ERDC

2007/08 Geochemical Studies, Keno Hill Silver District, YT

Prepared for:

Elsa Reclamation and
Development Company Ltd.

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Project Reference Number
SRK 1CE012.001

February 2009

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SRK Project Number 1CE012.001

February 2009

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1 Introduction

Elsa Reclamation and Development Company Ltd. (ERDC) is in the process of preparing a closure plan for the various components of the former United Keno Hill Mine (UKHM) property in the Yukon. ERDC contracted SRK Consulting (Canada) Inc. (SRK) to carry out geochemical studies to better understand in-situ tailings weathering conditions at the Valley Tailings Facility (VTF) and to evaluate the geochemistry of the various waste rock dumps with respect to potential for significant metal leaching.

Work plans for the waste rock and VTF geochemical studies were developed from collaborative discussions between Government of Yukon, Indian and North Affairs Canada, First Nation of Na-cho Nyak Dun, ERDC and SRK. A planning meeting was held on July 23, 2007 in Whitehorse and further discussions took place on July 25, 2007 at the mine site.

This document discusses the results of the VTF and waste rock geochemical studies. Results of the related hydrogeological and geotechnical studies are reported elsewhere (SRK 2008a and SRK 2008b).

2 Tailings Geochemistry: Valley Tailings Facility

2.1 Introduction

Understanding the tailings geochemistry and weathering characteristics is necessary to facilitate evaluation of closure options for the VTF. Key considerations relate to the rates of metal release through weathering of tailings, to the potential for these rates to increase over time due to increasingly acidic weathering conditions, and to the chemical loads being generated by the tailings and being released to the environment via surface water and groundwater pathways.

This chapter summarizes the operational history of the VTF and the results of previous tailings geochemistry studies, documents the tailings geochemical investigations carried out in 2007 and 2008, and proposes a limited amount of additional assessment to inform the evaluation of VTF closure options.

2.2 Background

2.2.1 Operational History

The present configuration of the Valley Tailings Facility (VTF) is the result of deposition of tailings from milling of silver-lead-zinc ores in the Elsa mill between 1936 and 1989. A detailed summary of the history of the VTF compiled from available records can be found in Appendix A.

Initial processing consisted of bulk flotation to produce a silver/lead/zinc concentrate, with differential flotation introduced in 1950 to produce separate lead and zinc concentrates. Zinc recovery was practiced intermittently from 1950 through 1981, after which no zinc concentrate was produced. A portion of the flotation tailings were subjected to cyanidation from 1952 through 1967, and again from 1979 through 1982.

Initial tailings were discharged into Porcupine Creek immediately below the Elsa Mill. This practice occurred from mill start-up in 1936 until the completion of Dam #1 (circa 1958). The initial tailings were hydraulically deposited along the original channel of Porcupine Creek with the bulk of the tailings mass ending up in topographic low areas in the valley bottom adjacent to Porcupine, Brefalt and Flat Creeks. These early tailings deposits resulting from direct tailings discharge into Porcupine Creek are hereafter referred to as “Old Tailings”.

An eastward shift in tailings discharge location occurred circa 1958 following construction of Dam #1, and discharge continued at this general location through the final tailings production in 1989. A tailings pipeline was constructed such that tailings were discharged directly onto the hillside roughly 300 m east of Porcupine Creek. Tailings deposited at this location formed a self-eroding fan, with process water and fine tailings flowing north towards Dam #1 along the original North Fork Flat Creek alignment. These later tailings deposits on the hillside and adjacent to North Fork Flat Creek are hereafter referred to as “New Tailings”.

2.2.2 Previous Geochemical Characterization

1995 Static Testing

A tailings geochemistry study was carried out in 1995 in support of the closure plan being developed as part of UKHM's efforts to restart production at the site. Ten hand test pits were excavated, with tailings logged and sampled at various depths based on discrete horizons that were identified visually. Design and results of this program are discussed in detail in the 1996 Site Characterization Report (AMC 1996).

Tailings testing included:

- Measurements of paste pH and TDS;
- Elemental analysis; and
- ABA testing.

Results of the 1995 investigations are provided in Appendix B. These results demonstrated that pH conditions in the samples tested were mildly alkaline to moderately acidic in 1995 (paste pH ranging from 4.5 to 8.8), with slightly lower paste pH values typically found in the Old Tailings and slightly higher paste pH values typically found in the New Tailings. Typical paste conductivities in the Old Tailings exceeded 2000 ppm total dissolved solids (TDS), while paste conductivities in the New Tailings ranged from 170 to 480 ppm TDS.

The 1995 analyses included ABA testing on several samples. Acid Potential (AP) was calculated based on determinations of total sulphur and sulphate sulphur, and Neutralization Potential (NP) was directly determined using the Modified NP procedure (MEND 1991). NP/AP values from the 1995 testing ranged from 0.1 to 2.9, with the majority of the samples tested having NP/AP values below one. Any sample with NP/AP<1 theoretically has the potential to develop acid weathering conditions at some point in the future and should be classified as potentially acid generating (PAG). Given that most of the 1995 tailings samples had NP/AP<1 and were thus classified as PAG, the observed neutral to slightly acidic nature of the in-situ tailings has given rise to the question of whether development of increasingly acidic conditions will occur some time in the future.

2.2.3 Additional Information Required to Assess Closure Options

Two information gaps relating to VTF geochemistry were identified during the development of work plans for 2007 closure studies. To support evaluation of closure options, a work plan was developed to answer the following questions:

1. What is current metal loading from the VTF?
2. What is the potential for order-of-magnitude increases in metal loading rates due to widespread and significant decreases in tailings pH?

2.2.4 Study Design

Estimating Current Contaminant Loading

There are two main considerations which relate to the current contaminant load being generated by the VTF. These are:

- What is the chemical flux currently leaving the facility? This aspect is important to allow assessment of current impacts from the VTF and to consider VTF remedial strategies appropriately with respect to the contribution of the VTF to overall chemical loadings to the receiving environment from the former UKHM site as a whole.
- How much chemical load is being removed internally through water treatment? This consideration stems from the need to assess the requirements for future water treatment for VTF discharge, and to weigh the various remedial strategies.

Chemical loadings in surface and groundwater are a function of both water flux and water chemistry. Operational monitoring records and the results of previous monitoring and closure studies provided a basis for chemical loading estimates, and additional monitoring was planned to supplement the exisiting information.

Evaluating Potential for Increase in Metal Loadings Due to Acid Generation

A central consideration in the selection of a closure alternative for the VTF is whether the present geochemical conditions reflect a mature weathering state. At present, both Old and New Tailings display neutral to moderately acidic weathering conditions, with measured porewater and rinse pH values ranging from 4.5 to 8.8. If the current weathering conditions represent a mature equilibrium state, then presently observed porewater chemistry provides a good indication of what to expect in the future.

On the other hand, if weathering conditions within the VTF become more acidic with time, zinc and other metal loadings to Flat Creek will likely increase. As discussed in Section 2.2.2, previous ABA testing suggested that there is less NP than AP in some of the tailings, and that portions of both the Old and New Tailings are considered *potentially* acid generating (PAG). However, standard ABA tests do not definitively indicate whether individual materials *will* actually generate acidic weathering conditions, and an important component of the 2007 VTF geochemical study focussed on looking further into the tendency of the tailings to generate acid.

The Old Tailings are a minimum of about 50 years old, while the New Tailings range in age from about 20 to 50 years, in both cases representing a long history of weathering under ambient site conditions. The presently observed pH conditions (neutral to moderately acidic) appear to contradict the PAG character of the tailings indicated by the 1995 ABA testing. One possible explanation for this apparent inconsistency is that the classical interpretation of the results of the 1995 ABA tests may not be appropriate for the Valley Tailings, with potential explanations lying in the details of both the NP and AP testing methods.

In an analytical laboratory, NP is determined by:

- adding a sufficient known volume of hydrochloric acid (HCl) to a small aliquot of sample to lower the sample pH below a value of pH 2;
- allowing the pulp to digest for a period of time;
- back titrating the pulp to pH 8.3 using a sodium hydroxide solution; and
- calculating the quantity of acid consumed by the sample and reporting the NP value, typically in units of ‘kg $CaCO_3$ equivalent/tonne of material’ (MEND 1991).

There are a couple of important assumptions inherent to the NP determination as outlined above. These primarily include:

- only minerals that are geochemically reactive under field conditions participate in the consumption of the acid added during the test; and
- any reduced iron or manganese ions released by mineral dissolution subsequently oxidize within the timeframe of the test and release additional acid due to hydrolysis.

On the other hand, determination of AP of a sample is not a direct measurement. The following steps are required to arrive at an AP value for a sample:

- determine the total sulphur content (S(T)) of the sample, commonly by combustion in a Leco furnace;
- determine the sulphate sulphur content ($S(SO_4)$) of the sample, by leaching sulphate from the sample using HCl and gravimetrically determine the sulphate removed;
- calculate sulphide sulphur content ($S(S^{2-})$) of the sample by difference, i.e. ($S(T) – S(SO_4) = S(S^{2-})$); and
- calculate AP from $S(S^{2-})$.

There are a couple of important assumptions inherent to the AP determination as outlined above. These primarily include:

- all $S(S^{2-})$ is present in the form of pyrite (FeS_2); and
- all $S(SO_4)$ in the sample is soluble by HCl.

There are several ways in which the assumptions regarding the calculation of AP in particular may not hold true for the Valley Tailings. Specifically, it is highly likely that both lead and zinc sulphides (galena and sphalerite) host a portion of the $S(S^{2-})$, and there may be HCl-insoluble sulphate minerals present (specifically barite ($BaSO_4$) and anglesite ($PbSO_4$)). Both cases would cause calculated AP values to be inflated above the actual acid potential present in the form of pyritic sulphur.

The 2007 geochemical work plan included testing to better understand the mineralogical sources of neutralization and of acid in the Valley Tailings. In addition, accelerated weathering tests were conducted to provide additional insight into whether future weathering of the bulk tailings material is likely to lead to more acidic pH conditions at some later date.

2.3 Methods

2.3.1 Sample Collection

Tailings Solids

An excavator-supported test pit program was carried out in May 2007 under the supervision of staff from Access Consulting Group (ACG). Test pits were located in approximately the same locations as the 1995 test pits, as well as at several additional locations to improve lateral coverage of sample locations. No replicate of UK/TP/02 was excavated in 2007, as tailings at that location were noted to be heavily influenced by water treatment residues and residual lime in 1995.

A total of 17 test pits were excavated from the tailings surface to original ground. Exposed materials were logged by ACG staff and samples were collected from discrete depth intervals corresponding to visually distinct tailings horizons.

In addition, two hand test pits were excavated in October 2007 by SRK and ACG staff to provide additional coverage in the area of northern limit of the exposed Old Tailings, and in the terraced tailings located on the hillside west of the VTF access road near the Silver Trail Highway. Materials were logged and samples were collected from discrete horizons for field and laboratory testing.

Tailings Seepage and Porewater

Standing Water in Test Pits

During May 2007 test pit excavation, most test pits encountered tailings material that appeared to be saturated. These test pits were left open, and were inspected during the October 2007 site visit. Water quality samples were collected from those test pits that contained standing water to provide an indication of porewater quality in the adjacent tailings deposit. Although processes such as oxidation, evaporation, and precipitation would cause the standing water chemistry to be somewhat different than that of the adjacent porewater, it was considered that the water quality results would provide screening level information about local porewater quality in the tailings.

Tailings Seepage

During the October 2007 site visit, an actively flowing seep was identified at the head of the ditch that runs north through the lower portion of the New Tailings. Based on the distribution of the Old

Tailings evident in the 1953 aerial photograph (Appendix A) it is likely that water chemistry at this seep reflects porewater chemistry in the Old Tailings located immediately upgradient.

Tailings Drive Points

Four shallow drive points (MDP10, MDP11, MDP12, and MDP13) were installed in the New Tailings in 2006 by ACG staff as part of initial VTF closure studies, and one shallow drive point was installed immediately west (downgradient) of Dam #3. Drive point installation is described in ERDC (2007). Water quality samples were collected from these drive points by ACG staff in both July and August 2007.

Tailings Wells

Three paired sets of wells were installed in the tailings area in October 2007. Wells were installed using a Becker Hammer drill owned by Glacier Dredge of Whitehorse, YT, with supervision of well installation by SRK and ACG staff. Well logs and installation details can be found in SRK (2008a) and SRK (2008b).

Samples were collected from the tailings area wells in October 2007 and submitted for laboratory analyses including pH, conductivity, alkalinity, nitrate, nitrite, chloride, cyanide, and dissolved metals. Conductivity and pH were measured in the field.

Dam #3 Decant

During 2007/08, bucket-and-stopwatch measurements of Dam #3 decant volumes were made by ERDC staff on days that water was decanted. Daily water quality samples were collected and analysed for total zinc using ERDC’s on-site atomic absorption spectrophotometer.

2.3.2 Field Testing

Rinse pH and conductivity testing was carried out on all tailings samples collected in 2007. Tests were performed by mixing equal parts tailings and distilled water (by mass), letting the mixture stand for 5 to 15 minutes, and measuring the pH and conductivity (or TDS) of the supernatant water.

2.3.3 Laboratory Testing

Selection of Samples for Detailed Assessment

To better understand the geochemistry of the VTF tailings, it was necessary to undertake a variety of laboratory tests. To provide adequate coverage of the various tailings materials in a cost-effective manner, a subset of the available tailings samples was selected for detailed testing. Results from the rinse pH and conductivity tests were used to screen the available samples, with test samples selected to cover a range of age of tailings (old and new), saturated and unsaturated conditions, and typical and worst case rinse parameters. The six samples selected for detailed laboratory testing are listed in Table 2-1.

Table 2-1: Tailings Samples Selected for Detailed Assessment

Tailings Deposit	Test Pit	Sample	Depth (m)	Saturated/ Unsaturated	Rinse pH	Rinse Conductivity (µS/cm)	Rinse pH/ conductivity screen
Old Tailings	UKTP62007	B	0.37	Unsat	5.7	1174	Typical pH, lower cond. for unsat. Old Tailings
Old Tailings	UKTP72007	B	0.5	Unsat	5.2	5560	Lowest pH, highest cond. for Old Tails in area of TP7
Old Tailings	UKTP182007	D	1.3	Sat	5.7	2600	Lowest pH, highest cond. in Old Tailings in area of TP18
New Tailings	UKTP142007	C	0.2	Unsat	6.4	718	Typical pH, cond. for unsat. New Tailings in area of TP14
New Tailings	UKTP122007	B	0.45	Sat	6.8	1042	Typical pH, cond. for sat. New Tailings in area of TP12
New Tailings	UKTP82007	H	1.2	Unsat	5.3	9950	Lowest pH, highest cond. for unsat. New Tailings

Estimating Current Contaminant Loading

Shake flask extractions (SFEs) were carried out to measure the soluble load contained within the tailings samples. In addition to the six samples listed in Table 2-1, a SFE was carried out on a seventh sample collected from the 1950s-era tailings located in terraces on the hillside adjacent to the VTF access road. SFE testing was carried by Cantest Ltd. of Burnaby B.C. according to the 24 hour distilled water extraction method using a 3:1 ratio of water to solids, as specified in Price (1997).

Evaluating Potential for Increase in Metal Loadings Due to Acid Generation

Basic Characterization

A number of basic analyses were carried out by Cantest or by subcontactor laboratories to define the basic characteristics of the tailings samples selected for detailed characterization. These analyses consisted of:

- Elemental Analysis by aqua regia digestion followed by ICP-MS finish;
- Whole Rock Analysis by lithium metaborate fusion and x-ray fluorescence;
- Modified ABA, including Modified NP and sulphur speciation (i.e. determination of (S(T) and HCl-leachable S(SO_4)) by methods prescribed in MEND (1991);
- Total Carbon determination by Leco furnace and Total Inorganic Carbon (TIC) determined by carbonate removal by HCl leach followed determination of remaining carbon by Leco furnace; and
- NP determination with siderite correction, consisting of a standard Sobek NP determination with an addition of peroxide to ensure complete oxidation of iron and manganese ions released during carbonate dissolution (internal Cantest method based on Skousen et al. (1997)).

Short Term Weathering Tests

Three types of short term weathering tests were conducted as follows.

- Static Net Acid Generation (NAG) testing: this test consists of adding hydrogen peroxide (pH 5 to 5.5) to a small aliquot of sample (at a 100:1 mass ratio (i.e. 250mL 15% hydrogen peroxide: 2.5 g sample)) to rapidly oxidize sulphide minerals and allow the available neutralizing minerals to neutralize any acidity produced by oxidation (AMIRA 2002).
- Sequential Net Acid Generation (NAG) testing: this test is similar to the Static NAG test, with multiple sequential additions of hydrogen peroxide to the sample, and analysis of the liquor extracted at each step. This test is carried out to ensure complete oxidation of contained sulphides for samples with higher sulphide contents (AMIRA 2002).
- Acid Buffering Characteristic Curve (ABCC) procedure: this test involves slow titration of a sample with acid while continuously monitoring pH. Results can provide an indication of what portion of the NP measured in a sample is readily available for acid neutralisation (AMIRA 2002). Although the standard method specifies titration to an endpoint of pH 2.5, tests on the VTF samples were terminated at an endpoint of pH 4 due to the time-consuming and labour-intensive nature of the procedure. A pH 4 endpoint was considered appropriate, as it was the available buffering capacity above pH 4 that was of interest.

Mineralogical Testing

The six tailings samples selected for detailed evaluation were submitted for mineralogical determination by quantitative X-ray Diffraction with Rietveld refinement (XRD) and for petrographic examination by optical microscopy. XRD was conducted at the Department of Earth & Ocean Sciences at the University of British Columbia. Polished thin sections were prepared by Vancouver Petrographics and thin section descriptions were prepared by Craig Leitch (a mineralogical consultant associated with Vancouver Petrographics).

A selection of carbonate grains were identified optically in thin section, and these carbonate grains were subsequently assessed by electron microprobe to determine carbonate speciation. Electron microprobe analyses were conducted by Mati Raudsepp at the University of British Columbia's Department of Earth and Ocean Sciences.

2.4 Results

2.4.1 Test Pit Logs

Field observations of tailings stratigraphy, colour, and moisture content are summarized in test pit logs prepared by ACG (UK/TP/01-07 through UK/TP/19-07 inclusive)and SRK (UK/TP/22-07 and UK/TP/23-07). The logs include photographs of the test pit walls that illustrate the variation in colour from surface down through the weathering profile of the tailings (see Appendix C). Locations of test pits are shown in Figure 1.

2.4.2 Contact Testing

Rinse pH and conductivity results for the 2007 tailings samples are included with the individual test pit logs in Appendix C. For those locations where 1995 test pits were also located, results from 1995 rinse pH and conductivity testing are included for comparison. Results from the 1995 test pit UK/TP/02 are not shown, as tailings at this location are influenced by water treatment residues and residual lime as noted in Section 2.3.1.

The range of 1995 and 2007 paste pH results are plotted against sample depth in Figure 2. For those samples where both lab and field paste pH values were available, the lower of both values is plotted. The highest paste pH values (up to pH 8.8) were measured in the field for New Tailings from test pit UK/TP/01 in 1995. Where parallel lab paste pH measurements were conducted in 1995, resulting values were all less than pH 8 (see UK/TP/01 results in Appendix B). On this basis, the paste pH values in excess of pH 8 from 1995 are considered anomalous.

The lowest observed paste pH result (lab paste pH of 4.49) was obtained from a depth of 0.2 m in UK/TP/05 in 1995. This test pit is located near a sharp change in gradient in Porcupine Creek, where the steeper portion leading down from Elsa enters the flat valley bottom. Deeper samples from UK/TP/05 returned paste pH values of 5.1 (at 0.75 m depth) and 4.7 (at 1.2 m) depth, which (together with the 0.2 m sample) represent the three lowest paste pH values measured in 1995. It is likely that tails in this area have larger particle size and contain a higher proportion of the denser sulphide mineral grains than typical tailings (due to depositional characteristics), and this is supported the sulphur analyses from 1995, with several samples from UK/TP/05 and adjacent test pits returning around 4% total sulphur. Paste pH measurements on samples taken from this same area in 2007 were somewhat higher than in 1995, with all samples returning values of pH 5 or higher.

For the New Tailings, all samples having pH<6 were collected from UK/TP/08 (in 1995) and from UK/TP/08-07 (in 2007). This test pit is located on the hillside below the former tailings discharge point and was found to be unsaturated in both May and October 2007. The tailings in this area formed the ‘self-eroding fan’ below the discharge point, and are thought to be generally coarser grained and to contain a higher proportion of dense sulphide mineral grains than most of the New Tailings located lower in the valley. The paste pH values from the vicinity of UK/TP/08-07 indicate that the New Tailings on the hillside below the discharge point have weathering characteristics more like Old Tailings than like the New Tailings located lower in the flatter portion of the valley.

Paste pH values for samples of peat collected from each of the 2007 test pits are also shown in Figure 2. In general, the paste pH values of the peat reflect the paste pH of the overlying tailings, with peat underlying the Old Tailings have lower pH values. The lowest paste pH value for peat (pH 4.7) was observed from the peat sample collected from beneath the New Tailings at UK/TP/08-07.

The results show that there has been no overall progression towards increasingly acidic conditions in either the New Tailings or the Old Tailings in the intervening 12 years. The New Tailings in located in the valley bottm appear to have higher paste pH values (typical values around pH 7) than the Old Tailings (typical values around pH 6). The New Tailings located on the hillside below the discharge point appear to be weathering in a geochemically-similar manner to the Old Tailings. There is no strong pH trend with depth in either deposit, although nearly all values less than pH 6 were derived from a depth of 1.5 m or less. This apparent correlation of lower pH values with shallow depths may be a function of there being limited areas where deeper tailings exist for which the near-surface tailings have paste pH < 6.

2.4.3 Water Quality Analyses

Tailings Seepage and Ponded Test Pit Water

Water samples were collected and analysed from standing water in seven open May 2007 test pits and from one seep at the south end of the ditch crossing the New Tailings. Analytical results of water chemistry from the seep and the test pits are presented in Appendix D1. Sample locations are shown in Figure 1.

Tailings Porewater and Groundwater

A total of eight drive point water samples were collected in July and August 2007- analytical water chemistry results are presented in Appendix D2. Sample locations are shown in Figure 1. Based on the location (downgradient of Dam #3) and the uncertainty about the source of water sampled at VTF1 (groundwater, local standing water, or Dam #3 decant water), the water chemistry results from this station are not discussed further.

Tailings porewater samples were collected from wells H4S (Old Tailings) and H5S (New Tailings) in October 2007, along with groundwater samples from immediately beneath the tailings from H4D, H5D and H6D. Deeper groundwater samples were collected from the five monitoring wells (GT-7, GT-8, GT-9, GT-10 and GT-12) installed through the VTF dams. Water chemistry from samples collected from the monitoring wells is reported in Appendix D3, and a summary of dissolved concentrations of key parameters is provided in Table 2-12. Sample locations are shown in Figure 1.

Well H4S had the highest sulphate and dissolved metal concentrations of all groundwater monitoring stations. The field pH of 6.35 showed that conditions within the saturated tailings at H4S remain near neutral, however concentrations of sulphate (2760 mg/L), manganese (351 mg/L), zinc (194 mg/L), iron (73 mg/L), cadmium (1.3 mg/L), and lead (0.58 mg/L) indicate that sulphide oxidation and production of soluble metals is occurring in the overlying tailings, and that pH is being buffered at greater than pH 6 within the tailings mass. Well H4D (screened in original soil below the tailings at H4S) had elevated sulphate concentrations (840 mg/L) in October 2007, but relatively lower dissolved metal concentrations (e.g. manganese (10.4 mg/L) and zinc (0.032 mg/L). The difference in dissolved metal concentrations between H4S and H4D suggest that there is an important metal attenuation process occur between the two screen elevations; this concept is discussed further in Section 2.5.2.

Table 2-2: Dissolved Concentrations of Key Parameters in Tailings Porewater and Groundwater

Sample ID	GT7	GT8	GT9	GT10	GT12	H4S	H4D	H5S	H5D	H6D
Location	Dam 1	Dam 2	Dam 2	Dam 3	Dam 3	Old Tailings		Recent Tailings		
Screened material	Soil	Soil	Soil	Soil	Soil	Tailings	Soil	Tailings	Soil	Soil
Date Sampled	10/31/07	10/30/07	10/27/07	10/27/07	10/27/07	10/31/07	10/31/07	10/31/07	10/31/07	10/31/07
Field pH	7.37	7.4	7.48	7.31	7.95	6.38	7.05	8.73	7.14	6.84
Sulfate (mg/L)	442	308	335	327	250	2760	840	441	628	898
Cadmium (mg/L)	0.00079	0.00338	0.00001	0.00002	0.00004	1.34	0.00058	0.0106	0.00011	0.0004
Iron (mg/L)	44.3	47.1	29.7	35.7	1.42	73	20.4	4.73	17	50.6
Lead (mg/L)	0.0244	0.19	0.0002	0.0006	0.0007	0.583	0.0031	1.42	0.0043	0.001
Manganese (mg/L)	8.68	7.29	6.77	3.24	0.218	351	10.4	6.13	8.6	26.7
Zinc (mg/L)	0.036	0.169	0.002	0.005	0.006	194	0.032	0.476	0.027	0.044

Dam #3 Decant

Flow measurements of Dam #3 decant volumes were made by ERDC staff on the 128 days that water was decanted. On many of those days, decant volumes were greater than the maximum flows that could effectively be measured using the available 19 L (5 gallon) bucket. For days where time recorded to fill the bucket is reported as <1 second, a flow volume of 20 L/s was adopted as a crude indicator of discharge. This was necessary to account for the days with the greatest discharge volume, and likely represents a minimum accounting of both discharge and chemical loads. The adoption of flows of 20 L/s was also carried out for days where ‘siphon’ was reported in place of the bucket filling time (specifically August 15-18, 2008)- this also likely under-represents actual flows and chemical loads for those days.

Daily in-house total zinc analyses were carried out by ERDC on Dam #3 decant (dissolved zinc concentrations were not determined). Monitoring results are reported in Appendix D4. Table 2-3 summarizes the total decant volume and total zinc load in Dam #3 discharge (based on sum of daily discharge and load) for the one year period spanning November 2007 through October 2008.

Table 2-3: Estimates of Dam #3 Decant Volume, Total Zinc Load and Concentration

Dam #3 decant		
November 1, 2007 through October 31, 2008		
Discharge	Total Zinc Load	Average Total Zinc Concentration
(m^3)	(kg)	(mg/L)
150,718	14.9	0.099

Notes:

1. ‘Discharge’ is sum of daily discharge estimates based on daily instantaneous flow measurements (bucket-and -stopwatch procedure) during periods of discharge.
2. Total zinc load is calculated from daily discharge estimates and daily measurements of total zinc concentration.

2.4.4 Mineralogical Assessment

Petrographic descriptions of the six tailings samples selected from detailed assessment are provided in a report prepared by Vancouver Petrographics (Appendix E1). The report includes selected photomicrographs of the polished thin sections prepared from the selected tailings samples. Table 2-4 summarizes the visual estimates of mineral abundance for the six samples evaluated.

Semi-quantitative mineral abundances were determined by x-ray diffraction with Rietveld refinement. A report summarizing the procedural details and the analytical results is included as Appendix E2.

Table 2-5 summarizes the XRD determinations of mineral abundance for the six samples evaluated. Tailings sample were dominated by quartz and siderite, with up to 10% pyrite content and 1.9% sphalerite content.

Carbonate grains identified in thin section were identified optically and the cation abundance (Ca, Mg, Mn and Fe) of several carbonate grains in each thin section was determined by electron microbe. A report summarizing the analytical procedure and the resulting carbonate cation speciation is included as Appendix E3. Table 2-6 summarizes the cation content of the carbonate mineral grain identified in each sample as determined by electron microprobe. Figure 3 shows iron is the dominant cation for most grains analysed (ranging from 40 to 80% of cation population) with a significant manganese content (ranging from about 20 to 60% of cation population). Calcium plus magnesium content of the samples analyzed ranges from nearly absent to greater than 20% of the cation population, and averaged 9% in the grains analyzed for this investigation.

A subset of grains (9 of 40 grains analyzed from samples 12I and 14C) from the New Tailings that have higher iron content (>60% of cations), as shown by the grouping of points in the lower left corner of the plot in Figure 3. Notwithstanding this observation, the New and Old Tailings appear to have compositionally similar carbonate populations in a broad sense, as indicated by the largely-coincident plotting of cation compositions in Figure 3.

Most of the carbonate grains analyzed are classified as siderite since iron generally exceeds managanese, while those grains where manganese exceeds iron would be classified as rhodochrosite. In practical terms, the VTF carbonates are dominated by a mixed iron/ manganese solid solution that has previously been classified as manganoan siderite.

Table 2-4: Petrographic (Visual) Estimates of Mineral Abundance in Select Tailings Samples

	Mineral Phase										
Sample ID	**Quartz**	**Carbonate***	**Pyrite**	**Sphalerite**	**Galena**	**Chalcopyrite**	**Barite**	**Limonite (goethite, local lepidocrocite?)**	**Muscovite**	**Rutile**	**Total**
	%	%	%	%	%	%	%	%	%	%	%
6-B	50	35	5	1.5	<1	trace		5	2.5	<1	99
7-B	60	25	3	<1			1	7	3	<1	99
18-D	60	20	2	<1				12	5	<1	99
14-C	50	20	3	<1				20	5	<1	98
12-I	60	20	2	1				12	5		100
8-H	50	30	5	<1			1.5	10	3	<1	99.5

Note: Blank cells indicate the mineral phase was not observed.

*: Petrographic descriptions indicate carbonate may be siderite or ankerite, however definitive characterization will require other methods of mineralogical characterization.

Table 2-5: XRD Determinations of Mineral Abundance in Select Tailings Samples

	Mineral Phase (ideal formula in brackets)																
	Quartz	**Muscovite**	**Biotite**	**K-feldspar**	**Plagioclase**	**Clinochlore**	**Kaolinite**	**Gypsum**	**Bassanite ?**	**Siderite**	**Goethite**	**Pyrite**	**Sphalerite**	**Cerussite**	**Anglesite**	**Reinerite ?**	**Total**
	SiO2	KAl2AlSi3O10(OH)2	K(Mg,Fe2+)3AlSi3O10(OH)2	KAlSi3O8	NaAlSi3O8 – CaAl2Si2O8	(Mg,Fe2+)5Al(Si3Al)O10(OH)8	Al2Si2O5(OH)4	CaSO4·2H2O	CaSO4·0.5H2O	Fe2+CO3	a-Fe3+O(OH)	FeS2	(Zn,Fe)S	PbCO3	PbSO4	Zn3(As3+O3)2	
Sample ID	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %	Wt. %
6-B	37.1		3.8							47.2		10	1.9				100
7-B	64.6	7						2.1	0.9	18.7	4.2	1.9	0.5				100
18-D	58.3	9.5		3.2	6.7	3				14.1	3.4	0.8		0.6	0.5		100
14-C	59.2	12.9					5			12.6	10.3						100
12-I	57.8	18.4				2.3	1.5	3.5		11	3.8			1.6			100
8-H	49.8	15				1.5	1.7	2	0.8	23.9		2.2	0.7		1.4	1.1	100

Note: Blank cells indicate the mineral phase was not observed.

Table 2-6: Carbonate Cation Proportions in Select Tailings Samples as Determined By Electron Microprobe Analysis

	Carbonate Cation Content (as proportion of total)				
Sample ID	**MG2+**	**CA2+**	**MN2+**	**FE2+**	**Total**
6-B	8%	3%	35%	54%	100%
7-B	5%	2%	38%	55%	100%
18-D	7%	3%	36%	54%	100%
14-C	6%	3%	35%	56%	100%
12-I	5%	8%	34%	53%	100%
8-H	7%	2%	37%	54%	100%

2.4.5 Static Testing

Results of 24 hour distilled water SFEs on the six tailings samples selected for detailed assessment are provided in Appendix F1. Table 2-7 shows a summary of key SFE leachate concentrations, and a summary of soluble load per kilogram for selected parameters is shown in Table 2-8.

Table 2-7: Tailings SFE Results: Leachate Concentrations for Key Parameters

		Sample ID						
Parameter	**Units**	**6-B**	**7-B**	**18-D**	**8-H**	**12-I**	**14-C**	**UKTP23C**
Dissolved Cadmium Cd	mg/L	2.7	5	8	13	0.04	0.03	4
Dissolved Calcium Ca	mg/L	243	477	136	438	584	55	48
Dissolved Iron Fe	mg/L	0.01	0.01	< 0.01	0.04	0.02	< 0.01	< 0.01
Dissolved Lead Pb	mg/L	2.1	2.1	1.5	2.5	0.1	< 0.03	3.2
Dissolved Magnesium Mg	mg/L	17	161	127	585	31	23	57
Dissolved Manganese Mn	mg/L	167	1280	381	2870	0.8	0.7	96
Dissolved Silicon Si	mg/L	0.9	3.0	4	7	1.1	1.0	1.7
Dissolved Zinc Zn	mg/L	52	65	217	567	0.32	0.15	80
Dissolved Sulphate (calc. from ICP-S)	mg/L	978	4050	1788	9000	1461	138.9	600

Note: '<' indicates parameter concentration was less than detection in extraction test leachate.

Table 2-8: Tailings SFE Results: Soluble Loads for Key Parameters

		Sample ID						
Parameter	**Units**	**6-B**	**7-B**	**18-D**	**8-H**	**12-I**	**14-C**	**UKTP23C**
Soluble Cadmium Cd	mg/kg	8.1	15	23	40	0.12	0.09	12
Soluble Calcium Ca	mg/kg	729	1431	408	1314	1752	164	145
Soluble Iron Fe	mg/kg	0.03	0.03	N/A	0.12	0.06	N/A	N/A
Soluble Lead Pb	mg/kg	6.2	6.2	4.5	7.4	0.3	N/A	9.7
Soluble Magnesium Mg	mg/kg	50	483	381	1755	94	70	170
Soluble Manganese Mn	mg/kg	501	3840	1143	8610	2.3	2.1	287
Soluble Silicon Si	mg/kg	2.6	9.0	11	20	3.3	2.9	5.1
Soluble Zinc Zn	mg/kg	155	194	651	1701	0.96	0.45	239
Soluble Sulphate (calc. from ICP-S)	mg/kg	2934	12150	5364	27000	4383	417	1800

Note: 'N/A' indicates parameter was not detected in extraction test leachate.

Results of ABA testing on the six tailings samples selected for detailed assessment are provided in Appendix F2. A summary of tailings ABA results is shown in Table 2-9. Carbonate NP was calculated based on Total Carbon (TC) content rather than the reported Total Inorganic Carbon (TIC) content because the TC values determined by Leco furnace were in better agreement with the mineralogically-determined carbonate content of the samples.

Table 2-9: Summary of Tailings ABA Results

Sample ID	Paste pH	Total Carbon	Carbonate NP[1]	S (Total)	S (Sulphate)	S (Sulphide)	AP[2]	Modified NP[3]	Siderite-corrected NP[4]
		(Wt.%)	(Kg $CaCO_3$/T)	(Wt.%)	(Wt.%)	(Wt.%)	(Kg $CaCO_3$/T)		
6-B	5.86	4.29	358	6.45	0.22	6.23	195	149	164
7-B	5.63	1.89	158	1.76	0.72	1.04	33	30	43
18-D	6.38	4.88	407	0.69	0.27	0.42	13	42	67
8-H	5.59	3.58	298	2.71	1.27	1.44	45	27	43
12-I	7.8	1.62	135	0.54	0.25	0.29	9	62	74
14-C	7.39	1.36	113	0.35	0.09	0.26	8	66	92

1. Carbonate NP calculated from total carbon content.
2. AP= Acid Potential, calculated from S (Sulphide).
3. Modified NP= Modified Neutralization Potential, determined by MEND (1991) method.
4. Siderite-corrected NP = Neutralization potential detemined by Sobek method followed by peroxide addition.

Results of elemental determinations on the six tailings samples selected for detailed assessment are provided in Appendices F3 and F4. Selected tailings elemental determinations are shown in Table 2-10. A supplemental set of tailings elemental analyses provided by Alexco are included in Appendix F5 for reference purposes only- these supplemental results are not discussed further in this report.

Table 2-10: Selected Results from Tailings Elemental Content Determinations

Sample ID	Ag ppm	As ppm	Cd ppm	Cu ppm	Fe %	Mn Ppm	Pb ppm	S %	Sb ppm	Se ppm	Zn ppm
6-B	10.6	2564	173	180	18.5	24790	6731	5.5	191	2.4	9451
7-B	4.5	1329	72	145	10.9	17900	6178	1.6	70	1.6	5003
18-D	3.1	654	425	407	7.9	16690	16820	0.6	116	2.6	7077
8-H	4.8	1755	124	256	10.5	20490	9163	2.4	58	2.9	6952
12-I	3.2	743	125	250	8.3	16420	24840	0.5	256	2.9	4652
14-C	4	1072	181	162	12.3	22500	12860	0.3	170	2.8	4008

Analytical Methods:
ICP-MS Package: 0.5 gram sample digested in hot reverse aqua regia (soil, silt) or hot aqua regia (for rocks).

2.4.6 Short-term Weathering Tests

Results of Static NAG testing on the six tailings samples selected for detailed assessment are provided in Appendix G1, along with results from two additional samples tested. As shown in Table 2-11, all samples tested returned NAG pH values greater than 4.5.

Table 2-11: Static NAG pH and NAG Acidity for Tailings Samples

Sample ID	NAG pH	NAG Acidity to pH 4.5	NAG Acidity to pH 7.0
		(kg H_2SO_4/tonne)	(kg H_2SO_4/tonne)
6-B	4.77	0.0	41.6
7-B	5.6	0.0	2.2
18-D	7.14	0.0	0.0
8-H	6.37	0.0	1.7
12-I	6.62	0.0	0.4
14-C	6.82	0.0	0.3
UKTP22E	4.89	0.0	26.2
UKTP23C	6.21	0.0	0.6

Note: Initial H_2O_2 pH : 5.22

Results of Sequential NAG testing on the six tailings samples selected for detailed assessment are provided in Appendix G2. Although the NAG pH values determined in the Static NAG tests indicated that the tailings samples were unlikely to generate net acid, the Sequential NAG tests were undertaken to assess whether residual reactive sulphide minerals remained in the sample material following the initial addition of hydrogen peroxide. As shown in Table 2-12, all samples tested returned NAG pH values greater than 4.5 for both Stage 1 and Stage 2 NAG tests.

Table 2-12: Sequential NAG Test Results for Tailings Samples

Sample ID	Stage 1 Initial NAG Liquor pH	Stage 1 NAG Acidity to pH 4.5	Stage 1 NAG Acidity to pH 7.0	Stage 2 Initial NAG Liquor pH	Stage 2 NAG Acidity to pH 4.5	Stage 2 NAG Acidity to pH 7.0
	(pH Units)	(Kg H_2SO_4/T)	(Kg H_2SO_4/T)	(pH Units)	(Kg H_2SO_4/T)	(Kg H_2SO_4/T)
6-B	4.81	0.0	23.1	5.14	0.0	0.4
7-B	5.47	0.0	0.8	4.65	0.0	0.2
18-D	6.83	0.0	0.1	4.74	0.0	0.8
8-H	6.49	0.0	0.1	4.81	0.0	0.4
12-I	6.52	0.0	0.5	5.02	0.0	0.4
14-C	6.76	0.0	0.3	5.03	0.0	0.4

Note: Stage 1: Initial H_2O_2 pH : 5.22; Stage 2: Initial H_2O_2 pH : 5.40

Results of ABCC tests on the six tailings samples selected for detailed assessment are provided in Appendix G3. A summary of the buffering capacity indicated for each sample to selected pH levels is presented in Table 2-13.

Table 2-13: Summary of ABCC test results for Tailings Samples

Sample ID	Buffering capacity to pH 6	Buffering capacity to pH 5	Buffering capacity to pH 4
	kg $CaCO_3$/t	kg $CaCO_3$/t	kg $CaCO_3$/t
6-B	-	2.5	12.5
7-B	-	4.5	14.5
18-D	2.5	10.0	15.0
8-H	-	9.0	21.0
12-I	11.2	25.0	31.3
14-C	2.5	5.6	11.3

Note: ABCC results reported in units of kg H_2SO_4/t.

2.5 Discussion and Conclusions

2.5.1 Contaminants of Potential Concern

Review of tailings porewater chemistry from drive points, monitoring wells, and seeps has pointed to zinc and cadmium as primary contaminants of concern. There is a lesser degree of concern for a number of other elements: antimony, arsenic, cobalt, iron, lead, manganese and nickel. These elements are unlikely to drive selection of closure options, but are present at sufficient concentrations in one or more of the data sets reviewed to warrant consideration (see Minnow (2008) for a detailed review of contaminants of concern in receiving waters). The following discussions will focus on zinc, with the understanding that cadmium tends to behave in a geochemically similar manner.

2.5.2 Estimating Current Contaminant Loading

Current Loadings via Groundwater and Surface Water

Current contaminant loading exiting the VTF occurs through both surface water and groundwater pathways. These pathways report to the west of Dam 3 and to the Porcupine Diversion.

Portions of Porcupine Creek, Brefalt Creek, and the Porcupine Diversion traverse exposed tailings deposits. Ongoing erosion and alluvial transport of tailings occurs to varying degrees, and these physical processes are thought to be responsible for most of the contaminant loading to the Porcupine Diversion and lower Flat Creek. Estimates of contaminant flux within the Porcupine Diversion have been developed as part of the site water and load balance developed by ERDC (ERDC 2007). As all VTF closure options being considered include provisions for isolating the tailings from the surface flows, contaminant loadings via this pathway will be minimized in closure. For this reason, and because the magnitude of current Pocupine Diversion loadings is thought to vary with the amount of erosion occurring, loadings reporting to the Porcupine Diversion were not considered in detail.

Contaminant flux via groundwater along the Porcupine Diversion flow path has not been assessed in detail. However, gradients inferred as part of the VTF groundwater assessment(SRK 2008a) indicate that groundwater in the vicinity of the Old Tailings along Porcupine Creek flows northwest towards Dam 3 (along the original alignment of Flat Creek) rather than due west along the present alignment of the diversion.

The present understanding of VTF hydrogeology is that groundwater below the New Tailings flows towards the west roughly along the original alignment of North Fork Flat Creek, and that groundwater flows from area above the Porcupine Diversion towards Dam 3 roughly along the original alignment of Flat Creek. Virtually all groundwater is thought to leave the VTF via the unconsolidated silty gravels underlying Dam 3 (SRK 2008a). Similarly, all surface water leaving the VTF does so via the Dam 3 decant (excluding Porcupine Creek). Using these conceptual models of surface and groundwater hydrology, the water and load fluxes from the VTF can be estimated.

Groundwater chemistry is monitored at Dam 3 in wells GT10 and GT12. Zinc concentrations from October 2007 monitoring (0.005 mg/L in GT10 and 0.006 mg/L in GT12) were used together with the estimated annual groundwater flux (SRK 2008a) of 18 m^3/day to arrive at an estimated zinc load of 0.04 kg Zn/year reporting from the VTF west of Dam #3 via groundwater.

Surface water from the facility is discharged seasonally either through the Dam 3 decant culvert, or by siphoning water over the dam from Pond 3. As discussed in Section 2.4.3, zinc flux leaving the VTF is estimated to be at least 14.9 kg/ year, based on daily monitoring records gathered from November 2007 to October 2008. As was noted, the surface water zinc load is almost certainly somewhat higher than 14.9 kg/yr due to underestimation of Dam #3 decant volumes during peak flows. The combined annual zinc loading estimate leaving the VTF via surface water and groundwater is therefore estimated to be at least 15 kg (>14.9 kg via Dam #3 decant and 0.036 kg via groundwater), and it is clear that the most of the zinc leaving the VTF does so via surface water.

A sensitivity analysis carried out as part of the 2007 groundwater assessment suggested an upper bound on the groundwater flux beneath Dam #3 on the order of 2075 m^3/day (SRK 2008a). At this upper bound groundwater flux, groundwater zinc loading would be 4.2 kg/year, or roughly 25% of the load from the VTF. It is clear that, given the groundwater zinc concentrations observed in 2007, the total zinc load leaving the VTF is not particularly sensitive to the groundwater flux estimate.

Current water management within the VTF includes seasonal lime addition to the Pond 1 decant water as required to lower total zinc concentrations in Pond 3 to less than the discharge limit of 0.5 mg/L. The zinc load removed through lime addition can be estimated from the mass of lime consumed annually at the VTF with an allowance for treatment efficiency. For simple lime addition systems, lime efficiency is commonly in the range of 30%. In 2008, 5.95 tonnes of lime (as CaO) were consumed in VTF water treatment, and a rough estimate of zinc removed from water within the VTF was 2100 kg.

Tailings Porewater Chemistry and the Role of Attenuation

The preceding section discusses the magnitude of zinc loads that leave the VTF annually, with estimated magnitudes of surface water and groundwater loads reflecting zinc concentrations typically less than 0.5 mg/L at Dam 3 (in Pond 3 discharge and in wells GT10 and GT12). These low zinc concentrations in water leaving the VTF are in contrast to some of the measured porewater zinc concentrations discussed in Section 2.4.3. In particular, the porewater within the Old Tailings deposit had zinc concentrations in the 200 to 300 mg/L range (at H4S and at Ditch Seep) in October 2007.

Infiltration of precipitation into the tailings deposits displaces an equivalent volume of porewater. However, the water chemistry in Pond 3, in groundwater beneath the tailings (wells H4D, H5D and H6D), and in groundwater downgradient of the tailings (wells GT7, GT8, GT9, GT10 and GT12) all indicate that contaminant flux out of the tailings is much less than that indicated by zinc concentrations in the Old Tailings porewater. Groundwater sulphate concentrations in the range of hundreds of mg/L, both beneath the tailings and downgradient, indicate that sulphate loading from the tailings is reporting to these monitoring points and that these wells are therefore adequately intercepting the tailings seepage plume. The zinc and sulphate concentrations in tailings porewater and groundwater lead to two conclusions: first, that water chemistry in the existing monitoring wells reflects the influence of tailings seepage, and second, that there is a significant degree of attenuation of zinc and other metals that is occurring.

The monitoring wells installed within and beneath the Old Tailings (H4S and H4D) provide strong evidence that this attenuation process occurs in the peat that is present at the interface between the tailings and the original ground. Monitoring well H4S is screened entirely within the tailings and yielded porewater containing 194 mg/L dissolved zinc and 2794 mg/L sulphate in October 2007. The adjacent monitoring well H4D is screened in silty gravel immediately below the 3 metre thick peat layer, and October 2007 dissolved zinc and sulphate concentrations were 0.48 and 441 mg/L respectively. The sulphate concentrations between the two monitoring points are reduced by about a factor of 6, whereas zinc concentrations are reduced approximately 400 times. Other metals were reduced by lesser factors, including cadmium (126-fold reduction), manganese (57-fold reduction) and iron (15-fold reduction).

At present, the attenuating process that is occurring in the VTF peat is not known, however other studies of zinc attenuation suggest that sorption onto organic matter plays an important role.

- One such study, undertaken along the flowpath of the untreated Galkeno 300 discharge in 2000 found that, under near-surface conditions, attenuation in peat occurred largely by adsorption to organic matter and by co-precipitation of zinc with manganese oxide minerals (MacGregor, 2002).

- Another study conducted on the Rose Creek tailings facility at the Faro Mine in 2005 found that zinc was being removed from tailings porewater by sorption onto peat. Testing of peat samples recovered from beneath the tailings area found high zinc concentrations in the organic material, and good correlations between zinc concentration and organic carbon. Attenuated zinc mass was found to be typically 8 to 9% of the mass of organic carbon, with individual estimates ranging up to 24% (mass Zn/mass C) (SRK, 2006). There was no evidence that the zinc removal capacity was exhausted at these levels of attenuation.

Although the Rose Creek peat may have had slightly higher or lower capacity to attenuate zinc, the typical attenuation of 9% Zn per unit of organic carbon can be used to determine the scale of attenuation capacity that is likely to be provided by the peat underlying the VTF. Assuming a peat dry bulk density of 250 kg/m^3 and an average organic carbon content of 39% (Hossain, 2006), a peat layer one metre thick could attenuate about 9 kg of zinc per m^2 of plan surface area.

Observed peat thicknesses were 3 m (H4D), 2 m (H5D), and 0.5 m (H6D). The flatter areas (at H4D and H5D) appeared to have thicker accumulations of peat, with the Old Tailings borehole (H4D) returning the thickest intersection of peat. Using the parameters noted above, 2 m of peat could attenuate about 18 kg of zinc per unit of plan surface area, and a 3m thick peat layer could attenuate about 26 kg zinc/ m^2.

The total mass of zinc contained within the tailings provides an upper bound for total zinc that could possibly be leached from the tailings over time. The average zinc content of the Old Tailings samples tested in 2007 was 0.5% Zn. Assuming an average 2 m thickness of tailings, and using a tailings bulk density of 2000 kg/m^3, the estimated total mass of zinc in the Old Tailings is equivalent to about 21 kg Zn per m^2 of surface area.

The average contained zinc mass of 21 kg/m^2 is in the range of attenuation capacity of 2 to 3 m of peat by sorption processes alone. There are a number of other geochemical processes which may also contribute to limiting zinc flux from the VTF, including: sorption to iron hydroxides and manganese oxides, both within the tailings and potentially within the peat and underlying mineral soils; sorption to clays in the underlying mineral soils; and potentially sulphate reduction and precipitation of metal sulphides within the peat and in underlying mineral soils.

Complete leaching of all contained zinc from the tailings is highly unlikely due to several factors. One is that a considerable portion of the tailings are presently saturated, and any zinc sulphide minerals are isolated from atmospheric oxygen. Secondly, iron oxyhydroxides and manganese oxides within the tailings are effective scavengers of zinc ions from solution through sorption and coprecipitation, and will act to retain zinc within the tailings deposit.

In summary, there appears to be sufficient capacity within the underlying peat to attenuate all the zinc contained within the tailings (should it be released) by sorption alone. There are other processes that are likely to be occurring to varying degrees which will enhance the attenuation capacity provided by the peat. Finally, it is unlikely that 100% of the contained zinc would be leached out of the tailings. Considering all these factors, it is unlikely that zinc loadings to the underlying aquifer will increase significantly in future.

This conclusion relies on an assumption that the tailings will not become strongly acidic, and that sorption within the peat will remain important. The development of strongly acidic conditions could cause release of any metals sorbed to the peat. For this reason it is still necessary to assess the acid generation potential of the tailings; the following section provides a discussion of this topic.

2.5.3 Evaluating Potential for Increase in Metal Loadings Due to Acid Generation

Assessment of AP

Pyritic Sulphur

AP reported from ABA analyses was compared against the AP value calculated from the pyrite abundance reported for each sample by XRD (AP_{XRD}). The results of this comparison are summarized in Table 2-14, which illustrates that the reported AP values are a conservative representation of the pyritic sulphur content of the samples tested, with AP exceeding AP_{XRD} by up to 22% for the samples with the highest sulphur content (6-B and 8-H).

No pyrite was detected by XRD for the samples with the lowest sulphur content (12-I and 14-C)- this is consistent with the lower limits of the XRD method (reliable lower limits of quantitation are typically around 1%). Pyrite was positively identified in both 12-I and 14-C during petrographic examination. Sphalerite (ZnS) was also identified petrographically while being less than XRD detection levels- for low sulphur tailings such as samples 12-I and 14-C (<0.3% sulphide-S), non pyrite sulphur from sphalerite and other species may form a significant component of AP.

Table 2-14: Comparison of Pyrite Content of Tailings and Laboratory-Determined AP

Sample ID	Pyrite Abundance by XRD	XRD Pyritic Sulphur (calculated)	AP_{XRD}	Sulphide Sulphur[(1)]	AP[(2)]	AP/ AP_{XRD}
	%	%	kg $CaCO_3$/ tonne	%	kg $CaCO_3$/ tonne	ratio
6-B	10	5.3	167	6.23	195	1.17
7-B	1.9	1.0	32	1.04	33	1.02
18-D	0.8	0.4	13	0.42	13	0.98
14-C	0	0	0	0.26	8.1	N/A(3)
12-I	0	0	0	0.29	9.1	N/A(3)
8-H	2.2	1.2	37	1.44	45	1.22

Notes:
(1) Sulphide sulphur calcuated by difference (Total Sulphur - Sulphate Sulphur (determined by HCl leach)).
(2) AP calculated from Sulphide Sulphur.
(3) 'N/A' indicates ratio not applicable

Other Sulphur Species

Base metal sulphides (chiefly sphalerite (ZnS), with lesser galena (PbS) and chalcopyrite ($CuFeS_2$)) were identified petrographically (Table 2-4). However, sphalerite was the only base metal sulphide sufficiently abundant to be quantified by XRD (Table 2-5) and was only detected in three of six samples. The petrographic and XRD results broadly agree with the ICP-determined base metal content of the samples (Table 2-10) and confirm that the dominant sulphide mineral is pyrite.

For tailings with the highest zinc contents (in the range of 1 to 2% zinc), the sulphide sulphur contained in sphalerite would result in an overestimation of pyritic sulphur by 0.5 to 1%. This overestimation of pyritic sulphur would translate to an overestimation of actual AP by up to 31 kg $CaCO_3$ equivalent/tonne. For example, sample 6-B was determined to contain 1.9% sphalerite; the contained sulphide sulphur (0.62%) corresponds to 19 kg $CaCO_3$ equivalent/tonne, which accounts for the bulk of the difference between AP and AP_{XRD} for this sample (Table 2-14).

Sulphate sulphur was determined as part of ABA testing (Table 2-9) by leaching with HCl and determined sulphate content of the leachate by gravimetric methods. However, the HCl leach procedure does not dissolve barite (barium sulphate) or anglesite (lead sulphate), and since sulphide sulphur (S_{2-}) is calculated as the difference between total sulphur (S_T) and HCl-leachable sulphate sulphur (S_{SO4}), any insoluble sulphate ends up reporting to S_{S2-} and thus causing AP to be overestimated.

- Barite evaluation: barium concentrations (determined by XRF- see Appendix F4) were low (maximum of 0.15% Ba) and corresponding sulphate sulphur concentrations were low (up to 0.02%). With a maximum AP equivalent of 0.7 kg $CaCO_3$ equivalent/tonne in the samples tested, it appears that barite-hosted sulphur does not significantly contribute to widespread overestimation of AP. Although barite was identified in two samples petrographically, no barite was detected in XRD analyses.

- Anglesite evaluation: anglesite was identified by XRD in two of six samples (1.4% in 8-H and 0.5% in 18-D (Table 2-5)) with corresponding sulphate sulphur of 0.15% and 0.05% (AP of 4.7 and 1.5 kg $CaCO_3$ equivalent/ tonne, respectively). These results suggest that insoluble anglesite- hosted sulphur may result in overestimation of AP that is significant only where tailings have low total sulphur content.

Summary of AP Evaluation

Table 2-15 shows the potential contribution of non-pyrite sulphur hosted in sphalerite (ZnS), galena (PbS), anglesite ($PbSO_4$), and barite ($BaSO_4$) to the AP reported from ABA testing, along with an estimate of Pyrite AP that reflects discounting of non-pyrite sulphur for the six samples evaluated in detail. Although this method of evaluation relies on several assumptions (chiefly that ZnS, PbS, $PbSO_4$, and $BaSO_4$ are the primary hosts of Zn, Pb, and Ba), the results suggest that non-pyrite sulphur can lead to overestimation of AP by a factor of nearly 50% for VTF tailings with a measured AP up to 45 kg $CaCO_3$ equivalent/ tonne. For those tailings with lower AP (<20 kg $CaCO_3$ equivalent/ tonne) and elevated Pb and Zn content, the non-pyrite forms of sulphur may constitute the majority of the AP reported from ABA tests.

Table 2-15: Potential Influence of Non-pyrite Sulphur Minerals on AP Determination

Age of Tailings	Sample ID	$S_{Zn}^{(1)}$	$S_{Pb}^{(2)}$	$S_{Bar}^{(3)}$	$AP^{(4)}$	Pyrite $AP^{(5)}$	Pyrite AP: AP
		(kg $CaCO_3$ equiv/t)					ratio
Old	6-B	14	3.3	0.1	195	177	0.91
Old	7-B	8	3.0	0.2	33	22	0.67
New	8-H	8	4.4	0.4	45	33	0.72
New	12-I	11	6.0	0.7	9	-8	-0.91
New	14-C	5	6.2	0.5	8	-4	-0.50
Old	18-D	7	5.9	0.4	13	0	-0.02

(1) S_{Zn} = estimated S contained in ZnS, assuming all analytical zinc is hosted in ZnS.

(2) S_{Pb} = estimated S contained in PbS and $PbSO_4$. Calculated from analytical Pb content, less Pb contained in XRD-indicated PbCO3.

(2) S_{Bar} = estimated S contained in $BaSO_4$, assuming all analytical barium is hosted in $BaSO_4$.

(4) AP = acid potential determined in ABA tests

(5) Pyrite AP = AP - S_{Zn} -$S_{Pb\ -Sbar}$

Therefore, AP values determined in ABA tests are a conservative indicators of VTF tailings properties, with measured AP exceeding actual tailings pyrite content by 10 to 30% for all samples, and by a considerably greater portion in tailings with reported AP values less than 45 kg $CaCO_3$ equivalent/ tonne.

Assessment of NP

Effects of Method of NP determination

The results of parallel Modified NP and Siderite Corrected NP (Table 2-9) showed that both methods returned similar NP values, with Siderite Corrected NP values typically exceeding Modified NP values. These results indicate that there is sufficient time for complete oxidation of reduced iron and manganese during the Modified NP test, and that there is no need to include a hydrogen peroxide addition step to obtain a NP value for VTF tailings. This conclusion is in agreement with literature reports of oxidation of reduced iron in the Modified NP test (Jambor 2003).

Carbonate Mineralogy

The VTF tailings have a high carbonate content that consists almost exlcusively of manganoan siderite containing a combined average of 9% calcium and magnesium (mol (Ca+Mg)/ mol cations), with manganese comprising about 35% of the cation population and iron making up the balance (roughly 55%). The samples tested contained between 12.6 and 47.2% siderite by mass, as indicated by X-ray Diffraction analyses.

XRD also identified cerussite ($PbCO_3$) in two of six samples tested (0.6% in sample 18-D and 1.6% in sample 12-I). Cerrussite will dissolve readily to neutralize acid in the same manner as calcite and dolomite.

Other Minerals With Neutralization Potential

Clinochlore was identified in three samples by XRD and ranged from 1.5 to 4% of the samples by mass. Clinochlore is a chlorite-group aluminosilicate mineral that is known to contribute to NP faster than most other silicate minerals (Jambor et al. 2002). Dissolution of clinochlore may contribute to both laboratory measurements of NP and to actual neutralization of acid in the VTF to a small degree.

Role of Manganese and Iron in VTF Carbonate Weathering

Iron and manganese carbonates contain the reduced divalent form of the respective cations (Fe^{2+} and Mn^{2+}). Under fully oxidizing neutral pH conditions, iron and manganese carbonates do not contribute to effective neutralization of acid because the reduced cations undergo oxidation. This oxidation process generates the same amount of acidity that is consumed during dissolution, and the overall process is neither acid producing or acid consuming. However, where conditions are not fully oxidizing, iron and manganese ions can remain in the reduced form, and the stability of the reduced ions is increased as pH conditions transition from neutral pH towards more acidic conditions (Martin 2005).

Figure 4 shows a pair Eh-pH diagrams for iron and manganese that were plotted using The Geochemist's Workbench (Bethke 2008), a geochemical modelling software package that can be used to assess chemical speciation under equilibrium conditions. The Eh-pH plots were prepared to reflect dissolved species and mineral precipitates that commonly control Fe and Mn behaviour in the natural environment (Martin 2005), with Fe and Mn concentrations (1 mmol each) and temperature (5°C) set to approximate conditions within the VTF. These diagrams provide a useful framework from which to consider the dynamics of iron and manganese within the VTF.

As discussed in Section 2.3.2, VTF tailings range from unsaturated to saturated and pH conditions typically range from 5.5 to 7.5. Within this pH range, the reduced form of manganese (Mn^{2+}) is favoured over a wide range of Eh conditions and the reduced form of iron (Fe^{2+}) is favoured over a more restricted range of conditions, as shown for both elements in Figure 4. The stability fields of reduced iron and manganese are shown as blue fields bounded by red lines, with the adjacent yellow fields indicating conditions where mineral precipitates containing oxidized iron and manganese are favoured. The position of the red boundary lines provide an indication of the Eh conditions that are required to favour oxidation of the reduced ions and the generation of acid through hydrolysis.

Typical Eh conditions at the tailings surface are likely to be in the range of 0.5 V. At this Eh, oxidation of Fe^{2+} would be favoured and precipitation of iron oxyhydroxide minerals would be expected. Below the tailings surface, Eh would transition to more reducing conditions, in part facilitated by consumption of oxygen through sulphide oxidation. At some depth, Eh becomes sufficiently low that the reduced Fe^{2+} ion is favoured (corresponding to a transition from the $Fe(OH)_3$ stability field (yellow) to the Fe^{2+} stability field (blue) in Figure 4), and from this depth iron will move through the system with tailings porewater and the underlying groundwater. Evidence of this transition from iron oxidizing to iron reducing conditions can be found in the photographs of May 2007 test pits in Appendix C- the upper profile in most test pits displays the characteristic orange colouration associated with iron oxyhydroxide minerals, while grey unoxidized tailings are present at depth in several test pits.

In contrast, the reduced Mn^{2+} ion is the thermodynamically stable form of manganese under most of the Eh conditions described above. Most manganese liberated from siderite under these conditions will remain as Mn^{2+} and will move through the tailings and groundwater system without oxidizing and generating protons through hydrolysis. This mobility of reduced manganese is further enhanced by kinetic limitations to manganese oxidation even under thermodynamically favourable conditions ((Hem 1989); Stumm and Morgan 1981).

Summary of NP Evaluation

NP in the VTF tailings is dominated by mixed iron manganese carbonate mineral that contains minor calcium and magnesium. This mineral species has a typical composition of $Fe_{0.55}Mn_{0.35}(Ca,Mg)_{0.1}CO_3$. The calcium and magnesium component of this mineral provide NP under all weathering conditions, and the Mn component provides NP under all but the most oxdizing weathering conditions for the pH conditions observed at the VTF. The iron component provides NP under moderately reducing conditions such as occur in the saturated zone and perhaps under unsaturated conditions where oxygen is limited due to consumption by sulphide oxidation.

Short-term Weathering Tests

Both Static NAG and Sequential NAG tests returned NAG pH values greater than 4.5 for all samples and all iterations. These results suggest that there is sufficient neutralization potential within the samples tested to offset the acidity produced by rapid oxidation of contained sulphides and to cause the samples to be net acid neutralizing.

Results of the ABCC tests indicated that there was between 11 and 31 kg $CaCO_3$ equivalent/ tonne of NP that was reactive above pH 4. These results are in apparent contrast with both the Modified NP and the Siderite-Corrected NP in that the ABCC results appear to indicate a much lower Neutralization Potential that is available at neutral and slightly acidic pH values. The ABCC test results are thought to be somewhat less reliable than other test results based on the limited utilization of the procedure in the broader mine waste field, the common reliance on parallel testing of mineral standards to calibrate interpretation of results, and the lack of familiarity with the procedure on the part of the analytical staff.

Geochemical Performance of Other Tailings Facilities Containing Siderite

The process of buffering of pH between values of 4.8 to 6.3 by dissolution of siderite is reported in the literature (e.g Blowes et al. 2003) and has been observed at several sulphide tailings storage facilities (e.g. Nordic Main tailings, Elliott Lake district, Ontario (Morin et al. 1988)). Laboratory column studies have also demonstrated buffering of tailings pH by siderite dissolution (Jurjovec et al. 2002).

This siderite buffering process relies on transport of dissolved ferrous iron (Fe^{2+}) out of the tailings impoundment via groundwater. Where ferrous iron becomes oxidized to ferric iron and precipitates as iron oxyhydroxide minerals, hydrogen ions are produced. However, if the iron oxidation occurs downgradient of the tailings deposit, the resulting acid cannot consume NP within the tailings and cannot increase leaching of metals from the tailings.

Comparison of NP and AP

Of the six VTF samples selected for detailed mineralogical and chemical study, the three samples with the highest sulphur content were classified as potentially acid generating (PAG) based on

NP/AP ratios less than 1 during preliminary static geochemical characterization. All three (6-B, 7-B, and 8-H) were slightly acidic at the time of testing (paste pH 5.59 to 5.86), which suggests buffering of pH by siderite dissolution.

The three PAG samples were used to evaluate whether the Ca+Mg+Mn component of siderite would be consumed before the AP was fully oxidized. The first step in the evaluation was determining the Ca+Mg+Mn component of the siderite using the cation molar ratios determined by EMPA. The corresponding NP ($NP_{Ca+Mg+Mn}$) was then compared with the raw AP value reported from ABA testing (Table 2-16). The resulting $NP_{Ca+Mg+Mn}$ /AP ratio was greater than 1 for all three samples initially classified as PAG, indicating that there is sufficient NP present within these samples to neutralize acid produced by oxidation of the contained sulphide minerals. No correction was made for overestimation of AP due to non-pyrite sulphur. This conclusion would be further strengthened if the correction for sulphur hosted in sphalerite, galena, anglesite, and barite was included.

The lowest $NP_{Ca+Mg+Mn}$/AP value corresponded to sample 6-B; this sample had the highest total sulphur content of all samples analyzed in both 1995 and 2007, and serves to demonstrate how even portions of the tailings with elevated sulphur content can remain buffered within the moderately acidic pH range that reflects siderite weathering. This evidence does not preclude local development of pH values less than 5, but does demonstrate that widespread evolution of tailings pH to more acidic levels is not likely to develop.

Table 2-16: Comparison of AP and Mineralogical NP

Sample ID	ABA Results			XRD Results			EMPA Results				Estimated NP from siderite				Mineralogical NP/AP
	AP(1)	NP(2)	NP/AP	Siderite	Pyrite	Sphalerite	Molar fraction of cations in siderite				NP_{Mn}(3)	NP_{Ca}(4)	NP_{Mg}(5)	$NP_{Ca+Mg+Mn}$(6)	$NP_{Ca+Mg+Mn}$/AP
	kg $CaCO_3$/ t	kg $CaCO_3$/ t	ratio	%	%	%	Mg	Ca	Mn	Fe	kg $CaCO_3$/ t				ratio
6-B	195	149	0.8	47.2	10	1.9	8%	3%	35%	54%	144	14	45	203	1.04
7-B	33	30	0.9	18.7	1.9	0.5	5%	2%	38%	55%	62	4	11	77	2.4
18-D	13	42	3.2	14.1	0.8	0	7%	3%	36%	54%	44	4	12	60	4.6
14-C	8	66	8.1	12.6	0	0	6%	3%	35%	56%	38	4	9	51	6.3
12-I	9	62	6.8	11	0	0	5%	8%	34%	53%	33	9	7	48	5.3
8-H	45	27	0.6	23.9	2.2	0.7	7%	2%	37%	54%	77	5	20	102	2.3

(1) AP = Acid potential, calculated from sulphide sulphur determined by difference (Total Sulphur - HCl-soluble Sulphate Sulphur) (MEND 1991).

(2) NP = Modified neutralization potential (MEND 1991).

(3) NP_{Mn} = Neutralization potential from Mn component of XRD-determined siderite.

(4) NP_{Ca} = Neutralization potential from Ca component of XRD-determined siderite.

(5) NP_{Mg} = Neutralization potential from Mg component of XRD-determined siderite.

(6) $NP_{Ca+Mg+Mn}$ = Sum of NP_{Ca}, NP_{Mg} and $NP_{Mn.}$

2.6 Conclusions and Recommendations

2.6.1 Current Contaminant Loading

Contaminants leave the VTF via two main pathways: via surface flows in Porcupine Diversion, and via surface and groundwater flow paths that report east of Dam 3. Zinc and cadmium are the primary contaminants of concern, with the study focussing on zinc as the primary indicator of contaminant flux.

Monitoring results indicate that zinc loads leaving via the Dam 3 route are in the range of a few tens of kg of zinc annually. Chemical flux via groundwater appears to be inconsequential, as both water flux and contaminant concentrations are much lower for groundwater below Dam 3 than for surface discharge.

Elevated zinc concentrations (up to 300 mg/L) were indicated at several locations within the Old Tailings. These elevated zinc concentrations are not reflected in the observed surface water or groundwater chemistry, and it seems likely that zinc is being removed as tailings porewater infiltrates through the peat which underlies the VTF. In contrast, the maximum observed zinc concentration in New Tailings porewater was 2 mg/L.

A scoping assessment was carried out to estimate the magnitude of zinc attenuation potential in the peat horizon beneath the VTF tailings. Observed rates of zinc attenuation on peat under the Rose Creek tailings at Faro Mine were compared the logged thickness of peat in VTF drillholes. The result of this order-of-magntiude assessment suggests that the VTF peat has the capacity to attenuate a mass of zinc similar to the total mass contained within the tailings solids through sorption processes alone, provided strongly acidic pH conditions do not develop. In addition, other geochemical processes, such as sulphate reduction and precipitation of dissolved metals as sulphide minerals, may also contribute to attenuation of metals. Therefore, it is unlikely that loadings to the groundwater beneath the VTF will increase significantly in future.

Current contaminant loadings along the Porcupine Diversion flow path are considered to be largely a function of the active erosion of tailings solids and the reworking of tailings solids within the stream channel. Contaminant flux via the Porcupine Diversion has been evaluated as part of the development of the site water and load balance, and was not considered further as part of this study. Groundwater is not expected to move parallel to the Porcupine Diversion- water level elevations recorded in 2007 indicated that groundwater in the vicinity of the Old Tailings east of the Porcupine Diversion flows northwest towards Dam 3.

Treatment of VTF surface water is carried out for a short period of time during each freshet to reduce zinc concentrations in Pond 3 to below permitted discharge levels. In 2008, 5.95 tonnes of lime was used for treatment, which corresponded to removal of roughly 2000 kg of zinc from VTF surface water. On this basis, current zinc loading to to the environment would be higher by 2 orders of magnitude in the absence of water treatment.

The present understanding of loading to VTF surface water does not support assigning load to specific sources. Freshet runoff from exposed tailings may be responsible for the bulk of the loading, however the displacement of porewater by freshet infiltration may also be a factor.

If surface runoff is the main source of chemical load to VTF surface water, then closure measures that isolate the tailings surface from runoff (such as a simple cover) will effectively mitigate this load. If porewater displacement is significant, then some level of load will continue to report to surface water as shallow flow through the tailings mass under a simple cover scenario.

2.6.2 Potential for Increased Contaminant Loading due to Acidification

Tailings mineralogy was evaluated to determine the mineral sources of acid potential (AP) and neutralization potential (NP) and to evaluate the risk of widespread development of strongly acid weathering conditions at the VTF.

Pyrite was found to be the only significant mineral with acid potential in the VTF tailings. Standard AP determinations attempt to quantify pyrite content indirectly, by measuring total sulphur (S(T)) and HCl-leachable sulphate sulphur ($S(SO_4)$), and attributing the difference to sulphide sulphur (S^{2-}). S^{2-} is then assumed to be hosted entirely by pyrite, and stoichiometrically converted to AP units (kg $CaCO_3$ equivalent/tonne).

For the VTF tailings, there are other sulphur minerals (chiefly sphalerite (ZnS) and anglesite ($PbSO_4$ - an HCl-insoluble sulphate)) that are reflected in conventional AP values, but do not generate acid on weathering. The presence of these non-pyrite sulphur hosts was commonly found to cause AP to overestimate pyrite acid potential (AP_{Py}) by 10 to 30%.

Neutralization Potential in the Valley Tailings is hosted in a mixed carbonate mineral, referred to as manganoan siderite and having a typical composition of $(Ca_{0.04}Mg_{0.06}Mn_{0.36}Fe_{0.54})CO_3$. The calcium and magnesium components act to neutralize acid in the same manner as calcite or dolomite, however the contribution of iron and manganese carbonate to neutralization of acid under field conditions is complicated by the redox-active nature of these elements.

Under the oxidizing conditions present in a laboratory determination of Modified NP, the iron and manganese ions are oxidized and H^+ ions are released. The released H^+ ions in turn react with any available buffering capacity, and the result is that there is no net contribution to measured NP from iron or manganese carbonate. However, under field conditions, oxidation of Mn^{2+} does not readily occur for both thermodynamic and kinetic reasons, and as such no H^+ ions are generated. Similarly, under moderately reducing conditions Fe^{2+} may also remain in the reduced form. Where Mn^{2+} and Fe^{2+} are stable, dissolution of manganese and iron carbonates is a reliable acid neutralization mechanism, and effective NP values can be higher than those measured in laboratory tests.

Three of the six VTF samples examined in detail had conventional NP/AP ratios of less than one. When the mineralogically-indicated value for neutralization potential from the calcium, magnesium, and manganese portion of siderite ($NP_{Ca+Mg+Mn}$) was inserted in place of NP, the ratio for all three samples was greater than 1. In this evaluation, no allowance was made for neutralization from the iron component of siderite, or for the XRD-indicated presence of sphalerite as a non-pyrite host of sulphur. Both are conservative factors that provide a measure of contingency to the conclusion that none of the samples tested will develop strongly acidic weathering conditions in situ.

One of the samples subjected to detailed mineralogical characterization (sample 6-B) had the highest total sulphur content of all tailings samples analyzed in 1995 and in 2007. The $NP_{Ca+Mg+Mn}/AP>1$ result for sample 6-B provides a measure of confidence that widespread highly acidic pH conditions will not develop even for those tails with higher sulphur concentrations. The implications of the mineralogical findings for future contaminant loadings from the VTF as a whole are that widespread, highly acidic (pH<4) conditions are not expected to develop. Consequently, no big increase in contaminant generation is expected, and no significant remobilization of sorbed zinc is anticipated. Therefore, current contaminant loadings can be considered to provide a good indication of the magnitude of future loadings.

2.6.3 Recommendations

Remediation Considerations

Under a ‘minimal effort’ closure scenario where the current tailings distribution is maintained, contaminant loadings from the VTF via groundwater are not expected to get significantly worse. Water treatment will continue to provide an effective tool to reduce surface loads leaving the VTF to acceptable levels, either through the present practice of lime treatment or through other methods. Continued oxidation of tailings is likely to lead to near-surface tailings pH values in the range of pH 5 to 6 across the VTF. At that pH, surface loadings of zinc from tailings that are currently neutral would increase and treatment demand would increase accordingly. However, zinc would continue to be removed from any infiltrating water as it passes through the underlying peat.

In considering remedial options that include some relocation of tailings, those tailings moved from below the water table to above the water table would be subject to these same oxidation reactions. Any tailings left in an unsaturated condition should be covered to minimize the potential for increasing zinc loadings in surface runoff.

For closure options where tailings are to be moved from unsaturated conditions to locations where saturation is likely, consideration should be given to neutralising any soluble metals present from prior oxidation.

If the objective is to reduce long-term surface water treatment requirements, then tailings cover designs will need to be optimized. It may also be necessary to evaluate whether a lined channel is required to convey flows over or past the Old Tailings, as metal concentrations in Old Tailings porewater are high and groundwater discharge to the channel could be a significant source of chemical load to any re-established stream. Long term evolution of pore water in the New Tailings should be considered when evaluating the need for lining of channels over or past the New Tailings.

Additional Monitoring to Support Remediation Design

The present understanding of VTF geochemistry is adequate for evaluating the various closure options and for supporting the selection of a final closure option. However, there are some pieces of information that should be gathered now to support remediation designs once a closure option has been selected.

There remains some uncertainty about the zinc loading from the VTF and the Porcupine Diversion to Flat Creek. Resolving some of this uncertainty may have implications for the remedial designs for these facilities. The following recommendations aim to achieve a better understanding of sources of zinc load within the VTF and zinc flux to Flat Creek below the VTF.

- Improve measurement of Dam #3 decant volumes
    - The current estimates of zinc flux from the VTF via the decant are poorly constrained, chiefly due to the current flow measuring system’s inability to accurately measure flow rates during periods of high flow. Better decant volume estimates would also facilitate calibration of the water and load balance.
    - A volume-time measurement method of flow measurement using a large calibrated container such as a graduated barrel would greatly increase the capacity to measure the highest flow volumes with reasonable precision.
- Improve understanding of flow and load in the Porcupine Diversion
    - The present understanding of zinc sources to water flowing through the Porcupine Diversion does not differentiate between flushing of physically eroded tailings and seepage of porewater into the diversion from in-situ tailings. Implications for remedial design include determination of whether surface water channels will require low permeability liners to prevent tailings seepage from reporting to surface water.

Any closure option that involves surface flow over or adjacent to tailings would benefit from understanding whether lateral (shallow) seepage through tailings would result in surface water zinc concentrations that require treatment prior to discharge. The presently-available information is not sufficient to determine the loadings to VTF surface water generated by surface runoff and by lateral seepage.

- Improve the understanding of water and load flux between Ponds #1, #2 and #3.
    - Current sources of zinc loading to VTF surface water are poorly understood. Understanding zinc flux into Pond #1 via North Fork Flat Creek, out of Pond #1, out of Pond #2, and in the Pond #3 decant would permit estimates of zinc flux from both the New and Old Tailings. Implications for remediation design include identifying

the major sources of load, determining whether load mitigation is necessary, and designing mitigative measures.

  - Monitoring during winter conditions would minimize or eliminate the confounding influence of loadings generated by tailings surface runoff. Evolution of pond chemistry over the winter period may allow estimation of lateral seepage loads to the ponds.

    - Monitoring of both dissolved and total metals, at least initially, would permit an assessment of the role of suspend tailings particles and other solids in compliance monitoring. Implications include identifying whether surface runoff or tailings porewater efflux are dominant sources of load and designing appropriate mitigative measures.

Any option that relies on attenuation to minimize metal loadings to groundwater would benefit from a better understanding of the attenuation mechanism(s).

- Investigate the nature of the geochemical process(es) responsible for the metal removal occurring within the peat and mineral soils underlying the VTF tailings.

  - Understanding the metal removal processes will provide insight into the attenuation capacity of the system, and into the stability of the attenuated species under more acidic conditions.

  - A combination of field monitoring of aqueous geochemical conditions, laboratory analysis of dissolved species, laboratory testing on solids, and perhaps geochemical modelling will likely be necessary to determine whether sorption is the only significant attenuating process, or whether other geochemical processes are also contributing.

3 Waste Rock Geochemistry

3.1 Introduction

Previous assessments of waste rock geochemistry at the various dumps within the former UKHM site were reasonably comprehensive with respect to solids geochemistry. At least one sample had been analyzed for metals and ABA parameters from most of the large waste rock dumps (those having estimated tonnage >25,000 tonnes).

This chapter summarizes the results of previous geochemical characterization programs and presents new ABA and leach extraction results from tests carried out in 2007. A scoping assessment is presented that evaluates the potential for release of significant metal loads from the various waste rock piles, and the results of the mineralogical characterization of tailings are reviewed in the context of waste rock at the site. Finally, an updated waste rock decision matrix is provided that summarizes information relevant to evaluating closure options for each waste rock pile.

3.2 Background

3.2.1 Operational History

Mining and exploration activity on the former UKHM property from 1936 through 1989 resulted in development of approximately 70 waste rock piles ranging in size from less than 100 tonnes to greater than 1 million tonnes. The largest waste dumps are related to open pit mining during the 1970s and 1980s. No formal waste dump designs have been identified in the operational records, and it is considered that all dumps were constructed without formal engineering consideration.

Waste rock produced during open pit mining tends to be coarse and blocky due to the scale of the production equipment used. In the Keno Hill silver district, pits were developed to exploit steeply dipping, relatively narrow vein mineralization. The resulting pit geometry generally resulted in most of the open pit waste rock being produced from hanging wall rocks, with a relatively minor contribution from mineralized waste vein material. The mineralized waste displays partial to complete oxidation of original sulphide minerals, as pit-minable resources were generally shallow and in communication with the atmosphere.

In contrast, waste rock produced during underground mining tends to be finer grained due to the smaller scale of underground development and the blasting and waste handling methods employed. Most underground development within the Keno Hill silver district occurred by drifting along vein structures. The resulting dumps typically contain a high proportion of barren and mineralized vein material, with a higher sulphide mineral content than open pit waste dumps. In many cases, mineralized vein material that was considered waste at the time of mining was later recovered from the respective underground waste rock dump and used as mill feed. Operational records indicate that, at the time operations ceased, a number of dumps contained material of sufficient grade that they were considered potential sources of mill feed.

3.2.2 Previous geochemical characterization

1995 through 1997 Geochemical Testing

A waste rock geochemistry study was carried out from 1995 through 1997 in support of the closure plan being developed as part of UKHM's efforts to restart production at the site. Design and results of this program are discussed in detail in the 1996 Site Characterization Report (AMC 1996) and in the 1996 Geochemical Testing Report (Broughton, 1996).

The mine rock testing program was undertaken to better understand the range of geochemical characteristics at several of the major mines, the potential for acid generation and acid rock drainage, the potential for metal leaching, and the extent to which storage of oxidation products and leaching had occurred in different rock types.

Samples were collected from test pits or excavator trenches, with roughly 60 kg of material collected into 20L pails at each location. Brief field descriptions documented rock type, colour, percentage of material > 3" (7.6 mm) and presence of sulphide minerals.

Static mine rock testing included measurements of paste pH and conductivity, elemental analysis, and ABA testing. Static test results were used to select seven samples to represent the four main rock units in the Keno Hill district and mixtures of those rocks, and these samples were subject to laboratory column testing. The columns contained 30 to 56 kg of <4" (10.2 cm) material and vertical flowpath lengths of 35 to 46 cm. Tests were trickle leached with 0.5 L of water on a weekly basis for 30 weeks, and leachate was analyzed (initially weekly for 22 weeks, then biweekly).

The following conclusions were drawn from the results of the 1996 column testing.

- Buff quartzite (Column 1): This rock unit typically had low NP and low AP values- the sample tested higher slightly higher NP, and higher AP, than was typical for the buff quartzite unit. NP/AP was 0.7. Sulphate and metal release were lower than for all other tests, reflecting the low reactivity of the rock. The column developed acidic pH conditions (down to pH 3.85) after 30 weeks of testing, however significant acidic conditions were not expected to develop in the waste dumps due to the low overall sulphur content of the rock type and to typical buff quartzite having lower AP than the column test sample.

- Grey quartzite (Column 3, Column 10): Grey quartzite from the Ruby dump (Column 3, NP/AP = 1) and from the Keno 700 dump (Column 10- NP/AP = 1.2) was tested. This material had higher NP, AP, and metal contents that the buff quartzite. Both columns had neutral pH leachate over the duration of testing, and depletion calculations showed that AP would be expected to be depleted slightly before NP in both cases. Sulphate release from both columns was high relative to other columns, and metal release was correlated with metal content of the column test charges.

- Schist (Column 8, Column 9): A sample from the Hector Adit dump (Column 8, NP/AP = 1.3) and a composite of Bermingham, Calumet and Onek pit wall and waste rock (Column 9, NP/AP = 3.8) were tested. Both columns had neutral pH leachate over the duration of testing, and depletion calculations showed that AP would be expected to be depleted slightly before NP in both cases. Column 8 had higher sulphate and metal release rates than Column 9, and these rates were high relative to production from other columns as well.

- Mixed acidic waste (Column 4, Column 5): These columns were replicates, testing a mixture of quartzite, schist, ore and mineralized vein waste collected from the Dixie dump. Acid conditions were well developed in this material prior to initiation of testing, and no NP remained in the test material. These columns generated high rates of sulphate and metal release. Depletion calculations suggested that contained sulphide minerals would be fully oxidized within 3 years at laboratory oxidation rates.

- Vein and ore (Column 6): Test material was collected from ore stockpiles located on the Bermingham dump and had an NP/AP ratio of 5.8. Leachate in the early stages of testing was slightly acid, and a large stored load of soluble salts was flushed during this period. Leachate pH evolved to neutral conditions by the eight leaching cycle and remained neutral for the duration of the test. Only Mn and Zn were released at elevated rates during the latter stages of the test.

3.2.3 Additional information required to assess closure options

Several information gaps relating to waste rock geochemistry were identified during the development of work plans for 2007 closure studies. To support evaluation of closure options, a work plan was developed which included:

- Assessing whether large dumps, dumps near water courses, and dumps expected to generate ARD are adequately characterized;

- Assessing whether a regional trend in ARD potential exists running WSW to ENE;

- Conducting waste rock dump seepage surveys;

- Evaluating the potential for significant contaminant loading to receiving environments using a water and load balance approach;

- Assess the need for mineralogical information on waste dumps to interpret waste rock ABA data; and

- Assessing closure options on a dump by dump basis.

3.3 Methods

3.3.1 Review and Compilation of Existing Geochemical Data

Existing ABA data from the 1995 investigations (AMC 1996) and the 1999 investigations (PWGSC 2000) were compiled by ACG, and the data were reviewed to assess the potential for generating ARD from waste rock piles at the various sites. ABA tests were carried out according to the Modified Sobek procedure (MEND 1991), including determination of both total and sulphate sulphur.

No toe seepage data were available for any dumps.

All dumps within the former UKHM claim block were categorized according to estimated contained tonnage. Dump tonnages were sourced primarily from the Site Characterization Report (AMC 1996), with supplementary data from PWGSC (2000). The dumps were then subdivided into four groups on the basis of contained tonnage: Category A- >100 000 tons; Category B- 10 000 to 100 000 tons; Category C- 1 000 to 10 000 tons; Category D- <1 000 tons. Imperial tons were used for categorization purposes.

To identify any site conditions that required consideration for each dump, a matrix was developed that consisted of the categorized dumps, a suite of closure considerations, and various candidate closure options.

3.3.2 Scoping Assessment of Potential For Contaminant Loading

Samples For Geochemical Testing

Samples collected for geochemical testing during the 1995 sampling program were stored in 20 L plastic pails in Elsa. These samples were revisited by ACG in 2007 and aliquots of 47 samples were retrieved for further laboratory testing. During the storage period, the sample material was likely subject to ongoing oxidation under prevailing temperatures at the site. However, as no flushing occurred during storage, the stored samples likely accumulated a higher soluble load than the source waste rock over this time period. It is assumed that oxygen concentrations within the pails were sufficient to support oxidation of sulphide minerals.

Field and Laboratory Testing

ABA testing (total sulphur, sulphate sulphur by both HCl and $NaCO_3$ leach, inorganic carbon, and Sobek NP) and elemental analysis (four acid digestion with ICP-AES finish) were carried out at ALS Chemex in North Vancouver. Shake flask extractions were carried out at ALS Environmental in Vancouver according to the 24 hour distilled water extraction method (Price 1997).

As waste dump toe seeps provide a direct route for measuring seepage chemistry, a toe seep survey was conducted at several of the larger dumps in October 2007. At the same time, a number of solids samples were collected from selected dumps for rinse pH and conductivity testing to supplement the existing information regarding current geochemical weathering conditions. These samples were hand sorted to remove particles larger than 0.5 cm, then the fine grained portions were mixed with distilled water at a 1:1 mass ratio. The mixture was allowed to settle for approximately 15 minutes and pH and conductivity were measured on the supernatant.

Scoping Assessment of Annual Loadings from Waste Rock Piles

Results from the shake flask extraction tests were used to develop reasonable worst-case estimates of current chemical loading from individual waste rock piles. Worst-case loading estimates were then compared to known load sources to evaluate whether loading from waste rock piles is likely to be significant at a district scale.

Shake flask extractions (SFEs) provide a measure of the soluble mass of products of sulphide mineral oxidation in a given mass of rock, and the tests are designed to be sufficiently dilute that the extracting fluid remains undersaturated with respect to soluble secondary minerals. Results are typically presented in units of mg/L, which can be converted to units of 'mg/kg of waste rock' using the volume of water and mass of rock employed in the extraction test. The biggest challenge in using SFE data lies in determining how to scale the results to evaluate the rate of production and flushing of oxidation products from full scale facilities.

In a waste rock pile with ongoing sulphide oxidation, a portion of the soluble weathering products will be flushed from the pile by infiltrating water and surface runoff and the remainder will be retained within the waste rock pile as a stored soluble load. Factors that control the amount of soluble mass stored within a rock pile include a) the fraction of the waste rock mass that is contacted by infiltrating porewater, and b) saturation of porewater with respect to secondary mineral species (which prevents otherwise-soluble minerals from dissolving and being removed). Precise determination of the importance of these two factors is challenging, but some reasonable assumptions can be made to facilitate a scoping assessment.

The samples available for SFEs had been stored under cover in plastic pails for 12 years prior to SFE testing in 2007. For purposes of this assessment, it is assumed that oxygen concentrations within the pails did not limit the progress of oxidation. Over the period of storage, oxidation of contained sulphide minerals would have proceeded and all secondary oxidation products would have been retained within the rock sample due to the lack of flushing. The soluble load measured in the SFE tests represents both the initial stored load present at the time of sample collection, as well as the accumulated load generated during the storage period.

To simplify the scoping assessment of loading potential, it was assumed that 100% of the stored load measured in the 2007 SFEs had been generated over the 12 year storage period. This assumption is conservative, in that it results in higher calculated rates of metal production than if the original soluble load was accounted for. Annual production rates were estimated by simply dividing the total load measured in SFE tests by the assumed period of production (i.e. 12 years).

A first pass assessment was undertaken to identify SFE results that indicated significant soluble oxidation products were being generated. As an initial screening criterion, samples were flagged for further consideration where SFE results, when applied to the entire mass of the respective dump, the annual soluble zinc production exceeded 273 kg/year. The value of 273 kg Zn/year is the calculated loading from the Bermingham 200 adit (ERDC 2007) as shown in the 2006 zinc mass loading balance. This adit was selected for comparison purposes because it represents a point source of elevated chemical load that is remote from receiving water bodies and for which the chemical load appears to be attenuated locally along the downgradient flowpath. These conditions are analogous to most of the waste rock piles on site, except that seepage from waste rock would be somewhat less point source in nature.

Those samples flagged by the initial screen were reviewed in greater detail, including review of sample descriptions and comparison of flagged results with other results from the same waste rock pile (where available). Refinements to scoping calculations were carried out to evaluate whether allowances for storage of oxidation products and for the larger particle size distributions expected in full scale dumps would reduce loads below those observed at the Bermingham 200 adit. A scaling factor of 50% was applied to account for storage and an additional scaling factor of 50% was applied to account for the lower reactive surface area due to larger particle sizes in full scale dumps relative to the SFE test material.

Finally, porewater metal concentrations that would result if the annual load produced were dissolved in infiltrating water were calculated as a check on whether there might be mineral solubility constraints that could limit contaminant flux from the dumps. These concentrations were estimated for a 1m^2 column of rock by allowing an annual infiltration of 300 mm[1] (ERDC 2007) to pass through the average height of waste rock in each dump. This was carried out not as a prediction of seepage chemistry, but as a scoping assessment to evaluate whether waste dump loadings could be significant in the context of the major known load sources in the district.

3.3.3 Evaluate Requirement for Detailed Mineralogical Testing on Waste Rock

The results of mineralogical testing on tailings samples were reviewed to evaluate whether detailed mineralogical information is necessary for interpretation of waste rock ABA data. Consideration was given to the mineralogical distribution of sulphur (which determines the Acid Potential (AP) portion of the Acid-Base Account) and to carbonates and other minerals that contribute to Neutralization Potential.

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[1] Based on mean annual runoff (MAR) from the site water and load balance for the catchment defined as ‘No Cash Creek above LES-21’. The elevation adopted for this catchment is closest to the elevation of the Hector Adit dump

3.4 Results and Discussion

3.4.1 Waste Rock Geochemical Characterization

Results from previous waste rock geochemical characterization are provided in Appendix H1 through H4. These results included ABA, elemental content and leach extraction data and samples descriptions- original results and discussion can be found in AMC (1996), Broughton (1996), and PWGSC (2000).

A selected suite of samples originally collected and tested in 1995 were retrieved from storage and subjected to additional testing in 2007. Source locations and descriptions of the samples retrieved can be found in Appendix H5, ABA and elemental content results can be found in Appendix H6, and leach extraction results can be found in Appendix H7.

In broad terms, waste rock piles sourced from underground development tend to have higher sulphur and soluble metal content. Most of the larger dumps (those containing greater than 30 000 tonnes of rock) have been tested by at least one sample, and geochemical characterization is considered to be adequate for selection of closure options. Exceptions include:

- the Galkeno 300 dump and the No Cash 500 dump, for which no ABA data has been identified;
- limited characterization of the waste rock used as construction fill within the Elsa townsite; and
- no geochemical characterization for the Coral & Wigwam and Calumet C-Structure dumps. However, both these dumps are thought to contain largely overburden material that is relatively chemically inert.

3.4.2 Regional Trend in Potential for ARD

Waste rock at the west southwest end of the district appears to have a higher propensity for developing acid weathering conditions. Acidic conditions have been observed in waste rock at the following sites (moving west to east): Silver King; Husky SW; Husky; Elsa; and Dixie. East of the Dixie mine, local evidence of acid generation is observed at isolated locations within individual dumps, but most dumps remain largely near neutral. Sites east of Dixie that display larger scale acid weathering include the Eagle site (outside of, but adjacent to, the former UKHM claim block) and portions of the Flame & Moth, Galkeno 900 adit and Onek 400 adit waste rock. It is clear that the western end of the district has a higher potential to develop acid weathering conditions in exposed rock, but also that local acid weathering conditions have been observed towards the eastern end of the district. Figure 5 illustrates this pattern, with lower NP/AP ratios and acidic paste pH values typical of the western-most waste rock dumps.

3.4.3 Assessment of Potential For Chemical Loadings from Waste Rock

The absence of waste rock pile seepage from nearly all dumps prevents a clear understanding of leaching rates of metals and other oxidation products. To assess the potential scale of leaching and transport of oxidation products from waste rocks dumps to the aquatic receiving environment, a series of scoping calculations were carried out. As zinc is the primary metal of concern, the following discussion focuses on zinc, however the calculations indicate that the discussion applies to other oxidation products as well.

The scoping calculation method is described in detail in Section 3.3.2. The following is a summary of the calculation steps and assumptions.

- Soluble load measured in SFE was assumed to be generated over the 12 year storage period; total load was divided by 12 years to determine annual rate of load generation (mg/kg/year).
- Annual load flushed (mg/kg/year) was calculated from annual load generated (mg/kg/year) reduced by 50% storage factor (to account for soluble load not flushed from waste rock pile) and by a further 50% to account for the lower reactive surface are of in-situ waste rock.
- The annual load flushed (mg/kg/year) was multiplied by the dump mass and mass conversion factors to produce an estimate of total annual loading from each dump (kg/dump/year).

For the various waste dumps, the upper bound annual load was calculated based on each SFE result as though the material tested was representative of the entire waste rock pile. For those dumps where more than one sample was tested, this approach resulted in a range of upper bound annual load estimates that provide some indication of chemical variability within a particular waste rock pile. Table 3-1 summarizes the results of this screening assessment of waste rock loading, along with annual loads generated by other better-constrained sources within the former UKHM claim block.

The highest upper bound load shown in Table 3-1 corresponds to Bermingham Dump sample 95UKHBD03. This sample consisted of vein material from a remnant ore stockpile on top of the Bermingham Dump. The large upper bound load was calculated assuming the entire Bermingham Dump volume was made up of this material- this is clearly not the case, as indicated by the results from other Bermingham dump and pit samples.

Scoping load estimates for the Hector Adit dump were calculated independently from three separate samples. Results of these calculations span two orders of magnitude and reflect the variable nature of leaching characteristics that can occur within a waste rock pile. Two of the three load estimates exceed those calculated from all other waste dumps, with the exception of the Bermingham Dump vein sample noted above. These load estimates, together with the high component of underground waste vein material and the relatively large size of the Hector Adit dump, indicate that this dump has the highest potential for generating contaminant loadings to the immediate environment.

Notwithstanding the conclusion that the Hector Adit dump has the highest potential to generate a contaminant load, a number of further points bear consideration.

- Scoping load estimates discussed above are predicated on a number of conservative assumptions- actual chemical loadings are expected to be lower than the upper bound estimates developed for screening purposes. The anomalous Bermingham Dump vein sample aside, the upper bound estimates of load from the various dumps are of similar magnitude to better constrained sources of load (e.g. the Bermingham 200 adit discharge and the No Cash 500 adit discharge).

- Sandy Creek was estimated to have an annual zinc load of 325 kg/year where it crosses the Silver Trail Highway. The upgradient catchment contains a number of potential sources of zinc load, including the Hector underground workings, the Hector Adit dump, the Townsite dump, the Hector Pit dump, and possibly the Calumet Pit dumps. The Sandy Creek zinc load may provide an upper limit to the loading from the Hector Adit and other zinc sources to the aquatic receiving environment of the South McQuesten River.

- The South McQuesten River is reportedly isolated from surface water originating in the Sandy Creek drainage by several kilometres of low gradient wetland and black spruce/ sphagnum moss forest. Water quality monitoring along the stretch of the South McQuesten River that could conceivably be receiving chemical loading from the Sandy Creek drainage has not shown any evidence that there is in fact a measurable chemical load that originates from this source.

Table 3-1: Screening Assessment of Potential Zinc Loading from Waste Rock Piles

Site	Sample ID	Zn_kg/yr	Notes
Dixie	95UKHDD01	8.3	Acidic sample
Dixie	95UKHDD02	161	Acidic sample
Dixie	95UKHDD03	33	Acidic sample
Bermingham Pit	95UKHBP01	6.7	
Bermingham Pit	95UKHBP02	0.5	
Bermingham Pit	95UKHBP03	0.9	
Bermingham Pit	95UKHBP04	0.7	
Bermingham Pit	95UKHBP06	0.7	
Bermingham Pit	95UKHBP07	0.6	
Bermingham Dump	95UKHBD01	3.7	
Bermingham Dump	95UKHBD02	8.4	
Bermingham Dump	95UKHBD03	22,623	Sample was oxidized vein material from remnant ore stockpile
Bermingham Dump	95UKHBD04	29.9	
Bermingham Dump	95UKHBD05	1.5	

Table 3-1: Screening Assessment of Zinc Loading from Waste Rock Piles (cont'd.)

Bermingham Dump	95UKHBD06	89.3	
Ruby	95UKHRD01	0.2	
Ruby	95UKHRD02	27	
Ruby	95UKHRD03	1.0	
Calumet 1-15 Dump	95UKHCD01	1.8	
Calumet 1-15 Dump	95UKHCD02	37	Mildly acidic sample
Calumet 1-15 Dump	95UKHCD03	2.9	
Calumet 1-15 Pit	95UKHCP01	1.1	
Calumet 1-15 Pit	95UKHCP02	11	Mildly acidic sample
Husky SW	95UKHWD01	4.2	Acidic sample
Hector Pit dump	95UKHCD04	5.8	
Miller Dump	95UKHMD01	0.1	
Hector Adit dump	95UKHHD01	3,110	Collected from top of dump
Hector Adit dump	95UKHHD02	369	Collected from top of dump
Hector Adit dump	95UKHHD03	41	Collected from bottom of dump
Sime Pit	95UKHSP01	5.1	
Sime Pit	95UKHSP02	0.9	
Sime Pit	95UKHSP03	0.3	
Sime Pit	95UKHSP04	0.8	
Sime Pit	95UKHSP05	2.2	
Sime dump	95UKHSD01	1.2	
Keno 700 dump	95UKHKD01	2.7	
Keno 700 dump	95UKHKD02	0.3	
UN Adit dump	95UKHUD01	0.0	
Townsite	95UKHTD01	234	
Townsite	95UKHTD02	13.8	
Bellekeno 625	95UKHLD01	0.2	
Silver King Pit Dump	95UKHVD01	31.0	Acidic sample
Galkeno 900	95UKGK901	9.9	Acidic sample
No Cash 500 Adit	*N/A*[1]	*2,407*	*2006 estimate*
Ruby 400 Adit	*N/A*[1]	*78*	*2006 estimate*
Bermingham 200 Adit	*N/A*[1]	*273*	*2006 estimate*
Sandy Creek catchment[2]	*N/A*[1]	*325*	*2006 estimate*
Flat Creek catchment above KV-9	*N/A*[1]	*382*	*2006 estimate*

1. Loads from 2006 site-wide water and load balance (ERDC 2007),

2. Catchment contains Hector Adit Dump, Calumet and Hector Pit dumps, Townsite adit dump, and Hector underground workings.

3.4.4 Assessment of Need for Detailed Mineralogical Testing on Waste Rock

Tailings mineralogy was evaluated through optical microscopy, x-ray diffraction with Rietveld refinement, and electron microprobe analysis of carbonate grains. Results of the tailings mineralogy investigations are summarized in Table 2-4, Table 2-5 and Table 2-6.

Sulphur Minerals

Sulphur minerals in the tailings included sulphides and sulphates. Pyrite was the dominant sulphide mineral, with minor galena and sphalerite identified. Sulphate minerals included gypsum (calcium sulphate), a species tentatively identified as bassanite (chemically similar to gypsum), barite (barium sulphate) and anglesite (lead sulphate).

In calculating AP, all sulphur that is not leached out during the sulphate determination by HCl leach is assumed to be sulphide sulphur hosted by pyrite. If a significant portion of the sulphide sulphur is hosted by galena and sphalerite, errors will be introduced to the AP calculation as oxidation of galena and sphalerite do not generate net acidity. For the tailings, the pyrite content was significantly in excess of the galena and sphalerite content, likely due to the removal of galena and sphalerite during mineral processing. No systematic correction was applied to reported AP values for tailings to adjust for base metal sulphide sulphur, and the degree to which AP values exceed the actual acid potential from pyrite provides a measure of conservatism.

For waste rock, galena and sphalerite could be more important sulphur hosts than in the tailings, particularly for those dumps where vein material that did not make ore grade was disposed with other waste rock. To asses how important this factor might be, the zinc and lead concentrations in the waste rock samples tested in 2007 were used to calculate an upper limit of sphalerite-sulphur and galena-sulphur, respectively, that could be present if all the zinc and lead were in sulphide form. Results of these calcuations showed that the samples tested may contain up to 0.87% sulphur hosted in sphalerite and galena, which would correspond to an overestimate of the AP of these samples by about 27 kg $CaCO_3$/ tonne. This overestimate will cause the corresponding NP/AP ratios to be conservatively low. The Hector Adit dump samples had the highest zinc concentrations, suggesting that AP values reported for this dump may significantly overestimate the actual acid generating potential of the rock.

Several of the Bermingham Pit dump samples had sufficient zinc content that sphalerite-hosted sulphur could cause AP to be overestimated by a significant percentage; however, all Bermingham Pit dump samples have conventional NP/AP values greater than 2, and are classified as non-PAG despite the potential overestimation of AP due to sphalerite.

Another mineralogical complication that can arise in the interpretation of AP results stems from the presence of sulphate minerals that resist dissolution by the HCl and $NaCO_3$ used in sulphate sulphur determinations. Barite and anglesite are known to resist dissolution, and the sulphate sulphur contained in these minerals is not reliably reflected in sulphate sulphur determinations. The resulting underestimation of sulphate sulphur would correspond to an overestimation of sulphide sulphur and a higher AP value for a sample. While barite was identified petrographically in the tailings study, no barite was identified by XRD and barium analyses by XRF indicated that barite was an insignificant sulphur host in the tailings. The likelihood of significant barite-hosted sulphur in the waste rock was therefore considered to be low.

Review of lead content for rock samples tested in 2007 showed that the maximum possible anglesite-hosted sulphur content for those samples was 0.15% (determined for one of the Townsite dump samples (95UKHTD02) with high lead and silver content). This corresponds to a maximum overestimation of AP by 19 kg $CaCO_3$ equivalent/ tonne. The actual AP value for this same sample was 3.8 kg $CaCO_3$ equivalent/ tonne, and it is likely that anglesite is a proportionally-important sulphur host for this sample.

Two other samples tested show similar characteristics of high lead and silver content and low AP (Calumet 1-15 pit dump samples 95UKHCD02 (total sulphur of 0.17%, paste pH= 6.1) and 95UKHCD03 (total sulphur of 0.14%, paste pH= 6.7)). The two Calumet 1-15 dump samples contained no detectable inorganic carbon, which rules out $PbCO_3$ as a mineral host of lead, and there is insufficient sulphur in the samples for all lead to be hosted in galena. It is therefore likely that anglesite is an important sulphur host for these samples. Both samples have conventional NP/AP values of less than 1 (due to low measured NP), which suggests that these materials are PAG using a standard NP/AP criteria of 1. However, AP is likely overestimated due to anglesite sulphur. Given both the low AP, and given the probability of a high proportion of the sulphur being hosted in anglesite, the pH conditions of the Calumet 1-15 dump material are not expected to change, and these samples have been classified as having low reactivity.

In general, anglesite is known to occur in oxidized portions of the veins in the Keno Hill district. For dumps containing a significant proportion of oxidized vein material, anglesite sulphur may cause sufficient overestimation of AP that waste rock is mis-classified as PAG. This misclassification will only occur for rock with low total sulphur content, such that anglesite sulphur constitutes a significant portion of total sulphur, as in the case of the Calumet 1-15 dump waste.

Neutralizing Minerals

Neutralizing minerals identified in tailings samples included carbonates (siderite (iron carbonate) and minor cerussite (lead carbonate)) and minor aluminosilicates (specifically clinochlore ($(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$)) (Table 2-5). Detailed examination of the tailings siderite grains by electron microprobe analysis indicated that the grains were a mixture of iron, manganese, calcium and magnesium carbonate (roughly 55% iron carbonate, 35% manganese carbonate, 10% calcium + magnesium carbonate) (Table 2-6).

The waste rock at the former UKHM site was characterized in 2007 using the Sobek NP method (Sobek et al., 1978). For rocks containing siderite, the Sobek NP method may preclude complete oxidation of iron and manganese released on siderite dissolution, which can result in higher NP values being reported than if complete oxidation occurred. An alternative NP determination method often referred to as the Modified NP method (MEND 1991) has been shown to fully oxidize iron derived from siderite, and the resulting NP values reported account for acid released during the iron oxidation step (Jambor 2003). This Modified NP method was used in the 1995 waste rock characterization program (AMC 1996).

Comparison of 2007 Sobek NP values with those determined in 1995 by the Modified NP method shows considerable variability, particularly for those samples reported to have NP values less than 20 kg $CaCO_3$ equivalent/ tonne in 1995 (Figure 6). This variability may reflect a high degree of subsampling variability when aliquots were taken for analysis; however, for samples with 1995 NP values < 20, the results are positively biased in the direction of the corresponding 2007 NP values. This bias likely reflects incomplete oxidation of iron and manganese in the 2007 tests.

Results for several of the 1995 tests indicated NP values of zero that do not appear to be valid based on the measurable NP and inorganic carbon returned in the 2007 tests for the same parent sample. Results for these samples (95UKHHD01 (Hector adit dump), 95UKHOP02 (Onek Pit wall), 95UKHOD01 (Onek Pit dump), 95UKHTD01 (Townsite Adit dump) and 95UKHTD02 (Townsite Adit dump)) were not plotted on Figure 6. The apparent discrepancy in 1995 and 2007 NP values caused the classification of the Hector Adit dump sample to change from PAG (potentially acid generating- see Appendix H1) to Uncertain (having an uncertain potential to generate acid- see Appendix H6); classification of the other four samples did not change with the non-zero NP values determined in 2007.

Conclusions on Need For Detailed Mineralogical Characterization of Waste Rock

In general, detailed mineralogical investigation on waste rock materials does not appear to be warranted. Due to the widespread occurrence of manganoan siderite in the Keno Hill silver district, future ABA testing should employ the Modified NP method to ensure oxidation of reduced iron and manganese is accounted for, and should include inorganic carbon analysis for comparison.

The Hector Adit dump samples indicated that sulphur, zinc, and lead concentrations were elevated relative to most other dumps, and classification of ARD potential ranged from PAG to Uncertain (1995) to Uncertain to Non-PAG (2007) (Appendix H). Given the large size of this dump and the high metal content, onset of acid weathering conditions within the Hector Adit dump could lead to significant metal loadings to the adjacent environment (as discussed in Section 3.4.3). If advance knowledge of the development of acid weathering conditions and increased metal leaching would cause a different closure option to be selected when compared to a closure option selected for current conditions, a limited program of XRD testing and additional ABA analysis should be undertaken to determine sphalerite, galena, anglesite, and carbonate content of the Hector Adit waste rock. However, this additional testing is unnecessary if the same closure option is preferred for scenarios where the current conditions persist and where onset of ARD occurs in the future.

3.4.5 Assessment of Closure Options for Individual Waste Rock Dumps

As introduced in the 2007 Geotechnical Closure Studies report (SRK 2008b), a decision matrix has been developed to facilitate selection of closure options for each waste rock dump. The dumps are ranked by contained tonnage and group into four classes (A through D) and requirements, considerations, and options for closure have been added where appropriate. The decision matrix remains a work in progress; the most recent (November 2008) version can be found in Appendix I.

3.5 Discussion and Conclusions

All leach extraction tests demonstrated that the various dumps contained a store of soluble oxidation products. Any dump disturbance (e.g. for resloping or relocation purposes) will lead to a short-term increase in loading from the disturbed material. Column test results from 1996 showed initial zinc release exceeding steady state release by 14 to 300 times- these results provide an indication of the increases in short term loads that might be expected immediately following disturbance of waste rock.

Results from the shake flask extraction work indicated that the largest waste rock load is likely to be generated by the Hector Adit dump. Scoping calculations carried out to provide an indication of porewater chemistry indicated that zinc concentrations could be on the order of a few hundred mg/L. For comparison, the porewater zinc concentrations suggested by the scoping calculations are of the same magnitude as concentrations observed in the Galkeno 300 adit discharge.

The Hector Adit dump is several kilometres from the nearest downgradient receiving water (as is the case for most other dumps in the district). Based on the modest chemical loadings from the waste dumps relative to other sources in the district, and based on the length and attenuating nature of the downgradient flowpath to the receiving environment, it is unlikely that contaminants from the waste dumps pose a significant risk to water quality in the receiving streams that are the focus of reclamation across the former UKHM site.

3.6 Recommendations: Waste Rock Closure Option Selection

For most waste rock dumps, geochemical loads in dump seepage are expected to be minor compared to loadings from various adit discharges. Therefore, reducing chemical loading from the majority of the waste rock dumps is not a priority, and other considerations will drive selection of closure options. The primary closure considerations for most waste rock dumps include physical stabilization and reclamation, as discussed in the 2007 geotechnical closure studies report (SRK 2008b) and summarized in the waste rock closure matrix included in Appendix I.

The Hector Adit dump appears to be the only dump that, in the context of other site load sources, has potential to generate chemical loads that may pose significant incremental risk to the aquatic receiving environment. However, the available information is insufficient to estimate actual chemical loads generated by the Hector Adit dump or to determine whether the loads are attenuated prior to reaching the aquatic receiving environment.

A sequential approach to resolving those uncertainties is as follows.

- Review monitoring results from Sandy Creek element in the water balance to determine whether refinements to the monitoring program (water quality and discharge volume) could increase annual zinc load assigned to this element.
    - This review should include a consideration of whether additional monitoring is required in the drainage adjacent to, and east of, the Sandy Creek catchment. The discoloured patch of vegetation below the Hector Adit dump appears to trend towards this adjacent drainage rather than to Sandy Creek; if this vegetation pattern reflects surface flow of water pumped from the Hector mine during operations (as is thought), it may be that any current dump seepage also follows this route. If this were the case, chemical loads measured in Sandy Creek would not reflect potentially significant contributions from the Hector Adit dump and from other mine components (including the Hector workings) east of Sandy Creek.
    - If warranted by the findings of the Sandy Creek data review, additional monitoring should be carried out to determine whether loadings are significant. If no surface water can be identified for monitoring, consideration should be given to monitoring of groundwater, perhaps in the small northwest-trending gully immediately below (north of) the Silver Trail Highway west of the intersection of the highway and the Hansen Lake road (see Figure 6 for locations).
- Conduct a focussed study to evaluate whether water chemistry in ponded surface water mapped as the downgradient terminus of surface flow from Sandy Creek (and adjacent creeks draining Galena Hill) reflects transport of sulphide oxidation products.
- Additional monitoring of Hector Adit dump may allow a better estimate of actual chemical load being generated in the waste rock. Monitoring options that could provide useful information include:
    - Ditching or well installation at the dump toe to intercept shallow subsurface seepage and to allow monitoring of water chemistry;
    - Additional waste rock monitoring (more contact tests and shake flask extractions) to define the chemical variability and bulk characteristics of the dump as a whole;
    - Installation of monitoring wells to enable sampling of dump porewater within or below the waste rock material (if waste dump drilling is carried out for resource evaluation purposes);
    - If none of the above methods provide the necessary information, large scale (several tonne) field leaching tests could be established to assess flushing of soluble loads under field conditions.

This report, "**1CE012.001 – 2007/08 Geochemical Closure Studies, Keno Hill, YT**" was prepared by SRK Consulting (Canada) Inc.

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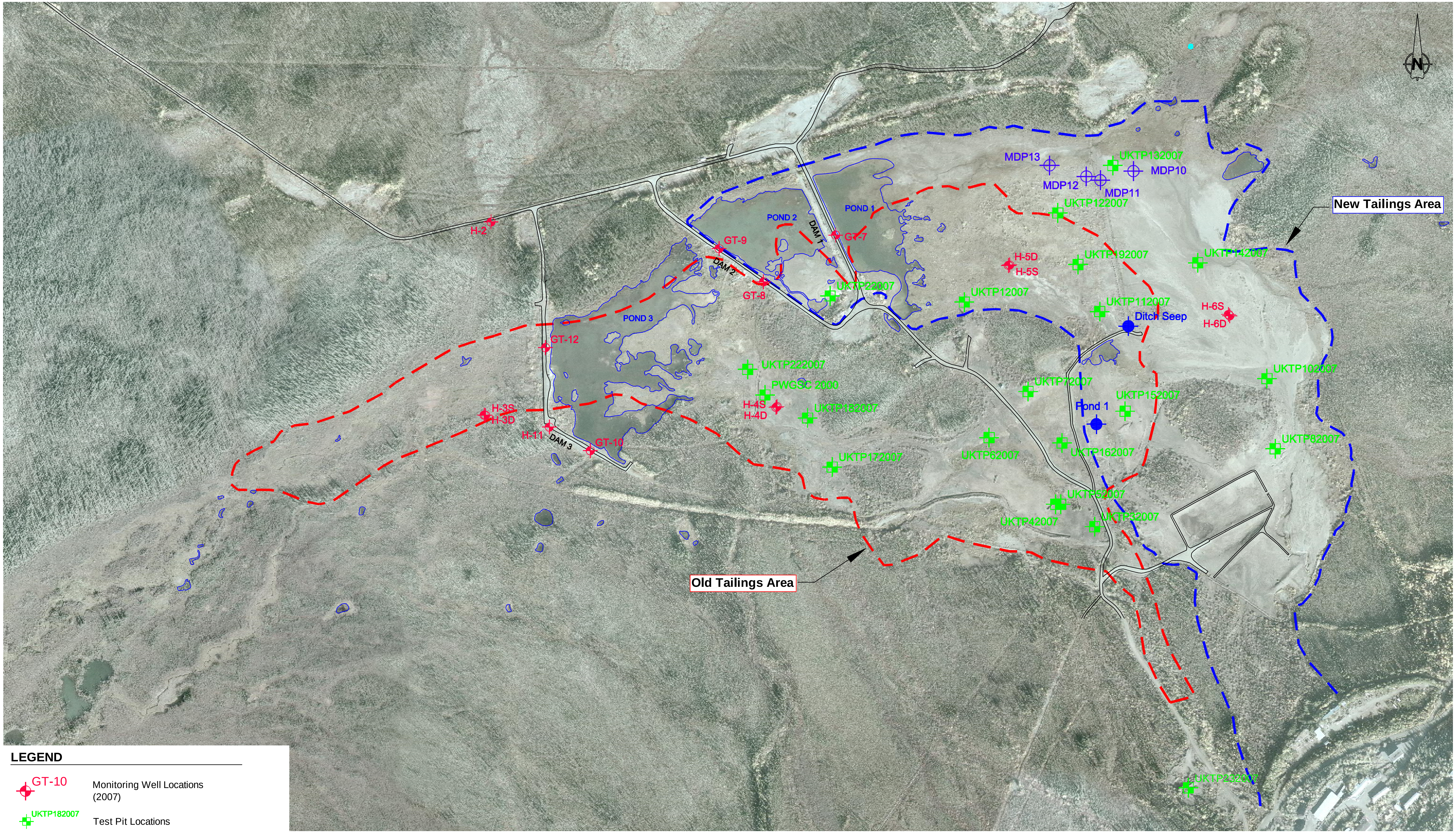
Figures



LEGEND

GT-10	Monitoring Well Locations (2007)
UKTP182007	Test Pit Locations
MDP10	Manual Drive Points
●	2007 Water Sample

Note:
GT-* locations also contain Thermistor Strings
H-* locations are Monitoring Wells only

NOTES

1. Base drawing and orthophoto provided by ERDC. Orthophoto prepared by AeroGeometric, from photos flown September 2006 by Geodesy Remote Sensing Inc, Calgary, Ab.
2. Coordinate projection is NAD83, UTM projection.

0 50 100 150 200 250
Scale in Metres

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SRK JOB NO.: 1CE12.001.0GC4
FILE NAME: 1CE012_001-GC4-1.dwg

Keno Hill Silver District

2007 Geochemistry Closure Studies

Valley Tailings Facility
Plan of Arrangement

DATE:	APPROVED:	FIGURE:
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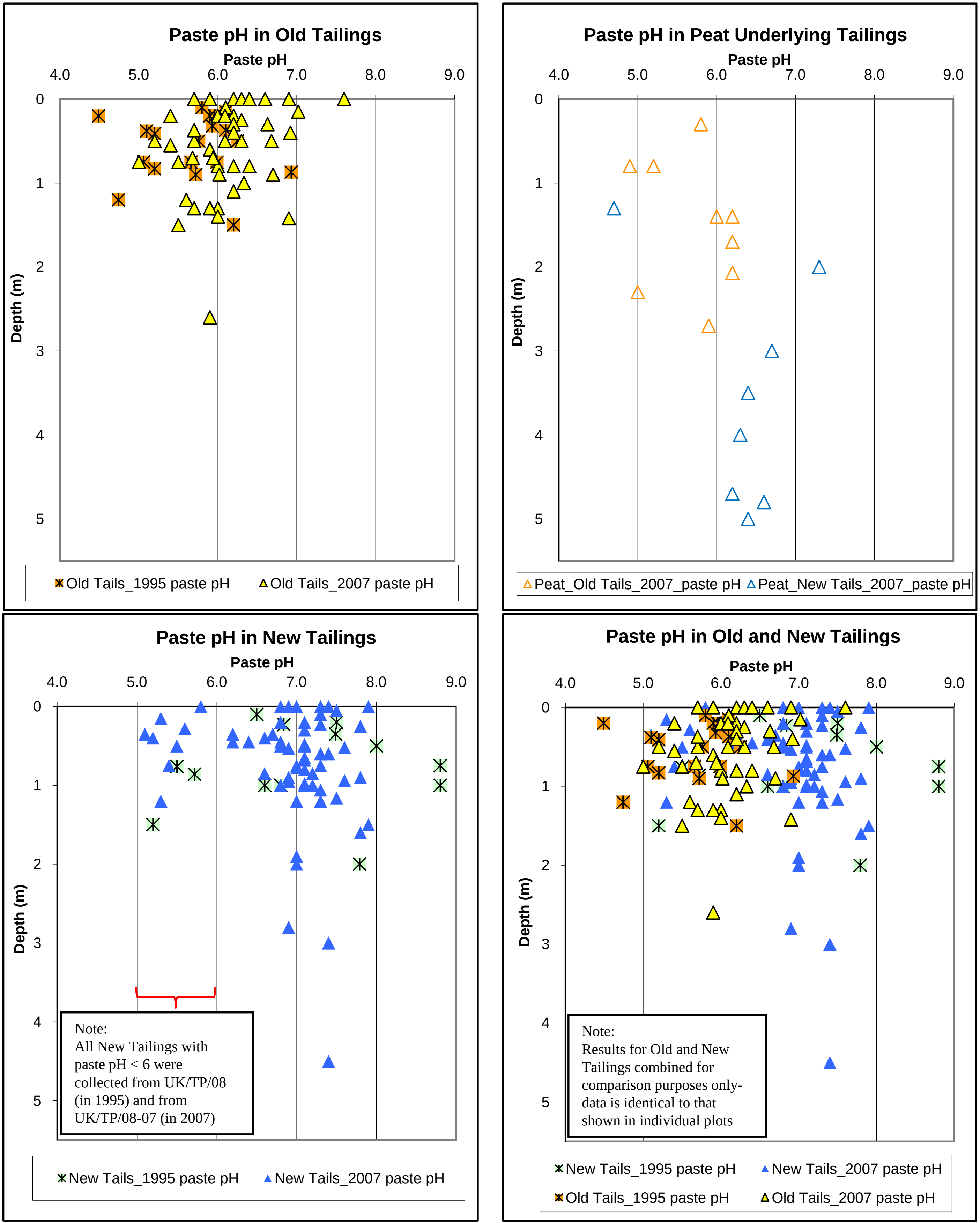

Note:
All New Tailings with paste pH < 6 were collected from UK/TP/08 (in 1995) and from UK/TP/08-07 (in 2007)

Note:
Results for Old and New Tailings combined for comparison purposes only- data is identical to that shown in individual plots

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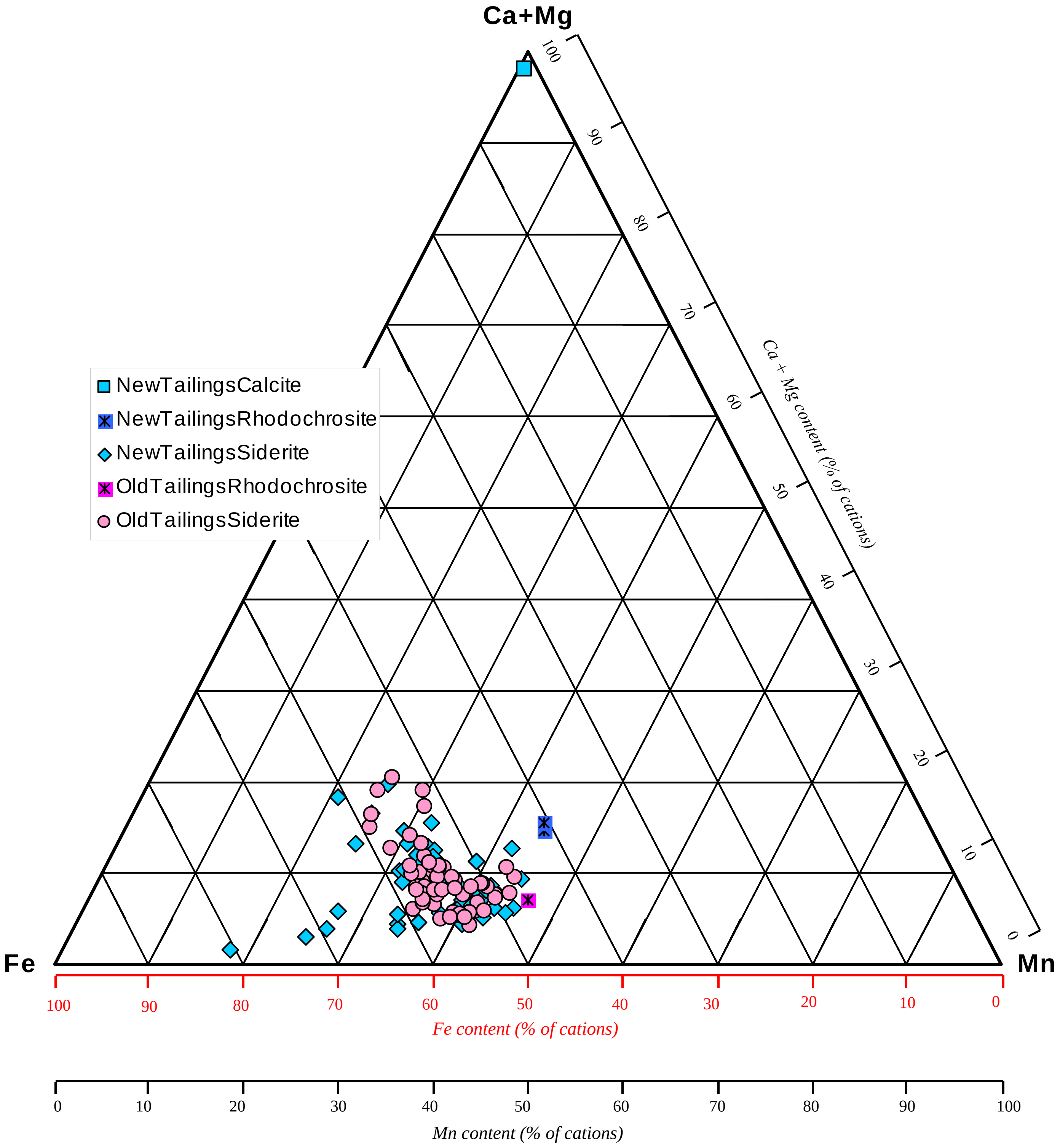
Tailings Paste pH vs. Depth

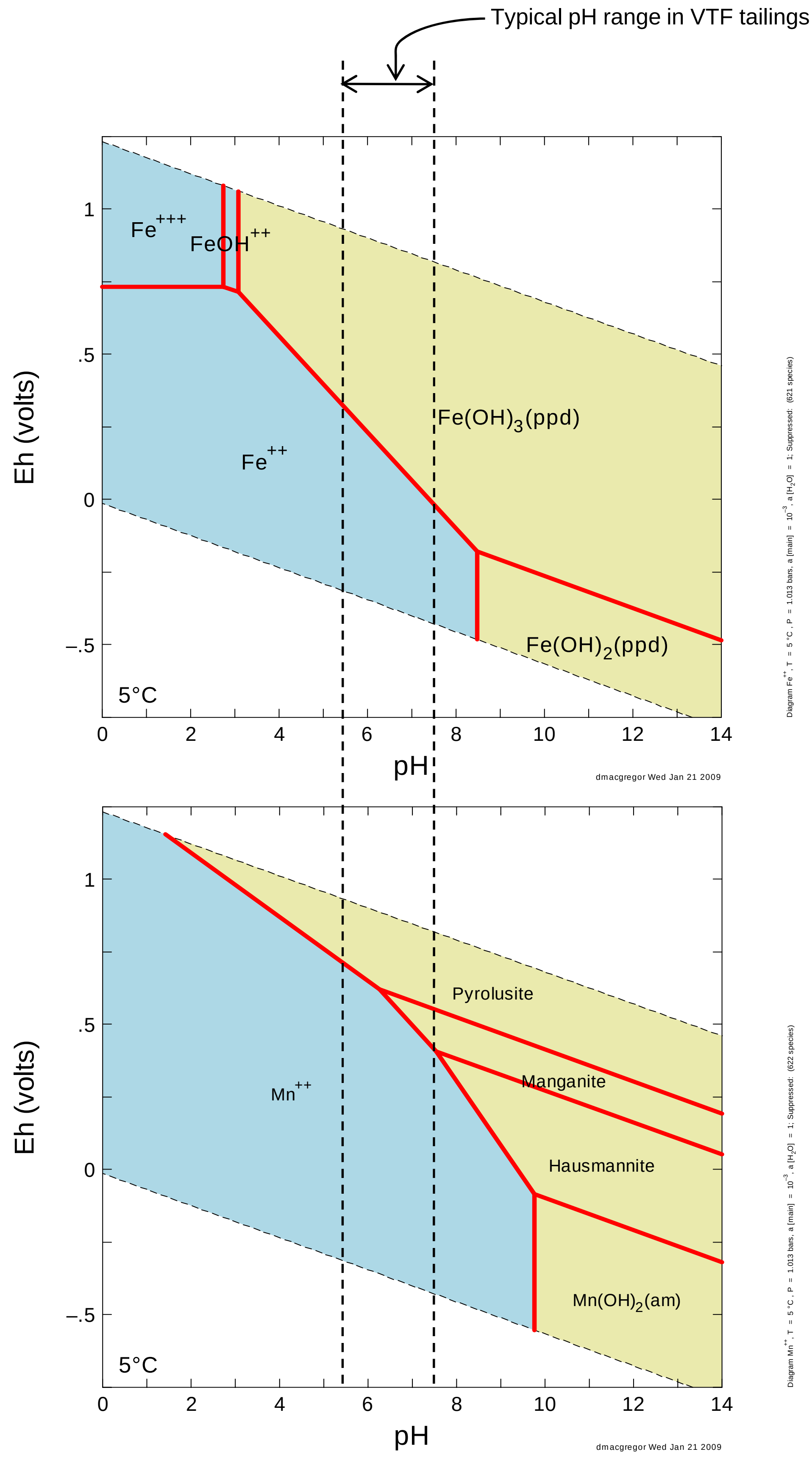
Job No: 1CE012.001.0GC4
Filename:Fig.2_Tailiings_Paste pH.ppt

Keno Hill Silver District
2007/08 Geochemistry Closure Studies

Date: February 2009
Approved:
Figure: 2



SRK Consulting Engineers and Scientists VANCOUVER	ERDC	**Cation Composition of VTF Carbonate Minerals**
Job No: 1CE012.001.0GC4 Filename:Fig.3_Tailings_EPMA results.ppt	Keno Hill Silver District 2007/08 Geochemistry Closure Studies	Date: February 2009
		Approved:
		Figure: 3



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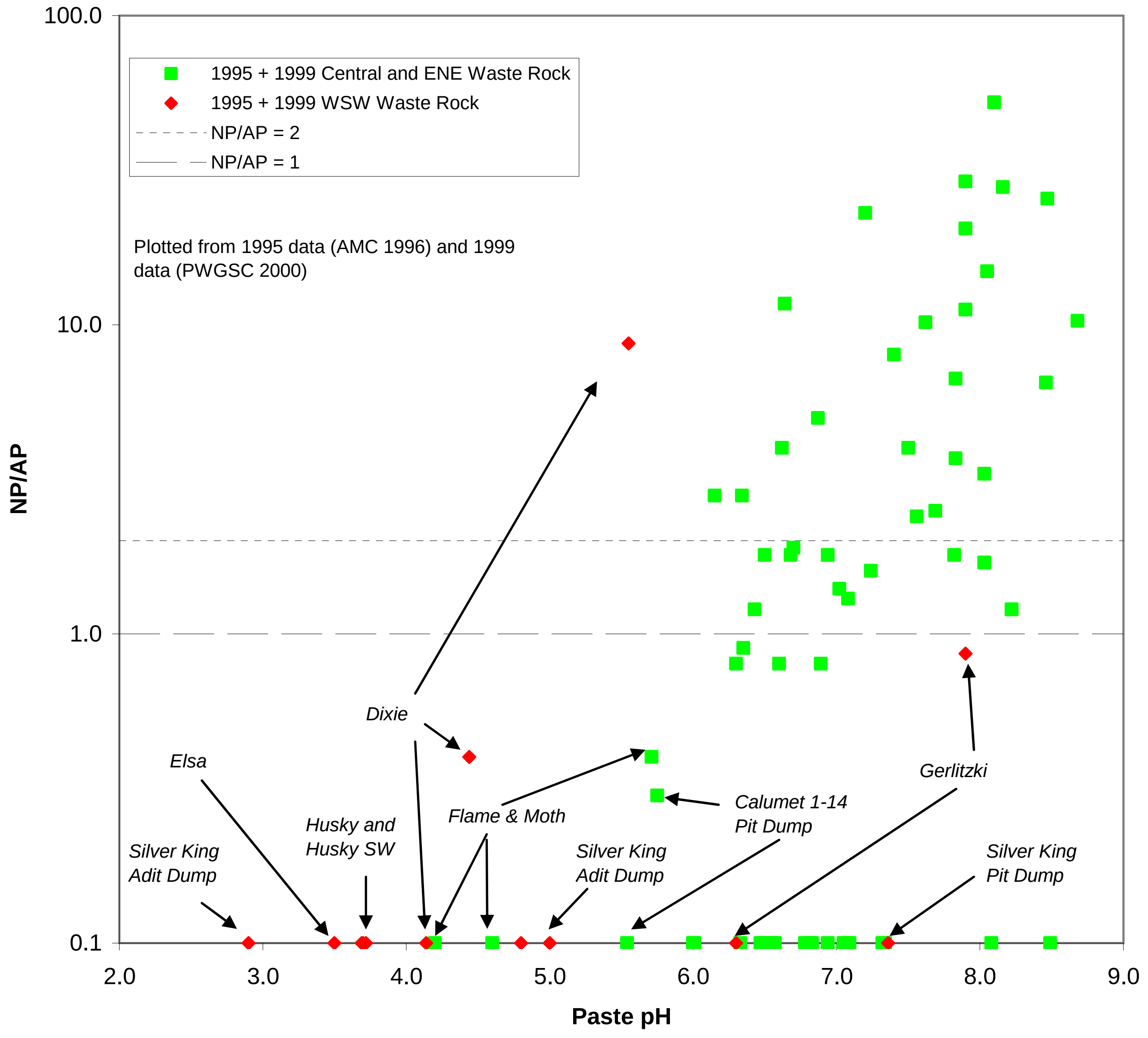
Eh-pH diagrams for Fe and Mn

Job No: 1CE012.001.0GC4

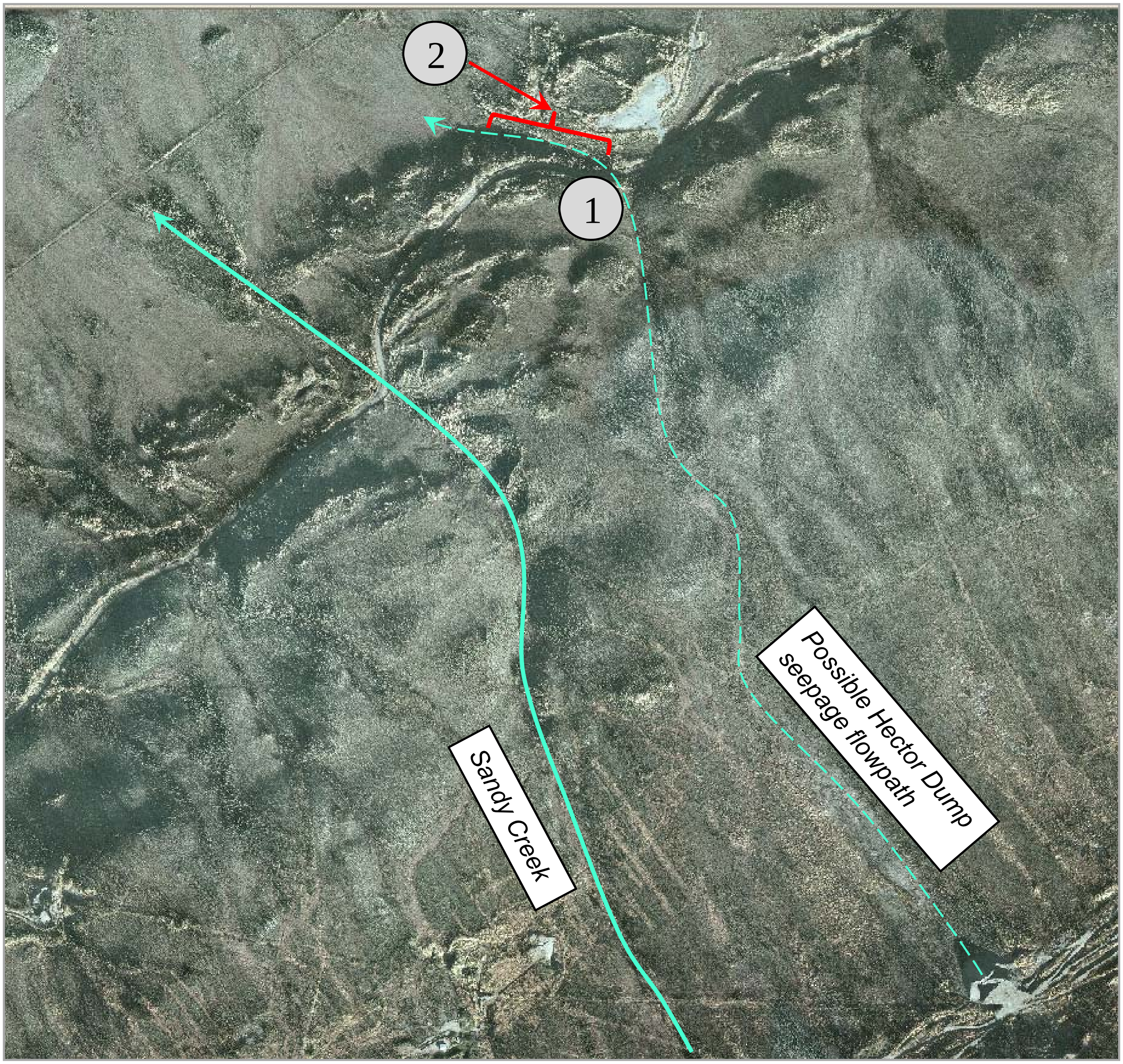
Filename:Fig.4_Tailings_Eh-pH.ppt

Keno Hill Silver District
2007/08 Geochemistry Closure Studies

Date:	Approved:	Figure:
February 2009		4



SRK Consulting Engineers and Scientists VANCOUVER	ERDC	**Waste Rock NP/AP vs. Paste pH**
Job No: 1CE012.001.0GC4 FilenameFig.5_WasteRock_NP-APvs.Paste_pH.ppt:	Keno Hill Silver District 2007/08 Geochemistry Closure Studies	Date: February 2009 | Approved: | Figure: 5



Source of photobase: Aerial photograph captured by Geodesy Remote Sensing, Calgary AB. Flown September 13-14, 2006.

Notes:

1. Potential surface water monitoring location (above highway). If surface water is identified, the flow should be traced upslope to its origin.
2. Potential surface water or groundwater monitoring location if no surface water is available at location #1.

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Potential Monitoring Locations Below Hector Dump

Job No: 1CE012.001.0GC4
Filename: Fig.6_Potential monitoring below Hector Dump.ppt

Keno Hill Silver District
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Date:	Approved:	Figure:
February 2009		6

Appendices

Appendix A

History of Valley Tailings Facility

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Memo

To:	File	**Date:**	March 31, 2008
cc:		**From:**	Dylan MacGregor
Subject:	History of Valley Tailings Facility	**Project #:**	1CE012.000

1 Physical Setting

The Valley Tailings Facility (VTF) is situated immediately north of Elsa in a broad east-west trending glacial valley. Near Elsa, this broad valley is occupied by South McQuesten River, which is situated on the north side of the valley, with Flat Creek and its tributaries on the south side of the valley. Flat Creek and the South McQuesten River are separated by a low valley-parallel ridge that runs from a point northeast of the VTF to the southwest, where it gradually merges with broad valley floor near the discharge of Flat Creek into the South McQuesten River. The distance from the discharge downstream limit of the VTF to the mouth of Flat Creek is approximately 10 km.

The VTF is separated from No Cash Creek to the east by a topographic divide that forms the eastern limit of the Flat Creek watershed. Figure 1 shows a overview of the current configuration of the VTF, superimposed with the original streams located in the vicinity of the VTF prior to onset of milling at Elsa. The VTF covers much of the original alignment of North Fork Flat Creek, and also covers portions of the lower reaches of Porcupine Creek, Brefalt Creek, and Flat Creek (UKHM 1956).

2 History of Milling at Elsa

The bulk flotation mill from Wernecke was moved to Elsa in 1936 by Treadwell Yukon (TY) and expanded to process 225 Imperial tons per day (tpd) (Cathro 2006). TY operated the mill continuously from 1936 through 1942, when operations were halted.

Operations resumed in 1947 under UKHM, and proceeded with minimal interruption until 1989 when UKHM ceased operations (Cathro 2006). In 1949, the mill burned and was rebuilt with a design capacity of 500 tpd with a standard flotation circuit designed to recover a silver/ lead/ zinc concentrate (UKHM, 1996a). A differential flotation circuit was added in 1950, allowing the recovery of separate silver/ lead and zinc concentrates (Cathro 2006). Zinc recovery was intermittent and records are poor or contradictory, but it is accepted that there was no zinc recovery attempted after 1981 due to economic factors.

A cyanidation plant was built and operated from 1952 through 1967, and again from 1979 through 1982 (Hawthorne 1996). This plant had insufficient capacity to treat the entire flotation tailings stream, and it is estimated that 80% of produced tailings underwent cyanidation during the period when the plant was operating. Hawthorne estimates that approximately 1.8 million tons of tailings were treated via cyanidation.

3 Mill feed

A total of 5.3 million Imperial tons of ore was milled at Elsa from 1936 to 1989, which yielded 4.6 million tonnes of tailings (Hawthorne 1996). All ore processed prior to 1977 was sourced from various underground mines (Cathro 2006). Open pit mining began in 1977 and continued until UKHM shut down in 1989, and during this period mill feed was a variable mixture of open pit and underground ore. In general, underground ores were characterized by relatively fresh sulphide mineralogy, whereas open pit ores had varying degrees of mixed oxide and sulphide mineralogy. The two sources have been referenced as ‘sulphide ore’ and ‘oxide ore’ previously, and this convention is maintained here.

About 79% of the ore processed at Elsa was sourced from the Hector-Calumet (50.9%) and the Elsa-Husky (18.2%) mines (Cathro 2006).

At least two periods of tailings reprocessing occurred, the first in 1952 when an unreported quantity of Wernecke mill tailings were shipped to Elsa and reprocessed (Aho 2005, and Cathro 2006) and the latter in 1988 when 1884 Imperial tons of Elsa mill tailings were reprocessed (Cathro 2006). At different times, part or all of several rock dumps were hauled to Elsa for processing. There was also period when a high grade jarosite ore from the Elsa mine was processed, with a high degree of silver loss to the tailings mass due to poor recovery.

4 Ore mineralogy

Sulphide ores consisted mainly of siderite ($FeCO_3$), quartz (SiO_2), galena (PbS), pyrite (FeS_2), sphalerite (ZnS), tetrahedrite- tennantite- freibergite ($Cu_{12}(Sb,As)_4S_{13}$, with up to 15% Ag), hawleyite (CdS), and local jarosite. The cadmium sulphide hawleyite was first identified in the Keno Hill district, and cadmium concentrations in some ore were sufficient that, at times, the company received net smelter returns for cadmium. Barite ($BaSO_4$) occurred in small quantities in some vein structures.

Oxide ores are reported to be a variable mix of the sulphide minerals that make up the sulphide ore, as well as a variety of oxide, sulphate, and carbonate minerals. Cerussite ($PbCO_3$), anglesite ($PbSO_4$), smithsonite ($ZnCO_3$), hemimorphite ($Zn_4Si_2(OH)_2$-H_2O), (gypsum ($CaSO_4 \cdot 2H_2O$), and limonite (a mix of iron oxyhydroxide minerals) were all present in the oxide ore prior to milling.

5 Tailings mineralogy and solids chemistry

Hawthorne (1996) reported that 65% of the lead in the tailings was oxidized. Analyses carried out as part of economic evaluation of tailings reprocessing options included analysis for ‘non-sulphide lead’, with results reported as %NSPb, and it is these analyses that were relied on to conclude the degree of lead oxidation. It was thought that the majority of the oxidation occurred prior to milling and reported to the mill largely as anglesite, cerrussite, and a variety of iron-lead-manganese oxide minerals which were typically referred to as limonite.

Lockstein (1981) reported that lime was being added to tailings at the mill- no other records of this practised have been identified. The source implied that the practice was being evaluated and might not continue. There were no indications from other available sources to indicate whether direct addition of lime to the tailings stream continued beyond 1981.

6 Tailings Deposition

During the initial period of milling at Elsa, tailings were discharged directly into Porcupine Creek immediately downslope of the road north of the mill. Tailings deposited during this period formed a shallow linear deposit along the channel of Porcupine Creek, then fanned out across the low-lying valley bottom as shown in Figure 2a.

This practice continued until the late 1950s or early 1960s. By 1962, Dam #1 had been constructed and the tailings discharge had been moved northeast to a location on the hillside below the framing mill (Figure 2b). Hawthorne (1996) reported that a meandering and frequently self-eroding tailings fan formed immediately below the discharge point, with both larger particle sizes and denser mineral grains being preferentially deposited within the fan. High silver grades were noted in the fan tailings.

By 1967, a large deposit of tailings slimes had formed immediately east of Dam 1, with continued development of the tailings fan on the hillside below the discharge point (Figure 2c). Tailings deposition continued in similar fashion through 1971 (Figure 2d), with tailings mass building up behind Dam 1 and expanding slightly towards the low areas on the eastern margin of the VTF. The latest available photograph from the operational period was captured in 1984 (Figure 2e)- by this time both Dam 2 and Dam 3 had been constructed, along with the Porcupine Diversion, and the present configuration of the VTF was generally established.

The best available photograph of Flat Creek below the present location of Dam 3 was taken in August 1971 (Figure 2d). The 1971 photo shows the known exposed tailings deposit located east of the present location of Dam 3 (this deposit has been previously mapped as a spill). The photo also shows two areas approximately 1 km east of the Dam 3 location that have similar contrasting colouration to the known exposed tailings surfaces. One area forms a narrow linear band straddling Flat Creek, and the other area (north of the creek) is broader and more widespread. Although the contrasting tones in these areas are similar to those of certain areas of known undisturbed ground elsewhere in the photograph, one of the historical UKHM drawings reviewed indicated that surface tailings deposits did extend east into the area in question (UKHM 1956).

7 Tailings Facility Management

The following notes relating to VTF infrastructure, events, and operating conditions have been extracted from a review of historical UKHM files and other relevant documents.

7.1 Dam 1

- Constructed around 1958 (based on photo captions in EBA 1988). No design or as-built reports were identified. Dam 1 is evident in 1962 aerial photographs.
- Constructed across original alignments of North Fork Flat Creek and Porcupine Creek (UKHM 1956 and UKHM 1962).
- Dam is thought to be of unzoned construction. UKHM (1981) indicates a dam raise and flattening of 1:1 side slopes to 2:1 was carried out in 1973, using mine waste (likely from Husky mine) on downstream side and gravel (likely local ablation till) as an upstream blanket. No compaction noted.
- Abutments: south abutment is bedrock, north abutment is unconsolidated overburden.
- Experienced overtopping during freshet in various years prior to 1981 (UKHM 1981).
- Breached ‘several times 1962-1972’ (PWGSC 2000); dam broke and washed out for 20 feet in 1972 (UKHM 1981).
- Placement of the Stage 1 Toe Berm recommended in EBA (1983) was reported as complete in EBA (1989).
- A downstream toe berm was partially constructed below Dam 1 in fall of 1996, spanning the entire length of the dam (EBA 1997).

7.2 Dam 2

- Constructed in 1972, raised in 1974 (UKHM 1981). No design or as-built reports were identified; zoned design sketches were located, but no records were available to verify whether design sketches were used as basis for construction (UKHM 1973).
- Constructed to contain polishing pond for Dam 1 decant water.
- Thought to be of unzoned construction, utilizing gravel, till, and mine rock (likely from Husky mine).
- Minor tailings occurred within Dam 2 footprint prior to construction. No records of foundation stripping have been identified, and it is assumed that the original tailings remain beneath Dam 2.
- Constructed across original alignment of North Fork Flat Creek (UKHM 1956 and UKHM 1962).
- History of failure includes a pre-1975 failure (UKHM 1975) and the recorded 1978 failure (UKHM 1981).

7.3 Dam 3

- Constructed in 1979 (UKHM 1981). No design or as-built reports were identified.
- Constructed to contain polishing pond for Dam 2 decant water.
- Thought to have a till core and extended blanket, a graded filter, and a downstream body of waste rock (likely form Husky mine) (PWGSC 2000).
- UKHM (1981) reports construction carried out according to design by Geocon.
- UKHM (1981) reports:

  > "A 12' deep 'cut trench' the entire length of the dike was excavated with backhoe, refilled with impermeable glacial fill and compacted with a sheepsfoot compactor. Extensive pumping was required during the trenching operations. Blasting was required for the decant."
- Extensive settlement occurred in 1980 and 1981, evidenced by buckling of culverts. May have been due to incorporation of frozen material and snow into dam during construction. Settlement was anticipated and excess fill was placed at time of construction (1' to 3' over specified height) (UKHM 1981).
- Constructed across original alignments of Flat Creek and North Fork Flat Creek (UKHM 1956 and UKHM 1962).

7.4 Diversions

- Porcupine Creek initially diverted to Brefalt Creek in 1962 using an earthen dam (UKHM 1962) at present location.
- Another earthen dam was constructed further downhill (north) to divert spring runoff to the northwest towards lower Brefalt Creek (UKHM 1962).
- Previous works to contain and direct Porcupine Creek flows to northwest included embankments constructed from tailings within the Porcupine tailings fan area (UKHM 1962).
- Present Porcupine Diversion constructed in 1979 (UKHM 1981).
- Diversions below the framing mill send water west to Porcupine Creek and east to No Cash Creek (UKHM 1981).

7.5 Operational water treatment

- Operational water treatment was undertaken using both lime (at Dam 1) and chlorine gas (at both Dam 1 and Dam 2) (UKHM 1979). Treatment was required for freshet flows only.
- Lime treatment was carried out in ditch through old tailings southwest of Dam 2 (UKHM 1996b). Timing and duration of treatment is unknown- does not appear to be in place in 1984 air photo.

- Excess lime is present in tailings, spillage, and treatment residues between Dam 1 and Dam 2 from lime treatment operations at Dam 1.
- Water treatment sludge was deposited directly into Pond 1 during the 1990s (UKHM 1997).

8 References

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UKHM 1973. Sketches and notes discussing design and construction materials for proposed Dam 2. Scanned by ERDC and archived as file “09291- Tailing Dam Design Calcs.pdf”.

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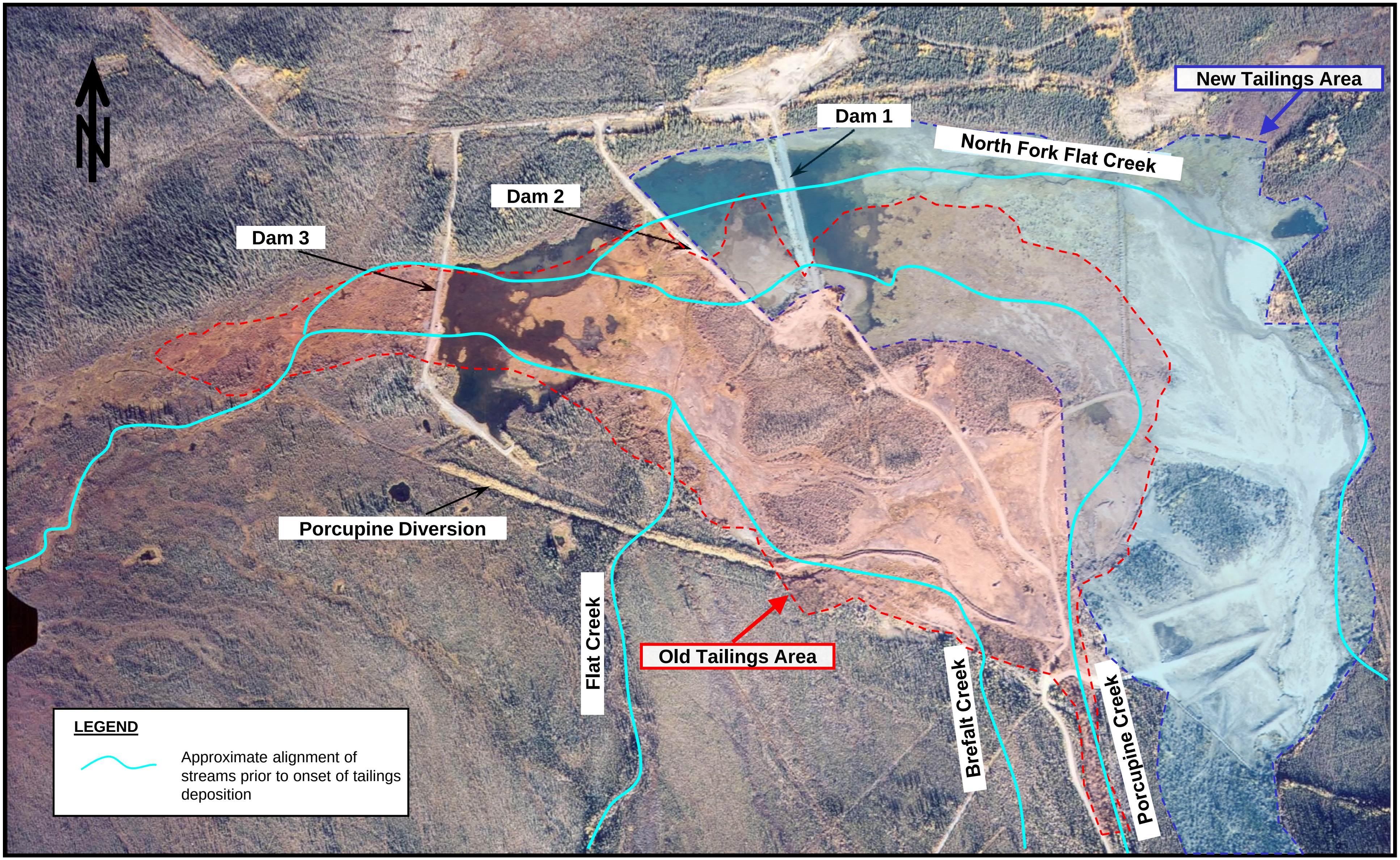

Source of photobase: Aerial photograph captured by Geodesy Remote Sensing, Calgary AB. Flown September 13-14, 2006.

Source of original stream alignments and Old Tailings Area outline:
Internal UKHM map (Drawing H-F-18-10, digital scanned file “23283-Tailings Disposal Area HF-18-10.JPG”) and aerial photograph from the National Air Photo Library (Roll A13753, Photo 72)

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General arrangement of VTF with alignments of original streams

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Keno Hill Silver District

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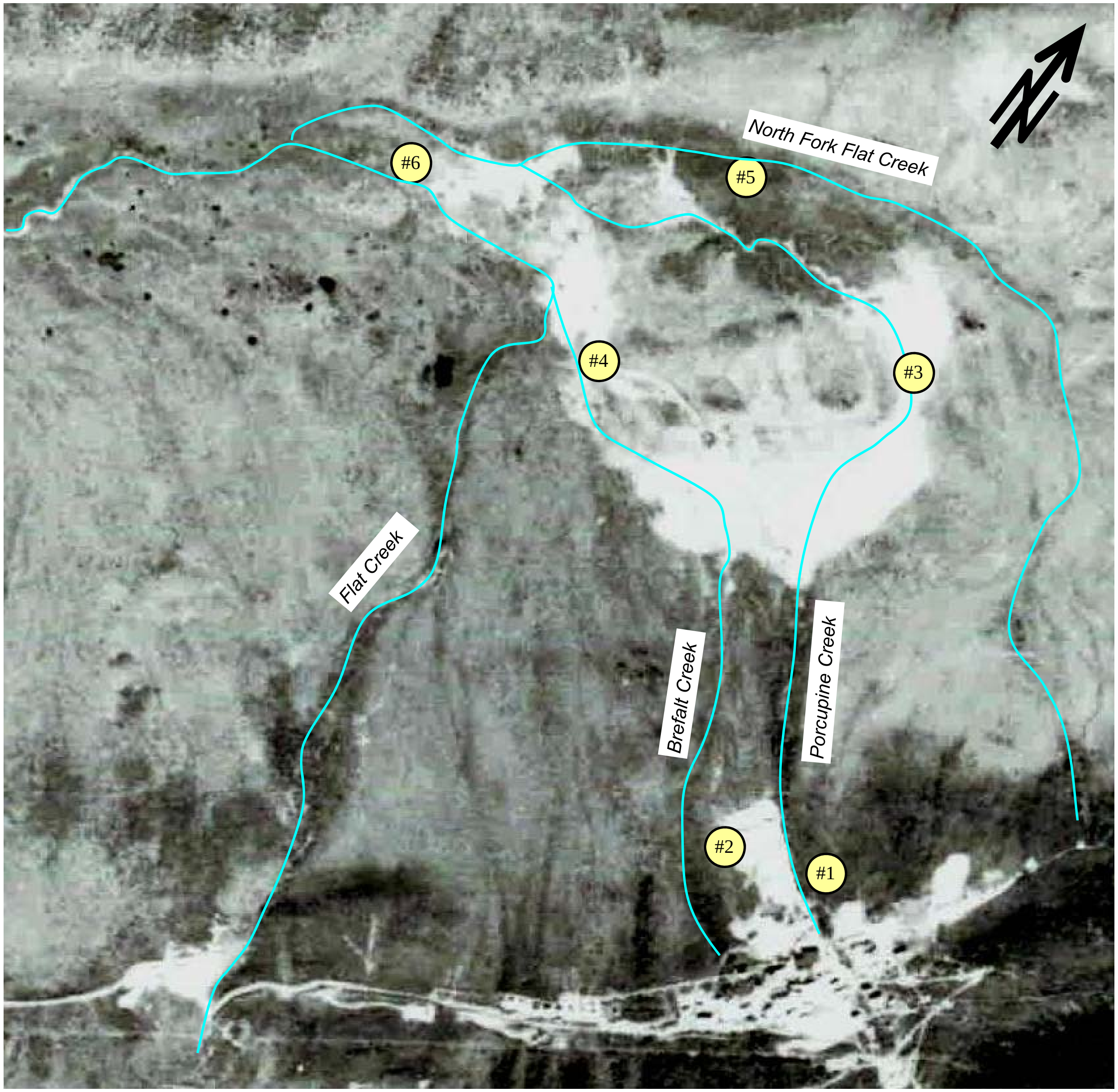

Source: National Air Photo Library, Roll A13753, Photo 72

#1: Early tailings were discharged into Porcupine Creek and were deposited by gravity in the valley bottom.

#2: Terraced tailings below Silver Trail highway were in place by 1953. UKHM documents referring to tailings reprocessing indicate that these tailings were produced by UKHM (not Treadwell Yukon)- this brackets the time of deposition between 1947 (when UKHM restarted the Elsa operations) and the time of this photo (1953).

#3: A portion of the tailings by 1953 had been deposited east of the high ground in the middle of the VTF. The tailings in this area are located upgradient of Dam 1.

#4: Some of the tailings deposited by 1953 were located in the Brefalt Creek- Flat Creek portion of the valley bottom. No records were identified that indicated whether tailings deposition in this area resulted from direction of tailings flows by ditching or diking, or whether deposition occurred as a natural course of tailings fan evolution where the steeper reach of Porcupine Creek encountered the flatter valley bottom.

#5: Tailings deposits within the future footprint of Dam 1 by 1953 appear to be limited to the immediate channel of Porcupine Creek. The original path of both Porcupine Creek and North Fork Flat Creek crosses the future alignment of the north limb of Dam 1.

#6: Tailings deposits appear to cover much of the area within the future footprint of of the north limb of Dam 3 by 1953. The original path of both Flat Creek and North Fork Flat Creek crosses the future alignment of the north limb of Dam 3.

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VTF Aerial Photograph: July 1953

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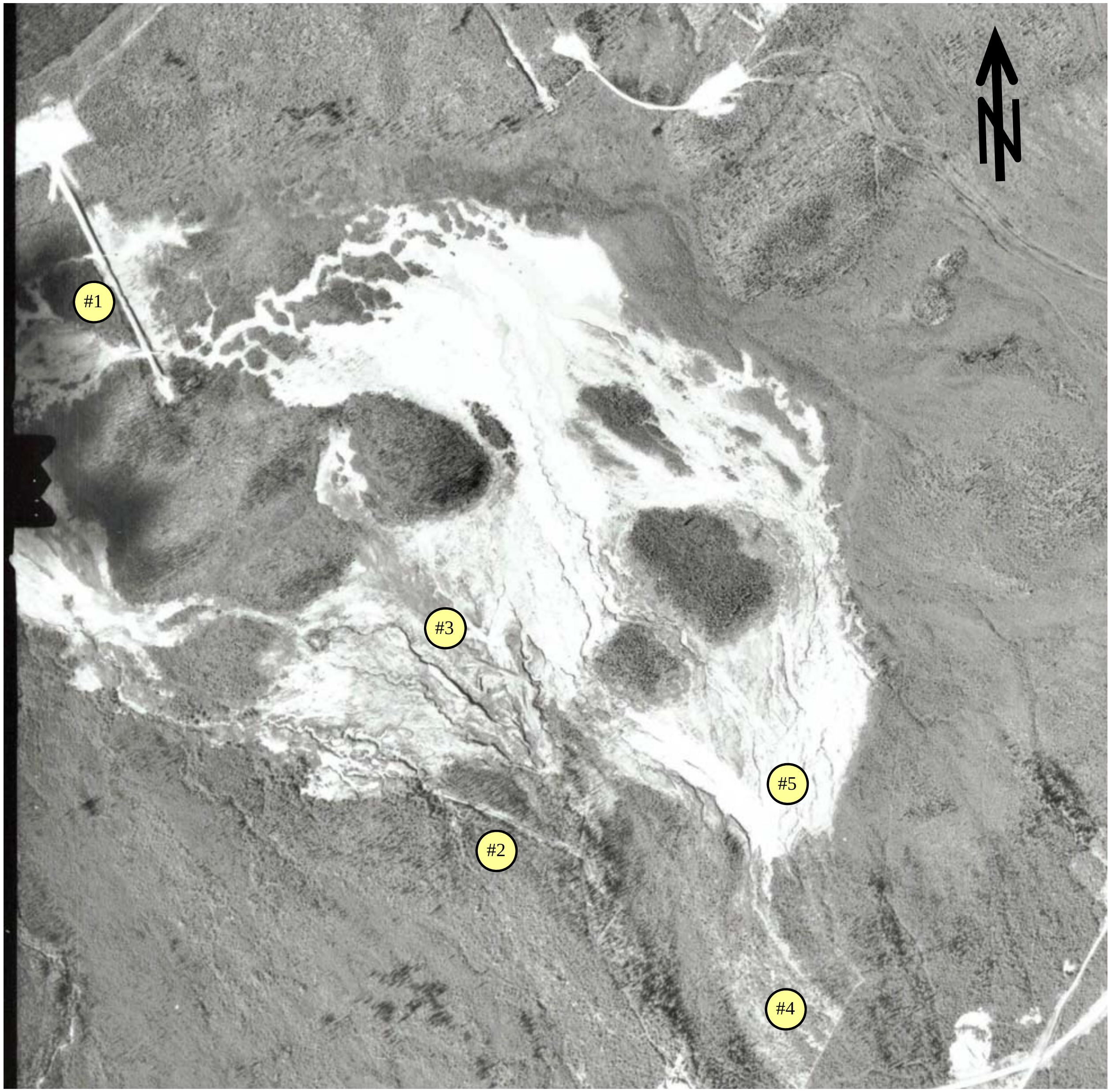

#1: Dam 1 constructed by 1962. Photo shows minimal tailings at downstream toe of dam, indicating that the dam is not founded on any significant mass of tailings. Present-day access road not yet constructed- access to Dam 1 was via a road east of the tailings that is no longer active.

Locations of decant culverts near north and south ends of Dam 1 are evident. Minor accumulation of tailings against upstream (east) toe of Dam 1 has occurred by 1962.

#2: Original diversion of Porcupine Creek to lower Brefalt Creek is in place by 1962.

#3: Evidence of old ditching and dike construction, as part of efforts to direct Porcupine Creek tailings discharge westward. These works are noted on the UKHM drawing scanned as “23346-Topography Tailings and Dam Area HF-18-1.JPG”, dated 1962.

#4: New tailings discharge location, on hillside east of Porcupine Creek.

#5: Tailings formed what was referred to as a ‘self-eroding fan’ on the hillside below the discharge point.

Source: National Air Photo Library, Roll A17623, Photo 59

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VTF Aerial Photograph:
August 1962

Job No: 1CE012.001
Filename:
Tailings Area History.figures.1CE012.000.dbm.rev00.ppt

Keno Hill Silver District

Date: February 2009
Approved:
Figure: **2b**

Source: National Air Photo Library, Roll A20223, Photo 38

#1: Present-day access road and water supply pipeline constructed by 1967.

#2: Flat Creek flowing through inactive Old Tailings. Braided channel morphology below confluence of Flat Creek and Brefalt Creek suggests active erosion and transport of tailings.

#3: Tailings in place in area west of future location of Dam 3.

There has been no evidence observed that these tailings were deposited due to a spill or dam breach- any rapid transport of this mass of tailings from Dam 1 to the deposit location would be expected to leave erosional evidence of such a flow along the upgradient flow path.

#4: Surface tailings evident along future alignment of southeast limb of Dam 3.

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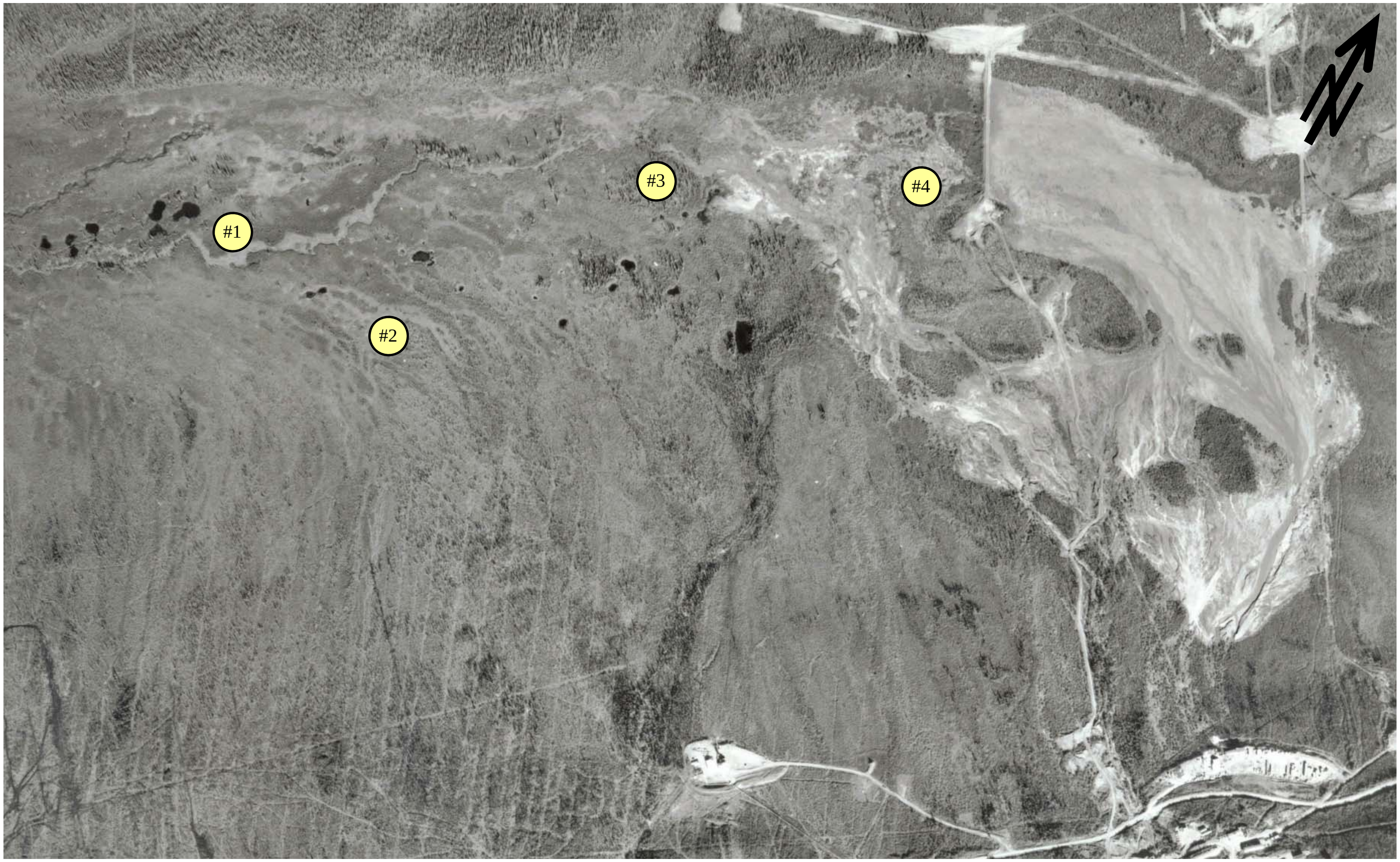
VTF Aerial Photograph: September 1967

Job No: 1CE012.001
Filename:
Tailings Area History.figures.1CE012.000.dbm.rev00.ppt

Keno Hill Silver District

Date: February 2009
Approved:
Figure: 2c



Source: National Air Photo Library, Roll A22476, Photo 49

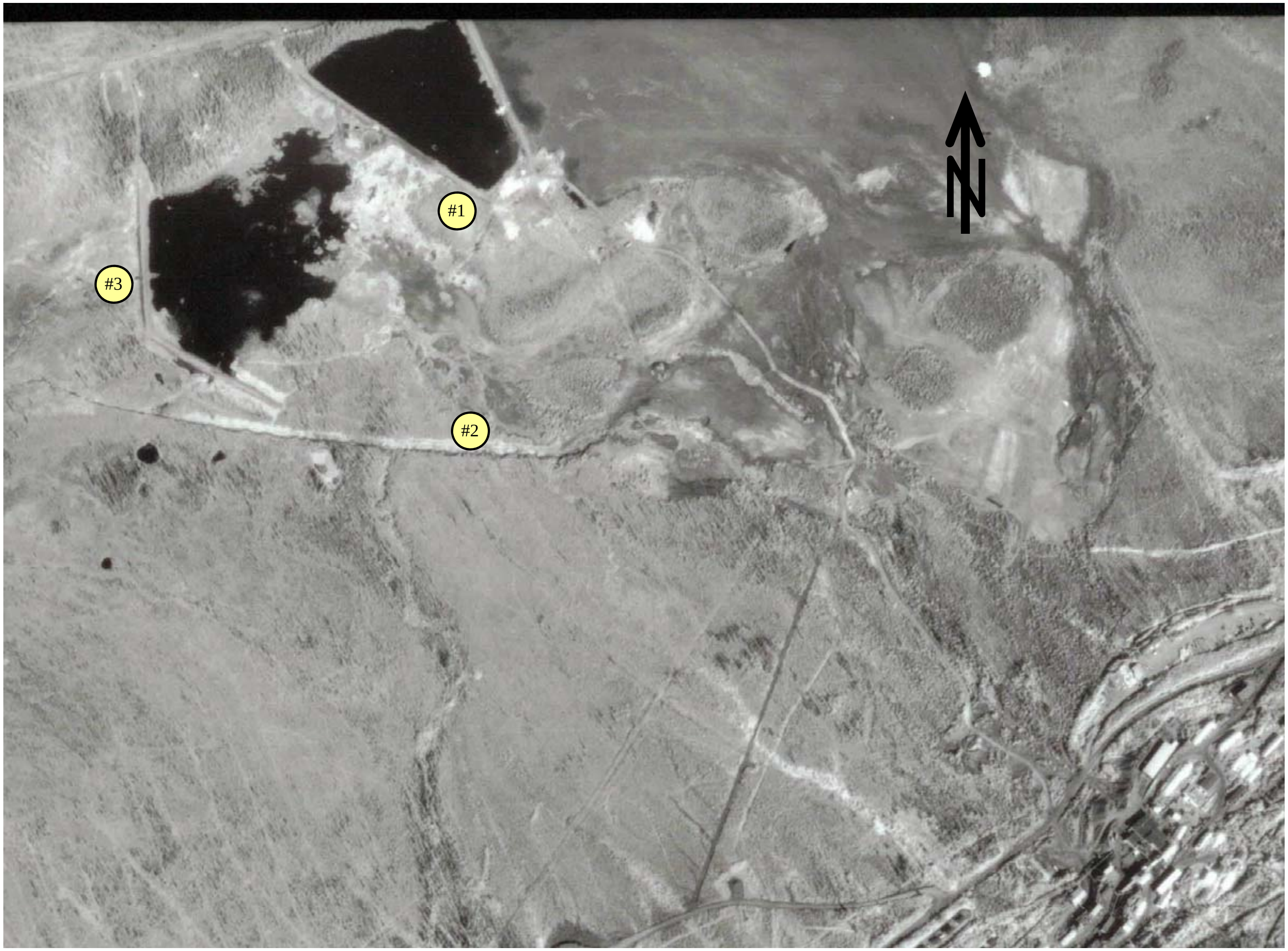
#1: Possible unmapped deposits of tailings west ol present location of Dam 3. Light colouration both along the southern-most Flat Creek channel and in flat area northwest of the #1 placemarker suggest areas of tailings deposition.

#2: Area in known original ground within similar light colouration noted in #1. Indicates the need for verification of suspected tailings deposits in vicinity and upgradient of #1.

#3: By 1971, both North Fork Flat Creek and Flat Creek had re-established channels in the approximate location of the original channels where the creeks cross the present Dam 3 alignment. The 1971 photo is better quality than the 1967 photo- from the 1971 photo, it appears that the central portion of the alignment of the future north limb of Dam 3 was not covered by deposited tailings.

#4: The future alignment of Dam 2 appeared to contain a minimal quantity of tailings in 1971 (the year prior to construction).

SRK Consulting Engineers and Scientists VANCOUVER	ERDC	2007/08 Geochemical Closure Studies **VTF Aerial Photograph: August 1971**
Job No: 1CE012.001 Filename: Tailings Area History.figures.1CE012.000.dbm.rev00.ppt	**Keno Hill Silver District**	Date: February 2009 Approved: Figure: **2d**



#1: Dam 1 constructed across original alignment of North Fork Flat Creek in 1972. Light colouration in photo at southwest end of Dam 2 shows the area where historic dam breaches occurred.

#2: Porcupine Diversion Constructed in 1979 to convey flows from Porcupine Creek, Brefalt Creek and Flat Creek to original Flat Creek channel west of Dam 3.

#3: Dam 3 constructed across original alignment of Flat Creek in 1979. Old Tailings remain in place to west of Dam 3.

Source: National Air Photo Library, Roll A26587, Photo 107

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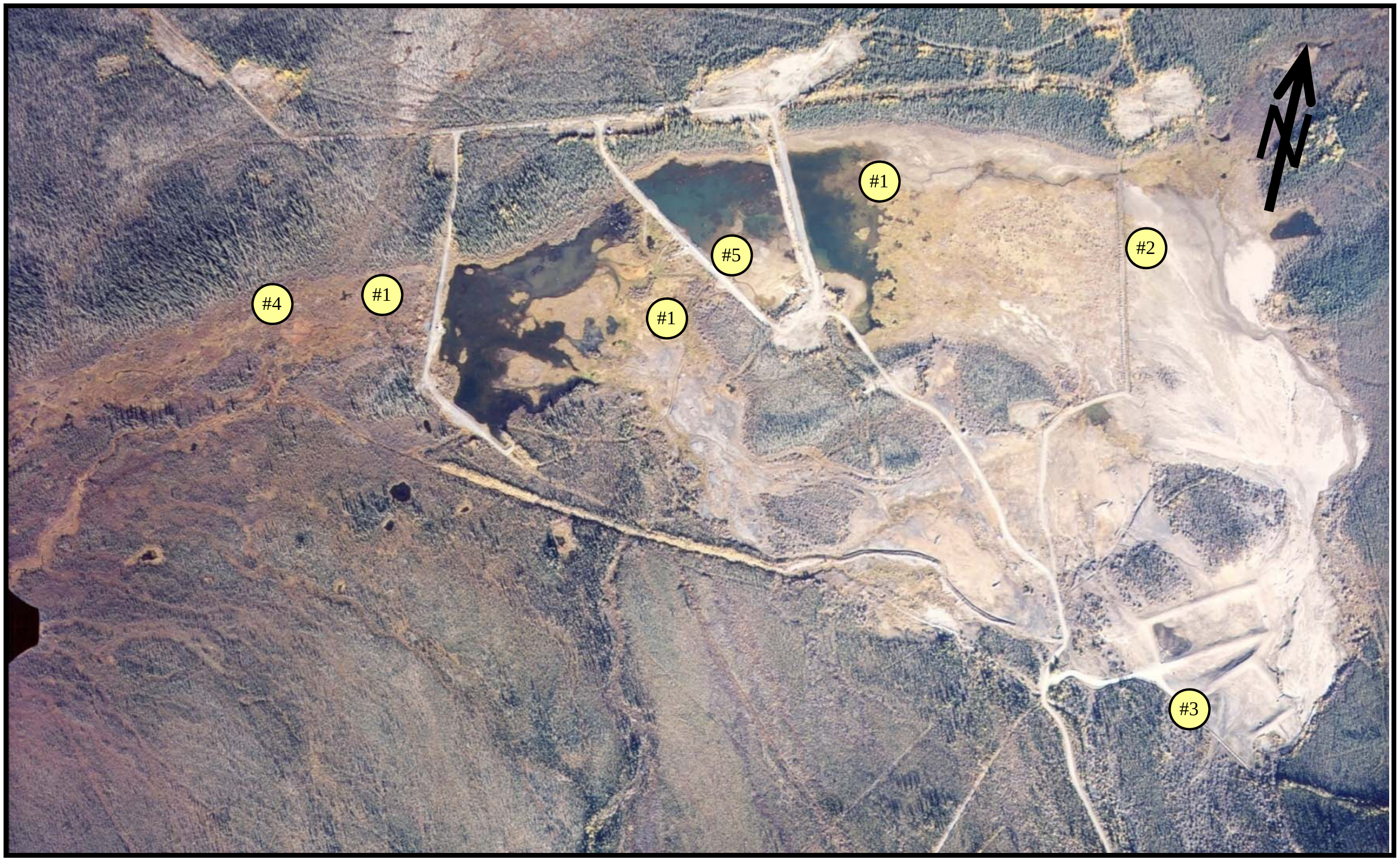
VTF Aerial Photograph: August 1984

Job No: 1CE012.001
Filename:
Tailings Area History.figures.1CE012.000.dbm.rev00.ppt

Keno Hill Silver District

Date: February 2009
Approved:
Figure: **2e**



#1: Natural revegetation of tailings has occurred within and adjacent to surface water bodies and where the water table is near the tailings surface.

#2: A ditch through the New Tailings was excavated some time after 1984. The finer tailings west of this ditch have been colonized by vegetation, whereas coarser tailings to the east are largely unvegetated. North Fork Flat Creek flows around the northern end of this ditch and reports to Pond 1.

#3: Tailings paddies constructed in 1996/1997 are being used for storage of water treatment sludge.

#4: Surface exposure of Old Tailings with no vegetation. Most of the Old Tailings visible in earlier photographs west of Dam 3 have revegetated naturally.

#5: Tailings, water treatment sludge and lime residues form a exposed surface south of Pond 2.

Source: Aerial photograph captured by Geodesy Remote Sensing, Calgary AB. Flown September 13-14, 2006.

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2007/08 Geochemical Closure Studies

VTF Aerial Photograph:
September 2006

Job No: 1CE012.001
Filename:
Tailings Area History.figures.1CE012.000.dbm.rev00.ppt

Keno Hill Silver District

Date: February 2009
Approved:
Figure: **2f**

Appendix B

1995 Tailings Characterization: Appendix IX from 1996 Site Characterization Report

Appendix IX

Tailing Characterization

ELSA TAILINGS - TEST PITS JULY 1995

TEST PIT NO. UK/TP/01

Location: Upstream of Dam No. 1, at edge of ponded water, near original ground peninsula

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0				
A	10	6.5	800	medium brown, wet slimes	wet
				no visible oxidation or iron staining	wet
B	20	7.5		medium to dark brown, wet slimes	seeping
				no visible oxidation or iron staining	flowing
C	35	8		dark brown, wet slimes, no staining	flowing
D	50	8		as C	flowing
E	75	8.8		as C	flowing
F	100	8.8	190	as C	flowing
G		8.4	170	as C - stopped as hole collapsing	flowing

TEST PIT NO. UK/TP/02

Location: on "island" in pond upstream of Dam No. 2, just below old treatment plant (decant)

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0				
A	10	8	260	sandy, med. to light brown	moist
B	35	7.6	440	sandy, med. to light brown	moist
C	50	7.8	480	sandy, med. to light brown	seeping
D	80	7.8	260	sandy, med. to light brown	seeping
E	90	9.5	340	sandy, med. to light brown	flowing
				but can see fine chunks of lime(?)	
				stopped as hole collapsing	

TEST PIT NO. UK/TP/03

Location: in tailings along road at power pole by 2 pipes from Husky Shaft

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0				
A	10	5.8	>2000	brown moist sand	
B	15	6.1	>2000	med. orange brown moist sand	
C	32	6.1	>2000	med. brown orange moist silt	
D	38	5.1	>2000	orange sand, dry to moist	
E	41	5.2	1500	med. brown orange moist silt	
F	83	5.2	>2000	med. brown orange moist silt	
NOTE:	32 to end of hole is alternating layers of C and D				
	F? is a composite of the alternating fine sand and the silt layers which are less orange				

ELSA TAILINGS - TEST PITS JULY 1995

TEST PIT NO. UK/TP/04

Location: along channel in old tailings near Diversion

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0				
A	20			dark brown moist silty sand	moist
				some iron stained blebs	
B	50			layered light brown sand with iron stained	moist
				sand in <2 cm layers	
C	90			layered fine orange sands with brown-	moist
				orange silt layers of 2 to 6 cm thickness	

TEST PIT NO. UK/TP/05

Location: along channel in old tailings near Diversion, further south from previous two test pits

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0			med. to dark brown soil-like sands	
A	20	7.8		med. to dark brown soil-like sands	moist
B	75			dark orange-brown sands, moist, loose -	moist
				i.e. not compacted like other lenses	
C	120	5.8	>2000	mixed grey silt with orange sand	moist
				layers - compacted	
D	150	6.2	270	wet, light grey fine silty sand	seeping
				hole collapsing	
seep		6.9	700	seep at toe of bank at depth of D	flowing

TEST PIT NO. UK/TP/06

Location: downslope from previous test pits, near pole across from chemical storage

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0			med. to dark brown soil-like sands	
A	37	6.1	1600	med. to dark brown soil-like sands	dry
B	75	6.1	900	light brown/orange coarse slightly	damp
				moist sands - like a hardpan	
C	87	8	0	fine light grey wet sand	wet

? are these upper tailings like a soil becuase of weathering and leaching or because of erosion and transport of soil like material overlying the tailings

ELSA TAILINGS - TEST PITS JULY 1995

TEST PIT NO. UK/TP/07-1 (No samples collected).

Location: in old dozed test pit, on north side of road, downstream to trees
did two pits here, on in excavation (#1) and one at edge (#2)

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0			hardpan - orange, fine, compacted	
A	30			hardpan - orange, fine, compacted	
B	50			grey/brown sands	
C	EOH			hardpan - can't dig through	

TEST PIT NO. UK/TP/07-2

Location: in old dozed test pit, on north side of road, downstream to trees
did two pits here, on in excavation and one at edge

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0				
A	20			moist grey sands with some Fe stained	damp
				bands, less than .5 cm thick	
B	50			same as A, Fe bands 1 to 2 cm thick	damp
C	75			hardpan	damp

TEST PIT NO. UK/TP/08

Location: upper part of Pond 1 - old tailings area below garbage dump and bunkhouse
in old metallurgical bulk sample test pit location

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0			light brown grey sands, eroded by wind, water	
A	23	7.1	700	fine, light brown-grey, wind-blown	dry
B	76	5.5	1480	hardpan	dry
C	86	6.1	560	fine, moist, grey sand	moist
D	150	5.2	1460	hardpan with some fine sands (25%)	damp

Then walked along channel cut by water flow (1 to 1.5 m depth) - cam water/sewage channel. No hardpan evident even at depth in embankment to the north(east).

ELSA TAILINGS - TEST PITS JULY 1995

TEST PIT NO. UK/TP/10

Location: downstream adjacent to sewage channel, but closer to trees of original ground

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0				
A	100			dark brown sands - similar to surface and	damp
				upper layers of other test pits	

TEST PIT NO. UK/TP/11

Location: downstream adjacent to sewage channel, but moving closer to road and trees

LAYER	DEPTH (cm)	PASTE pH	PASTE TDS	DESCRIPTION	WATER
SURFACE	0			dark brown sands - similar to surface and	
A	50			upper layers of other test pits	
B	100	6.6	310	orange-brown sands, hard to dig but	
				not as cemented as "hardpan" layers	

United Keno Hill Mines Ltd.

TAILINGS		HEAD ICP ANALYSES						DRAFT
ELEMENT		UK/TP/01-A	UK/TP/01-B	UK/TP/01-C	UK/TP/01-D	UK/TP/01-E	UK/TP/01-F	UK/TP/01-G
Ag	ppm	169.6	107.7	160.6	192.2	177	110.9	125.8
Al	%	0.5	0.19	0.31	0.38	0.34	0.27	0.29
As	ppm	1	1	1	1	1	1	1
Ba	ppm	154	150	155	219	189	243	216
Be	ppm	3	2.3	3.1	3.2	3	2.8	2.8
Bi	ppm	24	28	40	33	32	30	30
Ca	%	0.57	0.76	0.99	0.93	0.89	1.29	1.55
Cd	ppm	88.2	>100.0	>100.0	>100.0	>100.0	>100.0	>100.0
Co	ppm	16	13	20	18	17	15	16
Cr	ppm	1	1	1	1	1	1	1
Cu	ppm	658	193	318	306	292	242	326
Fe	%	10.78	9.33	>15.00	13.17	12.42	10.85	11.92
Ga	ppm	1	1	1	1	1	1	1
K	%	0.1	0.05	0.08	0.07	0.06	0.06	0.07
Li	ppm	4	1	2	3	3	2	2
Mg	%	0.2	0.18	0.17	0.21	0.2	0.28	0.24
Mn	ppm	>10000	>10000	>10000	>10000	>10000	>10000	>10000
Mo	ppm	3	4	4	5	6	5	5
Na	%	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ni	ppm	78	119	178	141	137	128	129
P	ppm	740	510	840	820	750	660	740
Pb	ppm	9518	>10000	>10000	>10000	>10000	>10000	>10000
Sb	ppm	557	460	827	876	824	572	659
Sn	ppm	10	7	15	11	10	10	10
Sr	ppm	1	1	1	1	1	1	1
Th	ppm	1	1	1	1	1	1	1
Ti	%	0.01	0.01	0.01	0.01	0.01	0.01	0.01
U	ppm	1	1	1	1	1	1	1
V	ppm	22.8	16.9	27.5	25.8	24.4	20.8	22.6
W	ppm	6	9	12	11	11	10	11
Zn	ppm	5161	4676	8224	7367	6558	6336	7046

TAILINGS		HEAD ICP ANALYSES						DRAFT
ELEMENT		UK/TP/02-A	UK/TP/02-B	UK/TP/02-C	UK/TP/02-D	UK/TP/02-E	UK/TP/03-A	UK/TP/03-B
Ag	ppm	100.4	53.4	49.5	75.7	57.2	97	75.7
Al	%	0.24	0.13	0.14	0.17	0.21	0.12	0.15
As	ppm	1	1	1	1	1	1	1
Ba	ppm	249	291	258	312	179	46	41
Be	ppm	1.9	1.4	1.4	1.8	1.4	3.5	2.7
Bi	ppm	20	17	16	19	17	40	31
Ca	%	2.33	0.71	0.83	0.94	7.51	0.6	0.77
Cd	ppm	95.5	40.2	48.3	55	>100.0	>100.0	40.9
Co	ppm	15	10	9	11	29	20	16
Cr	ppm	1	1	1	1	1	1	1
Cu	ppm	259	119	122	158	460	200	187
Fe	%	7.16	5.55	5.54	6.64	4.65	>15.00	10.93
Ga	ppm	1	1	1	1	1	1	1
K	%	0.06	0.05	0.05	0.05	0.05	0.04	0.05
Li	ppm	2	1	1	1	2	1	1
Mg	%	0.46	0.21	0.2	0.22	3.47	0.41	0.36
Mn	ppm	>10000	>10000	>10000	>10000	>10000	>10000	>10000
Mo	ppm	5	4	3	5	3	5	4
Na	%	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ni	ppm	93	66	64	76	151	179	132
P	ppm	530	290	330	390	390	360	350
Pb	ppm	>10000	5159	6104	8444	5656	7162	7634
Sb	ppm	351	141	179	248	166	234	217
Sn	ppm	7	4	5	5	6	12	9
Sr	ppm	1	1	1	1	73	1	1
Th	ppm	1	1	1	1	1	1	1
Ti	%	0.01	0.01	0.01	0.01	0.01	0.01	0.01
U	ppm	1	1	1	1	1	1	1
V	ppm	16.1	11	10.9	13.3	19.4	23.1	17.6
W	ppm	9	7	6	8	12	16	11
Zn	ppm	5325	2929	2947	3660	8193	9826	5276

TAILINGS		HEAD ICP ANALYSES						DRAFT
ELEMENT		UK/TP/03-C	UK/TP/08-D	UK/TP/10-A	UK/TP/11-A	UK/TP/11-B	UK/GJ/01	UK/TE/09
Ag	ppm	118.2	10.1	122	60.6	111.1	96.6	>200.0
Al	%	0.34	0.15	0.16	0.17	0.11	0.21	0.15
As	ppm	1	1	1	1	1	1	1
Ba	ppm	67	347	79	256	142	122	51
Be	ppm	2.9	2.1	1.8	1.8	2.8	1.8	2.6
Bi	ppm	28	27	15	18	35	20	28
Ca	%	1.49	0.89	0.39	0.75	0.76	0.44	0.4
Cd	ppm	>100.0	68.8	59.7	56.2	>100.0	61.4	>100.0
Co	ppm	16	12	11	11	21	10	16
Cr	ppm	1	1	1	1	1	1	1
Cu	ppm	308	75	371	131	184	254	714
Fe	%	11	9.42	7.41	7.6	14.02	7.48	12.19
Ga	ppm	1	1	1	1	1	1	1
K	%	0.1	0.06	0.05	0.07	0.05	0.06	0.05
Li	ppm	1	1	1	1	1	1	1
Mg	%	0.33	0.42	0.14	0.24	0.49	0.15	0.12
Mn	ppm	>10000	>10000	>10000	>10000	>10000	>10000	>10000
Mo	ppm	5	3	2	4	4	4	3
Na	%	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Ni	ppm	114	114	64	80	148	82	110
P	ppm	560	320	300	370	290	410	290
Pb	ppm	>10000	1991	6435	3947	5383	7433	>10000
Sb	ppm	442	78	193	138	180	274	280
Sn	ppm	10	8	6	7	12	5	11
Sr	ppm	1	1	1	1	1	1	1
Th	ppm	1	1	1	1	1	1	1
Ti	%	0.01	0.01	0.01	0.01	0.01	0.01	0.01
U	ppm	1	1	1	1	1	1	1
V	ppm	19.5	15.4	12.2	13.6	19.8	14.1	17
W	ppm	20	9	7	8	18	6	11
Zn	ppm	>10000	5387	4144	4782	>10000	2791	7438

ELSA TAILINGS - TEST PITS JULY 1995

TEST PIT NO. UK/TP/01

Location: Upstream of Dam No. 1, at edge of ponded water, near original ground peninsula

LAYER	DEPTH (cm)	Paste pH field	TDS field	Paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	10	6.5	800	7.17	0.36	0	11.25	11	-0.25	1.0
B	20	7.5	300	7.57	0.39	0.00	12.2	13.8	1.6	1.1
C	35	8	800	7.49	0.52	0.52	0.0	8.3	8.3	<0.1
D	50	8	700							
E	75	8.8	700							
F	100	8.8	190							
G		8.4	170	7.79	0.70	0.36	10.6	25.8	15.1	2.4

TEST PIT NO. UK/TP/02

Location: on "island" in pond upstream of Dam No. 2, just below old treatment plant (decant)

LAYER	DEPTH (cm)	PASTE pH field	TDS field	Paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	10	8	260	8.18	1.35	0.30	32.8	56.3	23.4	1.7
B	35	7.6	440	7.78	1.27	0.14	35.3	22.5	-12.8	0.6
C	50	7.8	480							
D	80	7.8	260							
E	90	9.5	340	9.18	1.48	0.94	16.9	326.9	310.0	19.4

TEST PIT NO. UK/TP/03

Location: in tailings along road at power pole by 2 pipes from Husky Shaft

LAYER	DEPTH (cm)	PASTE pH field	TDS field	Paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	10	5.8	>2000	6.16	4.27	0.53	116.9	32.1	-84.8	0.3
B	15	6.1	>2000	6.40	2.57	0.53	63.8	23.1	-40.6	0.4
C	32	6.1	>2000	5.93	2.93	1.71	38.1	95.0	56.9	2.5
D	38	5.1	>2000	5.79	1.94	0.92	31.9	21.5	-10.4	0.7
E	41	5.2	1500	5.68	1.88	0.76	35.0	14.1	-20.9	0.4
F	83	5.2	>2000							
NOTE:	32 to end of hole is alternating layers of C and D									
	F is a composite of the alternating fine sand and the silt layers which are less orange									

ELSA TAILINGS - TEST PITS JULY 1995

TEST PIT NO. UK/TP/04

Location: along channel in old tailings near Diversion

LAYER	DEPTH	PASTE pH	TDS	Paste pH	S(T)	S(SO4)	AP	NP	Net NP	NP/AP
	(cm)	field	field	lab	%	%				
Surface	0									
A	20		>2000	5.90	2.95	0.99	61.3	6.6	-54.6	0.1
B	50		>2000	6.25	3.99	0.58	106.6	18.4	-88.2	0.2
C	90		>2000	5.72	3.82	0.59	100.9	46.0	-54.9	0.5

TEST PIT NO. UK/TP/05

Location: along channel in old tailings near Diversion, further south from previous two test pits

LAYER	DEPTH	PASTE pH	TDS	Paste pH	S(T)	S(SO4)	AP	NP	Net NP	NP/AP
	(cm)	field	field	lab	%	%				
Surface	0									
A	20	7.8	>2000	4.49	3.72	1.85	58.4	7.6	-50.8	0.1
B	75		1100	5.06	3.93	0.45	108.8	11.4	-97.4	0.1
C	120	5.8	>2000	4.74	3.88	0.48	106.3	13.6	-92.6	0.1
D	150	6.2	270	7.01	0.61	0.22	12.2	35.9	23.8	2.9
seep		6.9	700							

TEST PIT NO. UK/TP/06

Location: downslope from previous test pits, near pole across from chemical storage

LAYER	DEPTH	PASTE pH	TDS	Paste pH	S(T)	S(SO4)	AP	NP	Net NP	NP/AP
	(cm)	field	field	lab	%	%				
Surface	0									
A	37	6.1	1600							
B	75	6.1	900	5.99	4.66	0.44	131.9	98.3	-33.6	0.7
C	87	8	0	6.93	3.17	0.36	87.8	28.8	-59.1	0.3

TEST PIT NO. UK/TP/07-2

Location: in old dozed test pit, on north side of road, downstream to trees

LAYER	DEPTH	PASTE pH	TDS	Paste pH	S(T)	S(SO4)	AP	NP	Net NP	NP/AP
	(cm)	field	field	lab	%	%				
Surface	0									
A	20		>2000	5.96	1.65	0.82	25.9	16.5	-9.4	0.6
B	50		>2000	5.76	1.70	0.94	23.8	7.3	-16.5	0.3
C	75		>2000	5.66	2.70	0.52	68.1	51.3	-16.9	0.8

ELSA TAILINGS - TEST PITS JULY 1995

TEST PIT NO. UK/TP/08

Location: upper part of Pond 1 - old tailings area below garbage dump and bunkhouse in old metallurgical bulk sample test pit location

LAYER	DEPTH	PASTE pH	TDS	Paste pH	S(T)	S(SO4)	AP	NP	Net NP	NP/AP
	(cm)	field	field	lab	%	%				
Surface	0									
A	23	7.1	700	6.84	1.05	0.27	24.4	17.3	-7.1	0.7
B	76	5.5	1480	5.87	2.16	0.67	46.6	16.0	-30.6	0.3
C	86	6.1	560	5.72	2.61	0.71	59.4	56.5	-2.9	1.0
D	150	5.2	1460							

TEST PIT NO. UK/TP/10

Location: downstream adjacent to sewage channel, but closer to trees of original ground

LAYER	DEPTH	PASTE pH	TDS	Paste pH	S(T)	S(SO4)	AP	NP	Net NP	NP/AP
	(cm)	field	field	lab	%	%				
Surface	0									
A	100		600							

TEST PIT NO. UK/TP/11

Location: downstream adjacent to sewage channel, but moving closer to road and trees

LAYER	DEPTH	PASTE pH	TDS	Paste pH	S(T)	S(SO4)	AP	NP	Net NP	NP/AP
	(cm)	field	field	lab	%	%				
Surface	0									
A	50		1100	6.80	2.23	0.39	57.5	13.4	-44.1	0.2
B	100	6.6	310	6.81	5.25	0.26	155.9	104.8	-51.2	0.7

ELSA TAILINGS - TEST PITS JULY 1995

	DEPTH (cm)	Paste pH field	TDS field	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
TEST PIT NO. UK/TP/01	10	6.5	800	0.36	0	11.25	11	-0.25	1.0
	20	7.5	300	0.39	0.00	12.2	13.8	1.6	1.1
	35	8	800	0.52	0.52	0.0	8.3	8.3	<0.1
	50	8	700	0.52	0.52	0.0	8.3	8.3	<0.1
	75	8.8	700	0.52	0.52	0.0	8.3	8.3	<0.1
	100	8.8	190	0.52	0.52	0.0	8.3	8.3	<0.1
	200	8.4	170	0.70	0.36	10.6	25.8	15.1	2.4
weighted average			1053	0.76	0.66	3.13	13.75		
median			700	0.52	0.52	0.00	8.25		
count			7	7	7	7	7		

TEST PIT NO. UK/TP/02	10	8	260	1.35	0.30	32.8	56.3	23.4	1.7
	35	7.6	440	1.27	0.14	35.3	22.5	-12.8	0.6
	50	7.8	480	1.27	0.14	35.3	22.5	-12.8	0.6
	80	7.8	260	1.35	0.30	32.8	56.3	23.4	1.7
	90	9.5	340	1.48	0.94	16.9	326.9	310.0	19.4
weighted average			0	0.00	0.30	32.15	71.32		
median			340	1.35	0.30	32.81	56.25		
count			5	5	5	5	5		

ELSA TAILINGS - TEST PITS JULY 1995

	DEPTH (cm)	Paste pH field	TDS field	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
TEST PIT NO. UK/TP/03	10	5.8	>2000	4.27	0.53	116.9	32.1	-84.8	0.3
	15	6.1	>2000	2.57	0.53	63.8	23.1	-40.6	0.4
	32	6.1	>2000	2.93	1.71	38.1	95.0	56.9	2.5
	38	5.1	>2000	1.94	0.92	31.9	21.5	-10.4	0.7
	41	5.2	1500	1.88	0.76	35.0	14.1	-20.9	0.4
TEST PIT NO. UK/TP/04	20		>2000	2.95	0.99	61.3	6.6	-54.6	0.1
	50		>2000	3.99	0.58	106.6	18.4	-88.2	0.2
	90		>2000	3.82	0.59	100.9	46.0	-54.9	0.5
TEST PIT NO. UK/TP/05	20	7.8	>2000	3.72	1.85	58.4	7.6	-50.8	0.1
	75		1100	3.93	0.45	108.8	11.4	-97.4	0.1
	120	5.8	>2000	3.88	0.48	106.3	13.6	-92.6	0.1
	150	6.2	270	0.61	0.22	12.2	35.9	23.8	2.9
TEST PIT NO. UK/TP/06	37	6.1	1600	4.66	0.44				
	75	6.1	900	4.66	0.44	131.9	98.3	-33.6	0.7
	87	8	0	3.17	0.36	87.8	28.8	-59.1	0.3
weighted average				3.60	0.63	79.5	30.69		
median				3.72	0.53	75.8	22.31		
max				4.66	1.85	131.9	98.25		
min				0.61	0.22	12.2	6.63		
count				15	15	14	14		

ELSA TAILINGS - TEST PITS JULY 1995

	DEPTH (cm)	Paste pH field	TDS field	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
TEST PIT NO. UK/TP/07-2	20		>2000	1.65	0.82	25.9	16.5	-9.4	0.6
	50		>2000	1.70	0.94	23.8	7.3	-16.5	0.3
	75		>2000	2.70	0.52	68.1	51.3	-16.9	0.8
TEST PIT NO. UK/TP/08	23	7.1	700	1.05	0.27	24.4	17.3	-7.1	0.7
	76	5.5	1480	2.16	0.67	46.6	16.0	-30.6	0.3
	86	6.1	560	2.61	0.71	59.4	56.5	-2.9	1.0
	150	5.2	1460	2.61	0.71	59.4	56.5	-2.9	1.0
TEST PIT NO. UK/TP/11	50		1100	2.23	0.39	57.5	13.4	-44.1	0.2
	100	6.6	310	5.25	0.26	155.9	104.8	-51.2	0.7
weighted average				3.45	0.61	88.69	56.61		
median				2.2	0.7	57.5	17.3		
max				5.3	0.9	155.9	104.8		
min				1.1	0.3	23.8	7.3		
count				9	9	9	9		

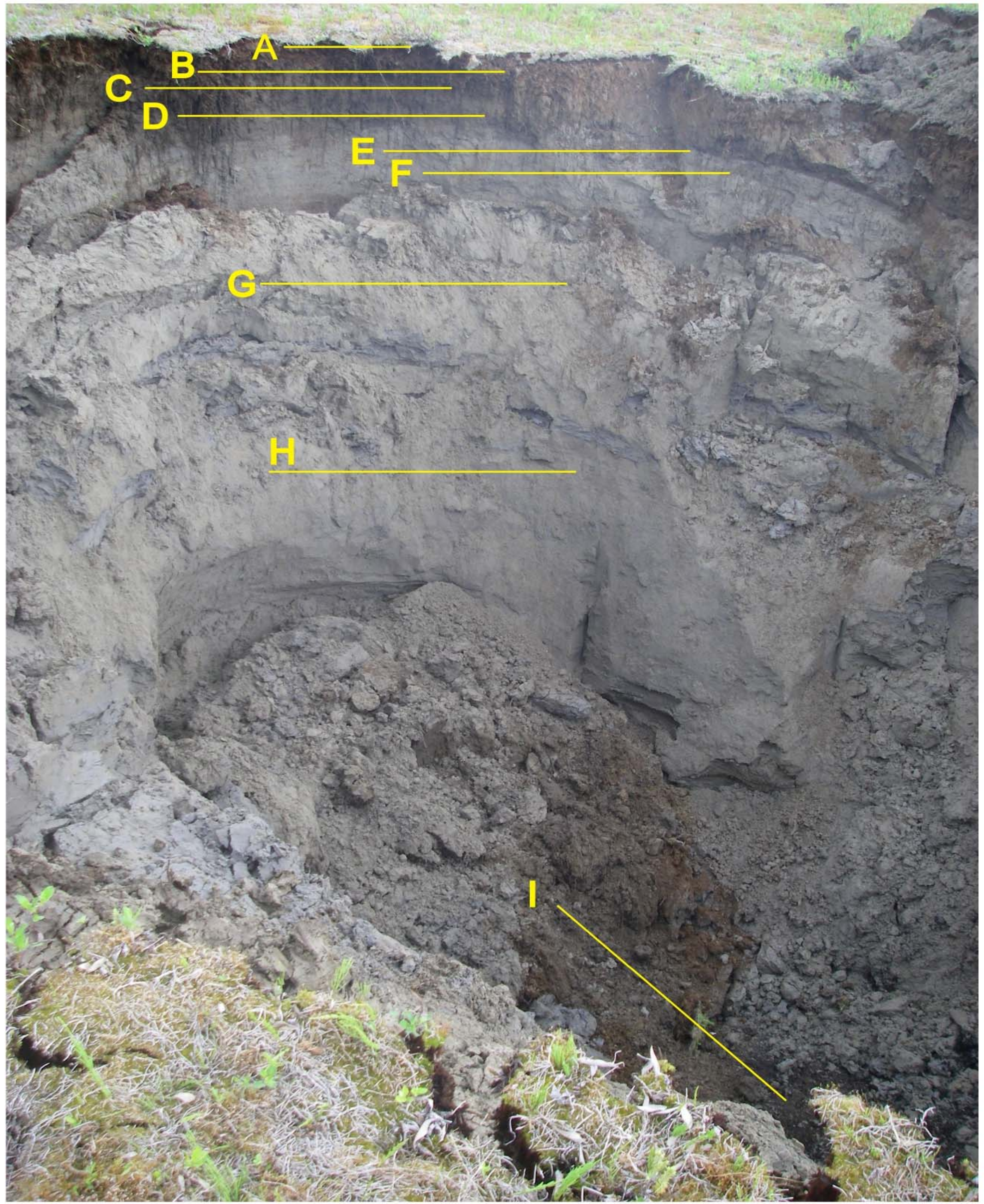
Appendix C

2007 Tailings Test Pit Logs with Paste pH and Conductivity Results

TEST PIT NO. **UK/TP/01-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	7.0	373	745	Organics, moss (red-brown) soil (10cm); organic clay-like silty sand (10cm)	N
B	0.20	6.8	577	285	med/dark brown organics, silty clay-like wet	N
C	0.35	6.7	364	630	some oxidation. Silty clay-like sand, organics	N
D	0.50	6.8	335	717	clay, wet slimes. No oxidation, no iron staining.	N
E	0.75	7.3	427	860	silt. No organics, no oxidation	N
F	1.00	7.1	415	813	same as E	N
G	2.00	7.0	185	368	Wet sand, light and dark grey, with dark band at	N
H	3.00	7.4	165	329	Wet sand, light and dark grey. No oxidation	N
I	4.80	6.6	775	1471	ORIGINAL GROUND - dark brown, organics	Y
	5.25				End of Hole	

*Note: hole filled rapidly with groundwater
Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



Valley Tailings Facility 2007 Test Pitting - Test Pit #1

1995 Results for Comparison

UK/TP/01
Year: **1995**
Location: **Upstream of Dam No. 1, at edge of ponded water, near original ground peninsula**

1995 Data										
Layer	Depth (m)	Paste pH field	TDS field	paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	10	6.5	800	7.17	0.36	0.00	11.25	11.00	-0.25	1.00
B	0.2	7.5	300	7.57	0.39	0.00	12.20	13.80	1.60	1.10
C	0.35	8	800	7.49	0.52	0.52	0.31	8.30	8.30	>26
D	0.5	8	700							
E	0.75	8.8	700							
F	1	8.8	190							
G	2	8.4	170	7.79	0.70	0.36	10.60	25.80	15.10	2.40

TEST PIT NO.   UK/TP/03-07

Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	7.6	256	507	Surface material - grey-black med grained sands, dry	N
B	0.10	6.1	602	1200	Med grained sands, alt. iron stained and grey-black beds ~0.5-1cm thick. Cross bedding.	N
C	0.30	5.8	798	1605	ORIGINAL GROUND - iron stained leaching onto OG for 1st 10cm. Organics present.	N
	0.75				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007

Valley Tailings Facility 2007 Test Pitting - Test Pit #3

1995 Results for Comparison

UK/TP/03
Year: **1995**
Location: **in tailings along road at power pole by 2 pipes from husky shaft**

1995 Data

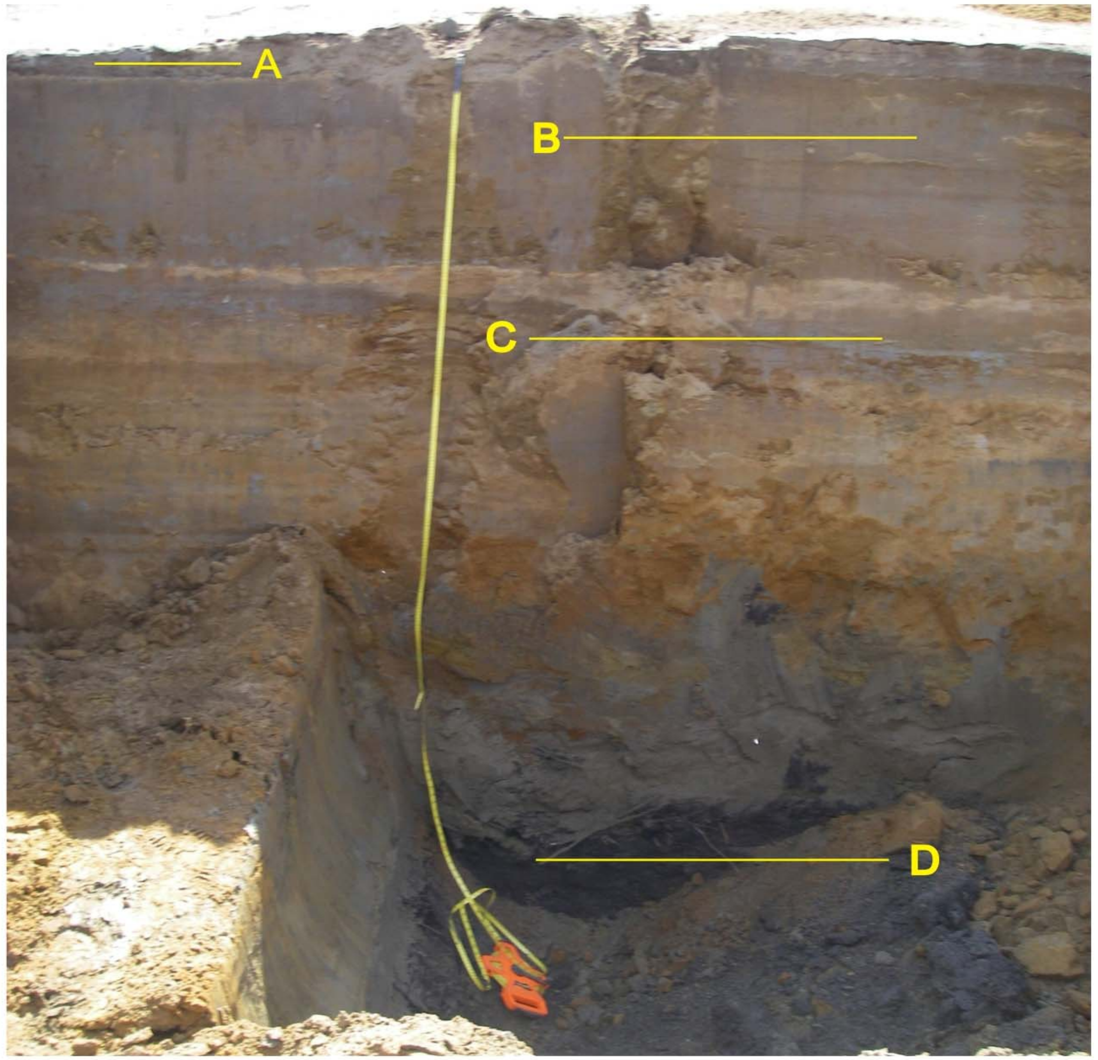
Layer	DEPTH (m)	Paste pH field	TDS field	paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	0.1	5.8	>2000	6.16	4.27	0.53	116.90	32.10	-84.80	0.30
B	0.15	6.1	>2000	6.4	2.57	0.53	63.80	23.10	-40.60	0.40
C	0.32	6.1	>2000	5.93	2.93	1.71	38.10	95.00	56.90	2.50
D	0.38	5.1	>2000	5.79	1.94	0.92	31.90	21.50	-10.40	0.70
E	0.41	5.2	1500	5.68	1.88	0.76	35.00	14.10	-20.90	0.40
F	0.83	5.2	>2000							

Note: 32 to end of hole is alternating layers of C and D, F is a composite of the alternating fine sand and silt layers which are less orange

TEST PIT NO. UK/TP/04-07

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	6.4	411	840	Surface material. Loose, dry, grey-black med grained sands.	N
B	0.20	6.0	814	1642	light brown & red sands alternating. Cross bedding. Iron stained layers (red) more frequent and compact with depth.	N
C	0.50	5.7	2770	5340	light brown & red sands alternating with moist, grey-blue elastic clay-like layers. More compacted than B	N
D	2.30	5.0	2030	4140	ORIGINAL GROUND - black, organics	N
	2.80				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



Valley Tailings Facility 2007 Test Pitting - Test Pit #4

1995 Results for Comparison

UK/TP/04

Year: **1995**

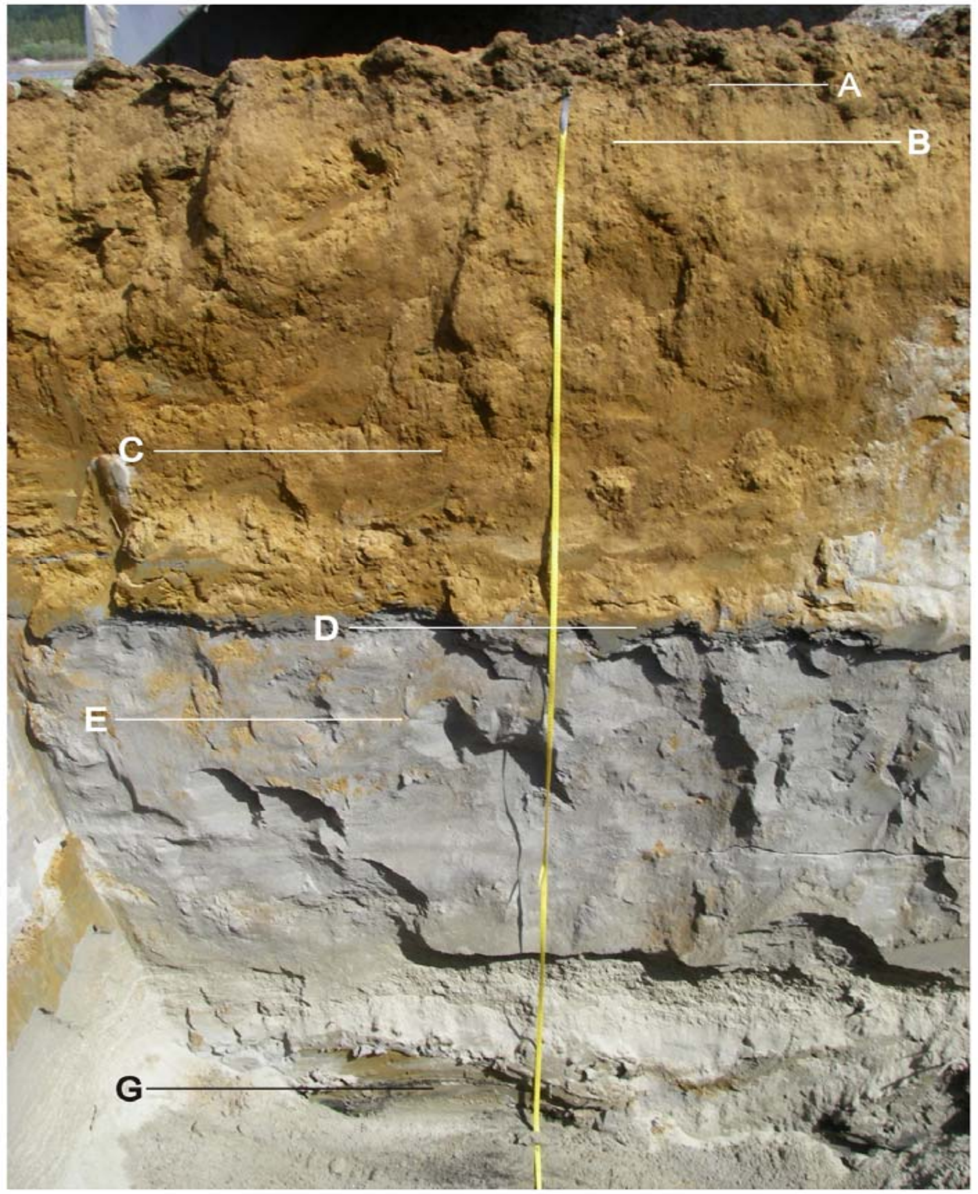
Location: **along channel in old tailings near Diversion**

1995 Data										
Layer	Depth (m)	Paste pH field	TDS field	paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	0.2		>2000	5.9	2.95	0.99	61	7	-55	0.10
B	0.5		>2000	6.25	3.99	0.58	107	18	-88	0.20
C	0.9		>2000	5.72	3.82	0.59	101	46	-55	0.50

TEST PIT NO. **UK/TP/05-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	6.2	403	757	surface material. Grey-black and red sands, med grained and loose	N
B	0.20	5.4	1460	2950	red-brown med grained sands. Moist and compacted	N
C	0.75	5.0	2700	5280	dark red-brown med grained sands. Less compact than B. thin grey silty layers increasing with depth	N
D	1.20	5.6	1340	2710	grey silt beds alternating with red-orange sands. Moist. Silt beds ~4.5cm thick, sand beds ~5-10 cm thick.	N
E	1.50	5.5	862	1735	moist grey sands, med grained and loosely compacted	N
F	2.60	5.9	617	1215	grey-brown silty layer, very moist, elastic	N
G	2.70	5.9	793	1593	ORIGINAL GROUND - black, organics	N
	3.00				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



Valley Tailings Facility 2007 Test Pitting - Test Pit #5

1995 Results for Comparison

UK/TP/05
Year: **1995**
Location: **along channel in old tailings near diversion, further south than previous test pits**

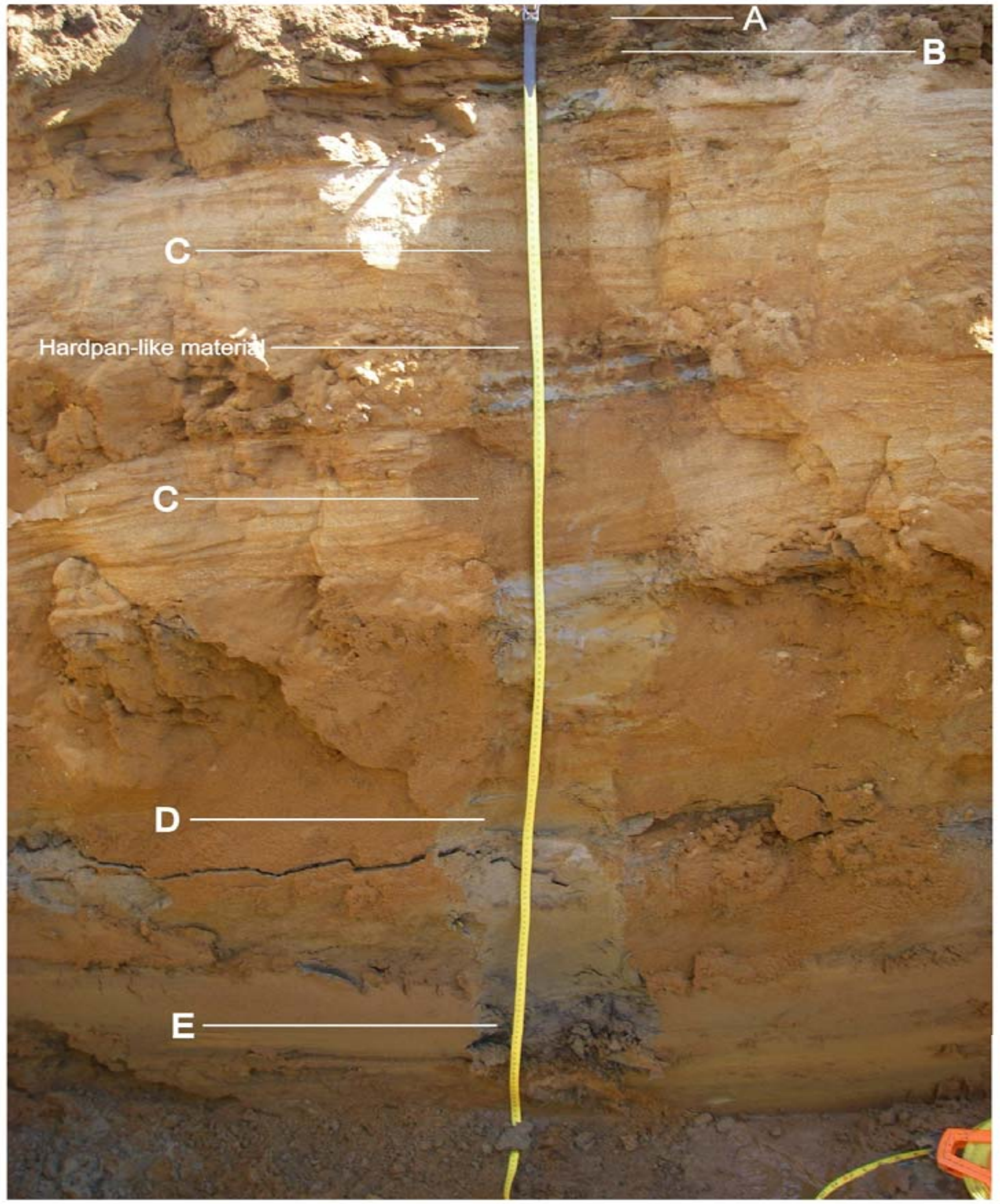
1995 Data

Layer	Depth (m)	Paste pH field	TDS field	paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	0.2	7.8	>2000	4.49	3.72	1.85	58.40	7.60	-50.80	0.10
B	0.75		1100	5.06	3.93	0.45	108.80	11.40	-97.40	0.10
C	1.2	5.8	>2000	4.74	3.88	0.48	106.30	13.60	-92.60	0.10
D	1.5	6.2	270	7.01	0.61	0.22	12.20	35.90	23.80	2.90
seep		6.9	700							

TEST PIT NO. **UK/TP/06-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	5.9	2210	4380	Surface material (1st 10cm): dark red and grey/black sands at surface. Red brown at depth. Loose, med grained	N
B	0.37	5.7	589	1174	red-brown sands, med grained. Some clay-like beds (0.47cm and 0.7cm) ~5-10 cm thick. Iron staining.	N
C	0.75	5.5	1310	2560	red-brown and orange sands, hardpan-like at 1m. Some iron staining.	N
D	1.10	6.2	435	875	fine to med grained grey sands. Moist to wet, no iron	N
E	1.30	6.0	380	762	grey-blue, silty layer. Approx 5-8cm thick. No iron staining. Seep emerging from this layer (at 1.40m)	N
F	1.40	6.0	436	872	ORIGINAL GROUND - dark grey, organics	N
	1.60				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



Valley Tailings Facility 2007 Test Pitting - Test Pit #6

1995 Results for Comparison

UK/TP/06
Year: **1995**
Location: **downslope from previous test pits, near pole across from chemical storage**

1995 Data										
Layer	**Depth (m)**	**Paste pH field**	**TDS field**	**paste pH lab**	**S(T) %**	**S(SO4) %**	**AP**	**NP**	**Net NP**	**NP/AP**
Surface	0									
A	0.37	6.1	1600		4.66	0.44				
B	0.75	6.1	900	5.99	4.66	0.44	132	98	-34	0.70
C	0.87	8	0	6.93	3.17	0.36	88	29	-59	0.30

TEST PIT NO. **UK/TP/07-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	5.7	2580	5090	Surface material (first 0.2m). Med. Grained sand; iron-stained bands	N
B	0.50	5.2	2650	5560	Grey moist sands, iron banding. Some oxidation in layers, growing thinner with depth. Free debris found at 0.7m	N
C	0.75	5.5	1900	3920	Moist grey sands, hardpan	N
D	0.80	5.2	3380	6730	Dark organic layer, grey sands below	N
	1.30				End of hole.	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007

Valley Tailings Facility 2007 Test Pitting - Test Pit #7

1995 Results for Comparison

UK/TP/07
Year: **1995**
Location: **in old dozed test pit, on north side of road, downstream to trees**

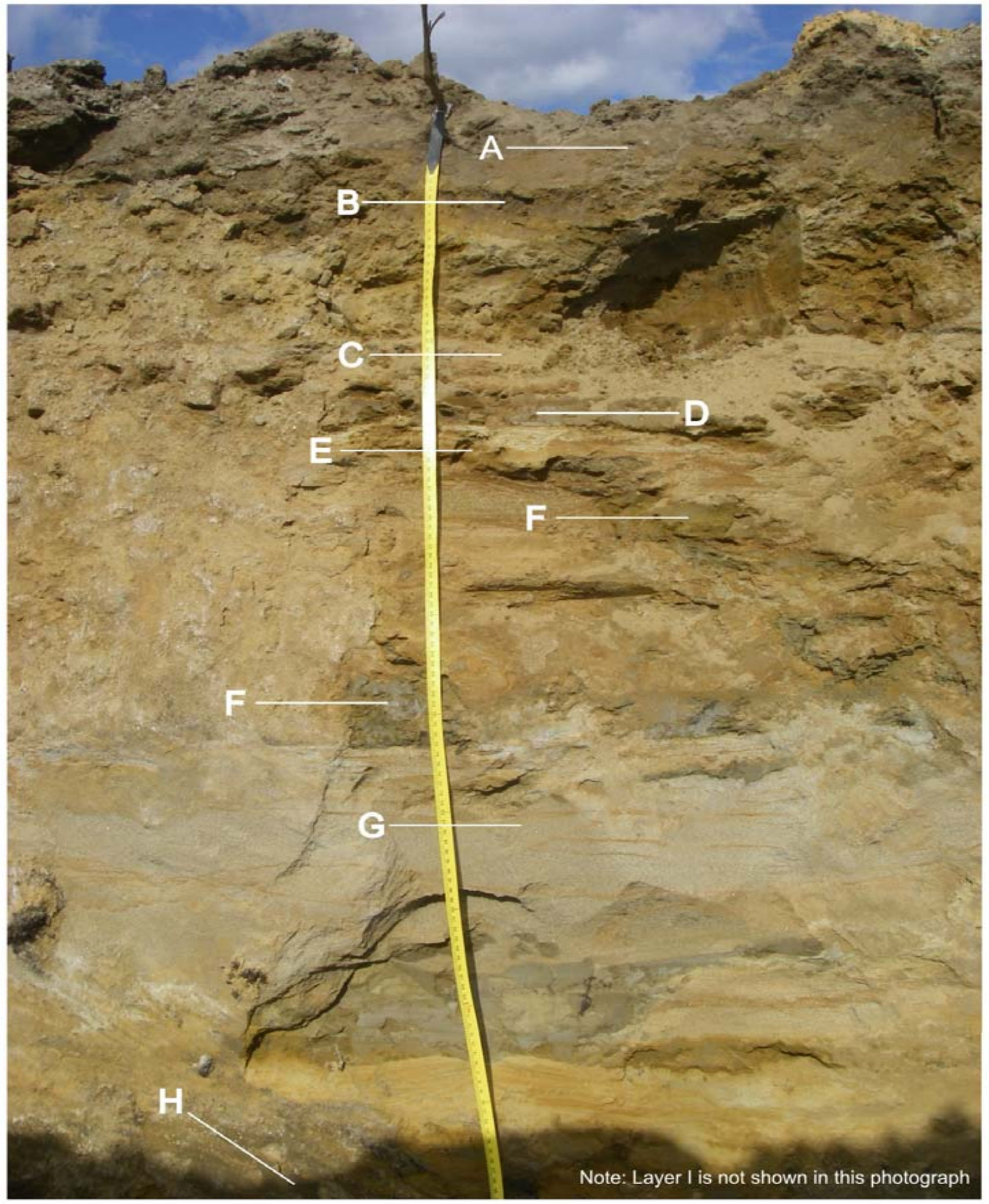
1995 Data

Layer	Depth (m)	Paste pH field	TDS field	paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	0.2		>2000	5.96	1.65	0.82	26	17	-9	0.60
B	0.5		>2000	5.76	1.70	0.94	24	7	-17	0.30
C	0.75		>2000	5.66	2.70	0.52	68	51	-17	0.80

TEST PIT NO. UK/TP/08-07
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	5.8	2780	5540	Surface material. Grey-black, med grained sands.	N
B	0.15	5.3	1860	3820	red-brown sands, med grained and iron stained	N
C	0.28	5.6	1980	3870	light-brown sands, med grained. cross-bedded.thin red-brown bedding (~2mm thick) alternating w/ light brown sands	N
D	0.35	5.1	2790	5620	hard packed silts, red-brown, grey	N
E	0.40	5.2	1630	3490	same as C, with interdespersed clay-like lobes	N
F	0.50	5.5	4090	8070	dark grey-blue silts, iron staining, some med grained sands where iron staining apparent	N
G	0.75	5.4	2560	5170	same as C, iron staining and bedding increase with depth.	N
H	1.20	5.3	4990	9950	grey-blue clay-like, moist	N
I	1.30	4.7	2220	4700	ORIGINAL GROUND - black, organics	N
	1.45				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



Valley Tailings Facility 2007 Test Pitting - Test Pit #8

1995 Results for Comparison

UK/TP/08
Year: **1995**
Location: **upper part of Pond 1 - old tailings area below garbage dump and bunkhouse**

1995 Data

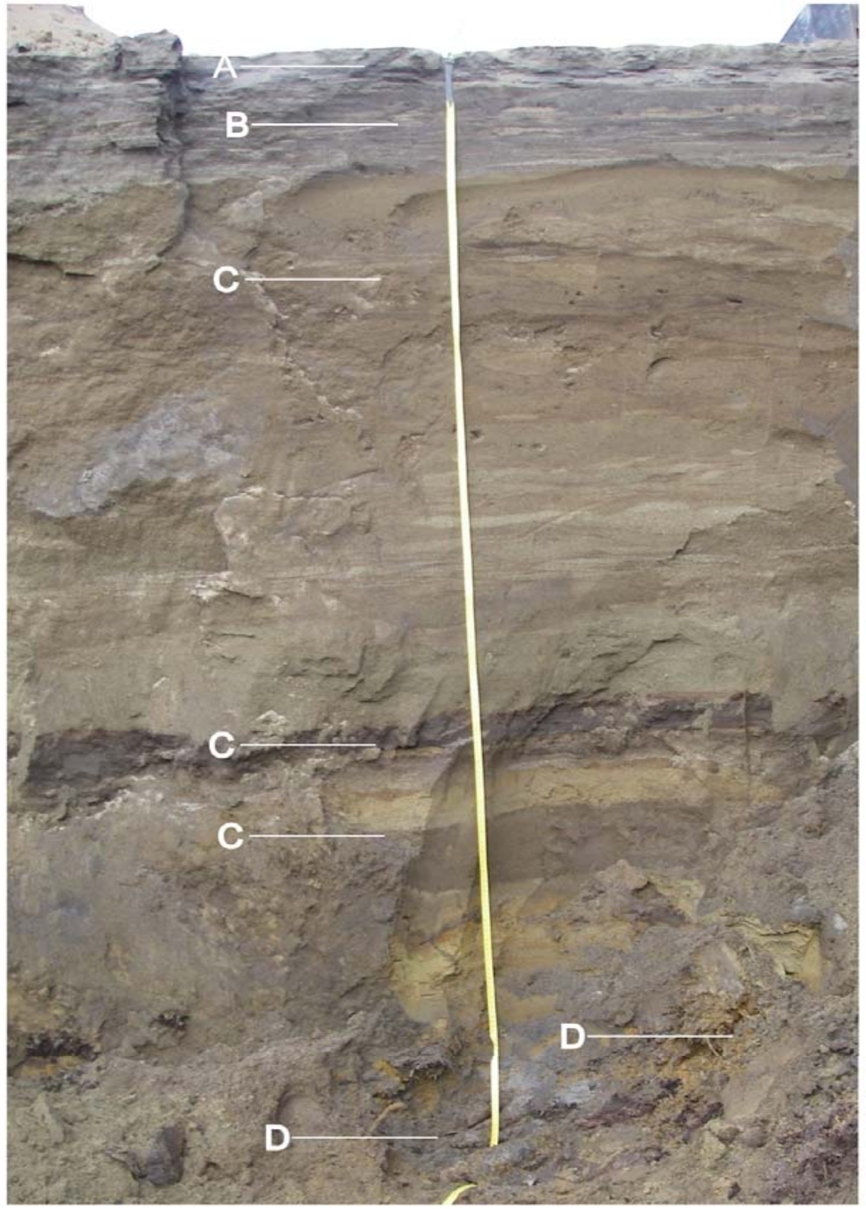
Layer	Depth (m)	Paste pH field	TDS field	paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	0.23	7.1	700	6.84	1.05	0.27	24.40	17.30	-7.10	0.70
B	0.76	5.5	1480	5.87	2.16	0.67	46.60	16.00	-30.60	0.30
C	0.86	6.1	560	5.72	2.61	0.71	59.40	56.50	-2.90	1.00
D	1.5	5.2	1460		2.61	0.71	59.40	56.50	-2.90	1.00

Note: Sample locations are not identical due to construction of tailings paddy cell. 2007 test pit is ~150 m NE and results are not directly comparable

TEST PIT NO. **UK/TP/10-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	7.9	82.3	166	grey-black, med grained sands. Under wind influence, some weak iron	N
B	0.05	7.5	73.2	148	sands, med grained alternating cross beds. Red-brown,grey-black, light.	N
C	0.25	7.8	61.7	127	alt. light and dark brown med grained beds (0.5-1cm thick). Cross bedding. Bedding becomes thicker w/ depth	N
D	2.00	7.3	158	317	ORIGINAL GROUND - very iron stained for first 0.3m. Below: black organics. Organics throughout. Large Cobbles	N
E	2.50				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



Valley Tailings Facility 2007 Test Pitting - Test Pit #10

1995 Results for Comparison

UK/TP/10
Year: **1995**
Location: **downstream adjacent to sewage channel, but closer to trees of original ground**

1995 Data

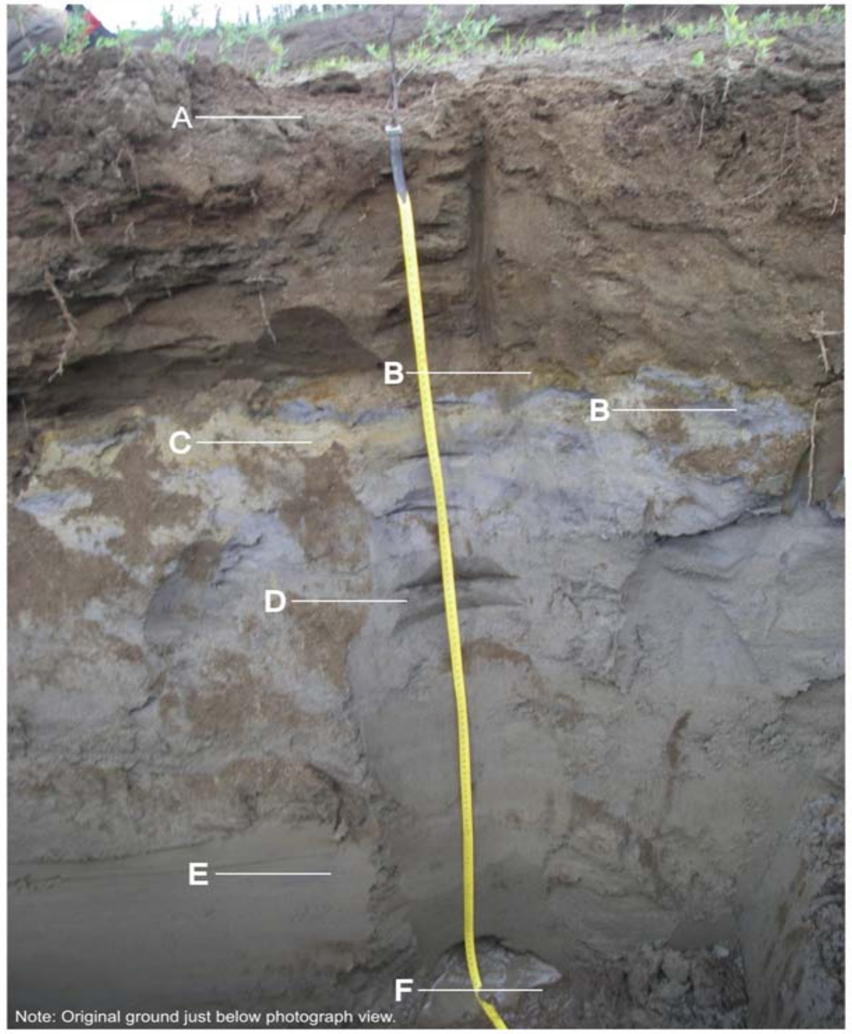
Layer	Depth (m)	Paste pH field	TDS field	paste pH lab	S(T) %	S(SO4) %	AP	NP	Net NP	NP/AP
Surface	0									
A	1		600							

Note: No other 1995 data is reported for UK/TP/10

TEST PIT NO. **UK/TP/11-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	6.9	661	1322	Red-brown, med grained dry sand. Iron staining present. Intermittent brown clay-like bands 2-5cm thick near bottom	N
B	0.35	6.2	838	1326	Blue-grey, clay-like wet slimes. Some iron staining at top of bed	N
C	0.40	6.6	704	1507	Light red-brown, med grained sand. Laminar flow pattern w/ cross bedding. Intermittent iron staining	N
D	0.45	6.2	444	890	Same as B (slightly more crumbly and coarse)	N
E	0.48	7.1	386	774	Same as C (iron staining lessens with depth)	N
F	2.80	6.9	113	227	Same as B	N
G	3.00	6.7	184	368	ORIGINAL GROUND - dark brown, organics	N
	3.50				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



Note: Original ground just below photograph view.

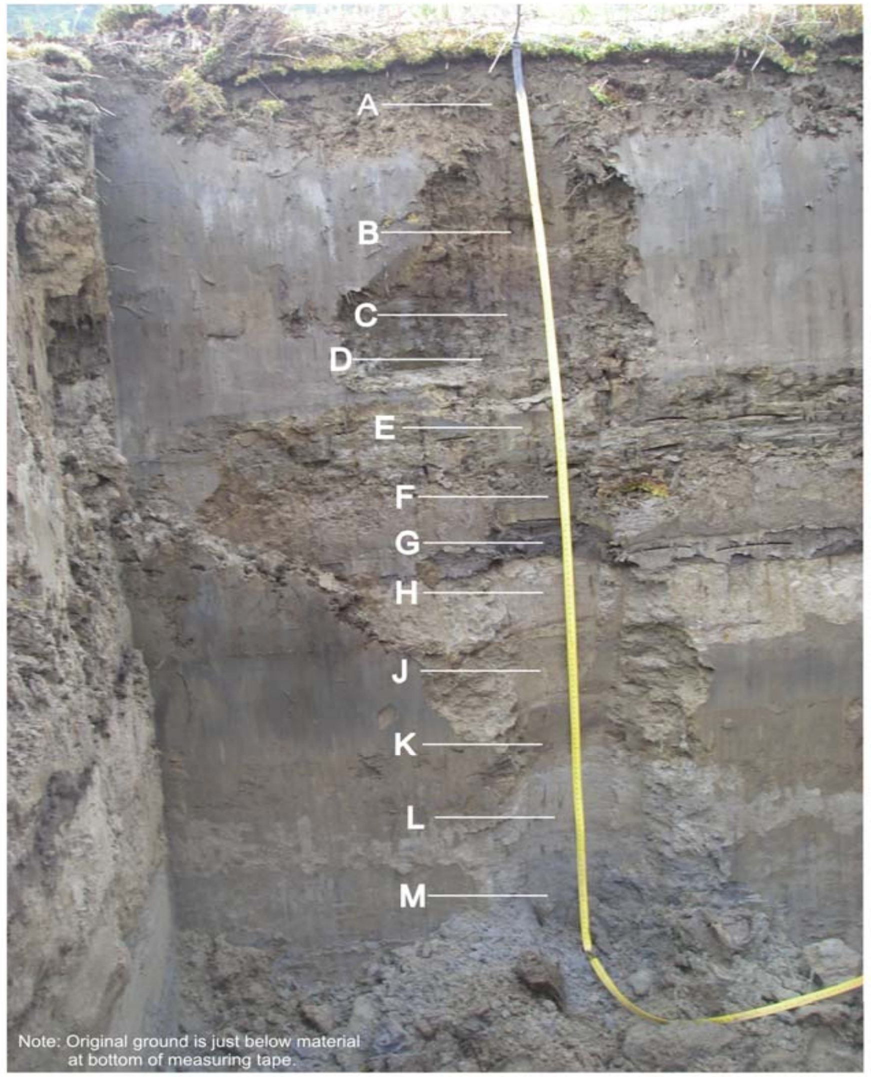
Valley Tailings Facility 2007 Test Pitting - Test Pit #11

Note: There was no data recorded in 1995 for Test Pit #9.

TEST PIT NO. **UK/TP/12-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	6.9	267	519	Red brown med grained sand. Some iron staining. Organics from 0-30cm	N
B	0.45	6.8	515	1042	Fine grained silty-sand. Red-brown, very moist.	N
C	0.53	6.9	478	957	light brown, med grained sand	N
D	0.60	7.3	492	996	less moist than B, light brown and clay-like	N
E	0.68	7.1	361	727	very hard laminae. Alt. bands of light-dark brown . Some organics (grasses) present	N
F	0.75	7	502	1008	light brown, clay-like wet slimes. No iron staining	N
G	0.78	7	565	1128	dark brown, clay-like, very moist	N
H	0.85	7.2	262	539	light brown med grained sand, some iron staining. Organics (grasses) present	N
I	0.95	6.9	511	1023	same as F	N
J	0.98	7.1	527	1059	red-brown med/fine grained sand. Some organic material (grasses).	N
K	1.00	6.8	395	793	light brown sands, med grained. Some iron staining. Some organics, but less than J	N
L	1.20	7	222	441	blue-grey clay-like. Very moist, wet slimes. No iron staining	N
M	1.50	7.9	188	380	dark grey sands. Med grained, moist	N
N	4.00	6.3	141	286	ORIGINAL GROUND - grey/black, organics	N
	4.50				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



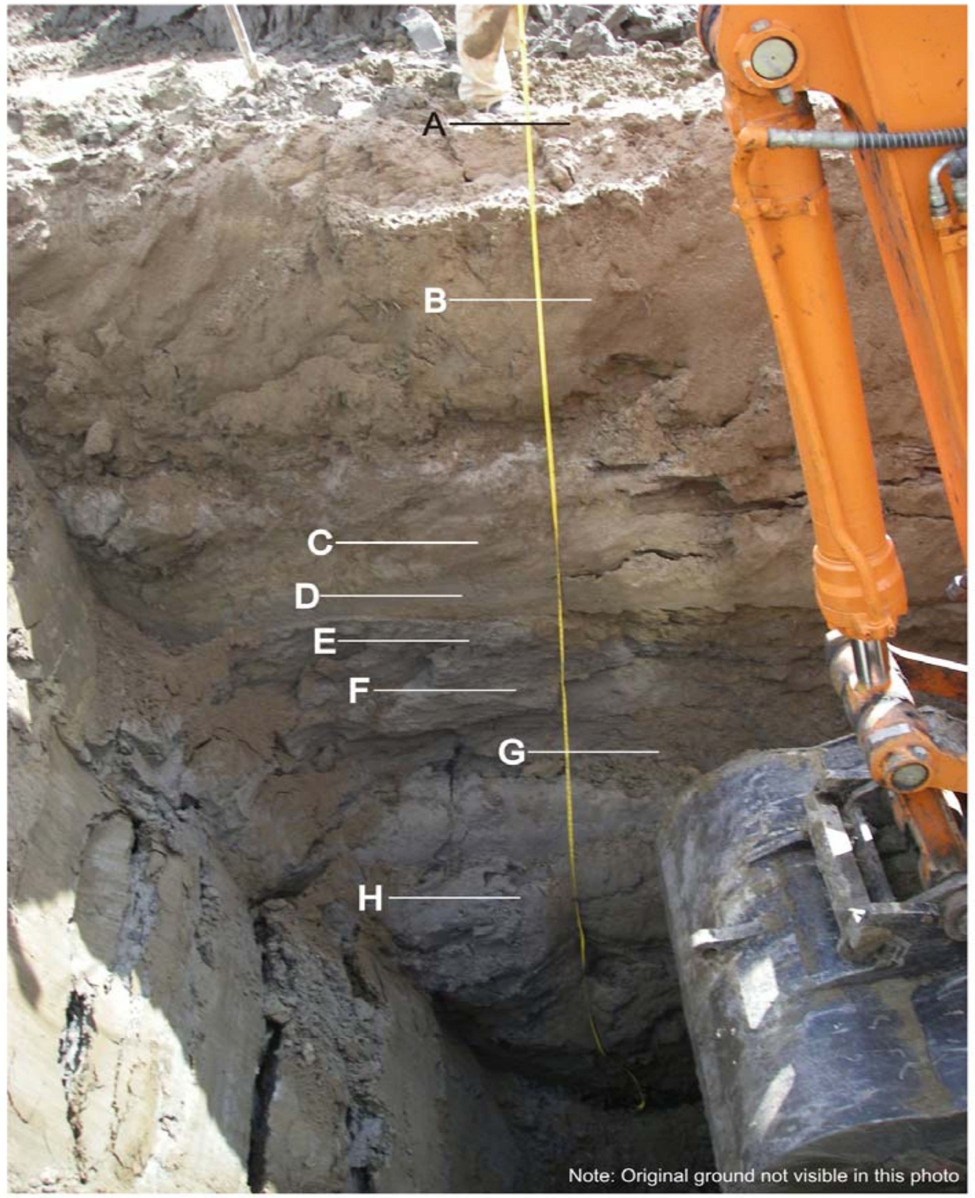
Note: Original ground is just below material at bottom of measuring tape.

Valley Tailings Facility 2007 Test Pitting - Test Pit #12

TEST PIT NO. **UK/TP/13-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	7.3	278	554	Reb-brown Fe-stained bands alternating with non-Fe-stained. Sub-laminar bedding	N
B	0.65	7.1	149	299	Light-brown and clay-like. Wet slimes and water seeping from pit wall. Some grain coarsening at bottom of level.	N
C	0.80	7.1	228	358	Very hard laminae trapping water from above. Red-grey Same hard material encountered in UK/TP/12.	N
D	0.90	6.9	183	408	Blue-grey clay-like layer. Very moist This layer bounded by harder layers above and below. Layer hardens with depth.	N
E	0.94	7.6	145	288	Meduim grained, light-grey sands. Homogeneous colouring throughout	N
F	1.06	7.3	457	230	Red-brown clay-like. Very moist Alternating light and dark (light layers: clay-like, Dark layers: silt.	N
G	1.16	7.5	221	438	Medium grained, Red-brown sands. Homogeneuos throughout. Sands become light brown with depth.	N
H	1.60	7.8	92.3	196	Blue-grey clay-like layer. Very moist Wet slimes	N
I	5.00	6.4	139	279	Black earth with organics. Mosses, and woody debris. Very little mineral soils here.	N
	5.50				End of hole	

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007

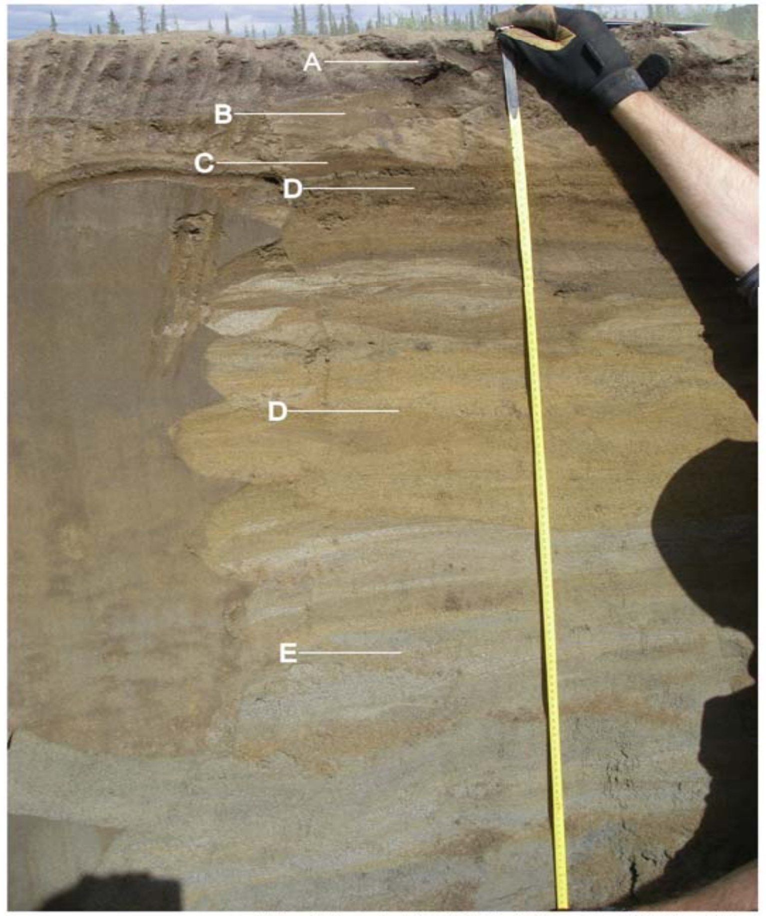


Valley Tailings Facility 2007 Test Pitting - Test Pit #13

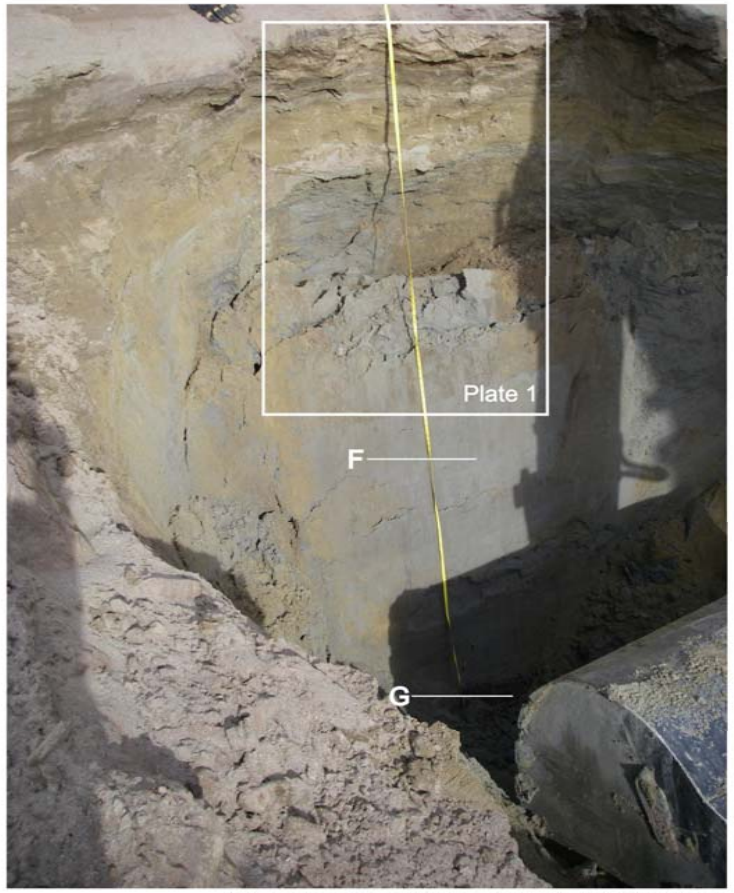
TEST PIT NO. **UK/TP/14-07**
Location:

LAYER	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	WATER
A	0	7.4	195	392	Dry medium grained sands. Grey-Red and Brown	N
B	0.1	7.3	123	248	Dry medium grained sands. Homogenous Fe-staining throughout	N
C	0.2	7.1	254	507	Dark brown-red clay-like. Lacks elasticity.	N
D	0.23	7.3	229	467	Same as layer B. Thinly bedded (2 to 3 cm) moist silts. Bed-discontinuous along pit wall.	N
E	0.45	6.4	363	718	Alternating medium grained red-brown and grey sands. Fe-staining in red-brown beds. Red-brown beds decrease with depth.	N
F	0.85	6.6	324	648	Grey, medium grained sands. Homogeneous throughout.	N
G	3	7.4	705	129	Moist silt layer. Grey-blue Directly on top of original ground.	N
H	3.5	5.8	245	483	Original ground. Black organics. Mosses and woody debris	N
					End of hole.	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007



Valley Tailings Facility 2007 Test Pitting - Test Pit #14 - Plate 1

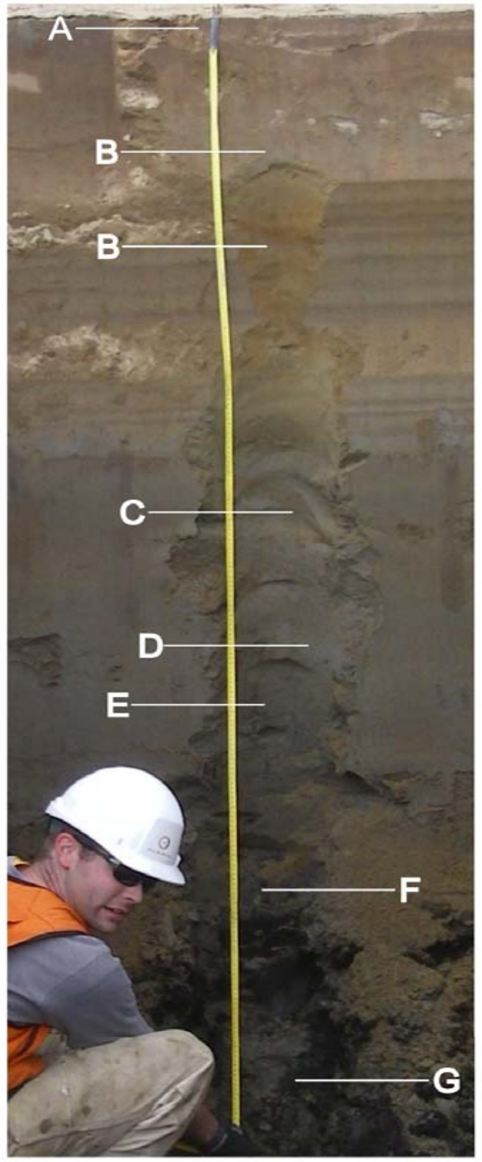


Valley Tailings Facility 2007 Test Pitting - Test Pit #14 - Plate 2

TEST PIT NO. **UK/TP/15-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	6.3	484	976	Dark brown-red sands, med grained. Iron staining present. Top 0.1m dry and windblown.	N
B	0.20	6.2	894	2160	Red-grey sands, med grained. Intermittent iron	N
C	0.80	6.0	1250	2510	Grey moist sands, med grained. Intermittent iron staining, lessening with depth.	N
D	1.30	5.9	877	1734	Grey-blue, clay-like layer. Wet slimes.	N
E	1.40	6.0	1440	2950	Uniform grey sands, med grained. Moisture content greater than C. No iron staining.	N
F	1.70	6.2	475	916	ORIGINAL GROUND - dark brown, organics	N
	2.25				End of hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007

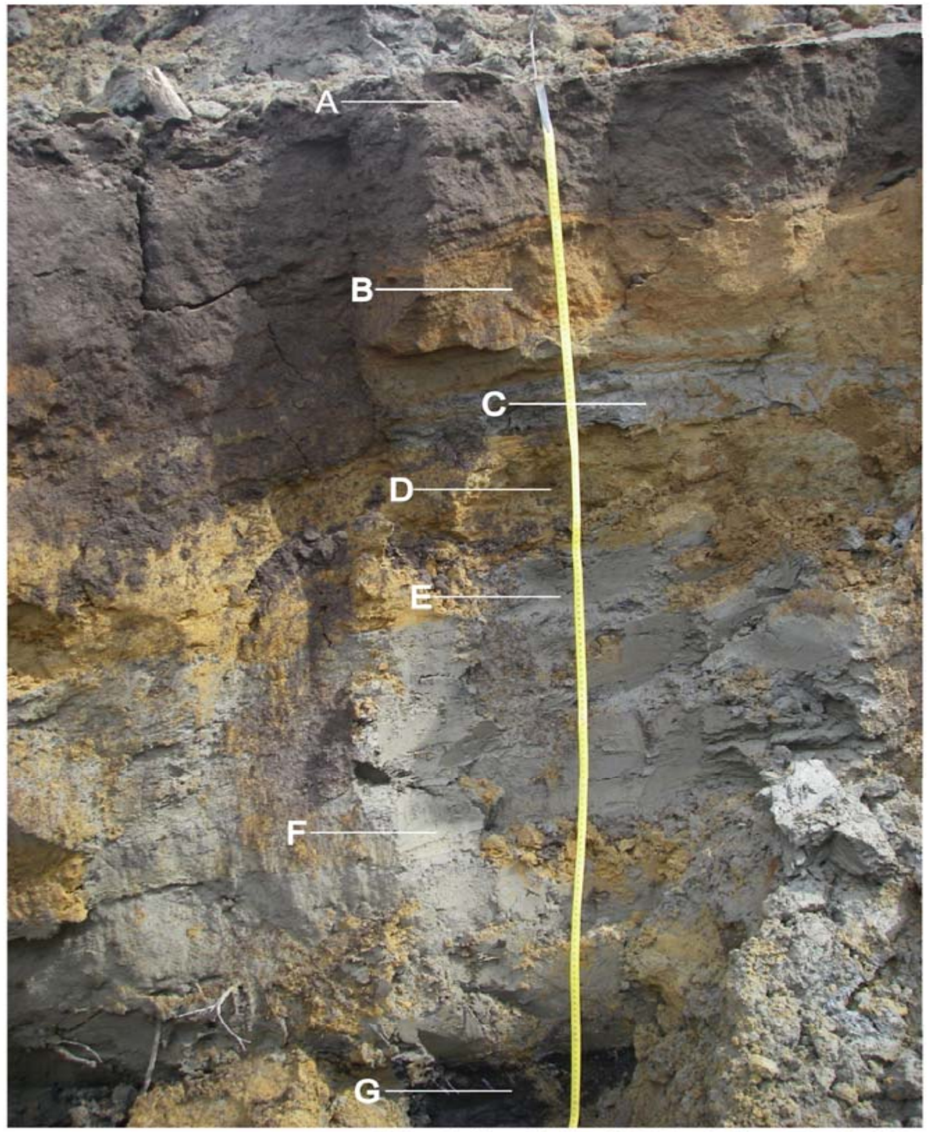


Valley Tailings Facility 2007 Test Pitting - Test Pit #15

TEST PIT NO. UK/TP/16-07
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	6.4	1350	2700	dark brown sands, med grained. Uniform iron staining.	N
B	0.25	6.3	701	1377	red-brown med grained sands, growing lighter to red-grey with depth. Iron staining present.	N
C	0.50	6.3	575	1152	Grey moist clay-like material, wet slimes.	N
D	0.60	5.9	1600	3210	red-grey sands, med grained, iron staining	N
E	0.80	6.4	528	1063	same as C	N
F	0.90	6.7	716	1424	Grey, med grained sands. No iron staining	N
G	1.40	6.2	124	247	ORIGINAL GROUND - grey/black, organics	N
	1.65				End of hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007

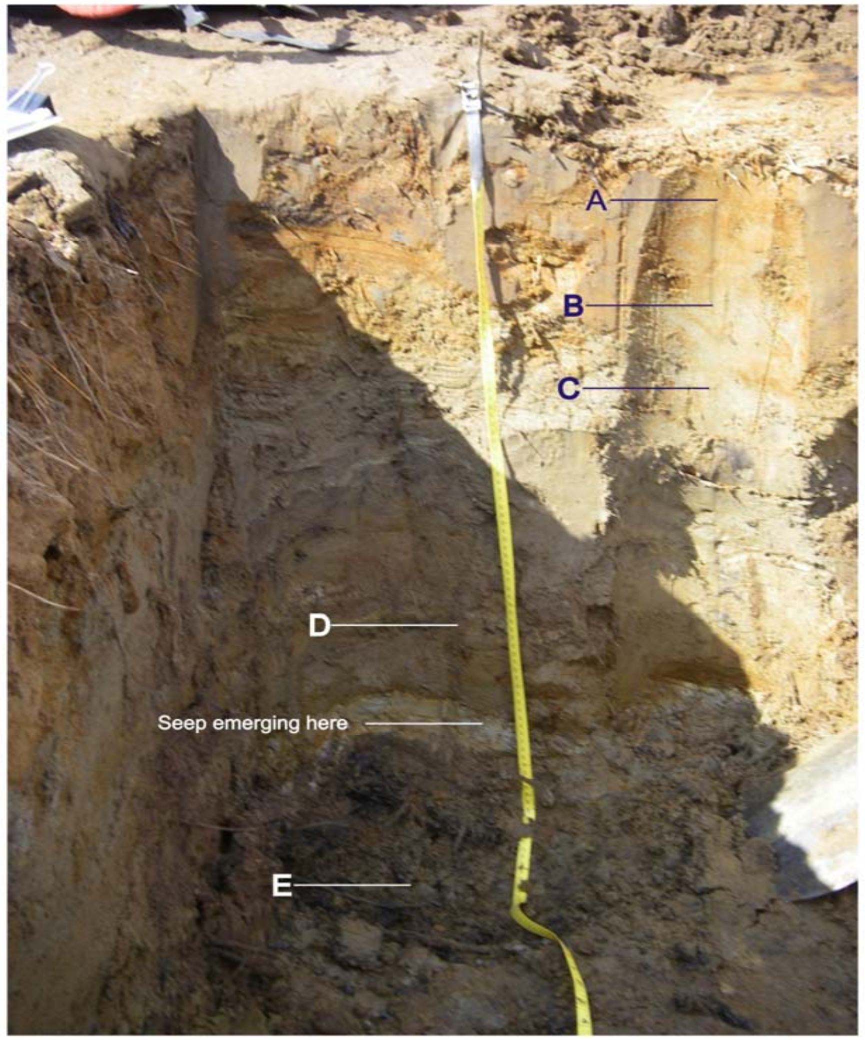


Valley Tailings Facility 2007 Test Pitting - Test Pit #16

TEST PIT NO. **UK/TP/17-07**
Location:

LAYER	DEPTH (m)		PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	WATER
A	0	0.00	6.6	294	645	Surface material. Heavy oxidation at surface. Grey-black-red sands. Medium to coarse grained. Moist to dry.	N
B	10	0.10	6.1	684	1369	Medium brown sands. Fe-staining in whisps throughout. Medium to coarse grained. Fe-stained organic mat at bottom of this layer.	N
C	30	0.30	6.2	803	1580	Light brown sands.	N
D	55	0.55	5.4	792	1585	Same as B. Intermittent light brown silty layer at 0.75 m (same as found in layer C) Seep emmerging from silty layer.	N
E	80	0.80	4.9	1140	2300	Original ground	N
F	100	1.00				End of hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007

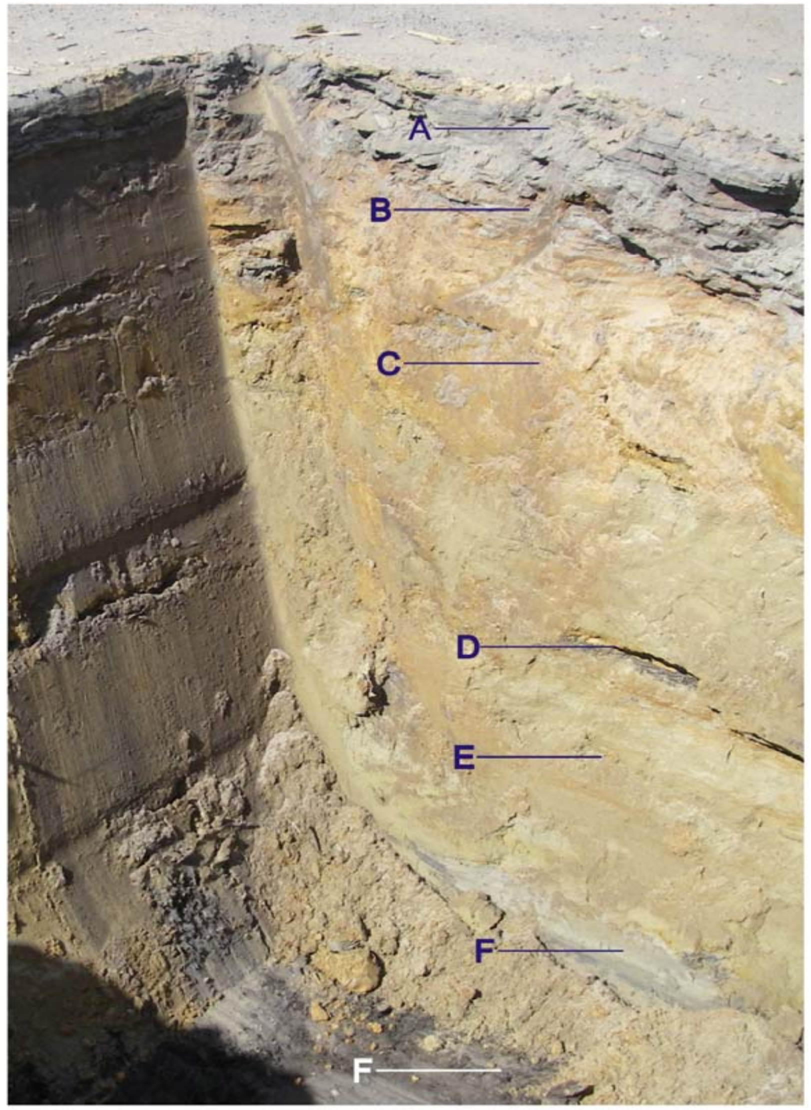


Valley Tailings Facility 2007 Test Pitting - Test Pit #17

TEST PIT NO UK/TP/18-07
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	6.9	327	657	Surface material. Grey-red, med grained to coarse sands. Dry, hard, crumbly. Heavy oxidation. Evident cross-bedding. Alternating iron-stained and dark grey beds ~3.5cm thick each. Iron bands thicker with depth	N
B	0.40	6.2	556	1158	Alternating red-brown and light brown sands, med grained. Cross bedding. Iron staining, thickens with depth.	N
C	0.80	6.2	673	1339	Light and med brown beds of med-coarse grained sands. Light beds lessen with depth. Sub-parallel bedding.	N
D	1.30	5.7	1320	2600	dark and light grey alternating beds of silty soil. Light brown med-coarse sand 1st and last 5cm. Organic debris	N
E	1.42	6.9	450	824	red-orange and light brown med grained sands. Some iron staining. Thinly scattered organics with Fe-stained halos.	N
F	2.07	6.2	217	422	ORIGINAL GROUND - 2.07-2.12m: grey silty material w/ organics. Below: grey/black organics	N
	2.57				End of hole	

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007

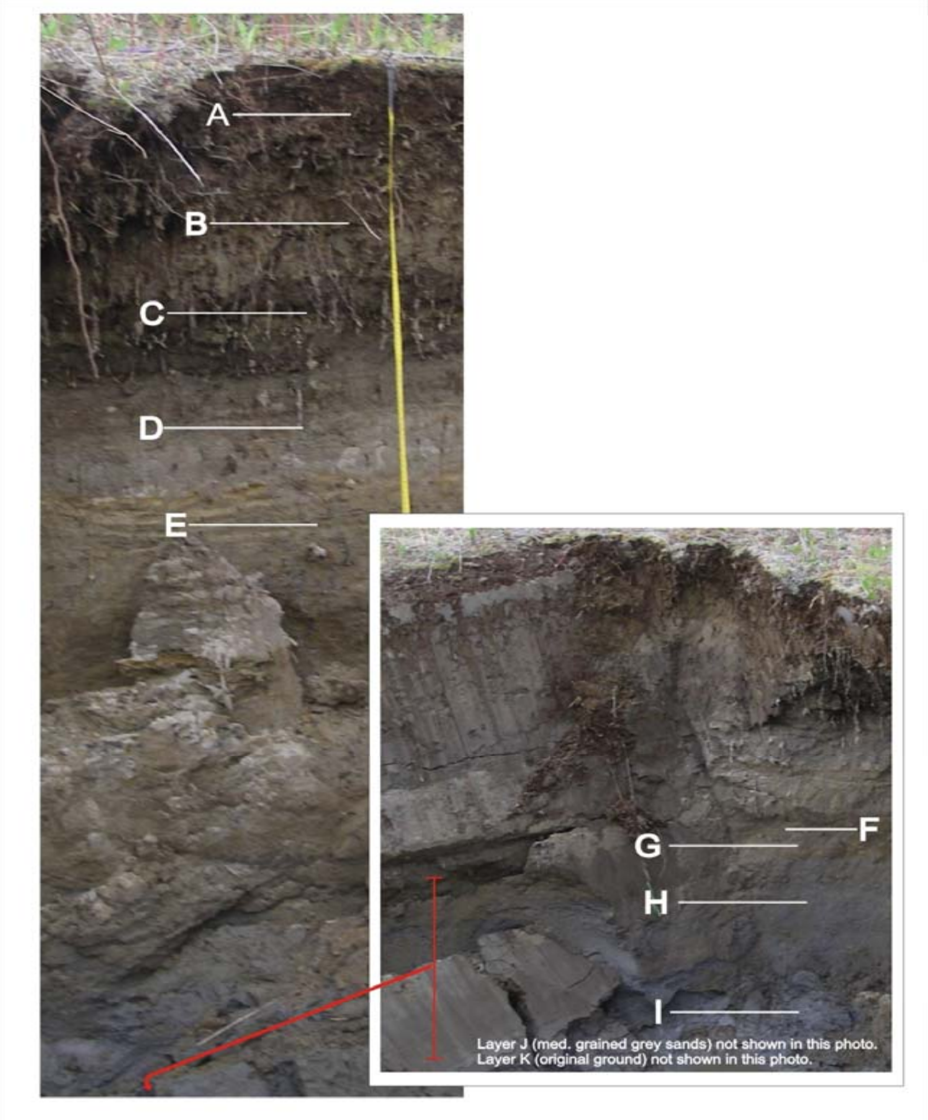


Valley Tailings Facility 2007 Test Pitting - Test Pit #18

TEST PIT NO. **UK/TP/19-07**
Location:

Sample	DEPTH (m)	PASTE pH	PASTE TDS (ppm)	PASTE COND. (uS)	DESCRIPTION	GROUND WATER
A	0.00	6.8	445	888	Surface Material. Organics first 10cm. dark brown sands, med grained.	N
B	0.30	7.1	306	604	Light brown, med grained sands. Some iron staining, lessens with depth.	N
C	0.50	7.1	321	599	Light brown silt, wet slimes. Layer is intermittent at this depth throughout pit	N
D	0.52	7.6	281	550	Dark brown, moist and silty	N
E	0.60	7.4	329	674	Thinly bedded, silty material. Alternating iron-staining bands ~0.5cm thickness	N
F	0.90	7.8	252	508	Grey-brown sands. Moist, med grained, some weak iron staining.	N
G	1.00	7.2	267	538	same as C	N
H	1.20	7.3	279	557	dark grey, med grained sands. No iron staining.	N
I	1.90	7.0	200	404	Clay-like layer. Very moist, grey-blue wet slimes with seeps	N
J	4.50	7.4	208	431	Same as H	N
K	4.70	6.2	113	228	ORIGINAL GROUND - brown/black, organics	N
	5.10				End of Hole	N

Test pit log, field testing, and data compilation by Access Consulting Group, May 2007

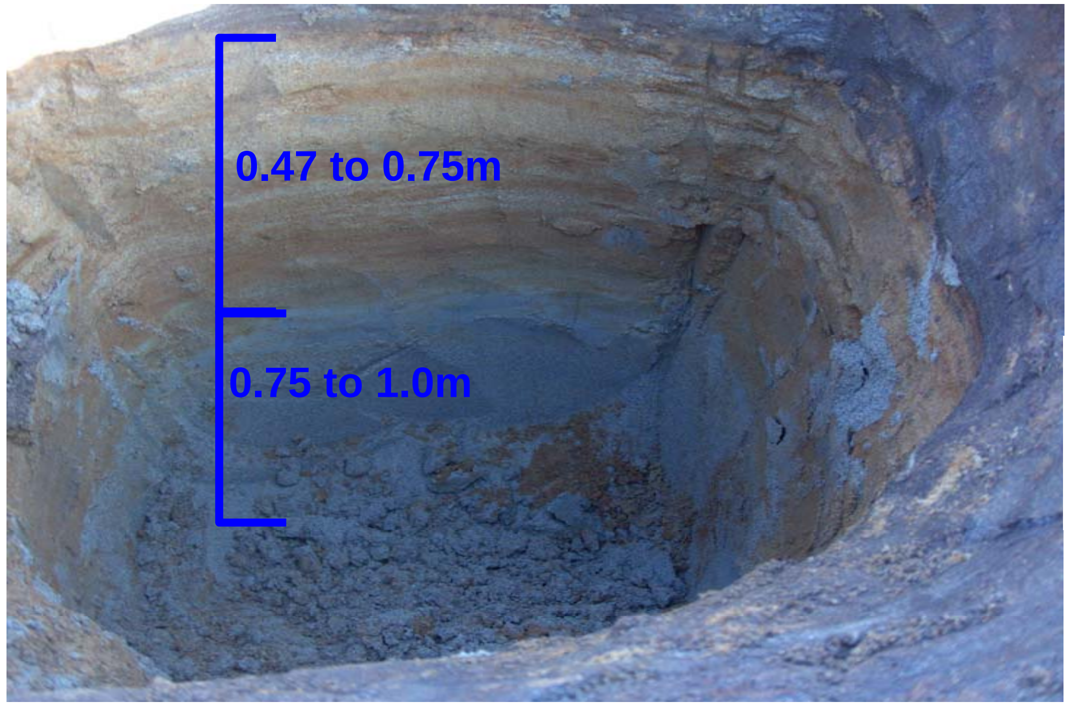


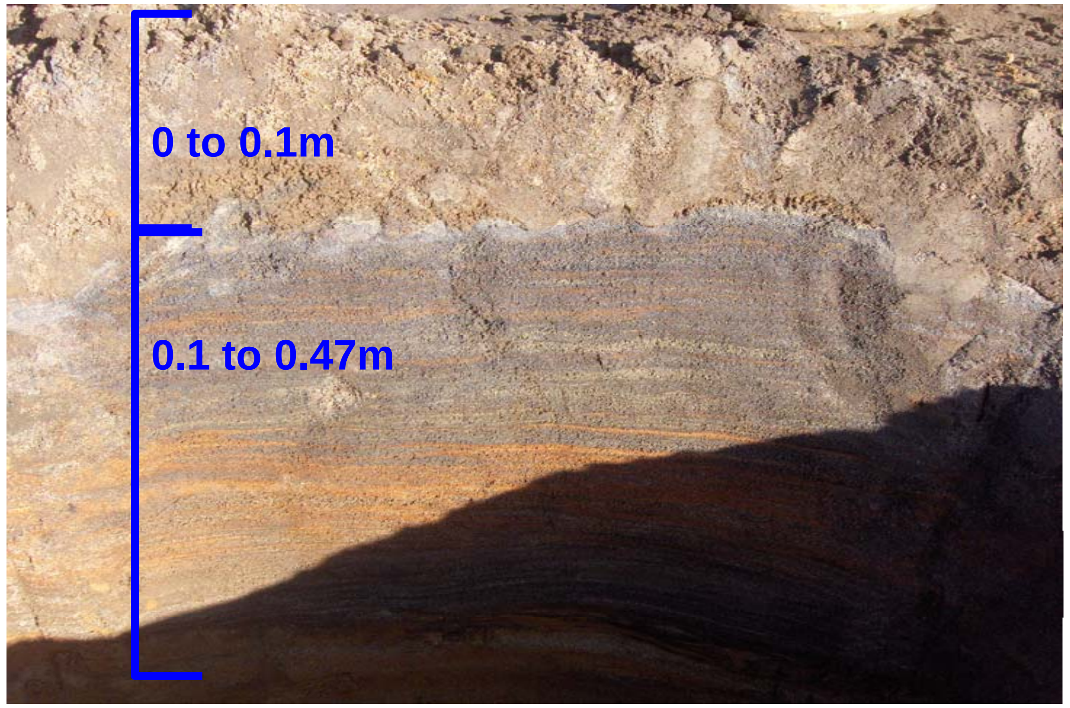
Valley Tailings Facility 2007 Test Pitting - Test Pit #19

Test Pit: UKTP22
Test pit log, field testing, and data compilation by SRK Consulting, October 2007
Easting (UTM NAD83): 474747
Northing (UTM NAD83): 7088291

SampleID	From Depth (m)	To Depth (m)	Paste pH	Paste Conductivity (uS/cm)	Notes
UKTP22_Top Layer	0	0.1	6.49	1100	Light brown silt, moist. Sample at 0.05m
	0.1	0.47	-	-	Purplish black sand with rusty laminations, cemented, sllightly moist. Samples at 0.15, 0.3, 0.4m
UKTP22A			7.02	750	0.15m sample
UKTP22B			6.63	1180	0.3m sample
UKTP22C			6.92	1590	0.4m sample
	0.47	0.75	-	-	Laminated rusty orange and yellowish orange sand, slightly cemented, moist. Samples at 0.5 and 0.7m
UKTP22D			6.68	1490	0.5m sample
UKTP22E			5.68	1650	0.7m sample
	0.75	1	6.02	790	Fresh yellowish grey sand, moist, loose. Original ground not intersected. Sample at 0.9m
EOH	1				still in tailings. Uniform, grey, uncemented, wet

Location: Old Tailings between UKTP18 and Pond #3, north of cross-tailings ditch
Hand test pit excavated in exposed tailings where surface was locally slightly elevated





Test Pit: UKTP23
Test pit log, field testing, and data compilation by SRK Consulting, October 2007
Easting (UTM NAD83): 475665
Northing (UTM NAD83): 7087415

SampleID	From Depth (m)	To Depth (m)	Paste pH	Paste Conductivity (uS/cm)	Notes
	0	0.65			Fine dark chocolate brown sand, dry to slightly moist, loose. Lower contact is gradational
UKTP23A			6.09	750	0.2m sample
UKTP23B			6.09	1450	0.5m sample
	0.65	1.1			Fine orange to rusty brown sand,slightly moist
UKTP23C			5.94	1600	0.7m sample
UKTP23D			6.33	760	1m sample
	1.1	1.3			Original ground contact. Mix of orange fine sand tailings and fibrous organics, slighlty moist.
	1.3	1.4			Olive brown silty with sand and gravel (appears to be a colluviated till)
	1.4				EOH

Location 1950 tailings stack on S valley wall adjacent to VTA access road
test pit excavated in wall of erosion gully immed. east of old decant structure

Appendix D

2007/08 Tailings Water Quality Monitoring Results

Appendix D1

2007 Test Pit Pond and Surface Seepage Water Chemistry

			New Tailings		Old Tailings					
		Sample Description	UKTP13	UKTP19	UKTP15	UKTP16	UKTP17	UKTP18	Ditch Seep	Pond 1
		Date Sampled	10/3/2007	10/3/2007	10/3/2007	10/3/2007	10/3/2007	10/3/2007	10/3/2007	10/3/2007
Physical Properties		**Detection Limit**								
Turbidity	NTU	0.1	0.6	1	17	14	7.1	17	240	8
TSS	mg/L	1	<2	3	40	16	18	15	114	8
Colour	Colour units	5	<5	<5	6	<5	6	8	33	<5
TDS	mg/L	5	2300	3270	9480	9000	10400	8730	4990	8530
Routine Analyses										
pH			7.24	7.23	6.52	6.4	6.29	6.39	6.6	5.02
Electrical Conducti	µS/cm at 25 C	1	2130	2990	5910	5920	6340	5510	3840	5550
Chloride	mg/L	0.02	2.77	15	14.9	20.8	5.25	6.65	4.12	17.5
Nitrate - N	mg/L	0.02	<0.02	<0.02	0.08	<0.02	0.2	0.41	0.02	0.04
Nitrite - N	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Sulfate (SO4)	mg/L	0.05	1520	2460	8830	7600	8760	7390	3480	7900
Hydroxide	mg/L as CaCO3	5	<5	<5	<5	<5	<5	<5	<5	<5
Carbonate	mg/L as CaCO3	6	<6	<6	<6	<6	<6	<6	<6	<6
Bicarbonate	mg/L as CaCO3	5	171	375	110	73	41	110	331	<5
T-Alkalinity	mg/L as CaCO3	5	141	307	91	60	33	87	272	<5
Cyanide (Total)	mg/L	0.001	0.001	0.002	0.001	0.001	<0.001	<0.001	0.001	<0.001
Dissolved Metals										
Calcium	mg/L	0.2	366	540	431	400	406	384	324	368
Magnesium	mg/L	0.2	120	150	306	789	421	171	147	250
Sodium	mg/L	0.4	6	52.7	30.7	25.9	5.2	7.5	36.4	26.6
Potassium	mg/L	0.4	3.1	5.4	7.8	2.9	2.8	2.5	5.4	3.7
Iron	mg/L	0.01	0.05	0.02	0.62	1.22	<0.01	<0.01	39.3	18.7
Manganese	mg/L	0.005	3.38	7.56	1190	708	1450	984	302	800
Silicon	mg/L	0.05	3.5	4.63	4.61	6.66	4.95	5.27	7.68	3.15
Sulfur	mg/L	0.3	424	633	1840	1810	2020	1680	802	1670
Aluminum	mg/L	0.005	<0.05	not reported	<0.05	<0.05	0.05	<0.05	<0.05	<0.05
Antimony	mg/L	0.0002	<0.002	not reported	0.005	0.004	0.004	0.008	<0.002	<0.002
Arsenic	mg/L	0.0002	0.007	not reported	0.016	0.009	0.014	0.016	0.025	0.012
Barium	mg/L	0.001	0.01	not reported	<0.01	<0.01	<0.01	<0.01	0.05	<0.01
Beryllium	mg/L	0.0001	<0.001	not reported	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth	mg/L	0.0005	<0.005	not reported	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	mg/L	0.002	<0.02	not reported	0.03	0.02	0.03	<0.02	<0.02	0.08
Cadmium	mg/L	0.00001	0.168	not reported	12	2.93	4.94	9.82	1.95	6.03
Chromium	mg/L	0.0005	<0.005	not reported	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	mg/L	0.0001	<0.001	not reported	0.737	0.407	0.48	0.292	0.267	1.01
Copper	mg/L	0.001	<0.01	not reported	0.02	0.02	0.17	0.29	0.01	0.04
Lead	mg/L	0.0001	0.064	not reported	0.834	0.323	4.57	1.78	0.21	1.56
Lithium	mg/L	0.001	0.02	not reported	0.07	0.07	0.05	0.04	0.02	0.06
Molybdenum	mg/L	0.001	<0.01	not reported	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	mg/L	0.0005	0.024	not reported	1.18	1.17	0.832	0.565	0.519	1.86
Selenium	mg/L	0.0002	<0.002	not reported	<0.002	<0.002	<0.002	<0.002	0.003	<0.002
Silver	mg/L	0.0001	<0.001	not reported	<0.001	<0.001	0.001	<0.001	<0.001	<0.001
Strontium	mg/L	0.001	1.11	not reported	1.55	0.67	0.19	0.29	1.22	0.56
Thallium	mg/L	0.00005	0.0013	not reported	0.042	0.0245	0.0205	0.016	0.0256	0.0428
Tin	mg/L	0.001	<0.01	not reported	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Titanium	mg/L	0.0005	0.018	not reported	0.072	0.075	0.08	0.066	0.037	0.077
Uranium	mg/L	0.0005	<0.005	not reported	<0.005	<0.005	<0.005	<0.005	0.008	<0.005
Vanadium	mg/L	0.0001	<0.001	not reported	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.001	8.06	not reported	830	280	722	788	283	739
Total Metals										
Calcium	mg/L	0.2	378	483	439	401	405	387	313	360
Iron	mg/L	0.1	0.2	<0.1	3.1	2.4	2.7	<0.1	32.3	19.7
Magnesium	mg/L	0.1	122	149	307	822	516	371	176	247
Manganese	mg/L	0.005	3.57	7.7	1260	703	1510	986	464	809
Potassium	mg/L	0.4	3.2	5.7	7.9	2.9	3	2.6	5.7	3.8
Silicon	mg/L	0.05	3.85	4.63	5.11	6.73	5.17	5.19	7.27	3.14
Sodium	mg/L	0.4	6	1280	30.4	25.7	5.2	7.5	41.8	26.7
Sulfur	mg/L	0.3	439	649	1880	1840	2090	1760	1040	1720
Aluminum	mg/L	0.005	0.06	0.014	0.14	<0.05	0.29	<0.05	0.4	<0.05
Antimony	mg/L	0.0002	0.003	0.0036	0.019	0.008	0.034	0.012	0.007	<0.002
Arsenic	mg/L	0.0002	0.009	0.0053	0.1	0.022	0.06	0.022	0.048	0.015
Barium	mg/L	0.001	0.02	0.016	0.01	0.01	<0.01	<0.01	0.08	<0.01
Beryllium	mg/L	0.0001	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Bismuth	mg/L	0.0005	<0.005	<0.0005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Boron	mg/L	0.002	0.04	0.094	0.04	0.04	0.04	0.02	<0.02	0.08
Cadmium	mg/L	0.00001	0.174	0.185	11.6	3.06	4.99	9.89	3.27	5.84
Chromium	mg/L	0.0005	<0.005	<0.0005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Cobalt	mg/L	0.0001	<0.001	0.0018	0.891	0.484	0.579	0.328	0.406	1.13
Copper	mg/L	0.001	0.01	0.009	0.25	0.1	0.41	0.52	0.15	0.25
Lead	mg/L	0.0001	0.099	0.0787	1.64	0.673	4.9	1.85	0.542	1.75
Lithium	mg/L	0.001	0.02	0.092	0.07	0.07	0.05	0.03	0.02	0.05
Molybdenum	mg/L	0.001	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Nickel	mg/L	0.0005	0.029	0.0486	1.41	1.39	0.993	0.641	0.835	2.14
Selenium	mg/L	0.0002	<0.002	0.0015	0.005	<0.002	<0.002	0.004	<0.002	<0.002
Silver	mg/L	0.0001	<0.001	0.0009	0.008	0.002	0.02	0.005	0.003	<0.001
Strontium	mg/L	0.001	1.26	1.11	1.76	0.78	0.22	0.33	1.26	0.63
Thallium	mg/L	0.00005	0.0013	0.00099	0.0429	0.0256	0.0209	0.017	0.0378	0.0446
Tin	mg/L	0.001	<0.01	<0.001	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Titanium	mg/L	0.0005	0.034	0.0348	0.124	0.127	0.133	0.114	0.07	0.115
Uranium	mg/L	0.0005	<0.005	0.0027	<0.005	<0.005	<0.005	<0.005	0.006	<0.005
Vanadium	mg/L	0.0001	<0.001	0.0002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	mg/L	0.001	8.14	13.2	804	274	729	828	430	769

Appendix D2

2007 Drive Point Water Chemistry

		Sample Description	MDP10	MDP10	MDP11	MDP11	MDP12	MDP13	MDP13	VTF1
		Sample Date	28-Jun-07	17-Aug-07	28-Jun-07	17-Aug-07	17-Aug-07	28-Jun-07	17-Aug-07	17-Aug-07
Parameter Name	Unit	Detection Limit								
Physical Properties										
Turbidity	NTU	0.1	20	not reported	4.9	not reported	not reported	4.7	not reported	not reported
TSS	mg/L	1	20700	not reported	106000	not reported	not reported	25600	not reported	not reported
Colour	Colour units	5	<5	not reported	<5	not reported	not reported	<5	not reported	not reported
TDS	mg/L	5	568	not reported	2080	not reported	not reported	432	not reported	not reported
Field Parameters										
pH			nm	8.13	nm	8.18	8.02	nm	8.10	7.83
Electrical Conductivity	µS/cm		nm	722	nm	1743	1939	nm	714	1751
Temperature	C		nm	8	nm	8.5	8.5	nm	8.2	14
Water Depth	m		0.95	1.12	0.9	0.99	0.99	1.25	1.42	0.95
Routine Analyses										
pH			7.92	7.99	8.12	8.06	7.94	8.26	8.07	7.56
Electrical Conductivity	µS/cm at 25 C	1	824	683	2150	2000	2110	591	591	1880
Chloride	mg/L	0.1	24	not reported	6.6	not reported	not reported	4	not reported	not reported
Nitrate - N	mg/L	0.1	0.4	not reported	0.2	not reported	not reported	0.2	not reported	not reported
Nitrite - N	mg/L	0.05	<0.05	not reported	<0.05	not reported	not reported	<0.05	not reported	not reported
Sulfate (SO4)	mg/L	0.1	289	not reported	1400	not reported	not reported	229	not reported	not reported
Hydroxide	mg/L as CaCO3	5	<5	not reported	<5	not reported	not reported	<5	not reported	not reported
Carbonate	mg/L as CaCO3	6	<6	not reported	<6	not reported	not reported	<6	not reported	not reported
Bicarbonate	mg/L as CaCO3	5	185	not reported	36	not reported	not reported	110	not reported	not reported
T-Alkalinity	mg/L as CaCO3	5	151	not reported	29	not reported	not reported	94	not reported	not reported
Dissolved Metals										
Aluminum	mg/L	0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	0.027
Antimony	mg/L	0.0002	0.0044	0.003	0.0052	0.0013	0.0015	0.0061	0.0062	0.0035
Arsenic	mg/L	0.0002	0.0013	0.0011	0.0022	0.0008	0.0009	0.0022	0.0018	0.0111
Barium	mg/L	0.001	0.063	0.03	0.027	0.044	0.024	0.077	0.049	0.392
Beryllium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.002	0.021	0.028	0.057	0.147	0.076	0.063	0.061	0.104
Cadmium	mg/L	0.00001	0.007	0.00483	0.00062	0.00051	0.00519	0.00241	0.00054	0.00002
Calcium	mg/L	0.2	111	104	321	294	352	90.6	58.6	258
Chromium	mg/L	0.0005	0.0008	0.0007	<0.0005	0.0006	<0.0005	<0.0005	0.0007	0.0036
Cobalt	mg/L	0.0001	0.0027	0.0027	0.0003	0.0003	0.001	0.0009	0.0015	0.0014
Copper	mg/L	0.001	0.003	0.005	0.009	0.004	0.007	0.003	0.003	0.005
Iron	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	5.86
Lead	mg/L	0.0001	0.121	0.0959	0.0087	0.0407	0.0434	0.101	0.043	0.0004
Lithium	mg/L	0.001	0.009	0.013	0.03	0.028	0.036	0.014	0.016	0.004
Magnesium	mg/L	0.1	22.6	22.1	107	83.4	92.1	27.4	18	131
Manganese	mg/L	0.005	5.65	5.73	<0.005	3.61	5.37	3.32	3.2	9.2
Molybdenum	mg/L	0.001	<0.001	<0.001	0.002	<0.001	<0.001	<0.001	<0.001	0.004
Nickel	mg/L	0.0005	0.0012	0.0057	<0.0005	<0.0005	<0.0005	0.0025	0.0112	<0.0005
Potassium	mg/L	0.4	3.3	3.6	7.7	8.5	8.3	5.2	5	<4
Selenium	mg/L	0.0002	<0.0002	<0.0002	<0.0002	<0.0002	0.0002	<0.0002	<0.0002	0.001
Silicon	mg/L	0.05	2.16	2.01	0.43	0.15	0.95	1.73	1.71	5.1
Silver	mg/L	0.0001	<0.0001	0.0002	<0.0001	<0.0001	0.0002	0.0002	0.0001	<0.0001
Sodium	mg/L	0.4	5.5	4	15.9	16.3	17.2	5.4	5.3	14
Strontium	mg/L	0.001	0.673	0.768	2.45	2.3	1.35	1.09	0.676	0.656
Sulfur	mg/L	0.3	86.7	89.2	406	356	407	78.2	57.7	242
Thallium	mg/L	0.00005	0.00245	0.00333	0.00585	0.00207	0.00467	0.00173	0.00128	<0.00005
Tin	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	mg/L	0.0005	0.0068	0.0052	0.0319	0.0214	0.0238	0.0063	0.0035	0.0178
Uranium	mg/L	0.0005	0.0006	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.0024
Vanadium	mg/L	0.0001	0.0004	0.0004	0.0003	0.0002	0.0013	0.0004	0.0003	0.0049
Zinc	mg/L	0.001	0.592	0.889	0.04	1.03	2.1	0.379	0.347	21.3
Total Metals										
Aluminum	mg/L	0.005	18.3	16.8	5.58	18.4	33.2	116	20.1	87.3
Antimony	mg/L	0.0002	2.61	1.66	0.444	1.02	1.94	7.53	1.09	0.02
Arsenic	mg/L	0.0002	4.44	2.66	1.04	4.68	12.3	19	2.73	0.19
Barium	mg/L	0.001	0.91	0.68	0.325	0.85	3.83	1.7	0.6	2.12
Beryllium	mg/L	0.0001	0.0034	0.002	0.0005	0.002	0.007	0.013	0.002	0.003
Bismuth	mg/L	0.0005	0.0068	0.01	0.0041	0.047	0.019	0.017	0.009	0.02
Boron	mg/L	0.002	0.051	0.03	0.06	0.1	0.05	0.16	0.05	0.2
Cadmium	mg/L	0.00001	2.17	0.993	0.107	0.589	4.82	7.59	0.93	0.0174
Calcium	mg/L	0.2	305	269	366	487	2350	712	628	219
Chromium	mg/L	0.0005	0.137	0.09	0.0278	0.107	0.163	0.394	0.101	0.19
Cobalt	mg/L	0.0001	0.0522	0.042	0.0088	0.048	0.133	0.194	0.049	0.087
Copper	mg/L	0.001	2.58	1.51	0.412	1.76	3.46	10	1.67	0.5
Iron	mg/L	0.1	1040	1060	88.9	905	10200	2730	2590	225
Lead	mg/L	0.0001	327	190	20.3	109	520	909	158	2.26
Lithium	mg/L	0.001	0.029	0.02	0.027	0.03	0.05	0.11	0.02	0.1
Magnesium	mg/L	0.1	67.9	59.3	107	161	472	144	114	131
Manganese	mg/L	0.005	1090	905	33.1	614	8440	2170	2170	12.9
Molybdenum	mg/L	0.001	0.009	<0.01	0.004	<0.01	0.01	0.04	<0.01	<0.02
Nickel	mg/L	0.0005	0.141	0.122	0.0359	0.143	0.335	0.549	0.137	0.259
Potassium	mg/L	0.4	8.2	9.6	8.9	13	38	33	22	8
Selenium	mg/L	0.0002	0.009	0.008	0.0032	0.012	0.014	0.032	0.009	0.02
Silicon	mg/L	0.05	32.3	36.6	11.3	47.8	190	117	87.6	63.3
Silver	mg/L	0.0001	1.62	1.19	0.121	0.348	1.6	1.24	1.01	0.035
Sodium	mg/L	0.4	8.2	5.4	15	17	35	9	6.3	14
Strontium	mg/L	0.001	0.95	0.71	2.59	1.86	1.82	2.79	0.6	0.88
Sulfur	mg/L	0.3	106	105	433	475	806	127	113	221
Thallium	mg/L	0.00005	0.0189	0.0125	0.0108	0.0124	0.045	0.055	0.017	0.0028
Tin	mg/L	0.001	0.027	0.02	0.01	0.04	0.04	0.05	0.03	<0.02
Titanium	mg/L	0.0005	0.237	0.146	0.164	0.173	0.05	0.646	0.144	1.72
Uranium	mg/L	0.0005	0.018	0.014	0.0038	0.016	0.047	0.0675	0.024	0.01
Vanadium	mg/L	0.0001	0.0508	0.051	0.016	0.051	0.098	0.218	<0.001	0.218
Zinc	mg/L	0.001	127	96.4	16.2	572	290	358	102	589

Appendix D3

2007 Tailings Monitoring Well Water Chemistry

		Sample Description	GT7	GT8	GT9	GT10	GT12
		Location	Dam 1	Dam 2	Dam 2	Dam 3	Dam 3
		Date Sampled	10/31/2007	10/30/2007	10/27/2007	10/27/2007	10/27/2007
		Sampling Method	Grab	Grab	Grab	Grab	Grab
		Sampled By	D. Desmarais	D. Desmarais	D. Desmarais	D. Desmarais	D. Desmarais
		Sampling Company	ACG	ACG	ACG	ACG	ACG
		Matrix	Water	Water	Water	Water	Water
Parameter Name	Unit	Detection Limit					
pH			7.27	7.51	7.63	7.11	8
Electrical Cond	µS/cm at 25 C	1	1400	1300	1230	1220	751
Hydroxide	mg/L	5	<5	<5	<5	<5	<5
Carbonate	mg/L	6	<6	<6	<6	<6	<6
Bicarbonate	ng/L as HCO3	5	547	584	505	466	257
Bicarbonate	ng/L as CaCO	calc by SRK					
T-Alkalinity	ng/L as CaCO	5	449	479	414	382	210
Nitrate - N	mg/L	0.02	<0.02	<0.02	<0.02	0.02	0.13
Nitrite - N	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chloride	mg/L	0.02	5	5.21	4.26	14.1	3.95
Sulfate (SO4)	mg/L	0.05	442	308	335	327	250
Turbidity	NTU	0.1	120	110	38	280	31
Solids	mg/L	1	4160	7340	75	23700	27600
Colour	Colour units	5	29	30	20	110	10
Solids	mg/L	5	1170	982	1000	954	536
Dissolved metals							
Aluminum	mg/L	0.005	0.826	3.41	0.008	0.041	0.209
Antimony	mg/L	0.0002	0.0015	0.0023	0.0018	0.0017	0.0016
Arsenic	mg/L	0.0002	0.149	0.219	0.103	0.0538	0.0216
Barium	mg/L	0.001	0.51	0.481	0.254	0.098	0.107
Beryllium	mg/L	0.0001	<0.0001	0.0003	<0.0001	0.0001	<0.0001
Bismuth	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.002	0.003	0.005	0.006	0.004	0.008
Cadmium	mg/L	0.00001	0.00079	0.00338	0.00001	0.00002	0.00004
Calcium	mg/L	0.2	230	220	190	181	91.9
Chromium	mg/L	0.0005	0.0059	0.0125	0.0062	0.0048	0.0013
Cobalt	mg/L	0.0001	0.0087	0.017	0.0014	0.0039	0.002
Copper	mg/L	0.001	0.023	0.087	<0.001	<0.001	0.001
Iron	mg/L	0.01	44.3	47.1	29.7	35.7	1.42
Lead	mg/L	0.0001	0.0244	0.19	0.0002	0.0006	0.0007
Lithium	mg/L	0.001	0.011	0.014	0.011	0.011	0.02
Magnesium	mg/L	0.2	60.1	58	52.2	52.1	27.1
Manganese	mg/L	0.005	8.68	7.29	6.77	3.24	0.218
Molybdenum	mg/L	0.001	0.002	0.002	0.003	0.003	0.009
Nickel	mg/L	0.0005	0.0061	0.0256	<0.0005	0.0037	0.0091
Potassium	mg/L	0.4	2.6	5.1	4.1	2.9	3.8
Selenium	mg/L	0.0002	0.0002	0.0004	<0.0002	0.0006	0.0018
Silicon	mg/L	0.05	10.2	13.6	7.67	8.14	6.89
Silver	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium	mg/L	0.4	17.5	16.1	15.4	19.7	29.6
Strontium	mg/L	0.001	1.23	1.06	1.11	0.741	0.517
Sulfur	mg/L	0.3	140	97.7	107	113	67.1
Thallium	mg/L	0.00005	0.00008	0.00014	<0.00005	<0.00005	<0.00005
Tin	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	mg/L	0.0005	0.0406	0.0965	0.008	0.0106	0.0133
Uranium	mg/L	0.0005	0.0028	0.0037	0.0019	0.002	0.0007
Vanadium	mg/L	0.0001	0.0033	0.015	0.0013	0.0016	0.0014
Zinc	mg/L	0.001	0.036	0.169	0.002	0.005	0.006
Cyanide	mg/L	0.001	0.09	0.23	0.041	0.001	<0.001

		Sample Description	**H4S**	**H4D**	**H5S**	**H5D**	**H6D**
		Location	Old Tailings	Old Tailings	Recent Tailings	Recent Tailings	Recent Tailings
		Date Sampled	10/31/2007	10/31/2007	10/31/2007	10/31/2007	10/31/2007
		Sampling Method	Grab	Grab	Grab	Grab	Grab
		Sampled By	D. Desmarais	D. Desmarais	D. Desmarais	D. Desmarais	D. Desmarais
		Sampling Company	ACG	ACG	ACG	ACG	ACG
		Matrix	Water	Water	Water	Water	Water
Parameter Name	Unit	Detection Limit					
pH			6.35	7.01	8.25	7.24	6.7
Electrical Cond	µS/cm at 25 C	1	3330	1850	1050	1620	1780
Hydroxide	mg/L	5	<5	<5	<5	<5	<5
Carbonate	mg/L	6	<6	<6	<6	<6	<6
Bicarbonate	ng/L as HCO3	5	373	486	134	512	338
Bicarbonate	ng/L as CaCO	calc by SRK					
T-Alkalinity	ng/L as CaCO	5	306	399	110	420	278
Nitrate - N	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Nitrite - N	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Chloride	mg/L	0.02	8.25	8.04	13.4	7.14	3.18
Sulfate (SO4)	mg/L	0.05	2760	840	441	628	898
Turbidity	NTU	0.1	530	59	54	37	270
Solids	mg/L	1	1980	493	17700	1580	835
Colour	Colour units	5	28	16	17	9	36
Solids	mg/L	5	4140	1750	778	1400	1680
Dissolved metals							
Aluminum	mg/L	0.005	0.014	0.006	0.15	<0.005	0.02
Antimony	mg/L	0.0002	0.0285	0.0009	0.0233	0.0011	0.001
Arsenic	mg/L	0.0002	0.727	0.0089	0.0388	0.0193	0.0406
Barium	mg/L	0.001	0.035	0.057	0.051	0.03	0.059
Beryllium	mg/L	0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Bismuth	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Boron	mg/L	0.002	0.006	0.006	0.052	0.004	0.013
Cadmium	mg/L	0.00001	1.34	0.00058	0.0106	0.00011	0.0004
Calcium	mg/L	0.2	281	306	48.7	262	305
Chromium	mg/L	0.0005	0.008	0.0045	0.0024	0.0037	0.0059
Cobalt	mg/L	0.0001	0.152	0.0287	0.0033	0.0227	0.0592
Copper	mg/L	0.001	0.04	0.003	0.011	<0.001	0.001
Iron	mg/L	0.01	73	20.4	4.73	17	50.6
Lead	mg/L	0.0001	0.583	0.0031	1.42	0.0043	0.001
Lithium	mg/L	0.001	0.017	0.013	0.018	0.016	0.01
Magnesium	mg/L	0.2	144	89.5	66.4	66.1	58
Manganese	mg/L	0.005	351	10.4	6.13	8.6	26.7
Molybdenum	mg/L	0.001	<0.001	<0.001	0.006	0.001	<0.001
Nickel	mg/L	0.0005	0.192	0.0076	0.0098	0.001	0.0579
Potassium	mg/L	0.4	3.1	3.1	5.1	3.9	2.3
Selenium	mg/L	0.0002	0.0004	<0.0002	0.0006	<0.0002	<0.0002
Silicon	mg/L	0.05	12.6	8.22	1.84	7.93	8.74
Silver	mg/L	0.0001	0.0005	<0.0001	0.0012	<0.0001	<0.0001
Sodium	mg/L	0.4	10.2	12.4	37.4	22.4	9
Strontium	mg/L	0.001	0.531	1.29	0.352	1.56	1.01
Sulfur	mg/L	0.3	764	259	142	192	280
Thallium	mg/L	0.00005	0.00212	<0.00005	0.00195	<0.00005	<0.00005
Tin	mg/L	0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Titanium	mg/L	0.0005	0.0504	0.0196	0.0158	0.015	0.0216
Uranium	mg/L	0.0005	0.0016	0.0086	0.0005	0.0187	0.0038
Vanadium	mg/L	0.0001	<0.0001	0.0004	0.0005	<0.0001	<0.0001
Zinc	mg/L	0.001	194	0.032	0.476	0.027	0.044
Cyanide	mg/L	0.001	0.001	0.001	0.3	<0.001	0.002

Appendix D4

2007/2008 Dam 3 Decant Monitoring Results

Valley Tailing Pond #3 Decant

Internal Analysis

Notes:

-Data collected by ERDC, including on-site analysis of total zinc concentrations

-Blank cells indicate data was not collected

-Grey highlights indicate calculated decant volumes based on either reported indicators (e.g. <1 second to fill pail) or on a 20 L/second decant rate when siphoning

Parameter	**Time**	**Air Temp**	**Water Temp**	**Total Zinc**	**pH**	**Discharge**	**Discharge**	**Discharge**	**Zn Load**	**Staff Gauge**
Units	**HH:MM**	**°C**	**°C**	**mg/L**		**sec**	**L/s**	**L/day**	**kg/day**	**m**
Sample Date						**(per 5gal)**		Calculated by SRK	Calculated by SRK	
1-Nov-07			1.2	0.147	7.87	no decant		0	0.00	
2-Nov-07			2.4	0.172	7.84	no decant		0	0.00	
3-Nov-07			2.2	0.139	7.64	no decant		0	0.00	
4-Nov-07			2.9	0.206	7.73	no decant		0	0.00	
5-Nov-07			2.1	0.138	7.93	no decant		0	0.00	
6-Nov-07			1.1	0.010	7.50	no decant		0	0.00	
7-Nov-07			0.6	0.255	7.46	no decant		0	0.00	
8-Nov-07			0.5	0.211	8.53	no decant		0	0.00	
9-Nov-07			0.8	0.225	8.47	no decant		0	0.00	
10-Nov-07			0.9	0.229	8.49	no decant		0	0.00	
11-Nov-07			1.0	0.237	8.05	no decant		0	0.00	
12-Nov-07			1.5	0.308	8.24	no decant		0	0.00	
13-Nov-07			1.2	0.010	7.51	no decant		0	0.00	
14-Nov-07			1.2	0.257	7.44	no decant		0	0.00	
15-Nov-07			0.7	0.293	6.93	no decant		0	0.00	
16-Nov-07			1.0	0.222	7.62	no decant		0	0.00	
17-Nov-07			3.4	0.304	7.50	no decant		0	0.00	
18-Nov-07			1.1	0.336	7.75	no decant		0	0.00	
19-Nov-07			2.1	0.422	7.52	no decant		0	0.00	
20-Nov-07			0.3	0.356	7.85	no decant		0	0.00	
21-Nov-07			1.5	0.261	7.46	no decant		0	0.00	
22-Nov-07			1.3	0.314	8.09	no decant		0	0.00	
23-Nov-07			0.8	0.240	8.18	no decant		0	0.00	
24-Nov-07			1.3	0.605	7.64	no decant		0	0.00	
25-Nov-07			0.5	0.440	7.46	no decant		0	0.00	
26-Nov-07			0.5	0.492	7.43	no decant		0	0.00	
27-Nov-07			0.5	0.373	7.75	no decant		0	0.00	
28-Nov-07			0.5	0.292	7.50	no decant		0	0.00	
29-Nov-07			0.5	0.357	7.34	no decant		0	0.00	
30-Nov-07			0.5	0.319	7.39	no decant		0	0.00	
1-Dec-07								0	0.00	
2-Dec-07								0	0.00	
3-Dec-07								0	0.00	
4-Dec-07								0	0.00	
5-Dec-07								0	0.00	
6-Dec-07								0	0.00	
7-Dec-07								0	0.00	
8-Dec-07								0	0.00	
9-Dec-07								0	0.00	
10-Dec-07								0	0.00	
11-Dec-07								0	0.00	
12-Dec-07								0	0.00	
13-Dec-07								0	0.00	
14-Dec-07								0	0.00	
15-Dec-07								0	0.00	
16-Dec-07								0	0.00	
17-Dec-07								0	0.00	
18-Dec-07								0	0.00	
19-Dec-07								0	0.00	
20-Dec-07								0	0.00	
21-Dec-07								0	0.00	
22-Dec-07								0	0.00	
23-Dec-07								0	0.00	
24-Dec-07								0	0.00	
25-Dec-07								0	0.00	
26-Dec-07								0	0.00	
27-Dec-07								0	0.00	
28-Dec-07								0	0.00	
29-Dec-07								0	0.00	
30-Dec-07								0	0.00	
31-Dec-07								0	0.00	
1-Jan-08								0	0.00	
2-Jan-08								0	0.00	
3-Jan-08								0	0.00	
4-Jan-08								0	0.00	
5-Jan-08								0	0.00	
6-Jan-08								0	0.00	
7-Jan-08								0	0.00	
8-Jan-08								0	0.00	
9-Jan-08								0	0.00	
10-Jan-08								0	0.00	
11-Jan-08								0	0.00	
12-Jan-08								0	0.00	
13-Jan-08								0	0.00	

Valley Tailing Pond #3 Decant

Internal Analysis

Notes:

-Data collected by ERDC, including on-site analysis of total zinc concentrations

-Blank cells indicate data was not collected

-Grey highlights indicate calculated decant volumes based on either reported indicators (e.g. <1 second to fill pail) or on a 20 L/second decant rate when siphoning

Parameter	**Time**	**Air Temp**	**Water Temp**	**Total Zinc**	**pH**	**Discharge**	**Discharge**	**Discharge**	**Zn Load**	**Staff Gauge**
Units	**HH:MM**	**°C**	**°C**	**mg/L**		**sec**	**L/s**	**L/day**	**kg/day**	**m**
Sample Date						**(per 5gal)**		Calculated by SRK	Calculated by SRK	
14-Jan-08								0	0.00	
15-Jan-08								0	0.00	
16-Jan-08								0	0.00	
17-Jan-08								0	0.00	
18-Jan-08								0	0.00	
19-Jan-08								0	0.00	
20-Jan-08								0	0.00	
21-Jan-08								0	0.00	
22-Jan-08								0	0.00	
23-Jan-08								0	0.00	
24-Jan-08								0	0.00	
25-Jan-08								0	0.00	
26-Jan-08								0	0.00	
27-Jan-08								0	0.00	
28-Jan-08								0	0.00	
29-Jan-08								0	0.00	
30-Jan-08								0	0.00	
31-Jan-08								0	0.00	
1-Feb-08								0	0.00	
2-Feb-08								0	0.00	
3-Feb-08								0	0.00	
4-Feb-08								0	0.00	
5-Feb-08								0	0.00	
6-Feb-08								0	0.00	
7-Feb-08								0	0.00	
8-Feb-08								0	0.00	
9-Feb-08								0	0.00	
10-Feb-08								0	0.00	
11-Feb-08								0	0.00	
12-Feb-08								0	0.00	
13-Feb-08								0	0.00	
14-Feb-08								0	0.00	
15-Feb-08								0	0.00	
16-Feb-08								0	0.00	
17-Feb-08								0	0.00	
18-Feb-08								0	0.00	
19-Feb-08								0	0.00	
20-Feb-08								0	0.00	
21-Feb-08								0	0.00	
22-Feb-08								0	0.00	
23-Feb-08								0	0.00	
24-Feb-08								0	0.00	
25-Feb-08								0	0.00	
26-Feb-08								0	0.00	
27-Feb-08								0	0.00	
28-Feb-08								0	0.00	
29-Feb-08								0	0.00	
1-Mar-08								0	0.00	
2-Mar-08								0	0.00	
3-Mar-08								0	0.00	
4-Mar-08								0	0.00	
5-Mar-08								0	0.00	
6-Mar-08								0	0.00	
7-Mar-08								0	0.00	
8-Mar-08								0	0.00	
9-Mar-08								0	0.00	
10-Mar-08								0	0.00	
11-Mar-08								0	0.00	
12-Mar-08								0	0.00	
13-Mar-08								0	0.00	
14-Mar-08								0	0.00	
15-Mar-08								0	0.00	
16-Mar-08								0	0.00	
17-Mar-08								0	0.00	
18-Mar-08								0	0.00	
19-Mar-08								0	0.00	
20-Mar-08								0	0.00	
21-Mar-08								0	0.00	
22-Mar-08								0	0.00	
23-Mar-08								0	0.00	
24-Mar-08								0	0.00	
25-Mar-08								0	0.00	
26-Mar-08								0	0.00	
27-Mar-08								0	0.00	

Valley Tailing Pond #3 Decant

Internal Analysis

Notes:

-Data collected by ERDC, including on-site analysis of total zinc concentrations

-Blank cells indicate data was not collected

-Grey highlights indicate calculated decant volumes based on either reported indicators (e.g. <1 second to fill pail) or on a 20 L/second decant rate when siphoning

Parameter	**Time**	**Air Temp**	**Water Temp**	**Total Zinc**	**pH**	**Discharge**	**Discharge**	**Discharge**	**Zn Load**	**Staff Gauge**
Units	**HH:MM**	**°C**	**°C**	**mg/L**		**sec**	**L/s**	**L/day**	**kg/day**	**m**
Sample Date						**(per 5gal)**		Calculated by SRK	Calculated by SRK	
28-Mar-08								0	0.00	
29-Mar-08								0	0.00	
30-Mar-08								0	0.00	
31-Mar-08								0	0.00	
1-Apr-08								0	0.00	
2-Apr-08								0	0.00	
3-Apr-08								0	0.00	
4-Apr-08								0	0.00	
5-Apr-08								0	0.00	
6-Apr-08								0	0.00	
7-Apr-08								0	0.00	
8-Apr-08								0	0.00	
9-Apr-08								0	0.00	
10-Apr-08								0	0.00	
11-Apr-08								0	0.00	
12-Apr-08								0	0.00	
13-Apr-08								0	0.00	
14-Apr-08								0	0.00	
15-Apr-08								0	0.00	
16-Apr-08								0	0.00	
17-Apr-08								0	0.00	
18-Apr-08								0	0.00	
19-Apr-08								0	0.00	
20-Apr-08								0	0.00	
21-Apr-08								0	0.00	
22-Apr-08								0	0.00	
23-Apr-08								0	0.00	
24-Apr-08								0	0.00	
25-Apr-08								0	0.00	
26-Apr-08								0	0.00	
27-Apr-08								0	0.00	
28-Apr-08								0	0.00	
29-Apr-08								0	0.00	
30-Apr-08								0	0.00	
1-May-08								0	0.00	
2-May-08								0	0.00	
3-May-08								0	0.00	
4-May-08								0	0.00	0.00
5-May-08								0	0.00	0.00
6-May-08								0	0.00	0.00
7-May-08								0	0.00	0.00
8-May-08								0	0.00	0.00
9-May-08								0	0.00	0.05
10-May-08								0	0.00	0.06
11-May-08			5.0	3.365	7.43			0	0.00	0.06
12-May-08			5.0	3.365	7.43			0	0.00	0.07
13-May-08			7.3	4.324	7.44			0	0.00	0.07
14-May-08			7.5	2.988	7.89			0	0.00	0.08
15-May-08			7.1	3.937	7.58			0	0.00	0.08
16-May-08			7.5	2.301	7.78			0	0.00	0.09
17-May-08			9.5	3.573	7.96			0	0.00	0.09
18-May-08								0	0.00	
19-May-08								0	0.00	
20-May-08								0	0.00	0.11
21-May-08								0	0.00	0.12
22-May-08								0	0.00	0.14
23-May-08						9.87		0	0.00	0.14
24-May-08								0	0.00	0.15
25-May-08						0.00		0	0.00	0.17
26-May-08						0.00		0	0.00	0.17
27-May-08						0.00		0	0.00	2.18
28-May-08						0.00		0	0.00	0.20
29-May-08						0.00		0	0.00	0.21
30-May-08						0.00		0	0.00	0.22
31-May-08						0.00		0	0.00	0.27
1-Jun-08								0	0.00	0.33
2-Jun-08			13.9	0.376	8.76			0	0.00	0.33
3-Jun-08			15.6	0.386	8.79			0	0.00	0.32
4-Jun-08			14.1	0.269	8.46			0	0.00	0.30
5-Jun-08				0.260	0.00			0	0.00	8.64
6-Jun-08			15	0.256	8.64			0	0.00	0.26
7-Jun-08			15.1	0.268	8.51			0	0.00	0.25
8-Jun-08			15.25	0.225	8.55			0	0.00	0.24
9-Jun-08			16.8	0.192	8.28	1.50	12.62	1090199	0.21	0.23

Valley Tailing Pond #3 Decant

Internal Analysis

Notes:
-Data collected by ERDC, including on-site analysis of total zinc concentrations
-Blank cells indicate data was not collected
-Grey highlights indicate calculated decant volumes based on either reported indicators (e.g. <1 second to fill pail) or on a 20 L/second decant rate when siphoning

Parameter	**Time**	**Air Temp**	**Water Temp**	**Total Zinc**	**pH**	**Discharge**	**Discharge**	**Discharge**	**Zn Load**	**Staff Gauge**
Units	**HH:MM**	**°C**	**°C**	**mg/L**		**sec**	**L/s**	**L/day**	**kg/day**	**m**
Sample Date						**(per 5gal)**		Calculated by SRK	Calculated by SRK	
10-Jun-08			15	0.131	8.11	1.43	13.24	1143565	0.15	0.21
11-Jun-08			15.6	0.138	8.30	1.59	11.90	1028489	0.14	0.21
12-Jun-08			15.0	0.132	7.96	1.48	12.79	1104931	0.15	0.21
13-Jun-08			14.9	0.129	8.10	1.68	11.27	973392	0.13	0.21
14-Jun-08			15.7	0.105	8.05	1.83	10.34	893605	0.09	0.21
15-Jun-08			15.7	0.071	8.04	1.68	11.27	973392	0.07	0.22
16-Jun-08			16.6	0.111	7.92	1.69	11.20	967632	0.11	0.22
17-Jun-08			171.0	0.041	8.51			0	0.00	0.22
18-Jun-08			17.0	0.039	8.09	1.69	11.20	967632	0.04	0.22
19-Jun-08			16.8	0.042	8.12	1.54	12.29	1061882	0.04	0.22
20-Jun-08			18.6	0.043	8.42	1.16	16.32	1409740	0.06	0.24
21-Jun-08			18.9	0.004	8.35	1.31	14.45	1248319	0.01	0.22
22-Jun-08			18.7	0.080	8.33	1.28	14.79	1277576	0.10	0.22
23-Jun-08			19.0	0.021	8.70	1.10	17.21	1486634	0.03	0.24
24-Jun-08			18.5	0.085	8.54	1.20	15.77	1362748	0.12	0.23
25-Jun-08			18.3	0.039	8.59	1.00	18.93	1635298	0.06	0.23
26-Jun-08			18.8	0.075	8.64	1.00	18.93	1635298	0.12	0.23
27-Jun-08			18.0	0.032	8.75	1.30	14.56	1257921	0.04	0.23
28-Jun-08				0.038	8.50	1.10	17.21	1486634	0.06	0.22
29-Jun-08				0.017	8.80	1.00	18.93	1635298	0.03	0.24
30-Jun-08				0.010	8.29	<1	20.00	1728000	0.02	0.25
1-Jul-08				0.010		<1	20.00	1728000	0.02	0.27
2-Jul-08			14.0	0.013	8.65	<1	20.00	1728000	0.02	0.28
3-Jul-08			15.3	0.006	8.66	<1	20.00	1728000	0.01	0.27
4-Jul-08			17.4	0.037	8.48	<1	20.00	1728000	0.06	0.27
5-Jul-08			18.2	0.028	8.69	<1	20.00	1728000	0.05	0.26
6-Jul-08			17.6	0.012	8.61	<1	20.00	1728000	0.02	0.28
7-Jul-08			17.6	0.010	8.56	<1	20.00	1728000	0.02	0.28
8-Jul-08			17.0	0.010	8.64	<1	20.00	1728000	0.02	0.27
9-Jul-08			17.0	0.010	8.71	<1	20.00	1728000	0.02	0.26
10-Jul-08			17.5	0.013	8.61	<1	20.00	1728000	0.02	0.25
11-Jul-08			17.0	0.012	8.73	<1	20.00	1728000	0.02	0.25
12-Jul-08			16.5	0.022	8.89	<1	20.00	1728000	0.04	0.26
13-Jul-08			16.5	0.019	9.01	<1	20.00	1728000	0.03	0.26
14-Jul-08			17.5	0.010	9.04	<1	20.00	1728000	0.02	0.25
15-Jul-08			17.0	0.010	7.86	2.00	9.46	817649	0.01	0.26
16-Jul-08			18.0	0.010	9.05	2.00	9.46	817649	0.01	0.25
17-Jul-08			18.4	0.022	9.15	<1	20.00	1728000	0.04	0.24
18-Jul-08			17.5	0.010	9.00	<1	20.00	1728000	0.02	0.23
19-Jul-08			14.5	0.043	8.96	<1	20.00	1728000	0.07	0.23
20-Jul-08			15.0	0.030	9.05	<1	20.00	1728000	0.05	0.23
21-Jul-08			15.0	0.014	8.91	<1	20.00	1728000	0.02	0.23
22-Jul-08			16.0	0.010	8.34	<1	20.00	1728000	0.02	0.23
23-Jul-08			14.6	0.010	9.03	1.32	14.34	1238862	0.01	0.22
24-Jul-08			14.5	0.002	8.58	1.50	12.62	1090199	0.00	0.22
25-Jul-08			14.9	0.001	8.85	1.36	13.92	1202425	0.00	0.22
26-Jul-08			15.7	0.012	8.87	1.56	12.13	1048268	0.01	0.22
27-Jul-08			15.5	0.015	9.17	1.40	13.52	1168070	0.02	0.22
28-Jul-08			15.4	0.024	9.04	1.31	14.45	1248319	0.03	0.22
29-Jul-08			15.5	0.025	9.06	1.18	16.04	1385846	0.03	0.22
30-Jul-08			15.5	0.010	9.10	1.20	15.77	1362748	0.01	0.22
31-Jul-08			14.0	0.010	9.18	1.30	14.56	1257921	0.01	0.21
1-Aug-08			13.8	0.004	9.20	1.50	12.62	1090199	0.00	0.20
2-Aug-08			14.3	0.044	9.34	1.70	11.13	961940	0.04	0.19
3-Aug-08			15.5	0.010	9.30	2.30	8.23	710999	0.01	0.18
4-Aug-08			15.0	0.010	9.26	3.70	5.12	441972	0.00	0.17
5-Aug-08			15.5	0.010	9.36	4.70	4.03	347936	0.00	0.17
6-Aug-08			15.0	0.032	9.39	3.60	5.26	454249	0.01	0.18
7-Aug-08			14.0	0.010	9.91			0	0.00	0.17
8-Aug-08			13.5	0.253	9.56	0.00		0	0.00	
9-Aug-08			15.0	0.011	9.48	0.00		0	0.00	0.22
10-Aug-08			14.0	0.013	9.39	0.00		0	0.00	0.24
11-Aug-08			15.7	0.014	9.20	0.00		0	0.00	0.24
12-Aug-08			14.8	0.010	9.21	<1	20.00	1728000	0.02	0.24
13-Aug-08			14.3	0.010	9.25	<1	20.00	1728000	0.02	0.22
14-Aug-08			14.7	0.000	9.39	<1	20.00	1728000	0.00	0.21
15-Aug-08			14.8	0.010	9.13	siphon	20.00	1728000	0.02	0.21
16-Aug-08			15.3	0.005	9.02	siphon	20.00	1728000	0.01	0.20
17-Aug-08			15.0	0.010	8.78	siphon	20.00	1728000	0.02	0.19
18-Aug-08			14.3	0.020	9.23	siphon	20.00	1728000	0.03	0.19

Valley Tailing Pond #3 Decant

Internal Analysis

Notes:

-Data collected by ERDC, including on-site analysis of total zinc concentrations

-Blank cells indicate data was not collected

-Grey highlights indicate calculated decant volumes based on either reported indicators (e.g. <1 second to fill pail) or on a 20 L/second decant rate when siphoning

Parameter	Time	Air Temp	Water Temp	Total Zinc	pH	Discharge	Discharge	Discharge	Zn Load	Staff Gauge
Units	HH:MM	°C	°C	mg/L		sec	L/s	L/day	kg/day	m
Sample Date						(per 5gal)		Calculated by SRK	Calculated by SRK	
19-Aug-08			13.5	0.018	9.34	3.40	5.57	480970	0.01	0.18
20-Aug-08			12.8	0.010	9.12	4.31	4.39	379419	0.00	0.17
21-Aug-08			13.0	0.052	9.21	7.12	2.66	229677	0.01	0.16
22-Aug-08			13.0	0.010	9.05	7.03	2.69	232617	0.00	0.16
23-Aug-08			12.5	0.062	8.87	11.28	1.68	144973	0.01	0.15
24-Aug-08			11.5	0.010	8.84	13.00	1.46	125792	0.00	0.14
25-Aug-08			11.5	0.007	8.84	13.00	1.46	125792	0.00	0.15
26-Aug-08			11.3	0.034	8.81	5.90	3.21	277169	0.01	0.17
27-Aug-08			10.8	0.050	8.49	3.10	6.11	527515	0.03	0.18
28-Aug-08			11.0	0.153	8.27	2.60	7.28	628961	0.10	0.19
29-Aug-08			11.8	0.166	8.43	2.00	9.46	817649	0.14	0.20
30-Aug-08			11.3	0.130	8.29	1.70	11.13	961940	0.12	0.20
31-Aug-08			10.5	0.179	8.35	1.60	11.83	1022061	0.18	0.21
1-Sep-08			10.9	0.245	8.20	1.60	11.83	1022061	0.25	0.22
2-Sep-08			11.0	0.152	8.09	1.70	11.13	961940	0.15	0.21
3-Sep-08			10.6	0.220	8.14	1.20	15.77	1362748	0.30	0.22
4-Sep-08			10.9	0.250	8.09	1.30	14.56	1257921	0.31	0.22
5-Sep-08			11.3	0.185	7.94	1.40	13.52	1168070	0.22	0.22
6-Sep-08			11.0	0.411	8.15	1.20	15.77	1362748	0.56	0.23
7-Sep-08			10.4	0.198	8.05	1.30	14.56	1257921	0.25	0.23
8-Sep-08			10.8	0.083	8.18	1.10	17.21	1486634	0.12	0.23
9-Sep-08			11.0	0.169	7.85	1.30	14.56	1257921	0.21	0.24
10-Sep-08			10.5	0.119	7.90	<1	20.00	1728000	0.20	0.24
11-Sep-08			10.0	0.078	7.94	<1	20.00	1728000	0.13	0.25
12-Sep-08			9.7	0.077	7.94	<1	20.00	1728000	0.13	0.24
13-Sep-08			9.8	0.076	7.92	<1	20.00	1728000	0.13	0.24
14-Sep-08			9.5	0.040	7.98	<1	20.00	1728000	0.07	0.24
15-Sep-08			10.0	0.006	8.13	<1	20.00	1728000	0.01	0.23
16-Sep-08			9.0	0.072	8.21	<1	20.00	1728000	0.12	0.23
17-Sep-08			9.0	0.097	8.00	<1	20.00	1728000	0.17	0.23
18-Sep-08			9.0	0.083	8.47	<1	20.00	1728000	0.14	0.24
19-Sep-08			9.0	0.108	8.21	<1	20.00	1728000	0.19	0.24
20-Sep-08			8.8	0.091	8.15	<1	20.00	1728000	0.16	0.24
21-Sep-08			7.0	0.097	8.44	<1	20.00	1728000	0.17	0.24
22-Sep-08			7.0	0.173	8.38	<1	20.00	1728000	0.30	0.23
23-Sep-08			6.7	0.264	8.78	<1	20.00	1728000	0.46	0.23
24-Sep-08			5.5	0.370	8.47	<2	10.00	864000	0.32	0.22
25-Sep-08			5.0	0.282	8.14	<2	10.00	864000	0.24	0.22
26-Sep-08			5.0	0.237	8.07	<2	10.00	864000	0.20	0.20
27-Sep-08			4.9	0.344	7.96	<3	6.67	576000	0.20	0.19
28-Sep-08			4.3	0.334	7.95	3.18	5.95	514245	0.17	0.18
29-Sep-08			3.0	0.255	7.68	4.65	4.07	351677	0.09	0.17
30-Sep-08			2.4	0.216	7.79	5.18	3.65	315695	0.07	0.16
1-Oct-08			4.0	0.260	7.69	7.78	2.43	210193	0.05	0.16
2-Oct-08			4.0	0.253	8.01	7.62	2.48	214606	0.05	0.16
3-Oct-08			5.0	0.243	7.93	6.72	2.82	243348	0.06	0.17
4-Oct-08			4.0	0.378	8.05	4.93	3.84	331703	0.13	0.18
5-Oct-08				0.368	7.98			0	0.00	
6-Oct-08				0.611	7.87			0	0.00	
7-Oct-08				0.377	7.86			0	0.00	
8-Oct-08				0.388	7.90			0	0.00	
9-Oct-08				0.392	7.79			0	0.00	
10-Oct-08				0.291	8.17			0	0.00	
11-Oct-08				0.010	7.99			0	0.00	
12-Oct-08			2.0	0.275	7.69	<1	20.00	1728000	0.47	0.20
13-Oct-08								0	0.00	0.24
14-Oct-08			1.7	0.257	8.15	<1	20.00	1728000	0.44	0.26
15-Oct-08			2.7	0.307	8.02	<1	20.00	1728000	0.53	0.27
16-Oct-08			3.9	0.496	8.20	<1	20.00	1728000	0.86	0.27
17-Oct-08			2.9	0.481	8.11	<1	20.00	1728000	0.83	0.26
18-Oct-08			3.2	0.511	8.03	<1	20.00	1728000	0.88	0.26
19-Oct-08				0.497				0	0.00	
20-Oct-08				0.572				0	0.00	
21-Oct-08	10:40		0.7	0.241	7.71			0	0.00	0.37
22-Oct-08	11:00	1.0	0.6	0.146	8.09	19.56	0.97	83604	0.01	0.42
23-Oct-08	11:00	-11.0	0.7	0.179	8.19	15.31	1.24	106812	0.02	0.47
24-Oct-08	13:00	2.0	1.3	0.229	7.52	15.17	1.25	107798	0.02	0.53
25-Oct-08	11:00	-24.0	0.5	0.234	7.53	14.12	1.34	115814	0.03	<0.540
26-Oct-08	11:10	-22.0	0.3	0.257	7.65			0	0.00	0.53
27-Oct-08	10:55	-12.0	0.8	0.210	7.60	19.60	0.97	83434	0.02	0.53
28-Oct-08	12:35	-24.0	0.3	0.231	7.44	17.65	1.07	92651	0.02	0.00
29-Oct-08	11:35	-26.0	1.3	0.286	8.07	<1	20.00	1728000	0.49	0.56
30-Oct-08	11:35	-14.0	1.8	0.420	8.05			0	0.00	0.54
31-Oct-08	11:20	-16.0	1.3	0.379	8.41	<1	20.00	1728000	0.66	0.53

Appendix D5

2008 Tailings Monitoring Well Water Chemistry

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

		GT7							
		Norwest Labs Number	585585-10				630692-50	648008-36	
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/JM**	**ACG**	**ACG**	
		Sample Date	31-Oct-07	17-Apr-08	15-May-08	21-Jun-08	7-Jul-08	4-Oct-08	
		Matrix	water	water	water	water	water	water	
		Units							
Field Anaylsis									
pH			7.37	**Well was plowed over by snow removal on Dam #1**	**Frozen at 1.5m**	**Dry**	7.29	7.42	
Temperature C		C	0.3				3.5	2	
Conductivity		µS/cm	12.67				1313	1318	
Water level		m	6.28				5.67		
Oxidation Reduction Potentia	ORP	mg/L							
Dissolved oxygen	DO	mg/L							
External Anaylsis									
Metals Dissolved (Trace)									
Aluminum (Al)	Dissolved	mg/L	0.826				0.005	<0.005	
Antimony (Sb)	Dissolved	mg/L	0.0015				0.0011	0.0016	
Arsenic (As)	Dissolved	mg/L	0.149				0.0237	0.0315	
Barium (Ba)	Dissolved	mg/L	0.51				0.487	0.407	
Beryllium (Be)	Dissolved	mg/L	<0.0001				<0.0001	<0.00004	
Bismuth (Bi)	Dissolved	mg/L	<0.0005				<0.0005		
Boron (B)	Dissolved	mg/L	0.003				0.005	<0.004	
Cadmium (Cd)	Dissolved	mg/L	0.00079				0.00004	0.00011	
Calcium (Ca)	Dissolved	mg/L	230				234	228	
Chromium (Cr)	Dissolved	mg/L	0.0059				0.0014	0.0014	
Cobalt (Co)	Dissolved	mg/L	0.0087				0.0062	0.00548	
Copper (Cu)	Dissolved	mg/L	0.023				0.001	<0.001	
Iron (Fe)	Dissolved	mg/L	44.3				8.23	1.59	
Lead (Pb)	Dissolved	mg/L	0.0244				<0.0001	0.0002	
Lithium (Li)	Dissolved	mg/L	0.011				0.012	0.01	
Magnesium (Mg)	Dissolved	mg/L	60.1				62.4	63.7	
Manganese (Mn)	Dissolved	mg/L	8.68				8.9	10.6	
Mercury (Hg)	Dissolved	mg/L							
Molybdenum (Mo)	Dissolved	mg/L	0.002				0.003	0.00248	
Nickel (Ni)	Dissolved	mg/L	0.0061				0.0138	0.019	
Phosphorus (P)	Dissolved	mg/L					0.09	<0.01	
Potassium (K)	Dissolved	mg/L	2.6				2.6	2.5	
Selenium (Se)	Dissolved	mg/L	0.0002				<0.0002	<0.0006	
Silicon (Si)	Dissolved	mg/L	10.2				7.82	7.65	
Silver (Ag)	Dissolved	mg/L	<0.0001				<0.00001	<0.00001	
Sodium (Na)	Dissolved	mg/L	17.5				17.1	15.9	
Stronium (Sr)	Dissolved	mg/L	1.23				1.16	1.04	
Sulphur (S)	Dissolved	mg/L	140				147		
Tellurium (Te)	Dissolved	mg/L						<0.0001	
Thallium (Tl)	Dissolved	mg/L	0.00008				<0.00005	0.00006	
Thorium								<0.0001	
Tin (Sn)	Dissolved	mg/L	<0.001				<0.001	0.0001	
Titanium (Ti)	Dissolved	mg/L	0.0406				0.019	0.0012	
Uranium (U)	Dissolved	mg/L	0.0028				0.0028	0.0025	
Vanadium (V)	Dissolved	mg/L	0.0033				<0.0001	0.00045	
Zinc (Zn)	Dissolved	mg/L	0.036				0.007	0.009	
Zirconium (Zr)	Dissolved	mg/L						0.0007	
Physical and Aggregate									
Temp. of observed pH and EC	°C								
Total Suspended Solids - TSS	Total	mg/L	4160				20100	3580	
Total Dissolved Solids	Calculated	mg/L	1170						
True Colour	Colour units		29						
Routine Water									
pH			7.27				7.71	7.06	
Electrical Conductivity		µS/cm	1400				1450	1380	
Sulphate (SO4)	Dissolved	mg/L	442				441		Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	<5						
Carbonate		mg/L	<6						
Bicarbonate		mg/L	547						
P-Alkalinity	as CaCO3	mg/L							
T-Alkalinity	as CaCO3	mg/L	449						
Turbidity	NTU		120						
Hardness	Dissolved	mg/L					841	833	
Chloride	Dissolved	mg/L	5						
Nutrients									
Ammonia -N									
Nitrite Nitrogen (NO2)		mg/L	<0.02						
Nitrate Nitrogen (NO3)		mg/L	<0.02						
Cyanide									
Total Cyanide		mg/L	0.09						
Cyanide<WAD		mg/L							

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

GT8

Norwest Labs Number			585585-4	614609-3		626903-3	630692-49	648008-35
Collected by			**ACG**	**ACG**	**DD/DC**	**ACG**	**ACG**	**ACG**
Sample Date			27-Oct-07	17-Apr-08	15-May-08	21-Jun-08	7-Jul-08	4-Oct-08
Matrix			water	water	water		water	water
Units								
Field Anaylsis								
pH			7.4	7.64		7.10	7.22	7.58
Temperature C		C	1.6	1.8		6.5	4	3
Conductivity		µS/cm	1125	555		1160	1121	1403
Water level		m	5.12	5.73		4.72	4.83	5.05
Oxidation Reduction Potentia	ORP	mg/L						
Dissolved oxygen	DO	mg/L						
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L	3.41	<0.005		<0.005	0.009	<0.005
Antimony (Sb)	Dissolved	mg/L	0.0023	0.001		0.0016	0.001	0.0014
Arsenic (As)	Dissolved	mg/L	0.219	0.0134		0.0337	0.0425	0.0316
Barium (Ba)	Dissolved	mg/L	0.481	0.236		0.246	0.231	0.203
Beryllium (Be)	Dissolved	mg/L	0.0003	<0.0001		<0.0001	<0.0001	<0.00004
Bismuth (Bi)	Dissolved	mg/L	<0.0005	<0.0005		<0.0005	<0.0005	
Boron (B)	Dissolved	mg/L	0.005	0.008		0.008	0.005	<0.004
Cadmium (Cd)	Dissolved	mg/L	0.00338	0.00038		0.00036	0.00002	0.00003
Calcium (Ca)	Dissolved	mg/L	220	184		200	211	234
Chromium (Cr)	Dissolved	mg/L	0.0125	0.0034		0.0005	0.0022	0.002
Cobalt (Co)	Dissolved	mg/L	0.017	0.0118		0.0132	0.0065	0.0117
Copper (Cu)	Dissolved	mg/L	0.087	0.002		0.002	<0.001	<0.001
Iron (Fe)	Dissolved	mg/L	47.1	0.04		0.09	10.6	1.8
Lead (Pb)	Dissolved	mg/L	0.19	<0.0001		0.0003	0.0002	0.0002
Lithium (Li)	Dissolved	mg/L	0.014	0.011		0.011	0.011	0.01
Magnesium (Mg)	Dissolved	mg/L	58	48.4		56.1	57	65.8
Manganese (Mn)	Dissolved	mg/L	7.29	4.7		5.35	5.95	8.07
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L	0.002	0.007	Frozen	0.005	0.003	0.00326
Nickel (Ni)	Dissolved	mg/L	0.0256	0.0215		0.021	0.0103	0.018
Phosphorus (P)	Dissolved	mg/L					0.11	<0.01
Potassium (K)	Dissolved	mg/L	5.1	5.5		4.6	2.9	3.7
Selenium (Se)	Dissolved	mg/L	0.0004	0.0013		0.0004	<0.0002	<0.0006
Silicon (Si)	Dissolved	mg/L	13.6	7.45		8.45	8.48	8.79
Silver (Ag)	Dissolved	mg/L	<0.0001	<0.00001		<0.00001	<0.00001	<0.00001
Sodium (Na)	Dissolved	mg/L	16.1	15.6		16.9	15.7	14.8
Stronium (Sr)	Dissolved	mg/L	1.06	0.808		0.879	1	1.01
Sulphur (S)	Dissolved	mg/L	97.7	93.7		109	120	
Tellurium (Te)	Dissolved	mg/L						<0.0001
Thallium (Tl)	Dissolved	mg/L	0.00014	<0.00005		<0.00005	<0.00005	0.00002
Thorium								<0.0001
Tin (Sn)	Dissolved	mg/L	<0.001	<0.001		<0.001	<0.001	0.0001
Titanium (Ti)	Dissolved	mg/L	0.0965	0.0035		0.0037	0.0152	0.0013
Uranium (U)	Dissolved	mg/L	0.0037	0.004		0.0035	0.0031	0.0028
Vanadium (V)	Dissolved	mg/L	0.015	0.0063		0.0009	0.0003	0.00075
Zinc (Zn)	Dissolved	mg/L	0.169	0.013		0.018	0.004	0.002
Zirconium (Zr)	Dissolved	mg/L						0.0013
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L	7340	278		7170	5110	656
Total Dissolved Solids	Calculated	mg/L	982	984				
True Colour	Colour units		30	37				
Routine Water								
pH			7.51	7.61		7.57	7.69	7.06
Electrical Conductivity		µS/cm	1300	1260		1290	1380	1430
Sulphate (SO4)	Dissolved	mg/L	308	298		327	360	
Hydroxide		mg/L	<5	<5				
Carbonate		mg/L	<6	<6				
Bicarbonate		mg/L	584	596				
P-Alkalinity	as CaCO3	mg/L		489				
T-Alkalinity	as CaCO3	mg/L	479					
Turbidity	NTU		110	32				
Hardness	Dissolved	mg/L				730	763	854
Chloride	Dissolved	mg/L	5.21	4.96				
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L	<0.02	<0.02				
Nitrate Nitrogen (NO3)		mg/L	<0.02	<0.02				
Cyanide								
Total Cyanide		mg/L	0.23	0.24				
Cyanide<WAD		mg/L						

Grey cells indicate sulphate calc. from ICP sulphur

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

		GT9							
Norwest Labs Number			585585-3	614609-2			630692-48	648008-34	
Collected by			**ACG**	**ACG**	**DD/DC**	**DC/JM**	**ACG**	**ACG**	
Sample Date			27-Oct-07	17-Apr-08	15-May-08	21-Jun-08	7-Jul-08	4-Oct-08	
Matrix			water	water	water	water	water	water	
		Units							
Field Anaylsis									
pH			7.48	7.33			7.20	7.53	
Temperature C		C	2.6	1.80			7.00	3.00	
Conductivity		µS/cm	1088	864			901	1130	
Water level		m	4.53	5.21			4.34	5.02	
Oxidation Reduction Potentia	ORP	mg/L							
Dissolved oxygen	DO	mg/L							
External Anaylsis									
Metals Dissolved (Trace)									
Aluminum (Al)	Dissolved	mg/L	0.008	<0.005			0.011	<0.005	
Antimony (Sb)	Dissolved	mg/L	0.0018	0.0004			0.0022	0.0022	
Arsenic (As)	Dissolved	mg/L	0.103	0.0056			0.0751	0.0504	
Barium (Ba)	Dissolved	mg/L	0.254	0.143			0.123	0.153	
Beryllium (Be)	Dissolved	mg/L	<0.0001	<0.0001			<0.0001	<0.00004	
Bismuth (Bi)	Dissolved	mg/L	<0.0005	<0.0005			<0.0005		
Boron (B)	Dissolved	mg/L	0.006	0.01			0.007	<0.004	
Cadmium (Cd)	Dissolved	mg/L	0.00001	<0.00001			0.00003	0.00001	
Calcium (Ca)	Dissolved	mg/L	190	188			142	192	
Chromium (Cr)	Dissolved	mg/L	0.0062	0.0032			0.0006	0.0014	
Cobalt (Co)	Dissolved	mg/L	0.0014	0.0015			0.007	0.00899	
Copper (Cu)	Dissolved	mg/L	<0.001	0.001			<0.001	<0.001	
Iron (Fe)	Dissolved	mg/L	29.7	<0.01			0.22	0.107	
Lead (Pb)	Dissolved	mg/L	0.0002	<0.0001			0.0003	0.0001	
Lithium (Li)	Dissolved	mg/L	0.011	0.015			0.011	0.011	
Magnesium (Mg)	Dissolved	mg/L	52.2	52			42.2	56.2	
Manganese (Mn)	Dissolved	mg/L	6.77	6.33			4.45	7.34	
Mercury (Hg)	Dissolved	mg/L							
Molybdenum (Mo)	Dissolved	mg/L	0.003	0.003	**Frozen**	**Frozen**	0.005	0.00479	
Nickel (Ni)	Dissolved	mg/L	<0.0005	0.0013			0.0273	0.019	
Phosphorus (P)	Dissolved	mg/L					0.13	<0.01	
Potassium (K)	Dissolved	mg/L	4.1	4.5			4	4.3	
Selenium (Se)	Dissolved	mg/L	<0.0002	0.0008			0.0002	<0.0006	
Silicon (Si)	Dissolved	mg/L	7.67	6.56			6.73	7.36	
Silver (Ag)	Dissolved	mg/L	<0.0001	<0.00001			<0.00001	<0.00001	
Sodium (Na)	Dissolved	mg/L	15.4	16.6			12.5	13.4	
Stronium (Sr)	Dissolved	mg/L	1.11	1.04			0.771	0.92	
Sulphur (S)	Dissolved	mg/L	107	108			74.8		
Tellurium (Te)	Dissolved	mg/L						<0.0001	
Thallium (Tl)	Dissolved	mg/L	<0.00005	<0.00005			<0.00005	0.00001	
Thorium								<0.0001	
Tin (Sn)	Dissolved	mg/L	<0.001	<0.001			<0.001	0.0002	
Titanium (Ti)	Dissolved	mg/L	0.008	0.0041			0.0106	0.0012	
Uranium (U)	Dissolved	mg/L	0.0019	0.002			0.0021	0.0022	
Vanadium (V)	Dissolved	mg/L	0.0013	0.0058			0.0007	0.00058	
Zinc (Zn)	Dissolved	mg/L	0.002	0.011			0.004	0.002	
Zirconium (Zr)	Dissolved	mg/L							
Physical and Aggregate									
Temp. of observed pH and EC	°C								
Total Suspended Solids - TSS	Total	mg/L	75	359			2500	1600	
Total Dissolved Solids	Calculated	mg/L	1000	908					
True Colour	Colour units		20	20					
Routine Water									
pH			7.63	7.7			7.82	7.24	
Electrical Conductivity		µS/cm	1230	1160			1000	1120	
Sulphate (SO4)	Dissolved	mg/L	335	320			224.4		Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	<5	<5					
Carbonate		mg/L	<6	<6					
Bicarbonate		mg/L	505	484					
P-Alkalinity	as CaCO3	mg/L		397					
T-Alkalinity	as CaCO3	mg/L	414						
Turbidity	NTU		38	28					
Hardness	Dissolved	mg/L					529	710	
Chloride	Dissolved	mg/L	4.26	4.66					
Nutrients									
Ammonia -N									
Nitrite Nitrogen (NO2)		mg/L	<0.02	<0.02					
Nitrate Nitrogen (NO3)		mg/L	<0.02	<0.02					
Cyanide									
Total Cyanide		mg/L	0.041	0.059					
Cyanide<WAD		mg/L							

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

		GT10							
		Norwest Labs Number	585585-1			626903-4	630692-52	648008-33	
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/JM**	**DC/CB**	**DC/TL**	
		Sample Date	27-Oct-07	17-Apr-08	14-May-08	21-Jun-08	7-Jul-08	4-Oct-08	
		Matrix	water	water	water	water	water	water	
		Units							
Field Anaylsis									
pH			7.31			6.23	7.03	7.44	
Temperature C		C	3.8			11	5.5	2	
Conductivity		µS/cm	1074			3020	1606	1265	
Water level		m	4.1			4.1	4	4.16	
Oxidation Reduction Potentia	ORP	mg/L							
Dissolved oxygen	DO	mg/L							
External Anaylsis									
Metals Dissolved (Trace)									
Aluminum (Al)	Dissolved	mg/L	0.041			0.22	0.036	0.012	
Antimony (Sb)	Dissolved	mg/L	0.0017			<0.002	0.001	0.0012	
Arsenic (As)	Dissolved	mg/L	0.0538			0.01	0.0053	0.0062	
Barium (Ba)	Dissolved	mg/L	0.098			0.11	0.037	0.064	
Beryllium (Be)	Dissolved	mg/L	0.0001			<0.001	0.0002	<0.00004	
Bismuth (Bi)	Dissolved	mg/L	<0.0005			<0.005	<0.0005		
Boron (B)	Dissolved	mg/L	0.004			<0.02	0.005	<0.004	
Cadmium (Cd)	Dissolved	mg/L	0.00002			0.0734	0.00727	0.00016	
Calcium (Ca)	Dissolved	mg/L	181			353	244	203	
Chromium (Cr)	Dissolved	mg/L	0.0048			<0.005	0.0017	0.0018	
Cobalt (Co)	Dissolved	mg/L	0.0039			0.096	0.0135	0.00189	
Copper (Cu)	Dissolved	mg/L	<0.001			<0.01	0.002	<0.001	
Iron (Fe)	Dissolved	mg/L	35.7			105	28.5	2.75	
Lead (Pb)	Dissolved	mg/L	0.0006			0.001	0.0004	0.0002	
Lithium (Li)	Dissolved	mg/L	0.011			0.06	0.018	0.008	
Magnesium (Mg)	Dissolved	mg/L	52.1			182	89.6	60.3	
Manganese (Mn)	Dissolved	mg/L	3.24			41.7	9.56	4.01	
Mercury (Hg)	Dissolved	mg/L							
Molybdenum (Mo)	Dissolved	mg/L	0.003			<0.01	<0.001	0.00153	
Nickel (Ni)	Dissolved	mg/L	0.0037			0.262	0.037	0.006	
Phosphorus (P)	Dissolved	mg/L					<0.05	<0.01	
Potassium (K)	Dissolved	mg/L	2.9	**Waterra tubing frozen in place**	**Waterra tubing frozen in place**	<4	2.8	3.1	
Selenium (Se)	Dissolved	mg/L	0.0006			<0.002	0.0004	<0.0006	
Silicon (Si)	Dissolved	mg/L	8.14			11	7.63	7.73	
Silver (Ag)	Dissolved	mg/L	<0.0001			0.00018	0.00006	<0.00001	
Sodium (Na)	Dissolved	mg/L	19.7			44	17.8	10	
Stronium (Sr)	Dissolved	mg/L	0.741			1.06	0.801	0.625	
Sulphur (S)	Dissolved	mg/L	113			635	239		
Tellurium (Te)	Dissolved	mg/L						<0.0001	
Thallium (Tl)	Dissolved	mg/L	<0.00005			<0.0005	<0.00005	0.00002	
Thorium								<0.0001	
Tin (Sn)	Dissolved	mg/L	<0.001			<0.01	<0.001	0.0003	
Titanium (Ti)	Dissolved	mg/L	0.0106			0.02	0.03	0.0018	
Uranium (U)	Dissolved	mg/L	0.002			<0.005	0.0017	0.0015	
Vanadium (V)	Dissolved	mg/L	0.0016			<0.001	<0.0001	0.00093	
Zinc (Zn)	Dissolved	mg/L	0.005			4.8	0.373	0.013	
Zirconium (Zr)	Dissolved	mg/L						0.0022	
Physical and Aggregate									
Temp. of observed pH and EC	°C								
Total Suspended Solids - TSS	Total	mg/L	23700			13300	6370	1190	
Total Dissolved Solids	Calculated	mg/L	954						
True Colour	Colour units		110						
Routine Water									
pH			7.11			5.38	7.45	6.96	
Electrical Conductivity		µS/cm	1220			3180	1580	1220	
Sulphate (SO4)	Dissolved	mg/L	327			1905	717		Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	<5						
Carbonate		mg/L	<6						
Bicarbonate		mg/L	466						
P-Alkalinity	as CaCO3	mg/L							
T-Alkalinity	as CaCO3	mg/L	382						
Turbidity	NTU		280						
Hardness	Dissolved	mg/L				1630	978	756	
Chloride	Dissolved	mg/L	14.1						
Nutrients									
Ammonia -N									
Nitrite Nitrogen (NO2)		mg/L	<0.02						
Nitrate Nitrogen (NO3)		mg/L	0.02						
Cyanide									
Total Cyanide		mg/L	0.001						
Cyanide<WAD		mg/L							

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

		GT12					
		Norwest Labs Number	585585-2	614609-1	620382-2	630692-51	648008-32
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/CB**	**DC/TL**
		Sample Date	27-Oct-07	17-Apr-08	14-May-08	7-Jul-08	4-Oct-08
		Matrix	water	water	water	water	water
		Units					
Field Anaylsis							
pH			7.95	7.68	7.51	7.48	7.48
Temperature C		C	2.8	1.9	5	8	2
Conductivity		µS/cm	623	645	772	691	849
Water level		m	8.16	8.51	7.43	7.49	7.64
Oxidation Reduction Potentia	ORP	mg/L			100		
Dissolved oxygen	DO	mg/L			15.76		
External Anaylsis							
Metals Dissolved (Trace)							
Aluminum (Al)	Dissolved	mg/L	0.209	<0.005	0.008	0.005	<0.005
Antimony (Sb)	Dissolved	mg/L	0.0016	0.0003	0.0027	0.0014	0.0009
Arsenic (As)	Dissolved	mg/L	0.0216	0.0082	0.0062	0.0027	0.0058
Barium (Ba)	Dissolved	mg/L	0.107	0.073	0.036	0.054	0.052
Beryllium (Be)	Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.00004
Bismuth (Bi)	Dissolved	mg/L	<0.0005	<0.0005	<0.0005	<0.0005	
Boron (B)	Dissolved	mg/L	0.008	0.011	0.012	0.011	0.004
Cadmium (Cd)	Dissolved	mg/L	0.00004	0.00001	<0.00001	0.00002	0.00001
Calcium (Ca)	Dissolved	mg/L	91.9	93.8	62.2	90.9	110
Chromium (Cr)	Dissolved	mg/L	0.0013	0.0019	<0.0005	<0.0005	0.0008
Cobalt (Co)	Dissolved	mg/L	0.002	0.0002	0.0006	0.0008	0.00097
Copper (Cu)	Dissolved	mg/L	0.001	0.001	<0.001	0.002	<0.001
Iron (Fe)	Dissolved	mg/L	1.42	<0.01	<0.01	0.03	0.014
Lead (Pb)	Dissolved	mg/L	0.0007	<0.0001	0.0001	0.0002	0.0001
Lithium (Li)	Dissolved	mg/L	0.02	0.023	0.025	0.02	0.017
Magnesium (Mg)	Dissolved	mg/L	27.1	27.4	23.9	28.4	32.4
Manganese (Mn)	Dissolved	mg/L	0.218	0.184	0.138	0.358	1.25
Mercury (Hg)	Dissolved	mg/L					
Molybdenum (Mo)	Dissolved	mg/L	0.009	0.009	0.015	0.007	0.00572
Nickel (Ni)	Dissolved	mg/L	0.0091	<0.0005	0.0108	0.0044	0.004
Phosphorus (P)	Dissolved	mg/L				<0.05	<0.01
Potassium (K)	Dissolved	mg/L	3.8	2.9	1.9	2.8	2
Selenium (Se)	Dissolved	mg/L	0.0018	0.0006	<0.0002	<0.0002	<0.0006
Silicon (Si)	Dissolved	mg/L	6.89	6.54	6.18	6.57	6.8
Silver (Ag)	Dissolved	mg/L	<0.0001	<0.00001	<0.00001	<0.00001	<0.00001
Sodium (Na)	Dissolved	mg/L	29.6	33.8	88.8	44.6	43.8
Stronium (Sr)	Dissolved	mg/L	0.517	0.532	0.368	0.514	0.49
Sulphur (S)	Dissolved	mg/L	67.1	70.4	82	73.6	
Tellurium (Te)	Dissolved	mg/L					<0.0001
Thallium (Tl)	Dissolved	mg/L	<0.00005	<0.00005	<0.00005	<0.00005	0.00002
Thorium							<0.0001
Tin (Sn)	Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	0.0006
Titanium (Ti)	Dissolved	mg/L	0.0133	0.0027	0.0017	0.0096	0.0009
Uranium (U)	Dissolved	mg/L	0.0007	0.0006	0.0046	0.0011	0.0012
Vanadium (V)	Dissolved	mg/L	0.0014	0.0026	0.0009	0.0002	0.00023
Zinc (Zn)	Dissolved	mg/L	0.006	0.008	0.004	0.006	0.002
Zirconium (Zr)	Dissolved	mg/L					<0.0001
Physical and Aggregate							
Temp. of observed pH and EC	°C						
Total Suspended Solids - TSS	Total	mg/L	27600	7140	4240	629	1650
Total Dissolved Solids	Calculated	mg/L	536	524			
True Colour	Colour units		10	<5			
Routine Water							
pH			8	8.14	8.08	8.07	7.72
Electrical Conductivity		µS/cm	751	697	825	818	837
Sulphate (SO4)	Dissolved	mg/L	250	218	246	220.8	
Hydroxide		mg/L	<5	<5			
Carbonate		mg/L	<6	<6			
Bicarbonate		mg/L	257	233			
P-Alkalinity	as CaCO3	mg/L		191			
T-Alkalinity	as CaCO3	mg/L	210				
Turbidity	NTU		31	27			
Hardness	Dissolved	mg/L			254	344	408
Chloride	Dissolved	mg/L	3.95	4.52			
Nutrients							
Ammonia -N							
Nitrite Nitrogen (NO2)		mg/L	<0.02	<0.02			
Nitrate Nitrogen (NO3)		mg/L	0.13	<0.02			
Cyanide							
Total Cyanide		mg/L	<0.001	0.001			
Cyanide<WAD		mg/L					

Grey cells indicate sulphate calc. from ICP sulphur

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

		H2						
Norwest Labs Number								
Collected by			**ACG**	**ACG**	**DD/DC**	**DC/JM**	**DC/CB**	**DC/TL**
Sample Date			27-Oct-07	17-Apr-08	14-May-08	21-Jun-08	7-Jul-08	4-Oct-08
Matrix			water	water	water	water	water	water
Units								
Field Anaylsis								
pH								
Temperature C		C						
Conductivity		µS/cm						
Water level		m	14.18	14.2				
Oxidation Reduction Potential	ORP	mg/L						
Dissolved oxygen	DO	mg/L						
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L						
Antimony (Sb)	Dissolved	mg/L						
Arsenic (As)	Dissolved	mg/L						
Barium (Ba)	Dissolved	mg/L						
Beryllium (Be)	Dissolved	mg/L						
Bismuth (Bi)	Dissolved	mg/L						
Boron (B)	Dissolved	mg/L						
Cadmium (Cd)	Dissolved	mg/L						
Calcium (Ca)	Dissolved	mg/L						
Chromium (Cr)	Dissolved	mg/L						
Cobalt (Co)	Dissolved	mg/L						
Copper (Cu)	Dissolved	mg/L						
Iron (Fe)	Dissolved	mg/L						
Lead (Pb)	Dissolved	mg/L						
Lithium (Li)	Dissolved	mg/L						
Magnesium (Mg)	Dissolved	mg/L	**no water found**	**no water found**	**no water found - dry**	**no water found - dry**	**no water found - dry**	**no water found - dry**
Manganese (Mn)	Dissolved	mg/L						
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L						
Nickel (Ni)	Dissolved	mg/L						
Phosphorus (P)	Dissolved	mg/L						
Potassium (K)	Dissolved	mg/L						
Selenium (Se)	Dissolved	mg/L						
Silicon (Si)	Dissolved	mg/L						
Silver (Ag)	Dissolved	mg/L						
Sodium (Na)	Dissolved	mg/L						
Stronium (Sr)	Dissolved	mg/L						
Sulphur (S)	Dissolved	mg/L						
Tellurium (Te)	Dissolved	mg/L						
Thallium (Tl)	Dissolved	mg/L						
Thorium								
Tin (Sn)	Dissolved	mg/L						
Titanium (Ti)	Dissolved	mg/L						
Uranium (U)	Dissolved	mg/L						
Vanadium (V)	Dissolved	mg/L						
Zinc (Zn)	Dissolved	mg/L						
Zirconium (Zr)	Dissolved	mg/L						
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L						
Total Dissolved Solids	Calculated	mg/L						
True Colour	Colour units							
Routine Water								
pH								
Electrical Conductivity		µS/cm						
Sulphate (SO4)	Dissolved	mg/L						
Hydroxide		mg/L						
Carbonate		mg/L						
Bicarbonate		mg/L						
P-Alkalinity	as CaCO3	mg/L						
T-Alkalinity	as CaCO3	mg/L						
Turbidity	NTU							
Hardness	Dissolved	mg/L						
Chloride	Dissolved	mg/L						
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L						
Nitrate Nitrogen (NO3)		mg/L						
Cyanide								
Total Cyanide		mg/L						
Cyanide<WAD		mg/L						

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

		H3 Deep						
		Norwest Labs Number						
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/JM**	**DC/CB**	**DC/TL**
		Sample Date	30-Oct-07	17-Apr-08	14-May-08	21-Jun-08	7-Jul-08	4-Oct-08
		Matrix	water	water	water	water	water	water
		Units						
Field Anaylsis								
pH								
Temperature C		C						
Conductivity		µS/cm						
Water level		m	5.55	5.42				
Oxidation Reduction Potential	ORP	mg/L						
Dissolved oxygen	DO	mg/L						
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L						
Antimony (Sb)	Dissolved	mg/L						
Arsenic (As)	Dissolved	mg/L						
Barium (Ba)	Dissolved	mg/L						
Beryllium (Be)	Dissolved	mg/L						
Bismuth (Bi)	Dissolved	mg/L						
Boron (B)	Dissolved	mg/L						
Cadmium (Cd)	Dissolved	mg/L						
Calcium (Ca)	Dissolved	mg/L						
Chromium (Cr)	Dissolved	mg/L						
Cobalt (Co)	Dissolved	mg/L						
Copper (Cu)	Dissolved	mg/L						
Iron (Fe)	Dissolved	mg/L						
Lead (Pb)	Dissolved	mg/L						
Lithium (Li)	Dissolved	mg/L					**no water found - dry**	**no water found - dry**
Magnesium (Mg)	Dissolved	mg/L	**no water found**	**no water found**	**no water found**	**no water found**		
Manganese (Mn)	Dissolved	mg/L						
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L						
Nickel (Ni)	Dissolved	mg/L						
Phosphorus (P)	Dissolved	mg/L						
Potassium (K)	Dissolved	mg/L						
Selenium (Se)	Dissolved	mg/L						
Silicon (Si)	Dissolved	mg/L						
Silver (Ag)	Dissolved	mg/L						
Sodium (Na)	Dissolved	mg/L						
Stronium (Sr)	Dissolved	mg/L						
Sulphur (S)	Dissolved	mg/L						
Tellurium (Te)	Dissolved	mg/L						
Thallium (Tl)	Dissolved	mg/L						
Thorium								
Tin (Sn)	Dissolved	mg/L						
Titanium (Ti)	Dissolved	mg/L						
Uranium (U)	Dissolved	mg/L						
Vanadium (V)	Dissolved	mg/L						
Zinc (Zn)	Dissolved	mg/L						
Zirconium (Zr)	Dissolved	mg/L						
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L						
Total Dissolved Solids	Calculated	mg/L						
True Colour	Colour units							
Routine Water								
pH								
Electrical Conductivity		µS/cm						
Sulphate (SO4)	Dissolved	mg/L						
Hydroxide		mg/L						
Carbonate		mg/L						
Bicarbonate		mg/L						
P-Alkalinity	as CaCO3	mg/L						
T-Alkalinity	as CaCO3	mg/L						
Turbidity	NTU							
Hardness	Dissolved	mg/L						
Chloride	Dissolved	mg/L						
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L						
Nitrate Nitrogen (NO3)		mg/L						
Cyanide								
Total Cyanide		mg/L						
Cyanide<WAD		mg/L						

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

		H3 Shallow						
		Norwest Labs Number						
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/JM**	**DC/CB**	**DC/TL**
		Sample Date	30-Oct-07	17-Apr-08	14-May-08	21-Jun-08	7-Jul-08	4-Oct-08
		Matrix	water	water	water	water	water	water
		Units						
Field Anaylsis								
pH								
Temperature C		C						
Conductivity		µS/cm						
Water level		m	3.27	3.05				
Oxidation Reduction Potential	ORP	mg/L						
Dissolved oxygen	DO	mg/L						
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L						
Antimony (Sb)	Dissolved	mg/L						
Arsenic (As)	Dissolved	mg/L						
Barium (Ba)	Dissolved	mg/L						
Beryllium (Be)	Dissolved	mg/L						
Bismuth (Bi)	Dissolved	mg/L						
Boron (B)	Dissolved	mg/L						
Cadmium (Cd)	Dissolved	mg/L						
Calcium (Ca)	Dissolved	mg/L						
Chromium (Cr)	Dissolved	mg/L						
Cobalt (Co)	Dissolved	mg/L						
Copper (Cu)	Dissolved	mg/L						
Iron (Fe)	Dissolved	mg/L			no water found - waterra frozen	no water found - waterra frozen		
Lead (Pb)	Dissolved	mg/L						
Lithium (Li)	Dissolved	mg/L					no water found - dry	no water found - dry
Magnesium (Mg)	Dissolved	mg/L	no water found	no water found				
Manganese (Mn)	Dissolved	mg/L						
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L						
Nickel (Ni)	Dissolved	mg/L						
Phosphorus (P)	Dissolved	mg/L						
Potassium (K)	Dissolved	mg/L						
Selenium (Se)	Dissolved	mg/L						
Silicon (Si)	Dissolved	mg/L						
Silver (Ag)	Dissolved	mg/L						
Sodium (Na)	Dissolved	mg/L						
Stronium (Sr)	Dissolved	mg/L						
Sulphur (S)	Dissolved	mg/L						
Tellurium (Te)	Dissolved	mg/L						
Thallium (Tl)	Dissolved	mg/L						
Thorium								
Tin (Sn)	Dissolved	mg/L						
Titanium (Ti)	Dissolved	mg/L						
Uranium (U)	Dissolved	mg/L						
Vanadium (V)	Dissolved	mg/L						
Zinc (Zn)	Dissolved	mg/L						
Zirconium (Zr)	Dissolved	mg/L						
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L						
Total Dissolved Solids	Calculated	mg/L						
True Colour	Colour units							
Routine Water								
pH								
Electrical Conductivity		µS/cm						
Sulphate (SO4)	Dissolved	mg/L						
Hydroxide		mg/L						
Carbonate		mg/L						
Bicarbonate		mg/L						
P-Alkalinity	as CaCO3	mg/L						
T-Alkalinity	as CaCO3	mg/L						
Turbidity	NTU							
Hardness	Dissolved	mg/L						
Chloride	Dissolved	mg/L						
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L						
Nitrate Nitrogen (NO3)		mg/L						
Cyanide								
Total Cyanide		mg/L						
Cyanide<WAD		mg/L						

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed i
the accompanying report

H4 Deep

Norwest Labs Number			585585-8	614609-4	620382-4	630692-54	648008-40	
Collected by			**ACG**	**ACG**	**DD/DC**	**DC/CB**	**DC/TL**	
Sample Date			31-Oct-07	17-Apr-08	14-May-08	7-Jul-08	4-Oct-08	
Matrix			water	water	water	water	water	
		Units						
Field Anaylsis								
pH			7.05	7.36	7.16	6.98	7.06	
Temperature C		C	2	1.8	2.5	6	3	
Conductivity		µS/cm	1517	311	1440	1519	1979	
Water level		m	2.07	2.96	1.84	2.2	2.02	
Oxidation Reduction Potentia	ORP	mg/L			9			
Dissolved oxygen	DO	mg/L			13.93			
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L	0.006	<0.005	<0.005	<0.005	<0.005	
Antimony (Sb)	Dissolved	mg/L	0.0009	<0.0002	0.0013	0.0008	0.001	
Arsenic (As)	Dissolved	mg/L	0.0089	0.0008	0.0052	0.0064	0.0056	
Barium (Ba)	Dissolved	mg/L	0.057	0.035	0.04	0.045	0.041	
Beryllium (Be)	Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.00004	
Bismuth (Bi)	Dissolved	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		
Boron (B)	Dissolved	mg/L	0.006	0.005	0.005	0.005	<0.004	
Cadmium (Cd)	Dissolved	mg/L	0.00058	0.00116	0.00171	0.00077	0.00007	
Calcium (Ca)	Dissolved	mg/L	306	282	277	292	306	
Chromium (Cr)	Dissolved	mg/L	0.0045	0.0029	0.0007	0.0016	0.0014	
Cobalt (Co)	Dissolved	mg/L	0.0287	0.0261	0.0252	0.0276	0.0243	
Copper (Cu)	Dissolved	mg/L	0.003	<0.001	0.001	0.001	<0.001	
Iron (Fe)	Dissolved	mg/L	20.4	1.83	6.15	13	15.2	
Lead (Pb)	Dissolved	mg/L	0.0031	<0.0001	0.0003	0.0001	<0.0001	
Lithium (Li)	Dissolved	mg/L	0.013	0.012	0.011	0.012	0.011	
Magnesium (Mg)	Dissolved	mg/L	89.5	79.2	81.7	84.8	94	
Manganese (Mn)	Dissolved	mg/L	10.4	10.9	10.6	11.6	15.4	
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	0.00046	
Nickel (Ni)	Dissolved	mg/L	0.0076	0.0128	0.0196	0.0214	0.018	
Phosphorus (P)	Dissolved	mg/L				<0.05	<0.01	
Potassium (K)	Dissolved	mg/L	3.1	2.7	2.5	2.7	2.7	
Selenium (Se)	Dissolved	mg/L	<0.0002	0.0004	<0.0002	<0.0002	<0.0006	
Silicon (Si)	Dissolved	mg/L	8.22	7.45	7.5	7.7	7.8	
Silver (Ag)	Dissolved	mg/L	<0.0001	<0.00001	<0.00001	<0.00001	<0.00001	
Sodium (Na)	Dissolved	mg/L	12.4	12	11.5	12	11.4	
Stronium (Sr)	Dissolved	mg/L	1.29	1.06	0.983	1.11	1.14	
Sulphur (S)	Dissolved	mg/L	259	232	227	239		
Tellurium (Te)	Dissolved	mg/L					<0.0001	
Thallium (Tl)	Dissolved	mg/L	<0.00005	<0.00005	0.00007	0.00007	0.00004	
Thorium							<0.0001	
Tin (Sn)	Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.0001	
Titanium (Ti)	Dissolved	mg/L	0.0196	0.0082	0.0042	0.0284	0.001	
Uranium (U)	Dissolved	mg/L	0.0086	0.008	0.009	0.0084	0.0081	
Vanadium (V)	Dissolved	mg/L	0.0004	0.0051	0.0008	<0.0001	0.00032	
Zinc (Zn)	Dissolved	mg/L	0.032	0.031	0.273	0.04	0.018	
Zirconium (Zr)	Dissolved	mg/L					0.0001	
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L	493	460	2090	3010	246	
Total Dissolved Solids	Calculated	mg/L	1750	1500				
True Colour	Colour units		16	<5				
Routine Water								
pH			7.01	7.22	7.51	7.52	6.88	
Electrical Conductivity		µS/cm	1850	1650	1720	1810	1750	
Sulphate (SO4)	Dissolved	mg/L	840	714	681	717		Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	<5	<5				
Carbonate		mg/L	<6	<6				
Bicarbonate		mg/L	486	461				
P-Alkalinity	as CaCO3	mg/L		378				
T-Alkalinity	as CaCO3	mg/L	399					
Turbidity	NTU		59	21				
Hardness	Dissolved	mg/L			1030	1080	1150	
Chloride	Dissolved	mg/L	8.04	6.65				
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L	<0.02	<0.02				
Nitrate Nitrogen (NO3)		mg/L	<0.02	<0.02				
Cyanide								
Total Cyanide		mg/L	0.001	0.001				
Cyanide<WAD		mg/L						

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

H4 Shallow

		Norwest Labs Number	585585-9		620382-3	630692-53	648008-39
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/CB**	**DC/TL**
		Sample Date	31-Oct-07	17-Apr-08	14-May-08	7-Jul-08	4-Oct-08
		Matrix	water	water	water	water	water
		Units					
Field Anaylsis							
pH			6.38		6.95	6.62	7.29
Temperature C		C	3.8		2	7	5
Conductivity		µS/cm	4110		3540	437	6380
Water level		m	2.33		1.84	2.2	2.02
Oxidation Reduction Potentia	ORP	mg/L			69		
Dissolved oxygen	DO	mg/L			3.21		
External Anaylsis							
Metals Dissolved (Trace)							
Aluminum (Al)	Dissolved	mg/L	0.014		0.006	0.007	<0.005
Antimony (Sb)	Dissolved	mg/L	0.0285		0.0089	0.0098	0.0044
Arsenic (As)	Dissolved	mg/L	0.727		0.311	0.322	0.0493
Barium (Ba)	Dissolved	mg/L	0.035		0.025	0.019	0.016
Beryllium (Be)	Dissolved	mg/L	<0.0001		<0.0001	<0.0001	<0.00004
Bismuth (Bi)	Dissolved	mg/L	<0.0005		<0.0005	<0.0005	
Boron (B)	Dissolved	mg/L	0.006		0.004	0.01	0.005
Cadmium (Cd)	Dissolved	mg/L	1.34		0.192	1.72	2.36
Calcium (Ca)	Dissolved	mg/L	281		258	264	295
Chromium (Cr)	Dissolved	mg/L	0.008		0.0016	0.0022	0.0012
Cobalt (Co)	Dissolved	mg/L	0.152		0.0956	0.175	0.253
Copper (Cu)	Dissolved	mg/L	0.04	**no water found**	0.006	0.068	0.031
Iron (Fe)	Dissolved	mg/L	73		65.8	54.4	45
Lead (Pb)	Dissolved	mg/L	0.583		0.0049	0.133	0.0148
Lithium (Li)	Dissolved	mg/L	0.017		0.011	0.026	0.022
Magnesium (Mg)	Dissolved	mg/L	144		173	207	351
Manganese (Mn)	Dissolved	mg/L	351		277	385	525
Mercury (Hg)	Dissolved	mg/L			<0.001		
Molybdenum (Mo)	Dissolved	mg/L	<0.001		0.112	<0.001	0.00004
Nickel (Ni)	Dissolved	mg/L	0.192			0.24	0.336
Phosphorus (P)	Dissolved	mg/L				0.08	<0.01
Potassium (K)	Dissolved	mg/L	3.1		2.6	2.8	3.4
Selenium (Se)	Dissolved	mg/L	0.0004		0.0002	0.0003	<0.0006
Silicon (Si)	Dissolved	mg/L	12.6		12.8	12.2	11.8
Silver (Ag)	Dissolved	mg/L	0.0005		0.00009	0.00044	0.00006
Sodium (Na)	Dissolved	mg/L	10.2		10.5	8.4	9.3
Stronium (Sr)	Dissolved	mg/L	0.531		0.458	0.417	0.3
Sulphur (S)	Dissolved	mg/L	764		623	787	
Tellurium (Te)	Dissolved	mg/L				0.00292	<0.0001
Thallium (Tl)	Dissolved	mg/L	0.00212		0.00115		0.00451
Thorium							0.001
Tin (Sn)	Dissolved	mg/L	<0.001		<0.001	<0.001	0.0007
Titanium (Ti)	Dissolved	mg/L	0.0504		0.0083	0.0825	0.0017
Uranium (U)	Dissolved	mg/L	0.0016		0.0021	0.001	0.0004
Vanadium (V)	Dissolved	mg/L	<0.0001		0.0013	<0.0001	0.00025
Zinc (Zn)	Dissolved	mg/L	194		118	247	200
Zirconium (Zr)	Dissolved	mg/L					<0.0001
Physical and Aggregate							
Temp. of observed pH and EC	°C						
Total Suspended Solids - TSS	Total	mg/L	1980		1160	4460	430
Total Dissolved Solids	Calculated	mg/L	4140				
True Colour	Colour units		28				
Routine Water							
pH			6.35		6.81	6.65	5.97
Electrical Conductivity		µS/cm	3330		2380	3400	4110
Sulphate (SO4)	Dissolved	mg/L	2760		1869	2361	
Hydroxide		mg/L	<5				
Carbonate		mg/L	<6				
Bicarbonate		mg/L	373				
P-Alkalinity	as CaCO3	mg/L					
T-Alkalinity	as CaCO3	mg/L	306				
Turbidity	NTU		530				
Hardness	Dissolved	mg/L			1360	1510	2180
Chloride	Dissolved	mg/L	8.25				
Nutrients							
Ammonia -N							
Nitrite Nitrogen (NO2)		mg/L	<0.02				
Nitrate Nitrogen (NO3)		mg/L	<0.02				
Cyanide							
Total Cyanide		mg/L	0.001				
Cyanide<WAD		mg/L					

Grey cells indicate sulphate calc. from ICP sulphur

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		H5 Deep						
		Norwest Labs Number	585585-6	614609-6	620382-6	630692-60	648008-42	
		Collected by	**ACG**	**ACG**	**ACG**	**DC/CB**	**DC/TL**	
		Sample Date	31-Oct-07	17-Apr-08	14-May-08	7-Jul-08	4-Oct-08	
		Matrix	water	water	water	water	water	
		Units						
Field Anaylsis								
pH			7.14	7.81	7.39	7.12	7.29	
Temperature C		C	1	2.3	2	5	3	
Conductivity		µS/cm	1408	137	1411	1482	1649	
Water level		m	1.96	4.03	ice block	2.48	2.3	
Oxidation Reduction Potentia	ORP	mg/L			11			
Dissolved oxygen	DO	mg/L			2.73			
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L	<0.005	<0.005	0.005	0.01	0.007	
Antimony (Sb)	Dissolved	mg/L	0.0011	0.0014	0.002	0.0009	0.0012	
Arsenic (As)	Dissolved	mg/L	0.0193	0.0024	0.0093	0.0159	0.0113	
Barium (Ba)	Dissolved	mg/L	0.03	0.065	0.022	0.022	0.02	
Beryllium (Be)	Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.00004	
Bismuth (Bi)	Dissolved	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		
Boron (B)	Dissolved	mg/L	0.004	0.004	0.005	0.006	<0.004	
Cadmium (Cd)	Dissolved	mg/L	0.00011	0.00001	0.00043	0.00025	0.00023	
Calcium (Ca)	Dissolved	mg/L	262	230	277	271	290	
Chromium (Cr)	Dissolved	mg/L	0.0037	0.001	<0.0005	0.0026	0.0014	
Cobalt (Co)	Dissolved	mg/L	0.0227	0.0024	0.0205	0.0228	0.0222	
Copper (Cu)	Dissolved	mg/L	<0.001	0.002	0.001	0.002	0.001	
Iron (Fe)	Dissolved	mg/L	17	<0.01	0.62	9.86	8.9	
Lead (Pb)	Dissolved	mg/L	0.0043	0.131	0.0004	0.0034	0.0004	
Lithium (Li)	Dissolved	mg/L	0.016	0.014	0.019	0.02	0.015	
Magnesium (Mg)	Dissolved	mg/L	66.1	<0.2	67.8	63.4	74.2	
Manganese (Mn)	Dissolved	mg/L	8.6	<0.005	7.21	7.55	10.2	
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L	0.001	0.029	0.005	0.004	0.00174	
Nickel (Ni)	Dissolved	mg/L	0.001	0.0159	0.0144	0.0162	0.013	
Phosphorus (P)	Dissolved	mg/L				0.11	<0.01	
Potassium (K)	Dissolved	mg/L	3.9	17.4	6.3	5.8	4.7	
Selenium (Se)	Dissolved	mg/L	<0.0002	0.0018	0.0007	<0.0002	<0.0006	
Silicon (Si)	Dissolved	mg/L	7.93	1.19	7.11	7.37	8.21	
Silver (Ag)	Dissolved	mg/L	<0.0001	<0.00001	<0.00001	<0.00001	<0.00001	
Sodium (Na)	Dissolved	mg/L	22.4	26.8	33.7	31.2	25.3	
Stronium (Sr)	Dissolved	mg/L	1.56	0.844	1.39	1.46	1.47	
Sulphur (S)	Dissolved	mg/L	192	91.4	204	190		
Tellurium (Te)	Dissolved	mg/L					<0.0001	
Thallium (Tl)	Dissolved	mg/L	<0.00005	0.00007	<0.00005	<0.00005	0.00002	
Thorium							<0.0001	
Tin (Sn)	Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.0001	
Titanium (Ti)	Dissolved	mg/L	0.015	0.0028	0.004	0.0272	0.0013	
Uranium (U)	Dissolved	mg/L	0.0187	<0.0005	0.0212	0.0186	0.0197	
Vanadium (V)	Dissolved	mg/L	<0.0001	0.0004	0.0005	0.0002	0.00032	
Zinc (Zn)	Dissolved	mg/L	0.027	0.005	0.022	0.04	0.027	
Zirconium (Zr)	Dissolved	mg/L					0.0005	
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L	1580	623	3480	5970		
Total Dissolved Solids	Calculated	mg/L	1400	628			3560	
True Colour	Colour units		9	6				
Routine Water								
pH			7.24	9.82	7.8	7.76		
Electrical Conductivity		µS/cm	1620	766	1700	1770	6.97	
Sulphate (SO4)	Dissolved	mg/L	628	356	612	570	1700	Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	<5	<5				
Carbonate		mg/L	<6	67				
Bicarbonate		mg/L	512	190				
P-Alkalinity	as CaCO3	mg/L		267				
T-Alkalinity	as CaCO3	mg/L	420					
Turbidity	NTU		37	11				
Hardness	Dissolved	mg/L			971	937		
Chloride	Dissolved	mg/L	7.14	7.91			1030	
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L	<0.02	<0.02				
Nitrate Nitrogen (NO3)		mg/L	<0.02	<0.02				
Cyanide								
Total Cyanide		mg/L	<0.001	0.17				
Cyanide<WAD		mg/L						

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		H5 Shallow						
		Norwest Labs Number	585585-7	614609-5	620382-5	630692-59	648008-43	
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/CB**	**DC/TL**	
		Sample Date	31-Oct-07	17-Apr-08	14-May-08	7-Jul-08	4-Oct-08	
		Matrix	water	water	water	water	water	
		Units						
Field Anaylsis								
pH			8.73		7.76	7.81	7.83	
Temperature C		C	3		2.2	6	4	
Conductivity		µS/cm	875		952	825	1144	
Water level		m	1.7	3.27	3.21	2.1	2.3	
Oxidation Reduction Potential	ORP	mg/L			120			
Dissolved oxygen	DO	mg/L			2.77			
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L	0.15	0.01	0.015	0.039	0.008	
Antimony (Sb)	Dissolved	mg/L	0.0233	0.0152	0.0126	0.0142	0.0129	
Arsenic (As)	Dissolved	mg/L	0.0388	0.0097	0.0077	0.0137	0.0094	
Barium (Ba)	Dissolved	mg/L	0.051	0.02	0.027	0.018	0.02	
Beryllium (Be)	Dissolved	mg/L	<0.0001	<0.0001	<0.0001	<0.0001	<0.00004	
Bismuth (Bi)	Dissolved	mg/L	<0.0005	<0.0005	<0.0005	<0.0005		
Boron (B)	Dissolved	mg/L	0.052	0.055	0.041	0.053	0.047	
Cadmium (Cd)	Dissolved	mg/L	0.0106	0.00909	0.00907	0.00362	0.00666	
Calcium (Ca)	Dissolved	mg/L	48.7	25.4	46	26.6	43	
Chromium (Cr)	Dissolved	mg/L	0.0024	0.0014	<0.0005	0.0006	0.0006	
Cobalt (Co)	Dissolved	mg/L	0.0033	0.0037	0.0029	0.0029	0.00286	
Copper (Cu)	Dissolved	mg/L	0.011	0.021	0.012	0.006	0.011	
Iron (Fe)	Dissolved	mg/L	4.73	0.02	0.03	0.18	0.033	
Lead (Pb)	Dissolved	mg/L	1.42	0.115	0.115	0.159	0.113	
Lithium (Li)	Dissolved	mg/L	0.018	0.016	0.017	0.017	0.017	
Magnesium (Mg)	Dissolved	mg/L	66.4	63.2	76	68.4	87.2	
Manganese (Mn)	Dissolved	mg/L	6.13	1.83	3.42	1.65	2.46	
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L	0.006	0.012	0.005	0.01	0.00861	
Nickel (Ni)	Dissolved	mg/L	0.0098	0.008	0.0081	0.0056	0.005	
Phosphorus (P)	Dissolved	mg/L				0.13	<0.01	
Potassium (K)	Dissolved	mg/L	5.1	5.6	3.8	5.2	5.4	
Selenium (Se)	Dissolved	mg/L	0.0006	0.0011	<0.0002	0.0008	<0.0006	
Silicon (Si)	Dissolved	mg/L	1.84	0.95	1.07	0.97	1.11	
Silver (Ag)	Dissolved	mg/L	0.0012	0.00003	<0.00001	0.00027	<0.00001	
Sodium (Na)	Dissolved	mg/L	37.4	29.4	40.2	29.4	32.9	
Stronium (Sr)	Dissolved	mg/L	0.352	0.144	0.321	0.143	0.211	
Sulphur (S)	Dissolved	mg/L	142	128	158	132		
Tellurium (Te)	Dissolved	mg/L					<0.0001	
Thallium (Tl)	Dissolved	mg/L	0.00195	0.00346	0.00284	0.00229	0.00261	
Thorium							<0.0001	
Tin (Sn)	Dissolved	mg/L	<0.001	<0.001	<0.001	<0.001	<0.0001	
Titanium (Ti)	Dissolved	mg/L	0.0158	0.0045	0.0032	0.0189	0.0003	
Uranium (U)	Dissolved	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0004	
Vanadium (V)	Dissolved	mg/L	0.0005	0.0011	0.0002	0.0003	0.00008	
Zinc (Zn)	Dissolved	mg/L	0.476	0.055	0.06	0.086	0.046	
Zirconium (Zr)	Dissolved	mg/L					<0.0001	
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L	17700	1770	10000	17800	10800	
Total Dissolved Solids	Calculated	mg/L	778	636				
True Colour	Colour units		17	19				
Routine Water								
pH			8.25	8.37	8.02	8.19	8.39	
Electrical Conductivity		µS/cm	1050	904	1140	1160	1070	
Sulphate (SO4)	Dissolved	mg/L	441	376	474	396		Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	<5	<5				
Carbonate		mg/L	<6	<6				
Bicarbonate		mg/L	134	100				
P-Alkalinity	as CaCO3	mg/L		90				
T-Alkalinity	as CaCO3	mg/L	110					
Turbidity	NTU		54	30				
Hardness	Dissolved	mg/L			428	348	467	
Chloride	Dissolved	mg/L	13.4	13.2				
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L	<0.02	<0.02				
Nitrate Nitrogen (NO3)		mg/L	<0.02	<0.02				
Cyanide								
Total Cyanide		mg/L	0.3	0.13				
Cyanide<WAD		mg/L						

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		H6 Deep						
		Norwest Labs Number	585585-5			626903-5	630692-55	648008-41
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/JM**	**DC/CB**	**DC/TL**
		Sample Date	27-Oct-07	17-Apr-08	14-May-08	21-Jun-08	7-Jul-08	4-Oct-08
		Matrix	water	water	water	water	water	water
		Units						
Field Anaylsis								
pH			6.84			6.53	6.83	7.16
Temperature C		C	2.5			6	8	2
Conductivity		µS/cm	1522			1625	1446	1751
Water level		m	2.89	4.95		4.1	3.81	
Oxidation Reduction Potentia	ORP	mg/L						
Dissolved oxygen	DO	mg/L						
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L	0.02	waterra tubing frozen in place	no water found	0.006	0.011	<0.005
Antimony (Sb)	Dissolved	mg/L	0.001			0.0008	0.0011	0.0013
Arsenic (As)	Dissolved	mg/L	0.0406			0.0028	0.0369	0.0066
Barium (Ba)	Dissolved	mg/L	0.059			0.049	0.05	0.04
Beryllium (Be)	Dissolved	mg/L	<0.0001			<0.0001	<0.0001	<0.00004
Bismuth (Bi)	Dissolved	mg/L	<0.0005			<0.0005	<0.0005	
Boron (B)	Dissolved	mg/L	0.013			0.015	0.016	0.01
Cadmium (Cd)	Dissolved	mg/L	0.0004			0.00097	0.00072	0.00076
Calcium (Ca)	Dissolved	mg/L	305			317	275	304
Chromium (Cr)	Dissolved	mg/L	0.0059			<0.0005	0.0029	0.001
Cobalt (Co)	Dissolved	mg/L	0.0592			0.0712	0.0646	0.0466
Copper (Cu)	Dissolved	mg/L	0.001			<0.001	0.001	<0.001
Iron (Fe)	Dissolved	mg/L	50.6			32.4	50.1	36
Lead (Pb)	Dissolved	mg/L	0.001			<0.0001	0.0004	0.0001
Lithium (Li)	Dissolved	mg/L	0.01			0.013	0.011	0.008
Magnesium (Mg)	Dissolved	mg/L	58			67.8	55.9	68
Manganese (Mn)	Dissolved	mg/L	26.7			35.7	28.5	22.1
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L	<0.001			<0.001	<0.001	0.00028
Nickel (Ni)	Dissolved	mg/L	0.0579			0.0766	0.0711	0.06
Phosphorus (P)	Dissolved	mg/L					<0.05	<0.01
Potassium (K)	Dissolved	mg/L	2.3			2.2	2	1.9
Selenium (Se)	Dissolved	mg/L	<0.0002			0.0003	<0.0002	<0.0006
Silicon (Si)	Dissolved	mg/L	8.74			9.07	8.6	8.55
Silver (Ag)	Dissolved	mg/L	<0.0001			<0.00001	0.00002	<0.00001
Sodium (Na)	Dissolved	mg/L	9			9.9	7.9	7.8
Stronium (Sr)	Dissolved	mg/L	1.01			0.92	0.864	0.848
Sulphur (S)	Dissolved	mg/L	280			299	241	
Tellurium (Te)	Dissolved	mg/L						<0.0001
Thallium (Tl)	Dissolved	mg/L	<0.00005			0.00011	0.00006	0.00006
Thorium								<0.0001
Tin (Sn)	Dissolved	mg/L	<0.001			<0.001	<0.001	<0.0001
Titanium (Ti)	Dissolved	mg/L	0.0216			0.0096	0.0303	0.0012
Uranium (U)	Dissolved	mg/L	0.0038			0.0063	0.004	0.0036
Vanadium (V)	Dissolved	mg/L	<0.0001			0.0003	<0.0001	0.00031
Zinc (Zn)	Dissolved	mg/L	0.044			0.08	0.065	0.046
Zirconium (Zr)	Dissolved	mg/L						0.0009
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L	835	4320			1070	410
Total Dissolved Solids	Calculated	mg/L	1680					
True Colour	Colour units		36					
Routine Water								
pH			6.7	6.83			7.11	6.5
Electrical Conductivity		µS/cm	1780	1870			1660	1680
Sulphate (SO4)	Dissolved	mg/L	898			897	723	
Hydroxide		mg/L	<5					
Carbonate		mg/L	<6					
Bicarbonate		mg/L	338					
P-Alkalinity	as CaCO3	mg/L						
T-Alkalinity	as CaCO3	mg/L	278					
Turbidity	NTU		270					
Hardness	Dissolved	mg/L		1070			917	1040
Chloride	Dissolved	mg/L	3.18					
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L	<0.02					
Nitrate Nitrogen (NO3)		mg/L	<0.02					
Cyanide								
Total Cyanide		mg/L	0.002					
Cyanide<WAD		mg/L						

Grey cells indicate sulphate calc. from ICP sulphur

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

		H6 Shallow						
		Norwest Labs Number						
		Collected by	**ACG**	**ACG**	**DD/DC**	**DC/JM**	**DC/CB**	**DC/TL**
		Sample Date	31-Oct-07	17-Apr-08	14-May-08	21-Jun-08	7-Jul-08	4-0ct-08
		Matrix	water	water	water	water	water	water
		Units						
Field Anaylsis								
pH								
Temperature C		C						
Conductivity		µS/cm						
Water level		m	1.49	nm				
Oxidation Reduction Potential	ORP	mg/L						
Dissolved oxygen	DO	mg/L						
External Anaylsis								
Metals Dissolved (Trace)								
Aluminum (Al)	Dissolved	mg/L						
Antimony (Sb)	Dissolved	mg/L						
Arsenic (As)	Dissolved	mg/L						
Barium (Ba)	Dissolved	mg/L						
Beryllium (Be)	Dissolved	mg/L						
Bismuth (Bi)	Dissolved	mg/L						
Boron (B)	Dissolved	mg/L						
Cadmium (Cd)	Dissolved	mg/L						
Calcium (Ca)	Dissolved	mg/L						
Chromium (Cr)	Dissolved	mg/L						
Cobalt (Co)	Dissolved	mg/L						
Copper (Cu)	Dissolved	mg/L						
Iron (Fe)	Dissolved	mg/L						
Lead (Pb)	Dissolved	mg/L						
Lithium (Li)	Dissolved	mg/L						
Magnesium (Mg)	Dissolved	mg/L	**no water found**	**no water found**	**no water found**	**no water found - dry**	**no water found - dry**	**no water found - dry**
Manganese (Mn)	Dissolved	mg/L						
Mercury (Hg)	Dissolved	mg/L						
Molybdenum (Mo)	Dissolved	mg/L						
Nickel (Ni)	Dissolved	mg/L						
Phosphorus (P)	Dissolved	mg/L						
Potassium (K)	Dissolved	mg/L						
Selenium (Se)	Dissolved	mg/L						
Silicon (Si)	Dissolved	mg/L						
Silver (Ag)	Dissolved	mg/L						
Sodium (Na)	Dissolved	mg/L						
Stronium (Sr)	Dissolved	mg/L						
Sulphur (S)	Dissolved	mg/L						
Tellurium (Te)	Dissolved	mg/L						
Thallium (Tl)	Dissolved	mg/L						
Thorium								
Tin (Sn)	Dissolved	mg/L						
Titanium (Ti)	Dissolved	mg/L						
Uranium (U)	Dissolved	mg/L						
Vanadium (V)	Dissolved	mg/L						
Zinc (Zn)	Dissolved	mg/L						
Zirconium (Zr)	Dissolved	mg/L						
Physical and Aggregate								
Temp. of observed pH and EC	°C							
Total Suspended Solids - TSS	Total	mg/L						
Total Dissolved Solids	Calculated	mg/L						
True Colour	Colour units							
Routine Water								
pH								
Electrical Conductivity		µS/cm						
Sulphate (SO4)	Dissolved	mg/L						
Hydroxide		mg/L						
Carbonate		mg/L						
Bicarbonate		mg/L						
P-Alkalinity	as CaCO3	mg/L						
T-Alkalinity	as CaCO3	mg/L						
Turbidity	NTU							
Hardness	Dissolved	mg/L						
Chloride	Dissolved	mg/L						
Nutrients								
Ammonia -N								
Nitrite Nitrogen (NO2)		mg/L						
Nitrate Nitrogen (NO3)		mg/L						
Cyanide								
Total Cyanide		mg/L						
Cyanide<WAD		mg/L						

Samples collected and data compiled by Access Consulting Group. Results from 2008 monitoring are provided for reference only and are not discussed in the accompanying report

Drive Point Piezometer - MDP10 Valley Tailings 100m West of Dam # 1 (veg. line)

		Norwest Labs Number	485084-15	554386-4	630692-56	
		Collected by	**DD/DC**	**DD/DC**	**DC/CB**	
		Sample Date	11-Aug-06	20-Jun-07	7-Jul-08	
		Matrix	water	water	water	
		Units				
Field Anaylsis						
pH					7.27	
Temperature C		C			15.0	
Conductivity		µS/cm			684	
External Anaylsis						
Metals Dissolved (Trace)						
Aluminum (Al)	Dissolved	mg/L	0.006	<0.005	<0.005	
Antimony (Sb)	Dissolved	mg/L	0.0042	0.0044	0.0035	
Arsenic (As)	Dissolved	mg/L	0.0013	0.0013	0.0012	
Barium (Ba)	Dissolved	mg/L	0.021	0.063	0.024	
Beryllium (Be)	Dissolved	mg/L	<0.0001	<0.0001	<0.0001	
Bismuth (Bi)	Dissolved	mg/L	<0.0005	<0.0005	<0.0005	
Boron (B)	Dissolved	mg/L	0.173	0.021	0.039	
Cadmium (Cd)	Dissolved	mg/L	0.00902	0.007	0.0156	
Calcium (Ca)	Dissolved	mg/L	129	111	133	
Chromium (Cr)	Dissolved	mg/L	0.001	0.0008	<0.0005	
Cobalt (Co)	Dissolved	mg/L	0.0024	0.0027	0.0022	
Copper (Cu)	Dissolved	mg/L	0.003	0.003	0.012	
Iron (Fe)	Dissolved	mg/L	0.02	<0.01	0.01	
Lead (Pb)	Dissolved	mg/L	0.0843	0.121	0.097	
Lithium (Li)	Dissolved	mg/L	0.014	0.009	0.012	
Magnesium (Mg)	Dissolved	mg/L	19.9	22.6	22.3	
Manganese (Mn)	Dissolved	mg/L	3.35	5.65	6.97	
Mercury (Hg)	Dissolved	mg/L				
Molybdenum (Mo)	Dissolved	mg/L	0.001	<0.001	<0.001	
Nickel (Ni)	Dissolved	mg/L	0.0198	0.0012	0.0127	
Phosphorus (P)	Dissolved	mg/L			<0.05	
Potassium (K)	Dissolved	mg/L	6.2	3.3	3.7	
Selenium (Se)	Dissolved	mg/L	<0.0002	<0.0002	<0.0002	
Silicon (Si)	Dissolved	mg/L	2.36	2.16	2.89	
Silver (Ag)	Dissolved	mg/L	0.0002	<0.0001	0.00007	
Sodium (Na)	Dissolved	mg/L	7.4	5.5	3.6	
Stronium (Sr)	Dissolved	mg/L	0.65	0.673	0.79	
Sulphur (S)	Dissolved	mg/L	99.6	86.7	91.1	
Tellurium (Te)	Dissolved	mg/L				
Thallium (Tl)	Dissolved	mg/L	0.00125	0.00245	0.00357	
Thorium	Dissolved	mg/L				
Tin (Sn)	Dissolved	mg/L	<0.001	<0.001	<0.001	
Titanium (Ti)	Dissolved	mg/L	0.005	0.0068	0.0118	
Uranium (U)	Dissolved	mg/L	0.0006	0.0006	<0.0005	
Vanadium (V)	Dissolved	mg/L	0.0003	0.0004	0.0002	
Zinc (Zn)	Dissolved	mg/L	0.289	0.592	3.19	
Zirconium (Zr)	Dissolved	mg/L				
Physical and Aggregate						
Temp. of observed pH and EC	°C		23.6			
Total Suspended Solids	TSS	mg/L		20700	3400	
Total Dissolved Solids	TDS	mg/L	546	568		
Routine Water						
pH			7.94	7.92	7.96	
Electrical Conductivity		µS/cm	812	824	826	
Sulphate (SO4)	Dissolved	mg/L	299	289	273.3	Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	<5	<5		
Carbonate		mg/L	<6	<6		
Bicarbonate		mg/L	171	185		
P-Alkalinity	as CaCO3	mg/L	<5			
T-Alkalinity	as CaCO3	mg/L	140	151		
Hardness	Dissolved	mg/L	403		424	
Ionic Balance	Dissolved	%	96			
Chloride	Dissolved	mg/L	1.2	24		
Nutrients						
Ammonia -N						
Nitrite Nitrogen (NO2)		mg/L	0.09	<0.05		
Nitrate Nitrogen (NO3)		mg/L	0.015	0.4		
Nitrate and Nitrite - N		mg/L	0.11			

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Drive Point Piezometer - MDP11 Valley Tailings just West of Dam # 1 (veg. line)

		Norwest Labs Number	485084-16	554386-5	630692-61	
		Collected by	**DD/DC**	**DD/DC**	**DC/CB**	
		Sample Date	11-Aug-06	20-Jun-07	8-Jul-08	
		Matrix	Water	water	water	
		Units				
Field Anaylsis						
pH					7.95	
Temperature C		C			9.0	
Conductivity		µS/cm			1925	
External Anaylsis						
Metals Dissolved (Trace)						
Aluminum (Al)	Dissolved	mg/L	0.006	<0.005	0.031	
Antimony (Sb)	Dissolved	mg/L	0.0046	0.0052	0.007	
Arsenic (As)	Dissolved	mg/L	0.0023	0.0022	0.0017	
Barium (Ba)	Dissolved	mg/L	0.013	0.027	0.027	
Beryllium (Be)	Dissolved	mg/L	0.0001	<0.0001	<0.0001	
Bismuth (Bi)	Dissolved	mg/L	0.0005	<0.0005	<0.0005	
Boron (B)	Dissolved	mg/L	0.389	0.057	0.06	
Cadmium (Cd)	Dissolved	mg/L	0.00702	0.00062	0.00201	
Calcium (Ca)	Dissolved	mg/L	359	321	424	
Chromium (Cr)	Dissolved	mg/L	0.0009	<0.0005	0.0011	
Cobalt (Co)	Dissolved	mg/L	0.0056	0.0003	0.0012	
Copper (Cu)	Dissolved	mg/L	0.005	0.009	0.03	
Iron (Fe)	Dissolved	mg/L	0.03	<0.01	0.04	
Lead (Pb)	Dissolved	mg/L	0.116	0.0087	0.0276	
Lithium (Li)	Dissolved	mg/L	0.029	0.03	0.034	
Magnesium (Mg)	Dissolved	mg/L	94.4	107	136	
Manganese (Mn)	Dissolved	mg/L	23.1	<0.005		
Mercury (Hg)	Dissolved	mg/L			0.074	
Molybdenum (Mo)	Dissolved	mg/L	0.001	0.002	0.002	
Nickel (Ni)	Dissolved	mg/L	0.0302	<0.0005	0.0085	
Phosphorus (P)	Dissolved	mg/L			0.13	
Potassium (K)	Dissolved	mg/L	7.8	7.7	8.9	
Selenium (Se)	Dissolved	mg/L	0.0004	<0.0002	<0.0002	
Silicon (Si)	Dissolved	mg/L	3.26	0.43	0.26	
Silver (Ag)	Dissolved	mg/L	0.0005	<0.0001	0.00006	
Sodium (Na)	Dissolved	mg/L	10.9	15.9	17.3	
Stronium (Sr)	Dissolved	mg/L	1.95	2.45	3.14	
Sulphur (S)	Dissolved	mg/L	397	406	564	
Tellurium (Te)	Dissolved	mg/L				
Thallium (Tl)	Dissolved	mg/L	0.00203	0.00585	0.0434	
Thorium						
Tin (Sn)	Dissolved	mg/L	0.001	<0.001	<0.001	
Titanium (Ti)	Dissolved	mg/L	0.02	0.0319	0.0731	
Uranium (U)	Dissolved	mg/L	0.0029	<0.0005	<0.0005	
Vanadium (V)	Dissolved	mg/L	0.0005	0.0003	0.0003	
Zinc (Zn)	Dissolved	mg/L	0.571	0.04	0.142	
Zirconium (Zr)	Dissolved	mg/L				
Physical and Aggregate						
Temp. of observed pH and EC	°C		21.2			
Total Suspended Solids - TSS	Total	mg/L			278000	
Routine Water						
pH			7.76		8.28	
Electrical Conductivity		µS/cm	2000		2330	
Sulphate (SO4)	Dissolved	mg/L	1190	1218	1692	Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	5			
Carbonate		mg/L	6			
Bicarbonate		mg/L	202			
P-Alkalinity	as CaCO3	mg/L	5			
T-Alkalinity	as CaCO3	mg/L	166			
Hardness	Dissolved	mg/L	1280		1620	
Ionic Balance	Dissolved	%	97			
Ammonia -N						
Chloride	Dissolved	mg/L	3.1			
Total Dissolved Solids	Calculated	mg/L	1770			
Nutrients						
Nitrite Nitrogen (NO2)		mg/L	0.02			
Nitrate Nitrogen (NO3)		mg/L	0.016			
Nitrate and Nitrite - N		mg/L	0.04			

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Drive Point Piezometer - MDP12 Valley Tailings just East of Dam # 1 (veg. line)

		Norwest Labs Number	485084-17		630692-58	
		Collected by	**DD/DC**	**DD/DC**	**DC/CB**	
		Sample Date	11-Aug-06	20-Jun-07	7-Jul-08	
		Matrix	Water	water	water	
		Units				
Field Anaylsis						
pH					ot enough water	
Temperature C		C				
Conductivity		µS/cm				
External Anaylsis						
Metals Dissolved (Trace)						
Aluminum (Al)	Dissolved	mg/L	0.005		0.016	
Antimony (Sb)	Dissolved	mg/L	0.0056		0.0046	
Arsenic (As)	Dissolved	mg/L	0.0026		0.0015	
Barium (Ba)	Dissolved	mg/L	0.012		0.02	
Beryllium (Be)	Dissolved	mg/L	0.0001		<0.0001	
Bismuth (Bi)	Dissolved	mg/L	0.0005		<0.0005	
Boron (B)	Dissolved	mg/L	0.151		0.067	
Cadmium (Cd)	Dissolved	mg/L	0.00832		0.0155	
Calcium (Ca)	Dissolved	mg/L	430		352	
Chromium (Cr)	Dissolved	mg/L	0.0026		0.0008	
Cobalt (Co)	Dissolved	mg/L	0.0021		0.0034	
Copper (Cu)	Dissolved	mg/L	0.002		0.022	
Iron (Fe)	Dissolved	mg/L	0.04		0.02	
Lead (Pb)	Dissolved	mg/L	0.107		0.105	
Lithium (Li)	Dissolved	mg/L	0.04		0.025	
Magnesium (Mg)	Dissolved	mg/L	100		78	
Manganese (Mn)	Dissolved	mg/L	7.27		17.8	
Mercury (Hg)	Dissolved	mg/L				
Molybdenum (Mo)	Dissolved	mg/L	0.001		<0.001	
Nickel (Ni)	Dissolved	mg/L	0.0274		0.0266	
Phosphorus (P)	Dissolved	mg/L			0.11	
Potassium (K)	Dissolved	mg/L	10		5.5	
Selenium (Se)	Dissolved	mg/L	0.0008		0.0004	
Silicon (Si)	Dissolved	mg/L	2.21		5	
Silver (Ag)	Dissolved	mg/L	0.0002		0.00012	
Sodium (Na)	Dissolved	mg/L	16.1	**No water found**	8.4	
Stronium (Sr)	Dissolved	mg/L	1.58		1.08	
Sulphur (S)	Dissolved	mg/L	478		340	
Tellurium (Te)	Dissolved	mg/L				
Thallium (Tl)	Dissolved	mg/L	0.00334		0.0038	
Thorium	Dissolved	mg/L				
Tin (Sn)	Dissolved	mg/L	0.001		<0.001	
Titanium (Ti)	Dissolved	mg/L	0.0237		0.0453	
Uranium (U)	Dissolved	mg/L	0.0019		<0.0005	
Vanadium (V)	Dissolved	mg/L	0.0003		0.0002	
Zinc (Zn)	Dissolved	mg/L	0.382		6.72	
Zirconium (Zr)	Dissolved	mg/L				
Physical and Aggregate						
Temp. of observed pH and EC	°C		21.5			
Total Suspended Solids - TSS	Total	mg/L			413000	
Routine Water						
pH			7.9		7.9	
Electrical Conductivity		µS/cm	2230		1880	
Sulphate (SO4)	Dissolved	mg/L	1430		1020	Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	5			
Carbonate		mg/L	6			
Bicarbonate		mg/L	136			
P-Alkalinity	as CaCO3	mg/L	5			
T-Alkalinity	as CaCO3	mg/L	112			
Hardness	Dissolved	mg/L	1490		1200	
Ionic Balance	Dissolved	%	96			
Ammonia -N						
Chloride	Dissolved	mg/L	2.8			
Total Dissolved Solids	Calculated	mg/L	2060			
Nutrients						
Nitrite Nitrogen (NO2)		mg/L	0.36			
Nitrate Nitrogen (NO3)		mg/L	0.01			
Nitrate and Nitrite - N		mg/L	0.38			

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Drive Point Piezometer - MDP13 Valley Tailings100m East of Dam # 1 (veg. line)

		Norwest Labs Number	485084-18	554386-6	630692-57	
		Collected by	**DD/DC**	**DD/DC**	**DC/CB**	
		Sample Date	11-Aug-06	20-Jun-07	7-Jul-08	
		Matrix	water	water	water	
		Units				
Field Anaylsis						
pH					7.29	
Temperature C		C			14.5	
Conductivity		µS/cm			555	
External Anaylsis						
Metals Dissolved (Trace)						
Aluminum (Al)	Dissolved	mg/L	0.01	<0.005	<0.005	
Antimony (Sb)	Dissolved	mg/L	0.0048	0.0061	0.0098	
Arsenic (As)	Dissolved	mg/L	0.0025	0.0022	0.0019	
Barium (Ba)	Dissolved	mg/L	0.018	0.077	0.032	
Beryllium (Be)	Dissolved	mg/L	0.0001	<0.0001	<0.0001	
Bismuth (Bi)	Dissolved	mg/L	0.0005	<0.0005	<0.0005	
Boron (B)	Dissolved	mg/L	0.098	0.063	0.04	
Cadmium (Cd)	Dissolved	mg/L	0.0237	0.00241	0.00532	
Calcium (Ca)	Dissolved	mg/L	115	90.6	103	
Chromium (Cr)	Dissolved	mg/L	0.001	<0.0005	<0.0005	
Cobalt (Co)	Dissolved	mg/L	0.0014	0.0009	0.0031	
Copper (Cu)	Dissolved	mg/L	0.003	0.003	0.004	
Iron (Fe)	Dissolved	mg/L	0.03	<0.01	0.02	
Lead (Pb)	Dissolved	mg/L	0.0611	0.101	0.0988	
Lithium (Li)	Dissolved	mg/L	0.02	0.014	0.01	
Magnesium (Mg)	Dissolved	mg/L	35.3	27.4	25.4	
Manganese (Mn)	Dissolved	mg/L	2.88	3.32	13.2	
Mercury (Hg)	Dissolved	mg/L				
Molybdenum (Mo)	Dissolved	mg/L	0.001	<0.001	<0.001	
Nickel (Ni)	Dissolved	mg/L	0.0131	0.0025	0.0171	
Phosphorus (P)	Dissolved	mg/L			0.06	
Potassium (K)	Dissolved	mg/L	8.3	5.2	2.7	
Selenium (Se)	Dissolved	mg/L	0.0002	<0.0002	<0.0002	
Silicon (Si)	Dissolved	mg/L	1.93	1.73	3.98	
Silver (Ag)	Dissolved	mg/L	0.0005	0.0002	0.00033	
Sodium (Na)	Dissolved	mg/L	7.9	5.4	3.8	
Stronium (Sr)	Dissolved	mg/L	0.666	1.09	0.474	
Sulphur (S)	Dissolved	mg/L	120	78.2	67.2	
Tellurium (Te)	Dissolved	mg/L				
Thallium (Tl)	Dissolved	mg/L	0.00107	0.00173	0.00411	
Thorium						
Tin (Sn)	Dissolved	mg/L	0.001	<0.001	<0.001	
Titanium (Ti)	Dissolved	mg/L	0.0062	0.0063	0.0084	
Uranium (U)	Dissolved	mg/L	0.0005	<0.0005	<0.0005	
Vanadium (V)	Dissolved	mg/L	0.0002	0.0004	0.0002	
Zinc (Zn)	Dissolved	mg/L	0.564	0.379	2.19	
Zirconium (Zr)	Dissolved	mg/L				
Physical and Aggregate						
Temp. of observed pH and EC	°C		21.9			
Total Suspended Solids - TSS	Total	mg/L			25600	
Routine Water						
pH			7.95		7.85	
Electrical Conductivity		µS/cm	803		769.00	
Sulphate (SO4)	Dissolved	mg/L	362	234.6	201.6	Grey cells indicate sulphate calc. from ICP sulphur
Hydroxide		mg/L	5			
Carbonate		mg/L	6			
Bicarbonate		mg/L	124			
P-Alkalinity	as CaCO3	mg/L	5			
T-Alkalinity	as CaCO3	mg/L	102			
Hardness	Dissolved	mg/L	433		362	
Ionic Balance	Dissolved	%	97			
Ammonia -N						
Chloride	Dissolved	mg/L	1.3			
Total Dissolved Solids	Calculated	mg/L	590			
Nutrients						
Nitrite Nitrogen (NO2)		mg/L	0.09			
Nitrate Nitrogen (NO3)		mg/L	0.013			
Nitrate and Nitrite - N		mg/L	0.1			

Appendix E

Tailings Mineralogical Testing

Appendix E1

Petrography Report

PETROGRAPHIC REPORT ON 6 SAMPLES (PROJECT SRK Keno Hill 2-21-900)

Report for: Ivy Rajan Invoice 080261
CANTEST
4606 Canada Way
Vancouver, B.C. V5G 1K5 (604) 734-7276 Mar. 24, 2008.

SUMMARY:

Samples are flotation tailings (that may or may not have undergone cyanidation) from Ag-Pb-Zn veins of quartz-carbonate-sulfide or near-surface partially oxidized (sulfate) mineralogy, possibly further oxidized since tailings deposition. Under the microscope, most samples consist of angular fragments (locally aggregated and cemented by amorphous limonite, especially where extremely fine-grained), of quartz (likely vein and metamorphic, the latter with sericite locally attached), carbonate (likely Fe-carbonate such as ankerite or siderite), pyrite (partly to almost completely oxidized in some samples, but only slightly oxidized in others), significant limonite (likely mostly after pyrite; Pb-sulfate or carbonate not definitely identified in any samples), minor muscovite and/or sericite, local sphalerite, barite (?) and rutile. Significant oxidation (to goethite, lepidocrocite?, or possibly hematite?) in some samples may have occurred prior to inclusion in tailings, with the slight oxidation of most pyrite possibly occurring after inclusion in the tailings. Pyrite rarely contains inclusions of galena and chalcopyrite in one sample.

Capsule descriptions are as follows:

6-B: subangular to angular <1 mm fragments of quartz, Fe-carbonate, pyrite (partly or locally completely oxidized to goethite and local lepidocrocite?), sphalerite and a little mica (muscovite) containing traces of sagenitic rutile. Part of the pyrite may be after former pyrrhotite; pyrite contains rare inclusions of galena and chalcopyrite.

7-B: subangular to angular fragments rarely over 0.2 mm long of quartz, Fe-carbonate, pyrite (partly oxidized to limonite) and minor mica (sericite) commonly stained by limonite or locally containing trace rutile, accessory barite (?), sphalerite and rutile. Pb carbonate/sulfate not recognized.

8-H: very fine-grained sample, mostly in aggregated clumps, cemented by limonite, of minute shards of quartz, Fe-carbonate, pyrite or limonite after pyrite, and minor sericite, possible barite (?), trace rutile. If Pb-carbonate or sulfate is present, it will require SEM or XRD analysis to confirm it.

12-I: very fine-grained sample, mostly aggregated clumps, cemented by limonite, of minute shards of quartz, Fe-carbonate, limonite (probably mostly after pyrite, possibly oxidized prior to inclusion in tailings), and minor sericite and pyrite (mainly fresh, or only slightly oxidized), trace sphalerite.

14-C: mostly aggregated clumps, cemented by limonite, of small shards of quartz, Fe-carbonate, limonite (probably mostly after pyrite, possibly oxidized prior to inclusion in tailings), and minor sericite and pyrite (mainly fresh, or only slightly oxidized), trace rutile, possible sphalerite (?).

18-D: fine -grained, partly aggregated clumps, cemented by limonite, of minute shards, or between these, larger shards, of quartz, Fe-carbonate, limonite (probably mostly after pyrite but possibly also locally containing Pb-sulfate?; these may have been oxidized prior to their inclusion in the tailings), and minor sericite and pyrite (which is mainly fresh, or only locally oxidized), trace sphalerite.

Detailed petrographic descriptions and photomicrographs are appended (on CD). If you have any questions regarding the petrography, please do not hesitate to contact me.

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6-B: QUARTZ-FE CARBONATE-PYRITE (PARTLY OXIDIZED TO LIMONITE)-MINOR MUSCOVITE-SPHALERITE-RUTILE-TRACE GALENA, CHALCOPYRITE

Sample consists of fine-grained (mainly <0.5 mm) brown sand. The offcut prepared from grain mount of this material is weakly magnetic, but shows no reaction to cold dilute HCl (even when scratched/powdered), and no stain for K-feldspar after etching with HF. Modal mineralogy in polished thin section is approximately:

Quartz (vein, metamorphic?)	50%
Carbonate (ankerite/siderite?)	35%
Pyrite	5%
Limonite (goethite, local lepidocrocite?)s	5%
Muscovite	2-3%
Sphalerite	1-2%
Rutile	<1%
Galena	<1%
Chalcopyrite	trace

Under the microscope, this sample consists mainly of subangular to angular fragments rarely up to 1 mm long (commonly with elongate shapes) of quartz, carbonate, pyrite (partly oxidized to limonite), sphalerite and a little mica (muscovite) containing traces of sagenitic rutile.

Quartz occurs either as single-crystal fragments up to about 0.6 mm long, likely derived from vein material, or as aggregates of finer-grained (mainly <0.1 mm) tightly interlocking, anhedral to subhedral crystals with weak to moderate flattening (length:width ratios up to 2.5:1), likely reflecting metamorphic rocks. In some of the fine-grained fragments, staining by amorphous red-brown limonite is common along grain boundaries. Rarely, minor muscovite occurs attached to quartz.

Carbonate occurs mainly as sub- to euhedral cleavage fragments up to about 0.75 mm long, or locally aggregates of finer-grained sub/euhedra mostly <0.1 mm in diameter, both with apparent high relief (high refractive indices) and brownish colour that argue against it being calcite. Prominent Fe-staining (amorphous red-brown limonite) along fragment margins, cleavages, and grain boundaries indicates that most is Fe-carbonate, and the lack of reaction to cold dilute HCl in the offcut suggests that is likely either ankerite or possibly siderite. Only SEM/microprobe analysis will resolve this question. Locally, minor quartz, sphalerite or pyrite (all mostly <0.15 mm) is contained within carbonate fragments.

Pyrite occurs as subhedral fragments mainly <0.5 mm in diameter, locally surrounding and apparently replacing cores of fine-grained, radial or lamellar-textured relict pyrrhotite (?). This might explain the weak magnetism detected in the sample. Commonly, the pyrite is oxidized around the rims to deep red-brown or opaque limonite, grading to partial to complete replacement of pyrite by *in situ* limonite (likely mainly goethite, α-FeOOH) that may or may not contain traces of relict pyrite mostly <10 microns in size. Rarely, pyrite contains traces of galena as 20-30 micron sized subhedral inclusions, or lesser chalcopyrite as inclusions <15 microns in size. Some of the limonite is virtually opaque and has relatively high reflectance (~20-25%) and strong anisotropism under crossed polars, suggestive of lepidocrocite (γ-FeOOH) or possible hematite (Fe2O3).

Sphalerite occurs as orange-brown (moderate Fe) subhedral fragments up to 0.5 mm long, or as smaller crystals locked within carbonate. Galena does not appear to occur separate from pyrite.

Muscovite occurs as bundles of sub-parallel aligned flakes mostly <0.25 mm in diameter that locally contain traces of rutile as minute needles mostly <2 x 20 microns. Rutile also occurs as dark brown crystal fragments up to 0.5 mm in size.

7-B: VERY FINE-GRAINED QUARTZ-FE CARBONATE-PYRITE (PARTLY OXIDIZED TO LIMONITE)-MINOR SERICITE-BARITE?-SPHALERITE-RUTILE

Sample consists of extremely fine-grained silt-sized particles (commonly aggregated in the grain mount). The offcut prepared from a grain mount is not magnetic, shows no reaction to cold dilute HCl (even when scratched), and no stain for K-feldspar after etching with HF. Modal mineralogy in polished thin section is approximately:

Quartz (mostly vein fragments?)	60%
Carbonate (ankerite/siderite?)	25%
Limonite (goethite, local lepidocrocite?)s	7%
Pyrite	3%
Sericite (muscovite)	3%
Barite (?)	1% (?)
Sphalerite	<1%
Rutile	<1%

Under the microscope, this sample consists mainly of subangular to angular fragments rarely over 0.2 mm long (commonly with elongate shapes) of quartz, carbonate, pyrite (partly oxidized to limonite), sphalerite and minor mica (sericite) locally containing traces of sagenitic rutile, accessory barite (?), sphalerite and rutile. Aggregates, mostly cemented by transported (amorphous) limonite, are common, with rounded outlines up to about 2 mm (6 mm in the offcut). These aggregates vary from quartz-sericite rich or quartz-carbonate rich, with variable limonite.

Quartz occurs either as single-crystal fragments up to about 0.25 mm long, likely derived from vein material, or much less commonly as aggregates of finer-grained (mainly <50 μm) tightly interlocking, anhedral to subhedral crystals. In some of the fine-grained fragments, staining by amorphous red-brown limonite occurs along grain boundaries, or the quartz is mixed with minor interstitial muscovite or carbonate.

Carbonate occurs mainly as sub- to euhedral cleavage fragments up to about 0.15 mm long, with apparent high relief (high refractive indices) and brownish colour that argue against it being calcite. Prominent Fe-staining (amorphous red-brown limonite) along fragment margins, cleavages, and grain boundaries indicates it is mostly Fe-carbonate, and the lack of reaction to cold dilute HCl in the offcut suggests that is likely either ankerite or possibly siderite. Only SEM/microprobe analysis will resolve this question.

Pyrite occurs as angular shards mainly <0.1 mm in diameter, commonly oxidized around the rims to deep red-brown or opaque limonite, grading to partial to complete replacement of pyrite by *in situ* limonite (likely mainly goethite, α-FeOOH) that may or may not contain traces of relict pyrite mostly <20 microns in size. A small proportion of the limonite is shows relatively high reflectance (~20-25%) and strong anisotropism under crossed polars, suggestive of lepidocrocite (γ-FeOOH) or possibly even hematite (Fe2O3).

Muscovite occurs as bundles of sub-parallel aligned flakes mostly <75 mm in diameter that are mostly partly stained by limonite, or locally contain traces of rutile as euhedra mostly <20 microns in size. Rutile also occurs as dark brown crystal fragments up to 50 microns in size that are difficult to distinguish from limonite except by slightly higher reflectivity and slightly paler colour.

Barite occurs as angular cleavage fragments <0.1 mm in diameter distinguished from quartz by strong positive relief, however it is hard to be sure of the abundance of barite.

Sphalerite occurs as rare yellow- to orange-brown (low to moderate Fe) subhedral fragments up to 65 microns long, or as smaller crystals rarely locked within carbonate.

In summary, this is similar in composition to 6-B, but much finer-grained, and with less carbonate, pyrite and sphalerite (no galena or chalcopyrite detected), but more quartz, sericite, and limonite, and also containing minor possible barite (?). Secondary Pb sulfates and carbonates are not obvious, if present.

8-H: EXTREMELY FINE-GRAINED QUARTZ-FE CARBONATE-PYRITE (PARTLY OXIDIZED TO LIMONITE)-MINOR SERICITE-BARITE?-SPHALERITE-RUTILE

This sample consists of mineral grains so fine that they hardly show up in the offcut prepared from a grain mount, except where they are aggregated (and plucked out during section preparation). These aggregates are so hard (likely due to cementing by limonite) that they strongly resist crushing. The sample material is slightly magnetic, but shows no reaction to cold dilute HCl even when scratched, and no stain for K-feldspar in the etched offcut. Modal mineralogy in polished thin section is approximately:

Quartz (vein, metamorphic?)	50%
Carbonate (ankerite/siderite?)	30%
Limonite (mainly goethite?)	10%
Pyrite (partly oxidized to limonite)	5%
Sericite	3%
Barite (?)	1-2% (?)
Sphalerite	<1%
Rutile	<1%

In thin section, the sample consists mainly of aggregates with irregular angular outlines up to about 7 mm long, strongly cemented by limonite. Between these aggregates, mineral shards are mostly <50 microns in size (but elongate examples up to 0.1 mm long). Recognizable shards include quartz, carbonate, sericite, pyrite (largely oxidized to limonite), minor barite (?) and rutile. This sample is so fine-grained that it is at the limit of optical petrography; it would benefit significantly from XRD analysis to help identify and quantify the phases present.

Quartz shards are rarely up to 80 microns long and locally coated or partly coated with dark red-brown limonite. Rarely, highly strained quartz in aggregates up to 0.3 mm (with strong undulose extinction, sub-grain development, suturing of grain boundaries) may be derived from a metamorphic source rock.

Carbonate occurs as sub- to euhedral cleavage flakes or less commonly irregular shaped fragments, mostly <80 microns long. Strong limonite staining, high relief, brownish colour and complete lack of reaction to cold dilute HCl in the offcut all suggest it is likely ankerite or siderite.

Sericite forms flakes mainly <25 microns in diameter, but generally in flake-like aggregates up to 80 microns long, commonly attached to pyrite or limonite, or locally mixed with quartz, but not carbonate.

Limonite is abundant, but is mostly amorphous and transported (coating silicate or carbonate grains, along silicate/carbonate grain boundaries, filling fractures, or cementing shards to form the large aggregates). However, a portion of it is derived by *in situ* oxidation of pyrite, where it forms narrow rims or coatings on the pyrite shards, which are angular and mainly <100 microns in size (but locally occur as granular aggregates up to 0.2 mm across). Some pyrite is attached to or locally contained within carbonate crystals.

Rare possible barite (?) with low birefringence like that of quartz, but significant positive relief, forms angular cleavage fragments mostly <40 microns in diameter, but rarely up to 0.1 mm long. Sphalerite is rare, forming dark red-brown (moderate to high Fe) fragments <25 microns in size that are difficult to tell apart from limonite due to similar reflectivity and colour (isotropism difficult to confirm at this grain size). Some sphalerite contains inclusions of pyrite <15 microns in diameter.

Rutile forms sub- to euhedral yellow brown crystals up to 30 microns long. The reflectance is a little higher than that of nearby limonite, which is therefore likely mostly goethite rather than lepidocrocite.

In summary, this is a very fine-grained sample consisting of (mostly aggregated) clumps, cemented by limonite, of minute shards of quartz, Fe-carbonate, pyrite or limonite after pyrite, and minor sericite, possible barite (?), trace rutile. If Pb-carbonate or sulfate is present, it would require SEM or XRD analysis to confirm.

12-I: EXTREMELY FINE-GRAINED QUARTZ-FE CARBONATE-LIMONITE (AFTER SULFIDE)-MINOR SERICITE-PYRITE (MAINLY UNOXIDIZED)-SPHALERITE?

This sample consists of extremely fine, tan-coloured mineral grains. The sample material is slightly magnetic, but shows no reaction to cold dilute HCl even when scratched, and no stain for K-feldspar in the etched offcut. Modal mineralogy in polished thin section is approximately:

Quartz (vein, metamorphic?)	60%
Carbonate (ankerite/siderite?)	20%
Limonite (goethite, significant lepidocrocite?)	12%
Sericite	5%
Pyrite (rarely oxidized)	2%
Sphalerite (?)	1%

In thin section, the sample consists mainly of aggregates with subrounded/subangular outlines up to about 3.5 mm long, mostly cemented by amorphous limonite. Within the aggregates, mineral shards are mainly either <20 or up to 150 microns in size; between the aggregates, mineral shards are mostly <0.2 mm in size (but elongate examples up to 0.3 mm long). Recognizable shards include quartz, carbonate, sericite, limonite after sulfides and pyrite (mostly fresh and unoxidized). This sample is so fine-grained in the aggregates that it is at the limit of optical petrography; it too would benefit significantly from XRD analysis to help identify phases that may be missed by optical examination alone.

Quartz shards are rarely up to 80 microns long, with irregular conchoidal or locally scalloped, sub- to anhedral outlines, and are generally strongly fractured. Most are single crystals that are relatively unstrained, but locally, more strongly strained quartz occurs in fine-grained aggregates up to 0.3 mm (with strong undulose extinction, sub-grain development, suturing of grain boundaries).

Carbonate occurs as sub- to euhedral cleavage flakes or less commonly irregular shaped fragments, mostly <0.15 mm long. Strong limonite staining, high relief, brownish colour and complete lack of reaction to cold dilute HCl in the offcut all suggest it is likely ankerite or even siderite; SEM or microprobe analysis would be required to answer this question.

Sericite forms flakes mainly <50 microns in diameter, commonly in lensy booklet-like aggregates up to 0.1 mm long, locally mixed with quartz, or locally attached to pyrite or limonite, but not to carbonate.

Limonite is abundant, but is mostly amorphous and transported (coating silicate or carbonate grains, along silicate/carbonate grain boundaries, filling fractures, or cementing the mineral shards forming the subrounded aggregates). However, a portion of it is likely derived by *in situ* oxidation of sulfides, forming aggregates up to 0.2 mm across composed of either low reflectivity goethite, commonly with a boxwork texture, or locally more massive, higher reflectivity, strongly anisotropic lepidocrocite (?). The latter generally forms the core of the aggregate, with the goethite forming a botryoidal or collomorphic rim. Rarely, traces of pyrite are preserved in the cores of these aggregates, suggesting most of this limonite is after pyrite.

Pyrite is relatively rare, forming mostly minute (<75 micron long) ragged, angular shards that mostly do not appear to be significantly oxidized to limonite (very thin coatings <10 microns thick, possibly developed while in the tailings?). Some pyrite is attached to or contained within carbonate crystals (euhedra <.15 microns). Sphalerite is also uncommon or rare, forming dark red-brown (moderate to high Fe) fragments up to 0.15 mm long that are difficult to tell apart from limonite due to similar reflectivity and colour (isotropism difficult to confirm at this grain size). Some sphalerite contains inclusions of pyrite <25 microns in diameter.

In summary, this is a very fine-grained sample consisting of (mostly aggregated) clumps, cemented by limonite, of minute shards of quartz, Fe-carbonate, limonite (probably mostly after pyrite, possibly oxidized prior to inclusion in tailings), and minor sericite and pyrite (mainly fresh, or only slightly oxidized), trace sphalerite. If Pb-carbonate or sulfate, or barite, are present, it will require SEM or XRD analysis to confirm.

14-C: FINE-GRAINED QUARTZ-FE CARBONATE-LIMONITE (AFTER SULFIDE)-MINOR SERICITE-PYRITE (MAINLY UNOXIDIZED)-RUTILE-SPHALERITE?

Sample consists of medium brown, extremely fine-grained material, commonly aggregated but clumps are crushable between the fingers. The material is weakly magnetic, but shows no reaction to cold dilute HCl, and no stain for K-feldspar in the etched offcut prepared from a grain mount (in which cores of the aggregates, not wetted by epoxy, have plucked out during diamond sawing). Modal mineralogy in polished thin section prepared from the grain mount is approximately:

Quartz (vein, metamorphic?)	50%
Carbonate (ankerite or siderite?)	20%
Limonite (amorphous, likely goethite?)	10%
(crystalline, lepidocrocite/lesser goethite?)	10%
Sericite	5%
Pyrite (relatively fresh)	3%
Rutile, possible sphalerite	<1% each

This sample consists of subangular aggregates up to about 2 mm long of minute shards of quartz, carbonate, limonite and possible sericite, cemented by amorphous, transported limonite too fine-grained to be optically resolvable, plus separate, larger (mainly <0.4 mm) shards of the same minerals that are more readily identified optically. Most of the discussion below therefore focuses on them.

Quartz shards are rarely up to 0.3 mm across, with irregular angular, conchoidal or locally scalloped, sub- to anhedral outlines, commonly coated with transported limonite, and locally fractured. Most are single crystals that are relatively unstrained and likely represent vein quartz, but locally, more strongly strained quartz occurs in finer-grained aggregates up to 0.5 mm (in which the crystals show moderate to intense undulose extinction, sub-grain development and suturing of grain boundaries, likely reflecting metamorphic quartz). In places the latter type is intergrown with flakes of sericite/muscovite aligned with flattening/elongation of quartz crystals.

Carbonate occurs as sub- to euhedral cleavage flakes or less commonly irregular shaped fragments, mostly <0.4 mm long. Local limonite staining, general high relief and brownish colour, and complete lack of reaction to cold dilute HCl in the offcut all suggest it is likely ankerite or even siderite; SEM or microprobe analysis will be required to answer this question.

Sericite/muscovite forms flakes mainly <60 microns in diameter, commonly in lensy booklet-like aggregates up to 0.15 mm long, locally mixed with quartz, but not to carbonate. This suggests that the sericite is mostly part of a metamorphic assemblage and the carbonate part of a vein assemblage. Sericite locally contains needle-like rutile as euhedra <5 by up to 35 microns.

Limonite occurs in several modes in this sample: mainly relatively large (0.5 mm) aggregates of crystalline, nearly opaque material that commonly consists of relict cores of more highly reflective material (possibly lepidocrocite) apparently veined and replaced by less reflective material (likely goethite). Minor inclusions of more highly reflective material may be hematite (?). There are also common aggregates of limonite with much lower reflectivity (likely cryptocrystalline or amorphous goethite?), which occur separately or locally attached to the former aggregates. Most of the limonite is likely after former pyrite (or other sulfides?), but may have developed prior to incorporation into tailings, since most pyrite is relatively fresh and does not grades to the limonite-only particles.

Pyrite is either fresh (unoxidized), or locally rimmed to partly replaced by dark red-brown limonite with relatively low reflectivity, similar to goethite in aggregates separate from it. There may be sphalerite (and more rutile than described?), but because the reflectance values for these minerals are so similar to the ubiquitous limonite, they are difficult to identify/quantify.

In summary, this is a fine-grained sample consisting of (mostly aggregated) clumps, cemented by limonite, of small shards of quartz, Fe-carbonate, limonite (probably mostly after pyrite, possibly oxidized prior to inclusion in tailings), and minor sericite and pyrite (mainly fresh, or only slightly oxidized), trace rutile, possible sphalerite (?). If Pb-carbonate or sulfate, or barite, are present, it will require SEM or XRD analysis to identify them.

18-D: FINE-GRAINED QUARTZ-FE CARBONATE-LIMONITE (AFTER SULFIDE)-MINOR SERICITE-PYRITE (MAINLY UNOXIDIZED)-SPHALERITE

This sample consists of extremely fine, buff-coloured mineral grains, partly aggregated (but soft enough that aggregates are crushable between the fingers). The sample material is very slightly magnetic, but shows no reaction to cold dilute HCl even when scratched, and no stain for K-feldspar in the etched offcut. Modal mineralogy in polished thin section is approximately:

Quartz (vein, metamorphic?)	60%
Carbonate (ankerite/siderite?)	20%
Limonite (goethite, significant lepidocrocite?)	12%
Sericite	5%
Pyrite (rarely oxidized)	2%
Sphalerite	<1%
Unidentified (could include Pb-sulfate?)	<1%

In thin section, the sample consists partly (~20%) of aggregates with subrounded/subangular outlines up to about 4 mm across, mostly cemented by amorphous limonite. Within the aggregates, mineral shards are mainly either <15 microns or up to 0.4 mm in size; between the aggregates, mineral shards are mostly <0.3 mm in size (but some are up to 0.6 mm long). Recognizable shards include quartz, carbonate, sericite, abundant limonite, likely after sulfides, pyrite (locally oxidized) and sphalerite. This sample is so fine-grained in the aggregates that they at the limit of optical petrography; it would benefit from XRD analysis to help identify phases that may be missed by optical examination.

Quartz shards are commonly aggregates or multiple crystal fragments (irregular conchoidal or locally scalloped, sub- to anhedral outlines) and are commonly fractured. Within these fragments, quartz forms interlocking an/subhedral crystals mostly <0.15 mm in size, mostly strongly strained (undulose extinction, sub-grain development, suturing of grain boundaries), and in some of these, significant sericite is mixed with the quartz. Local single crystals that are relatively unstrained).

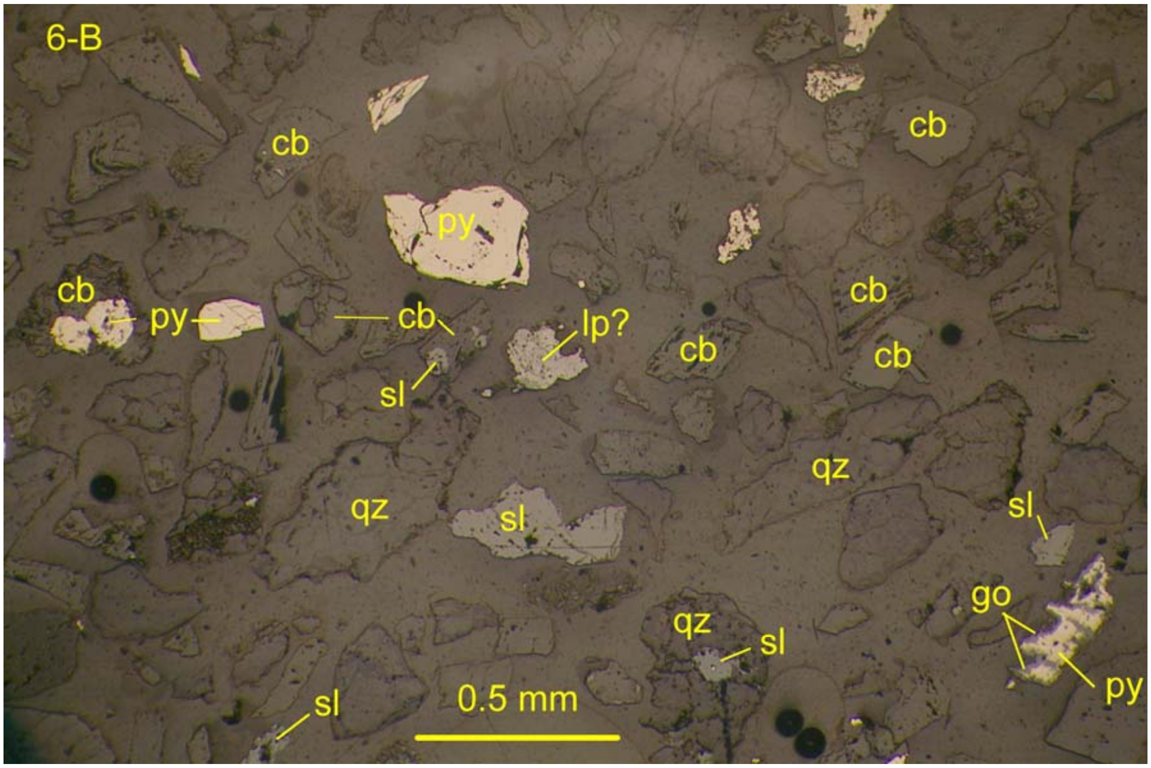
Carbonate occurs as sub- to euhedral cleavage flakes or less commonly irregular shaped fragments, mostly <0.2 mm long. Locally moderate to strong limonite staining, high relief, brownish colour and complete lack of reaction to cold dilute HCl in the offcut all suggest it is likely ankerite or even siderite, but SEM or microprobe analysis would be required to resolve this.

Sericite forms flakes mainly <50 microns in diameter, locally in lensy booklet-like aggregates up to 0.2 mm long, or mixed with quartz, or locally attached to pyrite or limonite, but never to carbonate. Traces of minute needle-like rutile (<2 x up to 25 microns) are included in the aggregates.

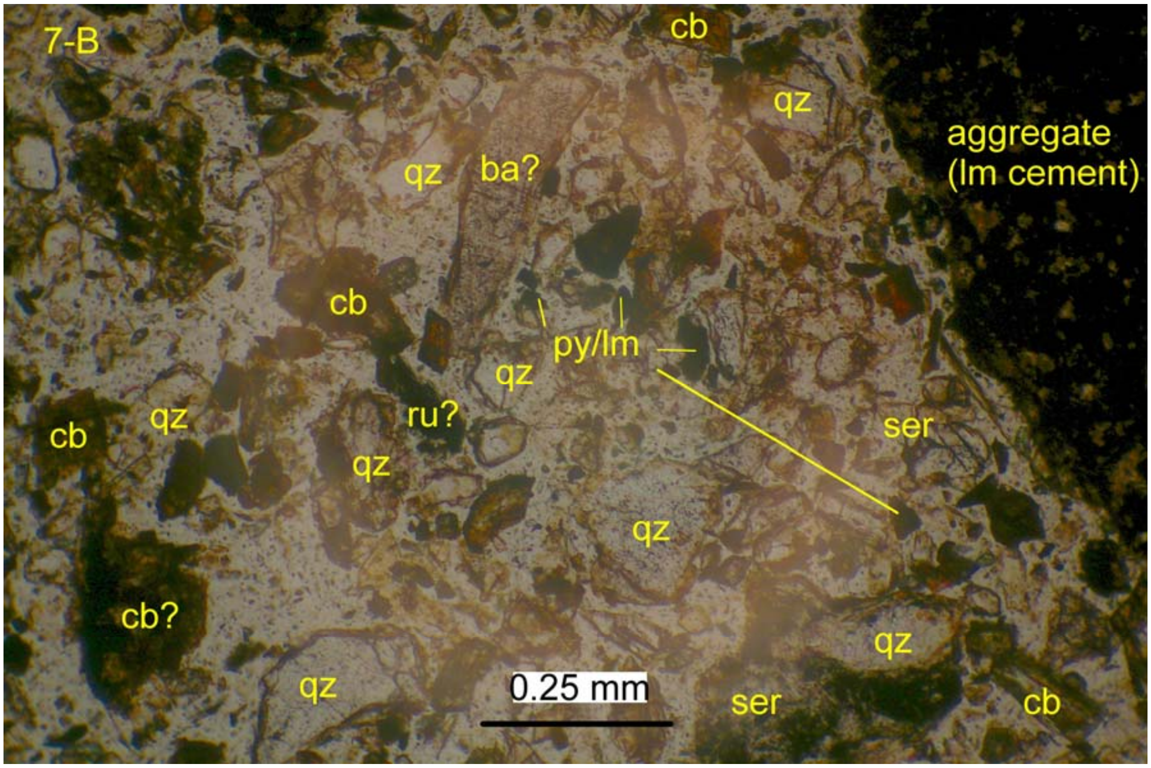
Limonite is abundant, but is mostly amorphous and transported (coating silicate or carbonate grains, staining elongate shards up to 0.2 mm long of semi-isotropic material, likely amorphous limonite and included with it, or cementing the mineral shards forming the subrounded aggregates). However, a portion of it is likely derived by *in situ* oxidation of sulfides, forming aggregates up to 0.3 mm composed of either low reflectivity goethite, commonly with a boxwork texture, or locally more massive, higher reflectivity, strongly anisotropic lepidocrocite (?). The latter generally forms the core of the aggregate, with the goethite forming a botryoidal/collomorphic rim. Rarely, trace pyrite is preserved in the cores of these aggregates, suggesting most of this limonite is after pyrite; however, locally a phase with slightly higher R than lepidocrocite might be Pb sulfate (?) (needs SEM).

Pyrite is relatively rare, forming mostly small (<0.2 mm) ragged, angular shards that are only rarely significantly (25%) oxidized to limonite (most have only thin coatings <10 microns thick, possibly developed while in the tailings?). Sphalerite is also relatively rare, forming dark red-brown (moderate to high Fe) fragments up to 0.15 mm that are definitely isotropic.

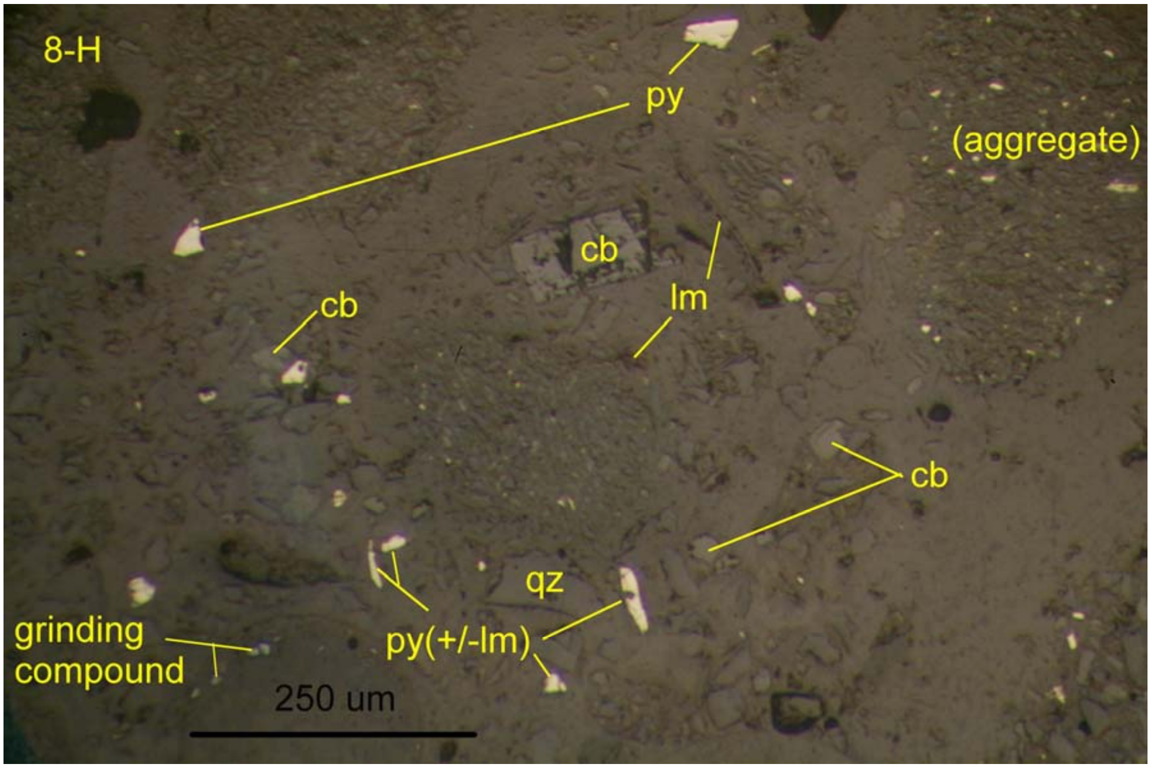
In summary, this is a fine to very fine-grained sample consisting of partly aggregated clumps, cemented by limonite, of minute shards, or between these, larger shards, of quartz, Fe-carbonate, limonite (probably mostly after pyrite but possibly also locally containing Pb-sulfate?; these may have been oxidized prior to their inclusion in the tailings), and minor sericite and pyrite (which is mainly fresh, or only locally oxidized), trace sphalerite.



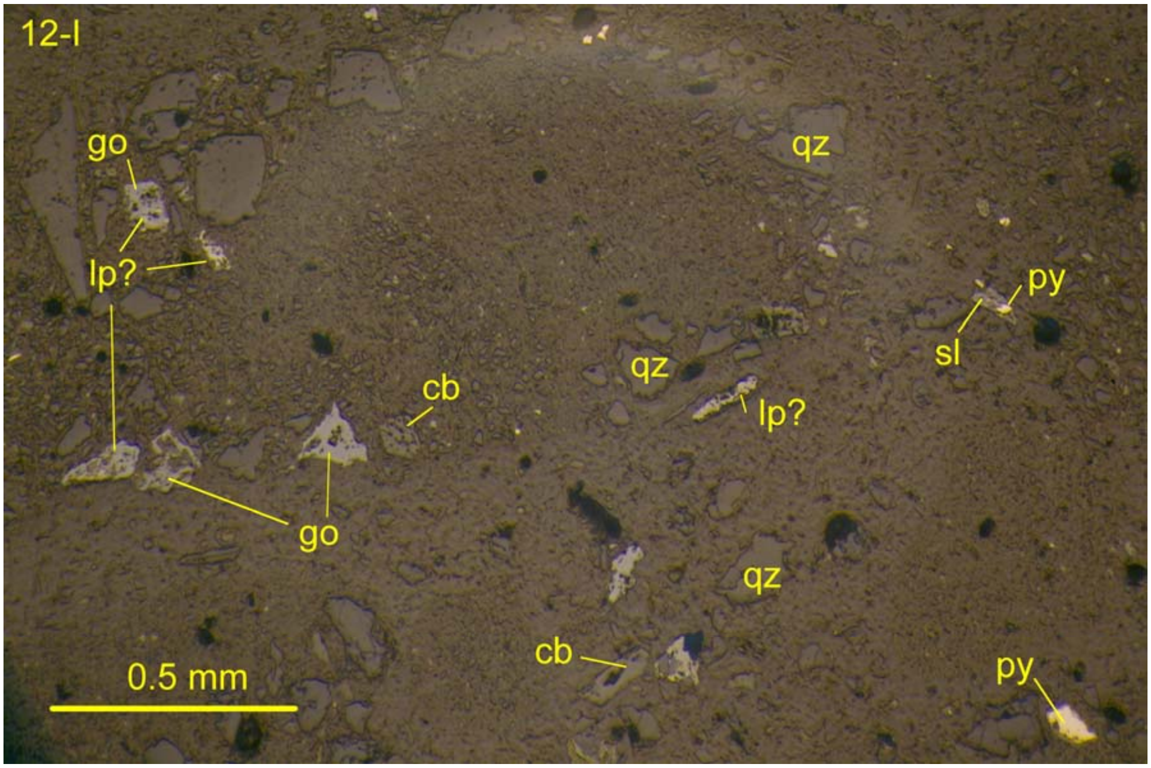
6-B: Fragments of quartz (qz), Fe-carbonate (cb), pyrite (partly oxidized to limonite that may include goethite, go, and lepidocrocite, lp), and sphalerite (sl). Both sphalerite and pyrite also occur locked within carbonate fragments. Reflected light, uncrossed polars, field of view 2.75 mm wide.



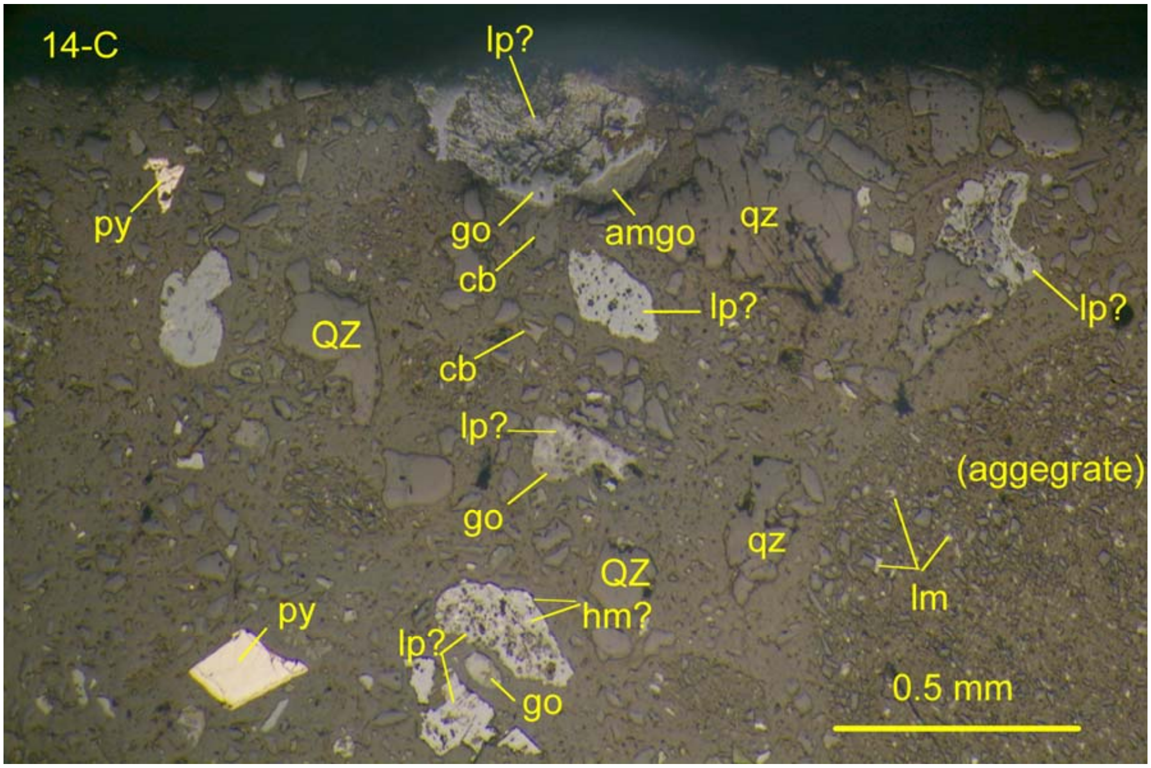
7-B: Small angular shards of quartz (qz), Fe-carbonate (cb) stained by limonite, pyrite oxidized to limonite (lm), minor sericite (ser), rare barite? (ba?), rutile (ru), and larger aggregates cemented by transported limonite. Transmitted plane light, field of view 1.5 mm wide.



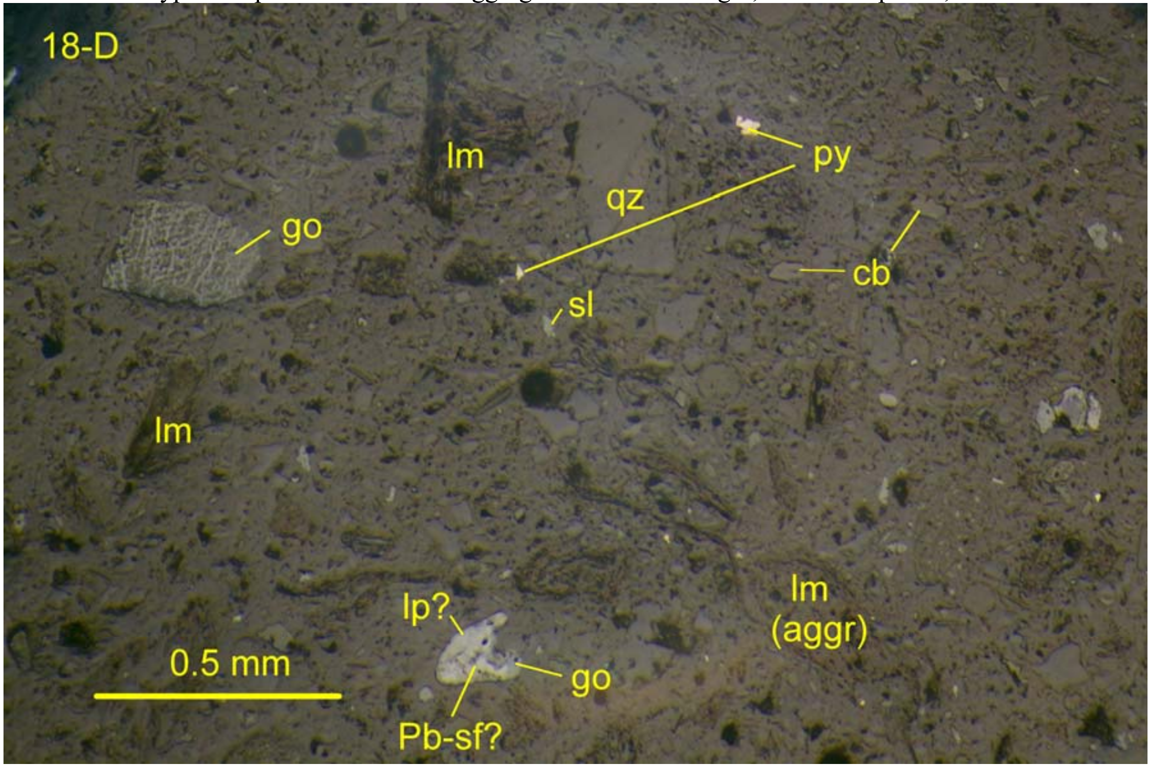
8-H: Relatively large cleavage shard of Fe-carbonate (cb), angular quartz (qz) shards, and pyrite (py) generally partly rimmed or replaced by limonite (lm) which is abundant coating grains or cementing aggregates, but is amorphous and has so low reflectivity it is hard to distinguish in this view (reflected light, uncrossed polars, field of view 1.0 mm wide).



12-I: Shards of quartz (qz), Fe-carbonate (cb), limonite including possible brighter lepidocrocite (lp?) and darker goethite (go), difficult to distinguish from sphalerite (sl) containing pyrite (py), which also occurs as relatively fresh (unoxidized) shards. Amorphous limonite cements rounded aggregate around which shards are coarser. Reflected light, uncrossed polars, field of view 2.25 mm wide.



14-C: Aggregates of (locally botryoidal-textured) limonite that may include both more highly reflective lepidocrocite? (lp?) and/or hematite? (hm?), more abundant goethite (go), plus separate pyrite (py) that is virtually unoxidized, quartz as single-crystal shards (QZ) or aggregates of metamorphic crystals (qz), and carbonate (cb) fragments. Fine-grained limonite of uncertain type also present in rounded aggregates. Reflected light, uncrossed polars, field of view 2.25 mm.



18-D: Shards of quartz (qz), Fe-carbonate (cb), rare pyrite (py) and sphalerite (sl), plus abundant amorphous limonite (lm) cementing aggregates, some elongated, goethite (go) as boxworks or rims to central lepidocrocite? (lp?) or Pb-sulfate? (with highest reflectivity). Reflected light, uncrossed polars, field of view 2.25 mm wide.

Overview of thin sections and offcuts (green semi-circles mark photomicrograph locations).

Appendix E2

X-Ray Diffraction Report

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

Project: SRK Keno Hill
2-21-900
Internal ref. R 72693

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March 13, 2008

EXPERIMENTAL METHODS

The samples **6-B**, **7-B**, **14-C**, **18-D**, **12-I** and **8-H** 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 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

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 1-6.

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

Mineral	**Ideal Formula**	**6-B**	**7-B**	**14-C**	**18-D**	**12-I**	**8-H**
Quartz	SiO_2	37.1	64.6	59.2	58.3	57.8	49.8
Muscovite	$KAl_2AlSi_3O_{10}(OH)_2$		7.0	12.9	9.5	18.4	15.0
Biotite	$K(Mg,Fe^{2+})_3AlSi_3O_{10}(OH)_2$	3.8					
K-feldspar	$KAlSi_3O_8$				3.2		
Plagioclase	$NaAlSi_3O_8 – CaAl_2Si_2O_8$				6.7		
Clinochlore	$(Mg,Fe^{2+})_5Al(Si_3Al)O_{10}(OH)_8$				3.0	2.3	1.5
Kaolinite	$Al_2Si_2O_5(OH)_4$			5.0		1.5	1.7
Gypsum	$CaSO_4{\cdot}2H_2O$		2.1			3.5	2.0
Siderite	$Fe^{2+}CO_3$	47.2	18.7	12.6	14.1	11.0	23.9
Bassanite ?	$CaSO_4{\cdot}0.5H_2O$		0.9				0.8
Goethite	$\alpha\text{-}Fe^{3+}O(OH)$		4.2	10.3	3.4	3.8	
Pyrite	FeS_2	10.0	1.9		0.8		2.2
Sphalerite	(Zn,Fe)S	1.9	0.5				0.7
Cerussite	$PbCO_3$				0.6	1.6	
Anglesite	$PbSO_4$				0.5		1.4
Reinerite ?	$Zn_3(As^{3+}O_3)_2$						1.1
Total		100.0	100.0	100.0	100.0	100.0	100.0

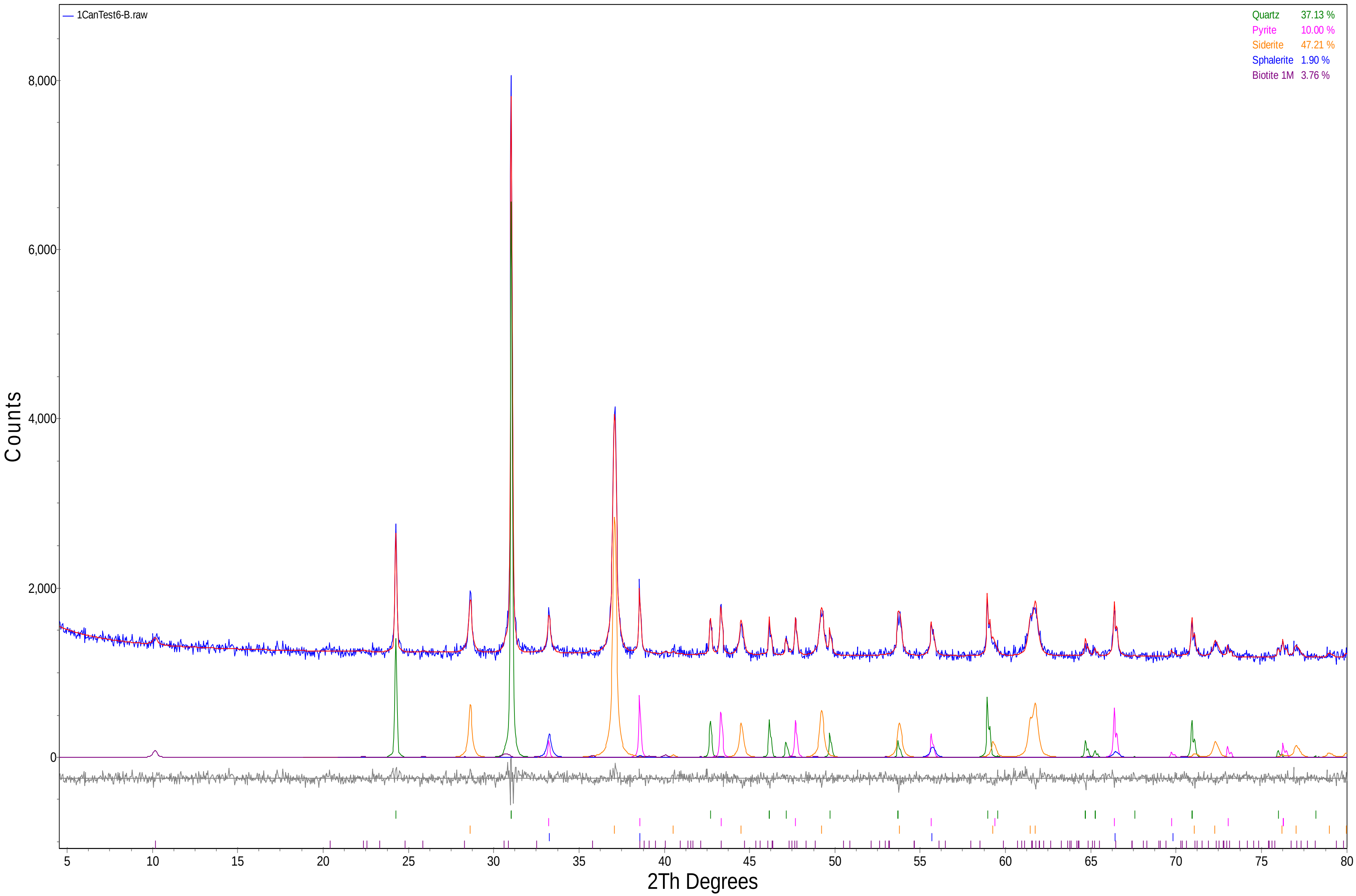

Figure 1. Rietveld refinement plot of sample **6-B** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

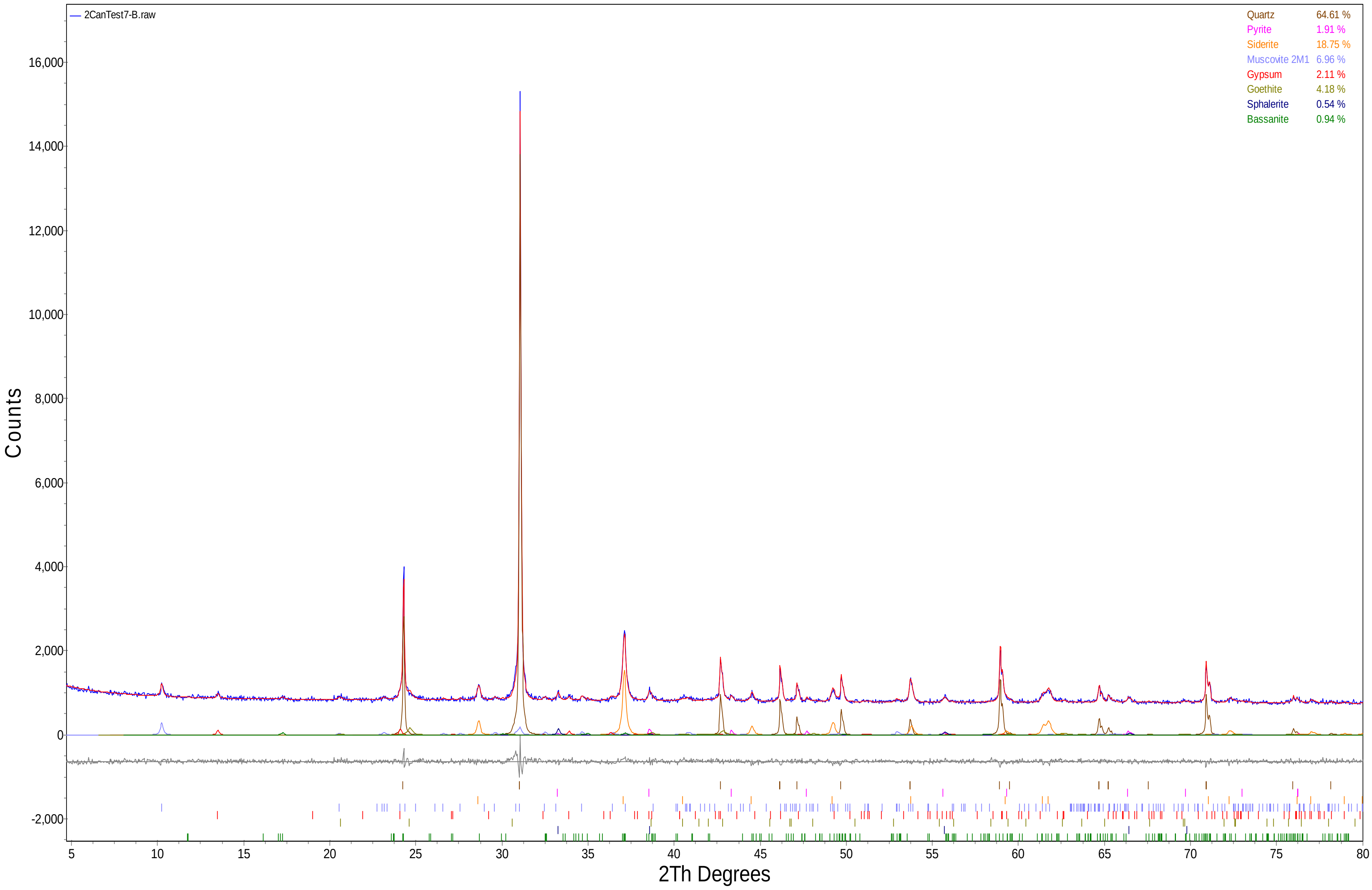

Figure 2. Rietveld refinement plot of sample **7-B** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

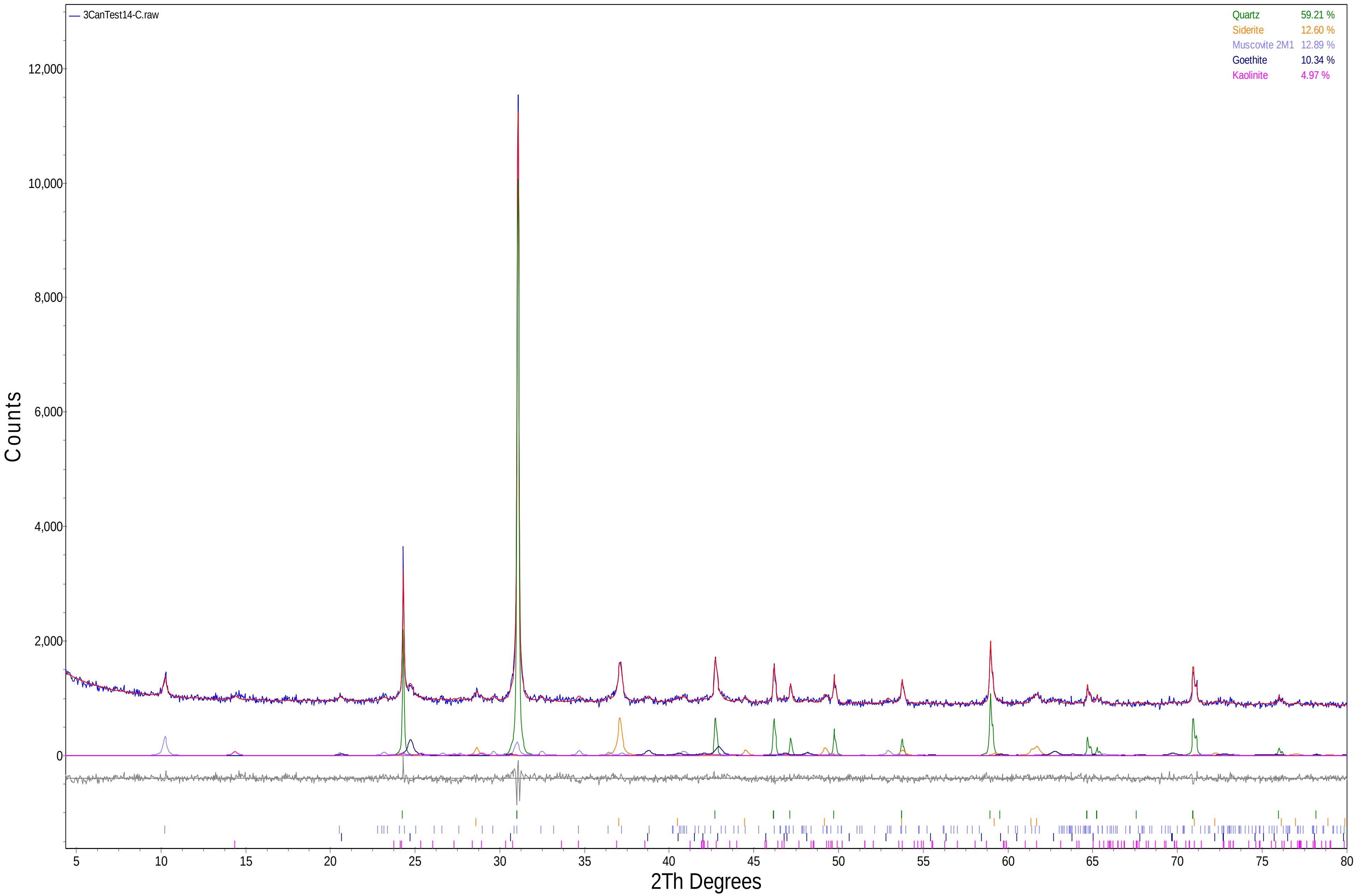

Figure 3. Rietveld refinement plot of sample **14-C** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

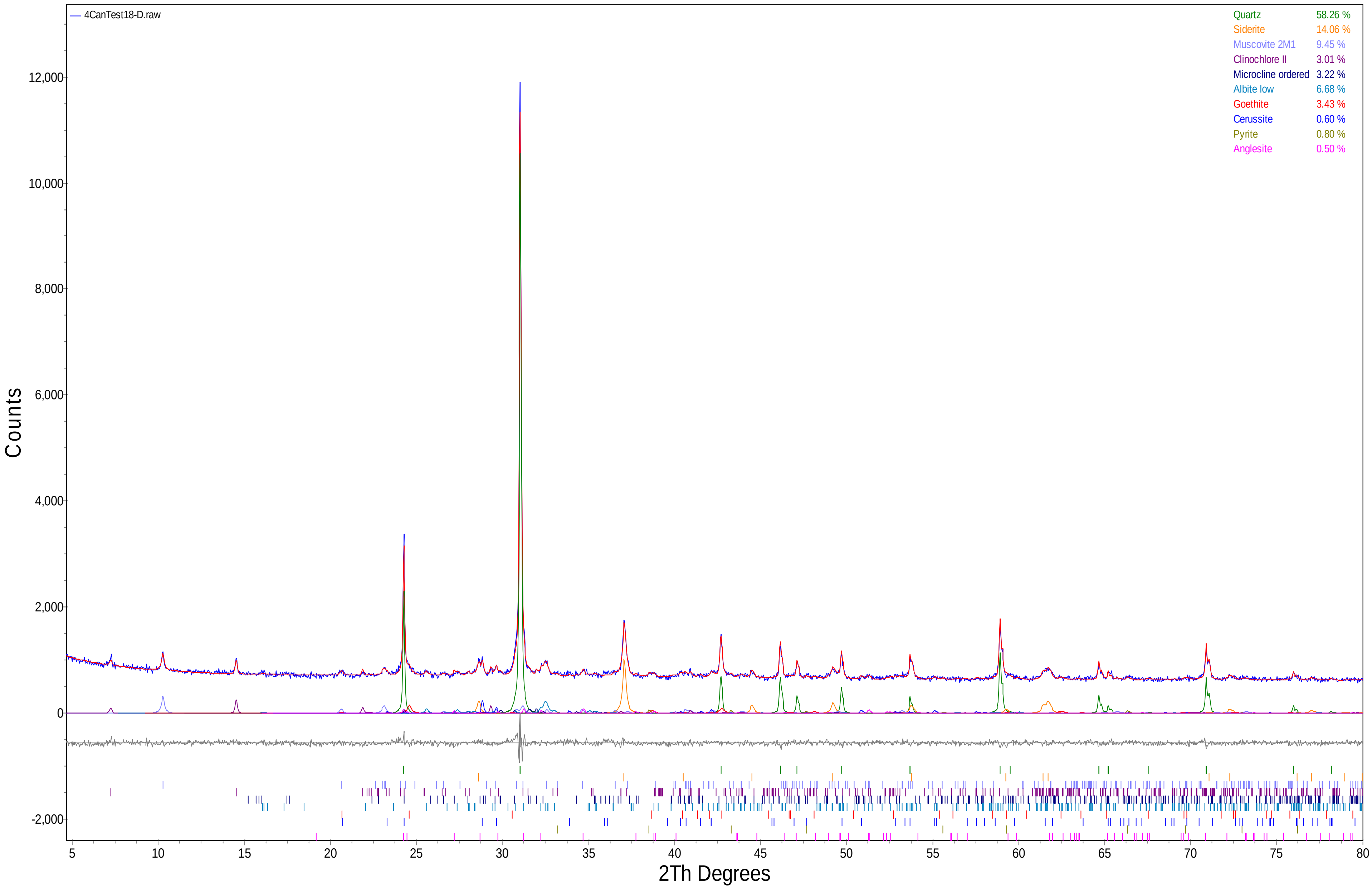

Figure 4. Rietveld refinement plot of sample **18-D** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

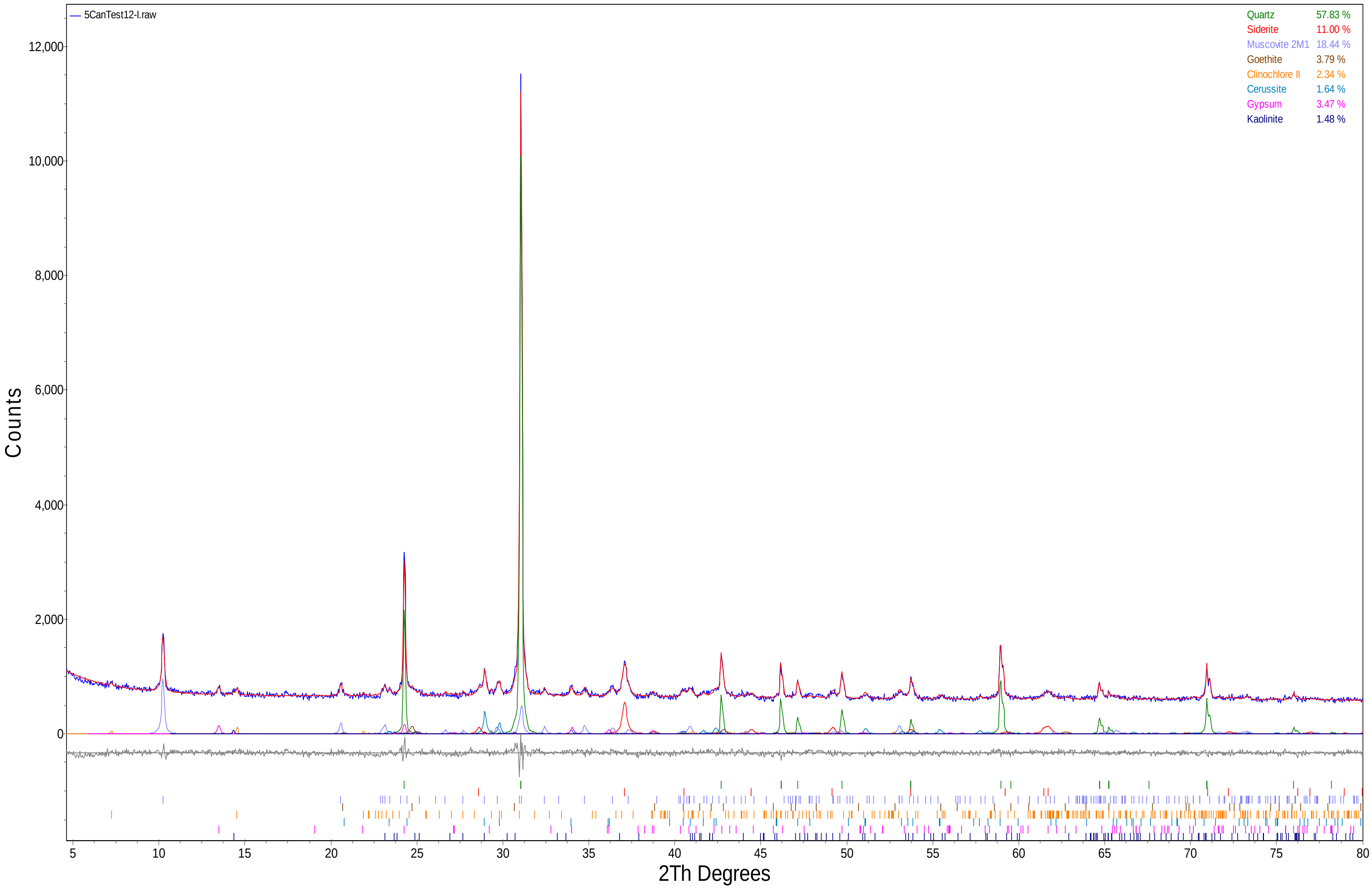

Figure 5. Rietveld refinement plot of sample **12-I** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction patterns of all phases.

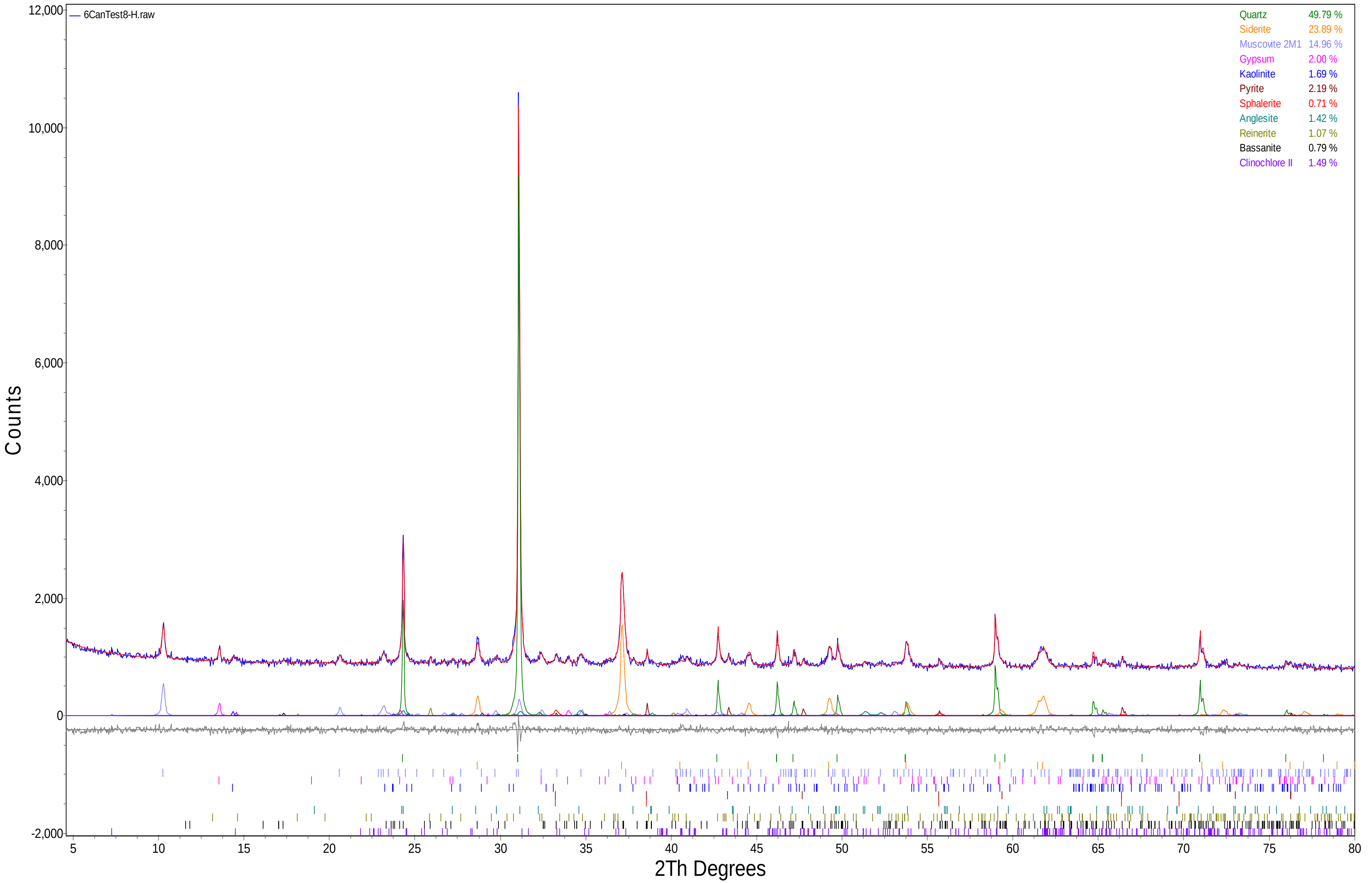

Figure 6. Rietveld refinement plot of sample **8-H** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are individual diffraction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

Appendix E3

Electron Microprobe Report

MINERAL SERVICES
CANADA

REPORT NO. MSC07/028R

CHARACTERIZATION OF CARBONATE COMPOSITION IN SIX SAMPLES FROM THE KENO HILL PROJECT BY ELECTRON MICROPROBE ANALYSIS

Report prepared for
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May 1, 2008

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CHARACTERIZATION OF CARBONATE COMPOSITION IN SIX SAMPLES FROM THE KENO HILL PROJECT BY ELECTRON MICROPROBE ANALYSIS

1. INTRODUCTION

The results of microprobe analysis of six samples from the Keno Hill Ag-Pb-Zn Project are presented in this report. The samples were received March 31, 2008 from Tim O'Hearn of CanTest Ltd.

The purpose of the study was to characterize the composition of carbonates using electron microprobe analysis of 15 to 20 target carbonate grains per sample. The polished thin sections prepared previously for petrographic analysis of the samples were made available for this study.

2. METHODS

1) Target grain definition

Polished thin sections of the samples were examined by the author in the office of Mineral Services Canada Inc. using a Nikon eclipse E400 microscope equipped with transmitted and reflected light. Representative carbonate grains were selected for analysis and maps to facilitate recognition of the carbonates under the microprobe were also prepared.

2) Microprobe analyses

Electron microprobe analysis was carried out by Mati Raudsepp at the University of British Columbia, on a fully-automated Cameca SX-50 Scanning Electron Microprobe with four vertical wavelength-dispersion X-ray spectrometers and a fully-integrated SAMx energy-dispersion X-ray spectrometer. One of the spectrometers has two layered dispersion elements (W/Si, Ni/C), which allow for quantitative analysis of the light elements (F, O, N, C, B). The detection limit for Pb is about 0.3 wt%.

Approximately 25 points were analyzed per sample, but the results from only twenty of the analyses from each sample (those with total oxide closest to 100.00 %) were preserved and used in the interpretation.

3. SUMMARY OF RESULTS

The results of microprobe analysis are presented in the Appendix and indicate the following:

- The analyzed carbonates in all the samples are similar in composition. They contain approximately 26 to 50 wt% FeO and approximately 11 to 30 wt% MnO and are thus identified as carbonates within the siderite - rhodochrosite series (typically manganese-rich siderite).
- CaO and MgO are present in all siderite – rhodochrosite analyses in amounts typically well below 5 wt%.
- A minor lead component was detected in only one of the siderite – rhodochrosite analyses (1.7 wt% PbO in analysis 18D-4). No lead component was detected in the other analyses (detection limit for Pb is 0.3 wt%).
- One grain of probable calcite composition was also identified (analysis 12I-4), although the reliability of the result is poor due to the low total oxide of the analysis (97.05 wt%).

Results reported by:
Alexandra Mauler, Ph. D.

Signed and sealed on May 1, 2008
by Tom Nowicki, P. Geo.
APEG BC Lic. # 30747

APPENDIX: RESULTS OF MICROPROBE ANALYSIS

A1: SAMPLE 6-B

	Oxide wt.% (*CO2 from stoichiometry)						
	MgO	CaO	MnO	FeO	PbO	CO2 *	TOTAL
6B-1	4.23	4.55	16.38	35.19	0.00	39.91	100.26
6B-2	3.44	4.89	18.91	33.51	0.00	39.85	100.60
6B-3	2.49	0.66	21.82	37.08	0.00	39.49	101.54
6B-4	2.63	0.60	21.79	37.32	0.00	39.72	102.06
6B-5	2.60	1.12	21.99	35.82	0.00	39.30	100.83
6B-6	3.20	1.54	21.19	35.48	0.00	39.58	100.99
6B-7	2.89	1.48	22.11	35.40	0.00	39.72	101.60
6B-8	3.51	1.80	20.77	35.53	0.00	39.90	101.51
6B-9	3.18	1.12	21.64	35.22	0.00	39.35	100.51
6B-10	2.22	1.76	27.99	30.14	0.00	39.63	101.74
6B-11	1.76	0.49	26.56	33.83	0.00	39.51	102.15
6B-12	2.02	0.54	26.36	33.45	0.00	39.47	101.84
6B-13	2.30	1.27	26.13	32.67	0.00	39.73	102.10
6B-14	1.95	0.85	23.07	36.86	0.00	39.69	102.42
6B-15	2.86	1.37	23.00	34.73	0.00	39.74	101.70
6B-16	4.51	3.40	16.00	36.83	0.00	40.08	100.82
6B-17	1.87	0.71	23.37	36.29	0.00	39.33	101.57
6B-18	2.33	1.28	21.93	36.39	0.00	39.45	101.38
6B-19	2.62	1.66	22.55	34.77	0.00	39.45	101.05
6B-20	3.67	1.35	18.70	37.78	0.00	39.81	101.31

A2: SAMPLE 7-B

Oxide wt.% (*CO2 from stoichiometry)

	MgO	CaO	MnO	FeO	PbO	CO2 *	TOTAL
7B-1	2.64	1.35	21.26	36.20	0.00	39.31	100.76
7B-2	1.47	0.56	25.34	34.64	0.00	38.98	100.99
7B-3	1.45	0.48	24.25	36.16	0.00	39.15	101.49
7B-4	1.76	0.51	21.87	37.47	0.00	38.84	100.45
7B-5	1.82	0.84	22.43	36.88	0.00	39.15	101.12
7B-6	1.20	1.11	25.83	33.88	0.00	38.96	100.98
7B-7	2.81	0.88	22.58	35.16	0.00	39.31	100.74
7B-8	2.36	0.97	22.01	36.28	0.00	39.22	100.84
7B-9	2.15	0.92	21.96	36.40	0.00	38.99	100.42
7B-10	2.78	1.04	20.76	36.57	0.00	39.13	100.28
7B-11	1.45	0.83	24.78	34.95	0.00	39.02	101.03
7B-12	2.04	0.97	27.14	31.75	0.00	39.28	101.18
7B-13	1.90	0.94	26.91	31.47	0.00	38.78	100.00
7B-14	1.43	0.78	25.19	34.60	0.00	39.00	101.00
7B-15	1.41	0.54	24.80	35.49	0.00	39.09	101.33
7B-16	3.19	1.00	22.58	34.98	0.00	39.70	101.45
7B-17	1.04	0.69	26.24	34.45	0.00	39.06	101.48
7B-18	1.25	0.80	25.65	34.41	0.00	38.98	101.09
7B-19	2.29	1.10	26.37	32.18	0.00	39.44	101.38
7B-20	1.68	0.56	26.94	33.23	0.00	39.34	101.75

A3: SAMPLE 8-H

	Oxide wt.% (*CO2 from stoichiometry)						
	MgO	CaO	MnO	FeO	PbO	CO2 *	TOTAL
8H-1	2.72	2.58	26.66	29.07	0.00	39.34	100.37
8H-2	2.74	0.86	28.27	29.43	0.00	39.23	100.53
8H-3	1.64	1.04	24.95	33.19	0.00	38.42	99.24
8H-4	1.84	0.93	24.80	33.81	0.00	38.84	100.22
8H-5	2.80	0.88	21.04	36.47	0.00	39.14	100.33
8H-6	2.30	0.81	24.75	33.70	0.00	39.15	100.71
8H-7	1.74	0.87	25.90	33.82	0.00	39.37	101.70
8H-8	2.08	0.93	26.23	33.17	0.00	39.59	102.00
8H-9	2.04	1.23	27.07	32.10	0.00	39.65	102.09
8H-10	1.51	0.70	23.74	35.99	0.00	38.97	100.91
8H-11	1.65	0.48	24.77	35.21	0.00	39.11	101.22
8H-12	2.37	1.12	23.49	35.20	0.00	39.60	101.78
8H-13	2.52	1.12	22.89	34.91	0.00	39.22	100.66
8H-14	1.57	0.93	28.70	31.09	0.00	39.29	101.58
8H-15	2.18	1.03	22.62	35.77	0.00	39.13	100.73
8H-16	2.90	1.24	20.79	35.41	0.00	38.73	99.07
8H-17	3.69	1.65	19.76	36.67	0.00	40.05	101.82
8H-18	2.92	1.11	20.03	37.80	0.00	39.64	101.50
8H-19	3.87	1.95	18.84	35.90	0.00	39.44	100.00
8H-20	4.54	2.20	16.42	38.13	0.00	40.23	101.52

A4: SAMPLE 12-I

Oxide wt.% (*CO2 from stoichiometry)

	MgO	CaO	MnO	FeO	PbO	CO2 *	TOTAL
12I-1	2.40	4.10	28.68	26.69	0.00	39.98	101.85
12I-2	1.17	0.62	22.63	37.60	0.00	38.84	100.86
12I-3	2.39	1.07	24.48	34.21	0.00	39.59	101.74
12I-4	0.27	52.81	0.40	0.98	0.00	42.59	97.05
12I-5	1.16	2.65	26.11	31.34	0.00	38.74	100.00
12I-6	1.58	3.42	24.55	31.75	0.00	39.09	100.39
12I-7	4.05	2.38	21.04	34.69	0.00	40.59	102.75
12I-8	1.46	0.76	25.59	33.35	0.00	38.50	99.66
12I-9	1.50	0.61	25.85	34.15	0.00	39.07	101.18
12I-10	3.92	1.22	16.11	39.61	0.00	39.50	100.36
12I-11	2.21	1.45	23.00	34.17	0.00	38.75	99.58
12I-12	1.40	1.12	27.04	31.96	0.00	38.76	100.28
12I-13	1.27	0.41	21.30	39.13	0.00	38.89	101.00
12I-14	1.15	0.35	21.61	39.43	0.00	39.09	101.63
12I-15	0.45	0.11	10.93	49.86	0.00	37.90	99.25
12I-16	1.52	0.63	24.71	35.35	0.00	39.14	101.35
12I-17	2.78	1.41	21.52	35.00	0.00	38.93	99.64
12I-18	2.73	1.79	22.32	34.71	0.00	39.49	101.04
12I-19	2.06	4.99	28.17	26.24	0.00	39.72	101.18
12I-20	1.81	0.38	16.96	42.54	0.00	38.85	100.54

A5: SAMPLE 14-C

Oxide wt.% (*CO2 from stoichiometry)

	MgO	CaO	MnO	FeO	PbO	CO2 *	TOTAL
14C-1	2.97	2.31	21.01	34.80	0.00	39.41	100.50
14C-2	3.06	2.01	21.62	34.69	0.00	39.58	100.96
14C-3	2.75	2.13	21.67	34.87	0.00	39.48	100.90
14C-4	1.50	0.87	24.36	34.27	0.00	38.43	99.43
14C-5	1.81	0.51	25.16	35.10	0.00	39.49	102.07
14C-6	1.59	0.55	21.02	38.72	0.00	38.93	100.81
14C-7	1.27	1.04	28.17	31.58	0.00	39.02	101.08
14C-8	2.91	0.49	20.54	37.78	0.00	39.45	101.17
14C-9	1.51	0.66	25.64	34.14	0.00	38.99	100.94
14C-10	0.91	0.21	15.79	45.77	0.00	38.99	101.67
14C-11	3.48	1.28	20.71	36.15	0.00	39.80	101.42
14C-12	4.59	3.61	16.24	35.57	0.00	39.71	99.72
14C-13	1.11	0.38	16.83	43.84	0.00	38.81	100.97
14C-14	2.62	1.98	21.19	35.85	0.00	39.52	101.16
14C-15	1.74	1.21	26.16	32.30	0.00	38.86	100.27
14C-16	1.13	0.63	25.48	34.58	0.00	38.72	100.54
14C-17	2.16	1.10	26.34	32.34	0.00	39.37	101.31
14C-18	4.17	3.58	13.45	39.80	0.00	40.09	101.09
14C-19	3.07	0.95	20.09	37.16	0.00	39.32	100.59
14C-20	1.32	0.66	26.85	33.15	0.00	38.92	100.90

A6: SAMPLE 18-D

			Oxide wt.% (*CO2 from stoichiometry)				
	MgO	CaO	MnO	FeO	PbO	CO2 *	TOTAL
18D-1	2.11	0.88	25.16	34.18	0.00	39.54	101.87
18D-2	3.34	2.42	19.37	35.56	0.00	39.35	100.04
18D-3	3.99	3.20	19.65	33.93	0.00	39.84	100.61
18D-4	2.18	2.13	25.90	29.59	1.72	38.59	100.11
18D-5	2.18	1.60	24.03	34.19	0.00	39.49	101.49
18D-6	2.30	1.60	23.87	34.45	0.00	39.68	101.90
18D-7	2.18	0.58	22.58	37.19	0.00	39.63	102.16
18D-8	1.81	1.42	28.05	30.84	0.00	39.38	101.50
18D-9	2.09	0.88	23.44	35.90	0.00	39.51	101.82
18D-10	1.63	1.32	29.69	29.93	0.00	39.57	102.14
18D-11	1.99	1.69	26.07	32.72	0.00	39.72	102.19
18D-12	2.56	2.03	21.72	35.47	0.00	39.59	101.37
18D-13	2.18	1.01	21.43	36.66	0.00	38.92	100.20
18D-14	2.23	1.04	22.89	35.91	0.00	39.45	101.52
18D-15	4.08	2.01	16.71	38.71	0.00	40.11	101.62
18D-16	3.28	0.92	20.74	37.13	0.00	39.91	101.98
18D-17	4.64	1.94	16.39	38.05	0.00	40.07	101.09
18D-18	1.89	1.67	25.47	33.59	0.00	39.75	102.37
18D-19	1.69	1.70	23.54	35.28	0.00	39.39	101.60
18D-20	1.84	1.58	24.09	34.07	0.00	39.06	100.64

Appendix F

Tailings Static Test Results

Appendix F1

Shake Flask Extraction Results

CANTEST Ltd. 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.cantest.com

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Table 6: Results of BCMEM Shakeflask Extraction on 6 (of 34) Keno Hill Samples - March 2008

S. No:				1	2	3	4	5	6	7	Method Blank
				Sample ID							
Parameter	Units	Method	Detection Limit	6-B	7-B	8-H	12-I	14-C	18-D	UKTP23C	
pH (24h)	pH Units	pH Meter	0.5	6.4	6.6	6.5	7.9	7.9	7.1	7.0	5.7
Conductivity (24h)	µS/cm	Conductivity Meter	0.5	1504	5310	10050	2620	391	2850	929	1.0
Dissolved Metals (Cantest)											
Dissolved Aluminum Al	mg/L	ICP-ES	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	-
Dissolved Antimony Sb	mg/L	ICP-ES	0.05	< 0.05	< 0.05	0.15	< 0.05	< 0.05	0.12	< 0.05	-
Dissolved Arsenic As	mg/L	ICP-ES	0.03	< 0.03	0.04	0.1	< 0.03	< 0.03	< 0.03	< 0.03	-
Dissolved Barium Ba	mg/L	ICP-ES	0.001	0.017	0.005	0.002	0.011	0.024	0.012	0.006	-
Dissolved Beryllium Be	mg/L	ICP-ES	0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	< 0.003	-
Dissolved Boron B	mg/L	ICP-ES	0.01	< 0.01	< 0.01	0.02	0.02	0.01	0.03	0.01	-
Dissolved Cadmium Cd	mg/L	ICP-ES	0.01	2.71	4.85	13.4	0.04	0.03	7.63	3.95	-
Dissolved Calcium Ca	mg/L	ICP-ES	0.05	243	477	438	584	54.8	136	48.2	-
Dissolved Chromium Cr	mg/L	ICP-ES	0.01	< 0.01	0.09	0.2	< 0.01	< 0.01	0.03	< 0.01	-
Dissolved Cobalt Co	mg/L	ICP-ES	0.02	0.03	0.13	0.89	< 0.02	< 0.02	0.26	0.03	-
Dissolved Copper Cu	mg/L	ICP-ES	0.02	< 0.02	< 0.02	0.06	< 0.02	< 0.02	< 0.02	0.04	-
Dissolved Iron Fe	mg/L	ICP-ES	0.01	0.01	0.01	0.04	0.02	< 0.01	< 0.01	< 0.01	-
Dissolved Lead Pb	mg/L	ICP-ES	0.03	2.06	2.07	2.47	0.1	< 0.03	1.5	3.24	-
Dissolved Magnesium Mg	mg/L	ICP-ES	0.05	16.8	161	585	31.2	23.3	127	56.5	-
Dissolved Manganese Mn	mg/L	ICP-ES	0.003	167	1280	2870	0.75	0.71	381	95.8	-
Dissolved Molybdenum Mo	mg/L	ICP-ES	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-
Dissolved Nickel Ni	mg/L	ICP-ES	0.02	0.04	0.19	1.62	< 0.02	< 0.02	0.51	0.04	-
Dissolved Phosphorus P	mg/L	ICP-ES	0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	< 0.15	-
Dissolved Potassium K	mg/L	ICP-ES	0.25	1.3	3	16.4	3.3	0.5	1.7	1.7	-
Dissolved Silicon Si	mg/L	ICP-ES	0.05	0.88	2.99	6.77	1.1	0.96	3.52	1.69	-
Dissolved Silver Ag	mg/L	ICP-ES	0.01	< 0.01	0.07	0.17	< 0.01	< 0.01	0.02	< 0.01	-
Dissolved Sodium Na	mg/L	ICP-ES	0.1	0.5	7.4	20.4	11.9	0.8	1.2	0.4	-
Dissolved Strontium Sr	mg/L	ICP-ES	0.001	0.19	0.16	0.28	1.22	0.097	0.021	0.009	-
Dissolved Tin Sn	mg/L	ICP-ES	0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	< 0.03	-
Dissolved Titanium Ti	mg/L	ICP-ES	0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	-
Dissolved Vanadium V	mg/L	ICP-ES	0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	-
Dissolved Zinc Zn	mg/L	ICP-ES	0.005	51.8	64.8	567	0.32	0.15	217	79.6	-
Dissolved Zirconium Zr	mg/L	ICP-ES	0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	< 0.02	-
Dissolved Sulphur S	mg/L	ICP-ES	0.05	326	1350	3000	487	46.3	596	200	-

Extraction Method Used: Using Rotary Extractor for 24h.
Liquid:Solid Ratio Used = 3:1; 750ml DI H2O:250g Cone crushed (<9.5 mm) Sample.

Appendix F2

ABA Results

CANTEST Ltd. 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.cantest.com

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Table 1: ABA Test Results for 6 (of 34) Keno Hill Samples - March 2008

									Mod. ABA NP			**Siderite NP**
S. No.	**Sample ID**	**Paste pH**	**Total C (Wt.%)**	**CaCO3 NP (Kg CaCO3)**	**Total Sulphur (Wt.%)**	**Sulphate Sulphur (Wt.%)**	**Sulphide Sulphur* (Wt.%)**	**Maximum Potential Acidity** (Kg CaCO3)**	**Neutralization Potential (Kg CaCO3)**	**Net Neutralization Potential (Kg CaCO3)**	**Fizz Rating**	**Neutralization Potential (Kg CaCO3)**
1	6-B	5.9	4.3	358	6.45	0.22	6.23	194.7	149.1	-45.6	Moderate	164.2
2	7-B	5.6	1.9	158	1.76	0.72	1.04	32.5	30.4	-2.1	Slight	42.5
6	18-D	6.4	4.9	407	0.69	0.27	0.42	13.1	42.0	28.9	Moderate	66.7
3	8-H	5.6	3.6	298	2.71	1.27	1.44	45.0	26.7	-18.3	Slight	43.2
4	12-I	7.8	1.6	135	0.54	0.25	0.29	9.1	62.0	53.0	Moderate	74.1
5	14-C	7.4	1.4	113	0.35	0.09	0.26	8.1	65.8	57.7	Moderate	92.0
Client's Request												
1	7-B								42.6		as if Moderate	
2	8-H								44.5		as if Moderate	
Detection Limits		*0.1*	*0.01*	*0.8*	*0.01*	*0.01*	*0.01*	*0.3*				
CANTEST SOP No:		7160	LECO	Calculation	LECO	7410	Calculation	Calculation	7150	Calculation	7150	7120

Notes:

T-S values are what was reported earlier

*Based on difference between total sulphur and sulphate-sulphur

**Based on sulphide-sulphur

Total Sulphur by LECO furnace

Reference for Mod ABA NP method (SOP No. 7150): MEND Acid Rock Drainage Prediction Manual, MEND Project 1.16.1b (pages 6.2-11 to 17), March 1991.

Siderite NP Method Used (Cantest SOP No. 7120): Peroxide Siderite Correction for Sobek Method

Appendix F3

Elemental Analysis Results

CANTEST
CANTEST Ltd. 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.cantest.com

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Table 3: Trace Metals Using Aqua Regia Digestion with ICP-MS/ES Finish for 6 (of 34) Keno Hill Samples - March 2008

S. No:	Sample ID	Ag ppm	Al %	As ppm	Ba ppm	Bi ppm	Ca %	Cd ppm	Co ppm	Cr ppm	Cu ppm	Fe %	Ga ppm	Hg ppb	K %	La ppm	Mg %	Mn ppm	Mo ppm	Na %	Ni ppm	P ppm	Pb ppm	S %	Sb ppm	Sc ppm	Se ppm	Sr ppm	Te ppm	Th ppm	Ti %	Tl ppm	U ppm	V ppm	W ppm	Y ppm	Zn ppm
1	6-B	10.6	0.17	2564	18	0.2	0.52	173.0	8.5	95	180	18.47	5.8	1620	0.03	1.4	0.62	24790	8.2	0.04	21.6	162	6731	5.54	190.5	1.6	2.4	4	<.5	1.0	<.01	6.8	1.5	<2	1.0	11.3	9451
2	7-B	4.5	0.19	1329	23	0.1	0.42	72.0	5.1	77	145	10.88	4.4	695	0.04	2.4	0.29	17900	6.0	0.04	15.1	337	6178	1.64	70.2	1.3	1.6	5	<.5	1.6	<.01	2.1	1.8	<2	0.5	7.6	5003
3	7-D	2.6	0.75	238	169	0.2	0.91	92.9	15.5	82	101	3.40	4.8	233	0.06	4.8	0.55	15600	6.8	0.05	47.4	736	1920	2.01	10.5	2.8	2.5	24	<.5	1.8	<.01	0.6	2.1	19	0.6	6.3	4992
4	8-H	4.8	0.33	1755	42	0.2	0.58	124.0	9.6	45	256	10.46	5.1	661	0.08	3.3	0.45	20490	3.8	0.04	27.3	460	9163	2.41	57.8	1.8	2.9	11	<.5	2.9	<.01	2.0	2.6	<2	0.6	10	6952
5	8-I	3.1	0.93	75	234	0.1	1.13	21.6	17.7	44	50	2.38	4.3	92	0.08	6.3	0.56	9316	2.2	0.05	35.2	731	222	1.49	1.0	3.6	3.7	39	<.5	2.1	0.01	0.3	1.9	28	0.4	6.6	3593
6	12-I	3.2	0.51	743	178	0.4	0.80	125.0	4.1	70	250	8.29	4.5	751	0.08	4.2	0.20	16420	4.9	0.04	16.6	688	24840	0.46	255.5	2.9	2.9	32	<.5	3.3	<.01	1.3	2.2	6	0.2	6.6	4652
7	13-G	2.2	0.23	425	201	0.2	0.46	117.5	3.8	83	148	7.30	3.9	396	0.05	3.2	0.17	18880	5.7	0.04	11.5	349	10900	0.58	158.6	1.8	1.6	23	<.5	1.5	<.01	1.2	1.0	<2	0.4	5.1	4387
8	13-I	2.8	0.11	38	303	<.1	2.49	2.3	2.2	5	19	0.89	1.0	60	<.01	<1	0.23	2329	3.5	0.05	14.9	350	206	0.87	5.3	0.4	0.8	77	<.5	<.2	<.01	<.1	0.3	2	0.4	0.9	194
9	14-C	4	0.31	1072	279	0.1	0.30	181.0	3.4	60	162	12.27	5.1	449	0.07	3.6	0.20	22500	4.0	0.04	12.7	541	12860	0.31	169.6	3.4	2.8	22	<.5	2.0	<.01	1.1	1.6	<2	0.2	8.2	4008
10	14-H	2.2	0.51	339	397	0.1	1.38	73.6	15.1	11	577	4.60	1.6	159	0.03	3.9	0.18	2654	3.7	0.04	42.1	1283	212	0.66	5.5	2.5	3.4	60	<.5	1.3	<.01	0.5	1.6	18	0.5	6	3127
11	15-F	2.6	1.26	57	305	0.1	1.35	7.6	11.6	81	64	2.57	3.7	137	0.07	8.6	0.42	1490	5.1	0.05	33.7	877	545	0.62	2.1	4.1	2.5	50	<.5	2.5	0.01	0.2	2.5	33	0.3	8.5	440
12	16-G	3.5	1.17	43	329	0.1	1.06	3.5	16.5	83	43	2.42	3.4	116	0.07	8.7	0.34	1544	4.7	0.05	35.8	860	145	0.32	0.6	3.4	1.5	38	<.5	2.4	0.01	0.2	2.3	30	0.2	7.1	236
13	17-E	2.4	1.06	97	217	0.1	0.98	18.2	18.5	40	102	2.97	4.0	120	0.08	6.6	0.39	7682	2.9	0.04	39.4	824	1026	1.39	4.2	3.6	1.7	31	<.5	2.5	0.01	0.5	2.4	26	0.2	6.9	3683
14	18-D	3.1	0.6	654	141	0.1	0.43	425.0	10.2	85	407	7.90	4.9	404	0.07	4.9	0.40	16690	5.6	0.04	36	611	16820	0.62	115.6	2.6	2.6	16	<.5	2.4	<.01	0.9	1.7	12	0.2	8.3	7077
15	18-F	3	1.24	32	462	0.1	1.27	1.9	14.9	42	60	2.07	3.9	90	0.08	8.3	0.50	653	2.8	0.05	42	859	87	0.63	0.6	4.6	2.8	47	<.5	2.7	<.01	0.4	2.6	34	0.5	8.2	230
16	19-K	2.1	1.39	34	489	0.1	0.64	1.8	16.3	52	65	3.28	4.7	91	0.08	11.7	0.47	713	3.3	0.05	36.9	935	76	0.19	0.4	5.1	2.1	32	<.5	3.8	0.01	0.3	2.6	40	0.3	9	176
17	UKTP22E	7.3	0.17	1790	17	0.2	0.51	157.0	5.6	64	151	15.90	5.7	1231	0.04	1.7	0.57	<5	5.4	0.04	14.6	231	6424	3.69	148.9	1.7	2.2	9	<.5	1.2	<.01	5.1	1.7	<2	0.8	10.8	8906
18	UKTP23C	28.1	0.23	993	28	0.1	0.29	195.0	5.7	45	761	14.80	5.0	1262	0.04	1.7	0.36	<5	3.8	0.04	13.3	254	47400	2.66	598.3	1.9	2.9	7	<.5	1.2	<.01	1.8	1.4	<2	0.3	8.8	7245
QA/QC (Duplicates																																					
10	14-H	2.4	0.52	341	400	0.1	1.38	76.4	15.3	13	574	4.67	1.6	154	0.04	3.9	0.19	2587	3.8	0.04	43	1312	215	0.68	5.9	2.5	3.4	60	<.5	1.3	<.01	0.5	1.6	20	0.3	6.2	3152
18	UKTP 23 C	25.8	0.22	961	25	0.1	0.28	189	5.6	44	742	14.38	5.2	1224	0.04	1.7	0.36	<5	3.6	0.04	12.8	253	47020	2.56	507.2	1.8	2.7	7	<.5	1.2	<.01	1.8	1.4	<2	0.3	8.6	7164
STANDARD MS2		0.3	2.63	25	97	3.3	0.17	0.4	13.1	37	154	3.51	8.4	71	0.35	26.4	0.66	589	10.8	0.06	31.3	562	20	<.05	0.2	5.1	<.5	13	<.5	12.9	0.07	0.30	2.5	39	1	10	140
True Values STD M		0.2	2.7	22	95.0	4	0.2	0.3	13	40	149	3.2	8.0	74	0.33	28	0.65	570	11	0.04	31	540	21	<.05	0.2	5.5	<.5	12	<.5	14	0.07	0.30	3	38	1	11	116
Percent Difference		50.0	-2.6	13.6	2.1	-17.5	6.3	33.3	0.8	-7.5	3.4	9.7	5.0	-4.1	6.1	-5.7	1.5	3.3	-1.8	50.0	1.0	4.1	-4.8	0.0	0.0	-7.3	0.0	8.3	0.0	-7.9	0.0	0.0	-16.7	2.6	0.0	-9.1	20.7
Detection Limits		0.1	0.01	0.5	1	0.1	0.01	0.1	0.1	1	0.2	0.01	1	0.01	0.01	1	0.01	5	0.1	0.01	0.2	0.001	0.2	0.05	0.1	0.1	0.5	1	0.05	0.2	0.005	0.1	0.1	2	0.1	2	1
Method		1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B	1B

Analysis done at Global Discovery Labs (Teck Cominco)

Analytical Methods:
ICP-MS Package: 0.5 gram sample digested in hot reverse aqua regia (soil, silt) or hot aqua regia (for rocks).

Appendix F4

Whole Rock Analysis

CANTEST

CANTEST Ltd. 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.cantest.com

SRK Consulting, Keno Hill, 25-Jan & 4-Feb-08

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Table 4: Results of Whole Rock Analysis by XRF for 6 (of 34) Keno Hill Samples - March 2008

S. No:	Sample ID	SiO2 %	TiO2 %	Al2O3 %	Fe2O3 %	MnO %	MgO %	CaO %	Na2O %	K2O %	P205 %	Ba(F) %	LOI %	Total %
1	6-B	36.34	0.13	2.74	27.12	9.61	1.27	0.75	0.13	0.27	0.03	0.01	19.75	98.15
2	7-B	61.62	0.21	3.67	16.14	4.50	0.75	0.62	0.04	0.55	0.09	0.03	10.96	99.18
6	18-D	55.90	0.37	7.60	11.63	3.66	1.02	0.94	0.59	0.92	0.15	0.06	16.06	98.90
3	8-H	47.95	0.30	8.66	15.63	5.57	1.10	0.90	0.25	1.18	0.11	0.05	18.15	99.85
4	12-I	58.90	0.35	9.17	12.24	3.91	0.66	1.22	0.16	1.49	0.16	0.09	8.66	97.01
5	14-C	57.87	0.27	5.16	17.75	7.03	0.60	0.42	0.22	0.85	0.13	0.07	8.58	98.95
7	UKTP22E	44.10	0.17	3.15	22.69	8.51	1.14	0.73	0.07	0.40	0.07	0.02	17.07	98.12
8	UKTP23C	43.46	0.20	3.47	21.39	8.40	0.81	0.41	0.17	0.42	0.09	0.02	14.22	93.06
QA/QC														
STD: SY-4		49.71	0.27	20.70	6.20	0.11	0.53	7.93	7.21	1.65	0.13	0.04	4.47	98.96
True Value Std SY-4		49.90	0.29	20.69	6.21	0.11	0.54	8.05	7.10	1.66	0.13	0.03	-	-
Percent Difference		0.4	6.9	0.0	0.2	0.0	1.9	1.5	-1.5	0.6	0.0	-17.6	-	-
Detection Limits		0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	-	-

Analytical Methods:

Other elements by Li borate fusion/XRF. Where no FeO value shown "Fe2O3" is total Fe as Fe2O3

Note: Data from Global Discovery Labs (Teck Cominco).

Appendix F5

Tailings Assays

TR08121502	Finalized
CLIENT	ALERES - Alexco Resource Corp.
# of SAMPLES	33
DATE RECEIVED	260808
DATE COMPLETED	180908
PROJECT	Keno Hill(1)
CERTIFICATE COMMENT:	ALL:NSS is non-sufficient sample.
PO NUMBER	1620-720-034

	WEI-21	Au-AA25	ME-ICP61(2)			ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61		ME-ICP61	ME-ICP61	Pb-OG62	Ag-OG62	Zn-OG62
SAMPLE	**Recvd Wt.**	**Au**	**Ag**	**Al**	**As**	**Ba**	**Be**	**Bi**	**Ca**	**Cd**	**Co**	**Cr**	**Cu**	**Fe**	**Ga**	**K**	**La**	**Mg**	**Mn**	**Mo**	**Na**	**Ni**	**P**	**Pb**	**S**	**Sb**	**Sc**	**Sr**	**Th**	**Ti**	**Tl**	**U**	**V**	**W**	**Zn**	**Pb**	**Ag**	**Zn**
DESCRIPTION	**kg**	**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**	**%**
DETECTION	0.02	0.01	0.5	0.01	5	10	0.5	2	0.01	0.5	1	1	1	0.01	10	0.01	10	0.01	5	1	0.01	1	10	2	0.01	5	1	1	20	0.01	10	10	1	10	2	0.01	0.5	0.01
TP-08-03	4.52	0.1	60.5	1.12	765	180	<0.5	<2	0.28	74.1	3	22	104	7.58	<10	0.33	10	0.28	32900	1	0.02	9	250	7240	1.71	210	2	13	<20	0.07	10	<10	22	<10	5140		60.5	
TP-08-04	5.99	0.17	>100	1.09	729	210	<0.5	<2	0.34	178	3	15	529	13.35	<10	0.31	10	0.39	62000	<1	0.02	7	310	>10000	1.22	603	3	19	<20	0.1	20	<10	27	<10	8240	2.72	609	
TP-08-08	4.8	0.14	80.3	1.2	1250	180	<0.5	<2	0.6	115	4	16	116	11.6	<10	0.32	10	0.43	51100	<1	0.02	12	300	8350	3.26	265	3	20	<20	0.06	20	<10	23	<10	7070		80.3	
TP-08-10	4.54	0.11	95.8	1.63	1045	230	<0.5	<2	0.53	126	4	27	179	11.05	<10	0.46	10	0.39	47600	1	0.03	11	350	>10000	2.41	350	4	22	<20	0.1	20	<10	33	<10	7540	1.14	95.8	
TP-08-10A	0.06	1.52	21.9	7	8	800	0.9	<2	4.35	102	9	21	2680	4.56	20	0.66	10	1.34	1235	3	1.59	7	800	>10000	1.74	32	11	504	<20	0.24	<10	<10	102	<10	>10000	1.24	21.9	2.07
UKTP03-A	1.92	0.28	>100	0.82	2870	120	<0.5	2	0.37	117	5	11	121	19.05	<10	0.23	10	0.33	76200	<1	0.01	16	290	5810	6.6	265	3	11	<20	0.06	20	<10	18	<10	8590		145	
UKTP03-B	1.77	0.26	>100	1.27	2000	170	<0.5	5	0.36	93.8	4	19	191	16.4	<10	0.36	10	0.45	59900	<1	0.02	12	260	>10000	4.74	313	3	19	<20	0.08	20	<10	25	<10	6320	1.26	155	
UKTP03-C	1.34	0.12	>100	4.69	287	950	1.1	<2	1.17	493	14	66	117	4.31	10	0.97	30	0.66	10850	1	0.68	54	910	660	1.03	31	10	132	<20	0.31	10	<10	89	<10	5500		126	
UK-TP03-Z	7.53	0.22	>100	1.89	1705	300	0.5	<2	0.56	186	7	31	140	14.45	<10	0.45	10	0.46	52800	<1	0.17	24	410	6670	4.59	220	5	42	<20	0.12	20	<10	39	<10	6830		148	
UK-TP03-ZZ	<0.02	0.23	>100	1.74	1710	280	0.5	3	0.54	176.5	7	26	137	14.85	<10	0.42	10	0.45	55000	<1	0.15	22	370	6760	4.8	226	4	38	<20	0.11	20	<10	35	<10	6970		143	
UKTP07-A	1.71	0.15	>100	1.12	1635	160	<0.5	<2	0.33	130.5	3	19	114	11.3	<10	0.32	10	0.29	38500	<1	0.02	13	300	6900	2	190	3	14	<20	0.06	10	<10	23	<10	4570		104	
UKTP07-C	2.32	0.08	59.2	2.99	865	410	0.7	<2	0.79	169	7	48	304	9.63	10	0.86	10	0.32	43400	<1	0.07	16	450	>10000	2.4	535	6	40	<20	0.14	10	<10	57	<10	8210	1.71	59.2	
UKTP07-D	1.15	0.01	13.8	2.58	160	560	0.7	<2	1.31	103	16	40	108	3.2	10	0.55	10	0.6	24400	2	0.3	48	750	1640	2.16	47	6	72	<20	0.16	10	<10	56	<10	7150		13.8	
UKTP07-Z	5.42	0.11	69.2	2.04	909	310	0.5	<2	0.68	160	6	34	207	9.01	10	0.57	10	0.32	36400	1	0.07	18	400	>10000	2.11	322	4	31	<20	0.11	10	<10	41	<10	6470	1.13	69.2	
UKTP12-A	1.84	0.06	>100	1.17	660	250	<0.5	<2	0.13	72.3	2	25	244	5.59	<10	0.33	10	0.09	19400	1	0.03	8	320	7820	0.23	358	3	28	<20	0.08	10	<10	25	<10	2290		154	
UKTP12-H	1.54	0.05	>100	1.15	337	320	<0.5	<2	0.41	80.7	1	20	100	5.83	<10	0.34	10	0.16	30200	1	0.02	5	260	8960	0.45	277	3	27	<20	0.09	10	<10	26	<10	3690		114	
UKTP12-HH	1.05	<0.01	0.7	0.14	7	10	<0.5	<2	18.6	0.5	2	4	1	0.15	<10	0.02	<10	10.85	223	<1	<0.01	3	290	30	0.03	<5	1	106	<20	0.01	<10	<10	3	<10	20		0.7	
UKTP12-N	0.71	NSS	>100	0.99	122	330	<0.5	<2	1.83	12.5	5	18	198	2.57	<10	0.15	<10	0.18	2820	2	0.09	42	1590	460	0.82	14	3	74	<20	0.04	<10	<10	22	<10	579		109	
UKTP12-Z	13.79	0.09	>100	1.97	532	520	0.5	<2	0.46	80.9	4	36	173	6.81	10	0.57	10	0.22	27100	1	0.05	13	410	9240	1.15	310	4	36	<20	0.11	10	<10	41	<10	4250		116	
UKTP14-A	1.62	0.21	>100	0.98	1320	490	<0.5	5	0.28	158	5	17	320	12.8	<10	0.27	10	0.26	52800	<1	0.04	15	240	>10000	3.05	336	3	23	<20	0.09	10	<10	23	<10	9810	1.36	258	
UKTP14-E	2.52	0.3	>100	0.98	1730	310	<0.5	3	0.47	170	9	15	232	13.3	<10	0.3	10	0.36	44400	<1	0.03	26	220	>10000	6.63	303	3	19	<20	0.07	<10	<10	22	<10	>10000	1.39	282	1.28
UKTP14-H	0.77	0.05	>100	3.35	385	1210	0.9	<2	1.49	107.5	14	45	448	4.79	10	0.79	10	0.47	4150	2	0.22	43	950	675	0.58	22	8	93	<20	0.15	<10	<10	73	<10	4920		194	
UKTP14-Z	5.61	0.12	>100	1.33	1145	530	<0.5	<2	0.55	132.5	4	24	174	9.88	<10	0.39	10	0.29	38800	<1	0.05	16	310	9060	2.82	270	4	27	<20	0.09	10	10	29	<10	8010		153	
UKTP14-ZZ	0.06	0.1	>100	4.07	981	300	0.7	343	1.81	6.1	7	35	5190	7.86	10	1.02	10	0.84	8100	567	1	13	1450	668	0.75	1830	10	175	<20	0.15	<10	10	69	<10	465		402	
UKTP15-A	1.84	0.14	83.1	1.11	1620	240	<0.5	6	0.72	103.5	4	18	116	10.1	<10	0.33	10	0.3	40000	1	0.04	15	240	6180	3.13	203	3	17	<20	0.06	<10	10	23	<10	7250		83.1	
UKTP15-C	1.85	0.18	>100	0.92	1905	130	<0.5	2	0.5	178	2	16	149	11.85	10	0.26	10	0.37	48700	<1	0.03	15	200	9900	3.93	303	2	14	<20	0.05	<10	<10	17	<10	>10000		140	1.29
UKTP15-F	1.28	0.02	28.8	3.94	87	810	1	<2	1.71	12.8	9	54	106	3.35	10	0.82	20	0.55	3520	1	0.55	28	910	1295	0.74	44	9	132	<20	0.24	<10	<10	79	<10	855		28.8	
UKTP15-Z	6.62	0.13	81.5	2.23	1475	370	0.6	4	0.86	157.5	6	39	152	10.1	10	0.6	10	0.4	40400	<1	0.12	19	400	9500	2.77	299	5	42	<20	0.11	<10	<10	44	<10	9630		81.5	
UKTP17-A	1.82	0.18	>100	0.86	2570	140	<0.5	4	0.24	174	6	16	148	13.25	<10	0.25	10	0.26	52300	<1	0.03	17	210	>10000	4.78	276	2	12	<20	0.05	<10	10	17	<10	>10000	1.15	131	1.2
UKTP17-C	2.19	0.14	>100	1.08	954	160	<0.5	4	0.32	137	<1	15	499	14.05	<10	0.31	10	0.34	59500	<1	0.04	8	310	>10000	1.7	660	3	14	<20	0.09	10	10	26	<10	6740	3.45	559	
UKTP17-CC	1.06	<0.01	0.8	0.14	<5	10	<0.5	<2	19.95	0.8	1	3	5	0.15	<10	0.03	<10	11.1	265	<1	0.01	1	270	62	0.03	<5	<1	107	<20	0.01	<10	<10	2	<10	31		0.8	
UKTP17-E	1.61	0.22	19	4.86	65	820	1.1	2	1.34	7.7	18	63	53	2.94	10	1.07	20	0.67	7150	<1	0.76	38	830	485	1.22	19	10	135	<20	0.3	<10	<10	89	<10	4080		19	
UKTP17-Z	11.86	0.29	>100	1.35	1720	240	<0.5	6	0.44	125.5	6	21	276	12.15	<10	0.36	10	0.36	46700	<1	0.1	17	390	>10000	3.57	420	4	29	<20	0.09	<10	10	30	<10	8470	1.74	299	
Ch:UKTP03-A																																				0.61	142	0.94
Ch:UK-TP03-ZZ		0.25																																				
Ch:UKTP14-Z																																				0.98	160	0.87
Ch:UKTP17-A			>100	0.89	2610	140	<0.5	6	0.24	177	5	17	152	13.5	<10	0.26	10	0.26	53100	<1	0.04	15	210	>10000	4.9	287	2	12	<20	0.06	10	<10	18	<10	>10000			
Ch:UKTP17-C		0.17																																				
Blank01_08121502		<0.01																																				
Blank02_08121502		<0.01																																				
Blank03_08121502			<0.5	<0.01	<5	<10	<0.5	<2	<0.01	<0.5	<1	1	<1	<0.01	<10	<0.01	<10	<0.01	<5	<1	<0.01	<1	<10	<2	<0.01	<5	<1	<1	<20	<0.01	<10	<10	<1	<10	<2			
Blank04_08121502			<0.5	<0.01	<5	<10	<0.5	<2	<0.01	<0.5	<1	<1	<1	<0.01	<10	<0.01	<10	<0.01	<5	<1	<0.01	<1	10	<2	<0.01	<5	<1	1	<20	<0.01	<10	<10	<1	<10	<2			
Blank05_08121502																																				<0.01	<1	<0.01
Blank06_08121502																																				<0.01	<1	<0.01
St01:OxN62_08121502		7.47																																				
St02:OxN62_08121502		7.76																																				
St03:G2000_08121502			4	4.7	458	2290	1.2	<2	0.6	6.9	22	95	285	3.75	10	1.2	20	0.71	542	6	0.18	256	920	646	0.25	29	10	116	<20	0.33	<10	<10	97	10	1230			
St04:GBM3961c_08121502			8.4	4.14	736	280	0.9	26	3.06	20.5	153	648	2830	8.78	<10	0.76	20	2.57	868	9	0.64	2040	270	1885	3.58	23	13	92	<20	0.24	<10	<10	104	10	6640			
St05:GBM306-12_08121502																																				2.72	4	2.05
St06:GBM399-5_08121502																																				2.18	25	0.95
St07:GBM999-5_08121502			56.9	4.54	<5	170	1.2	<2	0.1	0.5	3	7	461	2.93	10	3.43	10	0.03	132	4	0.95	4	50	535	0.29	<5	2	20	<20	0.02	<10	<10	6	<10	124			
St08:CDN-GS-2C_08121502		2.05																																				
St09:GBM399-5_08121502																																				2.18	22	0.94
St10:OREAS-45P_08121502			<0.5	6.38	16	260	0.7	<2	0.28	0.9	108	999	703	17.3	20	0.31	20	0.18	1240	2	0.07	356	420	24	0.03	<5	62	32	<20	1.01	10	<10	243	<10	146			
St11:GBM306-12_08121502																																				2.72	4	2.03
St12:CDN-GS-2C_08121502		2.17																																				

Notes:

1. Elemental determinations commissioned by Alexco in August 2008.
2. Method ME_ICP61 is an ALS Chemex method (4 acid digestion with ICP finish)
3. Grey highlight on Sample Description indicates sample of same name sourced from VTF test pit excavated in May 2007 and logged by Access Consulting Group staff. Test pit logs are appended as Appendix C of this report (2007/08 Geochemical Studies, Keno Hill Silver District, SRK Consulting, 2009)
4. Origin of other samples is uncertain.

Appendix G

Tailings Short Term Weathering Tests

Appendix G1

Static NAG Results

CANTEST Ltd. 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.cantest.com

SRK Consulting, Keno Hill, 25-Jan & 4-Feb-08
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Table 5: Results of Static NAG on 6 (of 34) Keno Hill Samples - March 2008

S. No:	Sample ID	NAG pH	NaOH to pH 4.5 (mL)	NaOH to pH 7.0 (mL)	NaOH Conc. (N)	Sample Weight (g)	NAG Acidity pH 4.5 (kg H_2SO_4/tonne)	NAG Acidity pH 7.0 (kg H_2SO_4/tonne)
1	6-B	4.77	0.00	21.20	0.1	2.5	0.0	41.6
2	7-B	5.6	0.00	1.10	0.1	2.5	0.0	2.2
6	18-D	7.14	0.00	0.00	0.1	2.5	0.0	0.0
3	8-H	6.37	0.00	0.85	0.1	2.5	0.0	1.7
4	12-I	6.62	0.00	0.20	0.1	2.5	0.0	0.4
5	14-C	6.82	0.00	0.15	0.1	2.5	0.0	0.3
7	UKTP22E	4.89	0.00	13.35	0.1	2.5	0.0	26.2
8	UKTP23C	6.21	0.00	0.30	0.1	2.5	0.0	0.6
CANTEST SOP No:		7200						

Note:
Initial H_2O_2 pH : 5.22

Volume of 15% H2O2 used for each test = 250mL.
Solid:Liquid ratio used = 1:100; 2.5g Pulp Sample:250mL 15% H_2O_2.

Procedure: Miller et al., May 1998.

Dup = is a repeat of the entire NAG procedure.

Appendix G2

Sequential NAG Results

CANTEST Ltd. 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.cantest.com

SRK Consulting, Keno Hill, 25-Jan & 4-Feb-08
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Table 1: Sequential NAG Results for 6 (of 34) Keno Hill Samples - May 2008

Stage 1											
				on Slurry Sample		**on NAG Liquor**					
S. No.	**Sample ID**	**Dry Sample Wt. (g)**	**Vol. of 15% H_2O_2 Used (ml)**	**pH (pH Units)**	**EC (µS/cm)**	**Initial NAG Liquor pH (pH Units)**	**NaOH to pH 4.5 (ml)**	**NaOH to pH 7.0 (ml)**	**NaOH Conc. (N)**	**NAG Acidity pH 4.5 (Kg H_2SO_4/tonne)**	**NAG Acidity pH 7.0 (Kg H_2SO_4/tonne)**
1	6-B	2.5	250	5.19	2020	4.81	0.00	11.80	0.1	0.0	23.1
2	7-B	2.5	250	5.40	1005	5.47	0.00	0.40	0.1	0.0	0.8
6	18-D	2.5	250	7.06	490	6.83	0.00	0.05	0.1	0.0	0.1
3	8-H	2.5	250	6.46	1256	6.49	0.00	0.05	0.1	0.0	0.1
4	12-I	2.5	250	6.47	393	6.52	0.00	0.25	0.1	0.0	0.5
5	14-C	2.5	250	6.78	239	6.76	0.00	0.15	0.1	0.0	0.3
Method Blank			250	4.90	164		0.00	7.55	0.1		

Stage 2											
				on Slurry Sample		**on NAG Liquor**					
S. No.	**Sample ID**	**Stage 1 Residue Wet Sample Wt. (g)**	**Vol. of 15% H_2O_2 Used (ml)**	**pH (pH Units)**	**EC (µS/cm)**	**Initial NAG Liquor pH (pH Units)**	**NaOH to pH 4.5 (ml)**	**NaOH to pH 7.0 (ml)**	**NaOH Conc. (N)**	**NAG Acidity pH 4.5 (Kg H_2SO_4/tonne)**	**NAG Acidity pH 7.0 (Kg H_2SO_4/tonne)**
1	6-B	2.5	250	5.44	1210	5.14	0.00	0.20	0.1	0.0	0.4
2	7-B	2.5	250	4.60	697	4.65	0.00	0.10	0.1	0.0	0.2
6	18-D	2.5	250	4.81	358	4.74	0.00	0.40	0.1	0.0	0.8
3	8-H	2.5	250	4.77	810	4.81	0.00	0.20	0.1	0.0	0.4
4	12-I	2.5	250	5.00	365	5.02	0.00	0.20	0.1	0.0	0.4
5	14-C	2.5	250	5.02	375	5.03	0.00	0.20	0.1	0.0	0.4
Method Blank			250	4.94	170		0.00	7.50	0.1		

Note:
State 1: Initial H_2O_2 pH : 5.22; Stage 2: Initial H_2O_2 pH : 5.40 (room temperature pH's).
Solid:Liquid ratio used = 1:100; 2.5g pulp sample:250ml 15% H_2O_2.

Stage 2 was carried out at client request, although stage 1 NAG liquor pH was greater than 4.5.

Procedure: EGi-Environmental Geochemistry International; Stuart D. Miller, March 2001; Section 4.4 Sequential NAG.

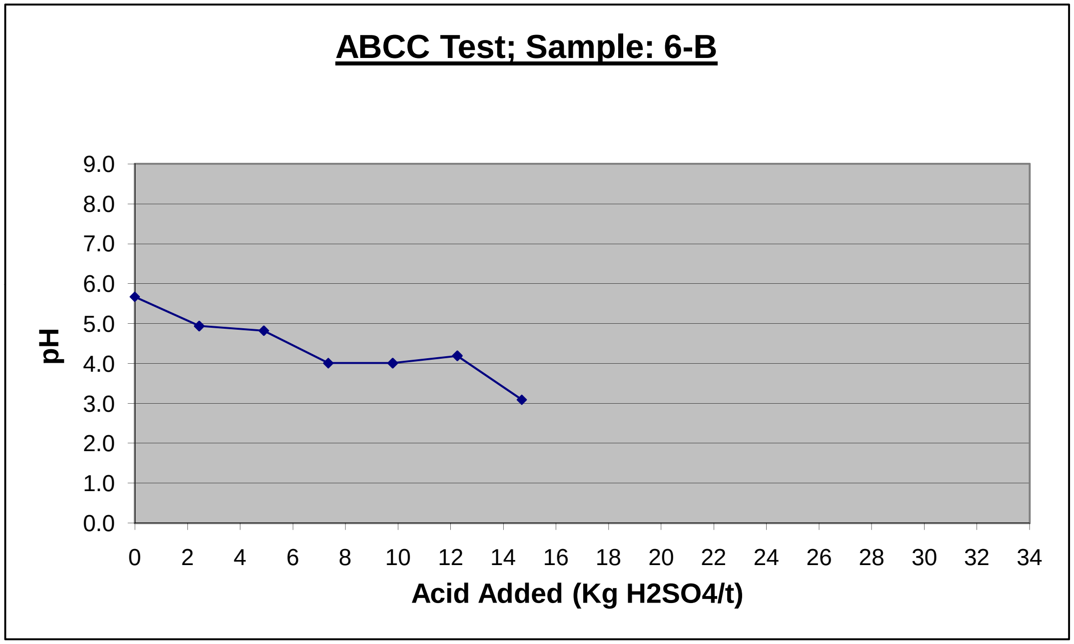
Appendix G3

Acid Buffering Characteristic Curve Results

Table 7: Results of ABCC Test on 6 (of 34) Keno Hill Samples - March 2008

Sample ID: 6-B
Mod. ABA NP: 149.1 kg CaCO3/tonne

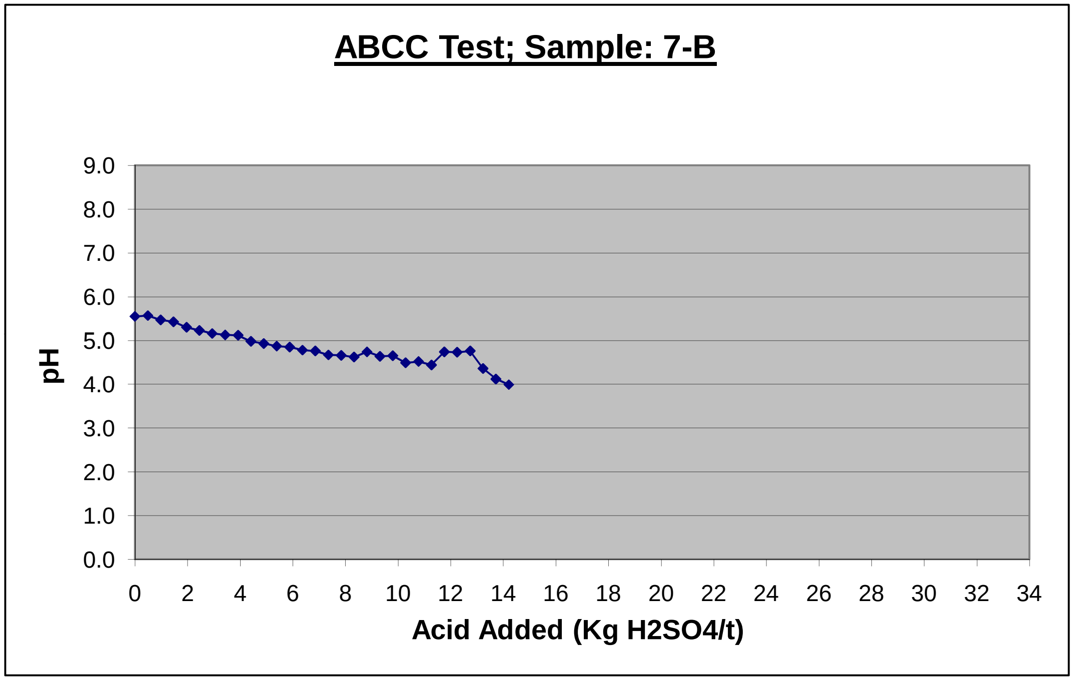
Vol. 0.5N HCl (mL)	Consumption (kg H2SO4/t)	Stable pH after 1000 sec.
0.00	0.00	5.67
0.20	2.45	4.94
0.40	4.90	4.82
0.60	7.35	4.01
0.80	9.80	4.01
1.00	12.25	4.19
1.20	14.70	3.09



Sample ID: 7-B

Mod. ABA NP: 30.4 kg CaCO3/tonne

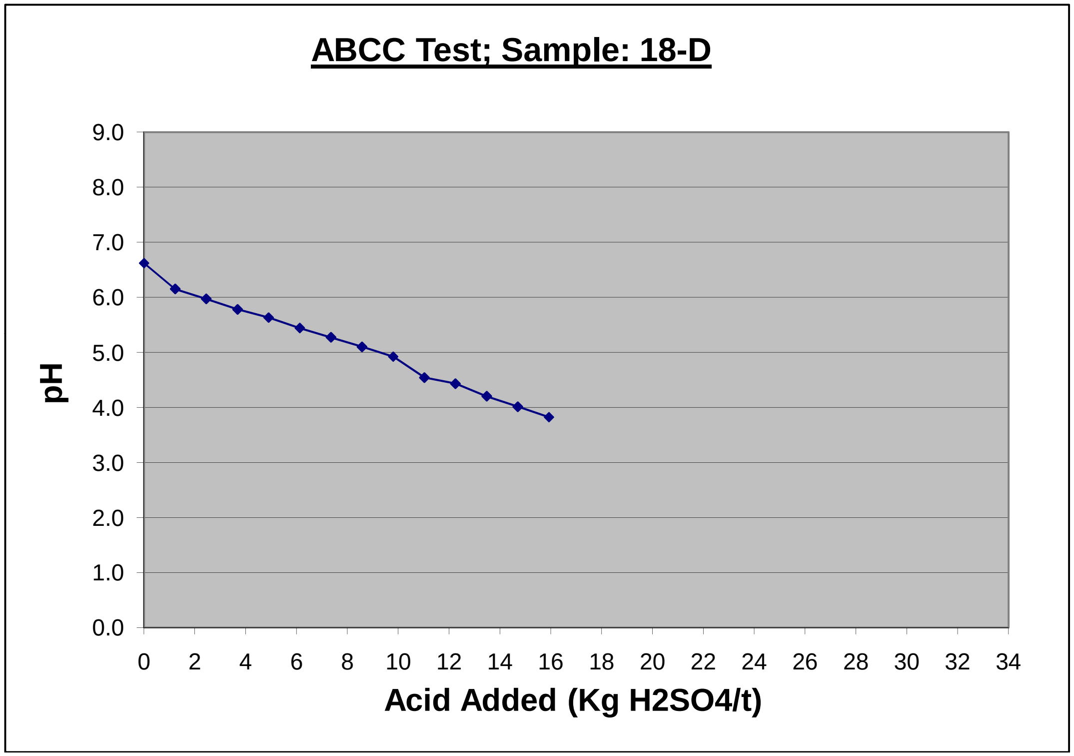
Vol. 0.1N HCl (mL)	Consumption (kg H2SO4/t)	Stable pH after 1000 sec.
0.00	0.00	5.55
0.20	0.49	5.57
0.40	0.98	5.47
0.60	1.47	5.43
0.80	1.96	5.30
1.00	2.45	5.23
1.20	2.94	5.16
1.40	3.43	5.13
1.60	3.92	5.12
1.80	4.41	4.98
2.00	4.90	4.93
2.20	5.39	4.87
2.40	5.88	4.85
2.60	6.37	4.78
2.80	6.86	4.76
3.00	7.35	4.67
3.20	7.84	4.66
3.40	8.33	4.62
3.60	8.82	4.74
3.80	9.31	4.64
4.00	9.80	4.65
4.20	10.29	4.49
4.40	10.78	4.52
4.60	11.27	4.44
4.80	11.76	4.74
5.00	12.25	4.73
5.20	12.74	4.76
5.40	13.23	4.36
5.60	13.72	4.12
5.80	14.21	3.99



Sample ID: 18-D

Mod. ABA NP: 42.0 kg CaCO3/tonne

Vol. 0.1N HCl (mL)	Consumption (kg H2SO4/t)	Stable pH after 1000 sec.
0.00	0.00	6.62
0.50	1.23	6.15
1.00	2.45	5.97
1.50	3.68	5.78
2.00	4.90	5.63
2.50	6.13	5.44
3.00	7.35	5.27
3.50	8.58	5.10
4.00	9.80	4.92
4.50	11.03	4.54
5.00	12.25	4.43
5.50	13.48	4.20
6.00	14.70	4.01
6.50	15.93	3.82



CANTEST
CANTEST Ltd. 4606 Canada Way, Burnaby, BC Canada V5G 1K5 Tel: 604 734 7276 Fax: 604 731 2386 www.cantest.com

SRK Consulting, Keno Hill, 25-Jan & 4-Feb-08
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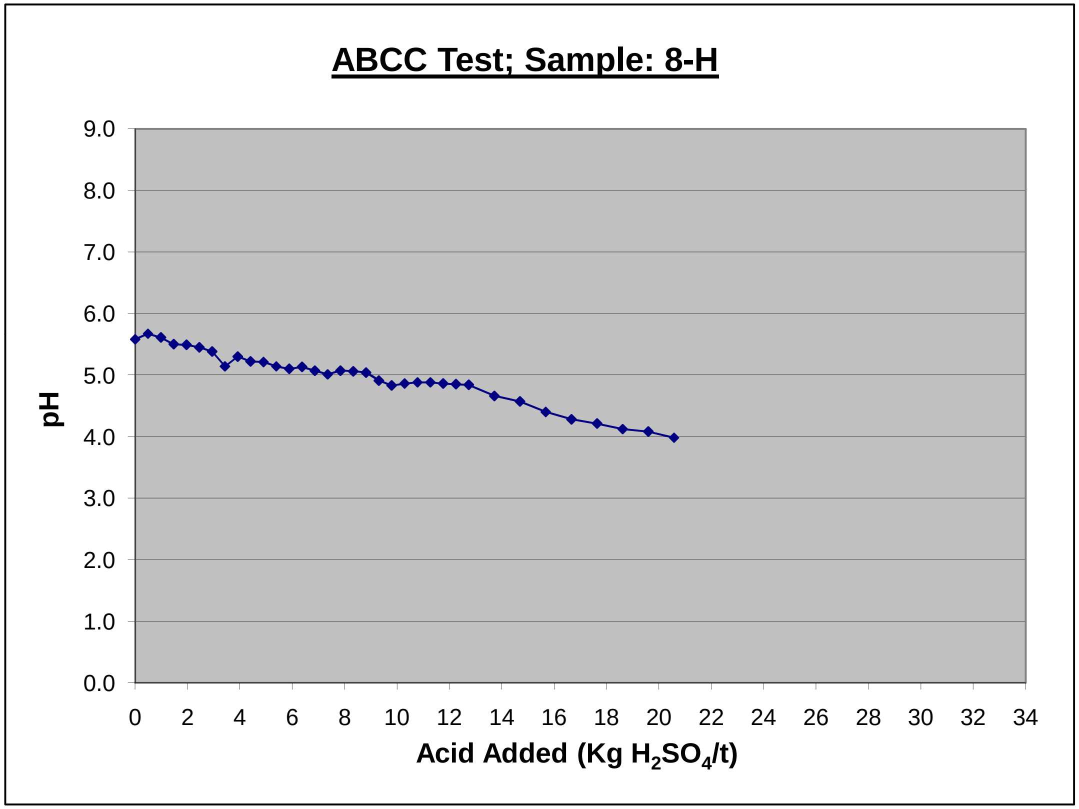
Sample ID: 8-H

Mod. ABA NP: 26.7 kg CaCO3/tonne

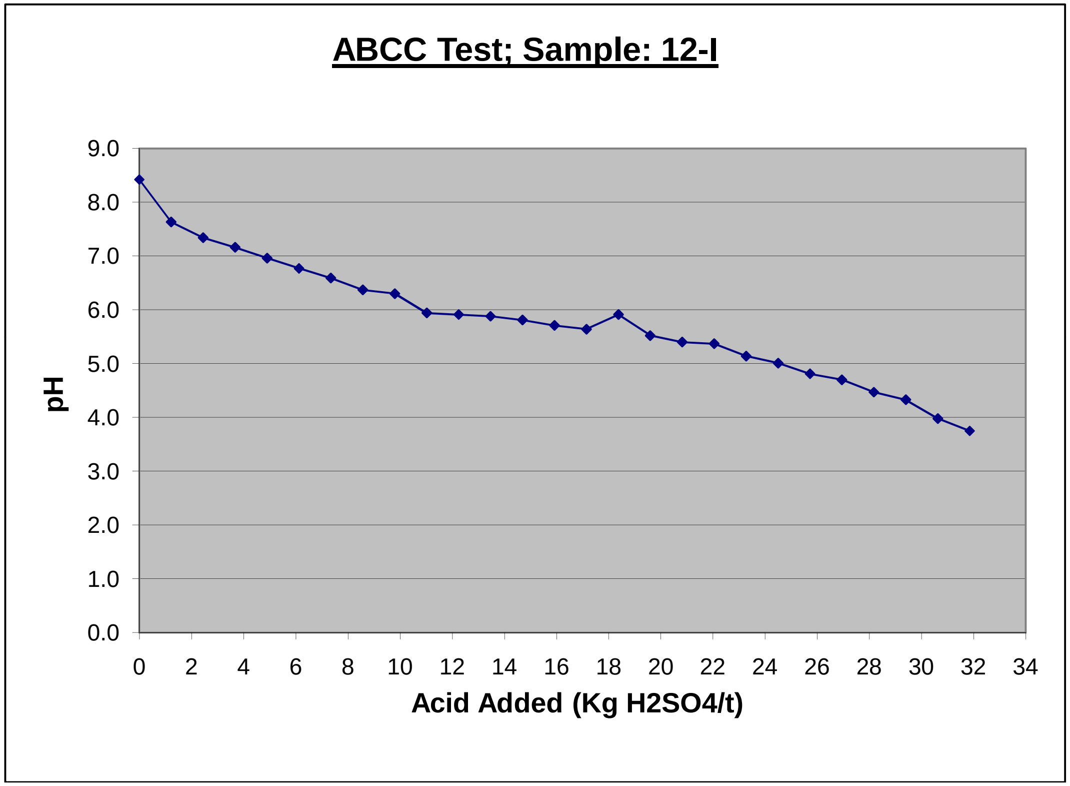
Vol. 0.1N HCl (mL)	Consumption (kg H2SO4/t)	Stable pH after 1000 sec.
0.00	0.00	5.58
0.20	0.49	5.67
0.40	0.98	5.61
0.60	1.47	5.50
0.80	1.96	5.49
1.00	2.45	5.45
1.20	2.94	5.38
1.40	3.43	5.14
1.60	3.92	5.30
1.80	4.41	5.22
2.00	4.90	5.21
2.20	5.39	5.14
2.40	5.88	5.10
2.60	6.37	5.13
2.80	6.86	5.07
3.00	7.35	5.01
3.20	7.84	5.07
3.40	8.33	5.06
3.60	8.82	5.04
3.80	9.31	4.91
4.00	9.80	4.83
4.20	10.29	4.86
4.40	10.78	4.88
4.60	11.27	4.88
4.80	11.76	4.86
5.00	12.25	4.85
5.20	12.74	4.84
5.60	13.72	4.66
6.00	14.70	4.57
6.40	15.68	4.40
6.80	16.66	4.28
7.20	17.64	4.21
7.60	18.62	4.12
8.00	19.60	4.08
8.40	20.58	3.98



Sample ID: 12-I

Mod. ABA NP: 62.0 kg CaCO3/tonne

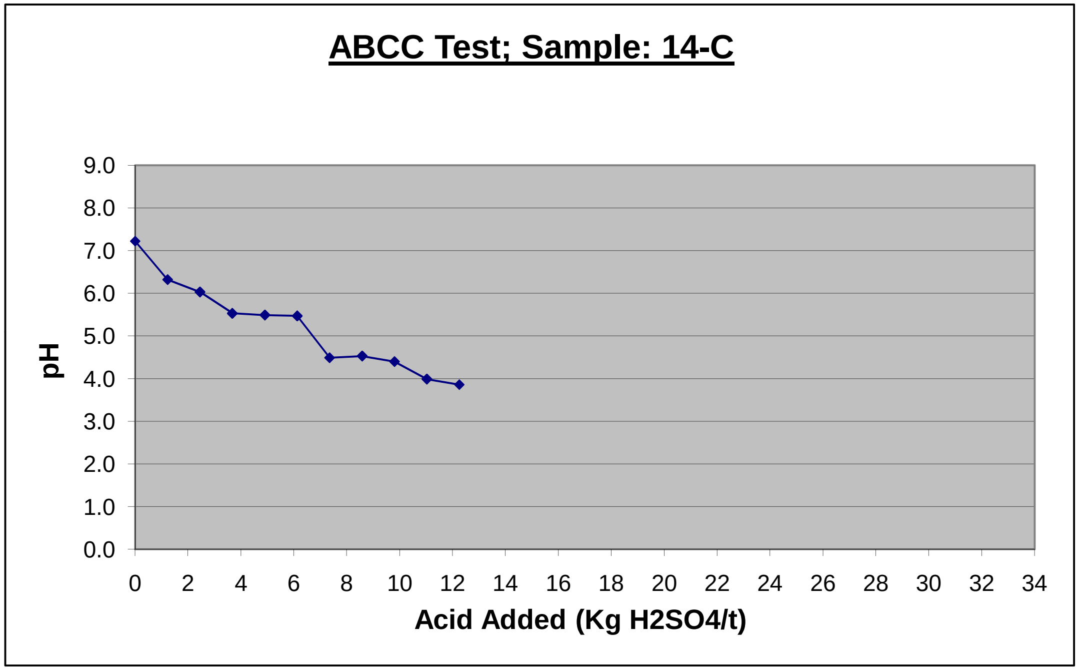
Vol. 0.1N HCl (mL)	Consumption (kg H2SO4/t)	Stable pH after 1000 sec.
0.00	0.00	8.42
0.50	1.23	7.63
1.00	2.45	7.34
1.50	3.68	7.16
2.00	4.90	6.96
2.50	6.13	6.77
3.00	7.35	6.59
3.50	8.58	6.37
4.00	9.80	6.30
4.50	11.03	5.94
5.00	12.25	5.91
5.50	13.48	5.88
6.00	14.70	5.81
6.50	15.93	5.71
7.00	17.15	5.64
7.50	18.38	5.91
8.00	19.60	5.52
8.50	20.83	5.40
9.00	22.05	5.37
9.50	23.28	5.14
10.00	24.50	5.01
10.50	25.73	4.81
11.00	26.95	4.70
11.50	28.18	4.47
12.00	29.40	4.33
12.50	30.63	3.98
13.00	31.85	3.75



Sample ID: 14-C

Mod. ABA NP: 65.8 kg CaCO3/tonne

Vol. 0.1N HCl (mL)	Consumption (kg H2SO4/t)	Stable pH after 1000 sec.
0.00	0.00	7.22
0.50	1.23	6.32
1.00	2.45	6.03
1.50	3.68	5.53
2.00	4.90	5.49
2.50	6.13	5.47
3.00	7.35	4.49
3.50	8.58	4.53
4.00	9.80	4.40
4.50	11.03	3.99
5.00	12.25	3.86



Appendix H

Waste Rock Geochemical Test Results

Appendix H1

1995 ABA Test Results

1995 Waste Rock Acid Base Accounting Results(1)

LOCATION	SAMPLE ID	PASTE pH	S (T)	S (SO_4)	AP	NP	NP/AP	Classification(3)
			%	%	kg $CaCO_3$/t		ratio	
DIXIE	95UKHDD01	4.14	0.35	0.28	2.2	0.0	<0.1	Acid generating
adit dump	95UKHDD02	4.44	0.51	0.34	5.3	2.3	0.4	Acid generating
	95UKHDD03	5.55	0.47	0.42	1.6	13.6	8.7	Non-PAG
BERMINGHAM	95UKHBP01	7.05	0.09	0.09	0.0	1.5	---	Low reactivity
pit wall	95UKHBP02	7.09	0.07	0.07	0.0	1.8	---	Low reactivity
	95UKHBP03	6.94	0.21	0.20	0.3	0.0	<0.1	Low reactivity
	95UKHBP04	6.89	0.04	0.03	0.3	0.3	0.8	Low reactivity
	95UKHBP05	6.87	0.07	0.06	0.3	1.6	5.0	Low reactivity
	95UKHBP06	8.03	0.95	0.27	21.3	70.1	3.3	Non-PAG
	95UKHBP07	8.68	0.19	0.16	0.9	9.6	10.3	Non-PAG
BERMINGHAM	95UKHBD01	7.34	0.30	0.30	0.0	6.0	---	Low reactivity
pit dump	95UKHBD02	7.20	0.32	0.31	0.3	7.2	23.0	Low reactivity
	95UKHBD03	6.62	1.94	0.69	39.1	155.6	4.0	Non-PAG
	95UKHBD04	7.24	0.49	0.21	8.8	14.1	1.6	Uncertain
	95UKHBD05	7.56	2.50	0.54	61.3	144.4	2.4	Non-PAG
	95UKHBD06	7.32	0.07	0.07	0.0	0.0	---	Low reactivity
RUBY	95UKHRD01	7.82	1.06	0.43	19.7	36.3	1.8	Uncertain
adit dump	95UKHRD02	7.83	0.72	0.28	13.8	51.1	3.7	Non-PAG
	95UKHRD03	7.02	0.66	0.32	10.6	15.0	1.4	Uncertain
CALUMET	95UKHCD01	6.55	0.05	0.05	0.0	0.6	--	Low reactivity
1-15 pit dump	95UKHCD02	5.54	0.41	0.41	0.0	0.0	---	Low reactivity
CALUMET	95UKHCP01	5.75	0.09	0.06	0.9	0.3	0.3	Low reactivity
1-15 pit wall	95UKHCP02	6.83	0.04	0.04	0.0	0.4	--	Low reactivity
CALUMET	95UKHCD04	6.82	0.01	0.01	0.0	0.6	--	Low reactivity
1-15 pit dump	95UKHCD03	6.34	0.12	0.11	0.3	0.9	2.8	Low reactivity
HECTOR	95UKHHD01	6.01	2.10	0.48	50.6	0.0(4)	<0.10	PAG
adit dump	95UKHHD02	6.35	1.92	0.31	50.3	47.8	0.9	PAG
	95UKHHD03	6.94	0.84	0.26	18.1	32.4	1.8	Uncertain
SIME6	95UKHSP01	6.15	0.09	0.07	0.6	1.8	2.8	Non-PAG
pit wall	95UKHSP02	6.49	0.03	0.03	0.0	0.8	---	Low reactivity
SIME4 pit wall	95UKHSP03	6.57	<0.01	<0.01	0.0	0.8	---	Low reactivity
SIME 35	95UKHSP04	6.47	0.11	0.11	0.0	2.5	---	Low reactivity
pit wall	95UKHSP05	7.08	0.02	0.01	0.3	0.0	<0.10	Low reactivity
SIME4&6 pit dump	95UKHSD01	7.08	0.04	,0.01	1.1	1.4	1.3	Low reactivity
ONEK pit	95UKHOP02	8.49	0.16	0.08	2.5	0.0(4)	<0.10	Low reactivity
ONEK	95UKHOD01	8.08	0.13	0.12	0.3	0.0(4)	<0.10	Low reactivity
pit dump	95UKHOD02	7.62	0.01	<0.01	0.2	1.6	10.2	Non-PAG
	95UKHOD03	8.16	0.23	0.17	1.9	52.3	27.9	Non-PAG
KENO 700	95UKHKD01	8.03	1.03	0.16	27.2	47.0	1.7	Uncertain
adit dump	95UKHKD02	8.22	0.45	0.16	9.1	10.9	1.2	Uncertain
UN adit dump	95UKHUD01	7.69	0.08	0.06	0.6	1.6	2.5	Non-PAG
TOWNSITE	95UKHTD01	6.33	1.16	0.11	32.8	0.0(4)	<0.10	PAG
aditdump	95UKHTD02	6.78	0.33	0.26	2.2	0.0(4)	<0.10	Low reactivity
HUSKY S.W. shaft dump	95UKHWD01	3.72	0.96	0.28	21.3	0.0	<0.10	Acid generating
HUSKY shaft dump	95UKHYD01	3.69	7.76	0.09	239.7	0.0	<0.10	Acid generating
MILLER pit dump	95UKHMD01	6.43	0.03	0.02	0.3	0.4	1.2	Low reactivity
BELLEKENO adit dump	95UKHLD01	8.05	0.50	0.22	8.8	130.0	14.9	Non-PAG
SILVER KING pit dump	95UKHVD01	7.36	0.06	0.03	0.9	0.0	<0.10	Low reactivity

Notes:

(1) 1995 test results compiled by Access Consulting Group, from 1996 Site Characterization Report

(2) ABA tests carried out according to Modified ABA method (MEND 1991)

(3) Classification by SRK as follows:

Acid generating: Paste pH < 5
PAG: Potentially acid generating (NP/AP < 1)
Uncertain: Uncertain potential to generate acid (1<NP/AP<2)
Non-PAG: Non-potentially acid generating (NP/AP > 2)
Low reactivity: Low reactive sulphide mineral content (NP/AP < 2, sulphide sulphur content < 0.1%)

(4) NP values of zero for these samples do not agree with NP and inorganic carbon results from 2007 testing

Appendix H2

1995 Elemental Content

1995 Waste Rock Metal Content (ICP)

LOCATION	SAMPLE ID	As (ppm)	Ca (%)	Cd (ppm)	Co (ppm)	Cr (ppm)	Cu (ppm)	Fe (%)	Mn (ppm)	Pb (ppm)	Sb (ppm)	Zn (ppm)
QUARTZITE SAMPLES												
CALUMET	95UKHCD03	189.00		6.80	4.00	47.00	192.00	2.53	2193.00	>10000	168.00	805.00
CALUMET	95UKHCP02	25.00	0.11	0.30	1.00	55.00	6.00	0.55	30.00	380.00	4.00	99.00
DIXIE	95UKHDD01	1.00	0.38	0.10	4.00	95.00	13.00	1.59	470.00	176.00	15.00	336.00
DIXIE	95UKHDD03	1.00	1.03	0.10	5.00	90.00	13.00	1.17	257.00	65.00	3.00	186.00
HECTOR	95UKHHD01	1.00	0.79	>100	16.00	1.00	162.00	10.42	>10000	2768.00	114.00	>10000
HECTOR	95UKHHD02	1.00	1.07	>100	12.00	1.00	32.00	8.76	>10000	852.00	51.00	>10000
KENO 700	95UKHKD01	1.00	2.03	>100	7.00	41.00	51.00	2.66	6094.00	2473.00	53.00	>10000
MILLER	95UKHMD01	1.00	0.06	11.30	3.00	41.00	13.00	1.55	5094.00	462.00	5.00	902.00
RUBY	95UKHRD01	1.00	1.92	0.10	13.00	49.00	25.00	2.14	3450.00	162.00	5.00	439.00
RUBY	95UKHRD02	1.00	2.19	10.40	5.00	62.00	54.00	1.60	1810.00	1339.00	46.00	646.00
RUBY	95UKHRD03	1.00	1.13	0.10	16.00	43.00	77.00	2.72	1192.00	559.00	8.00	460.00
SILVER KING	95UKHVD01	39.00	0.07	0.10	2.00	62.00	11.00	0.61	22.00	28.00	2.00	20.00
SIME4	95UKHSP03	62.00	0.01	2.00	1.00	48.00	5.00	0.20	13.00	205.00	6.00	36.00
BERMINGHAM	95UKHBD06	1.00	0.05	5.70	2.00	53.00	17.00	0.68	993.00	778.00	15.00	218.00
BERMINGHAM	95UKHBP03	126.00	0.08	0.60	16.00	8.00	18.00	9.98	7175.00	1097.00	1.00	2237.00
BERMINGHAM	95UKHBP05	1.00	0.05	4.60	1.00	29.00	10.00	0.81	2068.00	352.00	2.00	313.00
CALUMET	95UKHCD01	44.00	0.01	0.10	3.00	59.00	97.00	1.35	520.00	>10000	51.00	376.00
CALUMET	95UKHCD02	114.00	0.03	1.50	12.00	1.00	575.00	10.52	>10000	>10000	360.00	3516.00
ONEK	95UKHOD02	66.00	0.05	0.10	1.00	45.00	34.00	0.46	69.00	198.00	2.00	96.00
SIME4&6	95UKHSD01	1.00	0.08	8.60	2.00	44.00	6.00	0.47	927.00	126.00	3.00	334.00
SIME6	95UKHSP02	1.00	0.02	0.10	2.00	51.00	13.00	0.89	43.00	874.00	7.00	106.00
TOWNSITE	95UKHTD01	1.00	0.40	94.60	7.00	37.00	37.00	2.57	5781.00	1213.00	23.00	5632.00
BERMINGHAM	95UKHBP01	1.00	0.21	0.10	9.00	82.00	48.00	2.32	620.00	186.00	4.00	311.00
BERMINGHAM	95UKHBP02	1.00	0.23	21.60	6.00	46.00	20.00	1.79	2172.00	84.00	12.00	595.00
BELLEKENO	95UKHLD01	81.00	5.47	0.10	3.00	68.00	6.00	0.61	129.00	123.00	3.00	31.00
HUSKY	95UKHYD01	226.00	0.03	0.10	10.00	52.00	15.00	5.49	81.00	129.00	1.00	94.00
HUSKY S.W.	95UKHWD01	1.00	0.19	0.10	10.00	66.00	23.00	2.16	438.00	400.00	8.00	62.00
Average		36.60	0.66	17.40	6.41	47.30	58.30	2.84	2653.00	1668.00	36.00	1772.20
Median		1.00	0.11	0.60	5.00	48.00	20.00	1.60	993.00	400.00	7.00	336.00
Maximum		226.00	5.47	>100	16.00	95.00	575.00	10.52	>10000	>10000	360.00	>10000
Minimum		1.00	0.01	0.10	1.00	1.00	5.00	0.20	13.00	28.00	1.00	20.00
Count		27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00	27.00
SCHIST SAMPLES												
BERMINGHAM	95UKHBP07	1.00	0.51	0.10	8.00	49.00	23.00	2.27	335.00	49.00	1.00	78.00
BERMINGHAM	95UKHBD04	1.00	0.20	>100	9.00	5.00	105.00	5.35	>10000	>10000	110.00	3468.00
BERMINGHAM	95UKHBP06	1.00	2.38	0.10	9.00	67.00	20.00	1.67	549.00	19.00	1.00	77.00
CALUMET	95UKHCP01	1.00	0.03	0.1	4.00	53.00	45.00	3.00	28.00	534.00	5.00	483.00
HECTOR	95UKHHD03	1.00	1.07	50.60	8.00	60.00	48.00	2.93	9328.00	1000.00	50.00	4054.00
KENO 700	95UKHKD02	1.00	0.73	9.8	13.00	48.00	108.00	2.45	3415.00	808.00	9.00	1460.00
ONEK	95UKHOD03	1.00	2.47	0.10	10.00	44.00	23.00	2.45	200.00	40.00	1.00	85.00
SIME6	95UKHSP01	15.00	0.29	1.3	4.00	0.42	45.00	2.50	258.00	1160.00	15.00	747.00
Average		2.75	0.96	20.30	8.13	46.00	52.10	2.83	3014.10	1701.30	24.00	1306.50
Std. Dev.		4.95	0.96	36.6	3.00	18.50	35.40	1.10	4251.30	3383.40	38.00	1592.30
Median		1.00	0.62	0.70	8.50	48.50	45.00	2.48	442.00	671.00	7.00	615.00
Maximum		15.00	2.47	>100	13.00	67.00	108.00	5.35	>10000	>10000	110.00	4054.00
Minimum		1.00	0.03	0.10	4.00	5.00	20.00	1.68	28.00	19.00	1.00	77.00
Count		8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00	8.00
VEIN SAMPLES												
BERMINGHAM	95UKHBD01	1.00	0.20	>100	11.00	1.00	146.00	8.23	>10000	6503.00	164.00	2103.00
BERMINGHAM	95UKHBD02	1.00	0.40	65.2	11.00	1.00	78.00	5.43	>10000	3864.00	76.00	1324.00
BERMINGHAM	95UKHBD03	1.00	0.98	>100	25.00	1.00	156.00	>15.00	>10000	>10000	180.00	>10000
BERMINGHAM	95UKHBD05	1.00	3.02	>100	30.00	1.00	123.00	13.02	>10000	3073.00	77.00	8800.00
CALUMET	95UKHCD04	1.00	0.06	25.3	2.00	30.00	14.00	0.73	1512.00	357.00	9.00	643.00
Average		1.00	0.93	78.1	15.80	6.80	103.00	8.48	8302.00	4759.00	101.00	4574.00
Std. Dev.		0.00	1.22	33.1	11.40	13.00	58.30	5.76	3796.00	3658.00	70.00	4455.90
Median		1.00	0.40	>100	11.00	1.00	123.00	8.23	>10000	3864.00	77.00	2103.00
Maximum		1.00	3.02	>100	30.00	30.00	156.00	15.00	>10000	>10000	180.00	>10000
Minimum		1.00	0.06	25.3	2.00	1.00	14.00	0.73	1512.00	357.00	9.00	643.00
Count		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
MIXED SCHIST AND QUARTZITE												
BERMINGHAM	95UKHBP04	1.00	0.03	0.1	3.00	57.00	6.00	0.81	235.00	45.00	3.00	83.00
DIXIE	95UKHDD02	1.00	0.27	5.8	4.00	72.00	24.00	1.93	4454.00	567.00	18.00	771.00
ONEK pit	95UKHOP02	15.00	1.40	0.1	6.00	63.00	9.00	0.93	410.00	20.00	1.00	498.00
TOWNSITE	95UKHTD02	79.00	0.18	53.8	6.00	50.00	339.00	3.61	2681.00	>10000	571.00	1882.00
UN adit dump	95UKHUD01	1.00	0.14	0.1	4.00	35.00	48.00	1.94	55.00	660.00	11.00	220.00
Average		19.40	0.40	12	4.60	55.40	85.20	1.84	1567.00	2258.00	121.00	690.80
Std. Dev.		33.90	0.56	23.5	1.34	14.00	143.00	1.12	1935.00	4338.00	252.00	716.53
Median		1.00	0.18	0.10	4.00	57.00	24.00	1.93	410.00	567.00	11.00	498.00
Maximum		79.00	1.40	53.8	6.00	72.00	339.00	3.61	4454.00	>10000	571.00	1882.00
Minimum		1.00	0.03	0.1	3.00	35.00	6.00	0.81	55.00	20.00	1.00	83.00
Count		5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00	5.00
GREENSTONE SAMPLE												
ONEK	95UKHOD01	1.00	0.93	0.1	23.00	99.00	129.00	3.26	568.00	14.00	1.00	190.00
SIME 35	95UKHSP04	1.00	0.32	0.1	8.00	51.00	36.00	3.62	324.00	1380.00	8.00	676.00
SIME 35	95UKHSP05	22.00	0.03	0.1	1.00	53.00	4.00	0.41	60.00	15.00	3.00	93.00

Note: 1995 test results compiled by Access Consulting Group, from 1996 Site Characterization Report

Appendix H3

1995 Leach Extraction Test Results

1995 Waste Rock Shake Flask Extraction Results (24 hr distilled water extraction (3:1 water:rock ratio)

LOCATION	SAMPLE ID	PASTE S	(tot.)	Rock	Descrip.	Concentration mg/L											
		(PH)	%	Type		pH	S04	Al	As	Cd	Ca	Co	Fe	Pb	Mn	Zn
CALUMET 1-15 pit dump	95UKHCD04	6.82	0.01	1	10	5.7	4	<0.20	<0.20	<0.010	0.55	<0.015	<0.030	<0.050	0.03	0.031
DIXIE adit dump	95UKHDD03	5.55	0.47	1	10	2.9	1504	37.7	<0.20	0.741	338	0.159	25.8	<0.050	18.6	52.1
HECTOR adit dump	95UKHHD01	6.01	2.1	1	10	2.3	1845	42.5	3.58	0.017	18.9	0.137	520	0.557	2.84	1.25
HECTOR adit dump	95UKHHD02	6.35	1.92	1	10	6.9	883	<0.20	<0.20	0.323	259	<0.015	<0.030	<0.050	1.15	6.68
KENO 700 adit dump	95UKHKD01	8.03	1.03	1	10	7	92	<0.20	<0.20	0.217	35.6	<0.015	<0.030	0.078	0.029	6.65
RUBY adit dump	95UKHRD01	7.82	1.06	1	10	7.7	1540	<0.20	<0.20	<0.010	384	<0.015	<0.030	<0.050	0.033	0.047
RUBY adit dump	95UKHRD02	7.83	0.72	1	10	6.5	691	<0.20	<0.20	0.38	233	<0.015	<0.030	0.279	2.32	7.3
SIME 4 pit wall	95UKHSP03	6.57	<0.01	1	10	5.8	<3	<0.20	<0.20	<0.010	0.48	<0.015	<0.030	<0.050	0.025	0.01
SILVER KING pit dump	95UKHVD01	7.36	0.06	1	10	6	131	<0.20	<0.20	<0.010	34.5	<0.015	<0.030	<0.050	0.373	0.013
BERMINGHAM pit wall	95UKHBP05	6.87	0.07	1	11	6.5	5	<0.20	<0.20	<0.010	1.08	<0.015	<0.030	<0.050	0.422	0.039
CALUMET 1-14 pit dump	95UKHCD01	6.55	0.05	1	11	5.2	<3	<0.20	<0.20	<0.010	1.65	<0.015	<0.030	8.89	0.1	0.167
ONEK pit dump	95UKHOD02	7.62	0.01	1	11	6.2	<3	<0.20	<0.20	<0.010	0.5	<0.015	<0.030	<0.050	0.021	0.045
SIME 4 & 6 pit dump	95UKHSD01	7.08	0.04	1	11	6.2	<3	<0.20	<0.20	0.064	1.12	<0.015	<0.030	<0.050	<0.005	0.316
SIME	95UKHSP02	6.49	0.03	1	11	5.9	<3	<0.20	<0.20	<0.010	0.37	<0.015	<0.030	<0.050	0.033	0.013
TOWNSITE adit dump	95UKHTD01	6.33	1.16	1	11	5.3	370	<0.20	<0.20	2.01	26.3	0.1	<0.030	0.384	100	81.4
BERMINGHAM pit wall	95UKHBP02	7.09	0.07	1	12	6.8	5	<0.20	<0.20	<0.010	1.86	<0.015	<0.030	<0.050	<0.005	0.008
BELLEKENO adit dump	95UKHLD01	8.05	0.5	1	15	7.1	23	<0.20	<0.20	<0.010	21.3	<0.015	<0.030	<0.050	0.1	0.017

Note: 1995 test results compiled by Access Consulting Group, from 1996 Site Characterization Report

Appendix H4
1999 ABA Test Results

1999 WASTE ROCK ABA RESULTS (MODIFIED SOBEK METHOD)[(1)]

Site	Sample	Site Description	Paste pH	S(T)	S(SO_4)	S(S^{2-})	AP	NP	NP/AP	Classification[(3)]
				%	%	%	kg $CaCO_3$/ t		ratio	
Bellekeno	99-22-3-1 - BK 200 - 16/9 - Rock	Bellekeno 200 level adit (WR200a)	7.90	0.04	0.02	NR[(2)]	0.60	7.00	11.20	Non-PAG
Bellekeno	99-22-3-2 - Bk 200 - 16/9 - Rock	Bellekeno 200 level adit (WR200b)	6.50	1.06	0.40	NR	20.60	37.30	1.80	Uncertain
Bellekeno	99-24-4-1 - Mayo Adit - 16/9 - Rock	Mayo Mines Adit waste rock pile	8.10	0.09	0.03	NR	1.90	98.30	52.40	Non-PAG
Bellekeno	99-22-06-1 - Bk. East - 115/9 - Rock	Eureka site waste rock pile	6.60	2.92	0.16	NR	86.30	68.80	0.80	PAG
CROESUS No. 1	24WR01-01 - Sept./99 - Soil	North side of Waste Rock Pile #2	7.40	0.45	0.33	NR	3.80	30.00	8.00	Non-PAG
DIVIDE	Divide - Waste Rock - Sept.14/99	Sample collected from trench B6	6.30	0.11	0.10	NR	0.30	0.20	0.80	Low reactivity
Elsa	3_WR_TPBM_01	400 portal area waste rock pile	3.5	2.05	0.43	NR	50.6	-1.3	<0.1	AG
FLAME AND MOTH	18_WR_TPBM-01 (On Bag - 06)	Flame and Moth northwestern waste rock pile	4.20	0.25	0.18	0.07	2.2	-1	<0.1	AG
FLAME AND MOTH	18_WR_TPBM_02 (On Bag - 07)	Duplicate of Bag 6	4.60	0.21	0.16	0.05	1.6	-1.5	<0.1	AG
FLAME AND MOTH	18_WR_TPBM_03	Representative of unmineralized waste rock	7.90	0.11	0.05	0.06	1.9	54.5	29.1	Non-PAG
FLAME AND MOTH	96UKFM01 Vein	NR- source is 1996 UKHM geochemical report	5.71	0.39	0.21	0.18	5.6	2.5	0.4	PAG
FLAME AND MOTH	96UKFM02 Schist	NR- source is 1996 UKHM geochemical report	7.90	0.19	0.12	0.07	2.2	44.9	20.5	Non-PAG
FLAME AND MOTH	96UKFM03 Ore/Vein	NR- source is 1996 UKHM geochemical report	6.64	1.89	1.78	0.11	3.4	40.4	11.7	Non-PAG
Fox	Fox - Waste Rock - Sept.1 8/99	Vein material at the north end of trench #1	6.00	0.24	0.19	0.05	1.60	-1.50	<0.1	Low reactivity
Gerlitzki	63-01-Waste -Gerlitzki -15cm -21/09/99 -Waste Rock	East side of Waste Rock Pile #3	6.30	3.68	0.16	NR	110.00	13.00	0.10	PAG
Gerlitzki	63-02-Waste -Gerlitzki -15cm -21/09/99 -Waste Rock	North side of Waste Rock Pile #2	7.90	0.07	0.07	NR	0.31	2.30	7.36	Non-PAG
Gold Hill No. 2	Gold Hill - Waste Rock - Sept.16/99	Sample from trench #10, from a strongly oxidized carbonaceous quartz phyllite	7.50	0.04	0.02	NR	0.60	2.50	4.00	Non-PAG
Highlander	GA/WR/P204	Upper adit. Sample collected over a thickness of 20 cm from chlorite schist. Sand and gravel size material with fragments up to 10 cm x 1 cm.	6.68	NR	NR	NR	1.90	3.40	1.80	Uncertain
Highlander	GA/WR/P205	Lower adit, east side of ore processing building. Sample collected over a thickness of 35 cm homogenous dark grey coloured sand. 30% quartz crystals in the sand.	7.83	NR	NR	NR	16.60	111.30	6.70	Non-PAG
Highlander	GA/WR/P206	Lower adit, unmineralized gabbro. Angular fragments up to 10 cm x 6 cm in 60% green coloured sand.	8.47	NR	NR	NR	4.10	103.90	25.60	Non-PAG
Highlander	GA/WR/P207	Lower adit, iron carbonate stained chlorite/graphite schist rock. 95% sand sized.	8.46	NR	NR	NR	16.90	109.00	6.50	Non-PAG
Husky - Shaft Dump	95UKHYD01	NR	3.69	7.76	0.09	NR	239.69	0.00	<0.10	AG
Husky SW - Shaft Dump	95UKHWD01	NR	3.72	0.96	0.28	NR	21.25	0.00	<0.10	AG
Keno 700	95UKHKD01	Top of waste pile on SE edge	8.03	1.03	0.16	NR	27.19	47.00	1.70	Uncertain
Keno 700	95UKHKD01 Replicate	Top of waste pile on SE edge	8.22	0.45	0.16	NR	9.06	10.94	1.20	Uncertain
Keno 700 area- Comstock 150	99-32-WR-01 -Sept 15/99	trestle)	6.70	0.45	0.16	0.29	9.10	17.60	1.90	Uncertain
Keno 700 area- Keno 200	99-32-WR-02 -Sept 15/99	Keno 200 (6' depth) Green Horizon (below loading trestle)	8.30	0.19	0.01	0.18	5.60	68.60	12.20	Non-PAG
Keno 700 area- Keno 700	99-32-WR-03 -Sept 15/99	Keno 700- near location of 95UKHKD01	7.90	0.29	0.02	0.27	8.40	15.80	1.90	Uncertain
Keno 700 area- Comstock 275	99-32-WR-04 -Sept 15/99	Comstock 275 (below loading trestle)	7.90	0.37	0.18	0.19	5.90	13.50	2.30	Non-PAG
Keno 700 area- Keno 200	99-32-WR-05 -Sept 15/99	Keno 200 -Weathered Horizon (below loading trestle)	8.10	0.27	0.04	0.23	7.20	85.30	11.90	Non-PAG
Keno No. 9	Keno Hill 12 Vein -Waste Rock - Sept. 18/99	Waste rock plume associated with No. 12 vein workings dumped in Faro Gulch	7.70	0.03	0.01	NR	0.60	3.00	4.80	Non-PAG
Keno No. 9	Keno Hill 9 Vein L3 -Waste Rock - Sept. 20/99	Waste rock located to the north of the uppermost trench	6.90	0.42	0.21	NR	6.60	9.90	1.50	Uncertain
Keno No. 9	Keno Hill 9 Vein -Waste Rock - Sept. 20/99	Waste rock located to the north of the uppermost trench	8.20	0.92	0.03	NR	27.80	84.80	3.00	Non-PAG
Keno No. 9	Main Vein WR1&WR2 -Waste Rock - Sept. 20/99	Waste rock pile between Open Pits #1 and #2	7.70	1.11	0.06	NR	32.80	62.30	1.90	Uncertain
Klondike Keno	20-Wr-01 - Klondike KENO -5-20cm - 18/9/99 Waste		7.90	1.09	0.06	NR	32.2	62.8	1.9	Uncertain
Lake	27WR01-01 - Sept./99 - Soil	North side of Waste Rock Pile #1	8.50	1.71	<0.01	NR	53.40	145.00	2.70	Non-PAG

1999 WASTE ROCK ABA RESULTS (MODIFIED SOBEK METHOD)(1)

Site	Sample	Site Description	Paste pH	S(T)	$S(SO_4)$	$S(S^{2-})$	AP	NP	NP/AP	Classification(3)
Black Cap Pit Dump	25WR01-01 Sept 18/99	Face of southeast pit dump	7.50	0.02	0.02	NR	0.00	-0.60	<0.1	Low reactivity
Black Cap Pit Dump	25WR01-02 Sept 18/99	Face of middle lobe of northermost dump (west of North Black Cap Pit)	7.10	0.03	0.02	NR	0.30	-1.10	<0.1	Low reactivity
Black Cap Pit Dump	25WR01-03 Sept 18/99	Face of lower pit dump west of South Pits on PWGSC (2000) map	7.40	0.02	0.01	NR	0.30	-0.80	<0.1	Low reactivity
Black Cap Adit Dump	25WR01-04 Sept 18/99	Adit dump (may be pit waste)	6.20	0.04	0.01	NR	0.90	0.20	0.30	Low reactivity
Lucky Queen 500 Adit Dump	25WR01-05 Sept 18/99	Center of Lucky Queen 500 adit dump	8.20	1.12	0.03	NR	34.10	82.80	2.40	Non-PAG
Lucky Queen Shaft Area	PWWR1	Argillite with abundant quartz veining, iron staining, 1% carbonate, <1% finely disseminated pyrite, blocky cleavage	7.37	0.02	0.02	NR	0.5*	2.50	5.00	Non-PAG
Lucky Queen Shaft Area	PWWR2	Argillite with abundant quartz veining, iron staining, 1% carbonate, <1% finely disseminated pyrite, blocky cleavage	6.82	0.11	0.08	NR	0.90	31.10	33.20	Non-PAG
Lucky Queen Shaft Area	PWWR3	Argillite with abundant quartz veining, iron staining, 1% carbonate, <1% finely disseminated pyrite, blocky cleavage	6.77	0.18	0.04	NR	4.40	4.90	1.10	Uncertain
Lucky Queen Shaft Area	PWWR4	Quartzite, with abundant quartz veining, buff to grey, gneissoid apprearance, <1% finely disseminated pyrite	7.15	0.02	<0.01	NR	0.5*	1.90	4.10	Non-PAG
Lucky Queen Shaft Area	PWWR5	Quartzite, with abundant quartz veining, buff to grey, gneissoid apprearance, <1% finely disseminated pyrite	6.91	0.11	0.05	NR	1.90	7.60	4.00	Non-PAG
Lucky Queen Shaft Area	PWWR6	Quartzite, with abundant quartz veining, buff to grey, gneissoid apprearance, <1% finely disseminated pyrite	7.24	0.02	<0.01	NR	0.5*	2.10	4.50	Non-PAG
Onek 400	19_WR_TPBM_01	portal	5.30	1.85	0.16	NR	52.8	2.8	0.1	PAG
Onek 400	19_WR_TPBM_02	portal	4.50	0.38	0.09	NR	9.1	-0.9	<0.1	AG
Sadie Ladue 600	SGWR/P301	Sample collected at the crest of the rock pile's northern edge in material that exhibited iron carbonate staining on the surface. Sample was collected over a thickness of 20 cm in dark grey/brown silt, sand and gravel size material that included chlorite schist and pyroxenite with minor galena and sphalerite.	8.01	1.22	0.21	NR	31.56	95.94	3.04	Non-PAG
Sadie Ladue 600	SGWR/P302/1	Sample collected from mixed waste rock material at southern edge of the rock pile over a thickness of 30 cm. Material consisted of graphite schist with <1% of the surface exhibiting staining.	7.92	1.41	0.18	NR	38.44	101.44	2.64	Non-PAG
Sadie Ladue 600	SGWR/P302/2	Sample collected over a thickness of 20 cm in sand and silt sized brown soil below P302/1.	8.28	0.47	n/a	NR	12.5	82.75	6.62	Non-PAG
Sadie Ladue 600	SGWR/P303	Sample collected in chlorite schist and greenstone below the load out facility. The sample was collected over a thickness of 40 cm in grey/green in coloured sand and gravel size material.	8	NR	NR	NR	NR	NR	6.6	Non-PAG
Sadie Ladue 600	SGWR/P304	Sample collected from mineralized graphitic schist on the northwest edge of the rock pile. The surface had a whitish precipitate. The sand and gravel size material was collected over a thickness of 30 cm. 1% of the material was cobble size up to 8 cm.	7.46	2.36	0.27	NR	65.31	86.38	1.32	Uncertain

1999 WASTE ROCK ABA RESULTS (MODIFIED SOBEK METHOD)(1)

Site	Sample	Site Description	Paste pH	S(T)	$S(SO_4)$	$S(S^{2-})$	AP	NP	NP/AP	Classification(3)
Sadie Ladue 600	SGWR/P305	Sample collected at the toe of the rock pile northwest corner in material similar to P301. The sample was collected over a thickness of 35 cm in moist dark grey/brown sand and gravel size material.	8.12	0.57	0.21	NR	11.25	105.38	9.37	Non-PAG
Sadie Ladue (Wernecke)	WWR1	Quartzite, grey; massive, <1% pyrite finely disseminated (5-10%)	7.45	0.51	0.18	NR	10.30	90.00	8.70	Non-PAG
Sadie Ladue (Wernecke)	WWR2	Quartzite, finely disseminated pyrite (1%); abundant fine calcium carbonate veining, partly oxidized	7.09	0.42	0.16	NR	8.10	49.30	6.10	Non-PAG
Sadie Ladue (Wernecke)	WWR3	Greenstone, dark green, <1% pyrite, 1% carbonate, massive	7.68	1.09	0.15	NR	29.40	81.30	2.80	Non-PAG
Sadie Ladue (Wernecke)	WWR4	Argillite, abundant quartz veining, iron staining associated with quartz veining, grey, slightly slate fabric	7.70	0.25	0.14	NR	3.40	75.30	21.90	Non-PAG
Sadie Ladue (Wernecke)	WWR5	Argillite to phyllite, abundant quartz veining, iron staining associated with quartz veining, grey, slightly, slate fabric slightly silky sheen	7.86	0.25	0.13	NR	3.80	73.80	19.70	Non-PAG
Sadie Ladue (Wernecke)	WWR6	Graphitic Schist, 20% carbonaceous material (graphite); medium to dark grey, silky sheen, platey texture, bounding quartz veining, finely disseminated cubes of pyrite <1%	7.94	0.52	0.20	NR	10.00	164.50	16.50	Non-PAG
Sadie Ladue (Wernecke)	WWR7	Graphitic Schist, 20% carbonaceous material (graphite); medium to dark grey, silky sheen, platey texture, bounding quartz veining, finely disseminated cubes of pyrite <1%	7.88	0.71	0.30	NR	12.80	112.80	8.80	Non-PAG
SHAMROCK	28_WR_TPBM_01	Waste rock pile - 200 Level portal	6.30	0.03	0.02	0.01	0.30	-0.50	<0.1	Low reactivity
SHAMROCK	28_WR_TPBM_ 02	Waste rock pile - 200 Level portal	6.40	0.06	0.04	0.02	0.60	0.60	1.00	Low reactivity
SHAMROCK	28_WR_TPBM_03	Waste rock pile - original Shamrock	6.20	0.04	0.03	0.01	0.30	1.00	3.20	Non-PAG
Silver King	1_WR_TPBM_01 - Rock	Northeast end of Waste rock from the 100 level adit	2.9	0.52	0.24	0.28	8.8	-3.2	<0.1	AG
Silver King	1_WR_TPBM_02 - Rock	Northwest end of waste rock from the 100 level adit	3.7	1.42	0.34	1.08	33.8	0.3	<0.1	AG
Silver King	1_WR_TPBM_03 - Rock	East side of waste rock from the open pit waste dump	5.0	0.51	0.2	0.31	9.7	-0.8	<0.1	PAG
Silver King	1_WR_TPBM_04 - Rock	North side of waste rock from the open pit waste dump	4.8	0.18	0.13	0.05	1.6	-0.4	<0.1	AG
Stone	31WR01-01 -Sept./99 -Soil	Upper Level Adit waste rock pile (#1)	8.80	0.20	<0.01	NR	6.30	196.50	31.40	Non-PAG
Stone	31WR02-01 -Sept./99 -Soil	Middle Level Adit waste rock pile (#2)	8.80	0.56	<0.01	NR	17.50	137.80	7.90	Non-PAG

Notes:

(1) Results compiled by Access Consulting Group and SRK from Public Works and Government Services Canada (2000) and Broughton (1996)

(2) 'NR' indicates value not reported

(3) Classification by SRK as follows:

AG: Acid generating (paste pH < 5)
PAG: Potentially acid generating (NP/AP < 1)
Uncertain: Uncertain potential to generate acid (1<NP/AP<2)
Non-PAG: Non-potentially acid generating (NP/AP > 2)
Low reactivity: Low reactive sulphide mineral content (NP/AP < 2, sulphide sulphur content < 0.1%)

Appendix H5

Description of Samples Tested in 2007

Waste Rock Dump Sample Descriptions - May 2007

Mine/dump location	No. of 20 L Pails	Sample ID	Sample Description
DIXIE Adit dump			
	1	95UKHDD01	grey fine gr. mat'l, minor >3", 3" rusty bands every 12"
	1	95UKHDD02	brownish & grey fine gr. mat'l (broken schist, some fragments, grey qtzite)
	1	95UKHDD03	grey fine gr. mat'l, rusty bands (6") every 14", sample from 8' depth
BERMINGHAM pit wall			
	1	95UKHBP01	thin bedded qtzite, rusty weathering; North wall of pit
	2	95UKHBP02	thick bedded blocky, rusty weathering qtzite; manganese staining (?); above old brim. Shaft; N. wall pit
	2	95UKHBP03	thick bedded, blocky qtzite, buff weathering, some minor graphitic schist talus; N. wall pit
	2	95UKHBP04	rusty weathering, blocky qtzite, minor schist; 70%>4", 10%>8"
	2	95UKHBP06	graphitic schist, platy talus on South pit wall, 1/2" x 8" pieces
	2	95UKHBP07	sericitic schist, platy to blocky talus on S. pit bench
BERMINGHAM pit dump			
	2	95UKHBD01	fine grained ore stockpile (1/2">x<3"), rusty weathering, 70% "soil" fraction mat'l
	2	95UKHBD02	fine grained ore stockpile (1/2">x<3"), rusty weathering, 70% "soil" fraction mat'l
	1	95UKHBD03	ore and colluvium (?) scraped from floor of ore stockpile area
	1	95UKHBD04	graphitic schist
	1	95UKHBD05	ore and colluvium (?) scraped from floor of ore stockpile area
	1	95UKHBD06	buff weathering, blocky qyzite
RUBY adit dump			
	2	95UKHRD01	grey - black fine grained qtzite rubble, iron stain banding (on only, 6" thick, dipping 45')
	2	95UKHRD02	grey - black fine grained qtzite rubble, weak iron stain banding (on only, 6" thick, dipping 45')
	2	95UKHRD03	grey - black fine grained qtzite rubble, iron stain banding (on only, 6" thick, dipping 45')
HUSKY SW			
	1	95UKHWD01	very pyritic grey qtzite
CALUMET 1-15 pit dump			
	2	95UKHCD01	buff weathering, altered (?) qtzite, rusty fractures
	2	95UKHCD02	buff weathering, blocky qtzite, rusty fracturing, possible some vein mat'l (15%)
	2	95UKHCD03	ore stockpile scrapings mixed and some colluvium, minor buff weathering qtzite w/ rusty fractures
CALUMET 1-15 pit wall			
	1	95UKHCP01	graphitic schist, platy talus (1/2" thick x 6-10" long)
	2	95UKHCP02	grey blocky qtzite, maroon fractures, >60%+4"
HECTOR pit dump			
	2	95UKHCD04	grey blocky qtzite, maroon weathering on fractures
MILLER pit dump			
	2	95UKHMD01	greenish-grey fine grained qtzite, rusty weathering on fracture surfaces, some pyrite casts
HECTOR adit dump			
	1	95UKHHD01	grey qtzite rubble, mixed with debris; top of dump
	2	95UKHHD02	grey qtzite rubble, mixed with debris; top of dump
	1	95UKHHD03	green sercite schist rubble, woody debris & fines; toe of dump
SIME 6 pit wall			
	2	95UKHSP01	grey, platy graphitic schist; 1/4" thick x 4-10" long
	2	95UKHSP02	buff weathering , blocky qtzite, some rusty fracture surfaces
SIME 4 pit wall			
	1	95UKHSP03	thick bedded, grey massive qtzite, some pyrite casts, all surfaces iron stained
SIME 35 pit wall			
	2	95UKHSP04	very fine grained schist, some Fe stain
	2	95UKHSP05	
SIME 4 & 6 pits wall			
	1	95UKHSD01	clean buff qtzite, 4" blocks, minor oxidation on 50% of fracture surfaces
ONEK pit			
	2	95UKHOP01	grey, clean qtzite mixed with schist - Fe staining laminar in schist
ONEK pit dump			
	1	95UKHOD01	greenstone, blocky 3" x 7" pieces and chips
	1	95UKHOD02	buff weathered qtzite, rusty fractures
	2	95UKHOD03	grey platy graphitic schist, 1/2" x 7"
KENO 700 adit dump			
	1	95UKHKD01	grey qtzite, qtz bands
	1	95UKHKD02	green seritic schist
UN adit dump			
	2	95UKHUD01	mixture grey graphitic schist and buff weath. qtzite, 30" + 3" 70" <3"
TOWNSITE adit dump			
	2	95UKHTD01	buff weathering qtzite, 10% >3", mostly fine fraction, some oxidation
	2	95UKHTD02	grey qtzite with serecite schist, 10% > 3", mostly fine fraction
BELLEKENO adit dump			
	2	95UKHLD01	dark grey pyritic qtzite, qtz stringers abundant
SILVER KING pit dump			
	1	95UKHVD01	mixed grey and buff qtzite, minor schist, some sandsize particles
GALKENO 900			
	1	95UKGK901	grey, fine gr. Schist
TOTAL # of SAMPLE SITES:	47		
TOTAL # of 20 L PAILS	74		

Appendix H6

2007 ABA Test Results and Elemental Content

Keno Hill Waste Rock Chemistry Data[1]			**DIXIE Adit dump**			**BERMINGHAM pit wall**						**BERMINGHAM pit dump**					
	Units	**Method**	**95UKHDD01**	**95UKHDD02**	**95UKHDD03**	**95UKHBP01**	**95UKHBP02**	**95UKHBP03**	**95UKHBP04**	**95UKHBP06**	**95UKHBP07**	**95UKHBD01**	**95UKHBD02**	**95UKHBD03**	**95UKHBD04**	**95UKHBD05**	**95UKHBD06**
AP[2]	tCaCO3/1000t	*SRK Calculated*	3.1	2.2	1.9	0.6	0.3	0.9	0.3	20.0	0.3	4.4	4.7	17.8	5.9	0.6	0.3
FIZZ RATING	Unity	OA-VOL08 *Basic Acid Base Accounting*	1	1	2	1	1	1	1	3	1	1	2	3	2	1	1
NNP	tCaCO3/1000t	OA-VOL08 *Basic Acid Base Accounting*	-6	-15	2	4	4	6	5	46	6	15	11	285	24	6	1
NP	tCaCO3/1000t	OA-VOL08 *Basic Acid Base Accounting*	4.0	-3.0	11.0	5.0	5.0	7.0	5.0	68.0	7.0	20.0	17.0	308.0	31.0	7.0	2.0
Carbonate NP	tCaCO3/1000t	*SRK Calculated*	7	4	13	4	4	4	4	67	4	15	13	303	31	9	4
pH	Unity	OA-ELE07 *Paste pH*	4.3	3.5	5.2	6.6	7	7.1	7.4	7.7	8.2	7.4	7.4	7	7.5	7.6	7.6
Ratio (NP:AP)	Unity	*SRK Calculated*	1.3	-1.4	5.9	8.0	16.0	7.5	16.0	3.4	22.4	4.6	3.6	17.3	5.2	11.2	6.4
Classification[3]		*Assigned by SRK*	AG	AG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG
S	%	S-IR08 *Total Sulphur (Leco)*	0.32	0.37	0.29	0.03	0.02	0.03	0.01	0.69	0.02	0.17	0.2	0.75	0.21	0.03	0.03
S	%	S-GRA06 *Sulfate Sulfur-carbonate leach*	0.22	0.3	0.23	0.01	0.01	<0.01	<0.01	0.05	0.01	0.03	0.05	0.18	0.02	0.01	0.02
S	%	S-GRA06a *Sulfate Sulfur (HCl leachable)*	0.21	0.3	0.22	<0.01	<0.01	<0.01	<0.01	0.03	<0.01	0.16	0.17	0.21	0.08	0.01	0.01
S	%	S-CAL06 *Sulfide Sulpher (calculated)*	0.1	0.07	0.06	0.02	0.01	0.03	0.01	0.64	0.01	0.14	0.15	0.57	0.19	0.02	0.01
C	%	C-GAS05 *Inorganic Carbon (CO2)*	0.08	<0.05	0.15	<0.05	<0.05	<0.05	<0.05	0.8	<0.05	0.18	0.15	3.64	0.37	0.11	<0.05
CO2	%	C-GAS05 *Inorganic Carbon (CO2)*	0.3	<0.2	0.6	<0.2	<0.2	<0.2	<0.2	2.9	<0.2	0.7	0.6	13.4	1.4	0.4	<0.2
Au	ppm	Au-ICP21 *Au 30g FA ICP-AES Finish*	0.013	0.015	0.003	0.005	0.008	0.019	0.004	0.001	<0.001	0.056	0.046	0.085	0.039	0.009	0.016
Ag (Silver)	ppm	ME-ICP61 *27 element four acid ICP-AES*	1.7	14.7	1.6	11.5	6.1	15.1	3.4	0.5	<0.5	**>100**	**>100**	**>100**	95.4	5.3	10.7
Al (Aluminum)	%	ME-ICP61 *27 element four acid ICP-AES*	2.08	1.3	3.42	1.87	4.16	5.69	1.02	4.49	8.68	2.39	2.94	1.72	3.19	0.46	0.99
As (Arsenic)	ppm	ME-ICP61 *27 element four acid ICP-AES*	66	49	22	69	304	331	43	38	<5	620	433	944	424	39	89
Ba (Barium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	300	210	430	350	600	1110	130	770	860	530	880	330	630	140	260
Be (Beryllium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	0.6	<0.5	1	0.5	1.3	1.4	<0.5	1.1	2.3	0.7	0.8	0.6	0.8	<0.5	<0.5
Bi (Bismuth)	ppm	ME-ICP61 *27 element four acid ICP-AES*	<2	<2	<2	2	<2	3	<2	<2	3	5	7	7	3	<2	2
Ca (Calcium)	%	ME-ICP61 *27 element four acid ICP-AES*	0.25	0.1	0.51	0.06	0.18	0.08	0.02	1.98	0.15	0.22	0.18	0.57	0.15	0.03	0.02
Cd (Cadmium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	<0.5	5.9	3.7	15.8	24.6	15.8	5.2	1.2	1	211	151	691	110	12.9	9
Co (Cobalt)	ppm	ME-ICP61 *27 element four acid ICP-AES*	<1	<1	2	3	2	6	1	8	14	5	3	<1	3	<1	<1
Cr (Chromium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	46	34	60	38	77	78	45	47	61	36	42	32	56	32	34
Cu (Copper)	ppm	ME-ICP61 *27 element four acid ICP-AES*	9	15	11	39	25	39	14	24	22	119	86	137	76	10	16
Fe (Iron)	%	ME-ICP61 *27 element four acid ICP-AES*	2.1	1.2	1.81	1.45	2.95	4.14	1.15	2.24	3.95	10.9	8.54	14.05	6.01	1.21	1.09
Ga (Gallium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	10	<10	10	10	10	10	<10	10	20	<10	10	<10	10	<10	<10
K (Potassium)	%	ME-ICP61 *27 element four acid ICP-AES*	0.36	0.36	0.66	0.5	0.88	1.69	0.21	1.27	2.56	0.62	0.87	0.49	0.85	0.13	0.27
La (Lanthanum)	ppm	ME-ICP61 *27 element four acid ICP-AES*	10	10	20	10	20	20	<10	20	40	10	10	10	20	<10	10
Mg (Magnesium)	%	ME-ICP61 *27 element four acid ICP-AES*	0.16	0.06	0.24	0.14	0.54	0.34	0.12	0.95	0.93	0.24	0.24	0.38	0.25	0.02	0.05
Mn (Manganese)	ppm	ME-ICP61 *27 element four acid ICP-AES*	1040	691	179	1690	1985	4430	1615	707	441	46400	29300	82800	18700	3420	1615
Mo (Molybdenum)	ppm	ME-ICP61 *27 element four acid ICP-AES*	1	<1	1	<1	1	1	<1	4	<1	1	2	1	<1	<1	<1
Na (Sodium)	%	ME-ICP61 *27 element four acid ICP-AES*	0.08	0.02	0.14	0.06	0.15	0.17	0.04	0.39	0.97	0.08	0.08	0.04	0.1	0.01	0.03
Ni (Nickel)	ppm	ME-ICP61 *27 element four acid ICP-AES*	8	6	15	15	26	25	10	24	34	19	17	11	17	3	2
P (Phosphorous)	ppm	ME-ICP61 *27 element four acid ICP-AES*	280	390	470	440	600	560	150	1320	340	630	650	750	540	190	140
Pb (Lead)	ppm	ME-ICP61 *27 element four acid ICP-AES*	81	896	122	897	75	576	101	38	18	**>10000**	8660	**>10000**	6010	489	864
S (Sulphur)	%	ME-ICP61 *27 element four acid ICP-AES*	0.29	0.36	0.28	0.02	0.02	0.03	0.01	0.71	0.03	0.17	0.21	0.78	0.21	0.02	0.02
Sb (Antimony)	ppm	ME-ICP61 *27 element four acid ICP-AES*	21	35	9	18	27	24	12	5	9	222	153	247	131	11	31
Sc (Scandium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	3	3	5	4	10	12	4	7	13	7	7	7	7	1	2
Sr (Strontium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	35	20	59	28	71	91	24	126	92	86	82	37	76	10	27
Th	ppm	ME-ICP61 *27 element four acid ICP-AES*	<20	<20	<20	<20	<20	<20	<20	<20	20	<20	<20	<20	<20	<20	<20
Ti (Titanium)	%	ME-ICP61 *27 element four acid ICP-AES*	0.13	0.12	0.18	0.11	0.25	0.23	0.11	0.22	0.24	0.1	0.1	0.08	0.18	0.05	0.08
Tl (Thallium)#	ppm	ME-ICP61 *27 element four acid ICP-AES*	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	<10	10	<10	<10	<10
U (Uranium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	<10	<10	<10
V (Vanadium)	ppm	ME-ICP61 *27 element four acid ICP-AES*	41	30	63	37	92	130	31	66	77	52	63	36	66	10	21
W (Tungsten)	ppm	ME-ICP61 *27 element four acid ICP-AES*	<10	<10	<10	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	<10	10
Zn (Zinc)	ppm	ME-ICP61 *27 element four acid ICP-AES*	93	489	214	646	621	659	276	120	112	3800	2860	**>10000**	3070	337	281
Fire Assay Results for samples triggered due to concentration indicated during ICP testing																	
Ag (Silver)	ppm	Ag-OG62 *Ore Grade Ag - Four Acid*										**230**	**191**	**190**			
Ag (Silver)	oz/ T	*Calculated*										**7.39**	**6.14**	**6.11**			
Pb (Lead)	%	Pb-OG62 *Ore Grade Pb - Four Acid*										**1.17**		**1.14**			
Zn (Zinc)	%	Zn-OG62 *Ore Grade Zn - Four Acid*												**1.18**			

Red = fire assay testing triggered

Notes:
(1) Testing commissioned and results compiled by Access Consulting Group
(2) ABA carried out according to Sobek (1978) method with additional sulphate speciation. AP is calculated from (total sulphur - sulphate sulphur).
(3) Classification by SRK as follows:
AG: Acid generating (Paste pH < 5)
PAG: Potentially acid generating (NP/AP < 1)
U: Uncertain potential to generate acid (1<NP/AP<2)
Non-PAG: Non-potentially acid generating (NP/AP > 2)
LR: Low reactive sulphide mineral content (NP/AP < 2, sulphide sulphur content≤0.1%)

Keno Hill Waste Rock Chemistry Data		RUBY adit dump			HUSKY SW	CALUMET 1-15 pit dump			CALUMET 1-15 pit wall		Hector Pit dump	MILLER pit dump	HECTOR adit dump			SIME 6 pit wall	
	Units	95UKHRD01	95UKHRD02	95UKHRD03	95UKHWD01	95UKHCD01	95UKHCD02	95UKHCD03	95UKHCP01	95UKHCP02	95UKHCD04	95UKHMD01	95UKHHD01	95UKHHD02	95UKHHD03	95UKHSP01	95UKHSP02
AP(2)	tCaCO3/1000t	24.4	9.1	7.5	24.4	0.3	3.1	0.9	0.6	0.3	1.6	0.3	46.3	45.6	16.3	1.3	0.9
FIZZ RATING	Unity	2	2	2	1	1	1	1	1	1	1	1	2	3	3	1	1
NNP	tCaCO3/1000t	14	5	2	-43	0	-3	-4	-1	1	3	4	1	49	19	2	1
NP	tCaCO3/1000t	52.0	18.0	18.0	-5.0	1.0	2.0	0.0	0.0	2.0	5.0	4.0	61.0	103.0	41.0	4.0	2.0
Carbonate NP	tCaCO3/1000t	65	28	10	4	5	4	4	4	4	4	4	76	152	53	4	4
pH	Unity	7.5	7.1	7.6	3.2	6.6	6.1	6.7	6.9	7.1	6.9	7.3	6	7.2	7.4	7.1	7.1
Ratio (NP:AP)	Unity	2.1	2.0	2.4	-0.2	3.2	0.6	0.0	0.0	6.4	3.2	12.8	1.3	2.3	2.5	3.2	2.1
Classification(3)		Non-PAG	Non-PAG	Non-PAG	AG	Non-PAG	LR	LR	LR	Non-PAG	Non-PAG	Non-PAG	U	Non-PAG	Non-PAG	Non-PAG	Non-PAG
S	%	1.22	0.41	0.5	1.2	0.02	0.17	0.14	0.03	0.03	0.07	0.01	1.93	1.72	0.7	0.06	0.04
S	%	0.44	0.12	0.26	0.42	0.01	0.07	0.11	0.01	0.02	0.02	<0.01	0.45	0.26	0.18	0.02	0.01
S	%	0.46	0.14	0.25	0.37	<0.01	0.13	0.11	0.02	0.02	0.04	<0.01	0.42	0.24	0.16	0.03	0.02
S	%	0.78	0.29	0.24	0.78	0.01	0.1	0.03	0.02	0.01	0.05	0.01	1.48	1.46	0.52	0.04	0.03
C	%	0.78	0.34	0.12	<0.05	0.06	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	0.91	1.82	0.63	<0.05	<0.05
CO2	%	2.9	1.3	0.5	<0.2	0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	3.3	6.7	2.3	<0.2	<0.2
Au	ppm	0.024	0.177	0.011	0.029	0.018	0.175	0.106	0.011	0.001	0.066	0.005	0.058	0.039	0.022	0.179	0.009
Ag (Silver)	ppm	19	**>100**	23	8.2	**>100**	**>100**	**>100**	21.5	34.3	**>100**	6.4	**>100**	60.1	54.8	51.4	8.9
Al (Aluminum)	%	4.73	3.02	4.85	2.62	1.15	2.59	1.87	6.8	2.21	2.14	0.6	3.15	2.44	3.46	7.04	2.97
As (Arsenic)	ppm	172	178	53	82	117	800	829	56	70	295	53	352	733	188	59	36
Ba (Barium)	ppm	610	420	310	420	100	480	230	1180	410	150	100	500	510	680	1070	480
Be (Beryllium)	ppm	1.2	0.8	0.8	0.5	<0.5	0.6	<0.5	1.5	0.7	<0.5	<0.5	0.8	0.6	0.8	1.9	0.7
Bi (Bismuth)	ppm	<2	<2	<2	<2	<2	2	<2	2	<2	3	3	2	2	2	2	3
Ca (Calcium)	%	1.47	0.3	3.09	0.08	0.02	0.03	0.02	0.02	0.05	0.04	0.03	0.57	0.95	0.67	0.09	0.02
Cd (Cadmium)	ppm	17.4	47.3	7.9	0.5	1	22.9	16.6	2	3.4	27.8	12.2	203	211	61.4	9.6	2.1
Co (Cobalt)	ppm	6	1	21	1	1	<1	<1	<1	<1	5	1	1	5	4	1	1
Cr (Chromium)	ppm	71	53	42	52	25	53	46	110	56	51	30	50	48	63	87	60
Cu (Copper)	ppm	21	128	100	14	73	242	211	27	11	295	8	109	58	51	59	16
Fe (Iron)	%	3.71	3.06	5.41	1.83	1.28	6.51	3.67	2.51	1.71	3.17	1.21	4.8	5.35	2.91	2.84	1.59
Ga (Gallium)	ppm	10	10	10													
K (Potassium)	%	1.16	0.73	0.46	0.51	0.27	0.81	0.52	2.12	0.62	0.27	0.19	0.92	0.74	1.05	2.36	0.93
La (Lanthanum)	ppm	20	20	10													
Mg (Magnesium)	%	0.42	0.22	1.52	0.17	0.04	0.07	0.04	0.14	0.11	0.44	0.02	0.27	0.46	0.3	0.16	0.1
Mn (Manganese)	ppm	8680	5920	1865	176	182	6630	3590	94	155	2950	4970	13550	23900	8300	952	174
Mo (Molybdenum)	ppm	2	1	<1	<1	<1	1	1	1	<1	<1	<1	<1	<1	1	1	<1
Na (Sodium)	%	0.15	0.09	0.49	0.09	0.02	0.06	0.04	0.14	0.05	0.19	0.02	0.08	0.06	0.1	0.17	0.05
Ni (Nickel)	ppm	40	14	41	10	6	5	5	9	8	20	3	16	21	15	10	5
P (Phosphorous)	ppm	650	430	730	70	80	440	320	370	500	270	250	440	350	390	740	440
Pb (Lead)	ppm	992	5520	915	447	9330	**>10000**	**>10000**	668	681	7890	620	5170	3020	2530	2250	1230
S (Sulphur)	%	1.28	0.42	0.56	1.25	0.02	0.17	0.14	0.04	0.03	0.07	0.01	2	1.78	0.73	0.06	0.04
Sb (Antimony)	ppm	24	161	27	22	54	282	258	17	20	136	13	130	76	59	46	17
Sc (Scandium)	ppm	8	6	18													
Sr (Strontium)	ppm	99	47	128	27	8	29	18	94	30	41	12	37	42	55	103	30
Th	ppm	<20	<20	<20													
Ti (Titanium)	%	0.24	0.15	0.69	0.24	0.08	0.11	0.1	0.36	0.14	0.23	0.06	0.16	0.13	0.17	0.38	0.19
Tl (Thallium)#	ppm	<10	<10	<10													
U (Uranium)	ppm	<10	<10	<10													
V (Vanadium)	ppm	77	57	197	65	16	48	32	108	42	72	13	54	47	58	117	49
W (Tungsten)	ppm	<10	<10	<10	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Zn (Zinc)	ppm	1430	1860	578	57	276	2050	1040	306	357	1155	950	**>10000**	**>10000**	4640	778	224
Fire Assay Results for samples trigge																	
Ag (Silver)	ppm		**241**			**126**	**290**	**219**			**265**		**123**				
Ag (Silver)	oz/ T		**7.75**			**4.05**	**9.32**	**7.04**			**8.52**		**3.95**				
Pb (Lead)	%						**1.51**	**1.46**									
Zn (Zinc)	%												**1.62**	**1.66**			

Notes:
(1) Testing commissioned and results
(2) ABA carried out according to Sobe
(3) Classification by SRK as follows:
AG: Acid generating (Paste pH < 5
PAG: Potentially acid generating (I
U: Uncertain potential to generate
Non-PAG: Non-potentially acid ger
LR: Low reactive sulphide mineral

Keno Hill Waste Rock Chemistry Data		SIME 4 pit wall	SIME 35 pit wall		SIME 4 & 6 pit wall	ONEK pit	ONEK pit dump			KENO 700 adit dump		UN adit dump	TOWNSITE adit dump		BELLEKENO adit dump	SILVER KING pit dump	GALKENO 900
	Units	95UKHSP03	95UKHSP04	95UKHSP05	95UKHSD01	95UKHOP01	95UKHOD01	95UKHOD02	95UKHOD03	95UKHKD01	95UKHKD02	95UKHUD01	95UKHTD01	95UKHTD02	95UKHLD01	95UKHVD01	95UKGK901
AP[2]	tCaCO3/1000t	0.3	1.3	0.9	0.6	9.4	0.3	0.3	1.9	16.6	10.3	0.9	32.2	3.8	23.1	1.6	6.3
FIZZ RATING	Unity	1	1	1	1	3	2	1	3	3	3	1	2	2	3	1	2
NNP	tCaCO3/1000t	1	3	2	3	55	17	1	36	17	28	3	-24	-1	49	-14	-11
NP	tCaCO3/1000t	1.0	4.0	3.0	4.0	64.0	17.0	1.0	38.0	35.0	41.0	4.0	16.0	10.0	73.0	1.0	7.0
Carbonate NP	tCaCO3/1000t	4	4	4	4	74	9	4	43	39	41	4	30	19	86	4	11
pH	Unity	7.5	7.4	7.6	8	8.4	8.7	8.1	7.7	7.8	7.9	7.8	5.7	6.7	7.1	4.2	4.6
Ratio (NP:AP)	Unity	3.2	3.2	3.2	6.4	6.8	54.4	3.2	20.3	2.1	4.0	4.3	0.5	2.7	3.2	0.6	1.1
Classification[3]		Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	Non-PAG	PAG	Non-PAG	Non-PAG	AG	AG
S	%	0.01	0.04	0.03	0.02	0.3	0.01	0.01	0.06	0.57	0.41	0.04	1.27	0.35	0.78	0.47	0.57
S	%	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	0.08	0.01	0.24	0.23	0.04	0.42	0.37
S	%	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.04	0.07	0.01	0.23	0.22	0.02	0.4	0.37
S	%	0.01	0.04	0.03	0.02	0.3	0.01	0.01	0.06	0.53	0.33	0.03	1.03	0.12	0.74	0.05	0.2
C	%	<0.05	<0.05	<0.05	<0.05	0.89	0.11	<0.05	0.51	0.47	0.49	<0.05	0.36	0.23	1.03	<0.05	0.13
CO2	%	<0.2	<0.2	<0.2	<0.2	3.3	0.4	<0.2	1.9	1.7	1.8	<0.2	1.3	0.9	3.8	0.2	0.5
Au	ppm	0.011	0.006	0.003	0.004	<0.001	<0.001	0.004	0.001	0.116	0.112	0.019	0.076	0.339	0.016	0.121	0.021
Ag (Silver)	ppm	2.5	0.7	1.5	1.2	<0.5	<0.5	4.9	<0.5	90.5	21.2	49.3	61.5	**>100**	28.5	19.7	25.3
Al (Aluminum)	%	0.43	5.52	3.59	0.58	3.92	8.55	0.58	9.26	1.72	3.93	5.57	2.07	2.08	2.24	4.37	3.47
As (Arsenic)	ppm	84	18	37	29	9	7	85	25	423	367	78	125	696	348	290	101
Ba (Barium)	ppm	70	940	440	80	500	20	50	1160	310	2870	1010	320	260	330	1050	1030
Be (Beryllium)	ppm	<0.5	1.4	0.9	<0.5	1	0.7	<0.5	2.3	<0.5	1.2	1.4	0.5	0.7	0.6	0.9	0.9
Bi (Bismuth)	ppm	<2	<2	2	<2	<2	<2	<2	<2	3	4	<2	<2	<2	<2	<2	<2
Ca (Calcium)	%	0.02	0.2	0.1	0.05	2.65	8.32	0.05	1.69	0.67	0.68	0.11	0.16	0.08	2.65	0.3	0.41
Cd (Cadmium)	ppm	4.5	2.3	10.3	7.8	2.9	0.9	6.2	1.4	85.2	34.9	5.7	90.8	56.5	12.9	1.4	1.1
Co (Cobalt)	ppm	<1	<1	2	2	6	41	<1	12	3	11	3	4	<1	3	1	2
Cr (Chromium)	ppm	27	95	79	34	58	109	42	112	48	56	90	58	46	61	54	61
Cu (Copper)	ppm	7	28	7	2	11	144	55	28	68	105	31	33	285	24	25	19
Fe (Iron)	%	0.46	3.12	2.09	0.45	2.17	8.5	1	4.52	2.19	3.33	2.81	2.99	4.17	2.03	2.33	2.11
Ga (Gallium)	ppm																
K (Potassium)	%	0.12	1.16	0.79	0.16	0.76	0.02	0.17	1.78	0.49	1.02	1.31	0.59	0.4	0.5	1.28	0.92
La (Lanthanum)	ppm																
Mg (Magnesium)	%	0.02	0.37	0.12	0.02	0.26	4.15	0.04	0.36	0.18	0.79	0.32	0.13	0.1	0.26	0.25	0.27
Mn (Manganese)	ppm	73	229	752	732	275	1440	163	277	3870	4900	371	7300	4260	2210	235	593
Mo (Molybdenum)	ppm	<1	2	<1	<1	<1	<1	1	1	1	2	1	<1	<1	1	<1	1
Na (Sodium)	%	0.01	0.26	0.1	0.02	0.16	1.08	0.02	0.31	0.07	0.24	0.21	0.04	0.05	0.06	0.15	0.12
Ni (Nickel)	ppm	2	21	16	4	21	93	2	54	13	35	19	9	12	16	11	18
P (Phosphorous)	ppm	120	1210	450	110	450	610	170	1030	260	300	720	340	430	490	360	430
Pb (Lead)	ppm	292	48	103	68	43	19	224	79	7170	1460	1960	941	**>10000**	1370	333	477
S (Sulphur)	%	0.01	0.04	0.03	0.02	0.32	0.01	0.01	0.07	0.59	0.38	0.04	1.29	0.36	0.85	0.46	0.56
Sb (Antimony)	ppm	19	<5	9	<5	5	11	6	<5	96	27	53	39	707	27	28	27
Sc (Scandium)	ppm																
Sr (Strontium)	ppm	8	108	43	10	207	253	6	226	42	100	89	21	20	107	78	78
Th	ppm																
Ti (Titanium)	%	0.05	0.27	0.2	0.06	0.2	0.97	0.07	0.27	0.13	0.15	0.3	0.12	0.08	0.14	0.5	0.18
Tl (Thallium)#	ppm																
U (Uranium)	ppm																
V (Vanadium)	ppm	8	108	60	9	59	341	12	145	31	81	95	35	30	42	157	70
W (Tungsten)	ppm	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	10	<10
Zn (Zinc)	ppm	108	161	414	309	421	181	172	168	5920	2920	240	7070	2630	1150	105	127
Fire Assay Results for samples trigge																	
Ag (Silver)	ppm													**679**			
Ag (Silver)	oz/ T													**21.83**			
Pb (Lead)	%													**3.95**			
Zn (Zinc)	%																

Notes:
(1) Testing commissioned and results
(2) ABA carried out according to Sobe
(3) Classification by SRK as follows:
AG: Acid generating (Paste pH < 5
PAG: Potentially acid generating (
U: Uncertain potential to generate
Non-PAG: Non-potentially acid ge
LR: Low reactive sulphide mineral

Appendix H7

2007 Leach Extraction Test Results

RESULTS OF ANALYSIS[(1)]

Mine/Dump Location		Dixie Adit Dump			Bermingham Pit Wall						Bemingham Pit Dump					
Sample ID		95UKHDD01	95UKHDD02	95UKHDD03	95UKHBP01	95UKHBP02	95UKHBP03	95UKHBP04	95UKHBP06	95UKHBP07	95UKHBD01	95UKHBD02	95UKHBD03	95UKHBD04	95UKHBD05	95UKHBD06
Date of Analysis	11-May-07															
ALS Sample ID		L481965-1	L481965-2	L481965-3	L481965-4	L481965-5	L481965-6	L481965-7	L481965-8	L481965-9	L481965-10	L481965-11	L481965-12	L481965-13	L481965-14	L481965-15
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Leachable Anions & Nutrients	**Units**															
pH	pH	3.43	2.61	4.99	6.17	6.94	6.67	6.69	7.45	7.56	7.14	7.07	6.07	7.20	7.27	6.95
Leachable Metals																
Aluminum (Al)-Leachable	mg/L	38.6	98.2	2.68	0.0111	0.0197	0.0204	0.0263	0.0198	0.840	<0.0030	0.203	<0.10	0.0054	<0.0030	0.0146
Antimony (Sb)-Leachable	mg/L	<0.0020	0.011	<0.0010	0.00289	0.00420	0.00205	0.00359	0.00558	0.00561	0.00051	0.00118	<0.010	0.00072	0.00208	0.00530
Arsenic (As)-Leachable	mg/L	0.0049	0.130	<0.0010	0.00102	0.00729	0.00177	0.00082	0.00051	0.00101	0.00029	0.00681	<0.010	0.00023	0.00036	0.00081
Barium (Ba)-Leachable	mg/L	0.109	<0.0050	0.0439	0.00935	0.00244	0.00683	0.00151	0.0232	0.00853	0.00224	0.0114	0.0569	0.00649	0.00267	0.00586
Beryllium (Be)-Leachable	mg/L	<0.010	<0.050	<0.0050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050	<0.050	<0.0010	<0.00050	<0.00050
Bismuth (Bi)-Leachable	mg/L	<0.010	<0.050	<0.0050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.00050	<0.00050	<0.00050	<0.050	<0.0010	<0.00050	<0.00050
Boron (B)-Leachable	mg/L	<0.20	<1.0	<0.10	0.013	<0.010	0.013	<0.010	<0.020	0.011	<0.010	<0.010	<1.0	<0.020	0.011	<0.010
Cadmium (Cd)-Leachable	mg/L	0.173	2.41	0.500	0.00604	0.000448	0.000716	0.000264	0.00111	0.000218	0.0120	0.0122	35.7	0.0446	0.00194	0.137
Calcium (Ca)-Leachable	mg/L	268	148	511	5.22	11.3	3.31	1.87	142	5.01	47.0	86.5	136	45.8	4.52	6.15
Chromium (Cr)-Leachable	mg/L	0.023	0.210	<0.0050	0.00094	0.00156	0.00084	0.00240	<0.0010	<0.00050	<0.00050	0.00081	<0.050	<0.0010	<0.00050	<0.00050
Cobalt (Co)-Leachable	mg/L	0.0478	0.210	0.108	0.00013	<0.00010	<0.00010	<0.00010	0.00178	0.00022	<0.00010	0.00066	0.064	<0.00020	0.00012	0.00025
Copper (Cu)-Leachable	mg/L	0.125	1.14	0.0732	0.00168	<0.00060	<0.00050	0.00170	0.00515	0.00434	<0.00050	0.00323	0.016	<0.0011	<0.0010	0.00091
Iron (Fe)-Leachable	mg/L	15.2	188	2.03	<0.030	0.036	<0.030	<0.030	<0.030	0.409	<0.030	0.215	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Leachable	mg/L	0.407	0.0697	0.0251	0.00168	<0.00050	<0.00090	0.000973	0.00238	0.00204	0.00226	0.0353	1.45	0.0187	<0.00070	0.0108
Lithium (Li)-Leachable	mg/L	<0.10	<0.50	0.066	0.0067	0.0097	0.0088	<0.0050	0.016	0.0085	0.0125	0.0111	<0.50	0.019	<0.0050	<0.0050
Magnesium (Mg)-Leachable	mg/L	48.1	30.4	62.1	1.10	2.13	0.92	0.47	30.4	1.59	26.1	28.2	51.0	19.9	1.24	1.66
Manganese (Mn)-Leachable	mg/L	90.6	207	15.9	0.142	0.00428	0.0237	0.0162	1.26	0.0443	0.0311	0.282	122	0.276	1.94	0.461
Mercury (Hg)-Leachable	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Molybdenum (Mo)-Leachable	mg/L	<0.0010	<0.0050	<0.00050	<0.000050	0.000216	0.000062	0.000068	0.00625	0.00495	<0.000050	0.000066	<0.0050	<0.00010	0.000189	0.000083
Nickel (Ni)-Leachable	mg/L	0.234	0.981	0.417	0.00317	<0.00050	0.00067	0.00051	0.0039	0.00075	0.00072	0.00183	0.166	0.0014	0.00068	0.00088
Phosphorus (P)-Leachable	mg/L	<0.30	1.59	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Leachable	mg/L	3.4	<2.0	4.5	4.2	<2.0	2.7	<2.0	6.3	3.5	2.6	3.5	6.4	3.4	<2.0	<2.0
Selenium (Se)-Leachable	mg/L	<0.020	<0.10	<0.010	<0.0010	<0.0010	<0.0010	<0.0010	0.0079	0.0013	0.0049	0.0075	<0.10	0.0073	0.0015	<0.0010
Silicon (Si)-Leachable	mg/L	5.84	4.35	3.77	3.99	3.04	3.85	2.48	2.41	5.79	2.00	2.29	1.85	1.81	2.44	2.54
Silver (Ag)-Leachable	mg/L	0.00452	0.0011	<0.00010	0.000077	0.000208	0.000375	0.000045	0.000065	0.000080	0.000216	0.00105	<0.0010	0.000080	0.000026	0.000141
Sodium (Na)-Leachable	mg/L	<2.0	<2.0	<2.0	<2.0	4.2	<2.0	<2.0	<2.0	2.6	4.8	6.2	5.9	<2.0	<2.0	<2.0
Strontium (Sr)-Leachable	mg/L	0.168	0.097	0.175	0.0243	0.0255	0.0173	0.00802	0.378	0.0110	0.0696	0.100	0.221	0.0561	0.0234	0.0296
Thallium (Tl)-Leachable	mg/L	0.0026	<0.010	0.0013	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010	<0.010	<0.00020	<0.00010	<0.00010
Tin (Sn)-Leachable	mg/L	<0.0020	<0.010	<0.0010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00010	<0.00010	<0.00010	<0.010	<0.00020	<0.00010	<0.00010
Titanium (Ti)-Leachable	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Leachable	mg/L	0.00947	0.0503	0.00043	<0.000010	0.000013	<0.000010	<0.000010	0.00155	0.000079	<0.000010	0.000075	<0.0010	<0.000020	<0.000010	<0.000010
Vanadium (V)-Leachable	mg/L	<0.020	<0.10	<0.010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0020	<0.0010	<0.0010	<0.0010	<0.10	<0.0020	<0.0010	<0.0010
Zinc (Zn)-Leachable	mg/L	7.42	143	29.0	0.0790	<0.0060	0.0107	<0.0080	0.0080	<0.0070	0.0437	0.0988	266	0.351	0.0178	1.05

(1) Testing commissioned and results compiled by Access Consulting Group

RESULTS OF ANALYSIS(1)

Mine/Dump Location		Ruby Adit Dump			Calumet 1-15 Pit Dump			Calumet 1-15 Pit Wall		Husky SW	Hector Pit Dump	Miller Pit Dump	Hector Adit Dump			SIME 6 Pit Wall	
Sample ID		95UKHRD01	95UKHRD02	95UKHRD03	95UKHCD01	95UKHCD02	95UKHCD03	95UKHCP01	95UKHCP02	95UKHWD01	95UKHCD04	95UKHMD01	95UKHHD01	95UKHHD02	95UKHHD03	95UKHSP01	95UKHSP02
Date of Analysis	11-May-07																
ALS Sample ID		L481965-16	L481965-17	L481965-18	L481962-1	L481962-2	L481962-7	L481962-4	L481962-5	L481962-3	L481962-6	L481962-8	L481962-9	L481962-10	L481962-11	L481962-12	L481962-13
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Leachable Anions & Nutrients	**Units**																
pH	pH	7.38	6.59	7.07	6.25	5.74	6.49	5.76	6.17	2.38	6.34	6.71	6.42	7.04	7.41	7.08	6.53
Leachable Metals																	
Aluminum (Al)-Leachable	mg/L	0.295	<0.0050	0.0468	<0.0030	0.0217	<0.0010	0.142	0.0041	158	0.0037	0.0245	<0.80	<0.080	0.0221	0.0286	0.0055
Antimony (Sb)-Leachable	mg/L	0.0031	0.00136	0.00277	0.00077	<0.00050	0.00170	0.00134	0.00299	0.0090	0.00069	0.00175	<0.010	0.0045	0.00454	0.00098	0.00101
Arsenic (As)-Leachable	mg/L	0.0068	<0.00050	0.00051	0.00014	0.00070	0.00031	0.00055	0.00080	1.40	0.00022	0.00083	0.012	0.0048	0.00127	0.00028	0.00051
Barium (Ba)-Leachable	mg/L	0.0263	0.0422	0.0392	0.0213	0.306	0.0418	0.00609	0.00765	0.0133	0.259	0.0255	0.0202	0.0860	0.0620	0.0226	0.00448
Beryllium (Be)-Leachable	mg/L	<0.0050	<0.0025	<0.0025	<0.00050	<0.0025	<0.00050	<0.00050	<0.00050	<0.010	<0.00050	<0.00050	<0.050	<0.0050	<0.0025	<0.00050	<0.00050
Bismuth (Bi)-Leachable	mg/L	<0.0050	<0.0025	<0.0025	<0.00050	<0.0025	<0.00050	<0.00050	<0.00050	<0.010	<0.00050	<0.00050	<0.050	<0.0050	<0.0025	<0.00050	<0.00050
Boron (B)-Leachable	mg/L	<0.10	<0.050	<0.050	0.013	<0.050	0.012	0.021	0.012	<0.20	<0.010	0.012	<1.0	<0.10	<0.050	0.022	0.020
Cadmium (Cd)-Leachable	mg/L	0.0156	1.25	0.0610	0.00208	0.0771	0.0107	0.000993	0.0169	0.0648	0.190	0.000435	5.03	1.10	0.350	0.0169	0.00230
Calcium (Ca)-Leachable	mg/L	548	351	439	1.22	32.3	2.75	0.723	3.73	129	6.86	3.39	418	483	458	1.12	1.16
Chromium (Cr)-Leachable	mg/L	<0.0050	<0.0025	<0.0025	<0.00050	<0.0025	<0.00050	<0.00050	<0.00050	0.450	<0.00050	0.00271	<0.050	<0.0050	<0.0025	<0.00050	<0.00050
Cobalt (Co)-Leachable	mg/L	0.0044	0.0237	0.0403	0.00024	0.00124	0.00014	0.00012	0.00138	0.356	0.00357	<0.00010	0.315	0.0218	0.00522	0.00038	0.00026
Copper (Cu)-Leachable	mg/L	0.0028	0.0460	0.00157	0.00052	0.0106	0.00130	0.00391	0.00486	1.04	0.00500	0.00283	0.017	0.0113	0.00756	0.00232	0.00395
Iron (Fe)-Leachable	mg/L	0.316	<0.030	0.054	<0.030	<0.030	<0.030	<0.030	<0.030	618	<0.030	0.036	<0.090	<0.030	<0.030	<0.030	<0.030
Lead (Pb)-Leachable	mg/L	0.0383	1.17	0.00482	1.56	16.3	1.08	0.0410	0.0786	0.144	1.75	0.0317	1.78	0.148	0.0878	0.319	0.0440
Lithium (Li)-Leachable	mg/L	<0.050	<0.025	0.036	<0.0050	<0.025	<0.0050	<0.0050	0.0054	0.27	<0.0050	<0.0050	<0.50	<0.050	<0.025	0.0050	0.0060
Magnesium (Mg)-Leachable	mg/L	205	49.3	46.2	0.17	3.70	0.51	0.16	0.54	95.3	1.63	0.25	75.9	85.0	48.3	0.20	0.29
Manganese (Mn)-Leachable	mg/L	3.48	14.2	16.6	0.0303	0.345	0.0462	0.0434	0.615	19.7	0.448	0.0251	515	17.1	5.41	0.230	0.182
Mercury (Hg)-Leachable	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Molybdenum (Mo)-Leachable	mg/L	<0.00050	<0.00025	<0.00025	<0.000050	<0.00025	<0.000050	<0.000050	<0.000050	0.0024	0.000547	<0.000050	0.0052	0.00053	0.00041	0.000230	<0.000050
Nickel (Ni)-Leachable	mg/L	0.0238	0.144	0.136	0.00176	0.0067	0.00090	<0.00050	0.00441	0.909	0.00863	<0.00050	0.663	0.0735	0.0260	0.00176	0.00118
Phosphorus (P)-Leachable	mg/L	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	2.27	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30
Potassium (K)-Leachable	mg/L	6.0	4.6	4.8	2.3	12.1	3.1	6.2	3.5	<2.0	2.4	<2.0	5.6	5.0	6.8	6.4	4.1
Selenium (Se)-Leachable	mg/L	<0.010	0.0050	<0.0050	<0.0010	<0.0050	<0.0010	0.0022	0.0015	<0.020	<0.0010	<0.0010	<0.10	<0.010	<0.0050	<0.0010	<0.0010
Silicon (Si)-Leachable	mg/L	1.30	2.45	2.19	2.06	3.52	2.87	3.17	2.65	6.77	3.45	2.72	2.32	2.06	2.03	3.99	3.58
Silver (Ag)-Leachable	mg/L	0.00099	0.000187	<0.000050	0.00156	0.00465	0.000618	0.000213	0.000061	0.00132	0.000023	0.000047	<0.0010	0.00016	0.000160	0.000883	0.000062
Sodium (Na)-Leachable	mg/L	<2.0	<2.0	<2.0	<2.0	6.2	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Strontium (Sr)-Leachable	mg/L	0.784	0.232	0.324	0.00670	0.156	0.0208	0.00563	0.0168	0.263	0.0582	0.00645	0.432	0.764	0.463	0.00678	0.00641
Thallium (Tl)-Leachable	mg/L	<0.0010	<0.00050	<0.00050	0.00017	<0.00050	<0.00010	0.00014	<0.00010	<0.0020	<0.00010	<0.00010	<0.010	<0.0010	<0.00050	<0.00010	<0.00010
Tin (Sn)-Leachable	mg/L	<0.0010	<0.00050	<0.00050	<0.00010	<0.00050	<0.00010	<0.00010	<0.00010	<0.0020	<0.00010	<0.00010	<0.010	<0.0010	<0.00050	<0.00010	<0.00010
Titanium (Ti)-Leachable	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.019	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Uranium (U)-Leachable	mg/L	0.00059	<0.000050	0.000276	<0.000010	<0.000050	<0.000010	<0.000010	<0.000010	0.0109	0.000046	<0.000010	<0.0010	0.00022	0.000435	0.000011	<0.000010
Vanadium (V)-Leachable	mg/L	<0.010	<0.0050	<0.0050	<0.0010	<0.0050	<0.0010	<0.0010	<0.0010	0.235	<0.0010	<0.0010	<0.10	<0.010	<0.0050	<0.0010	<0.0010
Zinc (Zn)-Leachable	mg/L	0.105	16.2	0.590	0.0318	0.660	0.0518	0.0194	0.192	4.36	1.03	0.0418	277	32.9	3.69	0.199	0.0342

(1) Testing commissioned and results
compiled by Access Consulting Group

RESULTS OF ANALYSIS[(1)]

Mine/Dump Location		SIME 4 Pit Wall	SIME 35 Pit Wall		SIME 4 & 6 Pit Walls	Onek Pit	Onek Pit Dump			Keno 700 Adit Dump		UN Adit Dump	Townsite Adit Dump		Bellekeno Adit Dump	Galkeno 900	
Sample ID		95UKHSP03	95UKHSP04	95UKHSP05	95UKHSD01	95UKHOP01	95UKHOD01	95UKHOD02	95UKHOD03	95UKHKD01	95UKHKD02	95UKHUD01	95UKHTD01	95UKHTD02	95UKHLD01	95UKHVD01	95UKGK901
Date of Analysis	11-May-07																
ALS Sample ID		L481962-14	L481962-15	L481962-16	L481962-17	L481962-18	L481962-19	L481962-20	L481962-21	L481962-22	L481962-23	L481962-24	L481962-25	L481962-26	L481962-27	L481962-28	L481962-29
Matrix		Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil	Soil
Leachable Anions & Nutrients	**Units**																
pH	pH	6.81	6.66	6.71	7.32	7.87	7.61	6.67	7.45	7.15	7.46	6.78	5.99	6.37	7.37	2.67	3.78
Leachable Metals																	
Aluminum (Al)-Leachable	mg/L	0.0084	0.0120	0.119	0.0408	0.156	0.270	0.0857	0.0486	0.0099	0.0101	0.0444	0.48	0.0448	0.0289	87.7	45.2
Antimony (Sb)-Leachable	mg/L	0.0156	0.00148	0.00361	0.00291	0.00232	0.0125	0.00337	0.00100	0.00938	0.00815	0.00558	<0.020	0.00628	0.00877	0.0011	<0.0050
Arsenic (As)-Leachable	mg/L	0.00508	0.00073	0.00274	0.00219	0.00091	0.0118	0.00463	0.00124	0.00121	0.00591	0.00063	<0.020	0.00106	0.00525	0.175	<0.0050
Barium (Ba)-Leachable	mg/L	0.00275	0.00327	0.00424	0.000447	0.00260	0.00118	0.00852	0.0133	0.0396	0.0386	0.0411	0.027	0.0359	0.0413	0.00800	0.0502
Beryllium (Be)-Leachable	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.00050	<0.10	<0.0025	<0.0025	0.0059	<0.025
Bismuth (Bi)-Leachable	mg/L	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	<0.0010	<0.0010	<0.00050	<0.10	<0.0025	<0.0025	<0.0050	<0.025
Boron (B)-Leachable	mg/L	<0.010	<0.010	<0.010	<0.010	0.011	<0.010	0.027	0.012	<0.020	<0.020	0.014	<2.0	<0.050	<0.050	<0.10	<0.50
Cadmium (Cd)-Leachable	mg/L	0.00247	0.00137	0.00298	0.00144	0.000071	<0.000050	0.00196	0.000301	0.174	0.0204	0.0132	5.58	1.29	0.00930	0.115	0.0995
Calcium (Ca)-Leachable	mg/L	2.33	5.42	1.91	9.57	18.7	9.93	1.80	39.6	134	155	3.76	91.7	61.8	214	506	402
Chromium (Cr)-Leachable	mg/L	<0.00050	<0.00050	<0.00050	0.00133	<0.00050	<0.00050	0.00118	0.00075	<0.0010	<0.0010	<0.00050	<0.10	<0.0025	<0.0025	0.234	<0.025
Cobalt (Co)-Leachable	mg/L	0.00014	0.00010	0.00014	<0.00010	<0.00010	0.00015	<0.00010	<0.00010	0.00198	<0.00020	0.00043	0.361	0.00736	<0.00050	0.307	0.369
Copper (Cu)-Leachable	mg/L	0.00144	0.00168	0.00158	0.00047	<0.0012	0.00272	0.00383	0.00348	0.00842	0.00527	0.00427	0.038	0.00893	0.00456	1.13	0.382
Iron (Fe)-Leachable	mg/L	<0.030	<0.030	0.081	<0.030	<0.030	0.098	0.081	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	<0.030	114	14.6
Lead (Pb)-Leachable	mg/L	0.0331	0.00965	0.0265	0.00161	0.00155	<0.00040	0.0175	0.00895	0.105	0.0199	0.156	0.881	3.03	0.0464	0.0447	0.229
Lithium (Li)-Leachable	mg/L	<0.0050	0.0126	0.0059	<0.0050	0.0057	<0.0050	<0.0050	0.0067	<0.010	<0.010	0.0066	<1.0	<0.025	<0.025	0.155	<0.25
Magnesium (Mg)-Leachable	mg/L	0.26	0.56	0.17	0.56	1.74	0.65	0.31	4.40	6.09	19.3	0.70	47.3	64.6	13.0	73.3	125
Manganese (Mn)-Leachable	mg/L	0.0577	0.0642	0.0874	0.0728	0.00686	0.00381	0.0847	0.00540	0.701	0.201	0.170	455	5.06	0.319	21.0	97.5
Mercury (Hg)-Leachable	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010
Molybdenum (Mo)-Leachable	mg/L	0.000104	0.000570	0.000206	0.000265	0.00201	0.00197	0.000269	0.00143	0.00086	0.0187	<0.000050	<0.010	<0.00025	0.00971	<0.00050	<0.0025
Nickel (Ni)-Leachable	mg/L	<0.00050	0.00079	0.00086	<0.00050	<0.00050	<0.00050	<0.00050	<0.00050	0.0054	<0.0010	0.00148	0.62	0.0293	<0.0025	0.445	1.26
Phosphorus (P)-Leachable	mg/L	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	<0.30	0.66	<0.30
Potassium (K)-Leachable	mg/L	<2.0	<2.0	2.3	<2.0	4.2	<2.0	<2.0	4.1	3.2	4.7	3.1	5.0	4.1	6.7	<2.0	4.5
Selenium (Se)-Leachable	mg/L	<0.0010	0.0030	<0.0010	<0.0010	0.0029	<0.0010	<0.0010	0.0068	<0.0020	<0.0020	<0.0010	<0.20	<0.0050	<0.0050	<0.010	<0.050
Silicon (Si)-Leachable	mg/L	1.69	3.71	2.11	1.67	1.79	4.03	2.52	2.04	2.24	2.09	3.59	2.24	4.02	2.16	7.86	5.82
Silver (Ag)-Leachable	mg/L	0.000078	0.000012	0.000328	0.000018	<0.000010	<0.000010	0.000229	0.000016	0.000171	0.000053	0.000172	<0.0020	0.000143	0.000096	0.00108	<0.00050
Sodium (Na)-Leachable	mg/L	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	4.5	<2.0	<2.0	<2.0	<2.0	<2.0	9.0	<2.0	<2.0
Strontium (Sr)-Leachable	mg/L	0.0101	0.0140	0.00621	0.00937	0.0557	0.0204	0.0126	0.103	0.205	0.335	0.0154	0.140	0.0225	0.332	0.386	0.443
Thallium (Tl)-Leachable	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00020	<0.00020	<0.00010	<0.020	<0.00050	<0.00050	<0.0010	<0.0050
Tin (Sn)-Leachable	mg/L	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	0.00016	<0.00010	<0.00020	<0.00020	<0.00010	<0.020	<0.00050	<0.00050	<0.0010	<0.0050
Titanium (Ti)-Leachable	mg/L	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.014	<0.010
Uranium (U)-Leachable	mg/L	<0.000010	<0.000010	0.000016	0.000021	0.000223	0.000033	0.000015	0.000240	0.000076	0.000545	<0.000010	<0.0020	<0.000050	0.00237	0.0311	0.00740
Vanadium (V)-Leachable	mg/L	<0.0010	<0.0010	<0.0010	<0.0010	<0.0010	0.0047	<0.0010	<0.0010	<0.0020	<0.0020	<0.0010	<0.20	<0.0050	<0.0050	<0.010	<0.050
Zinc (Zn)-Leachable	mg/L	0.0131	0.0317	0.0878	0.0473	<0.0040	<0.0050	0.0278	<0.0050	1.76	0.221	0.118	289	17.0	0.0829	4.56	8.43

(1) Testing commissioned and results
compiled by Access Consulting Group

Appendix I

Closure Options for Waste Rock Dumps

Table 1 Example decision matrix to be used for review of conceptual closure options for waste rock piles
Keno Hill Closure Planning
Rev. 01, November 2008

			Waste Rock Dump Closure Requirements				Considerations for implementation									Waste Rock Dump Closure Options					
Waste Rock Dump	Size Category[1]	Tonnage[2]	Ensure geotechnical stability	Reduce chemical loading	Revegetate	Esthetic improvement	Water course near toe	Adit discharging	Steep dump face angle	Can dump be used for borrow source?[3]	Steep slopes below dump (<3H:1V)	Status of adjacent vegetation	Adjacent surface materials similar to coarse waste rock	Value of area to be covered by resloping	Increase in load due to disturbance, or to increased surface area	1. Reslope 2.5:1, revegetate Suitable for dumps without ARD concerns and sufficient fines to promote revegetation without additional growth media	2. Reslope 2.5:1, growth media, revegetate Suitable for dumps with no compelling ARD concerns	3. Reslope 2.5:1, soil cover, revegetate Suitable for dumps that have ARD concern that require reduction or mitigation of metals load	4. Relocate	5. Reprocess high grade waste dumps Potential option that can be incorporated into remaining scenario, very specific to only 1 or 2 dumps, may not carry forward into options analysis	6. Do nothing
Bermingham pit dumps	A	1,500,000								Possibly											
Calumet 1-15 pit (2 dumps)	A	1,000,000							X	Possibly	X		X								
Onek	A	600,000							X	Possibly	X (SE only)										
Sime dumps	A	450,000								Possibly	X		X								
Black Cap	A	390,000	X						X	Possibly	X		X								
Hector 400 adit dump	A	198,000	X	Possibly					X	No	X		X		X						
Galkeno 100/200/300	A	150,000	X					X		No											
No Cash 500	A	138,100	X				X	X	X	No				Creek							
Silver King pit dump	A	120,000								No											
Hector #1 Vein Pit	A	100,000	X						X	Possibly	X		X								
Stone (3 piles)	B	84,540								No											
Coral & Wigwam	B	75,000								No			X								
Miller	B	63,000								Possibly			X								
Lucky Queen 500 adit dump	B	61,900								No											
Bellekeno 625	B	48,000	X (erosion)				X	X		No				Creek							
Elsa 400	B	44,100								No											
Silver King 100 adit	B	43,000	X (erosion)				X	X		No				Creek							
Ruby	B	28,900						X		No											
Keno 700	B	27,500	X (erosion)				X	X	X	No				Creek							
Calumet C-Structure	B	25,000								Possibly											
Sadie Ladue (Wernecke)	B	24,500								Possibly											
Galkeno 900	B	20,800						X		No											
Dixie	B	19,800								No											
Husky SW	B	17,000								No											
Shamrock King	B	16,200								Possibly			X								
Highlander	B	15,000					X	X		No											
Keno 200	B	14,600								No			X								
Townsite	B	14,300								No			X								
Bellekeno 200	B	13,000								No											
Gerlitski	B	10,281								No											
Hector 4-11 pits	B	10,000								Possibly			X								
Sadie Ladue 600	C	9,500	X (erosion)					X		Possibly											
Shamrock	C	9,000	X (erosion)						X	No			X								
Onek 400 adit dump	C	7,500	X (erosion)					X		No											
Bermingham adit dump	C	7,000						X	X	No											
No Cash 100	C	6,500								No											
Elsa 200	C	6,000								No											
Lucky Queen shaft area	C	5,000								No			X								
Husky	C	4,600								No											
Porcupine Pit Dump	C	3,400								Possibly			X								
UN adit dump	C	3,200								No											
Comstock 150	C	3,100								No			X								
Comstock 275	C	3,100								No			X								
Lake	C	2,550								No											
Bellekeno 100 (48 Vein)	C	2,450								No											
Klondike Keno	C	2,000						X		No											
Elsa +50	C	1,550								No											
Cub & Bunny (pit dump)	C	1,350								Possibly											
Flame & Moth	C	small- est. >1000 t								No											
Bellekeno 100 (50 Vein)	D	500								No											
Monument & Ladue Fraction adit	D	500								No			X								
Nabob No. 2	D	480								No			X								
Gold Hill No. 2	D	100 t + trenching								n/a			X								
Keno No. 9 System	D	Many small piles								n/a			X								
Apex	D	trenching								n/a											
Divide	D	trenching								n/a											
Fox	D	trenching								n/a											
Lake View	D	trenching								n/a			X								
Nabob	D	trenching								n/a			X								
Silver Basin	D	trenching								n/a			X								
Betty	D	none								n/a			X								
Christal (Dorothy)	D	minimal								n/a											
Duncan Creek	D	none								n/a											
Blue Bird	D	minimal								n/a											
Croesus No. 1	D	minimal								n/a											
Kijo	D	minimal								n/a											
Rico	D	minimal								n/a											
Shepherd	D	minimal								n/a											
Tin Can	D	minimal								n/a											

Notes

1. Size Category: A= >100,000 tonnes; B= 10,000 to 100,000 tonnes; C= 1,000 to 10,000 tonnes; D= <1000 tonnes
2. Tonnage- short tons (Source: Primary 1996 SCR, secondary PWGSC 2000 and estimates from SRK inspections)
3. 'Possibly' indicated for those dumps where screening leach extraction tests indicate minimal soluble loads; 'No' indicated where considerable soluble loads were indicate or where rock was sourced from underground and therefore likely contains waste vein material; 'n/a' indicated where minimal rock volume was noted