5-Jun-12	57	500	405	7.8	121	#N/A	3.5	66	4.0	0.40	0.060	0.30	0.010	0.010	59	0.079	0.0022	0.0024	0.20	0.000020	0.000010	0.0048	0.0000090	22	0.00050	0.000069	0.0046	0.0030	0.000020	0.0010	1.2	0.0063	0.010	0.40	0.00010	0.076	1.9	0.00022	1.1	0.000010	0.16	0.098	1.9	0.000020	0.0022	0.00030	0.0013	0.0019	0.0020	0.000010
12-Jun-12	58	500	410	7.9	120																																												
19-Jun-12	59	500	440	7.8	124																																												
26-Jun-12	60	500	405	7.9	118																																												
3-Jul-12	61	500	440	7.8	123	#N/A	8.0	70	4.0	0.30	0.060	0.30	0.010	0.010	56	0.080	0.0023	0.0025	0.21	0.000020	0.000010	0.0030	0.000070	21	0.00050	0.000032	0.0022	0.0050	0.000030	0.0010	1.1	0.0054	0.010	0.52	0.00010	0.080	1.9	0.00010	1.2	0.000010	0.15	0.091	1.8	0.000020	0.0018	0.00030	0.0012	0.0018	0.0020	0.000010
10-Jul-12	62	500	395	7.9	129																																												
17-Jul-12	63	500	450	7.8	114																																												
24-Jul-12	64	500	465	7.8	119																																												
31-Jul-12	65	500	440	7.9	112	#N/A	2.7	64	2.0	0.40	0.060	0.30	0.010	0.010	54	0.11	0.0021	0.0026	0.19	0.000020	0.000010	0.0036	0.000023	20	0.00050	0.000078	0.0039	0.0030	0.000030	0.0010	1.2	0.0039	0.010	0.28	0.00020	0.088	1.9	0.000080	1.7	0.000010	0.14	0.090	1.6	0.000020	0.0010	0.00020	0.00095	0.0018	0.0050	0.000010
7-Aug-12	66	500	440	7.9	109																																												
14-Aug-12	67	500	430	7.7	105																																												
21-Aug-12	68	500	440	7.7	109																																												
28-Aug-12	69	500	430	7.8	107	#N/A	3.9	60	4.0	0.30	0.060	0.30	0.010	0.010	48	0.11	0.0021	0.0044	0.19	0.000020	0.000020	0.0027	0.000018	18	0.00050	0.000083	0.0041	0.0030	0.000020	0.0010	1.0	0.0031	0.020	0.20	0.00020	0.060	1.6	0.00016	0.98	0.000010	0.21	0.081	1.3	0.000020	0.0012	0.00020	0.00083	0.0016	0.0020	0.000020
4-Sep-12	70	500	465	7.8	104																																												
11-Sep-12	71	500	430	7.8	102																																												
18-Sep-12	72	500	425	7.8	112																																												
25-Sep-12	73	500	460	7.8	105	#N/A	3.2	66	4.0	0.30	0.060	0.30	0.020	0.010	54	0.078	0.00070	0.0018	0.22	0.000020	0.000010	0.0018	0.0012	19	0.00050	0.00048	0.00050	0.0030	0.000050	0.0010	1.4	0.0021	0.030	0.19	0.0014	0.079	1.6	0.000040	1.3	0.000010	0.15	0.082	2.1	0.000020	0.0037	0.00010	0.00098	0.0015	0.023	0.000010
2-Oct-12	74	500	425	7.7	110																																												
9-Oct-12	75	500	425	7.7	108																																												
16-Oct-12	76	500	470	7.8	109																																												
23-Oct-12	77	500	380	7.7	107	#N/A	3.0	63	5.0	0.30	0.060	0.30	0.010	0.010	50	0.064	0.0013	0.0020	0.21	0.000020	0.000010	0.0034	0.000021	18	0.00050	0.000028	0.0016	0.0030	0.000020	0.0010	1.1	0.0026	0.010	0.26	0.00050	0.067	1.5	0.000070	1.0	0.000010	0.12	0.079	1.4	0.000020	0.0011	0.00010	0.00086	0.0013	0.0020	0.000010
30-Oct-12	78	500	435	7.7	120																																												
6-Nov-12	79	500	450	7.7	125																																												
13-Nov-12	80	500	445	7.6	130																																												
20-Nov-12	81	500	460	7.8	95	#N/A	6.7	54	3.0	0.010	0.010	0.20	0.060	0.30	46	0.050	0.0015	0.0025	0.21	0.000020	0.000010	0.0019	0.000021	17	0.00050	0.00012	0.0019	0.0030	0.000020	0.0010	1.0	0.0032	0.010	0.42	0.00020	0.078	1.4	0.000090	0.87	0.000020	0.10	0.071	1.3	0.000020	0.0024	0.00020	0.00077	0.0013	0.0020	0.000010
27-Nov-12	82	500	465	7.6	140																																												
4-Dec-12	83	500	375	7.8	96																																												
Cell Terminated																																																		

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for T5

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Total CN	WAD CN	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
3-May-11	0	750	495	8.2	572	#N/A	2.2	49	94	4.3	0.033	0.17	0.0055	0.0055	111	0.063	0.0015	0.0023	0.016	0.000011	0.0000055	0.039	0.0015	42	0.00044	0.00050	0.043	0.0033	0.00044	0.00055	1.3	0.013	0.0055	0.23	0.00028	0.17	13	0.0018	0.85	0.0000055	8.9	0.15	33	0.00011	0.0061	0.0012	0.0098	0.00013	0.0094	0.0000011
10-May-11	1	500	470	7.9	320	#N/A	2.3	47	37	0.89	0.031	0.16	0.0052	0.0052	59	0.059	0.0014	0.0021	0.013	0.000010	0.0000052	0.033	0.00033	22	0.00031	0.00026	0.023	0.0010	0.000047	0.00052	0.89	0.0073	0.0052	0.11	0.0011	0.084	8.3	0.00022	0.75	0.000016	3.2	0.087	13	0.00010	0.0013	0.00026	0.0045	0.0011	0.0016	0.000010
17-May-11	2	500	460	8.0	267	#N/A	2.2	46	24	0.26	0.031	0.15	0.0051	0.0051	51	0.063	0.0012	0.0021	0.020	0.000010	0.0000051	0.026	0.00012	19	0.00041	0.00015	0.015	0.0010	0.000015	0.00051	0.87	0.0059	0.0051	0.063	0.00056	0.077	7.3	0.00013	0.83	0.000041	2.3	0.078	15	0.00010	0.0023	0.00026	0.0037	0.0012	0.0010	0.0000051
24-May-11	3	500	380	7.9	247	#N/A	2.3	32	19	0.13	0.025	0.13	0.0042	0.0042	40	0.049	0.0011	0.0015	0.023	0.0000084	0.0000042	0.018	0.000060	15	0.00021	0.00013	0.011	0.00084	0.0000084	0.00042	0.67	0.0046	0.0042	0.042	0.00072	0.068	5.2	0.00020	0.61	0.0000084	0.95	0.065	13	0.000084	0.0020	0.00021	0.0029	0.00091	0.0013	0.0000042
31-May-11	4	500	400	8.0	242																																															
7-Jun-11	5	500	430	8.0	225	#N/A	1.6	41	14	0.096	0.029	0.14	0.0048	0.0048	41	0.051	0.0012	0.0015	0.026	0.0000096	0.0000048	0.018	0.000043	15	0.00024	0.000096	0.010	0.00096	0.000014	0.00048	0.75	0.0056	0.0048	0.034	0.00048	0.070	4.9	0.00015	0.72	0.0000048	0.57	0.070	5.8	0.000019	0.0012	0.00019	0.0029	0.00096	0.0014	0.0000096
14-Jun-11	6	500	445	8.1	189																																													
21-Jun-11	7	500	465	8.1	179	#N/A	1.1	42	12	0.10	0.031	0.16	0.0052	0.0052	39	0.043	0.0011	0.0014	0.032	0.000010	0.0000052	0.012	0.000034	15	0.00026	0.000052	0.0065	0.0010	0.000010	0.00052	0.76	0.0055	0.0052	0.023	0.000052	0.040	4.1	0.000078	0.68	0.0000052	0.34	0.070	4.0	0.000010	0.015	0.00010	0.0021	0.00090	0.0010	0.0000052
28-Jun-11	8	500	490	8.2	193																																													
5-Jul-11	9	500	450	7.9	148	#N/A	2.2	36	5.5	0.10	0.030	0.15	0.0050	0.0050	33	0.067	0.00090	0.0014	0.034	0.000010	0.0000050	0.0090	0.000034	12	0.00025	0.00010	0.0057	0.0010	0.000010	0.00050	0.65	0.0051	0.0050	0.011	0.00025	0.046	3.0	0.00014	0.70	0.0000050	0.20	0.062	2.4	0.000010	0.0030	0.000050	0.0013	0.00096	0.0020	0.00010
12-Jul-11	10	500	445	7.8	165																																													
19-Jul-11	11	500	440	7.9	154	#N/A	2.8	36	4.9	0.24	0.029	0.15	0.0049	0.0049	35	0.035	0.0010	0.0015	0.044	0.0000098	0.0000049	0.0070	0.000032	13	0.00024	0.000049	0.0036	0.00098	0.0000098	0.00049	0.70	0.0061	0.0049	0.013	0.00039	0.040	2.7	0.00030	0.65	0.0000049	0.18	0.066	2.2	0.0000098	0.0025	0.000049	0.0013	0.00083	0.00049	0.0000049
26-Jul-11	12	500	405	7.9	151																																													
2-Aug-11	13	500	430	7.9	150	#N/A	2.7	33	5.3	0.76	0.029	0.14	0.0048	0.0048	32	0.029	0.0013	0.0014	0.043	0.0000096	0.0000048	0.0067	0.000030	12	0.00096	0.000048	0.0032	0.00096	0.000019	0.00048	0.65	0.0062	0.0048	0.013	0.000048	0.038	2.4	0.00017	0.63	0.0000048	0.15	0.061	2.0	0.0000096	0.0029	0.000048	0.0011	0.00075	0.0019	0.00054
9-Aug-11	14	500	490	7.9	156																																													
16-Aug-11	15	500	445	7.8	149	#N/A	3.0	35	4.9	0.74	0.030	0.15	0.0049	0.0049	34	0.032	0.0019	0.0014	0.050	0.0000099	0.0000049	0.0058	0.000017	12	0.0011	0.000049	0.0032	0.0025	0.000030	0.00049	0.72	0.0070	0.0049	0.027	0.000049	0.046	2.3	0.000020	0.62	0.0000049	0.20	0.064	2.6	0.0000099	0.0068	0.000099	0.0014	0.00077	0.00049	0.0000049
23-Aug-11	16	500	435	7.8	139																																													
30-Aug-11	17	500	435	7.8	153	#N/A	2.4	34	6.3	0.73	0.029	0.15	0.0048	0.0048	35	0.031	0.0022	0.0016	0.050	0.0000097	0.0000048	0.0066	0.000021	13	0.00077	0.000048	0.0035	0.0029	0.000015	0.00048	0.74	0.0073	0.0048	0.044	0.00044	0.043	2.3	0.00013	0.66	0.0000048	0.15	0.067	2.6	0.000015	0.0042	0.000097	0.0013	0.00082	0.00097	0.0000048
6-Sep-11	18	500	415	8.0	154																																													
13-Sep-11	19	500	420	8.0	142	#N/A	2.1	32	5.1	0.47	0.028	0.14	0.0047	0.0047	32	0.023	0.0020	0.0014	0.048	0.0000093	0.0000047	0.0054	0.000021	12	0.00056	0.000047	0.0026	0.00093	0.000014	0.00047	0.69	0.0063	0.0047	0.039	0.000047	0.031	2.0	0.000019	0.60	0.0000047	0.12	0.060	2.0	0.0000093	0.0032	0.000047	0.0011	0.00073	0.00047	0.0000047
20-Sep-11	20	500	450	7.9	155																																													
27-Sep-11	21	500	445	7.8	149	#N/A	3.3	37	5.4	0.45	0.030	0.15	0.0049	0.0049	36	0.025	0.0022	0.0015	0.059	0.0000099	0.0000049	0.0036	0.000026	13	0.00045	0.000045	0.0026	0.0020	0.000015	0.00049	0.78	0.0083	0.0049	0.043	0.000049	0.041	2.1	0.00026	0.70	0.0000049	0.12	0.066	2.1	0.0000099	0.0028	0.000049	0.0012	0.00080	0.0015	0.0000049
4-Oct-11	22	500	445	7.9	152																																													
11-Oct-11	23	500	430	7.9	140	#N/A	3.3	34	4.8	0.38	0.029	0.14	0.0048	0.0048	35	0.021	0.0022	0.0015	0.061	0.0000096	0.0000048	0.0046	0.000025	13	0.00024	0.000029	0.0021	0.0014	0.000038	0.00048	0.77	0.0077	0.0048	0.040	0.00029	0.043	1.9	0.000096	0.69	0.0000048	0.12	0.067	1.8	0.0000096	0.0064	0.000048	0.00098	0.00073	0.00048	0.0000048
18-Oct-11	24	500	440	7.9	144																																													
25-Oct-11	25	500	415	7.8	129	#N/A	1.8	30	3.2	0.28	0.028	0.14	0.0046	0.0046	29	0.026	0.0016	0.0014	0.058	0.0000092	0.0000046	0.0040	0.000014	11	0.00078	0.000040	0.0052	0.0032	0.0000092	0.00046	0.64	0.0062	0.0046	0.032	0.00028	0.042	1.6	0.000046	0.55	0.0000046	0.083	0.056	1.5	0.0000092	0.0055	0.000046	0.00086	0.00071	0.00046	0.0000046
1-Nov-11	26	500	430	7.9	131																																													
8-Nov-11	27	500	460	7.8	134	#N/A	2.8	36	3.6	0.36	0.031	0.15	0.0051	0.0051	34	0.027	0.0018	0.0015	0.071	0.000010	0.0000051	0.0032	0.000025	12	0.00026	0.000044	0.0018	0.0015	0.000010	0.00051	0.76	0.0095	0.0051	0.041	0.00046	0.033	1.6	0.00015	0.65	0.0000051	0.12	0.064	1.5	0.000010	0.0054	0.000051	0.00097	0.00080	0.00051	0.0000051
15-Nov-11	28	500	400	7.8	139																																													
22-Nov-11	29	500	450	7.8	136	#N/A	2.9	37	3.0	0.30	0.030	0.15	0.0050	0.0050	34	0.035	0.0020	0.0017	0.074	0.000010	0.0000050	0.0040	0.000021	12	0.00025	0.000047	0.0047	0.0015	0.000010	0.00050	0.75	0.0083	0.0050	0.042	0.00035	0.041	1.5	0.000020	0.64	0.0000050	0.090	0.062	1.4	0.000010	0.0067	0.000050	0.00093	0.00089	0.00050	0.0000050
29-Nov-11	30	500	410	7.9	142																																													
6-Dec-11	31	500	455	7.8	134	#N/A	2.8	35	3.5	0.30	0.030	0.15	0.0051	0.0051	33	0.030	0.0017	0.0014	0.074	0.000010	0.0000051	0.0032	0.000026	12	0.00025	0.000029	0.0019	0.0015	0.000010	0.00051	0.73	0.0079	0.0051	0.044	0.000051	0.037	1.4	0.00011	0.61	0.0000040	0.071	0.061	1.4	0.000010	0.0027	0.00010	0.00086	0.00086	0.0015	0.0000051
13-Dec-11	32	500	440	7.9	134																																													
20-Dec-11	33	500	460	7.8	137	#N/A	2.8	39	2.6	0.20	0.031	0.15	0.0051	0.0051	36	0.031	0.0027	0.0016	0.084	0.000010	0.0000051	0.0037	0.000021	13	0.00026	0.000037	0.0018	0.0015	0.00027	0.00051	0.78	0.0084	0.0051	0.044	0.00046	0.040	1.5	0.000020	0.64	0.0000051	0.087	0.064	1.5	0.000010	0.0034	0.00010	0.00079	0.00082	0.00051	0.0000051
27-Dec-11	34	500	455	7.9	134																																													
3-Jan-12	35	500	375	7.8	127	#N/A	2.1	32	2.9	0.21	0.025	0.13	0.0042	0.0042	25	0.051	0.0015	0.0012	0.063	0.0000083	0.0000042	0.0026	0.000018	9.0	0.00021	0.000031	0.0060	0.0013	0.000096	0.00042	0.56	0.0060	0.0083	0.038	0.00042	0.028	1.0	0.000054	0.49	0.0000042	0.079	0.048	1.0	0.0000083	0.0034	0.00025	0.00065	0.00088	0.0063	0.0000042
10-Jan-12	36	500	495	7.8	134																																													
17-Jan-12	37	500	460	7.9	130	#N/A	1.4	42	2.0	0.20	0.031	0.15	0.0051	0.0051	34	0.023	0.0016	0.0015	0.087	0.000010	0.0000051	0.0025	0.000030	12	0.00026	0.000064	0.0044	0.0015	0.0011	0.00051	0.70	0.0084	0.0051	0.048	0.000051	0.040	1.2	0.000036	0.57	0.0000051	0.082	0.057	1.2	0.000010	0.0021	0.000051	0.00070	0.00077	0.0015	0.0000051
24-Jan-12	38	500	500	7.9	130																																													
31-Jan-12	39	500	490	7.8	133	#N/A	2.1	45	2.2	0.22	0.033	0.16	0.0054	0.0054	35	0.029	0.0022	0.0016	0.100	0.000011	0.0000054	0.0025	0.000014	13	0.00027	0.000032	0.0015	0.0016	0.000065	0.00054	0.75	0.0090	0.0054	0.050	0.00027	0.048	1.4	0.000054	0.68	0.0000054	0.087	0.062	1.3	0.000011	0.0059	0.000054	0.00075	0.00090	0.00054	0.0000054
7-Feb-12	40	500	420	7.9	136																																													
14-Feb-12	41	500	435	7.9	118	#N/A	2.5	33	3.4	0.19	0.029	0.15	0.0048	0.0048	28	0.019	0.0015	0.0015	0.080	0.0000097	0.0000048	0.0019	0.000014	10	0.00024	0.000072	0.0012	0.0015	0.0000097	0.00048	0.60	0.0064	0.0048	0.039	0.00024	0.036	1.1	0.00011	0.62	0.0000048	0.068	0.050	0.93	0.0000097	0.0016	0.000048	0.00063	0.00067	0.00048	0.0000048
21-Feb-12	42	500	400	7.9	137																																													
28-Feb-12	43	500	445	7.8	132	#N/A	2.1	36	2.5	0.20	0.030	0.15	0.0049	0.0049	31	0.023	0.0017	0.0013	0.090	0.0000099	0.0000049	0.0019	0.000058	11	0.00025	0.000049	0.0014	0.0020	0.00019	0.00049	0.69	0.0078	0.0049	0.047	0.000049	0.036	1.1	0.000064	0.68	0.0000049	0.094	0.056	1.0	0.0000099	0.0012	0.000099	0.00068	0.00075	0.0054	0.0000049
6-Mar-12	44	500	455	7.9	133																																													
13-Mar-12	45	500	445	7.8	120	#N/A	1.9	33	2.0	0.20	0.030	0.15	0.0099	0.0049	30	0.0027	0.0015	0.0033	0.089	0.0000099	0.0000049	0.0072	0.0000084	11	0.00025	0.00017	0.0015	0.0040	0.000020	0.00049	0.63	0.0067	0.0049	0.050	0.00045	0.039	1.1	0.000064	0.60	0.0000049	0.069	0.053	0.99	0.0000099	0.0026	0.000049	0.00059	0.00067	0.0015	0.0000049
20-Mar-12	46	500	410	7.9	138																																													
27-Mar-12	47	500	430	7.8	136																																												
3-Apr-12	48	500	405	7.9	132																																												
10-Apr-12	49	500	395	7.9	125	#N/A	1.3	29	2.6	0.18	0.026	0.13	0.0044	0.0044	26	0.028	0.0013	0.0011	0.081	0.0000088	0.0000044	0.0018	0.000017	9.5	0.00022	0.000019	0.0012	0.0013	0.00018	0.00044	0.55	0.0054	0.022	0.11	0.00018	0.029	0.94	0.000088	0.57	0.0000044	0.075	0.044	0.94	0.0000088	0.0038	0.000088	0.00052	0.00069	0.0022	0.0000044
17-Apr-12	50	500	390	7.9	133																																													
24-Apr-12	51	500	400	7.9	125																																												
1-May-12	52	500	460	7.9	132																																												
8-May-12	53	500	430	7.9	124	#N/A	1.4	31	3.3	0.19	0.029	0.14	0.0048	0.0048	28	0.025	0.0017	0.0035	0.089	0.0000096	0.0000048	0.0015	0.0000053	10	0.00024	0.000017	0.0011	0.0053	0.00010	0.00048	0.58	0.0040	0.0048	0.15	0.00014	0.039	1.0	0.00011	0.56	0.0000096	0.067	0.047	0.89	0.0000096	0.0025	0.000048	0.00052	0.00075	0.0019	0.0000048
15-May-12	54	500	425	8.0	122																																												
22-May-12	55	500	480	7.8	119																																											
29-May-12	56	500	440	7.9	130																																											
5-Jun-12	57	500	405	7.8	121	#N/A	1.6	30	1.8	0.18	0.027	0.14	0.0045	0.0045	27	0.036	0.00099	0.0011	0.091	0.0000090	0.0000045	0.0022	0.0000041	9.8	0.00023	0.000031	0.0021	0.0014	0.0000090	0.00045	0.54	0.0028	0.0045	0.18	0.000045	0.034	0.87	0.000099	0.50	0.0000045	0.072	0.044	0.87	0.0000090	0.00099	0.00014	0.00056	0.00083	0.00090	0.0000045
12-Jun-12	58	500	410	7.9	120																																													
19-Jun-12	59	500	440	7.8	124																																												
26-Jun-12	60	500	405	7.9	118																																												
3-Jul-12	61	500	440	7.8	123	#N/A	3.9	34	2.0	0.15	0.029	0.15	0.0049	0.0049	27	0.039	0.0011	0.0012	0.10	0.0000098	0.0000049	0.0015	0.000034	10	0.00024	0.000016	0.0011	0.0024	0.000015	0.00049	0.55	0.0026	0.0049	0.25	0.000049	0.039	0.94	0.000049	0.57	0.0000049	0.073	0.044	0.89	0.0000098	0.00087	0.00015	0.00058	0.00087	0.00098	0.0000049
10-Jul-12	62	500	395	7.9	129																																													
17-Jul-12	63	500	450	7.8	114																																												
24-Jul-12	64	500	465	7.8	119																																												
31-Jul-12	65	500	440	7.9	112	#N/A	1.3	31	0.98	0.20	0.029	0.15	0.0049	0.0049	26	0.053	0.0010	0.0013	0.092	0.0000098	0.0000049	0.0018	0.000011	9.6	0.00024	0.000038	0.0019	0.0015	0.000015	0.00049	0.56	0.0019	0.0049	0.14	0.000098	0.043	0.92	0.000039	0.81	0.0000049	0.068	0.044	0.79	0.0000098	0.00049	0.000098	0.00046	0.00088	0.0024	0.0000049
7-Aug-12	66	500	440	7.9	109																																													
14-Aug-12	67	500	430	7.7	105																																												
21-Aug-12	68	500	440	7.7	109																																												
28-Aug-12	69	500	430	7.8	107	#N/A	1.9	29	1.9	0.14	0.029	0.14	0.0048	0.0048	23	0.054	0.0010	0.0021	0.091	0.0000096	0.0000096	0.0013	0.0000086	8.4	0.00024	0.000040	0.0020	0.0014	0.0000096	0.00048	0.48	0.0015	0.0096	0.095	0.000096	0.029	0.76	0.000076	0.47	0.0000048	0.10	0.039	0.60	0.0000096	0.00055	0.000096	0.00040	0.00077	0.00096	0.0000096
4-Sep-12	70	500	465	7.8	104																																													
11-Sep-12	71	500	430	7.8	102																																												
18-Sep-12	72	500	425	7.8	112																																												
25-Sep-12	73	500	460	7.8	105	#N/A	1.6	34	2.0	0.15	0.031	0.15	0.010	0.0051	27	0.040	0.00036	0.00092	0.11	0.000010	0.0000051	0.00092	0.00063	9.8	0.00026	0.00024	0.00026	0.0015	0.000026	0.00051	0.69	0.0011	0.015	0.098	0.00072	0.040	0.83	0.000020	0.64	0.0000051	0.077	0.042	1.1	0.000010	0.0019	0.000051	0.00050	0.00074	0.012	0.0000051
2-Oct-12	74	500	425	7.7	110																																												
9-Oct-12	75	500	425	7.7	108																																												
16-Oct-12	76	500	470	7.8	109																																												
23-Oct-12	77	500	380	7.7	107	#N/A	1.2	26	2.1	0.13	0.025	0.13	0.0042	0.0042	21	0.027	0.00055	0.00084	0.089	0.0000084	0.0000042	0.0014	0.0000089	7.6	0.00021	0.000012	0.00068	0.0013	0.0000084	0.00042	0.46	0.0011	0.0042	0.11	0.00021	0.028	0.64	0.000030	0.43	0.0000042	0.051	0.033	0.58	0.0000084	0.00046	0.000042	0.00036	0.00055	0.00084	0.0000042
30-Oct-12	78	500	435	7.7	120																																													
6-Nov-12	79	500	450	7.7	125																																												
13-Nov-12	80	500	445	7.6	130																																												
20-Nov-12	81	500	460	7.8	95	#N/A	3.4	28	1.5	0.0051	0.0051	0.10	0.031	0.15	24	0.025	0.00077	0.0013	0.10	0.000010	0.0000051	0.00097	0.000011	8.6	0.00026	0.000059	0.00097	0.0015	0.000010	0.00051	0.53	0.0016	0.0051	0.21	0.00010	0.040	0.70	0.000046	0.44	0.000010	0.051	0.036	0.66	0.000010	0.0012	0.00010	0.00039	0.00067	0.0010	0.0000051
27-Nov-12	82	500	465	7.6	140																																													
4-Dec-12	83	500	375	7.8	96																																												
Median (last 5)				7.8	109	#N/A	1.6	29	1.9	0.14	0.029	0.14	0.0049	0.0049	24	0.040	0.00077	0.0013	0.092	0.0000098	0.0000051	0.0013	0.000011	8.6	0.00024	0.000040	0.00097	0.0015	0.000010	0.00049	0.53	0.0015	0.0051	0.11	0.00010	0.040	0.76	0.000039	0.47	0.0000049	0.068

Leachate Results for T6

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Total CN	WAD CN	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
3-May-11	0	750	455	7.9	500	#N/A	4.2	75	142	6.8	0.060	0.30	0.010	0.010	169	0.12	0.0025	0.0037	0.026	0.000020	0.000010	0.048	0.0014	65	0.00070	0.00070	0.083	0.0030	0.00048	0.0010	1.9	0.022	0.010	0.18	0.00060	0.29	23	0.0024	1.4	0.000010	14	0.23	56	0.00020	0.0096	0.0018	0.013	0.0018	0.0060	0.000010
10-May-11	1	500	485	7.9	277	#N/A	3.6	84	59	1.3	0.060	0.30	0.010	0.010	94	0.13	0.0027	0.0039	0.025	0.000020	0.000020	0.046	0.00043	36	0.00090	0.00040	0.044	0.0020	0.00015	0.0010	1.3	0.013	0.010	0.11	0.0019	0.14	16	0.00038	1.3	0.000030	5.3	0.14	22	0.00020	0.0027	0.00050	0.0068	0.0019	0.0050	0.000020
17-May-11	2	500	470	8.0	222	#N/A	3.7	82	31	0.30	0.060	0.30	0.010	0.010	79	0.16	0.0025	0.0037	0.038	0.000020	0.000010	0.034	0.00019	30	0.0010	0.00020	0.029	0.0020	0.000090	0.0010	1.2	0.0098	0.010	0.075	0.00090	0.11	13	0.00031	1.5	0.000040	3.0	0.13	24	0.00020	0.0048	0.00050	0.0057	0.0021	0.0020	0.000010
24-May-11	3	500	440	7.9	207	#N/A	5.1	74	31	0.20	0.060	0.30	0.010	0.010	79	0.12	0.0026	0.0036	0.052	0.000020	0.000010	0.034	0.00011	30	0.00050	0.00020	0.025	0.0020	0.000030	0.0010	1.2	0.010	0.010	0.064	0.0014	0.099	12	0.00092	1.4	0.000010	1.9	0.13	19	0.00020	0.0039	0.00050	0.0051	0.0019	0.0020	0.000010
31-May-11	4	500	435	8.0	186																																															
7-Jun-11	5	500	320	8.0	193	#N/A	2.8	86	17	0.20	0.060	0.30	0.010	0.010	75	0.093	0.0028	0.0033	0.064	0.000020	0.000020	0.025	0.000090	28	0.00050	0.00010	0.018	0.0020	0.000050	0.0010	1.3	0.010	0.010	0.054	0.00090	0.13	9.9	0.00022	1.5	0.000010	1.0	0.13	8.1	0.000030	0.0023	0.00040	0.0044	0.0018	0.0060	0.000030
14-Jun-11	6	500	415	8.2	174																																														
21-Jun-11	7	500	455	8.1	164	#N/A	2.1	82	14	0.20	0.060	0.30	0.010	0.010	69	0.096	0.0023	0.0052	0.071	0.000020	0.000010	0.019	0.000069	26	0.00050	0.00010	0.016	0.0020	0.000070	0.0010	1.3	0.010	0.020	0.043	0.00060	0.073	8.1	0.00083	1.3	0.000010	0.62	0.13	5.5	0.000020	0.011	0.00090	0.0032	0.0016	0.0060	0.000010
28-Jun-11	8	500	480	8.1	165																																														
5-Jul-11	9	500	440	7.9	137	#N/A	4.2	72	8.0	0.20	0.060	0.30	0.010	0.010	62	0.13	0.0021	0.0030	0.078	0.000020	0.000010	0.014	0.000052	23	0.00050	0.00010	0.0084	0.0020	0.000040	0.0010	1.1	0.010	0.010	0.022	0.00050	0.088	6.2	0.00020	1.3	0.000010	0.35	0.12	3.5	0.000020	0.0041	0.00010	0.0024	0.0017	0.010	0.000010
12-Jul-11	10	500	440	7.9	160																																														
19-Jul-11	11	500	435	7.9	144	#N/A	5.3	71	8.0	0.20	0.060	0.30	0.010	0.010	71	0.083	0.0053	0.0056	0.091	0.000020	0.000010	0.0097	0.000060	26	0.00050	0.00010	0.0075	0.0020	0.000050	0.0010	1.4	0.013	0.010	0.024	0.00090	0.11	5.8	0.0012	1.3	0.000010	0.34	0.13	3.7	0.000020	0.0024	0.00030	0.0022	0.0015	0.0020	0.000010
26-Jul-11	12	500	425	7.9	147																																														
2-Aug-11	13	500	435	7.9	150	#N/A	5.5	72	7.0	2.5	0.060	0.30	0.010	0.010	67	0.051	0.0030	0.0029	0.098	0.000020	0.000010	0.0098	0.000031	25	0.0012	0.00010	0.0065	0.0020	0.000060	0.0010	1.3	0.015	0.010	0.028	0.00010	0.067	5.1	0.00020	1.3	0.000010	0.29	0.13	3.5	0.000020	0.0045	0.00010	0.0022	0.0014	0.0040	0.000080
9-Aug-11	14	500	465	7.9	156																																														
16-Aug-11	15	500	445	7.9	150	#N/A	6.2	72	9.0	2.1	0.060	0.30	0.010	0.010	66	0.060	0.0041	0.0034	0.10	0.000020	0.000010	0.012	0.0000030	24	0.0023	0.00020	0.0072	0.0050	0.000060	0.0020	1.4	0.016	0.010	0.046	0.0012	0.079	4.4	0.00080	1.2	0.000010	0.35	0.12	4.7	0.000020	0.0039	0.00040	0.0024	0.0014	0.0040	0.000010
23-Aug-11	16	500	435	7.8	148																																														
30-Aug-11	17	500	420	7.8	149	#N/A	5.1	69	14	2.1	0.060	0.30	0.010	0.010	69	0.060	0.0049	0.0033	0.11	0.000020	0.000010	0.0089	0.000042	25	0.0013	0.00010	0.0063	0.0060	0.000040	0.0010	1.4	0.017	0.010	0.056	0.00080	0.071	4.3	0.00028	1.3	0.000010	0.27	0.13	4.8	0.000020	0.0017	0.00010	0.0025	0.0015	0.0020	0.000010
6-Sep-11	18	500	440	8.0	150																																														
13-Sep-11	19	500	390	8.0	142	#N/A	4.5	69	10	1.6	0.060	0.30	0.010	0.010	66	0.046	0.0048	0.0032	0.11	0.000020	0.000010	0.0074	0.00043	24	0.0010	0.00010	0.0059	0.0020	0.0073	0.0010	1.4	0.015	0.010	0.048	0.00030	0.045	3.9	0.000040	1.2	0.000010	0.22	0.12	4.2	0.000040	0.00090	0.00010	0.0024	0.0014	0.066	0.000010
20-Sep-11	20	500	465	7.9	157																																														
27-Sep-11	21	500	450	7.8	151	#N/A	6.7	74	8.0	1.3	0.060	0.30	0.010	0.010	71	0.041	0.0048	0.0035	0.12	0.000020	0.000010	0.0043	0.000036	26	0.0012	0.000080	0.0048	0.0040	0.000030	0.0010	1.5	0.020	0.010	0.046	0.00010	0.078	3.9	0.00011	1.4	0.000010	0.20	0.13	3.9	0.000020	0.0012	0.00010	0.0023	0.0015	0.0020	0.000010
4-Oct-11	22	500	440	7.9	153																																														
11-Oct-11	23	500	455	7.9	138	#N/A	7.5	69	9.0	1.0	0.060	0.30	0.010	0.010	70	0.046	0.0047	0.0042	0.12	0.000020	0.000010	0.0057	0.000017	26	0.00080	0.000081	0.0059	0.0020	0.000050	0.0010	1.5	0.020	0.010	0.047	0.00070	0.078	3.6	0.0017	1.4	0.000010	0.20	0.13	3.8	0.000020	0.0012	0.00020	0.0021	0.0014	0.0040	0.000010
18-Oct-11	24	500	445	7.9	143																																														
25-Oct-11	25	500	420	7.8	139	#N/A	4.0	67	8.0	0.90	0.060	0.30	0.010	0.010	70	0.046	0.0045	0.0034	0.13	0.000020	0.000010	0.0066	0.000037	26	0.0012	0.000075	0.0065	0.0040	0.000020	0.0010	1.5	0.019	0.010	0.049	0.00060	0.084	3.4	0.000040	1.2	0.000010	0.17	0.13	4.2	0.000020	0.00092	0.00010	0.0022	0.0014	0.0010	0.000010
1-Nov-11	26	500	440	7.9	142																																														
8-Nov-11	27	500	455	7.8	146	#N/A	5.0	72	10	0.90	0.060	0.30	0.010	0.010	74	0.041	0.0053	0.0031	0.14	0.000020	0.000010	0.0046	0.000041	27	0.00050	0.00011	0.0040	0.0030	0.000020	0.0010	1.6	0.024	0.010	0.072	0.0010	0.085	3.1	0.000040	1.2	0.000010	0.19	0.13	4.2	0.000020	0.00050	0.00020	0.0024	0.0014	0.0020	0.000010
15-Nov-11	28	500	450	7.8	136																																														
22-Nov-11	29	500	450	7.8	135	#N/A	5.0	69	6.0	0.70	0.060	0.30	0.010	0.010	66	0.063	0.0051	0.0032	0.13	0.000020	0.000010	0.0052	0.000043	24	0.00050	0.000080	0.0057	0.0030	0.000020	0.0010	1.4	0.021	0.010	0.12	0.00070	0.081	2.7	0.000040	1.2	0.000010	0.15	0.12	3.4	0.000020	0.0013	0.00040	0.0020	0.0017	0.0020	0.000010
29-Nov-11	30	500	450	7.9	132																																														
6-Dec-11	31	500	460	7.7	131	#N/A	5.5	65	9.0	0.70	0.060	0.30	0.010	0.010	63	0.051	0.0045	0.0032	0.13	0.000020	0.000010	0.0030	0.000073	23	0.00050	0.000080	0.0061	0.0030	0.000020	0.0010	1.3	0.020	0.010	0.28	0.00010	0.079	2.5	0.00010	1.1	0.000020	0.10	0.11	3.6	0.000020	0.00036	0.00020	0.0019	0.0014	0.0030	0.000010
13-Dec-11	32	500	465	7.8	133																																														
20-Dec-11	33	500	470	7.8	131	#N/A	5.6	67	8.0	0.60	0.060	0.30	0.010	0.010	67	0.056	0.0050	0.0029	0.14	0.000020	0.000010	0.0034	0.00015	24	0.00050	0.000084	0.0034	0.0030	0.000020	0.0010	1.4	0.021	0.010	0.56	0.00080	0.070	2.4	0.00015	1.1	0.000010	0.14	0.11	3.8	0.000020	0.00044	0.00030	0.0021	0.0015	0.0020	0.000010
27-Dec-11	34	500	460	7.9	132																																														
3-Jan-12	35	500	430	7.7	125	#N/A	5.5	72	7.0	0.60	0.060	0.30	0.010	0.010	59	0.094	0.0049	0.0031	0.13	0.000020	0.000010	0.0040	0.00013	22	0.00050	0.000085	0.0032	0.19	0.000020	0.0010	1.3	0.017	0.010	0.73	0.0010	0.060	2.4	0.000070	1.1	0.000010	0.15	0.10	3.3	0.000020	0.00095	0.00030	0.0018	0.0018	0.0020	0.000010
10-Jan-12	36	500	460	7.8	136																																														
17-Jan-12	37	500	440	7.9	137	#N/A	2.8	81	6.0	0.50	0.060	0.30	0.010	0.010	68	0.055	0.0044	0.0029	0.15	0.000020	0.000010	0.0079	0.00011	25	0.00050	0.000084	0.0042	0.0030	0.000020	0.0010	1.3	0.016	0.020	0.75	0.00020	0.076	2.2	0.00013	1.1	0.000010	0.14	0.10	3.3	0.000020	0.0018	0.00020	0.0020	0.0015	0.0020	0.000040
24-Jan-12	38	500	485	7.8	129																																														
31-Jan-12	39	500	480	7.8	141	#N/A	3.4	81	5.0	0.60	0.060	0.30	0.010	0.010	67	0.053	0.0052	0.0034	0.16	0.000020	0.000010	0.0030	0.00011	25	0.00050	0.000067	0.0029	0.0030	0.000020	0.0010	1.4	0.014	0.010	0.84	0.00050	0.086	2.5	0.00011	1.2	0.000010	0.14	0.11	3.3	0.000020	0.00066	0.00010	0.0018	0.0015	0.0020	0.000010
7-Feb-12	40	500	410	7.9	139																																														
14-Feb-12	41	500	370	7.9	129	#N/A	5.2	69	13	0.70	0.060	0.30	0.010	0.010	62	0.031	0.0043	0.0033	0.14	0.000020	0.000010	0.0029	0.000087	23	0.00050	0.000050	0.0029	0.0030	0.000020	0.0010	1.3	0.011	0.010	0.96	0.00040	0.081	2.2	0.00020	1.2	0.000010	0.14	0.10	3.2	0.000020	0.0066	0.00010	0.0019	0.0012	0.0010	0.000010
21-Feb-12	42	500	450	7.8	135																																														
28-Feb-12	43	500	450	7.8	133	#N/A	4.1	70	7.0	0.40	0.060	0.30	0.010	0.010	65	0.042	0.0042	0.0029	0.15	0.000020	0.000010	0.0030	0.00017	24	0.00050	0.00010	0.0029	0.0040	0.00015	0.0010	1.4	0.011	0.010	0.90	0.00010	0.073	2.2	0.00017	1.3	0.000010	0.15	0.11	3.0	0.000020	0.0025	0.00020	0.0018	0.0014	0.0030	0.000010
6-Mar-12	44	500	450	7.9	137																																														
13-Mar-12	45	500	425	7.8	130	#N/A	3.8	65	7.0	0.50	0.060	0.30	0.010	0.010	64	0.040	0.0039	0.0052	0.15	0.000020	0.000010	0.0062	0.00010	23	0.00050	0.00020	0.0031	0.0030	0.000020	0.0010	1.3	0.0091	0.010	0.99	0.00060	0.087	2.1	0.00016	1.2	0.000010	0.14	0.10	3.4	0.000020	0.0018	0.00010	0.0018	0.0012	0.0020	0.000010
20-Mar-12	46	500	445	7.8	148																																														
27-Mar-12	47	500	435	7.8	147																																														
3-Apr-12	48	500	430	7.8	136																																														
10-Apr-12	49	500	450	7.9	130	#N/A	2.8	61	10	0.50	0.060	0.30	0.010	0.010	60	0.072	0.0035	0.0030	0.14	0.000020	0.000010	0.0041	0.000024	22	0.00050	0.000046	0.0026	0.0040	0.000060	0.0010	1.2	0.0074	0.030	0.97	0.00060	0.066	2.0	0.00017	1.2	0.000010	0.13	0.093	3.9	0.000020	0.0037	0.00060	0.0017	0.0016	0.0020	0.000010
17-Apr-12	50	500	425	7.9	138																																														
24-Apr-12	51	500	420	7.9	132																																														
1-May-12	52	500	495	7.8	129																																														
8-May-12	53	500	455	7.9	127	#N/A	3.1	63	8.0	0.40	0.060	0.30	0.010	0.010	60	0.047	0.0036	0.0052	0.14	0.000020	0.000010	0.0026	0.000066	22	0.00050	0.000041	0.0031	0.0070	0.00012	0.0010	1.2	0.0056	0.010	0.62	0.00010	0.080	2.1	0.00017	1.1	0.000010	0.12	0.087	2.8	0.000020	0.0019	0.00020	0.0014	0.0014	0.0020	0.000010
15-May-12	54	500	485	7.9	120																																														
22-May-12	55	500	460	7.8	126																																													
29-May-12	56	500	480	7.8	128																																													
5-Jun-12	57	500	65	7.8	123	#N/A	3.7	62	7.0	0.40	0.060	0.30	0.010	0.010	62	0.072	0.0027	0.0033	0.15	0.000020	0.000010	0.0026	0.000043	23	0.00050	0.0033	0.030	0.0030	0.000020	0.0010	1.2	0.0053	0.010	0.63	0.036	0.080	1.9	0.00022	1.1	0.000010	0.13	0.090	3.1	0.000020	0.00081	0.00030	0.0014	0.0014	0.0020	0.000010
12-Jun-12	58	500	455	7.8	125																																														
19-Jun-12	59	500	480	7.8	124																																													
26-Jun-12	60	500	360	7.9	116																																													
3-Jul-12	61	500	415	7.8	131	#N/A	7.9	70	5.0	0.40	0.060	0.30	0.010	0.010	59	0.074	0.0028	0.0028	0.17	0.000020	0.000010	0.0028	0.000056	22	0.00050	0.000056	0.055	0.0030	0.000040	0.0010	1.2	0.0049	0.010	0.60	0.00010	0.064	1.9	0.000070	1.1	0.000010	0.15	0.085	2.5	0.000030	0.0024	0.00030	0.0015	0.0016	0.0040	0.000010
10-Jul-12	62	500	475	7.8	126																																														
17-Jul-12	63	500	455	7.8	107																																													
24-Jul-12	64	500	465	7.8	120																																													
31-Jul-12	65	500	465	7.9	113	#N/A	2.6	61	3.0	0.40	0.060	0.30	0.010	0.010	54	0.11	0.0026	0.0029	0.19	0.000020	0.000010	0.0022	0.000026	20	0.00050	0.00020	0.031	0.0030	0.000050	0.0010	1.2	0.0034	0.010	0.36	0.00030	0.088	1.8	0.000070	1.4	0.000010	0.13	0.079	2.1	0.000020	0.0011	0.00020	0.0011	0.0015	0.0040	0.000010
7-Aug-12	66	500	430	7.9	112																																														
14-Aug-12	67	500	480	7.7	102																																													
21-Aug-12	68	500	460	7.7	109																																													
28-Aug-12	69	500	415	7.7	103	#N/A	4.1	56	5.0	0.30	0.060	0.30	0.010	0.010	45	0.16	0.0022	0.0024	0.16	0.000020	0.000020	0.0022	0.000041	17	0.00050	0.00030	0.037	0.0030	0.000080	0.0010	0.96	0.0028	0.030	0.33	0.0014	0.062	1.6	0.00023	0.89	0.000010	0.13	0.067	1.6	0.000020	0.0011	0.00030	0.00088	0.0015	0.0070	0.000030
4-Sep-12	70	500	470	7.7	105																																														
11-Sep-12	71	500	480	7.7	97																																													
18-Sep-12	72	500	475	7.8	108																																													
25-Sep-12	73	500	445	7.7	105	#N/A	3.2	62	5.0	0.30	0.060	0.30	0.010	0.010	52	0.058	0.0019	0.0040	0.19	0.000020	0.000010	0.0090	0.000039	19	0.00050	0.000038	0.0012	0.0030	0.000020	0.0020	1.2	0.0021	0.010	0.34	0.00030	0.063	1.6	0.00017	1.1	0.000010	0.12	0.074	2.0	0.000060	0.0011	0.00030	0.0010	0.0012	0.0020	0.000010
2-Oct-12	74	500	470	7.7	115																																														
9-Oct-12	75	500	480	7.7	99																																													
16-Oct-12	76	500	470	7.7	107																																													
23-Oct-12	77	500	395	7.7	102	#N/A	2.9	57	6.0	0.30	0.060	0.30	0.010	0.010	48	0.057	0.0015	0.0020	0.17	0.000020	0.000010	0.0031	0.000032	18	0.00050	0.000029	0.0044	0.0040	0.000020	0.0010	1.1	0.0028	0.010	0.37	0.00020	0.077	1.4	0.00018	0.93	0.000010	0.10	0.069	1.9	0.000020	0.0085	0.00010	0.00093	0.0011	0.0020	0.000010
30-Oct-12	78	500	475	7.8	127																																														
6-Nov-12	79	500	415	7.7	120																																													
13-Nov-12	80	500	455	7.8	140																																													
20-Nov-12	81	500	465	7.7	97	#N/A	7.2	53	5.0	0.010	0.010	0.30	0.060	0.30	47	0.043	0.0017	0.0029	0.18	0.000020	0.000010	0.0018	0.000036	17	0.00050	0.00011	0.0017	0.0030	0.000060	0.0010	1.1	0.0027	0.010	0.43	0.00020	0.090	1.3	0.00012	0.85	0.000020	0.090	0.065	2.0	0.000020	0.00057	0.00020	0.00084	0.0012	0.0030	0.000010
27-Nov-12	82	500	505	7.8	155																																														
4-Dec-12	83	500	415	7.8	100																																													
Cell Terminated																																																		

Notes: blue print are values below the analytical detection limit

Calculated Production Rates for T6

Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Total CN	WAD CN	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
3-May-11	0	750	455	7.9	500	#N/A	1.9	34	65	3.1	0.027	0.14	0.0046	0.0046	77	0.054	0.0011	0.0017	0.012	0.0000091	0.0000046	0.022	0.00064	29	0.00032	0.00032	0.038	0.0014	0.00022	0.00046	0.87	0.0100	0.0046	0.084	0.00027	0.13	10	0.0011	0.63	0.0000046	6.5	0.11	25	0.000091	0.0044	0.00082	0.0057	0.00080	0.0027	0.0000046
10-May-11	1	500	485	7.9	277	#N/A	1.7	41	29	0.63	0.029	0.15	0.0049	0.0049	46	0.062	0.0013	0.0019	0.012	0.0000097	0.0000097	0.022	0.00021	17	0.00044	0.00019	0.021	0.00097	0.000073	0.00049	0.64	0.0062	0.0049	0.055	0.00092	0.068	7.6	0.00018	0.63	0.0000015	2.6	0.069	11	0.0000097	0.0013	0.00024	0.0033	0.00091	0.0024	0.0000097
17-May-11	2	500	470	8.0	222	#N/A	1.7	38	15	0.14	0.028	0.14	0.0047	0.0047	37	0.075	0.0012	0.0017	0.018	0.0000094	0.0000047	0.016	0.00008 7	14	0.00047	0.000094	0.014	0.00094	0.000042	0.00047	0.57	0.0046	0.0047	0.035	0.00042	0.054	6.3	0.00015	0.69	0.000019	1.4	0.061	11	0.0000094	0.0023	0.00024	0.0027	0.00097	0.00094	0.0000047
24-May-11	3	500	440	7.9	207	#N/A	2.2	33	14	0.088	0.026	0.13	0.0044	0.0044	35	0.054	0.0011	0.0016	0.023	0.0000088	0.0000044	0.015	0.000050	13	0.00022	0.000088	0.011	0.00088	0.000013	0.00044	0.54	0.0044	0.0044	0.028	0.00062	0.044	5.4	0.00040	0.61	0.0000044	0.83	0.057	8.3	0.000088	0.0017	0.00022	0.0022	0.00082	0.00088	0.0000044
31-May-11	4	500	435	8.0	186																																															
7-Jun-11	5	500	320	8.0	193	#N/A	0.91	28	5.4	0.064	0.019	0.096	0.0032	0.0032	24	0.030	0.00090	0.0011	0.020	0.0000064	0.0000064	0.0081	0.000029	8.9	0.00016	0.000032	0.0057	0.00064	0.000016	0.00032	0.40	0.0032	0.0032	0.017	0.00029	0.041	3.2	0.000070	0.48	0.0000032	0.32	0.042	2.6	0.0000096	0.00072	0.00013	0.0014	0.00056	0.0019	0.0000096
14-Jun-11	6	500	415	8.2	174																																														
21-Jun-11	7	500	455	8.1	164	#N/A	0.94	37	6.4	0.091	0.027	0.14	0.0046	0.0046	32	0.043	0.0010	0.0024	0.032	0.0000091	0.0000046	0.0084	0.000031	12	0.00023	0.000046	0.0072	0.00091	0.000032	0.00046	0.57	0.0047	0.0091	0.020	0.00027	0.033	3.7	0.00038	0.61	0.0000046	0.28	0.058	2.5	0.0000091	0.0052	0.00041	0.0014	0.00074	0.0027	0.0000046
28-Jun-11	8	500	480	8.1	165																																														
5-Jul-11	9	500	440	7.9	137	#N/A	1.8	32	3.5	0.088	0.026	0.13	0.0044	0.0044	27	0.058	0.00092	0.0013	0.034	0.0000088	0.0000044	0.0059	0.000023	10	0.00022	0.000044	0.0037	0.00088	0.000018	0.00044	0.50	0.0044	0.0044	0.0096	0.00022	0.039	2.7	0.000088	0.59	0.0000044	0.15	0.051	1.6	0.0000088	0.0018	0.000044	0.0010	0.00074	0.0044	0.0000044
12-Jul-11	10	500	440	7.9	160																																														
19-Jul-11	11	500	435	7.9	144	#N/A	2.3	31	3.5	0.087	0.026	0.13	0.0044	0.0044	31	0.036	0.0023	0.0024	0.039	0.0000087	0.0000044	0.0042	0.000026	11	0.00022	0.000044	0.0033	0.00087	0.000022	0.00044	0.59	0.0057	0.0044	0.010	0.00039	0.046	2.5	0.00054	0.57	0.0000044	0.15	0.057	1.6	0.0000087	0.0010	0.00013	0.00097	0.00063	0.00087	0.0000044
26-Jul-11	12	500	425	7.9	147																																														
2-Aug-11	13	500	435	7.9	150	#N/A	2.4	31	3.0	1.1	0.026	0.13	0.0044	0.0044	29	0.022	0.0013	0.0013	0.042	0.0000087	0.0000044	0.0043	0.000013	11	0.00052	0.000044	0.0028	0.00087	0.000026	0.00044	0.58	0.0064	0.0044	0.012	0.000044	0.029	2.2	0.000087	0.58	0.0000044	0.13	0.055	1.5	0.0000087	0.0019	0.000044	0.00094	0.00062	0.0017	0.000035
9-Aug-11	14	500	465	7.9	156																																														
16-Aug-11	15	500	445	7.9	150	#N/A	2.8	32	4.0	0.93	0.027	0.13	0.0045	0.0045	29	0.027	0.0018	0.0015	0.045	0.0000089	0.0000045	0.0051	0.0000013	11	0.0010	0.000089	0.0032	0.0022	0.000027	0.00089	0.61	0.0070	0.0045	0.020	0.00053	0.035	2.0	0.00036	0.53	0.0000045	0.16	0.055	2.1	0.0000089	0.0017	0.00018	0.0011	0.00060	0.0018	0.0000045
23-Aug-11	16	500	435	7.8	148																																														
30-Aug-11	17	500	420	7.8	149	#N/A	2.1	29	5.9	0.88	0.025	0.13	0.0042	0.0042	29	0.025	0.0021	0.0014	0.046	0.0000084	0.0000042	0.0037	0.000018	11	0.00055	0.000042	0.0026	0.0025	0.000017	0.00042	0.59	0.0071	0.0042	0.023	0.00034	0.030	1.8	0.00012	0.55	0.0000042	0.11	0.054	2.0	0.0000084	0.00069	0.000042	0.0010	0.00064	0.00084	0.0000042
6-Sep-11	18	500	440	8.0	150																																														
13-Sep-11	19	500	390	8.0	142	#N/A	1.7	27	3.9	0.62	0.023	0.12	0.0039	0.0039	26	0.018	0.0019	0.0012	0.043	0.0000078	0.0000039	0.0029	0.00017	9.4	0.00039	0.00039	0.0023	0.00078	0.0028	0.00039	0.54	0.0060	0.0039	0.019	0.00012	0.018	1.5	0.000016	0.48	0.0000039	0.086	0.048	1.6	0.000016	0.00035	0.00039	0.00092	0.00053	0.026	0.0000039
20-Sep-11	20	500	465	7.9	157																																														
27-Sep-11	21	500	450	7.8	151	#N/A	3.0	33	3.6	0.59	0.027	0.14	0.0045	0.0045	32	0.018	0.0022	0.0016	0.055	0.0000090	0.0000045	0.0019	0.000016	12	0.00054	0.000036	0.0022	0.0018	0.000014	0.00045	0.68	0.0090	0.0045	0.021	0.000045	0.035	1.7	0.000050	0.61	0.0000045	0.090	0.057	1.8	0.0000090	0.00052	0.000045	0.0010	0.00065	0.00090	0.0000045
4-Oct-11	22	500	440	7.9	153																																														
11-Oct-11	23	500	455	7.9	138	#N/A	3.4	31	4.1	0.46	0.027	0.14	0.0046	0.0046	32	0.021	0.0021	0.0019	0.056	0.0000091	0.0000046	0.0026	0.0000077	12	0.00036	0.000037	0.0027	0.00091	0.000023	0.00046	0.68	0.0089	0.0046	0.021	0.00032	0.035	1.6	0.00076	0.62	0.0000046	0.091	0.058	1.7	0.0000091	0.00054	0.000091	0.00094	0.00063	0.0018	0.0000046
18-Oct-11	24	500	445	7.9	143																																														
25-Oct-11	25	500	420	7.8	139	#N/A	1.7	28	3.4	0.38	0.025	0.13	0.0042	0.0042	29	0.019	0.0019	0.0014	0.055	0.0000084	0.0000042	0.0028	0.000016	11	0.00050	0.000032	0.0027	0.0017	0.0000084	0.00042	0.62	0.0081	0.0042	0.020	0.00025	0.035	1.4	0.000017	0.51	0.0000042	0.071	0.053	1.8	0.0000084	0.00039	0.000042	0.00094	0.00059	0.00042	0.0000042
1-Nov-11	26	500	440	7.9	142																																														
8-Nov-11	27	500	455	7.8	146	#N/A	2.3	33	4.6	0.41	0.027	0.14	0.0046	0.0046	33	0.019	0.0024	0.0014	0.061	0.0000091	0.0000046	0.0021	0.0000019	12	0.00023	0.000048	0.0018	0.0014	0.0000091	0.00046	0.71	0.011	0.0046	0.033	0.00046	0.039	1.4	0.000018	0.56	0.0000046	0.086	0.057	1.9	0.0000091	0.00023	0.000091	0.0011	0.00062	0.00091	0.0000046
15-Nov-11	28	500	450	7.8	136																																														
22-Nov-11	29	500	450	7.8	135	#N/A	2.3	31	2.7	0.32	0.027	0.14	0.0045	0.0045	30	0.028	0.0023	0.0014	0.058	0.0000090	0.0000045	0.0023	0.000019	11	0.00023	0.000036	0.0026	0.0014	0.0000090	0.00045	0.63	0.0093	0.0045	0.056	0.00032	0.036	1.2	0.000018	0.54	0.0000045	0.068	0.053	1.5	0.0000090	0.00059	0.00018	0.00090	0.00077	0.00090	0.0000045
29-Nov-11	30	500	450	7.9	132																																														
6-Dec-11	31	500	460	7.7	131	#N/A	2.5	30	4.1	0.32	0.028	0.14	0.0046	0.0046	29	0.023	0.0021	0.0015	0.058	0.0000092	0.0000046	0.0014	0.000034	11	0.00023	0.000037	0.0028	0.0014	0.0000092	0.00046	0.61	0.0092	0.0046	0.13	0.000046	0.036	1.2	0.000046	0.52	0.0000092	0.046	0.051	1.6	0.0000092	0.00017	0.000092	0.00087	0.00065	0.0014	0.0000046
13-Dec-11	32	500	465	7.8	133																																														
20-Dec-11	33	500	470	7.8	131	#N/A	2.6	31	3.8	0.28	0.028	0.14	0.0047	0.0047	31	0.026	0.0024	0.0014	0.064	0.0000094	0.0000047	0.0016	0.000070	11	0.00024	0.000039	0.0016	0.0014	0.0000094	0.00047	0.64	0.0097	0.0047	0.26	0.00038	0.033	1.1	0.000071	0.53	0.0000047	0.066	0.052	1.8	0.0000094	0.00021	0.00014	0.00098	0.00068	0.00094	0.0000047
27-Dec-11	34	500	460	7.9	132																																														
3-Jan-12	35	500	430	7.7	125	#N/A	2.3	31	3.0	0.26	0.026	0.13	0.0043	0.0043	25	0.040	0.0021	0.0013	0.055	0.0000086	0.0000043	0.0017	0.000057	9.3	0.00022	0.000037	0.0014	0.080	0.0000086	0.00043	0.54	0.0074	0.0043	0.32	0.00043	0.026	1.0	0.000030	0.48	0.0000043	0.065	0.044	1.4	0.0000086	0.00041	0.00013	0.00077	0.00077	0.00086	0.0000043
10-Jan-12	36	500	460	7.8	136																																														
17-Jan-12	37	500	440	7.9	137	#N/A	1.2	35	2.6	0.22	0.026	0.13	0.0044	0.0044	30	0.024	0.0019	0.0013	0.066	0.0000088	0.0000044	0.0035	0.000049	11	0.00022	0.000037	0.0018	0.0013	0.0000088	0.00044	0.59	0.0071	0.0088	0.33	0.000088	0.033	0.96	0.000057	0.48	0.0000044	0.062	0.046	1.4	0.0000088	0.00077	0.000088	0.00090	0.00067	0.00088	0.000018
24-Jan-12	38	500	485	7.8	129																																														
31-Jan-12	39	500	480	7.8	141	#N/A	1.6	39	2.4	0.29	0.029	0.14	0.0048	0.0048	32	0.025	0.0025	0.0016	0.075	0.0000096	0.0000048	0.0014	0.0000054	12	0.00024	0.000032	0.0014	0.0014	0.0000096	0.00048	0.66	0.0069	0.0048	0.40	0.00024	0.041	1.2	0.000053	0.60	0.0000048	0.067	0.051	1.6	0.0000096	0.00032	0.000048	0.00084	0.00072	0.00096	0.0000048
7-Feb-12	40	500	410	7.9	139																																														
14-Feb-12	41	500	370	7.9	129	#N/A	1.9	25	4.8	0.26	0.022	0.11	0.0037	0.0037	23	0.011	0.0016	0.0012	0.052	0.0000074	0.0000037	0.0011	0.000032	8.5	0.00019	0.000019	0.0011	0.0011	0.0000074	0.00037	0.48	0.0041	0.0037	0.36	0.00015	0.030	0.83	0.000074	0.46	0.0000037	0.052	0.037	1.2	0.0000074	0.0024	0.000037	0.00069	0.00045	0.00037	0.0000037
21-Feb-12	42	500	450	7.8	135																																														
28-Feb-12	43	500	450	7.8	133	#N/A	1.9	32	3.2	0.18	0.027	0.14	0.0045	0.0045	29	0.019	0.0019	0.0013	0.066	0.0000090	0.0000045	0.0014	0.000078	11	0.00023	0.000045	0.0013	0.0018	0.000068	0.00045	0.62	0.0047	0.0045	0.40	0.000045	0.033	0.99	0.000077	0.56	0.0000045	0.068	0.047	1.4	0.0000090	0.0011	0.000090	0.00081	0.00063	0.0014	0.0000045
6-Mar-12	44	500	450	7.9	137																																														
13-Mar-12	45	500	425	7.8	130	#N/A	1.6	28	3.0	0.21	0.026	0.13	0.0043	0.0043	27	0.017	0.0017	0.0022	0.063	0.0000085	0.0000043	0.0026	0.000044	9.9	0.00021	0.000085	0.0013	0.0013	0.0000085	0.00043	0.55	0.0039	0.0043	0.42	0.00026	0.037	0.91	0.000068	0.50	0.0000043	0.060	0.043	1.4	0.0000085	0.00078	0.000043	0.00076	0.00049	0.00085	0.0000043
20-Mar-12	46	500	445	7.8	148																																														
27-Mar-12	47	500	435	7.8	147																																														
3-Apr-12	48	500	430	7.8	136																																														
10-Apr-12	49	500	450	7.9	130	#N/A	1.3	28	4.5	0.23	0.027	0.14	0.0045	0.0045	27	0.032	0.0016	0.0014	0.062	0.0000090	0.0000045	0.0018	0.000011	9.9	0.00023	0.000021	0.0012	0.0018	0.000027	0.00045	0.55	0.0033	0.014	0.44	0.00027	0.030	0.90	0.000077	0.54	0.0000045	0.059	0.042	1.8	0.0000090	0.0017	0.00027	0.00077	0.00070	0.00090	0.0000045
17-Apr-12	50	500	425	7.9	138																																														
24-Apr-12	51	500	420	7.9	132																																														
1-May-12	52	500	495	7.8	129																																														
8-May-12	53	500	455	7.9	127	#N/A	1.4	29	3.6	0.18	0.027	0.14	0.0046	0.0046	27	0.021	0.0016	0.0024	0.064	0.0000091	0.0000046	0.0012	0.000030	10	0.00023	0.000019	0.0014	0.0032	0.000055	0.00046	0.54	0.0025	0.0046	0.28	0.000046	0.036	0.96	0.000077	0.50	0.0000046	0.055	0.040	1.3	0.0000091	0.00086	0.000091	0.00062	0.00064	0.00091	0.0000046
15-May-12	54	500	485	7.9	120																																														
22-May-12	55	500	460	7.8	126																																														
29-May-12	56	500	480	7.8	128																																														
5-Jun-12	57	500	65	7.8	123	#N/A	0.24	4.0	0.46	0.026	0.0039	0.020	0.00065	0.00065	4.0	0.0047	0.00018	0.00021	0.0097	0.0000013	0.00000065	0.00017	0.0000028	1.5	0.000033	0.00021	0.0020	0.00020	0.0000013	0.000065	0.081	0.00034	0.00065	0.041	0.0023	0.0052	0.13	0.000014	0.070	0.00000065	0.0085	0.0058	0.20	0.0000013	0.000053	0.000020	0.000090	0.000092	0.00013	0.00000065
12-Jun-12	58	500	455	7.8	125																																														
19-Jun-12	59	500	480	7.8	124																																														
26-Jun-12	60	500	360	7.9	116																																														
3-Jul-12	61	500	415	7.8	131	#N/A	3.3	29	2.1	0.17	0.025	0.12	0.0042	0.0042	25	0.031	0.0012	0.0012	0.071	0.0000083	0.0000042	0.0012	0.000023	9.0	0.00021	0.000023	0.023	0.0012	0.000017	0.00042	0.49	0.0020	0.0042	0.25	0.000042	0.027	0.78	0.000029	0.46	0.0000042	0.062	0.035	1.0	0.000012	0.00098	0.00012	0.00060	0.00066	0.0017	0.0000042
10-Jul-12	62	500	475	7.8	126																																														
17-Jul-12	63	500	455	7.8	107																																														
24-Jul-12	64	500	465	7.8	120																																														
31-Jul-12	65	500	465	7.9	113	#N/A	1.2	29	1.4	0.19	0.028	0.14	0.0047	0.0047	25	0.051	0.0012	0.0013	0.086	0.0000093	0.0000047	0.0010	0.000012	9.1	0.00023	0.000093	0.015	0.0014	0.000023	0.00047	0.53	0.0016	0.0047	0.17	0.00014	0.041	0.84	0.000033	0.66	0.0000047	0.060	0.037	0.98	0.0000093	0.00049	0.000093	0.00052	0.00072	0.0019	0.0000047
7-Aug-12	66	500	430	7.9	112																																														
14-Aug-12	67	500	480	7.7	102																																														
21-Aug-12	68	500	460	7.7	109																																														
28-Aug-12	69	500	415	7.7	103	#N/A	1.7	23	2.1	0.12	0.025	0.12	0.0042	0.0042	19	0.067	0.00091	0.00100	0.067	0.0000083	0.0000083	0.00091	0.000017	6.8	0.00021	0.00012	0.015	0.0012	0.000033	0.00042	0.40	0.0012	0.012	0.14	0.00058	0.026	0.65	0.000095	0.37	0.0000042	0.054	0.028	0.66	0.0000083	0.00044	0.00012	0.00037	0.00062	0.0029	0.000012
4-Sep-12	70	500	470	7.7	105																																														
11-Sep-12	71	500	480	7.7	97																																														
18-Sep-12	72	500	475	7.8	108																																														
25-Sep-12	73	500	445	7.7	105	#N/A	1.4	28	2.2	0.13	0.027	0.13	0.0045	0.0045	23	0.026	0.00085	0.0018	0.083	0.0000089	0.0000045	0.0040	0.000017	8.4	0.00022	0.000017	0.00053	0.0013	0.0000089	0.00089	0.54	0.00093	0.0045	0.15	0.00013	0.028	0.71	0.000076	0.48	0.0000045	0.053	0.033	0.91	0.000027	0.00049	0.00013	0.00046	0.00055	0.00089	0.0000045
2-Oct-12	74	500	470	7.7	115																																														
9-Oct-12	75	500	480	7.7	99																																														
16-Oct-12	76	500	470	7.7	107																																														
23-Oct-12	77	500	395	7.7	102	#N/A	1.1	22	2.4	0.12	0.024	0.12	0.0040	0.0040	19	0.023	0.00059	0.00079	0.068	0.0000079	0.0000040	0.0012	0.000013	7.0	0.00020	0.000011	0.0017	0.0016	0.0000079	0.00040	0.44	0.0011	0.0040	0.15	0.000079	0.030	0.57	0.000071	0.37	0.0000040	0.040	0.027	0.75	0.0000079	0.0034	0.000040	0.00037	0.00045	0.00079	0.0000040
30-Oct-12	78	500	475	7.8	127																																														
6-Nov-12	79	500	415	7.7	120																																														
13-Nov-12	80	500	455	7.8	140																																														
20-Nov-12	81	500	465	7.7	97	#N/A	3.3	24	2.3	0.0047	0.0047	0.14	0.028	0.14	22	0.020	0.00079	0.0013	0.085	0.0000093	0.0000047	0.00084	0.000017	7.9	0.00023	0.000049	0.00079	0.0014	0.000028	0.00047	0.51	0.0013	0.0047	0.20	0.000093	0.042	0.62	0.000056	0.40	0.0000093	0.042	0.030	0.94	0.0000093	0.00027	0.000093	0.00039	0.00055	0.0014	0.0000047
Median (last 5)				7.7	107	#N/A	1.4	24	2.2	0.12	0.025	0.13	0.0045	0.0045	22	0.026	0.00085	0.0013	0.083	0.0000089	0.0000047	0.0010	0.000017	7.9	0.00022	0.000049	0.0017	0.0014	0.000023	0.00047	0.51	0.0012	0.0047	0.15	0.00013	0.030	0.65	0.000071	0.40	0.0000045	0.053	0.030	0.91	0.0000093	0.00049

Leachate Results for T7

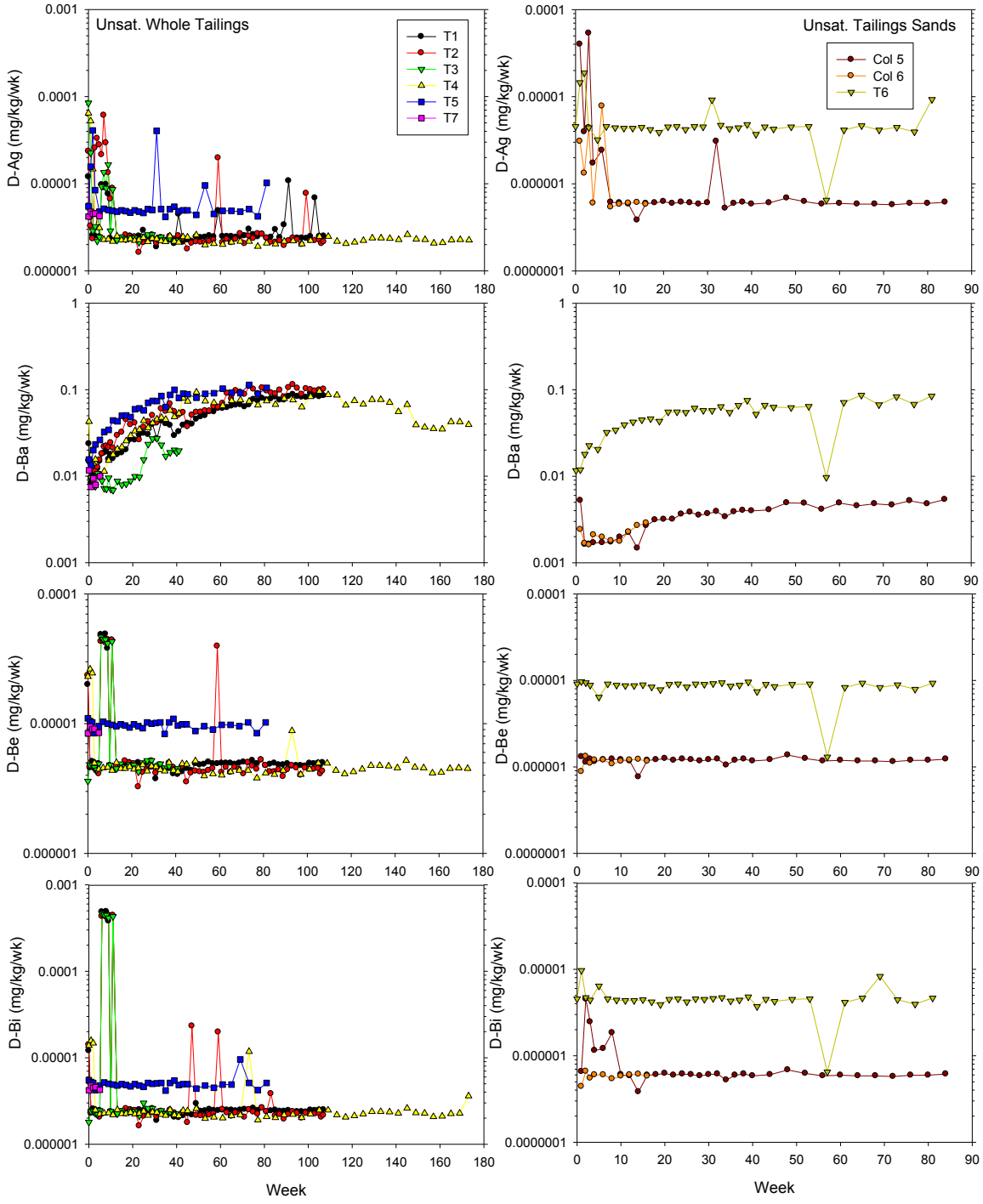
Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Total CN	WAD CN	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/L	mg $CaCO_3$/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg $CaCO_3$/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	ug/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
5-Mar-13	0	750	420	7.3	1829	#N/A	12	57	847	22	0.65	0.30	0.010	0.010	822	0.029	0.0014	0.033	0.028	0.000020	0.000010	0.041	0.0000022	304	0.00050	0.00030	0.0013	0.0030	0.00018	0.0040	15	0.069	0.010	0.019	0.0015	0.35	64	0.0027	13	0.000010	33	1.3	318	0.00010	0.017	0.00020	0.043	0.00014	0.0020	0.000070
12-Mar-13	1	500	475	7.3	719	#N/A	8.5	52	273	4.0	0.74	0.30	0.010	0.010	312	0.040	0.0012	0.17	0.016	0.000020	0.000010	0.037	0.000021	113	0.00050	0.000082	0.0011	0.0070	0.00012	0.0020	7.4	0.037	0.010	0.012	0.00070	0.11	33	0.0012	31	0.000010	9.2	0.51	112	0.000050	0.015	0.00040	0.021	0.00014	0.0010	0.000010
19-Mar-13	2	500	450	7.3	666	#N/A	12	67	268	1.5	0.83	0.30	0.010	0.010	265	0.028	0.0013	0.19	0.021	0.000020	0.000010	0.035	0.0000030	94	0.00050	0.00015	0.0013	0.0030	0.00011	0.0020	7.6	0.025	0.010	0.013	0.00040	0.076	29	0.0010	17	0.000010	5.9	0.46	89	0.000050	0.015	0.00020	0.026	0.000030	0.0010	0.000010
26-Mar-13	3	500	455	7.7	443	#N/A	7.9	62	138	0.50	0.73	0.30	0.010	0.010	185	0.052	0.0010	0.14	0.017	0.000020	0.000010	0.025	0.000024	65	0.00050	0.00023	0.0020	0.0030	0.000070	0.0010	5.6	0.018	0.010	0.0076	0.00030	0.048	19	0.00059	12	0.000010	2.6	0.31	52	0.000030	0.013	0.00010	0.020	0.00015	0.0010	0.000020
2-Apr-13	4	500	430	7.5	376																																														
9-Apr-13	5	500	425	7.8	371	#N/A	6.6	69	106	0.20	0.89	0.30	0.010	0.010	144	0.027	0.0013	0.13	0.024	0.000020	0.000010	0.025	0.000011	50	0.00050	0.00014	0.00050	0.0030	0.000070	0.0010	4.9	0.016	0.010	0.0098	0.00020	0.018	16	0.0017	9.2	0.000010	1.6	0.26	35	0.000030	0.017	0.00010	0.017	0.00014	0.0010	0.000010
16-Apr-13	6	500	440	7.5	376																																													
23-Apr-13	7	500	415																																														

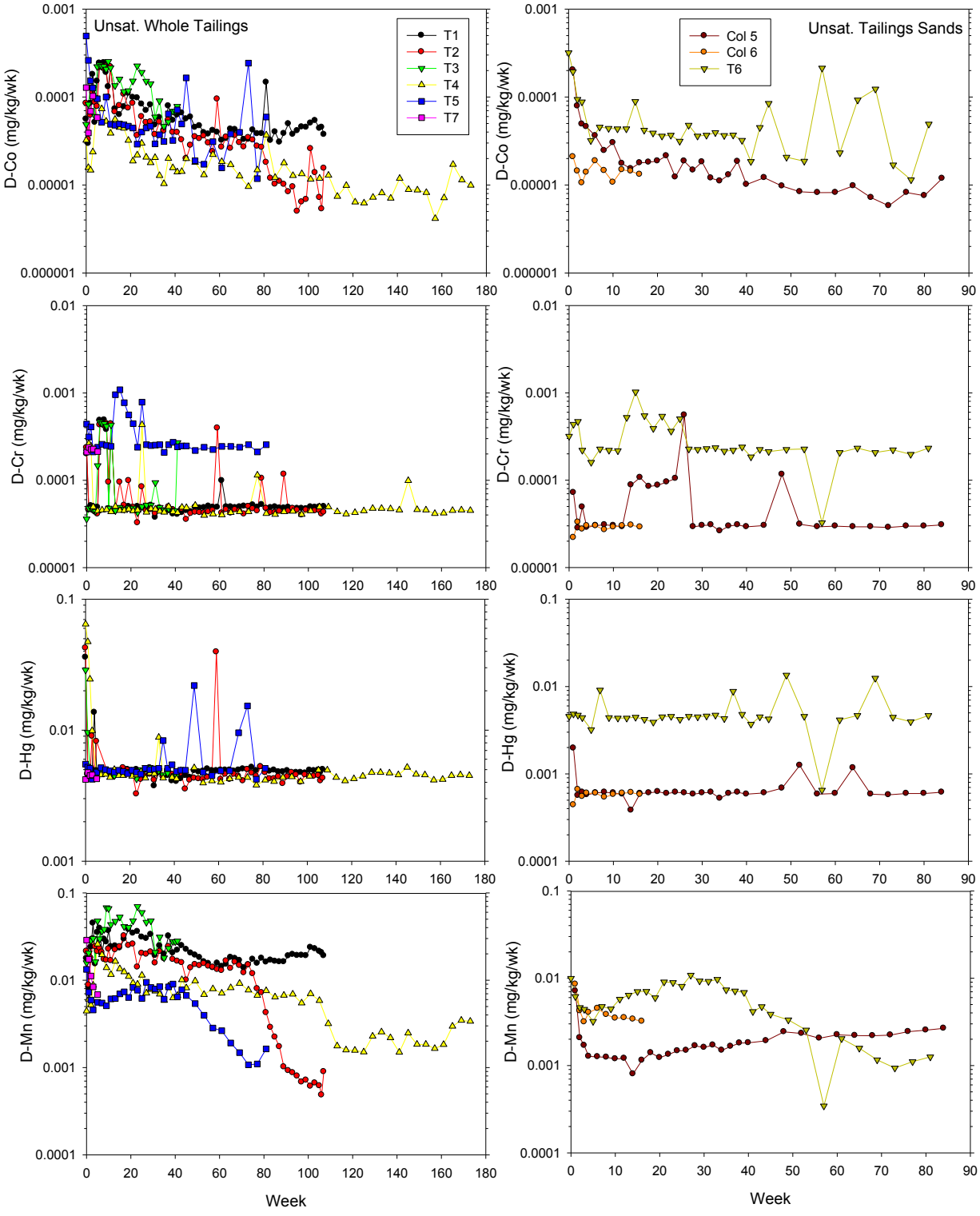
Notes: blue print are values below the analytical detection limit

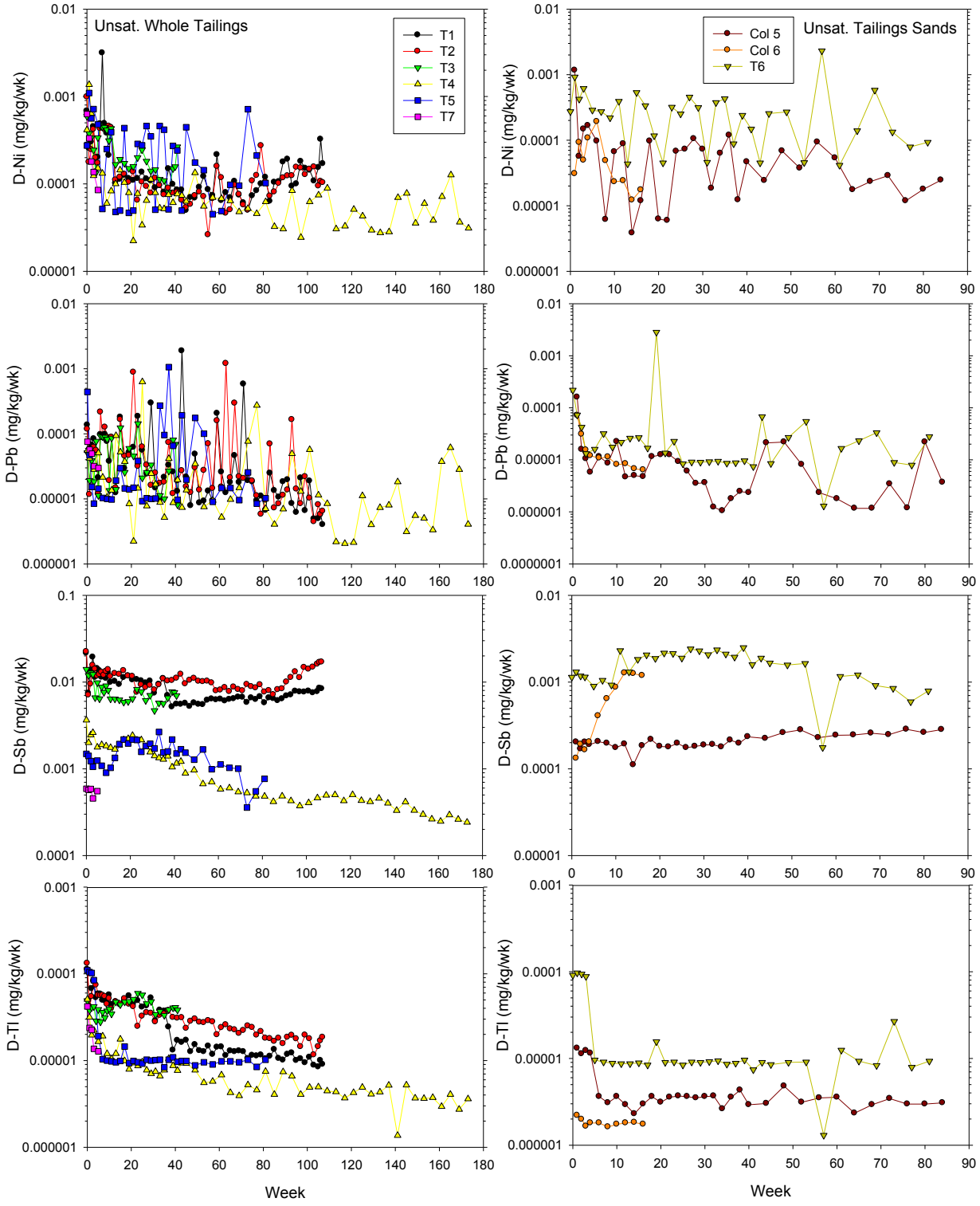
Calculated Production Rates for T7

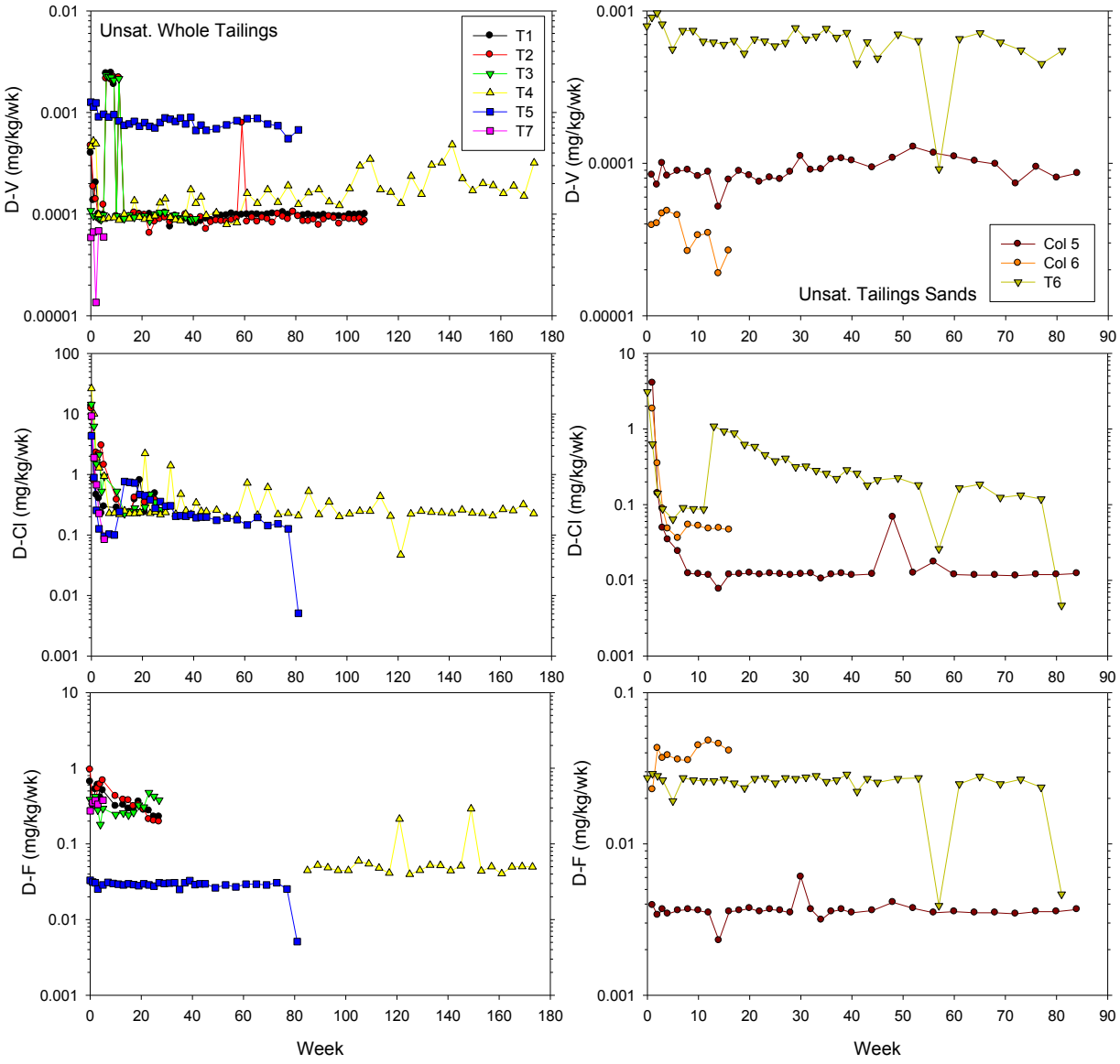
Date	Cycle	Volume mL		pH	Cond.	Acidity (pH 4.5)	Acidity (pH 8.3)	Alkalinity	SO_4	Cl	F	Br	Total CN	WAD CN	Hardness	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr
	No.	Input	Output		umhos/cm	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg $CaCO_3$/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
5-Mar-13	0	750	420	7.3	1829	#N/A	5.2	24	356	9.2	0.27	0.13	0.0042	0.0042	345	0.012	0.00059	0.014	0.012	0.0000084	0.0000042	0.017	0.0000092	128	0.00021	0.00013	0.00055	0.0013	0.000076	0.0017	6.4	0.029	0.0042	0.0079	0.00063	0.15	27	0.0011	5.6	0.0000042	14	0.53	134	0.000042	0.0071	0.000084	0.018	0.000059	0.00084	0.000029
12-Mar-13	1	500	475	7.3	719	#N/A	4.1	25	130	1.9	0.35	0.14	0.0048	0.0048	148	0.019	0.00057	0.078	0.0075	0.0000095	0.0000048	0.017	0.0000100	54	0.00024	0.000039	0.00052	0.0033	0.000057	0.00095	3.5	0.017	0.0048	0.0056	0.00033	0.050	16	0.00055	15	0.0000048	4.4	0.24	53	0.000024	0.0069	0.00019	0.0098	0.000067	0.00048	0.0000048
19-Mar-13	2	500	450	7.3	666	#N/A	5.3	30	121	0.68	0.37	0.14	0.0045	0.0045	119	0.013	0.00059	0.084	0.0094	0.0000090	0.0000045	0.016	0.0000014	42	0.00023	0.000069	0.00059	0.0014	0.000050	0.00090	3.4	0.011	0.0045	0.0057	0.00018	0.034	13	0.00046	7.6	0.0000045	2.7	0.21	40	0.000023	0.0069	0.000090	0.012	0.000014	0.00045	0.0000045
26-Mar-13	3	500	455	7.7	443	#N/A	3.6	28	63	0.23	0.33	0.14	0.0046	0.0046	84	0.024	0.00046	0.062	0.0079	0.0000091	0.0000046	0.012	0.000011	29	0.00023	0.00010	0.00091	0.0014	0.000032	0.00046	2.5	0.0084	0.0046	0.0035	0.00014	0.022	8.6	0.00027	5.2	0.0000046	1.2	0.14	24	0.000014	0.0061	0.000046	0.0091	0.000068	0.00046	0.0000091
2-Apr-13	4	500	430	7.5	376																																														
9-Apr-13	5	500	425	7.8	371	#N/A	2.8	29	45	0.085	0.38	0.13	0.0043	0.0043	61	0.011	0.00055	0.053	0.0100	0.0000085	0.0000043	0.010	0.0000047	21	0.00021	0.000058	0.00021	0.0013	0.000030	0.00043	2.1	0.0068	0.0043	0.0042	0.000085	0.0077	6.7	0.00072	3.9	0.0000043	0.66	0.11	15	0.000013	0.0072	0.000043	0.0071	0.000060	0.00043	0.0000043
16-Apr-13	6	500	440	7.5	376																																													
23-Apr-13	7	500	415																																														
Median (all)				7.4	555	#N/A	4.1	28	121	0.68	0.35	0.14	0.0045	0.0045	119	0.013	0.00057	0.062	0.0094	0.0000090	0.0000045	0.016	0.0000092	42	0.00023	0.000069	0.00055	0.0014	0.000050	0.00090	3.4	0.011	0.0045	0.0056	0.00018	0.034	13	0.00055	5.6	0.0000045	2.7	0.21	40	0.000023	0.0069	0.000084	0.0098	0.000060	0.00046	0.0000048

Appendix E.3: Loading Rates for Unsaturated Tailings Humidity Cells




Unsat. Whole Tailings
T1
T2
T3
T4
T5
T7
Unsat. Tailings Sands
Col 5
Col 6
T6
D-Co (mg/kg/wk)
D-Cr (mg/kg/wk)
D-Hg (mg/kg/wk)
D-Mn (mg/kg/wk)
Week
Week


Unsat. Whole Tailings
T1
T2
T3
T4
T5
T7
Unsat. Tailings Sands
Col 5
Col 6
T6
D-Ni (mg/kg/wk)
D-Pb (mg/kg/wk)
D-Sb (mg/kg/wk)
D-Tl (mg/kg/wk)
Week


Unsat. Whole Tailings
T1
T2
T3
T4
T5
T7
Unsat. Tailings Sands
Col 5
Col 6
T6
D-V (mg/kg/wk)
D-Cl (mg/kg/wk)
D-F (mg/kg/wk)
Week

APPENDIX E4 NP DEPLETION FOR NON-PAG UNSATURATED KINETIC TESTS

Molar Ratios and Depletion Rates for HC3

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumption (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum. (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
29-Nov-11	0	3.4	16	16	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	13	13	1.00
6-Dec-11	1	1.8	13	13	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	24	1.00
13-Dec-11	2	1.7	11	11	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.2	33	1.00
20-Dec-11	3	2.0	13	13	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	44	1.00
27-Dec-11	4	1.8	11	11	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.9	53	1.00
3-Jan-12	5	1.8	9.8	9.8	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.0	61	1.00
10-Jan-12	6	1.3	11	11	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.7	71	1.00
17-Jan-12	7	1.1	15	15	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	13	84	1.00
24-Jan-12	8	1.4	15	15	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	98	1.00
31-Jan-12	9	1.4	13	13	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	109	1.00
7-Feb-12	10	1.8	12	12	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	120	0.99
14-Feb-12	11	2.1	11	11	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.1	129	0.99
21-Feb-12	12	1.8	11	11	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.3	138	0.99
28-Feb-12	13	1.6	12	12	*DR*	0.0	0.0	0.0	1.00	*NC*	4.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	10	148	0.99
6-Mar-12	14	1.5	11	11	9.4	9.4	0.098	0.000074	1.00	1.2	4.2	2.3	9.8	23	0.023	23	0.023	1.00	19	168	0.99
13-Mar-12	15	1.3	9.8	9.8	17	17	0.18	0.00013	1.00	0.58	4.2	1.3	18	23	0.023	46	0.046	1.00	26	194	0.99
20-Mar-12	16	1.3	11	11	16	16	0.17	0.00013	1.00	0.66	4.2	1.4	17	23	0.023	69	0.069	1.00	26	220	0.99
27-Mar-12	17	1.3	11	11	15	15	0.15	0.00012	1.00	0.75	4.2	1.5	15	23	0.023	92	0.092	1.00	25	245	0.99
3-Apr-12	18	1.2	10	10	15	15	0.15	0.00012	1.00	0.71	4.2	1.5	15	22	0.022	114	0.11	0.99	24	270	0.99
10-Apr-12	19	1.1	9.0	9.0	14	14	0.14	0.00011	1.00	0.66	4.2	1.4	14	20	0.020	134	0.13	0.99	22	292	0.99
17-Apr-12	20	1.1	8.9	8.9	12	12	0.12	0.000094	1.00	0.74	4.2	1.4	12	18	0.018	152	0.15	0.99	20	312	0.99
24-Apr-12	21	1.3	10	10	12	12	0.13	0.000097	1.00	0.83	4.2	1.4	13	18	0.018	170	0.17	0.99	22	334	0.99
1-May-12	22	1.4	10	10	14	14	0.14	0.00011	1.00	0.77	4.2	1.4	14	19	0.019	189	0.19	0.99	23	357	0.98
8-May-12	23	1.4	10	10	15	15	0.15	0.00011	1.00	0.71	4.2	1.4	15	21	0.021	210	0.21	0.99	24	381	0.98
15-May-12	24	1.5	10	10	16	16	0.17	0.00013	1.00	0.62	4.2	1.4	17	23	0.023	233	0.23	0.99	26	407	0.98
22-May-12	25	1.5	8.8	8.8	16	16	0.17	0.00013	1.00	0.55	4.2	1.4	17	23	0.023	256	0.26	0.99	24	431	0.98
29-May-12	26	1.5	8.5	8.5	14	14	0.15	0.00011	1.00	0.59	4.2	1.4	15	21	0.021	278	0.28	0.99	22	453	0.98
5-Jun-12	27	1.5	7.6	7.6	12	12	0.12	0.000093	1.00	0.64	4.2	1.5	12	18	0.018	296	0.30	0.99	18	471	0.98
12-Jun-12	28	1.4	7.5	7.5	11	11	0.12	0.000088	1.00	0.67	4.2	1.5	12	18	0.018	314	0.31	0.99	18	489	0.98
19-Jun-12	29	1.3	7.1	7.1	10	10	0.11	0.000080	1.00	0.70	4.2	1.6	11	17	0.017	331	0.33	0.99	16	505	0.98
26-Jun-12	30	2.1	8.9	8.9	12	12	0.12	0.000091	1.00	0.78	4.2	1.5	12	18	0.018	348	0.35	0.98	19	524	0.98
3-Jul-12	31	2.9	11	11	13	13	0.13	0.000099	1.00	0.84	4.2	1.4	13	18	0.018	367	0.37	0.98	21	545	0.98
10-Jul-12	32	2.0	9.3	9.3	12	12	0.12	0.000094	1.00	0.79	4.2	1.5	12	19	0.019	386	0.39	0.98	20	565	0.97
17-Jul-12	33	1.0	8.0	8.0	11	11	0.11	0.000087	1.00	0.73	4.2	1.7	12	20	0.020	406	0.41	0.98	18	583	0.97
24-Jul-12	34	1.0	8.1	8.1	12	12	0.12	0.000093	1.00	0.69	4.2	1.7	12	20	0.020	426	0.43	0.98	19	602	0.97
31-Jul-12	35	1.0	8.1	8.1	12	12	0.13	0.000097	1.00	0.66	4.2	1.6	13	21	0.021	447	0.45	0.98	20	622	0.97
7-Aug-12	36	1.1	7.2	7.2	13	13	0.14	0.00011	1.00	0.54	4.2	1.4	14	20	0.020	467	0.47	0.98	20	642	0.97
14-Aug-12	37	1.3	6.4	6.4	15	15	0.15	0.00012	1.00	0.44	4.2	1.3	15	20	0.020	486	0.49	0.98	21	663	0.97
21-Aug-12	38	1.4	7.3	7.3	13	13	0.14	0.00010	1.00	0.55	4.2	1.4	14	19	0.019	505	0.50	0.98	20	683	0.97
28-Aug-12	39	1.6	8.8	8.8	13	13	0.13	0.000100	1.00	0.70	4.2	1.5	13	19	0.019	524	0.52	0.98	20	703	0.97
4-Sep-12	40	1.4	7.2	7.2	12	12	0.12	0.000095	1.00	0.60	4.2	1.5	12	18	0.018	542	0.54	0.98	18	721	0.97
11-Sep-12	41	1.3	6.3	6.3	12	12	0.13	0.000097	1.00	0.51	4.2	1.5	13	19	0.019	561	0.56	0.98	18	739	0.97
18-Sep-12	42	1.6	7.1	7.1	14	14	0.15	0.00011	1.00	0.49	4.2	1.4	15	21	0.021	582	0.58	0.97	20	760	0.97
25-Sep-12	43	1.5	6.4	6.4	14	14	0.14	0.00011	1.00	0.47	4.2	1.3	14	18	0.018	600	0.60	0.97	19	779	0.97
2-Oct-12	44	1.7	6.3	6.3	12	12	0.12	0.000093	1.00	0.53	4.2	1.3	12	16	0.016	616	0.62	0.97	17	796	0.96
9-Oct-12	45	1.8	6.1	6.1	9.8	9.8	0.10	0.000077	1.00	0.63	4.2	1.4	10	14	0.014	631	0.63	0.97	14	810	0.96
16-Oct-12	46	1.6	6.2	6.2	11	11	0.12	0.000088	1.00	0.56	4.2	1.5	12	18	0.018	648	0.65	0.97	16	826	0.96
23-Oct-12	47	1.5	6.4	6.4	12	12	0.13	0.000096	1.00	0.53	4.2	1.5	13	19	0.019	668	0.67	0.97	17	844	0.96
30-Oct-12	48	1.4	6.3	6.3	12	12	0.13	0.000097	1.00	0.51	4.2	1.6	13	20	0.020	688	0.69	0.97	18	862	0.96
6-Nov-12	49	1.3	6.0	6.0	12	12	0.13	0.000095	1.00	0.50	4.2	1.6	13	20	0.020	707	0.71	0.97	17	879	0.96
13-Nov-12	50	1.1	6.0	6.0	10	10	0.11	0.000082	1.00	0.58	4.2	1.6	11	17	0.017	725	0.72	0.97	16	894	0.96
20-Nov-12	51	1.1	6.6	6.6	10	10	0.11	0.000081	1.00	0.64	4.2	1.6	11	17	0.017	742	0.74	0.97	16	911	0.96
27-Nov-12	52	1.1	6.5	6.5	9.8	9.8	0.10	0.000077	1.00	0.67	4.2	1.6	10	16	0.016	758	0.76	0.97	16	926	0.96
4-Dec-12	53	1.00	6.3	6.3	8.9	8.9	0.093	0.000070	1.00	0.70	4.2	1.6	9.3	15	0.015	773	0.77	0.97	15	941	0.96
11-Dec-12	54	1.5	6.7	6.7	7.8	7.8	0.082	0.000062	1.00	0.85	4.2	1.7	8.2	14	0.014	787	0.79	0.97	13	954	0.96
18-Dec-12	55	1.6	6.5	6.5	6.9	6.9	0.071	0.000054	1.00	0.95	4.2	1.7	7.1	12	0.012	799	0.80	0.96	12	966	0.96
25-Dec-12	56	1.7	6.5	6.5	6.5	6.5	0.068	0.000051	1.00	1.0	4.2	1.7	6.8	12	0.012	810	0.81	0.96	12	978	0.96
1-Jan-13	57	1.9	6.9	6.9	6.5	6.5	0.068	0.000051	1.00	1.1	4.2	1.7	6.8	12	0.012	822	0.82	0.96	12	990	0.96
8-Jan-13	58	1.5	6.3	6.3	7.2	7.2	0.075	0.000057	1.00	0.88	4.2	1.6	7.5	12	0.012	834	0.83	0.96	12	1002	0.96
15-Jan-13	59	1.3	6.2	6.2	7.7	7.7	0.080	0.000060	1.00	0.81	4.2	1.5	8.0	12	0.012	845	0.85	0.96	13	1015	0.95
22-Jan-13	60	1.3	6.3	6.3	8.1	8.1	0.085	0.000064	1.00	0.77	4.2	1.5	8.5	12	0.012	858	0.86	0.96	14	1028	0.95
29-Jan-13	61	1.2	6.3	6.3	8.5	8.5	0.088	0.000067	1.00	0.74	4.2	1.4	8.8	13	0.013	871	0.87	0.96	14	1042	0.95
5-Feb-13	62	1.4	6.3	6.3	8.2	8.2	0.086	0.000065	1.00	0.77	4.2	1.5	8.6	13	0.013	883	0.88	0.96	14	1056	0.95
12-Feb-13	63	1.4	6.0	6.0	7.6	7.6	0.079	0.000060	1.00	0.79	4.2	1.5	7.9	12	0.012	895	0.89	0.96	12	1068	0.95
19-Feb-13	64	1.6	6.5	6.5	8.2	8.2	0.086	0.000065	1.00	0.79	4.2	1.5	8.6	13	0.013	908	0.91	0.96	14	1082	0.95
26-Feb-13	65	1.5	5.9	5.9	7.4	7.4	0.077	0.000058	**1.00**	0.80	4.2	1.5	7.7	11	0.011	919	0.92	**0.96**	12	1094	0.95
Median (last 5)					**8.5**							**1.6**		**12.7**							

Notes: adings data removed to avoid overestimating the rate of NP depletion
not calculated due to removed sulphate loading data.
set at half the limit for NP depletion calculations.

Casino Kinetic Testwork Update

Molar Ratios and Depletion Rates for HC4

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumption (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum. (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
29-Nov-11	0	2.0	16	16	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	14	1.00
6-Dec-11	1	1.7	30	46	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	28	42	1.00
13-Dec-11	2	1.4	16	63	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	15	58	1.00
20-Dec-11	3	1.7	23	86	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	21	79	1.00
27-Dec-11	4	1.8	21	106	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	19	98	1.00
3-Jan-12	5	2.1	21	127	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	19	117	1.00
10-Jan-12	6	1.6	20	147	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	18	135	1.00
17-Jan-12	7	1.3	21	168	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	19	154	1.00
24-Jan-12	8	1.4	19	187	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	18	172	1.00
31-Jan-12	9	1.6	19	206	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	17	190	1.00
7-Feb-12	10	1.8	18	224	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	16	205	1.00
14-Feb-12	11	2.0	16	240	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	220	1.00
21-Feb-12	12	1.9	15	256	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	233	1.00
28-Feb-12	13	1.7	15	270	*DR*	0.0	0.0	0.0	1.00	*NC*	4.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	13	246	1.00
6-Mar-12	14	1.5	14	284	8.5	8.5	0.088	0.000066	1.00	1.6	4.3	3.1	8.8	27	0.027	27	0.027	1.00	21	267	1.00
13-Mar-12	15	1.2	12	296	17	25	0.26	0.00020	1.00	0.73	4.3	1.4	17	25	0.025	52	0.052	1.00	29	296	0.99
20-Mar-12	16	1.3	13	309	17	43	0.44	0.00033	1.00	0.75	4.3	1.4	18	26	0.026	78	0.078	1.00	30	326	0.99
27-Mar-12	17	1.4	13	323	18	60	0.63	0.00047	1.00	0.76	4.3	1.4	18	26	0.026	104	0.10	1.00	30	356	0.99
3-Apr-12	18	1.2	14	337	18	78	0.82	0.00061	1.00	0.77	4.3	1.4	19	27	0.027	131	0.13	1.00	32	388	0.99
10-Apr-12	19	1.0	14	351	18	97	1.0	0.00075	1.00	0.77	4.3	1.4	19	27	0.027	158	0.16	1.00	32	420	0.99
17-Apr-12	20	1.0	13	364	16	113	1.2	0.00088	1.00	0.81	4.3	1.4	17	23	0.023	181	0.18	1.00	29	448	0.99
24-Apr-12	21	1.3	15	379	18	131	1.4	0.0010	1.00	0.85	4.3	1.4	19	26	0.026	207	0.21	1.00	33	481	0.99
1-May-12	22	1.4	16	395	20	150	1.6	0.0012	1.00	0.81	4.3	1.4	20	29	0.029	236	0.24	1.00	35	516	0.99
8-May-12	23	1.4	17	411	21	172	1.8	0.0013	1.00	0.78	4.3	1.4	22	32	0.032	268	0.27	1.00	38	554	0.99
15-May-12	24	1.4	15	427	19	190	2.0	0.0015	1.00	0.81	4.3	1.5	20	29	0.029	297	0.30	0.99	33	587	0.99
22-May-12	25	1.3	12	439	15	205	2.1	0.0016	1.00	0.85	4.3	1.5	15	23	0.023	320	0.32	0.99	26	613	0.99
29-May-12	26	1.5	15	454	16	221	2.3	0.0017	1.00	0.90	4.3	1.6	17	27	0.027	348	0.35	0.99	30	643	0.99
5-Jun-12	27	1.5	16	470	17	238	2.5	0.0019	1.00	0.95	4.3	1.7	17	29	0.029	377	0.38	0.99	32	675	0.99
12-Jun-12	28	1.4	16	486	15	253	2.6	0.0020	1.00	1.1	4.3	1.8	16	28	0.028	405	0.40	0.99	30	705	0.99
19-Jun-12	29	1.3	17	502	13	266	2.8	0.0021	1.00	1.2	4.3	1.9	14	26	0.026	431	0.43	0.99	29	735	0.99
26-Jun-12	30	2.3	17	519	13	280	2.9	0.0022	1.00	1.3	4.3	1.8	14	25	0.025	456	0.46	0.99	28	763	0.99
3-Jul-12	31	3.4	17	536	13	293	3.0	0.0023	1.00	1.3	4.3	1.8	14	24	0.024	481	0.48	0.99	27	790	0.99
10-Jul-12	32	2.3	17	553	14	306	3.2	0.0024	1.00	1.3	4.3	1.8	14	26	0.026	507	0.51	0.99	29	819	0.99
17-Jul-12	33	1.2	17	571	14	320	3.3	0.0025	1.00	1.3	4.3	1.9	14	27	0.027	534	0.53	0.99	30	849	0.99
24-Jul-12	34	1.1	15	586	12	332	3.5	0.0026	1.00	1.2	4.3	1.9	13	25	0.025	558	0.56	0.99	27	876	0.98
31-Jul-12	35	1.00	13	598	11	344	3.6	0.0027	1.00	1.1	4.3	1.9	12	23	0.023	581	0.58	0.99	24	900	0.98
7-Aug-12	36	1.2	12	610	13	357	3.7	0.0028	1.00	0.87	4.3	1.6	14	23	0.023	604	0.60	0.99	24	924	0.98
14-Aug-12	37	1.5	11	621	16	373	3.9	0.0029	1.00	0.68	4.3	1.5	17	25	0.025	629	0.63	0.99	26	951	0.98
21-Aug-12	38	1.5	12	633	15	388	4.0	0.0030	1.00	0.75	4.3	1.5	16	24	0.024	653	0.65	0.99	26	976	0.98
28-Aug-12	39	1.6	13	646	16	404	4.2	0.0031	1.00	0.84	4.3	1.5	17	25	0.025	677	0.68	0.99	28	1005	0.98
4-Sep-12	40	1.5	14	660	16	421	4.4	0.0033	1.00	0.85	4.3	1.6	17	27	0.027	704	0.70	0.99	29	1034	0.98
11-Sep-12	41	1.3	14	673	16	437	4.5	0.0034	1.00	0.85	4.3	1.6	17	27	0.027	731	0.73	0.99	29	1063	0.98
18-Sep-12	42	1.7	16	689	16	453	4.7	0.0035	1.00	0.96	4.3	1.6	17	28	0.028	759	0.76	0.99	31	1094	0.98
25-Sep-12	43	1.7	15	704	14	467	4.9	0.0036	1.00	1.1	4.3	1.6	14	23	0.023	782	0.78	0.99	27	1121	0.98
2-Oct-12	44	1.8	14	717	12	478	5.0	0.0037	1.00	1.2	4.3	1.7	12	20	0.020	802	0.80	0.99	24	1145	0.98
9-Oct-12	45	1.9	13	730	9.6	488	5.1	0.0038	1.00	1.3	4.3	1.8	10	18	0.018	820	0.82	0.99	21	1166	0.98
16-Oct-12	46	1.6	15	746	11	498	5.2	0.0039	1.00	1.5	4.3	2.1	11	23	0.023	843	0.84	0.99	25	1191	0.98
23-Oct-12	47	1.5	17	763	11	510	5.3	0.0040	1.00	1.5	4.3	2.2	12	26	0.026	869	0.87	0.98	28	1219	0.98
30-Oct-12	48	1.4	17	780	11	521	5.4	0.0041	1.00	1.5	4.3	2.2	12	26	0.026	895	0.90	0.98	28	1246	0.98
6-Nov-12	49	1.2	17	797	11	532	5.5	0.0041	1.00	1.6	4.3	2.3	11	26	0.026	921	0.92	0.98	27	1274	0.98
13-Nov-12	50	1.1	14	811	10	542	5.6	0.0042	1.00	1.4	4.3	2.0	11	22	0.022	943	0.94	0.98	23	1297	0.98
20-Nov-12	51	1.1	13	824	10	552	5.7	0.0043	1.00	1.2	4.3	1.9	11	20	0.020	963	0.96	0.98	22	1319	0.98
27-Nov-12	52	1.1	12	836	10	563	5.9	0.0044	1.00	1.2	4.3	1.8	11	20	0.020	983	0.98	0.98	22	1341	0.98
4-Dec-12	53	0.94	9.9	846	8.9	571	5.9	0.0044	1.00	1.1	4.3	1.8	9.3	16	0.016	999	1.00	0.98	18	1359	0.98
11-Dec-12	54	1.5	12	858	11	582	6.1	0.0045	1.00	1.2	4.3	1.7	11	18	0.018	1017	1.0	0.98	22	1381	0.98
18-Dec-12	55	1.7	13	871	11	593	6.2	0.0046	1.00	1.2	4.3	1.6	11	19	0.019	1036	1.0	0.98	22	1403	0.98
25-Dec-12	56	1.8	13	884	11	604	6.3	0.0047	1.00	1.2	4.3	1.6	11	18	0.018	1055	1.1	0.98	22	1426	0.98
1-Jan-13	57	2.0	14	898	12	616	6.4	0.0048	1.00	1.2	4.3	1.6	13	20	0.020	1075	1.1	0.98	25	1450	0.97
8-Jan-13	58	1.6	12	910	11	627	6.5	0.0049	1.00	1.1	4.3	1.7	11	19	0.019	1094	1.1	0.98	22	1472	0.97
15-Jan-13	59	1.4	11	921	11	637	6.6	0.0050	1.00	1.1	4.3	1.7	11	19	0.019	1112	1.1	0.98	21	1493	0.97
22-Jan-13	60	1.3	11	932	11	648	6.7	0.0050	0.99	1.0	4.3	1.7	11	19	0.019	1131	1.1	0.98	21	1513	0.97
29-Jan-13	61	1.2	10	943	10	658	6.8	0.0051	0.99	1.0	4.3	1.7	11	18	0.018	1149	1.1	0.98	20	1533	0.97
5-Feb-13	62	1.5	11	954	10	668	7.0	0.0052	0.99	1.1	4.3	1.7	11	18	0.018	1168	1.2	0.98	20	1554	0.97
12-Feb-13	63	1.4	11	965	9.1	677	7.0	0.0053	0.99	1.2	4.3	1.8	9.5	17	0.017	1185	1.2	0.98	19	1573	0.97
19-Feb-13	64	1.6	12	977	9.8	687	7.2	0.0053	0.99	1.2	4.3	1.8	10	18	0.018	1203	1.2	0.98	21	1593	0.97
26-Feb-13	65	1.5	11	988	8.8	696	7.2	0.0054	**0.99**	1.3	4.3	1.8	9.2	16	0.016	1219	1.2	**0.98**	19	1612	0.97
Median (last 5)					**10.2**							**1.8**		**18.4**							

Notes: adings data removed to avoid overestimating the rate of NP depletion
not calculated due to removed sulphate loading data.
set at half the limit for NP depletion calculations.

Casino Kinetic Testwork Update

Molar Ratios and Depletion Rates for HC5

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumption (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum. (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
29-Nov-11	0	3.1	15	15	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	12	1.00
6-Dec-11	1	2.0	13	28	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	23	1.00
13-Dec-11	2	1.7	12	40	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	10	33	1.00
20-Dec-11	3	2.5	14	54	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	44	1.00
27-Dec-11	4	2.2	11	65	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.8	53	1.00
3-Jan-12	5	2.2	9.8	74	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	7.6	61	1.00
10-Jan-12	6	1.8	10	84	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.3	69	1.00
17-Jan-12	7	1.4	11	95	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.4	78	1.00
24-Jan-12	8	1.4	11	106	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.4	88	0.99
31-Jan-12	9	1.5	11	118	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.8	98	0.99
7-Feb-12	10	1.9	11	129	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.4	107	0.99
14-Feb-12	11	2.4	12	140	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.2	116	0.99
21-Feb-12	12	2.2	11	152	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.2	125	0.99
28-Feb-12	13	1.9	11	163	*DR*	0.0	0.0	0.0	1.00	*DR*	2.2	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.2	135	0.99
6-Mar-12	14	1.7	10	173	21	21	0.22	0.00032	1.00	0.48	2.2	2.5	22	55	0.055	55	0.055	1.00	31	165	0.99
13-Mar-12	15	1.4	9.3	182	41	63	0.65	0.00095	1.00	0.22	2.2	1.1	43	46	0.046	102	0.10	0.99	51	216	0.99
20-Mar-12	16	1.3	9.5	192	38	100	1.0	0.0015	1.00	0.25	2.2	1.1	39	43	0.043	145	0.14	0.99	47	264	0.98
27-Mar-12	17	1.3	9.5	202	33	133	1.4	0.0020	1.00	0.29	2.2	1.1	34	39	0.039	184	0.18	0.99	43	306	0.98
3-Apr-12	18	1.2	9.6	211	30	163	1.7	0.0025	1.00	0.32	2.2	1.1	31	35	0.035	219	0.22	0.99	40	346	0.98
10-Apr-12	19	1.0	9.2	220	26	189	2.0	0.0029	1.00	0.36	2.2	1.1	27	29	0.029	249	0.25	0.99	35	381	0.98
17-Apr-12	20	0.99	9.1	229	22	211	2.2	0.0032	1.00	0.41	2.2	1.1	23	26	0.026	275	0.27	0.98	31	412	0.98
24-Apr-12	21	1.1	10	240	22	233	2.4	0.0035	1.00	0.48	2.2	1.2	23	27	0.027	302	0.30	0.98	32	444	0.97
1-May-12	22	1.1	9.7	249	18	251	2.6	0.0038	1.00	0.54	2.2	1.3	19	23	0.023	325	0.33	0.98	27	471	0.97
8-May-12	23	1.1	9.8	259	15	266	2.8	0.0040	1.00	0.63	2.2	1.3	16	22	0.022	347	0.35	0.98	25	496	0.97
15-May-12	24	1.3	11	270	16	282	2.9	0.0043	1.00	0.67	2.2	1.4	17	23	0.023	370	0.37	0.98	26	522	0.97
22-May-12	25	1.3	11	281	16	298	3.1	0.0045	1.00	0.71	2.2	1.4	16	24	0.024	393	0.39	0.98	26	548	0.97
29-May-12	26	1.4	11	292	13	311	3.2	0.0047	1.00	0.83	2.2	1.6	14	22	0.022	415	0.42	0.98	23	572	0.97
5-Jun-12	27	1.4	10	302	9.9	321	3.3	0.0048	1.00	1.0	2.2	1.9	10	19	0.019	435	0.43	0.98	19	591	0.97
12-Jun-12	28	1.3	9.6	312	9.8	331	3.4	0.0050	1.00	0.99	2.2	1.7	10	18	0.018	453	0.45	0.97	19	609	0.97
19-Jun-12	29	1.1	8.9	321	9.6	340	3.5	0.0051	0.99	0.93	2.2	1.6	10.0	16	0.016	468	0.47	0.97	18	627	0.96
26-Jun-12	30	2.2	11	332	10	350	3.6	0.0053	0.99	1.1	2.2	1.7	11	18	0.018	486	0.49	0.97	19	646	0.96
3-Jul-12	31	3.2	12	344	10	361	3.8	0.0054	0.99	1.2	2.2	1.8	11	19	0.019	505	0.50	0.97	20	666	0.96
10-Jul-12	32	2.1	11	355	9.5	370	3.9	0.0056	0.99	1.1	2.2	1.8	9.9	17	0.017	522	0.52	0.97	18	685	0.96
17-Jul-12	33	1.0	9.1	364	8.7	379	3.9	0.0057	0.99	1.1	2.2	1.8	9.1	16	0.016	538	0.54	0.97	17	702	0.96
24-Jul-12	34	0.97	9.2	373	8.2	387	4.0	0.0058	0.99	1.1	2.2	1.9	8.6	17	0.017	555	0.55	0.97	17	719	0.96
31-Jul-12	35	0.86	8.9	382	7.4	394	4.1	0.0060	0.99	1.2	2.2	2.1	7.7	16	0.016	571	0.57	0.97	16	734	0.96
7-Aug-12	36	1.1	11	392	8.9	403	4.2	0.0061	0.99	1.2	2.2	1.9	9.3	18	0.018	589	0.59	0.97	19	753	0.96
14-Aug-12	37	1.2	11	403	9.3	413	4.3	0.0062	0.99	1.2	2.2	1.8	9.7	18	0.018	607	0.61	0.97	19	773	0.96
21-Aug-12	38	1.4	11	414	10	423	4.4	0.0064	0.99	1.1	2.2	1.7	11	18	0.018	625	0.62	0.96	20	793	0.95
28-Aug-12	39	1.7	13	427	13	435	4.5	0.0066	0.99	1.0	2.2	1.6	13	21	0.021	646	0.65	0.96	24	817	0.95
4-Sep-12	40	1.4	11	438	11	446	4.6	0.0067	0.99	1.0	2.2	1.7	11	19	0.019	665	0.66	0.96	21	837	0.95
11-Sep-12	41	1.2	9.9	448	9.2	455	4.7	0.0069	0.99	1.1	2.2	1.8	9.6	17	0.017	682	0.68	0.96	18	856	0.95
18-Sep-12	42	1.5	11	459	9.8	465	4.8	0.0070	0.99	1.2	2.2	1.7	10	18	0.018	700	0.70	0.96	20	876	0.95
25-Sep-12	43	1.4	10	470	8.5	474	4.9	0.0072	0.99	1.2	2.2	1.7	8.8	15	0.015	714	0.71	0.96	18	894	0.95
2-Oct-12	44	1.6	10	480	7.7	481	5.0	0.0073	0.99	1.3	2.2	1.8	8.1	14	0.014	729	0.73	0.96	16	910	0.95
9-Oct-12	45	1.9	9.6	489	7.0	488	5.1	0.0074	0.99	1.4	2.2	1.9	7.3	14	0.014	743	0.74	0.96	15	925	0.95
16-Oct-12	46	1.5	10	500	6.7	495	5.2	0.0075	0.99	1.6	2.2	2.2	7.0	16	0.016	759	0.76	0.96	16	941	0.95
23-Oct-12	47	1.4	11	511	6.9	502	5.2	0.0076	0.99	1.6	2.2	2.4	7.2	17	0.017	776	0.78	0.96	17	958	0.95
30-Oct-12	48	1.3	11	522	6.5	508	5.3	0.0077	0.99	1.7	2.2	2.5	6.8	17	0.017	793	0.79	0.95	17	975	0.94
6-Nov-12	49	1.1	10	533	6.0	514	5.4	0.0078	0.99	1.7	2.2	2.6	6.3	16	0.016	809	0.81	0.95	16	990	0.94
13-Nov-12	50	0.98	11	544	5.9	520	5.4	0.0079	0.99	1.9	2.2	2.5	6.1	15	0.015	825	0.82	0.95	17	1007	0.94
20-Nov-12	51	1.0	13	557	6.5	527	5.5	0.0080	0.99	2.0	2.2	2.5	6.8	17	0.017	841	0.84	0.95	19	1026	0.94
27-Nov-12	52	0.99	13	571	6.4	533	5.6	0.0081	0.99	2.1	2.2	2.4	6.7	16	0.016	858	0.86	0.95	19	1045	0.94
4-Dec-12	53	0.88	13	584	5.9	539	5.6	0.0081	0.99	2.1	2.2	2.4	6.2	15	0.015	872	0.87	0.95	18	1063	0.94
11-Dec-12	54	1.3	12	596	6.1	545	5.7	0.0082	0.99	2.0	2.2	2.5	6.3	16	0.016	888	0.89	0.95	17	1080	0.94
18-Dec-12	55	1.5	12	608	6.2	551	5.7	0.0083	0.99	1.9	2.2	2.6	6.4	17	0.017	905	0.90	0.95	17	1097	0.94
25-Dec-12	56	1.6	12	620	6.2	558	5.8	0.0084	0.99	1.9	2.2	2.6	6.4	17	0.017	922	0.92	0.95	17	1114	0.94
1-Jan-13	57	1.8	12	632	6.4	564	5.9	0.0085	0.99	1.9	2.2	2.6	6.6	17	0.017	939	0.94	0.95	17	1131	0.94
8-Jan-13	58	1.5	12	643	6.1	570	5.9	0.0086	0.99	1.9	2.2	2.6	6.4	17	0.017	956	0.96	0.95	17	1147	0.93
15-Jan-13	59	1.3	12	655	6.1	576	6.0	0.0087	0.99	1.9	2.2	2.6	6.4	17	0.017	972	0.97	0.94	17	1164	0.93
22-Jan-13	60	1.2	11	666	6.0	582	6.1	0.0088	0.99	1.9	2.2	2.6	6.2	16	0.016	989	0.99	0.94	16	1180	0.93
29-Jan-13	61	1.1	11	678	5.9	588	6.1	0.0089	0.99	1.9	2.2	2.6	6.1	16	0.016	1005	1.0	0.94	16	1197	0.93
5-Feb-13	62	1.4	11	689	5.5	594	6.2	0.0090	0.99	2.0	2.2	2.6	5.8	15	0.015	1020	1.0	0.94	16	1212	0.93
12-Feb-13	63	1.5	11	700	5.2	599	6.2	0.0090	0.99	2.1	2.2	2.5	5.5	14	0.014	1034	1.0	0.94	15	1227	0.93
19-Feb-13	64	1.5	11	711	5.0	604	6.3	0.0091	0.99	2.1	2.2	2.5	5.2	13	0.013	1047	1.0	0.94	14	1242	0.93
26-Feb-13	65	1.5	11	721	4.8	609	6.3	0.0092	**0.99**	2.2	2.2	2.5	5.0	13	0.013	1059	1.1	**0.94**	14	1256	0.93
Median (last 5)					**5.9**							**2.6**		**16.1**							

Notes: adings data removed to avoid overestimating the rate of NP depletion
not calculated due to removed sulphate loading data.
set at half the limit for NP depletion calculations.

Casino Kinetic Testwork Update

Molar Ratios and Depletion Rates for HC6

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumption (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum. (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
29-Nov-11	0	3.0	9.5	9.5	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6.5	6.5	1.00
6-Dec-11	1	1.8	11	20	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.8	15	1.00
13-Dec-11	2	1.5	9.5	30	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.0	23	1.00
20-Dec-11	3	2.4	12	42	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.6	33	1.00
27-Dec-11	4	1.9	9.9	52	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.1	41	1.00
3-Jan-12	5	1.8	9.8	61	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.0	49	1.00
10-Jan-12	6	1.5	10	72	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.7	58	1.00
17-Jan-12	7	1.1	10	82	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.4	67	1.00
24-Jan-12	8	1.3	11	93	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	10.0	77	1.00
31-Jan-12	9	1.4	12	105	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	10	87	0.99
7-Feb-12	10	1.7	12	117	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.9	97	0.99
14-Feb-12	11	1.8	11	127	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.8	106	0.99
21-Feb-12	12	1.7	10	138	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.7	115	0.99
28-Feb-12	13	1.5	9.9	147	*DR*	0.0	0.0	0.0	1.00	*NC*	1.8	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.4	123	0.99
6-Mar-12	14	1.3	9.5	157	2.3	2.3	0.023	0.000041	1.00	4.2	1.8	5.2	2.3	12	0.012	12	0.012	1.00	11	134	0.99
13-Mar-12	15	1.2	9.4	166	4.5	6.7	0.070	0.00012	1.00	2.1	1.8	2.7	4.6	12	0.012	25	0.025	1.00	13	147	0.99
20-Mar-12	16	1.1	9.2	176	4.0	11	0.11	0.00020	1.00	2.3	1.8	2.7	4.2	11	0.011	36	0.036	1.00	12	159	0.99
27-Mar-12	17	1.1	9.0	185	3.6	14	0.15	0.00026	1.00	2.5	1.8	2.8	3.7	10	0.010	46	0.046	1.00	12	170	0.99
3-Apr-12	18	1.0	8.5	193	3.4	18	0.18	0.00033	1.00	2.5	1.8	2.8	3.6	10.0	0.0100	56	0.056	1.00	11	181	0.99
10-Apr-12	19	0.89	7.4	201	3.1	21	0.22	0.00038	1.00	2.4	1.8	2.8	3.2	9.1	0.0091	65	0.065	1.00	9.8	191	0.99
17-Apr-12	20	0.93	8.3	209	3.1	24	0.25	0.00044	1.00	2.7	1.8	2.8	3.2	9.0	0.0090	74	0.074	1.00	11	202	0.99
24-Apr-12	21	0.97	9.3	218	3.1	27	0.28	0.00050	1.00	3.0	1.8	2.8	3.2	9.0	0.0090	83	0.083	0.99	12	213	0.99
1-May-12	22	1.0	8.7	227	3.2	30	0.31	0.00056	1.00	2.7	1.8	2.8	3.3	9.4	0.0094	93	0.093	0.99	11	224	0.99
8-May-12	23	1.2	8.5	235	3.4	34	0.35	0.00062	1.00	2.5	1.8	2.9	3.6	10	0.010	103	0.10	0.99	11	235	0.99
15-May-12	24	1.3	8.1	243	3.1	37	0.38	0.00068	1.00	2.6	1.8	3.1	3.3	9.9	0.0099	113	0.11	0.99	10.0	245	0.98
22-May-12	25	1.4	7.5	251	2.8	39	0.41	0.00073	1.00	2.7	1.8	3.2	2.9	9.3	0.0093	122	0.12	0.99	9.0	254	0.98
29-May-12	26	1.3	8.0	259	2.2	42	0.43	0.00077	1.00	3.7	1.8	3.8	2.3	8.7	0.0087	131	0.13	0.99	9.0	263	0.98
5-Jun-12	27	1.2	9.3	268	1.8	43	0.45	0.00080	1.00	5.2	1.8	4.7	1.9	8.9	0.0089	140	0.14	0.99	10.0	273	0.98
12-Jun-12	28	1.1	8.3	277	1.8	45	0.47	0.00083	1.00	4.7	1.8	4.6	1.9	8.5	0.0085	148	0.15	0.99	9.1	282	0.98
19-Jun-12	29	1.1	7.4	284	1.8	47	0.49	0.00087	1.00	4.2	1.8	4.4	1.8	8.0	0.0080	156	0.16	0.99	8.2	290	0.98
26-Jun-12	30	1.9	9.1	293	2.0	49	0.51	0.00090	1.00	4.5	1.8	3.9	2.1	8.2	0.0082	165	0.16	0.99	9.3	300	0.98
3-Jul-12	31	2.8	11	304	2.3	51	0.53	0.00095	1.00	4.8	1.8	3.6	2.3	8.4	0.0084	173	0.17	0.99	10	310	0.98
10-Jul-12	32	1.8	9.0	313	2.2	53	0.56	0.00099	1.00	4.1	1.8	3.6	2.3	8.2	0.0082	181	0.18	0.99	9.5	320	0.98
17-Jul-12	33	0.90	7.4	320	2.2	56	0.58	0.0010	1.00	3.4	1.8	3.6	2.3	8.1	0.0081	189	0.19	0.99	8.8	328	0.98
24-Jul-12	34	0.90	7.4	328	2.2	58	0.60	0.0011	1.00	3.3	1.8	3.6	2.3	8.2	0.0082	198	0.20	0.99	8.7	337	0.98
31-Jul-12	35	0.89	7.1	335	2.2	60	0.62	0.0011	1.00	3.3	1.8	3.6	2.3	8.2	0.0082	206	0.21	0.99	8.5	346	0.98
7-Aug-12	36	0.96	7.1	342	2.6	63	0.65	0.0012	1.00	2.7	1.8	3.0	2.8	8.3	0.0083	214	0.21	0.99	8.9	354	0.98
14-Aug-12	37	1.1	7.3	349	3.3	66	0.69	0.0012	1.00	2.2	1.8	2.6	3.4	8.8	0.0088	223	0.22	0.99	9.6	364	0.98
21-Aug-12	38	1.2	7.2	356	3.4	69	0.72	0.0013	1.00	2.1	1.8	2.5	3.6	8.9	0.0089	232	0.23	0.99	9.5	374	0.98
28-Aug-12	39	1.5	7.8	364	3.9	73	0.76	0.0013	1.00	2.0	1.8	2.4	4.0	9.9	0.0099	242	0.24	0.98	10	384	0.98
4-Sep-12	40	1.3	7.3	371	4.0	77	0.80	0.0014	1.00	1.8	1.8	2.3	4.2	9.5	0.0095	251	0.25	0.98	10	394	0.98
11-Sep-12	41	1.0	6.6	378	4.0	81	0.85	0.0015	1.00	1.6	1.8	2.1	4.2	8.7	0.0087	260	0.26	0.98	9.7	404	0.97
18-Sep-12	42	1.4	7.6	386	4.0	85	0.89	0.0016	1.00	1.9	1.8	2.2	4.2	9.3	0.0093	269	0.27	0.98	10	414	0.97
25-Sep-12	43	1.4	7.0	393	3.1	88	0.92	0.0016	1.00	2.2	1.8	2.4	3.2	7.9	0.0079	277	0.28	0.98	8.8	423	0.97
2-Oct-12	44	1.4	6.3	399	2.9	91	0.95	0.0017	1.00	2.2	1.8	2.4	3.0	7.2	0.0072	284	0.28	0.98	7.8	431	0.97
9-Oct-12	45	1.6	6.1	405	2.8	94	0.98	0.0017	1.00	2.1	1.8	2.4	2.9	7.1	0.0071	291	0.29	0.98	7.3	438	0.97
16-Oct-12	46	1.4	6.3	411	2.5	97	1.0	0.0018	1.00	2.5	1.8	3.1	2.6	8.0	0.0080	299	0.30	0.98	7.5	446	0.97
23-Oct-12	47	1.4	6.8	418	2.5	99	1.0	0.0018	1.00	2.7	1.8	3.4	2.6	9.0	0.0090	308	0.31	0.98	8.0	454	0.97
30-Oct-12	48	1.3	6.6	425	2.4	101	1.1	0.0019	1.00	2.8	1.8	3.6	2.5	8.9	0.0089	317	0.32	0.98	7.8	462	0.97
6-Nov-12	49	1.2	6.5	431	2.2	104	1.1	0.0019	1.00	2.9	1.8	3.8	2.3	8.9	0.0089	326	0.33	0.98	7.6	469	0.97
13-Nov-12	50	1.0	6.5	437	2.9	107	1.1	0.0020	1.00	2.2	1.8	2.9	3.0	8.7	0.0087	335	0.33	0.98	8.5	478	0.97
20-Nov-12	51	1.0	7.2	445	3.6	110	1.1	0.0020	1.00	2.0	1.8	2.6	3.7	9.6	0.0096	345	0.34	0.98	9.8	488	0.97
27-Nov-12	52	0.99	7.2	452	3.7	114	1.2	0.0021	1.00	1.9	1.8	2.4	3.9	9.5	0.0095	354	0.35	0.98	10	498	0.97
4-Dec-12	53	0.96	7.3	459	4.0	118	1.2	0.0022	1.00	1.8	1.8	2.3	4.1	9.6	0.0096	364	0.36	0.98	10	508	0.97
11-Dec-12	54	1.3	7.2	466	2.8	121	1.3	0.0022	1.00	2.6	1.8	3.0	2.9	8.9	0.0089	373	0.37	0.98	8.9	517	0.97
18-Dec-12	55	1.4	7.1	473	2.3	123	1.3	0.0023	1.00	3.1	1.8	3.6	2.4	8.6	0.0086	381	0.38	0.98	8.1	525	0.97
25-Dec-12	56	1.5	7.3	481	2.1	125	1.3	0.0023	1.00	3.5	1.8	4.0	2.2	8.6	0.0086	390	0.39	0.98	7.9	533	0.97
1-Jan-13	57	1.6	7.2	488	1.8	127	1.3	0.0023	1.00	4.0	1.8	4.5	1.9	8.4	0.0084	398	0.40	0.97	7.5	540	0.97
8-Jan-13	58	1.5	7.2	495	2.5	129	1.3	0.0024	1.00	2.9	1.8	3.3	2.6	8.6	0.0086	407	0.41	0.97	8.3	549	0.97
15-Jan-13	59	1.2	6.4	501	2.6	132	1.4	0.0024	1.00	2.5	1.8	2.9	2.7	7.8	0.0078	414	0.41	0.97	7.8	557	0.96
22-Jan-13	60	1.1	6.1	508	2.6	134	1.4	0.0025	1.00	2.3	1.8	2.7	2.7	7.5	0.0075	422	0.42	0.97	7.7	564	0.96
29-Jan-13	61	1.1	5.9	513	2.7	137	1.4	0.0025	1.00	2.2	1.8	2.6	2.8	7.3	0.0073	429	0.43	0.97	7.7	572	0.96
5-Feb-13	62	1.3	6.0	519	2.7	140	1.5	0.0026	1.00	2.2	1.8	2.4	2.8	6.9	0.0069	436	0.44	0.97	7.5	579	0.96
12-Feb-13	63	1.5	6.2	526	2.8	143	1.5	0.0026	1.00	2.2	1.8	2.4	2.9	6.9	0.0069	443	0.44	0.97	7.6	587	0.96
19-Feb-13	64	1.5	5.9	532	2.7	145	1.5	0.0027	1.00	2.2	1.8	2.3	2.8	6.5	0.0065	450	0.45	0.97	7.2	594	0.96
26-Feb-13	65	1.6	6.0	538	2.7	148	1.5	0.0027	**1.00**	2.2	1.8	2.3	2.8	6.5	0.0065	456	0.46	**0.97**	7.3	602	0.96
Median (last 5)					**2.7**							**2.6**		**8.4**							

Notes: adings data removed to avoid overestimating the rate of NP depletion
not calculated due to removed sulphate loading data.
set at half the limit for NP depletion calculations.

Casino Kinetic Testwork Update

Molar Ratios and Depletion Rates for HC7

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumption (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum. (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
29-Nov-11	0	5.9	39	39	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	33	33	1.00
6-Dec-11	1	2.1	14	53	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	45	1.00
13-Dec-11	2	1.6	7.8	61	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6.2	51	1.00
20-Dec-11	3	2.2	8.7	69	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6.5	58	1.00
27-Dec-11	4	2.4	9.2	79	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6.8	65	1.00
3-Jan-12	5	2.5	9.3	88	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6.8	71	1.00
10-Jan-12	6	1.9	8.3	96	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6.5	78	1.00
17-Jan-12	7	1.6	8.8	105	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	7.2	85	1.00
24-Jan-12	8	1.5	7.3	112	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	5.7	91	1.00
31-Jan-12	9	1.8	7.2	120	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	5.4	96	1.00
7-Feb-12	10	2.1	9.0	129	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6.9	103	1.00
14-Feb-12	11	2.2	9.7	138	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	7.5	111	1.00
21-Feb-12	12	2.0	8.5	147	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6.5	117	1.00
28-Feb-12	13	1.9	7.4	154	*DR*	0.0	0.0	0.0	1.00	*NC*	3.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	5.5	123	0.99
6-Mar-12	14	1.7	7.2	161	24	24	0.25	0.00025	1.00	0.30	3.3	2.3	25	56	0.056	56	0.056	1.00	31	153	0.99
13-Mar-12	15	1.4	6.6	168	44	68	0.71	0.00070	1.00	0.15	3.3	1.2	46	53	0.053	109	0.11	1.00	51	204	0.99
20-Mar-12	16	1.3	6.0	174	37	105	1.1	0.0011	1.00	0.16	3.3	1.1	39	43	0.043	153	0.15	0.99	44	248	0.99
27-Mar-12	17	1.3	5.8	180	34	139	1.4	0.0014	1.00	0.17	3.3	1.1	35	37	0.037	190	0.19	0.99	40	288	0.99
3-Apr-12	18	1.1	5.9	186	32	171	1.8	0.0018	1.00	0.19	3.2	1.1	33	35	0.035	225	0.23	0.99	38	326	0.99
10-Apr-12	19	0.97	5.7	191	28	200	2.1	0.0020	1.00	0.20	3.2	1.1	30	31	0.031	257	0.26	0.99	34	360	0.99
17-Apr-12	20	1.0	5.6	197	26	225	2.3	0.0023	1.00	0.22	3.2	1.1	27	29	0.029	286	0.29	0.99	31	392	0.98
24-Apr-12	21	1.2	6.3	203	27	253	2.6	0.0026	1.00	0.23	3.2	1.1	28	30	0.030	316	0.32	0.99	34	425	0.98
1-May-12	22	1.3	5.5	209	23	275	2.9	0.0028	1.00	0.24	3.2	1.1	24	27	0.027	343	0.34	0.99	28	453	0.98
8-May-12	23	1.4	5.1	214	20	295	3.1	0.0030	1.00	0.25	3.2	1.2	21	25	0.025	368	0.37	0.98	25	478	0.98
15-May-12	24	1.5	5.6	220	22	318	3.3	0.0033	1.00	0.25	3.2	1.3	23	29	0.029	397	0.40	0.98	27	505	0.98
22-May-12	25	1.3	4.9	224	19	337	3.5	0.0035	1.00	0.25	3.2	1.3	20	26	0.026	423	0.42	0.98	24	529	0.98
29-May-12	26	1.4	5.6	230	20	357	3.7	0.0037	1.00	0.28	3.2	1.2	21	26	0.026	449	0.45	0.98	25	554	0.98
5-Jun-12	27	1.4	5.6	236	18	375	3.9	0.0038	1.00	0.32	3.2	1.1	18	21	0.021	470	0.47	0.98	22	576	0.98
12-Jun-12	28	1.3	5.7	241	17	391	4.1	0.0040	1.00	0.34	3.2	1.2	17	21	0.021	490	0.49	0.98	22	598	0.98
19-Jun-12	29	1.3	5.9	247	16	407	4.2	0.0042	1.00	0.37	3.2	1.3	17	21	0.021	512	0.51	0.98	21	619	0.97
26-Jun-12	30	2.2	7.0	254	16	424	4.4	0.0043	1.00	0.43	3.2	1.3	17	23	0.023	534	0.53	0.98	22	641	0.97
3-Jul-12	31	2.9	7.6	262	16	440	4.6	0.0045	1.00	0.47	3.2	1.4	17	23	0.023	557	0.56	0.98	21	662	0.97
10-Jul-12	32	1.9	6.6	268	15	454	4.7	0.0047	1.00	0.45	3.2	1.4	15	22	0.022	579	0.58	0.98	20	682	0.97
17-Jul-12	33	0.96	6.0	274	14	468	4.9	0.0048	1.00	0.43	3.2	1.5	15	21	0.021	600	0.60	0.98	20	702	0.97
24-Jul-12	34	0.88	5.2	280	12	480	5.0	0.0049	1.00	0.45	3.2	1.5	12	18	0.018	618	0.62	0.97	17	718	0.97
31-Jul-12	35	0.95	5.5	285	12	491	5.1	0.0050	0.99	0.47	3.2	1.6	12	19	0.019	637	0.64	0.97	16	735	0.97
7-Aug-12	36	1.1	5.2	290	13	504	5.3	0.0052	0.99	0.40	3.2	1.4	13	18	0.018	656	0.66	0.97	18	753	0.97
14-Aug-12	37	1.2	5.1	295	15	519	5.4	0.0053	0.99	0.35	3.2	1.2	15	18	0.018	674	0.67	0.97	19	772	0.97
21-Aug-12	38	1.3	5.1	301	14	533	5.5	0.0055	0.99	0.36	3.2	1.2	15	18	0.018	691	0.69	0.97	18	790	0.97
28-Aug-12	39	1.7	5.7	306	15	548	5.7	0.0056	0.99	0.38	3.2	1.2	16	20	0.020	711	0.71	0.97	20	810	0.97
4-Sep-12	40	1.4	5.3	312	15	563	5.9	0.0058	0.99	0.36	3.2	1.3	15	20	0.020	731	0.73	0.97	19	829	0.97
11-Sep-12	41	1.3	5.2	317	15	578	6.0	0.0059	0.99	0.35	3.2	1.3	16	21	0.021	752	0.75	0.97	19	848	0.96
18-Sep-12	42	1.6	6.0	323	17	594	6.2	0.0061	0.99	0.36	3.2	1.3	17	22	0.022	774	0.77	0.97	22	870	0.96
25-Sep-12	43	1.6	5.6	328	15	609	6.3	0.0062	0.99	0.37	3.2	1.2	16	19	0.019	793	0.79	0.97	20	890	0.96
2-Oct-12	44	1.8	5.2	334	13	623	6.5	0.0064	0.99	0.39	3.2	1.2	14	17	0.017	810	0.81	0.97	17	907	0.96
9-Oct-12	45	2.1	4.9	338	12	635	6.6	0.0065	0.99	0.41	3.2	1.3	12	16	0.016	825	0.83	0.97	15	922	0.96
16-Oct-12	46	1.8	5.0	343	12	647	6.7	0.0066	0.99	0.40	3.2	1.3	13	17	0.017	842	0.84	0.97	16	938	0.96
23-Oct-12	47	1.6	5.0	348	13	660	6.9	0.0068	0.99	0.40	3.2	1.3	13	17	0.017	860	0.86	0.96	17	955	0.96
30-Oct-12	48	1.5	5.1	354	13	673	7.0	0.0069	0.99	0.39	3.2	1.3	14	18	0.018	878	0.88	0.96	17	972	0.96
6-Nov-12	49	1.4	5.0	359	13	686	7.1	0.0070	0.99	0.39	3.2	1.3	13	18	0.018	895	0.90	0.96	17	989	0.96
13-Nov-12	50	1.2	6.3	365	16	701	7.3	0.0072	0.99	0.40	3.2	1.2	16	20	0.020	916	0.92	0.96	21	1011	0.96
20-Nov-12	51	1.1	6.8	372	17	718	7.5	0.0074	0.99	0.40	3.2	1.2	17	21	0.021	937	0.94	0.96	23	1034	0.96
27-Nov-12	52	1.1	7.2	379	18	736	7.7	0.0075	0.99	0.41	3.2	1.2	18	22	0.022	959	0.96	0.96	24	1058	0.96
4-Dec-12	53	0.89	6.3	385	16	751	7.8	0.0077	0.99	0.41	3.2	1.2	16	19	0.019	978	0.98	0.96	22	1080	0.96
11-Dec-12	54	1.3	6.1	391	14	765	8.0	0.0078	0.99	0.45	3.2	1.2	14	17	0.017	995	1.00	0.96	19	1099	0.95
18-Dec-12	55	1.5	5.8	397	12	777	8.1	0.0080	0.99	0.48	3.2	1.2	13	16	0.016	1011	1.0	0.96	17	1116	0.95
25-Dec-12	56	1.7	6.0	403	12	789	8.2	0.0081	0.99	0.50	3.2	1.2	12	15	0.015	1026	1.0	0.96	17	1132	0.95
1-Jan-13	57	1.9	6.1	409	12	801	8.3	0.0082	0.99	0.52	3.2	1.3	12	15	0.015	1041	1.0	0.96	17	1149	0.95
8-Jan-13	58	1.5	5.7	415	12	812	8.5	0.0083	0.99	0.48	3.2	1.3	12	16	0.016	1057	1.1	0.96	17	1166	0.95
15-Jan-13	59	1.3	5.6	420	12	825	8.6	0.0085	0.99	0.46	3.2	1.3	13	17	0.017	1074	1.1	0.96	17	1182	0.95
22-Jan-13	60	1.3	5.5	426	12	837	8.7	0.0086	0.99	0.45	3.2	1.3	13	17	0.017	1091	1.1	0.95	17	1199	0.95
29-Jan-13	61	1.2	5.5	431	12	849	8.8	0.0087	0.99	0.44	3.2	1.3	13	17	0.017	1108	1.1	0.95	17	1217	0.95
5-Feb-13	62	1.5	5.5	437	12	861	9.0	0.0088	0.99	0.45	3.2	1.2	13	16	0.016	1123	1.1	0.95	17	1233	0.95
12-Feb-13	63	1.7	5.5	442	12	874	9.1	0.0090	0.99	0.45	3.2	1.2	13	15	0.015	1139	1.1	0.95	16	1250	0.95
19-Feb-13	64	1.8	5.4	448	12	885	9.2	0.0091	0.99	0.46	3.2	1.2	12	15	0.015	1153	1.2	0.95	16	1266	0.95
26-Feb-13	65	1.8	5.4	453	12	897	9.3	0.0092	**0.99**	0.46	3.2	1.2	12	14	0.014	1167	1.2	**0.95**	16	1282	0.95
Median (last 5)					**12**							**1**		**17**							

Notes: adings data removed to avoid overestimating the rate of NP depletion
not calculated due to removed sulphate loading data.
set at half the limit for NP depletion calculations.

Casino Kinetic Testwork Update

Molar Ratios and Depletion Rates for HC11

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumption (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum. (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
29-Nov-11	0	3.1	14	14	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	10	10	1.00
6-Dec-11	1	2.2	14	27	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	22	1.00
13-Dec-11	2	2.1	14	41	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	34	1.00
20-Dec-11	3	2.4	15	56	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	46	1.00
27-Dec-11	4	2.3	15	71	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	13	59	1.00
3-Jan-12	5	2.0	13	85	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	70	1.00
10-Jan-12	6	1.6	14	98	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	83	1.00
17-Jan-12	7	1.3	15	113	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	13	96	0.99
24-Jan-12	8	1.5	15	128	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	110	0.99
31-Jan-12	9	1.6	15	144	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	124	0.99
7-Feb-12	10	1.9	14	158	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	136	0.99
14-Feb-12	11	2.2	13	171	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	147	0.99
21-Feb-12	12	2.0	12	184	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	10	157	0.99
28-Feb-12	13	1.7	11	195	*DR*	0.0	0.0	0.0	1.00	*NC*	2.3	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	9.6	167	0.99
6-Mar-12	14	1.5	11	206	2.9	2.9	0.030	0.000043	1.00	3.8	2.3	4.4	3.0	13	0.013	13	0.013	1.00	13	180	0.99
13-Mar-12	15	1.3	11	217	5.8	8.7	0.091	0.00013	1.00	1.9	2.3	2.2	6.0	13	0.013	27	0.027	1.00	15	195	0.99
20-Mar-12	16	1.4	11	227	6.2	15	0.16	0.00022	1.00	1.7	2.3	2.2	6.5	14	0.014	41	0.041	1.00	16	211	0.99
27-Mar-12	17	1.4	9.8	237	6.2	21	0.22	0.00031	1.00	1.6	2.3	2.2	6.5	14	0.014	55	0.055	1.00	15	225	0.99
3-Apr-12	18	1.4	10.0	247	6.6	28	0.29	0.00041	1.00	1.5	2.3	2.0	6.9	14	0.014	69	0.069	1.00	15	241	0.99
10-Apr-12	19	1.3	9.8	257	6.7	34	0.36	0.00051	1.00	1.5	2.3	2.0	7.0	14	0.014	83	0.083	1.00	15	256	0.99
17-Apr-12	20	1.4	10	267	6.1	41	0.42	0.00060	1.00	1.6	2.3	2.1	6.4	14	0.014	96	0.096	0.99	15	271	0.99
24-Apr-12	21	1.5	10	277	5.6	46	0.48	0.00068	1.00	1.9	2.3	2.4	5.9	14	0.014	110	0.11	0.99	15	286	0.98
1-May-12	22	1.4	9.7	287	5.3	51	0.54	0.00076	1.00	1.8	2.3	2.3	5.5	13	0.013	123	0.12	0.99	14	300	0.98
8-May-12	23	1.4	9.4	296	5.2	57	0.59	0.00083	1.00	1.8	2.3	2.3	5.4	12	0.012	136	0.14	0.99	13	313	0.98
15-May-12	24	1.5	9.3	306	4.5	61	0.64	0.00090	1.00	2.1	2.3	2.6	4.7	12	0.012	148	0.15	0.99	12	326	0.98
22-May-12	25	1.7	9.3	315	3.9	65	0.68	0.00096	1.00	2.4	2.3	3.0	4.1	12	0.012	160	0.16	0.99	12	337	0.98
29-May-12	26	1.7	9.0	324	3.8	69	0.72	0.0010	1.00	2.4	2.3	3.0	3.9	12	0.012	172	0.17	0.99	11	349	0.98
5-Jun-12	27	1.8	9.8	334	4.1	73	0.76	0.0011	1.00	2.4	2.3	3.0	4.2	13	0.013	185	0.19	0.99	12	361	0.98
12-Jun-12	28	1.6	8.3	342	3.9	77	0.80	0.0011	1.00	2.1	2.3	2.9	4.1	12	0.012	197	0.20	0.99	11	372	0.98
19-Jun-12	29	1.4	7.2	349	3.9	81	0.84	0.0012	1.00	1.8	2.3	2.7	4.1	11	0.011	208	0.21	0.99	9.9	382	0.98
26-Jun-12	30	2.3	8.7	358	4.0	85	0.88	0.0012	1.00	2.2	2.3	2.7	4.1	11	0.011	219	0.22	0.99	10	392	0.98
3-Jul-12	31	3.2	10	368	3.9	89	0.92	0.0013	1.00	2.6	2.3	2.7	4.1	11	0.011	230	0.23	0.99	11	403	0.98
10-Jul-12	32	2.3	9.5	377	4.2	93	0.97	0.0014	1.00	2.3	2.3	2.7	4.4	12	0.012	242	0.24	0.99	12	414	0.98
17-Jul-12	33	1.3	8.9	386	4.5	97	1.0	0.0014	1.00	2.0	2.3	2.7	4.6	12	0.012	254	0.25	0.99	12	427	0.98
24-Jul-12	34	1.2	7.9	394	4.0	101	1.1	0.0015	1.00	2.0	2.3	2.7	4.2	11	0.011	266	0.27	0.99	11	438	0.98
31-Jul-12	35	1.2	7.4	402	3.9	105	1.1	0.0015	1.00	1.9	2.3	2.8	4.1	11	0.011	277	0.28	0.98	10	448	0.98
7-Aug-12	36	1.5	7.7	409	5.5	111	1.2	0.0016	1.00	1.4	2.3	2.2	5.7	13	0.013	290	0.29	0.98	12	460	0.97
14-Aug-12	37	1.9	8.3	418	7.4	118	1.2	0.0017	1.00	1.1	2.3	1.9	7.7	14	0.014	304	0.30	0.98	14	474	0.97
21-Aug-12	38	1.8	8.3	426	6.2	124	1.3	0.0018	1.00	1.3	2.3	1.9	6.5	13	0.013	316	0.32	0.98	13	487	0.97
28-Aug-12	39	1.8	8.9	435	5.7	130	1.4	0.0019	1.00	1.6	2.3	2.0	5.9	12	0.012	328	0.33	0.98	13	500	0.97
4-Sep-12	40	1.9	8.9	444	6.2	136	1.4	0.0020	1.00	1.4	2.3	2.0	6.4	13	0.013	341	0.34	0.98	13	513	0.97
11-Sep-12	41	1.8	8.2	452	6.3	142	1.5	0.0021	1.00	1.3	2.3	2.0	6.6	13	0.013	355	0.35	0.98	13	526	0.97
18-Sep-12	42	2.0	9.5	461	6.2	149	1.5	0.0022	1.00	1.5	2.3	2.1	6.4	13	0.013	368	0.37	0.98	14	540	0.97
25-Sep-12	43	2.0	9.5	471	5.3	154	1.6	0.0023	1.00	1.8	2.3	2.1	5.6	12	0.012	380	0.38	0.98	13	553	0.97
2-Oct-12	44	2.0	8.3	479	4.7	159	1.7	0.0023	1.00	1.8	2.3	2.3	4.9	11	0.011	391	0.39	0.98	11	564	0.97
9-Oct-12	45	2.0	6.9	486	4.0	163	1.7	0.0024	1.00	1.7	2.3	2.4	4.2	10	0.010	401	0.40	0.98	9.1	573	0.97
16-Oct-12	46	1.9	8.2	494	4.5	167	1.7	0.0025	1.00	1.8	2.3	2.6	4.7	12	0.012	413	0.41	0.98	11	584	0.97
23-Oct-12	47	2.0	9.9	504	5.4	172	1.8	0.0025	1.00	1.8	2.3	2.7	5.6	15	0.015	428	0.43	0.98	13	598	0.97
30-Oct-12	48	1.9	10	514	5.4	178	1.9	0.0026	1.00	1.9	2.3	2.7	5.6	15	0.015	443	0.44	0.98	14	612	0.97
6-Nov-12	49	1.8	9.9	524	5.3	183	1.9	0.0027	1.00	1.9	2.3	2.7	5.5	15	0.015	458	0.46	0.97	14	625	0.97
13-Nov-12	50	1.6	8.6	533	5.5	189	2.0	0.0028	1.00	1.6	2.3	2.3	5.8	14	0.014	472	0.47	0.97	13	638	0.97
20-Nov-12	51	1.7	8.6	541	6.1	195	2.0	0.0029	1.00	1.4	2.3	2.2	6.4	14	0.014	486	0.49	0.97	13	651	0.96
27-Nov-12	52	1.7	8.4	550	6.2	201	2.1	0.0030	1.00	1.3	2.3	2.1	6.5	14	0.014	500	0.50	0.97	13	664	0.96
4-Dec-12	53	1.5	7.5	557	5.9	207	2.2	0.0030	1.00	1.3	2.3	2.0	6.2	13	0.013	512	0.51	0.97	12	677	0.96
11-Dec-12	54	1.9	9.9	567	4.2	211	2.2	0.0031	1.00	2.3	2.3	2.8	4.4	12	0.012	524	0.52	0.97	12	689	0.96
18-Dec-12	55	2.1	11	578	3.3	214	2.2	0.0032	1.00	3.3	2.3	3.5	3.4	12	0.012	536	0.54	0.97	12	701	0.96
25-Dec-12	56	2.1	11	589	2.7	217	2.3	0.0032	1.00	4.1	2.3	4.0	2.8	11	0.011	548	0.55	0.97	12	713	0.96
1-Jan-13	57	2.6	13	603	2.6	220	2.3	0.0032	1.00	5.1	2.3	4.8	2.7	13	0.013	561	0.56	0.97	14	727	0.96
8-Jan-13	58	1.9	10.0	613	3.3	223	2.3	0.0033	1.00	3.1	2.3	3.5	3.4	12	0.012	573	0.57	0.97	11	738	0.96
15-Jan-13	59	1.7	9.0	622	3.7	227	2.4	0.0033	1.00	2.4	2.3	3.2	3.9	12	0.012	585	0.59	0.97	11	749	0.96
22-Jan-13	60	1.6	8.3	630	3.8	231	2.4	0.0034	1.00	2.2	2.3	3.0	4.0	12	0.012	597	0.60	0.97	11	760	0.96
29-Jan-13	61	1.5	7.8	638	4.1	235	2.4	0.0035	1.00	1.9	2.3	2.9	4.2	12	0.012	609	0.61	0.97	11	770	0.96
5-Feb-13	62	1.8	8.7	646	4.4	239	2.5	0.0035	1.00	2.0	2.3	2.5	4.6	11	0.011	620	0.62	0.97	11	782	0.96
12-Feb-13	63	1.9	8.9	655	4.4	243	2.5	0.0036	1.00	2.0	2.3	2.3	4.6	11	0.011	631	0.63	0.97	12	793	0.96
19-Feb-13	64	2.0	9.2	664	4.5	248	2.6	0.0036	1.00	2.0	2.3	2.2	4.7	10	0.010	641	0.64	0.96	12	805	0.96
26-Feb-13	65	2.1	9.2	674	4.5	252	2.6	0.0037	**1.00**	2.1	2.3	2.1	4.7	10	0.010	651	0.65	**0.96**	12	817	0.96
Median (last 5)					**4.5**							**2.7**		**12.5**							

Notes: adings data removed to avoid overestimating the rate of NP depletion
not calculated due to removed sulphate loading data.
set at half the limit for NP depletion calculations.

Humidity Cell	Initial CaNP[1]	CaNP remaining after HC test		Median Consumption rate		Time to depletion[6]	
	kg $CaCO_3$/t	% of initial[2]	kg $CaCO_3$/kg sample[3]	mg $CaCO_3$/kg/wk[4]	kg $CaCO_3$/kg/wk[5]	weeks	years
HC11	18.3	97.1%	0.018	9.4	0.000009	1,896	36.5
HC3	22.5	95.9%	0.022	12.7	0.000013	1,695	32.6
HC4	57.5	97.9%	0.056	18.4	0.000018	3,056	58.8
HC5	17.5	94.4%	0.017	12.3	0.000012	1,340	25.8
HC6	15.8	98.0%	0.015	5.6	0.000006	2,754	53.0
HC7	24.15	95.2%	0.023	17.0	0.000017	1,352	26.0

Notes
1 From Tables 4-16 and 4-1
2 From Appendix E
3 = initial CaNP * % of initial ÷ 1,000 kg of sampl
4 Calculated as the median of the final five humidity cell valu
5 = mg $CaCO_3$/kg/wk ÷ 1,000,000 mg/kg
6 = (CaNP remaining after HC test) ÷ median leaching ra

Humidity Cell	Initial Total-S[1]	Total-S remaining after test		Median Production rate		Time to depletion[6]		Remainning T-S after CaNP depletion		
	%	% of initial[2]	mg Total-S /kg sample[3]	mg SO_4/kg/wk[4]	mg Tota-S /kg/wk[5]	weeks	years	T-S (mg/kg) produced to deplete NP	T-S (mg/kg)	T-S (%)
HC11	2.27	99.6%	22,616	4.50	1.50	15,058	289.6	2847.26	19,768	1.98
HC3	4.23	100.0%	42,298	8.46	2.82	14,980	288.1	4785.13	37,512	3.75
HC4	4.29	99.5%	42,668	10.23	3.41	12,497	240.3	10435.18	32,233	3.22
HC5	2.21	99.1%	21,897	5.92	1.97	11,092	213.3	2645.86	19,251	1.93
HC6	1.81	99.7%	18,051	2.7	0.90	20,031	385.2	2481.38	15,569	1.56
HC7	3.255	99.1%	32,251	12.42	4.15	7,780	149.6	5602.51	26,648	2.66

Notes:
1 based on non-sulfate S value from Tables 4-16 and 4-1
2 From Appendix E (i.e. Last T-S leaching valu
3 = initial non-sulphate S * % of initial * 1,000,000 mg of samp
4 Calculated as themedian of the final five humidity cell valu
5 = (mg SO_4/kg/wk*32.06)/(32.06+(4*15.9994))
6 = (T-S remaining after HC test) ÷ median Leaching ra

	Mineralization Zone	SUP	HYP			
	Lithology	WR	PP	WR	PP	WR	MX/IX
	Kinetic	**HC11**	**HC3**	**HC4**	**HC5**	**HC6**	**HC7**
Parameter	**Unit**						
Initial CaNP[1]	mg$CaCO_3$/kg	18.3	22.5	57.5	17.5	15.8	24.15
Initial Total S[1]	%	2.27	4.23	4.29	2.21	1.81	3.255
CaNP Consumption Rate[2]	mg$CaCO_3$/kg/wk	9.4	12.7	18.4	12.3	5.6	17.0
SO_4 Leaching Rate[2]	mg/kg/wk	4.50	8.46	10.23	5.92	2.7	12.42
CMR[2]	ratio	2.0	1.57	1.74	2.0	2.0	1.25
Total S Remaining upon CaNP Depletio	%	1.98	3.75	3.22	1.93	1.56	2.66
Time to onset of acid generation[3]	years	37.7	33.8	60.0	27.0	54.2	27.2

3 includes cycles of test

Molar Ratios and Depletion Rates for T1

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumptior (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
1-May-08	0	1.65	27.0	27.0	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	25	25	0.999
8-May-08	1	1.62	14.8	41.8	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	13.2	39	0.998
15-May-08	2	1.70	23.1	64.9	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	21	60	0.997
22-May-08	3	1.75	37.4	102	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	36	96	0.996
29-May-08	4	1.51	24.1	126	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	22.6	118	0.995
5-Jun-08	5	2.39	36.9	163	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	35	153	0.993
12-Jun-08	6	1.57	40.5	204	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	39.0	192	0.991
19-Jun-08	7	2.09	30.3	234	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	28.3	220	0.990
26-Jun-08	8	3.02	37.7	272	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	34.7	255	0.989
3-Jul-08	9	1.28	17.5	289	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	16	271	0.988
10-Jul-08	10	1.90	34.6	324	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	32.7	304	0.987
17-Jul-08	11	1.63	26.9	351	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	25.3	329	0.985
24-Jul-08	12	1.51	30.1	381	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	28.5	357	0.984
31-Jul-08	13	1.22	30.0	411	*DR*	0.0	0.0	0.0	1.00	*NC*	1.18	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	28.7	386	0.983
7-Aug-08	14	1.56	30.9	442	15.8	16	0.2	0.0004	1.000	1.953	1.18	4.612	16.5	76.1	0.0761	76	0.08	0.997	45.9	432	0.981
14-Aug-08	15	1.65	26.7	469	30.1	46	0.5	0.0013	0.999	0.889	1.18	2.045	31.3	64.1	0.0641	140	0.14	0.994	56.4	488	0.978
21-Aug-08	16	1.55	30.0	499	34.4	80	0.8	0.0023	0.998	0.872	1.18	1.892	35.8	67.8	0.0678	208	0.21	0.991	64.3	553	0.975
28-Aug-08	17	1.51	34.6	533	40.3	121	1.3	0.0034	0.997	0.859	1.18	1.776	42.0	74.6	0.0746	283	0.28	0.987	75.1	628	0.972
4-Sep-08	18	1.75	39.1	572	39.3	160	1.7	0.0045	0.995	0.996	1.17	1.895	40.9	77.5	0.0775	360	0.36	0.984	78.2	706	0.969
11-Sep-08	19	1.93	42.1	614	36.5	196	2.0	0.0056	0.994	1.15	1.17	2.033	38.0	77.3	0.0773	437	0.44	0.981	78.2	784	0.965
18-Sep-08	20	1.82	37.7	652	32.2	229	2.4	0.0065	0.994	1.17	1.17	2.071	33.5	69.5	0.0695	507	0.51	0.977	69.4	854	0.962
25-Sep-08	21	1.86	36.2	688	30.4	259	2.7	0.0073	0.993	1.19	1.17	2.114	31.7	67.0	0.0670	574	0.57	0.974	66.0	920	0.959
2-Oct-08	22	1.82	35.3	724	27.9	287	3.0	0.0081	0.992	1.27	1.17	2.238	29.1	65.0	0.0650	639	0.64	0.972	62.6	982	0.956
9-Oct-08	23	1.95	37.9	761	28.0	315	3.3	0.0089	0.991	1.35	1.17	2.379	29.2	69.4	0.0694	708	0.71	0.969	65.1	1047	0.953
16-Oct-08	24	1.59	33.8	795	26.9	342	3.6	0.0097	0.990	1.26	1.17	2.234	28.0	62.6	0.0626	771	0.77	0.966	60.2	1108	0.951
23-Oct-08	25	1.46	34.5	830	29.6	371	3.9	0.0105	0.989	1.17	1.17	2.102	30.8	64.8	0.0648	836	0.84	0.963	63.9	1171	0.948
30-Oct-08	26	1.56	29.1	859	24.1	395	4.1	0.0112	0.989	1.21	1.17	2.117	25.1	53.1	0.0531	889	0.89	0.960	52.6	1224	0.946
6-Nov-08	27	2.24	34.1	893	27.2	423	4.4	0.0120	0.988	1.25	1.17	2.134	28.4	60.5	0.0605	949	0.95	0.958	60.3	1284	0.943
13-Nov-08	28	1.84	36.1	929	26.3	449	4.7	0.0127	0.987	1.38	1.17	2.273	27.3	62.2	0.0622	1011	1.01	0.955	61.7	1346	0.940
20-Nov-08	29	1.45	38.9	968	25.8	475	4.9	0.0134	0.987	1.51	1.16	2.426	26.8	65.1	0.0651	1077	1.08	0.952	64.3	1410	0.937
27-Nov-08	30	1.29	37.8	1006	24.3	499	5.2	0.0141	0.986	1.56	1.16	2.367	25.3	59.8	0.0598	1136	1.14	0.949	61.8	1472	0.935
4-Dec-08	31	0.900	28.9	1035	18.0	517	5.4	0.0146	0.985	1.61	1.16	2.306	18.8	43.2	0.0432	1180	1.18	0.948	46.8	1519	0.932
11-Dec-08	32	1.30	29.2	1064	15.9	533	5.5	0.0151	0.985	1.84	1.16	2.487	16.6	41.2	0.0412	1221	1.22	0.946	44.5	1563	0.931
18-Dec-08	33	2.19	38.4	1102	18.1	551	5.7	0.0156	0.984	2.13	1.16	2.715	18.8	51.1	0.0511	1272	1.27	0.943	55.0	1618	0.928
25-Dec-08	34	#N/A	35.4	1138	19.6	570	5.9	0.0161	0.984	1.81	1.16	2.376	20.4	48.4	0.0484	1320	1.32	0.941	#N/A	#N/A	#N/A
1-Jan-09	35	#N/A	32.6	1170	20.9	591	6.2	0.0167	0.983	1.56	1.16	2.103	21.8	45.8	0.0458	1366	1.37	0.939	#N/A	#N/A	#N/A
8-Jan-09	36	#N/A	33.1	1204	17.4	609	6.3	0.0172	0.983	1.90	1.16	2.515	18.1	45.6	0.0456	1412	1.41	0.937	#N/A	#N/A	#N/A
15-Jan-09	37	2.34	40.6	1244	17.6	626	6.5	0.0177	0.982	2.31	1.16	3.012	18.3	55.1	0.0551	1467	1.47	0.935	56.5	1675	0.926
22-Jan-09	38	3.15	42.2	1286	12.7	639	6.7	0.0181	0.982	3.34	1.16	3.594	13.2	47.4	0.0474	1514	1.51	0.933	52.2	1727	0.923
29-Jan-09	39	3.49	38.3	1325	6.56	646	6.7	0.0183	0.982	5.83	1.16	5.011	6.83	34.2	0.0342	1548	1.55	0.931	41.6	1769	0.921
5-Feb-09	40	2.38	37.2	1362	6.59	652	6.8	0.0184	0.982	5.72	1.16	5.281	6.96	36.2	0.0362	1585	1.58	0.929	42.1	1811	0.920
12-Feb-09	41	1.10	34.0	1396	6.08	658	6.9	0.0186	0.981	5.59	1.16	5.568	6.33	35.2	0.0352	1620	1.62	0.928	39.2	1850	0.918
19-Feb-09	42	1.99	37.5	1434	5.88	664	6.9	0.0188	0.981	6.38	1.16	6.250	6.13	38.3	0.0383	1658	1.66	0.926	41.6	1892	0.916
26-Feb-09	43	2.87	40.2	1474	5.53	670	7.0	0.0189	0.981	7.28	1.16	7.036	5.76	40.5	0.0405	1699	1.70	0.925	43.1	1935	0.914
5-Mar-09	44	2.75	43.5	1517	6.31	676	7.0	0.0191	0.981	6.89	1.16	6.588	6.57	43.3	0.0433	1742	1.74	0.923	47.3	1982	0.912
12-Mar-09	45	2.07	38.0	1555	5.85	682	7.1	0.0193	0.981	6.50	1.16	6.141	6.09	37.4	0.0374	1779	1.78	0.921	42.0	2024	0.910
19-Mar-09	46	2.20	37.0	1592	5.12	687	7.2	0.0194	0.981	7.23	1.16	6.751	5.33	36.0	0.0360	1815	1.82	0.919	40.1	2064	0.908
26-Mar-09	47	2.29	35.6	1628	4.35	691	7.2	0.0196	0.980	8.17	1.16	7.544	4.53	34.2	0.0342	1850	1.85	0.918	37.8	2102	0.907
2-Apr-09	48	2.61	37.7	1666	4.85	696	7.2	0.0197	0.980	7.78	1.16	7.289	5.05	36.8	0.0368	1886	1.89	0.916	40.2	2142	0.905
9-Apr-09	49	2.70	36.2	1702	4.90	701	7.3	0.0198	0.980	7.38	1.16	7.034	5.11	35.9	0.0359	1922	1.92	0.915	38.6	2181	0.903
16-Apr-09	50	2.33	36.9	1739	4.64	706	7.3	0.0200	0.980	7.97	1.16	7.764	4.83	37.5	0.0375	1960	1.96	0.913	39.4	2220	0.901
23-Apr-09	51	1.71	33.4	1772	3.84	709	7.4	0.0201	0.980	8.71	1.16	8.678	4.00	34.7	0.0347	1995	1.99	0.911	35.7	2256	0.900
30-Apr-09	52	1.71	32.9	1805	3.68	713	7.4	0.0202	0.980	8.96	1.16	8.844	3.83	33.9	0.0339	2028	2.03	0.910	35.0	2291	0.898
7-May-09	53	1.66	31.4	1837	3.40	717	7.5	0.0203	0.980	9.25	1.16	9.034	3.54	32.0	0.0320	2060	2.06	0.908	33.3	2324	0.897
14-May-09	54	2.05	31.2	1868	3.80	720	7.5	0.0204	0.980	8.23	1.16	7.863	3.96	31.1	0.0311	2092	2.09	0.907	33.2	2357	0.895
21-May-09	55	2.64	33.8	1902	4.55	725	7.5	0.0205	0.979	7.43	1.16	6.951	4.74	32.9	0.0329	2124	2.12	0.906	35.9	2393	0.894
28-May-09	56	2.34	32.7	1934	5.45	730	7.6	0.0207	0.979	6.01	1.16	5.552	5.67	31.5	0.0315	2156	2.16	0.904	36.0	2429	0.892
4-Jun-09	57	2.07	32.0	1966	6.37	737	7.7	0.0208	0.979	5.02	1.16	4.583	6.64	30.4	0.0304	2186	2.19	0.903	36.5	2466	0.890
11-Jun-09	58	1.95	29.6	1996	4.40	741	7.7	0.0210	0.979	6.73	1.16	6.231	4.58	28.6	0.0286	2215	2.21	0.902	32.3	2498	0.889
18-Jun-09	59	2.28	34.0	2030	3.43	745	7.8	0.0211	0.979	9.91	1.16	9.292	3.57	33.2	0.0332	2248	2.25	0.900	35.3	2533	0.887
25-Jun-09	60	1.96	33.6	2063	3.75	748	7.8	0.0212	0.979	8.95	1.16	8.135	3.91	31.8	0.0318	2280	2.28	0.899	35.5	2569	0.886
2-Jul-09	61	1.57	32.1	2096	3.96	752	7.8	0.0213	0.979	8.10	1.15	7.123	4.13	29.4	0.0294	2309	2.31	0.897	34.6	2604	0.884
9-Jul-09	62	1.55	32.3	2128	3.47	756	7.9	0.0214	0.979	9.33	1.15	8.388	3.61	30.3	0.0303	2340	2.34	0.896	34.4	2638	0.883
16-Jul-09	63	1.53	32.6	2160	2.97	759	7.9	0.0215	0.978	11.0	1.15	10.076	3.09	31.2	0.0312	2371	2.37	0.895	34.1	2672	0.881
23-Jul-09	64	2.27	32.2	2193	2.85	762	7.9	0.0215	0.978	11.3	1.15	10.778	2.97	32.0	0.0320	2403	2.40	0.893	32.9	2705	0.880
30-Jul-09	65	3.19	34.6	2227	2.97	764	8.0	0.0216	0.978	11.6	1.15	11.479	3.09	35.5	0.0355	2438	2.44	0.892	34.5	2739	0.878
6-Aug-09	66	2.93	33.4	2261	2.35	767	8.0	0.0217	0.978	14.2	1.15	13.695	2.45	33.5	0.0335	2472	2.47	0.890	33.0	2772	0.877
13-Aug-09	67	2.92	35.1	2296	1.94	769	8.0	0.0217	0.978	18.1	1.15	17.018	2.02	34.4	0.0344	2506	2.51	0.889	34.2	2807	0.875
20-Aug-09	68	2.57	34.1	2330	2.64	771	8.0	0.0218	0.978	12.9	1.15	12.239	2.75	33.7	0.0337	2540	2.54	0.887	34.3	2841	0.874
27-Aug-09	69	2.33	34.5	2364	3.47	775	8.1	0.0219	0.978	9.95	1.15	9.508	3.61	34.3	0.0343	2574	2.57	0.886	35.8	2877	0.872
3-Sep-09	70	1.60	31.5	2396	3.12	778	8.1	0.0220	0.978	10.1	1.15	9.488	3.25	30.8	0.0308	2605	2.61	0.884	33.1	2910	0.871
10-Sep-09	71	0.985	31.1	2427	3.03	781	8.1	0.0221	0.978	10.2	1.15	9.464	3.16	29.9	0.0299	2635	2.63	0.883	33.2	2943	0.869
17-Sep-09	72	1.16	30.4	2457	3.09	784	8.2	0.0222	0.978	9.85	1.15	8.930	3.22	28.7	0.0287	2664	2.66	0.882	32.5	2976	0.868
24-Sep-09	73	1.47	33.3	2491	3.50	788	8.2	0.0223	0.978	9.52	1.15	8.472	3.65	30.9	0.0309	2694	2.69	0.880	35.5	3011	0.866
1-Oct-09	74	1.83	32.0	2523	3.80	791	8.2	0.0224	0.978	8.42	1.15	7.600	3.96	30.1	0.0301	2725	2.72	0.879	34.1	3045	0.865
8-Oct-09	75	2.47	35.4	2558	4.68	796	8.3	0.0225	0.977	7.57	1.15	6.921	4.88	33.7	0.0337	2758	2.76	0.877	37.8	3083	0.863
15-Oct-09	76	1.94	32.1	2590	3.60	800	8.3	0.0226	0.977	8.92	1.15	8.072	3.75	30.3	0.0303	2789	2.79	0.876	33.9	3117	0.861
22-Oct-09	77	1.63	32.1	2622	2.94	803	8.4	0.0227	0.977	10.9	1.15	9.797	3.06	30.0	0.0300	2819	2.82	0.875	33.6	3150	0.860
29-Oct-09	78	1.88	29.1	2651	2.42	805	8.4	0.0228	0.977	12.0	1.15	10.859	2.52	27.4	0.0274	2846	2.85	0.874	29.7	3180	0.859
5-Nov-09	79	2.75	34.9	2686	2.63	808	8.4	0.0228	0.977	13.3	1.15	12.132	2.73	33.2	0.0332	2879	2.88	0.872	34.9	3215	0.857
12-Nov-09	80	2.95	35.3	2722	2.86	811	8.4	0.0229	0.977	12.3	1.15	11.403	2.98	34.0	0.0340	2913	2.91	0.871	35.3	3250	0.856
19-Nov-09	81	2.90	32.9	2754	2.85	813	8.5	0.0230	0.977	11.5	1.15	10.795	2.97	32.1	0.0321	2945	2.95	0.869	33.0	3283	0.854
26-Nov-09	82	2.97	34.7	2789	2.02	815	8.5	0.0231	0.977	17.2	1.15	16.138	2.10	34.0	0.0340	2979	2.98	0.868	33.9	3317	0.853
3-Dec-09	83	2.75	33.1	2822	0.970	816	8.5	0.0231	0.977	34.2	1.15	32.167	1.01	32.5	0.0325	3012	3.01	0.866	31.4	3349	0.851
10-Dec-09	84	2.56	32.4	2855	1.44	818	8.5	0.0231	0.977	22.5	1.15	20.540	1.50	30.8	0.0308	3042	3.04	0.865	31.3	3380	0.850
17-Dec-09	85	2.46	33.0	2888	1.98	820	8.5	0.0232	0.977	16.6	1.15	14.726	2.06	30.4	0.0304	3073	3.07	0.863	32.6	3412	0.848
24-Dec-09	86	1.65	32.6	2920	2.48	822	8.6	0.0233	0.977	13.2	1.15	11.993	2.58	30.9	0.0309	3104	3.10	0.862	33.6	3446	0.847
31-Dec-09	87	0.821	31.3	2952	2.88	825	8.6	0.0233	0.977	10.9	1.15	10.171	3.00	30.5	0.0305	3134	3.13	0.861	33.5	3480	0.845
7-Jan-10	88	2.19	33.4	2985	3.19	828	8.6	0.0234	0.977	10.5	1.15	9.145	3.32	30.3	0.0303	3165	3.16	0.859	34.5	3514	0.844
14-Jan-10	89	3.48	34.0	3019	3.36	832	8.7	0.0235	0.976	10.1	1.15	8.267	3.50	28.9	0.0289	3194	3.19	0.858	34.0	3548	0.842
21-Jan-10	90	2.97	35.2	3054	3.35	835	8.7	0.0236	0.976	10.5	1.15	9.191	3.49	32.1	0.0321	3226	3.23	0.857	35.7	3584	0.841
28-Jan-10	91	2.11	32.3	3086	2.94	838	8.7	0.0237	0.976	11.0	1.15	10.270	3.06	31.5	0.0315	3257	3.26	0.855	33.2	3617	0.839
4-Feb-10	92	1.66	33.5	3120	2.97	841	8.8	0.0238	0.976	11.3	1.15	11.158	3.09	34.5	0.0345	3292	3.29	0.854	34.9	3652	0.838
11-Feb-10	93	1.13	32.6	3153	2.82	844	8.8	0.0239	0.976	11.6	1.15	12.046	2.94	35.4	0.0354	3327	3.33	0.852	34.4	3686	0.836
18-Feb-10	94	1.54	35.0	3188	3.86	848	8.8	0.0240	0.976	9.05	1.15	8.860	4.02	35.7	0.0357	3363	3.36	0.851	37.5	3724	0.834
25-Feb-10	95	1.70	31.5	3219	4.28	852	8.9	0.0241	0.976	7.38	1.15	6.736	4.45	30.0	0.0300	3393	3.39	0.849	34.3	3758	0.833
4-Mar-10	96	1.91	33.9	3253	4.29	856	8.9	0.0242	0.976	7.89	1.15	7.167	4.47	32.1	0.0321	3425	3.42	0.848	36.4	3795	0.831
11-Mar-10	97	1.90	32.2	3285	3.80	860	9.0	0.0243	0.976	8.47	1.15	7.652	3.96	30.3	0.0303	3455	3.46	0.846	34.3	3829	0.830
18-Mar-10	98	1.99	33.8	3319	3.75	864	9.0	0.0244	0.976	9.01	1.15	7.928	3.91	31.0	0.0310	3486	3.49	0.845	35.7	3864	0.828
25-Mar-10	99	1.86	31.6	3351	3.29	867	9.0	0.0245	0.975	9.62	1.15	8.244	3.43	28.3	0.0283	3514	3.51	0.844	33.2	3898	0.827
1-Apr-10	100	1.88	34.3	3385	3.47	871	9.1	0.0246	0.975	9.90	1.15	8.657	3.61	31.3	0.0313	3546	3.55	0.842	36.0	3934	0.825
8-Apr-10	101	1.81	35.2	3420	3.46	874	9.1	0.0247	0.975	10.2	1.15	9.071	3.60	32.7	0.0327	3578	3.58	0.841	37.0	3971	0.824
15-Apr-10	102	2.40	33.7	3454	2.91	877	9.1	0.0248	0.975	11.6	1.15	10.353	3.03	31.4	0.0314	3610	3.61	0.840	34.3	4005	0.822
22-Apr-10	103	3.05	33.2	3487	2.45	879	9.2	0.0249	0.975	13.6	1.15	12.149	2.55	31.0	0.0310	3641	3.64	0.838	32.7	4038	0.821
29-Apr-10	104	2.97	33.9	3521	2.27	882	9.2	0.0249	0.975	14.9	1.15	13.517	2.37	32.0	0.0320	3673	3.67	0.837	33.3	4071	0.819
6-May-10	105	2.74	33.0	3554	1.98	884	9.2	0.0250	0.975	16.6	1.15	15.226	2.06	31.4	0.0314	3704	3.70	0.835	32.3	4103	0.818
13-May-10	106	1.45	32.8	3587	3.33	887	9.2	0.0251	0.975	9.86	1.15	8.855	3.46	30.7	0.0307	3735	3.73	0.834	34.8	4138	0.816
20-May-10	107	2.66	31.1	3618	2.50	889	9.3	0.0252	**0.975**	12.5	1.15	11.391	2.60	29.7	0.0297	3764	3.76	**0.833**	31.1	4169	0.815
Median (last 5)					**2.5**							**11.4**		**31.0**							

Notes: loadings data removed to avoid overestimating the rate of NP depletion
= not calculated due to removed sulphate loading data.
re set at half the limit for NP depletion calculations

Molar Ratios and Depletion Rates for T2

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumptior (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
1-May-08	0	1.87	31.4	31.4	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	29	29	0.999
8-May-08	1	1.56	15.0	46.4	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	13.5	43	0.998
15-May-08	2	1.33	19.7	66.1	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	18	61	0.997
22-May-08	3	1.38	29.5	95.5	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	28	89	0.996
29-May-08	4	1.19	30.7	126	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	30	119	0.995
5-Jun-08	5	1.60	28.7	155	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	27.0	146	0.993
12-Jun-08	6	1.04	31.4	186	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	30.4	176	0.992
19-Jun-08	7	1.66	32.1	218	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	30.5	207	0.990
26-Jun-08	8	2.20	30.7	249	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	28.5	235	0.989
3-Jul-08	9	1.28	20.0	269	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	18.7	254	0.988
10-Jul-08	10	1.58	33.3	302	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	31.7	286	0.987
17-Jul-08	11	1.26	27.3	330	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	26.0	312	0.986
24-Jul-08	12	1.21	32.8	362	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	31.6	343	0.984
31-Jul-08	13	1.03	35.0	397	*DR*	0.0	0.0	0.0	1.00	*NC.*	1.09	*NC.*	0.0	0.0	0.0	0.0	0.0	*NC.*	34.0	377	0.983
7-Aug-08	14	1.25	34.4	432	9.0	9	0.1	0.0003	1.000	3.84	1.09	6.45	9.3	60.2	0.0602	60	0.06	0.997	42.5	420	0.981
14-Aug-08	15	1.52	34.9	467	18.5	27	0.3	0.0008	0.999	1.89	1.09	3.06	19.3	59.1	0.0591	119	0.12	0.995	52.7	472	0.978
21-Aug-08	16	1.47	38.5	505	22.1	50	0.5	0.0015	0.998	1.75	1.09	2.70	23.0	62.0	0.0620	181	0.18	0.992	60.0	532	0.975
28-Aug-08	17	1.48	43.9	549	26.8	76	0.8	0.0023	0.998	1.64	1.09	2.42	27.9	67.6	0.0676	249	0.25	0.989	70.4	603	0.972
4-Sep-08	18	1.69	44.0	593	27.5	104	1.1	0.0032	0.997	1.60	1.09	2.41	28.7	69.0	0.0690	318	0.32	0.985	71.0	674	0.969
11-Sep-08	19	1.61	37.0	630	23.8	128	1.3	0.0039	0.996	1.56	1.09	2.39	24.8	59.2	0.0592	377	0.38	0.983	60.1	734	0.966
18-Sep-08	20	1.63	33.9	664	21.9	149	1.6	0.0046	0.995	1.55	1.09	2.39	22.8	54.5	0.0545	432	0.43	0.980	55.0	789	0.964
25-Sep-08	21	1.88	35.6	700	23.0	172	1.8	0.0053	0.995	1.55	1.08	2.39	24.0	57.4	0.0574	489	0.49	0.977	57.7	847	0.961
2-Oct-08	22	1.57	30.6	730	22.8	195	2.0	0.0060	0.994	1.34	1.08	2.31	23.7	54.9	0.0549	544	0.54	0.975	52.8	899	0.959
9-Oct-08	23	0.920	18.8	749	16.3	212	2.2	0.0065	0.994	1.15	1.08	2.23	16.9	37.8	0.0378	582	0.58	0.973	34.8	934	0.957
16-Oct-08	24	1.02	25.1	774	19.7	231	2.4	0.0071	0.993	1.27	1.08	2.29	20.5	47.0	0.0470	629	0.63	0.971	44.6	979	0.955
23-Oct-08	25	1.01	29.8	804	21.4	253	2.6	0.0077	0.992	1.39	1.08	2.34	22.3	52.3	0.0523	681	0.68	0.969	51.1	1030	0.953
30-Oct-08	26	1.30	29.4	833	19.1	272	2.8	0.0083	0.992	1.54	1.08	2.49	19.9	49.6	0.0496	731	0.73	0.966	48.1	1078	0.950
6-Nov-08	27	1.68	30.8	864	17.8	290	3.0	0.0089	0.991	1.73	1.08	2.68	18.5	49.7	0.0497	780	0.78	0.964	47.7	1126	0.948
13-Nov-08	28	1.42	32.8	897	16.8	306	3.2	0.0094	0.991	1.95	1.08	2.87	17.5	50.4	0.0504	831	0.83	0.962	48.9	1175	0.946
20-Nov-08	29	1.12	34.5	932	15.6	322	3.4	0.0099	0.990	2.21	1.08	3.10	16.3	50.6	0.0506	881	0.88	0.959	49.7	1224	0.944
27-Nov-08	30	1.16	36.0	968	15.6	338	3.5	0.0103	0.990	2.31	1.08	3.04	16.3	49.4	0.0494	931	0.93	0.957	51.1	1275	0.941
4-Dec-08	31	0.988	31.1	999	12.9	350	3.6	0.0107	0.989	2.42	1.08	2.97	13.4	39.9	0.0399	971	0.97	0.955	43.5	1319	0.939
11-Dec-08	32	1.34	34.0	1033	13.1	364	3.8	0.0111	0.989	2.59	1.08	3.10	13.7	42.3	0.0423	1013	1.01	0.953	46.3	1365	0.937
18-Dec-08	33	1.86	39.8	1072	14.4	378	3.9	0.0116	0.988	2.77	1.08	3.23	15.0	48.5	0.0485	1061	1.06	0.951	53.0	1418	0.935
25-Dec-08	34	#N/A	37.7	1110	14.5	392	4.1	0.0120	0.988	2.60	1.08	2.98	15.1	45.0	0.0450	1106	1.11	0.949	#N/A	#N/A	#N/A
1-Jan-09	35	#N/A	35.7	1146	14.5	407	4.2	0.0125	0.988	2.46	1.08	2.76	15.1	41.7	0.0417	1148	1.15	0.947	#N/A	#N/A	#N/A
8-Jan-09	36	#N/A	31.7	1177	13.0	420	4.4	0.0129	0.987	2.43	1.08	2.90	13.6	39.4	0.0394	1187	1.19	0.945	#N/A	#N/A	#N/A
15-Jan-09	37	2.54	39.2	1217	16.3	436	4.5	0.0134	0.987	2.40	1.08	3.04	17.0	51.7	0.0517	1239	1.24	0.943	53.7	1472	0.932
22-Jan-09	38	3.41	38.6	1255	15.8	452	4.7	0.0138	0.986	2.44	1.07	2.77	16.5	45.7	0.0457	1285	1.28	0.941	51.7	1524	0.930
29-Jan-09	39	4.17	37.5	1293	15.2	467	4.9	0.0143	0.986	2.47	1.07	2.49	15.8	39.5	0.0395	1324	1.32	0.939	49.1	1573	0.928
5-Feb-09	40	2.65	34.9	1328	14.8	482	5.0	0.0148	0.985	2.36	1.07	2.63	15.4	40.5	0.0405	1365	1.36	0.937	47.7	1620	0.925
12-Feb-09	41	1.08	30.2	1358	13.4	496	5.2	0.0152	0.985	2.25	1.07	2.77	14.0	38.7	0.0387	1403	1.40	0.935	43.2	1664	0.923
19-Feb-09	42	1.92	31.0	1389	13.4	509	5.3	0.0156	0.984	2.31	1.07	2.77	13.9	38.6	0.0386	1442	1.44	0.934	43.0	1707	0.921
26-Feb-09	43	3.00	34.3	1423	14.4	523	5.4	0.0160	0.984	2.38	1.07	2.77	15.0	41.7	0.0417	1484	1.48	0.932	46.3	1753	0.919
5-Mar-09	44	1.12	14.9	1438	6.49	530	5.5	0.0162	0.984	2.29	1.07	2.72	6.76	18.4	0.0184	1502	1.50	0.931	20.5	1773	0.918
12-Mar-09	45	1.32	21.9	1460	9.94	540	5.6	0.0165	0.983	2.20	1.07	2.67	10.4	27.6	0.0276	1530	1.53	0.930	30.9	1804	0.917
19-Mar-09	46	1.72	29.2	1489	10.3	550	5.7	0.0168	0.983	2.83	1.07	3.33	10.8	35.8	0.0358	1566	1.57	0.928	38.3	1843	0.915
26-Mar-09	47	1.78	30.8	1520	8.30	558	5.8	0.0171	0.983	3.71	1.07	4.26	8.65	36.8	0.0368	1602	1.60	0.926	37.7	1880	0.913
2-Apr-09	48	1.74	28.9	1549	8.81	567	5.9	0.0174	0.983	3.27	1.07	3.66	9.18	33.6	0.0336	1636	1.64	0.925	36.3	1917	0.912
9-Apr-09	49	2.14	34.3	1583	11.6	579	6.0	0.0177	0.982	2.95	1.07	3.22	12.1	38.9	0.0389	1675	1.67	0.923	44.2	1961	0.910
16-Apr-09	50	1.58	28.7	1612	9.07	588	6.1	0.0180	0.982	3.16	1.07	3.47	9.44	32.8	0.0328	1708	1.71	0.921	36.5	1997	0.908
23-Apr-09	51	1.51	32.0	1644	9.35	597	6.2	0.0183	0.982	3.43	1.07	3.78	9.74	36.9	0.0369	1745	1.74	0.920	40.3	2038	0.906
30-Apr-09	52	1.76	35.0	1679	9.20	607	6.3	0.0186	0.981	3.80	1.07	4.22	9.58	40.4	0.0404	1785	1.79	0.918	42.8	2080	0.904
7-May-09	53	1.72	32.2	1711	7.56	614	6.4	0.0188	0.981	4.26	1.07	4.75	7.88	37.4	0.0374	1822	1.82	0.916	38.3	2119	0.902
14-May-09	54	2.06	33.3	1744	7.18	621	6.5	0.0190	0.981	4.65	1.07	5.02	7.48	37.5	0.0375	1860	1.86	0.914	38.8	2157	0.901
21-May-09	55	2.34	33.4	1778	6.53	628	6.5	0.0192	0.981	5.11	1.07	5.33	6.80	36.2	0.0362	1896	1.90	0.913	37.8	2195	0.899
28-May-09	56	2.12	34.1	1812	8.42	636	6.6	0.0195	0.981	4.05	1.07	4.19	8.77	36.8	0.0368	1933	1.93	0.911	40.8	2236	0.897
4-Jun-09	57	1.78	33.0	1845	9.90	646	6.7	0.0198	0.980	3.33	1.07	3.42	10.3	35.2	0.0352	1968	1.97	0.909	41.5	2278	0.895
11-Jun-09	58	1.99	34.2	1879	9.30	655	6.8	0.0201	0.980	3.68	1.07	3.76	9.69	36.5	0.0365	2005	2.00	0.908	41.9	2319	0.893
18-Jun-09	59	1.81	29.2	1908	7.11	663	6.9	0.0203	0.980	4.10	1.07	4.19	7.41	31.0	0.0310	2036	2.04	0.906	34.7	2354	0.892
25-Jun-09	60	1.78	34.4	1943	8.55	671	7.0	0.0206	0.979	4.02	1.07	3.99	8.91	35.5	0.0355	2071	2.07	0.905	41.5	2396	0.890
2-Jul-09	61	1.22	29.8	1972	7.56	679	7.1	0.0208	0.979	3.94	1.07	3.78	7.88	29.8	0.0298	2101	2.10	0.903	36.4	2432	0.888
9-Jul-09	62	1.51	31.7	2004	7.26	686	7.1	0.0210	0.979	4.36	1.07	4.35	7.56	32.9	0.0329	2134	2.13	0.902	37.7	2470	0.886
16-Jul-09	63	1.83	33.6	2038	6.90	693	7.2	0.0212	0.979	4.87	1.07	5.03	7.19	36.1	0.0361	2170	2.17	0.900	38.9	2509	0.884
23-Jul-09	64	2.50	35.0	2073	6.86	700	7.3	0.0214	0.979	5.10	1.07	5.25	7.15	37.5	0.0375	2208	2.21	0.898	39.7	2548	0.883
30-Jul-09	65	2.62	29.4	2102	5.46	705	7.3	0.0216	0.978	5.38	1.07	5.51	5.69	31.3	0.0313	2239	2.24	0.897	32.4	2581	0.881
6-Aug-09	66	2.59	33.4	2135	5.75	711	7.4	0.0218	0.978	5.81	1.07	5.89	5.99	35.3	0.0353	2274	2.27	0.895	36.8	2618	0.879
13-Aug-09	67	2.31	34.7	2170	5.52	716	7.5	0.0219	0.978	6.29	1.07	6.30	5.75	36.2	0.0362	2310	2.31	0.894	38.1	2656	0.878
20-Aug-09	68	1.85	30.4	2200	4.92	721	7.5	0.0221	0.978	6.17	1.07	6.28	5.13	32.2	0.0322	2343	2.34	0.892	33.6	2689	0.876
27-Aug-09	69	1.77	32.4	2233	5.34	727	7.6	0.0223	0.978	6.06	1.07	6.27	5.56	34.9	0.0349	2377	2.38	0.890	36.1	2726	0.874
3-Sep-09	70	1.18	30.1	2263	6.16	733	7.6	0.0224	0.978	4.88	1.07	5.11	6.42	32.8	0.0328	2410	2.41	0.889	35.3	2761	0.873
10-Sep-09	71	0.648	28.2	2291	6.97	740	7.7	0.0227	0.977	4.04	1.07	4.29	7.26	31.1	0.0311	2441	2.44	0.887	34.8	2796	0.871
17-Sep-09	72	0.966	34.6	2326	7.99	748	7.8	0.0229	0.977	4.33	1.07	4.35	8.32	36.2	0.0362	2478	2.48	0.886	41.9	2838	0.869
24-Sep-09	73	1.27	39.2	2365	8.50	756	7.9	0.0232	0.977	4.61	1.06	4.42	8.86	39.1	0.0391	2517	2.52	0.884	46.8	2884	0.867
1-Oct-09	74	1.56	33.7	2398	7.79	764	8.0	0.0234	0.977	4.32	1.06	4.31	8.11	35.0	0.0350	2552	2.55	0.882	40.2	2925	0.865
8-Oct-09	75	2.10	34.3	2433	8.46	773	8.0	0.0237	0.976	4.06	1.06	4.20	8.81	37.0	0.0370	2589	2.59	0.881	41.0	2966	0.863
15-Oct-09	76	1.87	36.2	2469	7.50	780	8.1	0.0239	0.976	4.83	1.06	4.82	7.81	37.6	0.0376	2626	2.63	0.879	42.1	3008	0.861
22-Oct-09	77	1.35	31.9	2501	5.34	785	8.2	0.0241	0.976	5.98	1.06	5.74	5.56	31.9	0.0319	2658	2.66	0.877	36.2	3044	0.860
29-Oct-09	78	1.82	33.6	2534	5.41	791	8.2	0.0242	0.976	6.22	1.06	6.02	5.63	33.9	0.0339	2692	2.69	0.876	37.5	3081	0.858
5-Nov-09	79	2.48	37.5	2572	5.78	797	8.3	0.0244	0.976	6.49	1.06	6.33	6.02	38.1	0.0381	2730	2.73	0.874	41.0	3122	0.856
12-Nov-09	80	2.51	33.9	2606	5.28	802	8.3	0.0246	0.975	6.43	1.06	6.33	5.50	34.8	0.0348	2765	2.77	0.873	36.9	3159	0.854
19-Nov-09	81	2.73	33.3	2639	5.23	807	8.4	0.0247	0.975	6.37	1.06	6.34	5.44	34.5	0.0345	2800	2.80	0.871	36.0	3195	0.853
26-Nov-09	82	2.57	34.0	2673	4.75	812	8.5	0.0249	0.975	7.16	1.06	7.23	4.95	35.8	0.0358	2835	2.84	0.869	36.4	3232	0.851
3-Dec-09	83	2.15	31.1	2704	3.83	816	8.5	0.0250	0.975	8.12	1.06	8.31	3.99	33.1	0.0331	2869	2.87	0.868	32.9	3265	0.850
10-Dec-09	84	2.03	33.2	2737	4.37	820	8.5	0.0251	0.975	7.61	1.06	7.55	4.55	34.4	0.0344	2903	2.90	0.866	35.8	3300	0.848
17-Dec-09	85	1.60	30.3	2768	4.25	824	8.6	0.0252	0.975	7.14	1.06	6.87	4.43	30.4	0.0304	2933	2.93	0.865	33.2	3333	0.846
24-Dec-09	86	1.56	34.4	2802	6.05	830	8.6	0.0254	0.975	5.69	1.06	5.42	6.30	34.2	0.0342	2967	2.97	0.863	39.1	3373	0.845
31-Dec-09	87	1.30	33.7	2836	7.04	837	8.7	0.0256	0.974	4.79	1.06	4.52	7.33	33.1	0.0331	3001	3.00	0.862	39.7	3412	0.843
7-Jan-10	88	2.27	32.1	2868	6.82	844	8.8	0.0259	0.974	4.71	1.06	4.58	7.11	32.6	0.0326	3033	3.03	0.860	37.0	3449	0.841
14-Jan-10	89	2.87	27.1	2895	5.85	850	8.8	0.0260	0.974	4.63	1.06	4.65	6.09	28.4	0.0284	3062	3.06	0.859	30.3	3480	0.840
21-Jan-10	90	2.54	33.1	2928	7.28	857	8.9	0.0263	0.974	4.55	1.06	4.59	7.58	34.8	0.0348	3096	3.10	0.857	38.1	3518	0.838
28-Jan-10	91	1.69	33.5	2962	7.48	865	9.0	0.0265	0.974	4.48	1.06	4.54	7.79	35.4	0.0354	3132	3.13	0.856	39.6	3557	0.836
4-Feb-10	92	1.45	28.4	2990	5.70	870	9.1	0.0267	0.973	4.98	1.06	5.26	5.94	31.3	0.0313	3163	3.16	0.854	32.9	3590	0.835
11-Feb-10	93	1.81	34.8	3025	6.18	877	9.1	0.0268	0.973	5.64	1.06	6.21	6.43	39.9	0.0399	3203	3.20	0.852	39.4	3630	0.833
18-Feb-10	94	1.42	29.6	3054	5.33	882	9.2	0.0270	0.973	5.55	1.06	5.99	5.55	33.3	0.0333	3236	3.24	0.851	33.7	3663	0.831
25-Feb-10	95	1.42	32.3	3087	5.92	888	9.2	0.0272	0.973	5.46	1.06	5.78	6.16	35.6	0.0356	3272	3.27	0.849	37.0	3700	0.829
4-Mar-10	96	1.60	34.1	3121	6.35	894	9.3	0.0274	0.973	5.38	1.06	5.45	6.61	36.0	0.0360	3308	3.31	0.848	39.2	3740	0.828
11-Mar-10	97	1.47	29.7	3151	5.60	900	9.4	0.0276	0.972	5.31	1.06	5.13	5.83	30.0	0.0300	3338	3.34	0.846	34.1	3774	0.826
18-Mar-10	98	1.52	31.6	3182	4.95	905	9.4	0.0277	0.972	6.38	1.06	6.20	5.15	31.9	0.0319	3370	3.37	0.845	35.2	3809	0.824
25-Mar-10	99	1.54	33.0	3215	4.10	909	9.5	0.0278	0.972	8.06	1.06	7.85	4.27	33.5	0.0335	3403	3.40	0.843	35.7	3845	0.823
1-Apr-10	100	1.46	33.3	3248	4.14	913	9.5	0.0280	0.972	8.04	1.06	7.88	4.31	34.0	0.0340	3437	3.44	0.842	36.1	3881	0.821
8-Apr-10	101	1.32	32.1	3281	4.01	917	9.5	0.0281	0.972	8.03	1.06	7.91	4.17	33.0	0.0330	3470	3.47	0.840	35.0	3916	0.820
15-Apr-10	102	1.63	31.7	3312	4.90	922	9.6	0.0282	0.972	6.48	1.06	6.31	5.10	32.2	0.0322	3503	3.50	0.839	35.2	3951	0.818
22-Apr-10	103	1.94	31.3	3344	5.79	928	9.7	0.0284	0.972	5.41	1.06	5.20	6.03	31.3	0.0313	3534	3.53	0.837	35.4	3986	0.816
29-Apr-10	104	2.05	30.5	3374	5.53	933	9.7	0.0286	0.971	5.52	1.06	5.39	5.76	31.0	0.0310	3565	3.56	0.836	34.2	4020	0.815
6-May-10	105	2.39	32.9	3407	5.85	939	9.8	0.0288	0.971	5.63	1.06	5.58	6.09	34.0	0.0340	3599	3.60	0.834	36.6	4057	0.813
13-May-10	106	1.67	29.2	3436	5.74	945	9.8	0.0289	0.971	5.09	1.06	4.91	5.98	29.3	0.0293	3628	3.63	0.833	33.5	4091	0.811
20-May-10	107	2.04	31.5	3468	6.02	951	9.9	0.0291	**0.971**	5.24	1.06	5.54	6.27	34.8	0.0348	3663	3.66	**0.831**	35.8	4126	0.810
Median (last 5)					**5.8**							**5.5**		**33.0**							

Notes: loadings data removed to avoid overestimating the rate of NP depletion
= not calculated due to removed sulphate loading data.
re set at half the limit for NP depletion calculations

Molar Ratios and Depletion Rates for T3

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumptior (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
1-May-08	0	1.50	17.8	17.8	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	16	16	0.999
8-May-08	1	2.01	17.0	34.8	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	15	31	0.999
15-May-08	2	1.51	16.3	51.1	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	15	46	0.998
22-May-08	3	1.21	14.6	65.7	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	13	60	0.998
29-May-08	4	1.16	10.1	75.8	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.9	68	0.997
5-Jun-08	5	2.06	15.1	90.9	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	13	81	0.997
12-Jun-08	6	1.42	10.0	101	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8.6	90	0.997
19-Jun-08	7	2.07	13.6	114	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	102	0.996
26-Jun-08	8	2.68	14.8	129	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	114	0.996
3-Jul-08	9	1.43	11.5	141	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	10	124	0.995
10-Jul-08	10	1.77	16.0	157	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	138	0.995
17-Jul-08	11	1.25	13.4	170	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	12	150	0.994
24-Jul-08	12	1.29	15.2	185	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	164	0.994
31-Jul-08	13	1.17	15.1	201	*DR*	0.0	0.0	0.0	1.00	*NC*	0.650	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	14	178	0.993
7-Aug-08	14	1.39	15.5	216	48	48	0.5	0.0025	0.998	0.322	0.648	2.554	50	128	0.128	128	0.13	0.995	64	242	0.991
14-Aug-08	15	1.69	16.5	233	102	150	1.6	0.008	0.992	0.162	0.645	1.161	107	124	0.124	252	0.25	0.990	122	364	0.986
21-Aug-08	16	1.43	16.0	249	91.1	242	2.5	0.012	0.988	0.176	0.642	1.164	94.9	110	0.110	362	0.36	0.986	109	473	0.982
28-Aug-08	17	1.28	16.7	265	87.0	329	3.4	0.017	0.983	0.192	0.639	1.168	90.6	106	0.106	468	0.47	0.982	106	579	0.978
4-Sep-08	18	1.45	17.3	283	82.7	411	4.3	0.021	0.979	0.209	0.636	1.192	86.1	103	0.103	571	0.57	0.978	102	681	0.974
11-Sep-08	19	1.62	17.9	301	78.1	489	5.1	0.025	0.975	0.229	0.634	1.219	81.4	99.2	0.0992	670	0.67	0.974	97.6	779	0.970
18-Sep-08	20	1.63	17.8	318	74.5	564	5.9	0.029	0.971	0.239	0.631	1.218	77.6	94.5	0.0945	764	0.76	0.970	93.9	873	0.966
25-Sep-08	21	1.80	19.5	338	78.2	642	6.7	0.033	0.967	0.250	0.629	1.216	81.5	99.2	0.0992	863	0.86	0.967	99.2	972	0.962
2-Oct-08	22	1.33	21.2	359	69.0	711	7.4	0.037	0.963	0.307	0.626	1.299	71.9	93.4	0.0934	957	0.96	0.963	91.8	1064	0.959
9-Oct-08	23	1.47	31.4	391	89.3	800	8.3	0.041	0.959	0.352	0.623	1.363	93.0	127	0.127	1084	1.08	0.958	123	1187	0.954
16-Oct-08	24	1.64	36.1	427	81.5	882	9.2	0.045	0.955	0.443	0.621	1.396	84.9	118	0.118	1202	1.20	0.953	119	1306	0.949
23-Oct-08	25	1.66	37.5	464	63.0	945	9.8	0.049	0.951	0.596	0.618	1.451	65.6	95.2	0.0952	1297	1.30	0.950	101	1408	0.945
30-Oct-08	26	2.07	36.8	501	51.0	996	10.4	0.051	0.949	0.722	0.617	1.572	53.1	83.5	0.0835	1381	1.38	0.946	87.9	1495	0.942
6-Nov-08	27	2.49	36.1	537	38.5	1034	10.8	0.053	0.947	0.937	0.615	1.779	40.1	71.3	0.0713	1452	1.45	0.944	73.7	1569	0.939
13-Nov-08	28	1.87	38.4	576	36.2	1070	11.1	0.055	0.945	1.06	0.614	1.881	37.7	71.0	0.0710	1523	1.52	0.941	74.3	1643	0.936
20-Nov-08	29	1.32	42.3	618	35.4	1106	11.5	0.057	0.943	1.20	0.613	1.992	36.8	73.4	0.0734	1596	1.60	0.938	77.9	1721	0.933
27-Nov-08	30	1.03	30.8	649	24.4	1130	11.8	0.058	0.942	1.26	0.612	2.040	25.5	51.9	0.0519	1648	1.65	0.936	55.2	1776	0.931
4-Dec-08	31	1.08	29.8	678	22.1	1152	12.0	0.059	0.941	1.35	0.612	2.109	23.0	48.5	0.0485	1697	1.70	0.934	51.7	1828	0.929
11-Dec-08	32	1.43	30.4	709	26.3	1179	12.3	0.061	0.939	1.16	0.611	1.883	27.4	51.5	0.0515	1748	1.75	0.932	56.4	1885	0.927
18-Dec-08	33	1.88	33.0	742	32.3	1211	12.6	0.062	0.938	1.02	0.610	1.722	33.7	58.0	0.0580	1807	1.81	0.930	64.8	1949	0.924
25-Dec-08	34	#N/A	26.7	769	26.2	1237	12.9	0.064	0.936	1.02	0.609	1.702	27.3	46.5	0.0465	1853	1.85	0.928	#N/A	#N/A	#N/A
1-Jan-09	35	#N/A	25.9	794	25.5	1263	13.1	0.065	0.935	1.02	0.608	1.679	26.5	44.6	0.0446	1898	1.90	0.926	#N/A	#N/A	#N/A
8-Jan-09	36	#N/A	26.2	821	25.4	1288	13.4	0.066	0.934	1.03	0.607	1.794	26.4	47.4	0.0474	1945	1.95	0.925	#N/A	#N/A	#N/A
15-Jan-09	37	2.27	28.5	849	27.3	1315	13.7	0.068	0.932	1.04	0.606	1.905	28.4	54.1	0.0541	1999	2.00	0.923	54.6	2004	0.922
22-Jan-09	38	3.17	31.4	881	33.2	1348	14.0	0.069	0.931	0.946	0.605	1.607	34.6	55.6	0.0556	2055	2.05	0.920	62.9	2067	0.920
29-Jan-09	39	4.22	36.2	917	40.9	1389	14.5	0.071	0.929	0.884	0.604	1.421	42.6	60.6	0.0606	2115	2.12	0.918	74.6	2141	0.917
5-Feb-09	40	1.44	32.6	949	30.6	1420	14.8	0.073	0.927	1.07	0.603	1.783	31.9	56.8	0.0568	2172	2.17	0.916	63.1	2204	0.915
12-Feb-09	41	1.03	33.0	982	26.6	1447	15.1	0.074	**0.926**	1.24	0.602	1.952	27.7	54.0	0.0540	2226	2.23	**0.914**	59.7	2264	0.912
Median (last 5)					**27.3**							**1.8**		**54.1**							

Notes: loadings data removed to avoid overestimating the rate of NP depletion
= not calculated due to removed sulphate loading data.
re set at half the limit for NP depletion calculations

Molar Ratios and Depletion Rates for T4

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumptior (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
15-Dec-09	0	2.01	18.9	18.9	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	17	17	0.999
22-Dec-09	1	1.82	13.0	31.9	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	28	0.998
29-Dec-09	2	2.35	20.0	51.9	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	18	46	0.997
5-Jan-10	3	3.62	25.3	77.2	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	22	67	0.996
12-Jan-10	4	3.07	25.1	102	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	22	90	0.994
19-Jan-10	5	2.68	25.9	128	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	23	113	0.993
26-Jan-10	6	2.07	30.4	159	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	28	141	0.991
2-Feb-10	7	1.63	37.9	197	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	36	177	0.989
9-Feb-10	8	1.84	36.5	233	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	35	212	0.987
16-Feb-10	9	2.12	36.3	269	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	34	246	0.984
23-Feb-10	10	1.50	35.4	305	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	33.9	280	0.982
2-Mar-10	11	0.805	31.9	337	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	31.1	311	0.980
9-Mar-10	12	0.998	23.1	360	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	22.1	333	0.979
16-Mar-10	13	2.20	35.6	395	*DR*	0.0	0.0	0.0	1.00	*NC*	1.49	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	33.4	367	0.977
23-Mar-10	14	1.61	33.7	429	49.9	50	0.5	0.0011	0.999	0.674	1.49	1.435	52.0	74.6	0.0746	75	0.07	0.995	84.1	451	0.972
30-Mar-10	15	1.05	31.1	460	43.2	93	1.0	0.0021	0.998	0.719	1.49	1.420	45.0	63.9	0.0639	139	0.14	0.991	75.0	526	0.967
6-Apr-10	16	1.24	31.7	492	28.0	121	1.3	0.0027	0.997	1.13	1.49	2.025	29.2	59.2	0.0592	198	0.20	0.988	59.6	585	0.963
13-Apr-10	17	1.45	32.9	525	28.8	150	1.6	0.0034	0.997	1.14	1.48	1.858	30.0	55.7	0.0557	253	0.25	0.984	61.5	647	0.959
20-Apr-10	18	1.37	31.3	556	32.9	183	1.9	0.0041	0.996	0.952	1.48	1.556	34.3	53.4	0.0534	307	0.31	0.981	64.3	711	0.955
27-Apr-10	19	1.36	31.5	587	27.9	211	2.2	0.0047	0.995	1.13	1.48	1.857	29.1	54.0	0.0540	361	0.36	0.977	59.2	770	0.951
4-May-10	20	1.17	31.1	619	26.7	237	2.5	0.0053	0.995	1.17	1.48	1.805	27.8	50.2	0.0502	411	0.41	0.974	57.8	828	0.948
11-May-10	21	0.961	30.1	649	20.9	258	2.7	0.0058	0.994	1.44	1.48	2.085	21.8	45.4	0.0454	456	0.46	0.971	51.0	879	0.944
18-May-10	22	1.47	29.8	678	18.2	277	2.9	0.0062	0.994	1.63	1.48	2.393	19.0	45.5	0.0455	502	0.50	0.968	47.3	926	0.941
25-May-10	23	2.02	30.1	709	11.4	288	3.0	0.0065	0.994	2.65	1.48	3.930	11.9	46.6	0.0466	548	0.55	0.965	39.9	966	0.939
1-Jun-10	24	1.60	30.8	739	7.83	296	3.1	0.0066	0.993	3.93	1.48	5.446	8.16	44.4	0.0444	593	0.59	0.963	37.4	1004	0.937
8-Jun-10	25	1.40	36.2	776	10.1	306	3.2	0.0069	0.993	3.59	1.48	4.658	10.1	48.9	0.0489	642	0.64	0.959	45.3	1049	0.934
15-Jun-10	26	1.07	31.1	807	8.55	314	3.3	0.0070	0.993	3.64	1.48	4.581	8.91	40.8	0.0408	683	0.68	0.957	39.0	1088	0.931
22-Jun-10	27	0.787	27.0	834	11.6	326	3.4	0.0073	0.993	2.33	1.48	2.825	12.1	34.2	0.0342	717	0.72	0.955	38.4	1126	0.929
29-Jun-10	28	0.933	27.8	861	9.68	336	3.5	0.0075	0.992	2.87	1.48	3.548	10.1	35.8	0.0358	753	0.75	0.952	36.9	1163	0.927
6-Jul-10	29	1.13	29.8	891	8.46	344	3.6	0.0077	0.992	3.52	1.48	4.435	8.81	39.1	0.0391	792	0.79	0.950	37.5	1201	0.924
13-Jul-10	30	1.40	29.8	921	5.06	349	3.6	0.0078	0.992	5.89	1.48	6.951	5.27	36.6	0.0366	828	0.83	0.948	33.7	1234	0.922
20-Jul-10	31	1.71	30.8	952	8.37	358	3.7	0.0080	0.992	3.68	1.48	4.061	8.72	35.41	0.03541	864	0.86	0.945	37.8	1272	0.920
27-Jul-10	32	1.50	28.9	981	9.24	367	3.8	0.0082	0.992	3.13	1.48	3.488	9.63	33.58	0.03358	897	0.90	0.943	37.0	1309	0.917
3-Aug-10	33	1.38	28.6	1009	7.04	374	3.9	0.0084	0.992	4.07	1.48	4.588	7.33	33.65	0.03365	931	0.93	0.941	34.6	1344	0.915
10-Aug-10	34	1.30	27.6	1037	10.0	384	4.0	0.0086	0.991	2.76	1.48	3.087	10.4	32.18	0.03218	963	0.96	0.939	36.7	1380	0.913
17-Aug-10	35	1.22	26.5	1064	6.45	390	4.1	0.0087	0.991	4.11	1.48	4.572	6.72	30.72	0.03072	994	0.99	0.937	32.0	1412	0.911
24-Aug-10	36	2.09	32.1	1096	18.9	409	4.3	0.0092	0.991	1.70	1.48	1.757	19.7	34.62	0.03462	1028	1.03	0.935	49.7	1462	0.908
31-Aug-10	37	2.89	35.3	1131	10.0	419	4.4	0.0094	0.991	3.53	1.48	3.423	10.4	35.67	0.03567	1064	1.06	0.933	42.8	1505	0.905
7-Sep-10	38	2.03	30.3	1161	9.00	428	4.5	0.0096	0.990	3.36	1.48	3.463	9.38	32.47	0.03247	1097	1.10	0.931	37.6	1542	0.903
14-Sep-10	39	1.41	27.8	1189	7.83	436	4.5	0.0098	0.990	3.56	1.48	3.892	8.16	31.75	0.03175	1128	1.13	0.929	34.6	1577	0.900
21-Sep-10	40	1.33	30.3	1219	9.30	445	4.6	0.0100	0.990	3.26	1.48	3.540	9.69	34.30	0.03430	1163	1.16	0.927	38.7	1616	0.898
28-Sep-10	41	1.05	28.3	1248	10.2	456	4.7	0.0102	0.990	2.77	1.47	2.980	10.6	31.67	0.03167	1194	1.19	0.925	37.8	1654	0.896
5-Oct-10	42	1.05	27.7	1275	9.88	465	4.8	0.0104	0.990	2.81	1.47	3.052	10.3	31.40	0.03140	1226	1.23	0.923	37.0	1691	0.893
12-Oct-10	43	1.38	36.2	1311	11.3	477	5.0	0.0107	0.989	3.21	1.47	3.524	11.7	41.38	0.04138	1267	1.27	0.920	46.6	1737	0.890
19-Oct-10	44	1.14	29.0	1341	9.13	486	5.1	0.0109	0.989	3.18	1.47	3.427	9.51	32.60	0.03260	1300	1.30	0.918	37.4	1775	0.888
26-Oct-10	45	1.29	32.0	1373	9.22	495	5.2	0.0111	0.989	3.48	1.47	3.671	9.60	35.24	0.03524	1335	1.33	0.916	40.3	1815	0.885
2-Nov-10	46	1.24	29.4	1402	8.36	503	5.2	0.0113	0.989	3.52	1.47	3.653	8.71	31.81	0.03181	1367	1.37	0.914	36.9	1852	0.883
9-Nov-10	47	1.41	32.7	1435	9.22	513	5.3	0.0115	0.989	3.54	1.47	3.644	9.60	34.98	0.03498	1402	1.40	0.911	40.9	1893	0.880
16-Nov-10	48	1.13	26.0	1461	7.32	520	5.4	0.0117	0.988	3.56	1.47	3.639	7.62	27.73	0.02773	1429	1.43	0.910	32.5	1925	0.878
23-Nov-10	49	1.53	34.9	1496	9.79	530	5.5	0.0119	0.988	3.57	1.47	3.635	10.2	37.05	0.03705	1467	1.47	0.907	43.6	1969	0.876
30-Nov-10	50	1.88	29.4	1525	8.68	538	5.6	0.0121	0.988	3.39	1.47	3.590	9.04	30.65	0.03065	1497	1.50	0.905	36.5	2005	0.873
7-Dec-10	51	2.02	27.1	1552	8.20	547	5.7	0.0122	0.988	3.30	1.47	3.273	8.54	27.94	0.02794	1525	1.53	0.904	33.6	2039	0.871
14-Dec-10	52	2.20	27.5	1580	8.45	555	5.8	0.0124	0.988	3.26	1.47	3.215	8.80	28.29	0.02829	1553	1.55	0.902	34.1	2073	0.869
21-Dec-10	53	2.17	25.4	1605	7.90	563	5.9	0.0126	0.987	3.22	1.47	3.158	8.23	25.99	0.02599	1579	1.58	0.900	31.5	2104	0.867
28-Dec-10	54	2.12	29.5	1634	9.36	572	6.0	0.0128	0.987	3.16	1.47	3.365	9.75	32.81	0.03281	1612	1.61	0.898	37.2	2142	0.865
4-Jan-11	55	1.68	26.2	1661	8.37	581	6.0	0.0130	0.987	3.13	1.47	3.472	8.72	30.29	0.03029	1642	1.64	0.896	33.2	2175	0.863
11-Jan-11	56	1.48	24.4	1685	7.84	589	6.1	0.0132	0.987	3.11	1.47	3.527	8.17	28.81	0.02881	1671	1.67	0.894	31.1	2206	0.861
18-Jan-11	57	1.37	24.1	1709	7.79	596	6.2	0.0134	0.987	3.09	1.47	3.582	8.12	29.07	0.02907	1700	1.70	0.893	30.9	2237	0.859
25-Jan-11	58	1.25	23.0	1732	6.05	602	6.3	0.0135	0.987	3.80	1.47	4.064	6.30	25.60	0.02560	1726	1.73	0.891	28.0	2265	0.857
1-Feb-11	59	1.36	25.6	1758	5.98	608	6.3	0.0136	0.986	4.29	1.47	4.397	6.23	27.40	0.02740	1753	1.75	0.889	30.5	2295	0.855
8-Feb-11	60	1.33	25.3	1783	5.54	614	6.4	0.0138	0.986	4.58	1.47	4.598	5.77	26.52	0.02652	1780	1.78	0.888	29.8	2325	0.853
15-Feb-11	61	1.23	23.6	1807	4.80	619	6.4	0.0139	0.986	4.91	1.47	4.827	5.00	24.14	0.02414	1804	1.80	0.886	27.4	2352	0.851
22-Feb-11	62	1.36	28.2	1835	5.58	624	6.5	0.0140	0.986	5.05	1.47	5.371	5.81	31.22	0.03122	1835	1.84	0.884	32.6	2385	0.849
1-Mar-11	63	1.26	27.3	1862	5.34	630	6.6	0.0141	0.986	5.11	1.47	5.643	5.56	31.39	0.03139	1867	1.87	0.882	31.6	2417	0.847
8-Mar-11	64	1.22	26.9	1889	5.22	635	6.6	0.0142	0.986	5.14	1.47	5.778	5.44	31.43	0.03143	1898	1.90	0.880	31.1	2448	0.845
15-Mar-11	65	1.17	26.4	1915	5.10	640	6.7	0.0143	0.986	5.18	1.47	5.914	5.31	31.43	0.03143	1930	1.93	0.878	30.5	2478	0.843
22-Mar-11	66	1.48	27.6	1943	6.30	646	6.7	0.0145	0.986	4.38	1.47	4.783	6.56	31.39	0.03139	1961	1.96	0.876	32.7	2511	0.841
29-Mar-11	67	1.65	28.3	1971	6.98	653	6.8	0.0146	0.985	4.06	1.47	4.330	7.27	31.47	0.03147	1992	1.99	0.874	33.9	2545	0.839
5-Apr-11	68	1.58	26.1	1997	6.67	660	6.9	0.0148	0.985	3.91	1.47	4.126	6.94	28.65	0.02865	2021	2.02	0.872	31.4	2576	0.837
12-Apr-11	69	1.66	26.3	2024	6.96	667	6.9	0.0149	0.985	3.78	1.47	3.934	7.25	28.53	0.02853	2050	2.05	0.871	31.9	2608	0.835
19-Apr-11	70	1.66	27.9	2051	7.44	674	7.0	0.0151	0.985	3.75	1.47	3.826	7.75	29.66	0.02966	2079	2.08	0.869	34.0	2642	0.833
26-Apr-11	71	1.48	25.7	2077	6.87	681	7.1	0.0153	0.985	3.74	1.47	3.774	7.15	27.00	0.02700	2106	2.11	0.867	31.4	2673	0.831
3-May-11	72	1.61	28.4	2106	7.59	689	7.2	0.0154	0.985	3.73	1.47	3.749	7.91	29.66	0.02966	2136	2.14	0.865	34.7	2708	0.829
10-May-11	73	1.54	27.6	2133	7.40	696	7.2	0.0156	0.984	3.73	1.47	3.724	7.70	28.09	0.02809	2165	2.16	0.863	33.7	2742	0.827
17-May-11	74	1.30	25.6	2159	7.06	703	7.3	0.0158	0.984	3.62	1.47	3.653	7.35	28.32	0.02832	2193	2.19	0.861	31.6	2773	0.825
24-May-11	75	1.15	24.0	2183	6.72	710	7.4	0.0159	0.984	3.57	1.47	3.917	7.00	27.40	0.02740	2220	2.22	0.860	29.8	2803	0.823
31-May-11	76	0.940	20.2	2203	5.70	716	7.4	0.0160	0.984	3.55	1.47	3.949	5.93	23.43	0.02343	2244	2.24	0.858	25.2	2829	0.821
7-Jun-11	77	1.03	22.7	2226	6.46	722	7.5	0.0162	0.984	3.52	1.47	3.981	6.73	26.80	0.02680	2271	2.27	0.857	28.4	2857	0.820
14-Jun-11	78	1.41	24.5	2250	7.40	729	7.6	0.0163	0.984	3.32	1.47	3.655	7.71	28.18	0.02818	2299	2.30	0.855	30.8	2888	0.818
21-Jun-11	79	1.78	28.0	2278	8.66	738	7.7	0.0165	0.983	3.23	1.47	3.511	9.02	31.68	0.03168	2330	2.33	0.853	35.2	2923	0.815
28-Jun-11	80	1.72	25.9	2304	8.14	746	7.8	0.0167	0.983	3.19	1.47	3.443	8.49	29.21	0.02921	2360	2.36	0.851	32.7	2956	0.813
5-Jul-11	81	1.81	26.1	2330	8.30	755	7.9	0.0169	0.983	3.15	1.46	3.377	8.65	29.21	0.02921	2389	2.39	0.849	32.9	2989	0.811
12-Jul-11	82	2.11	25.3	2355	8.08	763	7.9	0.0171	0.983	3.13	1.46	3.363	8.41	28.30	0.02830	2417	2.42	0.847	31.6	3020	0.809
19-Jul-11	83	2.26	24.9	2380	7.96	771	8.0	0.0173	0.983	3.12	1.46	3.356	8.29	27.81	0.02781	2445	2.44	0.846	30.9	3051	0.807
26-Jul-11	84	2.30	24.2	2405	7.76	778	8.1	0.0174	0.983	3.12	1.46	3.352	8.08	27.09	0.02709	2472	2.47	0.844	30.0	3081	0.805
2-Aug-11	85	2.25	22.7	2427	7.29	786	8.2	0.0176	0.982	3.12	1.46	3.348	7.60	25.43	0.02543	2497	2.50	0.842	28.1	3109	0.804
9-Aug-11	86	2.59	25.4	2453	8.58	794	8.3	0.0178	0.982	2.96	1.46	3.204	8.94	28.64	0.02864	2526	2.53	0.840	31.7	3141	0.802
16-Aug-11	87	2.66	25.7	2478	8.91	803	8.4	0.0180	0.982	2.89	1.46	3.139	9.28	29.14	0.02914	2555	2.56	0.839	32.4	3173	0.800
23-Aug-11	88	2.54	24.5	2503	8.56	812	8.5	0.0182	0.982	2.86	1.46	3.109	8.92	27.73	0.02773	2583	2.58	0.837	30.8	3204	0.798
30-Aug-11	89	2.70	25.8	2529	9.14	821	8.5	0.0184	0.982	2.82	1.46	3.080	9.52	29.31	0.02931	2612	2.61	0.835	32.6	3237	0.796
6-Sep-11	90	2.58	24.5	2553	9.13	830	8.6	0.0186	0.981	2.68	1.46	2.911	9.51	27.69	0.02769	2640	2.64	0.833	31.4	3268	0.794
13-Sep-11	91	2.52	23.8	2577	9.11	839	8.7	0.0188	0.981	2.61	1.46	2.832	9.49	26.88	0.02688	2667	2.67	0.832	30.8	3299	0.792
20-Sep-11	92	2.74	25.8	2603	10.0	849	8.8	0.0190	0.981	2.58	1.46	2.793	10.4	29.13	0.02913	2696	2.70	0.830	33.5	3332	0.789
27-Sep-11	93	2.74	25.8	2629	10.1	859	8.9	0.0193	0.981	2.55	1.46	2.756	10.5	29.06	0.02906	2725	2.72	0.828	33.6	3366	0.787
4-Oct-11	94	2.38	24.5	2653	9.78	869	9.0	0.0195	0.981	2.50	1.46	2.818	10.2	28.73	0.02873	2754	2.75	0.826	32.3	3398	0.785
11-Oct-11	95	1.98	21.6	2675	8.72	878	9.1	0.0197	0.980	2.48	1.46	2.853	9.08	25.90	0.02590	2780	2.78	0.824	28.7	3427	0.784
18-Oct-11	96	1.87	21.1	2696	8.56	886	9.2	0.0199	0.980	2.47	1.46	2.871	8.92	25.60	0.02560	2805	2.81	0.823	28.1	3455	0.782
25-Oct-11	97	1.71	19.9	2716	8.10	894	9.3	0.0200	0.980	2.45	1.46	2.890	8.44	24.39	0.02439	2830	2.83	0.821	26.6	3482	0.780
1-Nov-11	98	2.29	24.9	2741	8.65	903	9.4	0.0202	0.980	2.88	1.46	3.272	9.01	29.47	0.02947	2859	2.86	0.819	31.6	3513	0.778
8-Nov-11	99	2.42	25.6	2766	8.23	911	9.5	0.0204	0.980	3.12	1.46	3.478	8.58	29.83	0.02983	2889	2.89	0.818	31.8	3545	0.776
15-Nov-11	100	2.34	24.5	2791	7.57	919	9.6	0.0206	0.979	3.24	1.46	3.586	7.89	28.29	0.02829	2917	2.92	0.816	30.1	3575	0.774
22-Nov-11	101	2.60	26.9	2818	8.01	927	9.6	0.0208	0.979	3.36	1.46	3.696	8.35	30.84	0.03084	2948	2.95	0.814	32.7	3608	0.772
29-Nov-11	102	2.43	25.9	2843	7.65	935	9.7	0.0209	0.979	3.39	1.46	3.639	7.97	29.01	0.02901	2977	2.98	0.812	31.4	3639	0.770
6-Dec-11	103	2.80	30.3	2874	8.91	943	9.8	0.0211	0.979	3.40	1.46	3.611	9.28	33.52	0.03352	3011	3.01	0.810	36.8	3676	0.768
13-Dec-11	104	2.67	29.1	2903	8.55	952	9.9	0.0213	0.979	3.41	1.46	3.597	8.91	32.04	0.03204	3043	3.04	0.808	35.4	3712	0.766
20-Dec-11	105	2.77	30.4	2933	8.91	961	10.0	0.0215	0.978	3.41	1.46	3.583	9.28	33.26	0.03326	3076	3.08	0.806	36.9	3748	0.763
27-Dec-11	106	2.07	31.2	2964	9.60	970	10.1	0.0217	0.978	3.25	1.46	3.212	10.0	32.13	0.03213	3108	3.11	0.804	39.1	3788	0.761
3-Jan-12	107	1.53	27.7	2992	8.72	979	10.2	0.0219	0.978	3.17	1.46	3.053	9.08	27.72	0.02772	3136	3.14	0.802	35.2	3823	0.759
10-Jan-12	108	1.60	32.1	3024	10.2	989	10.3	0.0222	0.978	3.14	1.46	2.979	10.6	31.70	0.03170	3167	3.17	0.800	41.1	3864	0.756
17-Jan-12	109	1.50	33.9	3058	10.9	1000	10.4	0.0224	0.978	3.11	1.46	2.909	11.3	33.00	0.03300	3200	3.20	0.798	43.7	3908	0.753
24-Jan-12	110	1.93	30.9	3089	13.4	1014	10.6	0.0227	0.977	2.30	1.46	2.334	14.0	32.69	0.03269	3233	3.23	0.796	42.9	3950	0.750
31-Jan-12	111	2.29	31.4	3120	15.7	1029	10.7	0.0231	0.977	2.01	1.46	2.131	16.3	34.75	0.03475	3268	3.27	0.794	45.5	3996	0.748
7-Feb-12	112	2.05	26.2	3147	14.0	1043	10.9	0.0234	0.977	1.88	1.46	2.043	14.6	29.74	0.02974	3298	3.30	0.792	38.8	4035	0.745
14-Feb-12	113	2.18	26.2	3173	14.8	1058	11.0	0.0237	0.976	1.77	1.45	1.963	15.4	30.25	0.03025	3328	3.33	0.790	39.4	4074	0.743
21-Feb-12	114	1.91	24.9	3198	12.1	1070	11.1	0.0240	0.976	2.06	1.45	2.370	12.6	29.87	0.02987	3358	3.36	0.788	35.6	4110	0.740
28-Feb-12	115	1.77	24.4	3222	10.8	1081	11.3	0.0242	0.976	2.26	1.45	2.655	11.2	29.85	0.02985	3388	3.39	0.786	33.9	4144	0.738
6-Mar-12	116	1.68	23.7	3246	9.96	1091	11.4	0.0244	0.976	2.38	1.45	2.828	10.4	29.33	0.02933	3417	3.42	0.784	32.4	4176	0.736
13-Mar-12	117	1.49	21.7	3268	8.61	1100	11.4	0.0246

Molar Ratios and Depletion Rates for T4

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumptior (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
24-Apr-12	123	1.36	22.2	3408	11.4	1179	12.3	0.0264	0.974	1.94	1.45	2.313	11.9	27.58	0.02758	3630	3.63	0.771	32.8	4419	0.721
1-May-12	124	1.56	25.1	3433	12.4	1191	12.4	0.0267	0.973	2.02	1.45	2.357	12.9	30.47	0.03047	3661	3.66	0.769	36.4	4456	0.719
8-May-12	125	1.48	23.4	3456	11.1	1202	12.5	0.0269	0.973	2.10	1.45	2.404	11.6	27.87	0.02787	3689	3.69	0.767	33.5	4489	0.716
15-May-12	126	1.66	25.1	3481	11.5	1214	12.6	0.0272	0.973	2.18	1.45	2.503	12.0	30.04	0.03004	3719	3.72	0.765	35.5	4525	0.714
22-May-12	127	1.58	23.5	3505	10.6	1224	12.7	0.0274	0.973	2.22	1.45	2.556	11.0	28.16	0.02816	3747	3.75	0.763	32.9	4558	0.712
29-May-12	128	1.81	26.6	3531	11.9	1236	12.9	0.0277	0.972	2.24	1.45	2.583	12.4	31.91	0.03191	3779	3.78	0.761	37.1	4595	0.710
5-Jun-12	129	1.70	24.7	3556	10.9	1247	13.0	0.0279	0.972	2.26	1.45	2.611	11.4	29.72	0.02972	3808	3.81	0.759	34.4	4629	0.708
12-Jun-12	130	2.76	26.1	3582	10.6	1258	13.1	0.0282	0.972	2.46	1.45	2.799	11.0	30.85	0.03085	3839	3.84	0.757	34.3	4664	0.705
19-Jun-12	131	3.46	28.3	3610	11.0	1269	13.2	0.0284	0.972	2.56	1.45	2.892	11.5	33.27	0.03327	3873	3.87	0.755	36.3	4700	0.703
26-Jun-12	132	3.56	27.4	3638	10.5	1279	13.3	0.0287	0.971	2.61	1.45	2.939	10.9	32.05	0.03205	3905	3.90	0.753	34.7	4735	0.701
3-Jul-12	133	4.00	29.1	3667	10.9	1290	13.4	0.0289	0.971	2.66	1.45	2.986	11.4	33.99	0.03399	3939	3.94	0.751	36.5	4771	0.699
10-Jul-12	134	2.71	27.0	3694	10.1	1300	13.5	0.0291	0.971	2.67	1.45	3.182	10.5	33.50	0.03350	3972	3.97	0.749	34.8	4806	0.696
17-Jul-12	135	1.95	24.4	3718	9.13	1309	13.6	0.0293	0.971	2.67	1.45	3.290	9.51	31.29	0.03129	4003	4.00	0.747	32.0	4838	0.694
24-Jul-12	136	1.86	27.0	3745	10.1	1320	13.7	0.0296	0.970	2.67	1.45	3.347	10.5	35.17	0.03517	4039	4.04	0.745	35.6	4873	0.692
31-Jul-12	137	1.46	25.1	3770	9.40	1329	13.8	0.0298	0.970	2.67	1.45	3.406	9.79	33.36	0.03336	4072	4.07	0.743	33.5	4907	0.690
7-Aug-12	138	1.59	22.4	3793	10.5	1339	13.9	0.0300	0.970	2.14	1.45	2.749	10.9	29.97	0.02997	4102	4.10	0.741	31.7	4939	0.688
14-Aug-12	139	1.71	21.9	3814	11.4	1351	14.1	0.0303	0.970	1.92	1.44	2.481	11.9	29.44	0.02944	4131	4.13	0.739	32.1	4971	0.686
21-Aug-12	140	1.80	21.9	3836	12.0	1363	14.2	0.0305	0.969	1.82	1.44	2.359	12.5	29.47	0.02947	4161	4.16	0.737	32.6	5003	0.684
28-Aug-12	141	1.77	20.5	3857	11.8	1375	14.3	0.0308	0.969	1.73	1.44	2.243	12.3	27.65	0.02765	4188	4.19	0.735	31.0	5034	0.682
4-Sep-12	142	1.70	22.5	3879	17.7	1392	14.5	0.0312	0.969	1.27	1.44	1.900	18.5	35.1	0.0351	4224	4.22	0.733	39.3	5074	0.679
11-Sep-12	143	1.71	24.2	3903	21.3	1414	14.7	0.0317	0.968	1.14	1.44	1.800	22.1	39.9	0.0399	4263	4.26	0.731	44.6	5118	0.677
18-Sep-12	144	1.54	22.5	3926	20.8	1434	14.9	0.0321	0.968	1.08	1.44	1.760	21.7	38.2	0.0382	4302	4.30	0.728	42.7	5161	0.674
25-Sep-12	145	1.82	27.5	3953	26.5	1461	15.2	0.0327	0.967	1.04	1.44	1.725	27.6	47.7	0.0477	4349	4.35	0.725	53.3	5214	0.671
2-Oct-12	146	1.53	22.8	3976	24.2	1485	15.5	0.0333	0.967	0.943	1.44	1.607	25.2	40.4	0.0404	4390	4.39	0.723	46.4	5261	0.668
9-Oct-12	147	1.43	21.0	3997	23.4	1509	15.7	0.0338	0.966	0.898	1.44	1.551	24.4	37.9	0.0379	4428	4.43	0.720	44.0	5305	0.665
16-Oct-12	148	1.49	21.9	4019	24.9	1533	16.0	0.0344	0.966	0.876	1.44	1.523	26.0	39.6	0.0396	4467	4.47	0.718	46.3	5351	0.662
23-Oct-12	149	1.46	21.2	4040	24.8	1558	16.2	0.0349	0.965	0.855	1.44	1.496	25.9	38.7	0.0387	4506	4.51	0.715	45.7	5397	0.659
30-Oct-12	150	2.63	21.1	4061	20.0	1578	16.4	0.0354	0.965	1.05	1.44	1.711	20.9	35.7	0.0357	4541	4.54	0.713	39.3	5436	0.657
6-Nov-12	151	3.13	20.5	4082	17.3	1596	16.6	0.0357	0.964	1.19	1.44	1.857	18.0	33.4	0.0334	4575	4.57	0.711	35.4	5471	0.654
13-Nov-12	152	3.62	21.8	4104	17.2	1613	16.8	0.0361	0.964	1.27	1.44	1.943	17.9	34.8	0.0348	4610	4.61	0.709	36.1	5507	0.652
20-Nov-12	153	3.89	21.7	4125	15.9	1629	17.0	0.0365	0.964	1.36	1.44	2.042	16.6	33.9	0.0339	4644	4.64	0.707	34.4	5542	0.650
27-Nov-12	154	2.82	21.5	4147	17.6	1646	17.1	0.0369	0.963	1.22	1.44	1.912	18.4	35.1	0.0351	4679	4.68	0.704	37.1	5579	0.648
4-Dec-12	155	2.29	21.8	4169	18.8	1665	17.3	0.0373	0.963	1.16	1.43	1.853	19.6	36.3	0.0363	4715	4.71	0.702	39.1	5618	0.645
11-Dec-12	156	1.72	18.7	4187	16.5	1682	17.5	0.0377	0.962	1.13	1.43	1.825	17.2	31.4	0.0314	4746	4.75	0.700	34.2	5652	0.643
18-Dec-12	157	1.43	18.3	4206	16.6	1698	17.7	0.0380	0.962	1.10	1.43	1.798	17.3	31.1	0.0311	4778	4.78	0.698	34.1	5686	0.641
25-Dec-12	158	1.51	20.0	4226	17.6	1716	17.9	0.0384	0.962	1.13	1.43	1.771	18.4	32.5	0.0325	4810	4.81	0.696	36.8	5723	0.638
1-Jan-13	159	1.55	20.9	4247	18.1	1734	18.1	0.0388	0.961	1.15	1.43	1.758	18.9	33.2	0.0332	4843	4.84	0.694	38.2	5761	0.636
8-Jan-13	160	1.58	21.6	4268	18.6	1753	18.2	0.0393	0.961	1.16	1.43	1.751	19.4	33.9	0.0339	4877	4.88	0.692	39.4	5801	0.634
15-Jan-13	161	1.46	20.1	4288	17.2	1770	18.4	0.0397	0.960	1.17	1.43	1.745	17.9	31.3	0.0313	4908	4.91	0.690	36.6	5837	0.631
22-Jan-13	162	2.13	20.9	4309	21.6	1791	18.6	0.0401	0.960	0.971	1.43	1.642	22.5	36.9	0.0369	4945	4.95	0.688	41.3	5879	0.629
29-Jan-13	163	2.63	22.5	4332	25.2	1817	18.9	0.0407	0.959	0.895	1.43	1.602	26.2	42.0	0.0420	4987	4.99	0.685	46.1	5925	0.626
5-Feb-13	164	2.73	22.0	4354	25.6	1842	19.2	0.0413	0.959	0.861	1.43	1.584	26.6	42.2	0.0422	5030	5.03	0.682	45.9	5971	0.623
12-Feb-13	165	2.80	21.3	4375	25.7	1868	19.4	0.0418	0.958	0.829	1.43	1.568	26.7	41.9	0.0419	5071	5.07	0.680	45.2	6016	0.620
19-Feb-13	166	2.91	22.3	4397	25.2	1893	19.7	0.0424	0.958	0.885	1.43	1.677	26.3	44.0	0.0440	5115	5.12	0.677	45.6	6061	0.617
26-Feb-13	167	2.63	20.3	4418	22.1	1915	19.9	0.0429	0.957	0.916	1.43	1.738	23.0	40.0	0.0400	5156	5.16	0.674	40.7	6102	0.615
5-Mar-13	168	2.50	19.3	4437	20.6	1936	20.2	0.0434	0.957	0.933	1.43	1.771	21.5	38.1	0.0381	5194	5.19	0.672	38.3	6140	0.612
12-Mar-13	169	2.69	20.8	4458	21.8	1958	20.4	0.0439	0.956	0.951	1.42	1.806	22.8	41.1	0.0411	5235	5.23	0.669	40.8	6181	0.610
19-Mar-13	170	2.54	19.2	4477	21.7	1979	20.6	0.0443	0.956	0.884	1.42	1.657	22.6	37.4	0.0374	5272	5.27	0.667	39.2	6220	0.607
26-Mar-13	171	2.76	20.6	4497	24.2	2003	20.9	0.0449	0.955	0.853	1.42	1.589	25.2	40.0	0.0400	5312	5.31	0.664	43.0	6263	0.604
2-Apr-13	172	2.62	19.4	4517	23.2	2027	21.1	0.0454	0.955	0.839	1.42	1.556	24.1	37.6	0.0376	5350	5.35	0.662	40.9	6304	0.602
9-Apr-13	173	2.72	20.0	4537	24.3	2051	21.4	0.0459	**0.954**	0.824	1.42	1.524	25.3	38.6	0.0386	5388	5.39	**0.660**	42.6	6347	0.599
Median (last 5)					**21.8**							**1.7**		**38.6**							

Notes: loadings data removed to avoid overestimating the rate of NP depletion
= not calculated due to removed sulphate loading data.
re set at half the limit for NP depletion calculations

Molar Ratios and Depletion Rates for HC1

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumptior (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
3-Dec-09	0	2.95	13.5	13.5	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	11	11	1.000
10-Dec-09	1	2.33	9.96	23.5	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8	18	0.999
17-Dec-09	2	1.75	7.25	30.7	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6	24	0.999
24-Dec-09	3	1.63	10.1	40.9	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	8	32	0.999
31-Dec-09	4	1.74	8.22	49.1	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	6	39	0.999
7-Jan-10	5	2.06	7.30	56.4	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	5	44	0.998
14-Jan-10	6	2.27	7.37	63.7	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	5	49	0.998
21-Jan-10	7	2.26	6.77	70.5	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	5	54	0.998
28-Jan-10	8	2.16	6.24	76.8	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	4	58	0.998
4-Feb-10	9	2.01	5.58	82.3	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	4	61	0.998
11-Feb-10	10	1.82	6.07	88.4	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	4	65	0.998
18-Feb-10	11	1.57	6.26	94.7	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	5	70	0.997
25-Feb-10	12	1.64	6.05	101	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	4	75	0.997
4-Mar-10	13	1.61	5.47	106	*DR*	0.0	0.0	0.0	1.00	*NC*	1.53	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	4	78	0.997
11-Mar-10	14	1.80	5.46	112	142	142	1.5	0.0031	0.997	0.0386	1.53	1.08	147	159	0.159	159	0.16	0.994	151	229	0.991
18-Mar-10	15	1.91	5.10	117	116	257	2.7	0.0056	0.994	0.0441	1.52	1.09	120	131	0.131	290	0.29	0.989	124	353	0.987
25-Mar-10	16	1.97	5.44	122	118	375	3.9	0.0082	0.992	0.0461	1.52	1.02	123	125	0.125	415	0.41	0.984	126	479	0.982
1-Apr-10	17	1.82	5.16	127	110	485	5.0	0.0106	0.989	0.0471	1.51	0.937	114	107	0.107	522	0.52	0.980	118	597	0.978
8-Apr-10	18	1.72	5.47	133	92.0	577	6.0	0.0126	0.987	0.0594	1.51	1.19	95.9	114	0.114	636	0.64	0.976	99.6	697	0.974
15-Apr-10	19	1.50	5.49	138	117	694	7.2	0.0151	0.985	0.0469	1.51	0.942	122	115	0.115	750	0.75	0.972	126	822	0.969
22-Apr-10	20	1.41	5.97	144	148	842	8.8	0.0184	0.982	0.0403	1.50	0.733	154	113	0.113	864	0.86	0.968	159	981	0.963
29-Apr-10	21	1.28	6.33	151	112	954	9.9	0.0208	0.979	0.0567	1.50	0.934	116	109	0.109	972	0.97	0.964	122	1103	0.959
6-May-10	22	1.52	5.99	157	109	1063	11.1	0.0232	0.977	0.0548	1.49	0.959	114	109	0.109	1082	1.08	0.959	118	1221	0.954
13-May-10	23	1.87	6.04	163	114	1177	12.3	0.0257	0.974	0.0529	1.49	0.984	119	117	0.117	1199	1.20	0.955	123	1344	0.950
20-May-10	24	2.64	6.12	169	109	1286	13.4	0.0281	0.972	0.0560	1.49	0.956	114	109	0.109	1307	1.31	0.951	117	1462	0.945
27-May-10	25	3.54	6.53	175	85.6	1372	14.3	0.0299	0.970	0.0764	1.48	1.20	89.1	107	0.107	1414	1.41	0.947	92.1	1554	0.942
3-Jun-10	26	2.86	6.04	181	86.0	1458	15.2	0.032	0.968	0.0703	1.48	1.15	89.5	103	0.103	1517	1.52	0.943	92.7	1646	0.938
10-Jun-10	27	2.36	5.89	187	86.5	1544	16.1	0.034	0.966	0.0681	1.48	1.17	90.1	105	0.105	1622	1.62	0.939	93.6	1740	0.935
17-Jun-10	28	2.12	6.01	193	56.0	1600	16.7	0.035	0.965	0.107	1.48	1.67	58.3	97.7	0.0977	1720	1.72	0.936	62.2	1802	0.932
24-Jun-10	29	2.01	6.54	200	75.8	1676	17.4	0.037	0.963	0.0862	1.47	1.22	79.0	96.4	0.0964	1816	1.82	0.932	83.5	1886	0.929
1-Jul-10	30	1.48	5.44	205	70.9	1747	18.2	0.038	0.962	0.0767	1.47	1.11	73.9	82.0	0.0820	1898	1.90	0.929	77.8	1964	0.926
8-Jul-10	31	1.16	5.06	210	67.6	1815	18.9	0.040	0.960	0.0749	1.47	1.11	70.5	78.5	0.0785	1977	1.98	0.926	74.4	2038	0.924
15-Jul-10	32	1.56	5.49	216	63.9	1879	19.6	0.041	0.959	0.0858	1.47	1.17	66.6	78.2	0.0782	2055	2.05	0.923	70.5	2109	0.921
22-Jul-10	33	2.06	6.18	222	71.3	1950	20.3	0.043	0.957	0.0867	1.46	1.10	74.2	81.3	0.0813	2136	2.14	0.920	78.3	2187	0.918
29-Jul-10	34	1.92	5.91	228	88.4	2038	21.2	0.044	0.956	0.0669	1.46	0.887	92.0	81.6	0.0816	2218	2.22	0.917	96.0	2283	0.914
5-Aug-10	35	1.88	5.97	234	77.8	2116	22.0	0.046	0.954	0.0767	1.46	1.07	81.0	86.4	0.0864	2304	2.30	0.914	85.1	2368	0.911
12-Aug-10	36	2.64	5.96	240	71.5	2187	22.8	0.048	0.952	0.0833	1.46	1.08	74.5	80.3	0.0803	2385	2.38	0.911	77.8	2446	0.908
19-Aug-10	37	3.12	5.46	245	54.6	2242	23.3	0.049	0.951	0.100	1.46	1.20	56.8	68.1	0.0681	2453	2.45	0.908	59.2	2505	0.906
26-Aug-10	38	1.61	6.49	252	71.3	2313	24.1	0.050	0.950	0.0910	1.45	0.927	74.3	68.9	0.0689	2522	2.52	0.905	79.1	2584	0.903
2-Sep-10	39	2.40	6.28	258	72.8	2386	24.8	0.052	**0.948**	0.0863	1.45	0.852	75.8	64.6	0.0646	2586	2.59	**0.903**	79.7	2664	0.900
Median (last 5)					**71.3**							**1.1**		**68.9**							

Notes: loadings data removed to avoid overestimating the rate of NP depletion
= not calculated due to removed sulphate loading data.
re set at half the limit for NP depletion calculations

Molar Ratios and Depletion Rates for HC1

Date	Cycle	Acidity (mg $CaCO_3$/kg/wk)	Alkalinity (mg $CaCO_3$/kg/wk)	Cumulative Alkalinity (mg $CaCO_3$/kg)	Sulphate (mg/kg/wk)	Cumulative Sulphate (mg/kg)	Cumulative Sulphate (mmol/kg)	Fraction of total S Leached	Fraction of Total S remaining	Alkalinity/ Sulphate Production	Total S Conc Remaining (%)	CMR	Theoretical NP Consumption at pH 6	Carbonate NP Consumption (mg $CaCO_3$/kg/wk)	Carbonate NP Consumption (kg $CaCO_3$/t/wk)	Cum. Carb NP Consum. (mg $CaCO_3$/kg/wk)	Cum. Carb NP Consum (kg $CaCO_3$/t/wk)	Remaining Carbonate NP	Open System NP Consumption	Cumulative NP Consumption	Remaining NP
3-Dec-09	0	36.2	0.526	0.526	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	-36	-36	1.005
10-Dec-09	1	6.23	1.96	2.49	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	-4	-40	1.006
17-Dec-09	2	2.16	2.90	5.39	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	1	-39	1.006
24-Dec-09	3	1.49	3.44	8.83	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	1.9	-37	1.006
31-Dec-09	4	1.62	4.50	13.3	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	2.9	-34	1.005
7-Jan-10	5	1.77	5.65	19.0	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	3.9	-30	1.005
14-Jan-10	6	1.75	5.99	25.0	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	4.2	-26	1.004
21-Jan-10	7	1.81	6.59	31.6	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	4.8	-21	1.003
28-Jan-10	8	1.54	4.12	35.7	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	2.6	-19	1.003
4-Feb-10	9	1.47	2.23	37.9	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	0.8	-18	1.003
11-Feb-10	10	1.66	2.43	40.3	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	0.8	-17	1.003
18-Feb-10	11	1.85	2.63	43.0	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	0.8	-17	1.002
25-Feb-10	12	1.74	2.33	45.3	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	0.6	-16	1.002
4-Mar-10	13	1.39	1.72	47.0	*DR*	0.0	0.0	0.0	1.00	*NC*	1.23	*NC*	0.0	0.0	0.0	0.0	0.0	*NC*	0.3	-16	1.002
11-Mar-10	14	1.78	2.55	49.6	21.2	21	0.22	0.0006	0.999	0.120	1.23	1.029	22.0	22.7	0.0227	23	0.023	0.997	22.8	7	0.999
18-Mar-10	15	1.91	3.03	52.6	19.3	40	0.42	0.0011	0.999	0.157	1.23	1.209	20.1	24.3	0.0243	47	0.047	0.993	21.3	28	0.996
25-Mar-10	16	1.92	2.51	55.1	12.0	52	0.55	0.0014	0.999	0.209	1.23	1.811	12.5	22.7	0.0227	70	0.070	0.990	13.1	42	0.994
1-Apr-10	17	1.66	1.74	56.9	20.0	72	0.75	0.0020	0.998	0.0870	1.23	0.870	20.8	18.1	0.0181	88	0.088	0.987	20.9	62	0.991
8-Apr-10	18	1.68	2.07	58.9	14.2	87	0.90	0.0024	0.998	0.146	1.23	1.359	14.8	20.1	0.0201	108	0.108	0.984	15.2	78	0.988
15-Apr-10	19	1.44	2.15	61.1	17.0	104	1.08	0.0028	0.997	0.127	1.23	1.095	17.7	19.4	0.0194	127	0.127	0.981	18.4	96	0.986
22-Apr-10	20	1.35	2.37	63.5	19.3	123	1.28	0.0033	0.997	0.123	1.23	0.854	20.1	17.2	0.0172	144	0.144	0.978	21.2	117	0.982
29-Apr-10	21	1.19	2.50	66.0	13.5	136	1.42	0.0037	0.996	0.185	1.23	1.002	14.0	14.1	0.0141	159	0.159	0.976	15.4	133	0.980
6-May-10	22	1.19	3.46	69.4	11.6	148	1.54	0.0040	0.996	0.299	1.23	1.196	12.1	14.4	0.0144	173	0.173	0.974	14.3	147	0.978
13-May-10	23	1.37	5.03	74.4	14.4	162	1.69	0.0044	0.996	0.350	1.22	1.142	15.0	17.1	0.0171	190	0.190	0.971	18.6	165	0.975
20-May-10	24	2.06	4.06	78.5	12.9	175	1.8	0.0048	0.995	0.314	1.22	1.142	13.4	15.3	0.0153	205	0.205	0.969	15.4	181	0.973
27-May-10	25	3.05	3.79	82.3	9.40	185	1.9	0.0050	0.995	0.404	1.22	1.654	9.79	16.2	0.0162	222	0.222	0.967	10.5	191	0.971
3-Jun-10	26	2.42	3.58	85.9	9.10	194	2.0	0.0053	0.995	0.393	1.22	1.855	9.48	17.6	0.0176	239	0.239	0.964	10.6	202	0.970
10-Jun-10	27	1.89	3.48	89.3	14.6	208	2.2	0.0057	0.994	0.239	1.22	1.285	15.2	19.5	0.0195	259	0.259	0.961	16.8	219	0.967
17-Jun-10	28	1.87	3.59	92.9	9.30	218	2.3	0.0059	0.994	0.386	1.22	1.809	9.69	17.5	0.0175	276	0.276	0.959	11.4	230	0.965
24-Jun-10	29	1.82	3.65	96.6	8.93	227	2.4	0.0061	0.994	0.409	1.22	1.644	9.30	15.3	0.0153	291	0.291	0.956	11.1	241	0.964
1-Jul-10	30	1.54	3.09	99.7	8.16	235	2.4	0.0064	0.994	0.379	1.22	1.708	8.50	14.5	0.0145	306	0.306	0.954	10.0	251	0.962
8-Jul-10	31	1.13	2.27	102	7.57	242	2.5	0.0066	0.993	0.300	1.22	1.578	7.88	12.4	0.0124	318	0.318	0.952	9.02	260	0.961
15-Jul-10	32	1.46	2.36	104	6.37	249	2.6	0.0067	0.993	0.371	1.22	1.766	6.64	11.7	0.0117	330	0.330	0.950	7.54	268	0.960
22-Jul-10	33	1.91	2.61	107	5.94	255	2.7	0.0069	0.993	0.440	1.22	1.886	6.19	11.7	0.0117	342	0.342	0.949	6.89	275	0.959
29-Jul-10	34	1.66	2.60	110	5.76	260	2.7	0.0071	0.993	0.452	1.22	1.981	6.00	11.9	0.0119	354	0.35	0.947	6.94	282	0.958
5-Aug-10	35	1.43	2.59	112	7.44	268	2.8	0.0073	0.993	0.348	1.22	1.557	7.75	12.1	0.0121	366	0.37	0.945	8.91	291	0.956
12-Aug-10	36	2.25	3.25	115	7.35	275	2.9	0.0075	0.993	0.442	1.22	1.817	7.66	13.9	0.0139	380	0.38	0.943	8.65	299	0.955
19-Aug-10	37	2.63	3.31	119	7.74	283	2.9	0.0077	0.992	0.427	1.22	1.644	8.06	13.3	0.0133	393	0.39	0.941	8.74	308	0.954
26-Aug-10	38	1.33	3.30	122	7.91	291	3.0	0.0079	0.992	0.418	1.22	1.548	8.24	12.7	0.0127	406	0.41	0.939	10.2	318	0.952
2-Sep-10	39	2.07	2.92	125	9.10	300	3.1	0.0081	**0.992**	0.321	1.22	1.099	9.48	10.4	0.0104	416	0.42	**0.938**	10.3	329	0.951
Median (last 5)					**7.7**							**1.6**		**12.1**							

Notes: loadings data removed to avoid overestimating the rate of NP depletion
= not calculated due to removed sulphate loading data.
re set at half the limit for NP depletion calculations

Humidity Cell	Initial CaNP[1]	CMR	CaNP remaining after HC test		Median Consumption rate		Time to depletion[6]	
	kg $CaCO_3$/t		% of initial[2]	kg $CaCO_3$/kg sample[3]	mg $CaCO_3$/kg/wk[4]	kg $CaCO_3$/kg/wk[5]	weeks	years
T1	22.5	2.0	91.8%	0.021	5.2	0.000005	3,964	76.2
T2	21.7	2.0	90.9%	0.020	12.1	0.000012	1,636	31.5
T3	25.8	1.78	91.4%	0.024	54.1	0.000054	436	8.4
T4	15.8	1.74	66.0%	0.010	38.6	0.000039	271	5.2
HC1	26.7	1.07	90.3%	0.024	68.9	0.000069	350	6.7
HC2	6.7	1.56	93.8%	0.006	12.1	0.000012	518	10.0

Notes
1 From Tables 4-19 and 4-20
2 From Appendix E
3 = initial CaNP * % of initial ÷ 1,000 kg of sample
4 Calculated as the median of the final five humidity cell values
5 = mg $CaCO_3$/kg/wk ÷ 1,000,000 mg/kg
6 = (CaNP remaining after HC test) ÷ median leaching rate

Humidity Cell	Initial Total-S[1]	Total-S remaining after test		Median Production rate		Time to depletion[6]		Remaining T-S after CaNP Depletion		
	%	% of initial[2]	mg Total-S /kg sample[3]	mg SO_4/kg/wk[4]	mg T-S/kg/wk[5]	weeks	years	T-S (mg/kg) produced to deplete NP	T-S (mg/kg)	T-S (%)
T1	1.18	97.5%	11,503	2.50	0.83	13,786	265.1	3307.13	8,196	0.82
T2	1.09	97.1%	10,583	5.79	1.93	5,481	105.4	3158.49	7,424	0.74
T3	0.65	92.6%	6,017	27.26	9.10	661	12.7	3963.68	2,053	0.21
T4	1.49	95.4%	14,215	21.84	7.29	1,950	37.5	1972.41	12,243	1.22
HC1	1.53	94.8%	14,503	71.28	23.79	610	11.7	8318.05	6,185	0.62
HC2	1.23	99.2%	12,200	7.74	2.58	4,723	90.8	1338.10	10,862	1.09

Notes:
1. based on non-sulfate S value from Table 4-2
2. From Appendix E (*i.e.* , Last T-S leaching value)
3 = initial non-sulphate S * % of initial * 1,000,000 mg of sample
4. Calculated as the median of the final five humidity cell values

Sample Description		Whole Tailings			
Kinetic		**T1**	**T2**	**T3**	**T4**
Mineralization Zone		**71% SUP**	**71% SUP**	**71% SUP**	**60% HYP**
Parameter	**Unit**				
Initial CaNP[1]	mg$CaCO_3$/kg	22.5	21.7	25.8	15.83
Initial Total S[1]	wt. %	1.18	1.09	0.65	1.49
CaNP Consumption Rate[2]	mg$CaCO_3$/kg/wk	5.2	12.1	54.1	38.6
SO_4 Leaching Rate[2]	mg/kg/wk	2.50	5.79	27.26	21.84
CMR[2]	ratio	2.00	2.00	1.78	1.74
Total S Remaining upon CaNP Depletion	wt. %	0.82	0.74	0.21	1.22
Time to onset of acid generation[3]	years	78.3	33.5	9.2	8.5

Notes:
1. Data from Table 4-19 and Table 4-20.
2. Median of last five full cycles of kinetic test data available (Appendix E).
3. Time until complete depletion of CaNP and onset of acidic conditions (includes weeks of kinetic testwork).

Sample Description		Ore	
Kinetic		**HC2**	**HC1**
Parameter	**Unit**		
Initial CaNP[1]	mg$CaCO_3$/kg	6.7	26.7
Initial Total S[1]	wt. %	1.23	1.53
CaNP Consumption Rate[2]	mg$CaCO_3$/kg/wk	12.1	68.9
SO_4 Leaching Rate[2]	mg/kg/wk	7.74	71.28
CMR[2]	ratio	1.55	1.07
Total S Remaining upon CaNP Depletion	wt. %	1.09	0.62
Time to onset of acid generation[3]	years	10.7	7.5

Notes:
1. Data from Table 4-18;
2. Median of last five full cycles of kinetic test data available (Appendix E); and
3. Time until complete depletion of CaNP and onset of acidic conditions (includes weeks of kinetic testwork).

Appendix F
Field Bin Results

CASiNO
COPPER AND GOLD

APPENDIX F1 FIELD BIN LEACHATE RESULTS

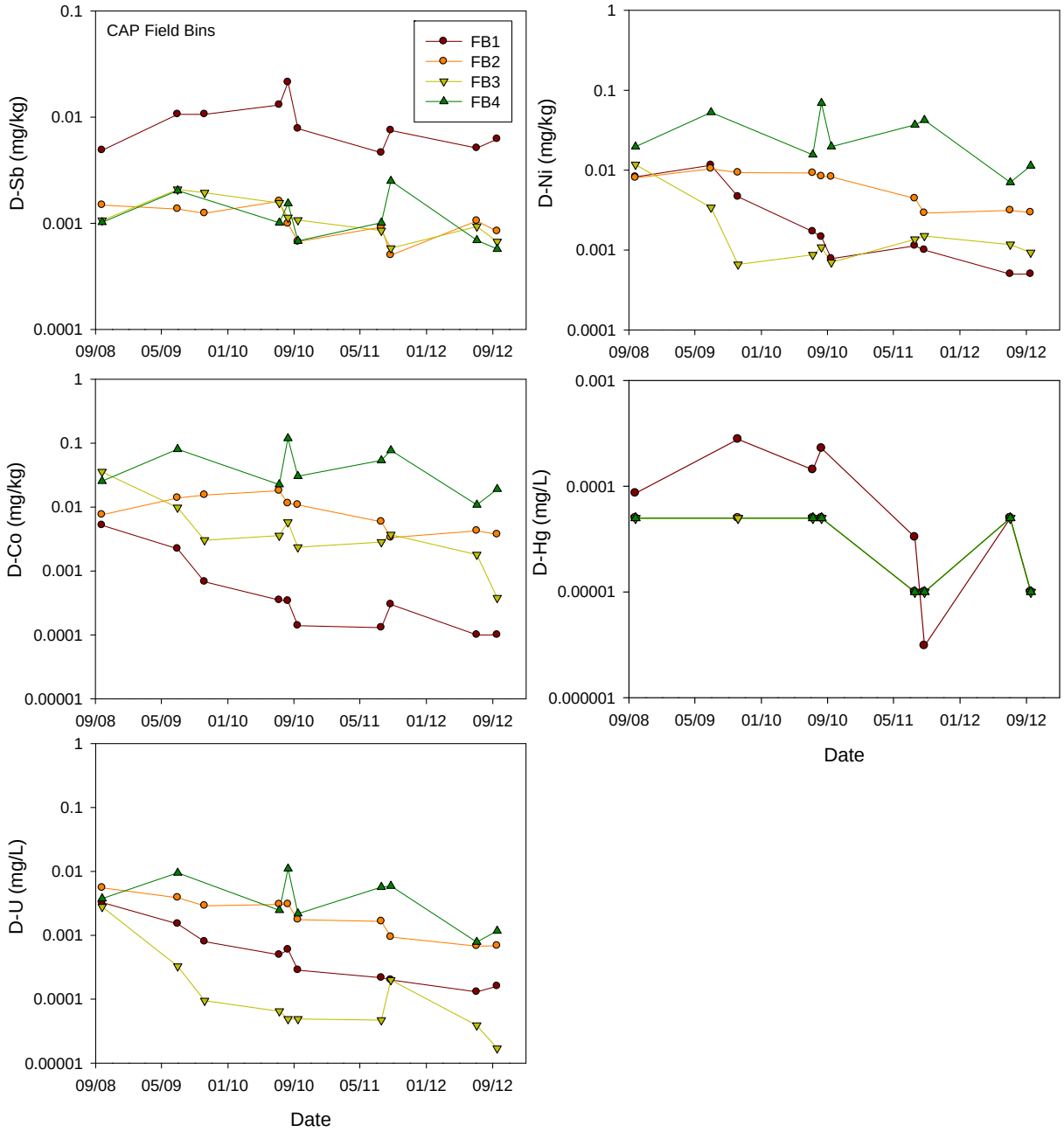
Date Sampled	Vol.	Cond.	Hardness	pH (lab)	T-Alk.	Br	Cl	F	SO_4	Ag	Al	As	Ba	Ca	Cd	Co	Cr	Cu	Fe	Hg	K	Mg	Mn	Mo	Na	Ni	Pb	Sb	Se	Si	Sr	Tl	U	Zn
	L	uS/cm	mg/L*	s.u.	mg/L*	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
FB-1																																		
25-Sep-08	2.5	*ND*	*ND*	6.6	78	0.060	14	0.50	50	0.0016	4.4	0.022	0.067	2.3	0.0042	0.0052	0.047	0.60	4.9	0.000086	4.6	0.30	0.093	0.072	84	0.0082	0.25	0.0049	0.077	3.1	0.017	0.00215	0.0033	0.094
30-Jun-09	5.5	197	21.5	7.4	40	<0.05	20	0.87	93	0.013	1.4	0.017	0.15	4.6	0.0019	0.0022	0.022	0.24	8.6	*ND*	6.6	2.4	0.054	0.21	83	0.012	0.075	0.011	0.18	65	0.025	<0.0001	0.0015	0.037
7-Oct-09	*ND*	296	10.1	8.0	13	<0.05	10	0.71	75	0.018	1.2	0.012	0.13	2.9	0.00053	0.00068	0.010	0.13	2.0	0.000278	2.7	0.71	0.011	0.22	63	0.0046	0.034	0.011	0.11	26	0.017	0.00019	0.00080	0.019
9-Jul-10	7.1	*ND*	*ND*	7.1	9.0	0.13	6.4	0.40	64	0.0056	2.7	0.0073	0.092	1.9	<0.00031	0.00035	0.0037	0.061	1.7	0.000143	2.2	0.59	0.0068	0.097	44	0.0017	0.020	0.013	0.064	25	0.015	*ND*	0.00050	0.012
10-Aug-10	11	*ND*	5.2	7.0	2.8	<0.05	3.5	0.44	47	0.0036	1.4	0.013	0.14	1.5	0.000048	0.00034	0.0039	0.069	1.3	0.000228	<2	0.33	0.013	0.094	30	0.0015	0.039	0.021	0.033	19	0.019	0.00011	0.00060	0.015
15-Sep-10	*ND*	*ND*	3.6	6.9	6.0	<0.05	2.2	0.29	45	0.0051	1.2	0.0049	0.048	0.98	0.000037	0.00014	0.0028	0.039	0.78	*ND*	<2	0.28	0.0047	0.080	28	0.00078	0.0098	0.0078	0.029	19	0.0082	<0.0001	0.00029	0.0072
19-Jul-11	6.6	83	3.2	6.8	3.3	<0.05	2.8	0.21	45	0.0020	0.46	0.0027	0.050	1.0	0.000036	0.00013	0.0021	0.029	0.26	0.0000033	1.1	0.15	0.0044	0.036	23	0.0011	0.0075	0.0046	0.021	17	0.0069	0.000045	0.00022	0.0046
23-Aug-11	17	81	1.9	6.8	4.0	<0.05	1.4	0.21	29	0.0019	0.60	0.0028	0.044	0.58	0.000020	<0.0003	0.0012	0.019	0.28	0.000003	<2	0.10	0.0030	0.031	13	<0.001	0.0068	0.0075	0.011	*ND*	*ND*	<0.0002	<0.0002	<0.005
4-Jul-12	*ND*	*ND*	2.7	6.8	3.1	<0.05	1.3	0.15	31	0.0013	0.62	0.0023	0.069	0.81	0.000035	<0.0001	0.0014	0.017	0.30	<0.00005	<2	0.15	0.0027	0.025	16	<0.0005	0.0047	0.0051	0.014	14	0.0073	0.000031	0.00013	0.0040
17-Sep-12	*ND*	100	3.4	6.3	*ND*	*ND*	*ND*	*ND*	*ND*	0.0011	0.60	0.0021	0.063	1.1	0.000030	<0.0001	0.00092	0.019	0.32	<0.00001	1.2	0.19	0.0037	0.019	17	<0.0005	0.0056	0.0062	0.014	14	0.0077	0.000036	0.00016	0.0040
FB-2																																		
25-Sep-08	1.1	*ND*	*ND*	4.9	21	<0.05	34	0.17	297	0.0015	1.9	0.00073	0.038	14	0.00052	0.0076	0.0095	0.75	0.25	<0.00005	6.7	5.9	0.18	0.023	149	0.0080	0.0012	0.0015	0.0054	12	0.13	0.00023	0.0055	0.088
30-Jun-09	3.5	485	83.6	5.3	15	<1	41	0.21	403	0.00010	0.69	<0.0008	0.029	19	0.00077	0.014	0.0062	0.74	0.21	*ND*	7.4	8.9	0.22	0.0063	192	0.010	0.00075	0.0014	0.0044	13	0.17	<0.0005	0.0039	0.13
7-Oct-09	*ND*	1040	66.5	7.2	4.8	<0.5	40	<0.2	387	0.00011	0.97	0.00033	0.026	14	0.00060	0.015	0.0018	0.68	0.15	<0.00005	7.4	7.4	0.23	0.0011	186	0.0093	0.00041	0.0012	0.0033	28	0.17	0.00025	0.0029	0.11
9-Jul-10	2.0	*ND*	*ND*	4.3	<1	1.1	34	<0.2	394	0.000030	0.80	0.00057	0.037	14	0.00050	0.018	<0.001	0.60	0.16	<0.00005	7.9	7.1	0.20	0.0036	187	0.0092	0.00061	0.0016	0.0037	29	0.16	*ND*	0.0030	0.093
10-Aug-10	9.0	*ND*	65.9	4.5	5.2	<0.5	32	<0.2	424	0.000053	1.0	0.00040	0.016	15	0.00066	0.011	0.0015	0.68	0.19	<0.00005	7.1	7.1	0.26	0.0011	194	0.0084	0.00052	0.00099	0.0037	28	0.18	0.00024	0.0031	0.085
15-Sep-10	*ND*	*ND*	61.6	4.3	<2	<0.5	26	<0.2	411	0.00011	1.0	0.00049	0.012	14	0.00068	0.011	0.0013	0.68	0.16	*ND*	6.7	6.6	0.30	0.00096	180	0.0082	0.00034	0.00067	0.0036	26	0.16	0.00022	0.0018	0.084
19-Jul-11	16	461	36.6	4.4	<2	<0.25	21	0.10	318	0.000032	0.44	0.00047	0.011	8.2	0.00036	0.0059	0.00084	0.38	0.082	<0.00001	5.4	4.0	0.15	0.00058	129	0.0044	0.00030	0.00092	0.0032	27	0.10	0.00019	0.0017	0.048
23-Aug-11	13	572	23.9	4.6	<2	<0.05	13	0.036	223	<0.00002	0.21	<0.0005	<0.02	5.4	0.00024	0.0033	<0.001	0.25	0.063	<0.00001	4.0	2.5	0.093	<0.001	81	0.0029	<0.0005	<0.0005	0.0027	*ND*	*ND*	<0.0002	0.00094	0.034
4-Jul-12	*ND*	*ND*	24.7	4.6	<1	<0.05	8.7	0.034	185	0.000016	0.21	0.00056	0.018	5.5	0.00023	0.0043	0.00063	0.25	0.053	<0.00005	4.4	2.7	0.094	0.00042	81	0.0031	0.00017	0.0011	0.0030	22	0.065	0.00014	0.00068	0.032
17-Sep-12	*ND*	466	24.8	4.5	*ND*	*ND*	*ND*	*ND*	*ND*	0.000012	0.21	0.00033	0.014	5.5	0.00025	0.0037	0.00043	0.24	0.039	<0.00001	4.2	2.7	0.098	0.00029	75	0.0030	0.00016	0.00084	0.0030	21	0.065	0.00014	0.00069	0.033
FB-3																																		
25-Sep-08	4.9	*ND*	*ND*	5.9	21	<0.05	5.8	1.2	139	0.00023	2.5	0.0029	0.13	25	0.00090	0.036	0.0018	2.9	0.13	<0.00005	7.3	3.5	0.31	0.11	46	0.012	0.00059	0.0011	0.014	0.92	0.082	0.00145	0.0028	0.075
30-Jun-09	5.5	198	52.0	6.6	23	<0.05	9.4	1.2	97	0.000026	0.071	0.0022	0.039	17	0.00051	0.0098	0.00051	0.23	0.030	*ND*	5.2	2.1	0.20	1.6	40	0.0034	0.00011	0.0021	0.035	2.0	0.060	<0.0001	0.00033	0.0098
7-Oct-09	*ND*	*ND*	41.8	7.0	13	<0.05	4.1	1.2	75	0.00014	0.12	0.0016	0.051	14	0.00042	0.0030	<0.0005	0.085	0.056	<0.00005	4.4	1.6	0.076	2.0	25	0.00066	0.000072	0.0019	0.020	2.8	0.061	0.00037	0.000095	0.0016
9-Jul-10	4.2	*ND*	*ND*	6.9	4.5	0.057	2.9	0.93	60	0.000010	0.016	0.0015	0.040	11	<0.0003	0.0036	<0.0005	0.067	<0.03	<0.00005	3.4	1.2	0.062	1.0	20	0.00087	<0.00005	0.0016	0.018	2.3	0.041	*ND*	0.000065	0.0049
10-Aug-10	8.8	*ND*	39.9	6.5	5.0	<0.05	3.7	0.83	77	<0.00001	0.010	0.0010	0.066	13	0.00014	0.0058	<0.0005	0.073	<0.03	<0.00005	3.7	1.6	0.10	0.67	22	0.0011	<0.00005	0.0011	0.018	3.1	0.061	<0.0001	0.000049	0.0057
15-Sep-10	*ND*	*ND*	24.7	6.6	2.8	<0.05	1.9	0.68	53	0.000037	0.88	0.0020	0.048	8.2	0.00024	0.0024	<0.0005	0.055	<0.03	*ND*	2.7	1.0	0.061	0.60	17	0.00070	0.00040	0.0011	0.013	2.8	0.039	<0.0001	0.000049	0.0046
19-Jul-11	17	120	33.9	6.2	<2	<0.05	2.9	0.66	75	0.000035	0.023	0.0011	0.054	11	<0.0002	0.0028	0.00020	0.079	<0.01	<0.00001	3.2	1.4	0.036	0.42	20	0.0014	<0.00005	0.00085	0.019	3.6	0.049	0.000036	0.000047	0.0088
23-Aug-11	13	193	33.8	6.0	<2	<0.05	2.4	0.59	75	<0.00002	0.017	0.00080	0.052	11	<0.0002	0.0037	<0.001	0.081	<0.03	<0.00001	2.9	1.5	0.051	0.29	16	0.0015	<0.0005	0.00058	0.015	*ND*	*ND*	<0.0002	<0.0002	0.0093
4-Jul-12	*ND*	*ND*	24.5	6.0	<1	<0.05	1.4	0.51	48	<0.00001	0.048	0.0013	0.040	8.0	0.00031	0.0018	<0.0005	0.082	<0.03	<0.00005	2.4	1.1	0.013	0.25	12	0.0012	<0.00005	0.00093	0.011	3.2	0.035	0.000023	0.000039	0.0077
17-Sep-12	*ND*	120	25.1	6.0	*ND*	*ND*	*ND*	*ND*	*ND*	<0.00001	0.028	0.00076	0.040	8.2	<0.00015	0.00038	0.00013	0.039	<0.01	<0.00001	2.4	1.1	0.0041	0.23	10	0.00093	<0.00005	0.00067	0.0094	2.8	0.033	0.000026	0.000017	0.0067
FB-4																																		
25-Sep-08	5.0	*ND*	*ND*	4.2	<2	<0.05	1.8	0.32	234	0.00011	25	0.012	0.033	8.0	0.0013	0.025	0.053	0.84	1.6	<0.00005	5.8	3.4	0.42	0.051	42	0.020	0.0018	0.0010	0.0032	0.39	0.036	0.0019	0.0038	0.29
30-Jun-09	2.0	402	67.5	4.1	<2	<0.05	4.0	1.6	540	0.00018	74	0.027	0.018	13	0.0033	0.080	0.11	2.9	3.3	*ND*	8.3	8.4	1.5	0.051	60	0.053	0.0016	0.0020	0.015	3.5	0.073	<0.0005	0.0095	0.83
7-Oct-09	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
9-Jul-10	2.5	*ND*	*ND*	4.3	<1	<0.05	1.2	0.68	162	0.000033	16	0.0055	0.018	5.4	0.00094	0.023	0.027	0.77	0.79	<0.00005	4.8	2.8	0.44	0.013	20	0.016	0.00038	0.0010	0.0057	2.4	0.029	*ND*	0.0025	0.29
10-Aug-10	7.3	*ND*	74.9	4.0	<2	<0.5	5.9	3.7	729	0.000054	97	0.018	0.017	11	0.0026	0.12	0.11	2.9	2.9	<0.00005	6.4	11	1.3	0.048	51	0.069	0.0011	0.0015	0.015	6.1	0.076	0.00	0.011	0.81
15-Sep-10	*ND*	*ND*	20.6	4.0	<2	<0.05	1.1	0.53	162	0.000027	23	0.0039	0.022	4.0	0.00079	0.030	0.019	0.95	0.32	*ND*	3.5	2.6	0.46	0.0080	17	0.020	0.00031	0.00068	0.0050	3.0	0.030	0.00019	0.0022	0.23
19-Jul-11	14	391	35.8	3.9	<2	<0.05	2.5	1.3	375	0.000028	42	0.0066	0.015	5.8	0.0013	0.054	0.041	1.5	0.51	<0.00001	4.4	5.2	0.68	0.015	27	0.037	0.00046	0.0010	0.0093	5.4	0.052	0.00033	0.0057	0.40
23-Aug-11	13	794	45.8	3.9	<2	<0.25	3.0	2.3	508	<0.0001	52	0.0042	<0.02	6.9	0.0013	0.077	0.045	1.7	0.43	<0.00001	4.1	7.0	0.80	0.013	33	0.042	<0.0025	<0.0025	0.0090	*ND*	*ND*	<0.001	0.0059	0.51
4-Jul-12	*ND*	*ND*	8.9	4.1	<1	<0.05	0.64	0.24	61	<0.00001	5.1	0.0028	0.023	1.9	0.00036	0.011	0.0038	0.36	0.059	<0.00005	2.5	1.0	0.18	0.0021	8.3	0.0070	0.00015	0.00069	0.0030	3.3	0.019	0.00012	0.00078	0.088
17-Sep-12	*ND*	226	13.1	4.1	*ND*	*ND*	*ND*	*ND*	*ND*	<0.00001	11	0.0014	0.017	2.4	0.00044	0.019	0.0075	0.49	0.079	<0.00001	2.4	1.7	0.22	0.0033	10	0.011	0.00011	0.00057	0.0034	2.9	0.020	0.00014	0.0012	0.12
FB-5																																		
25-Sep-08	3.5	*ND*	*ND*	7.1	50	<0.05	12	1.1	377	0.000048	0.38	0.0055	0.035	43	0.035	0.021	0.0083	3.3	0.25	<0.00005	8.6	4.4	0.19	0.12	156	0.010	0.0041	0.0047	0.065	1.7	0.19	0.00051	0.015	0.21
30-Jun-09	7.0	778	380	6.4	84	<0.25	33	2.3	762	<0.00005	0.011	0.0063	0.035	132	0.036	0.019	0.0028	0.92	<0.03	*ND*	12	12	0.39	0.19	254	0.013	0.0012	0.0066	0.25	3.4	0.53	<0.0005	0.042	0.15
7-Oct-09	*ND*	*ND*	394	7.1	39	<0.5	21	2.3	744	<0.00005	0.0058	0.0040	0.043	136	0.026	0.014	<0.0025	0.43	<0.03	<0.00005	12	13	0.48	0.17	218	0.0081	0.00038	0.012	0.17	4.8	0.62	<0.0005	0.018	0.087
9-Jul-10	5.0	*ND*	*ND*	7.4	22	<0.5	18	2.1	1010	<0.00005	0.0070	0.0029	0.037	204	0.055	0.034	<0.0025	0.58	<0.03	<0.00005	14	22	0.98	0.094	226	0.011	0.00030	0.010	0.19	5.8	0.96	*ND*	0.014	0.22
10-Aug-10	9.2	*ND*	477	6.9	22	<0.5	14	2.3	829	0.000014	0.0025	0.0020	0.028	161	0.068	0.043	<0.0005	0.61	<0.03	<0.00005	12	18	0.95	0.056	187	0.0096	0.00015	0.0092	0.14	7.3	0.74	0.00037	0.0054	0.34
15-Sep-10	*ND*	*ND*	571	6.7	8.3	<0.5	7.2	1.9	883	0.000035	0.11	0.0016	0.036	190	0.13	0.10	<0.0005	3.6	<0.03	*ND*	13	24	1.8	0.039	156	0.017	0.00080	0.0075	0.098	8.4	0.86	0.00039	0.0039	0.90
19-Jul-11	18	886	490	6.3	2.8	<0.05	5.4	2.9	889	0.000013	0.10	0.0013	0.020	164	0.13	0.11	0.00035	6.4	<0.01	<0.00001	11	20	1.8	0.023	108	0.019	0.0022	0.0073	0.080	9.8	0.83	0.00058	0.0037	0.95
23-Aug-11	4.0	890	269	6.1	2.2	<0.5	<5	2.2	461	<0.0001	0.26	<0.0025	<0.02	88	0.068	0.075	<0.005	7.0	<0.03	<0.00001	7.6	12	1.2	0.0066	52	0.012	<0.0025	0.0040	0.035	*ND*	*ND*	<0.001	0.0036	0.63
4-Jul-12	*ND*	*ND*	945	5.6	<1	<1	<10	2.7	1140	<0.00005	0.85	0.0017	0.033	309	0.27	0.32	<0.0025	25	<0.03	<0.00005	14	42	4.6	0.013	93	0.048	0.0070	0.0046	0.058	14	1.2	0.00060	0.010	2.2
17-Sep-12	*ND*	1640	832	5.3	*ND*	*ND*	*ND*	*ND*	*ND*	<0.00005	1.4	0.0013	0.037	269	0.24	0.38	<0.0005	40	<0.01	<0.00001	11	39	4.7	0.0066	56	0.053	0.010	0.0036	0.034	13	1.0	0.00063	0.017	2.4
FB-6																																		
25-Sep-08	6.0	*ND*	*ND*	7.4	51	<0.05	5.7	0.31	548	0.000029	0.12	0.0039	0.061	175	0.0066	0.020	0.0051	0.51	0.32	<0.00005	6.0	11	0.24	0.15	74	0.0093	0.010	0.0023	0.0083	0.42	0.90	0.00023	0.031	0.21
30-Jun-09	6.5	1111	1080	7.1	104	<2.5	55	1.0	1310	<0.00005	0.0090	0.015	0.068	391	0.0041	0.015	0.0076	0.29	<0.03	*ND*	7.4	25	0.35	0.70	190	0.016	0.0073	0.010	0.025	2.2	1.5	<0.0005	0.31	0.056
7-Oct-09	*ND*	2180	1110	7.2	43	<1	20	0.89	1250	<0.00005	0.0082	0.011	0.081	401	0.0030	0.0057	<0.0025	0.17	<0.03	<0.00005	6.7	26	0.22	0.40	127	0.0084	0.0025	0.014	0.011	2.5	1.7	<0.0005	0.16	0.035
9-Jul-10	6.5	*ND*	848	7.8	33	<0.5	13	1.0	967	<0.00005	0.0053	0.0076	0.063	304	0.0025	0.0027	<0.0025	0.099	<0.03	<0.00005	5.3	21	0.11	0.27	101	0.0063	0.0018	0.012	0.0085	2.2	1.5	*ND*	0.11	0.022
10-Aug-10	11	*ND*	898	7.4	36	<1	12	0.92	1060	0.000018	0.0057	0.0079	0.052	322	0.0028	0.0030	0.00055	0.086	<0.03	<0.00005	4.9	23	0.13	0.24	92	0.0046	0.0017	0.012	0.0065	2.3	1.6	<0.0001	0.11	0.036
15-Sep-10	*ND*	*ND*	636	7.4	27	<0.5	<5	0.56	730	0.000055	0.0069	0.0058	0.055	228	0.0028	0.0028	<0.0005	0.085	<0.03	*ND*	3.2	16	0.10	0.15	50	0.0028	0.00083	0.0095	0.0039	1.9	1.1	<0.0001	0.038	0.048
19-Jul-11	21	862	678	7.5	22	<0.5	<5	1.0	775	0.000013	0.0049	0.0052	0.049	243	0.0027	0.0012	0.00044	0.058	<0.01	<0.00001	3.5	17	0.048	0.16	56	0.0026	0.0011	0.011	0.0043	2.1	1.2	0.000014	0.076	0.041
23-Aug-11	16	1200	535	7.5	26	<0.5	<5	0.69	672	<0.00004	<0.01	0.0043	0.027	191	0.0023	0.00078	<0.002	0.033	<0.03	<0.00001	2.5	14	0.041	0.11	35	<0.002	<0.001	0.0083	0.0027	*ND*	*ND*	<0.0004	0.051	0.039
4-Jul-12	*ND*	*ND*	*ND*	7.4	27	<0.5	<5	0.50	637	<0.00002	<0.006	0.0043	0.063	230	0.0029	0.00087	<0.001	0.041	<0.03	<0.00005	2.4	15	0.034	0.14	28	0.0018	0.00070	0.0084	0.0035	1.8	1.1	<0.00002	0.055	0.052
17-Sep-12	*ND*	925	*ND*	7.3	*ND*	*ND*	*ND*	*ND*	*ND*	<0.00001	0.0041	0.0034	0.039	185	0.0024	0.00018	0.00025	0.023	<0.01	<0.00001	2.0	12	0.0088	0.088	22	0.0014	0.00012	0.0066	0.0023	1.5	0.79	<0.00001	0.050	0.047
FB-7																																		
25-Sep-08	2.9	*ND*	*ND*	7.0	153	<0.05	20	1.3	920	0.000051	0.032	0.014	0.11	194	<0.002	0.0090	0.0050	0.15	0.12	<0.00005	17	24	0.058	0.24	228	0.029	0.018	0.027	0.040	1.3	2.3	<0.0005	0.25	0.025
30-Jun-09	5	1060	684	7.7	150	<2.5	42	1.4	1040	0.000062	<0.005	0.017	0.077	228	<0.003	0.0085	0.0029	0.16	<0.03	*ND*	17	28	0.0029	0.56	291	0.071	0.0076	0.032	0.063	1.5	2.5	<0.0005	0.43	0.012
7-Oct-09	*ND*	2480	754	7.6	113	<1	40	2.4	1240	<0.00005	<0.005	0.0055	0.076	247	<0.0015	0.0031	<0.0025	0.13	<0.03	<0.00005	21	33	0.0013	0.57	329	0.072	0.0015	0.024	0.051	1.6	3.1	<0.0005	0.41	<0.005
9-Jul-10	0	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*
10-Aug-10	6.0	*ND*	403	8.0	103	<0.5	25	4.6	714	0.000024	0.0038	0.0055	0.054	133	0.00020	0.0027	<0.0005	0.084	<0.03	<0.00005	13	17	0.00098	0.31	216	0.053	0.0015	0.052	0.029	1.3	1.7	<0.0001	0.28	0.0041
15-Sep-10	*ND*	*ND*	355	8.0	83	<0.5	7.3	4.2	612	<0.00002	0.0041	0.0045	0.037	116	0.00014	0.0014	<0.001	0.045	<0.03	*ND*	11	16	0.0016	0.20	154	0.025	0.00071	0.075	0.013	1.2	1.6	<0.0005	0.25	0.0050
19-Jul-11	12	621	262	8.0	71	<0.5	6.0	5.3	427	0.000011	<0.003	0.0037	0.039	85	<0.00009	0.0010	0.00039	0.034	<0.01	<0.00001	11	12	0.00015	0.19	113	0.017	0.00030	0.054	0.0094	1.3	1.1	0.000032	0.19	<0.003
23-Aug-11	9.5	618	156	8.1	83	<0.05	1.3	4.3	217	<0.00002	<0.005	0.0026	0.026	50	<0.00004	0.00035	<0.001	0.018	<0.03	<0.00001	8.2	7.4	<0.0003	0.11	55	0.0063	<0.0005	0.069	0.0035	*ND*	*ND*	<0.0002	0.13	<0.005
4-Jul-12	*ND*	*ND*	*ND*	7.9	68	<0.5	<5	3.1	356	<0.00001	<0.003	0.0023	0.046	109	<0.00015	0.00031	<0.0005	0.015	<0.03	<0.00005	11	16	0.00029	0.11	47	0.0051	0.00011	0.048	0.0057	1.0	1.4	0.000029	0.13	<0.003
17-Sep-12	*ND*	686	*ND*	8.0	*ND*	*ND*	*ND*	*ND*	*ND*	<0.00001	0.0025	0.0022	0.036	86	<0.00007	0.00022	0.00021	0.015	<0.01	<0.00001	10.0	13	0.00023	0.11	45	0.0053	0.000054	0.067	0.0045	0.95	1.1	0.000023	0.14	0.0023
FB-8																																		
25-Sep-08	6.6	*ND*	*ND*	6.8	69	<0.05	4.9	0.87	651	0.000076	0.028	0.0087	0.037	182	0.0023	0.0073	0.0071	0.12	0.14	<0.00005	13	23	0.055	0.30	95	0.015	0.0017	0.0016	0.0029	0.56	1.8	<0.0002	0.044	0.011
30-Jun-09	9.0	1273	1370	7.8	140	<2.5	31	1.7	1620	0.000066	<0.005	0.014	0.047	428	0.0024	0.0090	0.0043	0.12	<0.03	*ND*	22	73	0.043	0.93	201	0.050	0.0028	0.0061	0.0086	2.0	4.5	<0.0005	0.23

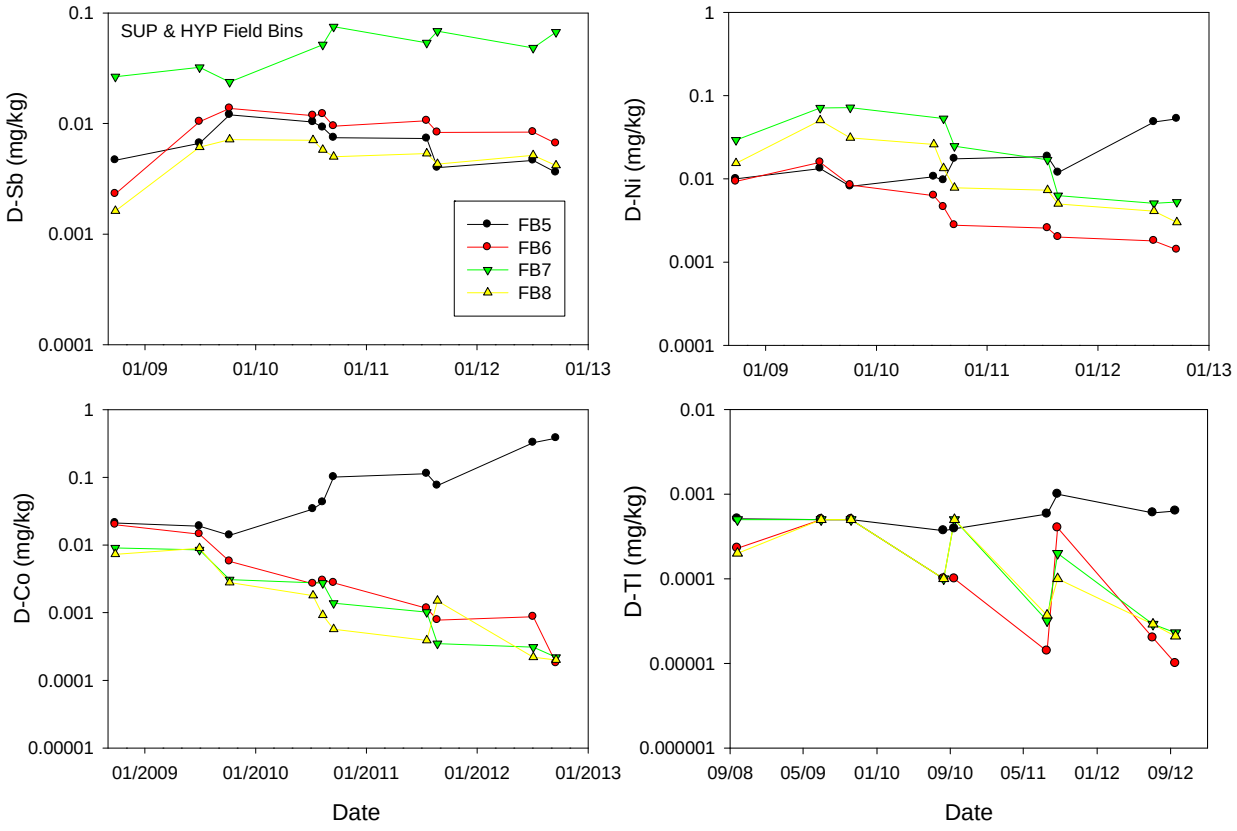
QA/QC Results

Sample ID	Date Sampled	Hardness	pH	Total Alk.	Br	Cl	F	NO_3-N	NO_2-N	Total N	SO_4	D-Al	D-Sb	D-As	D-Ba	D-Be	D-Bi	D-B	D-Cd	D-Ca	D-Cr	D-Co	D-Cu	D-Fe	D-Pb	D-Li	D-Mg	D-Mn	D-Hg	D-Mo	D-Ni	D-P	D-K	D-Se	D-Si	D-Ag	D-Na	D-Sr	D-Tl	D-Sn	D-Ti	D-U	D-V	D-Zn
		mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Duplicates																																											
FB1	30-Jun-09	21.5	7.35	39.6	<0.050	20.3	0.867	*ND*	*ND*	*ND*	93.4	1.43	0.0106	0.0172	0.148	<0.00050	0.00115	0.031	0.00191	4.6	0.0221	0.00223	0.24	8.58	0.0745	<0.0050	2.44	0.0541	*ND*	0.209	0.0115	<0.30	6.6	0.18	64.6	0.0132	82.7	0.0253	<0.00010	0.0007	0.845	0.00151	0.0012	0.0368
FB1-R	30-Jun-09	14.6	7.01	39.2	<0.050	20.2	0.866	*ND*	*ND*	*ND*	93.5	1.64	0.0132	0.0158	0.1	<0.00050	0.00096	0.025	0.00178	4.38	0.0202	0.00197	0.223	2.29	0.0524	<0.0050	0.88	0.0463	*ND*	0.209	0.0109	<0.60	<4.0	0.176	22.9	0.00968	86.8	0.0242	<0.00010	0.00068	0.173	0.00134	0.0012	0.0282
FB-5	10-Aug-10	477	6.92	22.1	<0.50	13.5	2.29	*ND*	*ND*	*ND*	829	0.0025	0.00922	0.00198	0.0279	<0.00050	<0.00050	0.034	0.0675	161	<0.00050	0.0427	0.610	<0.030	0.000151	0.0160	18.3	0.945	<0.000050	0.0560	0.00961	<0.30	12.2	0.139	7.34	0.000014	187	0.736	0.00037	<0.00010	<0.010	0.00540	<0.0010	0.339
FB5 Dup	10-Aug-10	486	6.94	22.3	<0.50	12.8	2.27	*ND*	*ND*	*ND*	818	0.0017	0.00925	0.00202	0.0279	<0.00050	<0.00050	0.036	0.0682	164	<0.00050	0.0436	0.628	<0.030	0.000165	0.0165	18.6	0.983	<0.000050	0.0557	0.00974	<0.30	12.4	0.140	7.41	0.000015	189	0.735	0.00036	<0.00010	<0.010	0.00536	<0.0010	0.349
FB-1	19-Jul-11	3.21	6.79	3.3	<0.050	2.79	0.206	0.149	<0.0010	0.730	45.0	0.461	0.00461	0.00271	0.0502	<0.00010	<0.00050	0.021	0.000036	1.03	0.00210	0.00013	0.0287	0.256	0.00753	0.00254	0.154	0.00443	0.000033	0.0362	0.00113	<0.30	1.09	0.0205	16.6	0.00199	22.9	0.00688	0.000045	0.00015	0.017	0.000217	<0.0010	0.0046
FB-1R	19-Jul-11	3.18	6.63	3.8	<0.050	2.76	0.206	0.148	<0.0010	0.700	45.2	0.486	0.00439	0.00272	0.0506	<0.00010	<0.00050	0.023	0.000032	1.01	0.00175	0.00012	0.0287	0.256	0.00732	0.00248	0.159	0.00460	0.000031	0.0355	<0.00050	<0.30	1.13	0.0203	16.6	0.00198	23.2	0.00677	0.000044	0.00015	0.019	0.000212	<0.0010	0.0049
FB2	23-Aug-11	23.9	4.56	<2.0	<0.050	12.9	0.036	1.06	<0.0010	2.87	223	0.210	<0.00050	<0.00050	<0.020	<0.0010	*ND*	<0.10	0.000235	5.39	<0.0010	0.00332	0.247	0.063	<0.00050	0.0067	2.54	0.0926	<0.000010	<0.0010	0.0029	*ND*	4.0	0.0027	*ND*	<0.000020	80.6	*ND*	<0.00020	<0.00050	<0.010	0.00094	<0.0010	0.0335
FB2-R	23-Aug-11	25.0	4.46	<2.0	<0.050	12.9	0.036	1.06	<0.0010	3.01	223	0.229	<0.00050	<0.00050	<0.020	<0.0010	*ND*	<0.10	0.000267	5.62	<0.0010	0.00349	0.259	0.059	<0.00050	0.0074	2.67	0.0986	<0.000010	<0.0010	0.0031	*ND*	4.2	0.0029	*ND*	<0.000020	84.7	*ND*	<0.00020	<0.00050	<0.010	0.00102	<0.0010	0.0353
FB8	4-Jul-12	813	7.80	52.2	<0.50	<5.0	1.26	0.278	<0.010	*ND*	719	<0.0060	0.00516	0.00248	0.0422	<0.00020	<0.0010	<0.020	<0.00070	272	<0.0010	0.00022	0.0139	<0.030	<0.00010	0.0034	32.7	0.00086	<0.000050	0.462	0.0041	<0.30	8.4	0.00084	1.47	<0.000020	29.0	2.70	0.000029	<0.00020	0.011	0.0802	<0.0020	<0.0060
FB8-R	4-Jul-12	771	7.80	52.3	<0.50	<5.0	1.34	0.297	0.016	*ND*	766	<0.0060	0.00483	0.00242	0.0412	<0.00020	<0.0010	<0.020	<0.00070	258	<0.0010	0.00022	0.0143	<0.030	0.00011	0.0028	30.8	0.00097	<0.000050	0.475	0.0040	<0.30	7.8	0.00074	1.37	<0.000020	27.3	2.64	0.000028	<0.00020	0.011	0.0865	<0.0020	<0.0060
FB-1	17-Sep-12	3.41	6.29	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.598	0.00620	0.00207	0.0627	<0.00010	<0.00050	0.012	0.000036	1.05	0.00092	<0.00010	0.0191	0.320	0.00555	0.00293	0.19	0.00371	<0.000010	0.0189	<0.00050	<0.050	1.17	0.0144	13.7	0.00111	16.6	0.00773	0.000036	0.00020	0.024	0.000160	<0.0010	0.0040
FB-1R	17-Sep-12	3.15	6.25	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	0.523	0.00550	0.00204	0.0667	<0.00010	<0.00050	0.016	0.000032	0.991	0.00110	<0.00010	0.0199	0.273	0.00530	0.00271	0.16	0.00383	0.000021	0.0196	<0.00050	<0.050	1.07	0.0146	13.3	0.00127	17.8	0.00737	0.000036	0.00019	0.019	0.000154	<0.0010	0.0048
Blanks																																											
FB-TB	30-Jun-09	<1.0	5.64	<2.0	<0.050	<0.50	<0.020	*ND*	*ND*	*ND*	<0.50	<0.0010	<0.00010	<0.00010	<0.000050	<0.00050	<0.00050	<0.010	<0.000017	<0.050	<0.00050	<0.00010	<0.00010	<0.030	<0.000050	<0.0050	<0.10	<0.000050	*ND*	<0.000050	<0.00050	<0.30	<2.0	<0.00050	<0.050	<0.000010	<2.0	<0.00010	<0.00010	<0.00010	<0.010	<0.000010	<0.0010	<0.0010
TRIP BLANK	7-Oct-09	<1.0	5.5	<2.0	<0.050	<0.50	<0.020	<0.0050	<0.0010	*ND*	<0.50	<0.0010	<0.00010	<0.00010	<0.000050	<0.00050	<0.00050	<0.010	<0.000017	<0.050	<0.00050	<0.00010	<0.00010	<0.030	<0.000050	<0.0050	<0.10	<0.000050	*ND*	<0.000050	<0.00050	<0.30	<2.0	<0.00050	<0.050	<0.000010	<2.0	<0.00010	<0.00010	<0.00010	<0.010	<0.000010	<0.0010	<0.0010
FB	10-Aug-10	0.73	5.58	<2.0	<0.050	<0.50	<0.020	*ND*	*ND*	*ND*	<0.50	<0.0010	<0.00010	<0.00010	<0.000050	<0.00050	<0.00050	<0.010	<0.000017	0.291	<0.00050	<0.00010	<0.00010	<0.030	<0.000050	<0.0050	<0.10	<0.000050	<0.000050	<0.000050	<0.00050	<0.30	<2.0	<0.00050	<0.050	<0.000010	<2.0	<0.00010	<0.00010	<0.00010	<0.010	<0.000010	<0.0010	<0.0010
TRIP BLANK	19-Jul-11	<0.50	5.64	<2.0	<0.050	<0.50	<0.020	<0.0050	<0.0010	<0.050	<0.50	<0.0030	<0.00010	<0.00010	<0.000050	<0.00010	<0.00050	<0.010	<0.000010	<0.020	<0.00010	<0.00010	<0.00050	<0.010	<0.000050	<0.00050	<0.0050	<0.000050	<0.000010	<0.000050	<0.00050	<0.30	<0.050	<0.00010	<0.050	<0.000010	<0.050	<0.00010	<0.00010	<0.00010	<0.010	<0.000010	<0.0010	<0.0030
FIELD BLANK	23-Aug-11	<0.50	5.64	<2.0	<0.050	<0.50	<0.020	<0.0050	<0.0010	<0.050	<0.50	<0.0050	<0.00050	<0.00050	<0.020	<0.0010	*ND*	<0.10	<0.000017	<0.10	<0.0010	<0.00030	<0.0010	<0.030	<0.00050	<0.0050	<0.10	<0.00030	<0.000010	<0.0010	<0.0010	*ND*	<2.0	<0.0010	*ND*	<0.000020	<2.0	*ND*	<0.00020	<0.00050	<0.010	<0.00020	<0.0010	<0.0050
FIELD BLANK	4-Jul-12	<0.50	6.17	<1.0	<0.050	<0.50	<0.020	<0.0050	<0.0010	*ND*	<0.50	<0.0030	<0.00010	<0.00010	0.000077	<0.00010	<0.00050	<0.010	<0.000017	<0.050	<0.00050	<0.00010	<0.00050	<0.030	<0.000050	<0.00050	<0.10	<0.000050	<0.000050	<0.000050	<0.00050	<0.30	<2.0	<0.00010	<0.050	<0.000010	<2.0	<0.00020	<0.00010	<0.00010	<0.010	<0.000010	<0.0010	<0.0030
FIELD BLANK	17-Sep-12	<0.50	6.56	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	*ND*	<0.0010	<0.00010	<0.00010	<0.000050	<0.00010	<0.00050	<0.010	<0.000010	<0.050	<0.00010	<0.00010	<0.00020	<0.010	<0.000050	<0.00050	<0.10	<0.000050	<0.000010	<0.000050	<0.00050	<0.050	<0.10	<0.00010	<0.050	<0.000010	<0.050	<0.00020	<0.00010	<0.00010	<0.010	<0.000010	<0.0010	<0.0010

Notes:
ND = no data
* mg $CaCO_3$/L
lculated based on meadian hardness of 111.4 mg CaCO3/L

Appendix F1: Concentrations of Metals in leachate from Waste Rock Field Kinetic Tests




SUP & HYP Field Bins
D-Sb (mg/kg)
0.1
0.01
0.001
0.0001
01/09
01/10
01/11
01/12
01/13
FB5
FB6
FB7
FB8
D-Ni (mg/kg)
1
0.1
0.01
0.001
0.0001
01/09
01/10
01/11
01/12
01/13
D-Co (mg/kg)
1
0.1
0.01
0.001
0.0001
0.00001
01/2009
01/2010
01/2011
01/2012
01/2013
Date
D-Tl (mg/kg)
0.01
0.001
0.0001
0.00001
0.000001
09/08
05/09
01/10
09/10
05/11
01/12
09/12
Date

APPENDIX F2 FIELD BIN PHREEQC INPUT DATA

FB1 PHREEQC Input

```
SELECTED_OUTPUT
   -file              selected.out
   -solution          true
   -ph                true
   -pe                true
 -water               true
   -temperature       true
   -alkalinity        true
   -charge_balance    true
   -percent_error     true

-saturation_indices  Gibbsite  Al(OH)3(am) Barite  Celestite  Chalcedony schwertmannite
siderite calcite     Dolomite(disordered) dolomite(ordered)  ferrihydrite Fe(OH)3(a)  Fluorite
Gypsum
Pyrolusite CaMoO4 PbMoO4
 Malachite  azurite tenorite K-jarosite

phases
fix_pe
e-=e-
log_k     0
phases
fix_pH
H+=H+
log_k     0
phases


phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999
phases
Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k          4.891

                     delta_H                -27.1
SOLUTION                          FB1
   temp      25
pH                                6.58
   pe        10
```

```
   redox     pe
   units                  mg/L
   density   1.0
Alkalinity                          94.794
Cl                                  13.8
F                                   0.503
S(6)                                49.9
Ag                                  0.00155
Al                                  4.43
As                                  0.0222
Ba                                  0.0669
Ca                                  2.3
Cd                                  0.00416
Co                                  0.00519
Cr                                  0.0474
Cu                                  0.595
Fe                                  4.88
Hg                                  0.000086
K                                   4.6
Mg                                  0.3
Mn                                  0.0934
Mo                                  0.072
Na                                  84
Ni                                  0.0082
Pb                                  0.253
Sb                                  0.00486
Se                                  0.0772
Si                                  3.09
Sr                                  0.0165
Tl                                  0.00215
U                                   0.00325
Zn                                  0.0935
-water    1 # kg
                    end

SOLUTION                            FB1
   temp      25
pH                                  7.35
   pe        10
   redox     pe
   units                  mg/L
   density   1.0
Alkalinity                          48.312
```

```
Cl                                20.3
F                                 0.867
S(6)                              93.4
Ag                                0.0132
Al                                1.43
As                                0.0172
Ba                                0.148
Ca                                4.6
Cd                                0.00191
Co                                0.00223
Cr                                0.0221
Cu                                0.24
Fe                                8.58
Hg                                ND
K                                 6.6
Mg                                2.44
Mn                                0.0541
Mo                                0.209
Na                                82.7
Ni                                0.0115
Pb                                0.0745
Sb                                0.0106
Se                                0.18
Si                                64.6
Sr                                0.0253
Tl                                0.0001
U                                 0.00151
Zn                                0.0368
-water    1 # kg
                  end

SOLUTION                          FB1
   temp      25
pH                                8
   pe        10
   redox     pe
   units                  mg/L
   density   1.0
Alkalinity                        15.738
Cl                                10
F                                 0.707
S(6)                              75
Ag                                0.0178
```

```
        Al                              1.21
        As                            0.0117
        Ba                             0.131
        Ca                              2.89
        Cd                          0.000534
        Co                           0.00068
        Cr                            0.0103
        Cu                             0.131
        Fe                              2.01
        Hg                          0.000278
        K                                2.7
        Mg                              0.71
        Mn                            0.0114
        Mo                             0.215
        Na                              63.1
        Ni                           0.00464
        Pb                            0.0342
        Sb                            0.0106
        Se                             0.105
        Si                              25.8
        Sr                             0.017
        Tl                           0.00019
        U                           0.000795
        Zn                              0.019
        -water    1 # kg
                        end

        SOLUTION                        FB1
          temp      25
        pH                              7.1
          pe        10
          redox     pe
          units                 mg/L
          density   1.0
#       Alkalinity                     10.98
        Cl                              6.39
        F                              0.401
        S(6)                            63.7
        Ag                          0.00557
        Al                              2.73
        As                            0.0073
        Ba                            0.0924
        Ca                              1.87
```

```
        Cd                              0.00031
        Co                              0.00035
        Cr                              0.00374
        Cu                               0.0609
        Fe                                 1.65
        Hg                             0.000143
        K                                   2.2
        Mg                                 0.59
        Mn                              0.00681
        Mo                               0.0965
        Na                                 43.7
        Ni                               0.0017
        Pb                               0.0195
        Sb                                0.013
        Se                               0.0637
        Si                                 24.9
        Sr                               0.0152
        Tl                                   ND
        U                               0.000495
        Zn                               0.0118
        -water    1 # kg
                        end

        SOLUTION                          FB1
          temp      25
        pH                                6.96
          pe        10
          redox     pe
          units                 mg/L
          density   1.0
#       Alkalinity                       3.416
        Cl                                3.47
        F                                0.437
        S(6)                              46.5
        Ag                              0.00363
        Al                                1.37
        As                               0.0131
        Ba                                0.14
        Ca                                1.54
        Cd                             0.000048
        Co                              0.00034
        Cr                              0.00388
        Cu                               0.0687
```

```
        Fe                              1.26
        Hg                              0.000228
        K                               2
        Mg                              0.33
        Mn                              0.0125
        Mo                              0.0935
        Na                              30.2
        Ni                              0.00146
        Pb                              0.0386
        Sb                              0.0212
        Se                              0.0329
        Si                              18.9
        Sr                              0.0193
        Tl                              0.00011
        U                               0.000597
        Zn                              0.0154
        -water    1 # kg
                        end

        SOLUTION                        FB1
          temp      25
        pH                              6.88
          pe        10
          redox     pe
          units             mg/L
          density   1.0
#       Alkalinity                      7.32
        Cl                              2.21
        F                               0.286
        S(6)                            44.9
        Ag                              0.00513
        Al                              1.21
        As                              0.0049
        Ba                              0.0478
        Ca                              0.978
        Cd                              0.000037
        Co                              0.00014
        Cr                              0.00282
        Cu                              0.0385
        Fe                              0.775
        Hg                              ND
        K                               2
        Mg                              0.28
```

```
        Mn                              0.00471
        Mo                               0.0796
        Na                                 28.2
        Ni                              0.00078
        Pb                              0.00984
        Sb                              0.00776
        Se                               0.0286
        Si                                 18.5
        Sr                              0.00818
        Tl                               0.0001
        U                              0.000285
        Zn                               0.0072
        -water    1 # kg
                        end

        SOLUTION                          FB1
          temp      25
        pH                                6.79
          pe        10
          redox     pe
          units                 mg/L
          density   1.0
#       Alkalinity                       4.026
        Cl                                2.79
        F                                0.206
        S(6)                                45
        Ag                             0.00199
        Al                               0.461
        As                             0.00271
        Ba                              0.0502
        Ca                                1.03
        Cd                            0.000036
        Co                             0.00013
        Cr                              0.0021
        Cu                              0.0287
        Fe                               0.256
        Hg                            0.000033
        K                                 1.09
        Mg                               0.154
        Mn                             0.00443
        Mo                              0.0362
        Na                                22.9
        Ni                             0.00113
```

```
        Pb                              0.00753
        Sb                              0.00461
        Se                               0.0205
        Si                                 16.6
        Sr                              0.00688
        Tl                             0.000045
        U                              0.000217
        Zn                               0.0046
        -water    1 # kg
                        end

        SOLUTION                          FB1
          temp      25
        pH                                6.76
          pe        10
          redox     pe
          units                 mg/L
          density   1.0
#       Alkalinity                       4.88
        Cl                               1.42
        F                               0.206
        S(6)                             28.6
        Ag                             0.00185
        Al                                 0.6
        As                             0.00284
        Ba                               0.044
        Ca                                0.58
        Cd                             0.00002
        Co                              0.0003
        Cr                              0.0012
        Cu                              0.0188
        Fe                               0.284
        Hg                           0.0000031
        K                                    2
        Mg                                 0.1
        Mn                             0.00296
        Mo                              0.0311
        Na                                13.1
        Ni                                0.001
        Pb                             0.00684
        Sb                             0.00748
        Se                              0.0111
        Si                                  ND
```

```
        Sr                              ND
        Tl                              0.0002
        U                               0.0002
        Zn                              0.005
        -water    1 # kg
                        end

        SOLUTION                        FB1
          temp      25
        pH                              6.78
          pe        10
          redox     pe
          units                 mg/L
          density   1.0
#       Alkalinity                      3.782
        Cl                              1.27
        F                               0.15
        S(6)                            30.7
        Ag                              0.00134
        Al                              0.624
        As                              0.00232
        Ba                              0.0689
        Ca                              0.814
        Cd                              0.000035
        Co                              0.0001
        Cr                              0.00135
        Cu                              0.0171
        Fe                              0.303
        Hg                              0.00005
        K                               2
        Mg                              0.15
        Mn                              0.00265
        Mo                              0.025
        Na                              15.6
        Ni                              0.0005
        Pb                              0.00465
        Sb                              0.00509
        Se                              0.0143
        Si                              14.1
        Sr                              0.00728
        Tl                              0.000031
        U                               0.00013
        Zn                              0.004
```

```
    -water    1 # kg
                    end

    SOLUTION                        FB1
      temp      25
    pH                              6.29
      pe        10
      redox     pe
      units                 mg/L
      density   1.0
#   Alkalinity                      3.782
    Cl                              0
    F                               0
    S(6)                            30.7
    Ag                              0.00111
    Al                              0.598
    As                              0.00207
    Ba                              0.0627
    Ca                              1.05
    Cd                              0.00003
    Co                              0.0001
    Cr                              0.00092
    Cu                              0.0191
    Fe                              0.32
    Hg                              0.00001
    K                               1.17
    Mg                              0.19
    Mn                              0.00371
    Mo                              0.0189
    Na                              16.6
    Ni                              0.0005
    Pb                              0.00555
    Sb                              0.0062
    Se                              0.0144
    Si                              13.7
    Sr                              0.00773
    Tl                              0.000036
    U                               0.00016
    Zn                              0.004
    -water    1 # kg
                    end
```

FB2 PHREEQC Input

```
SELECTED_OUTPUT
   -file              selected.out
   -solution          true
   -ph                true
   -pe                true
 -water               true
   -temperature       true
   -alkalinity        true
   -charge_balance    true
   -percent_error     true
-saturation_indices  Gibbsite  Al(OH)3(am) Barite  Celestite  Chalcedony schwertmannite
siderite calcite  Dolomite(disordered) dolomite(ordered)  ferrihydrite Fe(OH)3(a)  Fluorite  Gypsum
   Pyrolusite CaMoO4 PbMoO4
 Malachite  azurite tenorite K-jarosite

phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999
phases
Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k          4.891

SOLUTION                        FB2
   temp      25
pH                              4.88
   pe        10
   redox     pe
   units                    mg/L
   density   1.0
Alkalinity                   25.742
Cl                             33.6
F                             0.168
S(6)                            297
Ag                         0.00153
Al                             1.85
As                         0.00073
Ba                          0.0382
Ca                             13.6
Cd                         0.00052
```

```
Co                              0.00758
Cr                               0.0095
Cu                                0.749
Fe                                0.254
Hg                              0.00005
K                                   6.7
Mg                                 5.92
Mn                                0.177
Mo                               0.0231
Na                                  149
Ni                                0.008
Pb                              0.00122
Sb                              0.00148
Se                              0.00535
Si                                 12.2
Sr                                0.133
Tl                              0.00023
U                               0.00553
Zn                               0.0876
-water    1 # kg
                        end

SOLUTION                          FB2
   temp      25
pH                                5.25
   pe        10
   redox     pe
   units                  mg/L
   density   1.0
Alkalinity                      18.422
Cl                                  41
F                                0.207
S(6)                               403
Ag                             0.000101
Al                                0.693
As                               0.0008
Ba                               0.0285
Ca                                 18.8
Cd                             0.000765
Co                               0.0139
Cr                               0.0062
Cu                                0.737
Fe                                0.205
```

```
        Hg                              ND
        K                              7.4
        Mg                            8.92
        Mn                           0.221
        Mo                         0.00628
        Na                             192
        Ni                          0.0104
        Pb                         0.00075
        Sb                         0.00136
        Se                         0.00438
        Si                            12.7
        Sr                           0.165
        Tl                          0.0005
        U                          0.00388
        Zn                           0.133
        -water    1 # kg
                                end

        SOLUTION                      FB2
          temp      25
        pH                           7.16
          pe        10
          redox     pe
          units                    mg/L
          density   1.0
#       Alkalinity                 5.856
        Cl                          39.6
        F                            0.2
        S(6)                         387
        Ag                       0.00011
        Al                         0.972
        As                       0.00033
        Ba                        0.0264
        Ca                          14.4
        Cd                      0.000604
        Co                        0.0154
        Cr                        0.0018
        Cu                         0.683
        Fe                         0.149
        Hg                       0.00005
        K                            7.4
        Mg                          7.41
        Mn                         0.232
```

```
Mo                              0.00114
Na                                  186
Ni                               0.0093
Pb                              0.00041
Sb                              0.00124
Se                              0.00326
Si                                 28.1
Sr                                0.171
Tl                              0.00025
U                                0.0029
Zn                                0.112
-water    1 # kg
                        end

SOLUTION                          FB2
   temp      25
pH                                 4.3
   pe        10
   redox     pe
   units                    mg/L
   density   1.0
Alkalinity                        1.22
Cl                                33.8
F                                  0.2
S(6)                               394
Ag                              0.00003
Al                                0.801
As                              0.00057
Ba                                0.0368
Ca                                14.4
Cd                             0.000504
Co                                0.018
Cr                                0.001
Cu                                0.598
Fe                                0.16
Hg                              0.00005
K                                  7.9
Mg                                7.09
Mn                                0.201
Mo                              0.00361
Na                                  187
Ni                               0.0092
Pb                              0.00061
```

```
Sb                              0.00161
Se                              0.00366
Si                                 29.4
Sr                                0.158
Tl                                   ND
U                               0.00304
Zn                               0.0932
-water    1 # kg
                        end

SOLUTION                          FB2
   temp      25
pH                                 4.5
   pe        10
   redox     pe
   units                    mg/L
   density   1.0
Alkalinity                        6.344
Cl                                 31.9
F                                   0.2
S(6)                               424
Ag                              0.000053
Al                                    1
As                               0.0004
Ba                               0.0156
Ca                                 14.7
Cd                              0.000661
Co                               0.0114
Cr                               0.00151
Cu                                0.678
Fe                                0.189
Hg                               0.00005
K                                   7.1
Mg                                 7.09
Mn                                0.258
Mo                               0.00113
Na                                  194
Ni                               0.00835
Pb                              0.000518
Sb                               0.00099
Se                               0.00371
Si                                 27.9
Sr                                0.175
```

```
Tl                              0.00024
U                               0.00306
Zn                               0.0854
-water    1 # kg
                        end

SOLUTION                            FB2
   temp      25
pH                               4.33
   pe        10
   redox     pe
   units                        mg/L
   density   1.0
Alkalinity                       2.44
Cl                               25.5
F                                 0.2
S(6)                              411
Ag                           0.000108
Al                                  1
As                           0.00049
Ba                           0.0121
Ca                               13.8
Cd                           0.000684
Co                           0.0108
Cr                           0.00129
Cu                           0.682
Fe                           0.155
Hg                               ND
K                                 6.7
Mg                               6.58
Mn                           0.295
Mo                           0.000964
Na                                180
Ni                           0.00824
Pb                           0.000341
Sb                           0.00067
Se                           0.00359
Si                               25.6
Sr                           0.157
Tl                           0.00022
U                            0.00176
Zn                           0.0843
-water    1 # kg
```

```
                    end

SOLUTION                FB2
  temp      25
pH                      4.42
  pe        10
  redox     pe
  units                 mg/L
  density   1.0
Alkalinity              2.44
Cl                      21.1
F                       0.1
S(6)                    318
Ag                      0.000032
Al                      0.443
As                      0.00047
Ba                      0.0114
Ca                      8.16
Cd                      0.000364
Co                      0.00589
Cr                      0.00084
Cu                      0.375
Fe                      0.082
Hg                      0.00001
K                       5.43
Mg                      3.95
Mn                      0.145
Mo                      0.000577
Na                      129
Ni                      0.00442
Pb                      0.000296
Sb                      0.00092
Se                      0.00321
Si                      26.8
Sr                      0.103
Tl                      0.000186
U                       0.00165
Zn                      0.0483
-water    1 # kg
                    end

SOLUTION                FB2
  temp      25
```

```
pH                              4.56
   pe       10
   redox    pe
   units                     mg/L
   density  1.0
Alkalinity                      2.44
Cl                              12.9
F                               0.036
S(6)                            223
Ag                              0.00002
Al                              0.21
As                              0.0005
Ba                              0.02
Ca                              5.39
Cd                              0.000239
Co                              0.00332
Cr                              0.001
Cu                              0.247
Fe                              0.063
Hg                              0.00001
K                               4
Mg                              2.54
Mn                              0.0926
Mo                              0.001
Na                              80.6
Ni                              0.0029
Pb                              0.0005
Sb                              0.0005
Se                              0.0027
Si                              ND
Sr                              ND
Tl                              0.0002
U                               0.00094
Zn                              0.0335
-water   1 # kg
                          end

SOLUTION                        FB2
   temp     25
pH                              4.63
   pe       10
   redox    pe
   units                     mg/L
```

```
   density   1.0
Alkalinity                  1.22
Cl                          8.67
F                           0.034
S(6)                        185
Ag                          0.000016
Al                          0.212
As                          0.00056
Ba                          0.0183
Ca                          5.5
Cd                          0.000232
Co                          0.00425
Cr                          0.00063
Cu                          0.245
Fe                          0.053
Hg                          0.00005
K                           4.4
Mg                          2.65
Mn                          0.0937
Mo                          0.000419
Na                          81
Ni                          0.00313
Pb                          0.000172
Sb                          0.00105
Se                          0.00299
Si                          22.2
Sr                          0.0647
Tl                          0.000137
U                           0.000679
Zn                          0.0315
-water    1 # kg
                        end

SOLUTION                    FB2
   temp      25
pH                          4.46
   pe        10
   redox     pe
   units                    mg/L
   density   1.0
Alkalinity                  1.22
Cl                          0
F                           0
```

S(6)	185
Ag	0.000012
Al	0.205
As	0.00033
Ba	0.0143
Ca	5.53
Cd	0.000249
Co	0.00374
Cr	0.00043
Cu	0.243
Fe	0.039
Hg	0.00001
K	4.17
Mg	2.67
Mn	0.0983
Mo	0.000293
Na	74.9
Ni	0.00295
Pb	0.000157
Sb	0.00084
Se	0.00304
Si	21.2
Sr	0.0653
Tl	0.000138
U	0.000685
Zn	0.0326

-water 1 # kg

end

FB3 PHREEQC Input

```
SELECTED_OUTPUT
   -file              selected.out
   -solution          true
   -ph                true
   -pe                true
 -water               true
   -temperature
true
   -alkalinity        true
   -charge_balance    true
   -percent_error     true
-saturation_indices  Gibbsite  Al(OH)3(am) Barite  Celestite  Chalcedony schwertmannite
siderite calcite    Dolomite(disordered) dolomite(ordered)  ferrihydrite Fe(OH)3(a)  Fluorite
Gypsum
Pyrolusite CaMoO4 PbMoO4
 Malachite  azurite tenorite K-jarosite


phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999
phases
Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 +
3H2O
      log_k          4.891


SOLUTION             FB3
   temp      25
pH                   5.89
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity           25.254
Cl                    5.75
F                     1.23
S(6)                   139
Ag                0.000227
Al                    2.45
```

```
As                  0.00289
Ba                    0.131
Ca                     25.2
Cd                 0.000895
Co                   0.0357
Cr                  0.00179
Cu                     2.91
Fe                    0.133
Hg                  0.00005
K                        7.3
Mg                      3.47
Mn                     0.308
Mo                     0.113
Na                      45.7
Ni                    0.0117
Pb                 0.000585
Sb                  0.00106
Se                   0.0142
Si                     0.92
Sr                   0.0816
Tl                  0.00145
U                   0.00279
Zn                   0.0753
-water    1 # kg
          end

SOLUTION              FB3
   temp      25
pH                      6.6
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity           27.694
Cl                      9.42
F                       1.22
S(6)                    96.6
Ag                 0.000026
Al                   0.0705
As                  0.00217
Ba                   0.0393
Ca                     17.4
Cd                 0.000514
```

```
Co                    0.00982
Cr                    0.00051
Cu                      0.225
Fe                       0.03
Hg                         ND
K                         5.2
Mg                       2.07
Mn                      0.197
Mo                        1.6
Na                       39.8
Ni                    0.00341
Pb                   0.000113
Sb                    0.00208
Se                     0.0352
Si                       2.02
Sr                     0.0602
Tl                     0.0001
U                    0.000327
Zn                     0.0098
-water    1 # kg
          end

SOLUTION                FB3
   temp      25
pH                      7.01
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity            15.494
Cl                      4.06
F                       1.19
S(6)                    74.8
Ag                   0.000143
Al                      0.117
As                    0.00162
Ba                     0.0505
Ca                       14.1
Cd                   0.000419
Co                    0.00303
Cr                     0.0005
Cu                     0.0845
Fe                      0.056
```

```
Hg                  0.00005
K                       4.4
Mg                      1.6
Mn                   0.0761
Mo                        2
Na                     25.4
Ni                  0.00066
Pb                 0.000072
Sb                  0.00194
Se                   0.0195
Si                      2.8
Sr                   0.0614
Tl                  0.00037
U                  0.000095
Zn                   0.0016
-water    1 # kg
          end

SOLUTION          FB3
  temp      25
pH                  6.9
  pe        10
  redox     pe
  units             mg/L
  density   1.0
Alkalinity          5.49
Cl                  2.93
F                   0.93
S(6)                60.1
Ag                0.00001
Al                 0.0157
As                 0.0015
Ba                 0.0395
Ca                   10.5
Cd                 0.0003
Co                0.00357
Cr                 0.0005
Cu                 0.0667
Fe                   0.03
Hg                0.00005
K                      3.4
Mg                    1.23
Mn                  0.0618
```

```
Mo                    1.03
Na                    19.8
Ni                    0.00087
Pb                    0.00005
Sb                    0.00155
Se                    0.0175
Si                    2.33
Sr                    0.0414
Tl                    ND
U                     0.000065
Zn                    0.0049
-water    1 # kg
          end

SOLUTION              FB3
   temp      25
pH                    6.45
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity            6.1
Cl                    3.7
F                     0.828
S(6)                  77.1
Ag                    0.00001
Al                    0.01
As                    0.00103
Ba                    0.0662
Ca                    13.3
Cd                    0.000138
Co                    0.0058
Cr                    0.0005
Cu                    0.0725
Fe                    0.03
Hg                    0.00005
K                     3.7
Mg                    1.6
Mn                    0.103
Mo                    0.669
Na                    21.5
Ni                    0.00108
Pb                    0.00005
```

```
        Sb                  0.00113
        Se                  0.0184
        Si                  3.06
        Sr                  0.0608
        Tl                  0.0001
        U                   0.000049
        Zn                  0.0057
        -water    1 # kg
                  end

        SOLUTION            FB3
          temp      25
        pH                  6.6
          pe        10
          redox     pe
          units     mg/L
          density   1.0
#       Alkalinity          3.416
        Cl                  1.9
        F                   0.679
        S(6)                52.7
        Ag                  0.000037
        Al                  0.882
        As                  0.00201
        Ba                  0.0477
        Ca                  8.23
        Cd                  0.000236
        Co                  0.00235
        Cr                  0.0005
        Cu                  0.0554
        Fe                  0.03
        Hg                  ND
        K                   2.7
        Mg                  1
        Mn                  0.0609
        Mo                  0.602
        Na                  16.9
        Ni                  0.0007
        Pb                  0.000398
        Sb                  0.00107
        Se                  0.013
        Si                  2.77
        Sr                  0.0387
```

```
Tl                  0.0001
U                  0.000049
Zn                    0.0046
-water    1 # kg
          end

SOLUTION             FB3
   temp      25
pH                     6.21
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity             2.44
Cl                     2.89
F                     0.659
S(6)                   74.8
Ag                 0.000035
Al                   0.0234
As                   0.0011
Ba                   0.0535
Ca                     11.2
Cd                   0.0002
Co                  0.00284
Cr                   0.0002
Cu                   0.0794
Fe                     0.01
Hg                  0.00001
K                      3.19
Mg                     1.41
Mn                   0.0363
Mo                    0.418
Na                     19.9
Ni                  0.00136
Pb                  0.00005
Sb                  0.00085
Se                   0.0186
Si                     3.63
Sr                    0.049
Tl                 0.000036
U                  0.000047
Zn                   0.0088
-water    1 # kg
```

```
                end

SOLUTION            FB3
   temp      25
pH                  5.98
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity          2.44
Cl                  2.39
F                  0.594
S(6)                74.7
Ag                0.00002
Al                 0.0168
As                 0.0008
Ba                  0.052
Ca                   11.1
Cd                 0.0002
Co                0.00371
Cr                  0.001
Cu                 0.0812
Fe                   0.03
Hg                0.00001
K                      2.9
Mg                    1.47
Mn                  0.0511
Mo                   0.287
Na                    15.9
Ni                  0.0015
Pb                  0.0005
Sb                 0.00058
Se                  0.0154
Si                      ND
Sr                      ND
Tl                  0.0002
U                   0.0002
Zn                  0.0093
-water    1 # kg
                end

SOLUTION            FB3
   temp      25
```

```
pH                          6
   pe       10
   redox    pe
   units            mg/L
   density  1.0
Alkalinity                1.22
Cl                        1.36
F                        0.505
S(6)                      47.5
Ag                     0.00001
Al                      0.0477
As                     0.00134
Ba                      0.0402
Ca                        8.03
Cd                    0.000309
Co                      0.0018
Cr                      0.0005
Cu                      0.0822
Fe                        0.03
Hg                     0.00005
K                           2.4
Mg                         1.08
Mn                       0.0127
Mo                        0.251
Na                         11.7
Ni                     0.00117
Pb                     0.00005
Sb                     0.00093
Se                       0.0107
Si                         3.15
Sr                       0.0352
Tl                     0.000023
U                      0.000039
Zn                       0.0077
-water    1 # kg
              end

SOLUTION                  FB3
   temp     25
pH                        5.99
   pe       10
   redox    pe
   units            mg/L
```

```
    density   1.0
Alkalinity              1.22
Cl                         0
F                          0
S(6)                    47.5
Ag                     0.00001
Al                      0.0283
As                     0.00076
Ba                      0.0396
Ca                        8.24
Cd                     0.00015
Co                     0.00038
Cr                     0.00013
Cu                      0.0385
Fe                        0.01
Hg                     0.00001
K                         2.39
Mg                        1.09
Mn                     0.00409
Mo                       0.225
Na                        10.1
Ni                     0.00093
Pb                     0.00005
Sb                     0.00067
Se                     0.00941
Si                        2.81
Sr                      0.0329
Tl                    0.000026
U                     0.000017
Zn                      0.0067
-water    1 # kg
              end
```

FB4 PHREEQC Input

```
SELECTED_OUTPUT
   -file              selected.out
   -solution          true
   -ph                true
   -pe                true
 -water               true
   -temperature       true
   -alkalinity        true
   -charge_balance    true
   -percent_error     true
-saturation_indices  Gibbsite  Al(OH)3(am) Barite  Celestite  Chalcedony schwertmannite
siderite calcite    Dolomite(disordered) dolomite(ordered)  ferrihydrite Fe(OH)3(a)  Fluorite
Gypsum
Pyrolusite CaMoO4 PbMoO4
 Malachite  azurite tenorite K-Jarosite


phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999

phases
Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k          4.891
SOLUTION                FB4
   temp      25
pH                      4.16
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity              2.44
Cl                      1.84
F                      0.316
S(6)                    234
Ag                   0.000108
Al                      24.9
As                     0.0116
Ba                     0.0327
```

```
Ca                    7.99
Cd                 0.00127
Co                  0.0254
Cr                  0.0529
Cu                   0.835
Fe                     1.6
Hg                 0.00005
K                      5.8
Mg                    3.35
Mn                    0.42
Mo                  0.0508
Na                    41.7
Ni                  0.0196
Pb                 0.00182
Sb                 0.00102
Se                 0.00324
Si                   0.386
Sr                   0.036
Tl                 0.00188
U                  0.00375
Zn                   0.294
-water    1 # kg
          end

SOLUTION              FB4
  temp      25
pH                    4.13
  pe        10
  redox     pe
  units             mg/L
  density   1.0
Alkalinity            2.44
Cl                    4.02
F                     1.64
S(6)                   540
Ag                 0.00018
Al                    74.4
As                  0.0267
Ba                  0.0182
Ca                    13.2
Cd                 0.00326
Co                  0.0803
Cr                   0.109
```

```
        Cu                      2.88
        Fe                      3.31
        Hg                        ND
        K                        8.3
        Mg                      8.39
        Mn                      1.53
        Mo                    0.0509
        Na                        60
        Ni                    0.0528
        Pb                   0.00155
        Sb                   0.00203
        Se                    0.0146
        Si                      3.51
        Sr                    0.0734
        Tl                    0.0005
        U                    0.00947
        Zn                     0.825
        -water   1 # kg
                 end

#       SOLUTION              FB4
#         temp     25
#       pH                       0
#         pe       10
#         redox    pe
#         units            mg/L
#         density  1.0
#       Alkalinity        #VALUE!
#       Cl                    ND
#       F                     ND
#       S(6)                  ND
#       Ag                    ND
#       Al                    ND
#       As                    ND
#       Ba                    ND
#       Ca                    ND
#       Cd                    ND
#       Co                    ND
#       Cr                    ND
#       Cu                     0
#       Fe                    ND
#       Hg                    ND
#       K                     ND
```

```
#           Mg                      ND
#           Mn                      ND
#           Mo                      ND
#           Na                      ND
#           Ni                      ND
#           Pb                      ND
#           Sb                      ND
#           Se                      ND
#           Si                      ND
#           Sr                      ND
#           Tl                      ND
#           U                       ND
#           Zn                      ND
#           -water    1 # kg
#                       end

            SOLUTION                FB4
              temp      25
            pH                      4.3
              pe        10
              redox     pe
              units             mg/L
              density   1.0
            Alkalinity              1.22
            Cl                      1.15
            F                       0.678
            S(6)                    162
            Ag                      0.000033
            Al                      15.5
            As                      0.00551
            Ba                      0.0179
            Ca                      5.38
            Cd                      0.000935
            Co                      0.0225
            Cr                      0.0265
            Cu                      0.774
            Fe                      0.787
            Hg                      0.00005
            K                       4.8
            Mg                      2.83
            Mn                      0.435
            Mo                      0.0132
            Na                      20.1
```

```
Ni                    0.0156
Pb                  0.000378
Sb                   0.00101
Se                   0.00567
Si                      2.39
Sr                    0.0294
Tl                        ND
U                    0.00246
Zn                     0.289
-water    1 # kg
          end

SOLUTION              FB4
   temp      25
pH                      4.01
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity              2.44
Cl                       5.9
F                       3.73
S(6)                     729
Ag                  0.000054
Al                        97
As                    0.0177
Ba                    0.0168
Ca                      11.3
Cd                   0.00255
Co                     0.119
Cr                     0.107
Cu                      2.85
Fe                      2.92
Hg                   0.00005
K                         6.4
Mg                      11.3
Mn                      1.33
Mo                    0.0482
Na                      50.6
Ni                    0.0689
Pb                   0.00106
Sb                   0.00153
Se                    0.0147
```

```
Si                      6.13
Sr                    0.0761
Tl                    0.0004
U                      0.011
Zn                     0.811
-water    1 # kg
          end

SOLUTION              FB4
   temp      25
pH                      4.01
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity              2.44
Cl                      1.07
F                      0.532
S(6)                     162
Ag                  0.000027
Al                      22.6
As                   0.00392
Ba                     0.022
Ca                      4.03
Cd                  0.000792
Co                    0.0304
Cr                    0.0194
Cu                     0.948
Fe                     0.319
Hg                        ND
K                        3.5
Mg                      2.55
Mn                     0.459
Mo                   0.00795
Na                      17.4
Ni                    0.0197
Pb                  0.000314
Sb                   0.00068
Se                     0.005
Si                      3.02
Sr                    0.0298
Tl                   0.00019
U                    0.00218
```

```
Zn                      0.23
-water    1 # kg
          end

SOLUTION                FB4
   temp      25
pH                      3.9
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity              2.44
Cl                      2.54
F                       1.31
S(6)                    375
Ag                      0.000028
Al                      42
As                      0.00662
Ba                      0.0146
Ca                      5.8
Cd                      0.00127
Co                      0.0536
Cr                      0.0412
Cu                      1.53
Fe                      0.507
Hg                      0.00001
K                       4.42
Mg                      5.18
Mn                      0.683
Mo                      0.0146
Na                      26.9
Ni                      0.0369
Pb                      0.00046
Sb                      0.00101
Se                      0.00927
Si                      5.36
Sr                      0.0521
Tl                      0.000325
U                       0.00568
Zn                      0.403
-water    1 # kg
          end
```

```
SOLUTION                FB4
   temp      25
pH                      3.87
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity              2.44
Cl                      2.95
F                       2.31
S(6)                   507.6
Ag                     0.0001
Al                       52.2
As                     0.0042
Ba                       0.02
Ca                       6.87
Cd                    0.00132
Co                      0.077
Cr                     0.0452
Cu                       1.73
Fe                      0.428
Hg                    0.00001
K                        4.1
Mg                       6.96
Mn                      0.797
Mo                     0.0133
Na                       33.1
Ni                     0.0422
Pb                     0.0025
Sb                     0.0025
Se                      0.009
Si                         ND
Sr                         ND
Tl                      0.001
U                      0.0059
Zn                      0.506
-water    1 # kg
               end

SOLUTION                FB4
   temp      25
pH                      4.06
   pe        10
```

```
   redox   pe
   units   mg/L
   density 1.0
Alkalinity          1.22
Cl                  0.64
F                   0.236
S(6)                60.5
Ag                  0.00001
Al                  5.1
As                  0.00276
Ba                  0.0233
Ca                  1.92
Cd                  0.000357
Co                  0.0108
Cr                  0.00379
Cu                  0.362
Fe                  0.059
Hg                  0.00005
K                   2.5
Mg                  1
Mn                  0.176
Mo                  0.00211
Na                  8.3
Ni                  0.00702
Pb                  0.000153
Sb                  0.00069
Se                  0.00295
Si                  3.25
Sr                  0.0186
Tl                  0.000121
U                   0.000784
Zn                  0.0883
-water  1 # kg
        end

SOLUTION            FB4
   temp    25
pH                  4.06
   pe      10
   redox   pe
   units   mg/L
   density 1.0
Alkalinity          1.22
```

Cl		0
F		0
S(6)		60.5
Ag		0.00001
Al		10.7
As		0.0014
Ba		0.0166
Ca		2.44
Cd		0.000443
Co		0.0191
Cr		0.00753
Cu		0.493
Fe		0.079
Hg		0.00001
K		2.43
Mg		1.71
Mn		0.222
Mo		0.00332
Na		10.4
Ni		0.0113
Pb		0.000107
Sb		0.00057
Se		0.00341
Si		2.89
Sr		0.0202
Tl		0.000135
U		0.00117
Zn		0.122
-water	1 # kg	
	end	

FB5 PHREEQC Input

```
SELECTED_OUTPUT
   -file              selected.out
   -solution          true
   -ph                true
   -pe                true
 -water               true
   -temperature       true
   -alkalinity        true
   -charge_balance    true
   -percent_error     true

-saturation_indices
Gibbsite  Al(OH)3(am) Barite  Celestite  Chalcedony schwertmannite
siderite ankerite-dolomite calcite  Dolomite(disordered) dolomite(ordered)  ferrihydrite
Fe(OH)3(a)  Fluorite  Gypsum
 Pyrolusite CaMoO4 PbMoO4
 Malachite  azurite tenorite K-jarosite

phases
fix_pe
e-=e-
log_k     0
phases
fix_pH
H+=H+
log_k     0
phases

ankerite-dolomite
   CaFe0.6Mg0.4(CO3)2 + 2H+ = Ca+2 + 0.6Fe+2 + 0.4Mg+2 + 2HCO3-
   log_k     -17.4 #Al, 2002
   delta_h   -16.54 kJ #Chay and Navrotsky, 1996




phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999
phases
```

```
Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k         4.891

                    delta_H                 -27.1
SOLUTION                          FB5   25/09/2008
  temp     5
pH                                7.12
  pe       10
  redox    pe
  units              mg/L
  density  1.0
Alkalinity                       60.634
Cl                               11.7
F                                1.05
S(6)                             377
Ag                               0.000048
Al                               0.382
As                               0.00549
Ba                               0.035
Ca                               42.7
Cd                               0.0348
Co                               0.0212
Cr                               0.0083
Cu                               3.34
Fe                               0.248
Hg                               0.00005
K                                8.6
Mg                               4.39
Mn                               0.192
Mo                               0.118
Na                               156
Ni                               0.01
Pb                               0.00405
Sb                               0.00466
Se                               0.0648
Si                               1.69
Sr                               0.189
Tl                               0.00051
U                                0.015
Zn                               0.209
-water   1 # kg
                  end
```

```
SOLUTION                    FB5    30/06/2009
   temp      5
pH                          6.36
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity                  101.87
Cl                          33
F                           2.32
S(6)                        762
Ag                          0.00005
Al                          0.0105
As                          0.0063
Ba                          0.0349
Ca                          132
Cd                          0.0357
Co                          0.0189
Cr                          0.0028
Cu                          0.915
Fe                          0.03
Hg                          ND
K                           12
Mg                          12.1
Mn                          0.391
Mo                          0.192
Na                          254
Ni                          0.0133
Pb                          0.00116
Sb                          0.00664
Se                          0.248
Si                          3.44
Sr                          0.532
Tl                          0.0005
U                           0.0423
Zn                          0.145
-water    1 # kg
               end

SOLUTION                    FB5    07/10/2009
   temp      5
pH                          7.11
```

```
   pe      10
   redox   pe
   units           mg/L
   density 1.0
Alkalinity                47.214
Cl                         20.7
F                          2.29
S(6)                       744
Ag                         0.00005
Al                         0.0058
As                         0.00404
Ba                         0.043
Ca                         136
Cd                         0.0256
Co                         0.0139
Cr                         0.0025
Cu                         0.425
Fe                         0.03
Hg                         0.00005
K                          12.2
Mg                         12.9
Mn                         0.483
Mo                         0.168
Na                         218
Ni                         0.0081
Pb                         0.00038
Sb                         0.012
Se                         0.174
Si                         4.78
Sr                         0.619
Tl                         0.0005
U                          0.0177
Zn                         0.0868
-water  1 # kg
        end

SOLUTION                   FB5   09/07/2010
   temp    5
pH                         7.4
   pe      10
   redox   pe
   units           mg/L
   density 1.0
```

```
Alkalinity              27.206
Cl                      18.4
F                       2.08
S(6)                    1010
Ag                      0.00005
Al                      0.007
As                      0.00291
Ba                      0.0367
Ca                      204
Cd                      0.055
Co                      0.034
Cr                      0.0025
Cu                      0.584
Fe                      0.03
Hg                      0.00005
K                       13.9
Mg                      21.8
Mn                      0.978
Mo                      0.0939
Na                      226
Ni                      0.0106
Pb                      0.0003
Sb                      0.0103
Se                      0.191
Si                      5.8
Sr                      0.957
Tl                      ND
U                       0.0143
Zn                      0.217
-water  1 # kg
        end

SOLUTION                FB5   10/08/2010
  temp    5
pH                      6.92
  pe      10
  redox   pe
  units           mg/L
  density 1.0
Alkalinity              26.962
Cl                      13.5
F                       2.29
S(6)                    829
```

```
Ag                              0.000014
Al                                0.0025
As                               0.00198
Ba                                0.0279
Ca                                   161
Cd                                0.0675
Co                                0.0427
Cr                                0.0005
Cu                                  0.61
Fe                                  0.03
Hg                               0.00005
K                                    12.2
Mg                                   18.3
Mn                                  0.945
Mo                                  0.056
Na                                    187
Ni                                0.00961
Pb                               0.000151
Sb                                0.00922
Se                                  0.139
Si                                   7.34
Sr                                  0.736
Tl                                0.00037
U                                  0.0054
Zn                                  0.339
-water    1 # kg
          end

SOLUTION                          FB5    15/09/2010
  temp      5
pH                                  6.65
  pe        10
  redox     pe
  units             mg/L
  density   1.0
Alkalinity                        10.126
Cl                                   7.2
F                                   1.87
S(6)                                 883
Ag                               0.000035
Al                                  0.108
As                               0.00156
Ba                                0.0356
```

```
Ca                              190
Cd                              0.126
Co                              0.101
Cr                              0.0005
Cu                              3.63
Fe                              0.03
Hg                              ND
K                               12.5
Mg                              23.6
Mn                              1.81
Mo                              0.0391
Na                              156
Ni                              0.0174
Pb                              0.000795
Sb                              0.00745
Se                              0.0978
Si                              8.36
Sr                              0.86
Tl                              0.00039
U                               0.00391
Zn                              0.902
-water    1 # kg
          end

SOLUTION                        FB5    19/07/2011
   temp      5
pH                              6.32
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity                      3.416
Cl                              5.4
F                               2.88
S(6)                            889
Ag                              0.000013
Al                              0.101
As                              0.00132
Ba                              0.02
Ca                              164
Cd                              0.127
Co                              0.113
Cr                              0.00035
```

```
Cu                              6.38
Fe                              0.01
Hg                              0.00001
K                               10.9
Mg                              19.7
Mn                              1.82
Mo                              0.0231
Na                              108
Ni                              0.0185
Pb                              0.00224
Sb                              0.00732
Se                              0.0796
Si                              9.78
Sr                              0.832
Tl                              0.000582
U                               0.00365
Zn                              0.952
-water    1 # kg
          end

SOLUTION                        FB5    23/08/2011
   temp      5
pH                              6.08
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity                      2.684
Cl                              5
F                               2.24
S(6)                            461
Ag                              0.0001
Al                              0.256
As                              0.0025
Ba                              0.02
Ca                              88.1
Cd                              0.068
Co                              0.0754
Cr                              0.005
Cu                              6.97
Fe                              0.03
Hg                              0.00001
K                               7.6
```

```
Mg                              11.8
Mn                              1.16
Mo                              0.0066
Na                              51.8
Ni                              0.0119
Pb                              0.0025
Sb                              0.004
Se                              0.0346
Si                              ND
Sr                              ND
Tl                              0.001
U                               0.0036
Zn                              0.634
-water    1 # kg
          end

SOLUTION                        FB5    04/07/2012
   temp      5
pH                              5.55
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity                      1.22
Cl                              10
F                               2.69
S(6)                            1140
Ag                              0.00005
Al                              0.846
As                              0.00165
Ba                              0.0328
Ca                              309
Cd                              0.27
Co                              0.324
Cr                              0.0025
Cu                              25.2
Fe                              0.03
Hg                              0.00005
K                               13.6
Mg                              42.3
Mn                              4.59
Mo                              0.0128
Na                              93.4
```

```
Ni                              0.048
Pb                              0.007
Sb                              0.00464
Se                              0.058
Si                              13.5
Sr                              1.17
Tl                              0.000601
U                               0.0102
Zn                              2.23
-water    1 # kg
          end

SOLUTION                        FB5    17/09/2012
   temp      5
pH                              5.28
   pe        10
   redox     pe
   units             mg/L
   density   1.0
Alkalinity                      0
Cl                              0
F                               0
S(6)                            1140
Ag                              0.00005
Al                              1.44
As                              0.00125
Ba                              0.0365
Ca                              269
Cd                              0.241
Co                              0.379
Cr                              0.0005
Cu                              39.5
Fe                              0.01
Hg                              0.00001
K                               11.4
Mg                              39.1
Mn                              4.65
Mo                              0.00658
Na                              56.2
Ni                              0.0526
Pb                              0.0103
Sb                              0.00361
Se                              0.0342
```

```
Si                              13.1
Sr                              1.01
Tl                              0.000633
U                               0.0166
Zn                              2.37
-water    1 # kg
          end
```

FB6 PHREEQC Input

```
SELECTED_OUTPUT
   -file              selected.out
   -solution          true
   -ph                true
   -pe                true
 -water               true
   -temperature       true
   -alkalinity        true
   -charge_balance    true
   -percent_error     true
   -totals        S(6) F Cl Ag Al As Ba Ca Cd Co Cr Cu Fe Hg K Mg Mn Mo Na Ni Pb Sb Se Si Sr
                  Tl U Zn
-saturation_indices
Gibbsite  Al(OH)3(am) Barite  Celestite  Chalcedony schwertmannite
siderite ankerite-dolomite calcite     Dolomite(disordered) dolomite(ordered)  ferrihydrite
Fe(OH)3(a)  Fluorite  Gypsum
Pyrolusite CaMoO4 PbMoO4
 Malachite  azurite tenorite K-jarosite

phases
fix_pe
e-=e-
log_k     0
phases
fix_pH
H+=H+
log_k     0
phases

ankerite-dolomite
   CaFe0.6Mg0.4(CO3)2 + 2H+ = Ca+2 + 0.6Fe+2 + 0.4Mg+2 + 2HCO3-
   log_k     -17.4 #Al, 2002
   delta_h   -16.54 kJ #Chay and Navrotsky, 1996

phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999
phases
Fe(OH)3(a)
      Fe(OH)3 + 3H+ = Fe+3 + 3H2O
      log_k          4.891
```

```
                delta_H      -27.1
SOLUTION         FB6
  temp    5
pH                7.4
  pe      10
  redox   pe
  units       mg/L
  density  1.0
Alkalinity      61.732
Cl                5.74
F                 0.306
S(6)                548
Ag                0.029
Al                0.122
As              0.00388
Ba                0.0613
Ca                  175
Cd              0.00659
Co                 0.02
Cr                0.0051
Cu                0.513
Fe                0.323
Hg              0.00005
K                     6
Mg                 10.6
Mn                0.243
Mo                0.153
Na                 74.2
Ni                0.0093
Pb                 0.01
Sb              0.00231
Se              0.00833
Si                0.416
Sr                  0.9
Tl              0.00023
U                 0.0306
Zn                0.208
-water   1 # kg
          end

SOLUTION         FB6
  temp    5
pH                7.11
```

```
   pe       10
   redox    pe
   units          mg/L
   density  1.0
Alkalinity          126.88
Cl                      55
F                        1
S(6)                  1310
Ag                    0.05
Al                   0.009
As                  0.0149
Ba                  0.0677
Ca                     391
Cd                 0.00414
Co                  0.0145
Cr                  0.0076
Cu                   0.291
Fe                    0.03
Hg                      ND
K                      7.4
Mg                    25.4
Mn                   0.348
Mo                   0.702
Na                     190
Ni                  0.0158
Pb                  0.0073
Sb                  0.0104
Se                  0.0254
Si                    2.16
Sr                    1.48
Tl                  0.0005
U                     0.314
Zn                   0.0559
-water   1 # kg
         end

SOLUTION            FB6
   temp     5
pH                    7.21
   pe       10
   redox    pe
   units          mg/L
   density  1.0
```

```
Alkalinity          52.46
Cl                     20
F                    0.89
S(6)                 1250
Ag                   0.05
Al                 0.0082
As                 0.0107
Ba                  0.081
Ca                    401
Cd                0.00297
Co                0.00573
Cr                 0.0025
Cu                  0.165
Fe                   0.03
Hg                0.00005
K                      6.7
Mg                    26.3
Mn                    0.22
Mo                   0.403
Na                     127
Ni                  0.0084
Pb                0.00252
Sb                 0.0137
Se                 0.0112
Si                    2.51
Sr                    1.74
Tl                  0.0005
U                    0.161
Zn                  0.0354
-water    1 # kg
          end

SOLUTION            FB6
   temp      5
pH                    7.8
   pe        10
   redox     pe
   units           mg/L
   density   1.0
Alkalinity         40.748
Cl                   12.5
F                    1.02
S(6)                  967
```

```
Ag                    0.05
Al                  0.0053
As                 0.00756
Ba                  0.0632
Ca                     304
Cd                 0.00248
Co                 0.00268
Cr                  0.0025
Cu                  0.0989
Fe                    0.03
Hg                 0.00005
K                      5.3
Mg                    21.4
Mn                    0.11
Mo                   0.265
Na                     101
Ni                  0.0063
Pb                 0.00183
Sb                  0.0118
Se                 0.00846
Si                    2.22
Sr                    1.45
Tl                      ND
U                    0.106
Zn                  0.0217
-water    1 # kg
          end

SOLUTION            FB6
  temp      5
pH                    7.42
  pe        10
  redox     pe
  units             mg/L
  density   1.0
Alkalinity          43.676
Cl                      12
F                     0.92
S(6)                  1060
Ag                   0.018
Al                  0.0057
As                 0.00791
Ba                  0.0519
```

```
Ca                  322
Cd              0.00284
Co              0.00299
Cr              0.00055
Cu               0.0863
Fe                 0.03
Hg              0.00005
K                  4.9
Mg                22.9
Mn               0.125
Mo               0.239
Na                91.5
Ni              0.00459
Pb              0.00168
Sb               0.0122
Se              0.00649
Si                2.28
Sr                1.55
Tl              0.0001
U                 0.11
Zn               0.0364
-water    1 # kg
          end

SOLUTION          FB6
   temp      5
pH                7.44
   pe        10
   redox     pe
   units          mg/L
   density   1.0
Alkalinity       33.062
Cl                    5
F                  0.56
S(6)                730
Ag                0.055
Al               0.0069
As              0.00582
Ba               0.0553
Ca                  228
Cd              0.00276
Co              0.00276
Cr               0.0005
```

```
Cu                  0.0845
Fe                    0.03
Hg                      ND
K                      3.2
Mg                    16.1
Mn                   0.101
Mo                   0.149
Na                    50.3
Ni                 0.00277
Pb                0.000825
Sb                 0.00948
Se                  0.0039
Si                    1.85
Sr                    1.14
Tl                  0.0001
U                   0.0376
Zn                  0.0484
-water    1 # kg
          end

SOLUTION          FB6
   temp      5
pH                7.46
   pe        10
   redox     pe
   units          mg/L
   density   1.0
Alkalinity       27.206
Cl                    5
F                  1.01
S(6)                775
Ag                0.013
Al               0.0049
As              0.00515
Ba               0.0488
Ca                  243
Cd              0.00269
Co              0.00116
Cr              0.00044
Cu               0.0582
Fe                 0.01
Hg              0.00001
K                   3.5
```

```
Mg                  17.4
Mn                0.0481
Mo                 0.162
Na                    56
Ni               0.00256
Pb               0.00106
Sb                0.0106
Se               0.00426
Si                  2.12
Sr                  1.19
Tl              0.000014
U                 0.0757
Zn                0.0408
-water    1 # kg
          end

SOLUTION          FB6
   temp      5
pH                7.53
   pe        10
   redox     pe
   units          mg/L
   density   1.0
Alkalinity       31.354
Cl                    5
F                  0.69
S(6)                672
Ag                 0.04
Al                 0.01
As               0.0043
Ba                0.027
Ca                  191
Cd              0.00232
Co              0.00078
Cr                0.002
Cu               0.0333
Fe                 0.03
Hg              0.00001
K                   2.5
Mg                 13.8
Mn               0.0408
Mo                0.113
Na                 34.8
```

```
Ni                    0.002
Pb                    0.001
Sb                   0.0083
Se                   0.0027
Si                       ND
Sr                       ND
Tl                   0.0004
U                    0.0511
Zn                   0.0387
-water    1 # kg
          end

SOLUTION            FB6
   temp      5
pH                   7.39
   pe        10
   redox     pe
   units           mg/L
   density   1.0
Alkalinity         32.574
Cl                      5
F                     0.5
S(6)                  637
Ag                0.00002
Al                  0.006
As                0.00427
Ba                 0.0629
Ca                    230
Cd                0.00294
Co                0.00087
Cr                  0.001
Cu                  0.041
Fe                   0.03
Hg                0.00005
K                       2.4
Mg                    14.6
Mn                 0.0341
Mo                  0.135
Na                    27.5
Ni                 0.0018
Pb                 0.0007
Sb                0.00837
Se                0.00345
```

```
Si                  1.75
Sr                  1.06
Tl                0.00002
U                  0.0546
Zn                 0.0515
-water    1 # kg
          end

SOLUTION          FB6
   temp      5
pH                  7.27
   pe        10
   redox     pe
   units          mg/L
   density   1.0
Alkalinity         32.574
Cl                      0
F                       0
S(6)                  637
Ag                0.00001
Al                 0.0041
As                0.00343
Ba                 0.0394
Ca                    185
Cd                 0.0024
Co                0.00018
Cr                0.00025
Cu                 0.0232
Fe                   0.01
Hg                0.00001
K                    1.99
Mg                   11.6
Mn                0.00876
Mo                 0.0882
Na                   22.2
Ni                0.00141
Pb               0.000123
Sb                0.00662
Se                 0.0023
Si                   1.51
Sr                  0.787
Tl                0.00001
U                  0.0497
```

```
Zn                  0.0471
-water    1 # kg
          end
```

FB7 PHREEQC Input

```
SELECTED_OUTPUT
-file              selected.out
-solution          true
-ph                true
-pe                true
-water             true
-temperature       true
-alkalinity        true
-charge_balance    true
-percent_error     true
-saturation_indices  Gibbsite  Al(OH)3(am) Barite  Celestite  Chalcedony schwertmannite
siderite calcite    Dolomite(disordered) dolomite(ordered)  ferrihydrite Fe(OH)3(a)  Fluorite
Gypsum
Pyrolusite CaMoO4 PbMoO4
Malachite  azurite tenorite K-jarosite


phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999
phases
Fe(OH)3(a)
Fe(OH)3 + 3H+ = Fe+3 + 3H2O
log_k          4.891
delta_H                                          -27.1

SOLUTION                                         FB7
temp      25
pH                                               7.02
pe        10
redox     pe
units                                            mg/L
density   1.0
Alkalinity                                       186.66
Cl                                               19.6
F                                                1.27
S(6)                                             920
Ag                                               0.051
Al                                               0.0324
As                                               0.0135
Ba                                               0.11
```

Ca	194
Cd	0.002
Co	0.00904
Cr	0.005
Cu	0.147
Fe	0.122
Hg	0.00005
K	17
Mg	23.5
Mn	0.0578
Mo	0.24
Na	228
Ni	0.0292
Pb	0.0176
Sb	0.0265
Se	0.0399
Si	1.25
Sr	2.28
Tl	0.0005
U	0.25
Zn	0.0248

-water 1 # kg
end

SOLUTION	FB7
temp 25	
pH	7.68
pe 10	
redox pe	
units	mg/L
density 1.0	
Alkalinity	183
Cl	42
F	1.4
S(6)	1040
Ag	0.062
Al	0.005
As	0.0172
Ba	0.0765
Ca	228
Cd	0.003
Co	0.0085
Cr	0.0029

Cu	0.161
Fe	0.03
Hg	ND
K	17.1
Mg	27.6
Mn	0.0029
Mo	0.56
Na	291
Ni	0.0711
Pb	0.00759
Sb	0.0322
Se	0.0632
Si	1.47
Sr	2.47
Tl	0.0005
U	0.432
Zn	0.0116
-water 1 # kg	
end	

SOLUTION	FB7
temp 25	
pH	7.58
pe 10	
redox pe	
units	mg/L
density 1.0	
Alkalinity	137.86
Cl	40
F	2.36
S(6)	1240
Ag	0.05
Al	0.005
As	0.00549
Ba	0.0757
Ca	247
Cd	0.0015
Co	0.00308
Cr	0.0025
Cu	0.126
Fe	0.03
Hg	0.00005
K	21

```
Mg                              33.2
Mn                              0.00126
Mo                              0.568
Na                              329
Ni                              0.0716
Pb                              0.00148
Sb                              0.0238
Se                              0.0506
Si                              1.64
Sr                              3.11
Tl                              0.0005
U                               0.413
Zn                              0.005
-water    1 # kg
end
```

SOLUTION	FB7
temp 25	
pH	8
pe 10	
redox pe	
units	mg/L
density 1.0	
Alkalinity	125.66
Cl	24.7
F	4.61
S(6)	714
Ag	0.024
Al	0.0038
As	0.0055
Ba	0.0544
Ca	133
Cd	0.000197
Co	0.00274
Cr	0.0005
Cu	0.0844
Fe	0.03
Hg	0.00005
K	13
Mg	17.1
Mn	0.000981
Mo	0.306
Na	216
Ni	0.0531
Pb	0.00151
Sb	0.0516
Se	0.0291

Si	1.3
Sr	1.68
Tl	0.0001
U	0.278
Zn	0.0041
-water 1 # kg	
end	
SOLUTION	FB7
temp 25	
pH	8.04
pe 10	
redox pe	
units	mg/L
density 1.0	
Alkalinity	101.016
Cl	7.3
F	4.19
S(6)	612
Ag	0.02
Al	0.0041
As	0.00446
Ba	0.0368
Ca	116
Cd	0.000136
Co	0.00138
Cr	0.001
Cu	0.0445
Fe	0.03
Hg	ND
K	11.4
Mg	16
Mn	0.00162
Mo	0.202
Na	154
Ni	0.0247
Pb	0.00071
Sb	0.0751
Se	0.0133
Si	1.17
Sr	1.59
Tl	0.0005
U	0.253

Zn	0.005
-water 1 # kg	
end	

SOLUTION	FB7
temp 25	
pH	7.99
pe 10	
redox pe	
units	mg/L
density 1.0	
Alkalinity	86.864
Cl	6
F	5.25
S(6)	427
Ag	0.011
Al	0.003
As	0.0037
Ba	0.0389
Ca	85.4
Cd	0.00009
Co	0.00102
Cr	0.00039
Cu	0.0335
Fe	0.01
Hg	0.00001
K	11.3
Mg	11.8
Mn	0.00015
Mo	0.19
Na	113
Ni	0.0169
Pb	0.000296
Sb	0.0538
Se	0.00936
Si	1.34
Sr	1.12
Tl	0.000032
U	0.191
Zn	0.003
-water 1 # kg	
end	

SOLUTION	FB7
temp 25	
pH	8.07
pe 10	
redox pe	
units	mg/L
density 1.0	
Alkalinity	101.016
Cl	1.32
F	4.27
S(6)	217
Ag	0.02
Al	0.005
As	0.00261
Ba	0.026
Ca	50.3
Cd	0.00004
Co	0.00035
Cr	0.001
Cu	0.0184
Fe	0.03
Hg	0.00001
K	8.2
Mg	7.37
Mn	0.0003
Mo	0.114
Na	55.1
Ni	0.0063
Pb	0.0005
Sb	0.0687
Se	0.0035
Si	ND
Sr	ND
Tl	0.0002
U	0.134
Zn	0.005
-water 1 # kg	
end	

SOLUTION	FB7
temp 25	
pH	7.91
pe 10	

```
redox     pe
units                                   mg/L
density   1.0
Alkalinity                              83.082
Cl                                      5
F                                       3.08
S(6)                                    356
Ag                                      0.00001
Al                                      0.003
As                                      0.00229
Ba                                      0.0458
Ca                                      109
Cd                                      0.00015
Co                                      0.00031
Cr                                      0.0005
Cu                                      0.0151
Fe                                      0.03
Hg                                      0.00005
K                                       11.1
Mg                                      15.5
Mn                                      0.000293
Mo                                      0.113
Na                                      47.4
Ni                                      0.00508
Pb                                      0.000106
Sb                                      0.0483
Se                                      0.00569
Si                                      1.04
Sr                                      1.37
Tl                                      0.000029
U                                       0.132
Zn                                      0.003
-water    1 # kg
end

SOLUTION                                FB7
temp      25
pH                                      7.98
pe        10
redox     pe
units                                   mg/L
density   1.0
Alkalinity                              83.082
```

Cl	0
F	0
S(6)	356
Ag	0.00001
Al	0.0025
As	0.00222
Ba	0.0356
Ca	86.2
Cd	0.00007
Co	0.00022
Cr	0.00021
Cu	0.0145
Fe	0.01
Hg	0.00001
K	9.96
Mg	12.6
Mn	0.000229
Mo	0.113
Na	44.5
Ni	0.00526
Pb	0.000054
Sb	0.0671
Se	0.00451
Si	0.952
Sr	1.07
Tl	0.000023
U	0.14
Zn	0.0023

-water 1 # kg
end

FB8 PHREEQC Input

```
SELECTED_OUTPUT
   -file              selected.out
   -solution          true
   -ph                true
   -pe                true
 -water               true
   -temperature       true
   -alkalinity        true
   -charge_balance    true
   -percent_error     true
-saturation_indices  Gibbsite  Al(OH)3(am) Barite  Celestite  Chalcedony
schwertmannite
 siderite calcite     Dolomite(disordered) dolomite(ordered)  ferrihydrite
Fe(OH)3(a)  Fluorite  Gypsum
Pyrolusite CaMoO4 PbMoO4
 Malachite  azurite tenorite K-jarosite


phases
schwertmannite
Fe8O8(OH)4.4(SO4)1.8 + 20.4H+ = 8Fe+3 + 1.8SO4-2 + 12.4H2O
log_k 10.5   #Yu et al., 1999
phases
Fe(OH)3(a)
      Fe(OH)3 + 3H+ =
Fe+3 + 3H2O
      log_k          4.891

                                delta_H     -27.1
SOLUTION                                    FB8
   temp      25
pH 6.8
   pe        10
   redox     pe
   units  mg/L
   density   1.0
Alkalinity                      84.424
Cl                              4.89
F                                    0.868
S(6)                            651
```

```
Ag                              0.076
Al                             0.0278
As                             0.0087
Ba                             0.0367
Ca                                182
Cd                            0.00225
Co                            0.00731
Cr                             0.0071
Cu                              0.118
Fe                              0.137
Hg                            0.00005
K                                12.8
Mg                               22.8
Mn                             0.0552
Mo                              0.303
Na                               95.2
Ni                             0.0154
Pb                            0.00167
Sb                            0.00162
Se                            0.00292
Si                              0.562
Sr                               1.77
Tl                             0.0002
U                               0.044
Zn                             0.0112
-water    1 # kg
end

SOLUTION                        FB7
   temp      25
pH                               7.8
   pe        10
   redox     pe
   units                       mg/L
   density   1.0
                  Alkalinity   170.8
Cl                                31
F                                 1.7
S(6)                            1620
Ag                             0.066
Al                             0.005
As                             0.0142
Ba                             0.0472
```

```
Ca                              428
Cd                              0.00236
Co                              0.00897
Cr                              0.0043
Cu                              0.115
Fe                              0.03
Hg                              ND
K                               21.7
Mg                              72.5
Mn                              0.0427
Mo                              0.927
Na                              201
Ni                              0.0503
Pb                              0.00277
Sb                              0.00611
Se                              0.00862
Si                              2.03
Sr                              4.5
Tl                              0.0005
U                               0.231
Zn                              0.0123
-water    1 # kg
end

SOLUTION                        FB7
   temp      25
pH                              7.62
   pe        10
   redox     pe
   units                        mg/L
   density   1.0
                    Alkalinity  115.656
Cl                              19
F                               2.36
S(6)                            1650
Ag                              0.05
Al                              0.005
As                              0.0102
Ba                              0.0511
Ca                              473
Cd                              0.00104
Co                              0.00279
Cr                              0.0025
```

```
Cu                                0.0632
Fe                                  0.03
Hg                               0.00005
K                                  20.5
Mg                                 71.5
Mn                               0.00303
Mo                                 0.728
Na                                   154
Ni                                0.0311
Pb                               0.00198
Sb                               0.00716
Se                               0.00375
Si                                  2.09
Sr                                  4.83
Tl                                 0.0005
U                                  0.181
Zn                                 0.005
-water    1 # kg
end

SOLUTION                           FB7
   temp      25
pH                                 8.04
   pe        10
   redox     pe
   units                           mg/L
   density   1.0
                     Alkalinity   74.542
Cl                                 12.3
F                                  2.44
S(6)                               1410
Ag                                 0.05
Al                                 0.005
As                                 0.00823
Ba                                 0.0345
Ca                                 390
Cd                                 0.000484
Co                                 0.00179
Cr                                 0.0025
Cu                                 0
Fe                                 0.03
Hg                                 0.00005
K                                  17.9
```

```
Mg                              61.6
Mn                           0.00103
Mo                             0.676
Na                               138
Ni                            0.0259
Pb                           0.00106
Sb                           0.00707
Se                           0.00309
Si                                 2
Sr                              4.29
Tl                                ND
U                              0.165
Zn                             0.005
-water    1 # kg
end

SOLUTION                        FB7
   temp      25
pH                              7.84
   pe        10
   redox     pe
   units                        mg/L
   density   1.0
                  Alkalinity    82.96
Cl                                10
F                                2.4
S(6)                          1240
Ag                             0.025
Al                            0.0042
As                           0.00595
Ba                             0.035
Ca                               348
Cd                          0.000398
Co                           0.00092
Cr                           0.00057
Cu                            0.0329
Fe                              0.03
Hg                           0.00005
K                                13.9
Mg                               50.2
Mn                          0.000384
Mo                             0.444
Na                              97.9
```

Ni		0.0134
Pb		0.000481
Sb		0.00578
Se		0.00123
Si		1.7
Sr		3.46
Tl		0.0001
U		0.106
Zn		0.0033
-water 1 # kg		
end		
SOLUTION		FB7
temp 25		
pH		7.88
pe 10		
redox pe		
units		mg/L
density 1.0		
	Alkalinity	68.076
Cl		5
F		1.61
S(6)		987
Ag		0.028
Al		0.005
As		0.00405
Ba		0.0303
Ca		286
Cd		0.000311
Co		0.00057
Cr		0.0025
Cu		0.0225
Fe		0.03
Hg		ND
K		10.2
Mg		38
Mn		0.00072
Mo		0.337
Na		56.5
Ni		0.0078
Pb		0.00081
Sb		0.00501
Se		0.00058

```
Si                              1.49
Sr                              2.93
Tl                            0.0005
U                              0.102
Zn                            0.0056
-water    1 # kg
end

SOLUTION                        FB7
   temp      25
pH                              7.8
   pe        10
   redox     pe
   units                      mg/L
   density   1.0
                  Alkalinity   54.046
Cl                                5
F                              2.19
S(6)                            975
Ag                             0.05
Al                            0.006
As                          0.00333
Ba                           0.0408
Ca                              293
Cd                           0.0004
Co                          0.00039
Cr                          0.00063
Cu                           0.0206
Fe                             0.02
Hg                          0.00001
K                                11
Mg                             38.7
Mn                           0.0002
Mo                            0.523
Na                             62.7
Ni                           0.0073
Pb                          0.00017
Sb                          0.00536
Se                          0.00094
Si                             1.74
Sr                             2.88
Tl                          0.000037
U                              0.0889
```

```
Zn                                0.006
-water    1 # kg
end

SOLUTION                          FB7
   temp      25
pH                                7.86
   pe        10
   redox     pe
   units                          mg/L
   density   1.0
                     Alkalinity   60.634
Cl                                   5
F                                 1.75
S(6)                              868
Ag                                0.01
Al                                0.025
As                                0.0025
Ba                                0.027
Ca                                240
Cd                                0.00025
Co                                0.0015
Cr                                0.005
Cu                                0.0143
Fe                                0.03
Hg                                0.00001
K                                 8.4
Mg                                30.1
Mn                                0.0015
Mo                                0.24
Na                                33.6
Ni                                0.005
Pb                                0.0025
Sb                                0.0043
Se                                0.005
Si                                ND
Sr                                ND
Tl                                0.0001
U                                 0.0613
Zn                                0.005
-water    1 # kg
end
```

```
SOLUTION                    FB7
   temp      25
pH                          7.8
   pe        10
   redox     pe
   units                    mg/L
   density   1.0
                Alkalinity 63.684
Cl                          5
F                           1.26
S(6)                      719
Ag                          0.00002
Al                        0.006
As                        0.00248
Ba                        0.0422
Ca                        272
Cd                          0.0007
Co                          0.00022
Cr                          0.001
Cu                          0.0139
Fe                          0.03
Hg                          0.00005
K                           8.4
Mg                          32.7
Mn                          0.00086
Mo                          0.462
Na                          29
Ni                          0.0041
Pb                          0.0001
Sb                          0.00516
Se                          0.00084
Si                          1.47
Sr                          2.7
Tl                          0.000029
U                           0.0802
Zn                          0.006
-water    1 # kg
end

SOLUTION                    FB7
   temp      25
pH                          7.88
   pe        10
```

```
    redox     pe
    units                   mg/L
    density   1.0
                      Alkalinity   63.684
Cl                                      0
F                                       0
S(6)                                  719
Ag                                  0.00002
Al                                   0.0031
As                                  0.00203
Ba                                   0.0362
Ca                                      242
Cd                                   0.0003
Co                                   0.0002
Cr                                  0.00031
Cu                                   0.0102
Fe                                     0.01
Hg                                  0.00001
K                                       7.81
Mg                                      29.3
Mn                                  0.00024
Mo                                      0.29
Na                                        23
Ni                                     0.003
Pb                                     0.0001
Sb                                   0.00418
Se                                    0.0005
Si                                      1.31
Sr                                      2.25
Tl                                  0.000021
U                                      0.0714
Zn                                     0.0039
-water    1 # kg
end
```

APPENDIX F3 FIELD BIN PHREEQC Output

Appendix F3: Field Bin PHREEQC Output

Table F3-1:
Saturation Indices of CAB Field bins FB1 and FB2 Leachate

FB1	Calcite	Dolomite (disordered)	schwertmannite	Fe(OH)3(a)	K-jarosite	Gypsum	Malachite	azurite	tenorite
25-Sep-2008	-2.69	-6.46	16.23	2.18	5.49	-3.19	0.81	0.19	0.08
30-Jun-2009	-1.92	-4.31	21.43	3.12	6.65	-2.67	1.40	0.57	0.89
7-Oct-2009	-2.50	-5.80	17.27	2.91	3.55	-2.91	1.58	-0.03	1.83
9-Jul-2010	NA	NA	14.73	2.20	3.92	-3.14	NA	NA	0.28
10-Aug-2010	NA	NA	13.10	1.96	3.34	-3.32	NA	NA	0.10
15-Sep-2010	NA	NA	11.10	1.67	2.71	-3.53	NA	NA	-0.29
19-Jul-2011	NA	NA	6.91	1.11	1.03	-3.50	NA	NA	-0.58
23-Aug-2011	NA	NA	6.86	1.13	1.09	-3.90	NA	NA	-0.80
4-Jul-2012	NA	NA	7.21	1.17	1.22	-3.73	NA	NA	-0.81
17-Sep-2012	NA	NA	5.38	0.73	1.11	-3.62	NA	NA	-1.70
FB2	**calcite**	**Dolomite (disordered)**	**schwertmannite**	**Fe(OH)3(a)**	**K-jarosite**	**Gypsum**	**Malachite**	**azurite**	**tenorite**
25-Sep-2008	-4.14	-8.83	-0.35	-0.81	3.12	-1.88	-4.25	-6.74	-3.11
30-Jun-2009	-3.83	-8.17	0.73	-0.53	3.10	-1.67	-3.40	-5.73	-2.42
7-Oct-2009	NA	NA	7.59	1.18	2.51	-1.79	NA	NA	1.27
9-Jul-2010	-5.43	-11.34	-5.03	-1.68	2.53	-1.79	-6.94	-10.83	-4.40
10-Aug-2010	-5.01	-10.52	-3.12	-1.36	2.90	-1.76	-6.04	-9.47	-3.96
15-Sep-2010	-5.35	-11.20	-4.90	-1.66	2.48	-1.79	-6.68	-10.42	-4.29
19-Jul-2011	-5.51	-11.51	-6.57	-1.81	1.52	-2.06	-6.91	-10.84	-4.33
23-Aug-2011	-5.58	-11.67	-6.82	-1.75	0.91	-2.32	-6.84	-10.83	-4.19
4-Jul-2012	-5.66	-11.83	-7.17	-1.74	0.61	-2.36	-6.78	-10.87	-4.03
17-Sep-2012	-5.66	-11.83	-7.17	-1.74	0.61	-2.36	-6.78	-10.87	-4.03

Table F3-2:
Saturation Indices of CAB Field bins FB3 and FB4 Leachate

FB3	calcite	Dolomite(disordered)	schwertmannite		Fe(OH)3(a)	K-jarosite	Gypsum	Malachite	azurite	tenorite
25-Sep-2008	-2.90	-6.86	1.46		-0.07	1.80	-1.81	-0.03	-0.98	-0.43
30-Jun-2009	-2.17	-5.45	-0.90		-0.01	-0.57	-2.07	-0.16	-1.44	-0.22
7-Oct-2009	-2.10	-5.33	2.72		0.64	-0.08	-2.23	-0.16	-1.79	0.12
9-Jul-2010	-2.74	-6.62	0.03		0.28	-1.12	-2.42	-0.88	-3.03	-0.08
10-Aug-2010	-3.05	-7.22	-1.62		-0.15	-0.83	-2.24	-1.98	-4.43	-0.89
15-Sep-2010	NA	NA	-1.23		-0.01	-1.25	-2.56	NA	NA	-0.67
19-Jul-2011	-3.76	-8.61	-6.46		-0.87	-2.32	-2.31	-2.95	-5.96	-1.29
23-Aug-2011	-3.98	-9.03	-3.63		-0.61	-0.92	-2.32	-3.59	-6.80	-1.73
4-Jul-2012	-4.36	-9.79	-3.83		-0.59	-1.34	-2.60	-3.75	-7.20	-1.66
17-Sep-2012	-4.41	-9.89	-7.68		-1.08	-2.77	-2.59	-4.48	-8.31	-2.01
FB4	**calcite**	**Dolomite(disordered)**	**schwertmannite**		**Fe(OH)3(a)**	**K-Jarosite**	**Gypsum**	**Malachite**	**azurite**	**tenorite**
25-Sep-2008	-5.61	-11.79	1.61		-0.84	4.72	-2.25	-6.75	-10.42	-4.43
30-Jun-2009	-5.51	-11.39	4.00		-0.61	6.11	-1.88	-5.93	-9.18	-4.03
9-Jul-2010	-5.85	-12.17	0.10		-0.95	3.71	-2.49	-6.57	-10.34	-4.15
10-Aug-2010	-5.59	-11.35	2.33		-0.90	5.72	-1.87	-6.24	-9.50	-4.32
15-Sep-2010	-5.90	-12.19	-5.56		-1.77	1.83	-2.68	-6.89	-10.51	-4.63
19-Jul-2011	-5.81	-11.86	-5.04		-1.83	2.75	-2.27	-6.86	-10.33	-4.73
23-Aug-2011	-5.77	-11.72	-6.06		-2.00	2.54	-2.11	-6.89	-10.34	-4.78
4-Jul-2012	-6.21	-12.89	-11.20		-2.39	-0.86	-3.21	-7.55	-11.56	-4.89
17-Sep-2012	-6.14	-12.64	-10.41		-2.26	-0.74	-3.23	-7.32	-11.24	-4.75

NA= one or more component element was below detection limits or not measured.

Table F3-3:
Saturation Indices of SUP Field bin FB5 Leachate

FB5	calcite	schwertmannite	Dolomite(disordered)	Fe(OH)3(a)	K-jarosite	Gypsum	Malachite	azurite	tenorite
25-Sep-2008	-1.38	9.60	-4.32	1.08	1.73	-1.30	4.23	2.28	0.88
30-Jun-2009	-1.51	-0.80	-4.62	-0.61	-0.52	-0.69	1.30	-1.60	-1.08
7-Oct-2009	-1.07	2.48	-3.73	0.14	-0.52	-0.68	2.31	-0.64	-0.04
9-Jul-2010	-0.90	3.84	-3.34	0.42	-0.32	-0.46	3.09	0.26	0.63
10-Aug-2010	-1.45	1.70	-4.40	-0.05	-0.46	-0.59	2.04	-1.07	-0.14
15-Sep-2010	-2.09	0.54	-5.65	-0.32	-0.42	-0.51	2.47	-0.50	0.16
19-Jul-2011	-2.95	-4.67	-7.39	-1.13	-1.86	-0.55	1.55	-1.96	-0.24
23-Aug-2011	-3.45	-2.20	-8.33	-0.88	-0.96	-0.94	1.02	-2.67	-0.58
4-Jul-2012	-3.86	-4.26	-9.15	-1.43	-0.31	-0.28	0.00	-4.09	-1.20
17-Sep-2012	NA	-9.25	NA	-2.18	-1.79	-0.32	NA	NA	-1.55

NA= one or more component element was below detection limits or not measured.

Table F3-4:
Saturation Indices of HYP Field bins FB6, FB7 and FB8 Leachate

FB6	calcite	Dolomite(disordered)	schwertmannite	Fe(OH)3(a)	K-jarosite	Gypsum	Malachite	azurite	tenorite
25-Sep-2008	-0.51	-2.80	11.79	1.46	2.02	-0.65	3.08	0.43	0.44
30-Jun-2009	-0.29	-2.32	2.62	0.13	-0.53	-0.17	1.93	-1.00	-0.43
7-Oct-2009	-0.54	-2.83	3.04	0.23	-0.60	-0.16	1.63	-1.69	-0.34
9-Jul-2010	-0.14	-2.00	5.35	0.80	-0.89	-0.31	2.28	-1.07	0.33
10-Aug-2010	-0.48	-2.67	3.89	0.44	-0.81	-0.27	1.51	-2.02	-0.26
15-Sep-2010	-0.66	-3.04	3.84	0.46	-1.18	-0.47	1.57	-1.98	-0.16
19-Jul-2011	-0.71	-3.13	0.13	0.01	-2.55	-0.44	1.27	-2.50	-0.26
23-Aug-2011	-0.65	-3.01	4.21	0.55	-1.31	-0.55	0.94	-2.98	-0.42
4-Jul-2012	-0.69	-3.14	3.54	0.42	-1.41	-0.51	0.87	-3.02	-0.54
17-Sep-2012	-0.90	-3.56	-0.72	-0.18	-2.85	-0.57	0.13	-4.06	-0.97
FB7	calcite	Dolomite(disordered)	schwertmannite	Fe(OH)3(a)	K-jarosite	Gypsum	Malachite	azurite	tenorite
25-Sep-2008	-0.20	-1.50	6.67	0.95	3.03	-0.57	0.10	-0.87	-0.27
30-Jun-2009	0.48	-0.12	3.73	0.88	0.87	-0.49	1.05	0.21	0.54
7-Oct-2009	0.27	-0.51	3.62	0.81	1.16	-0.42	0.80	-0.18	0.43
10-Aug-2010	0.47	-0.12	3.87	1.06	0.16	-0.76	0.96	-0.16	0.74
15-Sep-2010	0.39	-0.26	3.80	1.08	-0.04	-0.84	0.52	-0.89	0.58
19-Jul-2011	0.21	-0.63	-0.19	0.59	-1.61	-1.04	0.27	-1.26	0.46
23-Aug-2011	0.22	-0.59	3.22	1.10	-0.90	-1.42	-0.21	-1.99	0.22
4-Jul-2012	0.24	-0.55	3.46	1.03	-0.23	-0.99	-0.48	-2.37	0.05
17-Sep-2012	0.22	-0.58	-0.29	0.58	-1.77	-1.07	-0.45	-2.35	0.10
FB8	calcite	Dolomite(disordered)	schwertmannite	Fe(OH)3(a)	K-jarosite	Gypsum	Malachite	azurite	tenorite
25-Sep-2008	-0.72	-2.52	6.07	0.81	2.89	-0.65	-0.38	-1.66	-0.45
30-Jun-2009	0.76	0.58	4.06	0.95	1.04	-0.17	0.92	-0.08	0.57
7-Oct-2009	0.46	-0.07	3.76	0.83	1.20	-0.12	0.30	-1.00	0.25
9-Jul-2010	0.62	0.28	4.12	1.07	0.53	-0.22	NA	NA	NA
10-Aug-2010	0.46	-0.09	4.00	0.98	0.67	-0.28	0.10	-1.48	0.33
15-Sep-2010	0.37	-0.30	3.94	1.00	0.37	-0.39	-0.13	-1.88	0.27
19-Jul-2011	0.21	-0.64	2.45	0.78	-0.04	-0.39	-0.26	-2.08	0.22
23-Aug-2011	0.25	-0.57	3.90	0.99	0.26	-0.48	-0.52	-2.48	0.09
4-Jul-2012	0.30	-0.50	3.66	0.96	0.15	-0.49	-0.62	-2.58	0.00
17-Sep-2012	0.33	-0.43	-0.04	0.53	-1.38	-0.52	-0.79	-2.88	-0.05

NA= one or more component element was below detection limits or not measured.