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February 28, 2009
RGC Project No.: 118013

Mrs. Valerie Chort
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Suite 1900, 79 Wellington Street West
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Attention: Mrs. Valerie Chort

RE: Final V1 – Geochemical Assessment of Groundwater Quality in Rose Creek aquifer, Anvil Range Mine, YT

This report presents a geochemical assessment of groundwater quality that includes conservative and reactive mixing calculations and purports to explain the recent deterioration in groundwater quality in the Rose Creek aquifer.

1. Background and Study Objectives

A recent review of groundwater quality throughout the Anvil Range Mining Complex identified increased levels of ARD products in the Rose Creek aquifer (RGC, 2009). Of particular concern are elevated levels of SO_4, Mg, and various metals at greater depths in the aquifer, particularly in the northern portion of the aquifer, and in areas of the aquifer down-gradient of Faro Creek along the northern boundaries of the Second and Intermediate Impoundments (Figure 1). For example, current concentrations of SO_4 in wells P03-06-02 and P03-06-03 are 2.5 times higher than the concentrations observed three years ago and increases of similar magnitude have also been observed for Zn and Fe over this period.

In the Second Impoundment, seepage from overlying tailings is likely the principal source of ARD products to groundwater located in the shallow portions of the aquifer. However, seepage from these tailings does not explain the differences in groundwater quality between the northern and southern portions of the aquifer, nor does it necessarily explain the detection of elevated levels of contaminants at greater depth in the aquifer. Contaminants in deeper groundwater are likely derived from a source located further up-gradient, such as the coarse and well-drained tailings located in the Original Impoundment and Second Impoundment and/or seepage from the Faro Creek channel/diversion channel located to the north of the tailings facility.

The main objective of this study was to determine whether seepage from the Faro Creek diversion channel can explain the recent deterioration of water quality in the Rose Creek aquifer. This was achieved by distinguishing the various sources of ARD products based on their distinct geochemical characteristics ("fingerprint") and subsequently evaluating the contribution of each source to ARD-impacted groundwater at different locations in the aquifer.

Recommendations provided in this report may assist on-going and/or future AMP studies that are triggered by threshold levels of contaminants in the Rose Creek aquifer.

2. Data Review

2.1 Hydraulic Gradients

Geodetic groundwater levels in wells screened in the aquifer were used to establish vertical and horizontal hydraulic gradients in the tailings and the underlying valley sediments and thus infer the directions of groundwater flow in the Rose creek aquifer (Figure 1). The geodetic groundwater level in the Rose Creek aquifer decreases from east-to-west, indicating that ground water flows down-valley from the Original Impoundment towards the Cross Valley Dam.

Measurements of the geodetic groundwater level were collected from each of the multi-level piezometers screened in the aquifer (P03-01 to P03-08) and depth profiles for these wells are shown in Figure A1a-g. In general, a downward hydraulic gradient was observed from the tailings to the aquifer indicating that water moves from the tailings into the aquifer below. Hence these gradients confirm that tailings seepage from the various Impoundments remain a probable source of contaminants to at least the shallower portions of the Rose Creek aquifer.

At the same time, higher water levels are observed in the deeper piezometers suggesting an upward hydraulic gradient in the deeper valley fill sediments. These upward gradients suggest that the Rose Creek valley is a discharge zone with groundwater from the valley sides entering the valley aquifer. Groundwater inflow from the southern valley side can be expected to be pristine and thus provide dilution. However, groundwater inflow from the northern valley side may be impacted by seepage from the Faro mine site (either directly from waste rock seepage or indirectly via seepage from the Faro Creek channel/diversion channel).

Conservative and reactive mixing calculations were completed to determine the relative contributions of tailings seepage and other contaminant sources (such as Faro Creek seepage) to the Rose Creek aquifer (see below).

2.2 Water Quality

Based on major ion data, the groundwater at the site ranges from a Ca-HCO_3 type water to a Ca-Mg-SO_4-type and plot accordingly in Figure A2a. Groundwater from the Second Impoundment area is distinguished from groundwater elsewhere at the site by higher concentrations of Fe and Mg. The chemistry of groundwater from the Second Impoundment reflects some degree of contamination by tailings seepage based on its similarity to tailings pore-water and seepage (Figure A3a).

Base-line water quality near the Rose Creek Tailings Facility is characterized by low concentrations of SO_4, Mg, and dissolved metals and comparatively high concentrations of Ca and HCO_3. For example, data from TH86-17 reflects base-line water quality (Figure A2). Also, note from Figure A3a that P03-08 is located in the southern portion of Intermediate Impoundment and that groundwater from this well is less affected by tailings seepage than groundwater from the Second Impoundment. Similarly, waters from wells screened in the deeper portions of the aquifer are generally less impacted than shallower portions of the aquifer and these waters tend to resemble base-line water quality (Figure A4).

Shallow monitoring wells screened in the valley sediments near the interface of the tailings with the valley fill sediments typically showed the greatest impact from tailings seepage, with SO_4, dominating over HCO_3 (see Figure A-5a). These wells typically also showed the highest absolute concentrations of major ions (SO_4, Mg, and Ca) and dissolved metals such as Fe, Mn and Zn (Figure A-5b).

3. Mixing calculations

Conservative and reactive mixing calculations were completed to explain the observed groundwater quality in the Rose Creek aquifer. Initially, conservative mixing calculations were carried out in the form of a sensitivity analysis to determine the relative proportions of clean groundwater (entering the Rose Creek aquifer from upstream) and known (or anticipated) contaminant sources. Subsequently, selected mixing scenarios were repeated using PHREEQC taking into account geochemical reactions (equilibration with minerals, redox reactions).

Mixing calculations were completed for two different regions of the Rose Creek Tailings Facility. The first region studied was the southeastern portion of the Second Impoundment represented by multi-level piezometer P03-01 (Figure 1). This area was selected because both the mixing end-members (i.e. clean groundwater and tailings

seepage) are well-defined. The second region studied was the northeastern portion of the Second Impoundment (represented by multi-level piezometer P03-06) (Figure 1). This area was selected because water quality monitoring suggested a recent deterioration in groundwater quality in this area. Furthermore, this area is located down-gradient of the Faro Creek canyon and cross-gradient of the Faro Creek diversion that may have contributed to the recent changes in groundwater quality at P03-06.

3.1 Definition of source terms

The concentrations of SO_4, Mg, Na, Ni, Co, and Fe were the basis for the geochemical "fingerprint" used to distinguish the various contaminant sources mixing with clean groundwater in the Rose Creek aquifer (Table 1). Data for P03-01-01 were selected as representative of the chemical composition of groundwater in the aquifer and data from X3 were selected to represent water from the Rose Creek diversion (identified as a potential source of dilution at P03-01). Note the low concentrations of major ions and dissolved metals in X3 and P03-03-01 compared to tailings seepage (P03-01-08 and P03-06-06) and Faro Creek seepage (FCS-4).

Table 1. Geochemical characteristics of various source-waters and the Rose Creek aquifer

Species, mg/L	Groundwater (P03-01-01)	Tailings seepage of varying 'strengths'			Faro Creek (FCS-4)	Rose Creek diversion (X3)
		"High" (P03-01-08)	"Moderate" (P03-06-06)	"Low" (P01-08A)		
Ca	76.1	331	357	6.0	483	16.2
Mg	13.9	569	1790	1.7	615	3.78
Na	8	596	110	122	83	1.51
SO_4	24.9	29600	9510	165	5920	9.29
Zn	< 0.005	1590	755	0.929	289	0.011
Co	< 0.0003	< 0.15	0.305	0.0012	0.4	< 0.001
Ni	< 0.001	< 0.5	1.58	< 0.01	0.56	< 0.001
Fe	4.03	12300	428	6.03	558	0.11

Three types of tailings seepage were identified based on the concentrations of major ions and metals (Table 1). In the P03-01 region, the tailings are well-oxidized and tailings seepage has a relatively poor water quality. Hence for mixing calculations at P03-01, the chemistry of "high-strength" tailings seepage observed in piezometer P03-01-08 was used. In the vicinity of P03-06, the water quality observed at P03-06-06 was assumed to be representative of oxidized tailings and "moderate-strength" tailings. Previous studies suggest that tailings seepage from the deeper portions of the tailings impoundments (located up-gradient of P03-06) is still dominated by tailings process water (RGC, 2006, 2008). The water quality observed in piezometer P01-08A was assumed to be representative of this "low-strength" tailings seepage.

3.2 Results of conservative mixing calculations

3.2.1 P03-01

P03-01 is located near the eastern (upgradient) boundary of the Second Impoundment (Figure 1). Mixing calculations were performed in order to deduce the contribution of contaminants by "high-strength" tailings seepage to groundwater in this area. Results of the mixing calculations are summarized in Table 2 (refer also to Table A1a of the Appendix A).

Table 2. Modeled results for P03-01.

	Water quality predicted by different model scenarios						Observed water quality	
Species, mg/L	1	2	3	4	5	6	P03-01-04	P03-01-05
Ca	77	78	95	78	87	76	91	108
Mg	15	18	54	19	37	14	15	16
Na	9	13	51	13	33	9	4	7
SO_4	76	255	2171	280	1257	51	251	262
Zn	2.8	12.4	115.4	13.7	66.2	1.4	2.7	0.0440
Co	0.0006	0.0015	0.0112	0.0016	0.0065	0.0004	0.0218	0.0021
Ni	0.0019	0.0049	0.0372	0.0053	0.0218	0.0014	0.3090	0.0345
Fe	25.4	99.5	896.5	110.0	516.4	14.7	< 0.03	0.112

Predicted water quality data yielded by the second scenario were the most reasonable approximation of actual groundwater quality observed in the interface region of P03-01 (see P03-01-04 and P03-01-05 in Table 2). Note that SO_4, Mg, Na, Co, and Ni are the most useful parameters for conservative mixing as these parameters are generally not reactive in the concentration range observed here. In comparison, Ca, Fe and Zn are known to be influenced by chemical reactions and require consideration of solubility limits (see section 3.2). Based on the second scenario, shallow groundwater in the aquifer beneath the tailings at P03-01 reflects a 99.2% contribution by water from the aquifer and only a 0.8% contribution by "high-strength" tailings seepage. This portion of the aquifer is thus not significantly contaminated by tailings seepage.

3.2.2 P03-06

Unlike P03-01, the groundwater quality observed at P03-06 could not be accurately predicted by the two-component mixing of "high-strength" tailings seepage and clean groundwater from the aquifer, nor could it be predicted by a three-component mixing model that incorporated an additional flux of Faro Creek tailings seepage (Table A2). This is due to the differences in the chemistry of tailings seepage in the two different regions. Tailings in vicinity of P03-06 are less oxidized than those in vicinity of P03-01 and thus tailings pore-water is more dilute near P03-06. Consequently, the "low-strength" tailings seepage end-member representing residual process water was incorporated into subsequent mixing calculations.

Additional mixing calculations were completed using a series of assumptions that pertained to rates of tailings seepage from the various sources. One set of sensitivity runs assumed no seepage from the Faro Creek diversion channel, and the flow rate of "low-strength" tailings seepage was varied in an attempt to match the observed groundwater chemistry at P03-06 (Table A1c). Predictions of water quality were also made by assuming no contribution of "low-strength" seepage and varying the rate of Faro Creek seepage (Table A1d) and by varying both the flow rates of "low-strength" tailings

seepage and Faro Creek tailings seepage (Table A1g). Each of these attempts yielded unsatisfactory matches of predicted and observed major ion and dissolved metal concentrations in groundwater at P03-06.

Assuming a mixture of high-strength" (47%) and low-strength" (53%) tailings seepage plus Faro Creek tailings seepage yielded the best overall match of predicted and observed water quality (Table A1f). Results of mixing calculations based on these end-members are summarized in Table 3. Assuming a contribution of 0.75 L/s from Faro Creek seepage (scenario 3 in Table A2) provided the best match with observed groundwater quality in shallow groundwater at P03-06. Co, Ni, and SO_4 were identified as particularly informative in terms of tracing the contributions of various source-waters and predictions based on this scenario corresponded well with the measured concentrations in groundwater.

It should be noted that the flow rates assumed for "high-strength" and "low-strength" tailings seepage (0.124 L/s and 0.138 L/s, respectively) and the matching flow contribution from Faro Creek seepage (0.75 L/s) fall within the range of flow estimates for those contaminant sources determined in an earlier study (RGC, 2006).

Table 3. Model predictions for P03-06.

	Water quality predicted by different model scenarios						Observed water quality	
Species, mg/L	1	2	3	4	5	6	P03-06-04	P03-06-05
Ca	87	95	103	110	124	137	176	81.1
Mg	33	45	56	67	88	107	46.5	96.4
Na	18	19	20	21	24	26	19.9	26.2
SO_4	489	600	706	808	1001	1180	538	851
Zn	24	30	35	40	49	58	3.36	42.3
Co	0.0103	0.0183	0.0259	0.0332	0.0471	0.0599	0.0254	0.0185
Ni	0.0185	0.0295	0.0401	0.0503	0.0695	0.0873	0.0406	0.08
Fe	157	165	173	180	195	208	42.1	228

Results for the selected scenario reflect a 91.9% contribution by clean groundwater from the aquifer up-gradient, a 6.0% contribution by Faro Creek seepage, and a 1.1% contribution by seepage from the overlying tailings. The results of these mixing calculations suggest that groundwater quality at P03-06 is more affected by seepage from the Faro Creek diversion channel than by seepage from the overlying tailings of the Original and Second Impoundment.

3.3 Results of reactive mixing calculations

The conservative mixing calculations discussed in section 3.2.2 suggest that groundwater in vicinity of P03-01 is only affected by “high-strength” tailings seepage, whereas groundwater in vicinity of P03-06 is affected by “low-strength” and “high-strength” tailings seepage as well as Faro Creek seepage. In order to verify these results and determine whether the process of mixing in the aquifer is non-conservative, additional calculations were performed using the geochemical modeling program PHREEQC.

Prior to performing the mixing calculations, the influence of different mineral phases on the chemical composition of groundwater was evaluated by computing the solubility products of well-known primary and secondary minerals in the groundwater environment. In turn, these solubility products were used to determine saturation indices for the various solutions in order to enable phases that became super-saturated to precipitate upon mixing. Details pertaining to saturation indices, phase assemblages, and the chemical compositions of the initial and final solutions are provided in Appendix B. It should be noted that insufficient information was available on mineral assemblages containing Co and Ni and hence these metals were not included in the PHREEQC mixing calculations.

2.3.1 P03-01

From section 2.2.1, groundwater at P03-01 constitutes a mixture of water from the up-gradient aquifer (99.2%) and “high-strength” tailings seepage (0.8%). Using these

proportions, mixing simulations were completed in PHREEQC by mixing water from the aquifer (P03-01-01) and "high-strength" tailings seepage (P03-01-08). Results of the mixing calculations are summarized in Table 4 and complete results are provided in Appendix B. The conservative mixing calculation represents the process of mixing in the presence of excess dolomite. In this calculation, dissolution may occur but phases that become super-saturated are not allowed to precipitate from solution. A second mixing calculation was performed under the same conditions but upon super-saturation, selected mineral phases were allowed to precipitate.

Table 4. Summary of end-member chemistry and results from PHREEQC mixing calculations for P03-01

	End-member water quality		Predicted water quality	
Sample	P03-01-01	P03-01-08	P03-01	P03-01
Type	Aquifer	"High-strength" tailings seepage	Dissolution	Dissolution/ precipitation
pH	6.82	5.25	6.8	7.0
Temp, ˚C	5.3	6.0	5.3	5.3
Na, mg/L	8	596	12.9	12.9
K, mg/L	2.5	100	3.3	3.3
Mg, mg/L	13.9	569	16.5	42.5
Ca, mg/L	76.1	331	68	111
Mn, mg/L	0.162	102	0.91	0.82
Fe, mg/L	4.03	12300	107	3.5
Ba, mg/L	0.104	0.4	0.0735	0.00728
Zn, mg/L	< .005	1590	13.3	6.9
Cu, mg/L	< 0.001	< 0.5	0.00133	0.00159
Ni, mg/L	< 0.001	< 0.5	-	-
SO_4, mg/L	24.9	29600	221	215
HCO_3, mg/L	254	< 2	223	293
Al, mg/L	0.0058	3.1	0.0030	0.00008
Cd, mg/L	0.000019	0.0085	0.000074	0.00008
Co, mg/L	< 0.0003	0.15	-	-

The concentrations of Na, K, Mn, and SO_4 were very similar for the two mixing calculations, suggesting that these elements were not sequestered into a solid phase assemblage and thus that they behave conservatively. Ca, Mg, and HCO_3 showed small to moderate differences, indicating the influence of mineral dissolution/precipitation

reactions (primarily the dissolution of dolomite) affects the concentrations of these elements in groundwater. Numerous metals appear to behave non-conservatively (Table B1). For example, lower concentrations of Fe, Ba, and Al after reactive mixing suggests that the concentrations of these metals are influenced by the precipitation of gibbsite ($Al(OH)_3$), barite ($BaSO_4$), and amorphous ferrihydrite ($Fe(OH)_3$), respectively. The concentrations of Zn were affected by the precipitation of smithsonite ($ZnCO_3$).

2.3.2 P03-06

Conservative mixing calculations from section 2.2.2 suggest that groundwater at P03-06 is comprised predominantly of water from the up-gradient aquifer and contaminants derived from a mixture of "low-strength" and "high-strength" tailings seepage as well as Faro Creek seepage (Table 1). In order to assess whether mixing at this location is non-conservative, representative solutions for each water type were mixed using the proportional flow rates inferred from the conservative mixing calculations and information from RGC (2006). At P03-06, the flow rate from the aquifer up-gradient was assumed to be 11.5 L/s and the flow rates for "low-strength", "high-strength", and Faro Creek tailings seepages were 0.124 L/s, 0.138 L/s, and 0.75 L/s, respectively.

Results of the mixing calculations for P03-06 are summarized in Table 5 and complete results are provided in Appendix B. The low pH of modeled groundwater suggests that the addition of acidity related to tailings seepage causes a build-up of CO_2 in groundwater. Na and K concentrations behave conservatively. Ca, Mg and HCO_3 are predicted to increase during reactive mixing due primarily to the dissolution of dolomite. Upon mixing, Ba is predicted to precipitate as barite ($BaSO_4$) and thus Ba (and to a lesser extent SO_4) appear to behave non-conservatively. Fe concentrations are predicted to be controlled primarily by amorphous ferrihydrite ($Fe(OH)_3$) and Zn concentrations are controlled by the precipitation of smithsonite ($ZnCO_3$).

Table 5. Summary of end-member chemistry and results of PHREEQC mixing calculations for P03-06

	End-member water quality				Predicted water quality	
Sample	P03-01-01	P03-01-08	P01-08A	FCS-4	P03-06	P03-06
Type	Aquifer	"High-strength" Tailings	"Low-strength" Tailings	Faro Cr.	Dissolution	Dissolution/ precipitation
pH	6.8	5.3	7.4	2.8	4.1	5.3
Temp, ˚C	5.3	6.0	4.5		5.3	5.3
Na, mg/L	8	596	122	83	19.8	19.5
K, mg/L	2.5	100	-	13	4.1	4.1
Mg, mg/L	13.9	569	1.67	615	45.2	427
Ca, mg/L	76.1	331	6.03	483	80.2	701
Mn, mg/L	0.162	102	0.163	60.4	4.1	4.7
Fe, mg/L	4.03	12300	6.03	558	140.7	62.0
Ba, mg/L	0.104	0.4	2.77	< 0.05	0.133	0.01195
Zn, mg/L	< 0.005	1590	0.929	289	21.6	32.7
Cu, mg/L	< 0.001	0.5	0.0217	< 0.05	0.00807	0.00072
Ni, mg/L	< 0.001	0.5	< 0.001	0.56	-	-
SO_4, mg/L	24.9	29600	165	5920	538	414
HCO_3, mg/L	254	< 2	109	21.6	208	357
Al, mg/L	0.0058	3.1	0.208	<1	0.100	0.095
Cd, mg/L	0.000019	0.0085	0.00113	< 0.05	0.00314	0.00281
Co, mg/L	< 0.0003	0.15	0.0012	0.4	-	-

3. Conclusions and Recommendations

Earlier studies have suggested that the recent increase in ARD products observed in monitoring wells screened in the northern portion of the Rose Creek aquifer (including P03-06) could be a result of Faro Creek seepage that is diverted along the northern side of the tailings facility (RGC, 2006). Geochemical "finger-printing" and mixing calculations support this contention and suggest that Faro Creek seepage may have contributed a significant contaminant load to the northern portion of the Rose Creek aquifer. Mixing calculations completed for P03-06 suggested that Faro Creek seepage contributes approximately 0.75 L/s of highly-contaminated waste rock seepage to this portion of the aquifer. Annually, this represents contaminant loads of 140 tonnes of SO_4 and 6.8 tonnes of Zn to this area of the Rose Creek aquifer alone.

Note that a higher contribution of contaminants derived from Faro Creek seepage can be expected further down-gradient of P03-06, such as at monitoring station X21 (located down-gradient of the Second Impoundment) and at X24 (located at the Intermediate Dam) due to additional seepage losses from the channel to the aquifer. More specifically, during the summer/fall 2006 monitoring period, total seepage losses along the reach between the mouth of the Faro Creek Canyon and the Intermediate Pond ranged from 3.2 to 4.2 L/s with associated Zn loads ranging from about 24 to 34 t/yr (RGC, 2007).

It should be emphasized that a seepage interception system (SIS) was designed and constructed in the fall of 2006 near the mouth of the Faro Creek canyon in order to curtail the contaminant loading to the Rose Creek aquifer (RGC, 2007). The SIS has been designed to capture most of the seepage from the ETA area except for the potentially high flows that occur during the ice-free periods of spring/summer/fall. Mixing calculations presented here suggest that continued operation of the SIS will result in significant improvement in groundwater quality in the northern portion of the Rose Creek aquifer. For example, conservative mixing calculations for P03-06 suggest that elimination of Faro Creek seepage could reduce SO_4 and Zn concentrations by about 50% (i.e. down to 374 mg/L SO_4 and 19 mg/L Zn, respectively).

The time required for the effect of the SIS to manifest itself in the Rose Creek aquifer depends on transport parameters such as transport velocity and distance. Conservative transport calculations suggest that an improvement in groundwater quality at P03-06 due to operation of the Faro Creek SIS can be expected to occur after 1 to 5 years. Similarly, an improvement in groundwater quality in the Rose Creek aquifer at the Intermediate Dam (X24) due to collection of Faro Creek seepage can be expected to take approximately 4 – 20 years. Note, however, that the contaminant load from the Rose Creek tailings is predicted to gradually increase over time and this loading may offset any

improvement in groundwater quality due to the interception of the Faro Creek seepage (RGC, 2006).

Detailed AMP monitoring in several monitoring wells in the northern portion of the Rose Creek aquifer (including P03-06, X21 and X24) should be continued to assess whether operation of the Faro Creek SIS is improving groundwater quality. Meanwhile, it is recommended that a more comprehensive geochemical assessment be completed that includes additional mixing calculations for the other AMP wells that have shown recent increases in contaminant concentrations (i.e. X21 and X24). In addition, consideration should be given to collecting stable isotope data in order to further constrain the sources of contaminants to the Rose Creek aquifer.

4. Closure

This report was prepared by Robertson GeoConsultants Inc. for Deloitte & Touche Inc. in its capacity as Interim Receiver of Anvil Range Mining Corporation. No third-party engineer or consultant shall rely on any of the information, conclusions, opinions, or any other material contained in this report without the express written consent of Deloitte & Touche Inc. and RGC.

We trust that the information provided in this report meets your requirements at this time. Should you have any questions or if we can be of further assistance, please do not hesitate to contact the undersigned.

ROBERTSON GEOCONSULTANTS INC.

Prepared by:	**Reviewed by:**
Dr. Paul R. Ferguson Hydrogeochemist	Dr. Christoph Wels, M.Sc., P.Geo. Principal and Senior Hydrogeologist

5. References

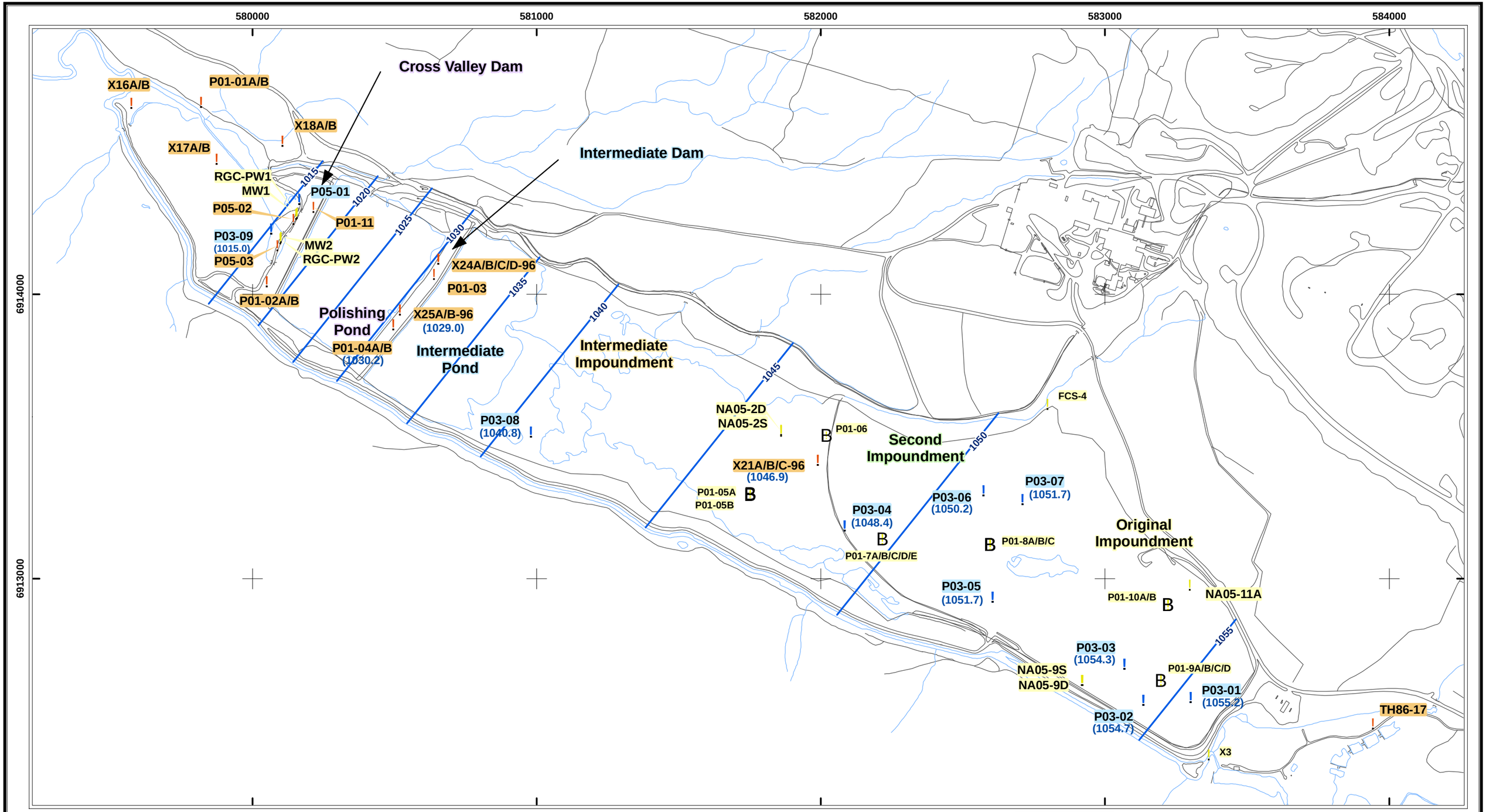
RGC, 2006. Water and load balance study for Rose Creek tailings storage facility, Faro Mine Yukon Territory, Report No. 118001/1, March 2006.

RGC, 2007. Results of Faro Creek Seepage Surveys. Memorandum submitted to Deloitte and Touche, April 16, 2007.

RGC, 2008. 2007 Groundwater Review: Anvil Range Mining Complex, Report No. 118012/1, May 2008.

RGC, 2009. 2008 Groundwater Review: Anvil Range Mining Complex, Report No. 118014/1, January 2009.

FIGURES



LEGEND

- 1015 Geodetic Water Level
- ! Monitoring Well
- ! Multilevel Monitoring Well
- ! Other Well (not Monitored Routinely)
- B Decommissioned Well

PROJECTION: UTM
ZONE: 8
DATUM: NAD 27
UNITS: Meters

Water Levels in Groundwater Monitoring Wells
June 2007
Anvil Range Mining Complex

SCALE
0 125 250 500 750 1,000 Meters

Deloitte & Touche

ROBERTSON GEOCONSULTANTS INC.
Consulting Geotechnical and Environmental Engineers

CLIENT: Deloitte & Touche Inc.
PROJECT: Geochemical Analysis of GWQ
REPORT: RGC 118013
LOCATION: Anvil Range Mining Complex,YT, Canada

FIGURE: 1

DATE: Jan - 09
DRAWN BY: OM
FILE: Faro_GW_07.mxd

APPENDIX A

Hydraulic gradients and geochemical data

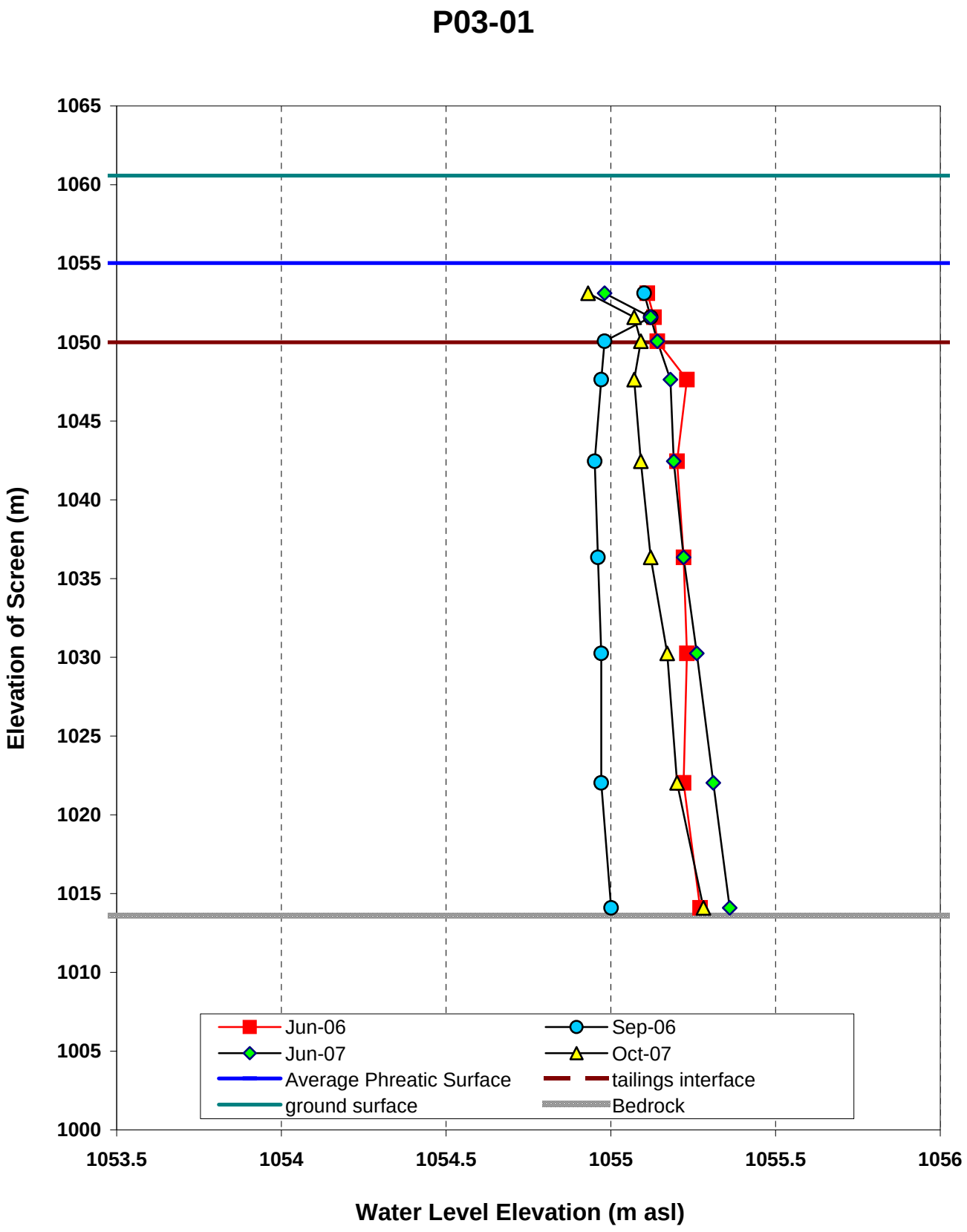


Figure A1a. Water level elevations in multi-level piezometer P03-01.

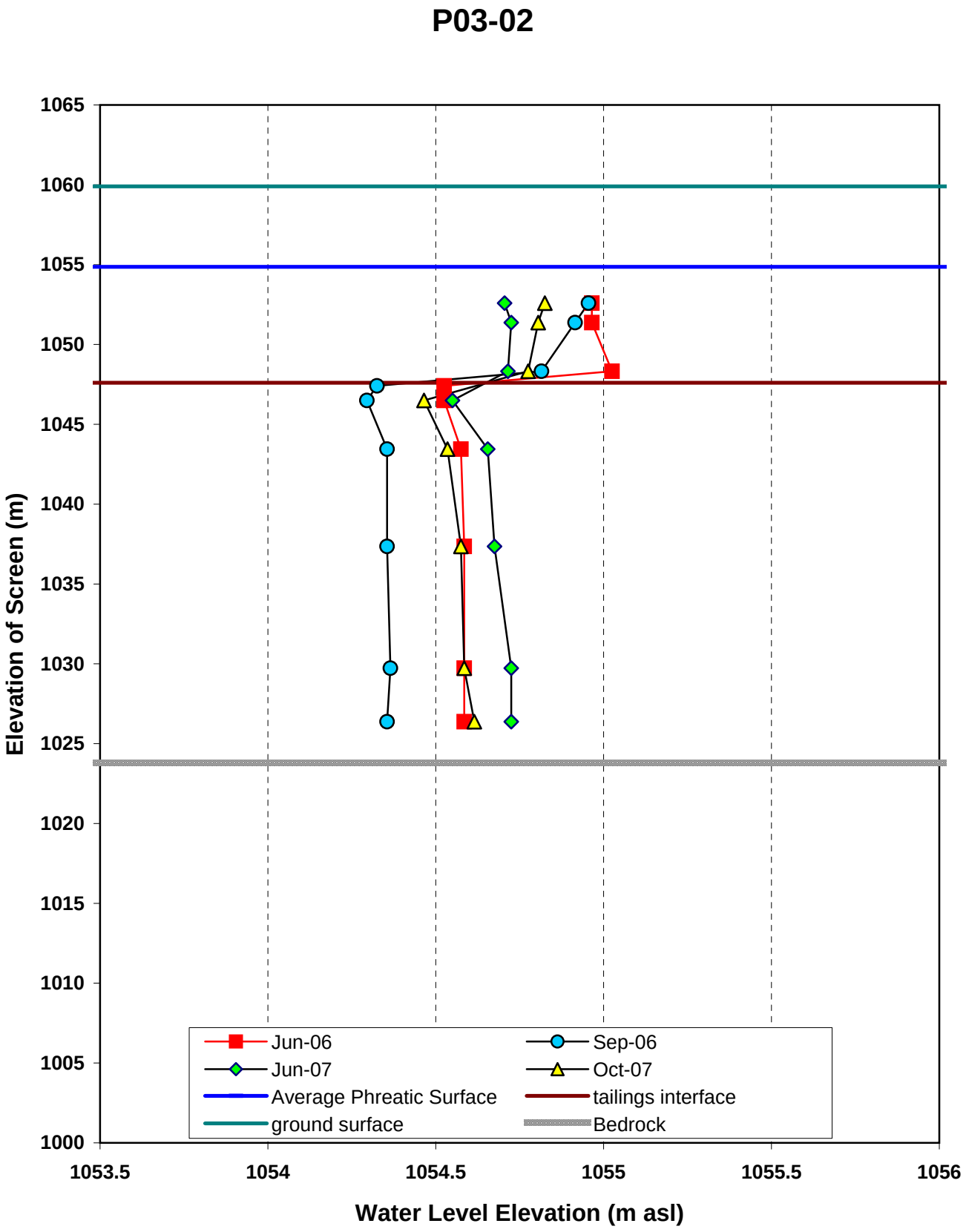


Figure A1b. Water level elevations in multi-level piezometer P03-02.

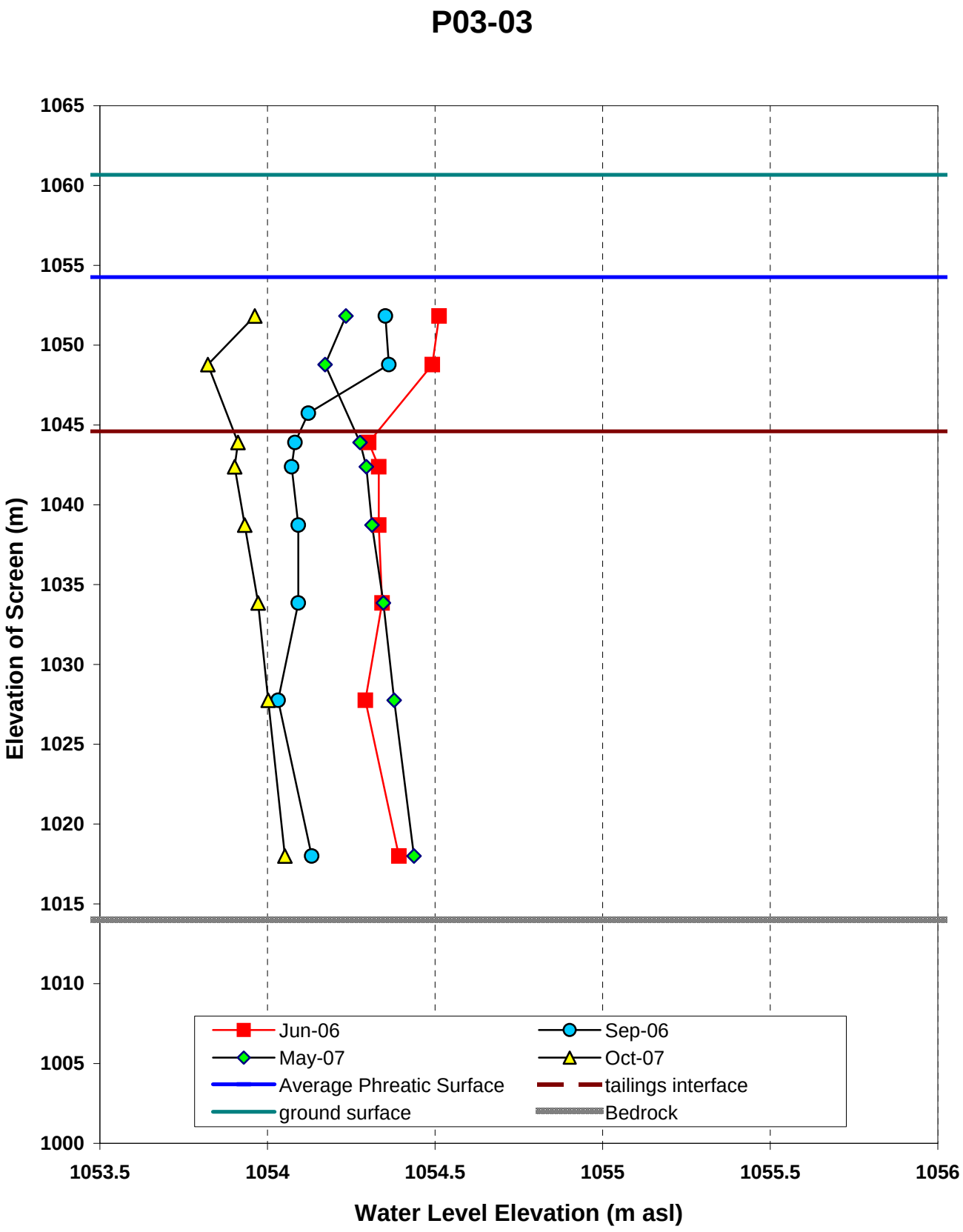


Figure A1c. Water level elevations in multi-level piezometer P03-03.

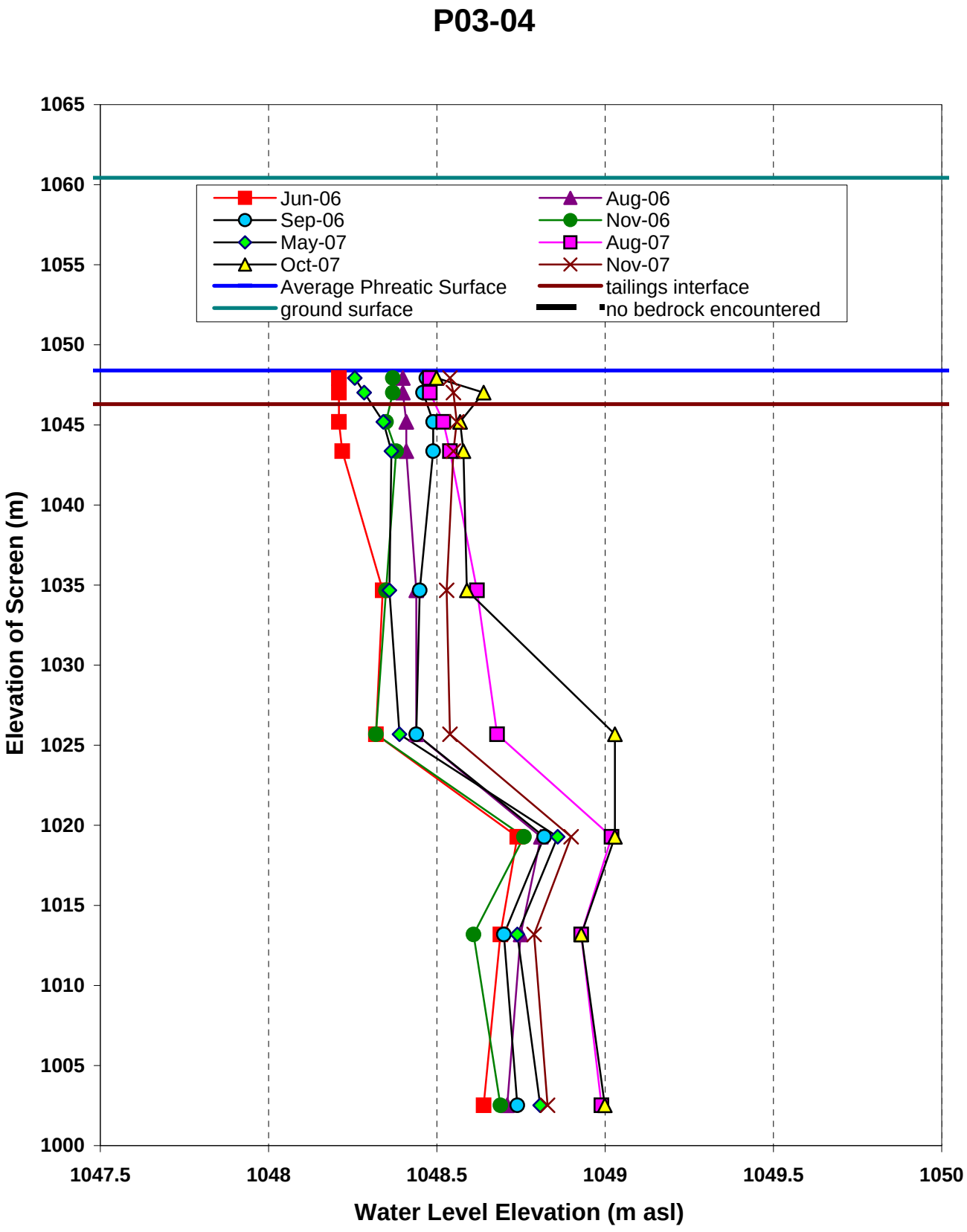


Figure A1d. Water level elevations in multi-level piezometer P03-04.

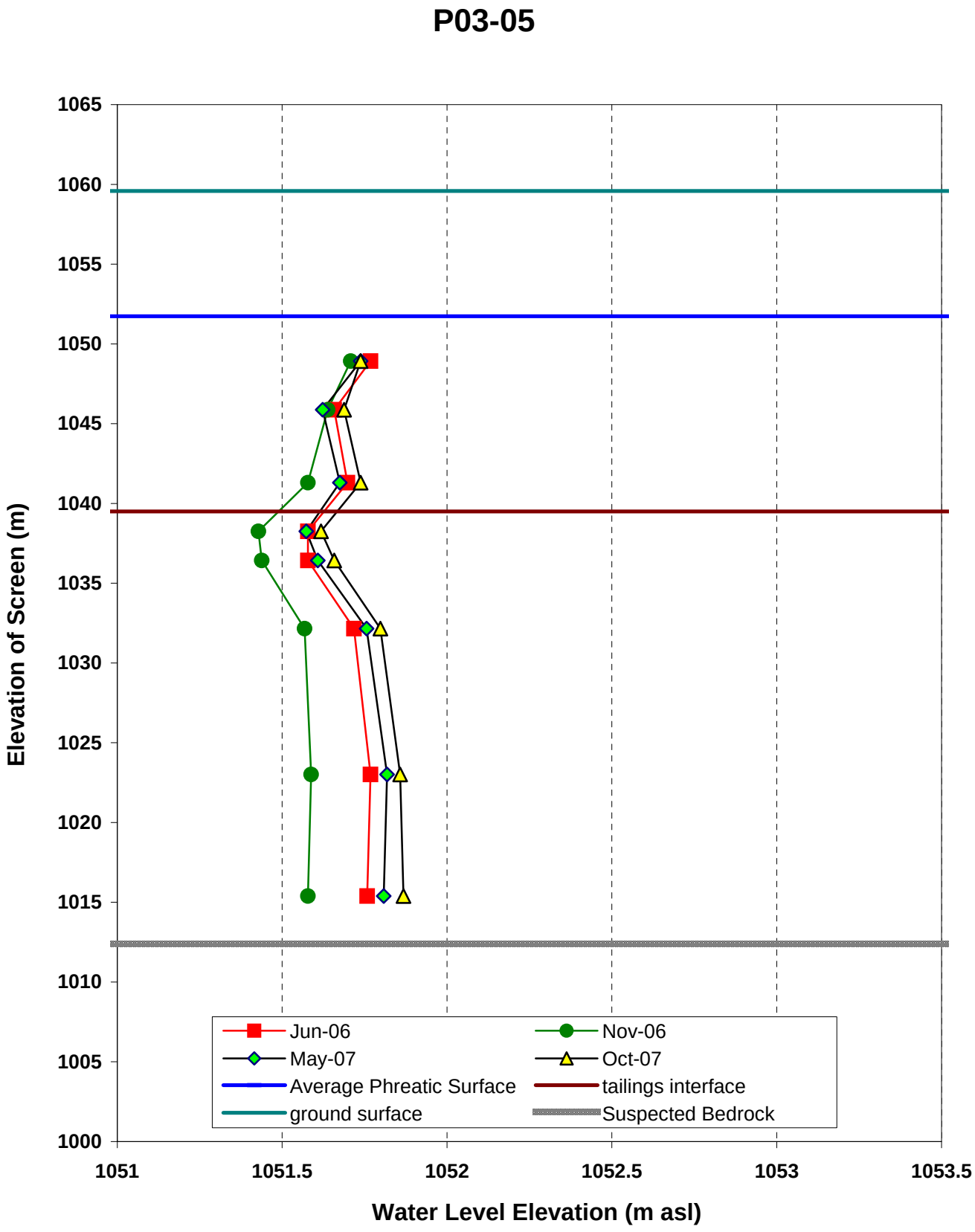


Figure A1e. Water level elevations in multi-level piezometer P03-05.

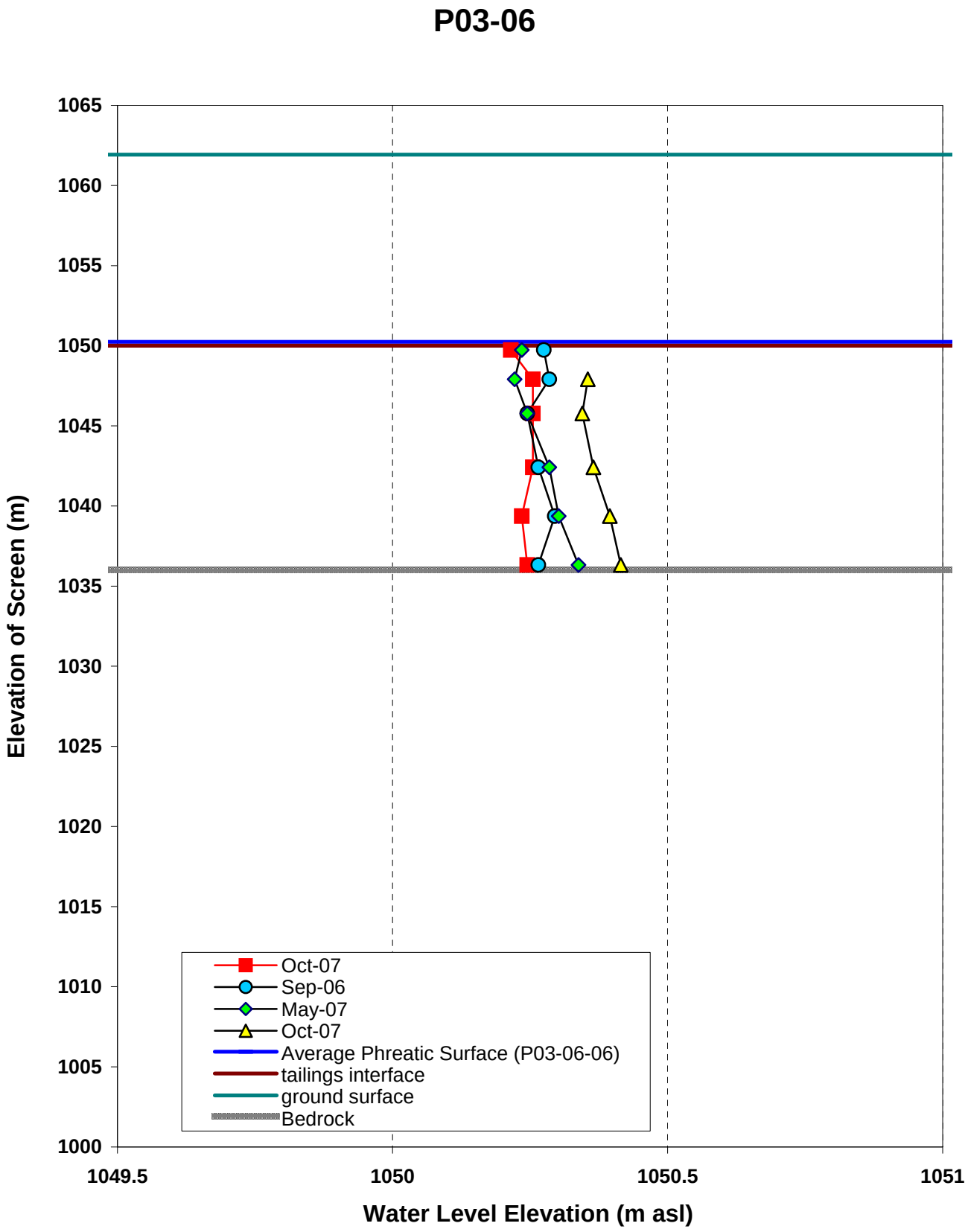


Figure A1f. Water level elevations in multi-level piezometer P03-06.

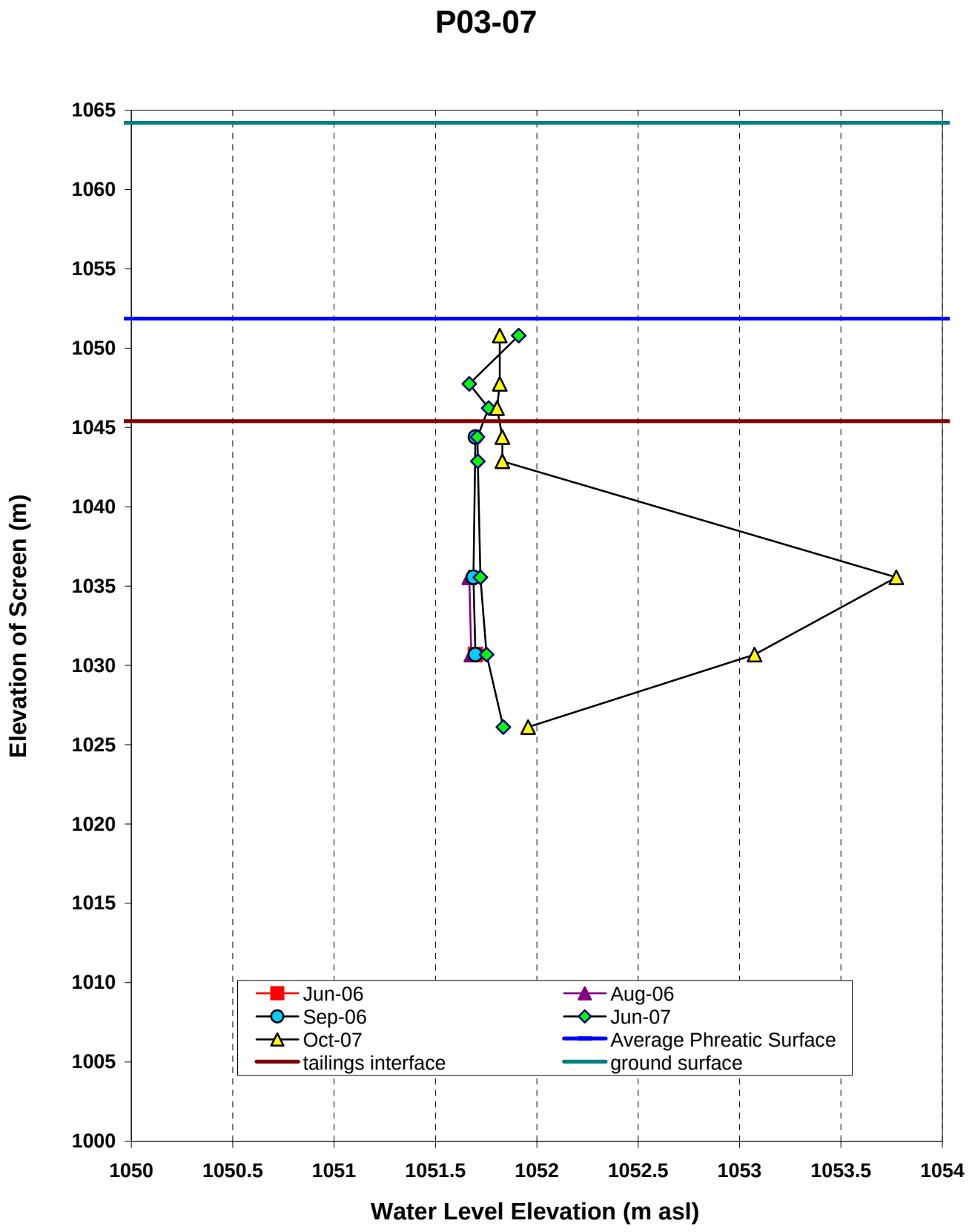


Figure A1g. Water level elevations in multi-level piezometer P03-07

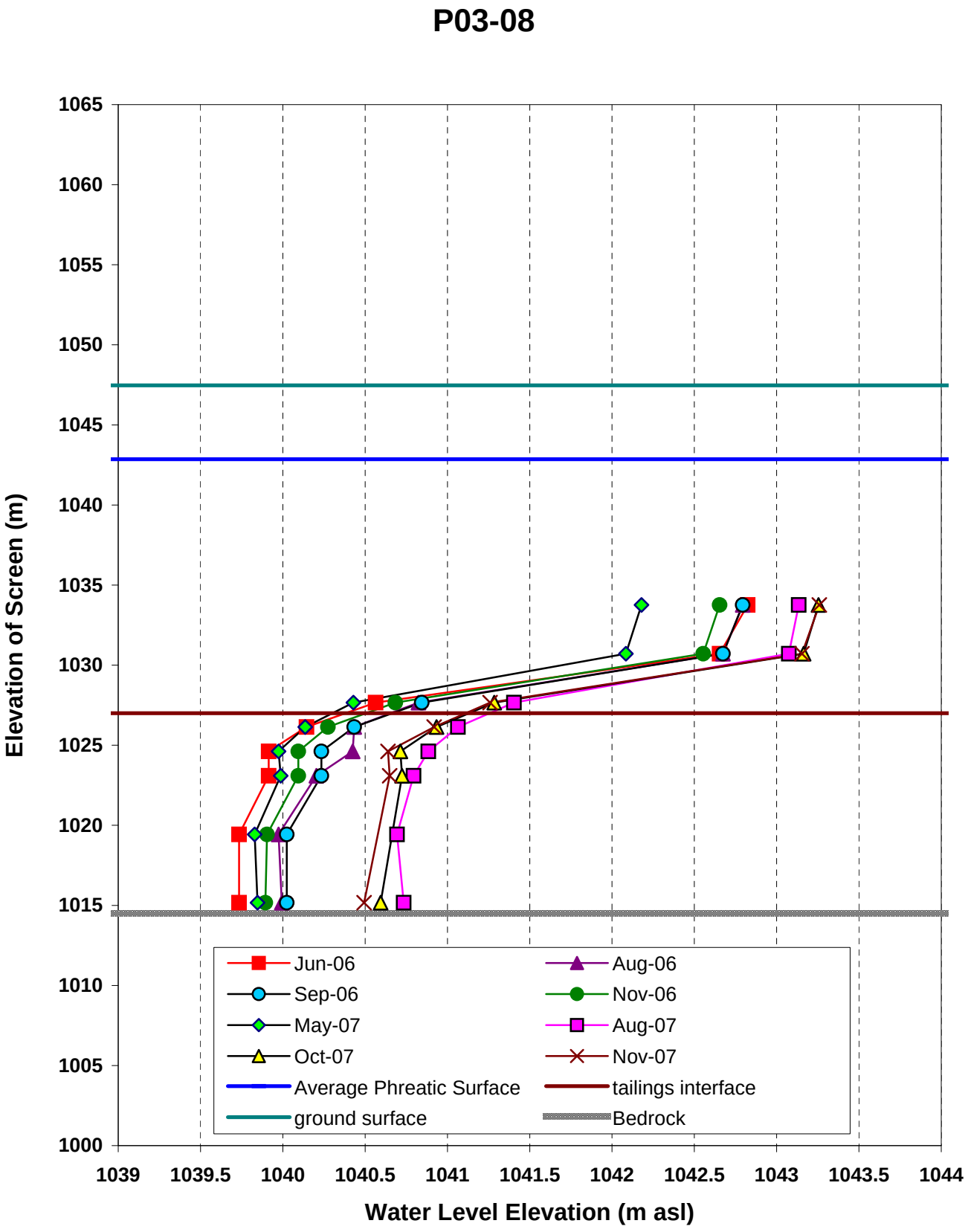
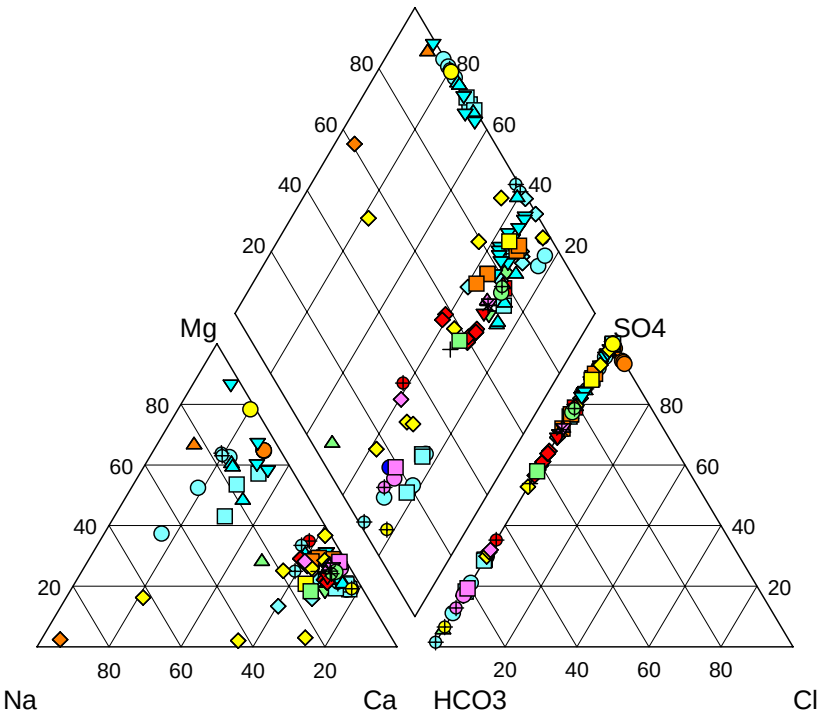
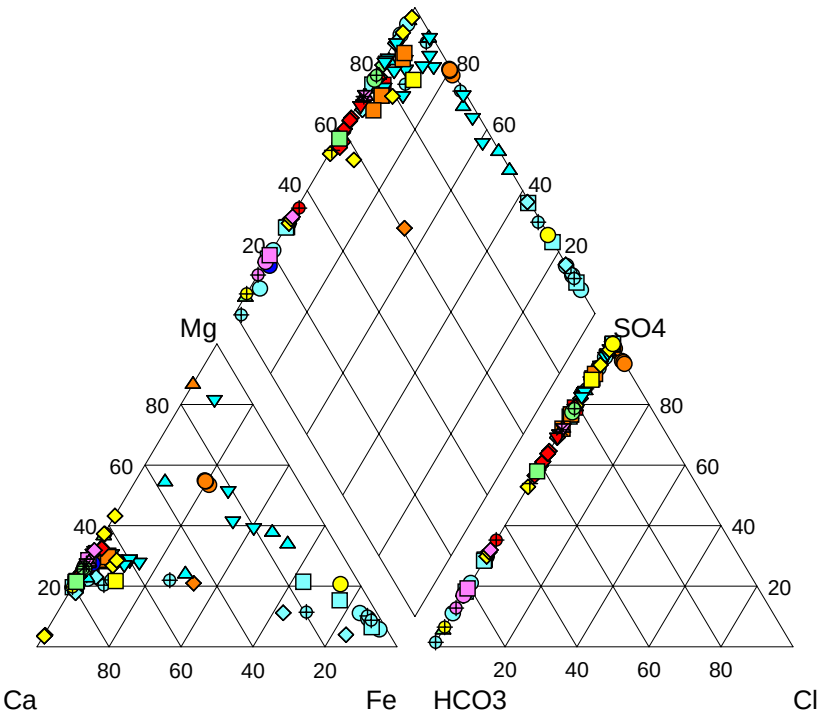


Figure A1h. Water level elevations in multi-level piezometer P03-08.

Legend:

- Baseline
- TH17-86
- Original Impoundment
- P03-07
- P01-08A
- P01-10A
- Second Impoundment
- P03-01
- P03-02
- P03-03
- P03-04
- P03-05
- P03-06
- Intermediate Impound
- X21A
- X21B
- X21C
- P03-08
- Toe-Intermediate Dam
- X24A
- X24D
- X25A
- X25B
- P01-03
- P01-04A
- P01-04B
- Toe-Cross Valley Dam
- P01-02B
- P01-11
- P03-09
- P05-01
- P05-03
- D/g Cross Valley Dam
- X16A
- X16B
- X17A
- X17B
- X18A
- X18B
- P01-01A
- Faro Creek Seepage
- FCS-series
- Rose Creek Diversion
- R9
- X3

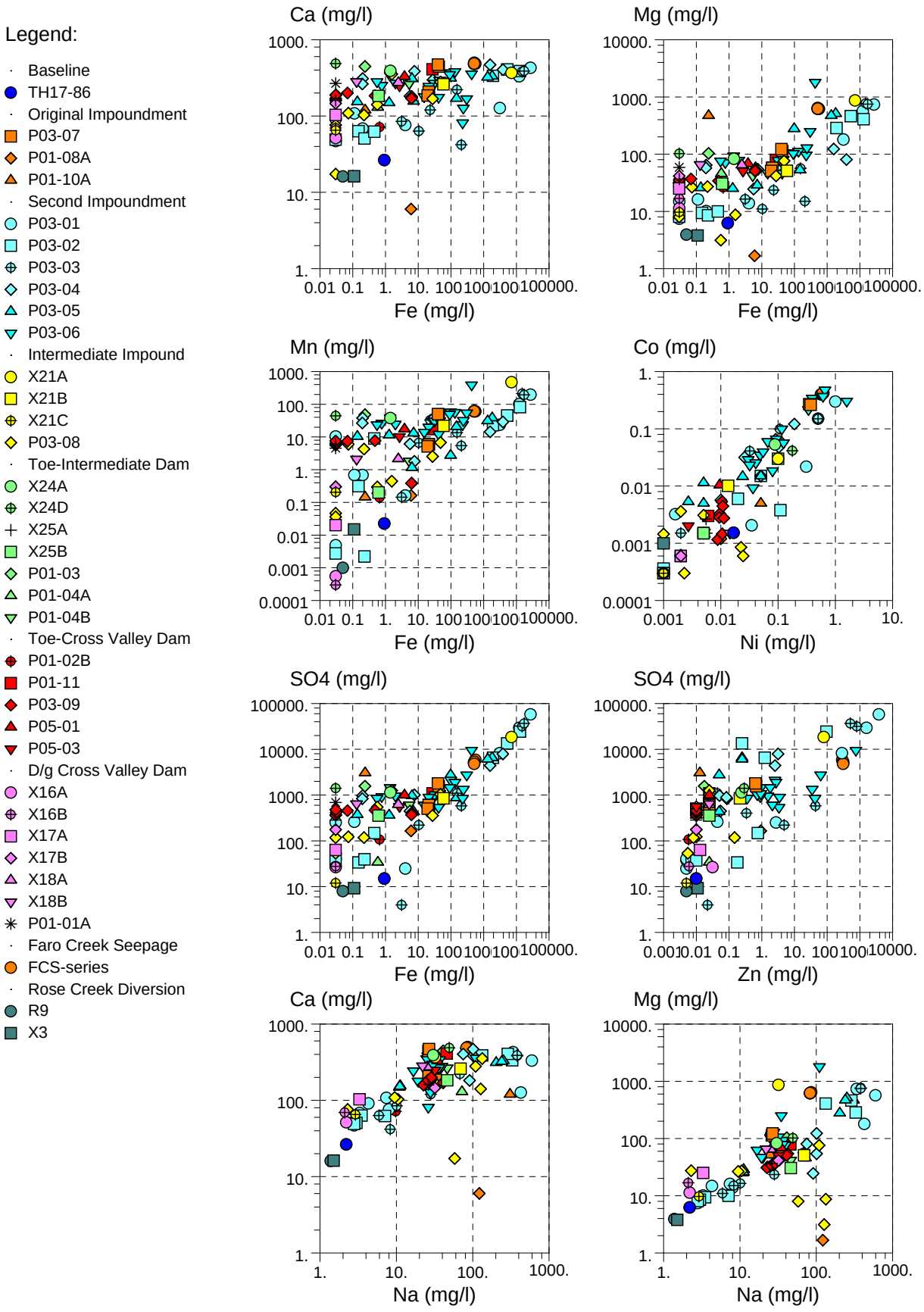




DESCRIPTION:

Figure A-2a: Piper Plots - all data

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008



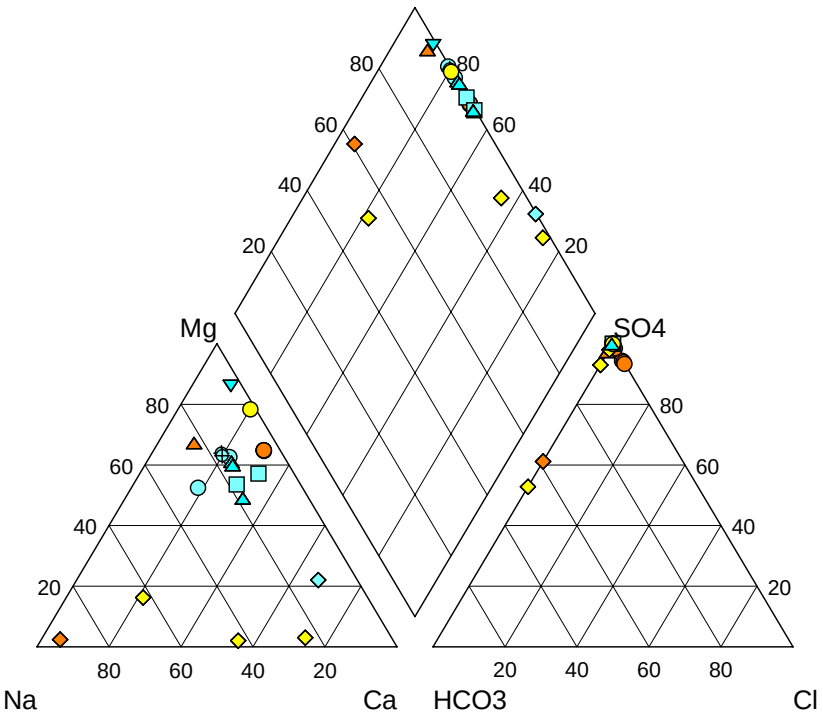
DESCRIPTION:

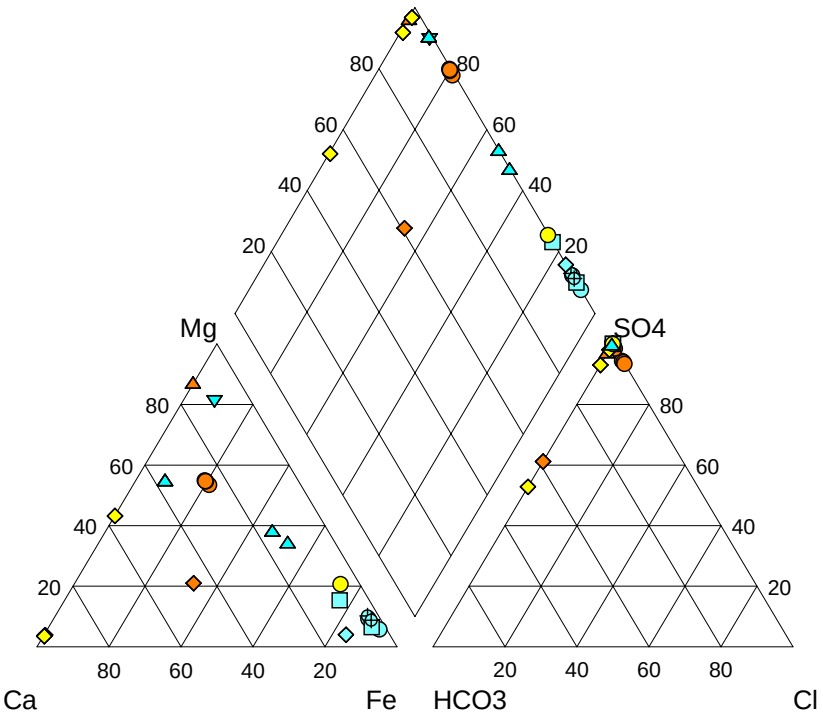
Figure A-2b: Scatter Plots - all data

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008

Legend:

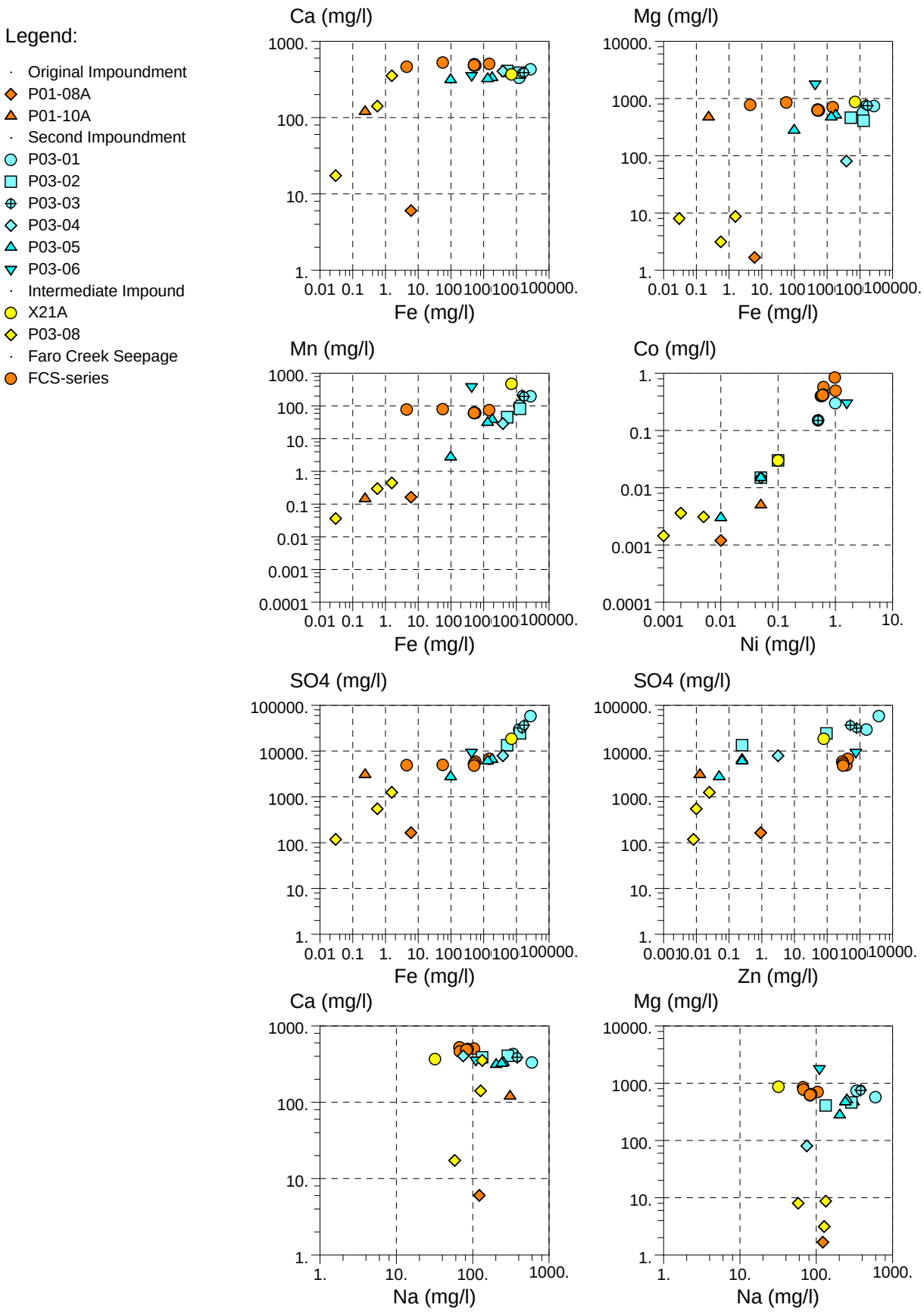
- Original Impoundment
- P01-08A
- P01-10A
- Second Impoundment
- P03-01
- P03-02
- P03-03
- P03-04
- P03-05
- P03-06
- Intermediate Impound
- X21A
- P03-08
- Faro Creek Seepage
- FCS-series





DESCRIPTION:
Figure A-3a: Piper Plots - Tailings Pore Water and Faro Creek Seepage

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008



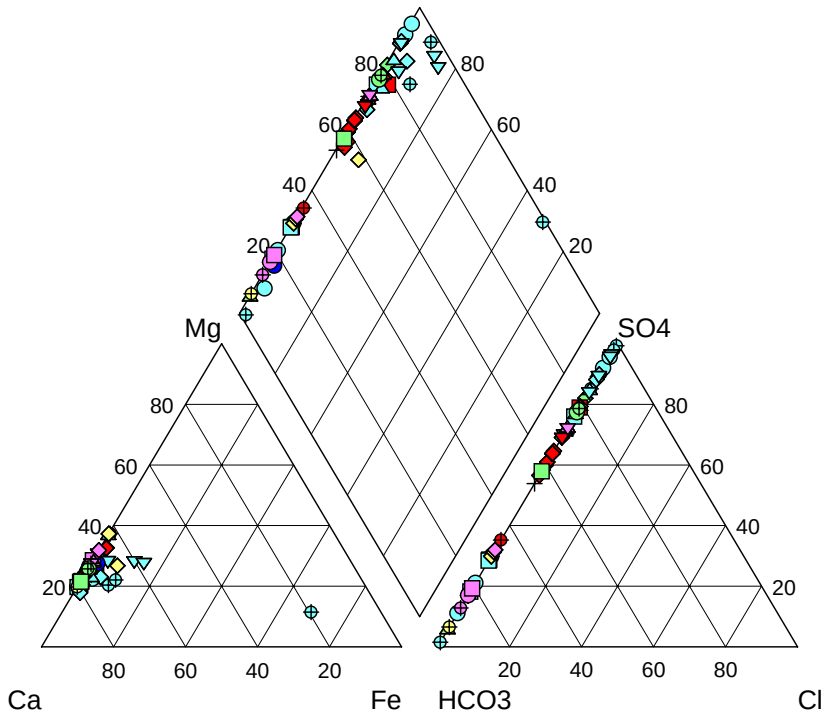
DESCRIPTION:

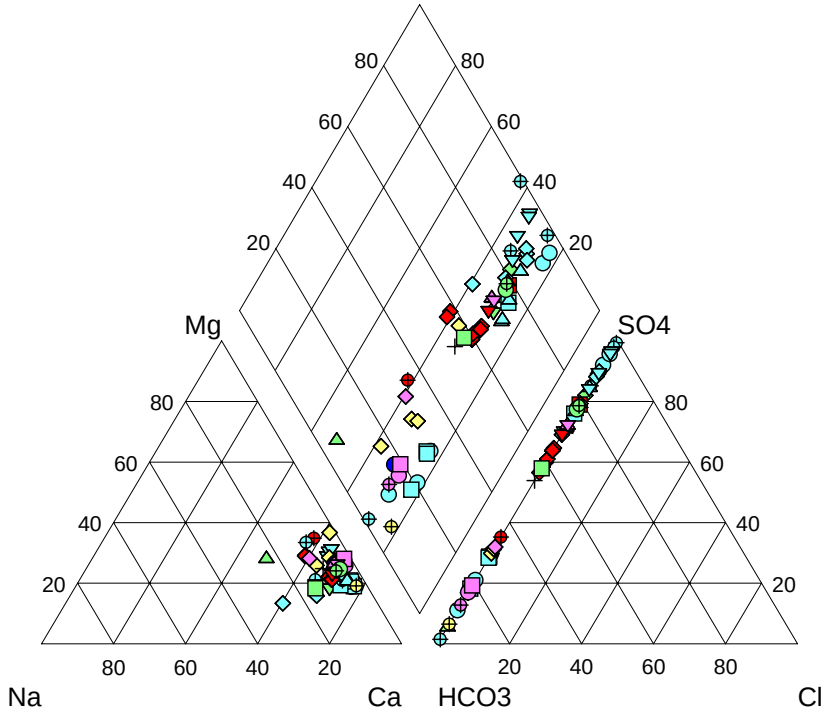
Figure A-3b: Scatter Plots - Tailings Pore Water and Faro Creek Seepage

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008

Legend:

- Baseline
- TH17-86
- Second Impoundment
- P03-01
- P03-02
- P03-03
- P03-04
- P03-05
- P03-06
- Intermediate Impound
- X21C
- P03-08
- Toe-Intermediate Dam
- X24A
- X24D
- X25A
- X25B
- P01-03
- P01-04A
- P01-04B
- Toe-Cross Valley Dam
- P01-02B
- P01-11
- P03-09
- P05-01
- P05-03
- D/g Cross Valley Dam
- X16A
- X16B
- X17A
- X17B
- X18A
- X18B
- P01-01A
- Rose Creek Diversion
- R9
- X3

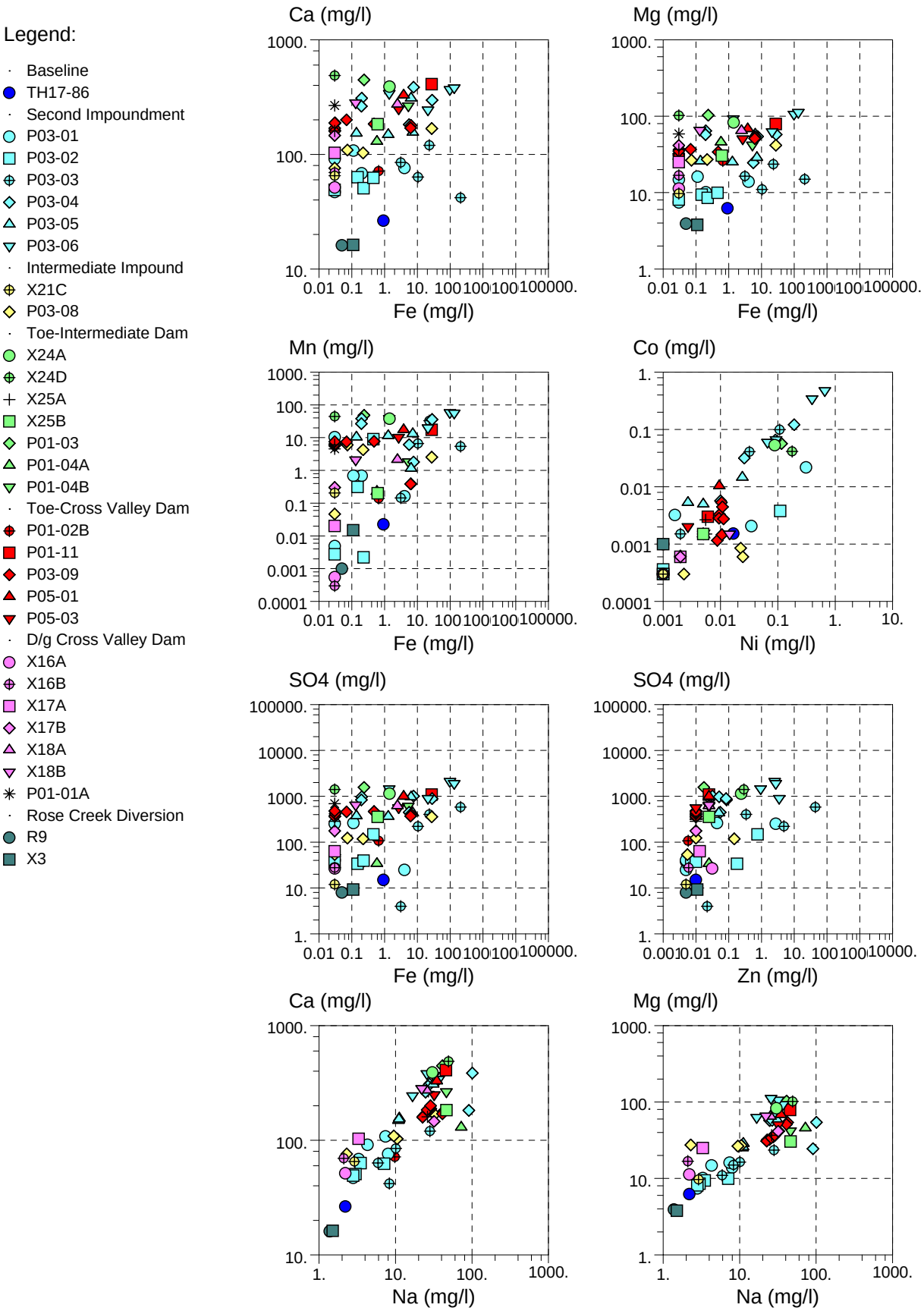




DESCRIPTION:

Figure A-4a: Piper Plots - Deep Aquifer

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008



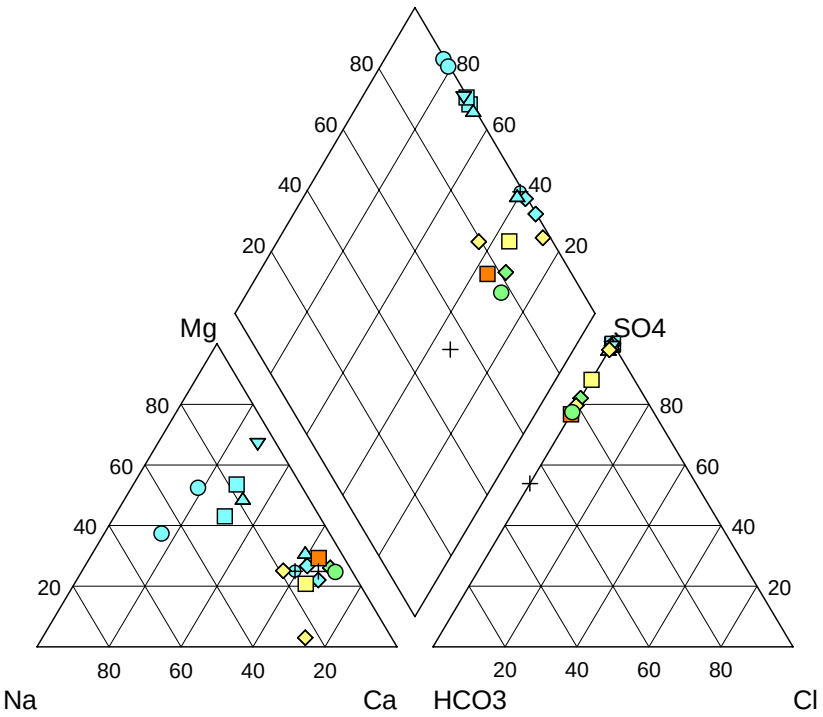
DESCRIPTION:

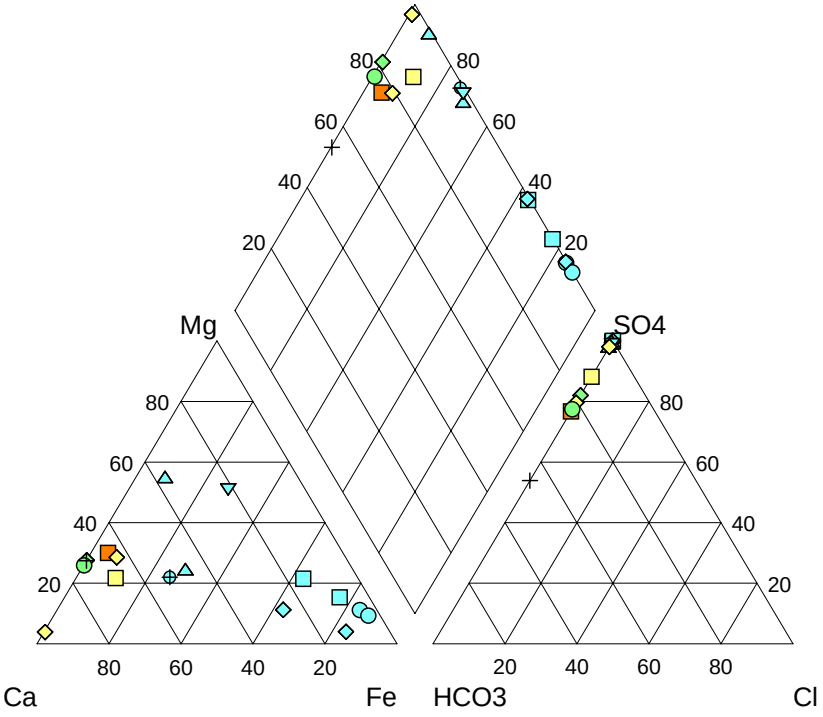
Figure A-4b: Scatter Plots - Deep Aquifer

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008

Legend:

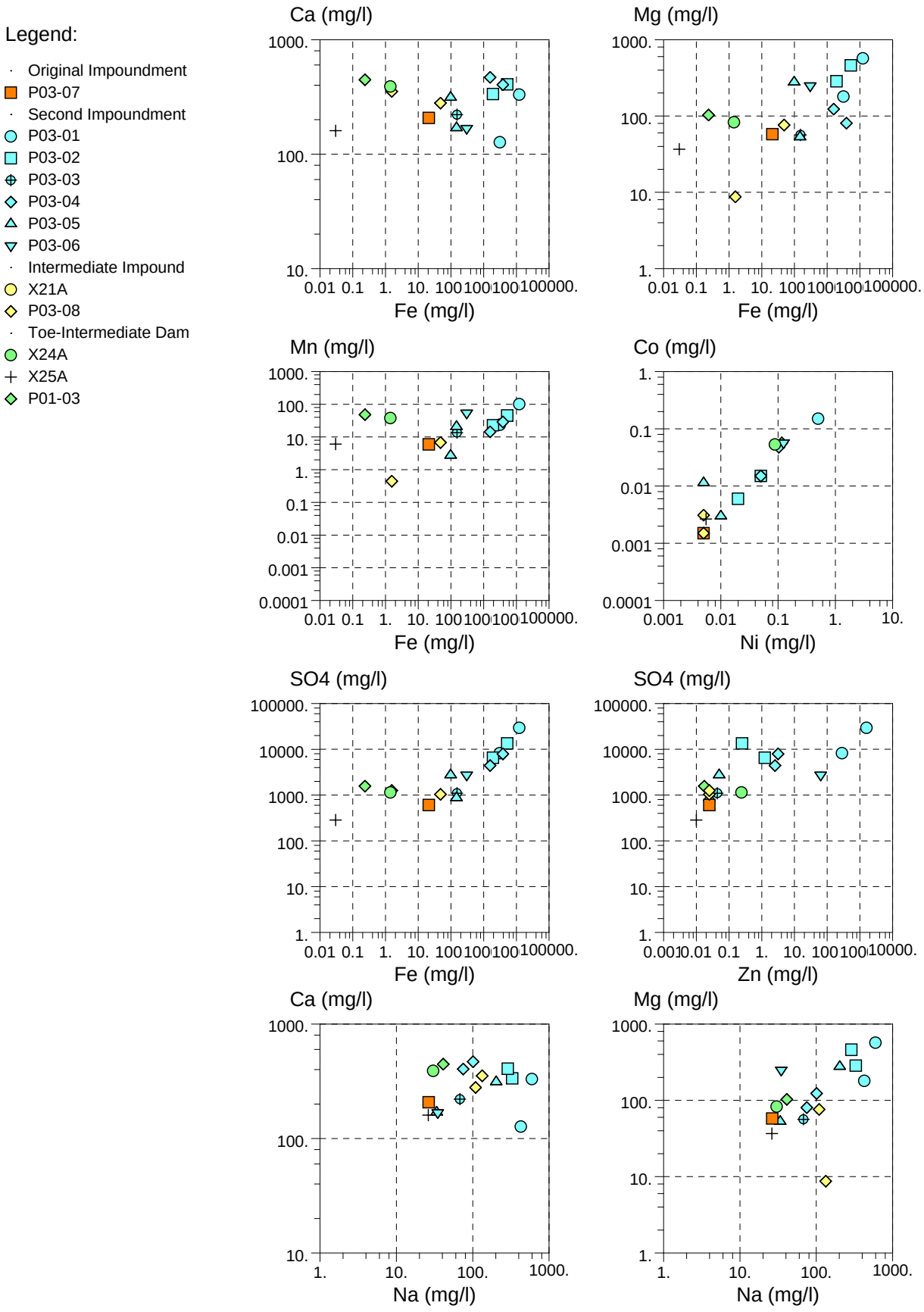
- Original Impoundment
- P03-07
- Second Impoundment
- P03-01
- P03-02
- P03-03
- P03-04
- P03-05
- P03-06
- Intermediate Impound
- X21B
- P03-08
- Toe-Intermediate Dam
- X24A
- X25A
- P01-03





DESCRIPTION:
Figure A-5a: Piper Plots - Interface Zone

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008



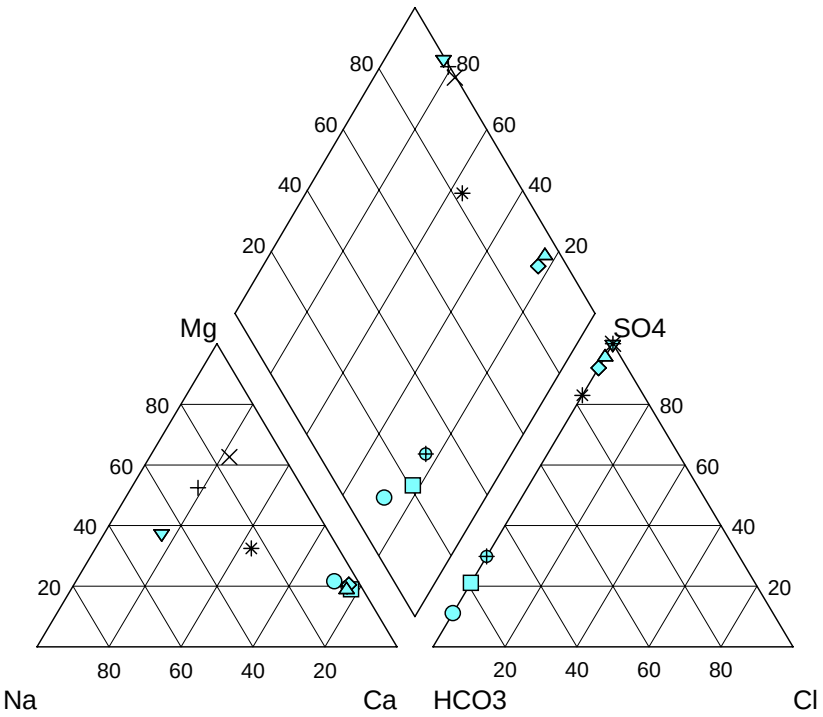
DESCRIPTION:

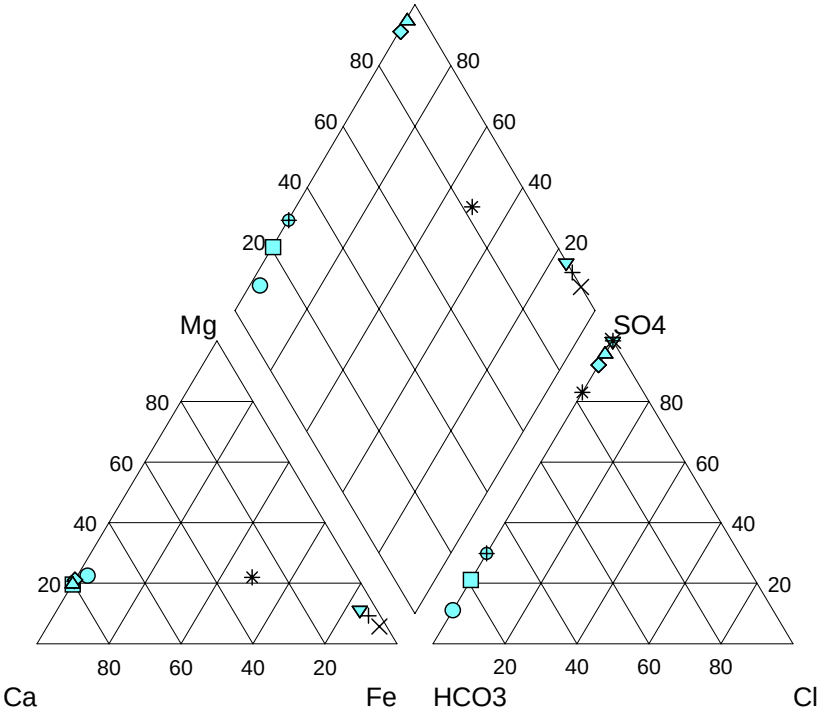
Figure A-5b: Scatter Plots - Interface Zone

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008

Legend:

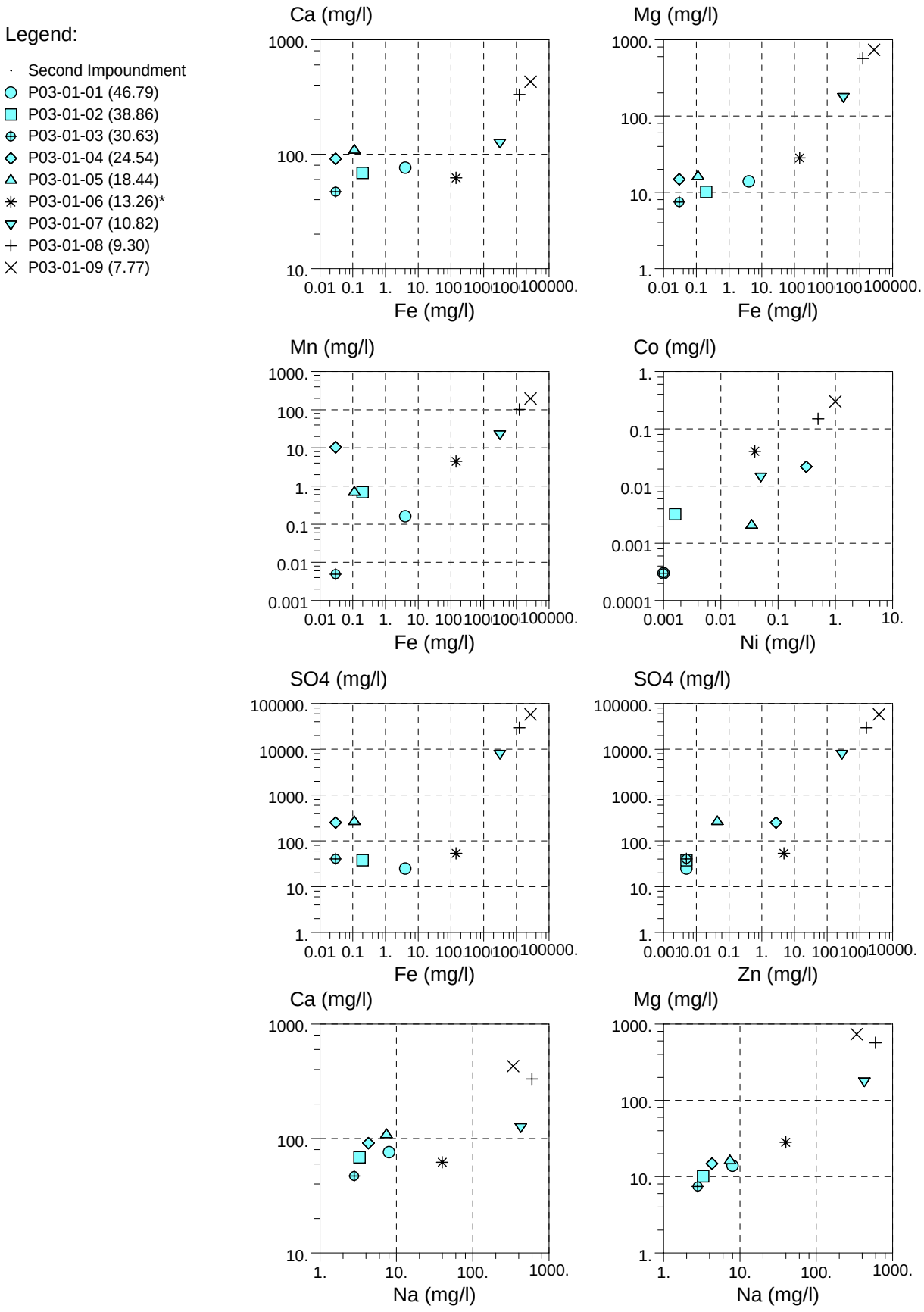
- Second Impoundment
- P03-01-01 (46.79)
- P03-01-02 (38.86)
- P03-01-03 (30.63)
- P03-01-04 (24.54)
- P03-01-05 (18.44)
- P03-01-06 (13.26)*
- P03-01-07 (10.82)
- P03-01-08 (9.30)
- P03-01-09 (7.77)





DESCRIPTION:
Figure A-6a: Piper Plots - Multi-level P03-01

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008



DESCRIPTION:

Figure A-6b: Scatter Plots - Multi-level P03-01

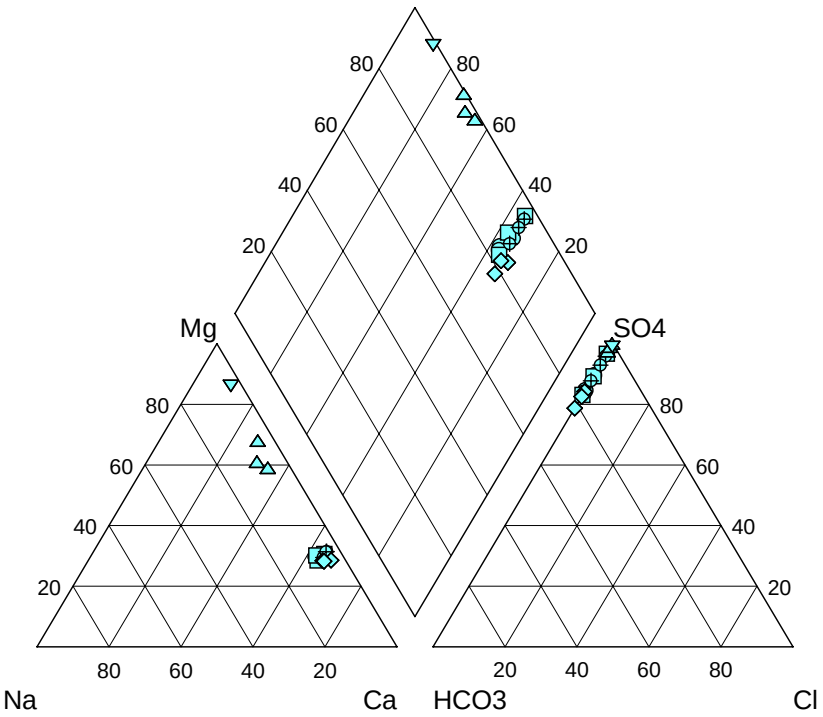
Robertson GeoConsultants Inc.

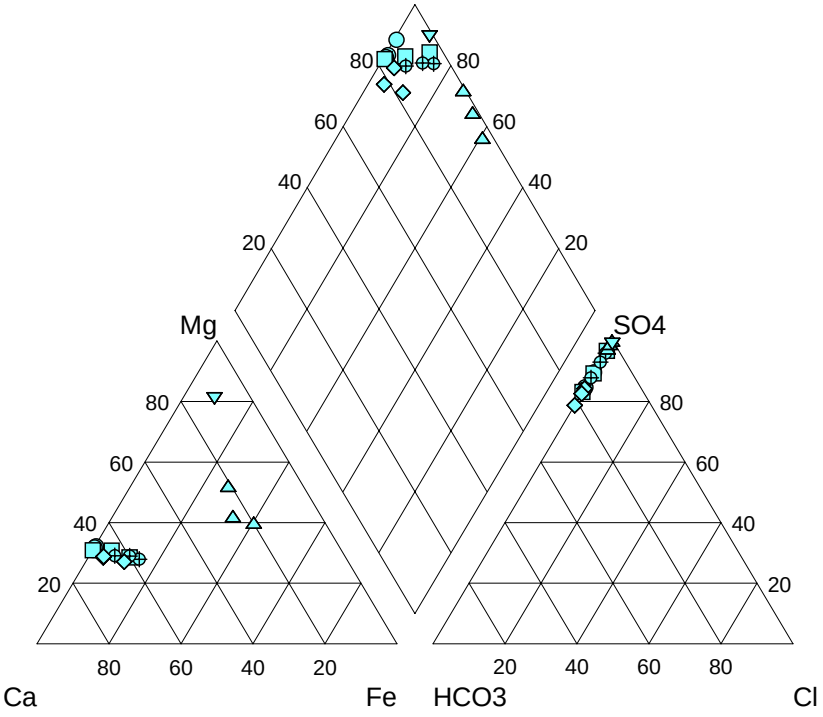
Mining, Geotechnical and Environmental Engineers

CLIENT:Deloitte & Touche Inc.	
PROJECT: Faro Geochemical Assessment	
PROJECT NO.118013	DATE: March 2008

Legend:

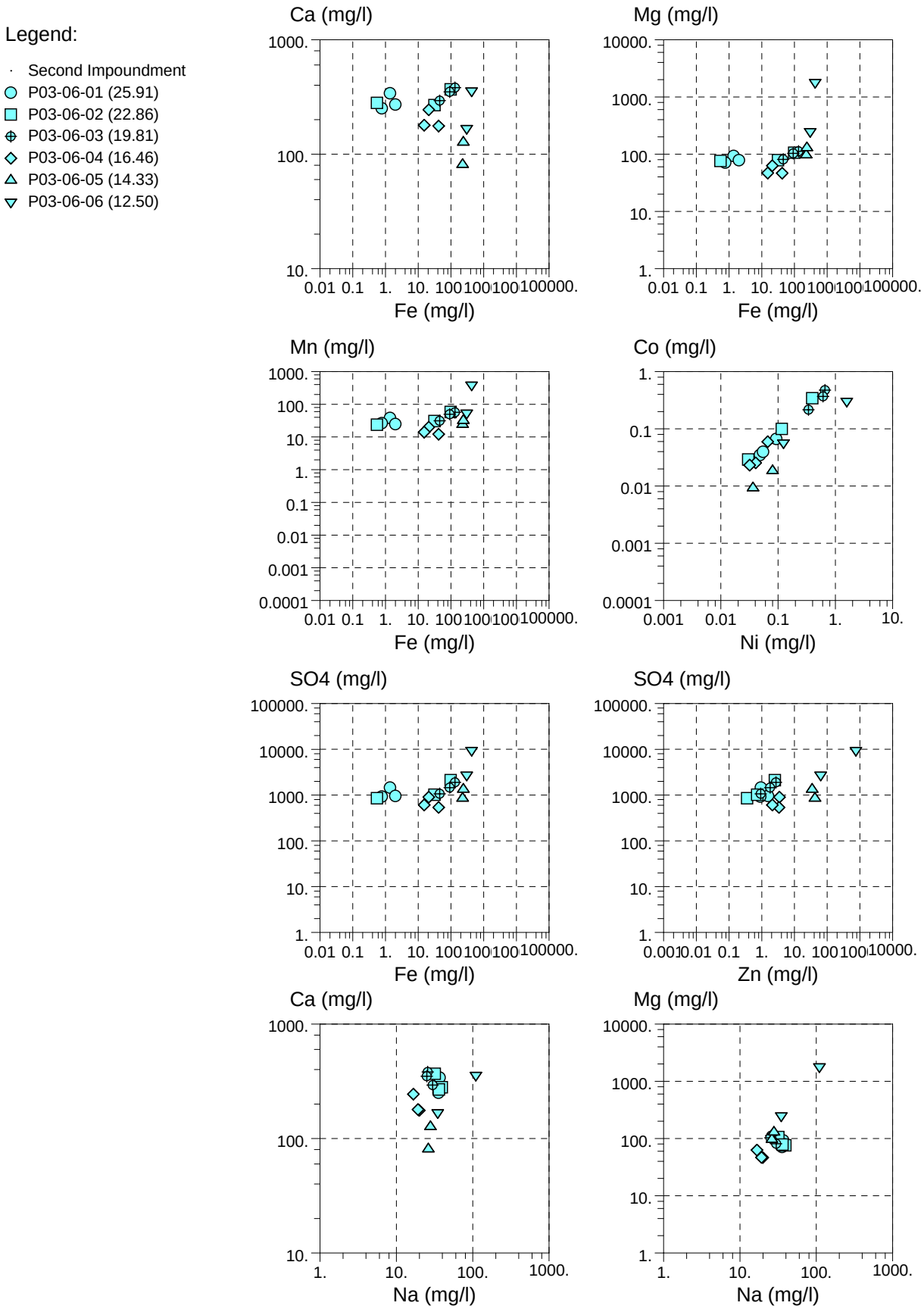
- Second Impoundment
- P03-06-01 (25.91)
- P03-06-02 (22.86)
- P03-06-03 (19.81)
- P03-06-04 (16.46)
- P03-06-05 (14.33)
- P03-06-06 (12.50)





DESCRIPTION:
Figure A-7a: Piper Plots - Multi-level P03-06

Robertson GeoConsultants Inc. Mining, Geotechnical and Environmental Engineers	CLIENT:Deloitte & Touche Inc.	
	PROJECT: Faro Geochemical Assessment	
	PROJECT NO.118013	DATE: March 2008



DESCRIPTION:

Figure A-7b: Scatter Plots - Multi-level P03-06

Robertson GeoConsultants Inc.

Mining, Geotechnical and Environmental Engineers

CLIENT:Deloitte & Touche Inc.	
PROJECT: Faro Geochemical Assessment	
PROJECT NO.118013	DATE: March 2008

		Relative Flows (L/s)				Percent contributions (%)			
Well #	Scenario #	Upgradient Aquifer	Tailings Seepage	Faro Creek Seepage	Rose Creek Diversion	% Aquifer Contribution	% Tailings Seepage	% Faro Creek Seepage	% Rose Creek Diversion
P03-01	Scenario 1	11.5	0.02	0	0	99.8%	0.2%	0.0%	0.0%
P03-01	Scenario 2	11.5	0.09	0	0	99.2%	0.8%	0.0%	0.0%
P03-01	Scenario 3	11.5	0.9	0	0	92.7%	7.3%	0.0%	0.0%
P03-01	Scenario 4	11.5	0.1	0	0	99.1%	0.9%	0.0%	0.0%
P03-01	Scenario 5	11.5	0.5	0	0	95.8%	4.2%	0.0%	0.0%
P03-01	Scenario 6	11.5	0.01	0	0	99.9%	0.1%	0.0%	0.0%

Source Concentrations (mg/L)

	Aquifer (P03-01-01)	Tailings Seepage (P03-01-08)	Faro Creek Seepage (FCS-4)	Rose Creek Diversion (X3)
Ca	76.1	331	483	16.2
Mg	13.9	569	615	3.78
Na	8	596	83	1.51
SO4	24.9	29600	5920	9.29
Zn	< 0.005	1590	289	0.011
Co	< 0.0003	< 0.15	0.4	< 0.001
Ni	< 0.001	< 0.5	0.56	< 0.001
Fe	4.03	12300	558	0.11

Predicted Aquifer Concentrations (mg/L)

	P03-01					
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Ca	77	78	95	78	87	76
Mg	15	18	54	19	37	14
Na	9	13	51	13	33	9
SO4	76	255	2171	280	1257	51
Zn	2.8	12	115	14	66	1.39
Co	< 0.001	< 0.001	< 0.01	< 0.002	< 0.0065	< 0.0004
Ni	< 0.002	< 0.005	< 0.04	< 0.005	< 0.022	< 0.001
Fe	25.38	100	896	110	516	15

Actual Aquifer Concentrations (mg/L)

P03-01-04	P03-01-05
91.2	108
14.8	16.1
4.3	7.4
251	262
2.72	0.044
0.0218	0.00206
0.309	0.0345
< 0.03	0.112

Table A1a P03-01

		Relative Flows (L/s)				Percent contributions (%)			
Well #	Scenario #	Upgradient Aquifer	Tailings Seepage	Faro Creek Seepage	Rose Creek Diversion	% Aquifer Contribution	% Tailings Seepage	% Faro Creek Seepage	% Rose Creek Diversion
P03-06	Scenario 1	11.5	10	0	0	53.5%	46.5%	0.0%	0.0%
P03-06	Scenario 2	11.5	20	0	0	36.5%	63.5%	0.0%	0.0%
P03-06	Scenario 3	11.5	200	0	0	5.4%	94.6%	0.0%	0.0%
P03-06	Scenario 4	11.5	1	0	0	92.0%	8.0%	0.0%	0.0%
P03-06	Scenario 5	11.5	30	0	0	27.7%	72.3%	0.0%	0.0%
P03-06	Scenario 6	11.5	40	0	0	22.3%	77.7%	0.0%	0.0%

Source Concentrations (mg/L)

	Aquifer (P03-01-01)	Tailings Seepage (P01-08A)	Faro Creek Seepage (FCS-4)	Rose Creek Diversion (X3)
Ca	76.1	6.03	483	16.2
Mg	13.9	1.67	615	3.78
Na	8	122	83	1.51
SO4	24.9	165	5920	9.29
Zn	< 0.005	0.929	289	0.011
Co	< 0.0003	0.0012	0.4	< 0.001
Ni	< 0.001	< 0.01	0.56	< 0.001
Fe	4.03	6.03	558	0.11

Predicted Aquifer Concentrations (mg/L)

	P03-06					
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Ca	44	32	10	70	25	22
Mg	8	6	2	13	5	4
Na	61	80	116	17	90	97
SO4	90	114	157	36	126	134
Zn	0.43	0.59	0.88	0.08	0.67	0.72
Co	0.001	0.001	0.001	0.0004	0.0010	0.0010
Ni	0.005	0.007	0.010	0.002	0.008	0.008
Fe	4.96	5	6	4	5	6

Actual Aquifer Concentrations (mg/L)

P03-06-04	P03-06-05
176	81.1
46.5	96.4
19.9	26.2
538	851
3.36	42.3
0.0254	0.0185
0.0406	0.08
42.1	228

Table A1b P03-06 (Run 1A)

Relative Flows (L/s)

Well #	Scenario #	Upgradient Aquifer	Tailings Seepage	Faro Creek Seepage	Rose Creek Diversion
P03-06	Scenario 1	11.5	0.25	0	0
P03-06	Scenario 2	11.5	0.5	0	0
P03-06	Scenario 3	11.5	1	0	0
P03-06	Scenario 4	11.5	0.55	0	0
P03-06	Scenario 5	11.5	0.65	0	0
P03-06	Scenario 6	11.5	0.75	0	0

Percent contributions (%)

% Aquifer Contribution	% Tailings Seepage	% Faro Creek Seepage	% Rose Creek Diversion
97.9%	2.1%	0.0%	0.0%
95.8%	4.2%	0.0%	0.0%
92.0%	8.0%	0.0%	0.0%
95.4%	4.6%	0.0%	0.0%
94.7%	5.3%	0.0%	0.0%
93.9%	6.1%	0.0%	0.0%

Source Concentrations (mg/L)

	Aquifer (P03-01-01)	Tailings Seepage (P03-06-06)	Faro Creek Seepage (FCS-4)	Rose Creek Diversion (X3)
Ca	76.1	357	483	16.2
Mg	13.9	1790	615	3.78
Na	8	110	83	1.51
SO4	24.9	9510	5920	9.29
Zn	< 0.005	755	289	0.011
Co	< 0.0003	0.305	0.4	< 0.001
Ni	< 0.001	1.58	0.56	< 0.001
Fe	4.03	428	558	0.11

Predicted Aquifer Concentrations (mg/L)

	Scenario 1	Scenario 2	P03-06 Scenario 3	Scenario 4	Scenario 5	Scenario 6
Ca	82	88	99	89	91	93
Mg	52	88	156	95	109	123
Na	10	12	16	13	13	14
SO4	227	420	784	458	532	606
Zn	16	31	60	34	40	46
Co	0.007	0.013	0.0247	0.014	0.017	0.019
Ni	0.035	0.067	0.127	0.073	0.085	0.098
Fe	13.05	22	38	23	27	30

Actual Aquifer Concentrations (mg/L)

P03-06-04	P03-06-05
176	81.1
46.5	96.4
19.9	26.2
538	851
3.36	42.3
0.0254	0.0185
0.0406	0.08
42.1	228

Table A1c P03-06 (Run 1B)

Relative Flows (L/s) | **Percent contributions (%)**

Well #	Scenario #	Upgradient Aquifer	Tailings Seepage	Faro Creek Seepage	Rose Creek Diversion	% Aquifer Contribution	% Tailings Seepage	% Faro Creek Seepage	% Rose Creek Diversion
P03-06	Scenario 1	11.5	0	0.5	0	95.8%	0.0%	4.2%	0.0%
P03-06	Scenario 2	11.5	0	0.75	0	93.9%	0.0%	6.1%	0.0%
P03-06	Scenario 3	11.5	0	1.0	0	92.0%	0.0%	8.0%	0.0%
P03-06	Scenario 4	11.5	0	1.25	0	90.2%	0.0%	9.8%	0.0%
P03-06	Scenario 5	11.5	0	1.5	0	88.5%	0.0%	11.5%	0.0%
P03-06	Scenario 6	11.5	0	1.75	0	86.8%	0.0%	13.2%	0.0%

Source Concentrations (mg/L)

	Aquifer (P03-01-01)	Tailings Seepage (P01-08A)	Faro Creek Seepage (FCS-4)	Rose Creek Diversion (X3)
Ca	76.1	6.03	483	16.2
Mg	13.9	1.67	615	3.78
Na	8	122	83	1.51
SO4	24.9	165	5920	9.29
Zn	< 0.005	0.929	289	0.011
Co	< 0.0003	0.0012	0.4	< 0.001
Ni	< 0.001	< 0.01	0.56	< 0.001
Fe	4.03	6.03	558	0.11

Predicted Aquifer Concentrations (mg/L)

	P03-06					
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Ca	93	101	109	116	123	130
Mg	39	51	62	73	83	93
Na	11	13	14	15	17	18
SO4	271	386	497	603	705	803
Zn	12.0	18	23	28	33	38.17
Co	0.017	0.025	0.032	0.039	0.046	0.053
Ni	0.024	0.035	0.046	0.056	0.066	0.075
Fe	27.11	38	48	58	68	77

Actual Aquifer Concentrations (mg/L)

P03-06-04	P03-06-05
176	81.1
46.5	96.4
19.9	26.2
538	851
3.36	42.3
0.0254	0.0185
0.0406	0.08
42.1	228

Table A1d P03-06 (Run 2)

Relative Flows (L/s) | **Percent contributions (%)**

Well #	Scenario #	Upgradient Aquifer	Weak tailings Seepage (P01-08A)	Strong tailings seepage (P03-06-06)	Faro Creek Seepage	Rose Creek Diversion	% Aquifer Contribution	% Tailings Seepage	% Faro Creek Seepage	% Rose Creek Diversion
P03-06	Scenario 1	11.5	0.138	0.124	0.25	0	95.7%	1.1%	2.1%	0.0%
P03-06	Scenario 2	11.5	0.138	0.124	0.50	0	93.8%	1.1%	4.1%	0.0%
P03-06	Scenario 3	11.5	0.138	0.124	0.75	0	91.9%	1.1%	6.0%	0.0%
P03-06	Scenario 4	11.5	0.138	0.124	1.00	0	90.1%	1.1%	7.8%	0.0%
P03-06	Scenario 5	11.5	0.138	0.124	1.50	0	86.7%	1.0%	11.3%	0.0%
P03-06	Scenario 6	11.5	0.138	0.124	2.00	0	83.6%	1.0%	14.5%	0.0%

Source Concentrations (mg/L)

	Aquifer (P03-01-01)	Weak tailings Seepage (P01-08A)	Strong tailings seepage (P03-06-06)	Faro Creek Seepage (FCS-4)	Rose Creek Diversion (X3)
Ca	76.1	6.03	357	483	16.2
Mg	13.9	1.67	1790	615	3.78
Na	8	122	110	83	1.51
SO4	24.9	165	9510	5920	9.29
Zn	< 0.005	0.929	755	289	0.011
Co	< 0.0003	0.0012	0.305	0.4	< 0.001
Ni	< 0.001	< 0.01	1.58	0.56	< 0.001
Fe	4.03	6.03	428	558	0.11

Predicted Aquifer Concentrations (mg/L)

	Scenario 1	Scenario 2	P03-06 Scenario 3	Scenario 4	Scenario 5	Scenario 6
Ca	87	95	103	110	124	137
Mg	47	58	69	80	100	119
Na	12	13	15	16	19	21
SO4	258	374	484	591	792	978
Zn	15	20	26	31	41	50
Co	0.0121	0.0200	0.0276	0.0349	0.0487	0.0615
Ni	0.0309	0.0417	0.0520	0.0620	0.0808	0.0982
Fe	20	31	42	52	71	89

Actual Aquifer Concentrations (mg/L)

P03-06-04	P03-06-05
176	81.1
46.5	96.4
19.9	26.2
538	851
3.36	42.3
0.0254	0.0185
0.0406	0.08
42.1	228

Table A1e P03-06 (Run 3A)

		Relative Flows (L/s)					Percent contributions (%)			
Well #	Scenario #	Upgradient Aquifer	Weak tailings Seepage (P01-08A)	Strong tailings Seepage (P03-01-08)	Faro Creek Seepage	Rose Creek Diversion	% Aquifer Contribution	% Tailings Seepage	% Faro Creek Seepage	% Rose Creek Diversion
P03-06	Scenario 1	11.5	0.138	0.124	0.25	0	95.7%	1.1%	2.1%	0.0%
P03-06	Scenario 2	11.5	0.138	0.124	0.50	0	93.8%	1.1%	4.1%	0.0%
P03-06	Scenario 3	11.5	0.138	0.124	0.75	0	91.9%	1.1%	6.0%	0.0%
P03-06	Scenario 4	11.5	0.138	0.124	1.00	0	90.1%	1.1%	7.8%	0.0%
P03-06	Scenario 5	11.5	0.138	0.124	1.50	0	86.7%	1.0%	11.3%	0.0%
P03-06	Scenario 6	11.5	0.138	0.124	2.00	0	83.6%	1.0%	14.5%	0.0%

Source Concentrations (mg/L)

	Aquifer (P03-01-01)	Weak tailings Seepage (P01-08A)	Tailings Seepage (P03-01-08)	Faro Creek Seepage (FCS-4)	Rose Creek Diversion (X3)
Ca	76.1	6.03	331	483	16.2
Mg	13.9	1.67	569	615	3.78
Na	8	122	596	83	1.51
SO4	24.9	165	29600	5920	9.29
Zn	< 0.005	0.929	1590	289	0.011
Co	< 0.0003	0.0012	< 0.15	0.4	< 0.001
Ni	< 0.001	< 0.01	< 0.5	0.56	< 0.001
Fe	4.03	6.03	12300	558	0.11

Predicted Aquifer Concentrations (mg/L)

			P03-06			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Ca	87	95	103	110	124	137
Mg	33	45	56	67	88	107
Na	18	19	20	21	24	26
SO4	489	600	706	808	1001	1180
Zn	24	30	35	40	49	58
Co	0.0103	0.0183	0.0259	0.0332	0.0471	0.0599
Ni	0.0185	0.0295	0.0401	0.0503	0.0695	0.0873
Fe	157	165	173	180	195	208

Actual Aquifer Concentrations (mg/L)

P03-06-04	P03-06-05
176	81.1
46.5	96.4
19.9	26.2
538	851
3.36	42.3
0.0254	0.0185
0.0406	0.08
42.1	228

Table A1f P03-06 (Run 3B)

		Relative Flows (L/s)				Percent contributions (%)			
Well #	Scenario #	Upgradient Aquifer	Tailings Seepage	Faro Creek Seepage	Rose Creek Diversion	% Aquifer Contribution	% Tailings Seepage	% Faro Creek Seepage	% Rose Creek Diversion
P03-06	Scenario 1	11.5	0.5	0.0	0	95.8%	4.2%	0.0%	0.0%
P03-06	Scenario 2	11.5	0.5	0.5	0	92.0%	4.0%	4.0%	0.0%
P03-06	Scenario 3	11.5	0.5	1	0	88.5%	3.8%	7.7%	0.0%
P03-06	Scenario 4	11.5	0.65	0.0	0	94.7%	5.3%	0.0%	0.0%
P03-06	Scenario 5	11.5	0.4	0.5	0	92.7%	3.2%	4.0%	0.0%
P03-06	Scenario 6	11.5	0.1	1	0	91.3%	0.8%	7.9%	0.0%

Source Concentrations (mg/L)

	Aquifer (P03-01-01)	Tailings Seepage (P03-06-06)	Faro Creek Seepage (FCS-4)	Rose Creek Diversion (X3)
Ca	76.1	357	483	16.2
Mg	13.9	1790	615	3.78
Na	8	110	83	1.51
SO4	24.9	9510	5920	9.29
Zn	< 0.005	755	289	0.011
Co	< 0.0003	0.305	0.4	< 0.001
Ni	< 0.001	1.58	0.56	< 0.001
Fe	4.03	428	558	0.11

Predicted Aquifer Concentrations (mg/L)

			P03-06			
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Ca	88	104	118	91	102	111
Mg	88	109	128	109	95	76
Na	12	15	18	13	14	15
SO4	420	640	843	532	569	568
Zn	31	42	51	40	36	29
Co	0.013	0.028	0.043	0.017	0.026	0.034
Ni	0.067	0.087	0.105	0.085	0.074	0.058
Fe	21.70	43	63	27	40	51

Actual Aquifer Concentrations (mg/L)

P03-06-04	P03-06-05
176	81.1
46.5	96.4
19.9	26.2
538	851
3.36	42.3
0.0254	0.0185
0.0406	0.08
42.1	228

Table A1g P03-06 (Run 4A)

		Relative Flows (L/s)				Percent contributions (%)			
Well #	Scenario #	Upgradient Aquifer	Tailings Seepage	Faro Creek Seepage	Rose Creek Diversion	% Aquifer Contribution	% Tailings Seepage	% Faro Creek Seepage	% Rose Creek Diversion
P03-06	Scenario 1	11.5	0.5	1.0	0	88.5%	3.8%	7.7%	0.0%
P03-06	Scenario 2	11.5	0.5	1.5	0	85.2%	3.7%	11.1%	0.0%
P03-06	Scenario 3	11.5	0.5	2.0	0	82.1%	3.6%	14.3%	0.0%
P03-06	Scenario 4	11.5	0.5	0.6	0	91.3%	4.0%	4.8%	0.0%
P03-06	Scenario 5	11.5	0.5	0.7	0	90.6%	3.9%	5.5%	0.0%
P03-06	Scenario 6	11.5	0.5	0.8	0	89.8%	3.9%	6.3%	0.0%

Source Concentrations (mg/L)

	Aquifer (P03-01-01)	Tailings Seepage (P01-08A)	Faro Creek Seepage (FCS-4)	Rose Creek Diversion (X3)
Ca	76.1	6.03	483	16.2
Mg	13.9	1.67	615	3.78
Na	8	122	83	1.51
SO4	24.9	165	5920	9.29
Zn	< 0.005	0.929	289	0.011
Co	< 0.0003	0.0012	0.4	< 0.001
Ni	< 0.001	< 0.01	0.56	< 0.001
Fe	4.03	6.03	558	0.11

Predicted Aquifer Concentrations (mg/L)

	P03-06					
	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Ca	105	119	132	93	96	99
Mg	60	80	99	42	47	51
Na	18	21	23	16	17	17
SO4	484	685	872	311	355	399
Zn	22.3	32	41	14	16	18.10
Co	0.031	0.045	0.057	0.019	0.022	0.025
Ni	0.044	0.063	0.081	0.028	0.032	0.036
Fe	46.72	66	83	30	35	39

Actual Aquifer Concentrations (mg/L)

P03-06-04	P03-06-05
176	81.1
46.5	96.4
19.9	26.2
538	851
3.36	42.3
0.0254	0.0185
0.0406	0.08
42.1	228

Table A1h P03-06 (Run 4B)

Table A2. Summary of Conservative Mixing Simulation for P03-06
(north side Rose Creek Tailings Facility, immediately downgradient of Original Impoundment)

Run ID	Description	Scenarios	Observations
Run1A (Table A1b)	Assume fixed ratio of 1 to 1.1 (47% to 53%) of high strength tailings (P03-06-06) to low strength tailings (P01-08A); assume no Faro Creek Seepage; try to match by varying the tailings seepage flow	Scenario 1 (0.124 & 0.138 L/s tails seep)	Tailings seepage must be fairly high, (significantly higher than estimated recharge rates). Also, the Mg and Ni concentrations are too high at the flow rate required to match SO4 and Na concentrations
		Scenario 2 (0.25 & 0.275 L/s tails seep)	
		Scenario 3 (0.5 & 0.55 L/s tails seep)	
		Scenario 4 (1 & 1.1 L/s tails seep)	
		Scenario 5 (2 & 2.2 L/s tails seep)	
		Scenario 6 (4 & 4.4 L/s tails seep)	
Run 1B (Table A1c)	Assume fixed ratio of 1 to 1.1 (47% to 53%) of high strength tailings (P03-01-08) to low strength tailings; assume no Faro Creek Seepage; try to match by varying the tailings seepage flow	Scenario 1 (0.124 & 0.138 L/s tails seep)	No match. Results in either (1) matching Co/Ni concentrations, but too high SO4 concentration, or (2) matching SO4 concentration, but too low Co/Ni concentrations
		Scenario 2 (0.25 & 0.275 L/s tails seep)	
		Scenario 3 (0.5 & 0.55 L/s tails seep)	
		Scenario 4 (1 & 1.1 L/s tails seep)	
		Scenario 5 (2 & 2.2 L/s tails seep)	
		Scenario 6 (4 & 4.4 L/s tails seep)	
Run 2 (Table A1d)	Assume no tailings seepage; try to match by varying Faro Creek Seepage	Scenario 1 (0.25 L/S FCS)	Co concentrations are too high at FCS seepage rates that provide adequate SO4 loading, and when Co concentrations match, SO4 and Na concentrations are too low
		Scenario 2 (0.5 L/S FCS)	
		Scenario 3 (0.75 L/S FCS)	
		Scenario 4 (1.0 L/S FCS)	
		Scenario 5 (1.5 L/S FCS)	
		Scenario 6 (2 L/S FCS)	
Run 3A (Table A1e)	Assume fixed ratio of flow of 0.124 L/s & 0.138 L/s for high strength tailings (P03-06-06) & low strength tailings, respectively; try to match by varying Faro Creek Seepage	Scenario 1 (0.25 L/S FCS)	Results in either (1) matching Co/Ni concentrations, but too low SO4 concentration, or (2) matching SO4 concentration, but too high Co/Ni concentrations
		Scenario 2 (0.5 L/S FCS)	
		Scenario 3 (0.75 L/S FCS)	
		Scenario 4 (1.0 L/S FCS)	
		Scenario 5 (1.5 L/S FCS)	
		Scenario 6 (2.0 L/S FCS)	
Run 3B (Table A1f)	Assume fixed flows of 0.124 L/s & 0.138 L/s for high strength tailings (P03-01-08) & low strength tailings, respectively; try to match by varying Faro Creek Seepage	Scenario 1 (0.25 L/S FCS)	Best match of any scenario is Run 3B, scenario 3. All flow values seem reasonable and are within the range of rates (recharge, seepage loss in Faro Creek) measured/estimated for the site
		Scenario 2 (0.5 L/S FCS)	
		Scenario 3 (0.75 L/S FCS)	
		Scenario 4 (1.0 L/S FCS)	
		Scenario 5 (1.5 L/S FCS)	
		Scenario 6 (2.0 L/S FCS)	
Run 4A (Table A1g)	Assume fixed ratio of flow of 0.273 L/s & 0.224 L/s for high strength tailings (P03-06-06) & low strength tailings, respectively, try to match by varying Faro Creek Seepage	Scenario 1 (0.0 L/S FCS)	0
		Scenario 2 (0.5 L/S FCS)	
		Scenario 3 (0.75 L/S FCS)	
		Scenario 4 (1.0 L/S FCS)	
		Scenario 5 (1.5 L/S FCS)	
		Scenario 6 (2.0 L/S FCS)	
Run 4B (Table A1g)	Assume fixed ratio of flow of 0.273 L/s & 0.224 L/s for high strength tailings (P03-01-08) & low strength tailings, respectively; try to match by varying Faro Creek Seepage	Scenario 1 (0.0 L/S FCS)	No match. Results show that either (1) SO4/Na concentrations match, but too low Ni/Co/Mg concentrations, or (2) the Ni/Co concentrations match, but too high SO4 concentrations
		Scenario 2 (0.05 L/S FCS)	
		Scenario 3 (0.1 L/S FCS)	
		Scenario 4 (0.25 L/S FCS)	
		Scenario 5 (0.5 L/S FCS)	
		Scenario 6 (0.75 L/S FCS)	

APPENDIX B

Detailed results of mixing calculations
(Available only in digital format on CD)

```
   Input file: \\Rgcserver1\rgc\Active Files\Active Projects\118_FaroMine\118013
Geochemical Analysis of GWQ\Water Quality Data\PhreeqcI - Faro\P03-01\P03-01.pqi
  Output file: \\Rgcserver1\rgc\Active Files\Active Projects\118_FaroMine\118013
Geochemical Analysis of GWQ\Water Quality Data\PhreeqcI - Faro\P03-01\P03-01.pqo
Database file: C:\Program Files\USGS\Phreeqc Interactive 2.14.3\wateq4f.dat

------------------
Reading data base.
------------------

      SOLUTION_MASTER_SPECIES
      SOLUTION_SPECIES
      PHASES
      EXCHANGE_MASTER_SPECIES
      EXCHANGE_SPECIES
      SURFACE_MASTER_SPECIES
      SURFACE_SPECIES
      RATES
      END
-----------------------------------
Reading input data for simulation 1.
-----------------------------------

      DATABASE C:\Program Files\USGS\Phreeqc Interactive 2.14.3\wateq4f.dat
      SOLUTION 1 P03-01-01     6/1/2007     Depth:  46.8
          temp      5.3
          pH        6.82
          pe        2.2
          redox     pe
          units     mg/l
          density   1
          Al        0.0058
          Alkalinity 208
          Ba        0.104
          Ca        76.1
          Cd        1.9e-005
          Cu        0.001
          Fe        4.03
          K         2.5
          Mg        13.9
          Mn        0.162
          Na        8
          S(6)      24.9
          Zn        0.005
          water    1 # kg
      SAVE SOLUTION 1
      SOLUTION 2 P03-01-08     6/1/2007     Depth:  9.3
          temp      6
          pH        5.25
          pe        2.1
          redox     pe
          units     mg/l
          density   1
          Al        3.1
          Alkalinity 2
          Ba        0.4
          Ca        331
          Cd        0.0085
          Cu        0.5
          Fe        12300
          K         100
          Mg        569
          Mn        102
          Na        596
          S(6)      29600
          Zn        1590
          water    1 # kg
```

```
      SAVE SOLUTION 2
      MIX 1 Mixture of deep aquifer (P03-01-01) and tailings pore water (P03-01-08)
          1    0.992
          2    0.008
      SAVE SOLUTION 3
      SELECTED_OUTPUT
          file                  P03-01 sim1.out
          reset                 false
          simulation            true
          ph                    true
          pe                    true
          totals                Ca  Mg  Na  S(6)  Zn  Fe  Fe(2)
                                 Fe(3)
          saturation_indices    Alunite  Barite  Basaluminite  Boehmite
                                 Fe(OH)3(a)  Gibbsite  Gypsum  Jurbanite
                                 Rhodochrosite  Siderite  Smithsonite  Zn(OH)2-g
                                 Zn2(OH)2SO4  ZnCO3:H2O
      END
-------------------------------------------
Beginning of initial solution calculations.
-------------------------------------------

Initial solution 1.     P03-01-01     6/1/2007     Depth:  46.8

-----------------------------Solution composition------------------------------

      Elements           Molality       Moles

      Al                2.150e-007  2.150e-007
      Alkalinity        4.157e-003  4.157e-003
      Ba                7.575e-007  7.575e-007
      Ca                1.899e-003  1.899e-003
      Cd                1.691e-010  1.691e-010
      Cu                1.574e-008  1.574e-008
      Fe                7.219e-005  7.219e-005
      K                 6.396e-005  6.396e-005
      Mg                5.719e-004  5.719e-004
      Mn                2.950e-006  2.950e-006
      Na                3.481e-004  3.481e-004
      S(6)              2.593e-004  2.593e-004
      Zn                7.651e-008  7.651e-008

----------------------------Description of solution----------------------------

                                       pH  =   6.820
                                       pe  =   2.200
                          Activity of water  =   1.000
                             Ionic strength  =  7.572e-003
                         Mass of water (kg)  =  1.000e+000
                    Total carbon (mol/kg)  =  5.994e-003
                       Total CO2 (mol/kg)  =  5.994e-003
                      Temperature (deg C)  =   5.300
                  Electrical balance (eq)  =  8.314e-004
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =   8.44
                                 Iterations  =  10
                                    Total H  = 1.110166e+002
                                    Total O  = 5.552340e+001

----------------------------Distribution of species----------------------------

                                                 Log       Log         Log
   Species                Molality    Activity  Molality  Activity     Gamma

   H+                    1.638e-007  1.514e-007    -6.786    -6.820    -0.034
   OH-                   1.375e-008  1.259e-008    -7.862    -7.900    -0.038
   H2O                   5.551e+001  9.998e-001     1.744    -0.000     0.000
Al             2.150e-007
```

Al(OH)4-	1.275e-007	1.167e-007	-6.894	-6.933	-0.038
Al(OH)2+	6.422e-008	5.878e-008	-7.192	-7.231	-0.038
AlOH+2	1.125e-008	7.897e-009	-7.949	-8.103	-0.154
Al(OH)3	1.084e-008	1.086e-008	-7.965	-7.964	0.001
Al+3	1.018e-009	4.587e-010	-8.992	-9.338	-0.346
AlSO4+	1.853e-010	1.696e-010	-9.732	-9.771	-0.038
Al(SO4)2-	8.166e-013	7.474e-013	-12.088	-12.126	-0.038
AlHSO4+2	2.881e-018	2.022e-018	-17.540	-17.694	-0.154
Ba	7.575e-007				
Ba+2	7.087e-007	4.973e-007	-6.150	-6.303	-0.154
BaSO4	3.824e-008	3.831e-008	-7.417	-7.417	0.001
BaHCO3+	1.047e-008	9.585e-009	-7.980	-8.018	-0.038
BaCO3	1.201e-010	1.203e-010	-9.920	-9.920	0.001
BaOH+	1.216e-013	1.113e-013	-12.915	-12.953	-0.038
C(4)	5.994e-003				
HCO3-	4.073e-003	3.738e-003	-2.390	-2.427	-0.037
CO2	1.840e-003	1.843e-003	-2.735	-2.734	0.001
CaHCO3+	4.242e-005	3.883e-005	-4.372	-4.411	-0.038
MgHCO3+	1.778e-005	1.627e-005	-4.750	-4.789	-0.038
FeHCO3+	1.577e-005	1.444e-005	-4.802	-4.841	-0.038
CaCO3	1.203e-006	1.205e-006	-5.920	-5.919	0.001
CO3-2	9.810e-007	6.957e-007	-6.008	-6.158	-0.149
NaHCO3	6.674e-007	6.685e-007	-6.176	-6.175	0.001
FeCO3	6.434e-007	6.445e-007	-6.192	-6.191	0.001
MnHCO3+	5.765e-007	5.276e-007	-6.239	-6.278	-0.038
MgCO3	1.904e-007	1.907e-007	-6.720	-6.720	0.001
MnCO3	8.737e-008	8.752e-008	-7.059	-7.058	0.001
ZnHCO3+	1.861e-008	1.704e-008	-7.730	-7.769	-0.038
BaHCO3+	1.047e-008	9.585e-009	-7.980	-8.018	-0.038
CuCO3	5.248e-009	5.258e-009	-8.280	-8.279	0.001
ZnCO3	5.017e-009	5.025e-009	-8.300	-8.299	0.001
CuHCO3+	2.880e-009	2.636e-009	-8.541	-8.579	-0.038
NaCO3-	1.553e-009	1.422e-009	-8.809	-8.847	-0.038
BaCO3	1.201e-010	1.203e-010	-9.920	-9.920	0.001
Zn(CO3)2-2	1.065e-010	7.474e-011	-9.973	-10.126	-0.154
CdHCO3+	1.370e-011	1.254e-011	-10.863	-10.902	-0.038
Cu(CO3)2-2	6.562e-012	4.605e-012	-11.183	-11.337	-0.154
CdCO3	5.853e-014	5.863e-014	-13.233	-13.232	0.001
Cd(CO3)2-2	1.838e-016	1.290e-016	-15.736	-15.889	-0.154
Ca	1.899e-003				
Ca+2	1.823e-003	1.292e-003	-2.739	-2.889	-0.149
CaHCO3+	4.242e-005	3.883e-005	-4.372	-4.411	-0.038
CaSO4	3.249e-005	3.254e-005	-4.488	-4.488	0.001
CaCO3	1.203e-006	1.205e-006	-5.920	-5.919	0.001
CaOH+	1.548e-009	1.417e-009	-8.810	-8.849	-0.038
CaHSO4+	2.594e-011	2.374e-011	-10.586	-10.624	-0.038
Cd	1.691e-010				
Cd+2	1.512e-010	1.061e-010	-9.820	-9.974	-0.154
CdHCO3+	1.370e-011	1.254e-011	-10.863	-10.902	-0.038
CdSO4	4.127e-012	4.134e-012	-11.384	-11.384	0.001
CdCO3	5.853e-014	5.863e-014	-13.233	-13.232	0.001
CdOH+	1.333e-014	1.220e-014	-13.875	-13.914	-0.038
Cd(SO4)2-2	1.129e-014	7.925e-015	-13.947	-14.101	-0.154
Cd(CO3)2-2	1.838e-016	1.290e-016	-15.736	-15.889	-0.154
Cd(OH)2	2.064e-017	2.068e-017	-16.685	-16.684	0.001
Cd2OH+3	1.829e-023	8.243e-024	-22.738	-23.084	-0.346
Cd(OH)3-	1.675e-023	1.533e-023	-22.776	-22.815	-0.038
Cd(OH)4-2	1.286e-030	9.025e-031	-29.891	-30.045	-0.154
Cu(1)	4.181e-009				
Cu+	4.181e-009	3.827e-009	-8.379	-8.417	-0.038
Cu(2)	1.156e-008				
CuCO3	5.248e-009	5.258e-009	-8.280	-8.279	0.001
CuHCO3+	2.880e-009	2.636e-009	-8.541	-8.579	-0.038
Cu+2	2.005e-009	1.407e-009	-8.698	-8.852	-0.154
Cu(OH)2	1.281e-009	1.283e-009	-8.893	-8.892	0.001
CuOH+	1.016e-010	9.296e-011	-9.993	-10.032	-0.038
CuSO4	3.811e-011	3.817e-011	-10.419	-10.418	0.001

Cu(CO3)2-2	6.562e-012	4.605e-012	-11.183	-11.337	-0.154
Cu2(OH)2+2	6.636e-016	4.657e-016	-15.178	-15.332	-0.154
Cu(OH)3-	5.580e-016	5.107e-016	-15.253	-15.292	-0.038
Cu(OH)4-2	9.592e-022	6.731e-022	-21.018	-21.172	-0.154
Fe(2)	7.218e-005				
Fe+2	5.503e-005	3.862e-005	-4.259	-4.413	-0.154
FeHCO3+	1.577e-005	1.444e-005	-4.802	-4.841	-0.038
FeSO4	7.165e-007	7.177e-007	-6.145	-6.144	0.001
FeCO3	6.434e-007	6.445e-007	-6.192	-6.191	0.001
FeOH+	1.823e-008	1.668e-008	-7.739	-7.778	-0.038
FeHSO4+	7.753e-013	7.096e-013	-12.111	-12.149	-0.038
Fe(OH)2	1.495e-013	1.497e-013	-12.825	-12.825	0.001
Fe(OH)3-	3.264e-017	2.988e-017	-16.486	-16.525	-0.038
Fe(3)	3.194e-009				
Fe(OH)2+	2.434e-009	2.228e-009	-8.614	-8.652	-0.038
Fe(OH)3	7.547e-010	7.561e-010	-9.122	-9.121	0.001
FeOH+2	3.230e-012	2.267e-012	-11.491	-11.645	-0.154
Fe(OH)4-	2.132e-012	1.951e-012	-11.671	-11.710	-0.038
Fe+3	4.082e-016	1.840e-016	-15.389	-15.735	-0.346
FeSO4+	2.124e-016	1.944e-016	-15.673	-15.711	-0.038
Fe(SO4)2-	6.577e-019	6.020e-019	-18.182	-18.220	-0.038
Fe2(OH)2+4	1.364e-021	3.307e-022	-20.865	-21.481	-0.615
FeHSO4+2	1.210e-022	8.492e-023	-21.917	-22.071	-0.154
Fe3(OH)4+5	9.862e-027	1.078e-027	-26.006	-26.967	-0.961
H(0)	1.590e-021				
H2	7.952e-022	7.966e-022	-21.100	-21.099	0.001
K	6.396e-005				
K+	6.391e-005	5.842e-005	-4.194	-4.233	-0.039
KSO4-	4.770e-008	4.366e-008	-7.321	-7.360	-0.038
Mg	5.719e-004				
Mg+2	5.458e-004	3.888e-004	-3.263	-3.410	-0.147
MgHCO3+	1.778e-005	1.627e-005	-4.750	-4.789	-0.038
MgSO4	8.121e-006	8.136e-006	-5.090	-5.090	0.001
MgCO3	1.904e-007	1.907e-007	-6.720	-6.720	0.001
MgOH+	1.516e-009	1.388e-009	-8.819	-8.858	-0.038
Mn(2)	2.950e-006				
Mn+2	2.257e-006	1.584e-006	-5.646	-5.800	-0.154
MnHCO3+	5.765e-007	5.276e-007	-6.239	-6.278	-0.038
MnCO3	8.737e-008	8.752e-008	-7.059	-7.058	0.001
MnSO4	2.890e-008	2.895e-008	-7.539	-7.538	0.001
MnOH+	5.264e-011	4.818e-011	-10.279	-10.317	-0.038
Mn(OH)3-	7.906e-021	7.236e-021	-20.102	-20.140	-0.038
Mn(3)	7.904e-031				
Mn+3	7.904e-031	3.563e-031	-30.102	-30.448	-0.346
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-68.506	-68.660	-0.154
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-77.185	-77.224	-0.038
Na	3.481e-004				
Na+	3.472e-004	3.181e-004	-3.459	-3.498	-0.038
NaHCO3	6.674e-007	6.685e-007	-6.176	-6.175	0.001
NaSO4-	2.342e-007	2.143e-007	-6.630	-6.669	-0.038
NaCO3-	1.553e-009	1.422e-009	-8.809	-8.847	-0.038
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-56.991	-56.990	0.001
S(6)	2.593e-004				
SO4-2	2.176e-004	1.537e-004	-3.662	-3.813	-0.151
CaSO4	3.249e-005	3.254e-005	-4.488	-4.488	0.001
MgSO4	8.121e-006	8.136e-006	-5.090	-5.090	0.001
FeSO4	7.165e-007	7.177e-007	-6.145	-6.144	0.001
NaSO4-	2.342e-007	2.143e-007	-6.630	-6.669	-0.038
KSO4-	4.770e-008	4.366e-008	-7.321	-7.360	-0.038
BaSO4	3.824e-008	3.831e-008	-7.417	-7.417	0.001
MnSO4	2.890e-008	2.895e-008	-7.539	-7.538	0.001
HSO4-	1.670e-009	1.528e-009	-8.777	-8.816	-0.038
ZnSO4	1.107e-009	1.109e-009	-8.956	-8.955	0.001
AlSO4+	1.853e-010	1.696e-010	-9.732	-9.771	-0.038

CuSO4	3.811e-011	3.817e-011	-10.419	-10.418	0.001
CaHSO4+	2.594e-011	2.374e-011	-10.586	-10.624	-0.038
CdSO4	4.127e-012	4.134e-012	-11.384	-11.384	0.001
Zn(SO4)2-2	2.322e-012	1.630e-012	-11.634	-11.788	-0.154
Al(SO4)2-	8.166e-013	7.474e-013	-12.088	-12.126	-0.038
FeHSO4+	7.753e-013	7.096e-013	-12.111	-12.149	-0.038
Cd(SO4)2-2	1.129e-014	7.925e-015	-13.947	-14.101	-0.154
FeSO4+	2.124e-016	1.944e-016	-15.673	-15.711	-0.038
AlHSO4+2	2.881e-018	2.022e-018	-17.540	-17.694	-0.154
Fe(SO4)2-	6.577e-019	6.020e-019	-18.182	-18.220	-0.038
FeHSO4+2	1.210e-022	8.492e-023	-21.917	-22.071	-0.154
Zn	7.651e-008				
Zn+2	5.159e-008	3.620e-008	-7.287	-7.441	-0.154
ZnHCO3+	1.861e-008	1.704e-008	-7.730	-7.769	-0.038
ZnCO3	5.017e-009	5.025e-009	-8.300	-8.299	0.001
ZnSO4	1.107e-009	1.109e-009	-8.956	-8.955	0.001
Zn(CO3)2-2	1.065e-010	7.474e-011	-9.973	-10.126	-0.154
ZnOH+	5.784e-011	5.294e-011	-10.238	-10.276	-0.038
Zn(OH)2	1.985e-011	1.989e-011	-10.702	-10.701	0.001
Zn(SO4)2-2	2.322e-012	1.630e-012	-11.634	-11.788	-0.154
Zn(OH)3-	4.539e-016	4.155e-016	-15.343	-15.381	-0.038
Zn(OH)4-2	6.199e-022	4.350e-022	-21.208	-21.362	-0.154

-------------------------------Saturation indices-------------------------------

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-1.05	11.12	12.17	Al(OH)3
AlumK	-15.66	-21.20	-5.54	KAl(SO4)2:12H2O
Alunite	-0.16	1.04	1.21	KAl3(SO4)2(OH)6
Anhydrite	-2.36	-6.70	-4.34	CaSO4
Antlerite	-11.38	-3.09	8.29	Cu3(OH)4SO4
Aragonite	-0.81	-9.05	-8.24	CaCO3
Artinite	-10.43	0.66	11.09	MgCO3:Mg(OH)2:3H2O
Azurite	-9.48	-4.13	5.35	Cu3(OH)2(CO3)2
Barite	0.23	-10.12	-10.35	BaSO4
Basaluminite	4.33	27.03	22.70	Al4(OH)10SO4
Bianchite	-9.50	-11.25	-1.76	ZnSO4:6H2O
Birnessite	-17.72	25.88	43.60	MnO2
Bixbyite	-20.16	-19.98	0.18	Mn2O3
Boehmite	1.08	11.12	10.05	AlOOH
Brochantite	-13.64	1.70	15.34	Cu4(OH)6SO4
Brucite	-8.02	10.23	18.25	Mg(OH)2
Calcite	-0.65	-9.05	-8.40	CaCO3
Cd(gamma)	-28.91	-14.37	14.53	Cd
Cd(OH)2	-9.98	3.67	13.65	Cd(OH)2
Cd(OH)2(a)	-11.14	3.67	14.81	Cd(OH)2
Cd3(OH)2(SO4)2	-30.62	-23.91	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-29.02	-6.46	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-31.19	-2.79	28.40	Cd4(OH)6SO4
CdMetal	-28.80	-14.37	14.42	Cd
CdSO4	-14.45	-13.79	0.66	CdSO4
CdSO4:2.7H2O	-12.14	-13.79	-1.65	CdSO4:2.67H2O
CdSO4:H2O	-12.52	-13.79	-1.27	CdSO4:H2O
Chalcanthite	-9.95	-12.67	-2.71	CuSO4:5H2O
CO2(g)	-1.54	-2.73	-1.20	CO2
Cu(OH)2	-4.64	4.79	9.43	Cu(OH)2
Cu2SO4	-18.93	-20.65	-1.71	Cu2SO4
CuCO3	-5.38	-15.01	-9.63	CuCO3
CuMetal	-0.97	-10.62	-9.65	Cu
CuOCuSO4	-21.25	-7.88	13.37	CuO:CuSO4
CupricFerrite	6.35	14.24	7.89	CuFe2O4
Cuprite	-1.32	-3.19	-1.87	Cu2O
CuprousFerrite	11.85	3.13	-8.72	CuFeO2
CuSO4	-16.62	-12.66	3.95	CuSO4
Diaspore	2.96	11.12	8.16	AlOOH
Dolomite	-2.01	-18.61	-16.60	CaMg(CO3)2

Dolomite(d)	-2.65	-18.61	-15.96	CaMg(CO3)2
Epsomite	-4.94	-7.22	-2.29	MgSO4:7H2O
Fe(OH)3(a)	-0.17	4.72	4.89	Fe(OH)3
Fe3(OH)8	-1.55	18.68	20.22	Fe3(OH)8
Gibbsite	1.83	11.12	9.29	Al(OH)3
Goethite	4.97	4.72	-0.25	FeOOH
Goslarite	-9.12	-11.26	-2.13	ZnSO4:7H2O
Gypsum	-2.10	-6.70	-4.60	CaSO4:2H2O
H2(g)	-18.04	-21.10	-3.06	H2
H2O(g)	-2.06	-0.00	2.06	H2O
Hausmannite	-24.69	41.56	66.25	Mn3O4
Hematite	11.86	9.45	-2.41	Fe2O3
Huntite	-9.12	-37.75	-28.63	CaMg3(CO3)4
Hydromagnesite	-21.99	-28.04	-6.05	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	-8.81	-18.64	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-10.56	-18.15	-7.59	KFe3(SO4)2(OH)6
Jarosite-Na	-14.01	-17.41	-3.40	NaFe3(SO4)2(OH)6
JarositeH	-18.20	-20.73	-2.53	(H3O)Fe3(SO4)2(OH)6
Jurbanite	-3.10	-6.33	-3.23	AlOHSO4
Langite	-17.14	1.70	18.84	Cu4(OH)6SO4:H2O
Maghemite	3.06	9.45	6.39	Fe2O3
Magnesite	-1.86	-9.57	-7.71	MgCO3
Magnetite	12.32	18.68	6.35	Fe3O4
Malachite	-5.85	0.33	6.17	Cu2(OH)2CO3
Manganite	-8.48	16.86	25.34	MnOOH
Melanterite	-5.75	-8.23	-2.48	FeSO4:7H2O
Mirabilite	-8.71	-10.81	-2.10	Na2SO4:10H2O
Mn2(SO4)3	-68.65	-72.34	-3.69	Mn2(SO4)3
MnSO4	-13.09	-9.61	3.47	MnSO4
Monteponite	-11.39	3.67	15.05	CdO
Nahcolite	-5.18	-5.92	-0.74	NaHCO3
Natron	-11.03	-13.15	-2.13	Na2CO3:10H2O
Nesquehonite	-4.25	-9.57	-5.32	MgCO3:3H2O
Nsutite	-16.68	25.88	42.56	MnO2
O2(g)	-54.27	-56.99	-2.72	O2
Otavite	-4.03	-16.13	-12.10	CdCO3
Portlandite	-13.66	10.75	24.41	Ca(OH)2
Pyrochroite	-7.36	7.84	15.20	Mn(OH)2
Pyrolusite	-18.88	25.88	44.76	MnO2
Rhodochrosite	-0.90	-11.96	-11.06	MnCO3
Rhodochrosite(d)	-1.57	-11.96	-10.39	MnCO3
Siderite	0.19	-10.57	-10.76	FeCO3
Siderite(d)(3)	-0.12	-10.57	-10.45	FeCO3
Smithsonite	-3.82	-13.60	-9.77	ZnCO3
Tenorite	-3.62	4.79	8.41	CuO
Thenardite	-10.66	-10.81	-0.15	Na2SO4
Thermonatrite	-13.42	-13.15	0.27	Na2CO3:H2O
Trona	-19.22	-19.08	0.14	NaHCO3:Na2CO3:2H2O
Witherite	-3.79	-12.46	-8.67	BaCO3
Zincite(c)	-6.07	6.20	12.27	ZnO
Zincosite	-15.26	-11.25	4.01	ZnSO4
Zn(OH)2-a	-6.25	6.20	12.45	Zn(OH)2
Zn(OH)2-b	-5.55	6.20	11.75	Zn(OH)2
Zn(OH)2-c	-6.00	6.20	12.20	Zn(OH)2
Zn(OH)2-e	-5.30	6.20	11.50	Zn(OH)2
Zn(OH)2-g	-5.51	6.20	11.71	Zn(OH)2
Zn2(OH)2SO4	-12.56	-5.06	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-38.55	-16.31	22.24	ZnO:2ZnSO4
Zn4(OH)6SO4	-21.06	7.34	28.40	Zn4(OH)6SO4
ZnCO3:H2O	-3.34	-13.60	-10.26	ZnCO3:H2O
ZnMetal	-39.51	-11.84	27.66	Zn
ZnO(a)	-5.11	6.20	11.31	ZnO
ZnSO4:H2O	-11.24	-11.25	-0.02	ZnSO4:H2O

Initial solution 2. P03-01-08 6/1/2007 Depth: 9.3

----------Solution composition----------

Elements	Molality	Moles
Al	1.203e-004	1.203e-004
Alkalinity	4.185e-005	4.185e-005
Ba	3.050e-006	3.050e-006
Ca	8.649e-003	8.649e-003
Cd	7.920e-008	7.920e-008
Cu	8.241e-006	8.241e-006
Fe	2.307e-001	2.307e-001
K	2.678e-003	2.678e-003
Mg	2.451e-002	2.451e-002
Mn	1.945e-003	1.945e-003
Na	2.715e-002	2.715e-002
S(6)	3.227e-001	3.227e-001
Zn	2.547e-002	2.547e-002

----------Description of solution----------

pH	=	5.250
pe	=	2.100
Activity of water	=	0.992
Ionic strength	=	6.193e-001
Mass of water (kg)	=	1.000e+000
Total carbon (mol/kg)	=	2.326e-004
Total CO2 (mol/kg)	=	2.326e-004
Temperature (deg C)	=	6.000
Electrical balance (eq)	=	-3.277e-002
Percent error, 100*(Cat-|An|)/(Cat+|An|)	=	-5.17
Iterations	=	9
Total H	=	1.110125e+002
Total O	=	5.679764e+001

----------Distribution of species----------

Species		Molality	Activity	Log Molality	Log Activity	Log Gamma
H+		7.376e-006	5.623e-006	-5.132	-5.250	-0.118
OH-		4.795e-010	3.588e-010	-9.319	-9.445	-0.126
H2O		5.551e+001	9.919e-001	1.744	-0.004	0.000
Al	1.203e-004					
AlSO4+		5.931e-005	4.438e-005	-4.227	-4.353	-0.126
Al(SO4)2-		5.182e-005	3.878e-005	-4.285	-4.411	-0.126
Al+3		8.184e-006	6.013e-007	-5.087	-6.221	-1.134
AlOH+2		9.270e-007	2.905e-007	-6.033	-6.537	-0.504
Al(OH)2+		8.335e-008	6.236e-008	-7.079	-7.205	-0.126
Al(OH)3		2.852e-010	3.289e-010	-9.545	-9.483	0.062
Al(OH)4-		1.262e-010	9.445e-011	-9.899	-10.025	-0.126
AlHSO4+2		6.285e-011	1.970e-011	-10.202	-10.706	-0.504
Ba	3.050e-006					
BaSO4		2.456e-006	2.833e-006	-5.610	-5.548	0.062
Ba+2		5.941e-007	1.862e-007	-6.226	-6.730	-0.504
BaHCO3+		1.362e-011	1.019e-011	-10.866	-10.992	-0.126
BaCO3		3.028e-015	3.492e-015	-14.519	-14.457	0.062
BaOH+		1.487e-015	1.113e-015	-14.828	-14.954	-0.126
C(4)	2.326e-004					
CO2		1.632e-004	1.883e-004	-3.787	-3.725	0.062
FeHCO3+		4.983e-005	3.728e-005	-4.302	-4.428	-0.126
HCO3-		1.512e-005	1.038e-005	-4.820	-4.984	-0.163
ZnHCO3+		3.161e-006	2.365e-006	-5.500	-5.626	-0.126
MgHCO3+		5.447e-007	4.075e-007	-6.264	-6.390	-0.126
MnHCO3+		3.774e-007	2.824e-007	-6.423	-6.549	-0.126
CaHCO3+		1.211e-007	9.058e-008	-6.917	-7.043	-0.126
NaHCO3		8.710e-008	1.004e-007	-7.060	-6.998	0.062
FeCO3		3.973e-008	4.581e-008	-7.401	-7.339	0.062
ZnCO3		1.665e-008	1.920e-008	-7.779	-7.717	0.062

CuHCO3+	4.591e-009	3.435e-009	-8.338	-8.464	-0.126
MnCO3	1.118e-009	1.289e-009	-8.952	-8.890	0.062
CO3-2	2.395e-010	5.318e-011	-9.621	-10.274	-0.654
CuCO3	1.635e-010	1.885e-010	-9.787	-9.725	0.062
MgCO3	1.152e-010	1.329e-010	-9.938	-9.877	0.062
CaCO3	6.561e-011	7.567e-011	-10.183	-10.121	0.062
BaHCO3+	1.362e-011	1.019e-011	-10.866	-10.992	-0.126
NaCO3-	8.182e-012	6.122e-012	-11.087	-11.213	-0.126
CdHCO3+	1.810e-012	1.354e-012	-11.742	-11.868	-0.126
Zn(CO3)2-2	6.967e-014	2.183e-014	-13.157	-13.661	-0.504
BaCO3	3.028e-015	3.492e-015	-14.519	-14.457	0.062
CdCO3	1.511e-016	1.743e-016	-15.821	-15.759	0.062
Cu(CO3)2-2	4.028e-017	1.262e-017	-16.395	-16.899	-0.504
Cd(CO3)2-2	9.351e-023	2.930e-023	-22.029	-22.533	-0.504
Ca	8.649e-003				
CaSO4	4.609e-003	5.316e-003	-2.336	-2.274	0.062
Ca+2	4.040e-003	1.061e-003	-2.394	-2.974	-0.581
CaHSO4+	1.936e-007	1.448e-007	-6.713	-6.839	-0.126
CaHCO3+	1.211e-007	9.058e-008	-6.917	-7.043	-0.126
CaCO3	6.561e-011	7.567e-011	-10.183	-10.121	0.062
CaOH+	4.150e-011	3.105e-011	-10.382	-10.508	-0.126
Cd	7.920e-008				
Cd(SO4)2-2	3.837e-008	1.202e-008	-7.416	-7.920	-0.504
CdSO4	2.767e-008	3.191e-008	-7.558	-7.496	0.062
Cd+2	1.316e-008	4.125e-009	-7.881	-8.385	-0.504
CdHCO3+	1.810e-012	1.354e-012	-11.742	-11.868	-0.126
CdOH+	1.796e-014	1.344e-014	-13.746	-13.872	-0.126
CdCO3	1.511e-016	1.743e-016	-15.821	-15.759	0.062
Cd(OH)2	4.971e-019	5.733e-019	-18.304	-18.242	0.062
Cd2OH+3	4.758e-021	3.496e-022	-20.323	-21.456	-1.134
Cd(CO3)2-2	9.351e-023	2.930e-023	-22.029	-22.533	-0.504
Cd(OH)3-	1.517e-026	1.135e-026	-25.819	-25.945	-0.126
Cd(OH)4-2	5.692e-035	1.784e-035	-34.245	-34.749	-0.504
Cu(1)	3.043e-006				
Cu+	3.043e-006	2.277e-006	-5.517	-5.643	-0.126
Cu(2)	5.198e-006				
CuSO4	3.084e-006	3.557e-006	-5.511	-5.449	0.062
Cu+2	2.107e-006	6.602e-007	-5.676	-6.180	-0.504
CuHCO3+	4.591e-009	3.435e-009	-8.338	-8.464	-0.126
CuOH+	1.556e-009	1.164e-009	-8.808	-8.934	-0.126
Cu(OH)2	3.721e-010	4.291e-010	-9.429	-9.367	0.062
CuCO3	1.635e-010	1.885e-010	-9.787	-9.725	0.062
Cu2(OH)2+2	2.525e-013	7.912e-014	-12.598	-13.102	-0.504
Cu(CO3)2-2	4.028e-017	1.262e-017	-16.395	-16.899	-0.504
Cu(OH)3-	6.096e-018	4.561e-018	-17.215	-17.341	-0.126
Cu(OH)4-2	5.122e-025	1.605e-025	-24.291	-24.794	-0.504
Fe(2)	2.307e-001				
FeSO4	1.160e-001	1.338e-001	-0.936	-0.874	0.062
Fe+2	1.146e-001	3.591e-002	-0.941	-1.445	-0.504
FeHCO3+	4.983e-005	3.728e-005	-4.302	-4.428	-0.126
FeHSO4+	6.554e-006	4.904e-006	-5.183	-5.309	-0.126
FeOH+	5.877e-007	4.397e-007	-6.231	-6.357	-0.126
FeCO3	3.973e-008	4.581e-008	-7.401	-7.339	0.062
Fe(OH)2	9.799e-014	1.130e-013	-13.009	-12.947	0.062
Fe(OH)3-	8.110e-019	6.068e-019	-18.091	-18.217	-0.126
Fe(3)	2.005e-009				
Fe(OH)2+	1.771e-009	1.325e-009	-8.752	-8.878	-0.126
FeOH+2	1.563e-010	4.897e-011	-9.806	-10.310	-0.504
FeSO4+	4.032e-011	3.017e-011	-10.394	-10.520	-0.126
Fe(SO4)2-	2.474e-011	1.851e-011	-10.607	-10.733	-0.126
Fe(OH)3	1.078e-011	1.243e-011	-10.967	-10.906	0.062
Fe+3	1.933e-012	1.420e-013	-11.714	-12.848	-1.134
FeHSO4+2	1.554e-015	4.871e-016	-14.808	-15.312	-0.504
Fe(OH)4-	1.182e-015	8.846e-016	-14.927	-15.053	-0.126
Fe2(OH)2+4	1.548e-017	1.493e-019	-16.810	-18.826	-2.016
Fe3(OH)4+5	3.793e-022	2.688e-025	-21.421	-24.571	-3.150
H(0)	2.998e-018				

H2	1.499e-018	1.729e-018	-17.824	-17.762	0.062
K	2.678e-003				
K+	2.376e-003	1.513e-003	-2.624	-2.820	-0.196
KSO4-	3.027e-004	2.265e-004	-3.519	-3.645	-0.126
Mg	2.451e-002				
MgSO4	1.283e-002	1.479e-002	-1.892	-1.830	0.062
Mg+2	1.168e-002	3.506e-003	-1.932	-2.455	-0.523
MgHCO3+	5.447e-007	4.075e-007	-6.264	-6.390	-0.126
MgOH+	4.802e-010	3.593e-010	-9.319	-9.445	-0.126
MgCO3	1.152e-010	1.329e-010	-9.938	-9.877	0.062
Mn(2)	1.945e-003				
Mn+2	9.740e-004	3.052e-004	-3.011	-3.515	-0.504
MnSO4	9.702e-004	1.119e-003	-3.013	-2.951	0.062
MnHCO3+	3.774e-007	2.824e-007	-6.423	-6.549	-0.126
MnCO3	1.118e-009	1.289e-009	-8.952	-8.890	0.062
MnOH+	3.537e-010	2.646e-010	-9.451	-9.577	-0.126
Mn(OH)3-	3.548e-023	2.655e-023	-22.450	-22.576	-0.126
Mn(3)	8.343e-028				
Mn+3	8.343e-028	6.130e-029	-27.079	-28.213	-1.134
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-78.550	-79.054	-0.504
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-87.539	-87.665	-0.126
Na	2.715e-002				
Na+	2.407e-002	1.721e-002	-1.618	-1.764	-0.146
NaSO4-	3.077e-003	2.302e-003	-2.512	-2.638	-0.126
NaHCO3	8.710e-008	1.004e-007	-7.060	-6.998	0.062
NaCO3-	8.182e-012	6.122e-012	-11.087	-11.213	-0.126
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-63.474	-63.412	0.062
S(6)	3.227e-001				
SO4-2	1.549e-001	3.036e-002	-0.810	-1.518	-0.708
FeSO4	1.160e-001	1.338e-001	-0.936	-0.874	0.062
MgSO4	1.283e-002	1.479e-002	-1.892	-1.830	0.062
Zn(SO4)2-2	1.014e-002	3.179e-003	-1.994	-2.498	-0.504
ZnSO4	9.553e-003	1.102e-002	-2.020	-1.958	0.062
CaSO4	4.609e-003	5.316e-003	-2.336	-2.274	0.062
NaSO4-	3.077e-003	2.302e-003	-2.512	-2.638	-0.126
MnSO4	9.702e-004	1.119e-003	-3.013	-2.951	0.062
KSO4-	3.027e-004	2.265e-004	-3.519	-3.645	-0.126
AlSO4+	5.931e-005	4.438e-005	-4.227	-4.353	-0.126
Al(SO4)2-	5.182e-005	3.878e-005	-4.285	-4.411	-0.126
HSO4-	1.518e-005	1.136e-005	-4.819	-4.945	-0.126
FeHSO4+	6.554e-006	4.904e-006	-5.183	-5.309	-0.126
CuSO4	3.084e-006	3.557e-006	-5.511	-5.449	0.062
BaSO4	2.456e-006	2.833e-006	-5.610	-5.548	0.062
CaHSO4+	1.936e-007	1.448e-007	-6.713	-6.839	-0.126
Cd(SO4)2-2	3.837e-008	1.202e-008	-7.416	-7.920	-0.504
CdSO4	2.767e-008	3.191e-008	-7.558	-7.496	0.062
AlHSO4+2	6.285e-011	1.970e-011	-10.202	-10.706	-0.504
FeSO4+	4.032e-011	3.017e-011	-10.394	-10.520	-0.126
Fe(SO4)2-	2.474e-011	1.851e-011	-10.607	-10.733	-0.126
FeHSO4+2	1.554e-015	4.871e-016	-14.808	-15.312	-0.504
Zn	2.547e-002				
Zn(SO4)2-2	1.014e-002	3.179e-003	-1.994	-2.498	-0.504
ZnSO4	9.553e-003	1.102e-002	-2.020	-1.958	0.062
Zn+2	5.775e-003	1.810e-003	-2.238	-2.742	-0.504
ZnHCO3+	3.161e-006	2.365e-006	-5.500	-5.626	-0.126
ZnOH+	1.004e-007	7.509e-008	-6.998	-7.124	-0.126
ZnCO3	1.665e-008	1.920e-008	-7.779	-7.717	0.062
Zn(OH)2	6.147e-010	7.089e-010	-9.211	-9.149	0.062
Zn(CO3)2-2	6.967e-014	2.183e-014	-13.157	-13.661	-0.504
Zn(OH)3-	5.285e-016	3.954e-016	-15.277	-15.403	-0.126
Zn(OH)4-2	3.527e-023	1.105e-023	-22.453	-22.956	-0.504

Saturation indices

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-2.60	9.52	12.12	Al(OH)3
AlumK	-6.59	-12.12	-5.53	KAl(SO4)2:12H2O
Alunite	5.85	6.96	1.11	KAl3(SO4)2(OH)6
Anhydrite	-0.15	-4.49	-4.34	CaSO4
Antlerite	-7.36	0.93	8.29	Cu3(OH)4SO4
Aragonite	-5.01	-13.25	-8.24	CaCO3
Artinite	-15.74	-4.70	11.03	MgCO3:Mg(OH)2:3H2O
Azurite	-12.81	-7.52	5.29	Cu3(OH)2(CO3)2
Barite	2.09	-8.25	-10.33	BaSO4
Basaluminite	3.36	26.06	22.70	Al4(OH)10SO4
Bianchite	-2.52	-4.28	-1.76	ZnSO4:6H2O
Birnessite	-21.92	21.68	43.60	MnO2
Bixbyite	-25.09	-24.94	0.15	Mn2O3
Boehmite	-0.47	9.52	9.99	AlOOH
Brochantite	-10.10	5.24	15.34	Cu4(OH)6SO4
Brucite	-10.15	8.04	18.19	Mg(OH)2
Calcite	-4.85	-13.25	-8.40	CaCO3
Cd(gamma)	-27.08	-12.58	14.49	Cd
Cd(OH)2	-11.54	2.11	13.65	Cd(OH)2
Cd(OH)2(a)	-12.66	2.11	14.77	Cd(OH)2
Cd3(OH)2(SO4)2	-24.41	-17.70	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-28.25	-5.69	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-31.98	-3.58	28.40	Cd4(OH)6SO4
CdMetal	-26.97	-12.58	14.39	Cd
CdSO4	-10.54	-9.90	0.64	CdSO4
CdSO4:2.7H2O	-8.25	-9.91	-1.66	CdSO4:2.67H2O
CdSO4:H2O	-8.62	-9.91	-1.28	CdSO4:H2O
Chalcanthite	-5.00	-7.72	-2.71	CuSO4:5H2O
CO2(g)	-2.52	-3.73	-1.21	CO2
Cu(OH)2	-5.09	4.31	9.40	Cu(OH)2
Cu2SO4	-11.08	-12.80	-1.72	Cu2SO4
CuCO3	-6.82	-16.45	-9.63	CuCO3
CuMetal	1.87	-7.74	-9.61	Cu
CuOCuSO4	-16.69	-3.38	13.30	CuO:CuSO4
CupricFerrite	2.30	10.11	7.81	CuFe2O4
Cuprite	1.07	-0.79	-1.86	Cu2O
CuprousFerrite	11.23	2.50	-8.73	CuFeO2
CuSO4	-11.61	-7.70	3.91	CuSO4
Diaspore	1.41	9.52	8.11	AlOOH
Dolomite	-9.36	-25.98	-16.62	CaMg(CO3)2
Dolomite(d)	-9.99	-25.98	-15.99	CaMg(CO3)2
Epsomite	-1.72	-4.00	-2.28	MgSO4:7H2O
Fe(OH)3(a)	-2.00	2.89	4.89	Fe(OH)3
Fe3(OH)8	-5.39	14.83	20.22	Fe3(OH)8
Gibbsite	0.27	9.52	9.25	Al(OH)3
Goethite	3.17	2.90	-0.28	FeOOH
Goslarite	-2.16	-4.28	-2.12	ZnSO4:7H2O
Gypsum	0.10	-4.50	-4.60	CaSO4:2H2O
H2(g)	-14.70	-17.76	-3.06	H2
H2O(g)	-2.04	-0.00	2.04	H2O
Hausmannite	-30.41	35.64	66.05	Mn3O4
Hematite	8.26	5.79	-2.47	Fe2O3
Huntite	-22.75	-51.44	-28.68	CaMg3(CO3)4
Hydromagnesite	-36.74	-42.89	-6.16	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	-3.54	-13.37	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-5.27	-12.92	-7.65	KFe3(SO4)2(OH)6
Jarosite-Na	-8.39	-11.86	-3.47	NaFe3(SO4)2(OH)6
JarositeH	-12.71	-15.35	-2.64	(H3O)Fe3(SO4)2(OH)6
Jurbanite	0.74	-2.49	-3.23	AlOHSO4
Langite	-13.53	5.24	18.77	Cu4(OH)6SO4:H2O
Maghemite	-0.59	5.79	6.39	Fe2O3
Magnesite	-5.01	-12.73	-7.72	MgCO3
Magnetite	8.59	14.85	6.25	Fe3O4
Malachite	-7.74	-1.60	6.14	Cu2(OH)2CO3
Manganite	-11.01	14.33	25.34	MnOOH

Melanterite	-0.52	-2.99	-2.47	FeSO4:7H2O
Mirabilite	-3.02	-5.08	-2.06	Na2SO4:10H2O
Mn2(SO4)3	-57.22	-60.98	-3.76	Mn2(SO4)3
MnSO4	-8.47	-5.03	3.44	MnSO4
Monteponite	-12.89	2.11	15.01	CdO
Nahcolite	-6.01	-6.75	-0.73	NaHCO3
Natron	-11.74	-13.84	-2.10	Na2CO3:10H2O
Nesquehonite	-7.41	-12.74	-5.33	MgCO3:3H2O
Nsutite	-20.89	21.68	42.56	MnO2
O2(g)	-60.69	-63.41	-2.73	O2
Otavite	-6.56	-18.66	-12.10	CdCO3
Portlandite	-16.83	7.52	24.35	Ca(OH)2
Pyrochroite	-8.22	6.98	15.20	Mn(OH)2
Pyrolusite	-22.95	21.68	44.63	MnO2
Rhodochrosite	-2.73	-13.79	-11.06	MnCO3
Rhodochrosite(d)	-3.40	-13.79	-10.39	MnCO3
Siderite	-0.95	-11.72	-10.77	FeCO3
Siderite(d)(3)	-1.27	-11.72	-10.45	FeCO3
Smithsonite	-3.23	-13.02	-9.78	ZnCO3
Tenorite	-4.06	4.32	8.38	CuO
Thenardite	-4.90	-5.05	-0.15	Na2SO4
Thermonatrite	-14.07	-13.81	0.26	Na2CO3:H2O
Trona	-20.66	-20.56	0.10	NaHCO3:Na2CO3:2H2O
Witherite	-8.34	-17.00	-8.67	BaCO3
Zincite(c)	-4.48	7.75	12.23	ZnO
Zincosite	-8.23	-4.26	3.97	ZnSO4
Zn(OH)2-a	-4.70	7.75	12.45	Zn(OH)2
Zn(OH)2-b	-4.00	7.75	11.75	Zn(OH)2
Zn(OH)2-c	-4.45	7.75	12.20	Zn(OH)2
Zn(OH)2-e	-3.75	7.75	11.50	Zn(OH)2
Zn(OH)2-g	-3.96	7.75	11.71	Zn(OH)2
Zn2(OH)2SO4	-4.01	3.49	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-22.88	-0.77	22.11	ZnO:2ZnSO4
Zn4(OH)6SO4	-9.41	18.99	28.40	Zn4(OH)6SO4
ZnCO3:H2O	-2.76	-13.02	-10.26	ZnCO3:H2O
ZnMetal	-34.53	-6.94	27.59	Zn
ZnO(a)	-3.56	7.75	11.31	ZnO
ZnSO4:H2O	-4.22	-4.26	-0.04	ZnSO4:H2O

Beginning of batch-reaction calculations.

Reaction step 1.

Using mix 1. Mixture of deep aquifer (P03-01-01) and tailings pore water (P03-01-08)

Mixture 1. Mixture of deep aquifer (P03-01-01) and tailings pore water (P03-01-08)

9.920e-001	Solution 1	P03-01-01	6/1/2007	Depth: 46.8
8.000e-003	Solution 2	P03-01-08	6/1/2007	Depth: 9.3

----------Solution composition----------

Elements	Molality	Moles
Al	1.176e-006	1.176e-006
Ba	7.758e-007	7.758e-007
C	5.947e-003	5.947e-003
Ca	1.953e-003	1.953e-003
Cd	8.014e-010	8.014e-010
Cu	8.154e-008	8.154e-008
Fe	1.917e-003	1.917e-003
K	8.487e-005	8.487e-005
Mg	7.634e-004	7.634e-004
Mn	1.848e-005	1.848e-005
Na	5.625e-004	5.625e-004

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      S                2.839e-003  2.839e-003
      Zn               2.039e-004  2.039e-004

----------------------------Description of solution----------------------------

                                     pH  =   6.758      Charge balance
                                     pe  =   1.744      Adjusted to redox equilibrium
                        Activity of water  =   1.000
                           Ionic strength  =  1.480e-002
                          Mass of water (kg)  =  1.000e+000
                 Total alkalinity (eq/kg)  =  4.124e-003
                       Total CO2 (mol/kg)  =  5.947e-003
                     Temperature (deg C)  =   5.306
                   Electrical balance (eq)  =  5.625e-004
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =   3.28
                                Iterations  =  12
                                   Total H  = 1.110166e+002
                                   Total O  = 5.553359e+001

----------------------------Distribution of species----------------------------

                                                 Log       Log         Log
   Species                Molality    Activity  Molality  Activity     Gamma

   H+                   1.932e-007  1.745e-007    -6.714    -6.758    -0.044
   OH-                  1.230e-008  1.093e-008    -7.910    -7.962    -0.051
   H2O                  5.551e+001  9.998e-001     1.744    -0.000     0.000
Al             1.176e-006
   Al(OH)4-             6.016e-007  5.344e-007    -6.221    -6.272    -0.051
   Al(OH)2+             4.024e-007  3.575e-007    -6.395    -6.447    -0.051
   AlOH+2               8.885e-008  5.532e-008    -7.051    -7.257    -0.206
   Al(OH)3              5.712e-008  5.731e-008    -7.243    -7.242     0.001
   AlSO4+               1.461e-008  1.298e-008    -7.835    -7.887    -0.051
   Al+3                 1.075e-008  3.703e-009    -7.969    -8.431    -0.463
   Al(SO4)2-            6.106e-010  5.424e-010    -9.214    -9.266    -0.051
   AlHSO4+2             2.864e-016  1.784e-016   -15.543   -15.749    -0.206
Ba             7.758e-007
   Ba+2                 5.295e-007  3.297e-007    -6.276    -6.482    -0.206
   BaSO4                2.400e-007  2.408e-007    -6.620    -6.618     0.001
   BaHCO3+              6.250e-009  5.552e-009    -8.204    -8.256    -0.051
   BaCO3                6.028e-011  6.048e-011   -10.220   -10.218     0.001
   BaOH+                7.208e-014  6.403e-014   -13.142   -13.194    -0.051
C(-4)          0.000e+000
   CH4                  0.000e+000  0.000e+000   -43.582   -43.580     0.001
C(4)           5.947e-003
   HCO3-                3.660e-003  3.265e-003    -2.437    -2.486    -0.050
   CO2                  1.849e-003  1.856e-003    -2.733    -2.732     0.001
   FeHCO3+              3.259e-004  2.895e-004    -3.487    -3.538    -0.051
   ZnHCO3+              3.814e-005  3.388e-005    -4.419    -4.470    -0.051
   CaHCO3+              3.124e-005  2.775e-005    -4.505    -4.557    -0.051
   MgHCO3+              1.741e-005  1.547e-005    -4.759    -4.811    -0.051
   FeCO3                1.118e-005  1.121e-005    -4.952    -4.950     0.001
   ZnCO3                8.643e-006  8.673e-006    -5.063    -5.062     0.001
   MnHCO3+              2.819e-006  2.504e-006    -5.550    -5.601    -0.051
   NaHCO3               9.083e-007  9.114e-007    -6.042    -6.040     0.001
   CO3-2                8.323e-007  5.273e-007    -6.080    -6.278    -0.198
   CaCO3                7.449e-007  7.474e-007    -6.128    -6.126     0.001
   MnCO3                3.592e-007  3.604e-007    -6.445    -6.443     0.001
   Zn(CO3)2-2           1.570e-007  9.777e-008    -6.804    -7.010    -0.206
   MgCO3                1.568e-007  1.573e-007    -6.805    -6.803     0.001
   CuCO3                1.437e-008  1.441e-008    -7.843    -7.841     0.001
   CuHCO3+              9.377e-009  8.330e-009    -8.028    -8.079    -0.051
   BaHCO3+              6.250e-009  5.552e-009    -8.204    -8.256    -0.051
   NaCO3-               1.894e-009  1.683e-009    -8.723    -8.774    -0.051
   BaCO3                6.028e-011  6.048e-011   -10.220   -10.218     0.001
   CdHCO3+              4.432e-011  3.937e-011   -10.353   -10.405    -0.051
   Cu(CO3)2-2           1.537e-011  9.569e-012   -10.813   -11.019    -0.206
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CdCO3		1.592e-013	1.597e-013	-12.798	-12.797	0.001
Cd(CO3)2-2		4.277e-016	2.663e-016	-15.369	-15.575	-0.206
Ca	1.953e-003					
Ca+2		1.670e-003	1.057e-003	-2.777	-2.976	-0.198
CaSO4		2.516e-004	2.525e-004	-3.599	-3.598	0.001
CaHCO3+		3.124e-005	2.775e-005	-4.505	-4.557	-0.051
CaCO3		7.449e-007	7.474e-007	-6.128	-6.126	0.001
CaOH+		1.132e-009	1.006e-009	-8.946	-8.998	-0.051
CaHSO4+		2.390e-010	2.123e-010	-9.622	-9.673	-0.051
Cd	8.014e-010					
Cd+2		6.123e-010	3.813e-010	-9.213	-9.419	-0.206
CdSO4		1.404e-010	1.409e-010	-9.853	-9.851	0.001
CdHCO3+		4.432e-011	3.937e-011	-10.353	-10.405	-0.051
Cd(SO4)2-2		4.112e-012	2.560e-012	-11.386	-11.592	-0.206
CdCO3		1.592e-013	1.597e-013	-12.798	-12.797	0.001
CdOH+		4.283e-014	3.805e-014	-13.368	-13.420	-0.051
Cd(CO3)2-2		4.277e-016	2.663e-016	-15.369	-15.575	-0.206
Cd(OH)2		5.575e-017	5.594e-017	-16.254	-16.252	0.001
Cd2OH+3		2.683e-022	9.240e-023	-21.571	-22.034	-0.463
Cd(OH)3-		4.049e-023	3.597e-023	-22.393	-22.444	-0.051
Cd(OH)4-2		2.950e-030	1.837e-030	-29.530	-29.736	-0.206
CdHS+		0.000e+000	0.000e+000	-40.026	-40.077	-0.051
Cd(HS)2		0.000e+000	0.000e+000	-74.548	-74.546	0.001
Cd(HS)3-		0.000e+000	0.000e+000	-113.144	-113.195	-0.051
Cd(HS)4-2		0.000e+000	0.000e+000	-151.628	-151.834	-0.206
Cu(1)	4.449e-008					
Cu+		4.449e-008	3.953e-008	-7.352	-7.403	-0.051
Cu(2)	3.705e-008					
CuCO3		1.437e-008	1.441e-008	-7.843	-7.841	0.001
CuHCO3+		9.377e-009	8.330e-009	-8.028	-8.079	-0.051
Cu+2		8.175e-009	5.091e-009	-8.088	-8.293	-0.206
Cu(OH)2		3.481e-009	3.493e-009	-8.458	-8.457	0.001
CuSO4		1.305e-009	1.309e-009	-8.884	-8.883	0.001
CuOH+		3.284e-010	2.917e-010	-9.484	-9.535	-0.051
Cu(CO3)2-2		1.537e-011	9.569e-012	-10.813	-11.019	-0.206
Cu2(OH)2+2		7.370e-015	4.589e-015	-14.133	-14.338	-0.206
Cu(OH)3-		1.358e-015	1.206e-015	-14.867	-14.919	-0.051
Cu(OH)4-2		2.215e-021	1.379e-021	-20.655	-20.860	-0.206
Cu(HS)3-		0.000e+000	0.000e+000	-104.828	-104.879	-0.051
Fe(2)	1.917e-003					
Fe+2		1.424e-003	8.866e-004	-2.847	-3.052	-0.206
FeHCO3+		3.259e-004	2.895e-004	-3.487	-3.538	-0.051
FeSO4		1.557e-004	1.562e-004	-3.808	-3.806	0.001
FeCO3		1.118e-005	1.121e-005	-4.952	-4.950	0.001
FeOH+		3.742e-007	3.324e-007	-6.427	-6.478	-0.051
FeHSO4+		2.004e-010	1.780e-010	-9.698	-9.749	-0.051
Fe(OH)2		2.581e-012	2.590e-012	-11.588	-11.587	0.001
Fe(OH)3-		5.046e-016	4.483e-016	-15.297	-15.348	-0.051
Fe(HS)2		0.000e+000	0.000e+000	-75.761	-75.760	0.001
Fe(HS)3-		0.000e+000	0.000e+000	-114.500	-114.551	-0.051
Fe(3)	1.919e-008					
Fe(OH)2+		1.519e-008	1.349e-008	-7.818	-7.870	-0.051
Fe(OH)3		3.960e-009	3.974e-009	-8.402	-8.401	0.001
FeOH+2		2.541e-011	1.582e-011	-10.595	-10.801	-0.206
Fe(OH)4-		1.002e-011	8.899e-012	-10.999	-11.051	-0.051
FeSO4+		1.669e-014	1.483e-014	-13.778	-13.829	-0.051
Fe+3		4.297e-015	1.480e-015	-14.367	-14.830	-0.463
Fe(SO4)2-		4.900e-016	4.353e-016	-15.310	-15.361	-0.051
Fe2(OH)2+4		1.071e-019	1.611e-020	-18.970	-19.793	-0.823
FeHSO4+2		1.199e-020	7.465e-021	-19.921	-20.127	-0.206
Fe3(OH)4+5		6.138e-024	3.179e-025	-23.212	-24.498	-1.286
H(0)	1.720e-020					
H2		8.598e-021	8.627e-021	-20.066	-20.064	0.001
K	8.487e-005					
K+		8.428e-005	7.466e-005	-4.074	-4.127	-0.053
KSO4-		5.956e-007	5.291e-007	-6.225	-6.276	-0.051
Mg	7.634e-004					

Mg+2	6.622e-004	4.230e-004	-3.179	-3.374	-0.195
MgSO4	8.366e-005	8.395e-005	-4.077	-4.076	0.001
MgHCO3+	1.741e-005	1.547e-005	-4.759	-4.811	-0.051
MgCO3	1.568e-007	1.573e-007	-6.805	-6.803	0.001
MgOH+	1.476e-009	1.311e-009	-8.831	-8.882	-0.051
Mn(2)	1.848e-005				
Mn+2	1.382e-005	8.605e-006	-4.860	-5.065	-0.206
MnHCO3+	2.819e-006	2.504e-006	-5.550	-5.601	-0.051
MnSO4	1.486e-006	1.491e-006	-5.828	-5.826	0.001
MnCO3	3.592e-007	3.604e-007	-6.445	-6.443	0.001
MnOH+	2.558e-010	2.272e-010	-9.592	-9.644	-0.051
Mn(OH)3-	2.889e-020	2.567e-020	-19.539	-19.591	-0.051
Mn(3)	1.970e-030				
Mn+3	1.970e-030	6.785e-031	-29.706	-30.168	-0.463
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-70.033	-70.239	-0.206
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-79.206	-79.258	-0.051
Na	5.625e-004				
Na+	5.580e-004	4.964e-004	-3.253	-3.304	-0.051
NaSO4-	3.571e-006	3.172e-006	-5.447	-5.499	-0.051
NaHCO3	9.083e-007	9.114e-007	-6.042	-6.040	0.001
NaCO3-	1.894e-009	1.683e-009	-8.723	-8.774	-0.051
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-59.059	-59.057	0.001
S(-2)	0.000e+000				
CdHS+	0.000e+000	0.000e+000	-40.026	-40.077	-0.051
H2S	0.000e+000	0.000e+000	-40.339	-40.337	0.001
HS-	0.000e+000	0.000e+000	-40.777	-40.829	-0.051
S6-2	0.000e+000	0.000e+000	-43.797	-43.951	-0.155
S5-2	0.000e+000	0.000e+000	-43.984	-44.148	-0.163
S4-2	0.000e+000	0.000e+000	-44.230	-44.402	-0.172
S-2	0.000e+000	0.000e+000	-47.410	-47.616	-0.206
S3-2	0.000e+000	0.000e+000	-47.709	-47.892	-0.183
S2-2	0.000e+000	0.000e+000	-48.998	-49.189	-0.191
Zn(HS)2	0.000e+000	0.000e+000	-70.803	-70.801	0.001
Cd(HS)2	0.000e+000	0.000e+000	-74.548	-74.546	0.001
Fe(HS)2	0.000e+000	0.000e+000	-75.761	-75.760	0.001
Cu(HS)3-	0.000e+000	0.000e+000	-104.828	-104.879	-0.051
Zn(HS)3-	0.000e+000	0.000e+000	-110.419	-110.470	-0.051
Cd(HS)3-	0.000e+000	0.000e+000	-113.144	-113.195	-0.051
Fe(HS)3-	0.000e+000	0.000e+000	-114.500	-114.551	-0.051
Cd(HS)4-2	0.000e+000	0.000e+000	-151.628	-151.834	-0.206
S(6)	2.839e-003				
SO4-2	2.317e-003	1.457e-003	-2.635	-2.836	-0.201
CaSO4	2.516e-004	2.525e-004	-3.599	-3.598	0.001
FeSO4	1.557e-004	1.562e-004	-3.808	-3.806	0.001
MgSO4	8.366e-005	8.395e-005	-4.077	-4.076	0.001
ZnSO4	2.386e-005	2.394e-005	-4.622	-4.621	0.001
NaSO4-	3.571e-006	3.172e-006	-5.447	-5.499	-0.051
MnSO4	1.486e-006	1.491e-006	-5.828	-5.826	0.001
KSO4-	5.956e-007	5.291e-007	-6.225	-6.276	-0.051
Zn(SO4)2-2	5.356e-007	3.335e-007	-6.271	-6.477	-0.206
BaSO4	2.400e-007	2.408e-007	-6.620	-6.618	0.001
HSO4-	1.880e-008	1.670e-008	-7.726	-7.777	-0.051
AlSO4+	1.461e-008	1.298e-008	-7.835	-7.887	-0.051
CuSO4	1.305e-009	1.309e-009	-8.884	-8.883	0.001
Al(SO4)2-	6.106e-010	5.424e-010	-9.214	-9.266	-0.051
CaHSO4+	2.390e-010	2.123e-010	-9.622	-9.673	-0.051
FeHSO4+	2.004e-010	1.780e-010	-9.698	-9.749	-0.051
CdSO4	1.404e-010	1.409e-010	-9.853	-9.851	0.001
Cd(SO4)2-2	4.112e-012	2.560e-012	-11.386	-11.592	-0.206
FeSO4+	1.669e-014	1.483e-014	-13.778	-13.829	-0.051
Fe(SO4)2-	4.900e-016	4.353e-016	-15.310	-15.361	-0.051
AlHSO4+2	2.864e-016	1.784e-016	-15.543	-15.749	-0.206
FeHSO4+2	1.199e-020	7.465e-021	-19.921	-20.127	-0.206
Zn	2.039e-004				

Zn+2	1.324e-004	8.243e-005	-3.878	-4.084	-0.206
ZnHCO3+	3.814e-005	3.388e-005	-4.419	-4.470	-0.051
ZnSO4	2.386e-005	2.394e-005	-4.622	-4.621	0.001
ZnCO3	8.643e-006	8.673e-006	-5.063	-5.062	0.001
Zn(SO4)2-2	5.356e-007	3.335e-007	-6.271	-6.477	-0.206
Zn(CO3)2-2	1.570e-007	9.777e-008	-6.804	-7.010	-0.206
ZnOH+	1.178e-007	1.046e-007	-6.929	-6.980	-0.051
Zn(OH)2	3.397e-008	3.408e-008	-7.469	-7.467	0.001
Zn(OH)3-	6.953e-013	6.176e-013	-12.158	-12.209	-0.051
Zn(OH)4-2	9.009e-019	5.610e-019	-18.045	-18.251	-0.206
Zn(HS)2	0.000e+000	0.000e+000	-70.803	-70.801	0.001
Zn(HS)3-	0.000e+000	0.000e+000	-110.419	-110.470	-0.051

-------------------------------Saturation indices-------------------------------

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-0.33	11.84	12.17	Al(OH)3
AlumK	-12.69	-18.23	-5.54	KAl(SO4)2:12H2O
Alunite	4.25	5.45	1.21	KAl3(SO4)2(OH)6
Anhydrite	-1.47	-5.81	-4.34	CaSO4
Anilite	-13.11	-47.25	-34.13	Cu0.25Cu1.5S
Antlerite	-8.97	-0.68	8.29	Cu3(OH)4SO4
Aragonite	-1.02	-9.25	-8.24	CaCO3
Artinite	-10.60	0.49	11.09	MgCO3:Mg(OH)2:3H2O
Azurite	-8.17	-2.82	5.35	Cu3(OH)2(CO3)2
Barite	1.03	-9.32	-10.35	BaSO4
Basaluminite	8.32	31.02	22.70	Al4(OH)10SO4
Bianchite	-5.16	-6.92	-1.76	ZnSO4:6H2O
Birnessite	-18.14	25.46	43.60	MnO2
Bixbyite	-19.97	-19.79	0.18	Mn2O3
BlaubleiI	-18.85	-43.01	-24.16	Cu0.9Cu0.2S
BlaubleiII	-17.69	-44.97	-27.28	Cu0.6Cu0.8S
Boehmite	1.80	11.84	10.04	AlOOH
Brochantite	-10.80	4.54	15.34	Cu4(OH)6SO4
Brucite	-8.10	10.14	18.24	Mg(OH)2
Calcite	-0.86	-9.25	-8.40	CaCO3
Cd(gamma)	-27.44	-12.91	14.53	Cd
Cd(OH)2	-9.55	4.10	13.65	Cd(OH)2
Cd(OH)2(a)	-10.71	4.10	14.81	Cd(OH)2
Cd3(OH)2(SO4)2	-27.12	-20.41	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-26.62	-4.06	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-28.36	0.04	28.40	Cd4(OH)6SO4
CdMetal	-27.33	-12.91	14.42	Cd
CdSO4	-12.92	-12.26	0.66	CdSO4
CdSO4:2.7H2O	-10.61	-12.26	-1.65	CdSO4:2.67H2O
CdSO4:H2O	-10.99	-12.26	-1.27	CdSO4:H2O
CH4(g)	-40.90	-43.58	-2.69	CH4
Chalcanthite	-8.42	-11.13	-2.71	CuSO4:5H2O
Chalcocite	-11.70	-48.88	-37.18	Cu2S
Chalcopyrite	-42.38	-79.49	-37.11	CuFeS2
CO2(g)	-1.53	-2.73	-1.20	CO2
Covellite	-18.85	-42.36	-23.51	CuS
Cu(OH)2	-4.21	5.22	9.43	Cu(OH)2
Cu2SO4	-15.93	-17.64	-1.71	Cu2SO4
CuCO3	-4.94	-14.57	-9.63	CuCO3
CuMetal	0.50	-9.15	-9.65	Cu
CuOCuSO4	-19.28	-5.91	13.37	CuO:CuSO4
CupricFerrite	8.23	16.11	7.89	CuFe2O4
Cuprite	0.58	-1.29	-1.87	Cu2O
CuprousFerrite	13.52	4.80	-8.72	CuFeO2
CuSO4	-15.08	-11.13	3.95	CuSO4
Diaspore	3.68	11.84	8.16	AlOOH
Djurleite	-12.04	-48.45	-36.40	Cu0.066Cu1.868S
Dolomite	-2.30	-18.91	-16.60	CaMg(CO3)2
Dolomite(d)	-2.94	-18.91	-15.97	CaMg(CO3)2
Epsomite	-3.92	-6.21	-2.29	MgSO4:7H2O

Fe(OH)3(a)	0.55	5.44	4.89	Fe(OH)3
Fe3(OH)8	1.13	21.35	20.22	Fe3(OH)8
FeS(ppt)	-33.21	-37.12	-3.92	FeS
Gibbsite	2.55	11.84	9.29	Al(OH)3
Goethite	5.69	5.44	-0.25	FeOOH
Goslarite	-4.79	-6.92	-2.13	ZnSO4:7H2O
Greenockite	-26.71	-43.49	-16.78	CdS
Greigite	-123.96	-168.99	-45.03	Fe3S4
Gypsum	-1.21	-5.81	-4.60	CaSO4:2H2O
H2(g)	-17.01	-20.06	-3.06	H2
H2O(g)	-2.06	-0.00	2.06	H2O
H2S(g)	-39.58	-40.34	-0.76	H2S
Hausmannite	-23.89	42.36	66.25	Mn3O4
Hematite	13.30	10.89	-2.41	Fe2O3
Huntite	-9.58	-38.21	-28.63	CaMg3(CO3)4
Hydromagnesite	-22.41	-28.46	-6.05	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	-4.41	-14.24	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-6.15	-13.74	-7.59	KFe3(SO4)2(OH)6
Jarosite-Na	-9.51	-12.92	-3.40	NaFe3(SO4)2(OH)6
JarositeH	-13.84	-16.37	-2.53	(H3O)Fe3(SO4)2(OH)6
Jurbanite	-1.28	-4.51	-3.23	AlOHSO4
Langite	-14.30	4.54	18.84	Cu4(OH)6SO4:H2O
Mackinawite	-32.47	-37.12	-4.65	FeS
Maghemite	4.50	10.89	6.39	Fe2O3
Magnesite	-1.94	-9.65	-7.71	MgCO3
Magnetite	15.00	21.35	6.35	Fe3O4
Malachite	-4.97	1.20	6.17	Cu2(OH)2CO3
Manganite	-8.39	16.95	25.34	MnOOH
Melanterite	-3.41	-5.89	-2.48	FeSO4:7H2O
Mirabilite	-7.35	-9.45	-2.10	Na2SO4:10H2O
Mn2(SO4)3	-65.16	-68.85	-3.69	Mn2(SO4)3
MnS(Green)	-43.24	-39.14	4.10	MnS
MnSO4	-11.37	-7.90	3.47	MnSO4
Monteponite	-10.96	4.10	15.05	CdO
Nahcolite	-5.05	-5.79	-0.74	NaHCO3
Natron	-10.76	-12.89	-2.13	Na2CO3:10H2O
Nesquehonite	-4.33	-9.65	-5.32	MgCO3:3H2O
Nsutite	-17.11	25.46	42.56	MnO2
O2(g)	-56.34	-59.06	-2.72	O2
Otavite	-3.60	-15.70	-12.10	CdCO3
Portlandite	-13.87	10.54	24.41	Ca(OH)2
Pyrite	-48.64	-67.70	-19.06	FeS2
Pyrochroite	-6.75	8.45	15.20	Mn(OH)2
Pyrolusite	-19.30	25.46	44.76	MnO2
Rhodochrosite	-0.29	-11.34	-11.06	MnCO3
Rhodochrosite(d)	-0.95	-11.34	-10.39	MnCO3
Siderite	1.43	-9.33	-10.76	FeCO3
Siderite(d)(3)	1.12	-9.33	-10.45	FeCO3
Smithsonite	-0.59	-10.36	-9.77	ZnCO3
Sphalerite	-26.11	-38.15	-12.05	ZnS
Sulfur	-28.69	-44.13	-15.44	S
Tenorite	-3.19	5.22	8.41	CuO
Thenardite	-9.30	-9.44	-0.15	Na2SO4
Thermonatrite	-13.16	-12.89	0.27	Na2CO3:H2O
Trona	-18.81	-18.68	0.14	NaHCO3:Na2CO3:2H2O
Witherite	-4.08	-12.76	-8.67	BaCO3
Wurtzite	-28.21	-38.15	-9.94	ZnS
Zincite(c)	-2.84	9.43	12.27	ZnO
Zincosite	-10.93	-6.92	4.01	ZnSO4
Zn(OH)2-a	-3.02	9.43	12.45	Zn(OH)2
Zn(OH)2-b	-2.32	9.43	11.75	Zn(OH)2
Zn(OH)2-c	-2.77	9.43	12.20	Zn(OH)2
Zn(OH)2-e	-2.07	9.43	11.50	Zn(OH)2
Zn(OH)2-g	-2.28	9.43	11.71	Zn(OH)2
Zn2(OH)2SO4	-4.99	2.51	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-26.64	-4.41	22.23	ZnO:2ZnSO4
Zn4(OH)6SO4	-7.02	21.38	28.40	Zn4(OH)6SO4

```
      ZnCO3:H2O        -0.10  -10.36  -10.26  ZnCO3:H2O
      ZnMetal         -35.24   -7.57   27.66  Zn
      ZnO(a)           -1.88    9.43   11.31  ZnO
      ZnS(a)          -28.91  -38.15   -9.24  ZnS
      ZnSO4:H2O        -6.90   -6.92   -0.02  ZnSO4:H2O

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End of simulation.
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Reading input data for simulation 2.
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      USE SOLUTION 1
      USE SOLUTION 2
      EQUILIBRIUM_PHASES 1 Selected minerals are allowed to precipitate when they reach
saturation
          Barite    0 0
          Boehmite  0 0
          Dolomite  -1 10
          Fe(OH)3(a) 0 0
          Gibbsite  0 0
          Gypsum    0 0
          Rhodochrosite 0 0
          Siderite(d)(3) 0 0
          ZnCO3:H2O 0 0
      MIX 2 Mixture of deep aquifer and tailings pore water allowing precipitation of pure
phases that become saturated
          1    0.992
          2    0.008
      SAVE solution 4
      SELECTED_OUTPUT
          file                 P03-01 sim2.out
          reset                false
          simulation           true
          ph                   true
          pe                   true
          totals               Ca  Mg  Na  S(6)  Zn  Fe  Fe(2)
                                Fe(3)
          saturation_indices   Alunite  Barite  Basaluminite  Boehmite
                                Fe(OH)3(a)  Gibbsite  Gypsum  Jurbanite
                                Rhodochrosite  Siderite  Smithsonite  Zn(OH)2-g
                                Zn2(OH)2SO4  ZnCO3:H2O
----------------------------------------
Beginning of batch-reaction calculations.
----------------------------------------

Reaction step 1.

Using mix 2.      Mixture of deep aquifer and tailings pore water allowing precipitation
of pure phases that become saturated
Using pure phase assemblage 1.      Selected minerals are allowed to precipitate when they
reach saturation

Mixture 2.  Mixture of deep aquifer and tailings pore water allowing precipitation of pure
phases that become saturated

       9.920e-001 Solution 1  P03-01-01     6/1/2007     Depth:  46.8
       8.000e-003 Solution 2  P03-01-08     6/1/2007     Depth:  9.3

-------------------------------Phase assemblage--------------------------------

                                                        Moles in assemblage
Phase                   SI log IAP  log KT      Initial       Final       Delta

Barite                0.00  -10.35  -10.35   0.000e+000  6.997e-007  6.997e-007
```

Boehmite	-0.75	9.29	10.04	0.000e+000	0	0.000e+000
Dolomite	-1.00	-17.60	-16.60	1.000e+001	9.999e+000	-1.185e-003
Fe(OH)3(a)	-0.10	4.80	4.89	0.000e+000	0	0.000e+000
Gibbsite	-0.00	9.29	9.29	0.000e+000	1.172e-006	1.172e-006
Gypsum	-1.04	-5.64	-4.60	0.000e+000	0	0.000e+000
Rhodochrosite	0.00	-11.06	-11.06	0.000e+000	1.266e-006	1.266e-006
Siderite(d)(3)	0.00	-10.45	-10.45	0.000e+000	1.848e-003	1.848e-003
ZnCO3:H2O	0.00	-10.26	-10.26	0.000e+000	7.545e-005	7.545e-005

----------Solution composition----------

Elements	Molality	Moles
Al	3.850e-009	3.850e-009
Ba	7.611e-008	7.611e-008
C	6.393e-003	6.393e-003
Ca	3.138e-003	3.138e-003
Cd	8.014e-010	8.014e-010
Cu	8.154e-008	8.154e-008
Fe	6.918e-005	6.918e-005
K	8.487e-005	8.487e-005
Mg	1.948e-003	1.948e-003
Mn	1.722e-005	1.722e-005
Na	5.625e-004	5.625e-004
S	2.838e-003	2.838e-003
Zn	1.284e-004	1.284e-004

----------Description of solution----------

pH	= 6.995	Charge balance
pe	= 1.857	Adjusted to redox equilibrium
Activity of water	= 1.000	
Ionic strength	= 1.633e-002	
Mass of water (kg)	= 1.000e+000	
Total alkalinity (eq/kg)	= 5.011e-003	
Total CO2 (mol/kg)	= 6.393e-003	
Temperature (deg C)	= 5.306	
Electrical balance (eq)	= 5.625e-004	
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= 2.94	
Iterations	= 14	
Total H	= 1.110164e+002	
Total O	= 5.553484e+001	

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	1.125e-007	1.012e-007	-6.949	-6.995	-0.046
OH-	2.131e-008	1.884e-008	-7.671	-7.725	-0.054
H2O	5.551e+001	9.998e-001	1.744	-0.000	0.000
Al	3.850e-009				
Al(OH)4-	2.931e-009	2.591e-009	-8.533	-8.587	-0.054
Al(OH)2+	6.593e-010	5.827e-010	-9.181	-9.235	-0.054
Al(OH)3	1.605e-010	1.611e-010	-9.795	-9.793	0.002
AlOH+2	8.568e-011	5.230e-011	-10.067	-10.282	-0.214
AlSO4+	7.628e-012	6.743e-012	-11.118	-11.171	-0.054
Al+3	6.164e-012	2.030e-012	-11.210	-11.693	-0.482
Al(SO4)2-	3.020e-013	2.670e-013	-12.520	-12.574	-0.054
AlHSO4+2	8.802e-020	5.372e-020	-19.055	-19.270	-0.214
Ba	7.611e-008				
Ba+2	5.299e-008	3.234e-008	-7.276	-7.490	-0.214
BaSO4	2.230e-008	2.238e-008	-7.652	-7.650	0.002
BaHCO3+	8.050e-010	7.115e-010	-9.094	-9.148	-0.054
BaCO3	1.332e-011	1.337e-011	-10.876	-10.874	0.002
BaOH+	1.225e-014	1.083e-014	-13.912	-13.965	-0.054
C(-4)	0.000e+000				

CH4	0.000e+000	0.000e+000	-46.501	-46.499	0.002
C(4)	6.393e-003				
HCO3-	4.804e-003	4.266e-003	-2.318	-2.370	-0.052
CO2	1.401e-003	1.406e-003	-2.854	-2.852	0.002
CaHCO3+	6.495e-005	5.741e-005	-4.187	-4.241	-0.054
MgHCO3+	5.735e-005	5.069e-005	-4.241	-4.295	-0.054
ZnHCO3+	2.811e-005	2.485e-005	-4.551	-4.605	-0.054
FeHCO3+	1.441e-005	1.274e-005	-4.841	-4.895	-0.054
ZnCO3	1.093e-005	1.097e-005	-4.962	-4.960	0.002
MnHCO3+	3.183e-006	2.814e-006	-5.497	-5.551	-0.054
CaCO3	2.656e-006	2.666e-006	-5.576	-5.574	0.002
CO3-2	1.911e-006	1.188e-006	-5.719	-5.925	-0.206
NaHCO3	1.180e-006	1.185e-006	-5.928	-5.926	0.002
MgCO3	8.857e-007	8.890e-007	-6.053	-6.051	0.002
FeCO3	8.479e-007	8.511e-007	-6.072	-6.070	0.002
MnCO3	6.958e-007	6.984e-007	-6.157	-6.156	0.002
Zn(CO3)2-2	4.564e-007	2.786e-007	-6.341	-6.555	-0.214
CuCO3	2.646e-008	2.656e-008	-7.577	-7.576	0.002
CuHCO3+	1.007e-008	8.901e-009	-7.997	-8.051	-0.054
NaCO3-	4.268e-009	3.772e-009	-8.370	-8.423	-0.054
BaHCO3+	8.050e-010	7.115e-010	-9.094	-9.148	-0.054
Cu(CO3)2-2	6.509e-011	3.973e-011	-10.186	-10.401	-0.214
CdHCO3+	5.687e-011	5.026e-011	-10.245	-10.299	-0.054
BaCO3	1.332e-011	1.337e-011	-10.876	-10.874	0.002
CdCO3	3.503e-013	3.516e-013	-12.456	-12.454	0.002
Cd(CO3)2-2	2.164e-015	1.321e-015	-14.665	-14.879	-0.214
Ca	3.138e-003				
Ca+2	2.693e-003	1.674e-003	-2.570	-2.776	-0.207
CaSO4	3.773e-004	3.787e-004	-3.423	-3.422	0.002
CaHCO3+	6.495e-005	5.741e-005	-4.187	-4.241	-0.054
CaCO3	2.656e-006	2.666e-006	-5.576	-5.574	0.002
CaOH+	3.106e-009	2.745e-009	-8.508	-8.561	-0.054
CaHSO4+	2.090e-010	1.847e-010	-9.680	-9.734	-0.054
Cd	8.014e-010				
Cd+2	6.105e-010	3.726e-010	-9.214	-9.429	-0.214
CdSO4	1.299e-010	1.304e-010	-9.886	-9.885	0.002
CdHCO3+	5.687e-011	5.026e-011	-10.245	-10.299	-0.054
Cd(SO4)2-2	3.681e-012	2.247e-012	-11.434	-11.648	-0.214
CdCO3	3.503e-013	3.516e-013	-12.456	-12.454	0.002
CdOH+	7.254e-014	6.412e-014	-13.139	-13.193	-0.054
Cd(CO3)2-2	2.164e-015	1.321e-015	-14.665	-14.879	-0.214
Cd(OH)2	1.619e-016	1.625e-016	-15.791	-15.789	0.002
Cd2OH+3	4.621e-022	1.522e-022	-21.335	-21.818	-0.482
Cd(OH)3-	2.039e-022	1.802e-022	-21.691	-21.744	-0.054
Cd(OH)4-2	2.601e-029	1.587e-029	-28.585	-28.799	-0.214
CdHS+	0.000e+000	0.000e+000	-43.092	-43.146	-0.054
Cd(HS)2	0.000e+000	0.000e+000	-80.674	-80.673	0.002
Cd(HS)3-	0.000e+000	0.000e+000	-122.326	-122.380	-0.054
Cd(HS)4-2	0.000e+000	0.000e+000	-163.862	-164.077	-0.214
Cu(1)	2.819e-008				
Cu+	2.819e-008	2.491e-008	-7.550	-7.604	-0.054
Cu(2)	5.336e-008				
CuCO3	2.646e-008	2.656e-008	-7.577	-7.576	0.002
CuHCO3+	1.007e-008	8.901e-009	-7.997	-8.051	-0.054
Cu(OH)2	8.463e-009	8.495e-009	-8.072	-8.071	0.002
Cu+2	6.821e-009	4.163e-009	-8.166	-8.381	-0.214
CuSO4	1.011e-009	1.015e-009	-8.995	-8.994	0.002
CuOH+	4.655e-010	4.114e-010	-9.332	-9.386	-0.054
Cu(CO3)2-2	6.509e-011	3.973e-011	-10.186	-10.401	-0.214
Cu2(OH)2+2	1.495e-014	9.128e-015	-13.825	-14.040	-0.214
Cu(OH)3-	5.723e-015	5.058e-015	-14.242	-14.296	-0.054
Cu(OH)4-2	1.634e-020	9.974e-021	-19.787	-20.001	-0.214
Cu(HS)3-	0.000e+000	0.000e+000	-114.088	-114.142	-0.054
Fe(2)	6.918e-005				
Fe+2	4.893e-005	2.987e-005	-4.310	-4.525	-0.214
FeHCO3+	1.441e-005	1.274e-005	-4.841	-4.895	-0.054
FeSO4	4.968e-006	4.987e-006	-5.304	-5.302	0.002

FeCO3	8.479e-007	8.511e-007	-6.072	-6.070	0.002
FeOH+	2.184e-008	1.931e-008	-7.661	-7.714	-0.054
FeHSO4+	3.728e-012	3.295e-012	-11.428	-11.482	-0.054
Fe(OH)2	2.585e-013	2.594e-013	-12.588	-12.586	0.002
Fe(OH)3-	8.761e-017	7.744e-017	-16.057	-16.111	-0.054
Fe(HS)2	0.000e+000	0.000e+000	-83.350	-83.349	0.002
Fe(HS)3-	0.000e+000	0.000e+000	-125.145	-125.199	-0.054
Fe(3)	2.878e-009				
Fe(OH)2+	1.984e-009	1.754e-009	-8.702	-8.756	-0.054
Fe(OH)3	8.873e-010	8.907e-010	-9.052	-9.050	0.002
Fe(OH)4-	3.891e-012	3.440e-012	-11.410	-11.464	-0.054
FeOH+2	1.954e-012	1.193e-012	-11.709	-11.923	-0.214
FeSO4+	6.948e-016	6.141e-016	-15.158	-15.212	-0.054
Fe+3	1.964e-016	6.469e-017	-15.707	-16.189	-0.482
Fe(SO4)2-	1.933e-017	1.708e-017	-16.714	-16.767	-0.054
Fe2(OH)2+4	6.593e-022	9.151e-023	-21.181	-22.039	-0.858
FeHSO4+2	2.937e-022	1.793e-022	-21.532	-21.746	-0.214
Fe3(OH)4+5	5.135e-027	2.347e-028	-26.289	-27.629	-1.340
H(0)	3.433e-021				
H2	1.717e-021	1.723e-021	-20.765	-20.764	0.002
K	8.487e-005				
K+	8.431e-005	7.430e-005	-4.074	-4.129	-0.055
KSO4-	5.645e-007	4.989e-007	-6.248	-6.302	-0.054
Mg	1.948e-003				
Mg+2	1.691e-003	1.061e-003	-2.772	-2.974	-0.202
MgSO4	1.988e-004	1.995e-004	-3.702	-3.700	0.002
MgHCO3+	5.735e-005	5.069e-005	-4.241	-4.295	-0.054
MgCO3	8.857e-007	8.890e-007	-6.053	-6.051	0.002
MgOH+	6.416e-009	5.671e-009	-8.193	-8.246	-0.054
Mn(2)	1.722e-005				
Mn+2	1.213e-005	7.401e-006	-4.916	-5.131	-0.214
MnHCO3+	3.183e-006	2.814e-006	-5.497	-5.551	-0.054
MnSO4	1.211e-006	1.215e-006	-5.917	-5.915	0.002
MnCO3	6.958e-007	6.984e-007	-6.157	-6.156	0.002
MnOH+	3.813e-010	3.370e-010	-9.419	-9.472	-0.054
Mn(OH)3-	1.281e-019	1.132e-019	-18.893	-18.946	-0.054
Mn(3)	2.300e-030				
Mn+3	2.300e-030	7.573e-031	-29.638	-30.121	-0.482
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-67.744	-67.959	-0.214
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-76.811	-76.864	-0.054
Na	5.625e-004				
Na+	5.580e-004	4.939e-004	-3.253	-3.306	-0.053
NaSO4-	3.383e-006	2.990e-006	-5.471	-5.524	-0.054
NaHCO3	1.180e-006	1.185e-006	-5.928	-5.926	0.002
NaCO3-	4.268e-009	3.772e-009	-8.370	-8.423	-0.054
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-57.660	-57.658	0.002
S(-2)	0.000e+000				
CdHS+	0.000e+000	0.000e+000	-43.092	-43.146	-0.054
H2S	0.000e+000	0.000e+000	-43.634	-43.632	0.002
HS-	0.000e+000	0.000e+000	-43.833	-43.887	-0.054
S6-2	0.000e+000	0.000e+000	-46.613	-46.773	-0.160
S5-2	0.000e+000	0.000e+000	-46.801	-46.969	-0.169
S4-2	0.000e+000	0.000e+000	-47.045	-47.224	-0.179
S-2	0.000e+000	0.000e+000	-50.223	-50.437	-0.214
S3-2	0.000e+000	0.000e+000	-50.524	-50.713	-0.190
S2-2	0.000e+000	0.000e+000	-51.812	-52.011	-0.199
Zn(HS)2	0.000e+000	0.000e+000	-77.170	-77.169	0.002
Cd(HS)2	0.000e+000	0.000e+000	-80.674	-80.673	0.002
Fe(HS)2	0.000e+000	0.000e+000	-83.350	-83.349	0.002
Cu(HS)3-	0.000e+000	0.000e+000	-114.088	-114.142	-0.054
Zn(HS)3-	0.000e+000	0.000e+000	-119.842	-119.896	-0.054
Cd(HS)3-	0.000e+000	0.000e+000	-122.326	-122.380	-0.054
Fe(HS)3-	0.000e+000	0.000e+000	-125.145	-125.199	-0.054
Cd(HS)4-2	0.000e+000	0.000e+000	-163.862	-164.077	-0.214

S(6)	2.838e-003					
SO4-2		2.239e-003	1.381e-003	-2.650	-2.860	-0.210
CaSO4		3.773e-004	3.787e-004	-3.423	-3.422	0.002
MgSO4		1.988e-004	1.995e-004	-3.702	-3.700	0.002
ZnSO4		1.268e-005	1.273e-005	-4.897	-4.895	0.002
FeSO4		4.968e-006	4.987e-006	-5.304	-5.302	0.002
NaSO4-		3.383e-006	2.990e-006	-5.471	-5.524	-0.054
MnSO4		1.211e-006	1.215e-006	-5.917	-5.915	0.002
KSO4-		5.645e-007	4.989e-007	-6.248	-6.302	-0.054
Zn(SO4)2-2		2.754e-007	1.681e-007	-6.560	-6.774	-0.214
BaSO4		2.230e-008	2.238e-008	-7.652	-7.650	0.002
HSO4-		1.038e-008	9.178e-009	-7.984	-8.037	-0.054
CuSO4		1.011e-009	1.015e-009	-8.995	-8.994	0.002
CaHSO4+		2.090e-010	1.847e-010	-9.680	-9.734	-0.054
CdSO4		1.299e-010	1.304e-010	-9.886	-9.885	0.002
AlSO4+		7.628e-012	6.743e-012	-11.118	-11.171	-0.054
FeHSO4+		3.728e-012	3.295e-012	-11.428	-11.482	-0.054
Cd(SO4)2-2		3.681e-012	2.247e-012	-11.434	-11.648	-0.214
Al(SO4)2-		3.020e-013	2.670e-013	-12.520	-12.574	-0.054
FeSO4+		6.948e-016	6.141e-016	-15.158	-15.212	-0.054
Fe(SO4)2-		1.933e-017	1.708e-017	-16.714	-16.767	-0.054
AlHSO4+2		8.802e-020	5.372e-020	-19.055	-19.270	-0.214
FeHSO4+2		2.937e-022	1.793e-022	-21.532	-21.746	-0.214
Zn	1.284e-004					
Zn+2		7.580e-005	4.627e-005	-4.120	-4.335	-0.214
ZnHCO3+		2.811e-005	2.485e-005	-4.551	-4.605	-0.054
ZnSO4		1.268e-005	1.273e-005	-4.897	-4.895	0.002
ZnCO3		1.093e-005	1.097e-005	-4.962	-4.960	0.002
Zn(CO3)2-2		4.564e-007	2.786e-007	-6.341	-6.555	-0.214
Zn(SO4)2-2		2.754e-007	1.681e-007	-6.560	-6.774	-0.214
ZnOH+		1.146e-007	1.013e-007	-6.941	-6.995	-0.054
Zn(OH)2		5.667e-008	5.688e-008	-7.247	-7.245	0.002
Zn(OH)3-		2.011e-012	1.778e-012	-11.697	-11.750	-0.054
Zn(OH)4-2		4.562e-018	2.784e-018	-17.341	-17.555	-0.214
Zn(HS)2		0.000e+000	0.000e+000	-77.170	-77.169	0.002
Zn(HS)3-		0.000e+000	0.000e+000	-119.842	-119.896	-0.054

Saturation indices

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-2.88	9.29	12.17	Al(OH)3
AlumK	-16.00	-21.54	-5.54	KAl(SO4)2:12H2O
Alunite	-4.16	-2.96	1.21	KAl3(SO4)2(OH)6
Anhydrite	-1.29	-5.64	-4.34	CaSO4
Anilite	-16.26	-50.39	-34.13	Cu0.25Cu1.5S
Antlerite	-8.31	-0.02	8.29	Cu3(OH)4SO4
Aragonite	-0.47	-8.70	-8.24	CaCO3
Artinite	-8.97	2.12	11.09	MgCO3:Mg(OH)2:3H2O
Azurite	-7.25	-1.90	5.35	Cu3(OH)2(CO3)2
Barite	0.00	-10.35	-10.35	BaSO4
Basaluminite	-2.38	20.32	22.70	Al4(OH)10SO4
Bianchite	-5.44	-7.20	-1.76	ZnSO4:6H2O
Birnessite	-17.04	26.56	43.60	MnO2
Bixbyite	-18.45	-18.27	0.18	Mn2O3
BlaubleiI	-21.79	-45.96	-24.16	Cu0.9Cu0.2S
BlaubleiII	-20.72	-48.00	-27.28	Cu0.6Cu0.8S
Boehmite	-0.75	9.29	10.04	AlOOH
Brochantite	-9.75	5.59	15.34	Cu4(OH)6SO4
Brucite	-7.23	11.02	18.24	Mg(OH)2
Calcite	-0.31	-8.70	-8.40	CaCO3
Cd(gamma)	-27.67	-13.14	14.53	Cd
Cd(OH)2	-9.09	4.56	13.65	Cd(OH)2
Cd(OH)2(a)	-10.25	4.56	14.81	Cd(OH)2
Cd3(OH)2(SO4)2	-26.73	-20.02	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-25.73	-3.17	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-27.01	1.39	28.40	Cd4(OH)6SO4

CdMetal	-27.57	-13.14	14.42	Cd
CdSO4	-12.95	-12.29	0.66	CdSO4
CdSO4:2.7H2O	-10.64	-12.29	-1.65	CdSO4:2.67H2O
CdSO4:H2O	-11.02	-12.29	-1.27	CdSO4:H2O
CH4(g)	-43.81	-46.50	-2.69	CH4
Chalcanthite	-8.53	-11.24	-2.71	CuSO4:5H2O
Chalcocite	-14.92	-52.10	-37.18	Cu2S
Chalcopyrite	-49.58	-86.69	-37.11	CuFeS2
CO2(g)	-1.66	-2.85	-1.20	CO2
Covellite	-21.76	-45.27	-23.51	CuS
Cu(OH)2	-3.82	5.61	9.43	Cu(OH)2
Cu2SO4	-16.35	-18.07	-1.71	Cu2SO4
CuCO3	-4.68	-14.31	-9.63	CuCO3
CuMetal	0.19	-9.46	-9.65	Cu
CuOCuSO4	-19.01	-5.63	13.37	CuO:CuSO4
CupricFerrite	7.31	15.20	7.89	CuFe2O4
Cuprite	0.66	-1.22	-1.87	Cu2O
CuprousFerrite	12.91	4.19	-8.72	CuFeO2
CuSO4	-15.19	-11.24	3.95	CuSO4
Diaspore	1.13	9.29	8.16	AlOOH
Djurleite	-15.25	-51.65	-36.40	Cu0.066Cu1.868S
Dolomite	-1.00	-17.60	-16.60	CaMg(CO3)2
Dolomite(d)	-1.64	-17.60	-15.97	CaMg(CO3)2
Epsomite	-3.55	-5.83	-2.29	MgSO4:7H2O
Fe(OH)3(a)	-0.10	4.80	4.89	Fe(OH)3
Fe3(OH)8	-1.17	19.06	20.22	Fe3(OH)8
FeS(ppt)	-37.50	-41.42	-3.92	FeS
Gibbsite	-0.00	9.29	9.29	Al(OH)3
Goethite	5.04	4.80	-0.25	FeOOH
Goslarite	-5.06	-7.20	-2.13	ZnSO4:7H2O
Greenockite	-29.54	-46.32	-16.78	CdS
Greigite	-139.44	-184.47	-45.03	Fe3S4
Gypsum	-1.04	-5.64	-4.60	CaSO4:2H2O
H2(g)	-17.70	-20.76	-3.06	H2
H2O(g)	-2.06	-0.00	2.06	H2O
H2S(g)	-42.87	-43.63	-0.76	H2S
Hausmannite	-21.97	44.28	66.25	Mn3O4
Hematite	12.00	9.59	-2.41	Fe2O3
Huntite	-6.77	-35.40	-28.63	CaMg3(CO3)4
Hydromagnesite	-18.53	-24.58	-6.05	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	-7.17	-17.00	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-8.86	-16.45	-7.59	KFe3(SO4)2(OH)6
Jarosite-Na	-12.22	-15.62	-3.40	NaFe3(SO4)2(OH)6
JarositeH	-16.78	-19.31	-2.53	(H3O)Fe3(SO4)2(OH)6
Jurbanite	-4.33	-7.56	-3.23	AlOHSO4
Langite	-13.26	5.59	18.84	Cu4(OH)6SO4:H2O
Mackinawite	-36.77	-41.42	-4.65	FeS
Maghemite	3.21	9.59	6.39	Fe2O3
Magnesite	-1.19	-8.90	-7.71	MgCO3
Magnetite	12.70	19.06	6.35	Fe3O4
Malachite	-4.32	1.85	6.17	Cu2(OH)2CO3
Manganite	-7.63	17.71	25.34	MnOOH
Melanterite	-4.90	-7.39	-2.48	FeSO4:7H2O
Mirabilite	-7.38	-9.47	-2.10	Na2SO4:10H2O
Mn2(SO4)3	-65.14	-68.82	-3.69	Mn2(SO4)3
MnS(Green)	-46.12	-42.02	4.10	MnS
MnSO4	-11.46	-7.99	3.47	MnSO4
Monteponite	-10.49	4.56	15.05	CdO
Nahcolite	-4.94	-5.68	-0.74	NaHCO3
Natron	-10.41	-12.54	-2.13	Na2CO3:10H2O
Nesquehonite	-3.58	-8.90	-5.32	MgCO3:3H2O
Nsutite	-16.00	26.56	42.56	MnO2
O2(g)	-54.94	-57.66	-2.72	O2
Otavite	-3.25	-15.35	-12.10	CdCO3
Portlandite	-13.19	11.21	24.41	Ca(OH)2
Pyrite	-55.53	-74.59	-19.06	FeS2
Pyrochroite	-6.34	8.86	15.20	Mn(OH)2

Pyrolusite	-18.19	26.56	44.76	MnO2
Rhodochrosite	0.00	-11.06	-11.06	MnCO3
Rhodochrosite(d)	-0.67	-11.06	-10.39	MnCO3
Siderite	0.31	-10.45	-10.76	FeCO3
Siderite(d)(3)	0.00	-10.45	-10.45	FeCO3
Smithsonite	-0.49	-10.26	-9.77	ZnCO3
Sphalerite	-29.18	-41.23	-12.05	ZnS
Sulfur	-31.29	-46.72	-15.44	S
Tenorite	-2.80	5.61	8.41	CuO
Thenardite	-9.32	-9.47	-0.15	Na2SO4
Thermonatrite	-12.81	-12.54	0.27	Na2CO3:H2O
Trona	-18.35	-18.21	0.14	NaHCO3:Na2CO3:2H2O
Witherite	-4.74	-13.42	-8.67	BaCO3
Wurtzite	-31.28	-41.23	-9.94	ZnS
Zincite(c)	-2.62	9.66	12.27	ZnO
Zincosite	-11.20	-7.19	4.01	ZnSO4
Zn(OH)2-a	-2.80	9.65	12.45	Zn(OH)2
Zn(OH)2-b	-2.10	9.65	11.75	Zn(OH)2
Zn(OH)2-c	-2.55	9.65	12.20	Zn(OH)2
Zn(OH)2-e	-1.85	9.65	11.50	Zn(OH)2
Zn(OH)2-g	-2.06	9.65	11.71	Zn(OH)2
Zn2(OH)2SO4	-5.04	2.46	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-26.97	-4.73	22.23	ZnO:2ZnSO4
Zn4(OH)6SO4	-6.63	21.77	28.40	Zn4(OH)6SO4
ZnCO3:H2O	0.00	-10.26	-10.26	ZnCO3:H2O
ZnMetal	-35.71	-8.05	27.66	Zn
ZnO(a)	-1.65	9.66	11.31	ZnO
ZnS(a)	-31.98	-41.23	-9.24	ZnS
ZnSO4:H2O	-7.18	-7.19	-0.02	ZnSO4:H2O

End of simulation.

Reading input data for simulation 3.

End of run.

```
   Input file: \\Rgcserver1\rgc\Active Files\Active Projects\118_FaroMine\118013
Geochemical Analysis of GWQ\Water Quality Data\PhreeqcI\P03-06\P03-06.pqi
  Output file: \\Rgcserver1\rgc\Active Files\Active Projects\118_FaroMine\118013
Geochemical Analysis of GWQ\Water Quality Data\PhreeqcI\P03-06\P03-06.pqo
Database file: C:\Program Files\USGS\Phreeqc Interactive 2.14.3\wateq4f.dat

------------------
Reading data base.
------------------

      SOLUTION_MASTER_SPECIES
      SOLUTION_SPECIES
      PHASES
      EXCHANGE_MASTER_SPECIES
      EXCHANGE_SPECIES
      SURFACE_MASTER_SPECIES
      SURFACE_SPECIES
      RATES
      END
-----------------------------------
Reading input data for simulation 1.
-----------------------------------

      DATABASE C:\Program Files\USGS\Phreeqc Interactive 2.14.3\wateq4f.dat
      SOLUTION 1 P03-01-01     6/1/2007     Depth:  46.8
          temp      5.3
          pH        6.82
          pe        2.2
          redox     pe
          units     mg/l
          density   1
          Al        0.0058
          Alkalinity 208
          Ba        0.104
          Ca        76.1
          Cd        1.9e-005
          Cu        0.001
          Fe        4.03
          K         2.5
          Mg        13.9
          Mn        0.162
          Na        8
          Ni        0.001
          S(6)      24.9
          Zn        0.005
          water    1 # kg
      SAVE SOLUTION 1
      SOLUTION 2 P03-01-08     6/1/2007     Depth:  9.3
          temp      6
          pH        5.25
          pe        3.8
          redox     pe
          units     mg/l
          density   1
          Al        3.1
          Alkalinity 2
          Ba        0.4
          Ca        331
          Cd        0.0085
          Cu        0.5
          Fe        12300
          K         100
          Mg        569
          Mn        102
          Na        596
          Ni        0.001       # was below detection, but MDL = <0.5 mg/L
          S(6)      29600
```

```
        Zn        1590
        water    1 # kg
    SAVE SOLUTION 2
    SOLUTION 3  P01-08A     11-May-05   put in average temperature and tailings redox
        temp      4.5
        pH        7.37
        pe        3.8
        redox     pe
        units     mg/l
        density   1
        Al        0.208
        Alkalinity 109
        Ba        2.77
        Ca        6.03
        Cd        0.00113
        Cu        0.0217
        Fe        6.03
        Mg        1.67
        Mn        0.163
        Na        122
        Ni        0.01
        S(6)      165
        Zn        0.929
        water    1 # kg
    SAVE SOLUTION 3
    SOLUTION 4 FCS-4     7/13/2006
        temp      6
        pH        2.83
        pe        4.4
        redox     pe
        units     mg/l
        density   1
        Al        1
        Alkalinity 17.7
        Ba        0.05
        Ca        483
        Cd        0.05
        Cu        0.05
        Fe        558
        K         13
        Mg        615
        Mn        60.4
        Na        83
        Ni        0.56
        S(6)      5920
        Zn        289
        water    1 # kg
    SAVE SOLUTION 4
    MIX 1 Mixture of deep aquifer (P03-01-01), high strength tailings (P03-01-08), low
strength tailings (P01-08A) and Faro creek seepage (FCS-4)
        1    11.5
        2    0.124
        3    0.138
        4    0.75
    SAVE SOLUTION 5
    SELECTED_OUTPUT
        file                 P03-06 sim1.out
        reset                false
        simulation           true
        ph                   true
        pe                   true
        totals               Ca  Mg  Na  S(6)  Zn  Fe  Fe(2)
                              Fe(3)
        saturation_indices   Alunite  Barite  Basaluminite  Boehmite
                              Cd(OH)2  Fe(OH)3(a)  Fe3(OH)8  Gibbsite
                              Gypsum  Jarosite-K  Jarosite-Na  Jurbanite
                              Otavite  Rhodochrosite  Siderite  Zn2(OH)2SO4
```

Zn4(OH)6SO4

END

Beginning of initial solution calculations.

Initial solution 1. P03-01-01 6/1/2007 Depth: 46.8

----------Solution composition----------

Elements	Molality	Moles
Al	2.150e-007	2.150e-007
Alkalinity	4.157e-003	4.157e-003
Ba	7.575e-007	7.575e-007
Ca	1.899e-003	1.899e-003
Cd	1.691e-010	1.691e-010
Cu	1.574e-008	1.574e-008
Fe	7.219e-005	7.219e-005
K	6.396e-005	6.396e-005
Mg	5.719e-004	5.719e-004
Mn	2.950e-006	2.950e-006
Na	3.481e-004	3.481e-004
Ni	1.704e-008	1.704e-008
S(6)	2.593e-004	2.593e-004
Zn	7.651e-008	7.651e-008

----------Description of solution----------

pH	= 6.820
pe	= 2.200
Activity of water	= 1.000
Ionic strength	= 7.572e-003
Mass of water (kg)	= 1.000e+000
Total carbon (mol/kg)	= 5.993e-003
Total CO2 (mol/kg)	= 5.993e-003
Temperature (deg C)	= 5.300
Electrical balance (eq)	= 8.314e-004
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= 8.44
Iterations	= 10
Total H	= 1.110166e+002
Total O	= 5.552340e+001

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	1.638e-007	1.514e-007	-6.786	-6.820	-0.034
OH-	1.375e-008	1.259e-008	-7.862	-7.900	-0.038
H2O	5.551e+001	9.998e-001	1.744	-0.000	0.000
Al	2.150e-007				
Al(OH)4-	1.275e-007	1.167e-007	-6.894	-6.933	-0.038
Al(OH)2+	6.422e-008	5.878e-008	-7.192	-7.231	-0.038
AlOH+2	1.125e-008	7.897e-009	-7.949	-8.103	-0.154
Al(OH)3	1.084e-008	1.086e-008	-7.965	-7.964	0.001
Al+3	1.018e-009	4.587e-010	-8.992	-9.338	-0.346
AlSO4+	1.853e-010	1.696e-010	-9.732	-9.771	-0.038
Al(SO4)2-	8.166e-013	7.474e-013	-12.088	-12.126	-0.038
AlHSO4+2	2.881e-018	2.022e-018	-17.540	-17.694	-0.154
Ba	7.575e-007				
Ba+2	7.087e-007	4.973e-007	-6.150	-6.303	-0.154
BaSO4	3.824e-008	3.831e-008	-7.417	-7.417	0.001
BaHCO3+	1.047e-008	9.585e-009	-7.980	-8.018	-0.038
BaCO3	1.201e-010	1.203e-010	-9.920	-9.920	0.001
BaOH+	1.216e-013	1.113e-013	-12.915	-12.953	-0.038
C(4)	5.993e-003				

HCO3-	4.073e-003	3.738e-003	-2.390	-2.427	-0.037
CO2	1.840e-003	1.843e-003	-2.735	-2.734	0.001
CaHCO3+	4.242e-005	3.883e-005	-4.372	-4.411	-0.038
MgHCO3+	1.778e-005	1.627e-005	-4.750	-4.789	-0.038
FeHCO3+	1.577e-005	1.444e-005	-4.802	-4.841	-0.038
CaCO3	1.203e-006	1.205e-006	-5.920	-5.919	0.001
CO3-2	9.810e-007	6.957e-007	-6.008	-6.158	-0.149
NaHCO3	6.674e-007	6.685e-007	-6.176	-6.175	0.001
FeCO3	6.434e-007	6.445e-007	-6.192	-6.191	0.001
MnHCO3+	5.765e-007	5.276e-007	-6.239	-6.278	-0.038
MgCO3	1.904e-007	1.907e-007	-6.720	-6.720	0.001
MnCO3	8.737e-008	8.752e-008	-7.059	-7.058	0.001
ZnHCO3+	1.861e-008	1.704e-008	-7.730	-7.769	-0.038
NiCO3	1.223e-008	1.225e-008	-7.912	-7.912	0.001
BaHCO3+	1.047e-008	9.585e-009	-7.980	-8.018	-0.038
CuCO3	5.248e-009	5.258e-009	-8.280	-8.279	0.001
ZnCO3	5.017e-009	5.025e-009	-8.300	-8.299	0.001
CuHCO3+	2.880e-009	2.636e-009	-8.541	-8.579	-0.038
NaCO3-	1.553e-009	1.422e-009	-8.809	-8.847	-0.038
NiHCO3+	1.339e-009	1.226e-009	-8.873	-8.912	-0.038
BaCO3	1.201e-010	1.203e-010	-9.920	-9.920	0.001
Zn(CO3)2-2	1.065e-010	7.474e-011	-9.973	-10.126	-0.154
Ni(CO3)2-2	2.111e-011	1.481e-011	-10.676	-10.829	-0.154
CdHCO3+	1.370e-011	1.254e-011	-10.863	-10.902	-0.038
Cu(CO3)2-2	6.561e-012	4.605e-012	-11.183	-11.337	-0.154
CdCO3	5.853e-014	5.863e-014	-13.233	-13.232	0.001
Cd(CO3)2-2	1.838e-016	1.290e-016	-15.736	-15.889	-0.154
Ca 1.899e-003					
Ca+2	1.823e-003	1.292e-003	-2.739	-2.889	-0.149
CaHCO3+	4.242e-005	3.883e-005	-4.372	-4.411	-0.038
CaSO4	3.249e-005	3.254e-005	-4.488	-4.488	0.001
CaCO3	1.203e-006	1.205e-006	-5.920	-5.919	0.001
CaOH+	1.548e-009	1.417e-009	-8.810	-8.849	-0.038
CaHSO4+	2.594e-011	2.374e-011	-10.586	-10.624	-0.038
Cd 1.691e-010					
Cd+2	1.512e-010	1.061e-010	-9.820	-9.974	-0.154
CdHCO3+	1.370e-011	1.254e-011	-10.863	-10.902	-0.038
CdSO4	4.127e-012	4.134e-012	-11.384	-11.384	0.001
CdCO3	5.853e-014	5.863e-014	-13.233	-13.232	0.001
CdOH+	1.333e-014	1.220e-014	-13.875	-13.914	-0.038
Cd(SO4)2-2	1.129e-014	7.925e-015	-13.947	-14.101	-0.154
Cd(CO3)2-2	1.838e-016	1.290e-016	-15.736	-15.889	-0.154
Cd(OH)2	2.064e-017	2.068e-017	-16.685	-16.684	0.001
Cd2OH+3	1.829e-023	8.243e-024	-22.738	-23.084	-0.346
Cd(OH)3-	1.675e-023	1.533e-023	-22.776	-22.815	-0.038
Cd(OH)4-2	1.286e-030	9.025e-031	-29.891	-30.045	-0.154
Cu(1) 4.181e-009					
Cu+	4.181e-009	3.827e-009	-8.379	-8.417	-0.038
Cu(2) 1.156e-008					
CuCO3	5.248e-009	5.258e-009	-8.280	-8.279	0.001
CuHCO3+	2.880e-009	2.636e-009	-8.541	-8.579	-0.038
Cu+2	2.005e-009	1.407e-009	-8.698	-8.852	-0.154
Cu(OH)2	1.281e-009	1.283e-009	-8.893	-8.892	0.001
CuOH+	1.016e-010	9.296e-011	-9.993	-10.032	-0.038
CuSO4	3.811e-011	3.817e-011	-10.419	-10.418	0.001
Cu(CO3)2-2	6.561e-012	4.605e-012	-11.183	-11.337	-0.154
Cu2(OH)2+2	6.636e-016	4.657e-016	-15.178	-15.332	-0.154
Cu(OH)3-	5.580e-016	5.107e-016	-15.253	-15.292	-0.038
Cu(OH)4-2	9.592e-022	6.731e-022	-21.018	-21.172	-0.154
Fe(2) 7.218e-005					
Fe+2	5.503e-005	3.862e-005	-4.259	-4.413	-0.154
FeHCO3+	1.577e-005	1.444e-005	-4.802	-4.841	-0.038
FeSO4	7.165e-007	7.177e-007	-6.145	-6.144	0.001
FeCO3	6.434e-007	6.445e-007	-6.192	-6.191	0.001
FeOH+	1.823e-008	1.668e-008	-7.739	-7.778	-0.038
FeHSO4+	7.753e-013	7.096e-013	-12.111	-12.149	-0.038
Fe(OH)2	1.495e-013	1.497e-013	-12.825	-12.825	0.001

Fe(OH)3-	3.264e-017	2.988e-017	-16.486	-16.525	-0.038
Fe(3)	3.194e-009				
Fe(OH)2+	2.434e-009	2.228e-009	-8.614	-8.652	-0.038
Fe(OH)3	7.547e-010	7.561e-010	-9.122	-9.121	0.001
FeOH+2	3.230e-012	2.267e-012	-11.491	-11.645	-0.154
Fe(OH)4-	2.132e-012	1.951e-012	-11.671	-11.710	-0.038
Fe+3	4.082e-016	1.840e-016	-15.389	-15.735	-0.346
FeSO4+	2.124e-016	1.944e-016	-15.673	-15.711	-0.038
Fe(SO4)2-	6.577e-019	6.020e-019	-18.182	-18.220	-0.038
Fe2(OH)2+4	1.364e-021	3.307e-022	-20.865	-21.481	-0.615
FeHSO4+2	1.210e-022	8.492e-023	-21.917	-22.071	-0.154
Fe3(OH)4+5	9.862e-027	1.078e-027	-26.006	-26.967	-0.961
H(0)	1.590e-021				
H2	7.952e-022	7.966e-022	-21.100	-21.099	0.001
K	6.396e-005				
K+	6.391e-005	5.842e-005	-4.194	-4.233	-0.039
KSO4-	4.770e-008	4.366e-008	-7.321	-7.360	-0.038
Mg	5.719e-004				
Mg+2	5.458e-004	3.888e-004	-3.263	-3.410	-0.147
MgHCO3+	1.778e-005	1.627e-005	-4.750	-4.789	-0.038
MgSO4	8.121e-006	8.136e-006	-5.090	-5.090	0.001
MgCO3	1.904e-007	1.907e-007	-6.720	-6.720	0.001
MgOH+	1.516e-009	1.388e-009	-8.819	-8.858	-0.038
Mn(2)	2.950e-006				
Mn+2	2.257e-006	1.584e-006	-5.646	-5.800	-0.154
MnHCO3+	5.765e-007	5.276e-007	-6.239	-6.278	-0.038
MnCO3	8.737e-008	8.752e-008	-7.059	-7.058	0.001
MnSO4	2.890e-008	2.895e-008	-7.539	-7.538	0.001
MnOH+	5.264e-011	4.818e-011	-10.279	-10.317	-0.038
Mn(OH)3-	7.906e-021	7.236e-021	-20.102	-20.140	-0.038
Mn(3)	7.904e-031				
Mn+3	7.904e-031	3.563e-031	-30.102	-30.448	-0.346
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-68.506	-68.660	-0.154
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-77.185	-77.224	-0.038
Na	3.481e-004				
Na+	3.472e-004	3.181e-004	-3.459	-3.498	-0.038
NaHCO3	6.674e-007	6.685e-007	-6.176	-6.175	0.001
NaSO4-	2.342e-007	2.143e-007	-6.630	-6.669	-0.038
NaCO3-	1.553e-009	1.422e-009	-8.809	-8.847	-0.038
Ni	1.704e-008				
NiCO3	1.223e-008	1.225e-008	-7.912	-7.912	0.001
Ni+2	3.386e-009	2.376e-009	-8.470	-8.624	-0.154
NiHCO3+	1.339e-009	1.226e-009	-8.873	-8.912	-0.038
NiSO4	5.928e-011	5.939e-011	-10.227	-10.226	0.001
Ni(CO3)2-2	2.111e-011	1.481e-011	-10.676	-10.829	-0.154
NiOH+	5.372e-013	4.917e-013	-12.270	-12.308	-0.038
Ni(OH)2	1.035e-014	1.037e-014	-13.985	-13.984	0.001
Ni(SO4)2-2	8.375e-016	5.877e-016	-15.077	-15.231	-0.154
Ni(OH)3-	7.484e-019	6.849e-019	-18.126	-18.164	-0.038
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-56.991	-56.990	0.001
S(6)	2.593e-004				
SO4-2	2.176e-004	1.537e-004	-3.662	-3.813	-0.151
CaSO4	3.249e-005	3.254e-005	-4.488	-4.488	0.001
MgSO4	8.121e-006	8.136e-006	-5.090	-5.090	0.001
FeSO4	7.165e-007	7.177e-007	-6.145	-6.144	0.001
NaSO4-	2.342e-007	2.143e-007	-6.630	-6.669	-0.038
KSO4-	4.770e-008	4.366e-008	-7.321	-7.360	-0.038
BaSO4	3.824e-008	3.831e-008	-7.417	-7.417	0.001
MnSO4	2.890e-008	2.895e-008	-7.539	-7.538	0.001
HSO4-	1.670e-009	1.528e-009	-8.777	-8.816	-0.038
ZnSO4	1.107e-009	1.109e-009	-8.956	-8.955	0.001
AlSO4+	1.853e-010	1.696e-010	-9.732	-9.771	-0.038
NiSO4	5.928e-011	5.939e-011	-10.227	-10.226	0.001
CuSO4	3.811e-011	3.817e-011	-10.419	-10.418	0.001

CaHSO4+	2.594e-011	2.374e-011	-10.586	-10.624	-0.038
CdSO4	4.127e-012	4.134e-012	-11.384	-11.384	0.001
Zn(SO4)2-2	2.322e-012	1.630e-012	-11.634	-11.788	-0.154
Al(SO4)2-	8.166e-013	7.474e-013	-12.088	-12.126	-0.038
FeHSO4+	7.753e-013	7.096e-013	-12.111	-12.149	-0.038
Cd(SO4)2-2	1.129e-014	7.925e-015	-13.947	-14.101	-0.154
Ni(SO4)2-2	8.375e-016	5.877e-016	-15.077	-15.231	-0.154
FeSO4+	2.124e-016	1.944e-016	-15.673	-15.711	-0.038
AlHSO4+2	2.881e-018	2.022e-018	-17.540	-17.694	-0.154
Fe(SO4)2-	6.577e-019	6.020e-019	-18.182	-18.220	-0.038
FeHSO4+2	1.210e-022	8.492e-023	-21.917	-22.071	-0.154
Zn	7.651e-008				
Zn+2	5.159e-008	3.620e-008	-7.287	-7.441	-0.154
ZnHCO3+	1.861e-008	1.704e-008	-7.730	-7.769	-0.038
ZnCO3	5.017e-009	5.025e-009	-8.300	-8.299	0.001
ZnSO4	1.107e-009	1.109e-009	-8.956	-8.955	0.001
Zn(CO3)2-2	1.065e-010	7.474e-011	-9.973	-10.126	-0.154
ZnOH+	5.784e-011	5.294e-011	-10.238	-10.276	-0.038
Zn(OH)2	1.985e-011	1.989e-011	-10.702	-10.701	0.001
Zn(SO4)2-2	2.322e-012	1.630e-012	-11.634	-11.788	-0.154
Zn(OH)3-	4.539e-016	4.155e-016	-15.343	-15.381	-0.038
Zn(OH)4-2	6.199e-022	4.350e-022	-21.208	-21.362	-0.154

-------------------------------Saturation indices-------------------------------

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-1.05	11.12	12.17	Al(OH)3
AlumK	-15.66	-21.20	-5.54	KAl(SO4)2:12H2O
Alunite	-0.16	1.04	1.21	KAl3(SO4)2(OH)6
Anhydrite	-2.36	-6.70	-4.34	CaSO4
Antlerite	-11.38	-3.09	8.29	Cu3(OH)4SO4
Aragonite	-0.81	-9.05	-8.24	CaCO3
Artinite	-10.43	0.66	11.09	MgCO3:Mg(OH)2:3H2O
Azurite	-9.48	-4.13	5.35	Cu3(OH)2(CO3)2
Barite	0.23	-10.12	-10.35	BaSO4
Basaluminite	4.33	27.03	22.70	Al4(OH)10SO4
Bianchite	-9.50	-11.25	-1.76	ZnSO4:6H2O
Birnessite	-17.72	25.88	43.60	MnO2
Bixbyite	-20.16	-19.98	0.18	Mn2O3
Boehmite	1.08	11.12	10.05	AlOOH
Brochantite	-13.64	1.70	15.34	Cu4(OH)6SO4
Brucite	-8.02	10.23	18.25	Mg(OH)2
Bunsenite	-8.67	5.02	13.69	NiO
Calcite	-0.65	-9.05	-8.40	CaCO3
Cd(gamma)	-28.91	-14.37	14.53	Cd
Cd(OH)2	-9.98	3.67	13.65	Cd(OH)2
Cd(OH)2(a)	-11.14	3.67	14.81	Cd(OH)2
Cd3(OH)2(SO4)2	-30.62	-23.91	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-29.02	-6.46	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-31.19	-2.79	28.40	Cd4(OH)6SO4
CdMetal	-28.80	-14.37	14.42	Cd
CdSO4	-14.45	-13.79	0.66	CdSO4
CdSO4:2.7H2O	-12.14	-13.79	-1.65	CdSO4:2.67H2O
CdSO4:H2O	-12.52	-13.79	-1.27	CdSO4:H2O
Chalcanthite	-9.95	-12.67	-2.71	CuSO4:5H2O
CO2(g)	-1.54	-2.73	-1.20	CO2
Cu(OH)2	-4.64	4.79	9.43	Cu(OH)2
Cu2SO4	-18.93	-20.65	-1.71	Cu2SO4
CuCO3	-5.38	-15.01	-9.63	CuCO3
CuMetal	-0.97	-10.62	-9.65	Cu
CuOCuSO4	-21.25	-7.88	13.37	CuO:CuSO4
CupricFerrite	6.35	14.24	7.89	CuFe2O4
Cuprite	-1.32	-3.19	-1.87	Cu2O
CuprousFerrite	11.85	3.13	-8.72	CuFeO2
CuSO4	-16.62	-12.66	3.95	CuSO4
Diaspore	2.96	11.12	8.16	AlOOH

Dolomite	-2.01	-18.61	-16.60	CaMg(CO3)2
Dolomite(d)	-2.65	-18.61	-15.96	CaMg(CO3)2
Epsomite	-4.94	-7.22	-2.29	MgSO4:7H2O
Fe(OH)3(a)	-0.17	4.72	4.89	Fe(OH)3
Fe3(OH)8	-1.55	18.68	20.22	Fe3(OH)8
Gibbsite	1.83	11.12	9.29	Al(OH)3
Goethite	4.97	4.72	-0.25	FeOOH
Goslarite	-9.12	-11.26	-2.13	ZnSO4:7H2O
Gypsum	-2.10	-6.70	-4.60	CaSO4:2H2O
H2(g)	-18.04	-21.10	-3.06	H2
H2O(g)	-2.06	-0.00	2.06	H2O
Hausmannite	-24.69	41.56	66.25	Mn3O4
Hematite	11.86	9.45	-2.41	Fe2O3
Huntite	-9.12	-37.75	-28.63	CaMg3(CO3)4
Hydromagnesite	-21.99	-28.04	-6.05	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	-8.81	-18.64	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-10.56	-18.15	-7.59	KFe3(SO4)2(OH)6
Jarosite-Na	-14.01	-17.41	-3.40	NaFe3(SO4)2(OH)6
JarositeH	-18.20	-20.73	-2.53	(H3O)Fe3(SO4)2(OH)6
Jurbanite	-3.10	-6.33	-3.23	AlOHSO4
Langite	-17.14	1.70	18.84	Cu4(OH)6SO4:H2O
Maghemite	3.06	9.45	6.39	Fe2O3
Magnesite	-1.86	-9.57	-7.71	MgCO3
Magnetite	12.32	18.68	6.35	Fe3O4
Malachite	-5.85	0.33	6.17	Cu2(OH)2CO3
Manganite	-8.48	16.86	25.34	MnOOH
Melanterite	-5.75	-8.23	-2.48	FeSO4:7H2O
Mirabilite	-8.71	-10.81	-2.10	Na2SO4:10H2O
Mn2(SO4)3	-68.65	-72.34	-3.69	Mn2(SO4)3
MnSO4	-13.09	-9.61	3.47	MnSO4
Monteponite	-11.39	3.67	15.05	CdO
Morenosite	-9.93	-12.44	-2.51	NiSO4:7H2O
Nahcolite	-5.18	-5.92	-0.74	NaHCO3
Natron	-11.03	-13.15	-2.13	Na2CO3:10H2O
Nesquehonite	-4.25	-9.57	-5.32	MgCO3:3H2O
Ni(OH)2	-4.21	5.02	9.22	Ni(OH)2
Ni4(OH)6SO4	-29.39	2.61	32.00	Ni4(OH)6SO4
NiCO3	-8.46	-14.78	-6.32	NiCO3
Nsutite	-16.68	25.88	42.56	MnO2
O2(g)	-54.27	-56.99	-2.72	O2
Otavite	-4.03	-16.13	-12.10	CdCO3
Portlandite	-13.66	10.75	24.41	Ca(OH)2
Pyrochroite	-7.36	7.84	15.20	Mn(OH)2
Pyrolusite	-18.88	25.88	44.76	MnO2
Retgersite	-10.34	-12.44	-2.10	NiSO4:6H2O
Rhodochrosite	-0.90	-11.96	-11.06	MnCO3
Rhodochrosite(d)	-1.57	-11.96	-10.39	MnCO3
Siderite	0.19	-10.57	-10.76	FeCO3
Siderite(d)(3)	-0.12	-10.57	-10.45	FeCO3
Smithsonite	-3.82	-13.60	-9.77	ZnCO3
Tenorite	-3.62	4.79	8.41	CuO
Thenardite	-10.66	-10.81	-0.15	Na2SO4
Thermonatrite	-13.42	-13.15	0.27	Na2CO3:H2O
Trona	-19.22	-19.08	0.14	NaHCO3:Na2CO3:2H2O
Witherite	-3.79	-12.46	-8.67	BaCO3
Zincite(c)	-6.07	6.20	12.27	ZnO
Zincosite	-15.26	-11.25	4.01	ZnSO4
Zn(OH)2-a	-6.25	6.20	12.45	Zn(OH)2
Zn(OH)2-b	-5.55	6.20	11.75	Zn(OH)2
Zn(OH)2-c	-6.00	6.20	12.20	Zn(OH)2
Zn(OH)2-e	-5.30	6.20	11.50	Zn(OH)2
Zn(OH)2-g	-5.51	6.20	11.71	Zn(OH)2
Zn2(OH)2SO4	-12.56	-5.06	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-38.55	-16.31	22.24	ZnO:2ZnSO4
Zn4(OH)6SO4	-21.06	7.34	28.40	Zn4(OH)6SO4
ZnCO3:H2O	-3.34	-13.60	-10.26	ZnCO3:H2O
ZnMetal	-39.51	-11.84	27.66	Zn

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      ZnO(a)           -5.11    6.20   11.31  ZnO
      ZnSO4:H2O       -11.24  -11.25   -0.02  ZnSO4:H2O

Initial solution 2.     P03-01-08     6/1/2007     Depth:  9.3

----------------------------Solution composition-----------------------------

      Elements           Molality       Moles

      Al               1.203e-004  1.203e-004
      Alkalinity       4.185e-005  4.185e-005
      Ba               3.050e-006  3.050e-006
      Ca               8.649e-003  8.649e-003
      Cd               7.920e-008  7.920e-008
      Cu               8.241e-006  8.241e-006
      Fe               2.307e-001  2.307e-001
      K                2.678e-003  2.678e-003
      Mg               2.451e-002  2.451e-002
      Mn               1.945e-003  1.945e-003
      Na               2.715e-002  2.715e-002
      Ni               1.784e-008  1.784e-008
      S(6)             3.227e-001  3.227e-001
      Zn               2.547e-002  2.547e-002

---------------------------Description of solution---------------------------

                                    pH  =   5.250
                                    pe  =   3.800
                       Activity of water  =   0.992
                          Ionic strength  =  6.193e-001
                       Mass of water (kg)  =  1.000e+000
                  Total carbon (mol/kg)  =  2.326e-004
                     Total CO2 (mol/kg)  =  2.326e-004
                    Temperature (deg C)  =   6.000
                  Electrical balance (eq)  = -3.277e-002
 Percent error, 100*(Cat-|An|)/(Cat+|An|)  =  -5.17
                                Iterations  =  10
                                   Total H  = 1.110125e+002
                                   Total O  = 5.679764e+001

----------------------------Distribution of species----------------------------

                                                 Log       Log         Log
   Species                Molality    Activity  Molality  Activity     Gamma

   H+                   7.376e-006  5.623e-006    -5.132    -5.250    -0.118
   OH-                  4.795e-010  3.588e-010    -9.319    -9.445    -0.126
   H2O                  5.551e+001  9.919e-001     1.744    -0.004     0.000
Al              1.203e-004
   AlSO4+               5.931e-005  4.438e-005    -4.227    -4.353    -0.126
   Al(SO4)2-            5.182e-005  3.878e-005    -4.285    -4.411    -0.126
   Al+3                 8.184e-006  6.013e-007    -5.087    -6.221    -1.134
   AlOH+2               9.270e-007  2.905e-007    -6.033    -6.537    -0.504
   Al(OH)2+             8.335e-008  6.236e-008    -7.079    -7.205    -0.126
   Al(OH)3              2.852e-010  3.289e-010    -9.545    -9.483     0.062
   Al(OH)4-             1.262e-010  9.445e-011    -9.899   -10.025    -0.126
   AlHSO4+2             6.285e-011  1.970e-011   -10.202   -10.706    -0.504
Ba              3.050e-006
   BaSO4                2.456e-006  2.833e-006    -5.610    -5.548     0.062
   Ba+2                 5.941e-007  1.862e-007    -6.226    -6.730    -0.504
   BaHCO3+              1.362e-011  1.019e-011   -10.866   -10.992    -0.126
   BaCO3                3.029e-015  3.493e-015   -14.519   -14.457     0.062
   BaOH+                1.487e-015  1.113e-015   -14.828   -14.954    -0.126
C(4)            2.326e-004
   CO2                  1.633e-004  1.883e-004    -3.787    -3.725     0.062
   FeHCO3+              4.984e-005  3.729e-005    -4.302    -4.428    -0.126
   HCO3-                1.513e-005  1.038e-005    -4.820    -4.984    -0.163
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ZnHCO3+	3.162e-006	2.366e-006	-5.500	-5.626	-0.126
MgHCO3+	5.448e-007	4.076e-007	-6.264	-6.390	-0.126
MnHCO3+	3.775e-007	2.824e-007	-6.423	-6.549	-0.126
CaHCO3+	1.211e-007	9.059e-008	-6.917	-7.043	-0.126
NaHCO3	8.711e-008	1.005e-007	-7.060	-6.998	0.062
FeCO3	3.973e-008	4.582e-008	-7.401	-7.339	0.062
ZnCO3	1.665e-008	1.921e-008	-7.779	-7.717	0.062
CuHCO3+	7.196e-009	5.384e-009	-8.143	-8.269	-0.126
MnCO3	1.118e-009	1.289e-009	-8.952	-8.890	0.062
CuCO3	2.562e-010	2.955e-010	-9.591	-9.529	0.062
CO3-2	2.396e-010	5.319e-011	-9.621	-10.274	-0.654
MgCO3	1.152e-010	1.329e-010	-9.938	-9.876	0.062
CaCO3	6.562e-011	7.568e-011	-10.183	-10.121	0.062
BaHCO3+	1.362e-011	1.019e-011	-10.866	-10.992	-0.126
NaCO3-	8.183e-012	6.123e-012	-11.087	-11.213	-0.126
NiHCO3+	4.535e-012	3.393e-012	-11.343	-11.469	-0.126
CdHCO3+	1.810e-012	1.354e-012	-11.742	-11.868	-0.126
NiCO3	8.094e-013	9.335e-013	-12.092	-12.030	0.062
Zn(CO3)2-2	6.969e-014	2.184e-014	-13.157	-13.661	-0.504
BaCO3	3.029e-015	3.493e-015	-14.519	-14.457	0.062
CdCO3	1.511e-016	1.743e-016	-15.821	-15.759	0.062
Cu(CO3)2-2	6.314e-017	1.979e-017	-16.200	-16.704	-0.504
Ni(CO3)2-2	2.753e-019	8.628e-020	-18.560	-19.064	-0.504
Cd(CO3)2-2	9.354e-023	2.931e-023	-22.029	-22.533	-0.504
Ca	8.649e-003				
CaSO4	4.609e-003	5.316e-003	-2.336	-2.274	0.062
Ca+2	4.040e-003	1.061e-003	-2.394	-2.974	-0.581
CaHSO4+	1.936e-007	1.448e-007	-6.713	-6.839	-0.126
CaHCO3+	1.211e-007	9.059e-008	-6.917	-7.043	-0.126
CaCO3	6.562e-011	7.568e-011	-10.183	-10.121	0.062
CaOH+	4.150e-011	3.105e-011	-10.382	-10.508	-0.126
Cd	7.920e-008				
Cd(SO4)2-2	3.837e-008	1.202e-008	-7.416	-7.920	-0.504
CdSO4	2.767e-008	3.191e-008	-7.558	-7.496	0.062
Cd+2	1.316e-008	4.125e-009	-7.881	-8.385	-0.504
CdHCO3+	1.810e-012	1.354e-012	-11.742	-11.868	-0.126
CdOH+	1.796e-014	1.344e-014	-13.746	-13.872	-0.126
CdCO3	1.511e-016	1.743e-016	-15.821	-15.759	0.062
Cd(OH)2	4.971e-019	5.733e-019	-18.304	-18.242	0.062
Cd2OH+3	4.758e-021	3.496e-022	-20.323	-21.456	-1.134
Cd(CO3)2-2	9.354e-023	2.931e-023	-22.029	-22.533	-0.504
Cd(OH)3-	1.517e-026	1.135e-026	-25.819	-25.945	-0.126
Cd(OH)4-2	5.692e-035	1.784e-035	-34.245	-34.749	-0.504
Cu(1)	9.516e-008				
Cu+	9.516e-008	7.120e-008	-7.022	-7.148	-0.126
Cu(2)	8.146e-006				
CuSO4	4.834e-006	5.575e-006	-5.316	-5.254	0.062
Cu+2	3.301e-006	1.035e-006	-5.481	-5.985	-0.504
CuHCO3+	7.196e-009	5.384e-009	-8.143	-8.269	-0.126
CuOH+	2.439e-009	1.825e-009	-8.613	-8.739	-0.126
Cu(OH)2	5.832e-010	6.725e-010	-9.234	-9.172	0.062
CuCO3	2.562e-010	2.955e-010	-9.591	-9.529	0.062
Cu2(OH)2+2	6.201e-013	1.943e-013	-12.208	-12.711	-0.504
Cu(CO3)2-2	6.314e-017	1.979e-017	-16.200	-16.704	-0.504
Cu(OH)3-	9.553e-018	7.148e-018	-17.020	-17.146	-0.126
Cu(OH)4-2	8.027e-025	2.516e-025	-24.095	-24.599	-0.504
Fe(2)	2.307e-001				
FeSO4	1.160e-001	1.338e-001	-0.936	-0.874	0.062
Fe+2	1.146e-001	3.591e-002	-0.941	-1.445	-0.504
FeHCO3+	4.984e-005	3.729e-005	-4.302	-4.428	-0.126
FeHSO4+	6.554e-006	4.904e-006	-5.183	-5.309	-0.126
FeOH+	5.877e-007	4.397e-007	-6.231	-6.357	-0.126
FeCO3	3.973e-008	4.582e-008	-7.401	-7.339	0.062
Fe(OH)2	9.799e-014	1.130e-013	-13.009	-12.947	0.062
Fe(OH)3-	8.110e-019	6.068e-019	-18.091	-18.217	-0.126
Fe(3)	1.005e-007				
Fe(OH)2+	8.874e-008	6.640e-008	-7.052	-7.178	-0.126

FeOH+2	7.832e-009	2.454e-009	-8.106	-8.610	-0.504
FeSO4+	2.021e-009	1.512e-009	-8.694	-8.820	-0.126
Fe(SO4)2-	1.240e-009	9.278e-010	-8.907	-9.033	-0.126
Fe(OH)3	5.402e-010	6.230e-010	-9.267	-9.206	0.062
Fe+3	9.687e-011	7.118e-012	-10.014	-11.148	-1.134
FeHSO4+2	7.790e-014	2.441e-014	-13.108	-13.612	-0.504
Fe(OH)4-	5.925e-014	4.433e-014	-13.227	-13.353	-0.126
Fe2(OH)2+4	3.889e-014	3.751e-016	-13.410	-15.426	-2.016
Fe3(OH)4+5	4.776e-017	3.384e-020	-16.321	-19.471	-3.150
H(0)	1.194e-021				
H2	5.968e-022	6.883e-022	-21.224	-21.162	0.062
K	2.678e-003				
K+	2.376e-003	1.513e-003	-2.624	-2.820	-0.196
KSO4-	3.027e-004	2.265e-004	-3.519	-3.645	-0.126
Mg	2.451e-002				
MgSO4	1.283e-002	1.479e-002	-1.892	-1.830	0.062
Mg+2	1.168e-002	3.506e-003	-1.932	-2.455	-0.523
MgHCO3+	5.448e-007	4.076e-007	-6.264	-6.390	-0.126
MgOH+	4.802e-010	3.593e-010	-9.319	-9.445	-0.126
MgCO3	1.152e-010	1.329e-010	-9.938	-9.876	0.062
Mn(2)	1.945e-003				
Mn+2	9.740e-004	3.052e-004	-3.011	-3.515	-0.504
MnSO4	9.702e-004	1.119e-003	-3.013	-2.951	0.062
MnHCO3+	3.775e-007	2.824e-007	-6.423	-6.549	-0.126
MnCO3	1.118e-009	1.289e-009	-8.952	-8.890	0.062
MnOH+	3.537e-010	2.646e-010	-9.451	-9.577	-0.126
Mn(OH)3-	3.548e-023	2.655e-023	-22.450	-22.576	-0.126
Mn(3)	4.181e-026				
Mn+3	4.181e-026	3.072e-027	-25.379	-26.513	-1.134
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-71.750	-72.254	-0.504
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-79.039	-79.165	-0.126
Na	2.715e-002				
Na+	2.407e-002	1.721e-002	-1.618	-1.764	-0.146
NaSO4-	3.077e-003	2.302e-003	-2.512	-2.638	-0.126
NaHCO3	8.711e-008	1.005e-007	-7.060	-6.998	0.062
NaCO3-	8.183e-012	6.123e-012	-11.087	-11.213	-0.126
Ni	1.784e-008				
NiSO4	1.021e-008	1.177e-008	-7.991	-7.929	0.062
Ni+2	7.555e-009	2.368e-009	-8.122	-8.626	-0.504
Ni(SO4)2-2	7.292e-011	2.285e-011	-10.137	-10.641	-0.504
NiHCO3+	4.535e-012	3.393e-012	-11.343	-11.469	-0.126
NiCO3	8.094e-013	9.335e-013	-12.092	-12.030	0.062
NiOH+	1.850e-014	1.384e-014	-13.733	-13.859	-0.126
Ni(OH)2	6.387e-018	7.366e-018	-17.195	-17.133	0.062
Ni(CO3)2-2	2.753e-019	8.628e-020	-18.560	-19.064	-0.504
Ni(OH)3-	1.737e-023	1.299e-023	-22.760	-22.886	-0.126
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-56.674	-56.612	0.062
S(6)	3.227e-001				
SO4-2	1.549e-001	3.036e-002	-0.810	-1.518	-0.708
FeSO4	1.160e-001	1.338e-001	-0.936	-0.874	0.062
MgSO4	1.283e-002	1.479e-002	-1.892	-1.830	0.062
Zn(SO4)2-2	1.014e-002	3.179e-003	-1.994	-2.498	-0.504
ZnSO4	9.553e-003	1.102e-002	-2.020	-1.958	0.062
CaSO4	4.609e-003	5.316e-003	-2.336	-2.274	0.062
NaSO4-	3.077e-003	2.302e-003	-2.512	-2.638	-0.126
MnSO4	9.702e-004	1.119e-003	-3.013	-2.951	0.062
KSO4-	3.027e-004	2.265e-004	-3.519	-3.645	-0.126
AlSO4+	5.931e-005	4.438e-005	-4.227	-4.353	-0.126
Al(SO4)2-	5.182e-005	3.878e-005	-4.285	-4.411	-0.126
HSO4-	1.518e-005	1.136e-005	-4.819	-4.945	-0.126
FeHSO4+	6.554e-006	4.904e-006	-5.183	-5.309	-0.126
CuSO4	4.834e-006	5.575e-006	-5.316	-5.254	0.062
BaSO4	2.456e-006	2.833e-006	-5.610	-5.548	0.062
CaHSO4+	1.936e-007	1.448e-007	-6.713	-6.839	-0.126

Cd(SO4)2-2	3.837e-008	1.202e-008	-7.416	-7.920	-0.504
CdSO4	2.767e-008	3.191e-008	-7.558	-7.496	0.062
NiSO4	1.021e-008	1.177e-008	-7.991	-7.929	0.062
FeSO4+	2.021e-009	1.512e-009	-8.694	-8.820	-0.126
Fe(SO4)2-	1.240e-009	9.278e-010	-8.907	-9.033	-0.126
Ni(SO4)2-2	7.292e-011	2.285e-011	-10.137	-10.641	-0.504
AlHSO4+2	6.285e-011	1.970e-011	-10.202	-10.706	-0.504
FeHSO4+2	7.790e-014	2.441e-014	-13.108	-13.612	-0.504
Zn	2.547e-002				
Zn(SO4)2-2	1.014e-002	3.179e-003	-1.994	-2.498	-0.504
ZnSO4	9.553e-003	1.102e-002	-2.020	-1.958	0.062
Zn+2	5.775e-003	1.810e-003	-2.238	-2.742	-0.504
ZnHCO3+	3.162e-006	2.366e-006	-5.500	-5.626	-0.126
ZnOH+	1.004e-007	7.509e-008	-6.998	-7.124	-0.126
ZnCO3	1.665e-008	1.921e-008	-7.779	-7.717	0.062
Zn(OH)2	6.147e-010	7.089e-010	-9.211	-9.149	0.062
Zn(CO3)2-2	6.969e-014	2.184e-014	-13.157	-13.661	-0.504
Zn(OH)3-	5.285e-016	3.954e-016	-15.277	-15.403	-0.126
Zn(OH)4-2	3.527e-023	1.105e-023	-22.453	-22.956	-0.504

-----Saturation indices-----

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-2.60	9.52	12.12	Al(OH)3
AlumK	-6.59	-12.12	-5.53	KAl(SO4)2:12H2O
Alunite	5.85	6.96	1.11	KAl3(SO4)2(OH)6
Anhydrite	-0.15	-4.49	-4.34	CaSO4
Antlerite	-6.78	1.51	8.29	Cu3(OH)4SO4
Aragonite	-5.01	-13.25	-8.24	CaCO3
Artinite	-15.74	-4.70	11.03	MgCO3:Mg(OH)2:3H2O
Azurite	-12.22	-6.93	5.29	Cu3(OH)2(CO3)2
Barite	2.09	-8.25	-10.33	BaSO4
Basaluminite	3.36	26.06	22.70	Al4(OH)10SO4
Bianchite	-2.52	-4.28	-1.76	ZnSO4:6H2O
Birnessite	-18.52	25.08	43.60	MnO2
Bixbyite	-21.69	-21.54	0.15	Mn2O3
Boehmite	-0.47	9.52	9.99	AlOOH
Brochantite	-9.32	6.02	15.34	Cu4(OH)6SO4
Brucite	-10.15	8.04	18.19	Mg(OH)2
Bunsenite	-11.77	1.87	13.64	NiO
Calcite	-4.85	-13.25	-8.40	CaCO3
Cd(gamma)	-30.48	-15.98	14.49	Cd
Cd(OH)2	-11.54	2.11	13.65	Cd(OH)2
Cd(OH)2(a)	-12.66	2.11	14.77	Cd(OH)2
Cd3(OH)2(SO4)2	-24.41	-17.70	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-28.25	-5.69	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-31.98	-3.58	28.40	Cd4(OH)6SO4
CdMetal	-30.37	-15.98	14.39	Cd
CdSO4	-10.54	-9.90	0.64	CdSO4
CdSO4:2.7H2O	-8.25	-9.91	-1.66	CdSO4:2.67H2O
CdSO4:H2O	-8.62	-9.91	-1.28	CdSO4:H2O
Chalcanthite	-4.81	-7.52	-2.71	CuSO4:5H2O
CO2(g)	-2.52	-3.73	-1.21	CO2
Cu(OH)2	-4.89	4.51	9.40	Cu(OH)2
Cu2SO4	-14.09	-15.81	-1.72	Cu2SO4
CuCO3	-6.63	-16.26	-9.63	CuCO3
CuMetal	-1.33	-10.95	-9.61	Cu
CuOCuSO4	-16.30	-2.99	13.30	CuO:CuSO4
CupricFerrite	5.90	13.71	7.81	CuFe2O4
Cuprite	-1.94	-3.80	-1.86	Cu2O
CuprousFerrite	11.43	2.70	-8.73	CuFeO2
CuSO4	-11.42	-7.50	3.91	CuSO4
Diaspore	1.41	9.52	8.11	AlOOH
Dolomite	-9.36	-25.98	-16.62	CaMg(CO3)2
Dolomite(d)	-9.99	-25.98	-15.99	CaMg(CO3)2
Epsomite	-1.72	-4.00	-2.28	MgSO4:7H2O

Fe(OH)3(a)	-0.30	4.59	4.89	Fe(OH)3
Fe3(OH)8	-1.99	18.23	20.22	Fe3(OH)8
Gibbsite	0.27	9.52	9.25	Al(OH)3
Goethite	4.87	4.60	-0.28	FeOOH
Goslarite	-2.16	-4.28	-2.12	ZnSO4:7H2O
Gypsum	0.10	-4.50	-4.60	CaSO4:2H2O
H2(g)	-18.10	-21.16	-3.06	H2
H2O(g)	-2.04	-0.00	2.04	H2O
Hausmannite	-27.01	39.04	66.05	Mn3O4
Hematite	11.66	9.19	-2.47	Fe2O3
Huntite	-22.75	-51.44	-28.68	CaMg3(CO3)4
Hydromagnesite	-36.74	-42.89	-6.16	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	1.56	-8.27	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-0.17	-7.82	-7.65	KFe3(SO4)2(OH)6
Jarosite-Na	-3.29	-6.76	-3.47	NaFe3(SO4)2(OH)6
JarositeH	-7.61	-10.25	-2.64	(H3O)Fe3(SO4)2(OH)6
Jurbanite	0.74	-2.49	-3.23	AlOHSO4
Langite	-12.75	6.02	18.77	Cu4(OH)6SO4:H2O
Maghemite	2.81	9.19	6.39	Fe2O3
Magnesite	-5.01	-12.73	-7.72	MgCO3
Magnetite	11.99	18.25	6.25	Fe3O4
Malachite	-7.35	-1.21	6.14	Cu2(OH)2CO3
Manganite	-9.31	16.03	25.34	MnOOH
Melanterite	-0.52	-2.99	-2.47	FeSO4:7H2O
Mirabilite	-3.02	-5.08	-2.06	Na2SO4:10H2O
Mn2(SO4)3	-53.82	-57.58	-3.76	Mn2(SO4)3
MnSO4	-8.47	-5.03	3.44	MnSO4
Monteponite	-12.89	2.11	15.01	CdO
Morenosite	-7.66	-10.17	-2.51	NiSO4:7H2O
Nahcolite	-6.01	-6.75	-0.73	NaHCO3
Natron	-11.74	-13.84	-2.10	Na2CO3:10H2O
Nesquehonite	-7.41	-12.74	-5.33	MgCO3:3H2O
Ni(OH)2	-7.41	1.87	9.28	Ni(OH)2
Ni4(OH)6SO4	-36.54	-4.54	32.00	Ni4(OH)6SO4
NiCO3	-12.56	-18.90	-6.34	NiCO3
Nsutite	-17.49	25.08	42.56	MnO2
O2(g)	-53.89	-56.61	-2.73	O2
Otavite	-6.56	-18.66	-12.10	CdCO3
Portlandite	-16.83	7.52	24.35	Ca(OH)2
Pyrochroite	-8.22	6.98	15.20	Mn(OH)2
Pyrolusite	-19.55	25.08	44.63	MnO2
Retgersite	-8.07	-10.16	-2.09	NiSO4:6H2O
Rhodochrosite	-2.73	-13.79	-11.06	MnCO3
Rhodochrosite(d)	-3.40	-13.79	-10.39	MnCO3
Siderite	-0.95	-11.72	-10.77	FeCO3
Siderite(d)(3)	-1.27	-11.72	-10.45	FeCO3
Smithsonite	-3.23	-13.02	-9.78	ZnCO3
Tenorite	-3.87	4.51	8.38	CuO
Thenardite	-4.90	-5.05	-0.15	Na2SO4
Thermonatrite	-14.07	-13.81	0.26	Na2CO3:H2O
Trona	-20.66	-20.56	0.10	NaHCO3:Na2CO3:2H2O
Witherite	-8.34	-17.00	-8.67	BaCO3
Zincite(c)	-4.48	7.75	12.23	ZnO
Zincosite	-8.23	-4.26	3.97	ZnSO4
Zn(OH)2-a	-4.70	7.75	12.45	Zn(OH)2
Zn(OH)2-b	-4.00	7.75	11.75	Zn(OH)2
Zn(OH)2-c	-4.45	7.75	12.20	Zn(OH)2
Zn(OH)2-e	-3.75	7.75	11.50	Zn(OH)2
Zn(OH)2-g	-3.96	7.75	11.71	Zn(OH)2
Zn2(OH)2SO4	-4.01	3.49	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-22.88	-0.77	22.11	ZnO:2ZnSO4
Zn4(OH)6SO4	-9.41	18.99	28.40	Zn4(OH)6SO4
ZnCO3:H2O	-2.76	-13.02	-10.26	ZnCO3:H2O
ZnMetal	-37.93	-10.34	27.59	Zn
ZnO(a)	-3.56	7.75	11.31	ZnO
ZnSO4:H2O	-4.22	-4.26	-0.04	ZnSO4:H2O

Initial solution 3. P01-08A 11-May-05 put in average temperature and tailings redox

----------Solution composition----------

Elements	Molality	Moles
Al	7.712e-006	7.712e-006
Alkalinity	2.179e-003	2.179e-003
Ba	2.018e-005	2.018e-005
Ca	1.505e-004	1.505e-004
Cd	1.006e-008	1.006e-008
Cu	3.416e-007	3.416e-007
Fe	1.080e-004	1.080e-004
Mg	6.872e-005	6.872e-005
Mn	2.968e-006	2.968e-006
Na	5.309e-003	5.309e-003
Ni	1.704e-007	1.704e-007
S(6)	1.718e-003	1.718e-003
Zn	1.422e-005	1.422e-005

----------Description of solution----------

pH	= 7.370
pe	= 3.800
Activity of water	= 1.000
Ionic strength	= 7.629e-003
Mass of water (kg)	= 1.000e+000
Total carbon (mol/kg)	= 2.415e-003
Total CO2 (mol/kg)	= 2.415e-003
Temperature (deg C)	= 4.500
Electrical balance (eq)	= 4.436e-004
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= 3.91
Iterations	= 11
Total H	= 1.110146e+002
Total O	= 5.552010e+001

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	4.617e-008	4.266e-008	-7.336	-7.370	-0.034
OH-	4.527e-008	4.142e-008	-7.344	-7.383	-0.039
H2O	5.551e+001	9.998e-001	1.744	-0.000	0.000
Al	7.712e-006				
Al(OH)4-	7.210e-006	6.598e-006	-5.142	-5.181	-0.039
Al(OH)2+	3.117e-007	2.853e-007	-6.506	-6.545	-0.039
Al(OH)3	1.727e-007	1.731e-007	-6.763	-6.762	0.001
AlOH+2	1.684e-008	1.180e-008	-7.774	-7.928	-0.154
AlSO4+	6.194e-010	5.668e-010	-9.208	-9.247	-0.039
Al+3	4.546e-010	2.046e-010	-9.342	-9.689	-0.347
Al(SO4)2-	2.061e-011	1.886e-011	-10.686	-10.724	-0.039
AlHSO4+2	2.710e-018	1.900e-018	-17.567	-17.721	-0.154
Ba	2.018e-005				
Ba+2	1.424e-005	9.987e-006	-4.846	-5.001	-0.154
BaSO4	5.824e-006	5.834e-006	-5.235	-5.234	0.001
BaHCO3+	1.064e-007	9.732e-008	-6.973	-7.012	-0.039
BaCO3	4.256e-009	4.263e-009	-8.371	-8.370	0.001
BaOH+	8.668e-012	7.932e-012	-11.062	-11.101	-0.039
C(4)	2.415e-003				
HCO3-	2.112e-003	1.938e-003	-2.675	-2.713	-0.037
CO2	2.747e-004	2.751e-004	-3.561	-3.560	0.001
FeHCO3+	1.227e-005	1.123e-005	-4.911	-4.950	-0.039
NaHCO3	5.258e-006	5.267e-006	-5.279	-5.278	0.001
CO3-2	1.760e-006	1.247e-006	-5.754	-5.904	-0.150
FeCO3	1.730e-006	1.733e-006	-5.762	-5.761	0.001

ZnHCO3+	1.726e-006	1.579e-006	-5.763	-5.802	-0.039
ZnCO3	1.608e-006	1.610e-006	-5.794	-5.793	0.001
CaHCO3+	1.540e-006	1.409e-006	-5.812	-5.851	-0.039
MgHCO3+	1.029e-006	9.417e-007	-5.988	-6.026	-0.039
MnHCO3+	3.029e-007	2.772e-007	-6.519	-6.557	-0.039
MnCO3	1.587e-007	1.590e-007	-6.800	-6.799	0.001
CaCO3	1.551e-007	1.554e-007	-6.809	-6.809	0.001
NiCO3	1.409e-007	1.411e-007	-6.851	-6.850	0.001
CuCO3	1.078e-007	1.080e-007	-6.967	-6.966	0.001
BaHCO3+	1.064e-007	9.732e-008	-6.973	-7.012	-0.039
Zn(CO3)2-2	6.124e-008	4.294e-008	-7.213	-7.367	-0.154
NaCO3-	4.041e-008	3.698e-008	-7.394	-7.432	-0.039
MgCO3	3.761e-008	3.767e-008	-7.425	-7.424	0.001
CuHCO3+	1.712e-008	1.567e-008	-7.766	-7.805	-0.039
NiHCO3+	4.462e-009	4.083e-009	-8.350	-8.389	-0.039
BaCO3	4.256e-009	4.263e-009	-8.371	-8.370	0.001
Ni(CO3)2-2	4.361e-010	3.058e-010	-9.360	-9.515	-0.154
CdHCO3+	3.755e-010	3.436e-010	-9.425	-9.464	-0.039
Cu(CO3)2-2	2.419e-010	1.696e-010	-9.616	-9.771	-0.154
CdCO3	5.544e-012	5.554e-012	-11.256	-11.255	0.001
Cd(CO3)2-2	3.124e-014	2.190e-014	-13.505	-13.660	-0.154
Ca	1.505e-004				
Ca+2	1.312e-004	9.295e-005	-3.882	-4.032	-0.150
CaSO4	1.757e-005	1.760e-005	-4.755	-4.755	0.001
CaHCO3+	1.540e-006	1.409e-006	-5.812	-5.851	-0.039
CaCO3	1.551e-007	1.554e-007	-6.809	-6.809	0.001
CaOH+	3.951e-010	3.616e-010	-9.403	-9.442	-0.039
CaHSO4+	3.933e-012	3.599e-012	-11.405	-11.444	-0.039
Cd	1.006e-008				
Cd+2	7.995e-009	5.606e-009	-8.097	-8.251	-0.154
CdSO4	1.644e-009	1.647e-009	-8.784	-8.783	0.001
CdHCO3+	3.755e-010	3.436e-010	-9.425	-9.464	-0.039
Cd(SO4)2-2	3.435e-011	2.408e-011	-10.464	-10.618	-0.154
CdCO3	5.544e-012	5.554e-012	-11.256	-11.255	0.001
CdOH+	2.334e-012	2.136e-012	-11.632	-11.670	-0.039
Cd(CO3)2-2	3.124e-014	2.190e-014	-13.505	-13.660	-0.154
Cd(OH)2	1.373e-014	1.376e-014	-13.862	-13.861	0.001
Cd2OH+3	1.715e-019	7.716e-020	-18.766	-19.113	-0.347
Cd(OH)3-	3.954e-020	3.618e-020	-19.403	-19.442	-0.039
Cd(OH)4-2	1.078e-026	7.558e-027	-25.967	-26.122	-0.154
Cu(1)	1.194e-009				
Cu+	1.194e-009	1.092e-009	-8.923	-8.962	-0.039
Cu(2)	3.404e-007				
Cu(OH)2	1.848e-007	1.851e-007	-6.733	-6.733	0.001
CuCO3	1.078e-007	1.080e-007	-6.967	-6.966	0.001
Cu+2	2.300e-008	1.613e-008	-7.638	-7.792	-0.154
CuHCO3+	1.712e-008	1.567e-008	-7.766	-7.805	-0.039
CuOH+	4.131e-009	3.780e-009	-8.384	-8.422	-0.039
CuSO4	3.291e-009	3.297e-009	-8.483	-8.482	0.001
Cu(CO3)2-2	2.419e-010	1.696e-010	-9.616	-9.771	-0.154
Cu2(OH)2+2	1.003e-012	7.030e-013	-11.999	-12.153	-0.154
Cu(OH)3-	2.857e-013	2.615e-013	-12.544	-12.583	-0.039
Cu(OH)4-2	1.744e-018	1.223e-018	-17.759	-17.913	-0.154
Fe(2)	1.047e-004				
Fe+2	8.262e-005	5.793e-005	-4.083	-4.237	-0.154
FeHCO3+	1.227e-005	1.123e-005	-4.911	-4.950	-0.039
FeSO4	8.015e-006	8.029e-006	-5.096	-5.095	0.001
FeCO3	1.730e-006	1.733e-006	-5.762	-5.761	0.001
FeOH+	9.058e-008	8.289e-008	-7.043	-7.082	-0.039
FeHSO4+	2.451e-012	2.243e-012	-11.611	-11.649	-0.039
Fe(OH)2	2.433e-012	2.437e-012	-11.614	-11.613	0.001
Fe(OH)3-	1.868e-015	1.710e-015	-14.729	-14.767	-0.039
Fe(3)	3.291e-006				
Fe(OH)3	1.682e-006	1.685e-006	-5.774	-5.773	0.001
Fe(OH)2+	1.592e-006	1.457e-006	-5.798	-5.837	-0.039
Fe(OH)4-	1.625e-008	1.487e-008	-7.789	-7.828	-0.039
FeOH+2	6.170e-010	4.327e-010	-9.210	-9.364	-0.154

FeSO4+	8.964e-014	8.203e-014	-13.047	-13.086	-0.039
Fe+3	2.322e-014	1.045e-014	-13.634	-13.981	-0.347
Fe(SO4)2-	2.097e-015	1.919e-015	-14.678	-14.717	-0.039
Fe2(OH)2+4	5.176e-017	1.251e-017	-16.286	-16.903	-0.617
Fe3(OH)4+5	2.670e-019	2.904e-020	-18.573	-19.537	-0.964
FeHSO4+2	1.449e-020	1.016e-020	-19.839	-19.993	-0.154
H(0)	8.044e-026				
H2	4.022e-026	4.029e-026	-25.396	-25.395	0.001
Mg	6.872e-005				
Mg+2	6.094e-005	4.337e-005	-4.215	-4.363	-0.148
MgSO4	6.710e-006	6.722e-006	-5.173	-5.173	0.001
MgHCO3+	1.029e-006	9.417e-007	-5.988	-6.026	-0.039
MgCO3	3.761e-008	3.767e-008	-7.425	-7.424	0.001
MgOH+	5.525e-010	5.056e-010	-9.258	-9.296	-0.039
Mn(2)	2.968e-006				
Mn+2	2.288e-006	1.605e-006	-5.640	-5.795	-0.154
MnHCO3+	3.029e-007	2.772e-007	-6.519	-6.557	-0.039
MnSO4	2.181e-007	2.185e-007	-6.661	-6.661	0.001
MnCO3	1.587e-007	1.590e-007	-6.800	-6.799	0.001
MnOH+	1.756e-010	1.607e-010	-9.755	-9.794	-0.039
Mn(OH)3-	3.578e-019	3.274e-019	-18.446	-18.485	-0.039
Mn(3)	2.792e-029				
Mn+3	2.792e-029	1.256e-029	-28.554	-28.901	-0.347
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-58.040	-58.194	-0.154
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-65.179	-65.217	-0.039
Na	5.309e-003				
Na+	5.277e-003	4.833e-003	-2.278	-2.316	-0.038
NaSO4-	2.683e-005	2.455e-005	-4.571	-4.610	-0.039
NaHCO3	5.258e-006	5.267e-006	-5.279	-5.278	0.001
NaCO3-	4.041e-008	3.698e-008	-7.394	-7.432	-0.039
Ni	1.704e-007				
NiCO3	1.409e-007	1.411e-007	-6.851	-6.850	0.001
Ni+2	2.177e-008	1.526e-008	-7.662	-7.816	-0.154
NiHCO3+	4.462e-009	4.083e-009	-8.350	-8.389	-0.039
NiSO4	2.865e-009	2.870e-009	-8.543	-8.542	0.001
Ni(CO3)2-2	4.361e-010	3.058e-010	-9.360	-9.515	-0.154
NiOH+	1.148e-011	1.051e-011	-10.940	-10.979	-0.039
Ni(OH)2	8.370e-013	8.385e-013	-12.077	-12.077	0.001
Ni(SO4)2-2	3.096e-013	2.171e-013	-12.509	-12.663	-0.154
Ni(OH)3-	2.148e-016	1.965e-016	-15.668	-15.707	-0.039
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-48.696	-48.695	0.001
S(6)	1.718e-003				
SO4-2	1.652e-003	1.166e-003	-2.782	-2.933	-0.151
NaSO4-	2.683e-005	2.455e-005	-4.571	-4.610	-0.039
CaSO4	1.757e-005	1.760e-005	-4.755	-4.755	0.001
FeSO4	8.015e-006	8.029e-006	-5.096	-5.095	0.001
MgSO4	6.710e-006	6.722e-006	-5.173	-5.173	0.001
BaSO4	5.824e-006	5.834e-006	-5.235	-5.234	0.001
ZnSO4	1.490e-006	1.493e-006	-5.827	-5.826	0.001
MnSO4	2.181e-007	2.185e-007	-6.661	-6.661	0.001
Zn(SO4)2-2	2.389e-008	1.675e-008	-7.622	-7.776	-0.154
HSO4-	3.519e-009	3.221e-009	-8.454	-8.492	-0.039
CuSO4	3.291e-009	3.297e-009	-8.483	-8.482	0.001
NiSO4	2.865e-009	2.870e-009	-8.543	-8.542	0.001
CdSO4	1.644e-009	1.647e-009	-8.784	-8.783	0.001
AlSO4+	6.194e-010	5.668e-010	-9.208	-9.247	-0.039
Cd(SO4)2-2	3.435e-011	2.408e-011	-10.464	-10.618	-0.154
Al(SO4)2-	2.061e-011	1.886e-011	-10.686	-10.724	-0.039
CaHSO4+	3.933e-012	3.599e-012	-11.405	-11.444	-0.039
FeHSO4+	2.451e-012	2.243e-012	-11.611	-11.649	-0.039
Ni(SO4)2-2	3.096e-013	2.171e-013	-12.509	-12.663	-0.154
FeSO4+	8.964e-014	8.203e-014	-13.047	-13.086	-0.039
Fe(SO4)2-	2.097e-015	1.919e-015	-14.678	-14.717	-0.039
AlHSO4+2	2.710e-018	1.900e-018	-17.567	-17.721	-0.154

FeHSO4+2	1.449e-020	1.016e-020	-19.839	-19.993	-0.154
Zn	1.422e-005				
Zn+2	9.230e-006	6.472e-006	-5.035	-5.189	-0.154
ZnHCO3+	1.726e-006	1.579e-006	-5.763	-5.802	-0.039
ZnCO3	1.608e-006	1.610e-006	-5.794	-5.793	0.001
ZnSO4	1.490e-006	1.493e-006	-5.827	-5.826	0.001
Zn(CO3)2-2	6.124e-008	4.294e-008	-7.213	-7.367	-0.154
Zn(OH)2	4.468e-008	4.476e-008	-7.350	-7.349	0.001
ZnOH+	3.422e-008	3.132e-008	-7.466	-7.504	-0.039
Zn(SO4)2-2	2.389e-008	1.675e-008	-7.622	-7.776	-0.154
Zn(OH)3-	3.625e-012	3.318e-012	-11.441	-11.479	-0.039
Zn(OH)4-2	1.758e-017	1.232e-017	-16.755	-16.909	-0.154

------------------------------Saturation indices-------------------------------

Phase	SI	log IAP	log KT	
Al(OH)3(a)	0.19	12.42	12.23	Al(OH)3
Anhydrite	-2.62	-6.97	-4.35	CaSO4
Antlerite	-5.12	3.17	8.29	Cu3(OH)4SO4
Aragonite	-1.70	-9.94	-8.23	CaCO3
Artinite	-11.05	0.11	11.16	MgCO3:Mg(OH)2:3H2O
Azurite	-4.74	0.68	5.42	Cu3(OH)2(CO3)2
Barite	2.43	-7.93	-10.37	BaSO4
Basaluminite	9.31	32.01	22.70	Al4(OH)10SO4
Bianchite	-6.37	-8.12	-1.76	ZnSO4:6H2O
Birnessite	-12.32	31.29	43.60	MnO2
Bixbyite	-13.80	-13.58	0.21	Mn2O3
Boehmite	2.31	12.42	10.11	AlOOH
Brochantite	-5.22	10.12	15.34	Cu4(OH)6SO4
Brucite	-7.93	10.38	18.31	Mg(OH)2
Bunsenite	-6.82	6.92	13.74	NiO
Calcite	-1.54	-9.94	-8.39	CaCO3
Cd(gamma)	-30.42	-15.85	14.57	Cd
Cd(OH)2	-7.16	6.49	13.65	Cd(OH)2
Cd(OH)2(a)	-8.37	6.49	14.85	Cd(OH)2
Cd3(OH)2(SO4)2	-22.59	-15.88	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-20.77	1.79	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-20.12	8.28	28.40	Cd4(OH)6SO4
CdMetal	-30.32	-15.85	14.46	Cd
CdSO4	-11.88	-11.18	0.70	CdSO4
CdSO4:2.7H2O	-9.54	-11.18	-1.64	CdSO4:2.67H2O
CdSO4:H2O	-9.93	-11.18	-1.25	CdSO4:H2O
Chalcanthite	-8.01	-10.73	-2.72	CuSO4:5H2O
CO2(g)	-2.38	-3.56	-1.18	CO2
Cu(OH)2	-2.52	6.95	9.47	Cu(OH)2
Cu2SO4	-19.15	-20.86	-1.70	Cu2SO4
CuCO3	-4.07	-13.70	-9.63	CuCO3
CuMetal	-3.07	-12.76	-9.69	Cu
CuOCuSO4	-17.23	-3.78	13.46	CuO:CuSO4
CupricFerrite	15.23	23.21	7.97	CuFe2O4
Cuprite	-1.30	-3.18	-1.89	Cu2O
CuprousFerrite	15.25	6.54	-8.71	CuFeO2
CuSO4	-14.72	-10.73	3.99	CuSO4
Diaspore	4.21	12.42	8.21	AlOOH
Dolomite	-3.62	-20.20	-16.58	CaMg(CO3)2
Dolomite(d)	-4.26	-20.20	-15.94	CaMg(CO3)2
Epsomite	-5.00	-7.30	-2.29	MgSO4:7H2O
Fe(OH)3(a)	3.24	8.13	4.89	Fe(OH)3
Fe3(OH)8	6.54	26.76	20.22	Fe3(OH)8
Gibbsite	3.08	12.42	9.34	Al(OH)3
Goethite	8.35	8.13	-0.22	FeOOH
Goslarite	-5.98	-8.12	-2.14	ZnSO4:7H2O
Gypsum	-2.36	-6.97	-4.60	CaSO4:2H2O
H2(g)	-22.34	-25.39	-3.05	H2
H2O(g)	-2.08	-0.00	2.08	H2O
Hausmannite	-17.30	49.18	66.48	Mn3O4

Hematite	18.60	16.26	-2.34	Fe2O3
Huntite	-12.16	-40.74	-28.57	CaMg3(CO3)4
Hydromagnesite	-24.76	-30.69	-5.93	Mg5(CO3)4(OH)2:4H2O
Jarosite-Na	-2.58	-5.91	-3.32	NaFe3(SO4)2(OH)6
JarositeH	-8.55	-10.96	-2.41	(H3O)Fe3(SO4)2(OH)6
Jurbanite	-2.02	-5.25	-3.23	AlOHSO4
Langite	-8.82	10.12	18.93	Cu4(OH)6SO4:H2O
Maghemite	9.87	16.26	6.39	Fe2O3
Magnesite	-2.57	-10.27	-7.70	MgCO3
Magnetite	20.29	26.76	6.47	Fe3O4
Malachite	-2.41	3.81	6.22	Cu2(OH)2CO3
Manganite	-5.22	20.12	25.34	MnOOH
Melanterite	-4.68	-7.17	-2.49	FeSO4:7H2O
Mirabilite	-5.42	-7.57	-2.14	Na2SO4:10H2O
Mn2(SO4)3	-63.01	-66.60	-3.60	Mn2(SO4)3
MnSO4	-12.23	-8.73	3.51	MnSO4
Monteponite	-8.62	6.49	15.11	CdO
Morenosite	-8.23	-10.75	-2.52	NiSO4:7H2O
Nahcolite	-4.28	-5.03	-0.75	NaHCO3
Natron	-8.37	-10.54	-2.16	Na2CO3:10H2O
Nesquehonite	-4.96	-10.27	-5.31	MgCO3:3H2O
Ni(OH)2	-2.23	6.92	9.15	Ni(OH)2
Ni4(OH)6SO4	-21.98	10.02	32.00	Ni4(OH)6SO4
NiCO3	-7.42	-13.72	-6.30	NiCO3
Nsutite	-11.28	31.29	42.56	MnO2
O2(g)	-45.99	-48.69	-2.71	O2
Otavite	-2.06	-14.16	-12.10	CdCO3
Portlandite	-13.77	10.71	24.48	Ca(OH)2
Pyrochroite	-6.25	8.95	15.20	Mn(OH)2
Pyrolusite	-13.62	31.29	44.90	MnO2
Retgersite	-8.65	-10.75	-2.10	NiSO4:6H2O
Rhodochrosite	-0.65	-11.70	-11.05	MnCO3
Rhodochrosite(d)	-1.31	-11.70	-10.39	MnCO3
Siderite	0.61	-10.14	-10.76	FeCO3
Siderite(d)(3)	0.31	-10.14	-10.45	FeCO3
Smithsonite	-1.33	-11.09	-9.76	ZnCO3
Tenorite	-1.50	6.95	8.44	CuO
Thenardite	-7.42	-7.57	-0.15	Na2SO4
Thermonatrite	-10.81	-10.54	0.28	Na2CO3:H2O
Trona	-15.74	-15.56	0.18	NaHCO3:Na2CO3:2H2O
Witherite	-2.22	-10.90	-8.68	BaCO3
Zincite(c)	-2.77	9.55	12.32	ZnO
Zincosite	-12.17	-8.12	4.05	ZnSO4
Zn(OH)2-a	-2.90	9.55	12.45	Zn(OH)2
Zn(OH)2-b	-2.20	9.55	11.75	Zn(OH)2
Zn(OH)2-c	-2.65	9.55	12.20	Zn(OH)2
Zn(OH)2-e	-1.95	9.55	11.50	Zn(OH)2
Zn(OH)2-g	-2.16	9.55	11.71	Zn(OH)2
Zn2(OH)2SO4	-6.07	1.43	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-29.07	-6.69	22.38	ZnO:2ZnSO4
Zn4(OH)6SO4	-7.87	20.53	28.40	Zn4(OH)6SO4
ZnCO3:H2O	-0.83	-11.09	-10.26	ZnCO3:H2O
ZnMetal	-40.54	-12.79	27.75	Zn
ZnO(a)	-1.76	9.55	11.31	ZnO
ZnSO4:H2O	-8.13	-8.12	0.01	ZnSO4:H2O

Initial solution 4. FCS-4 7/13/2006

----------Solution composition----------

Elements	Molality	Moles
Al	3.736e-005	3.736e-005
Alkalinity	3.565e-004	3.565e-004
Ba	3.670e-007	3.670e-007
Ca	1.215e-002	1.215e-002
Cd	4.484e-007	4.484e-007

Cu	7.932e-007	7.932e-007
Fe	1.007e-002	1.007e-002
K	3.352e-004	3.352e-004
Mg	2.550e-002	2.550e-002
Mn	1.108e-003	1.108e-003
Na	3.640e-003	3.640e-003
Ni	9.616e-006	9.616e-006
S(6)	6.213e-002	6.213e-002
Zn	4.457e-003	4.457e-003

----------Description of solution----------

pH	= 2.830
pe	= 4.400
Activity of water	= 0.785
Ionic strength	= 1.455e-001
Mass of water (kg)	= 1.000e+000
Total carbon (mol/kg)	= 1.253e+001
Total CO2 (mol/kg)	= 1.253e+001
Temperature (deg C)	= 6.000
Electrical balance (eq)	= -1.393e-002
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= -9.21
Iterations	= 16
Total H	= 1.110199e+002
Total O	= 8.081076e+001

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	1.816e-003	1.479e-003	-2.741	-2.830	-0.089
OH-	1.408e-012	1.080e-012	-11.852	-11.967	-0.115
H2O	5.551e+001	7.854e-001	1.744	-0.105	0.000
Al	3.736e-005				
AlSO4+	2.282e-005	1.751e-005	-4.642	-4.757	-0.115
Al(SO4)2-	8.499e-006	6.521e-006	-5.071	-5.186	-0.115
Al+3	6.037e-006	5.566e-007	-5.219	-6.254	-1.035
AlHSO4+2	5.897e-009	2.044e-009	-8.229	-8.690	-0.460
AlOH+2	2.335e-009	8.094e-010	-8.632	-9.092	-0.460
Al(OH)2+	6.817e-013	5.231e-013	-12.166	-12.281	-0.115
Al(OH)3	8.031e-018	8.305e-018	-17.095	-17.081	0.015
Al(OH)4-	9.357e-021	7.180e-021	-20.029	-20.144	-0.115
Ba	3.670e-007				
BaSO4	2.510e-007	2.595e-007	-6.600	-6.586	0.015
Ba+2	1.154e-007	4.002e-008	-6.938	-7.398	-0.460
BaHCO3+	5.908e-010	4.534e-010	-9.229	-9.344	-0.115
BaCO3	5.714e-016	5.909e-016	-15.243	-15.229	0.015
BaOH+	9.383e-019	7.200e-019	-18.028	-18.143	-0.115
C(4)	1.253e+001				
CO2	1.252e+001	1.295e+001	1.098	1.112	0.015
HCO3-	2.788e-003	2.149e-003	-2.555	-2.668	-0.113
FeHCO3+	5.977e-004	4.586e-004	-3.223	-3.339	-0.115
ZnHCO3+	2.357e-004	1.809e-004	-3.628	-3.743	-0.115
MgHCO3+	1.819e-004	1.396e-004	-3.740	-3.855	-0.115
MnHCO3+	5.956e-005	4.570e-005	-4.225	-4.340	-0.115
CaHCO3+	5.743e-005	4.407e-005	-4.241	-4.356	-0.115
NaHCO3	3.084e-006	3.189e-006	-5.511	-5.496	0.015
NiHCO3+	6.981e-007	5.357e-007	-6.156	-6.271	-0.115
CuHCO3+	1.705e-007	1.308e-007	-6.768	-6.883	-0.115
ZnCO3	5.399e-009	5.583e-009	-8.268	-8.253	0.015
CdHCO3+	5.166e-009	3.964e-009	-8.287	-8.402	-0.115
FeCO3	2.072e-009	2.143e-009	-8.684	-8.669	0.015
MnCO3	7.672e-010	7.933e-010	-9.115	-9.101	0.015
BaHCO3+	5.908e-010	4.534e-010	-9.229	-9.344	-0.115
NiCO3	5.418e-010	5.602e-010	-9.266	-9.252	0.015
MgCO3	1.673e-010	1.730e-010	-9.777	-9.762	0.015

CaCO3	1.353e-010	1.400e-010	-9.869	-9.854	0.015
CO3-2	1.185e-010	4.186e-011	-9.926	-10.378	-0.452
CuCO3	2.640e-011	2.730e-011	-10.578	-10.564	0.015
NaCO3-	9.632e-013	7.391e-013	-12.016	-12.131	-0.115
Zn(CO3)2-2	1.441e-014	4.997e-015	-13.841	-14.301	-0.460
CdCO3	1.875e-015	1.939e-015	-14.727	-14.712	0.015
BaCO3	5.714e-016	5.909e-016	-15.243	-15.229	0.015
Ni(CO3)2-2	1.176e-016	4.076e-017	-15.930	-16.390	-0.460
Cu(CO3)2-2	4.150e-018	1.439e-018	-17.382	-17.842	-0.460
Cd(CO3)2-2	7.405e-022	2.567e-022	-21.130	-21.591	-0.460
Ca	1.215e-002				
Ca+2	6.893e-003	2.492e-003	-2.162	-2.603	-0.442
CaSO4	5.149e-003	5.324e-003	-2.288	-2.274	0.015
CaHCO3+	5.743e-005	4.407e-005	-4.241	-4.356	-0.115
CaHSO4+	4.972e-005	3.815e-005	-4.303	-4.418	-0.115
CaCO3	1.353e-010	1.400e-010	-9.869	-9.854	0.015
CaOH+	2.862e-013	2.196e-013	-12.543	-12.658	-0.115
Cd	4.484e-007				
CdSO4	1.859e-007	1.923e-007	-6.731	-6.716	0.015
Cd+2	1.682e-007	5.832e-008	-6.774	-7.234	-0.460
Cd(SO4)2-2	8.910e-008	3.089e-008	-7.050	-7.510	-0.460
CdHCO3+	5.166e-009	3.964e-009	-8.287	-8.402	-0.115
CdCO3	1.875e-015	1.939e-015	-14.727	-14.712	0.015
CdOH+	7.454e-016	5.719e-016	-15.128	-15.243	-0.115
Cd2OH+3	2.281e-021	2.103e-022	-20.642	-21.677	-1.035
Cd(CO3)2-2	7.405e-022	2.567e-022	-21.130	-21.591	-0.460
Cd(OH)2	7.103e-023	7.345e-023	-22.149	-22.134	0.015
Cd(OH)3-	5.703e-033	4.376e-033	-32.244	-32.359	-0.115
Cd(OH)4-2	0.000e+000	0.000e+000	-43.224	-43.684	-0.460
Cu(1)	2.735e-009				
Cu+	2.735e-009	2.099e-009	-8.563	-8.678	-0.115
Cu(2)	7.905e-007				
Cu+2	3.503e-007	1.214e-007	-6.456	-6.916	-0.460
CuSO4	2.697e-007	2.789e-007	-6.569	-6.555	0.015
CuHCO3+	1.705e-007	1.308e-007	-6.768	-6.883	-0.115
CuCO3	2.640e-011	2.730e-011	-10.578	-10.564	0.015
CuOH+	8.403e-013	6.448e-013	-12.076	-12.191	-0.115
Cu(OH)2	6.917e-016	7.153e-016	-15.160	-15.146	0.015
Cu(CO3)2-2	4.150e-018	1.439e-018	-17.382	-17.842	-0.460
Cu2(OH)2+2	6.997e-020	2.426e-020	-19.155	-19.615	-0.460
Cu(OH)3-	2.983e-026	2.289e-026	-25.525	-25.640	-0.115
Cu(OH)4-2	6.995e-036	2.425e-036	-35.155	-35.615	-0.460
Fe(2)	1.007e-002				
Fe+2	6.156e-003	2.134e-003	-2.211	-2.671	-0.460
FeSO4	3.277e-003	3.388e-003	-2.485	-2.470	0.015
FeHCO3+	5.977e-004	4.586e-004	-3.223	-3.339	-0.115
FeHSO4+	4.257e-005	3.267e-005	-4.371	-4.486	-0.115
FeCO3	2.072e-009	2.143e-009	-8.684	-8.669	0.015
FeOH+	1.025e-010	7.865e-011	-9.989	-10.104	-0.115
Fe(OH)2	5.884e-020	6.085e-020	-19.230	-19.216	0.015
Fe(OH)3-	1.282e-027	9.835e-028	-26.892	-27.007	-0.115
Fe(3)	2.760e-010				
FeSO4+	1.987e-010	1.524e-010	-9.702	-9.817	-0.115
Fe(SO4)2-	5.196e-011	3.987e-011	-10.284	-10.399	-0.115
Fe+3	1.826e-011	1.684e-012	-10.739	-11.774	-1.035
FeOH+2	5.042e-012	1.748e-012	-11.297	-11.758	-0.460
FeHSO4+2	1.868e-012	6.474e-013	-11.729	-12.189	-0.460
Fe(OH)2+	1.855e-013	1.423e-013	-12.732	-12.847	-0.115
Fe(OH)3	3.887e-018	4.020e-018	-17.410	-17.396	0.015
Fe2(OH)2+4	1.317e-020	1.902e-022	-19.880	-21.721	-1.840
Fe(OH)4-	1.122e-024	8.612e-025	-23.950	-24.065	-0.115
Fe3(OH)4+5	2.763e-029	3.678e-032	-28.559	-31.434	-2.876
H(0)	5.811e-018				
H2	2.905e-018	3.004e-018	-17.537	-17.522	0.015
K	3.352e-004				
K+	3.157e-004	2.343e-004	-3.501	-3.630	-0.129
KSO4-	1.949e-005	1.495e-005	-4.710	-4.825	-0.115

Mg	2.550e-002					
Mg+2		1.523e-002	5.798e-003	-1.817	-2.237	-0.420
MgSO4		1.009e-002	1.043e-002	-1.996	-1.982	0.015
MgHCO3+		1.819e-004	1.396e-004	-3.740	-3.855	-0.115
MgCO3		1.673e-010	1.730e-010	-9.777	-9.762	0.015
MgOH+		2.331e-012	1.789e-012	-11.632	-11.747	-0.115
Mn(2)	1.108e-003					
Mn+2		6.883e-004	2.386e-004	-3.162	-3.622	-0.460
MnSO4		3.605e-004	3.728e-004	-3.443	-3.429	0.015
MnHCO3+		5.956e-005	4.570e-005	-4.225	-4.340	-0.115
MnCO3		7.672e-010	7.933e-010	-9.115	-9.101	0.015
MnOH+		8.116e-013	6.227e-013	-12.091	-12.206	-0.115
Mn(OH)3-		7.378e-031	5.661e-031	-30.132	-30.247	-0.115
Mn(3)	1.037e-025					
Mn+3		1.037e-025	9.560e-027	-24.984	-26.020	-1.035
Mn(6)	0.000e+000					
MnO4-2		0.000e+000	0.000e+000	-89.266	-89.726	-0.460
Mn(7)	0.000e+000					
MnO4-		0.000e+000	0.000e+000	-95.923	-96.038	-0.115
Na	3.640e-003					
Na+		3.440e-003	2.639e-003	-2.463	-2.579	-0.115
NaSO4-		1.961e-004	1.505e-004	-3.707	-3.823	-0.115
NaHCO3		3.084e-006	3.189e-006	-5.511	-5.496	0.015
NaCO3-		9.632e-013	7.391e-013	-12.016	-12.131	-0.115
Ni	9.616e-006					
Ni+2		5.208e-006	1.805e-006	-5.283	-5.743	-0.460
NiSO4		3.700e-006	3.826e-006	-5.432	-5.417	0.015
NiHCO3+		6.981e-007	5.357e-007	-6.156	-6.271	-0.115
Ni(SO4)2-2		9.133e-009	3.166e-009	-8.039	-8.499	-0.460
NiCO3		5.418e-010	5.602e-010	-9.266	-9.252	0.015
NiOH+		4.141e-014	3.177e-014	-13.383	-13.498	-0.115
Ni(CO3)2-2		1.176e-016	4.076e-017	-15.930	-16.390	-0.460
Ni(OH)2		4.923e-020	5.090e-020	-19.308	-19.293	0.015
Ni(OH)3-		3.523e-028	2.703e-028	-27.453	-27.568	-0.115
O(0)	0.000e+000					
O2		0.000e+000	0.000e+000	-64.109	-64.094	0.015
S(6)	6.213e-002					
SO4-2		3.834e-002	1.294e-002	-1.416	-1.888	-0.472
MgSO4		1.009e-002	1.043e-002	-1.996	-1.982	0.015
CaSO4		5.149e-003	5.324e-003	-2.288	-2.274	0.015
FeSO4		3.277e-003	3.388e-003	-2.485	-2.470	0.015
ZnSO4		1.677e-003	1.735e-003	-2.775	-2.761	0.015
HSO4-		1.659e-003	1.273e-003	-2.780	-2.895	-0.115
Zn(SO4)2-2		6.154e-004	2.133e-004	-3.211	-3.671	-0.460
MnSO4		3.605e-004	3.728e-004	-3.443	-3.429	0.015
NaSO4-		1.961e-004	1.505e-004	-3.707	-3.823	-0.115
CaHSO4+		4.972e-005	3.815e-005	-4.303	-4.418	-0.115
FeHSO4+		4.257e-005	3.267e-005	-4.371	-4.486	-0.115
AlSO4+		2.282e-005	1.751e-005	-4.642	-4.757	-0.115
KSO4-		1.949e-005	1.495e-005	-4.710	-4.825	-0.115
Al(SO4)2-		8.499e-006	6.521e-006	-5.071	-5.186	-0.115
NiSO4		3.700e-006	3.826e-006	-5.432	-5.417	0.015
CuSO4		2.697e-007	2.789e-007	-6.569	-6.555	0.015
BaSO4		2.510e-007	2.595e-007	-6.600	-6.586	0.015
CdSO4		1.859e-007	1.923e-007	-6.731	-6.716	0.015
Cd(SO4)2-2		8.910e-008	3.089e-008	-7.050	-7.510	-0.460
Ni(SO4)2-2		9.133e-009	3.166e-009	-8.039	-8.499	-0.460
AlHSO4+2		5.897e-009	2.044e-009	-8.229	-8.690	-0.460
FeSO4+		1.987e-010	1.524e-010	-9.702	-9.817	-0.115
Fe(SO4)2-		5.196e-011	3.987e-011	-10.284	-10.399	-0.115
FeHSO4+2		1.868e-012	6.474e-013	-11.729	-12.189	-0.460
Zn	4.457e-003					
Zn+2		1.928e-003	6.684e-004	-2.715	-3.175	-0.460
ZnSO4		1.677e-003	1.735e-003	-2.775	-2.761	0.015
Zn(SO4)2-2		6.154e-004	2.133e-004	-3.211	-3.671	-0.460
ZnHCO3+		2.357e-004	1.809e-004	-3.628	-3.743	-0.115
ZnCO3		5.399e-009	5.583e-009	-8.268	-8.253	0.015

ZnOH+	1.088e-010	8.349e-011	-9.963	-10.078	-0.115
Zn(CO3)2-2	1.441e-014	4.997e-015	-13.841	-14.301	-0.460
Zn(OH)2	2.295e-015	2.373e-015	-14.639	-14.625	0.015
Zn(OH)3-	5.192e-024	3.984e-024	-23.285	-23.400	-0.115
Zn(OH)4-2	9.672e-034	3.353e-034	-33.014	-33.475	-0.460

----------Saturation indices----------

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-10.20	1.92	12.12	Al(OH)3
AlumK	-9.39	-14.92	-5.53	KAl(SO4)2:12H2O
Alunite	-10.93	-9.82	1.11	KAl3(SO4)2(OH)6
Anhydrite	-0.15	-4.49	-4.34	CaSO4
Antlerite	-20.02	-11.73	8.29	Cu3(OH)4SO4
Aragonite	-4.74	-12.98	-8.24	CaCO3
Artinite	-20.75	-9.72	11.03	MgCO3:Mg(OH)2:3H2O
Azurite	-20.26	-14.97	5.29	Cu3(OH)2(CO3)2
Barite	1.05	-9.29	-10.33	BaSO4
Basaluminite	-22.35	0.35	22.70	Al4(OH)10SO4
Bianchite	-3.94	-5.69	-1.76	ZnSO4:6H2O
Birnessite	-27.31	16.29	43.60	MnO2
Bixbyite	-35.52	-35.37	0.15	Mn2O3
Boehmite	-7.96	2.03	9.99	AlOOH
Brochantite	-28.54	-13.20	15.34	Cu4(OH)6SO4
Brucite	-14.98	3.21	18.19	Mg(OH)2
Bunsenite	-13.83	-0.19	13.64	NiO
Calcite	-4.58	-12.98	-8.40	CaCO3
Cd(gamma)	-30.53	-16.03	14.49	Cd
Cd(OH)2	-15.43	-1.78	13.65	Cd(OH)2
Cd(OH)2(a)	-16.55	-1.78	14.77	Cd(OH)2
Cd3(OH)2(SO4)2	-26.74	-20.03	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-35.25	-12.69	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-42.87	-14.47	28.40	Cd4(OH)6SO4
CdMetal	-30.42	-16.03	14.39	Cd
CdSO4	-9.76	-9.12	0.64	CdSO4
CdSO4:2.7H2O	-7.74	-9.40	-1.66	CdSO4:2.67H2O
CdSO4:H2O	-7.95	-9.23	-1.28	CdSO4:H2O
Chalcanthite	-6.62	-9.33	-2.71	CuSO4:5H2O
CO2(g)	2.32	1.11	-1.21	CO2
Cu(OH)2	-10.87	-1.47	9.40	Cu(OH)2
Cu2SO4	-17.52	-19.24	-1.72	Cu2SO4
CuCO3	-7.66	-17.29	-9.63	CuCO3
CuMetal	-3.46	-13.08	-9.61	Cu
CuOCuSO4	-23.47	-10.16	13.30	CuO:CuSO4
CupricFerrite	-16.05	-8.24	7.81	CuFe2O4
Cuprite	-9.94	-11.80	-1.86	Cu2O
CuprousFerrite	-0.61	-9.34	-8.73	CuFeO2
CuSO4	-12.72	-8.80	3.91	CuSO4
Diaspore	-6.08	2.03	8.11	AlOOH
Dolomite	-8.98	-25.60	-16.62	CaMg(CO3)2
Dolomite(d)	-9.61	-25.60	-15.99	CaMg(CO3)2
Epsomite	-2.58	-4.86	-2.28	MgSO4:7H2O
Fe(OH)3(a)	-8.49	-3.60	4.89	Fe(OH)3
Fe3(OH)8	-24.64	-4.42	20.22	Fe3(OH)8
Gibbsite	-7.33	1.92	9.25	Al(OH)3
Goethite	-3.22	-3.49	-0.28	FeOOH
Goslarite	-3.67	-5.80	-2.12	ZnSO4:7H2O
Gypsum	-0.10	-4.70	-4.60	CaSO4:2H2O
H2(g)	-14.46	-17.52	-3.06	H2
H2O(g)	-2.14	-0.10	2.04	H2O
Hausmannite	-45.90	20.15	66.05	Mn3O4
Hematite	-4.41	-6.88	-2.47	Fe2O3
Huntite	-22.14	-50.83	-28.68	CaMg3(CO3)4
Hydromagnesite	-41.51	-47.67	-6.16	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	-16.36	-26.19	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-18.73	-26.38	-7.65	KFe3(SO4)2(OH)6

Jarosite-Na	-21.85	-25.33	-3.47	NaFe3(SO4)2(OH)6
JarositeH	-23.04	-25.68	-2.64	(H3O)Fe3(SO4)2(OH)6
Jurbanite	-2.19	-5.42	-3.23	AlOHSO4
Langite	-32.07	-13.31	18.77	Cu4(OH)6SO4:H2O
Maghemite	-13.27	-6.88	6.39	Fe2O3
Magnesite	-4.89	-12.61	-7.72	MgCO3
Magnetite	-10.25	-4.00	6.25	Fe3O4
Malachite	-14.35	-8.22	6.14	Cu2(OH)2CO3
Manganite	-16.28	9.06	25.34	MnOOH
Melanterite	-2.82	-5.29	-2.47	FeSO4:7H2O
Mirabilite	-6.03	-8.09	-2.06	Na2SO4:10H2O
Mn2(SO4)3	-53.94	-57.70	-3.76	Mn2(SO4)3
MnSO4	-8.95	-5.51	3.44	MnSO4
Monteponite	-16.68	-1.68	15.01	CdO
Morenosite	-5.86	-8.37	-2.51	NiSO4:7H2O
Nahcolite	-4.51	-5.25	-0.73	NaHCO3
Natron	-14.49	-16.58	-2.10	Na2CO3:10H2O
Nesquehonite	-7.60	-12.93	-5.33	MgCO3:3H2O
Ni(OH)2	-9.57	-0.29	9.28	Ni(OH)2
Ni4(OH)6SO4	-40.51	-8.51	32.00	Ni4(OH)6SO4
NiCO3	-9.78	-16.12	-6.34	NiCO3
Nsutite	-26.28	16.29	42.56	MnO2
O2(g)	-61.37	-64.09	-2.73	O2
Otavite	-5.51	-17.61	-12.10	CdCO3
Portlandite	-21.50	2.85	24.35	Ca(OH)2
Pyrochroite	-13.37	1.83	15.20	Mn(OH)2
Pyrolusite	-28.34	16.29	44.63	MnO2
Retgersite	-6.17	-8.26	-2.09	NiSO4:6H2O
Rhodochrosite	-2.94	-14.00	-11.06	MnCO3
Rhodochrosite(d)	-3.61	-14.00	-10.39	MnCO3
Siderite	-2.28	-13.05	-10.77	FeCO3
Siderite(d)(3)	-2.60	-13.05	-10.45	FeCO3
Smithsonite	-3.77	-13.55	-9.78	ZnCO3
Tenorite	-9.74	-1.36	8.38	CuO
Thenardite	-6.89	-7.05	-0.15	Na2SO4
Thermonatrite	-15.91	-15.64	0.26	Na2CO3:H2O
Trona	-21.09	-20.99	0.10	NaHCO3:Na2CO3:2H2O
Witherite	-9.11	-17.78	-8.67	BaCO3
Zincite(c)	-9.85	2.38	12.23	ZnO
Zincosite	-9.03	-5.06	3.97	ZnSO4
Zn(OH)2-a	-10.17	2.28	12.45	Zn(OH)2
Zn(OH)2-b	-9.47	2.28	11.75	Zn(OH)2
Zn(OH)2-c	-9.92	2.28	12.20	Zn(OH)2
Zn(OH)2-e	-9.22	2.28	11.50	Zn(OH)2
Zn(OH)2-g	-9.43	2.28	11.71	Zn(OH)2
Zn2(OH)2SO4	-10.29	-2.79	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-29.86	-7.75	22.11	ZnO:2ZnSO4
Zn4(OH)6SO4	-26.64	1.76	28.40	Zn4(OH)6SO4
ZnCO3:H2O	-3.40	-13.66	-10.26	ZnCO3:H2O
ZnMetal	-39.57	-11.97	27.59	Zn
ZnO(a)	-8.93	2.38	11.31	ZnO
ZnSO4:H2O	-5.13	-5.17	-0.04	ZnSO4:H2O

Beginning of batch-reaction calculations.

Reaction step 1.

Using mix 1. Mixture of deep aquifer (P03-01-01), high strength tailings (P03-01-08), low strength tailings (P01-08A) and Faro creek seepage (FCS-4)

Mixture 1. Mixture of deep aquifer (P03-01-01), high strength tailings (P03-01-08), low strength tailings (P01-08A) and Faro creek seepage (FCS-4)

1.150e+001	Solution 1	P03-01-01	6/1/2007	Depth:	46.8
1.240e-001	Solution 2	P03-01-08	6/1/2007	Depth:	9.3

1.380e-001 Solution 3 P01-08A 11-May-05 put in average temperature and tailings redox
7.500e-001 Solution 4 FCS-4 7/13/2006

----------Solution composition----------

Elements	Molality	Moles
Al	3.715e-006	4.648e-005
Ba	9.710e-007	1.215e-005
C	7.564e-001	9.464e+000
Ca	2.561e-003	3.205e-002
Cd	2.793e-008	3.495e-007
Cu	1.475e-007	1.845e-006
Fe	2.957e-003	3.700e-002
K	1.054e-004	1.319e-003
Mg	2.298e-003	2.875e-002
Mn	8.845e-005	1.107e-003
Na	8.657e-004	1.083e-002
Ni	5.941e-007	7.433e-006
S	7.180e-003	8.983e-002
Zn	5.198e-004	6.504e-003

----------Description of solution----------

pH	= 4.110	Charge balance
pe	= 6.902	Adjusted to redox equilibrium
Activity of water	= 0.987	
Ionic strength	= 2.631e-002	
Mass of water (kg)	= 1.251e+001	
Total alkalinity (eq/kg)	= 3.867e-003	
Total CO2 (mol/kg)	= 7.564e-001	
Temperature (deg C)	= 5.340	
Electrical balance (eq)	= -4.885e-003	
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= -1.35	
Iterations	= 12	
Total H	= 1.389041e+003	
Total O	= 7.138318e+002	

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	8.802e-005	7.766e-005	-4.055	-4.110	-0.054
OH-	2.823e-011	2.430e-011	-10.549	-10.614	-0.065
H2O	5.551e+001	9.869e-001	1.744	-0.006	0.000
Al	3.715e-006				
AlSO4+	2.412e-006	2.076e-006	-5.618	-5.683	-0.065
Al+3	1.072e-006	2.781e-007	-5.970	-6.556	-0.586
Al(SO4)2-	2.145e-007	1.847e-007	-6.669	-6.734	-0.065
AlOH+2	1.682e-008	9.237e-009	-7.774	-8.034	-0.260
Al(OH)2+	1.543e-010	1.328e-010	-9.812	-9.877	-0.065
AlHSO4+2	2.313e-011	1.270e-011	-10.636	-10.896	-0.260
Al(OH)3	4.710e-014	4.739e-014	-13.327	-13.324	0.003
Al(OH)4-	1.138e-015	9.799e-016	-14.944	-15.009	-0.065
Ba	9.710e-007				
Ba+2	5.226e-007	2.869e-007	-6.282	-6.542	-0.260
BaSO4	4.433e-007	4.460e-007	-6.353	-6.351	0.003
BaHCO3+	5.088e-009	4.379e-009	-8.293	-8.359	-0.065
BaCO3	1.066e-013	1.072e-013	-12.972	-12.970	0.003
BaOH+	1.435e-016	1.236e-016	-15.843	-15.908	-0.065
C(-4)	0.000e+000				
CH4	0.000e+000	0.000e+000	-61.043	-61.040	0.003
C(4)	7.564e-001				
CO2	7.524e-001	7.570e-001	-0.124	-0.121	0.003
HCO3-	3.413e-003	2.956e-003	-2.467	-2.529	-0.062

FeHCO3+	4.002e-004	3.445e-004	-3.398	-3.463	-0.065
ZnHCO3+	7.745e-005	6.667e-005	-4.111	-4.176	-0.065
MgHCO3+	3.999e-005	3.443e-005	-4.398	-4.463	-0.065
CaHCO3+	3.066e-005	2.639e-005	-4.513	-4.579	-0.065
MnHCO3+	1.085e-005	9.343e-006	-4.964	-5.030	-0.065
NaHCO3	1.216e-006	1.223e-006	-5.915	-5.913	0.003
NiHCO3+	1.004e-007	8.643e-008	-6.998	-7.063	-0.065
CuHCO3+	6.201e-008	5.338e-008	-7.208	-7.273	-0.065
ZnCO3	3.815e-008	3.838e-008	-7.419	-7.416	0.003
FeCO3	2.983e-008	3.001e-008	-7.525	-7.523	0.003
BaHCO3+	5.088e-009	4.379e-009	-8.293	-8.359	-0.065
MnCO3	3.006e-009	3.024e-009	-8.522	-8.519	0.003
CO3-2	1.908e-009	1.074e-009	-8.719	-8.969	-0.250
NiCO3	1.676e-009	1.686e-009	-8.776	-8.773	0.003
CaCO3	1.587e-009	1.597e-009	-8.799	-8.797	0.003
CdHCO3+	1.096e-009	9.437e-010	-8.960	-9.025	-0.065
MgCO3	7.830e-010	7.878e-010	-9.106	-9.104	0.003
CuCO3	2.065e-010	2.077e-010	-9.685	-9.682	0.003
NaCO3-	5.910e-012	5.088e-012	-11.228	-11.293	-0.065
Zn(CO3)2-2	1.605e-012	8.810e-013	-11.795	-12.055	-0.260
BaCO3	1.066e-013	1.072e-013	-12.972	-12.970	0.003
CdCO3	8.558e-015	8.610e-015	-14.068	-14.065	0.003
Ni(CO3)2-2	5.729e-015	3.146e-015	-14.242	-14.502	-0.260
Cu(CO3)2-2	5.115e-016	2.808e-016	-15.291	-15.552	-0.260
Cd(CO3)2-2	5.324e-020	2.923e-020	-19.274	-19.534	-0.260
Ca	2.561e-003				
Ca+2	1.970e-003	1.109e-003	-2.706	-2.955	-0.249
CaSO4	5.605e-004	5.639e-004	-3.251	-3.249	0.003
CaHCO3+	3.066e-005	2.639e-005	-4.513	-4.579	-0.065
CaHSO4+	2.453e-007	2.112e-007	-6.610	-6.675	-0.065
CaCO3	1.587e-009	1.597e-009	-8.799	-8.797	0.003
CaOH+	2.718e-012	2.339e-012	-11.566	-11.631	-0.065
Cd	2.793e-008				
Cd+2	1.839e-008	1.009e-008	-7.736	-7.996	-0.260
CdSO4	7.891e-009	7.939e-009	-8.103	-8.100	0.003
CdHCO3+	1.096e-009	9.437e-010	-8.960	-9.025	-0.065
Cd(SO4)2-2	5.592e-010	3.071e-010	-9.252	-9.513	-0.260
CdCO3	8.558e-015	8.610e-015	-14.068	-14.065	0.003
CdOH+	2.603e-015	2.240e-015	-14.585	-14.650	-0.065
Cd(CO3)2-2	5.324e-020	2.923e-020	-19.274	-19.534	-0.260
Cd(OH)2	7.238e-021	7.282e-021	-20.140	-20.138	0.003
Cd2OH+3	5.548e-022	1.440e-022	-21.256	-21.842	-0.586
Cd(OH)3-	1.206e-029	1.038e-029	-28.919	-28.984	-0.065
Cd(OH)4-2	2.142e-039	1.176e-039	-38.669	-38.930	-0.260
CdHS+	0.000e+000	0.000e+000	-55.673	-55.738	-0.065
Cd(HS)2	0.000e+000	0.000e+000	-107.293	-107.290	0.003
Cd(HS)3-	0.000e+000	0.000e+000	-162.957	-163.023	-0.065
Cd(HS)4-2	0.000e+000	0.000e+000	-218.484	-218.745	-0.260
Cu(1)	2.259e-012				
Cu+	2.259e-012	1.945e-012	-11.646	-11.711	-0.065
Cu(2)	1.475e-007				
Cu+2	6.562e-008	3.603e-008	-7.183	-7.443	-0.260
CuHCO3+	6.201e-008	5.338e-008	-7.208	-7.273	-0.065
CuSO4	1.961e-008	1.973e-008	-7.708	-7.705	0.003
CuCO3	2.065e-010	2.077e-010	-9.685	-9.682	0.003
CuOH+	5.319e-012	4.578e-012	-11.274	-11.339	-0.065
Cu(OH)2	1.208e-013	1.216e-013	-12.918	-12.915	0.003
Cu(CO3)2-2	5.115e-016	2.808e-016	-15.291	-15.552	-0.260
Cu2(OH)2+2	2.067e-018	1.135e-018	-17.685	-17.945	-0.260
Cu(OH)3-	1.081e-022	9.308e-023	-21.966	-22.031	-0.065
Cu(OH)4-2	4.299e-031	2.360e-031	-30.367	-30.627	-0.260
Cu(HS)3-	0.000e+000	0.000e+000	-155.215	-155.280	-0.065
Fe(2)	2.957e-003				
Fe+2	2.122e-003	1.165e-003	-2.673	-2.934	-0.260
FeSO4	4.347e-004	4.373e-004	-3.362	-3.359	0.003
FeHCO3+	4.002e-004	3.445e-004	-3.398	-3.463	-0.065
FeHSO4+	2.577e-007	2.218e-007	-6.589	-6.654	-0.065

FeCO3	2.983e-008	3.001e-008	-7.525	-7.523	0.003
FeOH+	1.129e-009	9.715e-010	-8.947	-9.013	-0.065
Fe(OH)2	1.674e-017	1.684e-017	-16.776	-16.774	0.003
Fe(OH)3-	7.514e-024	6.468e-024	-23.124	-23.189	-0.065
Fe(HS)2	0.000e+000	0.000e+000	-109.811	-109.808	0.003
Fe(HS)3-	0.000e+000	0.000e+000	-165.618	-165.683	-0.065
Fe(3)	3.529e-008				
Fe(OH)2+	1.467e-008	1.263e-008	-7.834	-7.899	-0.065
FeOH+2	1.214e-008	6.666e-009	-7.916	-8.176	-0.260
FeSO4+	6.955e-009	5.987e-009	-8.158	-8.223	-0.065
Fe+3	1.081e-009	2.805e-010	-8.966	-9.552	-0.586
Fe(SO4)2-	4.347e-010	3.742e-010	-9.362	-9.427	-0.065
Fe(OH)3	8.209e-012	8.259e-012	-11.086	-11.083	0.003
FeHSO4+2	2.443e-012	1.341e-012	-11.612	-11.872	-0.260
Fe2(OH)2+4	3.141e-014	2.854e-015	-13.503	-14.544	-1.042
Fe(OH)4-	4.772e-017	4.108e-017	-16.321	-16.386	-0.065
Fe3(OH)4+5	2.226e-018	5.251e-020	-17.652	-19.280	-1.627
H(0)	1.640e-025				
H2	8.201e-026	8.251e-026	-25.086	-25.083	0.003
K	1.054e-004				
K+	1.039e-004	8.895e-005	-3.984	-4.051	-0.067
KSO4-	1.560e-006	1.343e-006	-5.807	-5.872	-0.065
Mg	2.298e-003				
Mg+2	1.821e-003	1.040e-003	-2.740	-2.983	-0.243
MgSO4	4.370e-004	4.396e-004	-3.360	-3.357	0.003
MgHCO3+	3.999e-005	3.443e-005	-4.398	-4.463	-0.065
MgCO3	7.830e-010	7.878e-010	-9.106	-9.104	0.003
MgOH+	8.331e-012	7.172e-012	-11.079	-11.144	-0.065
Mn(2)	8.845e-005				
Mn+2	6.458e-005	3.546e-005	-4.190	-4.450	-0.260
MnSO4	1.301e-005	1.309e-005	-4.886	-4.883	0.003
MnHCO3+	1.085e-005	9.343e-006	-4.964	-5.030	-0.065
MnCO3	3.006e-009	3.024e-009	-8.522	-8.519	0.003
MnOH+	2.420e-012	2.083e-012	-11.616	-11.681	-0.065
Mn(OH)3-	1.340e-027	1.153e-027	-26.873	-26.938	-0.065
Mn(3)	1.560e-024				
Mn+3	1.560e-024	4.047e-025	-23.807	-24.393	-0.586
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-69.927	-70.188	-0.260
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-73.981	-74.046	-0.065
Na	8.657e-004				
Na+	8.529e-004	7.356e-004	-3.069	-3.133	-0.064
NaSO4-	1.162e-005	1.001e-005	-4.935	-5.000	-0.065
NaHCO3	1.216e-006	1.223e-006	-5.915	-5.913	0.003
NaCO3-	5.910e-012	5.088e-012	-11.228	-11.293	-0.065
Ni	5.941e-007				
Ni+2	3.858e-007	2.118e-007	-6.414	-6.674	-0.260
NiSO4	1.062e-007	1.069e-007	-6.974	-6.971	0.003
NiHCO3+	1.004e-007	8.643e-008	-6.998	-7.063	-0.065
NiCO3	1.676e-009	1.686e-009	-8.776	-8.773	0.003
Ni(SO4)2-2	3.885e-011	2.133e-011	-10.411	-10.671	-0.260
NiOH+	9.827e-014	8.459e-014	-13.008	-13.073	-0.065
Ni(CO3)2-2	5.729e-015	3.146e-015	-14.242	-14.502	-0.260
Ni(OH)2	3.400e-018	3.421e-018	-17.469	-17.466	0.003
Ni(OH)3-	5.050e-025	4.347e-025	-24.297	-24.362	-0.065
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-49.020	-49.017	0.003
S(-2)	0.000e+000				
H2S	0.000e+000	0.000e+000	-54.776	-54.773	0.003
CdHS+	0.000e+000	0.000e+000	-55.673	-55.738	-0.065
HS-	0.000e+000	0.000e+000	-57.847	-57.912	-0.065
S6-2	0.000e+000	0.000e+000	-63.499	-63.683	-0.184
S5-2	0.000e+000	0.000e+000	-63.682	-63.879	-0.196
S4-2	0.000e+000	0.000e+000	-63.923	-64.133	-0.210
S-2	0.000e+000	0.000e+000	-67.086	-67.347	-0.260
S3-2	0.000e+000	0.000e+000	-67.397	-67.623	-0.226

S2-2	0.000e+000	0.000e+000	-68.681	-68.920	-0.239
Zn(HS)2	0.000e+000	0.000e+000	-104.634	-104.631	0.003
Cd(HS)2	0.000e+000	0.000e+000	-107.293	-107.290	0.003
Fe(HS)2	0.000e+000	0.000e+000	-109.811	-109.808	0.003
Cu(HS)3-	0.000e+000	0.000e+000	-155.215	-155.280	-0.065
Zn(HS)3-	0.000e+000	0.000e+000	-161.318	-161.383	-0.065
Cd(HS)3-	0.000e+000	0.000e+000	-162.957	-163.023	-0.065
Fe(HS)3-	0.000e+000	0.000e+000	-165.618	-165.683	-0.065
Cd(HS)4-2	0.000e+000	0.000e+000	-218.484	-218.745	-0.260
S(6)	7.180e-003				
SO4-2	5.577e-003	3.101e-003	-2.254	-2.508	-0.255
CaSO4	5.605e-004	5.639e-004	-3.251	-3.249	0.003
MgSO4	4.370e-004	4.396e-004	-3.360	-3.357	0.003
FeSO4	4.347e-004	4.373e-004	-3.362	-3.359	0.003
ZnSO4	1.101e-004	1.108e-004	-3.958	-3.956	0.003
HSO4-	1.839e-005	1.583e-005	-4.735	-4.800	-0.065
MnSO4	1.301e-005	1.309e-005	-4.886	-4.883	0.003
NaSO4-	1.162e-005	1.001e-005	-4.935	-5.000	-0.065
Zn(SO4)2-2	5.980e-006	3.283e-006	-5.223	-5.484	-0.260
AlSO4+	2.412e-006	2.076e-006	-5.618	-5.683	-0.065
KSO4-	1.560e-006	1.343e-006	-5.807	-5.872	-0.065
BaSO4	4.433e-007	4.460e-007	-6.353	-6.351	0.003
FeHSO4+	2.577e-007	2.218e-007	-6.589	-6.654	-0.065
CaHSO4+	2.453e-007	2.112e-007	-6.610	-6.675	-0.065
Al(SO4)2-	2.145e-007	1.847e-007	-6.669	-6.734	-0.065
NiSO4	1.062e-007	1.069e-007	-6.974	-6.971	0.003
CuSO4	1.961e-008	1.973e-008	-7.708	-7.705	0.003
CdSO4	7.891e-009	7.939e-009	-8.103	-8.100	0.003
FeSO4+	6.955e-009	5.987e-009	-8.158	-8.223	-0.065
Cd(SO4)2-2	5.592e-010	3.071e-010	-9.252	-9.513	-0.260
Fe(SO4)2-	4.347e-010	3.742e-010	-9.362	-9.427	-0.065
Ni(SO4)2-2	3.885e-011	2.133e-011	-10.411	-10.671	-0.260
AlHSO4+2	2.313e-011	1.270e-011	-10.636	-10.896	-0.260
FeHSO4+2	2.443e-012	1.341e-012	-11.612	-11.872	-0.260
Zn	5.198e-004				
Zn+2	3.263e-004	1.791e-004	-3.486	-3.747	-0.260
ZnSO4	1.101e-004	1.108e-004	-3.958	-3.956	0.003
ZnHCO3+	7.745e-005	6.667e-005	-4.111	-4.176	-0.065
Zn(SO4)2-2	5.980e-006	3.283e-006	-5.223	-5.484	-0.260
ZnCO3	3.815e-008	3.838e-008	-7.419	-7.416	0.003
ZnOH+	5.875e-010	5.057e-010	-9.231	-9.296	-0.065
Zn(CO3)2-2	1.605e-012	8.810e-013	-11.795	-12.055	-0.260
Zn(OH)2	3.620e-013	3.642e-013	-12.441	-12.439	0.003
Zn(OH)3-	1.700e-020	1.464e-020	-19.769	-19.835	-0.065
Zn(OH)4-2	5.369e-029	2.948e-029	-28.270	-28.530	-0.260
Zn(HS)2	0.000e+000	0.000e+000	-104.634	-104.631	0.003
Zn(HS)3-	0.000e+000	0.000e+000	-161.318	-161.383	-0.065

----------Saturation indices----------

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-6.41	5.76	12.17	Al(OH)3
AlumK	-10.15	-15.69	-5.54	KAl(SO4)2:12H2O
Alunite	-5.31	-4.11	1.20	KAl3(SO4)2(OH)6
Anhydrite	-1.12	-5.46	-4.34	CaSO4
Anilite	-39.10	-73.23	-34.13	Cu0.25Cu1.5S
Antlerite	-16.71	-8.42	8.29	Cu3(OH)4SO4
Aragonite	-3.69	-11.92	-8.24	CaCO3
Artinite	-17.83	-6.74	11.09	MgCO3:Mg(OH)2:3H2O
Azurite	-16.31	-10.96	5.35	Cu3(OH)2(CO3)2
Barite	1.30	-9.05	-10.35	BaSO4
Basaluminite	-10.39	12.31	22.70	Al4(OH)10SO4
Bianchite	-4.53	-6.29	-1.76	ZnSO4:6H2O
Birnessite	-17.82	25.78	43.60	MnO2
Bixbyite	-24.32	-24.14	0.18	Mn2O3
BlaubleiI	-38.68	-62.84	-24.16	Cu0.9Cu0.2S

BlaubleiII	-40.36	-67.64	-27.28	Cu0.6Cu0.8S
Boehmite	-4.28	5.76	10.04	AlOOH
Brochantite	-23.00	-7.66	15.34	Cu4(OH)6SO4
Brucite	-13.02	5.23	18.24	Mg(OH)2
Bunsenite	-12.15	1.54	13.69	NiO
Calcite	-3.53	-11.92	-8.40	CaCO3
Cd(gamma)	-36.33	-21.80	14.53	Cd
Cd(OH)2	-13.44	0.21	13.65	Cd(OH)2
Cd(OH)2(a)	-14.59	0.21	14.80	Cd(OH)2
Cd3(OH)2(SO4)2	-27.51	-20.80	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-32.64	-10.08	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-38.27	-9.87	28.40	Cd4(OH)6SO4
CdMetal	-36.22	-21.80	14.42	Cd
CdSO4	-11.17	-10.50	0.66	CdSO4
CdSO4:2.7H2O	-8.87	-10.52	-1.65	CdSO4:2.67H2O
CdSO4:H2O	-9.24	-10.51	-1.27	CdSO4:H2O
CH4(g)	-58.35	-61.04	-2.69	CH4
Chalcanthite	-7.27	-9.98	-2.71	CuSO4:5H2O
Chalcocite	-40.05	-77.22	-37.17	Cu2S
Chalcopyrite	-80.88	-117.98	-37.11	CuFeS2
CO2(g)	1.08	-0.12	-1.20	CO2
Covellite	-37.73	-61.25	-23.51	CuS
Cu(OH)2	-8.66	0.76	9.43	Cu(OH)2
Cu2SO4	-24.22	-25.93	-1.71	Cu2SO4
CuCO3	-6.78	-16.41	-9.63	CuCO3
CuMetal	-8.97	-18.61	-9.65	Cu
CuOCuSO4	-22.55	-9.18	13.37	CuO:CuSO4
CupricFerrite	-1.57	6.31	7.88	CuFe2O4
Cuprite	-13.34	-15.21	-1.87	Cu2O
CuprousFerrite	3.89	-4.84	-8.72	CuFeO2
CuSO4	-13.90	-9.95	3.95	CuSO4
Diaspore	-2.39	5.76	8.16	AlOOH
Djurleite	-39.77	-76.17	-36.40	Cu0.066Cu1.868S
Dolomite	-7.27	-23.88	-16.60	CaMg(CO3)2
Dolomite(d)	-7.91	-23.88	-15.97	CaMg(CO3)2
Epsomite	-3.25	-5.53	-2.29	MgSO4:7H2O
Fe(OH)3(a)	-2.13	2.76	4.89	Fe(OH)3
Fe3(OH)8	-9.43	10.79	20.22	Fe3(OH)8
FeS(ppt)	-52.82	-56.74	-3.92	FeS
Gibbsite	-3.53	5.76	9.29	Al(OH)3
Goethite	3.02	2.77	-0.25	FeOOH
Goslarite	-4.16	-6.30	-2.13	ZnSO4:7H2O
Greenockite	-45.02	-61.80	-16.78	CdS
Greigite	-192.21	-237.25	-45.03	Fe3S4
Gypsum	-0.87	-5.47	-4.60	CaSO4:2H2O
H2(g)	-22.02	-25.08	-3.06	H2
H2O(g)	-2.06	-0.01	2.05	H2O
H2S(g)	-54.01	-54.77	-0.76	H2S
Hausmannite	-32.93	33.31	66.24	Mn3O4
Hematite	7.95	5.54	-2.41	Fe2O3
Huntite	-19.15	-47.78	-28.64	CaMg3(CO3)4
Hydromagnesite	-36.55	-42.61	-6.06	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	-3.25	-13.08	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-5.51	-13.10	-7.59	KFe3(SO4)2(OH)6
Jarosite-Na	-8.77	-12.18	-3.41	NaFe3(SO4)2(OH)6
JarositeH	-10.63	-13.16	-2.54	(H3O)Fe3(SO4)2(OH)6
Jurbanite	-1.73	-4.96	-3.23	AlOHSO4
Langite	-26.50	-7.66	18.84	Cu4(OH)6SO4:H2O
Mackinawite	-52.09	-56.74	-4.65	FeS
Maghemite	-0.85	5.54	6.39	Fe2O3
Magnesite	-4.24	-11.95	-7.71	MgCO3
Magnetite	4.47	10.82	6.35	Fe3O4
Malachite	-11.27	-5.10	6.17	Cu2(OH)2CO3
Manganite	-10.57	14.77	25.34	MnOOH
Melanterite	-3.00	-5.48	-2.48	FeSO4:7H2O
Millerite	-52.31	-60.48	-8.17	NiS
Mirabilite	-6.74	-8.83	-2.10	Na2SO4:10H2O

```
      Mn2(SO4)3       -52.62  -56.31   -3.69  Mn2(SO4)3
      MnS(Green)      -62.35  -58.25    4.10  MnS
      MnSO4           -10.43   -6.96    3.47  MnSO4
      Monteponite     -14.83    0.22   15.05  CdO
      Morenosite       -6.71   -9.22   -2.51  NiSO4:7H2O
      Nahcolite        -4.92   -5.66   -0.74  NaHCO3
      Natron          -13.17  -15.29   -2.13  Na2CO3:10H2O
      Nesquehonite     -6.65  -11.97   -5.32  MgCO3:3H2O
      Ni(OH)2          -7.69    1.53    9.22  Ni(OH)2
      Ni4(OH)6SO4     -36.58   -4.58   32.00  Ni4(OH)6SO4
      NiCO3            -9.32  -15.64   -6.33  NiCO3
      Nsutite         -16.78   25.78   42.56  MnO2
      O2(g)           -46.30  -49.02   -2.72  O2
      Otavite          -4.87  -16.97  -12.10  CdCO3
      Portlandite     -19.15    5.25   24.40  Ca(OH)2
      Pyrite          -77.67  -96.73  -19.06  FeS2
      Pyrochroite     -11.44    3.76   15.20  Mn(OH)2
      Pyrolusite      -18.97   25.78   44.75  MnO2
      Retgersite       -7.12   -9.22   -2.10  NiSO4:6H2O
      Rhodochrosite    -2.36  -13.42  -11.06  MnCO3
      Rhodochrosite(d)  -3.03  -13.42  -10.39  MnCO3
      Siderite         -1.14  -11.90  -10.76  FeCO3
      Siderite(d)(3)   -1.45  -11.90  -10.45  FeCO3
      Smithsonite      -2.94  -12.72   -9.77  ZnCO3
      Sphalerite      -45.50  -57.55  -12.04  ZnS
      Sulfur          -38.11  -53.54  -15.43  S
      Tenorite         -7.64    0.77    8.41  CuO
      Thenardite       -8.63   -8.78   -0.15  Na2SO4
      Thermonatrite   -15.51  -15.24    0.27  Na2CO3:H2O
      Trona           -21.05  -20.91    0.14  NaHCO3:Na2CO3:2H2O
      Witherite        -6.84  -15.51   -8.67  BaCO3
      Wurtzite        -47.61  -57.55   -9.94  ZnS
      Zincite(c)       -7.80    4.47   12.27  ZnO
      Zincosite       -10.26   -6.26    4.00  ZnSO4
      Zn(OH)2-a        -7.99    4.46   12.45  Zn(OH)2
      Zn(OH)2-b        -7.29    4.46   11.75  Zn(OH)2
      Zn(OH)2-c        -7.74    4.46   12.20  Zn(OH)2
      Zn(OH)2-e        -7.04    4.46   11.50  Zn(OH)2
      Zn(OH)2-g        -7.25    4.46   11.71  Zn(OH)2
      Zn2(OH)2SO4      -9.29   -1.79    7.50  Zn2(OH)2SO4
      Zn3O(SO4)2      -30.27   -8.04   22.23  ZnO:2ZnSO4
      Zn4(OH)6SO4     -21.27    7.13   28.40  Zn4(OH)6SO4
      ZnCO3:H2O        -2.46  -12.72  -10.26  ZnCO3:H2O
      ZnMetal         -45.21  -17.55   27.66  Zn
      ZnO(a)           -6.84    4.47   11.31  ZnO
      ZnS(a)          -48.31  -57.55   -9.24  ZnS
      ZnSO4:H2O        -6.24   -6.26   -0.02  ZnSO4:H2O

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End of simulation.
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Reading input data for simulation 2.
------------------------------------

      USE SOLUTION 1
      USE SOLUTION 2
      USE SOLUTION 3
      USE SOLUTION 4
      EQUILIBRIUM_PHASES 1 Selected minerals are allowed to precipitate when they reach
saturation
          Barite    0 0
          Boehmite  0 0
          Dolomite  -1 10
          Fe(OH)3(a) 0 0
          Gibbsite  0 0
```

```
          Gypsum    0 0
          Rhodochrosite 0 0
          Siderite(d)(3) 0 0
          ZnCO3:H2O 0 0
      MIX 4 Mixture of deep aquifer (P03-01-01), high strength tailings (P03-01-08), low
strength tailings (P01-08A) and Faro creek seepage (FCS-4)    1    11.5
          1    11.5
          2    0.124
          3    0.138
          4    0.75
      SAVE solution 6
      SELECTED_OUTPUT
          file                  P03-06 sim2.out
          reset                 false
          simulation            true
          ph                    true
          pe                    true
          totals                Ca  Mg  Na  S(6)  Zn  Fe  Fe(2)
                                 Fe(3)
          saturation_indices    Alunite  Barite  Basaluminite  Boehmite
                                 Fe(OH)3(a)  Gibbsite  Gypsum  Jurbanite
                                 Rhodochrosite  Siderite  Smithsonite  Zn(OH)2-g
                                 Zn2(OH)2SO4  ZnCO3:H2O
----------------------------------------
Beginning of batch-reaction calculations.
----------------------------------------

Reaction step 1.

Using mix 4.      Mixture of deep aquifer (P03-01-01), high strength tailings (P03-01-08),
low strength tailings (P01-08A) and Faro creek seepage (FCS-4)    1    11.5
Using pure phase assemblage 1.      Selected minerals are allowed to precipitate when they
reach saturation

Mixture 4.  Mixture of deep aquifer (P03-01-01), high strength tailings (P03-01-08), low
strength tailings (P01-08A) and Faro creek seepage (FCS-4)    1    11.5

       1.150e+001 Solution 1  P03-01-01     6/1/2007     Depth:  46.8
       1.240e-001 Solution 2  P03-01-08     6/1/2007     Depth:  9.3
       1.380e-001 Solution 3  P01-08A     11-May-05   put in average temperature and
tailings redox
       7.500e-001 Solution 4  FCS-4     7/13/2006

-------------------------------Phase assemblage--------------------------------

                                                        Moles in assemblage
Phase                   SI log IAP  log KT      Initial       Final       Delta

Barite               0.00  -10.35  -10.35   0.000e+000  1.089e-005  1.089e-005
Boehmite            -0.75    9.30   10.04   0.000e+000           0  0.000e+000
Dolomite            -1.00  -17.60  -16.60   1.000e+001  9.793e+000 -2.067e-001
Fe(OH)3(a)          -0.61    4.28    4.89   0.000e+000           0  0.000e+000
Gibbsite            -0.00    9.29    9.29   0.000e+000  2.408e-006  2.408e-006
Gypsum              -0.42   -5.02   -4.60   0.000e+000           0  0.000e+000
Rhodochrosite       -0.47  -11.53  -11.06   0.000e+000           0  0.000e+000
Siderite(d)(3)       0.00  -10.45  -10.45   0.000e+000  2.278e-002  2.278e-002
ZnCO3:H2O           -0.61  -10.87  -10.26   0.000e+000           0  0.000e+000

-----------------------------Solution composition------------------------------

      Elements           Molality       Moles

      Al               3.524e-006  4.407e-005
      Ba               1.009e-007  1.262e-006
      C                7.880e-001  9.854e+000
      Ca               1.909e-002  2.387e-001
      Cd               2.795e-008  3.495e-007
```

Cu	1.475e-007	1.845e-006
Fe	1.138e-003	1.423e-002
K	1.055e-004	1.319e-003
Mg	1.883e-002	2.354e-001
Mn	8.850e-005	1.107e-003
Na	8.662e-004	1.083e-002
Ni	5.944e-007	7.433e-006
S	7.183e-003	8.982e-002
Zn	5.201e-004	6.504e-003

----------Description of solution----------

pH	= 5.317	Charge balance
pe	= 5.750	Adjusted to redox equilibrium
Activity of water	= 0.986	
Ionic strength	= 1.003e-001	
Mass of water (kg)	= 1.251e+001	
Total alkalinity (eq/kg)	= 6.633e-002	
Total CO2 (mol/kg)	= 7.880e-001	
Temperature (deg C)	= 5.340	
Electrical balance (eq)	= -4.885e-003	
Percent error, 100*(Cat-|An|)/(Cat+|An|)	= -0.29	
Iterations	= 11	
Total H	= 1.389041e+003	
Total O	= 7.150035e+002	

----------Distribution of species----------

Species	Molality	Activity	Log Molality	Log Activity	Log Gamma
H+	5.813e-006	4.821e-006	-5.236	-5.317	-0.081
OH-	4.970e-010	3.911e-010	-9.304	-9.408	-0.104
H2O	5.551e+001	9.860e-001	1.744	-0.006	0.000
Al	3.524e-006				
Al+3	1.968e-006	2.279e-007	-5.706	-6.642	-0.936
AlSO4+	1.149e-006	9.042e-007	-5.940	-6.044	-0.104
AlOH+2	3.175e-007	1.218e-007	-6.498	-6.914	-0.416
Al(SO4)2-	5.431e-008	4.274e-008	-7.265	-7.369	-0.104
Al(OH)2+	3.582e-008	2.819e-008	-7.446	-7.550	-0.104
Al(OH)3	1.581e-010	1.618e-010	-9.801	-9.791	0.010
Al(OH)4-	6.842e-011	5.385e-011	-10.165	-10.269	-0.104
AlHSO4+2	8.951e-013	3.434e-013	-12.048	-12.464	-0.416
Ba	1.009e-007				
Ba+2	7.076e-008	2.715e-008	-7.150	-7.566	-0.416
BaSO4	2.191e-008	2.242e-008	-7.659	-7.649	0.010
BaHCO3+	8.265e-009	6.505e-009	-8.083	-8.187	-0.104
BaCO3	2.507e-012	2.566e-012	-11.601	-11.591	0.010
BaOH+	2.390e-016	1.881e-016	-15.622	-15.726	-0.104
C(-4)	0.000e+000				
CH4	0.000e+000	0.000e+000	-61.496	-61.486	0.010
C(4)	7.880e-001				
CO2	7.217e-001	7.386e-001	-0.142	-0.132	0.010
HCO3-	5.851e-002	4.641e-002	-1.233	-1.333	-0.101
MgHCO3+	3.794e-003	2.986e-003	-2.421	-2.525	-0.104
CaHCO3+	2.804e-003	2.206e-003	-2.552	-2.656	-0.104
FeHCO3+	7.706e-004	6.065e-004	-3.113	-3.217	-0.104
ZnHCO3+	3.706e-004	2.917e-004	-3.431	-3.535	-0.104
MnHCO3+	5.760e-005	4.533e-005	-4.240	-4.344	-0.104
NaHCO3	1.695e-005	1.735e-005	-4.771	-4.761	0.010
ZnCO3	2.643e-006	2.704e-006	-5.578	-5.568	0.010
CaCO3	2.101e-006	2.150e-006	-5.678	-5.668	0.010
MgCO3	1.076e-006	1.101e-006	-5.968	-5.958	0.010
FeCO3	8.317e-007	8.511e-007	-6.080	-6.070	0.010
CO3-2	6.857e-007	2.715e-007	-6.164	-6.566	-0.402
NiHCO3+	3.729e-007	2.934e-007	-6.428	-6.532	-0.104
MnCO3	2.310e-007	2.364e-007	-6.636	-6.626	0.010

CuHCO3+	1.287e-007	1.013e-007	-6.890	-6.994	-0.104
NiCO3	9.009e-008	9.219e-008	-7.045	-7.035	0.010
Zn(CO3)2-2	4.093e-008	1.570e-008	-7.388	-7.804	-0.416
CdHCO3+	1.063e-008	8.367e-009	-7.973	-8.077	-0.104
BaHCO3+	8.265e-009	6.505e-009	-8.083	-8.187	-0.104
CuCO3	6.205e-009	6.350e-009	-8.207	-8.197	0.010
NaCO3-	1.477e-009	1.162e-009	-8.831	-8.935	-0.104
Ni(CO3)2-2	1.134e-010	4.350e-011	-9.945	-10.361	-0.416
Cu(CO3)2-2	5.658e-012	2.171e-012	-11.247	-11.663	-0.416
BaCO3	2.507e-012	2.566e-012	-11.601	-11.591	0.010
CdCO3	1.201e-012	1.230e-012	-11.920	-11.910	0.010
Cd(CO3)2-2	2.752e-015	1.056e-015	-14.560	-14.976	-0.416
Ca	1.909e-002				
Ca+2	1.472e-002	5.906e-003	-1.832	-2.229	-0.397
CaHCO3+	2.804e-003	2.206e-003	-2.552	-2.656	-0.104
CaSO4	1.559e-003	1.596e-003	-2.807	-2.797	0.010
CaCO3	2.101e-006	2.150e-006	-5.678	-5.668	0.010
CaHSO4+	4.714e-008	3.710e-008	-7.327	-7.431	-0.104
CaOH+	2.547e-010	2.005e-010	-9.594	-9.698	-0.104
Cd	2.795e-008				
Cd+2	1.486e-008	5.700e-009	-7.828	-8.244	-0.416
CdHCO3+	1.063e-008	8.367e-009	-7.973	-8.077	-0.104
CdSO4	2.328e-009	2.383e-009	-8.633	-8.623	0.010
Cd(SO4)2-2	1.277e-010	4.897e-011	-9.894	-10.310	-0.416
CdCO3	1.201e-012	1.230e-012	-11.920	-11.910	0.010
CdOH+	2.587e-014	2.036e-014	-13.587	-13.691	-0.104
Cd(CO3)2-2	2.752e-015	1.056e-015	-14.560	-14.976	-0.416
Cd(OH)2	1.041e-018	1.065e-018	-17.983	-17.973	0.010
Cd2OH+3	6.378e-021	7.387e-022	-20.195	-21.132	-0.936
Cd(OH)3-	3.104e-026	2.443e-026	-25.508	-25.612	-0.104
Cd(OH)4-2	1.161e-034	4.453e-035	-33.935	-34.351	-0.416
CdHS+	0.000e+000	0.000e+000	-57.798	-57.902	-0.104
Cd(HS)2	0.000e+000	0.000e+000	-111.379	-111.369	0.010
Cd(HS)3-	0.000e+000	0.000e+000	-168.913	-169.017	-0.104
Cd(HS)4-2	0.000e+000	0.000e+000	-226.238	-226.655	-0.416
Cu(1)	4.244e-012				
Cu+	4.244e-012	3.340e-012	-11.372	-11.476	-0.104
Cu(2)	1.475e-007				
CuHCO3+	1.287e-007	1.013e-007	-6.890	-6.994	-0.104
Cu+2	1.135e-008	4.355e-009	-7.945	-8.361	-0.416
CuCO3	6.205e-009	6.350e-009	-8.207	-8.197	0.010
CuSO4	1.238e-009	1.267e-009	-8.907	-8.897	0.010
CuOH+	1.132e-011	8.905e-012	-10.946	-11.050	-0.104
Cu(CO3)2-2	5.658e-012	2.171e-012	-11.247	-11.663	-0.416
Cu(OH)2	3.718e-012	3.805e-012	-11.430	-11.420	0.010
Cu2(OH)2+2	1.119e-017	4.293e-018	-16.951	-17.367	-0.416
Cu(OH)3-	5.957e-020	4.688e-020	-19.225	-19.329	-0.104
Cu(OH)4-2	4.987e-027	1.913e-027	-26.302	-26.718	-0.416
Cu(HS)3-	0.000e+000	0.000e+000	-161.840	-161.944	-0.104
Fe(2)	1.138e-003				
FeHCO3+	7.706e-004	6.065e-004	-3.113	-3.217	-0.104
Fe+2	3.406e-004	1.307e-004	-3.468	-3.884	-0.416
FeSO4	2.547e-005	2.606e-005	-4.594	-4.584	0.010
FeCO3	8.317e-007	8.511e-007	-6.080	-6.070	0.010
FeOH+	2.228e-009	1.753e-009	-8.652	-8.756	-0.104
FeHSO4+	1.043e-009	8.208e-010	-8.982	-9.086	-0.104
Fe(OH)2	4.780e-016	4.892e-016	-15.321	-15.311	0.010
Fe(OH)3-	3.841e-021	3.023e-021	-20.416	-20.520	-0.104
Fe(HS)2	0.000e+000	0.000e+000	-114.599	-114.589	0.010
Fe(HS)3-	0.000e+000	0.000e+000	-172.276	-172.380	-0.104
Fe(3)	3.531e-008				
Fe(OH)2+	3.279e-008	2.580e-008	-7.484	-7.588	-0.104
FeOH+2	2.207e-009	8.466e-010	-8.656	-9.072	-0.416
Fe(OH)3	2.654e-010	2.716e-010	-9.576	-9.566	0.010
FeSO4+	3.191e-011	2.511e-011	-10.496	-10.600	-0.104
Fe+3	1.912e-011	2.214e-012	-10.719	-11.655	-0.936
Fe(SO4)2-	1.060e-012	8.340e-013	-11.975	-12.079	-0.104

Fe(OH)4-	2.762e-014	2.174e-014	-13.559	-13.663	-0.104
Fe2(OH)2+4	2.126e-015	4.604e-017	-14.672	-16.337	-1.664
FeHSO4+2	9.105e-016	3.493e-016	-15.041	-15.457	-0.416
Fe3(OH)4+5	6.901e-019	1.731e-021	-18.161	-20.762	-2.601
H(0)	1.255e-025				
H2	6.275e-026	6.421e-026	-25.202	-25.192	0.010
K	1.055e-004				
K+	1.047e-004	8.058e-005	-3.980	-4.094	-0.114
KSO4-	8.213e-007	6.464e-007	-6.085	-6.190	-0.104
Mg	1.883e-002				
Mg+2	1.377e-002	5.745e-003	-1.861	-2.241	-0.380
MgHCO3+	3.794e-003	2.986e-003	-2.421	-2.525	-0.104
MgSO4	1.261e-003	1.291e-003	-2.899	-2.889	0.010
MgCO3	1.076e-006	1.101e-006	-5.968	-5.958	0.010
MgOH+	8.102e-010	6.376e-010	-9.091	-9.195	-0.104
Mn(2)	8.850e-005				
MnHCO3+	5.760e-005	4.533e-005	-4.240	-4.344	-0.104
Mn+2	2.857e-005	1.096e-005	-4.544	-4.960	-0.416
MnSO4	2.101e-006	2.150e-006	-5.678	-5.668	0.010
MnCO3	2.310e-007	2.364e-007	-6.636	-6.626	0.010
MnOH+	1.316e-011	1.036e-011	-10.881	-10.985	-0.104
Mn(OH)3-	1.887e-024	1.485e-024	-23.724	-23.828	-0.104
Mn(3)	7.600e-026				
Mn+3	7.600e-026	8.803e-027	-25.119	-26.055	-0.936
Mn(6)	0.000e+000				
MnO4-2	0.000e+000	0.000e+000	-65.237	-65.653	-0.416
Mn(7)	0.000e+000				
MnO4-	0.000e+000	0.000e+000	-70.560	-70.664	-0.104
Na	8.662e-004				
Na+	8.432e-004	6.646e-004	-3.074	-3.177	-0.103
NaHCO3	1.695e-005	1.735e-005	-4.771	-4.761	0.010
NaSO4-	6.105e-006	4.804e-006	-5.214	-5.318	-0.104
NaCO3-	1.477e-009	1.162e-009	-8.831	-8.935	-0.104
Ni	5.944e-007				
NiHCO3+	3.729e-007	2.934e-007	-6.428	-6.532	-0.104
Ni+2	1.194e-007	4.580e-008	-6.923	-7.339	-0.416
NiCO3	9.009e-008	9.219e-008	-7.045	-7.035	0.010
NiSO4	1.200e-008	1.228e-008	-7.921	-7.911	0.010
Ni(CO3)2-2	1.134e-010	4.350e-011	-9.945	-10.361	-0.416
Ni(SO4)2-2	3.396e-012	1.303e-012	-11.469	-11.885	-0.416
NiOH+	3.740e-013	2.944e-013	-12.427	-12.531	-0.104
Ni(OH)2	1.872e-016	1.915e-016	-15.728	-15.718	0.010
Ni(OH)3-	4.977e-022	3.917e-022	-21.303	-21.407	-0.104
O(0)	0.000e+000				
O2	0.000e+000	0.000e+000	-48.810	-48.800	0.010
S(-2)	0.000e+000				
CdHS+	0.000e+000	0.000e+000	-57.798	-57.902	-0.104
H2S	0.000e+000	0.000e+000	-57.905	-57.895	0.010
HS-	0.000e+000	0.000e+000	-59.724	-59.828	-0.104
S6-2	0.000e+000	0.000e+000	-64.135	-64.392	-0.256
S5-2	0.000e+000	0.000e+000	-64.307	-64.587	-0.280
S4-2	0.000e+000	0.000e+000	-64.533	-64.842	-0.308
S-2	0.000e+000	0.000e+000	-67.639	-68.055	-0.416
S3-2	0.000e+000	0.000e+000	-67.988	-68.331	-0.343
S2-2	0.000e+000	0.000e+000	-69.254	-69.629	-0.375
Zn(HS)2	0.000e+000	0.000e+000	-109.027	-109.017	0.010
Cd(HS)2	0.000e+000	0.000e+000	-111.379	-111.369	0.010
Fe(HS)2	0.000e+000	0.000e+000	-114.599	-114.589	0.010
Cu(HS)3-	0.000e+000	0.000e+000	-161.840	-161.944	-0.104
Zn(HS)3-	0.000e+000	0.000e+000	-167.581	-167.685	-0.104
Cd(HS)3-	0.000e+000	0.000e+000	-168.913	-169.017	-0.104
Fe(HS)3-	0.000e+000	0.000e+000	-172.276	-172.380	-0.104
Cd(HS)4-2	0.000e+000	0.000e+000	-226.238	-226.655	-0.416
S(6)	7.183e-003				
SO4-2	4.308e-003	1.648e-003	-2.366	-2.783	-0.417
CaSO4	1.559e-003	1.596e-003	-2.807	-2.797	0.010
MgSO4	1.261e-003	1.291e-003	-2.899	-2.889	0.010

FeSO4	2.547e-005	2.606e-005	-4.594	-4.584	0.010
ZnSO4	1.603e-005	1.640e-005	-4.795	-4.785	0.010
NaSO4-	6.105e-006	4.804e-006	-5.214	-5.318	-0.104
MnSO4	2.101e-006	2.150e-006	-5.678	-5.668	0.010
AlSO4+	1.149e-006	9.042e-007	-5.940	-6.044	-0.104
KSO4-	8.213e-007	6.464e-007	-6.085	-6.190	-0.104
Zn(SO4)2-2	6.736e-007	2.584e-007	-6.172	-6.588	-0.416
HSO4-	6.639e-007	5.225e-007	-6.178	-6.282	-0.104
Al(SO4)2-	5.431e-008	4.274e-008	-7.265	-7.369	-0.104
CaHSO4+	4.714e-008	3.710e-008	-7.327	-7.431	-0.104
BaSO4	2.191e-008	2.242e-008	-7.659	-7.649	0.010
NiSO4	1.200e-008	1.228e-008	-7.921	-7.911	0.010
CdSO4	2.328e-009	2.383e-009	-8.633	-8.623	0.010
CuSO4	1.238e-009	1.267e-009	-8.907	-8.897	0.010
FeHSO4+	1.043e-009	8.208e-010	-8.982	-9.086	-0.104
Cd(SO4)2-2	1.277e-010	4.897e-011	-9.894	-10.310	-0.416
FeSO4+	3.191e-011	2.511e-011	-10.496	-10.600	-0.104
Ni(SO4)2-2	3.396e-012	1.303e-012	-11.469	-11.885	-0.416
Fe(SO4)2-	1.060e-012	8.340e-013	-11.975	-12.079	-0.104
AlHSO4+2	8.951e-013	3.434e-013	-12.048	-12.464	-0.416
FeHSO4+2	9.105e-016	3.493e-016	-15.041	-15.457	-0.416
Zn 5.201e-004					
ZnHCO3+	3.706e-004	2.917e-004	-3.431	-3.535	-0.104
Zn+2	1.301e-004	4.992e-005	-3.886	-4.302	-0.416
ZnSO4	1.603e-005	1.640e-005	-4.795	-4.785	0.010
ZnCO3	2.643e-006	2.704e-006	-5.578	-5.568	0.010
Zn(SO4)2-2	6.736e-007	2.584e-007	-6.172	-6.588	-0.416
Zn(CO3)2-2	4.093e-008	1.570e-008	-7.388	-7.804	-0.416
ZnOH+	2.881e-009	2.268e-009	-8.540	-8.644	-0.104
Zn(OH)2	2.568e-011	2.628e-011	-10.590	-10.580	0.010
Zn(OH)3-	2.159e-017	1.699e-017	-16.666	-16.770	-0.104
Zn(OH)4-2	1.436e-024	5.508e-025	-23.843	-24.259	-0.416
Zn(HS)2	0.000e+000	0.000e+000	-109.027	-109.017	0.010
Zn(HS)3-	0.000e+000	0.000e+000	-167.581	-167.685	-0.104

-----------------------------Saturation indices-------------------------------

Phase	SI	log IAP	log KT	
Al(OH)3(a)	-2.88	9.29	12.17	Al(OH)3
AlumK	-10.83	-16.38	-5.54	KAl(SO4)2:12H2O
Alunite	1.08	2.28	1.20	KAl3(SO4)2(OH)6
Anhydrite	-0.67	-5.01	-4.34	CaSO4
Anilite	-39.68	-73.82	-34.13	Cu0.25Cu1.5S
Antlerite	-14.91	-6.62	8.29	Cu3(OH)4SO4
Aragonite	-0.56	-8.79	-8.24	CaCO3
Artinite	-11.53	-0.44	11.09	MgCO3:Mg(OH)2:3H2O
Azurite	-11.84	-6.49	5.35	Cu3(OH)2(CO3)2
Barite	0.00	-10.35	-10.35	BaSO4
Basaluminite	1.05	23.75	22.70	Al4(OH)10SO4
Bianchite	-5.36	-7.12	-1.76	ZnSO4:6H2O
Birnessite	-15.81	27.79	43.60	MnO2
Bixbyite	-20.41	-20.23	0.18	Mn2O3
BlaubleiI	-40.17	-64.33	-24.16	Cu0.9Cu0.2S
BlaubleiII	-41.43	-68.71	-27.28	Cu0.6Cu0.8S
Boehmite	-0.75	9.30	10.04	AlOOH
Brochantite	-19.70	-4.36	15.34	Cu4(OH)6SO4
Brucite	-9.86	8.38	18.24	Mg(OH)2
Bunsenite	-10.40	3.29	13.69	NiO
Calcite	-0.40	-8.79	-8.40	CaCO3
Cd(gamma)	-34.27	-19.74	14.53	Cd
Cd(OH)2	-11.27	2.38	13.65	Cd(OH)2
Cd(OH)2(a)	-12.43	2.38	14.80	Cd(OH)2
Cd3(OH)2(SO4)2	-26.39	-19.68	6.71	Cd3(OH)2(SO4)2
Cd3(OH)4SO4	-28.83	-6.27	22.56	Cd3(OH)4SO4
Cd4(OH)6SO4	-32.30	-3.90	28.40	Cd4(OH)6SO4
CdMetal	-34.17	-19.74	14.42	Cd

CdSO4	-11.69	-11.03	0.66	CdSO4
CdSO4:2.7H2O	-9.39	-11.04	-1.65	CdSO4:2.67H2O
CdSO4:H2O	-9.77	-11.03	-1.27	CdSO4:H2O
CH4(g)	-58.80	-61.49	-2.69	CH4
Chalcanthite	-8.46	-11.17	-2.71	CuSO4:5H2O
Chalcocite	-40.29	-77.46	-37.17	Cu2S
Chalcopyrite	-84.16	-121.27	-37.11	CuFeS2
CO2(g)	1.07	-0.13	-1.20	CO2
Covellite	-39.36	-62.87	-23.51	CuS
Cu(OH)2	-7.17	2.26	9.43	Cu(OH)2
Cu2SO4	-24.02	-25.74	-1.71	Cu2SO4
CuCO3	-5.30	-14.93	-9.63	CuCO3
CuMetal	-7.58	-17.23	-9.65	Cu
CuOCuSO4	-22.25	-8.88	13.37	CuO:CuSO4
CupricFerrite	2.96	10.84	7.88	CuFe2O4
Cuprite	-10.45	-12.33	-1.87	Cu2O
CuprousFerrite	6.85	-1.88	-8.72	CuFeO2
CuSO4	-15.09	-11.14	3.95	CuSO4
Diaspore	1.14	9.30	8.16	AlOOH
Djurleite	-40.10	-76.50	-36.40	Cu0.066Cu1.868S
Dolomite	-1.00	-17.60	-16.60	CaMg(CO3)2
Dolomite(d)	-1.64	-17.60	-15.97	CaMg(CO3)2
Epsomite	-2.78	-5.07	-2.29	MgSO4:7H2O
Fe(OH)3(a)	-0.61	4.28	4.89	Fe(OH)3
Fe3(OH)8	-4.93	15.29	20.22	Fe3(OH)8
FeS(ppt)	-54.48	-58.39	-3.92	FeS
Gibbsite	-0.00	9.29	9.29	Al(OH)3
Goethite	4.53	4.28	-0.25	FeOOH
Goslarite	-5.00	-7.13	-2.13	ZnSO4:7H2O
Greenockite	-45.98	-62.75	-16.78	CdS
Greigite	-200.20	-245.24	-45.03	Fe3S4
Gypsum	-0.42	-5.02	-4.60	CaSO4:2H2O
H2(g)	-22.13	-25.19	-3.06	H2
H2O(g)	-2.06	-0.01	2.05	H2O
H2S(g)	-57.13	-57.90	-0.76	H2S
Hausmannite	-27.11	39.13	66.24	Mn3O4
Hematite	10.98	8.57	-2.41	Fe2O3
Huntite	-6.58	-35.22	-28.64	CaMg3(CO3)4
Hydromagnesite	-20.81	-26.87	-6.06	Mg5(CO3)4(OH)2:4H2O
Jarosite(ss)	-3.15	-12.98	-9.83	(K0.77Na0.03H0.2)Fe3(SO4)2(OH)6
Jarosite-K	-5.17	-12.76	-7.59	KFe3(SO4)2(OH)6
Jarosite-Na	-8.44	-11.84	-3.41	NaFe3(SO4)2(OH)6
JarositeH	-11.45	-13.99	-2.54	(H3O)Fe3(SO4)2(OH)6
Jurbanite	-0.88	-4.11	-3.23	AlOHSO4
Langite	-23.21	-4.37	18.84	Cu4(OH)6SO4:H2O
Mackinawite	-53.75	-58.39	-4.65	FeS
Maghemite	2.19	8.57	6.39	Fe2O3
Magnesite	-1.10	-8.81	-7.71	MgCO3
Magnetite	8.97	15.32	6.35	Fe3O4
Malachite	-8.29	-2.12	6.17	Cu2(OH)2CO3
Manganite	-8.61	16.73	25.34	MnOOH
Melanterite	-4.23	-6.71	-2.48	FeSO4:7H2O
Millerite	-53.68	-61.85	-8.17	NiS
Mirabilite	-7.10	-9.20	-2.10	Na2SO4:10H2O
Mn2(SO4)3	-56.77	-60.46	-3.69	Mn2(SO4)3
MnS(Green)	-63.57	-59.47	4.10	MnS
MnSO4	-11.21	-7.74	3.47	MnSO4
Monteponite	-12.67	2.38	15.05	CdO
Morenosite	-7.65	-10.17	-2.51	NiSO4:7H2O
Nahcolite	-3.77	-4.51	-0.74	NaHCO3
Natron	-10.86	-12.98	-2.13	Na2CO3:10H2O
Nesquehonite	-3.50	-8.83	-5.32	MgCO3:3H2O
Ni(OH)2	-5.94	3.28	9.22	Ni(OH)2
Ni4(OH)6SO4	-32.28	-0.28	32.00	Ni4(OH)6SO4
NiCO3	-7.58	-13.91	-6.33	NiCO3
Nsutite	-14.77	27.79	42.56	MnO2
O2(g)	-46.08	-48.80	-2.72	O2

Otavite	-2.71	-14.81	-12.10	CdCO3
Portlandite	-16.01	8.39	24.40	Ca(OH)2
Pyrite	-82.34	-101.41	-19.06	FeS2
Pyrochroite	-9.54	5.66	15.20	Mn(OH)2
Pyrolusite	-16.95	27.79	44.75	MnO2
Retgersite	-8.06	-10.16	-2.10	NiSO4:6H2O
Rhodochrosite	-0.47	-11.53	-11.06	MnCO3
Rhodochrosite(d)	-1.14	-11.53	-10.39	MnCO3
Siderite	0.31	-10.45	-10.76	FeCO3
Siderite(d)(3)	0.00	-10.45	-10.45	FeCO3
Smithsonite	-1.09	-10.87	-9.77	ZnCO3
Sphalerite	-46.77	-58.81	-12.04	ZnS
Sulfur	-41.12	-56.56	-15.43	S
Tenorite	-6.14	2.27	8.41	CuO
Thenardite	-8.99	-9.14	-0.15	Na2SO4
Thermonatrite	-13.20	-12.93	0.27	Na2CO3:H2O
Trona	-17.58	-17.44	0.14	NaHCO3:Na2CO3:2H2O
Witherite	-5.46	-14.13	-8.67	BaCO3
Wurtzite	-48.87	-58.81	-9.94	ZnS
Zincite(c)	-5.95	6.33	12.27	ZnO
Zincosite	-11.09	-7.08	4.00	ZnSO4
Zn(OH)2-a	-6.13	6.32	12.45	Zn(OH)2
Zn(OH)2-b	-5.43	6.32	11.75	Zn(OH)2
Zn(OH)2-c	-5.88	6.32	12.20	Zn(OH)2
Zn(OH)2-e	-5.18	6.32	11.50	Zn(OH)2
Zn(OH)2-g	-5.39	6.32	11.71	Zn(OH)2
Zn2(OH)2SO4	-8.27	-0.77	7.50	Zn2(OH)2SO4
Zn3O(SO4)2	-30.07	-7.84	22.23	ZnO:2ZnSO4
Zn4(OH)6SO4	-16.53	11.87	28.40	Zn4(OH)6SO4
ZnCO3:H2O	-0.61	-10.87	-10.26	ZnCO3:H2O
ZnMetal	-43.46	-15.80	27.66	Zn
ZnO(a)	-4.98	6.33	11.31	ZnO
ZnS(a)	-49.57	-58.81	-9.24	ZnS
ZnSO4:H2O	-7.07	-7.09	-0.02	ZnSO4:H2O

End of simulation.

Reading input data for simulation 3.

End of run.
