



Minto Explorations Ltd.

A SUBSIDIARY OF CAPSTONE MINING LTD.

APPENDIX I
ML-ARD Assessment
and
Post-Closure Water Quality Prediction



MINTO EXPLORATIONS LTD.

A Subsidiary of Capstone Mining Corp.

Minto Mine Expansion- Phase IV ML/ARD Assessment and Post-closure Water Quality Prediction

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Project No. 1CM002.001

August 2010



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SRK Project Number 1CM002.001

August 2010

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1 Introduction

As part of plans to expand the Minto Mine, Minto Explorations Ltd. (MintoEx) asked SRK to carry out an assessment of the metal leaching and acid rock drainage (ML/ARD) potential of the waste rock and tailings that will be produced during mining of new deposits. This report covers ML/ARD assessment of the Minto Mine Expansion- Phase IV, which consists of open pit mining of the near-surface portions of the Area 2 and Area 118 deposits, and underground exploration and mining of related mineralization at greater depths. Finally, this report also includes a post-closure water quality prediction for lower Minto Creek for the period following completion of Phase IV mining, processing, and site reclamation activities.

2 Background

2.1 Geological Setting

Section 2.1 is adapted from Section 6 of SRK (2009).

2.1.1 Regional Geology

The Minto Project is found in the north-northwest trending Carmacks Copper Belt along the eastern margin of the Yukon-Tanana Composite Terrain, which is comprised of several metamorphic assemblages and batholiths (Figure 2.1). The Belt is host to several intrusion-related Cu-Au mineralized hydrothermal systems. The Yukon-Tanana Composite Terrain is the easternmost and largest of the pericratonic terranes accreted to the Paleozoic northwestern margin of North America (e.g., Colpron *et al.*, 2005). It is interpreted to be the product of a continental arc and back-arc system, preserving meta-igneous and metasedimentary rocks of Permian age on top of a pre-Late Devonian metasedimentary basement (e.g., Piercey *et al.* 2002).

The Minto Property and surrounding area are underlain by plutonic rocks of the Granite Mountain Batholith (Early Mesozoic Age) (Figure 2.2) that have intruded into the Yukon-Tanana Composite Terrain. They vary in composition from quartz diorite and granodiorite to quartz monzonite. The batholith is unconformably overlain by clastic sedimentary rocks thought to be the Tantalus Formation and andesitic to basaltic volcanic rocks of the Carmacks Group. Both are assigned a Late Cretaceous age. Immediately flanking the Granite Mountain Batholith, to the east, is a package of undated mafic volcanic rocks, outcropping on the shores of the Yukon River. The structural relationship between the batholith and the undated mafic volcanics is poorly understood because the contact zone is not exposed.

2.1.2 Property Geology and Lithological Description

Much of the geological understanding of the rock around the Minto deposits is based on observations from diamond drill core and extrapolation from regional observations. The reason for this is poor

outcrop exposure, due to deep weathering and oxidation of the exposed outcrop. The terrain was not glaciated during the last ice age event.

The hypogene copper sulphide mineralization at Minto is hosted wholly within the Minto pluton, which intrudes near the boundary between the Stikinia and Yukon-Tanana terrains, however since the contact is not exposed it is unclear if the pluton stitches the two terrains. The Minto pluton is predominantly of granodiorite composition. Hood et al. (2008) distinguish three varieties of the intrusive rocks in the pluton. The first variety is a megacrystic K-feldspar granodiorite. It gradually ranges in mineralogy to quartz diorite and rarely to quartz monzonite or granite, typically maintaining a massive igneous texture. An exception occurs locally where weakly to strongly foliated granodiorite is seen in distinct sub-parallel zones several metres to tens of metres thick. A second variety of igneous rock is a folded quartzofeldspathic gneiss with centimeter-thick compositional layering and folded by centimetre to decimetre-scale disharmonic, gentle to isoclinal folds (Hood et al., 2008). The third variety of intrusive is a biotite-rich gneiss. MintoEx geologists consider all units to be similar in origin and are variously deformed equivalents of the same intrusion.

Copper sulphide mineralization is found in the rocks that have a structurally imposed fabric, ranging from a weak foliation to strongly developed gneissic banding. For this reason all core logging by the past and present operators separates the foliated to gneissic textured granodiorite as a distinctly discernable unit. It is generally believed by MintoEx geologists that this foliated granodiorite is just variably strained equivalents of the two primary granodiorite textures and not a separate lithology.

The contact relationship between the foliated deformation zones and the massive phases of granodiorite is generally very sharp. These contacts do not exhibit chilled margins and are considered by MintoEx geologists to be structural in nature, separating the variably strained equivalents of the same rock type. Tafti and Mortensen (2004) had interpreted the sharp contacts to be zones of deformed rock within the unfoliated rock i.e rafts or roof pendants. Supergene mineralization occurs proximal to near-surface extension of the primary mineralization and beneath the Cretaceous conglomerate.

2.1.3 Veining

Veins in the Minto Deposit appear to have been emplaced after the copper sulphide mineralization and are therefore not economically significant. The most common veins are very narrow (less than 30 cm) steeply dipping, simple quartz-feldspar pegmatite veins that often contain cavities that are indicative of shallow emplacement. The veins crosscut foliation in the deformation zones and the sulphide mineralization, and this cross-cutting is taken as evidence of their post sulphide mineral emplacement. Other types of late veins found in the deposit include thin (less than 2 mm) calcite, epidote, hematite and gypsum stringers, and fracture coatings. Quartz veining is extremely rare and economically insignificant.

2.2 Deposit Types

Section 2.2 is adapted from Section 7 of SRK (2009).

The abundance of the high Cu/S mineral bornite in a moderately oxidized magmatic system along with the obvious magnetite association suggests that Minto belongs to one of two recognized deposit types: Magnetite Skarn or Iron Oxide Copper Gold (“IOGC”). The lack of a typical calc-silicate skarn mineral assemblage seems to preclude the skarn deposit type, this appears to leave the IOGC model or alternatively it belongs to a previously unrecognized deposit type.

The host rocks to the Minto deposit were emplaced in a deep batholithic setting (exceeding 9 km deep to perhaps as much as 18-20 km deep), which is not considered to be the typical porphyry environment. The host is a moderately oxidized magma (Tafti and Mortensen, 2004) with widespread iron oxide (magnetite and hematite) mineralization. At least some of the hematite is supergene in origin but it is unclear if some hematite is also primary. There are very strong structural controls on ore mineral emplacement and there is no apparent genetic link to a specific phase of intrusion. Typical porphyry-type alteration zoning such as widespread propylitization, argillization, barren silicic core, or large barren pyritic halo is not recognized. Stockwork style, fracture or vein mineralization is also not present.

2.3 Mineralization

Section 2.3 is adapted from Section 8 of SRK (2009).

2.3.1 Mineralization

The primary hypogene sulphide mineralization consists of chalcopyrite, bornite, euhedral chalcocite and minor pyrite. Metallurgical testing also indicates the presence of covellite. Texturally, sulphide minerals predominantly occur as disseminations and foliaform stringers along foliation planes in the deformed granodiorite (i.e. sulphide stringers tend to follow the foliation planes). Sulphide mineral content, however, tends to increase where this foliation is disrupted by intense folding. In addition, semi-massive to massive mineralization is also observed; this style of mineralization tends to obliterate the foliation altogether. Silver telluride (hessite) is observed in polished samples but has not been logged macroscopically. Native gold and electrum have both been reported as inclusions within bornite and accounts for the high gold recoveries in test copper concentrates. Occasionally, coarse free gold is observed associated with chloritic or epidote lined fractures that cross-cut the sulphide mineralization. The free gold may be due to secondary enrichment during a later hydrothermal process overprinting the main copper sulphide-gold event. Sulphide mineralization is almost always accompanied by variable amounts of magnetite and biotite mineralization. While these minerals occur in the non-deformed rocks they are present in the mineralized horizons in a much greater abundance in the range of an order of magnitude greater than background.

Mineralization at Area 2 / 118 is distinct from the other Minto deposits in that mineralization is predominantly disseminated (+ occasional foliaform stringers) and that semi-massive to massive sulphide mineralization is absent; as a whole, the mineralization is more homogenous and consistent as compared to Minto Main and Minto North. The primary mineral assemblage at Area 2 / 118 includes chalcopyrite-bornite-magnetite with minor amounts of pyrite; and a crude zoning is present in that the higher grade northern half of the deposit shows increased bornite concentrations up to 8% locally.

2.3.2 Alteration, Weathering and Oxidation

Pervasive, strong potassic alteration occurs within the flat lying zones of mineralization, and is the predominant alteration assemblage observed in all of the Minto deposits. The potassic alteration assemblage is characterized by elevated biotite contents and minor secondary k-feldspar overgrowth on plagioclase relative to the more massive textured country rock. Biotite concentrations range up to 30 to 70% by volume locally, compared to about 5% in waste rock. Additional alteration includes the replacement of mafic minerals by secondary chlorite, epidote, or sericite observed both in mineralized and waste rock interstitially or fracture/vein proximal, as well as variable degrees of hematization of feldspars. Uncommon but locally pervasive sericite-muscovite alteration is observed associated with post-mineral brittle faults; this type of alteration is most common in the Area 2 / 118 Deposit.

The contacts between the altered and unaltered rocks are sharp, as are the contacts between mineralized rocks and waste rocks.

Copper oxide mineralization, like the hematitization seen at surface in float, trenches, and in the upper mineralized zones at Ridgetop is the result of supergene oxidation processes. This surface mineralization at Minto Main and Area 2 / 118 represents either the erosion remnants of foliated horizons that are located above the deposits or is vertical remobilization of copper up late brittle faults and fracture zones that intersect primary sulphide mineralization at depth. Chalcocite is the prime mineral in these horizons along with secondary malachite, minor azurite and rare native copper. The mineralization is found as fracture fill and joint coatings and more rarely interstitial to rock forming silicate minerals.

In addition to the obvious copper oxide minerals, oxidation is also evident by pervasive iron staining (limonite), earthy hematite, clay alteration of feldspars, and a significant loss in bulk density. The degree and distribution of copper oxide minerals appears to be directly related to the depth of the water table. For the most part this is confined to about -30 m but up to -60 m beneath the surface and is generally sub parallel with the present topographic surface.

2.4 Physical Setting

Sections 2.4.1 and 2.4.2 are reproduced from Section 4 of SRK (2009).

2.4.1 Climate

The climate in the Minto area of the Yukon is considered sub-arctic with short cool summers and long cold winters. The average temperature in the summer is 10°C and the average temperature in the winter is -20°C. Average precipitation is approximately about 25 cm of rain equivalent per annum in the form of rain and snow.

Like most northern Canadian mines the weather does not impede year round operation of the mine and processing plant except in short periods of harsh cold temperatures which may drop to -50°C, which can cause open pit mining operations to be temporarily suspended.

2.4.2 Physiography

The property lies in the Dawson Range, part of the Klondike Plateau, an uplifted surface that has been dissected by erosion. Local topography consists of rounded rolling hills and ridges and broad valleys (Figure 2.3). The highest elevation on the property is approximately 1,000 m above sea level, compared to elevations of 460 m along the Yukon River. Slopes on the property are relatively gentle and do not present accessibility problems. Bedrock outcrops can often be found at the tops of hills and ridges. There are no risks of avalanche on the property.

Overburden is colluvium primarily comprised of granite-based sand from weathering of the granitic bedrock in the area and is generally thin but pervasive but can reach +50 m in depth. Seams of clay and ice lenses are also present sporadically. South-facing slopes generally provide well-drained, sound foundation for buildings and roads. North-facing slopes in the area typically contain permafrost.

Vegetation in the area is sub-Arctic boreal forest made up of largely spruce and poplar trees. The area has experienced several wildfires over the years, and has no old-growth trees remaining.

2.4.3 Drainage Patterns

Minto Creek follows a moderately steep-sided ENE-trending V-shaped valley before reporting to the Yukon River. The profile of the creek contains a steep section where the channel is incised into exposed bedrock (commonly referred to as 'Minto Canyon'), and it is useful to consider the upper and lower portions of the catchment independently.

The existing mine facilities and all proposed Phase IV facilities are located within the upper Minto Creek watershed, upgradient of the Water Retention Dam and monitoring station W3 (Figure 2.4). The Water Retention Dam was constructed at a point where the Minto Creek valley narrows, naturally directing surface and any groundwater flow through a narrow cross-section. Along the

profile of Minto Creek between the Water Retention Dam and the top of Minto Canyon, overburden tapers out and effectively eliminates significant groundwater flow between the upper and lower portions of Minto Creek. Minto Canyon forms a barrier to fish passage, and the canyon and upper Minto Creek are not considered to be fish habitat.

Lower Minto Creek extends from the base of Minto Canyon to the confluence of Minto Creek with the Yukon River, and is monitored at monitoring station W1. The catchment area reporting to station W1 is roughly five times that reporting to station W3, and there are a number of undisturbed catchments that contribute flow and background chemical loadings to Minto Creek above W1. Lower Minto Creek is considered to be fish habitat due to seasonal use by fish migrating in from the Yukon River when flow conditions permit.

2.5 Exploration and Mining History

The Minto deposit was first identified during the 1970s through exploration that followed up on a stream sediment anomaly in Minto Creek. Drilling by several operators was carried out during the 1970s, '80s, and '90s, and resulted in the definition of the Minto deposit as a mineable resource. The permit to mine the deposit was granted in 1995, and construction began in 1997 only to be halted by an extended period of low copper prices.

MintoEx re-started mine construction in 2005 and commenced production in 2007. Mining in the Main Pit was carried out by conventional truck and shovel methods, with processing consisting of crushing, grinding and froth flotation. Tailings were dewatered through filtration, hauled, placed and roller-compacted in the Dry Stack Tailings Facility (DSTF) located southeast of the Main Pit.

Waste rock was placed initially in the Main Waste Dump (MWD), and later in the Southwest Waste Dump (SWD). Overburden was placed in the Overburden Stockpile. Stockpiles of low grade ore and mixed oxide/sulphide ore were stored in the Blue Stockpile and the Oxide Stockpile, respectively, adjacent to and east of the MWD. All of the stockpiles and dumps noted above are located upgradient of the Main Pit.

Exploration by MintoEx in the time since construction recommenced in 2005 has identified a number of mineable deposits within the Minto claim block, as well as several prospects that remain the subject of further evaluation. Deposits that have been demonstrated to contain economic reserves to date include Area 2, Area 118, Ridgetop North, Ridgetop South, and Minto North. Planning has proceeded to the point that expansion to extract the Area 2 and Area 118 deposits is proposed as the Phase IV Expansion.

2.6 Phase IV Expansion Plan

Details of the Phase IV expansion plan are provided in the Project Description (SRK 2010). A summary of details that are relevant to the Phase IV ML/ARD assessment and water quality prediction are included here.

2.6.1 Phase IV Mining Areas

Phase IV mining will include an open pit component and an underground mining component.

Open pit mining will consist of completion of mining in the Main Pit, mining of the Area 2 Pit in two stages (Stage 1 and Stage 2), and mining of the Area 118 pit.

Underground mining will extract deeper portions of the Area 2 and Area 118 resources, and will also include advancement of underground infrastructure to exploration targets at Minto East and Copper Keel. The underground workings will be accessed through a portal collared south of the Area 2 Pit, with a decline ramp being excavated from the portal to the mineral reserves and exploration targets. The portal will be at the highest elevation of the underground workings.

A detailed schedule of Phase IV mining and processing activities is included in the Phase IV Project Description (SRK 2010).

2.6.2 Phase IV Waste Management

Management of Phase IV overburden and waste rock is detailed in the Waste Management Plan (EBA 2010A) and management of Phase IV tailings is detailed in the Tailings Management Plan (EBA 2010B). Information from these two plans that is relevant to Phase IV ML/ARD assessment and water quality prediction is summarized below.

Waste rock and overburden

Overburden from the Area 2 and Area 118 pits will be placed in the Southwest Waste Dump Expansion Overburden Area (SWDE OVB) or used directly in progressive reclamation activities.

Waste rock from the Area 2 and Area 118 pits will be managed on the basis of copper content. Table 2-1 summarizes quantity of waste rock in each of five ranges of copper content (Grade Bins).

The Mill Valley Fill Expansion will be constructed exclusively of Grade Bin 0.0 material, and Grade Bin 0.0 material will also be placed in the SWD and the Area 1 Open Pit Buttress¹ (EBA 2010A). Grade Bin 0.0-0.05 and Grade Bin 0.05-0.10 waste rock will also be placed in the SWD and the Area 1 Open Pit Buttress. Waste rock with higher copper content (Grade Bin 0.10-0.20 and Grade Bin 0.20-0.64, collectively Grade Bin 0.1-0.64) will be used in the Area 1 Open Pit Buttress to the extent that scheduling permits, and excess Grade Bin 0.1-0.64 waste rock will be either placed directly into the Main Pit below the final tailings surface elevation or stored temporarily in the Grade

¹ The Area 1 Open Pit Buttress is a rock fill shell that will be placed against the overburden materials exposed in the south wall of the Area 1 Open Pit (also known as the Main Pit). To prevent loss of storage volume that could arise from movement of the overburden wall during pit filling, the buttress will be constructed early in the Phase IV schedule.

Bin Disposal Area (GBDA) within the Main Pit footprint. Any material placed in the GBDA will be relocated into the Main Pit below the final water elevation during closure works.

The Area 118 pit will be backfilled with either overburden or waste rock from the Area 2 pit prior to the completion of mining. If waste rock is used for backfill, it will consist of the same Grade Bin waste rock that is scheduled to be placed in the SWD.

Underground mining will produce a relatively small volume of waste rock that will be disposed on surface, mostly from initial decline development prior to opening up areas where underground waste can be used as backfill. The underground rock slated for surface disposal will be either disposed according to copper content (as per Grade Bins listed in Table 2-1:) or simply managed as described above for Grade Bin 0.1-0.64 open pit waste.

Table 2-1: Phase IV Waste Rock Quantity and Copper Content

Grade Bin ⁽¹⁾	Volume ⁽²⁾ (million m ³)	Tonnes ⁽³⁾ (T)	Contained Copper ⁽³⁾ (T)
0.0	8.77	17,197,898	0
0.00-0.05	0.18	346,904	102
0.05-0.10	0.18	362,042	270
0.10-0.20	0.44	863,532	1,302
0.20-0.64	1.79	3,511,013	13,497

Notes:

1. 'Grade Bin' indicates a copper grade category used in block modeling. It should be noted that 'Grade Bin 0.0' is an operational term- the waste in this category has copper content <50 mg/kg, and therefore while copper content of this material will be low, it will be somewhat greater than indicated
2. From Table 1 in Waste Management Plan (EBA 2010A)
3. From block model

Source: T:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQP\Tables\[Table2-x_GradeBin_Volume+CopperContent.xlsx]

Tailings

Tailings management will transition from placement of filtered tails in the DSTF to placement of thickened tails in the Main Pit, and possibly in the Area 2 pit after mining is complete (EBA 2010B). As described above, a waste rock buttress will be required to stabilize overburden in the south wall, and direct placement of GBDA 0.1-0.64 waste rock below the final tailings elevation may also be carried out depending on operational factors. The final tailings elevation will remain below the elevation of the low point in the rim of the Main Pit.

2.6.3 Phase IV Closure Plan

No reductions in loadings from the site due to reclamation measures have been incorporated into the site water quality prediction. The exception is the permanent subaqueous disposal of Grade Bin 0.1 to 0.64 waste rock, which will either be carried out during operations or relocated as part of closure activities.

A comprehensive description of planned reclamation measures is covered in a separate Phase IV closure plan document (EBA 2010C); the following is a summary of the operational and closure activities that are relevant to the post-closure water quality prediction:

- Reclamation of DSTF during Phase IV operations;
- Routing of diverted runoff from the catchment upstream of the DSTF through the Area 2 pit;
- Routing of runoff from the catchment upstream of the Main Pit (including runoff from the SWD and MWD) into the Main Pit lake;
- Removal of the Blue Stockpile and the Oxide stockpile, and reclamation of the underlying footprint to a standard that results in runoff having background water quality;
- Construction of sediment control facilities that limit sediment release to lower Minto Creek to less than 30 mg/L;
- Placement of all Grade Bin 0.1-0.64 waste rock below the water level in the Main Pit; and
- Placement of all Phase IV tailings below the water level in the Main Pit.

2.7 Pre-production Testing and Operational Monitoring

2.7.1 Mine Rock

Pre-production Testing

During initial review of the Minto Mine project proposal, eight drill core samples were retrieved and subjected to ABA testing, whole rock analysis and petrographic examination (Mills 1997).

- ABA testing was carried out at BC Research of Vancouver BC by the BC Research Standard Method, and included determination of total sulphur (S(T)), sulphate sulphur (S(SO₄)), neutralization potential (NP) by sulphuric acid titration to an end point of pH 3.5, and inorganic carbon content. Liquor from the NP determination was subjected to a 30-element ICP scan.
- Whole rock analysis was carried out to determine trace element content and major element content as oxide equivalents. The method of whole rock analysis was not specified.
- Petrographic examination and determination of modal mineralogy were carried out at Vancouver Petrographics of Fort Langley, BC.

The primary conclusions of the pre-production test were that waste rock was expected to be net acid neutralizing, and that the main acid neutralizing mineral was calcite (calcium carbonate, CaCO₃).

Operational Testing of Waste Rock

ABA testing of Main Pit overburden and waste rock has been carried out on composite samples of blast hole cuttings from each waste blast since mining commenced according to the BC Research Standard Method, as specified by Water Use Licence QZ96-006. Samples have been collected by mine geologists and delivered to SGS CEMI of Burnaby BC for ABA testing by the BC Research

method. Semi-annual reports have been prepared for the six month period ending in April and June of each year, and these reports are submitted to regulators for review (e.g. Minto Explorations Ltd. (2010)).

Results of operational ABA monitoring of waste rock are shown graphically in Figure 2.5. The excess of neutralization potential (NP) over acid potential (AP) appears to confirm the conclusion from pre-production testing that the Main Pit waste rock is not likely to be net acid generating.

2.7.2 Tailings

Operational Testing

Operational monitoring of Main Pit tailings has been carried out to track the ABA characteristics of the tailings produced over the operating period to date, and to verify that the as-produced tailings remain appropriate for dry-stack disposal of tailings from Main Pit ore.

ABA testing of tailings has been carried out according to the BC Research Standard Method, as specified by Water Use Licence QZ96-006. Samples for testing have consisted of 1 to 2 kg monthly composite samples, prepared from 200 to 500 gram tailings samples which were collected daily and stored in sealed plastic bags prior to preparation of the monthly composite sample.

The monthly composite was sent to Minto's accredited laboratory (SGS CEMI) where ABA analysis was conducted. The Acid Potential (AP) is determined from percent sulphide sulphur (obtained by subtracting percent sulphate sulphur from percent total sulphur). Additionally, paste pH and total inorganic carbon (TIC) were determined. Results have been reported to regulators, together with waste rock ABA results, in a semi-annual monitoring report (e.g. Minto Explorations Ltd. (2010)).

Results of operational ABA monitoring of Main Pit tailings are shown graphically in Figure 2.6. The excess of neutralization potential (NP) over acid potential (AP) appears to confirm the conclusion from pre-production testing that the Main Pit tailings are not likely to be net acid generating.

3 Methods

3.1 Phase IV Mine Rock

3.1.1 Static Tests

Exploration Assays

During recent exploration (2005 – 2008) all drill core from the Minto property was sawn and half core was sent for multi-element determination by aqua regia digestion followed by ICP-MS finish. Analyses were typically carried out at ALS Chemex (North Vancouver BC) and its predecessors.

ABA Testing- Area 2

Two rounds of ABA testing were carried out on samples from exploration drilling of the Area 2 deposit.

In 2007, testing of 36 samples was carried out at ALS Chemex according to an in-house method analogous to the Sobek method (Sobek et al., 1978). The BC Research method was not used because it is an uncommon method that has been largely avoided by industry in recent years, and because senior staff at SGS CEMI (the only laboratory in western Canada that provides the ABA testing services using the BC Research method) recommended that alternate methods be employed.

The following excerpt from the Area 2 prefeasibility study (SRK, 2007) describes the process that was followed to select samples for testing.

Italics below reproduced from SRK (2007).

To select samples for Acid-Base Accounting (“ABA”) testing, the Area 2 model described in Section 9 was reviewed using GEMS and FracSIS. The following objectives were used as guides for sample selection:

- Areal coverage of waste within the ultimate (Phase 3) Area 2 pit shell, but external to the ore zones, based on core drilled through the end of 2006;*
- Areal coverage of waste situated between the sub-parallel lenses of ore;*
- Targeted coverage of ore and mineralized waste lying immediately adjacent to the ore horizons.*

Where further refinement was required for sample selection, trace element content of the available core was assessed. Analytical records were compiled from the exploration assay records and summary statistics were calculated (minimum value, 10th, 50th, and 90th percentile values, and maximum value). Based on a review of the summary statistics for assayed elements, copper, iron, and sulphur were chosen as parameters to be used in defining the final selection of samples to be tested, with the median (50th percentile) and 90th percentile values for copper being the primary selection criteria.

Core intervals from fourteen 2006 drillholes were identified by MintoEx for ABA testing. The core intervals selected by MintoEx were reviewed by SRK and found to satisfy the sampling objectives and criteria listed above. At the time of sample selection, no exploration drilling had been done in the south-western region of the ultimate pit as it was outside the mineralized zones. As a result, waste characterization for this region of the pit has not yet been carried out. Figure 19-21 (in SRK 2007) shows the collar locations of the 2006 drillholes that were sampled for ML/ARD testing. Figure 19-22 (in SRK 2007) through 19-29 (in SRK 2007) show cross sections with the selected sample intervals plotted with the ultimate pit outline, borehole traces, and outlines of ore horizons.

Twenty-three samples of bulk granodiorite waste were selected for laboratory testing, with areal coverage of internal waste and of peripheral waste being the main criteria for selection samples.

Core logs from exploration drilling indicated sharp contacts between ore horizons and internal waste. A review of the exploration assay database showed that the transition from high grade zones to barren waste intervals was sharp, with copper concentrations in Area 2 declining from ore grade to background levels over a single assay interval (typically 1.5 m). This sharp transition from ore to waste is similar to the waste/ore transition encountered during mining of the Main Zone. To assess the ML/ARD characteristics of the mineralized waste rock in the transition zone, ten samples were selected for laboratory testing.

Three ore samples were selected for laboratory testing from the available core intervals to allow an assessment of whether inclusion of a small portion of ore within the waste rock (due to operational mis-classification) would have the potential to change the overall interpretation of the geochemical performance of the waste dumps. The selected ore samples were from the 240A, 270, and 280 horizons, and had total copper contents ranging from 0.45 to 1.29%, and total sulphur contents of 0.005 to 4.5%.

In 2008, an additional 20 samples were tested at ALS Chemex by the same methods as were used in 2007. These samples expanded ABA coverage to include the southwest portion of the pit for which no samples were available in the previous round of testing, and selections were made based on similar criteria to those described above for the 2007 testing. The 2008 samples were selected from core intervals drilled in 2007, and consisted of eleven samples of bulk granodiorite waste, seven samples of mineralized waste, and two samples of ore.

ABA Testing- Underground

An additional round of ABA testing was carried out in 2010 on drill core samples from rock along or adjacent to the alignment of the proposed decline. Using the exploration drillhole database provided by MintoEx and the preliminary decline alignment, SRK selected appropriate diamond drillhole intervals for testing. Intervals were selected from 2008 and 2009 drillholes, where the interval was within 20 m lateral distance of the decline centreline and within 10m elevation of the decline floor. Sample frequency was based on an approximate target of one sample for each 100 m length of decline. Testing was carried out at SGS CEMI by the Sobek acid-base accounting method (Sobek et al., 1978), along with inorganic carbon determination by Leco furnace and sulphate sulphur determination by hydrochloric acid leach. Twenty-seven samples were tested.

Sequential MWMP

The Meteoric Water Mobility Procedure (MWMP) is a procedure used to evaluate the potential for dissolution and leaching of weathering products from weathered mine rock (NDEP, 1990). It involves a single pass column leach over a period of 24 hours, using a 1:1 ratio of rock to extracting fluid, and is sometimes considered to chemically represent waste rock porewater.

A sequential MWMP (SMWMP) method has been devised to evaluate the accumulation of soluble weathering products in a leachate that passes through multiple aliquots of unleached weathered rock. This procedure is analogous to extending the flowpath which is encountered by a pore volume of water- leachate from the first cycle is recycled through an unleached aliquot of weathered rock in the second cycle, and subsequent cycles follow the same procedure. Care is taken to maintain a 1:1 water to rock ratio, and since water is both lost for analyses and is locked up in the spent charge, the mass leached in each stage is reduced. The initial mass of weathered rock ultimately determines the number of cycles that can be run, although all possible cycles need not be run if results warrant terminating the test.

Four SMWMP tests were carried out on Minto samples at SGS CEMI in 2009 with the goal of gaining insight into porewater chemistry of the existing waste dumps. Four 40 L grab samples were collected by SRK in 2009 and shipped to SGS CEMI for testing. Each test consisted of seven cycles of recycling leachate through unleached weathered rock, with analysis of pH, sulphate, other anions, and dissolved elements carried out in each cycle. Modified ABA testing and elemental determinations were carried out to provide sample characteristics.

Grab samples were collected under late February conditions using a bar to loosen frozen rock. Samples were collected from the Blue Ore Stockpile (two samples), the Main Waste Dump, and the Southwest Waste Dump, and are assumed to be typical material.

The mineralogical composition of the four SMWMP samples was determined by X-ray diffraction with Rietveld refinement at the Department of Earth and Ocean Sciences at the University of British Columbia.

3.1.2 Kinetic Testing: Humidity Cell Tests

Description- Humidity Cell Tests

Four humidity cell tests were started in July 2009 at SGS CEMI and these tests were ongoing at the time of preparation of this report. The objective of these tests was to evaluate the release rates of weathering products, including major and trace elements, under laboratory weathering conditions. A range of copper and sulphur content was targeted for the four tests during sample selection to provide a broad indication of variation of release rates with degree of mineralization.

Sample Selection- Humidity Cell Tests

At the time of sample selection, the mine plan envisioned accessing Phase 3 of the Area 2 deposit via open pit. The exploration ICP database (2005 - 2008) was queried to yield a list of core intervals that were both within the Phase 3 pit shell and contained less than 0.5% copper. The resulting list of 363 core intervals was taken to represent the Area 2 waste rock.

Summary statistics were calculated for the 363 Area 2 waste rock core intervals, including 50th, 75th, and 95th percentile concentrations of copper and sulphur. It was decided to target four separate populations for humidity cell testing:

1. 50th percentile concentrations of both copper and sulphur;
2. 50th percentile copper, 75th percentile sulphur;
3. 75th percentile copper, 50th percentile sulphur; and
4. 95th percentile copper and 95th percentile sulphur.

A shortlist of drill core intervals that approximately met each of the above criteria was forwarded to site staff for retrieval from archived diamond drill core from exploration drilling. Site staff were given latitude to select any interval from within each category shortlist for collection and forwarding to SGS CEMI for characterization and testing, due to the known challenges with locating specific intervals in a timely fashion. Table 3-1 summarizes the core intervals retrieved and the corresponding relative copper and sulphur contents- three were sourced from within the Area 2 Phase 2 pit, and one (HC1) was sourced from within three metres of the Phase 2 pit shell. Note that the HC1 sample was targeted to include rock with 95th percentile copper and sulphur content, but that the actual sample retrieved contained copper and sulphur at roughly 90th percentile concentrations.

Table 3-1: Phase IV Humidity Cell Samples

HCT ID	Hole ID	From	To	Copper	Sulphur	Selection Characteristics
		(m)	(m)	(%)	(%)	
HC 1	211	83.08	86.08	0.21	0.51	~90th percentile copper, ~90th percentile sulphur
HC 2	196	53.94	55.44	0.01	0.01	50th percentile copper, 50th percentile sulphur
HC 3	196	45.64	47.14	0.1	0.02	~75th percentile percentile copper, ~50th percentile
HC 4	211	70.79	73.79	0.01	0.08	~50th percentile copper, ~75th percentile sulphur

Source: X:\01_SITES\Minto\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQP\Tables\Table3-1_HCT_SampleSources.xlsx]

Test Method- Humidity Cell Tests

Humidity cell tests (HCTs) were carried out at SGS CEMI according ASTM D5744 (ASTM, 2007). For each test, a one kilogram charge of material (crushed to pass a 6.3 mm (¼”) sieve) was placed in a Plexiglas column (25.5 cm long, with an inner diameter of 10.2 cm). Each sample was subjected to consecutive 3 day cycles of moist and dry air, and the final day of the weekly cycle consisted of leaching of the sample by flooding with 500 mL (first flush 750 mL) of water and allowing the flood leach to drain into a collection container through a perforated acrylic disk topped with nylon mesh. Laboratory temperatures were maintained between 20 and 22° C.

Monitoring was carried out weekly to determine pH, conductivity, oxidation reduction potential (ORP) and dissolved oxygen (DO). Additional biweekly sampling was carried out to monitor sulphate, chloride, fluoride, acidity, alkalinity, and a suite of elements by ICP-MS.

3.1.3 Kinetic Testing: Barrel Tests

Description- Barrel Tests

Barrel tests are intended to provide a site-based weathering test that permits evaluation of rates of release of weathering products under site temperature and precipitation conditions. These tests also provide a larger scale of testing than is typically carried out in a laboratory setting.

Sample Selection- Barrel Tests

Initial efforts to understand the ML/ARD potential of Area 2 waste rock noted that there were two broad categories of Area 2 waste rock. The first category, containing by far the largest tonnage, was referred to as 'Bulk Waste' and was defined as all rock with less than 0.1% sulphur content (as determined by ICP). The second, and much smaller, category, was referred to as 'Mineralized Waste' and consisted of all rock with sulphur greater than 0.1% and copper less than 0.5% (as an approximation of mine cut-off grade). The Mineralized Waste material was identified as having a higher risk for ML/ARD, and barrel tests were proposed to evaluate samples of Mineralized Waste.

Exploration diamond drill core intervals within the Area 2 Phase 3 pit shell were identified which had sulphur content corresponding to four statistical categories. Table 3-2 lists these categories, the target sulphur content, and the number of drill core intervals that met the criteria for selection.

Table 3-2: Barrel Test Sample Selection Characteristics

Target Sulphur (%)	Selection Characteristics	Copper range (%)	Sulphur Range (%)	No. of Intervals in Sulphur Range
0.15	10th percentile sulphur amongst Mineralized Waste population with sulphur >0.1%	0.005 - 0.45	0.14 - 0.16	292
0.37	50th percentile sulphur amongst Mineralized Waste population with sulphur >0.1%	0.005 - 0.49	0.36 - 0.40	170
0.79	75th percentile sulphur amongst Mineralized Waste population with sulphur >0.1%	0.005 - 0.49	0.74 - 0.84	167
1.41	90th percentile sulphur amongst Mineralized Waste population with sulphur >0.1%	0.05 - 0.49	1.28 - 1.54	159

Source: X:\01_SITES\Minto\1CM002.001_PhaseIV_WaterQualityPrediction\Report_M LARDcharacterization+WQP\Tables\Table3-x_Barrel_SampleSources.xlsx]

Test Method- Barrel Tests

In Fall of 2009, five 200 L plastic barrels were set up at site in purpose-built stands to raise the barrels off the ground and allow monitoring of barrel drainage. Four barrels are filled with pieces of drill core broken to < 5 cm (2") size, and one barrel is empty and serves as a blank. Each barrel has several vent holes which are fitted with angled PVC fittings to ensure that fully oxygenated conditions are maintained within the barrel.

The barrels are open to the atmosphere and incident precipitation falls on the barrels. Rainfall and snowmelt percolate through the rock in the barrel, and barrel leachate is collected in a 20 L pail located beneath the barrel. Barrel leachate reports to the 20L pail via plastic tubing that is connected to the barrel through a bulkhead located in the lowest point of the base of the barrel.

Monthly monitoring is planned during non-freezing part of the year. Inspections will be carried out following substantial rain events at site, and samples will be collected on the first opportunity of each month when not frozen. Samples will be collected directly from the tubing where possible, and from the 20L pail when necessary. Field measurements will include pH, conductivity, and temperature, and samples will be collected for determination of laboratory pH and conductivity, acidity, alkalinity, anions (chloride, fluoride and sulphate) and trace-level dissolved metals by ICP-MS/OES.

3.2 Phase IV Tailings

3.2.1 Static Tests

Sample Source

Residues from metallurgical testing carried out on Area 2 and Area 118 ore samples were subjected to additional testing for purposes of ML/ARD characterization. For both deposits, locked cycle testing was carried out by G&T Metallurgical Services (G&T) of Kamloops, BC.

Area 2 ore samples consisted of drill core from each of the ore horizons that make up the Area 2 deposit (G&T, 2007). The core samples used to prepare the ore composites were selected by MintoEx personnel. Each of the seven ore horizons that make up the Area 2 deposit were tested separately, and the cleaner and rougher tails from each were reserved as separate products. To evaluate the acid-generating potential and trace metal content of the tailings, aliquots of rougher and cleaner tails from each ore horizon were combined, according to the 'as-produced' mass ratio. A combined sample (37% L Zone tails, 63% M Zone tails) was also tested to evaluate the ML/ARD characteristics of a mixed tailings product that would result from mixing of the tailings from the two main ore horizons (representing approximately 90% of the Area 2 ore) at the expected proportions in the final tailings mass (SRK, 2007).

Two Area 118 ore samples were subject to metallurgical testing. Ore samples consisted of drill core from the upper and lower portions of the Area 118 deposit (G&T (2009) and SRK (2009)). As for Area 2 samples, aliquots of rougher and cleaner tails from each ore sample were combined, according to the 'as-produced' mass ratio.

Test Methods

Tailings residues from metallurgical testing were submitted to ALS Chemex (Area 2 samples) and SGS CEMI (Area 118 samples) for further analysis. ABA testing was carried out on all samples, consisting of determination of total sulphur by induction furnace, sulphate- sulphur by hydrochloric acid leach, total inorganic carbon (TIC) by evolved gas analysis, and neutralization potential (NP) by the Sobek method (Sobek et al., 1978). Acid potential (AP) was calculated by multiplying total sulphur less sulphate sulphur by the conventional factor of 31.25.

Elemental analysis of tailings products was by aqua regia digestion followed by determination of major and trace element content by a combination of ICP-MS and ICP-AES.

3.2.2 Kinetic Tests- Subaqueous Column Tests

Description

Two subaqueous tailings columns were started in September 2009 at SGS CEMI and these tests were ongoing at the time of preparation of this report. The objective of these tests was to evaluate the porewater chemistry that would develop over a long period of contact with Phase IV tailings solids under a water cover.

Sample Source

The tailings being tested in these subaqueous columns were produced during metallurgical testing of Area 118 and Ridgetop ore samples. Details are as follows:

- Column 1: Area 118 subaqueous tailings column sample was a composite of upper and lower Area 118 ore tails produced in G&T tests 2351-33 and 2351-34 (G&T, 2009).
- Column 2: Ridgetop subaqueous tailings column sample was a composite of upper and lower Ridgetop ore tails produced in G&T tests 2351-35 and 2351-35 (G&T, 2009).

The Ridgetop subaqueous tailings column is included in this discussion for purposes of assessing the influence of different ore sources on tailings porewater chemistry.

Test Methods

The subaqueous tailings columns were constructed of 5.08 cm (2") internal diameter Plexiglas columns with an acrylic perforated disk topped with nylon mesh at the base of the column to retain the tailings solids, yet allow drainage for sampling. Approximately 2.5 kg of tailings solids were placed in each column, yielding a height of tailings of roughly 1 m in each column. Sampling ports were installed in the base of the column and in the side of the column above the tailings/ water interface.

Columns were initially saturated by slowly adding deionized water through the bottom sampling port. Once the tailings column was saturated, an additional volume of water was gently added from the top of the column to establish a 30cm column of water above the tailings/ water interface.

Operation of the subaqueous column tests consisted of circulation of water in the water cover using a peristaltic pump to ensure fully oxygenated conditions were maintained at the tailings interface. Sampling was carried out weekly from both bottom and side ports to determine pH, conductivity, oxidation reduction potential (ORP) and dissolved oxygen (DO). Additional biweekly sampling was carried out from both ports to monitor sulphate, chloride, fluoride, acidity, alkalinity, and a suite of elements by ICP-MS. For each sampling round, the minimum amount of water required for analysis was removed. Deionized water was added to the water cover each week to maintain 30 cm of water above the tailings interface.

4 Results and Discussion

4.1 Phase IV Mine Rock

4.1.1 Mineralogy

Samples for sequential MWMP tests were also subject to mineralogical determinations by quantitative x-ray diffraction (XRD). These samples were sourced from existing Main Pit dumps and stockpiles- given the similarity between the host rocks between the Main Pit and the Phase IV pits, the mineralogy is expected to be indicative. Results of XRD are reported in Appendix D.4 and are summarized in Table 2-1; the lower limit of quantitation for this technique is in the sub-percent range, and reported values less than 1% should be treated as approximate. Results from SMWMP testing are discussed in Section 4.1.2, however the mineralogical results are discussed here because they are useful for subsequent discussion.

All four samples were dominated by plagioclase, quartz, and potassium feldspar; chalcopyrite was detected in both Blue WD samples (at concentrations of 1.5 and 2.0 wt. %), and no other sulphide minerals were detected. All samples contained detectable calcite (wt.% values ranged from 0.3% for the Main Waste Dump sample up to 2.9% for Blue WD Sample 2), and two samples contained detectable siderite (0.3 wt % for the SW Dump Waste Rock sample; 0.8 wt % for Blue WD Sample 2). A mixed calcium/ magnesium carbonate (provisionally classified as dolomite) was identified in Blue WD Sample 2. All samples contained silicate minerals that may contribute to NP measurements determined by titration; the mineral clinocllore was present in all samples, and the clay minerals kaolinite and smectite (montmorillonite) were identified in select samples.

These results indicate that a portion of the inorganic carbon in Minto waste rock is present in a mineral form (siderite (FeCO_3)) that does not provided net acid neutralization, due to oxidation of the ferrous iron released when siderite is dissolved. The resulting ferric iron hydrolyzes and precipitates as iron oxyhydroxide minerals, releasing protons (H^+) and consuming available alkalinity in the same amount as released in the original dissolution of siderite.

4.1.2 Static Tests

Elemental Determinations

Exploration assay result for core intervals within the Phase IV final pit shells (Area 2 Phase 2, Area 118) were separated into ore and waste intervals, based on intersections with the modelled ore horizons used for mine planning purposes. Statistical summaries that describe the assay results are provided in Appendix A. Summary statistics for selected elements of interest (copper, cadmium, chromium, and manganese, based on operational water quality monitoring results) are shown in Table 4-2.

Table 4-1: Results of quantitative phase analysis (wt.%)

Mineral	Ideal Formula	Blue WD Sample 1 N. Side	Blue WD Sample 2 S. Side	Main Waste Dump	SW Dump Waste Rock
Quartz	SiO ₂	26.8	28.9	26.3	26.4
Clinocllore	(Mg,Fe ²⁺) ₅ Al(Si ₃ Al)O ₁₀ (OH) ₈	3.0	1.8	5.8	3.8
Kaolinite	Al ₂ Si ₂ O ₅ (OH) ₄	1.9	3.2	1.8	
Muscovite	KAl ₂ AlSi ₃ O ₁₀ (OH) ₂	3.6	3.6	3.6	
Biotite	K(Mg,Fe) ₃ (AlSi ₃ O ₁₀)(OH) ₂	6.0	5.2	5.1	6.0
Plagioclase	NaAlSi ₃ O ₈ – CaAl ₂ Si ₂ O ₈	40.1	34.5	42.5	52.2
K-feldspar	KAlSi ₃ O ₈	15.6	16.7	12.9	10.8
Dolomite	CaMg(CO ₃) ₂		0.4		
Calcite	CaCO ₃	1.5	2.9	0.3	0.4
Siderite	Fe ²⁺ CO ₃		0.8		0.3
Chalcopyrite	CuFeS ₂	1.5	2.0		
Montmorillonite	(Na,Ca) _{0.3} (Al,Mg) ₂ Si ₄ O ₁₀ (OH) ₂ ·nH ₂ O			1.8	
Total		100.0	100.0	100.0	100.0

Area 2 waste core intervals had a median copper content equal to the detection limit of 0.005% copper, which is reflective of the unmineralized nature of the bulk granodiorite waste rock. The maximum copper content (3.5%) of the Area 2 waste core intervals reflects the inclusion of ore-grade mineralized zones within the waste rock that are too small or too narrow to separate from the bulk waste. The large decrease in copper content between the maximum and 95th percentile values indicates that degree to which the maximum values are anomalous. The cadmium content of the Area 2 waste core intervals showed a similar skewed distribution, with the 95th percentile value of 0.25 ppm being equal to the detection limit. Other trace element concentrations in Area 2 waste core intervals were somewhat less skewed to high values.

Area 118 waste core intervals had higher median (0.03%) and maximum (3.9%) copper contents than Area 2. However, exploration assays were only carried out on waste core intervals drilled through 2008, and were available only for 6 waste core intervals. As Area 118 waste will be a small component of the overall waste tonnage produced in Phase IV, further discussion of the limited available data is not warranted.

Selenium determinations were not included in the reported exploration assay results. When queried, ALS Chemex was able to retrieve selenium results for some of the exploration core intervals from the raw ICP scans. However, the lower detection limit for the exploration assay method was 5 ppm, and over 85% of the results provided indicated a selenium concentration of 5 ppm. Elemental analysis of SMWMP samples (discussed below) returned selenium concentrations of 0.7 and 2.5 ppm for the Main Waste Dump and Southwest Waste Dump samples, respectively.

Table 4-2: Phase IV Waste Rock: Summary of Selected Elemental Content from Exploration Assays

Pit	Summary Statistic	Total Cu %	Cd_ppm	Cr_ppm	Mn_ppm
Area 2	Max	3.5	4.6	119	1430
Area 2	95th Percentile	0.17	0.25	38	738
Area 2	75th Percentile	0.01	0.25	8	612
Area 2	50th Percentile	0.005	0.25	7	543
Area 2	25th Percentile	0.005	0.25	5	447
Area 2	5th Percentile	0.005	0.25	4	280
Area 2	Min	0.005	0.25	0.5	40
Area 2	Average	0.04	0.26	11	528
Area 2	Count	2037	2037	2037	2037
Area 118	Max	0.0	0.25	8	554
Area 118	95th Percentile	0.0	0.25	7.8	551
Area 118	75th Percentile	0.0	0.25	7	524
Area 118	50th Percentile	0.01	0.25	7	464
Area 118	25th Percentile	0.00625	0.25	7	427
Area 118	5th Percentile	0.005	0.25	6.3	412
Area 118	Min	0.005	0.25	6	411
Area 118	Average	0.02	0.25	7.0	475
Area 118	Count	6	6	6	6
Source: X:\01_SITES\Minto\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQP\Tables\Table4-1_WR_Element_SummaryStats.xls					

Acid Base Accounting- Area 2

Results of 2007 and 2008 ABA testing are provided in tabular form in Appendix B.

Results show that sulphur in Area 2 mine rock is dominantly in the sulphide form. Figure 4.1 contains a plot of sulphide sulphur and total sulphur that shows the excellent 1:1 correlation between sulphide and total sulphur for most samples. One sample of mineralized waste had total sulphur concentration 64% higher than the corresponding sulphide sulphur concentration, likely due to sulphate sulphur hosted in gypsum veins ($\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$). Samples categorized as bulk waste had total sulphur contents up to 0.11%, and samples categorized as mineralized waste had total sulphur contents up to 0.75%. A comparison of sulphide sulphur and copper content showed that the copper mineral chalcopyrite (CuFeS_2) could account for most of the sulphide sulphur in the samples tested (Figure 4.2); as chalcopyrite is widely observed in Minto rocks, it is likely an important sulphur host.

To evaluate the degree to which NP measured by titration is likely to be derived from carbonate minerals, the NP values were compared with inorganic carbon content (converted to common units of kg CaCO_3 /tonne). Figure 4.3 shows the results of this comparison and illustrates two main points: that NP and inorganic carbon content (denoted as NP_{TIC}) are generally well correlated, particularly for bulk waste, and that NP values systematically exceed NP_{TIC} values by an amount of around 10 kg CaCO_3 /tonne. Both the $\text{NP} > \text{NP}_{\text{TIC}}$ phenomenon and the magnitude of roughly 10 kg CaCO_3 /tonne have been observed on other projects, and the typical conclusion is that silicate minerals (such as clays) are contributing a component of the neutralization that is measured in the NP titration.

Results of NP and AP determinations are shown in Figure 4.4. The current permit for the Minto Mine classifies rock with NP:AP ratio (NPR) greater than 3 as non-potentially acid generating (Non-PAG). It is common practice to categorize rock with a NPR between 1 and 3 as having uncertain potential for acid generation (Uncertain), and to categorize rock with a NPR ratio of less than 1 as potentially acid generating (PAG). These three categories (Non-PAG, Uncertain, and PAG) are adopted here for purposes of discussion.

It should be noted that specifying a NPR of 3 as the lower limit of the Non-PAG category is conservative. Theoretically, if grain-scale weathering is occurring at neutral pH, and if all NP is in the form of calcium and magnesium carbonates that are available to react, a NPR of 2 is the upper limit of this ratio that is required to ensure that neutral weathering conditions will persist indefinitely. This upper limit is sometimes referred to as a 'critical NPR', as it defines the transition from theoretically PAG to Non-PAG material. If grain-scale weathering occurs under acid pH conditions, the 'critical NPR' is less than 2, and can be as low as 1. The rationale for adopting a NPR of 3 as the lower limit of the Non-PAG category is to account for uncertainty related to interpreting ABA results. For example, uncertainty can arise from not knowing the mineral form of NP at the screening stage, or from scale effects such as concentration of sulphide grains in the blast fines (which has occurred at some mines, thereby causing the NPR of the blast fines to be lower than the bulk rock NPR). Defining Non-PAG as $\text{NPR} > 3$ provides some insurance, in light of the uncertainty, that Non-PAG rock will not develop dump-scale acidic weathering conditions.

Bulk waste samples had NPRs in excess of seven and were categorized as Non-PAG. Mineralized waste samples had NPRs ranging from 0.6 to 61: one sample had $\text{NPR} < 1$ (PAG); six samples had NPR values between 1 and 3 (Uncertain); and ten samples had $\text{NPR} > 3$ (Non-PAG). Ore samples had NPR values ranging from 1.5 to 42, with three samples having NPR values between 1 and 3 (Uncertain) and 2 samples having $\text{NPR} > 3$ (Non-PAG).

For purposes of comparing method performance, operational monitoring results were charted in a similar fashion, with neutralization potential determined by the BC Research method (BCR_NP) plotted against NP_{TIC} (Figure 4.5). Similar to the Sobek NP method, the BC Research method commonly indicated a higher value for neutralization potential than was indicated by inorganic carbon content; however, the correlation between the two test methods was much lower, with BCR_NP exceeding NP_{TIC} more than five-fold in some cases. On the basis of these observations, it is recommended that operational monitoring in Phase IV adopt the Sobek method of NP determination and maintain the measurement of inorganic carbon content.

A conservative assumption that is often adopted is that neutralization by silicate minerals is insufficiently reactive to maintain neutral pH weathering conditions, and that only calcium and magnesium carbonate minerals can reactive quickly enough to maintain the circum-neutral pH weathering conditions that are important for limiting leaching of trace elements like copper.

Figure 4.6 plots NP_{TIC} and AP for Phase IV samples, along with operational monitoring results² from the Main Pit for comparison. This figure shows that, while NP_{TIC} values are lower than NP values, using NP_{TIC} values for characterization of ARD potential would result in no substantial change in categorization of ARD potential: bulk waste NPRs (based on NP_{TIC}) remain greater than 3, and mineralized waste and ore NPRs (based on NP_{TIC}) remain distributed between Non-PAG, Uncertain and PAG categories. It should be noted that the results from operational monitoring show a similar distribution of material characteristics from Main Pit wastes (based on $NP_{TIC}:AP$), with the great majority of samples being classified as Non-PAG, a minority of samples classified as Uncertain, and two samples classified as PAG. Further, for materials with low total sulphur concentrations like those measured in most Phase IV rock, silicate weathering can generate alkalinity at rates that are significant in neutralizing acidity arising from sulphide oxidation.

Acid Base Accounting- Underground

A plan view of the preliminary decline alignment and the locations of decline samples tested is shown in Figure 4.7. Sample origins, copper content, and results of ABA testing of samples from the preliminary decline alignment are provided in Appendix C and are summarized in Figures 4.8, 4.9 and 4.10.

Figures 4.8 and 4.9 show plots of NP vs. AP and NP_{TIC} vs. AP, respectively. Sulphide sulphur content of most of the samples is low, with corresponding AP values less than 5 kg $CaCO_3$ equiv./tonne for 23 of 27 samples tested. Using the ARD classification described above for Area 2 rock, all samples with $AP < 5$ kg $CaCO_3$ equiv./tonne would be classified as Non-PAG using either NP or NP_{TIC} values. Four of 27 samples tested would be classified as either Uncertain or PAG- three of these four are some of the deepest samples tested (from drillholes 07SWC211, 06SWC080, and 06SWC116 in Figure 4.7), and represent a location where the decline passes through mineralization. All PAG and Uncertain samples have copper content near 1% (see Appendix C)- this rock would either be sent directly to the mill or stockpiled for later processing. Overall, these results are similar to those from Area 2 rock, which show that bulk rock will not generate ARD and that mineralized rock has some potential to generate ARD.

A plot of NP_{TIC} vs. NP for decline samples is shown in Figure 4.10. As for Area 2 and Main Pit rock, NP_{TIC} was typically less than NP, which suggests that a portion of the NP measured by titration was derived from non-carbonate sources (likely silicate minerals such as clays).

² The NP titration used for operational monitoring is carried out according to the BC Research method, as specified by the mine's water use license, despite the method being no longer commonly used in the field of ARD assessment. Results are not directly comparable to those NP values determined by the Sobek method (a standard method in widespread use); as a result, inorganic carbon content provides the only consistent measure of NP between operational monitoring and Phase IV characterization.

Sequential MWMP

Results of Sequential MWMP testing are provided in tabular form in Appendix D1 through D3, including ABA tests and elemental determinations for MWMP samples.

Selected results are plotted in Figure 4.11. Inspection of the charts for sulphate, copper and manganese reveals that concentrations of these three important elements had not stabilized after 7 cycles and that additional mass was dissolved in each cycle. Follow-up equilibrium modelling (not provided) on the SMWMP results using PHREEQC showed that gypsum (calcium sulphate) and malachite (basic copper carbonate) were all approaching saturation, but remained undersaturated in Cycle 7 leachate (Table 4-3).

It should be noted that the Blue WD samples were tested to aid development of source terms for the Blue Ore Stockpile area for purposes of water quality prediction. MintoEx has committed to milling the ore stockpiles in the Blue Ore Stockpile area, and therefore no source term for that facility has been derived.

Results for mineralogical characterization by XRD were discussed previously in Section 4.1.1.

Table 4-3: Saturation Indices for SMWMP Test Cycle 7 leachates

		Sequence #	Saturation Indices				
Sample			gypsum	tenorite	malachite	calcite	dolomite
Blue WD Sample 1	North Side	Sequence 7	-0.05	0.49	-0.23	0.26	1.11
Blue WD Sample 2	South Side	Sequence 7	-0.09	0.54	-0.24	0.41	1.60
Main	Waste Dump	Sequence 7	-1.06	0.17	-0.98	0.49	1.66
SW Dump	Waste Rock	Sequence 7	-0.55	0.25	-0.81	0.42	1.60

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQP\Tables\Table4-3_SMWMP_PHQoutput.xlsx

4.1.3 Kinetic Tests

Humidity Cell Tests

Results to date for the four Phase IV humidity cell tests (HCTs) are provided in Appendix E.

Over 51 weeks of testing, leachate pH for all four HCTs has drifted lower from typical initial values between pH 7.5 and 8 to values typically between 7.3 and 7.7. The greatest degree of variability in leachate pH was observed in HC1, which had the highest copper and sulphur concentrations of the four samples being tested. Leachate pHs for all four tests appear to have been within a stable range since around Week 30 of testing.

Sulphate release rates were initially elevated (around 30 mg/kg/week) for HC1, and declined over the duration of testing to levels similar to HC2, -3 and -4 (<5 mg/kg/week) by Week 50. Sulphate release from HC2, -3, and -4 was relatively stable over the duration of testing to date.

Copper release rates from all four HCTs declined over the duration over testing and appear to be crudely related to the copper content of the sample. HC1 had order-of-magnitude higher release rates than the other samples, with typical release rates around 0.01 mg/kg/week. HC2, -3, and -4 had typical copper release rates within an apparently stable range of around 0.0002 to 0.001 mg/kg/week.

Cadmium release rates from HC1 were initially elevated over later rates and declined over the duration of testing. Calculated rates of release of cadmium from HC2, -3, and -4 were influenced by detection level cadmium concentrations in HCT leachate and appear to have been stable at or near the detection level-indicated rate of around 0.000002 mg/kg/week.

Release rates for other elements were either stable or declining over the duration of testing.

Barrel Tests

Results from initial monitoring of barrel tests were incomplete at the time of report preparation. Monitoring of barrel test leachate is planned going forward to inform future site water quality assessments.

4.1.4 Implications for Waste Rock Management

The ABA characterization of Phase IV waste rock has shown that it will have similar characteristics to waste rock that has been produced from the Main Pit. The majority of the waste rock will consist of unmineralized granodiorite that has low sulphur content and modest carbonate mineral content; this bulk waste material is uniformly classified as Non-PAG and does not present a risk for generation of ARD. The bulk waste is appropriate for disposal in upland waste dumps.

A minor component of the waste rock will consist of mineralized rock that contains sub-economic copper grades and ranges in ARD classification from Non-PAG to PAG. This material will also contain a larger inventory of copper and other trace elements (e.g. arsenic, cadmium, chromium, manganese, molybdenum, nickel, zinc) that could impair downstream water quality if leaching occurs at unacceptable levels. If mixed with bulk waste, the mineralized waste rock would represent a minor risk for development of ARD and a more substantial risk for release of elevated concentrations of trace elements over the long term.

Due to the risk of long term trace element release from the mineralized waste, MintoEx has developed a mine plan that entails selective handling of most of the mineralized waste stream. Segregation of mineralized waste on the basis of copper content is proposed, with both the risk of ARD and trace element leaching being minimized by storage of mineralized waste under saturated conditions following the completion of closure activities. During operations, mineralized waste will either be co-disposed with thickened tailings in the Main Pit or stockpiled within the Main Pit footprint for later relocation below the ultimate water level in the Main Pit lake.

4.2 Phase IV Tailings

4.2.1 Static Test Results

Complete results of Phase IV tailings static testing are included in Appendix F, and results of operational monitoring of tailings generated from Main Pit ore are included in Appendix G for comparative purposes.

Total sulphur ($S(T)$) and sulphide sulphur ($S(Sx)$) content (calculated as the difference between $S(T)$ and sulphate sulphur ($S(SO_4)$)) for the Phase IV tailings are shown in Figure 4.12. Operational results from Main Zone tails are shown for comparative purposes. For Area 2 and Area 118 samples with $S(T) < 0.2\%$, most of the sulphur is in the sulphide form. For the two Area 2 samples with $S(T) > 0.2\%$, $S(T)$ was measurably greater than $S(Sx)$ due to the measurable $S(SO_4)$ content which suggests the test samples may have contained gypsum (these samples represent the deepest Area 2 ore horizons (P Zone and Q Zone)). By comparison, the operational Main Zone tails have consistently returned near-equal $S(Sx)$ and $S(T)$ content.

Figure 4.13 shows a plot of neutralization potential calculated from inorganic carbon content (NP_{TIC}) vs. NP for Phase IV tailings samples; results from operational monitoring of Main Zone tailings are shown for comparison. All Area 2 samples have $NP_{TIC} < NP$, with NP_{TIC} values being 10 to 20 kg $CaCO_3$ /tonne less than corresponding NP values. In contrast, both Area 118 samples have $NP_{TIC} > NP$. These results suggest that both silicate minerals and iron or manganese carbonates contribute to the various NP measurements for the Phase IV tailings. NP determinations for Main Zone samples have been carried out according to the BC Research method as specified by the site's water use license QZ96-006; the wide range of NP values and the narrower range of NP_{TIC} values suggest that the BC Research method (BC Research, 1995) may not be reflecting the carbonate mineral content of the samples appropriately (this was the stated intention of specifying the BC Research method in QZ96-006).

Plots of NP vs. AP and NP_{TIC} vs. AP are shown in Figure 4.14 and Figure 4.15. All Phase IV samples had NP:AP ratios greater than 2, and all but one sample had NP_{TIC} :AP ratios greater than 2. The operational monitoring results from the Main Zone tailings are shown for comparison in Figure 4.15; the Main Zone tails display a similar range of NP_{TIC} :AP ratios as observed in the Phase IV testing.

The elemental content of the Phase IV tailings test samples are provided in Appendix F, and the elemental content of from nine monthly composites from 2009 are provided for comparison (these nine sets of results are the complete set of available operational data at the time of report preparation). While trace element content of the monthly composite samples is often below the metallurgical detection limits provided, the following comparisons can be made:

- Copper and chromium content in the Phase IV samples was somewhat lower than in the available Main Zone monthly composites; and

- Iron, manganese, and zinc contents of Phase IV samples were similar to or slightly higher than the same elements in the available Main Zone monthly composite results.

Other trace element concentrations (including arsenic, cadmium and selenium) in Phase IV tailings samples were similar to typical crustal average concentrations for granitic rocks (Price 1997).

4.2.2 Kinetic Tests

Column Test Results

At the time of report preparation, 46 weeks of subaqueous tailings column testing had been received; results are provided in both tabular and chart form in Appendix H.

Monitoring of water cover pH from both Column 1 (Area 118 tails) and Column 2 (Ridgetop tails) has shown a decline from initial circum-neutral pH levels to slightly acidic values (between pH 5.5 and 6.5) in the latter weeks of testing to date. This decline in pH coincides with stable and low sulphate concentrations, and a decline in conductivity and major cation concentrations. These observations are consistent with the addition of deionized water (pH 5.5) to the water cover through the course of testing, coupled with depletion of readily available NP at the tailings surface. Trace element concentrations are uniformly low over time in the water cover in both columns. Of note, the manganese concentrations in the surface water in both columns over time suggest that there is a flux of manganese from the tails into the overlying water (although concentrations remain low at <0.03 mg/L).

Monitoring of bottom port leachate showed a consistent range of pH, typically ranging from pH 7 to pH 8 for both columns over the course of testing to date. Sulphate concentrations peaked in Week 6 of testing for both columns (Column 1 peak value of 67 mg/L; Column 2 peak value of 101 mg/L), before rapidly declining to < 20 mg/L by Week 15 and continuing to decline for the duration of the test. Similarly, alkalinity concentrations for both columns peaked in Week 8, then declined to long term stable values, with Column 2 (Ridgetop tails) having two-fold higher alkalinity concentrations in the most recent results. Major cations showed a similar pattern, with early peaks and lower stable concentrations in latter weeks of testing.

The following trace elements had similar concentrations in both surface water and bottom port leachate: arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. The following points discuss notably elevated concentrations of trace elements in bottom port water (compared to surface water) from the subaqueous tailings columns:

- Barium increased dramatically in Column 1 leachate beginning in Week 14, and appeared to stabilize at concentrations around 2.3 mg/L over the latest 10 weeks of testing for which results were available (Weeks 36 to 45). Inspection of sulphate concentrations shows a corresponding dramatic decline, and the increase in barium concentrations is thought to result from equilibrium dissolution of the sparingly-soluble mineral barite (barium sulphate) when sulphate concentrations became favourable.

- Manganese concentrations for both bottom ports peaked in Week 6, with a maximum concentration of 0.085 mg/L. In latter weeks, manganese concentrations declined more than 50%, with concentrations from Column 1 bottom port of less than half the concentrations in both water covers and Column 2 manganese concentrations approaching those of the water covers.
- Molybdenum concentrations in bottom port leachate from both columns appeared to be increasing in latter weeks. Concentrations remained below maxima (near 0.03 mg/L) reached in Week 6 of testing.

Overall, the differences in porewater geochemistry from the two tailings samples, as represented by column bottom port leachate, are minor.

4.2.3 Implications for Tailings Management

Phase IV tailings are expected to be similar to tailings produced from the Main Zone ore bodies. Test results indicate that there is minimal risk of widespread acid weathering conditions developing within the Phase IV tailings. Operational monitoring of the DSTF has shown that there is a potential for neutral pH leaching of manganese from the Main Zone tails, and it is expected that the Phase IV tails would behave in a geochemically-similar fashion.

Disposal of Phase IV tailings as a thickened tails product below the final spill elevation in the mined-out Main Pit will serve to minimize neutral pH metal leaching. Two factors will be most significant in this regard:

- disposal of the bulk of the tailings in a permanently-saturated state will minimize oxidation of contained metal-bearing sulphide minerals, and subsequent leaching of soluble oxidation products; and
- in-pit placement of a thickened tailings product will result in low volumes of pore fluid expelled from the tailings to the overlying water via consolidation over time.

5 Post-closure Water Quality Prediction

5.1 Approach

The Minto Phase IV post-closure water quality prediction has been developed using the GoldSim software package (GoldSim, 2010). MintoEx specified that predictions were required for Minto Creek monitoring stations W3 and W1, and for the parameters aluminum, ammonia, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, molybdenum, nickel, nitrate, nitrite, selenium, silver, thallium and zinc.

Monthly estimates of post-closure water chemistry at stations W1 and W3 were made using a water and load balance approach. Inputs to the water and load balance (WLB) consisted of the post-closure water balance prepared by Clearwater Consultants Limited (Clearwater) as well as estimates of source water chemistry from the various mine components. The prediction was carried out on the basis of dissolved loads, and then equivalent total loads were estimated.

For the purposes of the water quality prediction, the post-closure period is assumed to be the period following reclamation and decommissioning of the mine site when steady state conditions have been established. In the context of the Phase IV mine plan, a key aspect of these steady state conditions will be the filling of the Main Pit and the Area 2 Pit to the respective spill points, and the development of stable chemical loadings to these water bodies.

The philosophy in developing the WLB was to arrive at a conservative, but reasonable, estimate of post-closure water chemistry in Minto Creek. In practical terms, this philosophy was manifested in the selection of appropriate chemical source terms for the various mine components; where some uncertainty existed about the appropriate source terms, conservative (typically higher) values were selected for use as model inputs.

5.2 Inputs to Water Quality Prediction

5.2.1 Water balance

A post-closure water balance was prepared by Clearwater that estimated monthly runoff from various subcatchments of Minto Creek for a range of return periods (CCL 2010). The catchment flows for the average return period were adopted as the basis for the GoldSim water and load balance. The subcatchments of Minto Creek were defined to allow loads to be assigned to various discrete sources of load (e.g. waste dumps, pit walls, and dry stack tails). The water balance and a map showing the discrete catchments is included as Appendix I.

5.2.2 Source Terms

Undisturbed Catchment Areas

Minnow Environmental Inc. (Minnow) has reviewed monitoring records from reference streams within the Minto Creek catchment, and from the main stem of Minto Creek (Appendix J). The reviewed records span the pre-operational and operational periods through the end of 2009.

Minnow evaluated three approaches to characterizing water quality from undisturbed catchment areas:

- Option 1- water quality in undisturbed tributary catchments reporting to routine monitoring stations W6 and W7 through 2008, and the broader Minto Creek data set for 2005 (prior to significant site disturbance- stations W1, W2, W3, W8, W9, W10);
- Option 2- water quality in undisturbed tributary catchments reporting to routine monitoring stations W6 and W7 for the entire period of record; and
- Option 3- water quality in undisturbed tributary catchments reporting to routine monitoring stations W6 and W7 for the entire period of record (through 2009), and the broader Minto Creek data set for 2005 (prior to significant site disturbance- stations W1, W2, W3, W8, W9, W10).

Option 3 represented an update of Option 1 to include 2009 monitoring results. The annual and monthly mean concentrations for the Option 2 and Option 3 data sets were compared. Both approaches were found to yield similar mean concentrations, and Minnow recommended adopting Option 3 as the source term water chemistry for runoff from undisturbed catchment areas.

Dry Stack Tailings Facility

To appropriately estimate long-term chemical loadings from the DSTF, an estimate of tailings pore water chemistry was required. No samples of tailings porewater have been collected to date. Operational monitoring of water quality immediately below the DSTF has occurred at stations W8 and W8A. Both stations monitor discharge from finger drains constructed in the foundation of the DSTF. Monitoring results from W8 and W8A show considerable variation in concentrations over time, as typified by the plots of copper and sulphate concentrations shown in Figure 5.1.

Dissolved copper concentrations observed in DSTF seepage are typical of sources where secondary copper minerals provide a control on the upper limit of dissolved copper concentrations. Water chemistry for individual sampling dates where dissolved copper measured greater than 0.1 mg/L were evaluated using the geochemical equilibrium model PHREEQC, and results indicated that seepage waters were at or near equilibrium with respect to the common secondary copper minerals tenorite (CuO) and/or malachite (Cu₂CO₃(OH)₂).

The highest sulphate and dissolved copper concentrations in DSTF seepage were measured in the sample collected at station W8 on August 19, 2009. The water chemistry from this sample was adopted as a preliminary source term for DSTF seepage; a review of trace element concentrations in

all W8 and W8A results from 2008 to present was carried out, and where warranted higher trace element concentrations were substituted into the preliminary source term to arrive at a final source term water chemistry that was incorporated into the water and load balance.

There are a number of elements that are expected to cause the adopted source term to result in a conservative estimate of DSTF loadings, including:

- The model assumes all tailings are unfrozen and contributing load, ~~while monitoring shows that a portion of the DSTF tailings are frozen~~; and
- High (typically the highest) values from operational seepage monitoring were selected for use as source terms; for concentrations of trace elements not controlled by mineral equilibria, this may overestimate annual loading by applying uniformly high concentrations throughout the year. Monitoring results show differing degrees of seasonal variability for different trace elements.

Other assumptions made in defining the DSTF source term include:

- In the post-closure period tailings seepage will contain minimal suspended solids, and dissolved concentrations will be equal to total concentrations;
- Tailings seepage and runoff flows will be a function of precipitation directly onto the footprint of the DSTF, and that there will be insignificant volumes of upgradient water contacting DSTF tailings;
- Tailings seepage will have circum-neutral pH;
- Water chemistry at site water quality monitoring stations is reflective of tailings porewater chemistry; and
- No reduction in loading rates from the DSTF will occur as a result of reclamation of the DSTF.

In-Pit Tailings Facility

A conservative estimate of loadings to the pit lake due to post-closure consolidation of Main Pit thickened tails was developed to evaluate whether the in-pit tails are likely to be a significant source of load. The scoping estimate was developed as follows:

1. The in-pit tailings deposit was approximated as having a surface area of 18.5 ha and an average thickness of 60 m (actual projected maximum thickness will be roughly 60 m). These dimensions slightly exceed the expected actual dimensions indicated by subsequent mine planning.
2. For scoping purposes, a rate of porewater release ($0.17 \text{ m}^3 \text{ porewater} / \text{m}^2 \text{ tailings surface area}$) was adopted from results of consolidation analysis of slurry tails carried out for another copper mine project. The reference slurry tailings were modelled as a 90 m thick deposit having a finer grind than the Minto Phase IV tails (tails with a finer grind take longer to consolidate, so relatively more consolidation happens post-deposition). The initial consolidation rate for the third year after cessation of deposition was adopted, to correspond

to the planned 2 years between the end of tailings deposition and the completion of closure works. This adopted porewater release rate is an overestimation of the consolidation rate due to the following factors:

- a. The adopted reference rate is based on slurry tails rather than thickened tails;
- b. The adopted reference rate is based on a 90m thick deposit rather than a 60m thick deposit;
- c. The adopted reference rate was derived for tails that had a finer particle size distribution than is planned for Minto Phase IV tails; and
- d. The scoping assessment assumes consolidation of the Minto Phase IV tails will continue at this rate indefinitely, whereas in actuality consolidation rates will decrease with time.

To estimate loading to the pit lake, the maximum concentrations observed in Column 2 leachate (Section 4.2.2) were adopted to represent porewater chemistry. Selection of Column 2 was based on the generally higher leachate concentrations than measured from Column 1.

Main Dump and Southwest Dump

Waste rock from the Main Pit was initially placed in the Main Dump. Construction of the Main Dump is complete and construction of the Southwest Dump has been started using Main Pit waste rock. Water chemistry of drainage from these facilities has been recently monitored at several stations (including W15, W30, W31, W32, W38, W39, and W40).

Maximum dissolved copper concentration was observed in the sample collected at W15 on April 27, 2010. The water chemistry from W15 on April 27, 2010 was evaluated using PHREEQC, and it was found that the water was slightly oversaturated with respect to the copper minerals tenorite and malachite. As noted previously in the DSTF discussion, formation of these copper minerals commonly limits aqueous copper concentrations under neutral leaching conditions, and the characteristic green staining indicative of malachite is observed on pit walls and on waste rock particles at Minto. The results of seepage equilibrium modelling were in good agreement with the results of modelling the leachate from the sequential MWMP testing discussed in Section 4.1.2.

The complete water chemistry from W15 for April 27, 2010 has been adopted as the preliminary model source term for release of copper and other parameters from all waste rock produced through the end of Phase IV. Maximum dissolved trace element concentrations in other samples draining waste rock were inspected to ensure that the W15 water chemistry was an appropriate source term, and the maximum observed trace element concentrations (for most elements) were substituted into the source term where these exceeded the April 27, 2010 concentrations at W15. The exceptions were:

- Cadmium: a comparison between maximum cadmium concentrations in waste dump seepage and average annual loadings indicated by scale-up³ of humidity cell release rates⁴ showed that using maximum seepage cadmium concentrations as a source concentration was overly conservative. As a result, the average annual field-scale cadmium concentration indicated by humidity cell release rates (0.000544 mg/L) was adopted as the source concentration used in the water quality prediction.
- Iron and manganese: as for cadmium, maximum iron and manganese concentrations in waste dump seepage (Fe-D 22.8 mg/L; Mn- D 17.8 mg/L) were found to much higher than those indicated by HCT results for long term mean concentrations. Appropriate scale up of HCT results suggested concentrations similar to those observed in the April 27, 2010 results, and those concentrations (Fe-D 2.91 mg/L; Mn- D 0.569 mg/L) were used in the source term. Use of average concentrations is not likely to cause seasonal effects in lower Minto Creek to be overlooked, as most waste rock drainage will report to the fully-mixed Main Pit lake (which is expected to have a residence time on the order of a few years).

Table 5-1 contains the concentrations that were adopted for the MWD and SWD source term.

³ Laboratory release rates were multiplied by three scaling factors to estimate equivalent field release rates. These factors were:

- A temperature factor of 0.2, to account for lower rates of chemical reactions under field conditions. Typical lab operating temperatures were 20°C and average site ground temperatures were assumed to be 0°C; application of the Arrhenius equation (assuming an activation energy of 60 kJ/mol) suggests a factor of 0.17 would be justified.
- A particle size factor of 0.2, to account for the difference in reactive surface area between the crushed HCT sample and the blasted rock that will be present at full scale.
- A contact or flushing factor of 0.5, to account incomplete flushing of weathering products from the full scale waste dumps (HCT operating procedure ensure complete flushing of weathering products).

The complete scale-up calculation followed the model below:

- Laboratory release rate (mg/kg/wk) x 52 wk/yr x scaling factors (temperature factor of 0.2, particle size factor of 0.2, contact (flushing) factor of 0.5).

⁴ Cadmium release from HC 2, HC 3, and HC4 was nearly identical- these cells contained rock that was selected to have copper and sulphur concentrations ranging from the 50th to the 75th percentile for Area 2 waste. Cadmium concentrations in HC2, HC3, and HC4 leachate for nearly all cycles were below the detection limit of 0.000005 mg/L; field-scale release rates were estimated from lab release rates (determined from leachate concentrations assuming detection level concentration where actual concentrations were below detection) by applying scaling factors as discussed in for the pit wall source term.

Other assumptions made in defining the MWD and SWD source term include:

- In the post-closure period waste rock seepage will contain minimal suspended solids, and dissolved concentrations will be equal to total concentrations;
- Waste rock seepage and runoff flows will be a function of precipitation directly onto the footprint of the dumps, and that there will be insignificant volumes of upgradient water contacting the majority of the waste rock;
- Waste rock seepage and runoff will have circum-neutral pH (as indicated by acid base accounting);
- Water chemistry at site water quality monitoring stations is reflective of waste rock porewater chemistry; and
- No reduction in loading rates from the MWD and SWD will occur as a result of reclamation of the waste dumps.

Table 5-1: Concentrations Adopted as MWD and SWD Source Term

Parameter	Concentration mg/L
Ag-D	0.00
Al-D	2.65
As-D	0.0034
Cd-D	0.00054
Cr-D	0.003
Cu-D	0.42
Fe-D	2.91
Hg-D	0.00
Mn-D	0.569
Mo-D	0.0139
Ni-D	0.008
Pb-D	0.0027
Se-D	0.0044
Tl-D	0.00
Zn-D	0.062

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQP\Tables\[Table5-1_MWDSourceTerm.xlsx]

Mill Valley Extension Dump

The Mill Valley Fill Dump (MVF) will be constructed of waste rock with lower copper content, defined as Grade Bin 0.0 material; this will be waste that is designated as having the lowest copper content within the block model that is used for mine planning purposes. While there will be a much lower copper inventory within this dump than in the Main Dump and the Southwest Dump, the MVF will nevertheless generate a load of copper and other soluble weathering products that needs to be accounted for in the estimation of post-closure water quality.

One approach to estimating MVF loads would be to simply apply the same source term as was adopted for the Main and Southwest dumps. However, given the lower degree of mineralisation that will be contained in the MVF, a check calculation was carried out using the results from humidity cell testing to assess whether copper concentrations would likely be sufficiently elevated to cause formation of secondary copper minerals (as seems to be the case in the existing dumps).

Humidity cell HC2 (Section 4.2.2) tested a sample having approximately 50th percentile concentrations of both copper (0.01%) and sulphur (0.01%), and this was considered a reasonable representation of MVF waste rock. Scale-up calculations³ of annual loads were carried out on stable HC2 results (e.g. laboratory copper release rate of 0.00033 mg/kg/wk; equivalent field scale copper release rate of 0.00035 mg/kg/yr), and the results were applied to flow volumes to arrive at estimates of aqueous concentrations. Results of this exercise indicated that initial runoff from the MVF would likely be at or near geochemical equilibrium with secondary copper minerals, and that trace element concentrations would be similar to those concentrations in the Main/ Southwest Dump source term. As a result, the source term adopted for the Main and Southwest dumps was also adopted for the MVF. This is expected to be a conservative approach, as over time leaching of copper and other weathering products will be lower for the MVF than for the other waste rock.

Assumptions inherent to adopting the waste rock source term for the MVF include those noted previously for the MWD and the SWD.

Main Pit and Area 2 Pit Walls

Loadings from the pit walls exposed above the final lake elevations were estimated using results of humidity cell testing along with estimates of reactive rock mass. As shown in Figure 5.2 and Figure 5.3, nearly all the mineralized material exposed in pit walls will be well below the final lake elevations. Humidity cells HC2 and HC3 contained rock with copper ranging from 0.01 to 0.1% (50th to 75th percentile) and sulphur ranging from 0.01 to 0.02% (roughly 50th percentile), and an average of release rates from these two tests was adopted as an appropriate input to estimating loads from pit walls.

Reactive rock mass was estimated for each pit wall by multiplying the approximate wall rock surface area by a thickness of 2 m. Loadings from the resulting reactive rock mass were then estimated by multiplying rock mass by estimates of field release rates as described previously³.

Assumptions inherent to the estimates of loadings from Main Pit and Area 2 pit walls include:

- Loading rates remain constant over time, as fresh weathering surfaces are exposed by ravelling of walls; and
- Pit lakes reach final elevation quickly and long-term loadings from pit walls below the final lake elevation are minimal.

Area 118 Pit Backfill

Annual loadings from Area 118 Pit backfill were estimated based on scale up of humidity cell release rates in a manner similar to that described above for the Main Pit and Area 2 Pit walls. Area 2 Pit backfill mass was estimated by reducing the mined tonnage of ore and waste from the Area 118 pit by a bulking factor (1.3) to account for the reduction in bulk density that occurs during blasting and excavation.

Assumptions inherent to the estimates of loadings from Area 118 backfill include:

- All backfill consists of bulk waste rock (not overburden) from the Area 2 pit;
- Disposal within the pit does not reduce weathering rates;
- Loadings are not limited by mineral equilibria (e.g. removal of dissolved copper through formation of secondary copper minerals); and
- Closure measures do not reduce loadings.

Main Pit and Area 2 Pit Lakes

The pit lakes were treated as fully-mixed reservoirs that received mass and load from sources and released a fully-mixed flow at the outlet at flow rates specified by the water balance. No source term was developed for the pit lakes, as all loads are accounted for through discrete sources.

Assumptions inherent to this approach include that the pits are full to the respective spill points, that pit lake stratification does not occur and that the pits do not act as a geochemical sink.

Ore Stockpile and Mill Laydown Areas

Annual loadings from the Ore Stockpile and Mill Laydown pads were estimated based on scale up of humidity cell release rates in a manner similar to that described above for the Main Pit and Area 2 Pit walls. A mine rock thickness of 2 m was assumed to exist over the footprint of both areas, and laboratory release rates from humidity cells HC2 and HC3 were converted to field release rates as described for pit walls.

Nitrogen Loadings

Nitrogen loadings (mostly in the form of ammonia and nitrate) due to leaching of blasting residues can be important during active mining. Loadings typically decrease dramatically after blasting ceases in conjunction with final ore extraction, however loadings can continue at environmentally-significant levels for some number of years as blast residues are flushed.

A common approach to evaluating nitrogen release is described by Ferguson and Leask (1988).

That method was developed based on observations of nutrient export from coal mines in the Elk Valley of SE BC compared to actual explosives use. This resulted in estimated proportion of explosives not consumed during detonation. Inputs to the method are: the total annual use of

explosives the year before a prediction is required and the type of explosives employed (with slurry explosives substantially increasing leaching rates). The latter was found to be a significant factor in the study and resulted in good predictions of actual N export.

While the method is based on explosives use the year before the prediction is required, the loading used to calibrate to explosives residue leaching reflects the cumulative effect of leaching of explosives residues in all previous years. The authors recognized this.

During mining of Phase IV at Minto, the primary explosive in use is expected to be ANFO, with emulsion used when wet conditions are encountered during non-freezing times of the year. The consumption rate is expected to be 0.8 to 0.9 kg explosive/ tonne of waste and ore. Because ANFO has the highest nitrogen content and the highest susceptibility to generating blasting residues, all explosives were assumed to be ANFO for the purposes of this evaluation, and consumption was assumed to be 0.9 kg ANFO (0.315 kg N) per tonne. The maximum annual mining rate (12.97 million tonnes (planned for 2014)) was adopted for evaluation purposes.

The approach recommended by Ferguson and Leask suggests a loss of 0.2% of nitrogen contained in explosives used in the preceding year of mining is appropriate for mines that do not use slurry explosives. Using this approach the total blast residue nitrogen mass was estimated as follows:

- 12.98 million tonnes x 0.315 kg explosive (as N)/ tonne x 0.2% = 8 176 kg leachable N.
- Considering flow volumes at station W3, this works out to be about 9 mg/L as nitrate.

In the study by Ferguson and Leask, all explosive residue was assumed to be leached in the year following generation. However, the study was carried out where continuous mining was occurring year over year, and where leached residues were being replaced year over year through consumption of additional explosives. Where mining has halted and no new nitrogen is being stored, it seems unrealistic to assume that explosives leaching will be complete in a single year with no further release in subsequent years. However, no case studies of nitrogen export on cessation of mining were identified. For that reason, a decay approach to nitrogen release was considered, whereby half the remaining N load would leach in a given year. Using this approach, nitrogen release in the fifth year post-mining would have declined to 6% of the stored residues, down from 50% in the first year.

Given the lack of standard rigorous approaches available to estimate long term rates of nitrogen export, it was felt that the existing site monitoring results likely provide the best insight into the upper limits of what might reasonably be expected immediately post-closure. For that reason, the maximum or near-maximum concentrations of nitrogen species that have been observed at station W3 (see Figure 5.4) were adopted as source term concentrations for the water and load balance. The maximum concentrations were 8.8 mg/L nitrate-N, and 0.62 mg/L ammonia-N, respectively, and these were adopted as source terms. Maximum nitrite-N values (4.04 to 4.13 mg/L) were observed in three samples collected on Oct 30, 2007; these values were considered to be outliers and were not considered realistic for use as a source term. The next highest nitrite-N concentration at W3 (0.35 mg/L) was adopted as the value to be used as a source term. Over time, experience from other

closed mines has shown that nitrogen-species loading declines substantially after the use of blasting agents is halted, and the same qualitative pattern is expected at Minto in the post-closure period.

Underground Workings

No source term or load has been attributed to the underground workings. The underground workings are expected to be at least partially flooded following the cessation of mining, although there may not be discharge from the portal given the relatively high elevation of the portal and the proximity of some of higher elevation workings to the Area 2 pit. The workings themselves are not expected to be a significant source of load, given the small exposed surface area, the low expected rates of water flux, and the geochemical similarity of the underground rocks to the surface-disposed waste rock and tailings.

Particulate Loadings from Suspended Solids

To estimate total concentrations of the parameters of interest, operational monitoring records from W3 from 2008 onwards were evaluated to determine the composition of suspended sediment. Median elemental concentrations of suspended sediment were calculated from total suspended solids (TSS) results and from the associated elemental load (based on the difference between total (unfiltered) and dissolved (filtered) water chemistry). It was assumed that site discharge (at W3) would contain 30 mg/L TSS (the upper limit allowed under the current water licence), and incremental loadings due to suspended solids were calculated for each month.

In the GoldSim model, the incremental loadings from suspended solids were added as a discrete source to the dissolved load reporting to W3. For runoff entering Minto Creek between W3 and W1, the source term was calculated from actual site monitoring data; since the total concentrations from undisturbed ground runoff were used, no allowance for additional loading due to suspended solids was necessary.

5.3 Structure of the Water and Load Balance

The GoldSim model used to develop the post closure water quality estimate consists of a water balance component that mirrors the post-closure water balance developed by CCL, and a load balance component that combines the source terms described in the previous section to appropriate flows. Figure 5.5 and Figure 5.6 show the schematic layout of the water balance and the load balance, respectively, within the model.

5.4 Water and Load Balance Results and Discussion

Post-closure monthly water chemistry estimates for stations W3 and W1 are presented in Table 5-2 and Table 5-3, respectively.

Figure 5.7 contains pie charts that represent the relative annual load contribution from each of the sources in water and load balance to the total annual load that would report to W1. For copper,

waste rock will be the dominant load source, with over 70% of the total annual load estimated to be derived from the Southwest Dump, the Main Dump, and the Mill Valley Fill. For manganese, the DSTF is shown to be the largest contributor (at 42%), with other mine sources contributing an additional 25% of the total. For all other parameters shown in Figure 5.7, runoff from undisturbed portions of the catchment (both above W3 and between W3 and W1) represents the dominant source of annual loading. It should be noted that the relative contributions shown in Figure 5.7 are based on the 'reasonable worst case' source terms used in the prediction, and that the magnitude of the relative contributions from mine sources should also be considered as 'reasonable worst case' estimates.

The predictions for nitrogen species (nitrate, nitrite and ammonia) are based on the upper limit of observed concentrations to date at station W3. Standard calculations to quantify leaching of blast residues from Phase IV mining have shown that the maximum concentrations observed to date at W3 are reasonable upper limits for concentrations that can be expected in the post-closure period, and these were adopted in the water and load balance. Leaching of nitrogen species will decline with time, and for this reason the predicted concentrations should not be used as inputs to any assessments of post-closure stream productivity.

The predicted manganese loads reporting to W3 are strongly influenced by the manganese concentration adopted for the DSTF source term (5.04 mg/L in dissolved form). As discussed in Section 5.2.2, the maximum observed manganese concentrations in waste rock seepage exceed concentrations suggested by long term manganese release from waste rock HCTs; no parallel kinetic tests are available for tailings, and therefore the maximum observed manganese concentration in tailings seepage was adopted. It is likely that the maximum observed concentrations exceed long term average concentrations, however at this time the conservative approach is to adopt the maximum observed manganese concentration for the DSTF source term.

June concentrations at W1 are based on average background runoff concentrations- there is not the same degree of conservatism in the prediction for June at W1 as for other months. For periods when there is no flow from the upper Minto Creek catchment, concentrations at W1 will vary with background runoff concentrations and may well exceed the average concentrations adopted as the background source term. This condition is expected to be identical to conditions that would have occurred under similar flow regimes in the pre-mining period.

The following points highlight some aspects of the prediction approach which contribute a measure of conservatism to the predictions of post-closure water quality:

- Where uncertainty was encountered, or when required model inputs were poorly defined, choices were made that lead to higher estimates of loading.
- Waste dump loads will report to Main Pit lake, where settling of solids and some degree of removal of dissolved load is expected to occur. No attempt was made to account for mass removal due to these processes.

- Example: some dissolved iron and manganese will be removed as oxide or oxyhydroxide precipitates; these minerals are known to scavenge trace elements from the water column, and can be expected to be responsible for some reduction in loadings to lower Minto Creek.
- Example: depending on pH conditions, some dissolved aluminum will also be removed as aluminum hydroxide precipitates. Source terms for both waste rock and tailings allow for slightly alkaline pH values (in the pH 8 range) - under these conditions, aluminum is considerably more soluble than at neutral pH and predicted aluminum loadings are higher.

Table 5-2: Minto Phase IV Post-closure Water Quality Prediction: Station W3- Total Concentrations

	Ag mg/L	Al mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Hg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Tl mg/L	Zn mg/L	Ammonia- N mg/L	Nitrate- N mg/L	Nitrite-N mg/L
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.00018	1.5	0.0017	0.00023	0.0023	0.097	1.9	3.7E-05	0.37	0.0048	0.0042	0.0011	0.0013	2.0E-05	0.027	0.62	8.8	0.35
May	0.00017	1.7	0.0019	0.00020	0.0026	0.091	2.3	3.7E-05	0.37	0.0047	0.0056	0.0011	0.0014	8.7E-05	0.025	0.62	8.8	0.35
June	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
July	0.00018	2.3	0.0032	0.00031	0.0037	0.19	3.0	2.5E-04	0.91	0.0077	0.0076	0.0017	0.0027	5.9E-05	0.037	0.62	8.8	0.35
August	0.00019	2.3	0.0032	0.00034	0.0035	0.22	3.0	1.5E-04	0.83	0.0090	0.0075	0.0018	0.0029	4.8E-05	0.042	0.62	8.8	0.35
September	0.00020	1.8	0.0021	0.00023	0.0028	0.12	2.4	6.5E-05	0.45	0.0057	0.0057	0.0013	0.0016	4.6E-05	0.031	0.62	8.8	0.35
October	0.00019	1.6	0.0017	0.00026	0.0024	0.094	2.1	4.5E-05	0.38	0.0049	0.0050	0.0013	0.0014	3.7E-05	0.027	0.62	8.8	0.35
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQP\Tables\[Table5-1_and_Table5-2_W3+W1_Prediction.xlsx]

Note: Zero (‘0’) values indicate periods of no flow, as indicated by the post-closure water balance.

Table 5-3 Minto Phase IV Post-closure Water Quality Prediction: Station W1- Total Concentrations

	Ag mg/L	Al mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Hg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Tl mg/L	Zn mg/L	Ammonia-N mg/L	Nitrate-N mg/L	Nitrite-N mg/L
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000052	0.30	0.0005	0.000086	0.0009	0.023	0.4	1.4E-05	0.08	0.0015	0.0011	0.00029	0.00046	7.4E-06	0.009	0.10	1.4	0.056
May	0.000068	0.83	0.0010	0.000091	0.0016	0.035	1.2	2.0E-05	0.16	0.0022	0.0036	0.00056	0.00082	9.3E-05	0.011	0.22	3.2	0.125
June	0.000050	1.68	0.0011	0.000044	0.0036	0.006	2.5	1.4E-03	0.11	0.0010	0.0049	0.00077	0.00041	3.0E-05	0.009	0.01	0.1	0.004
July	0.000055	0.47	0.0008	0.000046	0.0010	0.025	0.7	7.4E-05	0.13	0.0018	0.0020	0.00036	0.00057	3.5E-05	0.008	0.07	1.0	0.038
August	0.000073	0.30	0.0008	0.000044	0.0009	0.024	0.4	3.4E-05	0.12	0.0025	0.0018	0.00037	0.00057	4.1E-05	0.008	0.06	0.9	0.036
September	0.000106	0.81	0.0010	0.000089	0.0016	0.043	1.2	3.6E-05	0.20	0.0025	0.0032	0.00061	0.00084	4.1E-05	0.014	0.23	3.2	0.128
October	0.000050	0.30	0.0005	0.000156	0.0009	0.014	0.5	2.3E-05	0.08	0.0015	0.0020	0.00076	0.00069	3.1E-05	0.008	0.07	1.0	0.040
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQP\Tables\[Table5-1_and_Table5-2_W3+W1_Prediction.xlsx]

Note: Zero (‘0’) values indicate periods of no flow, as indicated by the post-closure water balance.

- Phase IV bulk waste rock was assumed to generate long-term loadings similar to the combined bulk and mineralized waste from Main Pit. No attempt was made to reduce modelled loadings to account for the lower long-term loading rates that will result from selective management of mineralized waste in Phase IV.
- The adopted tailings and waste rock source terms typically assume maximum trace element concentrations in dump seepage over the long term. While decline in weathering rates over time is challenging to quantify, experience elsewhere has shown that, under neutral pH weathering conditions, weathering rates are fastest for freshly-broken rock and tend to decline over time as sulphide minerals oxidize and surfaces of other mineral grains weather. No attempt was made to reduce modelled loadings to account for declining weathering rates as mine wastes age.
- Reclamation of the DSTF is a component of the Phase IV mine plan, and will in all likelihood result in some reduction in loadings from the DSTF. No attempt was made to reduce modelled loadings to account for the reduction in long-term loading rates that result from DSTF reclamation.

This report, “**1CM002.001 Minto Mine Expansion- Phase IV ML/ARD Assessment and Post-closure Water Quality Prediction**”, has been prepared by SRK Consulting (Canada) Inc.

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All data used as source material plus the text, tables, figures, and attachments of this document have been reviewed and prepared in accordance with generally accepted professional engineering and environmental practices.

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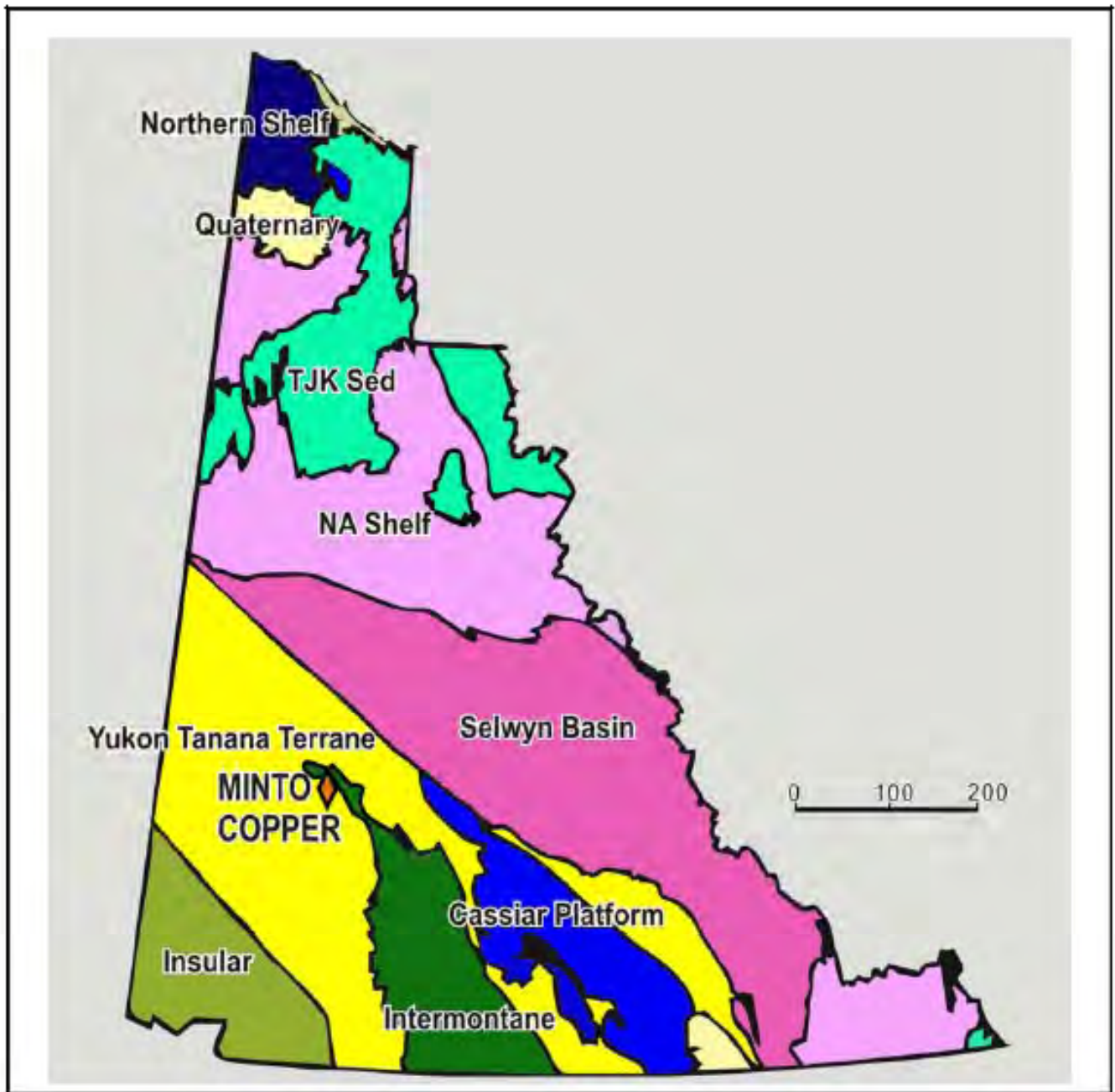
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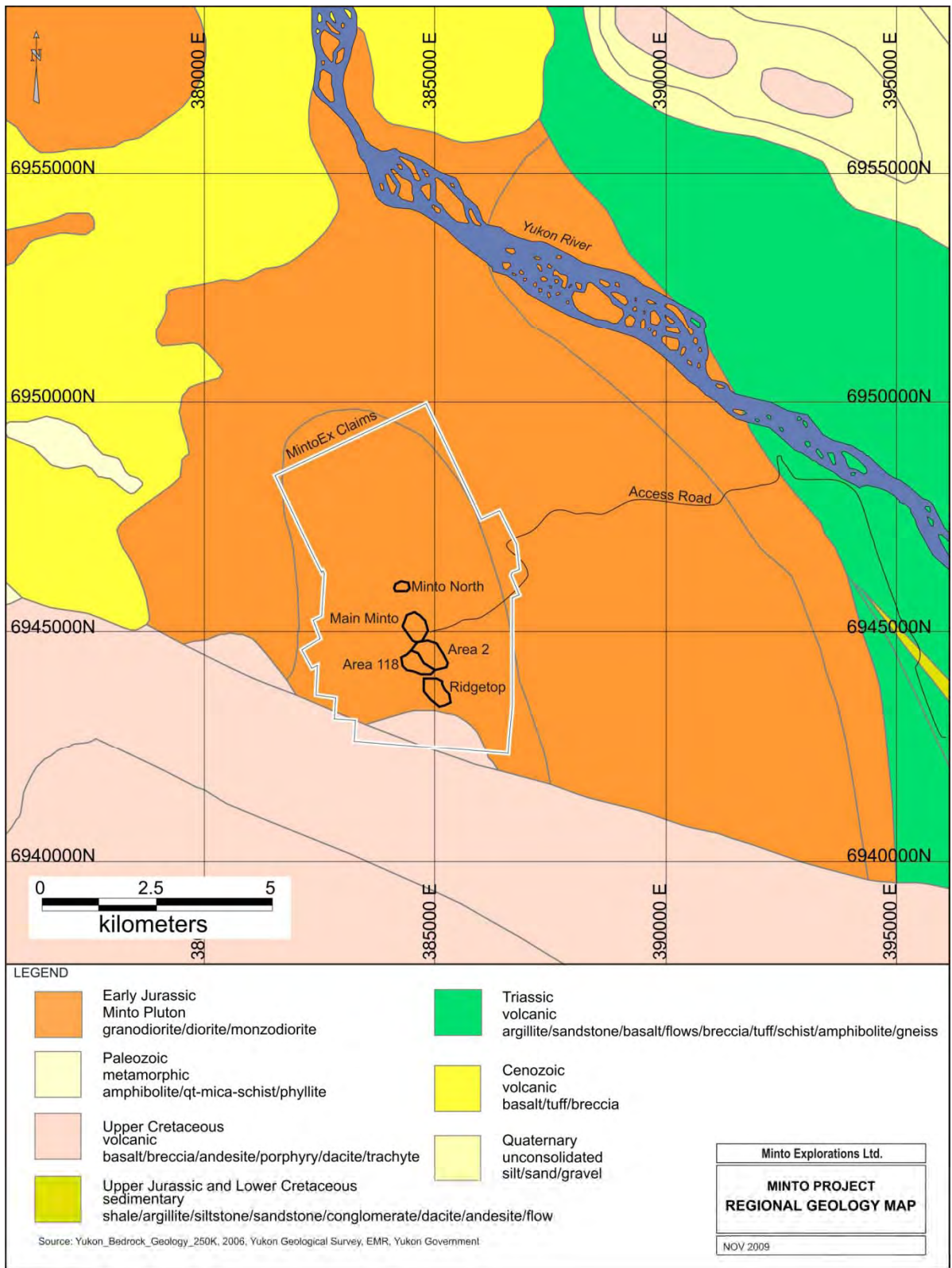
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Figures



From: Yukon Geologic Survey "Maps Yukon" website (www.geology.gov.yk.ca)



Minto Mine Expansion – Phase IV

Regional Geology

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1CM002.001

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August 2010

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DBM

FIGURE:
2.2



Minto Mine Expansion – Phase IV

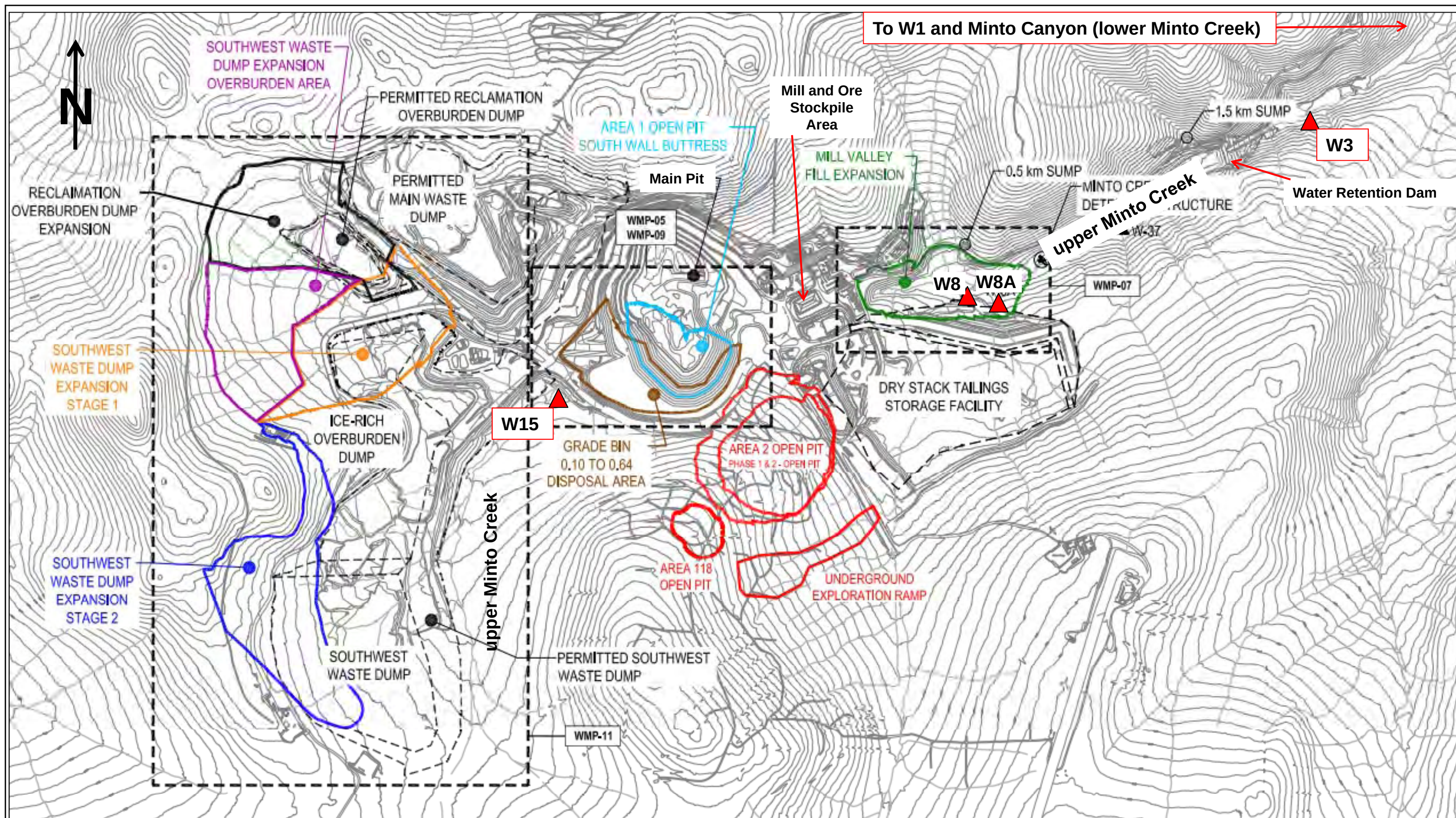
Mine Access Road Showing General Relief and Vegetation in the Area

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FIGURE:
2.3



Source:
Adapted from Figure WMP-01 in "Phase IV Development Preliminary Waste Management Plan, Minto Mine, YT" prepared by EBA Engineering Consultants Ltd., August 2010.



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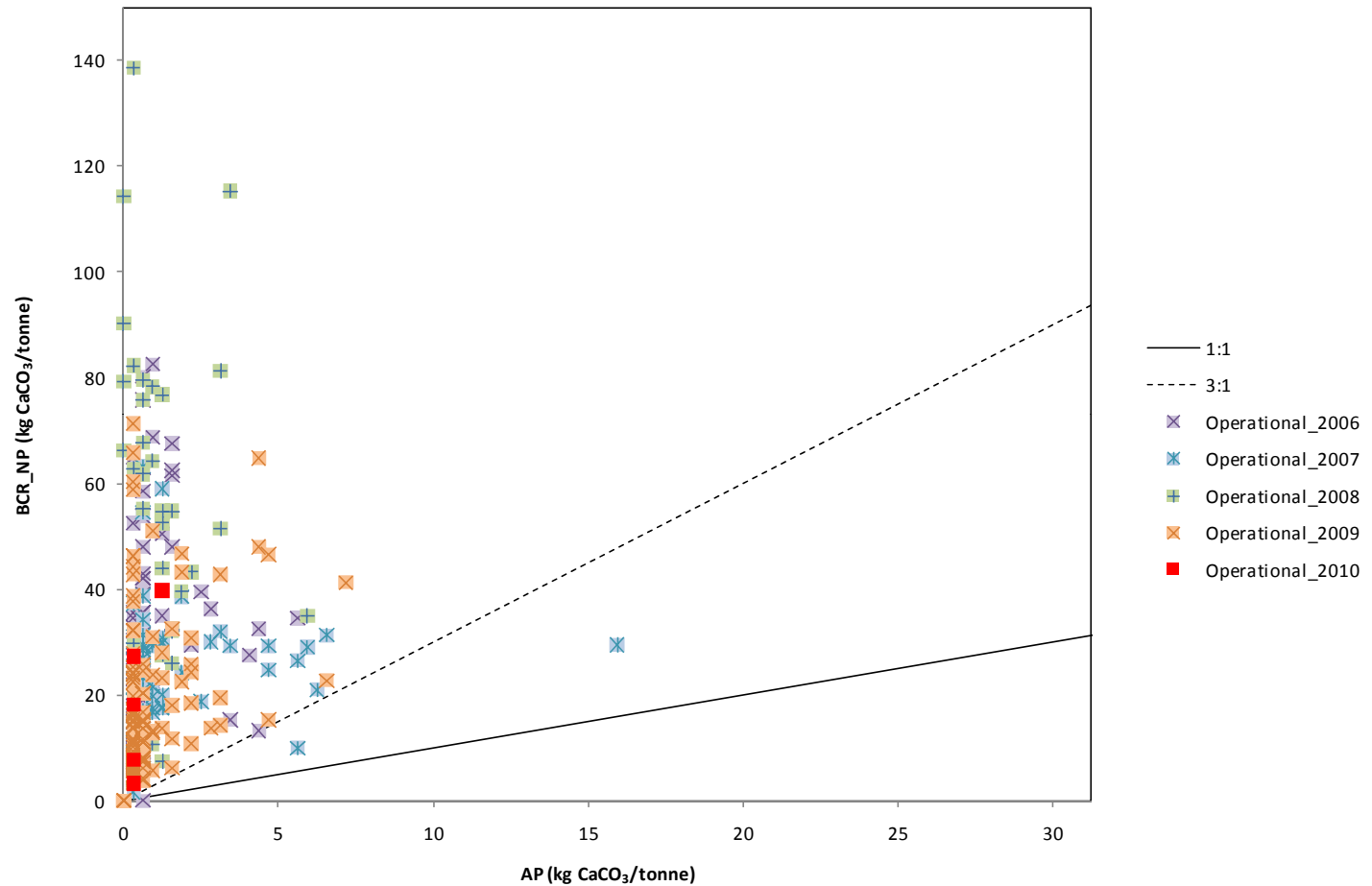


Minto Mine Expansion – Phase IV

General Arrangement

Date: August 2010	Approved: DBM	Figure: 2.4
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Main Pit BCR_NP:AP



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Minto Mine Expansion – Phase IV

Main Pit Operational Monitoring: ABA Results

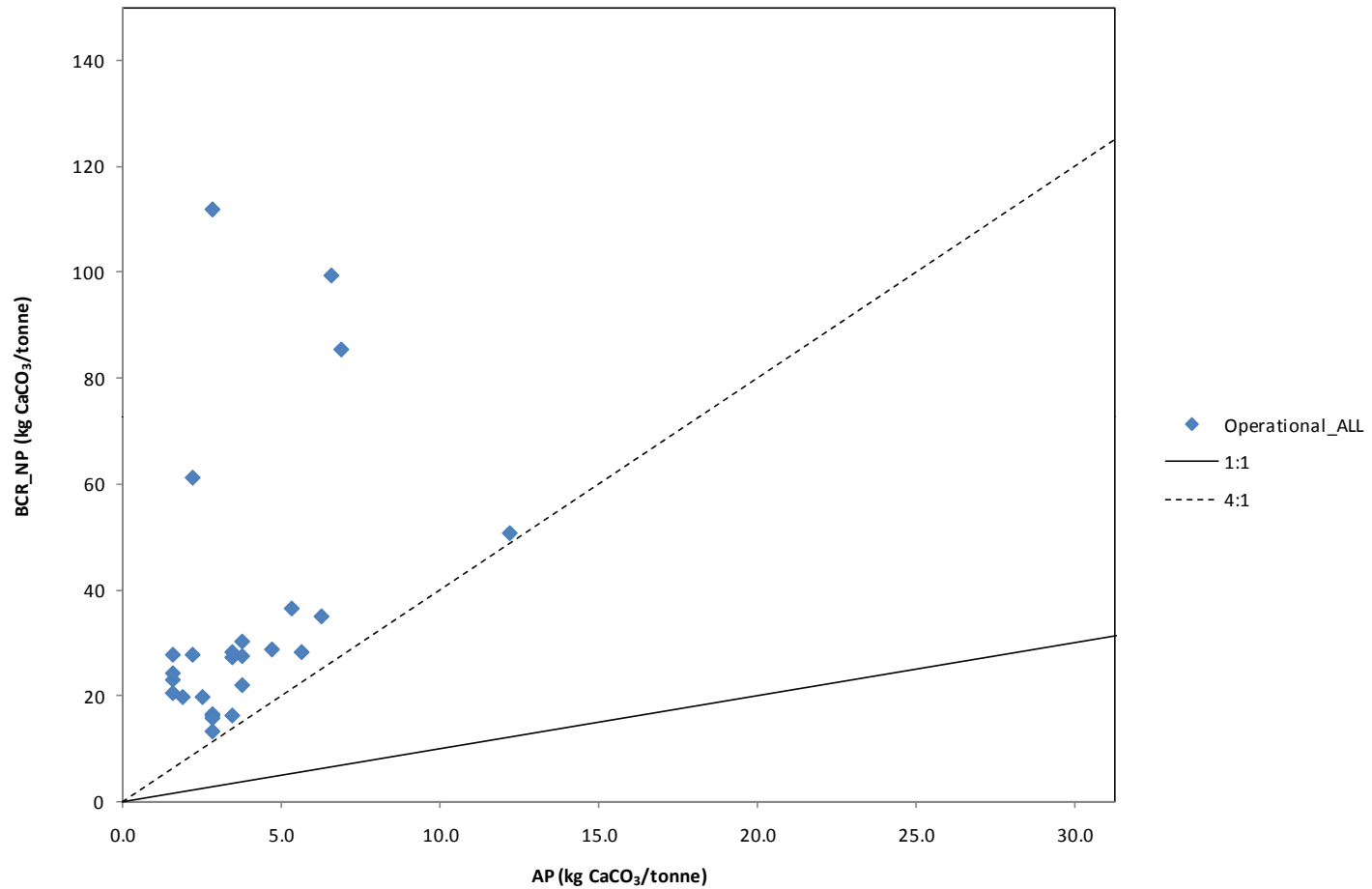
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FIGURE:
2.5

Tailings BCR_NP:AP



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Minto Mine Expansion – Phase IV

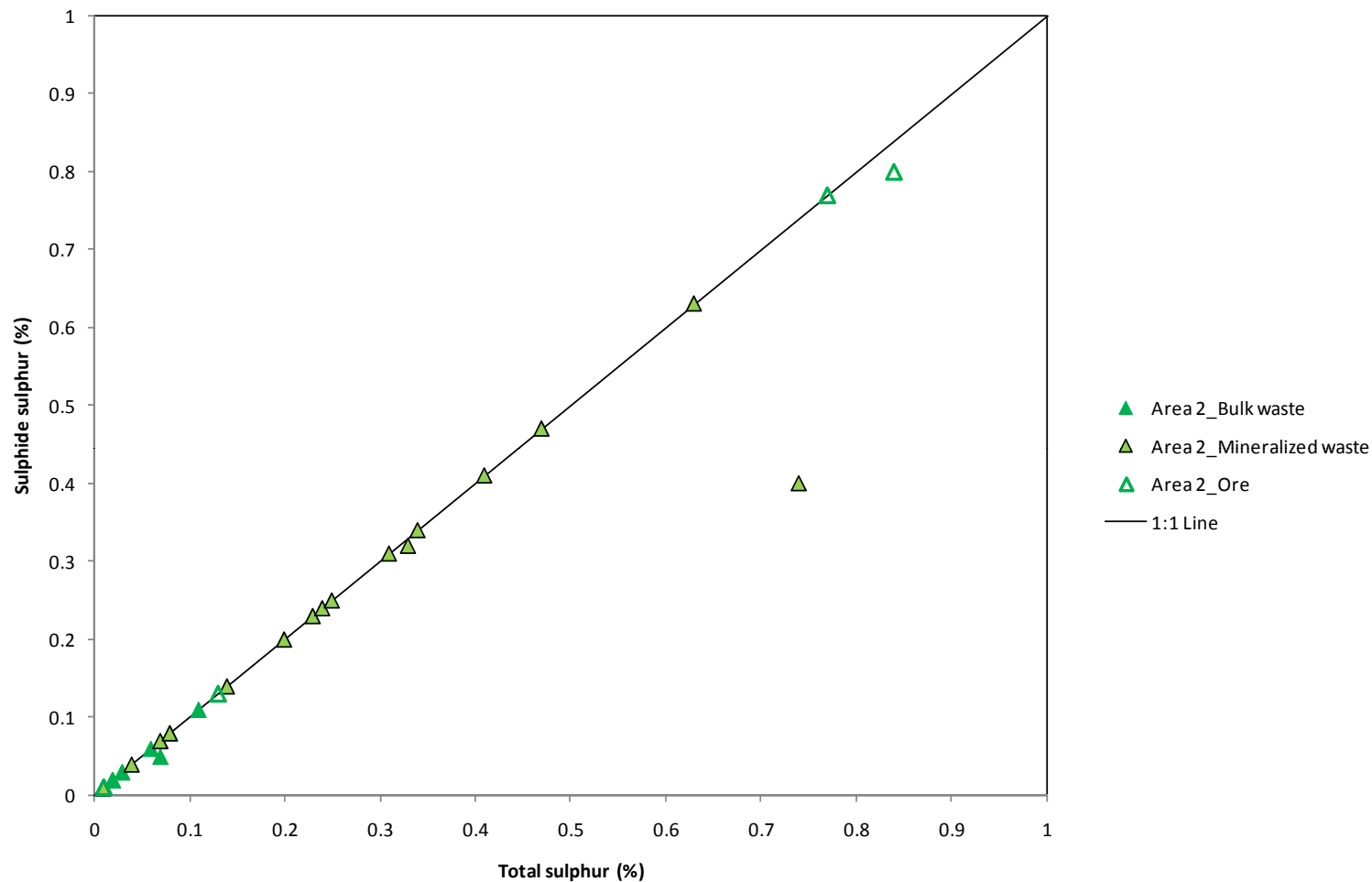
Tailings Operational Monitoring: ABA Results

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FIGURE:
2.6



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Minto Mine Expansion – Phase IV

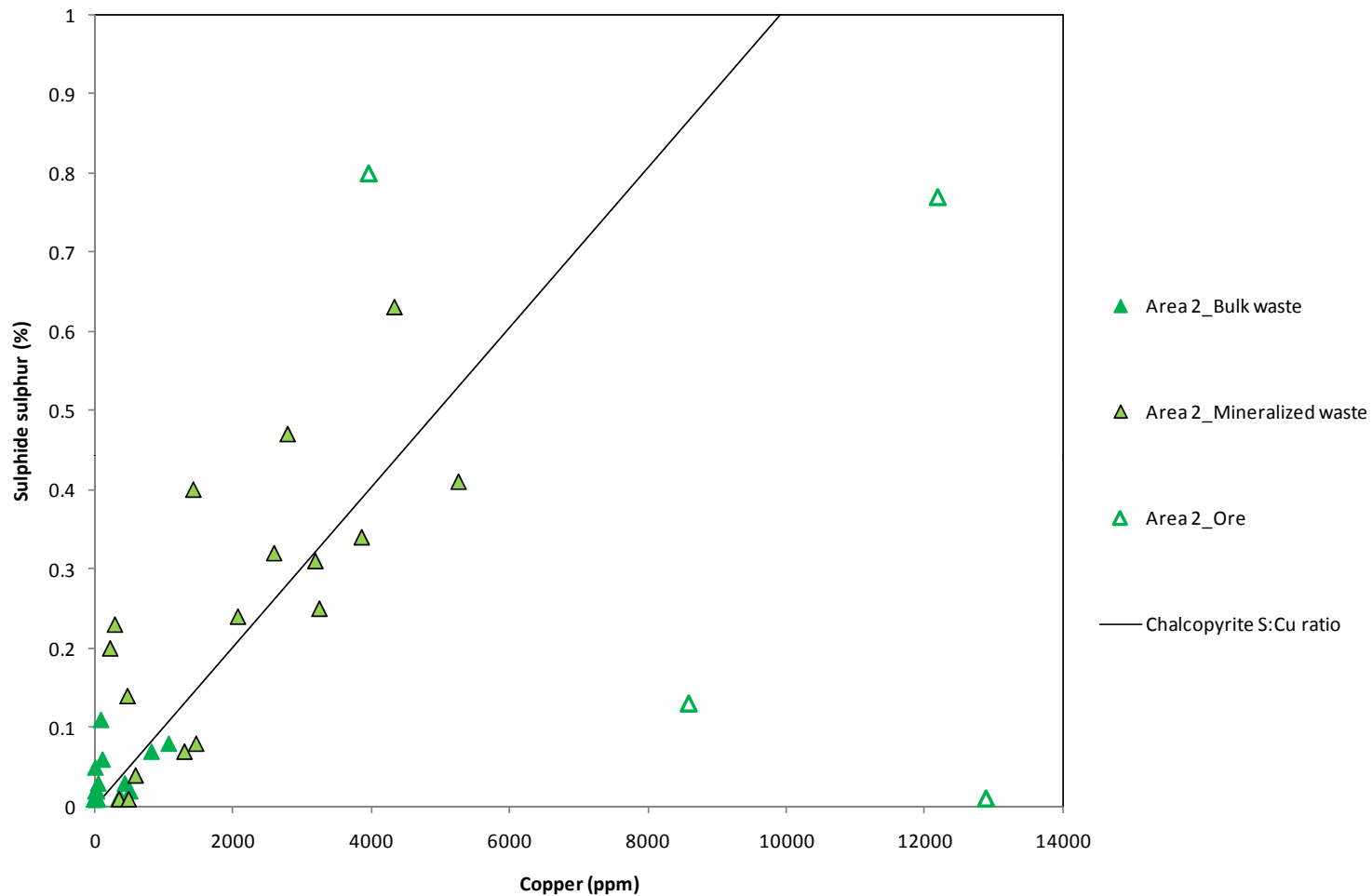
Phase IV Waste Rock: Sulphide Sulphur vs Total Sulphur

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FIGURE:
4.1



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Minto Mine Expansion – Phase IV

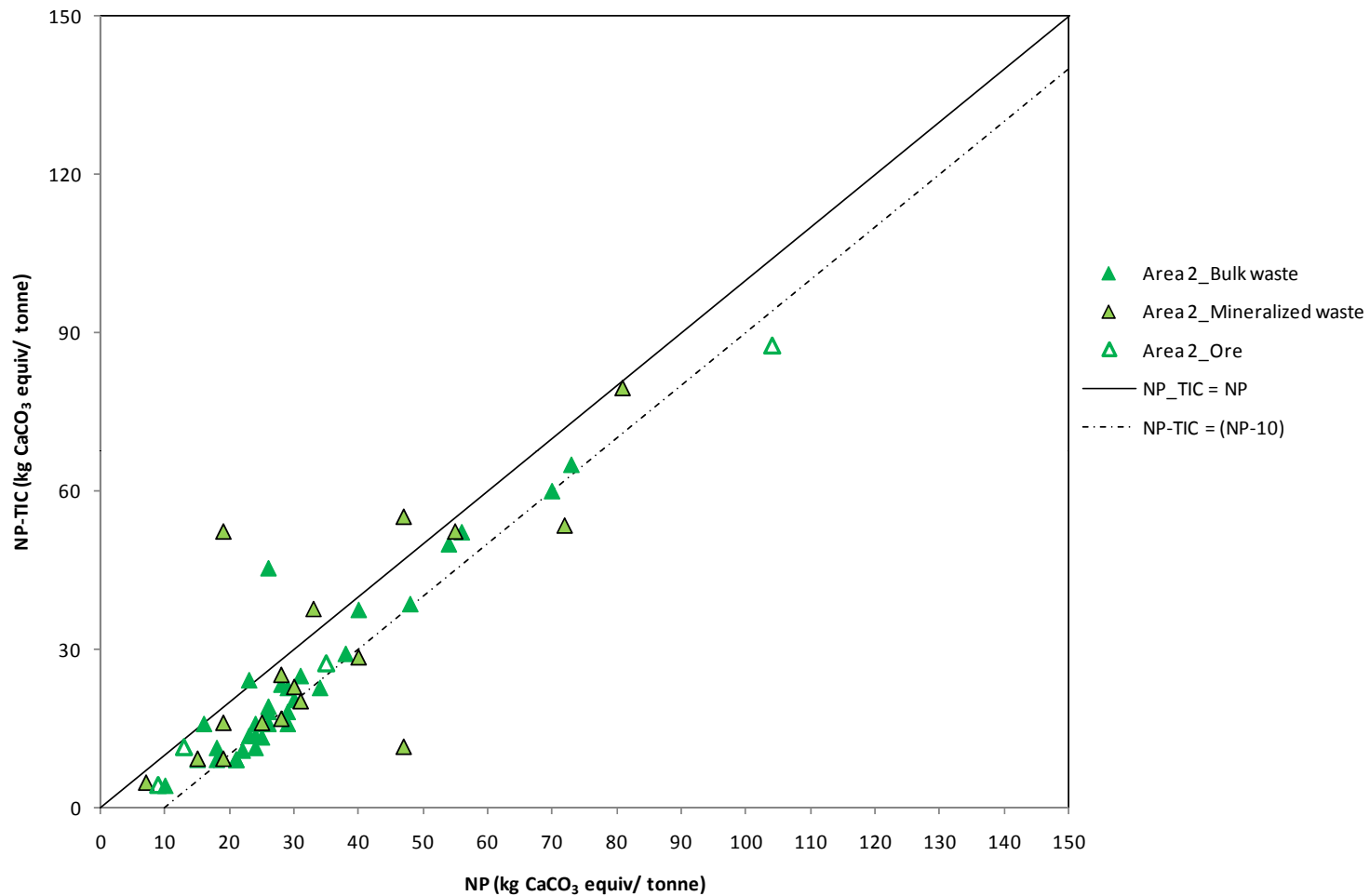
Phase IV Waste Rock: Sulphide Sulphur vs. Copper

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FIGURE:
4.2



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Minto Mine Expansion – Phase IV

Phase IV Waste Rock: NP-TIC:NP Results

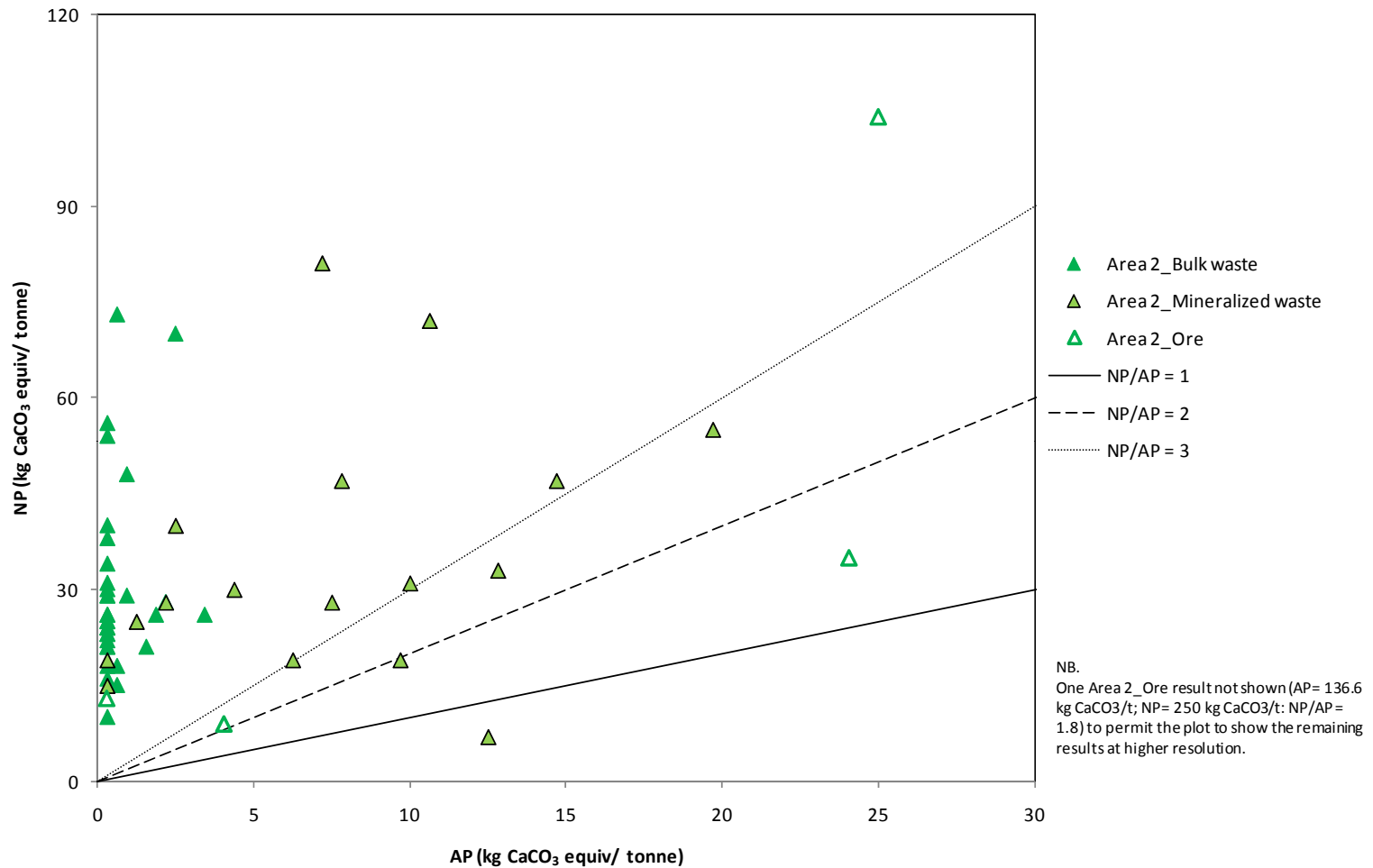
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FIGURE::

4.3



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Minto Mine Expansion – Phase IV

Phase IV Waste Rock: NP:AP Results

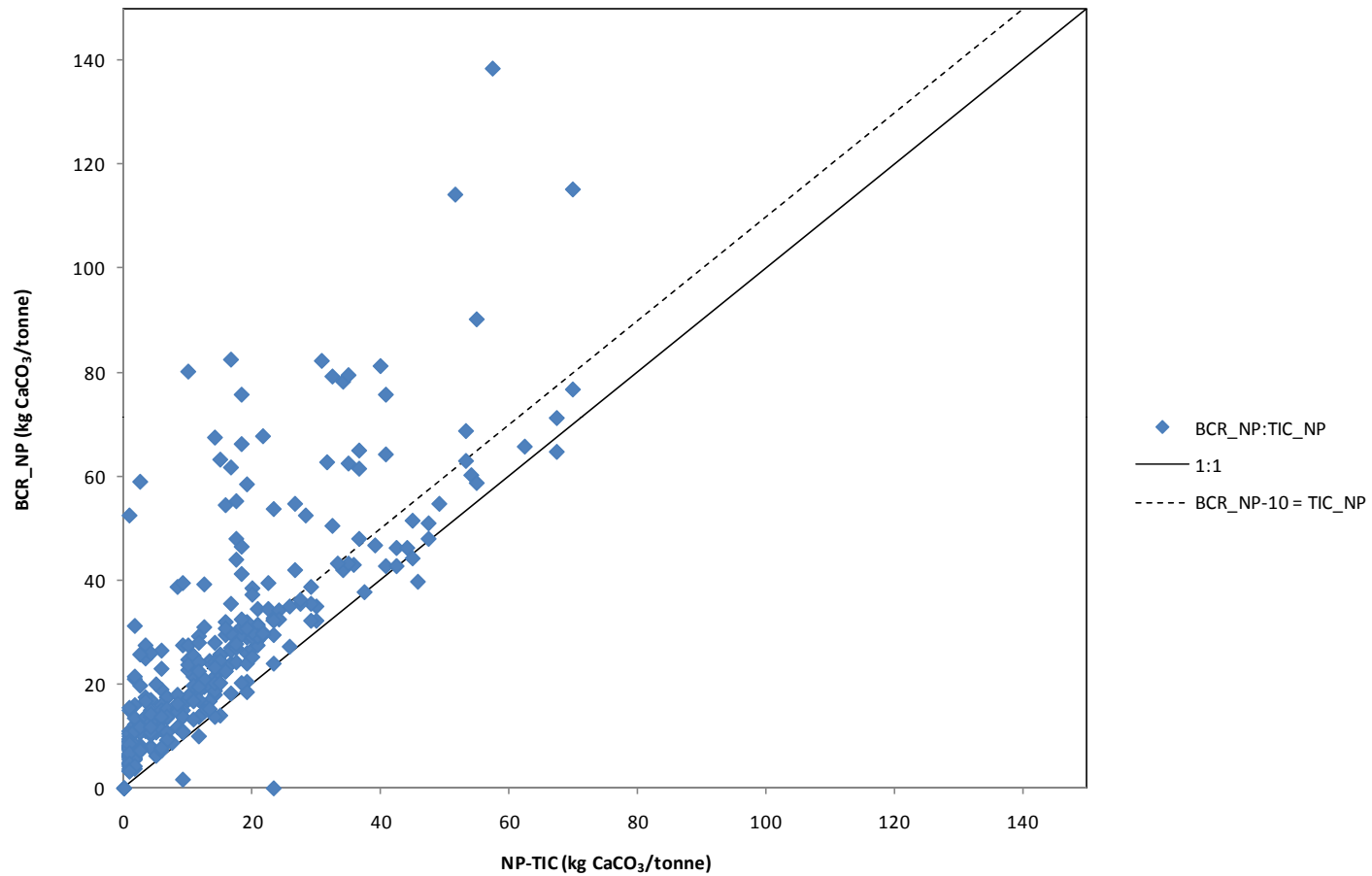
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FIGURE:
4.4

Main Pit BCR_NP: NP-TIC



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Minto Mine Expansion – Phase IV

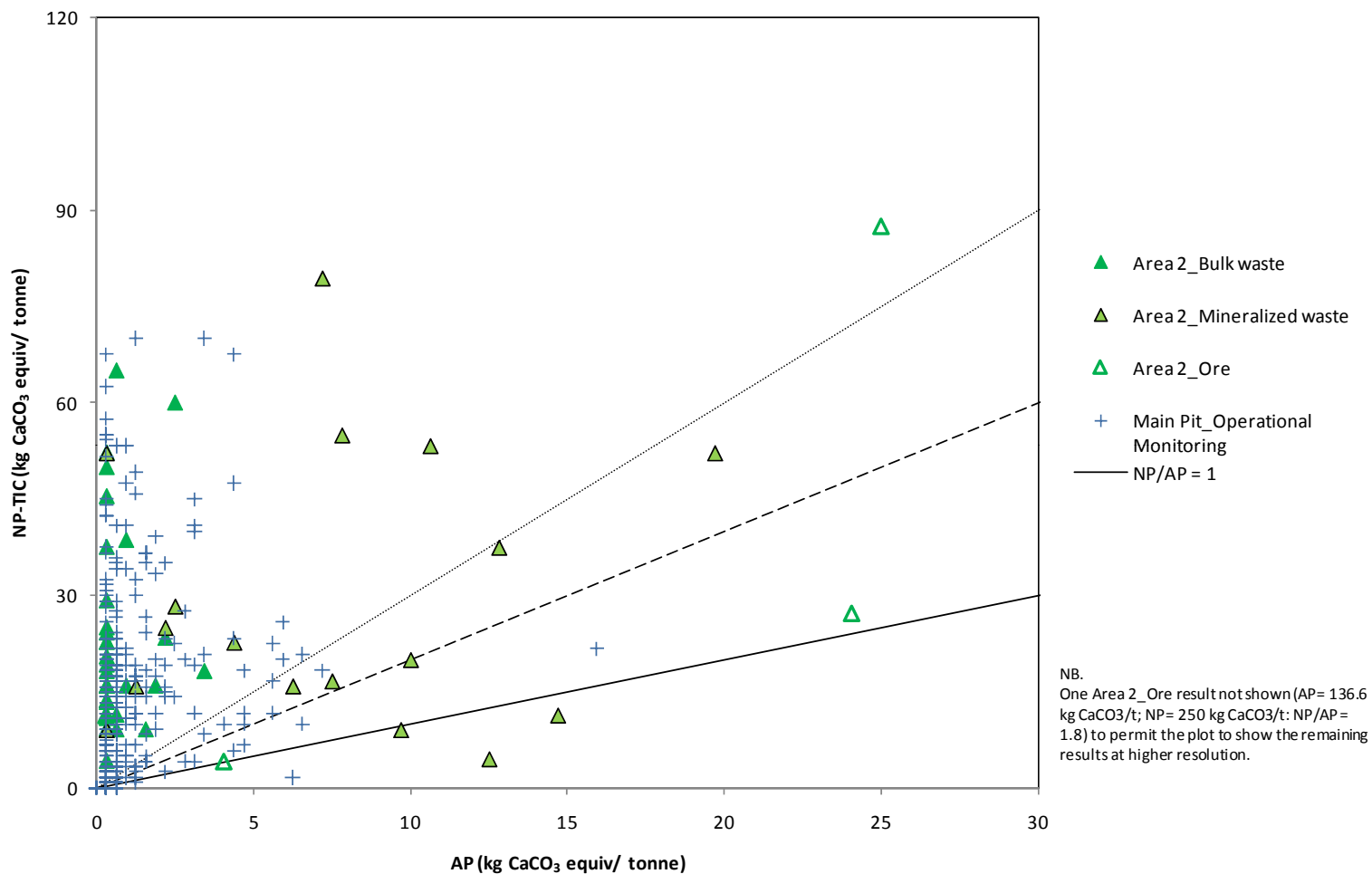
Main Pit BCR_NP:NP-TIC Results

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FIGURE::
4.5



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Minto Mine Expansion – Phase IV

Phase IV Waste Rock: NP-TIC:AP Results

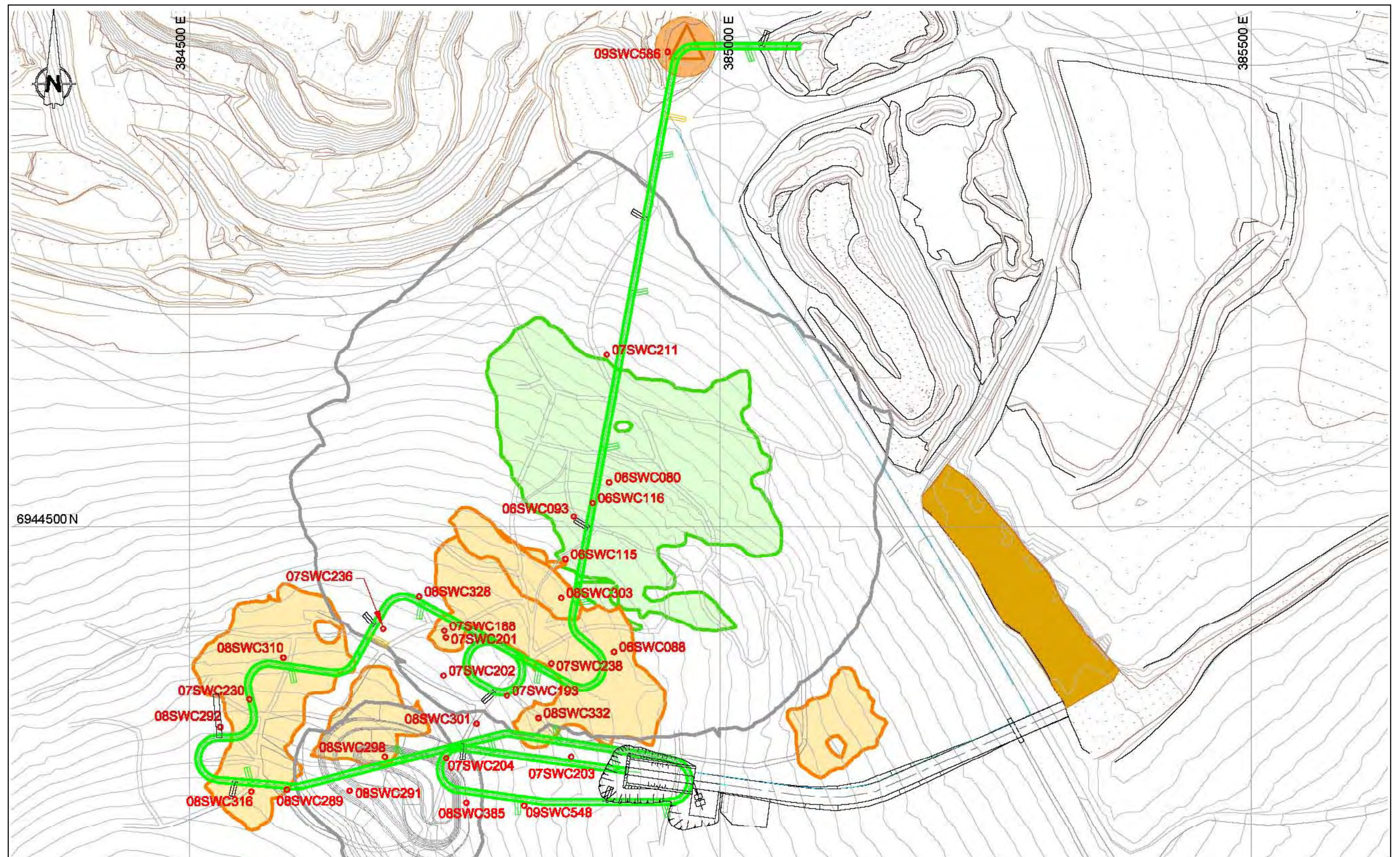
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FIGURE::

4.6



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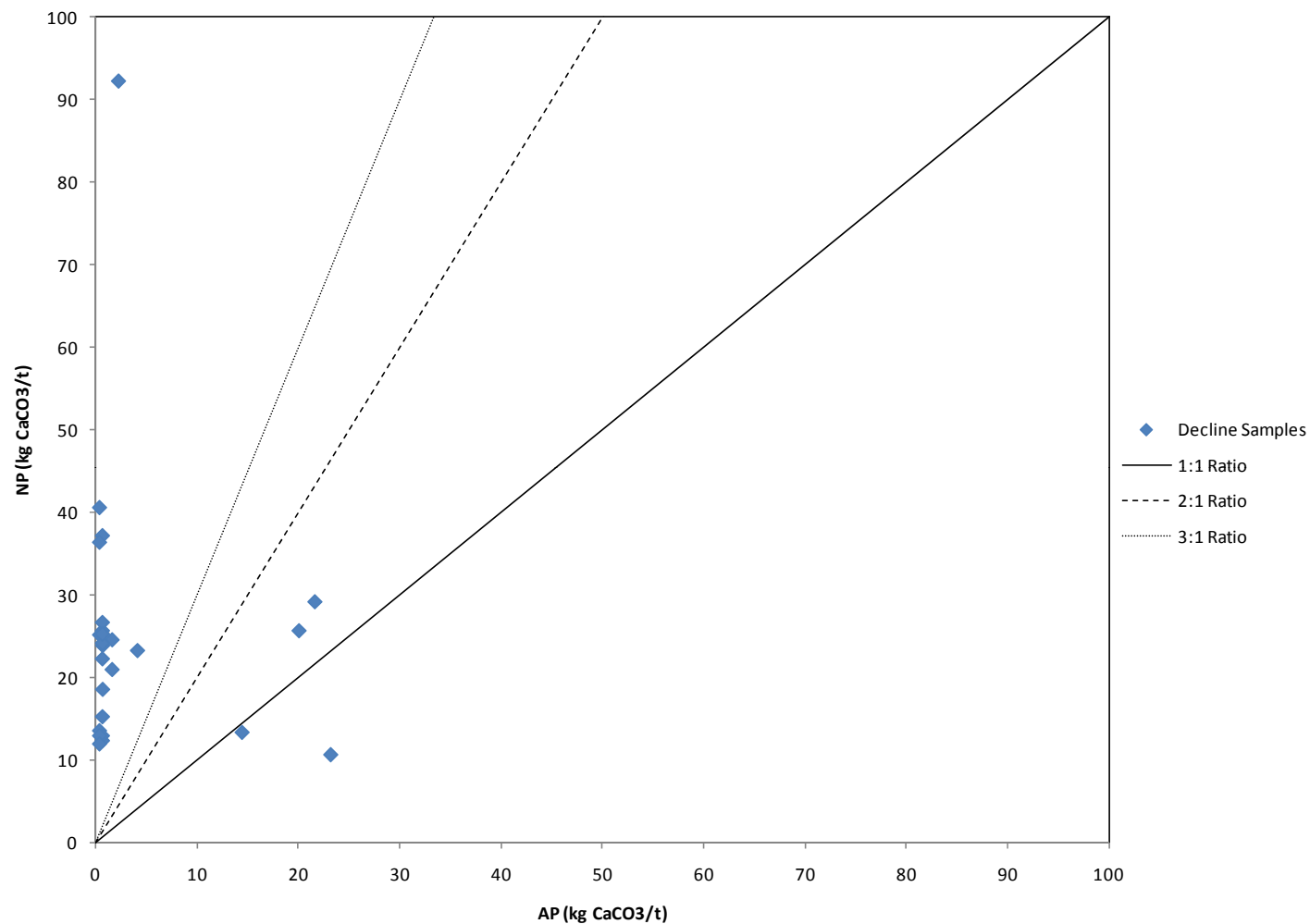
Minto Mine Expansion – Phase IV

**Underground Decline:
ABA Sample Locations**

Date:
August 2010

Approved:
DBM

Figure:
4.7



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Minto Mine Expansion – Phase IV

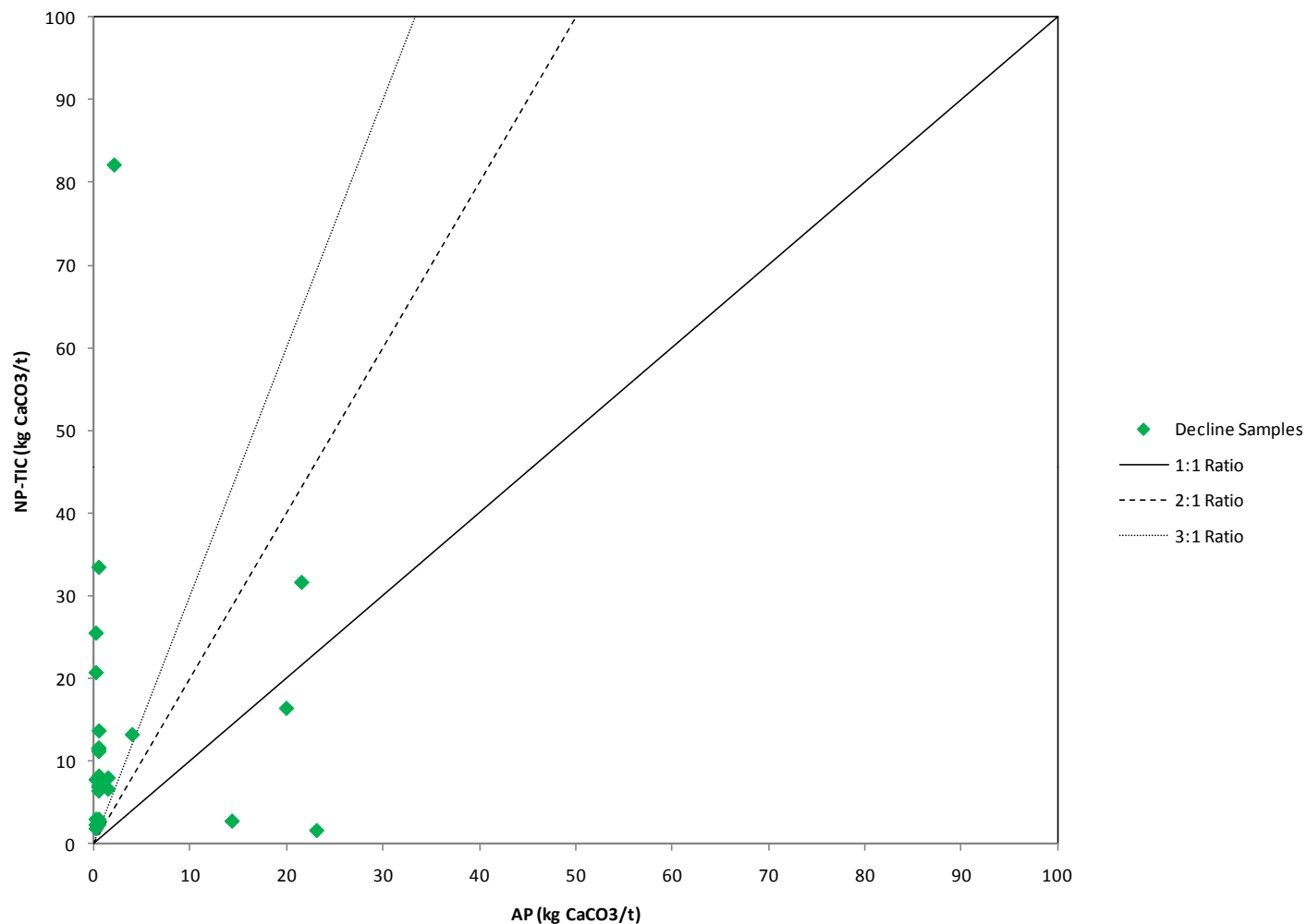
Underground Decline: NP vs. AP

PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
4.8



U:\Databases\ML-ARD\UG Exploration Permit\DeclineRockTesting_2CM022.009_dbm_rev00.xlsx]



Minto Mine Expansion – Phase IV

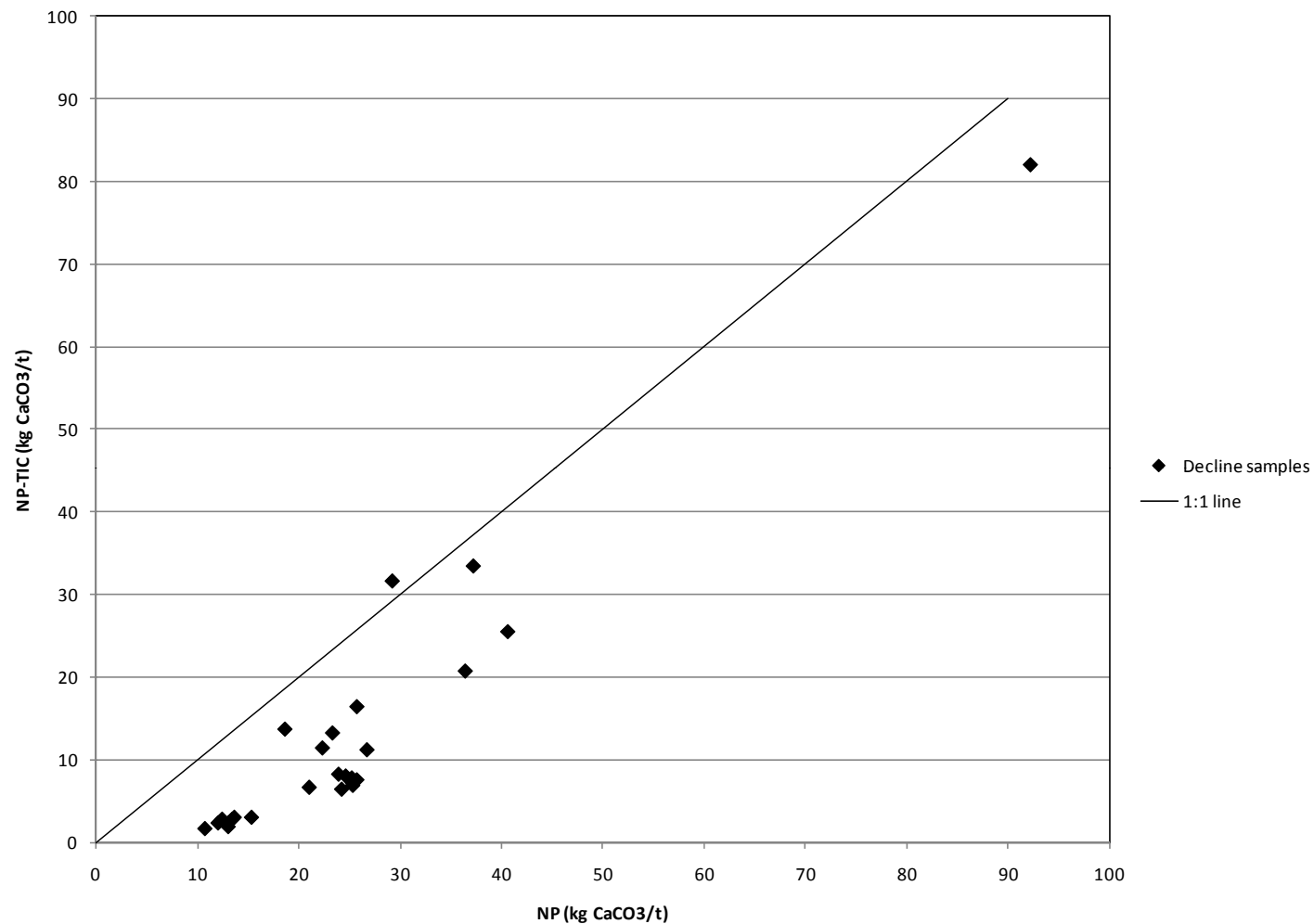
Underground Decline: NP-TIC vs. AP

PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
4.9



U:\Databases\ML-ARD\UG Exploration Permit\DeclineRockTesting_2CM022.009_dbm_rev00.xlsx]



Minto Mine Expansion – Phase IV

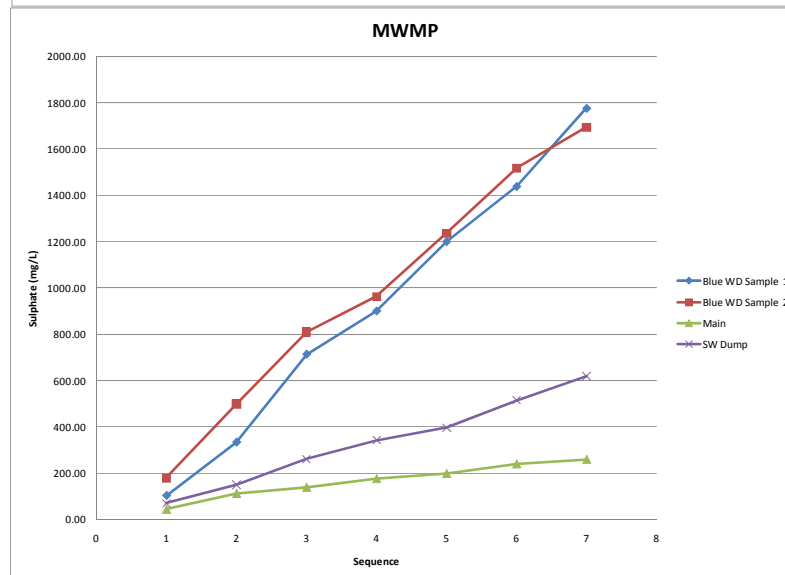
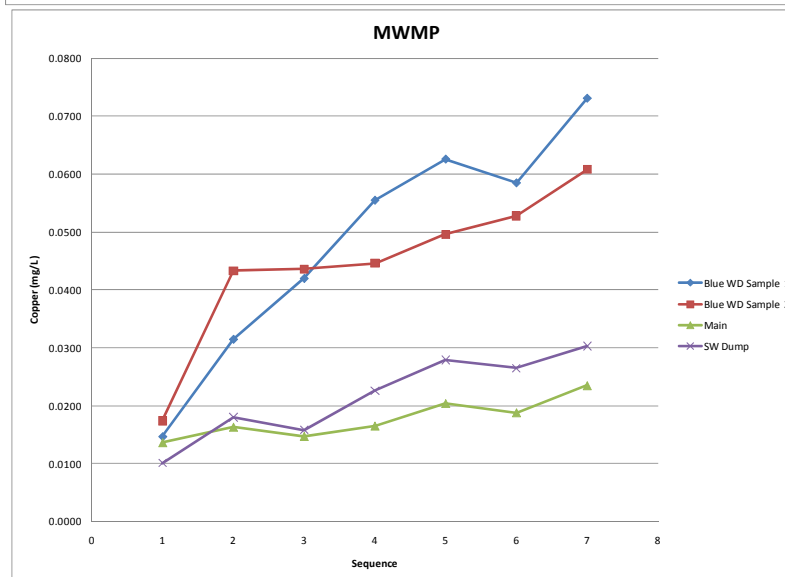
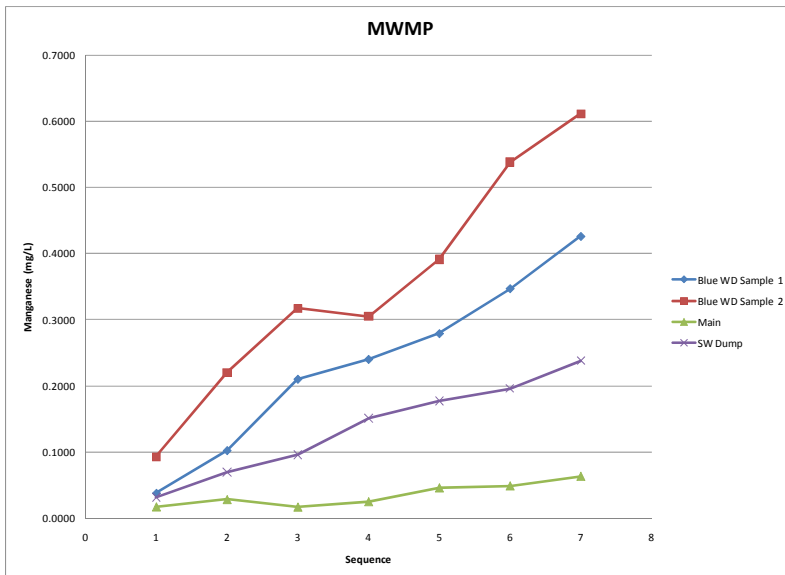
Underground Decline: NP-TIC vs. NP

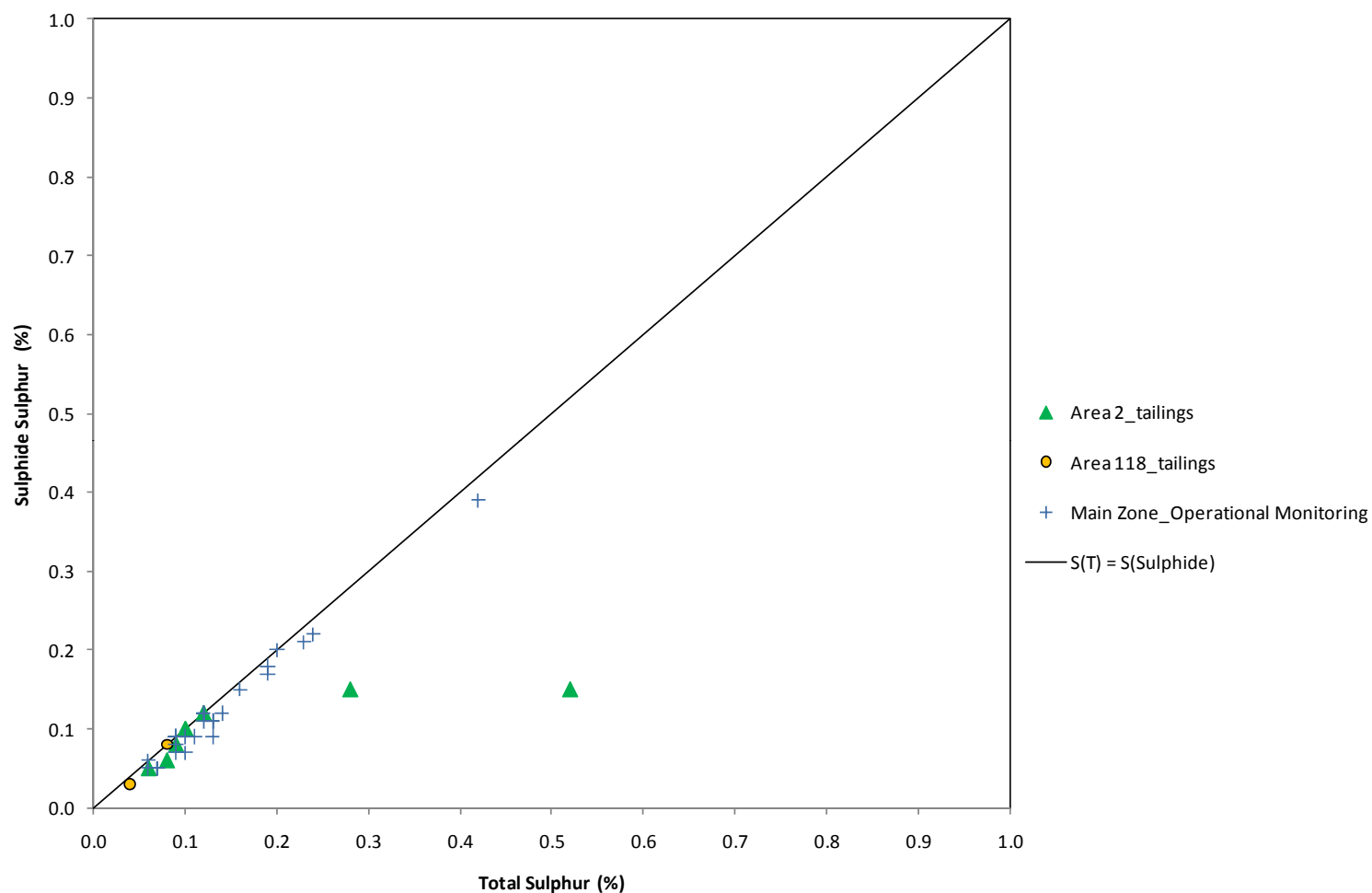
PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
4.10





U:\Databases\ML-ARD\Tailings\([Minto_Tailings_Phase4_ML-ARD_Results_Compiled_Aug2010.xlsx]



Minto Mine Expansion – Phase IV

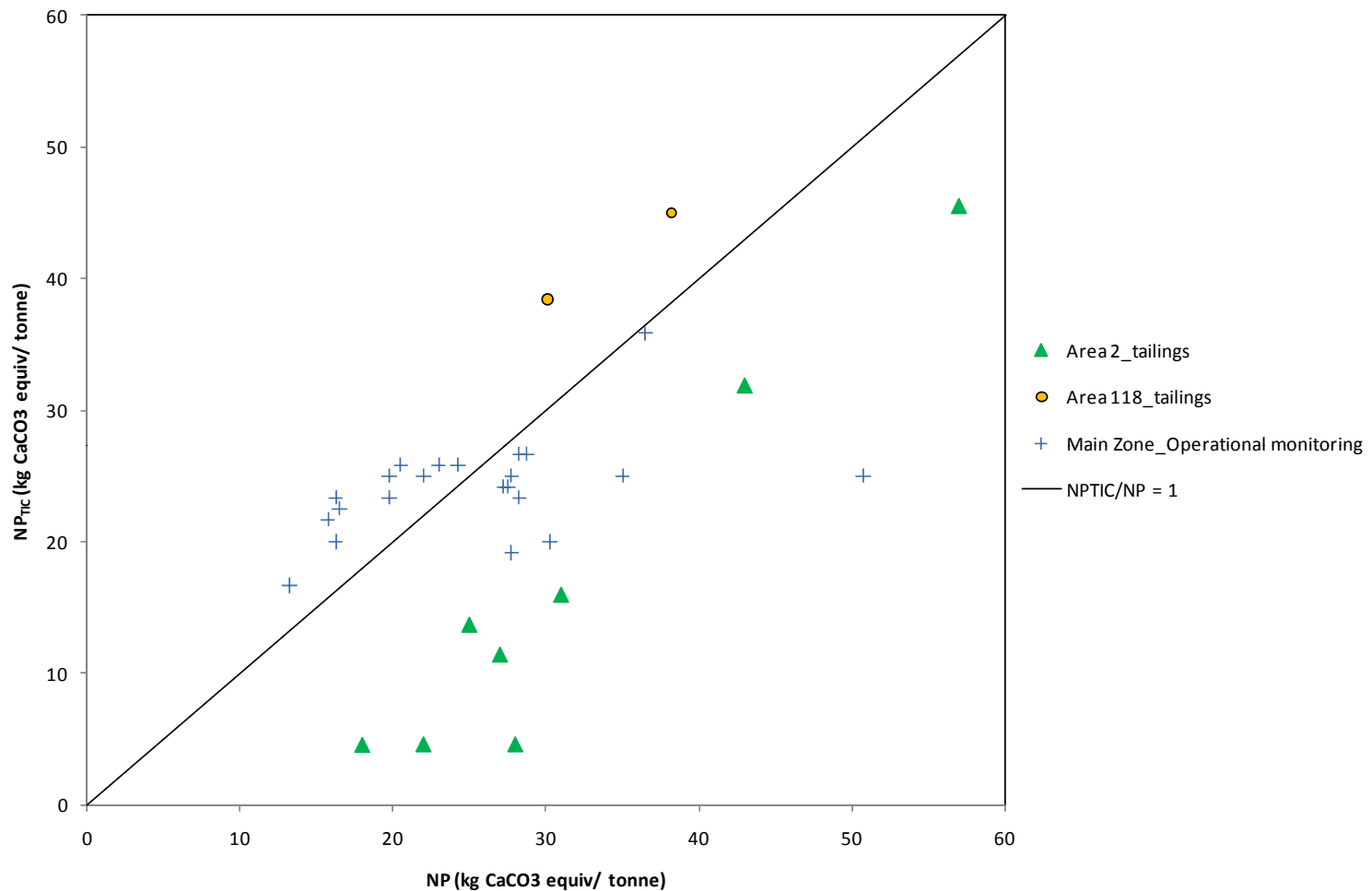
Tailings: Sulphide Sulphur vs. Total Sulphur

PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
4.12



U:\Databases\ML-ARD\Tailings\([Minto_Tailings_Phase4_ML-ARD_Results_Compiled_Aug2010.xlsx]

Note:

Main Zone tailings NP determined by BC Research method, per license condition.



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Minto Mine Expansion – Phase IV

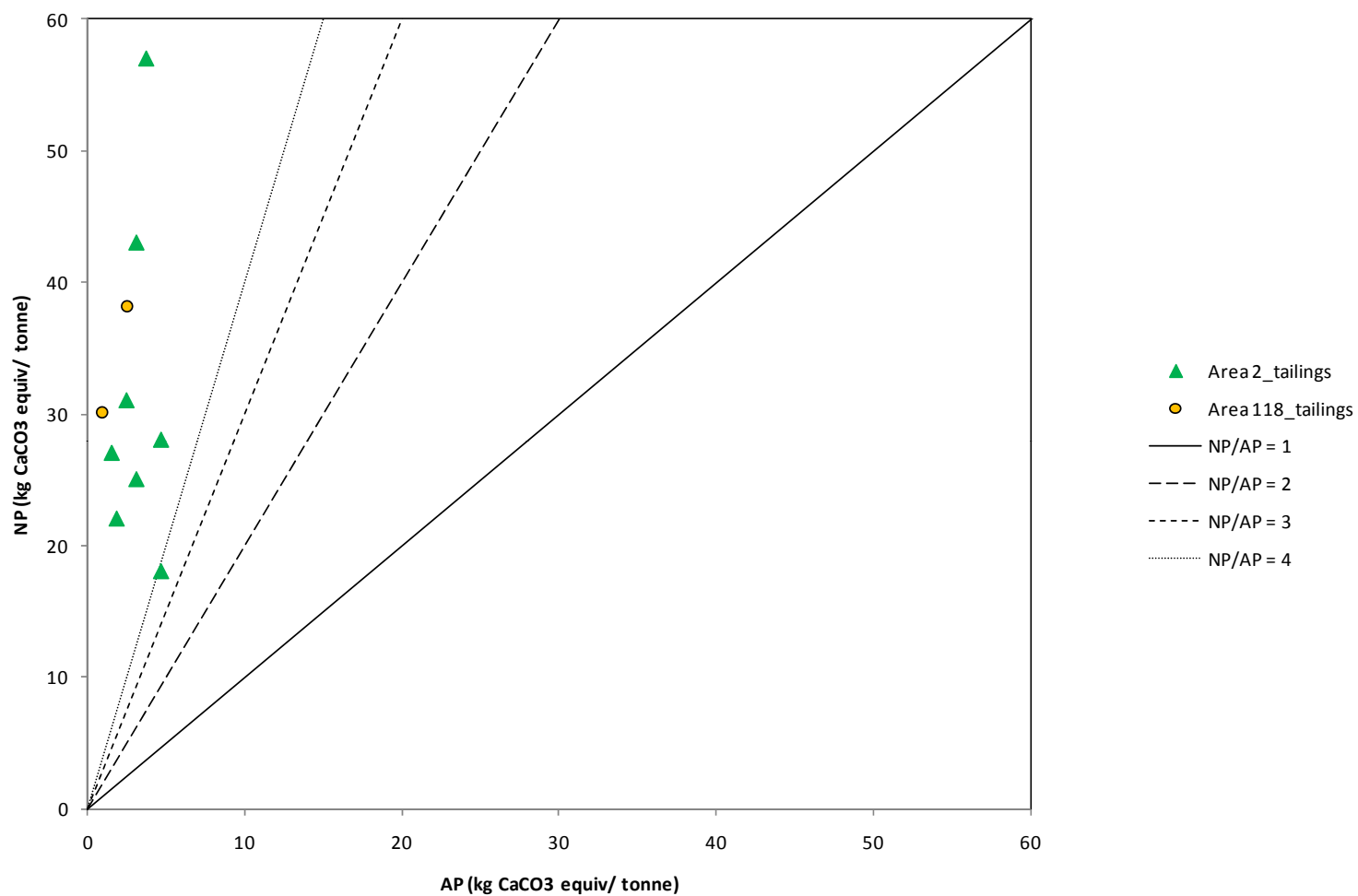
**Tailings:
NP_{TIC} vs. NP**

PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
4.13



U:\Databases\ML-ARD\Tailings\([Minto_Tailings_Phase4_ML-ARD_Results_Compiled_Aug2010.xlsx]



Minto Mine Expansion – Phase IV

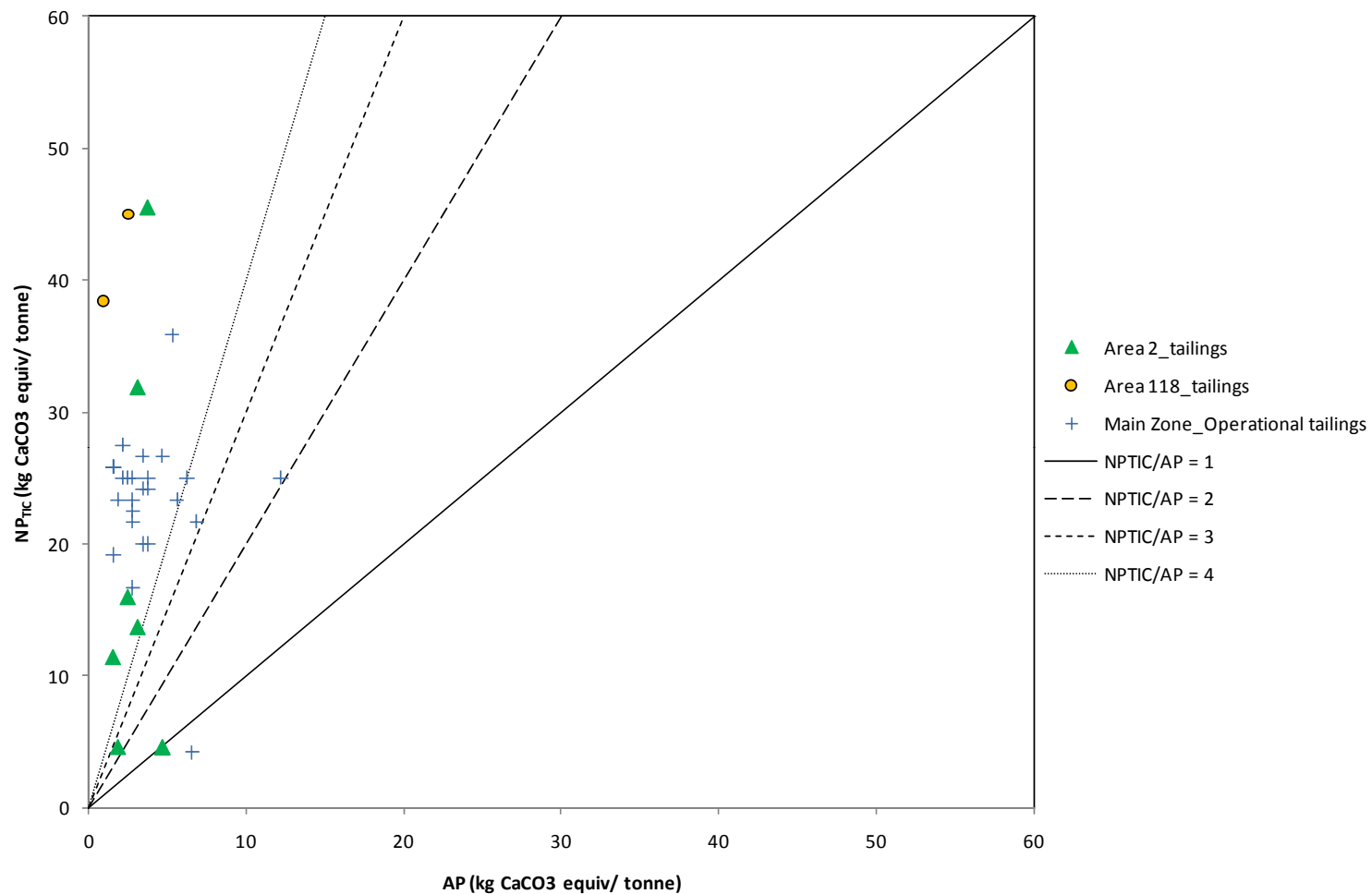
**Tailings:
NP vs. AP**

PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
4.14



U:\Databases\ML-ARD\Tailings\{Minto_Tailings_Phase4_ML-ARD_Results_Compiled_Aug2010.xlsx}



Minto Mine Expansion – Phase IV

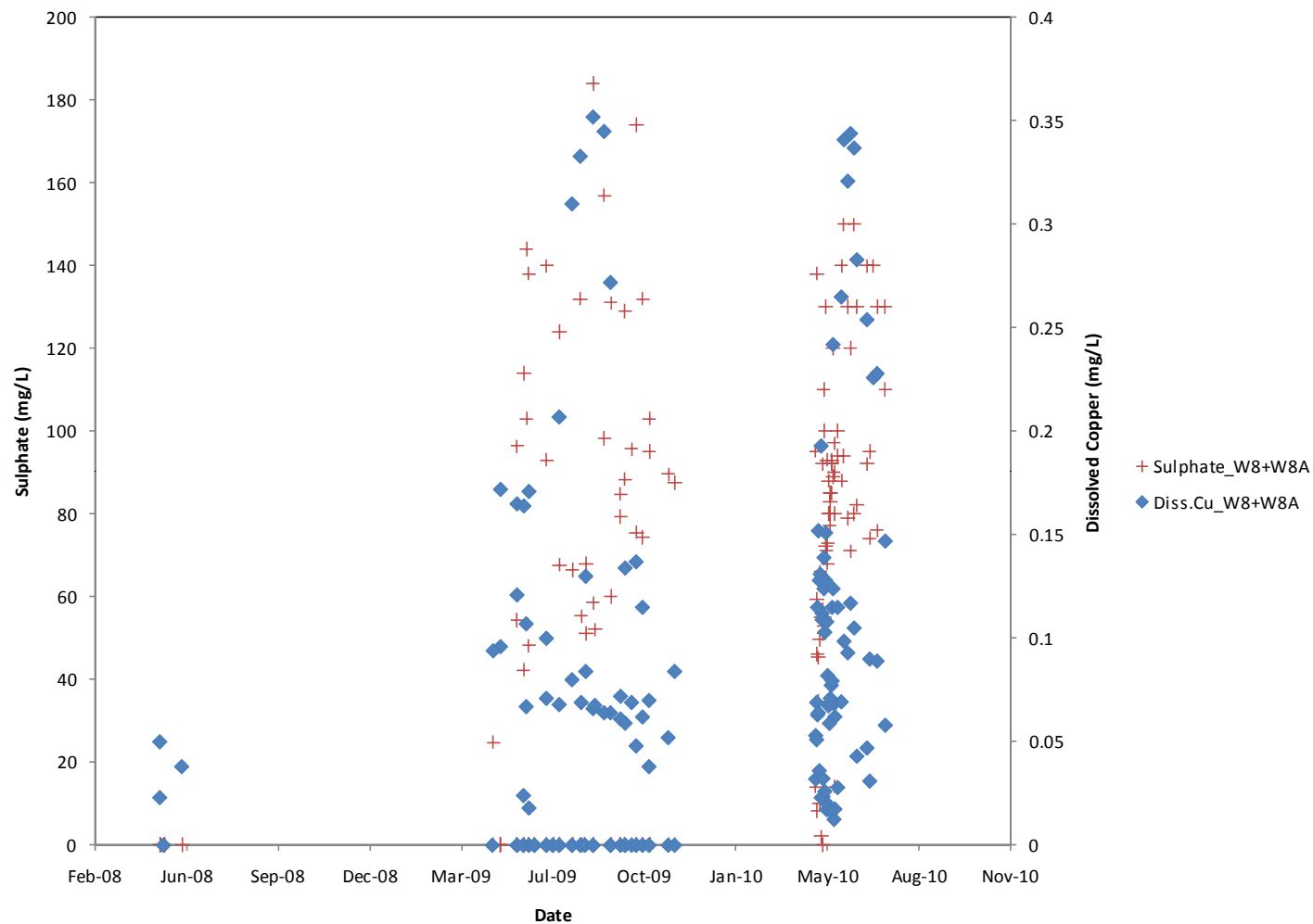
Tailings:
NP_{TIC} vs. AP

PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
4.15



\\Van-svr0\projects\01_SITES\Minto\1 Databases\ML-ARD\WQ_database\Selected Stations_July2010\Minto_RoutineMonitoringResults_1CM002-001_DBM_rev00.xlsx



Minto Mine Expansion – Phase IV

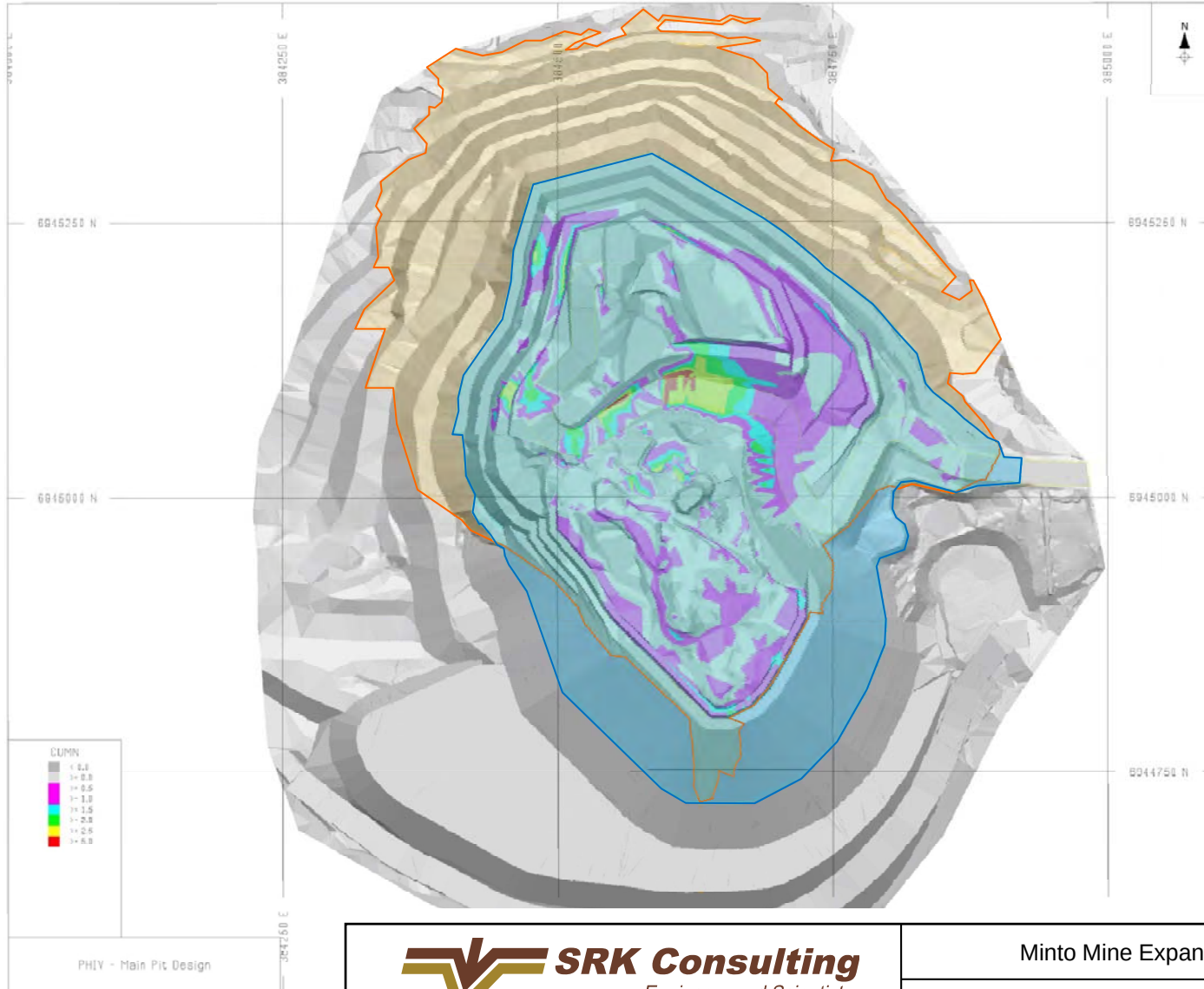
DSTF Seepage: Sulphate and Dissolved Copper Concentrations

PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
5.1



SRK Consulting
Engineers and Scientists

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Minto Mine Expansion – Phase IV

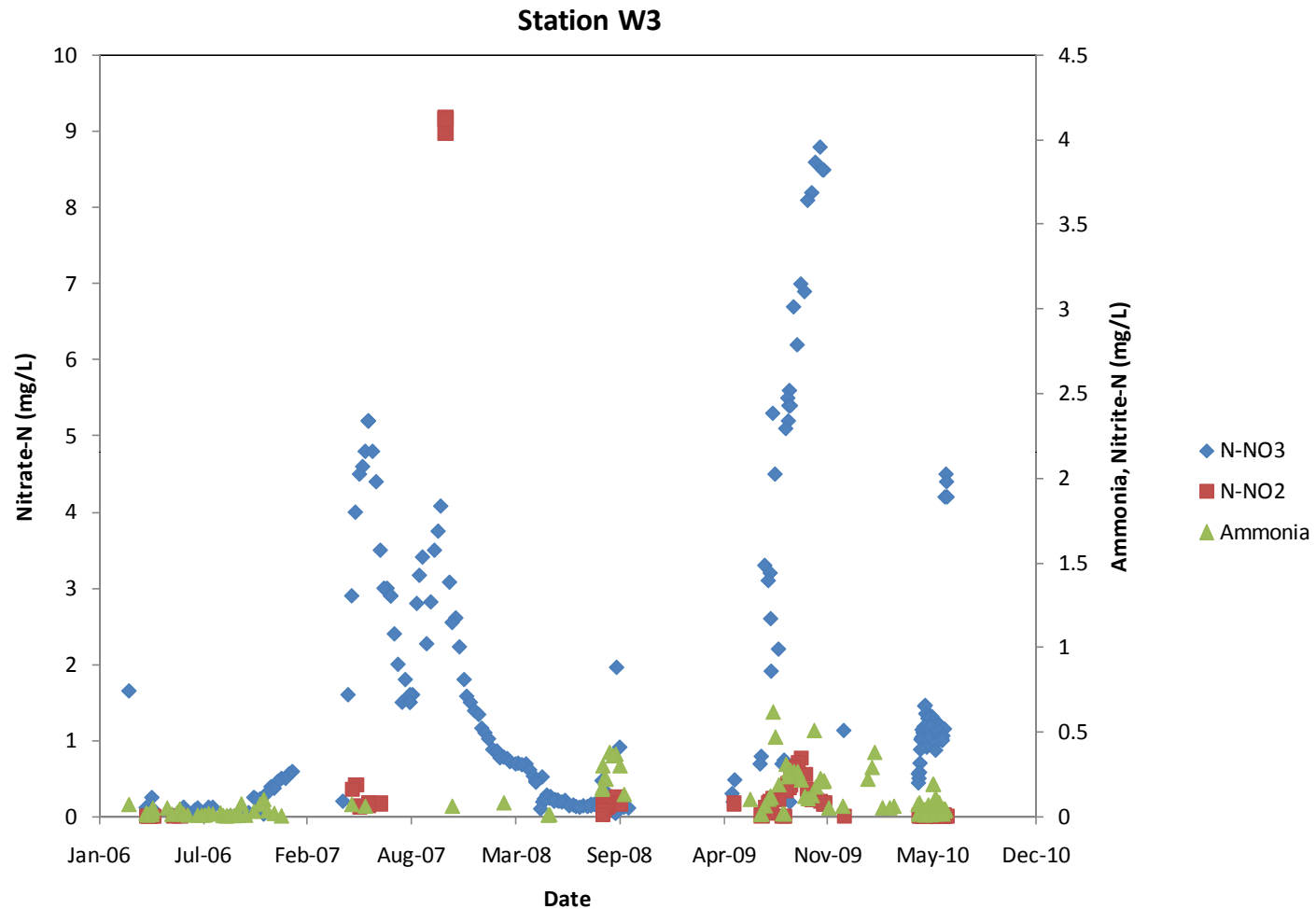
Minto Pit: Final Wall

PROJECT:
1CM002.001

DATE:
August 2010

APPROVED:
DBM

FIGURE:
5.2



\\Van-svr0\projects\01_SITES\Minto\Baseses\ML-ARD\WQ_Predictions\SourceTerms_July2010\NutrientExport\ResultsQuery_SRK_Nitrogen_species.xlsx



MINTO EXPLORATIONS LTD.
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Minto Mine Expansion – Phase IV

Station W3: Nitrate, Nitrite and Ammonia Concentrations

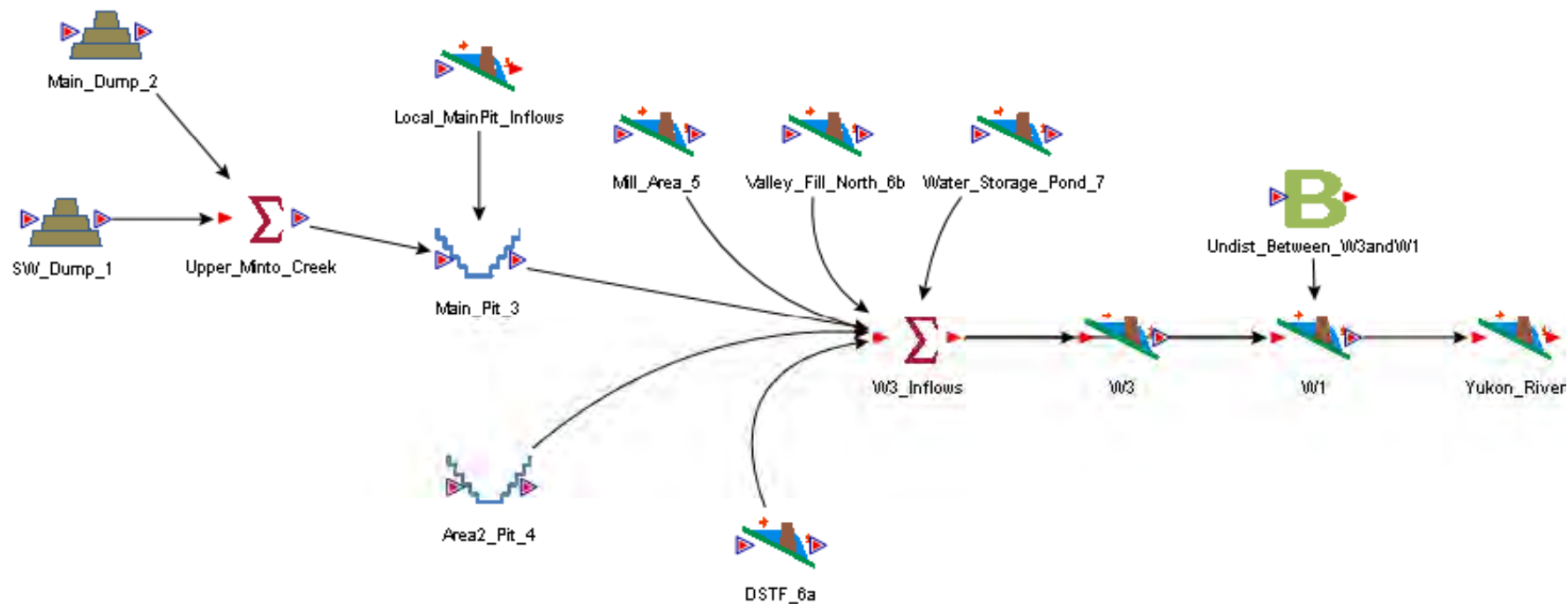
PROJECT:
1CM002.001

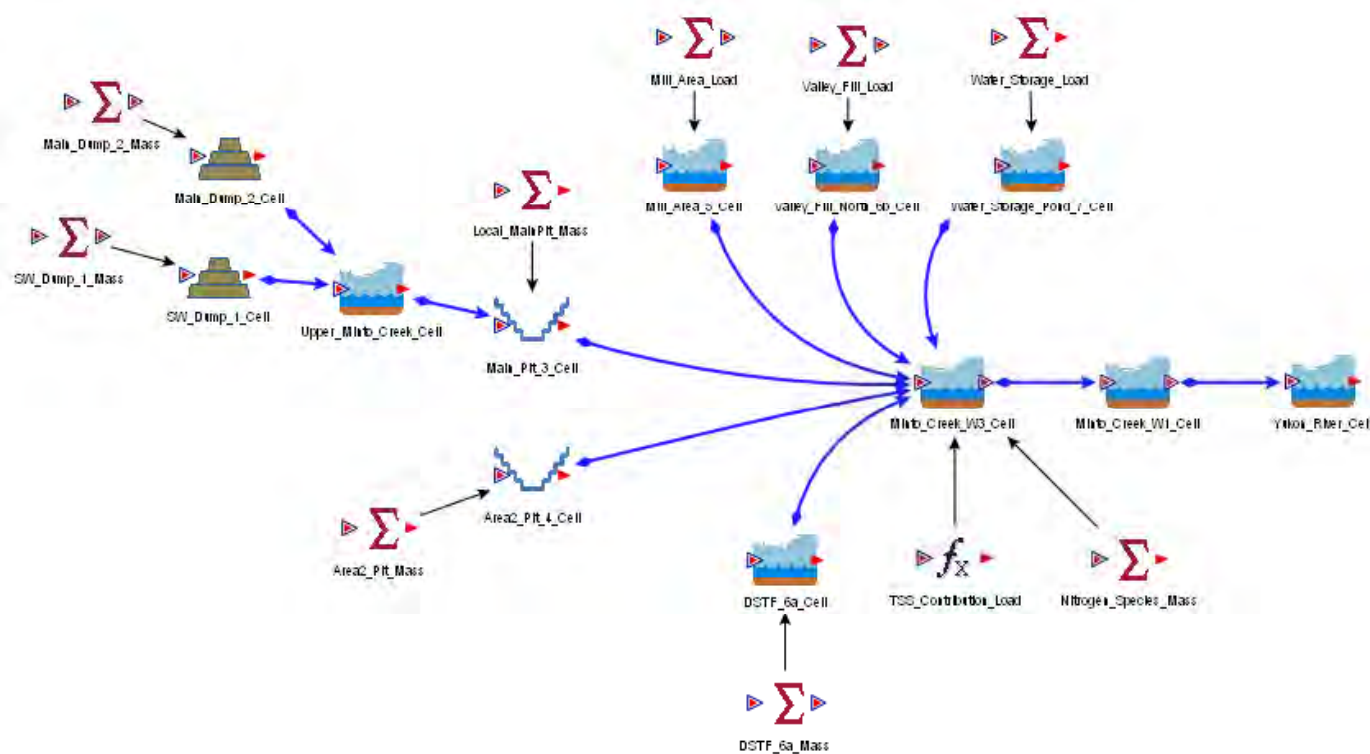
DATE:
August 2010

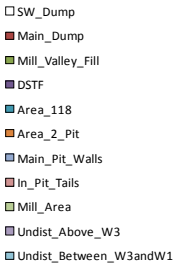
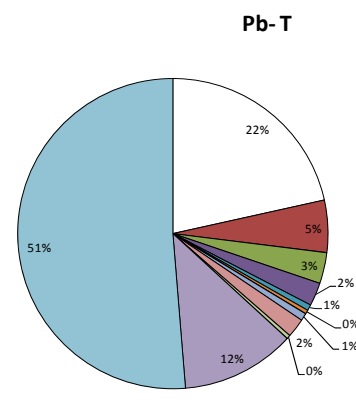
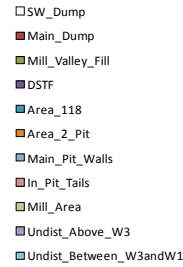
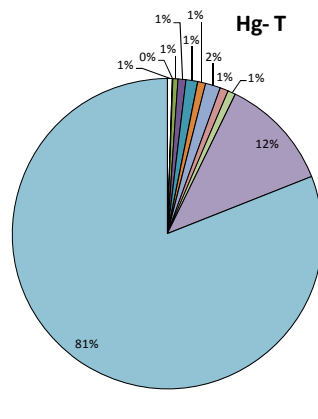
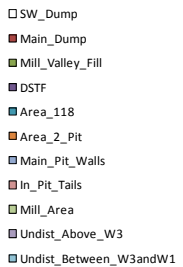
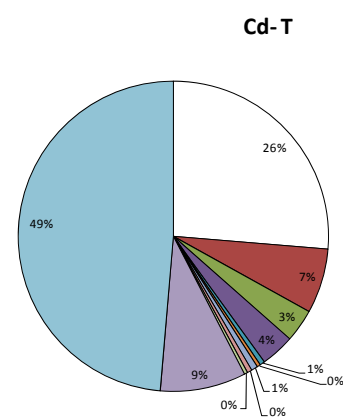
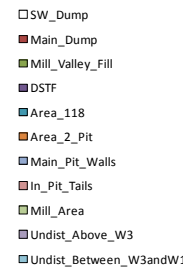
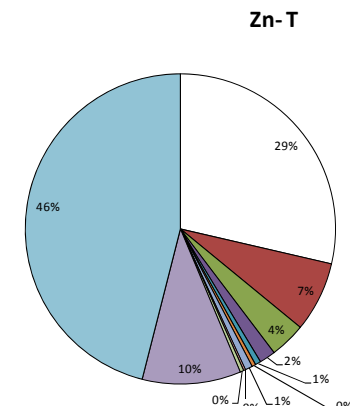
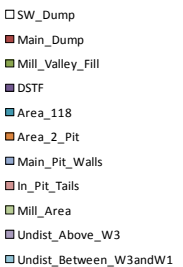
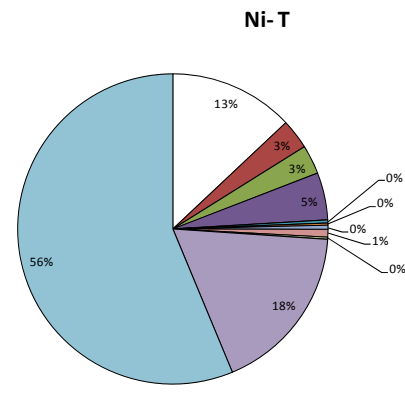
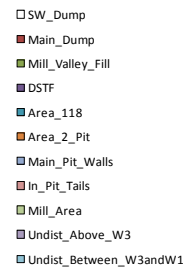
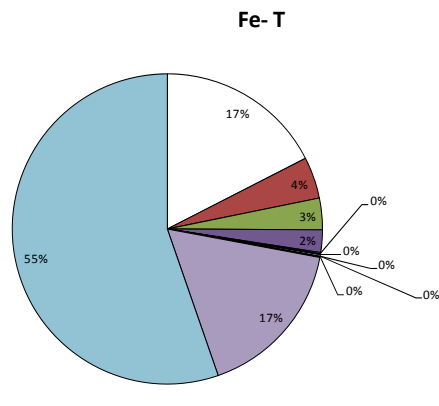
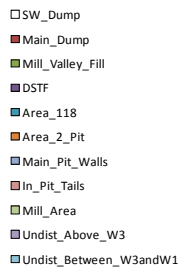
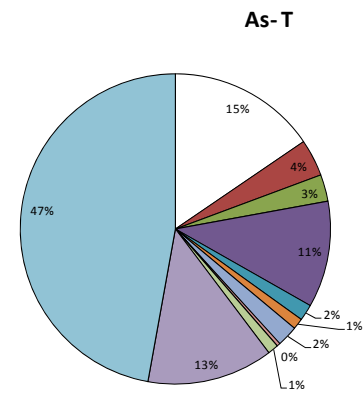
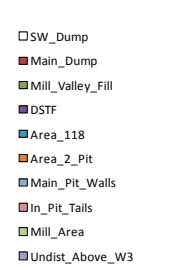
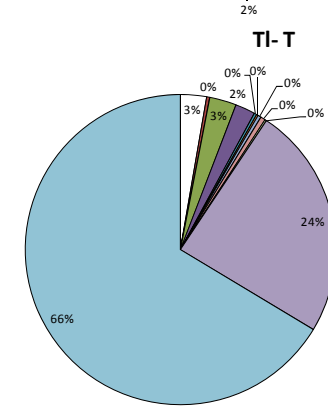
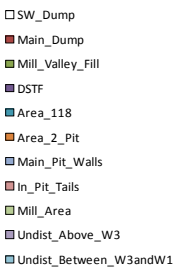
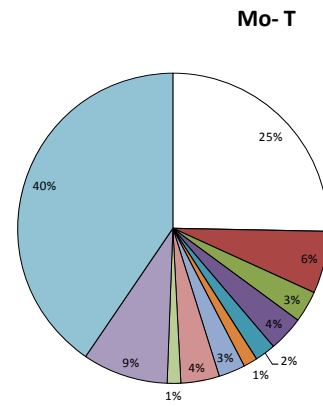
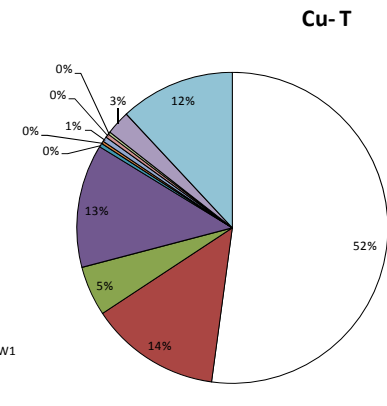
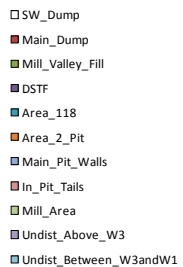
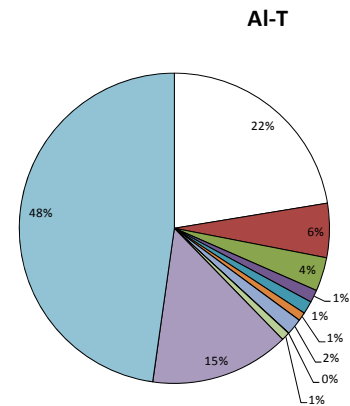
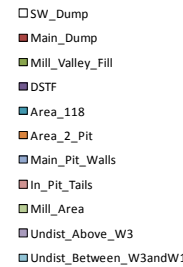
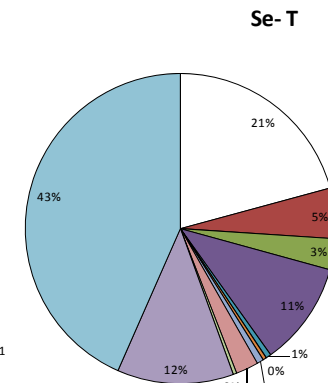
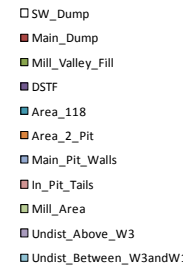
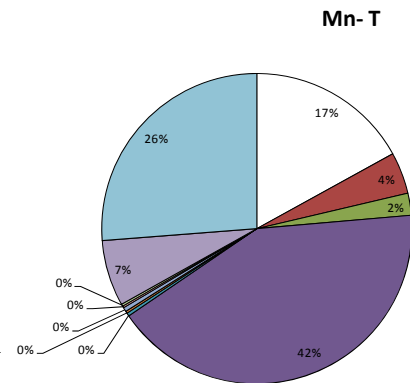
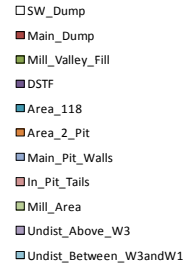
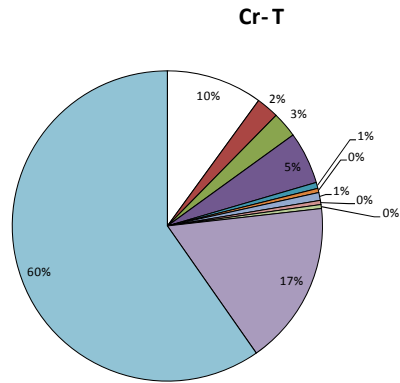
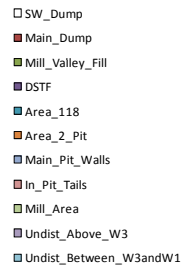
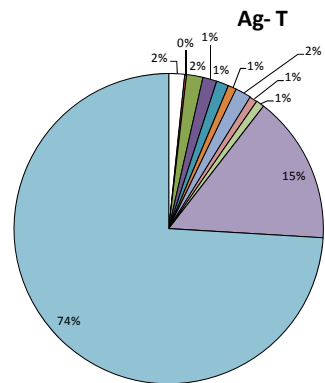
APPROVED:
DBM

FIGURE::

5.4







Appendices

Appendix A

Exploration Assay Results

Area 2, Phase 2: In-Pit Core Intervals- ORE

Summary Statistics

	Total Cu %	Cu(sol)%	Al_%ICP	As_ppmICP	B_ppmICP	Ba_ppmICP	Be_ppmICP	BI_ppmICP	Ca_%ICP	Cd_ppmICP	Co_ppmICP	Cr_ppmICP	Fe_%ICP	Ga_ppmICP	Hg_ppmICP	K_%ICP	La_ppmICP	Mg_%ICP	Mn_ppmICP	Mo_ppmICP	Na_%ICP	Ni_ppmICP	P_ppmICP	Pb_ppmICP	S_%ICP	Sb_ppmICP	Sc_ppmICP	Sr_ppmICP	Tl_%ICP	Tl_ppmICP	U_ppmICP	V_ppmICP	W_ppmICP	Zn_ppmICP
Max	16.7	2.09	7.04	76	20	1680	1	31	17.5	12.1	273	742	19.2	30	4	3.31	120	3.08	4160	1545	0.27	579	3520	62	9.63	9	23	1425	0.63	20	10	502	30	656
95th Percentile	3.206	0.3126	2.31	6	5	550	0.5	9	3.386	1.9	31	27	8.913	10	1	1.413	30	1.373	1196.5	148	0.11	5	1420	13	3.173	2	9	191.3	0.273	5	5	141.3	5	204.3
75th Percentile	1.085	0.054	1.64	3	5	300	0.25	2	1.51	0.5	11	7	5.37	10	0.5	0.97	20	0.92	796.5	15	0.07	3	1060	6	1.3	1	6	90	0.18	5	5	88	5	119.5
50th Percentile	0.4	0.017	1.36	1	5	160	0.25	1	0.95	0.25	7	5	3.52	10	0.5	0.64	10	0.75	597	1	0.05	2	860	4	0.52	1	4	59	0.12	5	5	69	5	83
25th Percentile	0.07	0.006	1.05	1	5	80	0.25	1	0.63	0.25	6	4	2.655	10	0.5	0.31	5	0.58	442	0.5	0.04	1	600	3	0.04	1	3	42	0.05	5	5	54	5	63
5th Percentile	0.005	0.0005	0.53	1	5	30	0.25	1	0.3	0.25	4	2	1.937	5	0.5	0.11	5	0.25	235.7	0.5	0.02	0.5	110	1	0.005	1	1	26	0.01	5	5	23	5	30
Min	0.005	0.0005	0.03	1	5	10	0.25	1	0.06	0.25	0.5	0.5	0.3	5	0.5	0.02	5	0.01	53	0.5	0.005	0.5	5	1	0.005	1	0.5	5	0.005	5	5	2	5	2
Average	0.827903	0.0718706	1.384825	2.208086	5.067385	214.7224	0.270296	2.285175	1.285235	0.534636	10.88814	8.865768	4.302146	9.12938	0.634771	0.678879	14.3531	0.7711	649.3892	26.51644	0.057957	2.408086	830.7628	5.309434	0.924792	1.211321	4.562264	78.48356	0.127027	5.150943	5.008086	75.06361	5.196765	97.94394
Count	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855	1855
Standard Deviation	1.205834	0.1860069	0.568942	3.326342	0.643018	182.3576	0.08748	3.239966	1.214066	0.754412	12.98252	20.80439	2.396487	2.524844	0.31012	0.428846	10.30479	0.339654	334.8206	78.46368	0.029101	13.48963	401.1159	4.638751	1.195447	0.598074	2.371857	73.33899	0.086272	0.901795	0.200967	38.18176	1.173508	60.82253

Area 2, Phase 2: In-Pit Core Intervals- Waste

Summary Statistics

	Total Cu %	Cu(sol)%	Al_%ICP	As_ppmICP	B_ppmICP	Ba_ppmICP	Be_ppmICP	BI_ppmICP	Ca_%ICP	Cd_ppmICP	Co_ppmICP	Cr_ppmICP	Fe_%ICP	Ga_ppmICP	Hg_ppmICP	K_%ICP	La_ppmICP	Mg_%ICP	Mn_ppmICP	Mo_ppmICP	Na_%ICP	Ni_ppmICP	P_ppmICP	Pb_ppmICP	S_%ICP	Sb_ppmICP	Sc_ppmICP	Sr_ppmICP	Tl_%ICP	Tl_ppmICP	U_ppmICP	V_ppmICP	W_ppmICP	Zn_ppmICP
Max	3.45	1.55	3.95	132	10	1800	1	25	6.23	4.6	45	119	16.8	20	3	1.58	70	4.95	1430	189	0.31	193	3390	54	5.27	5	15	2130	0.34	10	10	528	10	399
95th Percentile	0.17	0.02	1.77	5	5	630	0.25	2	2.032	0.25	8	38	3.25	10	1	1.05	20	0.93	738.2	2	0.15	4	1170	7	0.19	2	8	155	0.2	5	5	77	5	94
75th Percentile	0.01	0.002	1.48	2	5	400	0.25	1	1.16	0.25	6	8	2.7	10	0.5	0.79	10	0.79	612	0.5	0.1	3	810	4	0.02	1	5	92	0.15	5	5	60	5	72
50th Percentile	0.005	0.001	1.33	1	5	270	0.25	1	0.87	0.25	6	7	2.46	10	0.5	0.58	10	0.7	543	0.5	0.08	2	710	3	0.01	1	4	65	0.12	5	5	52	5	65
25th Percentile	0.005	0.0005	1.17	1	5	160	0.25	1	0.68	0.25	5	5	2.24	10	0.5	0.28	10	0.61	447	0.5	0.06	1	620	2	0.005	1	3	50	0.06	5	5	45	5	56
5th Percentile	0.005	0.0005	0.6	1	5	60	0.25	1	0.45	0.25	3	4	1.61	5	0.5	0.12	5	0.31	279.8	0.5	0.04	0.5	238	1	0.005	1	1	35	0.01	5	5	28	5	37
Min	0.005	0.0005	0.18	1	5	20	0.25	1	0.02	0.25	0.5	0.5	0.31	5	0.5	0.03	5	0.03	40	0.5	0.01	0.5	5	1	0.005	1	0.5	11	0.005	5	5	4	5	4
Average	0.040349	0.0085822	1.301424	1.930781	5.041728	295.7928	0.262445	1.118802	1.013765	0.263795	5.746441	10.54271	2.463829	8.961708	0.606529	0.562116	11.09229	0.686519	528.4865	1.362543	0.086274	2.075847	731.7231	3.494845	0.049863	1.161512	4.153412	78.73441	0.108611	5.11782	5.009818	52.38979	5.009818	64.86254
Count	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037	2037
Standard Deviation	0.162135	0.062272	0.339925	3.320417	0.454973	183.5125	0.067064	0.718562	0.597567	0.13907	2.487176	13.87057	0.667417	2.04673	0.247664	0.304984	6.349924	0.210417	149.2732	8.346367	0.034239	4.394531	308.3665	2.894612	0.229385	0.488504	2.035817	67.41564	0.06078	0.758619	0.221403	18.53397	0.221403	21.74431

Area 118: In-Pit Core Intervals- Ore

Summary Statistics

	Total Cu %	Cu(sol)%	Al_%ICP	As_ppmICP	B_ppmICP	Ba_ppmICP	Be_ppmICP	BI_ppmICP	Ca_%ICP	Cd_ppmICP	Co_ppmICP	Cr_ppmICP	Fe_%ICP	Ga_ppmICP	Hg_ppmICP	K_%ICP	La_ppmICP	Mg_%ICP	Mn_ppmICP	Mo_ppmICP	Na_%ICP	Ni_ppmICP	P_ppmICP	Pb_ppmICP	S_%ICP	Sb_ppmICP	Sc_ppmICP	Sr_ppmICP	Tl_%ICP	Tl_ppmICP	U_ppmICP	V_ppmICP	W_ppmICP	Zn_ppmICP
Max	3.92	0.11	1.75	5	10	860	0.25	1	1.25	1.1	17	10	6.19	10	2	1.26	30	0.93	607	326	0.14	3	1400	20	4.05	2	7	100	0.24	10	5	93	5	126
95th Percentile	3.5295	0.08745	1.7445	3.35	10	827	0.25	1	1.041	0.99	16.45	9.45	5.761	10	1.45	1.2325	30	0.908	605.35	310.6	0.1345	2.45	1323	12.85	3.5275	1.45	7	95.05	0.24	7.25	5	91.9	5	122.7
75th Percentile	1.105	0.04975	1.615	2	5	645	0.25	1	0.72	0.625	12	9	4.355	10	1	1.1575	12.5	0.795	589.5	18.5	0.11	2	1182.5	4.25	1.305	1	6	70.5	0.2225	5	5	82	5	113.75
50th Percentile	0.03	0.011	1.415	1	5	400	0.25	1	0.615	0.25	7.5	6.5	2.99	10	0.5	0.845	10	0.735	499	2.5	0.1	1.5	925	3	0.02	1	4.5	54	0.155	5	5	76.5	5	100
25th Percentile	0.01	0.002	1.215	1	5	270	0.25	1	0.4825	0.25	6.75	6	2.72	10	0.5	0.655	8.75	0.645	456.5	1	0.06	0.5	767.5	1.75	0.01	1	3.75	48	0.125	5	5	68	5	87
5th Percentile	0.005	0.001	0.794	1	5	96.5	0.25	1	0.41	0.25	6	5.55	2.222	5	0.5	0.3945	5	0.512	414.7	0.5	0.0455	0.5	596	1	0.00775	1	3	42	0.0565	5	5	50.55	5	68.1
Min	0.005	0.001	0.75	1	5	80	0.25	1	0.41	0.25	6	5	2.2	5	0.5	0.29	5	0.49	385	0.5	0.04	0.5	530	1	0.005	1	3	42	0.04	5	5	50	5	67
Average	0.795833	0.0276667	1.360833	1.666667	5.833333	450.8333	0.25	1	0.65	0.441667	9.333333	7.166667	3.540833	9.166667	0.75	0.861667	12.91667	0.721667	511	56.33333	0.090833	1.416667	962.5	4.333333	0.827917	1.083333	4.833333	60.91667	0.16	5.416667	5	73.83333	5	98
Count	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Standard Deviation	1.369613	0.0357093	0.331209	1.154701	1.946247	256.3541	0	0	0.241849	0.305877	3.938928	1.642245	1.298184	1.946247	0.452267	0.315619	8.908202	0.133132	73.39061	119.7604	0.031754	0.84835	265.6424	5.245489	1.390839	0.288675	1.527525	19.31301	0.067285	1.443376	0	14.03135	0	20.2215

Area 118: In-Pit Core Intervals- Waste

Summary Statistics

	Total Cu %	Cu(sol)%	Al_%ICP	As_ppmICP	B_ppmICP	Ba_ppmICP	Be_ppmICP	BI_ppmICP	Ca_%ICP	Cd_ppmICP	Co_ppmICP	Cr_ppmICP	Fe_%ICP	Ga_ppmICP	Hg_ppmICP	K_%ICP	La_ppmICP	Mg_%ICP	Mn_ppmICP	Mo_ppmICP	Na_%ICP	Ni_ppmICP	P_ppmICP	Pb_ppmICP	S_%ICP	Sb_ppmICP	Sc_ppmICP	Sr_ppmICP	Tl_%ICP	Tl_ppmICP	U_ppmICP	V_ppmICP	W_ppmICP	Zn_ppmICP
Max	0.04	0.014	1.72	9	5	720	0.25	2	0.69	0.25	7	8	2.79	10	1	1.21	20	0.85	554	1	0.12	2	1970	6	0.02	1	6	62	0.25	5	5	82	5	88
95th Percentile	0.0375	0.01125	1.7	8.75	5	707.5	0.25	1.75	0.6875	0.25	7	7.75	2.785	10	1	1.1875	17.5	0.8375	551.25	1	0.12	1.75	1872.5	5.75	0.0175	1	6	60.5	0.2425	5	5	79.5	5	87.5
75th Percentile	0.025	0.00275	1.62	7	5	637.5	0.25	1	0.675	0.25	7	7	2.7525	10	1	1.1075	10	0.795	523.75	0.875	0.1175	0.875	1390	4.75	0.01	1	5.75	54.25	0.2175	5	5	72	5	85.75
50th Percentile	0.01	0.0015	1.53	2.5	5	505	0.25	1	0.615	0.25	6.5	7	2.65	10	0.75	1.06	10	0.735	464	0.5	0.1	0.5	820	4	0.01	1	5	48.5	0.205	5	5	70.5	5	84.5
25th Percentile	0.00625	0.001	1.4625	1	5	470	0.25	1	0.435	0.25	6	7	2.48	10	0.5	0.9975	6.25	0.6825	426.75	0.5	0.09	0.5	775	2.5	0.01	1	3.5	38.25	0.1775	5	5	63	5	77.25
5th Percentile	0.005	0.000625	1.39	1	5	432.5	0.25	1	0.3225	0.25	5.25	6.25	2.3425	6.25	0.5	0.86	5	0.65	412	0.5	0.0825	0.5	737.5	2	0.00625	1	3	32.75	0.155	5	5	61	5	62.25
Min	0.005	0.0005	1.37	1	5	420	0.25	1	0.3	0.25	5	6	2.31	5	0.5	0.82	5	0.64	411	0.5	0.08	0.5	730	2	0.005	1	3	32	0.15	5	5	61	5	58
Average	0.016667	0.0035833	1.54	4	5	548.3333	0.25	1.166667	0.5483333	0.25	6.333333	7	2.601667	9.166667	0.75	1.041667	10	0.74	475.1667	0.666667	0.101667	0.833333	1113.3333	3.833333	0.010833	1	4.666667	47	0.2	5	5	69.5	5	79.333333
Count	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Standard Deviation	0.01472	0.0051809	0.127593	3.687818	0	120.8994	0	0.408248	0.16558	0	0.816497	0.632456	0.192189	2.041241	0.273861	0.132878	5.477226	0.081731	61.3365	0.258199	0.017224	0.60553	528.3055	1.602082	0.004916	0	1.36626	11.6619	0.035777	0	0	7.918333	0	11.3784

Appendix B
Phase IV Open Pit Mine Rock: Static Test Results

Appendix B1
2007 Results

VA07029566 - Finalized
CLIENT : "MINTEX - Minto Exploration Ltd"
of SAMPLES : 36
DATE RECEIVED : 2007-03-26 DATE FINALIZED : 2007-04-10
PROJECT : " "
CERTIFICATE COMMENTS : ""
PO NUMBER : " "

HOLE ID	FROM	TO	Length	Category ¹	SAMPLE DESCRIPTION	OA-VOL08 FIZZ RATING Unity	OA-VOL08 MPA tCaCO3/1000t ore	OA-VOL08 NNP	OA-VOL08 NP	OA-ELE07 pH Unity	OA-VOL08 Ratio (NP:MPA) Unity	S-IR08 S %	S-GRA06a S %	S-CAL06a S %	C-GAS05 C %	C-GAS05 CO2 %
06SWC107	85	87	2.00	B	B464081	2	0.3	21	21	9.5	67.2	0.01	<0.01	0.01	0.1	0.4
06SWC156	46.89	48.39	1.50	B	C486761	2	0.3	34	34	8.9	108.8	0.01	<0.01	0.01	0.27	1
06SWC156	134.93	136.43	1.50	B	C486805	2	0.3	56	56	8.8	179.2	0.01	<0.01	0.01	0.63	2.3
06SWC125	100.8	102.8	2.00	B	B797575	2	0.3	54	54	9.1	172.8	0.01	<0.01	0.01	0.59	2.2
06SWC115	18.29	19.79	1.50	B	B792721	2	0.3	30	30	9	96	0.01	<0.01	0.01	0.24	0.9
06SWC115	88.57	91.57	3.00	B	B792785	2	0.3	29	29	9.1	92.8	0.01	<0.01	0.01	0.26	1
06SWC145	14.01	15.01	1.00	B	C441551	1	0.6	14	15	9.3	24	0.02	<0.01	0.02	0.1	0.4
06SWC145	72.1	74.1	2.00	B	C441560	2	<0.3	25	25	9.6	160	<0.01	<0.01	<0.01	0.19	0.7
06SWC145	110.26	112	1.74	B	C441593	2	3.4	23	26	9.4	7.56	0.11	<0.01	0.11	0.21	0.8
06SWC145	128.41	129.41	1.00	B	C441609	2	0.3	24	24	9.2	76.8	0.01	<0.01	0.01	0.17	0.6
06SWC152	78.68	81.68	3.00	B	C486396	2	1.9	24	26	9.4	13.87	0.06	<0.01	0.06	0.2	0.7
06SWC152	100.05	101.6	1.50	B	C486413	2	2.2	19	21	9.2	9.6	0.07	0.02	0.05	0.11	0.4
06SWC118	56.3	57.3	1.00	B	B795306	2	0.6	17	18	9.5	28.8	0.02	<0.01	0.02	0.12	0.5
06SWC118	116	119	3.00	B	B795352	2	<0.3	23	23	9.4	147.2	<0.01	<0.01	<0.01	0.18	0.6
06SWC122	34.36	35.36	1.00	B	B795536	3	0.9	47	48	9.1	51.2	0.03	<0.01	0.03	0.47	1.7
06SWC111	53.99	55.5	1.50	B	B464533	2	<0.3	16	16	9.5	102.4	<0.01	<0.01	<0.01	0.19	0.7
06SWC111	77.9	80.9	3.00	B	B464552	2	<0.3	31	31	9.4	198.4	<0.01	<0.01	<0.01	0.3	1.1
06SWC103	50.24	51.64	1.40	B	B793427	2	0.3	26	26	9.5	83.2	0.01	<0.01	0.01	0.54	2
06SWC075	101	104	3.00	B	B463023	2	0.3	24	24	9.7	76.8	0.01	<0.01	0.01	0.13	0.5
06SWC105	10.95	12.75	1.80	B	B793608	2	<0.3	29	29	9.2	185.6	<0.01	<0.01	<0.01	0.23	0.8
06SWC105	80.45	81.76	1.31	B	B793671	2	0.9	28	29	9.6	30.93	0.03	<0.01	0.03	0.18	0.7
06SWC143	19.69	22.69	3.00	B	C486016	2	<0.3	18	18	9.6	115.2	<0.01	<0.01	<0.01	0.11	0.4
06SWC143	48.45	50.0	1.50	B	C486040	2	0.3	24	24	9.4	76.8	0.01	0.01	<0.01	0.2	0.7
06SWC107	19.81	21.44	1.63	M	B464032	1	23.1	-16	7	6.2	0.3	0.74	0.34	0.4	<0.05	<0.2
06SWC107	56.92	59	2.08	M	B464062	3	7.2	74	81	9	11.27	0.23	<0.01	0.23	0.95	3.5
06SWC146	148.7	150.2	1.50	M	C441666	2	1.3	24	25	9.4	20	0.04	<0.01	0.04	0.18	0.7
06SWC156	84.49	86.0	1.50	M	C486779	2	4.4	26	30	9.1	6.86	0.14	<0.01	0.14	0.27	1
06SWC125	17.34	18.8	1.46	M	B797524	1	0.3	15	15	8.8	48	0.01	<0.01	0.01	0.1	0.4
06SWC125	147.5	149	1.50	M	B797615	2	9.7	9	19	9.4	1.96	0.31	<0.01	0.31	0.11	0.4
06SWC103	71.93	73.31	1.38	M	B793448	2	14.7	32	47	9.1	3.2	0.47	<0.01	0.47	0.13	0.5
06SWC103	91.99	92.99	1.00	M	B793458	2	<0.3	19	19	9.8	121.6	<0.01	<0.01	<0.01	0.63	2.3
06SWC075	26	27	1.00	M	B462373	2	19.7	35	55	8.7	2.79	0.63	<0.01	0.63	0.64	2.3
06SWC105	42.65	43.07	0.42	M	B793635	2	6.3	13	19	9.6	3.04	0.2	<0.01	0.2	0.2	0.7
06SWC115	63.31	64.49	1.18	O	B792761	3	136.6	113	250	8.1	1.83	4.37	<0.01	4.37	3.48	12.8
06SWC115	129.05	130.54	1.49	O	B792807	2	24.1	11	35	8.8	1.45	0.77	<0.01	0.77	0.32	1.2
06SWC111	10.85	12.35	1.50	O	B464503	2	<0.3	13	13	8.4	83.2	<0.01	<0.01	<0.01	0.14	0.5

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQP\Appendices\App_B_PitRock_Static\2007\VA07029566_formatted_for_appendix.xls

Notes:

1 B = Bulk waste; M = Mineralized waste; O = Ore

Category	HOLE ID	FROM	TO	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Sr	Ti	Tl	U	V	W	Zn	
				ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm	ppm	%	ppm	%	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
Bulk waste	06SWC075	101	104	0.1	1.65	3	5	200	0.25	1	1.44	0.25	7	13	44	2.9	10	0.5	0.5	10	0.96	738	0.5	0.21	2	1010	5	0.005	1	10	110	0.17	5	5	68	5	77	
Bulk waste	06SWC107	85	87	0.1	1.36	1	5	160	0.25	2	0.99	0.25	6	36	5	2.25	10	0.5	0.34	10	0.84	526	0.5	0.14	3	740	4	0.02	1	4	86	0.15	5	5	53	5	58	
Bulk waste	06SWC111	53.99	55.49	0.1	1.17	3	5	410	0.25	1	0.58	0.25	5	8	10	2.2	5	0.5	0.71	5	0.51	378	1	0.11	3	390	4	0.005	1	4	48	0.13	5	5	44	5	45	
Bulk waste	06SWC111	77.9	80.9	0.1	1.46	1	5	380	0.25	1	1.21	0.25	5	7	13	2.72	10	0.5	0.73	10	0.69	608	0.5	0.09	2	710	3	0.01	1	3	66	0.16	10	5	61	5	72	
Bulk waste	06SWC115	18.29	19.79	0.5	1.35	1	5	290	0.25	1	1.11	0.25	6	5	7	2.62	10	0.5	0.44	10	0.73	665	0.5	0.09	3	720	1	0.01	1	6	50	0.07	5	5	52	5	63	
Bulk waste	06SWC115	88.57	91.57	0.1	1.17	1	5	170	0.25	1	1.06	0.25	6	107	9	2.66	10	1	0.32	10	0.64	496	0.5	0.09	4	640	1	0.005	1	3	74	0.06	5	5	43	5	69	
Bulk waste	06SWC103	50.24	51.64	0.1	1.89	1	5	630	0.25	1	0.93	0.25	7	5	7	3.04	10	0.5	1.2	10	0.93	534	0.5	0.13	2	1030	2	0.02	1	6	78	0.23	5	5	75	5	74	
Bulk waste	06SWC105	10.95	12.75	0.7	1.5	6	5	400	0.25	1	1.09	0.25	7	5	32	3.03	10	0.5	0.7	40	0.69	621	0.5	0.1	1	1040	2	0.01	2	3	57	0.12	5	5	65	5	73	
Bulk waste	06SWC105	80.45	81.76	0.3	1.65	5	5	220	0.25	1	1.18	0.25	8	10	440	3.04	10	0.5	0.73	20	0.96	933	1	0.14	2	1130	3	0.04	1	4	118	0.15	5	5	69	5	112	
Bulk waste	06SWC118	56.3	57.3	0.1	1.62	1	5	460	0.25	2	0.71	0.25	4	3	40	2.57	10	0.5	1.05	10	0.76	390	0.5	0.09	2	860	4	0.02	1	6	50	0.2	5	5	59	5	45	
Bulk waste	06SWC118	116	119	0.1	0.72	1	5	130	0.25	1	0.72	0.25	2	5	5	1.56	5	0.5	0.19	10	0.41	380	0.5	0.07	1	400	2	0.005	1	2	73	0.04	5	5	25	5	40	
Bulk waste	06SWC122	34.36	35.36	0.3	0.68	1	5	80	0.25	1	1.1	0.25	5	4	59	1.82	5	0.5	0.19	10	0.52	298	1	0.06	1	1160	12	0.03	1	4	85	0.03	5	5	51	5	48	
Bulk waste	06SWC125	100.8	102.8	0.1	1.21	1	5	180	0.25	1	1.57	0.25	5	10	0.5	2.32	5	0.5	0.34	10	0.65	594	0.5	0.08	0.5	720	1	0.005	2	5	110	0.06	10	5	43	5	65	
Bulk waste	06SWC145	14.01	15.01	0.1	1.6	1	5	440	0.25	1	0.46	0.25	6	8	17	2.84	10	0.5	0.97	20	0.83	550	0.5	0.04	3	780	2	0.005	1	4	29	0.19	5	5	66	5	66	
Bulk waste	06SWC145	72.1	74.1	0.1	1.42	1	5	520	0.25	1	0.85	0.25	6	7	1	2.82	10	0.5	0.88	20	0.86	906	0.5	0.05	1	830	2	0.005	1	8	58	0.16	5	5	65	5	62	
Bulk waste	06SWC145	110.26	112	0.1	1.54	1	5	490	0.25	1	0.76	0.25	5	6	97	2.54	10	0.5	0.94	5	0.71	408	0.5	0.05	2	620	5	0.06	1	2	130	0.19	5	5	60	5	50	
Bulk waste	06SWC145	128.41	129.41	0.1	1.5	1	5	360	0.25	1	1.1	0.25	7	4	54	2.53	10	0.5	0.95	10	0.8	524	0.5	0.04	3	1150	2	0.01	1	3	281	0.17	5	5	60	5	72	
Bulk waste	06SWC143	19.69	22.69	0.1	1.19	2	5	280	0.25	1	0.69	0.25	5	10	10	2.24	5	0.5	0.62	10	0.62	546	1	0.14	3	580	2	0.005	1	5	56	0.12	5	5	47	5	66	
Bulk waste	06SWC143	48.45	49.95	0.1	1.18	1	5	250	0.25	1	0.89	0.5	7	5	7	2.35	5	1	0.61	10	0.65	647	0.5	0.08	0.5	730	3	0.005	1	5	55	0.12	5	5	52	5	70	
Bulk waste	06SWC152	78.68	81.68	0.1	1.36	1	5	410	0.25	1	0.81	0.25	5	6	120	2.15	10	0.5	0.69	10	0.56	382	0.5	0.1	1	640	3	0.09	1	5	40	0.11	5	5	45	5	42	
Bulk waste	06SWC152	100.05	101.55	0.1	1.74	1	5	400	0.25	1	0.76	0.25	6	7	17	2.7	10	0.5	0.86	5	0.91	501	0.5	0.08	2	1190	1	0.06	1	2	2130	0.18	5	10	61	5	68	
Bulk waste	06SWC156	46.89	48.39	0.1	1.73	1	5	190	0.5	1	1.79	0.25	6	3	32	3.1	10	0.5	0.24	10	0.83	641	0.5	0.14	2	1230	5	0.02	1	7	117	0.07	5	5	68	5	64	
Bulk waste	06SWC156	134.93	136.43	0.1	1.06	1	5	370	0.25	1	1.94	0.25	5	5	7	2.32	5	0.5	0.52	10	0.51	822	0.5	0.07	1	630	4	0.005	1	7	141	0.08	5	5	46	5	77	
Min. waste	06SWC075	26	27	0.9	2.17	1	5	230	0.25	2	0.91	0.25	23	5	4330	5.37	10	1	0.5	10	1.18	765	39	0.05	3	90	3	1.36	1	5	32	0.09	5	5	116	5	86	
Min. waste	06SWC107	19.81	21.44	1	1.29	1	5	200	0.25	1	0.51	0.25	21	28	1430	3.4	10	0.5	0.46	10	0.59	693	2	0.08	2	830	4	0.87	1	5	34	0.08	5	5	58	5	65	
Min. waste	06SWC107	56.92	59	0.2	0.96	1	5	320	0.25	1	2.23	0.25	10	46	298	3.53	10	1	0.37	10	0.48	584	1	0.06	3	630	3	0.15	1	2	96	0.07	5	5	81	5	57	
Min. waste	06SWC103	71.93	73.31	0.5	1.74	1	5	230	0.25	1	1.91	0.25	9	5	2790	3.37	10	1	1.12	20	0.98	538	13	0.1	2	1120	4	0.61	1	10	104	0.2	5	5	90	5	74	
Min. waste	06SWC103	91.99	92.99	0.1	1.36	1	5	270	0.25	1	0.57	0.25	5	20	359	2.49	5	0.5	0.87	10	0.68	479	0.5	0.09	3	660	2	0.03	1	2	51	0.16	5	5	53	5	58	
Min. waste	06SWC105	42.65	43.07	0.1	0.97	1	5	250	0.25	1	0.4	0.25	5	4	230	1.69	5	0.5	0.59	20	0.45	312	0.5	0.08	1	160	3	0.09	2	3	33	0.13	5	5	46	5	46	
Min. waste	06SWC125	17.34	18.8	0.2	1.97	5	5	360	0.25	1	0.51	0.25	7	5	497	3.82	10	0.5	1.03	20	0.88	591	0.5	0.06	2	1210	4	0.01	1	8	28	0.18	5	5	88	5	97	
Min. waste	06SWC125	147.5	149	0.5	1.37	1	5	150	0.25	1	0.71	0.25	5	6	3190	2.09	5	0.5	0.89	20	1.03	462	59	0.09	3	1150	3	0.3	1	7	54	0.16	5	5	89	5	101	
Min. waste	06SWC146	148.7	150.2	0.4	1.5	3	5	220	0.25	1	0.79	0.25	7	7	597	2.48	10	0.5	0.5	10	0.72	535	0.5	0.13	2	740	3	0.04	1	1	88	0.13	5	5	52	5	64	
Min. waste	06SWC156	84.49	85.99	0.2	1.11	3	5	40	0.25	1	1.24	0.25	5	4	480	1.99	10	0.5	0.11	5	0.71	298	0.5	0.06	1	820	6	0.34	1	3	36	0.01	5	5	34	5	43	
Ore	06SWC111	10.85	12.35	2.4	1.04	1	5	90	0.25	1	0.26	0.25	5	4	10000	2.36	5	0.5	0.64	10	0.49	673	1	0.05	1	910	4	0.005	1	7	42	0.11	5	5	71	5	63	
Ore	06SWC115	63.31	64.49	1.2																																		

*Source: Price, W.A. (1997). Draft guidelines and recommended methods for the prediction of metal leaching and acid rock drainage at minesites in BC

Source: U:\11CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQPIAppendices\App_B_PitRock_Static\2007\VA07029566_formatted_for_appendix.xls]

VA08094740 - Finalized
CLIENT : "MINTEX - Minto Exploration Ltd."
of SAMPLES : 40
DATE RECEIVED : 2008-06-18 DATE FINALIZED : 2008-08-01
PROJECT : " "
CERTIFICATE COMMENTS : ""
PO NUMBER : "101735"

HOLE ID	FROM (m)	TO (m)	Length (m)	Category ¹	SAMPLE DESCRIPTION	OA-VOL08 FIZZ RATING Unity	OA-VOL08 MPA	OA-VOL08 NNP tCaCO3/1000t ore	OA-VOL08 NP	OA-ELE07 pH Unity	OA-VOL08 Ratio (NP:MPA) Unity	S-IR08 S %	S-GRA06a S %	S-CAL06a S %	C-GAS05 C %	C-GAS05 CO2 %
07SWC201	43.26	48.99	5.73	B	A2_ABA-1	2	0.3	38	38	8.3	121.6	0.01	<0.01	0.01	0.35	1.3
07SWC201	53.13	57.85	4.72	O	A2_ABA-2	3	26.3	78	104	8	3.96	0.84	0.04	0.8	1.05	3.9
07SWC201	75.9	81.9	6.0	M	A2_ABA-3	2	10.3	21	31	8.1	3.01	0.33	0.01	0.32	0.24	0.9
07SWC201	83.71	89.71	6.0	M	A2_ABA-4	2	7.5	21	28	8.4	3.73	0.24	<0.01	0.24	0.2	0.8
07SWC220	67.42	73.42	6.0	M	A2_ABA-5	2	10.6	61	72	8.4	6.78	0.34	<0.01	0.34	0.64	2.4
07SWC220	73.42	79.42	6.0	M	A2_ABA-6	2	7.8	39	47	8.5	6.02	0.25	<0.01	0.25	0.66	2.4
07SWC220	79.42	85.42	6.0	M	A2_ABA-7	2	12.8	20	33	8.4	2.58	0.41	<0.01	0.41	0.45	1.7
07SWC257	33.31	38.52	5.21	B	A2_ABA-8	2	0.3	25	25	8.9	80	0.01	<0.01	0.01	0.16	0.6
07SWC257	38.52	76	6.08	B	A2_ABA-9	2	2.2	26	28	9	12.8	0.07	<0.01	0.07	0.28	1
07SWC263	3.05	21.86	6.11	M	A2_ABA-10	2	2.2	26	28	8.9	12.8	0.07	<0.01	0.07	0.3	1.1
07SWC263	21.86	28.43	6.6	B	A2_ABA-11	2	0.3	40	40	9.1	128	0.01	<0.01	0.01	0.45	1.7
07SWC263	36.66	42.15	5.49	B	A2_ABA-12	2	0.3	21	21	9.2	67.2	0.01	<0.01	0.01	0.11	0.4
07SWC263	42.15	48.89	6.74	B	A2_ABA-13	2	0.3	23	23	9.2	73.6	0.01	<0.01	0.01	0.29	1.1
07SWC267	22.84	29.12	6.28	O	A2_ABA-14	1	4.1	5	9	7.6	2.22	0.13	<0.01	0.13	<0.05	<0.2
07SWC267	30.12	36.26	6.14	B	A2_ABA-15	1	<0.3	10	10	8.3	64	<0.01	<0.01	<0.01	<0.05	<0.2
07SWC267	36.26	41.82	5.56	B	A2_ABA-16	2	<0.3	26	26	8.5	166.4	<0.01	<0.01	<0.01	0.23	0.9
07SWC267	41.82	74.3	6.09	B	A2_ABA-17	2	<0.3	22	22	8.8	140.8	<0.01	<0.01	<0.01	0.13	0.5
07SWC267	74.3	80.77	6.47	B	A2_ABA-18	2	0.6	72	73	8.3	116.8	0.02	<0.01	0.02	0.78	2.8
07SWC267	80.77	87.1	6.33	M	A2_ABA-19	2	2.5	38	40	8.3	16	0.08	<0.01	0.08	0.34	1.3
07SWC267	88.5	95	6.5	B	A2_ABA-20	2	2.5	68	70	8.1	28	0.08	<0.01	0.08	0.72	2.7

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQPI\Appendices\App_B_PitRock_Static\2008\VA08094740_formatted_for_appendix.xlsx

Notes:

1 B = Bulk waste; M = Mineralized waste; O = Ore

Appendix C
Phase IV Underground Mine Rock: Static Test Results

BHID	FROM (m)	TO (m)	LITHO	SAMPLGTH (m)	SAMPLE	CU (%)
09SWC586	270.31	271.81	pG	1.5	E173643	0.001
09SWC548	75	76.5	fG	1.5	E170599	0.002
06SWC115	284.58	286	pG	3.0	B792913	0.005
07SWC188	231.46	232.52	pG	1.1	D023435	0.005
07SWC202	256.82	258.32	pG	1.5	D008776	0.005
07SWC203	112.83	114.33	fG	1.5	D022944	0.005
07SWC204	151.96	153.46	fG	1.5	D008837	0.005
07SWC236	218.05	218.59	Q	0.5	G097632	0.005
07SWC238	247.07	248.57	pG	1.5	G097177	0.005
08SWC289	189.5	191.73	pG	2.2	D041653	0.005
08SWC291	176.84	179	fG	2.2	D041796	0.005
08SWC292	197.22	198.22	pG	1.0	D026092	0.005
08SWC301	137.64	138.64	pG	1.0	D042517	0.005
08SWC316	192.22	193.72	eG	1.5	E032114	0.005
07SWC193	245.97	247.97	pG	2.0	D023872	0.01
07SWC201	241.21	242.37	fG	1.2	D021302	0.01
07SWC230	208.84	210.34	pG	1.5	D021028	0.01
08SWC328	223.77	224.77	pG	1.0	E032535	0.01
08SWC332	121.81	123.09	eG	1.3	E035735	0.01
07SWC203	34.97	35.25	pG	0.3	D022889	0.02
08SWC310	204.56	206.06	pG	1.5	D039330	0.03
06SWC093	274	277.37	pG	3.4	B777281	0.07
08SWC303	261.94	262.94	pG	1.0	D042747	0.15
08SWC298	167.62	169.12	fG	1.5	D026349	0.95
07SWC211	271.66	273.18	fG	1.5	D006069	1.05
06SWC080	275.29	276.79	fG	1.5	B775569	1.07
06SWC116	279.1	280.6	fG	1.5	B795240	1.3

Source:
U:\1CM002_001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQPI\Appendices\App_C_UG_Rock_Static[
AppC_UG_StaticTest_1CM002_001_dbm_rev00.xlsx]

CLIENT : SRK Consulting
PROJECT : Minto
CEMI Project # : 0907
Test : Sobek Acid-Base Accounting
Date : March 11, 2010

Sample ID	Paste pH Std. Units	CO2 % CO2	Equiv. CaCO3 kg CaCO3/t	Total S % S	Sulphate % S	Sulphur Diff. % S	AP kg CaCO3/t	NP kg CaCO3/t	Net NP kg CaCO3/t	NP/AP Ratio	Fizz Test Visual	NP-TIC/AP Ratio
LOD	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.2	#N/A	#N/A	#N/A	#N/A
Method Code	Sobek	HCl Leach	Calc.	Leco	HCl Leach	Calc.	Calc.	Sobek NP	Calc.	Calc.	Sobek	Calc.
B775569	7.2	0.12	2.7	2.12	1.66	0.46	14.375	13.4	-0.975	0.9	None	0.2
B777281	7.92	3.61	82.0	0.07	<0.01	0.07	2.1875	92.2	90.0125	42.1	Moderate	37.5
B792913	7.81	1.12	25.5	0.08	0.07	0.01	0.3125	40.6	40.2875	129.9	Slight	81.5
B795240	7.42	0.07	1.6	1.77	1.03	0.74	23.125	10.7	-12.425	0.5	None	0.1
D006067	7.71	0.72	16.4	1.08	0.44	0.64	20	25.7	5.7	1.3	Slight	0.8
D008776	8.07	0.13	3.0	0.13	0.12	0.01	0.3125	13.6	13.2875	43.5	None	9.5
D008837	9.32	0.5	11.4	<0.02	<0.01	<0.02	0.6	22.3	22.3	37.2	Slight	18.9
D021028	9.49	0.12	2.7	<0.02	<0.01	<0.02	0.6	12.4	12.4	20.7	None	4.5
D021302	9.59	0.13	3.0	<0.02	<0.01	<0.02	0.6	15.3	15.3	25.5	None	4.9
D022889	Insuff. Sam	0.51	11.6	<0.02	-	-	0.6	-	-	-	-	19.3
D022944	9.25	0.36	8.2	0.02	<0.01	0.02	0.625	23.9	23.275	38.2	Slight	13.1
D023435	8.17	0.29	6.6	0.35	0.3	0.05	1.5625	21	19.4375	13.4	Slight	4.2
D023872	8.25	0.34	7.7	0.15	0.14	0.01	0.3125	25.2	24.8875	80.6	Slight	24.7
D026092	9.64	0.1	2.3	<0.02	<0.01	<0.02	0.6	13	13	21.7	None	3.8
D026349	8.64	1.39	31.6	0.69	<0.01	0.69	21.5625	29.2	7.6375	1.4	Slight	1.5
D039330	9.28	0.58	13.2	0.13	<0.01	0.13	4.0625	23.3	19.2375	5.7	Slight	3.2
D041653	9.34	0.33	7.5	<0.02	<0.01	<0.02	0.6	25.7	25.7	42.8	Slight	12.5
D041796	9.18	0.3	6.8	<0.02	<0.01	<0.02	0.6	25.3	25.3	42.2	Slight	11.4
D042517	8.92	1.47	33.4	<0.02	<0.01	<0.02	0.6	37.2	37.2	62.0	Slight	55.7
D042747	8.39	0.35	8.0	0.17	0.12	0.05	1.5625	24.6	23.0375	15.7	Slight	5.1
E032114	9.32	0.28	6.4	<0.02	<0.01	<0.02	0.6	24.2	24.2	40.3	Slight	10.6
E032535	8.75	0.08	1.8	0.14	0.13	0.01	0.3125	13	12.6875	41.6	None	5.8
E035735	9.38	0.49	11.1	<0.02	<0.01	<0.02	0.6	26.7	26.7	44.5	Slight	18.6
E170599	9.42	0.31	7.0	<0.02	<0.01	<0.02	0.6	25.3	25.3	42.2	Slight	11.7
E173643	8.33	0.91	20.7	0.24	0.23	0.01	0.3125	36.4	36.0875	116.5	Slight	66.2
G097177	8.42	0.1	2.3	0.16	0.15	0.01	0.3125	12	11.6875	38.4	None	7.3
G097632	9.21	0.6	13.6	0.02	<0.01	0.02	0.625	18.6	17.975	29.8	Slight	21.8
Duplicates												
B775569	7.21	0.15						14.1			None	
B777281					<0.01							
D022944				<0.02								
E032114	7.94							25.3			Slight	
E035735		0.49										
E170599					<0.01							

Note:
Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.
Sulphur Difference = Total S - Sulphate S
AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.
NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.
NET NP = NP - AP

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARDcharacterization+WQPI\Appendices\App_C_UG_Rock_Static(AppC_UG_StaticTest_1CM002_001_dbm_rev00.xlsx)

Appendix D

Sequential MWMP Results

Appendix D1
Elemental Content of SMWMP Samples

CLIENT

PROJECT

CEMI Project #

Test

Date

: SRK Consulting

: Minto

: 0907

: Metals by Aqua Regia Digestion with ICP-MS Finish

: October 20, 2009

Sample ID	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppb	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Hg ppm	Sc ppm	Tl ppm	S %	Ga ppm	Se ppm	
LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5	
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Blue Waste Dump Sample 1 North Side	2	>10000.0	7	153	2.5	2.4	6.9	653	3.08	3	0.4	133.7	4.7	44	0.8	<0.1	1.3	62	0.96	0.092	13	44	0.77	227	0.118	<20	1.33	0.032	0.71	<0.1	<0.01	3.8	0.2	0.5	7	6.3	
Blue Waste Dump Sample 2 South Side	0.5	9768.8	5.9	146	2.8	3.2	7.3	635	2.97	<0.5	0.3	257.8	4.7	64	1.1	<0.1	1.7	57	1.33	0.083	12	65	0.68	176	0.106	<20	1.13	0.029	0.6	<0.1	0.02	3.8	0.2	0.59	6	8.4	
Main Waste Dump	3.2	2786.2	3.7	222	1	5.3	9.6	706	3.4	2.2	0.5	29.1	5.4	41	0.5	<0.1	0.2	76	0.53	0.101	16	63	0.91	205	0.122	<20	1.63	0.028	0.61	<0.1	<0.01	4.3	0.2	<0.05	7	0.7	
SW Dump Waste Rock	1.8	3470.2	3.2	119	1.3	3.6	7.8	580	2.7	<0.5	0.2	31.5	4.3	35	0.6	<0.1	0.4	60	0.4	0.082	18	59	0.68	274	0.115	<20	1.32	0.035	0.65	<0.1	<0.01	3	0.1	0.08	6	2.5	
Duplicate																																					
SW Dump Waste Rock	1.7	3377.3	3.3	117	1.2	3.9	7.3	562	2.69	<0.5	0.2	38.6	4.2	32	0.7	<0.1	0.3	60	0.4	0.081	18	53	0.68	269	0.115	<20	1.29	0.035	0.65	<0.1	<0.01	3	0.2	0.08	6	2.2	

Overlimit Re-Assay

Sample ID	Cu %
LOD	0.001
Method Code	7AR
Blue Waste Dump Sample 1 North Side	1.039
Duplicate	
Blue Waste Dump Sample 1 North Side	1.054

Appendix D2
ABA Characteristics of SMWMP Samples

CLIENT : SRK Consulting
PROJECT : Minto
CEMI Project # : 0907
Test : Modified Acid-Base Accounting
Date : September 29, 2009

Sample ID	Rinse pH Std. Units	Rinse EC Std. Units	Paste pH Std. Units	CO2 % CO2	Equiv. CaCO3 kg CaCO3/t	Total S % S	Sulphate % S	Sulphur Diff. % S	AP kg CaCO3/t	NP kg CaCO3/t	Net NP kg CaCO3/t	NP/AP Ratio	Fizz Test Visual
LOD	0.01	0.10	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.2	#N/A	#N/A	#N/A
Method Code	Sobek	Sobek	Sobek	HCl Leach	Calc.	Leco	HCl Leach	Calc.	Calc.	Modified NP	Calc.	Calc.	Sobek
Blue Waste Dump Sample 1 North Side	7.04	672	8.24	0.81	18.4	0.56	0.02	0.54	16.9	22.0	5.1	1.3	Moderate
Blue Waste Dump Sample 2 South Side	8.03	619	8.33	1.67	38.0	0.7	0.01	0.69	21.6	32.7	11.1	1.5	Moderate
Main Waste Dump	8.21	187.6	8.24	0.16	3.6	<0.02	<0.01	<0.02	<0.6	10.0	10.0	16.7	None
SW Dump Waste Rock	8.02	586	8.25	0.43	9.8	0.09	<0.01	0.09	2.8	8.5	5.7	3.0	None
Duplicates													
Blue Waste Dump Sample 1 North Side	-	-	8.28				0.02			20.9			Moderate

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Appendix D3
SMWMP Results

CLIENT : SRK Consulting
Project : Minto
CEMI Project # : 0907
Test : Meteoric Water Mobility Procedure
Date : September 28 - November 1, 2009

Leachate Analysis

Sample ID			Blue WD Sample 1 North Side Sequence 1	Blue WD Sample 1 North Side Sequence 2	Blue WD Sample 1 North Side Sequence 3
Parameter	Method	Units			
Initial Sample Wt		kg	8.00	7.11	6.02
Volume Influent		mL	8.75	7.85	6.65
Volume Effluent		mL	8.00	6.80	5.85
Sample Wet Wt. After Extraction	gravimetric	kg	8.55	7.60	6.45
pH	meter		7.90	7.78	7.65
Redox	meter	mV	235	297	338
Conductivity	meter	uS/cm	287	740	1287
Acidity (to pH 4.5)	titration	mg CaCO3/L	#N/A	#N/A	#N/A
Total Acidity (to pH 8.3)	titration	mg CaCO3/L	3.2	6.0	6.4
Alkalinity	titration	mg CaCO3/L	55.6	67.9	67.7
Chloride		mg/L	2.2	1.2	2.2
Fluoride		mg/L	0.65	1.19	1.4
Sulphate	Turbidity	mg/L	102	333	713
Ion Balance					
Major Anions	calc.	meq/L	3.33	8.39	16.34
Major Cations	calc.	meq/L	3.07	7.96	16.05
Difference	calc.	meq/L	0.27	0.43	0.29
Diff. (%)	calc.	meq/L	4.2%	2.7%	0.9%
Dissolved Metals					
Hardness CaCO3		mg/L	138	362	741
Aluminum Al	ICP-MS	mg/L	0.0047	0.0045	0.0038
Antimony Sb	ICP-MS	mg/L	0.00006	0.00008	0.0001
Arsenic As	ICP-MS	mg/L	0.00067	0.0009	0.0014
Barium Ba	ICP-MS	mg/L	0.0496	0.048	0.0409
Beryllium Be	ICP-MS	mg/L	<0.00001	<0.00001	<0.00001
Bismuth Bi	ICP-MS	mg/L	<0.000005	<0.000005	<0.000005
Boron B	ICP-MS	mg/L	<0.05	0.066	0.104
Cadmium Cd	ICP-MS	mg/L	0.000195	0.000403	0.000886
Calcium Ca	ICP-MS	mg/L	43.7	116	238
Chromium Cr	ICP-MS	mg/L	0.0001	0.0001	<0.0001
Cobalt Co	ICP-MS	mg/L	0.000057	0.000102	0.000224
Copper Cu	ICP-MS	mg/L	0.0147	0.0315	0.042
Iron Fe	ICP-MS	mg/L	0.004	0.012	0.004
Lead Pb	ICP-MS	mg/L	0.000042	0.000059	0.000067
Lithium Li	ICP-MS	mg/L	0.0017	0.0037	0.0061
Magnesium Mg	ICP-MS	mg/L	7.01	17.8	35.8
Manganese Mn	ICP-MS	mg/L	0.0375	0.102	0.21
Mercury Hg	CVAA	ug/L	<0.01	<0.01	<0.01
Molybdenum Mo	ICP-MS	mg/L	0.0116	0.0225	0.0305
Nickel Ni	ICP-MS	mg/L	0.00044	0.00054	0.00039
Phosphorus P	ICP-MS	mg/L	0.016	0.009	0.004
Potassium K	ICP-MS	mg/L	5.14	9.07	14.1
Selenium Se	ICP-MS	mg/L	0.00399	0.00766	0.0146
Silicon Si	ICP-MS	mg/L	2.93	3.57	4.4
Silver Ag	ICP-MS	mg/L	<0.000005	0.000016	0.000012
Sodium Na	ICP-MS	mg/L	3.8	10	18.3
Strontium Sr	ICP-MS	mg/L	0.558	1.44	2.72
Sulphur (S)	ICP-MS	mg/L	34	109	237
Thallium Tl	ICP-MS	mg/L	0.000002	0.000006	0.000009
Tin Sn	ICP-MS	mg/L	0.0294	0.0201	0.0039
Titanium Ti	ICP-MS	mg/L	<0.0005	<0.0005	<0.0005
Uranium U	ICP-MS	mg/L	0.000061	0.000206	0.000563
Vanadium V	ICP-MS	mg/L	<0.0002	<0.0002	0.0002
Zinc Zn	ICP-MS	mg/L	0.0027	0.0035	0.004
Zirconium Zr	ICP-MS	mg/L	<0.0001	<0.0001	<0.0001

CLIENT : SRK Consulting
Project : Minto
CEMI Project # : 0907
Test : Meteoric Water Mobility
Date : September 28 - November 2009

Leachate Analysis

Sample ID			Blue WD Sample 1 North Side Sequence 4	Blue WD Sample 1 North Side Sequence 5	Blue WD Sample 1 North Side Sequence 6
Parameter	Method	Units			
Initial Sample Wt		kg	5.16	4.54	3.98
Volume Influent		mL	5.70	5.01	4.39
Volume Effluent		mL	5.16	4.54	3.98
Sample Wet Wt. After Extraction	gravimetric	kg	5.60	5.05	4.35
pH	meter		7.66	7.39	7.74
Redox	meter	mV	356	311	324
Conductivity	meter	uS/cm	1555	1825	2240
Acidity (to pH 4.5)	titration	mg CaCO3/L	#N/A	#N/A	#N/A
Total Acidity (to pH 8.3)	titration	mg CaCO3/L	5.8	7.4	7.9
Alkalinity	titration	mg CaCO3/L	66.4	59.6	59.3
Chloride		mg/L	3.4	4.4	4.9
Fluoride		mg/L	1.58	1.47	1.49
Sulphate	Turbidity	mg/L	900	1200	1438
Ion Balance					
Major Anions	calc.	meq/L	20.26	26.39	31.36
Major Cations	calc.	meq/L	18.85	24.02	28.96
Difference	calc.	meq/L	1.41	2.38	2.40
Diff. (%)	calc.	meq/L	3.6%	4.7%	4.0%
Dissolved Metals					
Hardness CaCO3		mg/L	872	1110	1350
Aluminum Al	ICP-MS	mg/L	0.006	0.005	0.008
Antimony Sb	ICP-MS	mg/L	0.0004	0.0001	0.0001
Arsenic As	ICP-MS	mg/L	0.0016	0.0018	0.0022
Barium Ba	ICP-MS	mg/L	0.0397	0.0356	0.0336
Beryllium Be	ICP-MS	mg/L	<0.00005	<0.00005	<0.00005
Bismuth Bi	ICP-MS	mg/L	<0.00003	<0.00003	<0.00003
Boron B	ICP-MS	mg/L	<0.3	<0.3	<0.3
Cadmium Cd	ICP-MS	mg/L	0.00129	0.00155	0.00194
Calcium Ca	ICP-MS	mg/L	275	354	436
Chromium Cr	ICP-MS	mg/L	<0.0005	<0.0005	<0.0005
Cobalt Co	ICP-MS	mg/L	0.00028	0.00037	0.00032
Copper Cu	ICP-MS	mg/L	0.0555	0.0626	0.0585
Iron Fe	ICP-MS	mg/L	0.024	0.012	0.01
Lead Pb	ICP-MS	mg/L	0.00103	0.00109	0.00035
Lithium Li	ICP-MS	mg/L	0.007	0.009	0.009
Magnesium Mg	ICP-MS	mg/L	44.9	56.1	64
Manganese Mn	ICP-MS	mg/L	0.24	0.279	0.347
Mercury Hg	CVAA	ug/L	<0.05	<0.05	<0.05
Molybdenum Mo	ICP-MS	mg/L	0.0326	0.0364	0.0402
Nickel Ni	ICP-MS	mg/L	0.0022	0.0026	0.0005
Phosphorus P	ICP-MS	mg/L	<0.01	0.01	<0.01
Potassium K	ICP-MS	mg/L	14.5	16.1	17.9
Selenium Se	ICP-MS	mg/L	0.0177	0.0241	0.0311
Silicon Si	ICP-MS	mg/L	4.06	4.55	4.33
Silver Ag	ICP-MS	mg/L	<0.00003	<0.00003	<0.00003
Sodium Na	ICP-MS	mg/L	22.6	28.1	31
Strontium Sr	ICP-MS	mg/L	3.15	4.04	5.19
Sulphur (S)	ICP-MS	mg/L	275	341	457
Thallium Tl	ICP-MS	mg/L	0.00002	<0.00001	<0.00001
Tin Sn	ICP-MS	mg/L	0.00542	0.00476	0.0162
Titanium Ti	ICP-MS	mg/L	<0.003	<0.003	<0.003
Uranium U	ICP-MS	mg/L	0.00083	0.00126	0.00149
Vanadium V	ICP-MS	mg/L	<0.001	<0.001	<0.001
Zinc Zn	ICP-MS	mg/L	0.0225	0.0069	0.0084
Zirconium Zr	ICP-MS	mg/L	<0.0005	<0.0005	<0.0005

CLIENT : SRK Consulting
Project : Minto
CEMI Project # : 0907
Test : Meteoric Water Mobility
Date : September 28 - November 2009

Leachate Analysis

Sample ID			Blue WD Sample 1 North Side Sequence 7	Blue WD Sample 2 South Side Sequence 1	Blue WD Sample 2 South Side Sequence 2
Parameter	Method	Units			
Initial Sample Wt		kg	3.47	8.00	6.98
Volume Influent		mL	3.83	9.00	7.85
Volume Effluent		mL	3.47	8.00	6.98
Sample Wet Wt. After Extraction	gravimetric	kg	3.90	8.65	7.55
pH	meter		7.68	7.86	7.84
Redox	meter	mV	368	265	300
Conductivity	meter	uS/cm	2667	469	1078
Acidity (to pH 4.5)	titration	mg CaCO3/L	#N/A	#N/A	#N/A
Total Acidity (to pH 8.3)	titration	mg CaCO3/L	5.8	4.1	6.2
Alkalinity	titration	mg CaCO3/L	57.3	71.9	79.9
Chloride		mg/L	6.3	2.6	1.1
Fluoride		mg/L	1.44	1.58	2.2
Sulphate	Turbidity	mg/L	1776	179	499
Ion Balance					
Major Anions	calc.	meq/L	38.40	5.32	12.14
Major Cations	calc.	meq/L	33.51	5.53	13.79
Difference	calc.	meq/L	4.89	-0.21	-1.65
Diff. (%)	calc.	meq/L	6.8%	-1.9%	-6.4%
Dissolved Metals					
Hardness CaCO3		mg/L	1560	246	617
Aluminum Al	ICP-MS	mg/L	0.002	0.0045	0.003
Antimony Sb	ICP-MS	mg/L	0.0001	0.00011	0.0002
Arsenic As	ICP-MS	mg/L	0.0025	0.00026	0.0007
Barium Ba	ICP-MS	mg/L	0.036	0.0512	0.0514
Beryllium Be	ICP-MS	mg/L	<0.00005	<0.00001	<0.00005
Bismuth Bi	ICP-MS	mg/L	<0.00003	<0.000005	<0.00003
Boron B	ICP-MS	mg/L	<0.3	0.055	<0.3
Cadmium Cd	ICP-MS	mg/L	0.00227	0.000327	0.00083
Calcium Ca	ICP-MS	mg/L	499	70.5	182
Chromium Cr	ICP-MS	mg/L	<0.0005	0.0001	<0.0005
Cobalt Co	ICP-MS	mg/L	0.00062	0.00016	0.00043
Copper Cu	ICP-MS	mg/L	0.0731	0.0174	0.0433
Iron Fe	ICP-MS	mg/L	0.01	0.005	0.014
Lead Pb	ICP-MS	mg/L	0.00004	0.000065	0.0001
Lithium Li	ICP-MS	mg/L	0.01	0.0063	0.013
Magnesium Mg	ICP-MS	mg/L	77.4	16.9	39.8
Manganese Mn	ICP-MS	mg/L	0.426	0.0926	0.22
Mercury Hg	CVAA	ug/L	<0.05	<0.01	<0.05
Molybdenum Mo	ICP-MS	mg/L	0.0413	0.0039	0.0057
Nickel Ni	ICP-MS	mg/L	0.0012	0.00079	0.0031
Phosphorus P	ICP-MS	mg/L	<0.01	0.016	<0.01
Potassium K	ICP-MS	mg/L	19.5	7.69	12.7
Selenium Se	ICP-MS	mg/L	0.0332	0.018	0.0512
Silicon Si	ICP-MS	mg/L	4.33	1.63	2.17
Silver Ag	ICP-MS	mg/L	<0.00003	<0.000005	<0.00003
Sodium Na	ICP-MS	mg/L	36.5	8.56	21.9
Strontium Sr	ICP-MS	mg/L	5.95	2.38	6.51
Sulphur (S)	ICP-MS	mg/L	447	58	160
Thallium Tl	ICP-MS	mg/L	0.00001	0.000008	0.00001
Tin Sn	ICP-MS	mg/L	0.00971	0.00025	0.00046
Titanium Ti	ICP-MS	mg/L	<0.003	<0.0005	<0.003
Uranium U	ICP-MS	mg/L	0.00179	0.000251	0.00057
Vanadium V	ICP-MS	mg/L	<0.001	<0.0002	<0.001
Zinc Zn	ICP-MS	mg/L	0.0072	0.0027	0.0132
Zirconium Zr	ICP-MS	mg/L	<0.0005	<0.0001	<0.0005

CLIENT : SRK Consulting
Project : Minto
CEMI Project # : 0907
Test : Meteoric Water Mobility
Date : September 28 - November 2009

Leachate Analysis

Sample ID			Blue WD Sample 2 South Side Sequence 3	Blue WD Sample 2 South Side Sequence 4	Blue WD Sample 2 South Side Sequence 5
Parameter	Method	Units			
Initial Sample Wt		kg	6.07	5.26	5.16
Volume Influent		mL	6.83	5.92	5.80
Volume Effluent		mL	6.07	5.95	5.30
Sample Wet Wt. After Extraction	gravimetric	kg	6.30	5.50	5.60
pH	meter		7.74	7.82	7.66
Redox	meter	mV	331	337	288
Conductivity	meter	uS/cm	1587	1694	1903
Acidity (to pH 4.5)	titration	mg CaCO ₃ /L	#N/A	#N/A	#N/A
Total Acidity (to pH 8.3)	titration	mg CaCO ₃ /L	6.2	4.5	6.8
Alkalinity	titration	mg CaCO ₃ /L	78.5	76.6	68.1
Chloride		mg/L	1.6	2.3	2.5
Fluoride		mg/L	2.38	2.68	2.62
Sulphate	Turbidity	mg/L	810	962	1236
Ion Balance					
Major Anions	calc.	meq/L	18.62	21.78	27.32
Major Cations	calc.	meq/L	21.31	21.96	26.07
Difference	calc.	meq/L	-2.70	-0.18	1.25
Diff. (%)	calc.	meq/L	-6.8%	-0.4%	2.3%
Dissolved Metals					
Hardness CaCO ₃		mg/L	958	980	1170
Aluminum Al	ICP-MS	mg/L	0.005	0.007	0.02
Antimony Sb	ICP-MS	mg/L	0.0001	0.0003	0.0001
Arsenic As	ICP-MS	mg/L	0.0005	0.0008	0.0007
Barium Ba	ICP-MS	mg/L	0.0434	0.0346	0.0296
Beryllium Be	ICP-MS	mg/L	<0.00005	<0.00005	<0.00005
Bismuth Bi	ICP-MS	mg/L	<0.00003	<0.00003	<0.00003
Boron B	ICP-MS	mg/L	<0.3	<0.3	<0.3
Cadmium Cd	ICP-MS	mg/L	0.00111	0.00136	0.00134
Calcium Ca	ICP-MS	mg/L	281	283	340
Chromium Cr	ICP-MS	mg/L	<0.0005	<0.0005	<0.0005
Cobalt Co	ICP-MS	mg/L	0.00059	0.00055	0.00073
Copper Cu	ICP-MS	mg/L	0.0436	0.0446	0.0496
Iron Fe	ICP-MS	mg/L	<0.005	0.012	0.018
Lead Pb	ICP-MS	mg/L	0.00005	0.00038	0.00053
Lithium Li	ICP-MS	mg/L	0.019	0.021	0.023
Magnesium Mg	ICP-MS	mg/L	62.3	66.8	77.8
Manganese Mn	ICP-MS	mg/L	0.317	0.305	0.391
Mercury Hg	CVAA	ug/L	<0.05	<0.05	<0.05
Molybdenum Mo	ICP-MS	mg/L	0.0073	0.0072	0.0079
Nickel Ni	ICP-MS	mg/L	0.0021	0.003	0.0007
Phosphorus P	ICP-MS	mg/L	<0.01	<0.01	<0.01
Potassium K	ICP-MS	mg/L	17.6	17.3	19
Selenium Se	ICP-MS	mg/L	0.0827	0.0946	0.118
Silicon Si	ICP-MS	mg/L	2.06	2.04	2.16
Silver Ag	ICP-MS	mg/L	0.00005	<0.00003	0.00003
Sodium Na	ICP-MS	mg/L	34.4	38.6	45.4
Strontium Sr	ICP-MS	mg/L	8.84	9.07	10.1
Sulphur (S)	ICP-MS	mg/L	274	265	318
Thallium Tl	ICP-MS	mg/L	0.00002	0.00004	0.00002
Tin Sn	ICP-MS	mg/L	0.00032	0.00171	0.00048
Titanium Ti	ICP-MS	mg/L	<0.003	<0.003	<0.003
Uranium U	ICP-MS	mg/L	0.00112	0.00157	0.00205
Vanadium V	ICP-MS	mg/L	<0.001	<0.001	<0.001
Zinc Zn	ICP-MS	mg/L	0.101	0.0125	0.0102
Zirconium Zr	ICP-MS	mg/L	<0.0005	<0.0005	<0.0005

CLIENT : SRK Consulting
Project : Minto
CEMI Project # : 0907
Test : Meteoric Water Mobility
Date : September 28 - November 2009

Leachate Analysis

Sample ID			Blue WD Sample 2 South Side Sequence 6	Blue WD Sample 2 South Side Sequence 7	Main Waste Dump Sequence 1
Parameter	Method	Units			
Initial Sample Wt		kg	4.58	3.94	8.00
Volume Influent		mL	5.15	4.43	9.20
Volume Effluent		mL	4.58	3.94	8.00
Sample Wet Wt. After Extraction	gravimetric	kg	5.00	4.30	8.85
pH	meter		7.73	7.81	7.95
Redox	meter	mV	321	351	266
Conductivity	meter	uS/cm	2430	2867	253
Acidity (to pH 4.5)	titration	mg CaCO3/L	#N/A	#N/A	#N/A
Total Acidity (to pH 8.3)	titration	mg CaCO3/L	7.2	5.2	3.7
Alkalinity	titration	mg CaCO3/L	67.3	61.7	82.9
Chloride		mg/L	3.5	4.2	2.6
Fluoride		mg/L	2.63	2.66	1.21
Sulphate	Turbidity	mg/L	1517	1694	43
Ion Balance					
Major Anions	calc.	meq/L	33.19	36.78	2.69
Major Cations	calc.	meq/L	32.92	37.10	2.72
Difference	calc.	meq/L	0.27	-0.32	-0.03
Diff. (%)	calc.	meq/L	0.4%	-0.4%	-0.5%
Dissolved Metals					
Hardness CaCO3		mg/L	1490	1670	114
Aluminum Al	ICP-MS	mg/L	0.008	0.004	0.0068
Antimony Sb	ICP-MS	mg/L	0.0002	<0.0001	0.00114
Arsenic As	ICP-MS	mg/L	0.0009	0.0009	0.00078
Barium Ba	ICP-MS	mg/L	0.0225	0.0184	0.0498
Beryllium Be	ICP-MS	mg/L	<0.00005	<0.00005	<0.00001
Bismuth Bi	ICP-MS	mg/L	<0.00003	<0.00003	<0.000005
Boron B	ICP-MS	mg/L	<0.3	<0.3	0.058
Cadmium Cd	ICP-MS	mg/L	0.00204	0.00221	0.000104
Calcium Ca	ICP-MS	mg/L	440	480	34.2
Chromium Cr	ICP-MS	mg/L	<0.0005	<0.0005	0.0001
Cobalt Co	ICP-MS	mg/L	0.0009	0.00123	0.000035
Copper Cu	ICP-MS	mg/L	0.0528	0.0608	0.0136
Iron Fe	ICP-MS	mg/L	0.012	0.01	0.005
Lead Pb	ICP-MS	mg/L	0.00027	0.00005	0.000532
Lithium Li	ICP-MS	mg/L	0.029	0.031	0.0012
Magnesium Mg	ICP-MS	mg/L	94.1	115	7
Manganese Mn	ICP-MS	mg/L	0.538	0.611	0.0174
Mercury Hg	CVAA	ug/L	<0.05	<0.05	<0.01
Molybdenum Mo	ICP-MS	mg/L	0.0087	0.009	0.0932
Nickel Ni	ICP-MS	mg/L	0.0021	0.0017	0.00031
Phosphorus P	ICP-MS	mg/L	<0.01	<0.01	0.15
Potassium K	ICP-MS	mg/L	22.6	23.7	3.08
Selenium Se	ICP-MS	mg/L	0.166	0.18	0.00322
Silicon Si	ICP-MS	mg/L	2.25	2.09	5.61
Silver Ag	ICP-MS	mg/L	<0.00003	<0.00003	<0.000005
Sodium Na	ICP-MS	mg/L	54.1	64.1	7.95
Strontium Sr	ICP-MS	mg/L	11.8	11.9	0.43
Sulphur (S)	ICP-MS	mg/L	451	452	15
Thallium Tl	ICP-MS	mg/L	0.00002	0.00003	<0.000002
Tin Sn	ICP-MS	mg/L	0.00006	0.0002	0.00019
Titanium Ti	ICP-MS	mg/L	<0.003	<0.003	<0.0005
Uranium U	ICP-MS	mg/L	0.00265	0.00328	0.00125
Vanadium V	ICP-MS	mg/L	<0.001	<0.001	0.001
Zinc Zn	ICP-MS	mg/L	0.0108	0.0094	0.0013
Zirconium Zr	ICP-MS	mg/L	0.0012	<0.0005	<0.0001

CLIENT : SRK Consulting
Project : Minto
CEMI Project # : 0907
Test : Meteoric Water Mobility
Date : September 28 - November 2009

Leachate Analysis

Sample ID			Main Waste Dump Sequence 2	Main Waste Dump Sequence 3	Main Waste Dump Sequence 4
Parameter	Method	Units			
Initial Sample Wt		kg	6.83	5.81	4.92
Volume Influent		mL	7.85	6.68	5.66
Volume Effluent		mL	6.83	5.81	5.10
Sample Wet Wt. After Extraction	gravimetric	kg	7.60	6.30	5.40
pH	meter		8.02	7.93	8.01
Redox	meter	mV	285	309	315
Conductivity	meter	uS/cm	440	547	647
Acidity (to pH 4.5)	titration	mg CaCO3/L	#N/A	#N/A	#N/A
Total Acidity (to pH 8.3)	titration	mg CaCO3/L	4.7	4.4	3.3
Alkalinity	titration	mg CaCO3/L	99.3	102.1	105.4
Chloride		mg/L	1.7	2.3	3.4
Fluoride		mg/L	1.23	1.08	1.14
Sulphate	Turbidity	mg/L	112	139	176
Ion Balance					
Major Anions	calc.	meq/L	4.43	5.06	5.93
Major Cations	calc.	meq/L	4.28	5.61	6.86
Difference	calc.	meq/L	0.15	-0.55	-0.93
Diff. (%)	calc.	meq/L	1.7%	-5.1%	-7.3%
Dissolved Metals					
Hardness CaCO3		mg/L	182	241	295
Aluminum Al	ICP-MS	mg/L	0.0044	0.0044	0.0046
Antimony Sb	ICP-MS	mg/L	0.00102	0.00098	0.00104
Arsenic As	ICP-MS	mg/L	0.00081	0.00068	0.00077
Barium Ba	ICP-MS	mg/L	0.0638	0.0694	0.0688
Beryllium Be	ICP-MS	mg/L	<0.00001	<0.00001	<0.00001
Bismuth Bi	ICP-MS	mg/L	<0.000005	<0.000005	<0.000005
Boron B	ICP-MS	mg/L	0.087	0.095	0.11
Cadmium Cd	ICP-MS	mg/L	0.000118	0.00013	0.000075
Calcium Ca	ICP-MS	mg/L	55	73.8	88.9
Chromium Cr	ICP-MS	mg/L	0.0002	0.0001	0.0004
Cobalt Co	ICP-MS	mg/L	0.000054	0.000032	0.000057
Copper Cu	ICP-MS	mg/L	0.0163	0.0147	0.0165
Iron Fe	ICP-MS	mg/L	0.008	0.005	0.004
Lead Pb	ICP-MS	mg/L	0.00082	0.000694	0.000375
Lithium Li	ICP-MS	mg/L	0.0017	0.0021	0.0026
Magnesium Mg	ICP-MS	mg/L	10.8	13.7	17.8
Manganese Mn	ICP-MS	mg/L	0.0283	0.0171	0.0251
Mercury Hg	CVAA	ug/L	<0.01	<0.01	0.01
Molybdenum Mo	ICP-MS	mg/L	0.128	0.128	0.142
Nickel Ni	ICP-MS	mg/L	0.00061	0.0004	0.00054
Phosphorus P	ICP-MS	mg/L	0.028	0.005	0.014
Potassium K	ICP-MS	mg/L	3.67	4.75	5.12
Selenium Se	ICP-MS	mg/L	0.00614	0.00825	0.0115
Silicon Si	ICP-MS	mg/L	5.96	5.65	5.55
Silver Ag	ICP-MS	mg/L	0.000006	<0.000005	<0.000005
Sodium Na	ICP-MS	mg/L	12.4	15.1	18.6
Strontium Sr	ICP-MS	mg/L	0.666	0.827	1.02
Sulphur (S)	ICP-MS	mg/L	29	41	56
Thallium Tl	ICP-MS	mg/L	0.000002	0.000146	<0.000002
Tin Sn	ICP-MS	mg/L	0.00029	0.00015	0.00033
Titanium Ti	ICP-MS	mg/L	<0.0005	<0.0005	<0.0005
Uranium U	ICP-MS	mg/L	0.00202	0.00225	0.00297
Vanadium V	ICP-MS	mg/L	0.001	0.001	0.001
Zinc Zn	ICP-MS	mg/L	0.0028	0.0163	0.0061
Zirconium Zr	ICP-MS	mg/L	<0.0001	<0.0001	<0.0001

Appendix D4
X-ray Diffraction Results for SMWMP Samples

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

(Project: 0907 Minto – PO# 41977)

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October 6, 2009

EXPERIMENTAL METHOD

The four samples of **Project 0907 Minto** were reduced to the optimum grain-size range for quantitative X-ray analysis ($<10\ \mu\text{m}$) by grinding under ethanol in a vibratory McCrone Micronising Mill for 7 minutes. Step-scan X-ray powder-diffraction data were collected over a range $3\text{--}80^\circ 2\theta$ with CoK α radiation on a Bruker D8 Focus Bragg-Brentano diffractometer equipped with an Fe monochromator foil, 0.6 mm (0.3°) divergence slit, incident- and diffracted-beam Soller slits and a LynxEye detector. The long fine-focus Co X-ray tube was operated at 35 kV and 40 mA, using a take-off angle of 6° .

RESULTS

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

Note that the pattern of sample “**Main Waste Dump**” shows a hump at about $6.4^\circ 2\theta$ that likely corresponds to a smectite group mineral; an empirical montmorillonite structure model has been fitted as an approximation.

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

Mineral	Ideal Formula	Blue WD Sample 1N. Side	Blue WD Sample 2S. Side	Main Waste Dump	SW Dump Waste Rock
Quartz	SiO ₂	26.8	28.9	26.3	26.4
Clinochlore	(Mg,Fe ²⁺) ₅ Al(Si ₃ Al)O ₁₀ (OH) ₈	3.0	1.8	5.8	3.8
Kaolinite	Al ₂ Si ₂ O ₅ (OH) ₄	1.9	3.2	1.8	
Muscovite	KAl ₂ AlSi ₃ O ₁₀ (OH) ₂	3.6	3.6	3.6	
Biotite	K(Mg,Fe) ₃ (AlSi ₃ O ₁₀)(OH) ₂	6.0	5.2	5.1	6.0
Plagioclase	NaAlSi ₃ O ₈ – CaAl ₂ Si ₂ O ₈	40.1	34.5	42.5	52.2
K-feldspar	KAlSi ₃ O ₈	15.6	16.7	12.9	10.8
Dolomite ?	CaMg(CO ₃) ₂		0.4		
Calcite	CaCO ₃	1.5	2.9	0.3	0.4
Siderite	Fe ²⁺ CO ₃		0.8		0.3
Chalcopyrite	CuFeS ₂	1.5	2.0		
Montmorillonite Model	(Na,Ca) _{0.3} (Al,Mg) ₂ Si ₄ O ₁₀ (OH) ₂ ·nH ₂ O			1.8	
Total		100.0	100.0	100.0	100.0

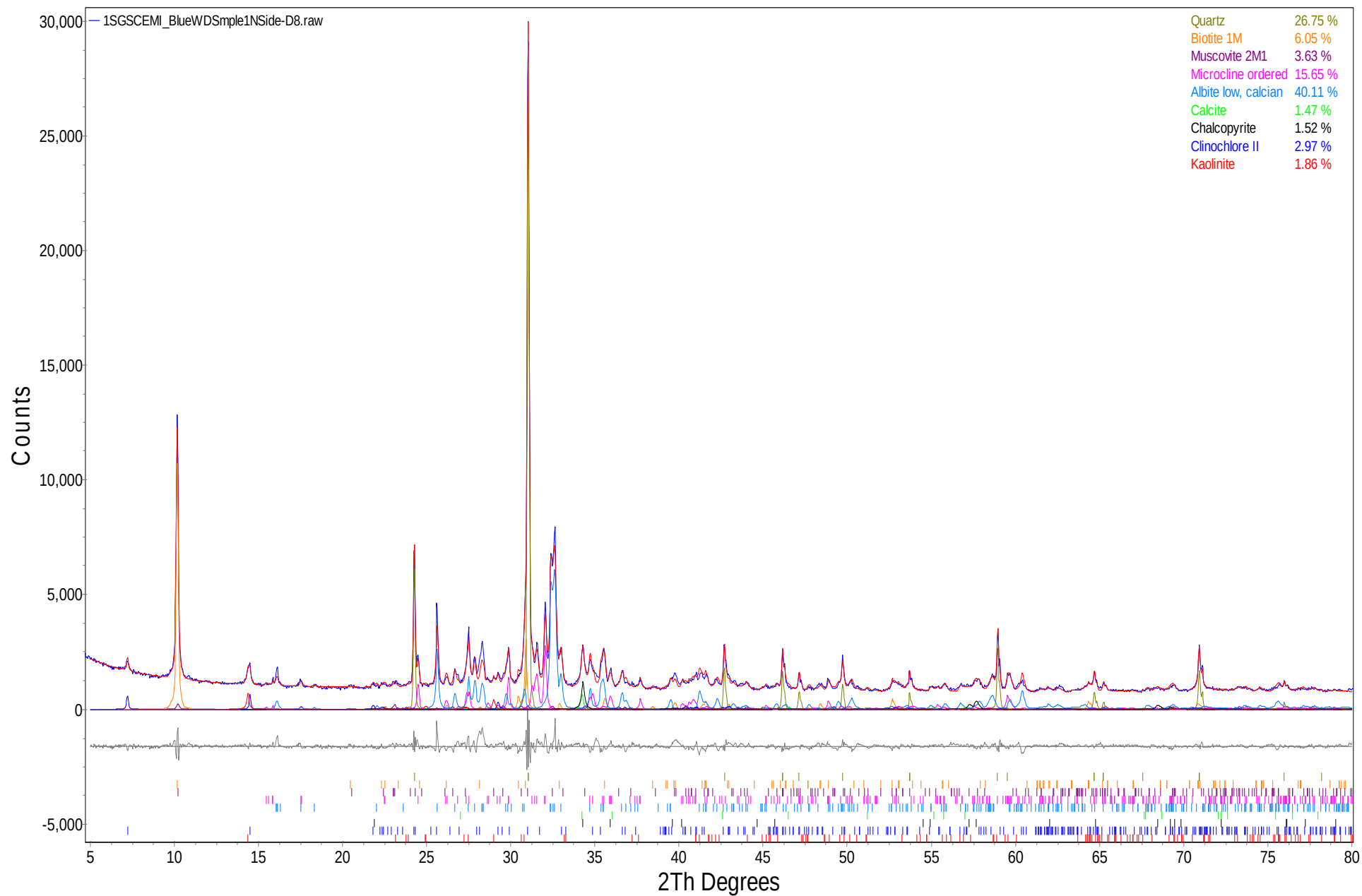


Figure 1. Rietveld refinement plot of sample **SGS CEMI “Blue WD Sample 1 N. Side”** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured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

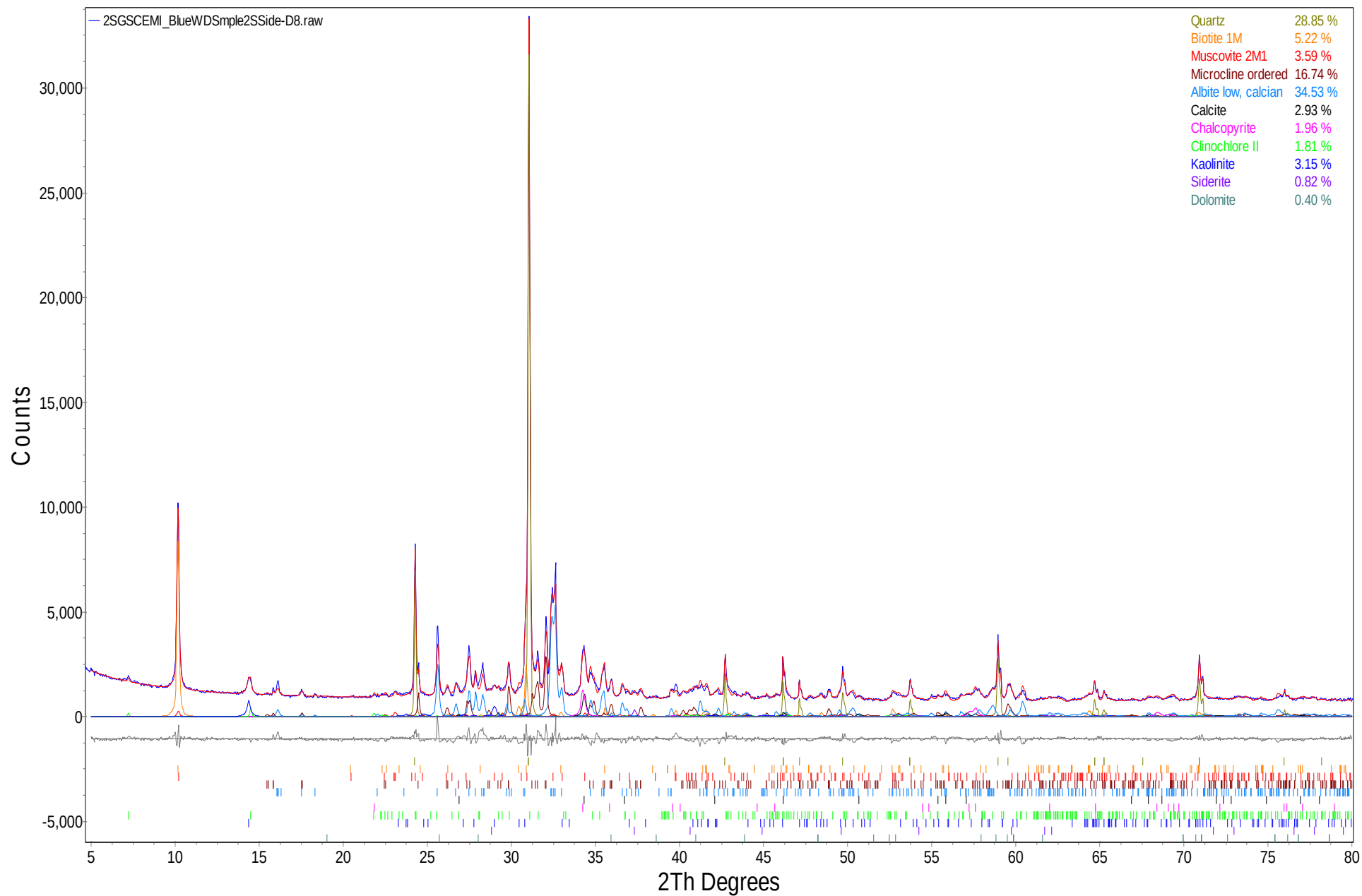


Figure 2. Rietveld refinement plot of sample **SGS CEMI “Blue WD Sample 2 S. Side”** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured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

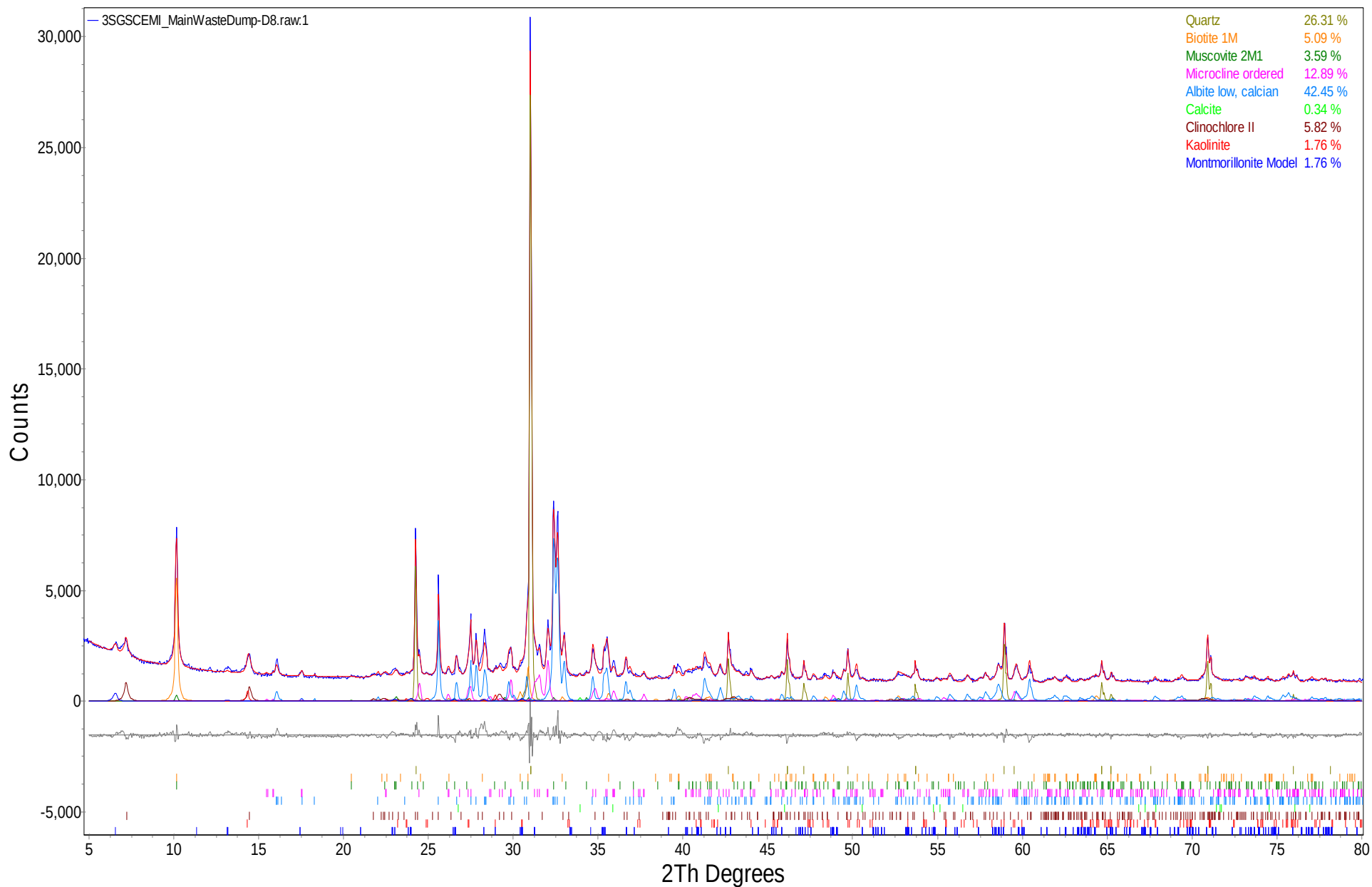


Figure 3. Rietveld refinement plot of sample **SGS CEMI “Main Waste Dump”** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines are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

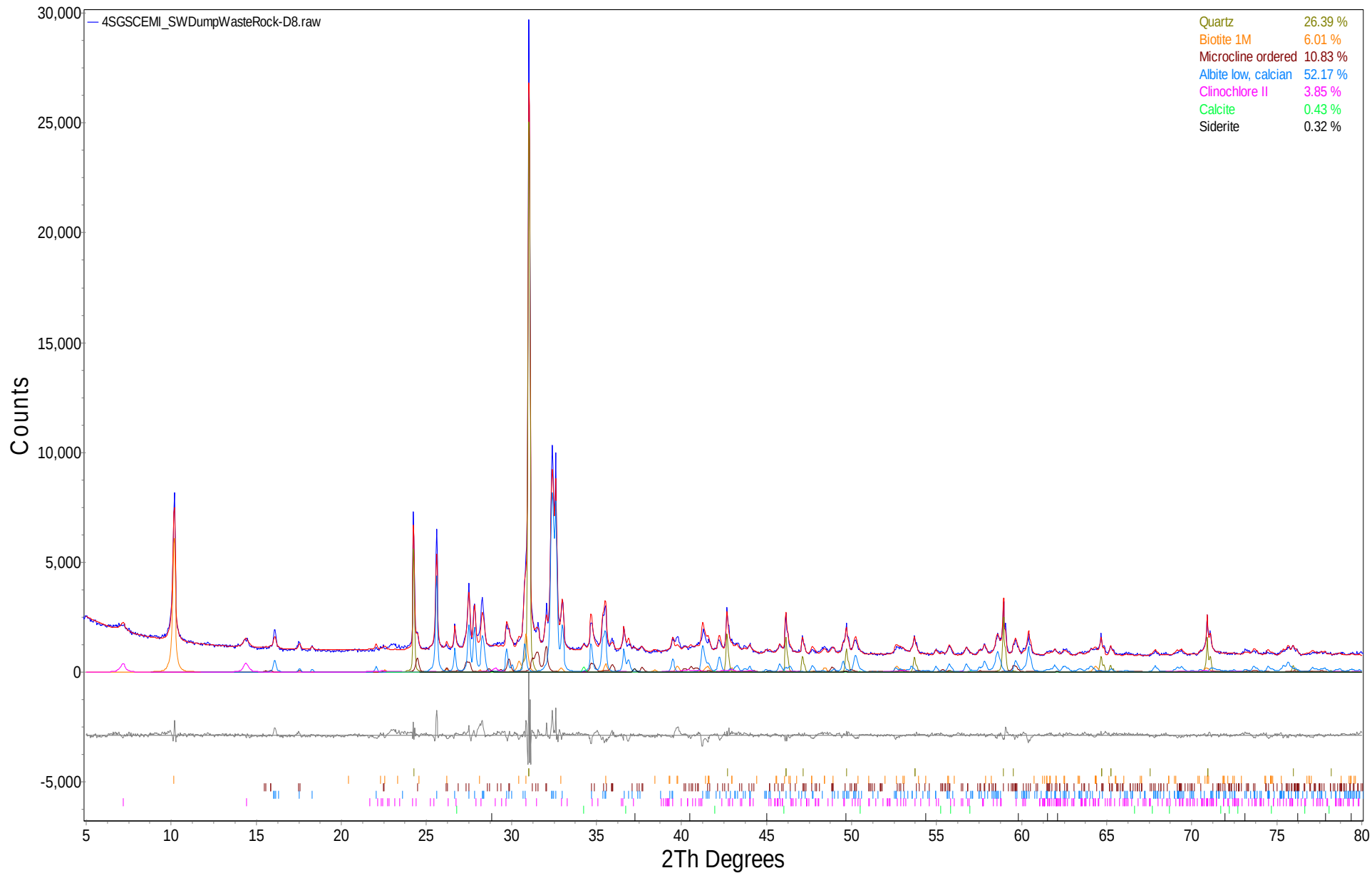


Figure 4. Rietveld refinement plot of sample **SGS CEMI “SW Dump Waste Rock”** (blue line - observed intensity at each step; red line - calculated pattern; solid grey line below – difference between observed and calculated intensities; vertical bars, positions of all Bragg reflections). Coloured lines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

Appendix E
Phase IV Mine Rock: Humidity Cell Test Results

Appendix E1
Size Fraction Analysis of Phase IV HCT Samples

CLIENT : SRK Consulting
PROJECT : Minto Mine: Phase IV Expansion
CEMI Project # : 0907
Test : Size Fraction Analysis
Date : August 4, 2009

Hole 196 45.64-47.14

Sieve Designation	Aperture (mm)	Weight Retained		
		(g)	(%)	Cumulative (%)
+3/8"	9.500	5.39	5.4%	5.4%
-3/8" + 1/4"	6.300	21.53	21.6%	27.0%
-1/4" + 6	3.360	21.36	21.4%	48.4%
-6 + 10	1.700	12.72	12.7%	61.1%
-10 + 35	0.425	16.82	16.9%	78.0%
-35 + 100	0.150	10.73	10.8%	88.7%
-100 + 270	0.053	6.77	6.8%	95.5%
-270	-0.053	4.49	4.5%	100.0%
TOTAL		99.81	100.0%	

Hole 196 53.94-55.44

Sieve Designation	Aperture (mm)	Weight Retained		
		(g)	(%)	Cumulative (%)
+3/8"	9.500	8.28	8.3%	8.3%
-3/8" + 1/4"	6.300	22.26	22.3%	30.6%
-1/4" + 6	3.360	22.09	22.2%	52.8%
-6 + 10	1.700	15.47	15.5%	68.3%
-10 + 35	0.425	17.97	18.0%	86.3%
-35 + 100	0.150	7.40	7.4%	93.8%
-100 + 270	0.053	3.02	3.0%	96.8%
-270	-0.053	3.20	3.2%	100.0%
TOTAL		99.69	100.0%	

Hole 211 70.79-73.79

Sieve Designation	Aperture (mm)	Weight Retained		
		(g)	(%)	Cumulative (%)
+3/8"	9.500	2.11	2.1%	2.1%
-3/8" + 1/4"	6.300	25.56	25.6%	27.7%
-1/4" + 6	3.360	21.42	21.5%	49.2%
-6 + 10	1.700	12.06	12.1%	61.3%
-10 + 35	0.425	19.16	19.2%	80.5%
-35 + 100	0.150	9.80	9.8%	90.3%
-100 + 270	0.053	4.09	4.1%	94.4%
-270	-0.053	5.54	5.6%	100.0%
TOTAL		99.74	100.0%	

Hole 211 83.08-86.03

Sieve Designation	Aperture (mm)	Weight Retained		
		(g)	(%)	Cumulative (%)
+3/8"	9.500	4.57	4.6%	4.6%
-3/8" + 1/4"	6.300	17.55	17.6%	22.2%
-1/4" + 6	3.360	18.30	18.3%	40.5%
-6 + 10	1.700	12.42	12.4%	52.9%
-10 + 35	0.425	23.05	23.1%	76.0%
-35 + 100	0.150	13.07	13.1%	89.1%
-100 + 270	0.053	5.54	5.5%	94.7%
-270	-0.053	5.32	5.3%	100.0%
TOTAL		99.82	100.0%	

Appendix E2
Elemental Content of Phase IV HCT Samples

CLIENT : SRK Consulting
PROJECT : Minto Mine: Phase IV Expansion
CEMI Project # : 0907
Test : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : July 20, 2009

Sample ID	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppb	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Hg ppm	Sc ppm	Tl ppm	S %	Ga ppm	Se ppm
LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Hole 196 45.64-47.14	3.7	549.2	2.6	105	0.2	3.3	8.1	550	2.93	1	0.4	9.6	8.4	26	0.1	<0.1	<0.1	66	0.37	0.093	16	106	0.77	194	0.175	<20	1.37	0.05	1.02	<0.1	<0.01	3.8	0.4	<0.05	6	<0.5
Hole 196 53.94-55.44	2.3	65.5	1.8	68	<0.1	3.5	6.6	600	2.43	0.6	0.3	0.5	2.4	39	<0.1	<0.1	<0.1	53	0.88	0.075	13	115	0.65	437	0.135	<20	1.17	0.055	0.81	<0.1	<0.01	3.7	0.2	<0.05	5	<0.5
Hole 211 70.79-73.79	2.3	178	3.3	50	<0.1	3.9	5.8	408	2.34	2.6	0.2	<0.5	2.3	29	<0.1	<0.1	<0.1	51	0.46	0.066	11	111	0.69	432	0.142	<20	1.25	0.066	0.83	<0.1	<0.01	5.1	0.3	0.12	6	<0.5
Hole 211 83.08-86.03	94.4	4151.3	7.4	34	0.5	3.2	13.5	225	2.62	<0.5	0.5	10.1	3.5	54	0.3	<0.1	<0.1	20	1.06	0.071	22	87	0.44	66	0.003	<20	0.94	0.024	0.14	<0.1	0.02	1.1	<0.1	1.63	3	4.2

Appendix E3
ABA Characteristics of Phase IV HCT Samples

CLIENT : SRK Consulting
PROJECT : Minto Mine: Phase IV Expansion
CEMI Project # : 0907
Test : Sobek Acid-Base Accounting
Date : July 15, 2009

Sample ID	Paste pH Std. Units	CO2 % CO2	Equiv. CaCO3 kg CaCO3/t	Total S % S	Sulphate % S	Sulphur Diff. % S	AP kg CaCO3/t	NP kg CaCO3/t	Net NP kg CaCO3/t	NP/AP Ratio	Fizz Test Visual
LOD	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.2	#N/A	#N/A	#N/A
Method Code	Sobek	HCl Leach	Calc.	Leco	HCl Leach	Calc.	Calc.	Modified NP	Calc.	Calc.	Sobek
Hole 196 45.64-47.14	8.43	0.1	2.3	<0.02	<0.01	<0.02	<0.6	11.4	11.4	19.0	None
Hole 196 53.94-55.44	8.36	0.72	16.4	<0.02	<0.01	<0.02	<0.6	27.0	27.0	45.0	Slight
Hole 211 70.79-73.79	8.76	0.36	8.2	0.13	<0.01	0.13	4.1	20.0	15.9	4.9	Slight
Hole 211 83.08-86.03	8.06	0.79	18.0	1.75	<0.01	1.75	54.7	28.2	-26.5	0.5	Slight
Duplicates											
Hole 196 45.64-47.14	8.50				<0.01			10.8			None
Hole 211 83.08-86.03				1.64							

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

Appendix E4
Phase IV HCT Results: Tables

Date	Cycle No.	Volume Input	Volume Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Ti mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
3-Jul-09	0	750	315	7.81	580	#N/A	3.3	102.3	108	25	2.94	125	0.041	0.00901	0.00086	0.0232	-0.00001	-0.000005	-0.05	0.000074	33.1	-0.0001	0.000105	0.154	0.002	0.00006	0.014	10.4	0.0184	0.1	0.199	0.00062	0.008	6.78	0.0537	2.35	-0.000005	70.6	0.773	40	0.000012	0.00026	-0.0005	0.000595	0.001	0.0006	-0.0001
10-Jul-09	1	500	455	7.77	296																																										
17-Jul-09	2	500	480	7.88	250	#N/A	2.8	168.6	59	0.8	1.23	72	0.0221	0.00291	0.00031	0.0287	-0.00001	-0.000005	-0.05	0.000077	19	-0.0001	0.000086	0.0455	0.004	0.00007	0.0088	5.95	0.0186	-0.01	0.117	0.00009	0.002	5.13	0.0119	3.24	-0.000005	27.5	0.441	23	0.000011	0.00007	-0.0005	0.000372	0.0007	0.0009	-0.0001
24-Jul-09	3	500	470	7.69	251																																										
31-Jul-09	4	500	455	7.75	236	#N/A	2.6	48.5	67	1	0.49	109	0.0239	0.00206	0.0002	0.0334	-0.00001	-0.000005	-0.05	0.000067	30	-0.0001	0.000076	0.0279	0.002	0.000042	0.0064	8.29	0.0224	-0.01	0.0608	-0.00002	0.005	5.28	0.0131	2.3	-0.000005	13.2	0.617	28	0.000012	0.00004	-0.0005	0.000103	0.0003	0.0004	-0.0001
7-Aug-09	5	500	485	7.51	198																																										
14-Aug-09	6	500	450	7.61	191	#N/A	3.2	45.3	49	0.6	0.76	96.5	0.0137	0.00193	0.0002	0.0314	-0.00001	-0.000005	-0.05	0.00005	27	-0.0001	0.000068	0.0232	0.002	0.000049	0.0039	7.09	0.0201	-0.01	0.0442	0.00008	0.002	3.77	0.00905	1.81	-0.000005	4.39	0.555	22	0.000011	0.00028	-0.0005	0.000055	-0.0002	0.0019	-0.0001
21-Aug-09	7	500	465	7.77	172																																										
28-Aug-09	8	500	425	7.71	144	#N/A	2.6	44.1	32	0.6	0.91	75.4	0.0583	0.00189	0.00016	0.0264	-0.00001	-0.000005	-0.05	0.000034	20.3	-0.0001	0.00004	0.0201	0.005	0.000063	0.0026	6.03	0.0103	-0.01	0.0399	0.00008	0.003	3.01	0.0101	2.09	-0.000005	2.63	0.432	13	0.000009	0.00008	-0.0005	0.000047	0.0002	0.0006	-0.0001
4-Sep-09	9	500	445	7.37	134																																										
11-Sep-09	10	500	405	7.73	135	#N/A	2.3	41.9	34	0.6	0.92	65.2	0.0387	0.0017	0.000																																

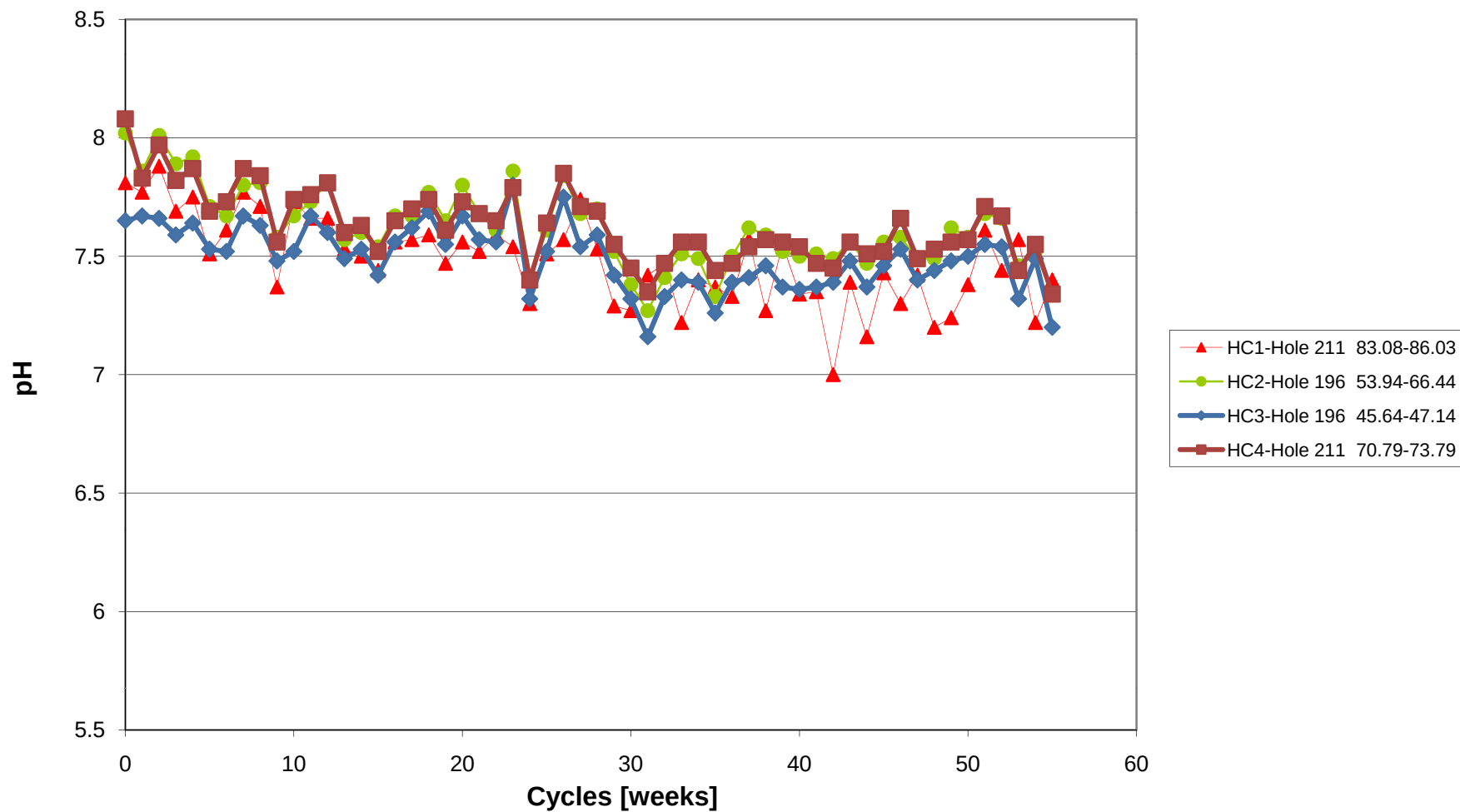
Sample = Hole 196 53.94-55.44																																																	
Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg mg/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Ti mg/L	Sn mg/L	Tl mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L		
3-Jul-09	0	750	375	8.02	164	#N/A	1.5	53.8	4	3.5	0.69	50.7	0.139	0.00006	0.00021	0.0127	-0.00001	-0.000005	-0.05	-0.000005	14.5	-0.0001	0.000106	0.0115	0.013	0.000138	0.0017	3.49	0.012	-0.01	0.0133	0.00085	0.005	3.34	0.00041	1.44	-0.000005	10.4	0.181	-3	0.000004	0.00023	-0.0005	0.000224	0.0013	0.0009	-0.0001		
10-Jul-09	1	500	455	7.86	82	#N/A	1.7	43.0	-1	0.8	0.84	24.9	0.0816	0.00009	0.00017	0.00628	-0.00001	-0.000005	-0.05	0.000006	7	-0.0001	0.000026	0.00256	0.011	0.000041	0.0008	1.81	0.0131	-0.01	0.0236	0.00004	-0.002	2.14	0.00031	1.89	-0.000005	5.88	0.092	-3	0.000002	0.00006	-0.0005	0.000817	0.0022	0.0003	-0.0001		
17-Jul-09	2	500	495	8.01	65	#N/A	1.7	43.0	-1	0.8	0.84	24.9	0.0816	0.00009	0.00017	0.00628	-0.00001	-0.000005	-0.05	0.000006	7	-0.0001	0.000026	0.00256	0.011	0.000041	0.0008	1.81	0.0131	-0.01	0.0236	0.00004	-0.002	2.14	0.00031	1.89	-0.000005	5.88	0.092	-3	0.000002	0.00006	-0.0005	0.000817	0.0022	0.0003	-0.0001		
24-Jul-09	3	500	455	7.89	54	#N/A	1.6	35.1	1	-0.5	0.64	23.4	0.125	0.00004	0.00014	0.0062	-0.00001	-0.000005	-0.05	-0.000005	6.87	-0.0001	0.000025	0.00161	0.044	0.000042	0.0005	1.51	0.0154	-0.01	0.0103	0.00011	0.003	1.95	0.00027	2.02	-0.000005	3.34	0.0749	-3	-0.000002	0.00003	0.002	0.000466	0.0024	0.0002	-0.0001		
31-Jul-09	4	500	440	7.92	53	#N/A	2.3	29.3	-1	0.6	0.44	21.8	0.0502	0.00004	0.00018	0.00402	-0.00001	-0.000005	-0.05	-0.000005	6.39	-0.0001	0.000012	0.00079	0.005	0.000012	0.0006	1.42	0.0129	-0.01	0.00517	0.00002	-0.002	1.78	0.00011	1.32	-0.000005	1.78	0.0717	-3	-0.000002	0.00016	-0.0005	0.000347	0.0015	0.0001	-0.0001		
7-Aug-09	5	500	435	7.71	41	#N/A	2.3	29.3	-1	0.6	0.44	21.8	0.0502	0.00004	0.00018	0.00402	-0.00001	-0.000005	-0.05	-0.000005	6.39	-0.0001	0.000012	0.00079	0.005	0.000012	0.0006	1.42	0.0129	-0.01	0.00517	0.00002	-0.002	1.78	0.00011	1.32	-0.000005	1.78	0.0717	-3	-0.000002	0.00016	-0.0005	0.000347	0.0015	0.0001	-0.0001		
14-Aug-09	6	500	455	7.67	44	#N/A	1.8	28.4	-1	-0.5	0.36	21.5	0.075	0.00006	0.00015	0.00478	-0.00001	-0.000005	-0.05	0.000006	6.15	-0.0001	0.000011	0.00061	0.009	0.000015	-0.0005	1.5	0.0115	0.01	0.0034	0.00003	-0.002	1.73	0.00014	1.51	-0.000005	1.12	0.0729	-3	0.000003	0.00003	-0.0005	0.000316	0.0016	0.0002	-0.0001		
21-Aug-09	7	500	465	7.80	44	#N/A	1.8	28.4	-1	-0.5	0.36	21.5	0.075	0.00006	0.00015	0.00478	-0.00001	-0.000005	-0.05	0.000006	6.15	-0.0001	0.000011	0.00061	0.009	0.000015	-0.0005	1.5	0.0115	0.01	0.0034	0.00003	-0.002	1.73	0.00014	1.51	-0.000005	1.12	0.0729	-3	0.000003	0.00003	-0.0005	0.000316	0.0016	0.0002	-0.0001		
28-Aug-09	8	500	455	7.81	43	#N/A	1.8	28.4	-1	-0.5	0.36	21.5	0.075	0.00006	0.00015	0.00478	-0.00001	-0.000005	-0.05	0.000006	6.15	-0.0001	0.000011	0.00061	0.009	0.000015	-0.0005	1.5	0.0115	0.01	0.0034	0.00003	-0.002	1.73	0.00014	1.51	-0.000005	1.12	0.0729	-3	0.000003	0.00003	-0.0005	0.000316	0.0016	0.0002	-0.0001		
4-Sep-09	9	500	450	7.58	38	#N/A	1.9	25.8	1	-0.5	0.38	18.6	0.141	0.00002	0.00019	0.00569	-0.00001	-0.000005	-0.05	-0.000005	5.13	-0.0001	0.000046	0.0018	0.039	0.000038	-0.0005	1.41	0.00918	-0.01	0.00233	0.00008	0.004	1.71	0.00026	1.63	-0.000005	0.97	0.0647	-3	0.000003	0.00006	0.0014	0.00025	0.0023	0.0006	-0.0001		
11-Sep-09	10	500	410	7.67	38	#N/A	1.9	25.8	1	-0.5	0.38	18.6	0.141	0.00002	0.00019	0.00569	-0.00001	-0.000005	-0.05	-0.000005	5.13	-0.0001	0.000046	0.0018	0.039	0.000038	-0.0005	1.41	0.00918	-0.01	0.00233	0.00008	0.004	1.71	0.00026	1.63	-0.000005	0.97	0.0647	-3	0.000003	0.00006	0.0014	0.00025	0.0023	0.0006	-0.0001		
18-Sep-09	11	500	460	7.73	41	#N/A	1.9	29.0	1	0.8	0.26	19.9	0.0896	0.00004	0.0001	0.00498	-0.00001	-0.000005	-0.05	-0.000005	5.74	-0.0001	0.000014	0.00087	0.021	0.000028	-0.0005	1.36	0.0106	0.01	0.00171	0.00011	0.002	1.7	0.00011	1.32	-0.000005	0.66	0.0653	-3	0.000003	-0.00001	0.0008	0.000218	0.0016	0.0003	-0.0001		
25-Sep-09	12	500	425	7.81	41	#N/A	1.9	29.0	1	0.8	0.26	19.9	0.0896	0.00004	0.0001	0.00498	-0.00001	-0.000005	-0.05	-0.000005	5.74	-0.0001	0.000014	0.00087	0.021	0.000028	-0.0005	1.36	0.0106	0.01	0.00171	0.00011	0.002	1.7	0.00011	1.32	-0.000005	0.66	0.0653	-3	0.000003	-0.00001	0.0008	0.000218	0.0016	0.0003	-0.0001		
2-Oct-09	13	500	425	7.57	42	#N/A	3.6	29.9	5	-0.5	0.2	21.4	0.0684	0.00004	0.00011	0.00484	-0.00001	-0.000005	-0.05	-0.000005	6.14	-0.0001	0.000009	0.0006	0.007	0.000031	-0.0005	1.47	0.012	-0.01	0.00185	0.00002	-0.002	1.78	0.0001	1.35	0.00002	0.49	0.0707	-3	-0.000002	0.00002	0.0009	0.000244	0.0015	0.0004	-0.0001		
9-Oct-09	14	500	430	7.60	41	#N/A	3.6	29.9	5	-0.5	0.2	21.4	0.0684	0.00004	0.00011	0.00484	-0.00001	-0.000005	-0.05	-0.000005	6.14	-0.0001	0.000009	0.0006	0.007	0.000031	-0.0005	1.47	0.012	-0.01	0.00185	0.00002	-0.002	1.78	0.0001	1.35	0.00002	0.49	0.0707	-3	-0.000002	0.00002	0.0009	0.000244	0.0015	0.0004	-0.0001		
16-Oct-09	15	500	415	7.54	45	#N/A	3.0	30.4	-1	-0.5	0.17	22.4	0.0665	0.00002	0.00005	0.00475	-0.00001	-0.000005	-0.05	-0.000005	6.46	-0.0001	0.000014	0.00127	0.011	0.000136	0.0005	1.53	0.0109	-0.01	0.00143	0.00013	0.003	1.83	0.00009	1.26	-0.000005	0.44	0.0737	-3	-0.000002	0.00009	0.0006	0.000248	0.0014	0.0004	-0.0001		
23-Oct-09	16	500	420	7.67	43	#N/A	3.0	30.4	-1	-0.5	0.17	22.4	0.0665	0.00002	0.00005	0.00475	-0.00001	-0.000005	-0.05	-0.000005	6.46	-0.0001	0.000014	0.00127	0.011	0.000136	0.0005	1.53	0.0109	-0.01	0.00143	0.00013	0.003	1.83	0.00009	1.26	-0.000005	0.44	0.0737	-3	-0.000002	0.00009	0.0006	0.000248	0.0014	0.0004	-0.0001		
30-Oct-09	17	500	430	7.67	39	#N/A	3.7	31.0	-1	-0.5	0.13	23.5	0.0478	-0.00002	0.00004	0.00488	-0.00001	-0.000005	-0.05	-0.000005	6.73	-0.0001	0.000007	0.00083	0.003	0.000012	-0.0005	1.62	0.00966	-0.01	0.00109	0.00007	0.003	1.65	0.00009	1.25	-0.000005	0.36	0.0794	-3	-0.000002	0.00002	-0.0005	0.000269	0.0013	0.0004	-0.0001		
6-Nov-09	18	500	480	7.77	43	#N/A	3.7	31.0	-1	-0.5	0.13	23.5	0.0478	-0.00002	0.00004	0.00488	-0.00001	-0.000005	-0.05	-0.000005	6.73	-0.0001	0.000007	0.00083	0.003	0.000012	-0.0005	1.62	0.00966	-0.01	0.00109	0.00007	0.003	1.65	0.00009	1.25	-0.000005	0.36	0.0794	-3	-0.000002	0.00002	-0.0005	0.000269	0.0013	0.0004	-0.0001		
13-Nov-09	19	500	460	7.65	39	#N/A	3.8	29.6	-1	-0.5	0.12	19.9	0.0539	0.00002	0.00006	0.00408	-0.00001	-0.000005	-0.05	-0.000005	5.69	-0.0001	0.000007	0.00036	0.007	0.000025	-0.0005	1.39	0.00888	-0.01	0.00083	0.00011	0.004	1.58	0.00006	1.06	-0.000005	0.29	0.0691	-3	-0.000002	0.00003	-0.0005	0.000205	0.0013	0.0012	-0.0001		
20-Nov-09	20	500	430	7.80	43	#N/A	3.8	29.6	-1	-0.5	0.12	19.9	0.0539	0.00002	0.00006	0.00408	-0.00001	-0.000005	-0.05	-0.000005	5.69	-0.0001	0.000007	0.00036	0.007	0.000025	-0.0005	1.39	0.00888	-0.01	0.00083	0.00011	0.004	1															

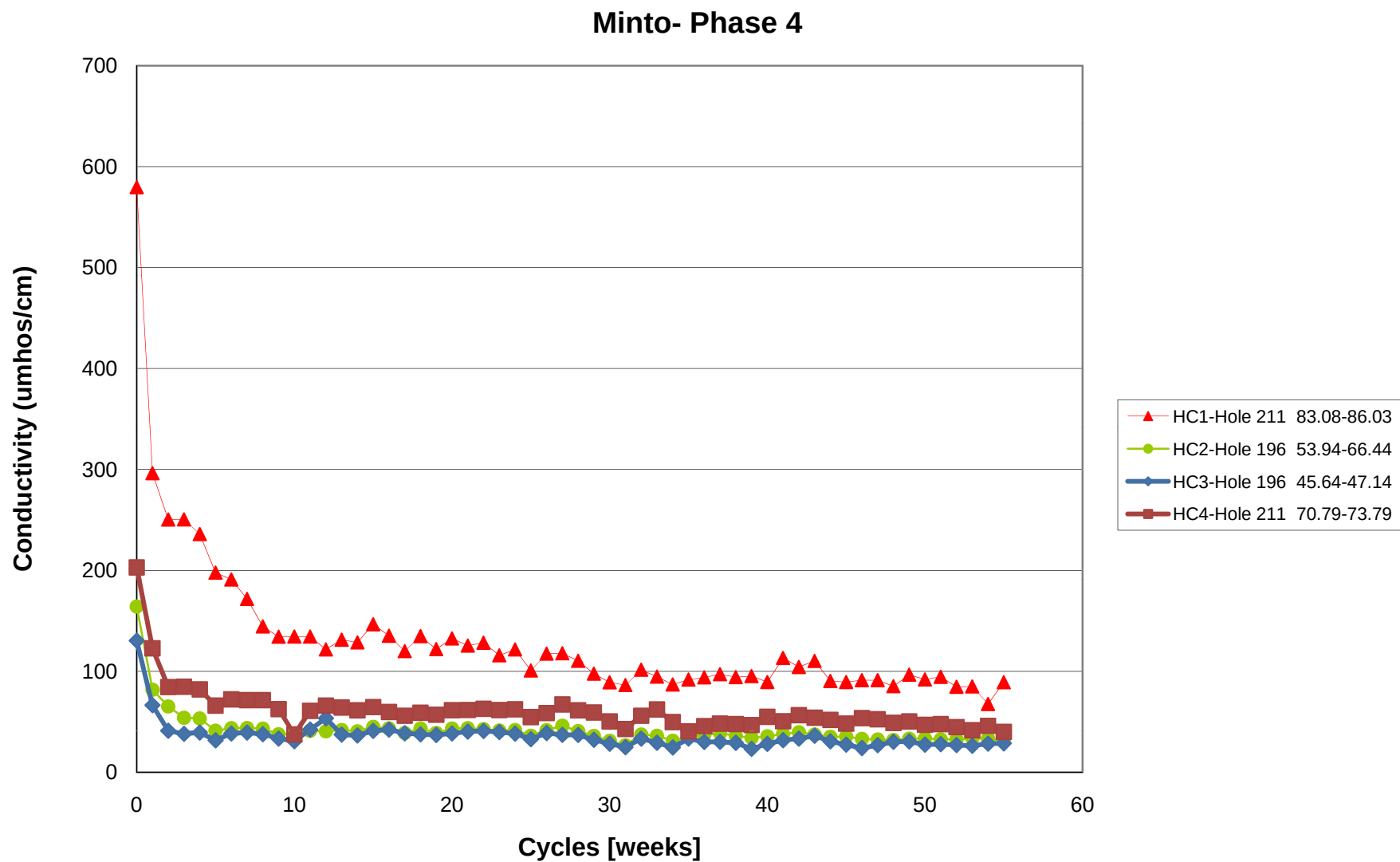
Sample = Hole 196 45.64-47.14																																																								
Date	Cycle No.	Volume mL Input	Volume mL Output	pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Ti mg/L	Sn mg/L	Tl mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L									
3-Jul-09	0	750	365	7.65	130	#N/A	2.1	37.4	2	2.2	0.4	43.5	0.108	0.00005	0.00032	0.0345	-0.00001	-0.000005	-0.05	-0.000005	12.4	-0.0001	0.000022	0.0276	0.003	0.000047	0.0019	3.04	0.0257	-0.01	0.0163	0.000063	0.006	4.39	0.00017	1.26	-0.000005	5.13	0.129	-3	0.000005	0.00023	-0.0005	0.000013	0.0005	0.0005	-0.0001									
10-Jul-09	1	500	450	7.67	66	#N/A	1.9	24.2	2	0.8	0.44	15.9	0.105	0.00006	0.00044	0.0101	-0.00001	-0.000005	-0.05	0.000015	4.46	-0.0001	0.000014	0.00381	0.019	0.00004	0.0006	1.15	0.0136	-0.01	0.033	-0.00002	0.003	2.41	0.00031	1.51	-0.000005	2.98	0.0463	-3	-0.000002	0.00008	0.0005	0.000121	0.0011	0.0007	-0.0001									
17-Jul-09	2	500	415	7.66	41	#N/A	2.0	25.7	-1	-0.5	0.34	17.1	0.0679	0.00006	0.00037	0.0106	-0.00001	-0.000005	-0.05	-0.000005	4.92	-0.0001	0.000008	0.00211	0.007	0.000114	0.0005	1.18	0.0133	-0.01	0.0161	0.00006	0.006	2.31	0.00016	1.62	-0.000005	1.99	0.0489	-3	-0.000002	0.00006	-0.0005	0.000152	0.0011	0.0005	-0.0001									
24-Jul-09	3	500	435	7.59	38	#N/A	2.3	24.5	-1	0.9	0.26	17.9	0.0655	0.00005	0.0005	0.0123	-0.00001	-0.000005	-0.05	-0.000005	5.19	-0.0001	0.000013	0.00243	0.006	0.000016	0.0007	1.19	0.0134	-0.01	0.00875	0.00006	0.002	2.31	0.00011	1.59	-0.000005	1.39	0.0526	-3	-0.000002	0.00016	-0.0005	0.000151	0.0008	0.0004	-0.0001									
31-Jul-09	4	500	455	7.64	39	#N/A	2.1	24.8	3	0.7	0.24	18.2	0.0885	0.00006	0.00051	0.0134	-0.00001	-0.000005	-0.05	-0.000005	5.11	-0.0001	0.000012	0.00224	0.008	0.000016	-0.0005	1.32	0.0114	-0.01	0.00506	0.00004	-0.002	2.33	0.00015	1.91	-0.000005	1	0.0541	-3	0.000002	0.00006	-0.0005	0.00016	0.0011	0.0002	-0.0001									
7-Aug-09	5	500	430	7.53	32	#N/A	1.9	22.4	1	-0.5	0.22	14.3	0.138	-0.00002	0.00054	0.0106	-0.00001	-0.000005	-0.05	-0.000005	3.95	-0.0001	0.000019	0.00277	0.027	0.000032	-0.0005	1.07	0.0074	-0.01	0.00305	0.00006	0.003	2.09	0.00011	1.78	-0.000005	0.74	0.0432	-3	0.000002	0.00008	0.0013	0.000107	0.0013	0.0004	-0.0001									
14-Aug-09	6	500	430	7.52	38	#N/A	2.5	32.3	-1	0.5	0.17	22.6	0.0741	0.00005	0.00049	0.0178	-0.00001	-0.000005	-0.05	0.000006	6.5	-0.0001	0.000012	0.00216	0.008	0.000197	0.0006	1.53	0.00907	0.02	0.00296	0.0001	-0.002	2.55	0.00014	2.02	-0.000005	0.56	0.0647	-3	0.000003	0.00002	-0.0005	0.000191	0.0012	0.0005	-0.0001									
21-Aug-09	7	500	460	7.67	39	#N/A	3.8	26.3	2	-0.5	0.14	18.2	0.121	0.00004	0.00056	0.0149	-0.00001	-0.000005	-0.05	-0.000005	5.12	-0.0001	0.00001	0.00282	0.017	0.000049	0.0006	1.31	0.00734	-0.01	0.00215	-0.00002	0.004	2.49	0.00009	2.14	-0.000005	0.52	0.0559	-3	-0.000002	0.00003	0.0009	0.000155	0.0014	0.0008	-0.0001									
28-Aug-09	8	500	450	7.63	38	#N/A	2.1	24.8	3	0.7	0.24	18.2	0.0885	0.00006	0.00051	0.0134	-0.00001	-0.000005	-0.05	-0.000005	5.11	-0.0001	0.000012	0.00224	0.008	0.000016	-0.0005	1.32	0.0114	-0.01	0.00506	0.00004	-0.002	2.33	0.00015	1.91	-0.000005	1	0.0541	-3	0.000002	0.00006	-0.0005	0.00016	0.0011	0.0002	-0.0001									
4-Sep-09	9	500	440	7.48	33	#N/A	1.9	22.4	1	-0.5	0.22	14.3	0.138	-0.00002	0.00054	0.0106	-0.00001	-0.000005	-0.05	-0.000005	3.95	-0.0001	0.000019	0.00277	0.027	0.000032	-0.0005	1.07	0.0074	-0.01	0.00305	0.00006	0.003	2.09	0.00011	1.78	-0.000005	0.74	0.0432	-3	0.000002	0.00008	0.0013	0.000107	0.0013	0.0004	-0.0001									
11-Sep-09	10	500	390	7.52	31	#N/A	2.5	32.3	-1	0.5	0.17	22.6	0.0741	0.00005	0.00049	0.0178	-0.00001	-0.000005	-0.05	0.000006	6.5	-0.0001	0.000012	0.00216	0.008	0.000197	0.0006	1.53	0.00907	0.02	0.00296	0.0001	-0.002	2.55	0.00014	2.02	-0.000005	0.56	0.0647	-3	0.000003	0.00002	-0.0005	0.000191	0.0012	0.0005	-0.0001									
18-Sep-09	11	500	435	7.67	42	#N/A	2.5	32.3	-1	0.5	0.17	22.6	0.0741	0.00005	0.00049	0.0178	-0.00001	-0.000005	-0.05	0.000006	6.5	-0.0001	0.000012	0.00216	0.008	0.000197	0.0006	1.53	0.00907	0.02	0.00296	0.0001	-0.002	2.55	0.00014	2.02	-0.000005	0.56	0.0647	-3	0.000003	0.00002	-0.0005	0.000191	0.0012	0.0005	-0.0001									
25-Sep-09	12	500	505	7.60	53	#N/A	2.5	32.3	-1	0.5	0.17	22.6	0.0741	0.00005	0.00049	0.0178	-0.00001	-0.000005	-0.05	0.000006	6.5	-0.0001	0.000012	0.00216	0.008	0.000197	0.0006	1.53	0.00907	0.02	0.00296	0.0001	-0.002	2.55	0.00014	2.02	-0.000005	0.56	0.0647	-3	0.000003	0.00002	-0.0005	0.000191	0.0012	0.0005	-0.0001									
2-Oct-09	13	500	410	7.49	37	#N/A	3.8	26.3	2	-0.5	0.14	18.2	0.121	0.00004	0.00056	0.0149	-0.00001	-0.000005	-0.05	-0.000005	5.12	-0.0001	0.00001	0.00282	0.017	0.000049	0.0006	1.31	0.00734	-0.01	0.00215	-0.00002	0.004	2.49	0.00009	2.14	-0.000005	0.52	0.0559	-3	-0.000002	0.00003	0.0009	0.000155	0.0014	0.0008	-0.0001									
9-Oct-09	14	500	420	7.53	37	#N/A	3.8	26.3	2	-0.5	0.14	18.2	0.121	0.00004	0.00056	0.0149	-0.00001	-0.000005	-0.05	-0.000005	5.12	-0.0001	0.00001	0.00282	0.017	0.000049	0.0006	1.31	0.00734	-0.01	0.00215	-0.00002	0.004	2.49	0.00009	2.14	-0.000005	0.52	0.0559	-3	-0.000002	0.00003	0.0009	0.000155	0.0014	0.0008	-0.0001									
16-Oct-09	15	500	380	7.42	41	#N/A	2.8	29.7	-1	-0.5	0.1	21.5	0.081	0.00003	0.00044	0.0165	-0.00001	-0.000005	-0.05	-0.000005	6.05	0.0001	0.000011	0.00287	0.013	0.000042	0.0006	1.55	0.00836	-0.01	0.00184	0.00028	0.003	2.29	0.00011	1.77	0.000017	0.41	0.0648	-3	-0.000002	0.0001	0.0005	0.000203	0.0012	0.0008	-0.0001									
23-Oct-09	16	500	450	7.56	42	#N/A	2.8	29.7	-1	-0.5	0.1	21.5	0.081	0.00003	0.00044	0.0165	-0.00001	-0.000005	-0.05	-0.000005	6.05	0.0001	0.000011	0.00287	0.013	0.000042	0.0006	1.55	0.00836	-0.01	0.00184	0.00028	0.003	2.29	0.00011	1.77	0.000017	0.41	0.0648	-3	-0.000002	0.0001	0.0005	0.000203	0.0012	0.0008	-0.0001									
30-Oct-09	17	500	435	7.62	39	#N/A	3.7	26.8	-1	-0.5	0.08	19.4	0.079	0.00002	0.00038	0.0152	-0.00001	-0.000005	-0.05	0.000005	5.44	-0.0001	0.000008	0.00162	0.008	0.000014	-0.0005	1.41	0.00683	-0.01	0.00141	0.00011	0.003	2.18	0.00008	1.68	-0.000005	0.33	0.0595	-3	-0.000002	0.00002	0.0006	0.000164	0.0013	0.0005	-0.0001									
6-Nov-09	18	500	450	7.69	38	#N/A	3.7	26.8	-1	-0.5	0.08	19.4	0.079	0.00002	0.00038	0.0152	-0.00001	-0.000005	-0.05	0.000005	5.44	-0.0001	0.000008	0.00162	0.008	0.000014	-0.0005	1.41	0.00683	-0.01	0.00141	0.00011	0.003	2.18	0.00008	1.68	-0.000005	0.33	0.0595	-3	-0.000002	0.00002	0.0006	0.000164	0.0013	0.0005	-0.0001									
13-Nov-09	19	500	465	7.55	37	#N/A	4.0	25.6	-1	-0.5	0.08	17.4	0.0777	0.00003	0.00036	0.0141	-0.00001	-0.000005	-0.05	0.000007	4.94	-0.0001	0.00001	0.00157	0.01	0.000041	-0.0005	1.24	0.00654	-0.01	0.00113	0.00008	0.005	2.03	0.00007	1.49	-0.000005	0.29	0.0535	-3	-0.000002	0.00002	0.0006	0.000126	0.0011	0.0006	-0.0001									
20-Nov-09	20	500	445	7.67	38	#N/A	4.0	25.6	-1	-0.5	0.08	17.4	0.0777	0.00003	0.00036	0.0141	-0.00001	-0.000005	-0.05	0.000007	4.94	-0.0001	0.00001	0.00157	0.01	0.000041	-0.00																													

Sample = Hole 211 70.79-73.79																																															
Date	Cycle No.	Volume mL		pH	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate mg/L	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Ti mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L
3-Jul-09	0	750	340	8.08	203	#N/A	1.2	58.4	7	6.1	1.13	44.8	0.198	0.00018	0.00048	0.0358	-0.00001	-0.000005	-0.05	-0.000005	13.1	-0.0001	0.000031	0.0127	0.004	0.000052	0.0045	2.94	0.00422	-0.01	0.00524	0.00071	0.01	7.79	0.00148	1.93	-0.000005	19.6	0.242	-3	0.00001	0.00043	-0.0005	0.000138	0.0037	0.0016	-0.0001
10-Jul-09	1	500	455	7.83	123	#N/A	1.3	44.5	10	-0.5	1.01	34.9	0.197	0.00026	0.00045	0.0374	-0.00001	-0.000005	-0.05	0.000007	10	-0.0001	0.000011	0.00192	0.011	0.000113	0.0029	2.39	0.00699	-0.01	0.00258	0.00003	-0.002	5.2	0.00129	2.39	-0.000005	5.38	0.191	3	0.000005	0.00006	0.0011	0.00138	0.0049	0.0011	-0.0001
17-Jul-09	2	500	450	7.97	84	#N/A	1.7	40.4	6	-0.5	1.02	39.2	0.21	0.00018	0.00035	0.0467	-0.00001	-0.000005	-0.05	-0.000005	11.9	-0.0001	0.000007	0.00126	0.014	0.000073	0.0022	2.27	0.00869	-0.01	0.00089	0.00012	0.005	4.06	0.00114	2.51	-0.000005	1.93	0.195	4	0.000004	0.0001	0.0008	0.00117	0.0037	0.0004	-0.0001
24-Jul-09	3	500	450	7.82	85	#N/A	1.7	40.4	6	-0.5	1.02	39.2	0.21	0.00018	0.00035	0.0467	-0.00001	-0.000005	-0.05	-0.000005	11.9	-0.0001	0.000007	0.00126	0.014	0.000073	0.0022	2.27	0.00869	-0.01	0.00089	0.00012	0.005	4.06	0.00114	2.51	-0.000005	1.93	0.195	4	0.000004	0.0001	0.0008	0.00117	0.0037	0.0004	-0.0001
31-Jul-09	4	500	450	7.87	82	#N/A	1.7	40.4	6	-0.5	1.02	39.2	0.21	0.00018	0.00035	0.0467	-0.00001	-0.000005	-0.05	-0.000005	11.9	-0.0001	0.000007	0.00126	0.014	0.000073	0.0022	2.27	0.00869	-0.01	0.00089	0.00012	0.005	4.06	0.00114	2.51	-0.000005	1.93	0.195	4	0.000004	0.0001	0.0008	0.00117	0.0037	0.0004	-0.0001
7-Aug-09	5	500	460	7.69	66	#N/A	2.2	36.3	4	0.9	0.81	37.8	0.141	0.00011	0.00032	0.0508	-0.00001	-0.000005	-0.05	-0.000005	11.7	-0.0001	0.000005	0.0014	0.004	0.000021	0.0017	2.09	0.00887	-0.01	0.00049	0.00005	-0.002	3.31	0.00099	1.97	-0.000005	1.05	0.188	4	0.000003	0.00022	-0.0005	0.000969	0.003	0.0002	-0.0001
14-Aug-09	6	500	460	7.73	72	#N/A	2.2	36.3	4	0.9	0.81	37.8	0.141	0.00011	0.00032	0.0508	-0.00001	-0.000005	-0.05	-0.000005	11.7	-0.0001	0.000005	0.0014	0.004	0.000021	0.0017	2.09	0.00887	-0.01	0.00049	0.00005	-0.002	3.31	0.00099	1.97	-0.000005	1.05	0.188	4	0.000003	0.00022	-0.0005	0.000969	0.003	0.0002	-0.0001
21-Aug-09	7	500	475	7.87	71	#N/A	1.8	36.9	4	0.5	0.74	36.6	0.197	0.00011	0.0003	0.054	-0.00001	-0.000005	-0.05	-0.000005	11.3	-0.0001	0.000007	0.00131	0.008	0.000037	0.0015	2.05	0.00929	0.01	0.0004	-0.00002	-0.002	2.81	0.00093	2.14	-0.000005	0.78	0.185	-3	0.000004	0.00002	0.0008	0.000796	0.0033	0.0003	-0.0001
28-Aug-09	8	500	460	7.84	71	#N/A	1.8	36.9	4	0.5	0.74	36.6	0.197	0.00011	0.0003	0.054	-0.00001	-0.000005	-0.05	-0.000005	11.3	-0.0001	0.000007	0.00131	0.008	0.000037	0.0015	2.05	0.00929	0.01	0.0004	-0.00002	-0.002	2.81	0.00093	2.14	-0.000005	0.78	0.185	-3	0.000004	0.00002	0.0008	0.000796	0.0033	0.0003	-0.0001
4-Sep-09	9	500	475	7.56	63	#N/A	1.5	25.6	2	0.6	0.42	19.6	0.286	-0.00002	0.00032	0.0276	-0.00001	-0.000005	-0.05	-0.000005	6.2	-0.0001	0.000006	0.00078	0.004	0.000026	-0.0005	0.99	0.00396	-0.01	0.00008	-0.00002	0.002	1.53	0.00063	1.47	-0.000005	0.32	0.0942	-3	0.000002	0.00002	-0.0005	0.00027	0.0035	0.0003	-0.0001
11-Sep-09	10	500	495	7.74	38	#N/A	1.5	25.6	2	0.6	0.42	19.6	0.286	-0.00002	0.00032	0.0276	-0.00001	-0.000005	-0.05	-0.000005	6.2	-0.0001	0.000006	0.00078	0.004	0.000026	-0.0005	0.99	0.00396	-0.01	0.00008	-0.00002	0.002	1.53	0.00063	1.47	-0.000005	0.32	0.0942	-3	0.000002	0.00002	-0.0005	0.00027	0.0035	0.0003	-0.0001
18-Sep-09	11	500	460	7.76	61	#N/A	2.1	40.2	4	0.5	0.7	34.3	0.151	0.00009	0.00023	0.0557	-0.00001	-0.000005	-0.05	-0.000005	11.1	-0.0001	-0.000005	0.00211	0.004	0.00004	0.0011	1.61	0.00631	0.03	0.00032	0.00013	-0.002	2	0.00071	1.97	-0.000005	0.54	0.161	-3	0.000004	-0.00001	0.0006	0.000554	0.0027	0.0004	-0.0001
25-Sep-09	12	500	490	7.81	66	#N/A	2.1	40.2	4	0.5	0.7	34.3	0.151	0.00009	0.00023	0.0557	-0.00001	-0.000005	-0.05	-0.000005	11.1	-0.0001	-0.000005	0.00211	0.004	0.00004	0.0011	1.61	0.00631	0.03	0.00032	0.00013	-0.002	2	0.00071	1.97	-0.000005	0.54	0.161	-3	0.000004	-0.00001	0.0006	0.000554	0.0027	0.0004	-0.0001
2-Oct-09	13	500	440	7.60	64	#N/A	3.5	33.9	6	-0.5	0.69	33.3	0.216	0.00006	0.00026	0.0544	-0.00001	-0.000005	-0.05	-0.000005	10.8	-0.0001	0.000007	0.00143	0.007	0.000053	0.0009	1.55	0.00522	-0.01	0.0003	-0.00002	0.005	1.95	0.00061	1.91	-0.000005	0.51	0.151	-3	0.000002	0.00001	-0.0005	0.000421	0.0031	0.0005	-0.0001
9-Oct-09	14	500	430	7.63	61	#N/A	3.5	33.9	6	-0.5	0.69	33.3	0.216	0.00006	0.00026	0.0544	-0.00001	-0.000005	-0.05	-0.000005	10.8	-0.0001	0.000007	0.00143	0.007	0.000053	0.0009	1.55	0.00522	-0.01	0.0003	-0.00002	0.005	1.95	0.00061	1.91	-0.000005	0.51	0.151	-3	0.000002	0.00001	-0.0005	0.000421	0.0031	0.0005	-0.0001
16-Oct-09	15	500	405	7.52	65	#N/A	3.2	34.1	2	-0.5	0.65	31.2	0.167	0.00005	0.00018	0.0529	-0.00001	-0.000005	-0.05	-0.000005	10.1	-0.0001	0.000009	0.0019	0.01	0.000246	0.0009	1.45	0.00499	-0.01	0.00027	0.0002	-0.002	1.68	0.00051	1.64	-0.000005	0.45	0.145	-3	0.000003	-0.00001	0.0008	0.000386	0.0024	0.003	-0.0001
23-Oct-09	16	500	450	7.65	60	#N/A	3.2	34.1	2	-0.5	0.65	31.2	0.167	0.00005	0.00018	0.0529	-0.00001	-0.000005	-0.05	-0.000005	10.1	-0.0001	0.000009	0.0019	0.01	0.000246	0.0009	1.45	0.00499	-0.01	0.00027	0.0002	-0.002	1.68	0.00051	1.64	-0.000005	0.45	0.145	-3	0.000003	-0.00001	0.0008	0.000386	0.0024	0.003	-0.0001
30-Oct-09	17	500	465	7.70	56	#N/A	3.4	32.5	2	-0.5	0.67	30.8	0.204	0.00002	0.00015	0.0519	-0.00001	-0.000005	-0.05	-0.000005	10.1	-0.0001	-0.000005	0.00092	0.006	0.000026	0.0006	1.37	0.00412	-0.01	0.00022	0.00009	0.003	1.64	0.00044	1.7	-0.000005	0.39	0.139	-3	-0.000002	-0.00001	0.0008	0.00032	0.0027	0.0005	-0.0001
6-Nov-09	18	500	450	7.74	59	#N/A	3.4	32.5	2	-0.5	0.67	30.8	0.204	0.00002	0.00015	0.0519	-0.00001	-0.000005	-0.05	-0.000005	10.1	-0.0001	-0.000005	0.00092	0.006	0.000026	0.0006	1.37	0.00412	-0.01	0.00022	0.00009	0.003	1.64	0.00044	1.7	-0.000005	0.39	0.139	-3	-0.000002	-0.00001	0.0008	0.00032	0.0027	0.0005	-0.0001
13-Nov-09	19	500	470	7.61	57	#N/A	3.9	31.5	1	-0.5	0.61	28.7	0.191	0.00003	0.00014	0.049	-0.00001	-0.000005	-0.05	-0.000005	9.49	-0.0001	-0.000005	0.00067	0.005	0.000038	0.0007	1.22	0.00388	-0.01	0.00025	0.00013	0.004	1.48	0.00037	1.44	-0.000005	0.37	0.13	-3	0.000002	0.00001	0.0008	0.000259	0.0023	0.0003	-0.0001
20-Nov-09	20	500	445	7.73	62	#N/A	3.9	31.5	1	-0.5	0.61	28.7	0.191	0.00003	0.00014	0.049	-0.00001	-0.000005	-0.05	-0.000005	9.49	-0.0001																									

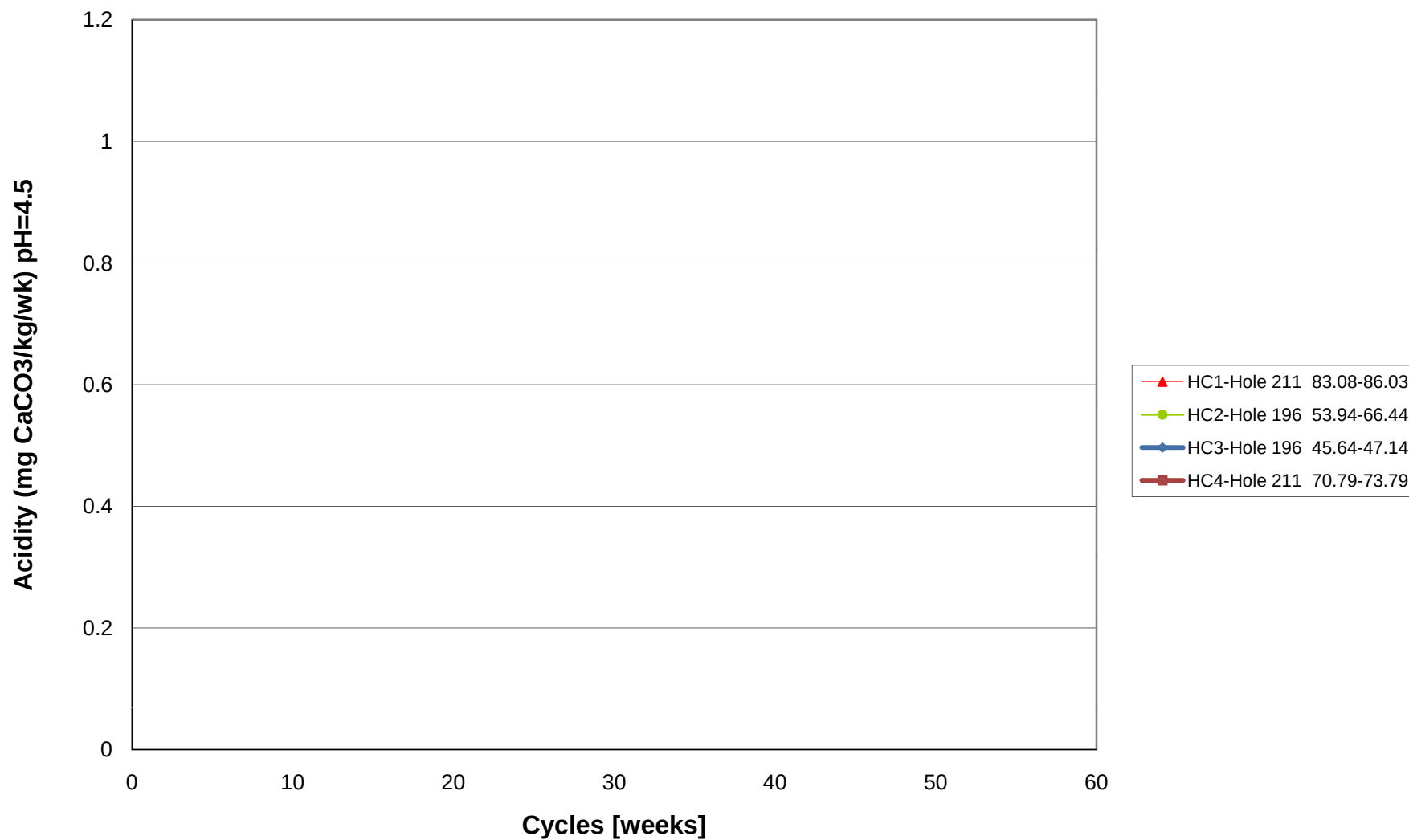
Appendix E5
Phase IV HCT Results: Charts

Minto- Phase 4

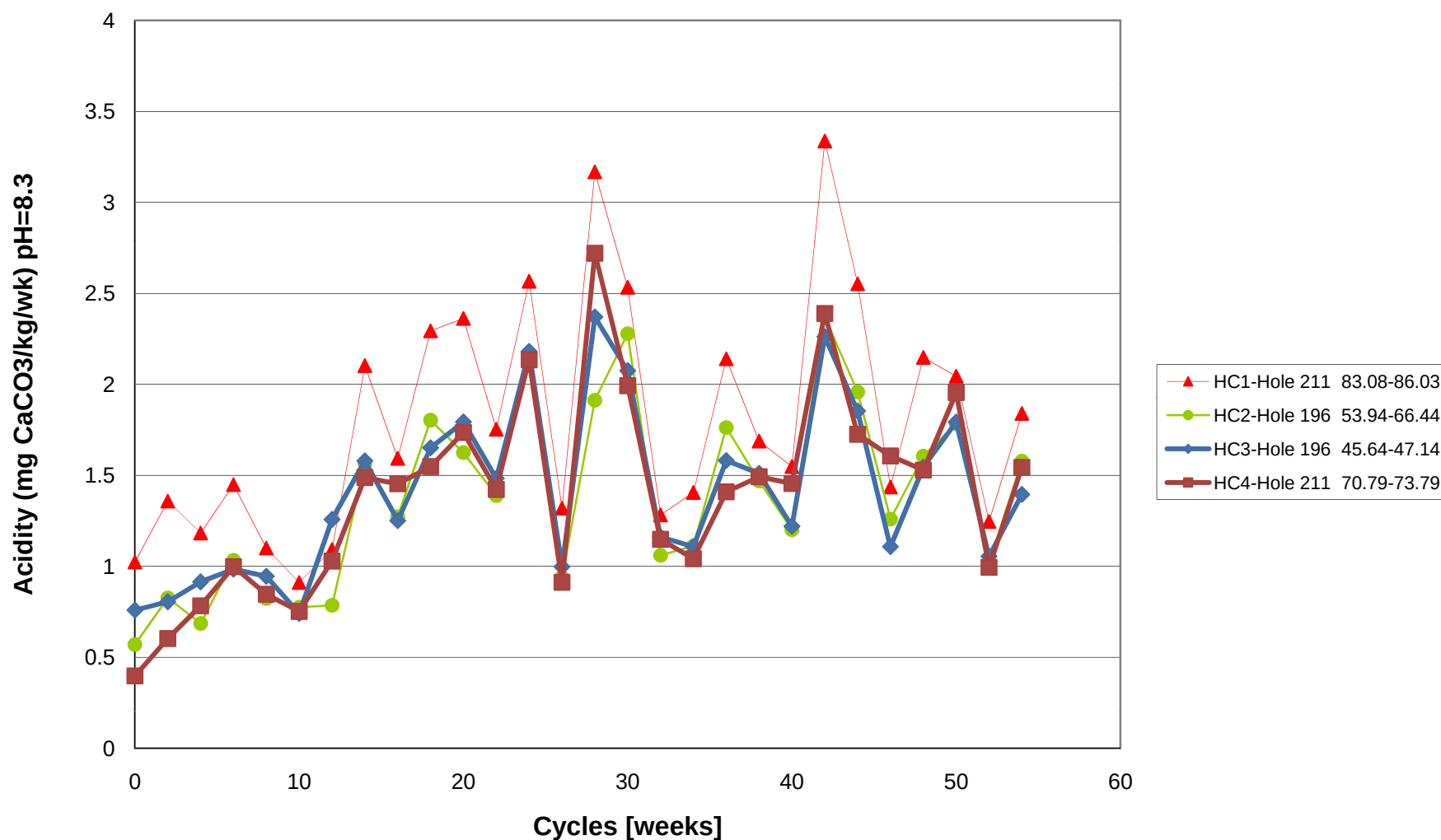




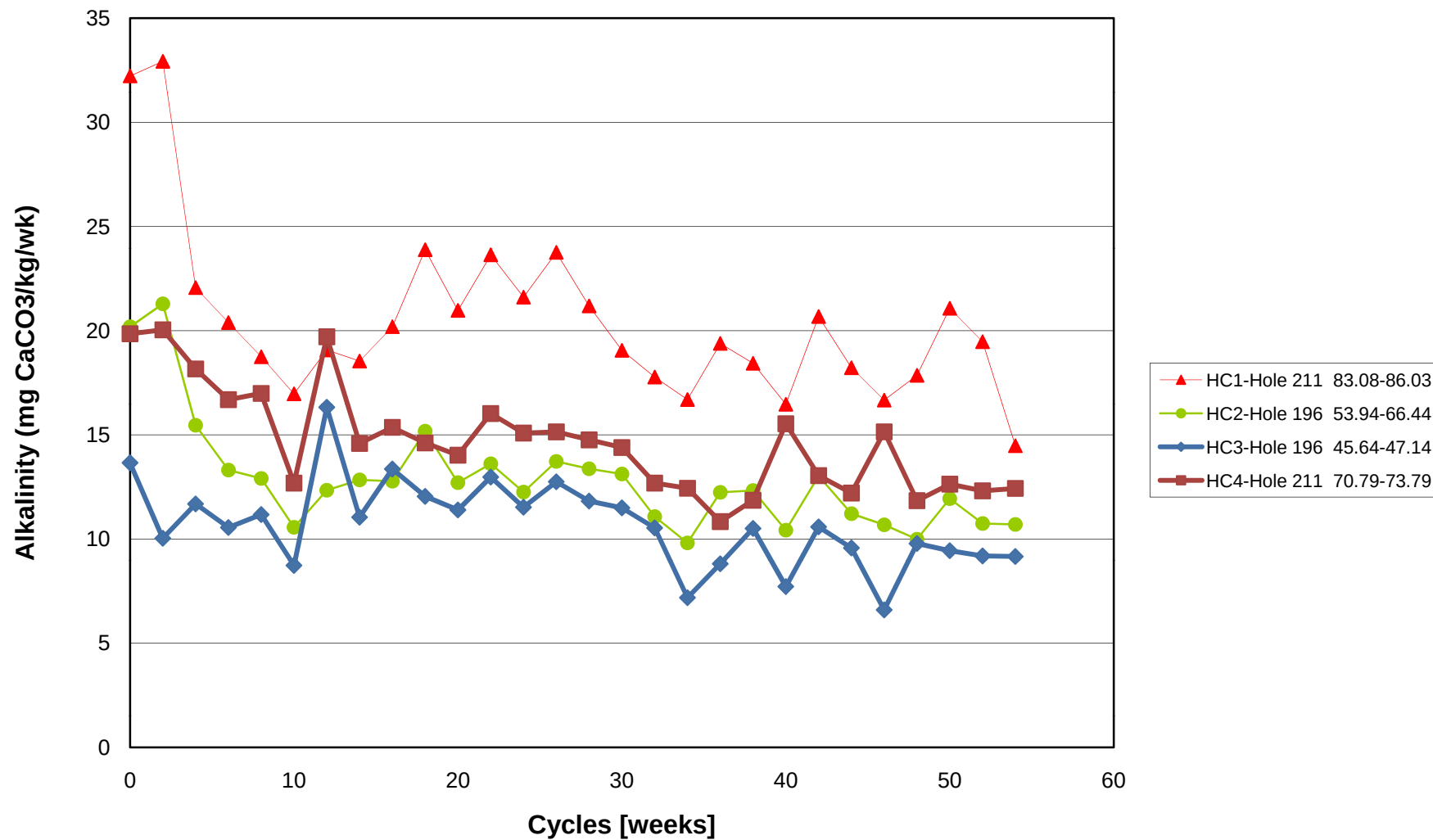
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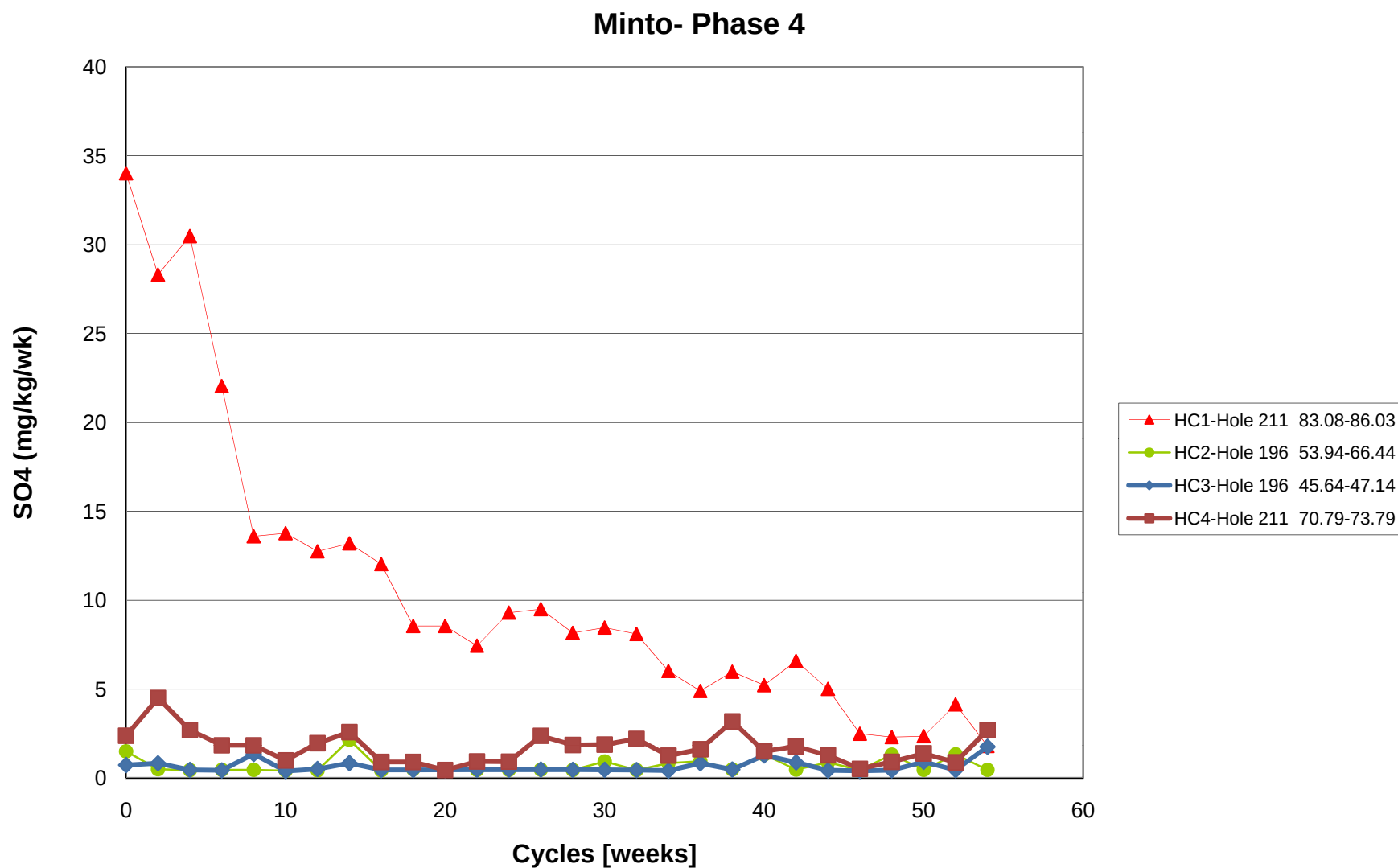


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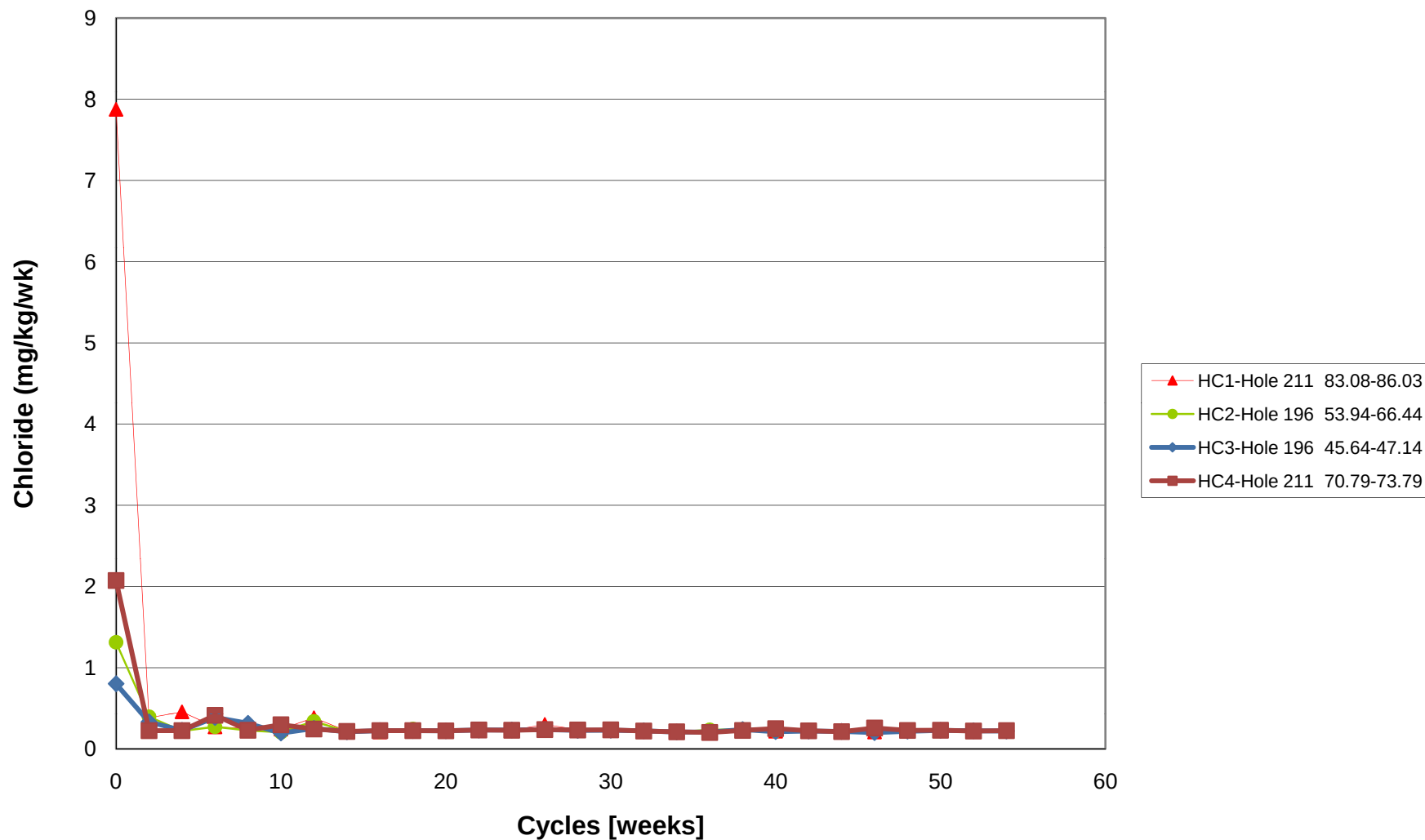


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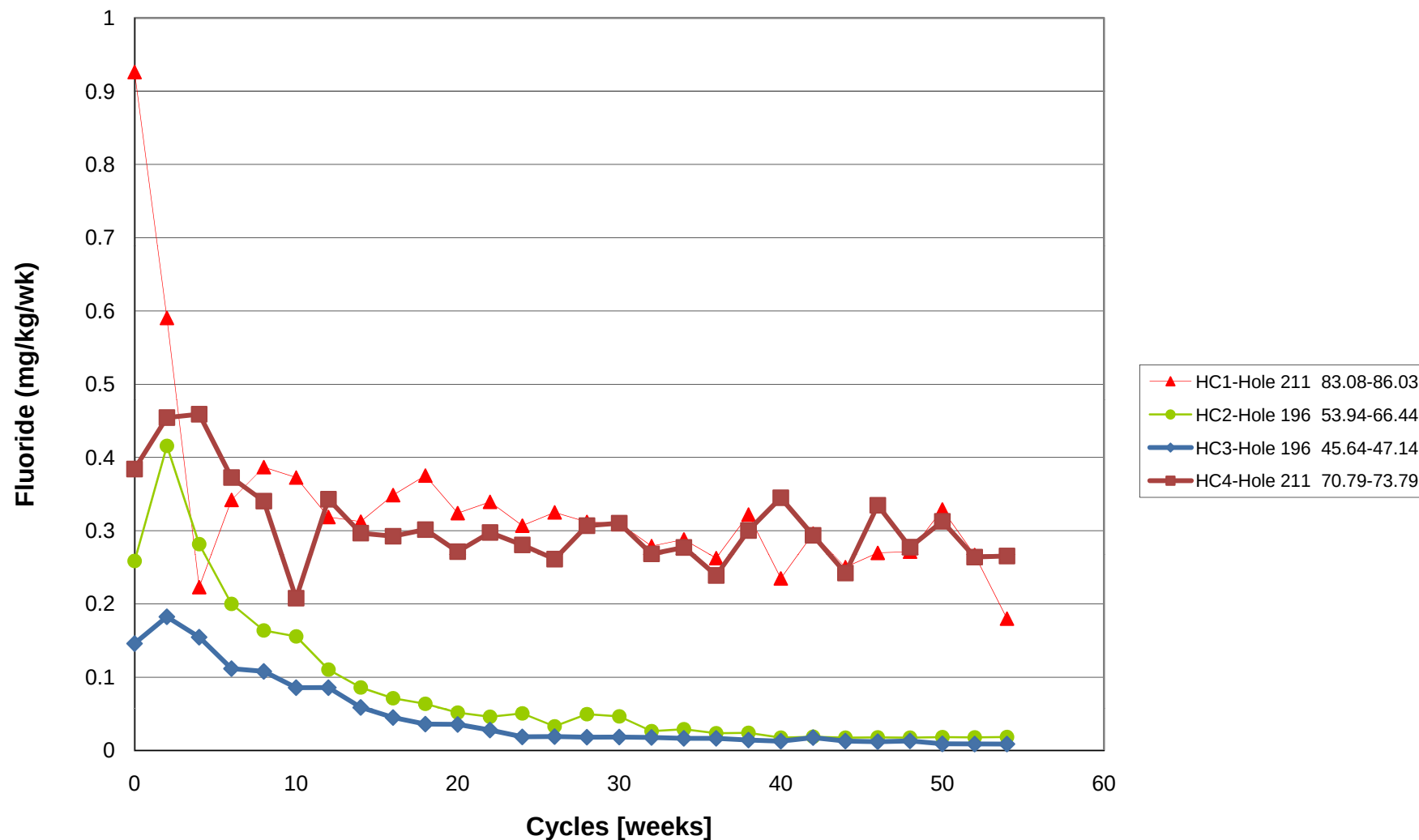




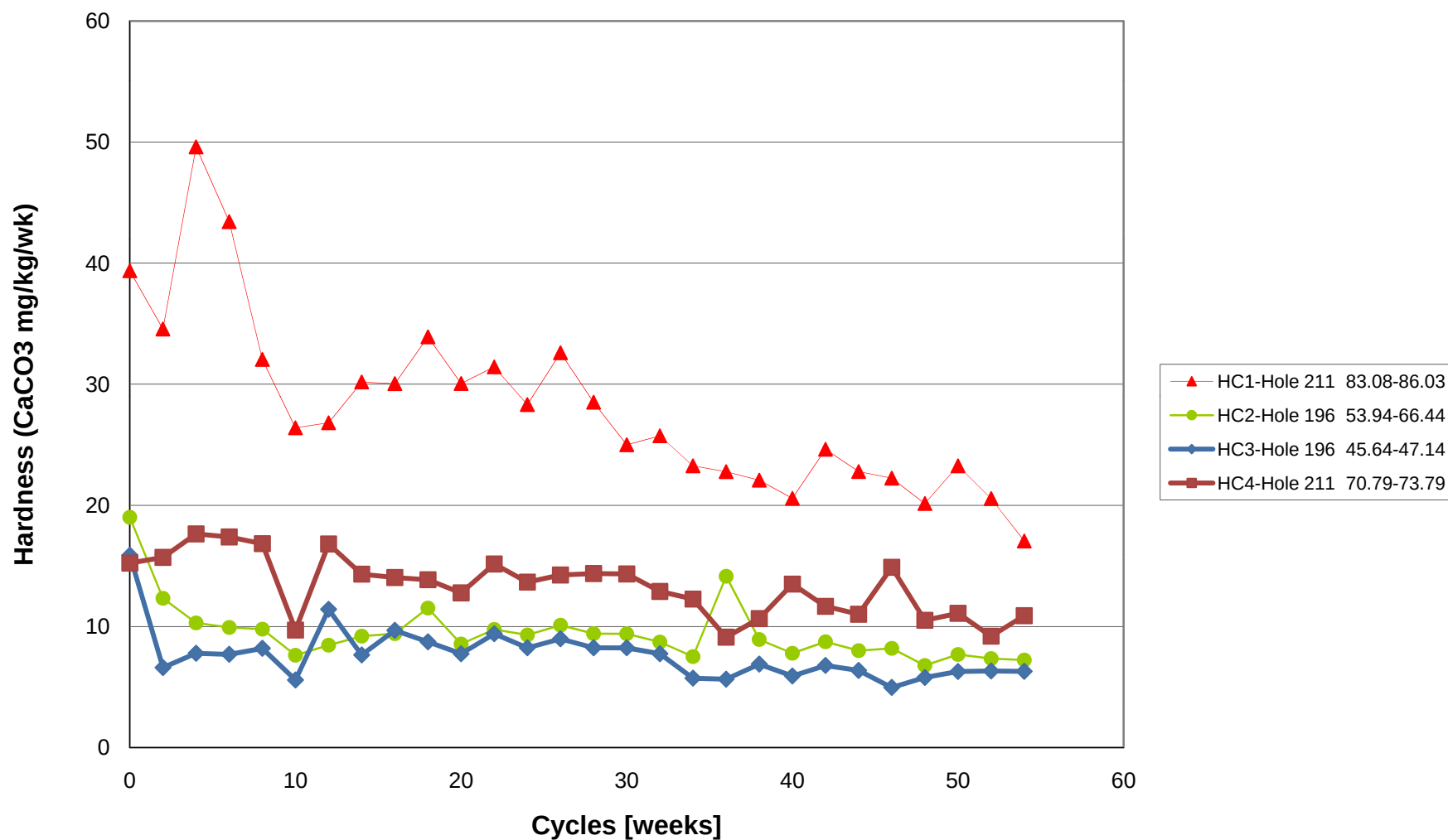
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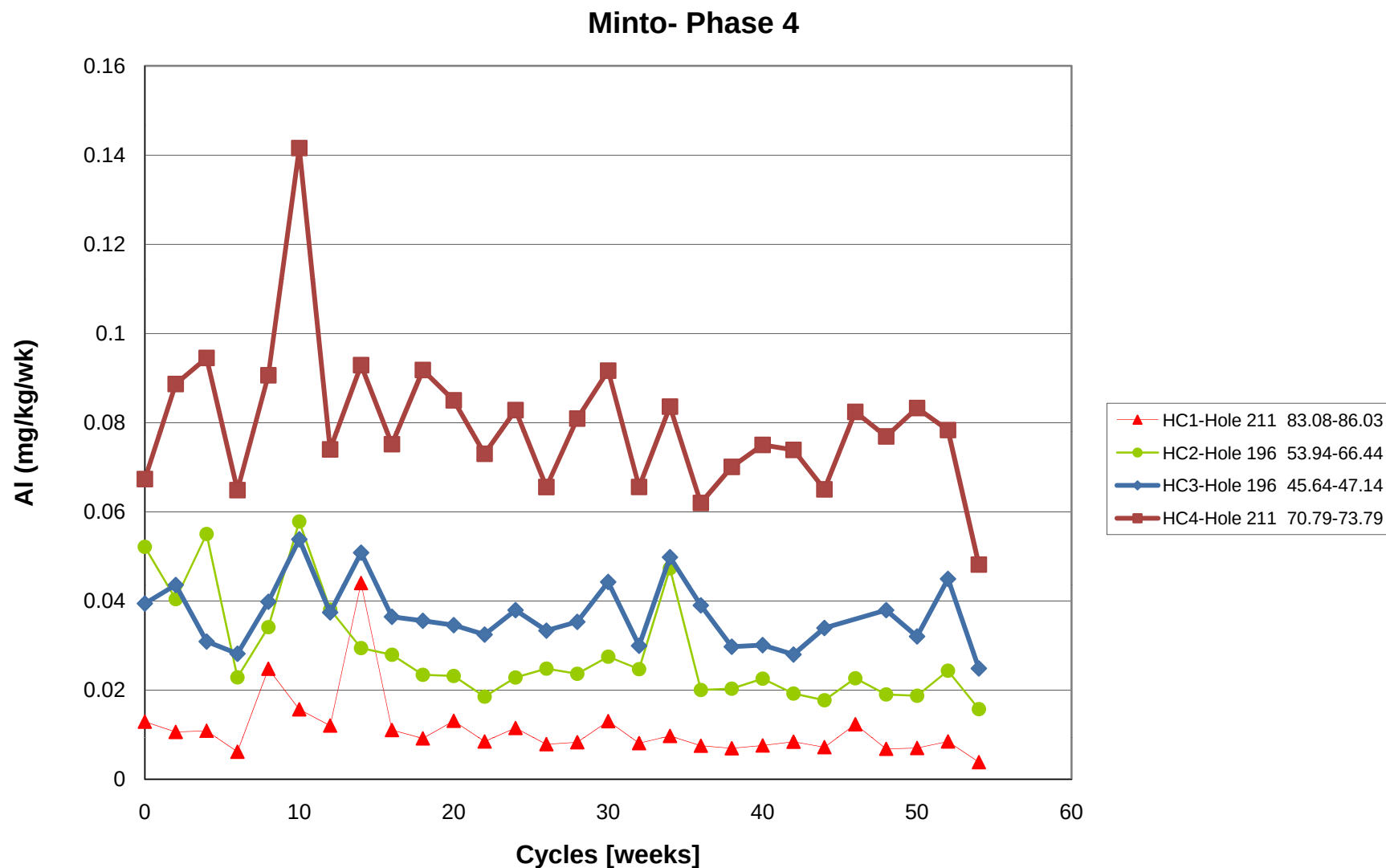


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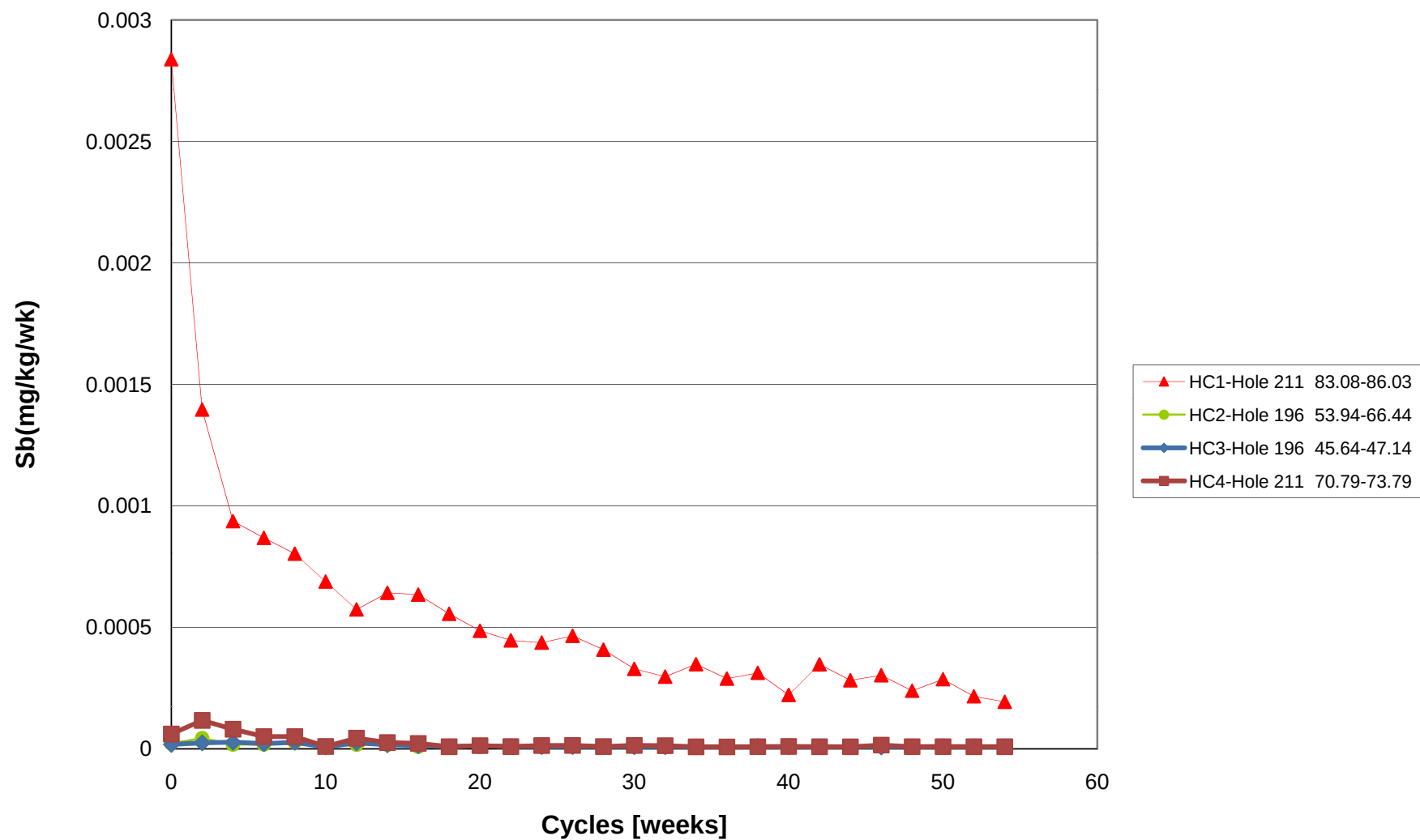


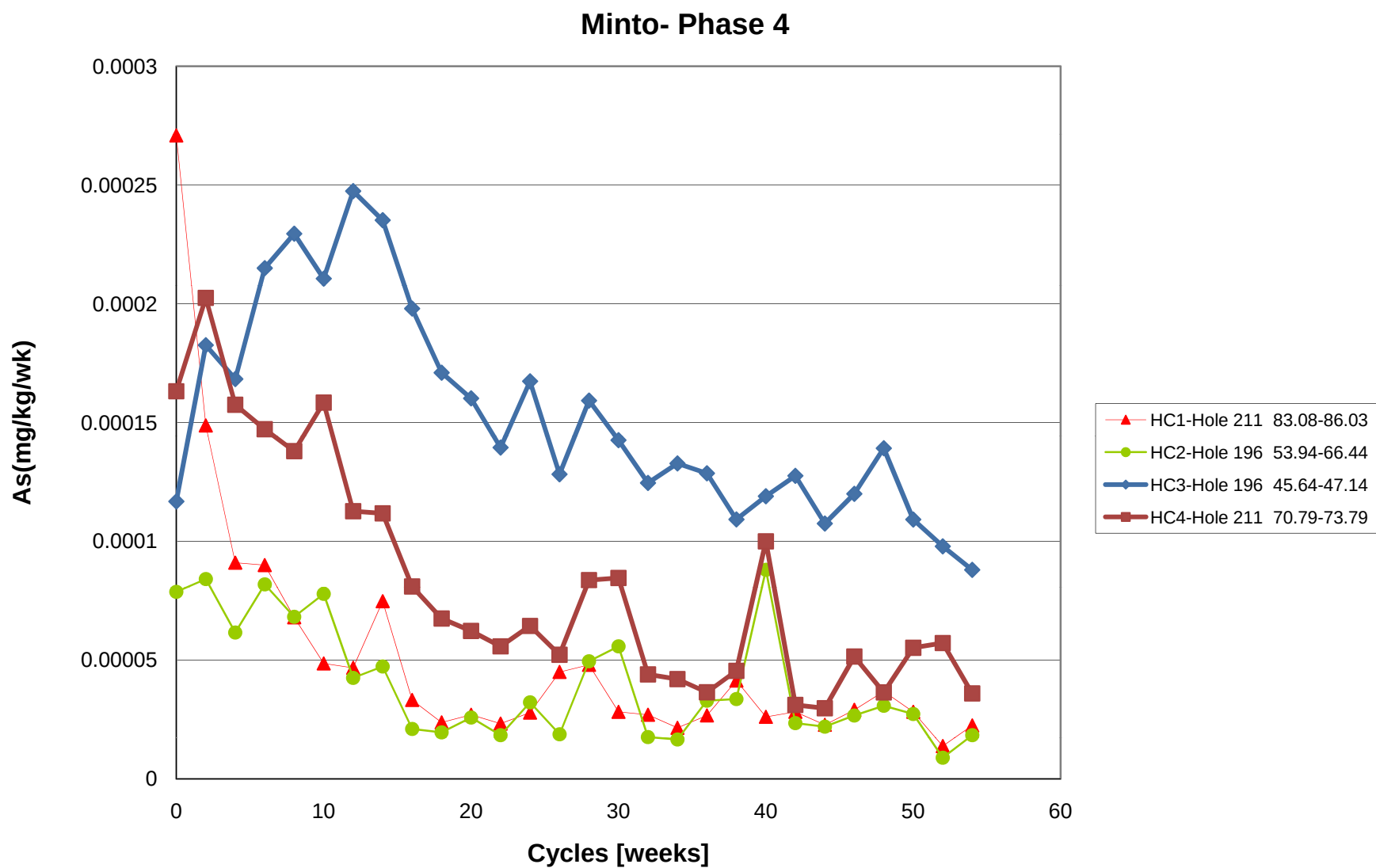
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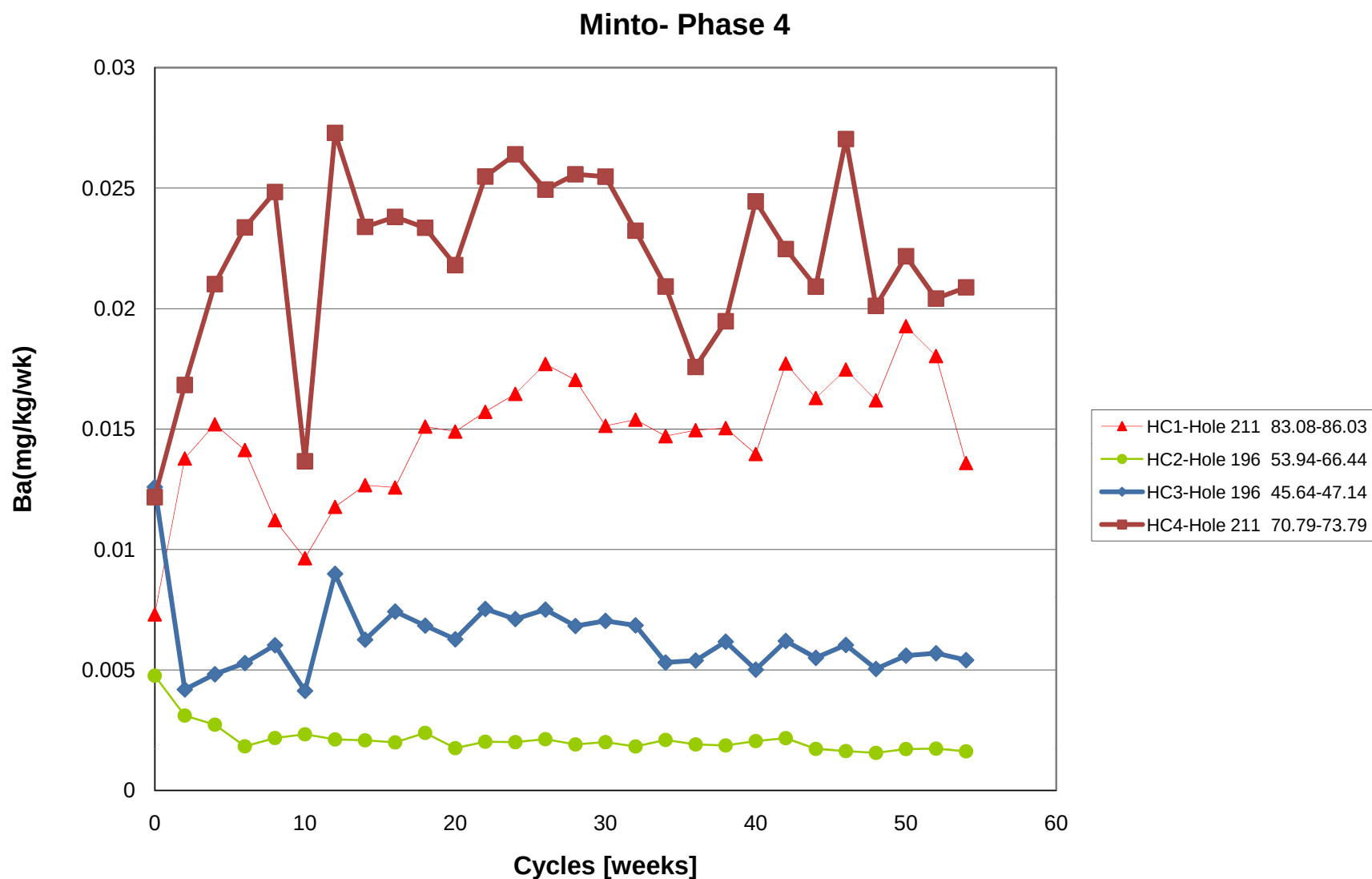


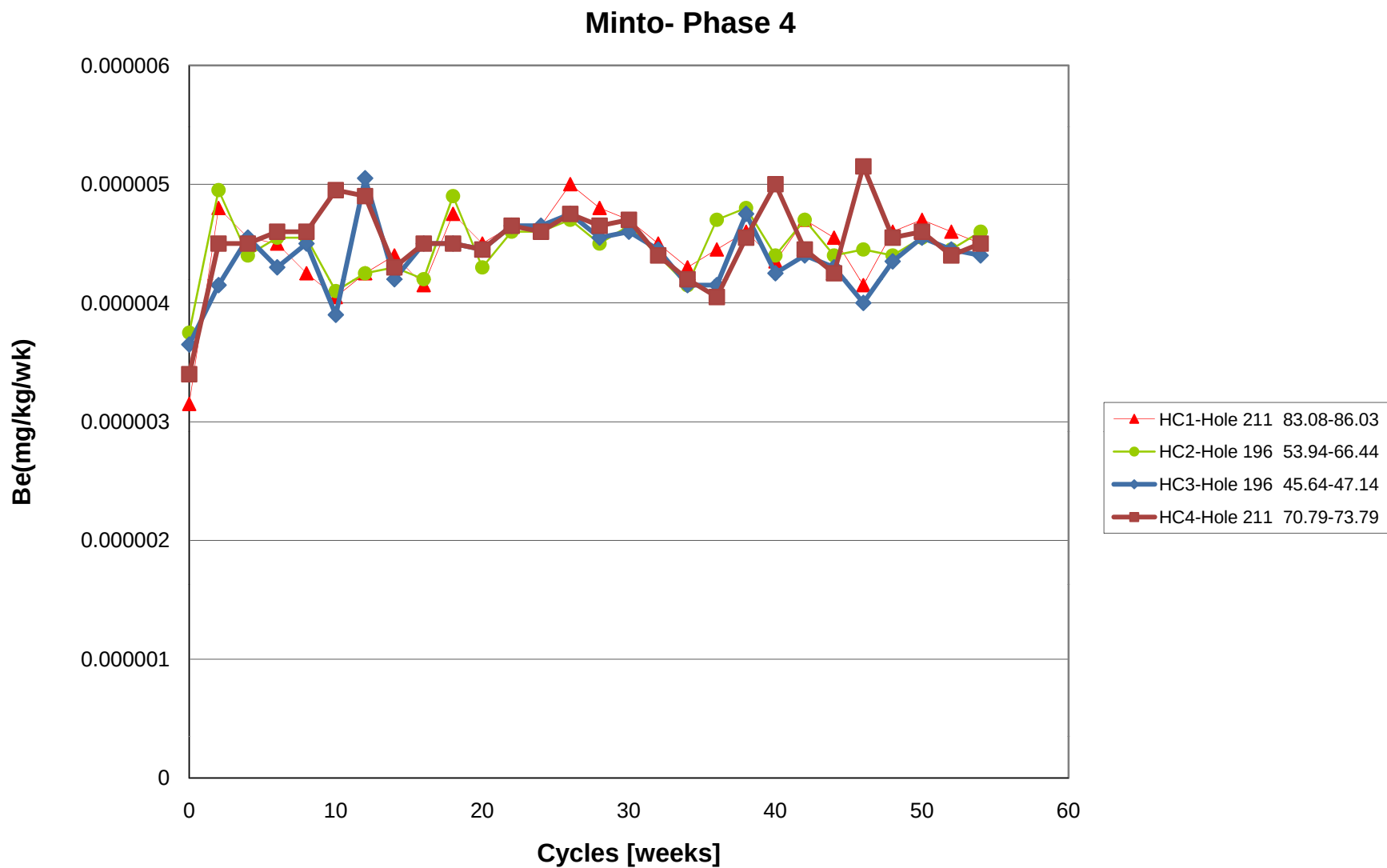


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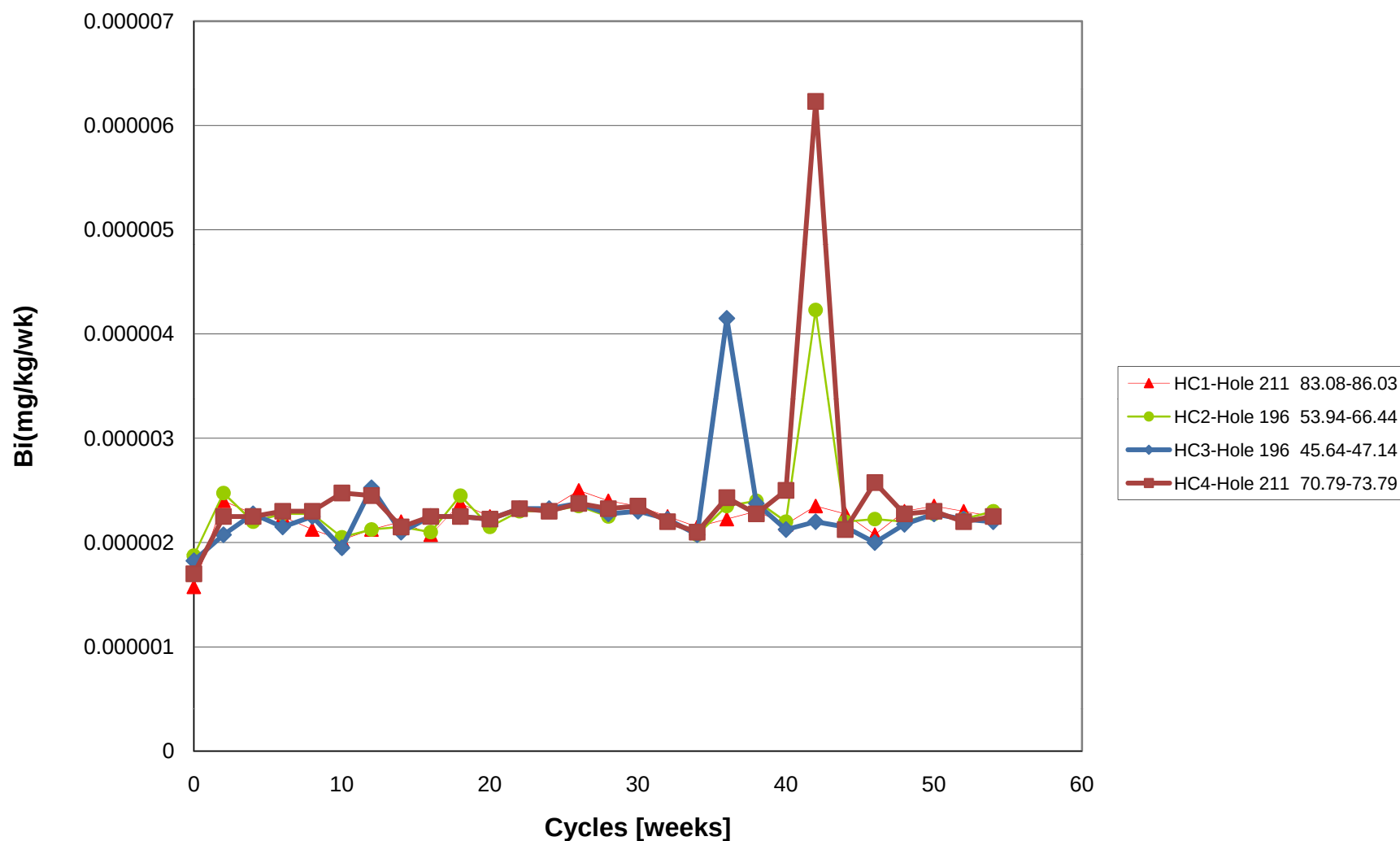


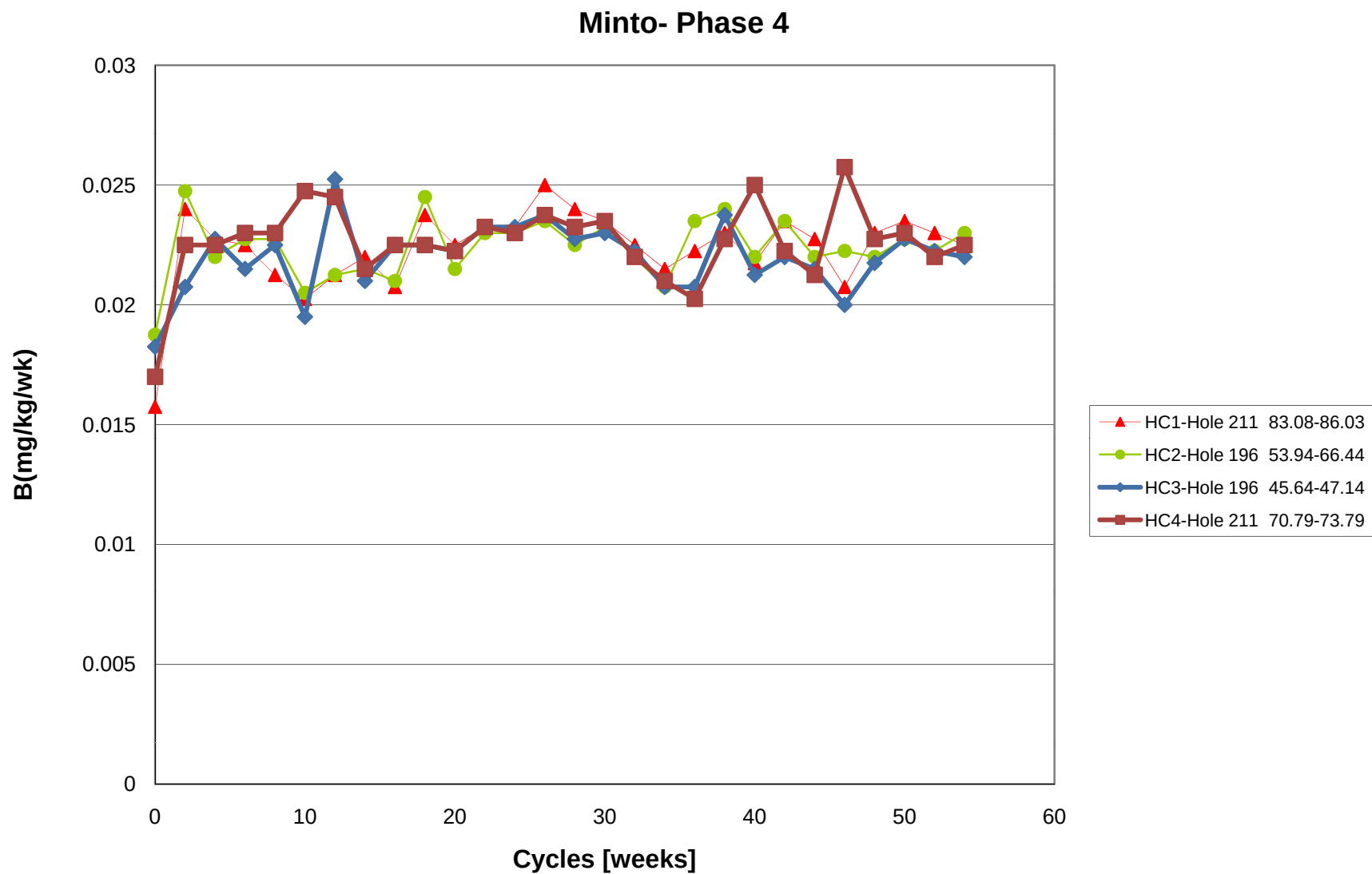


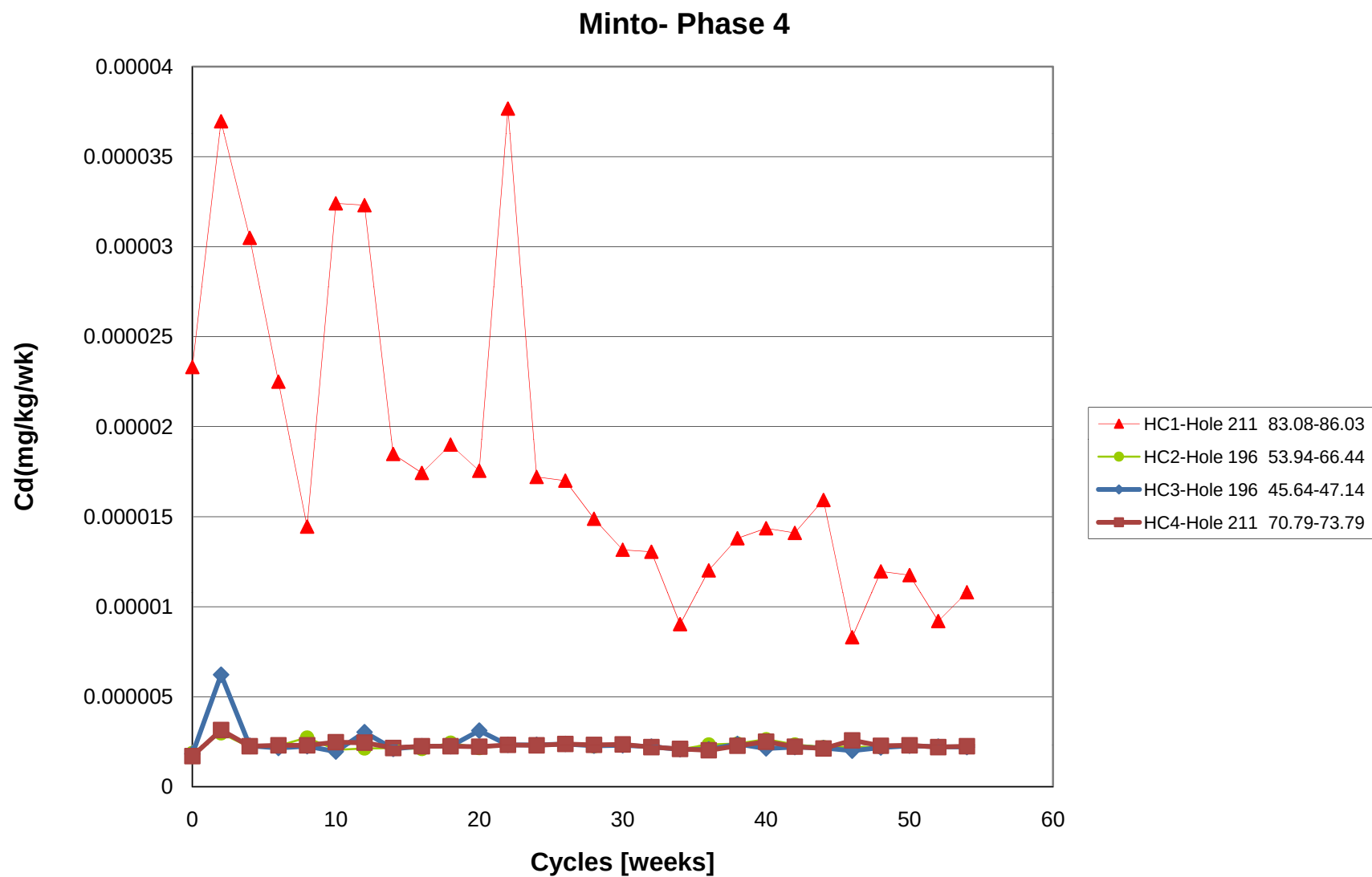


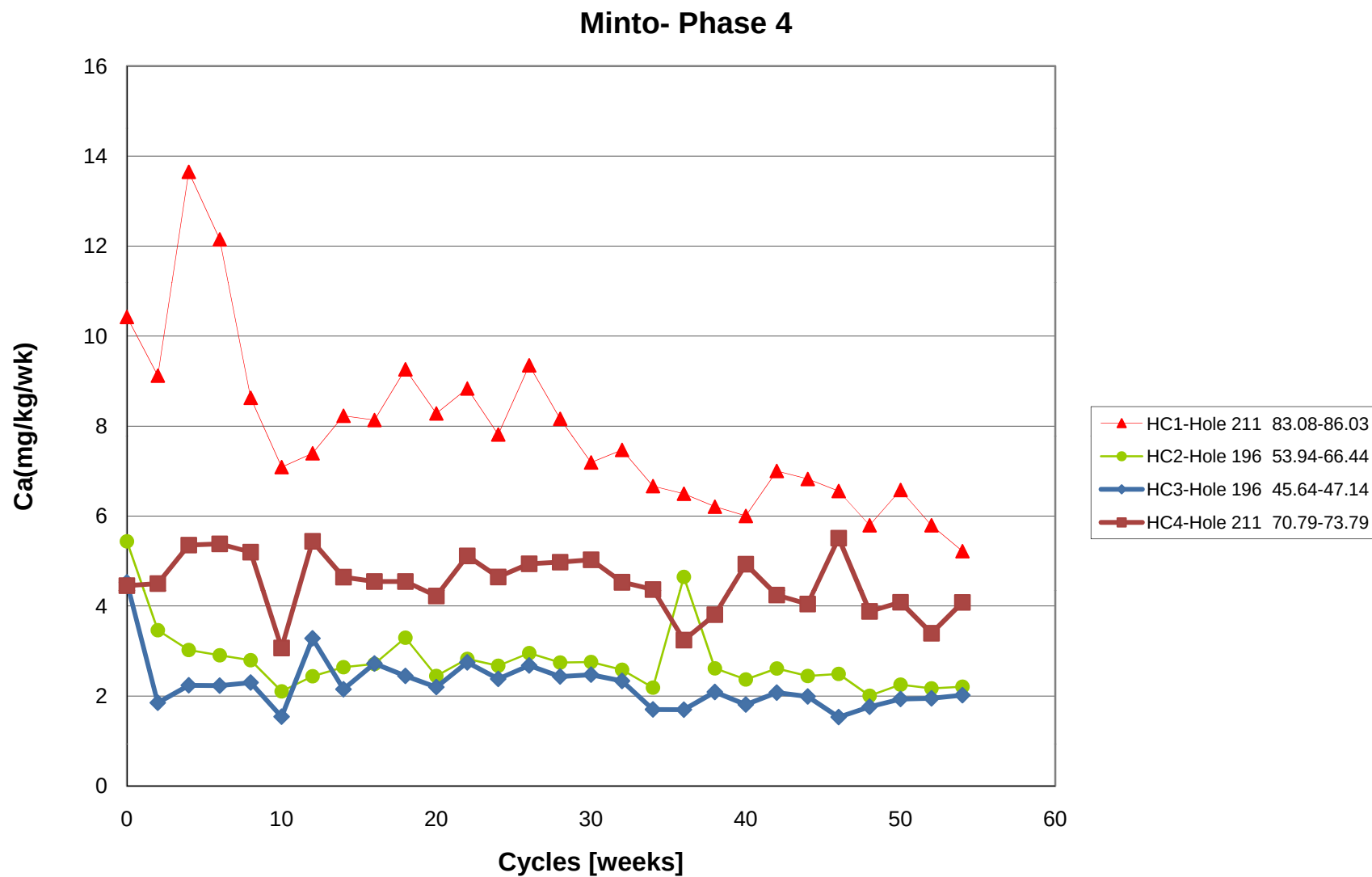


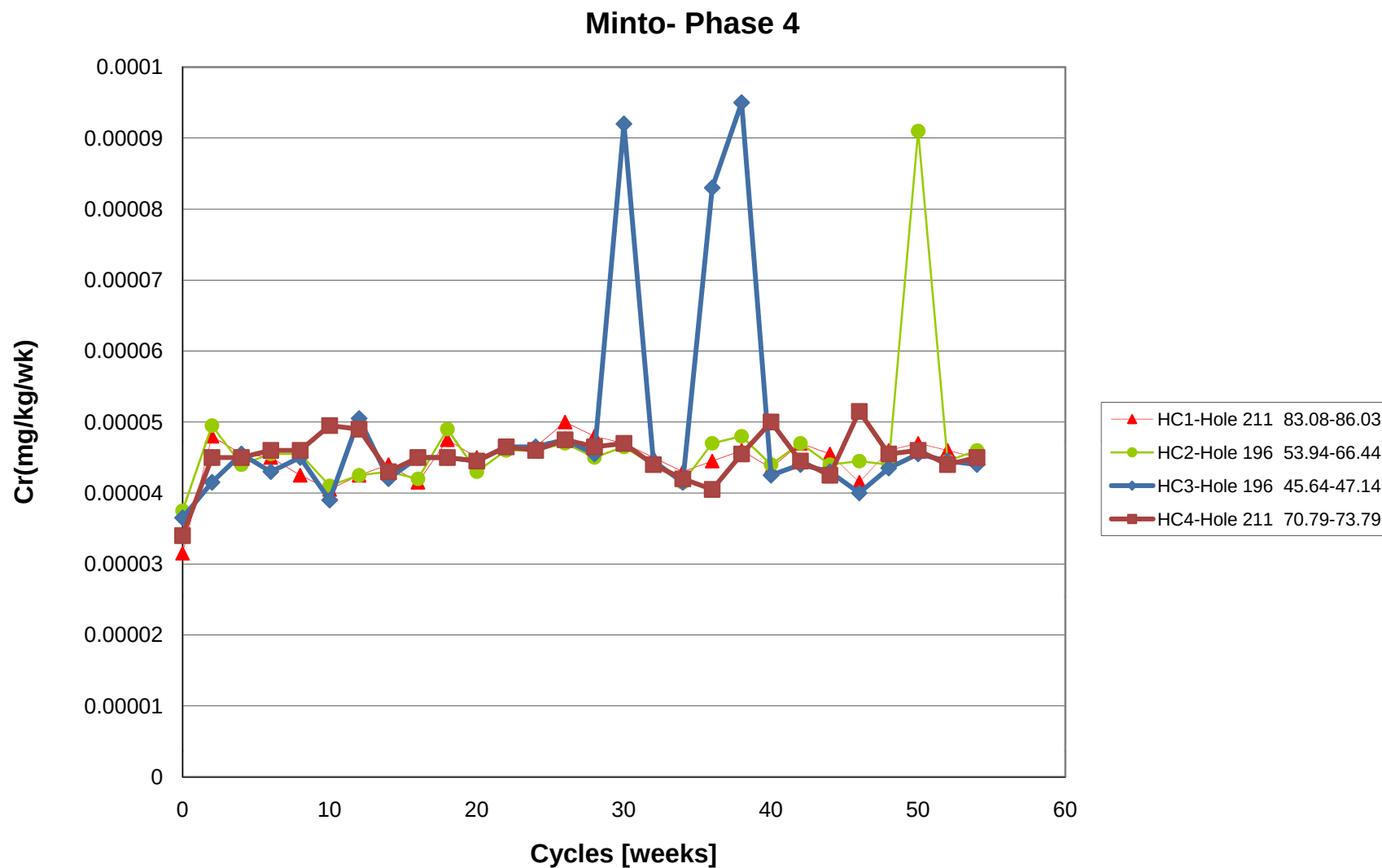
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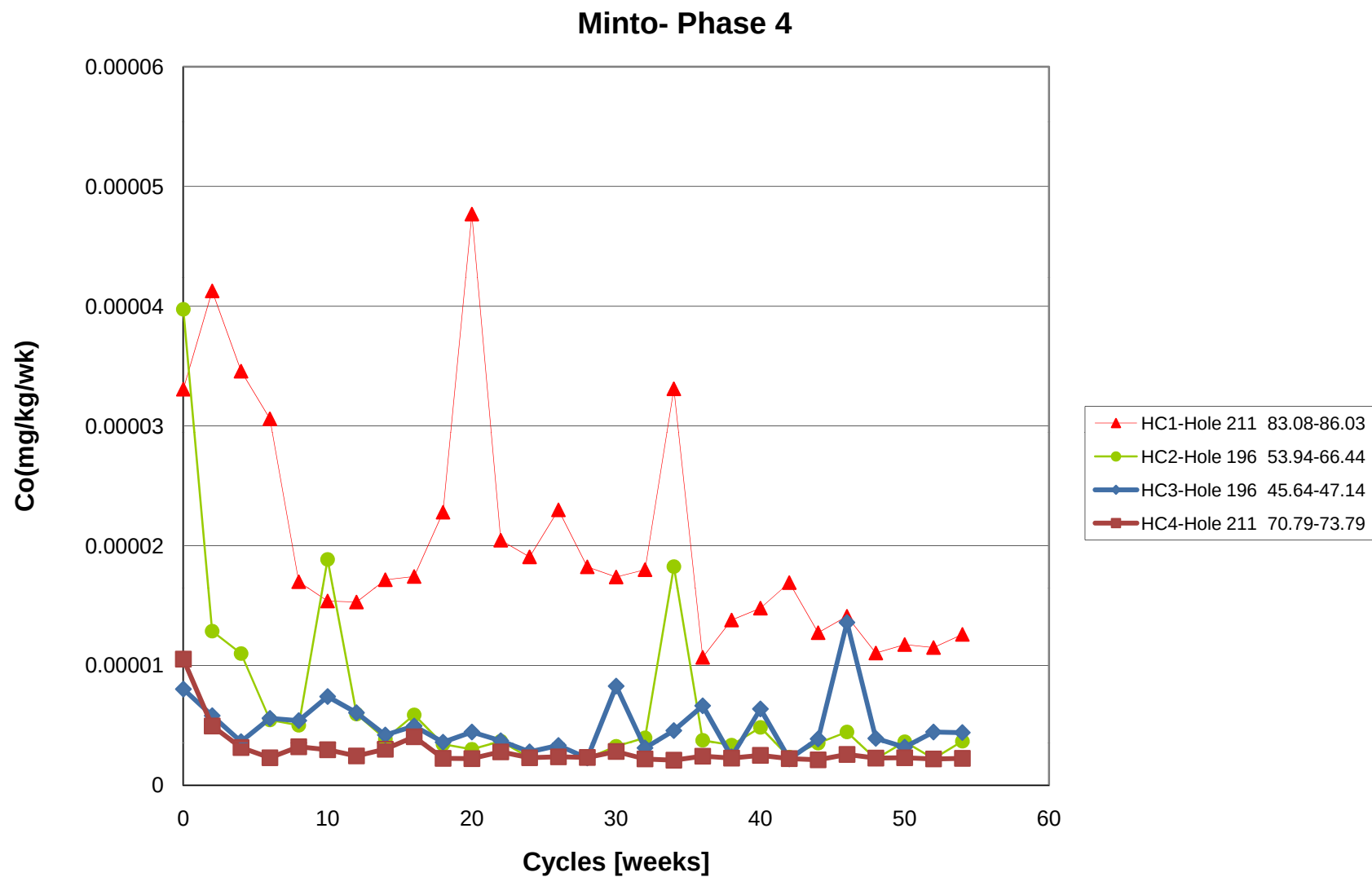


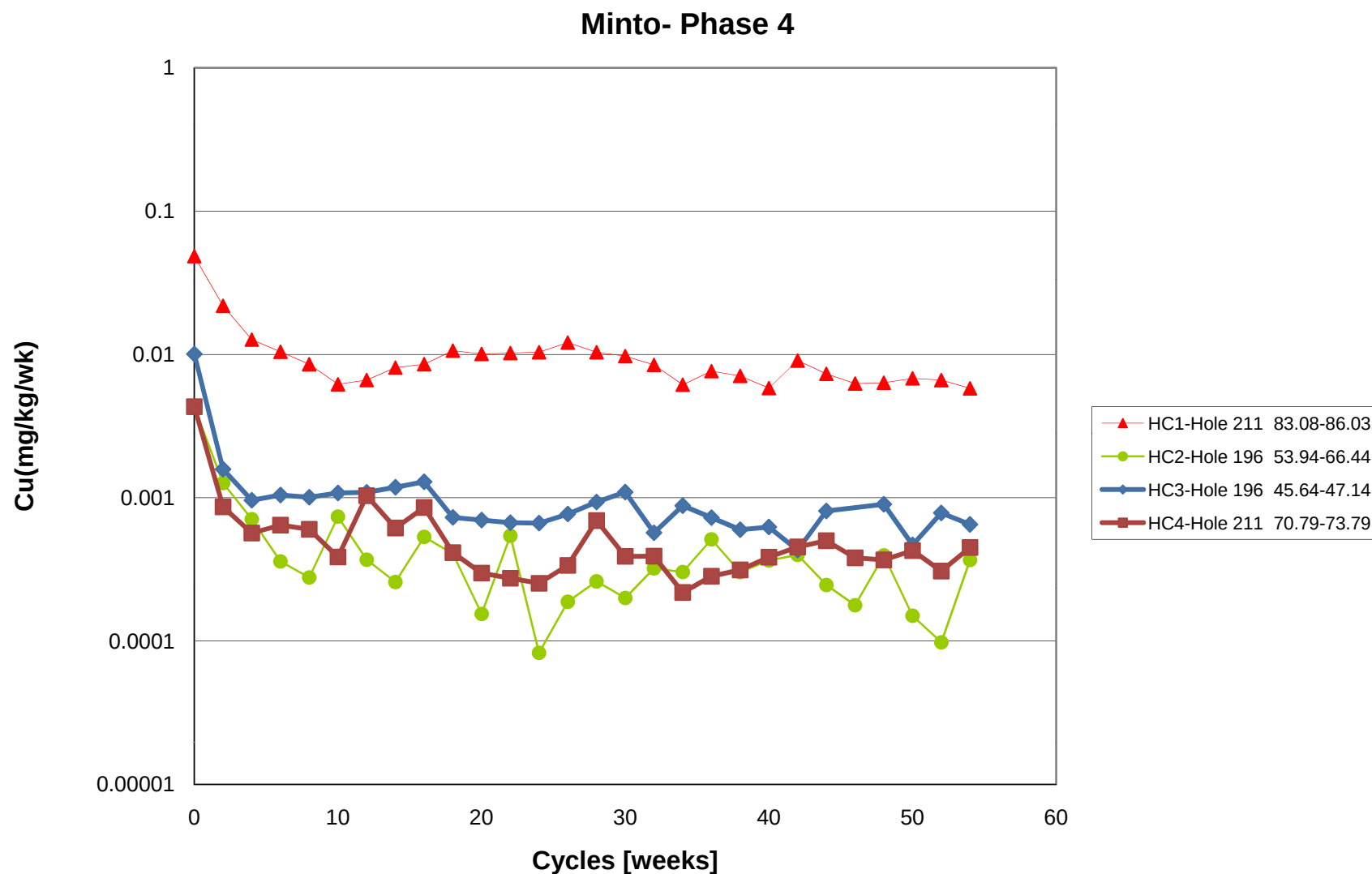


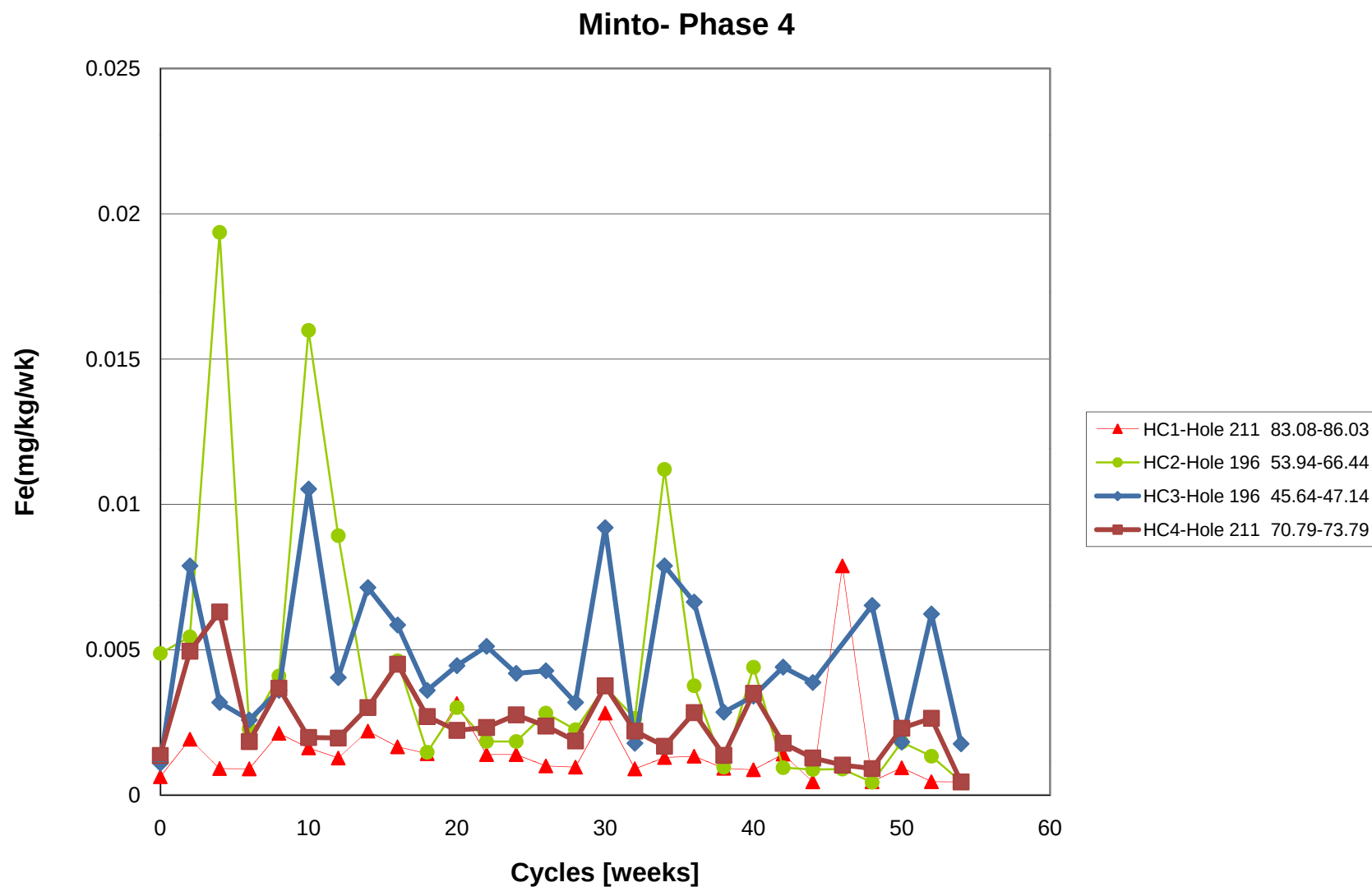


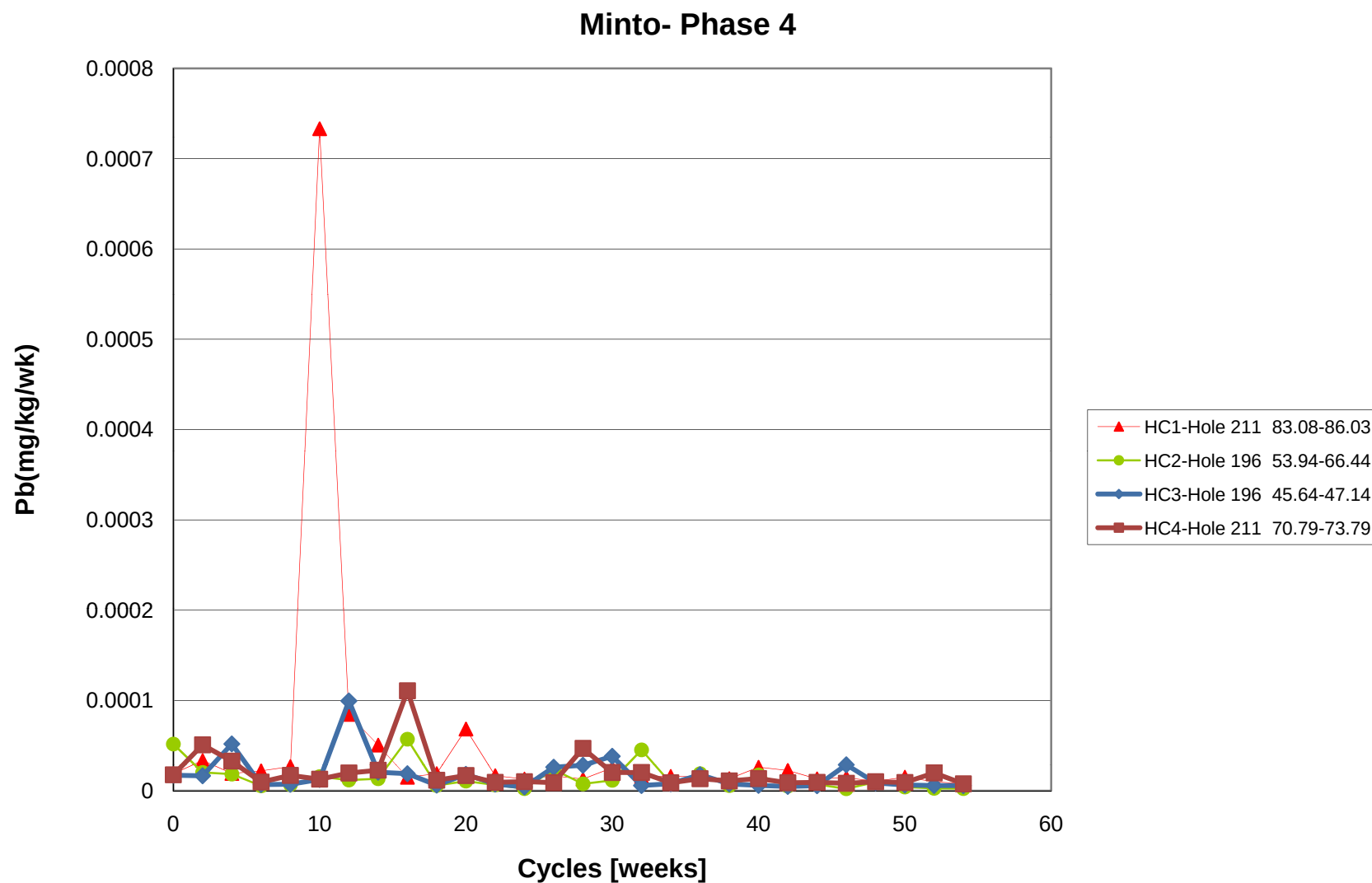


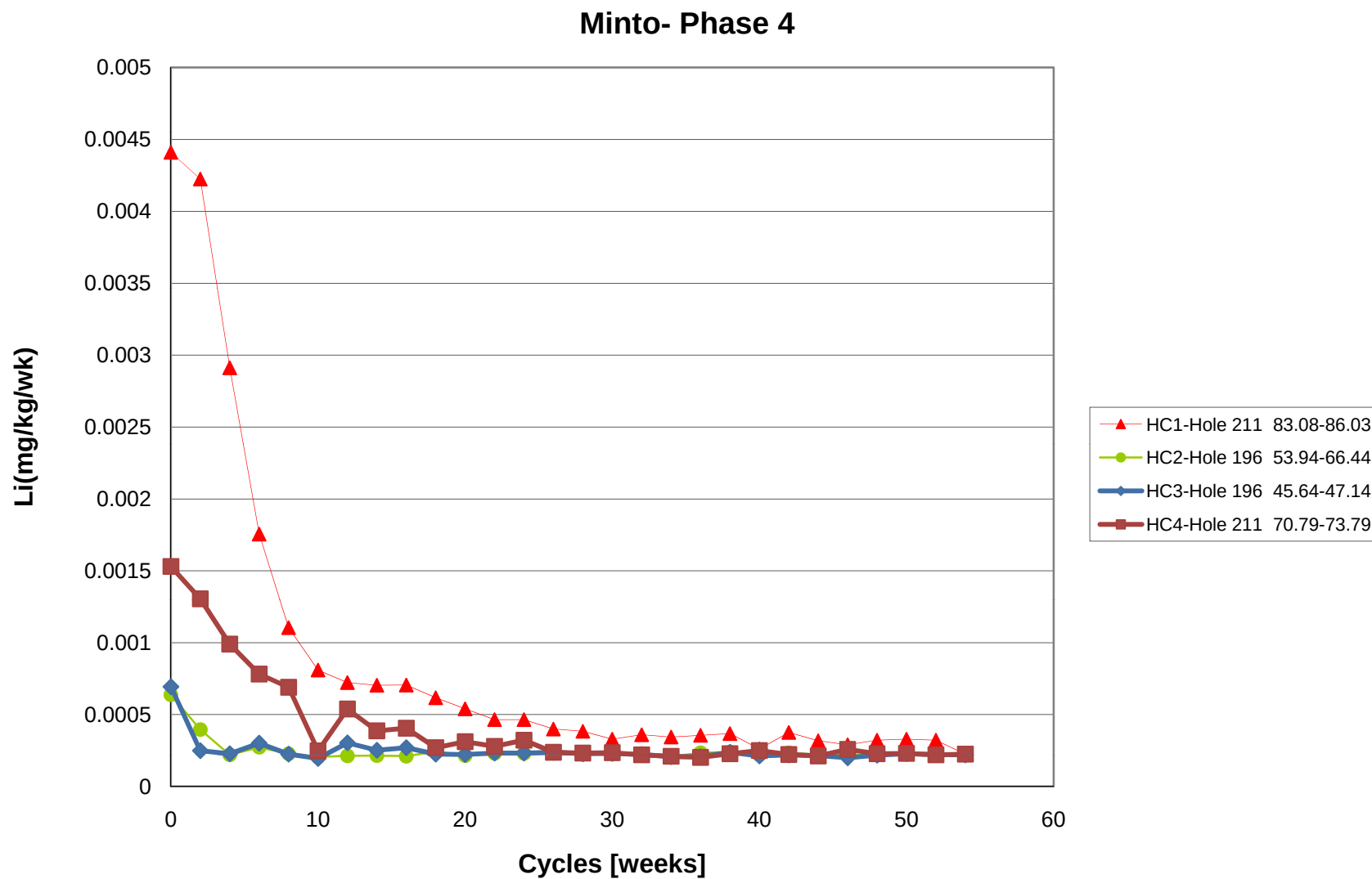


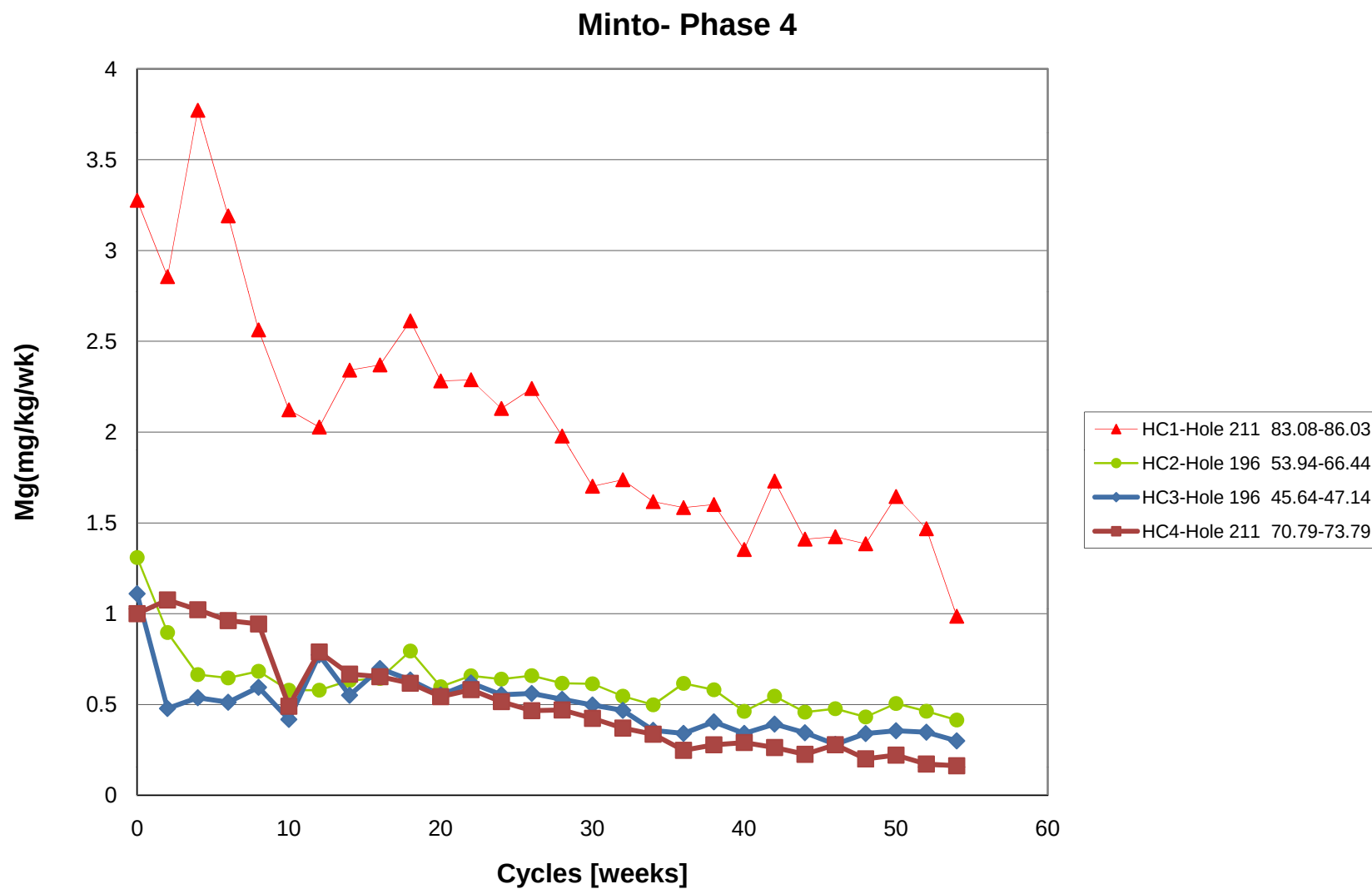


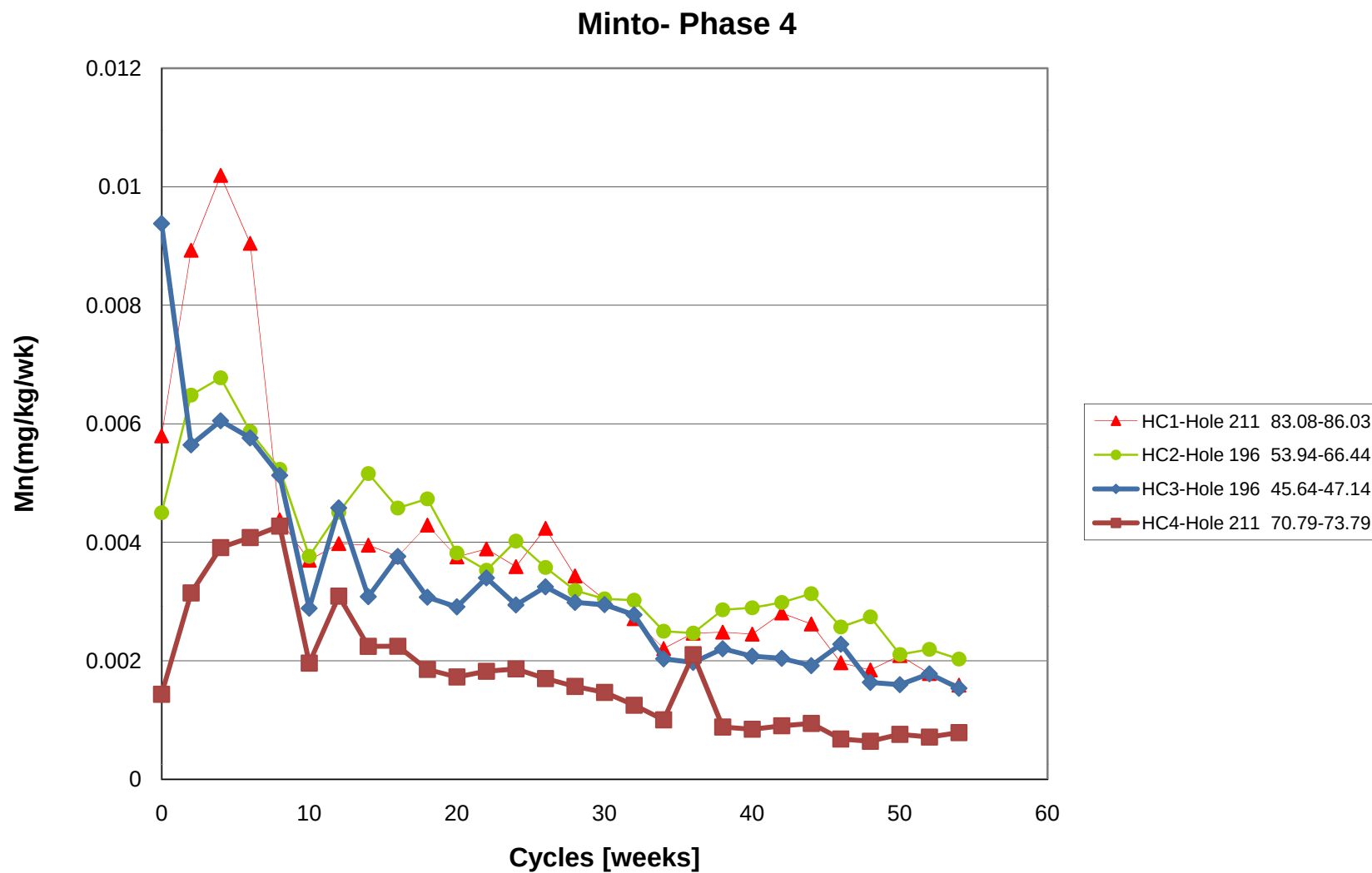


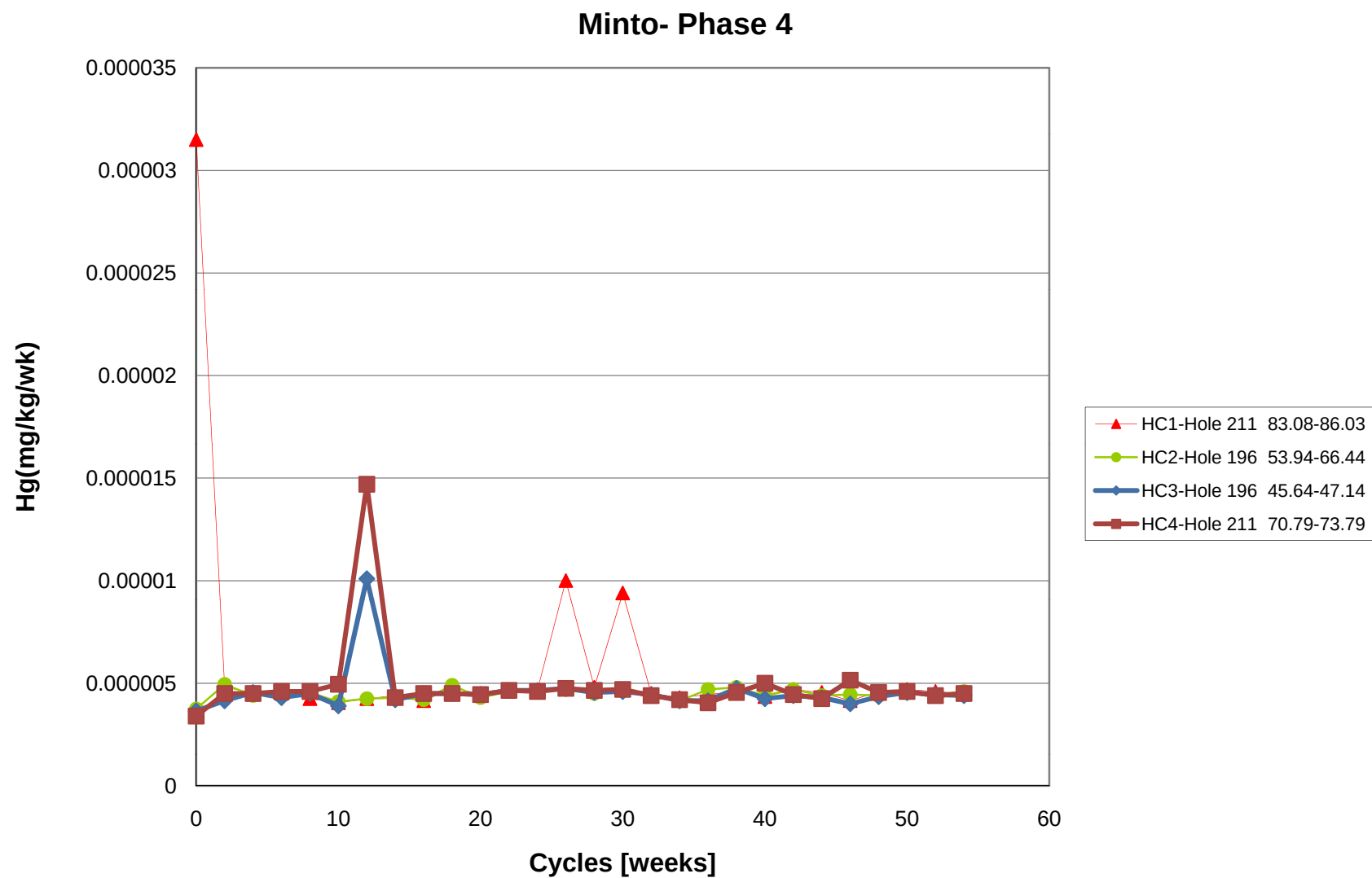


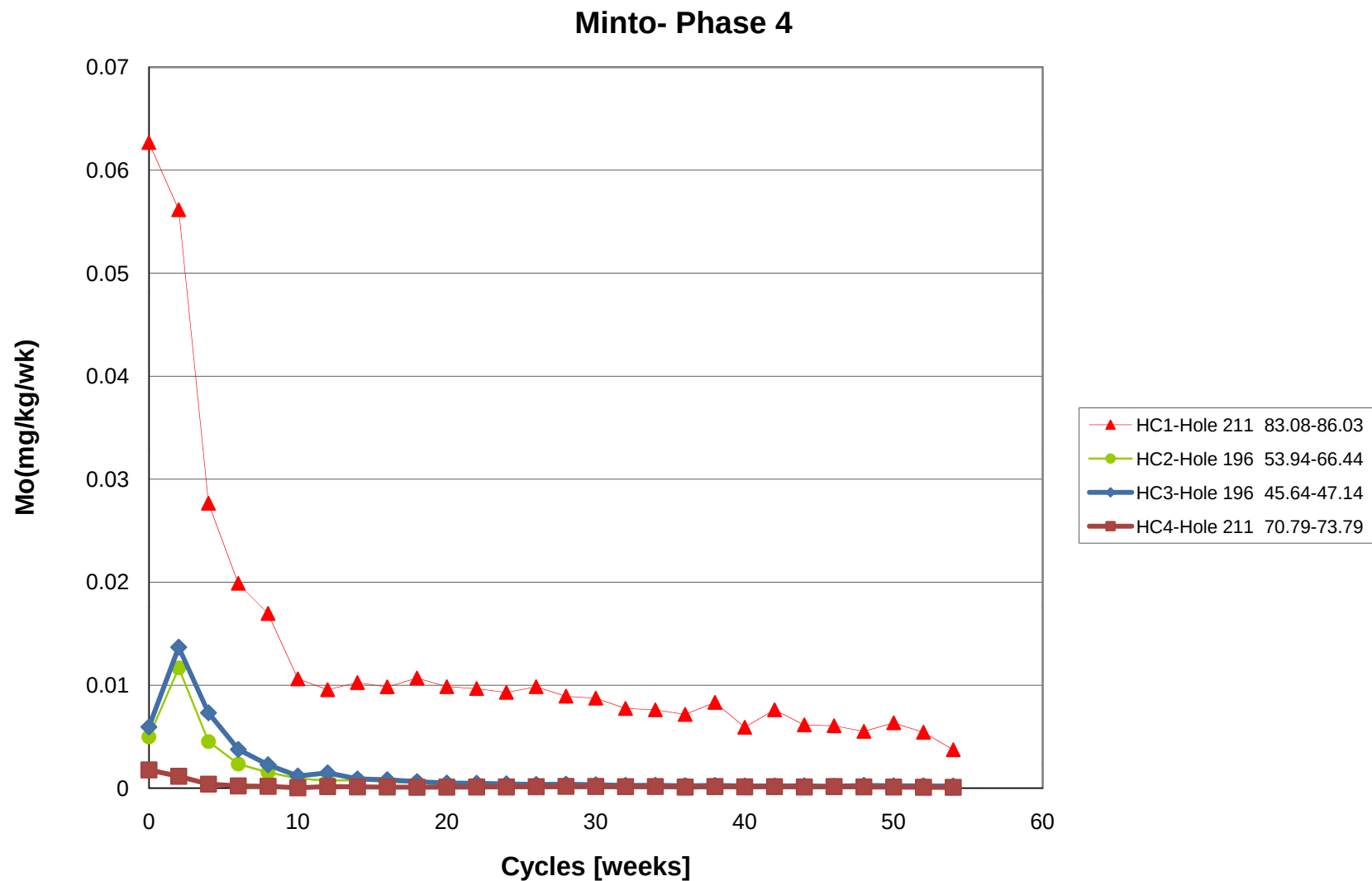


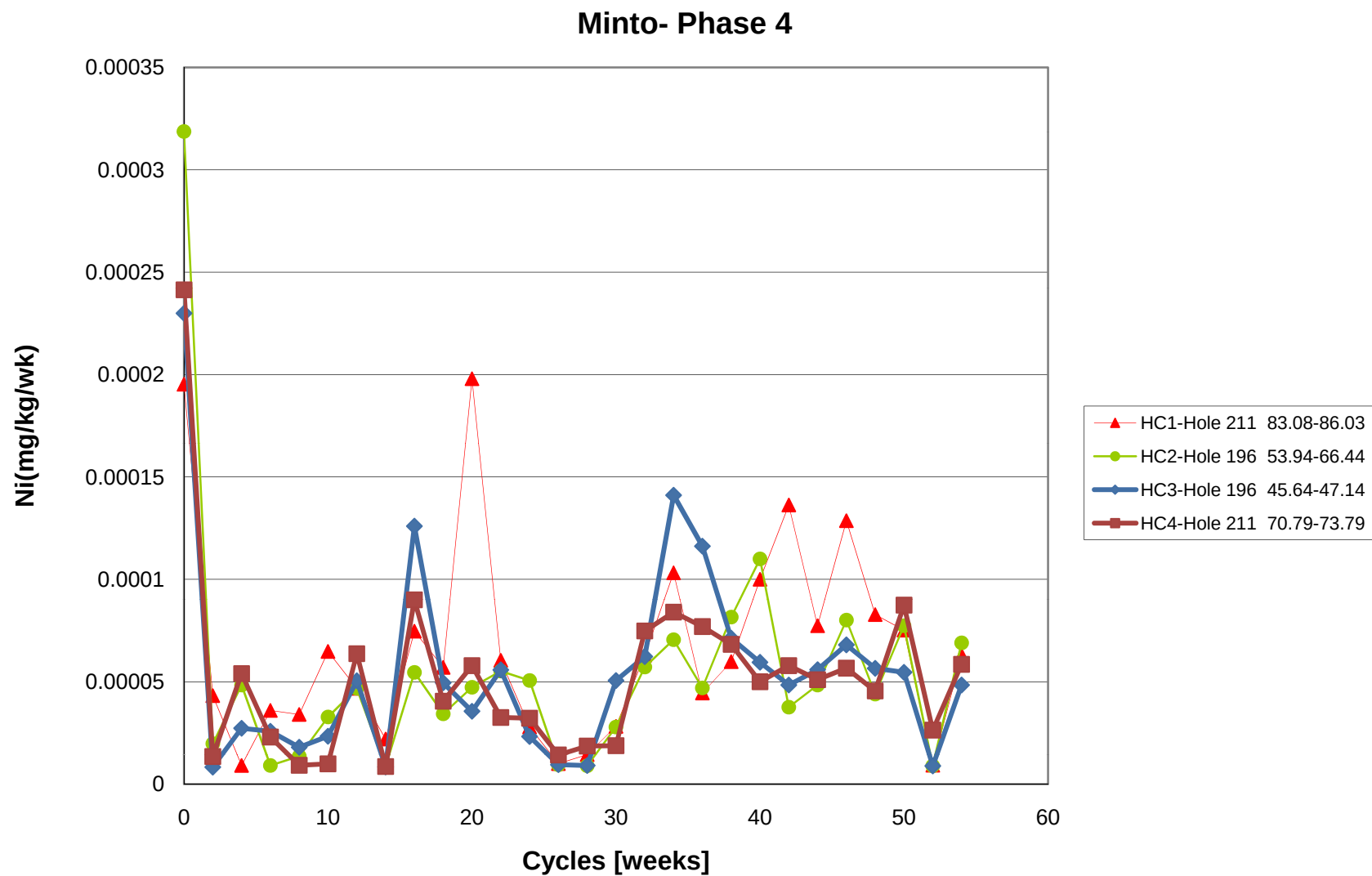


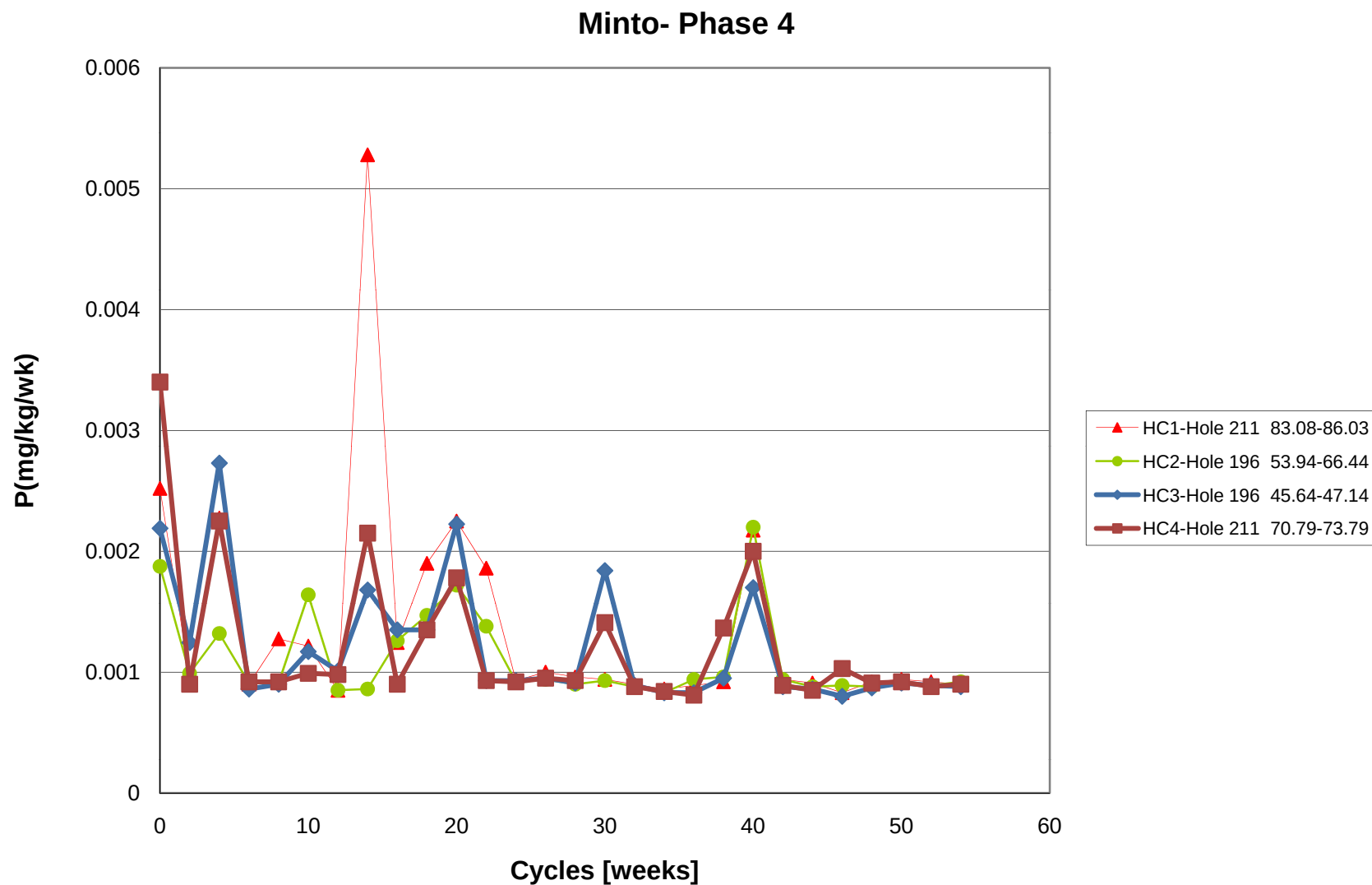




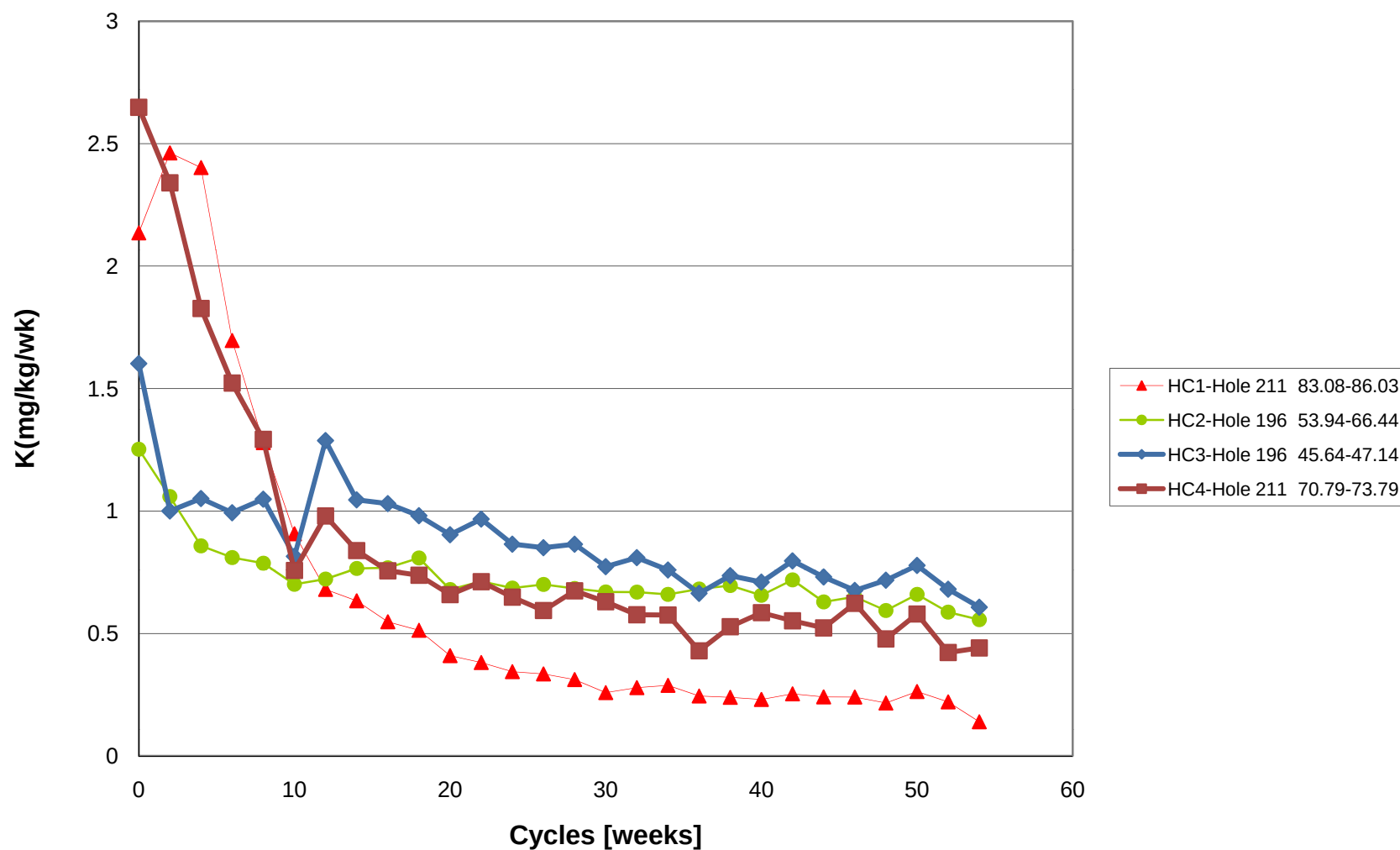


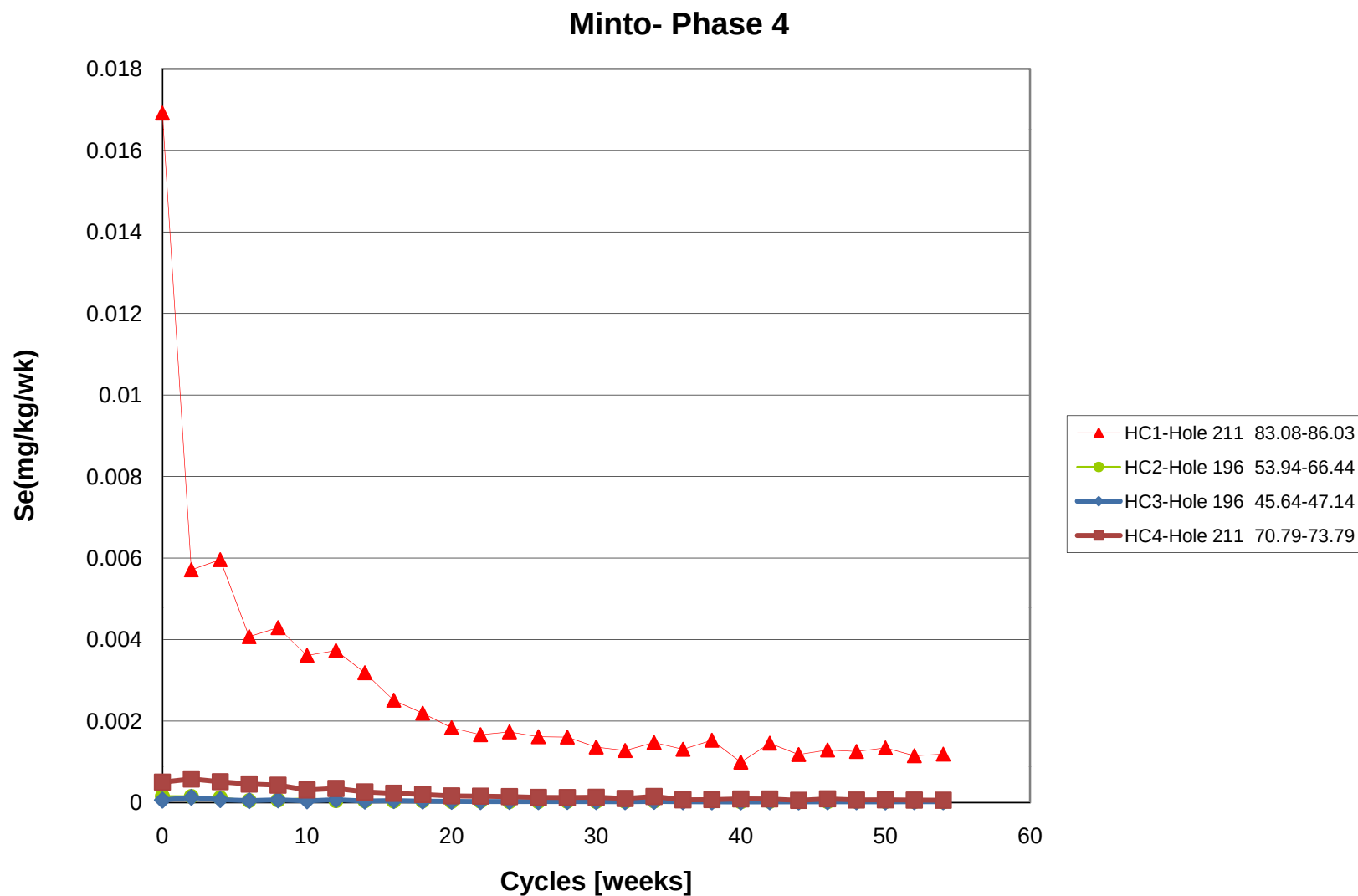


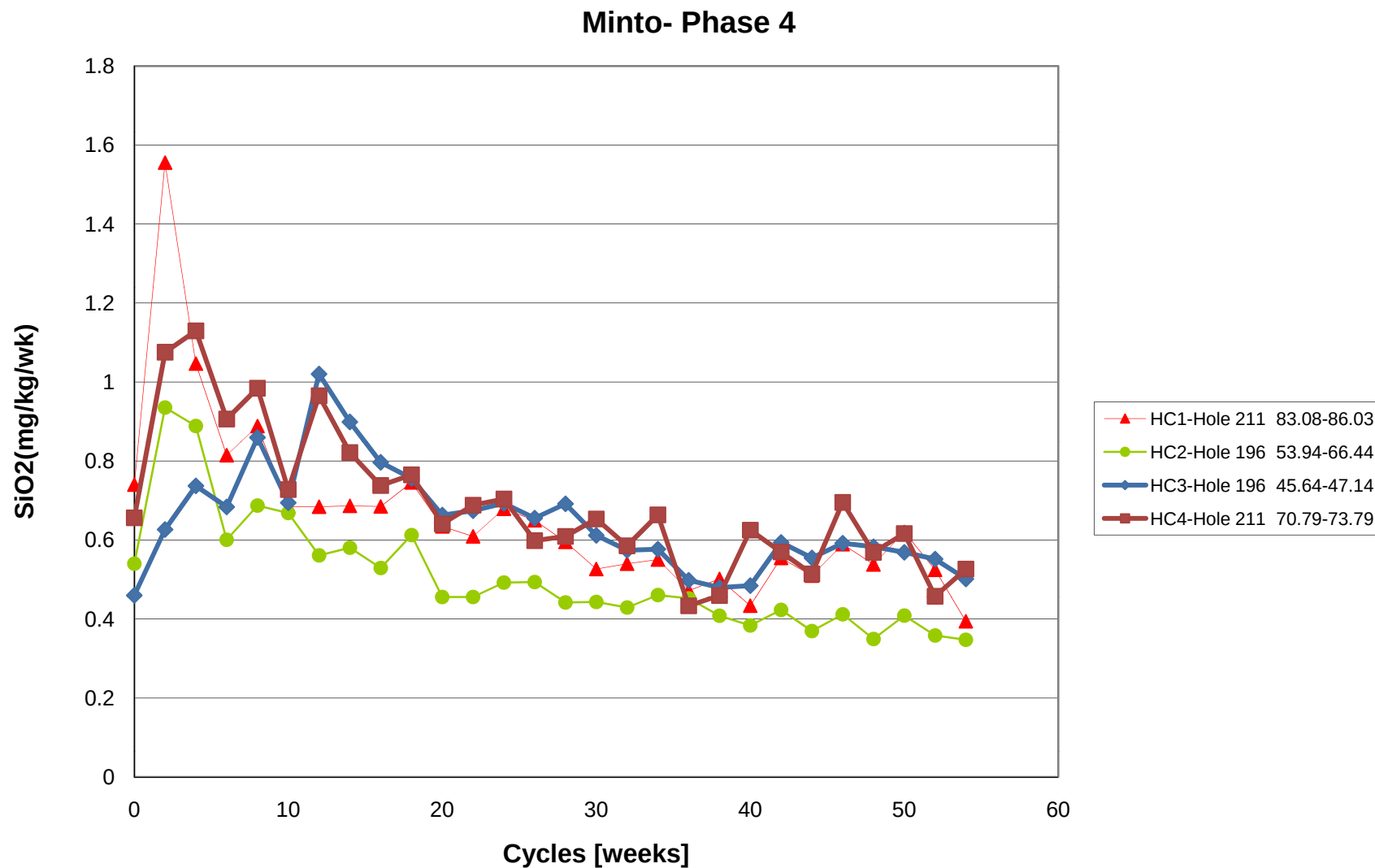


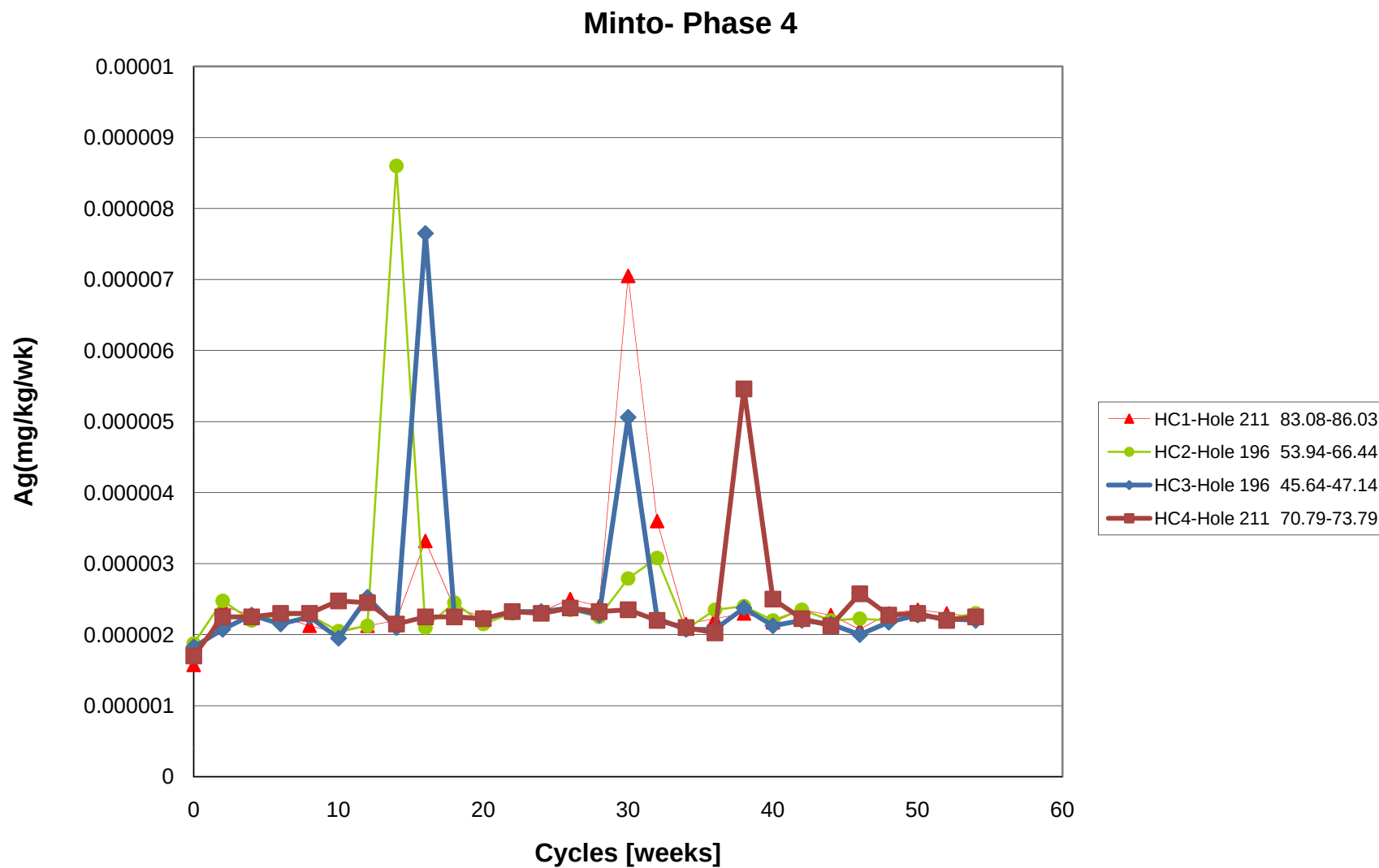


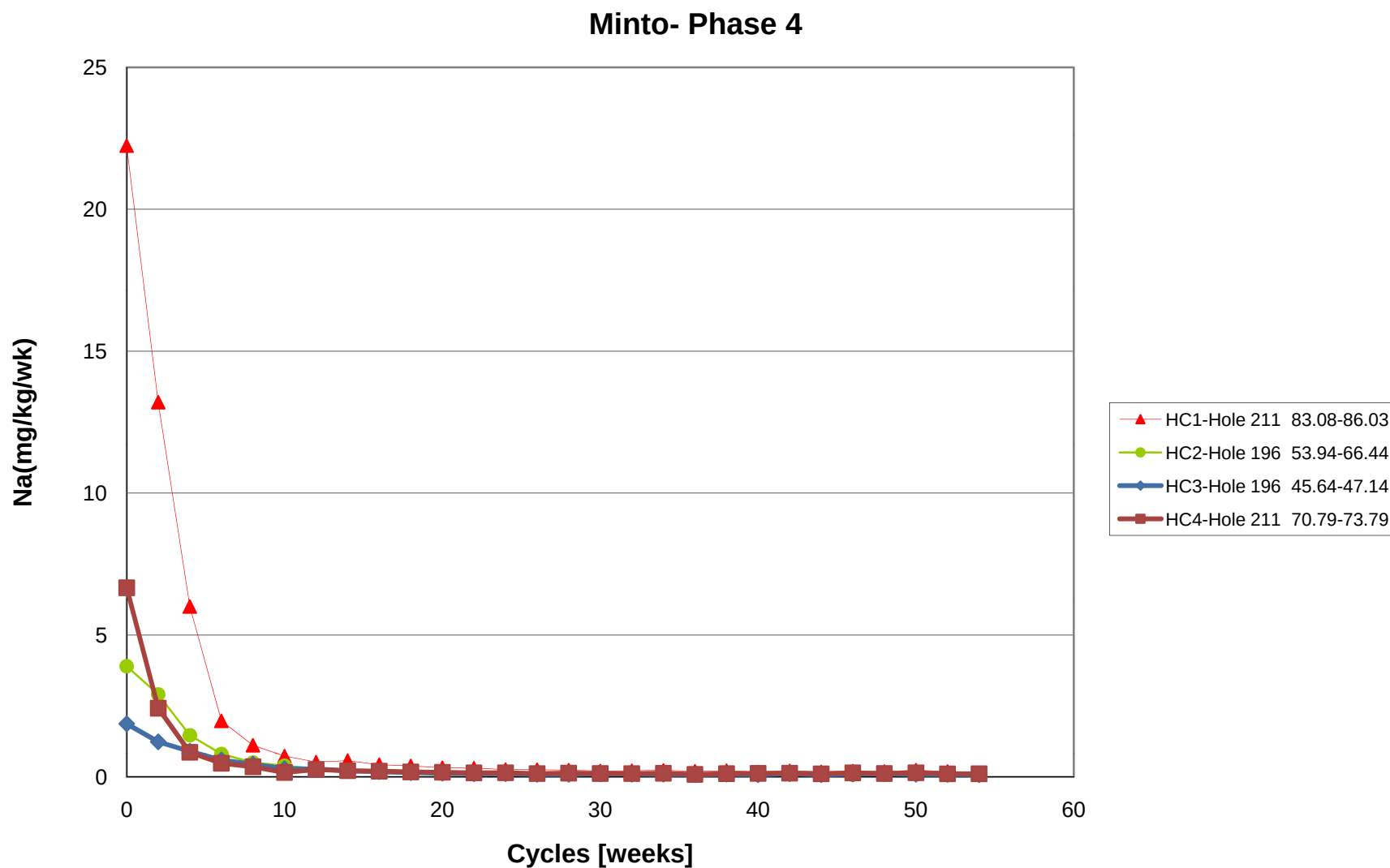
Minto- Phase 4

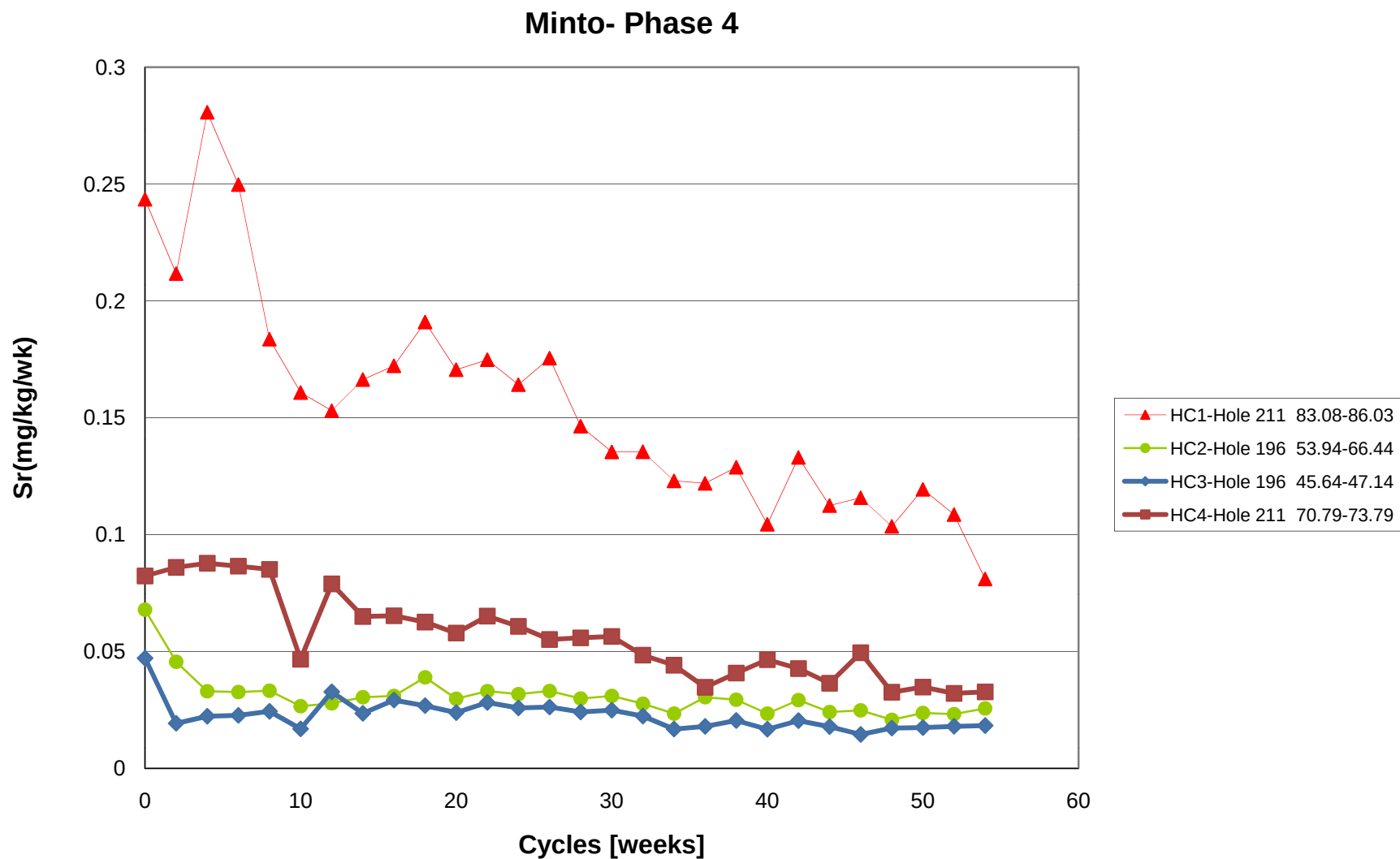


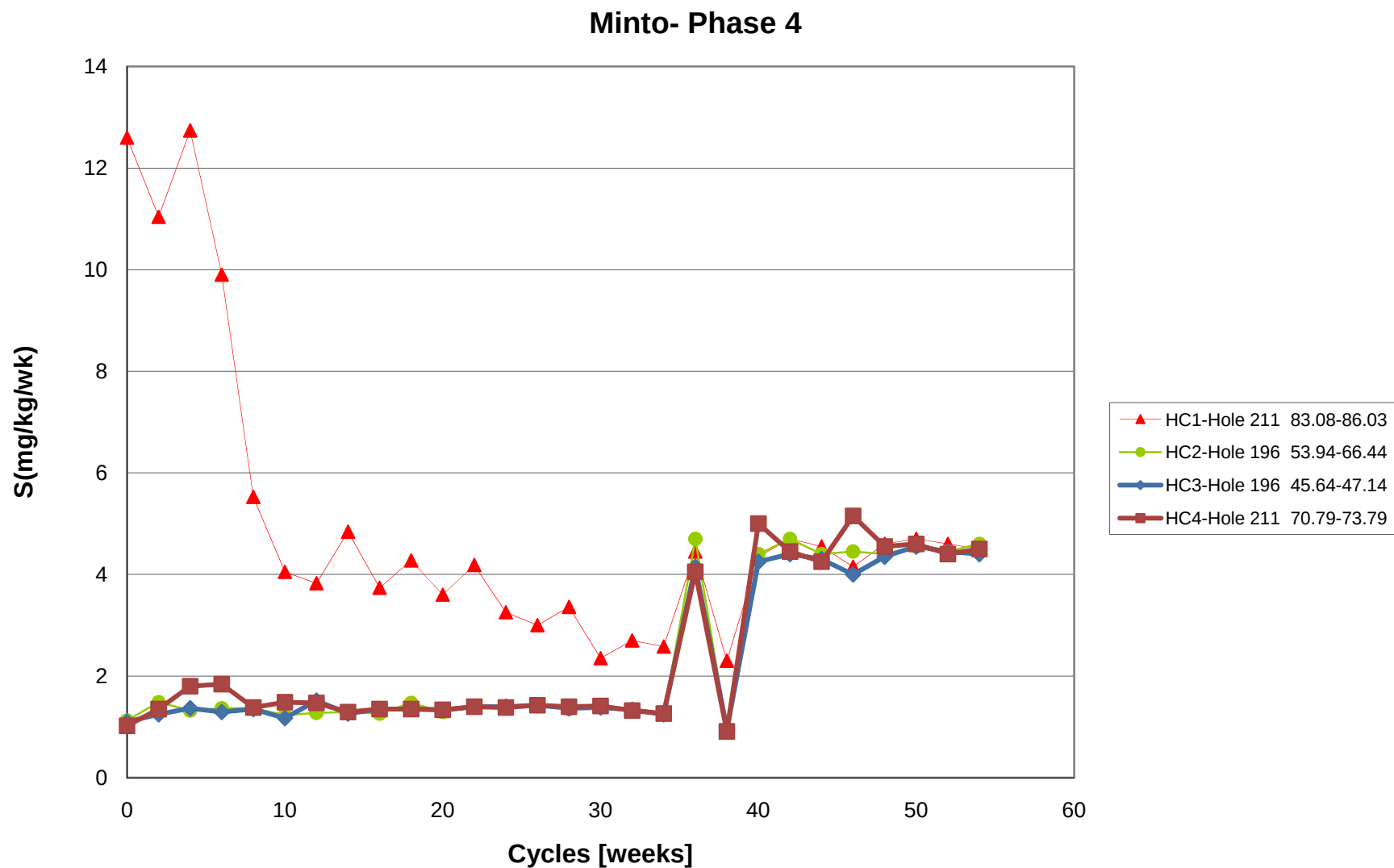


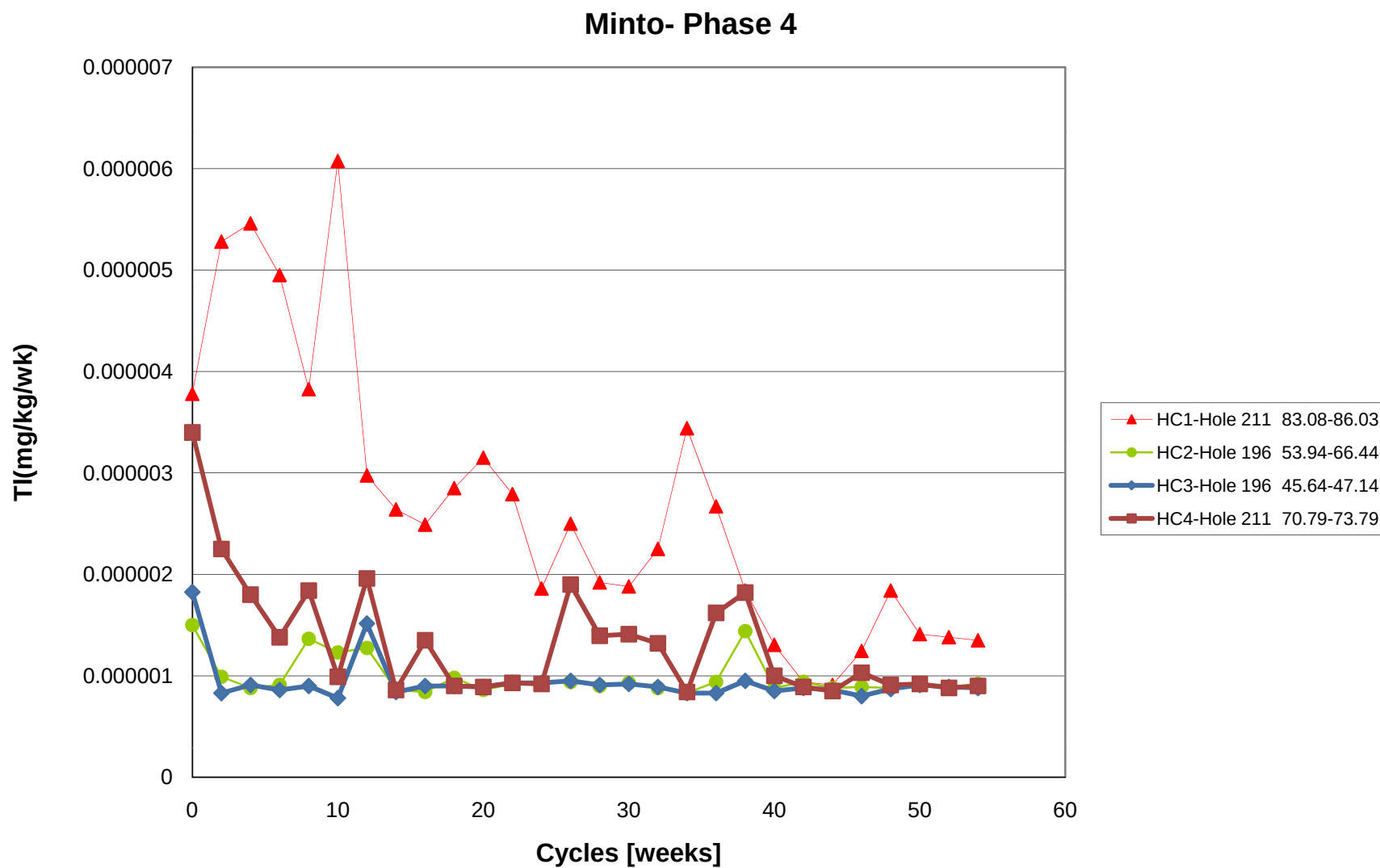




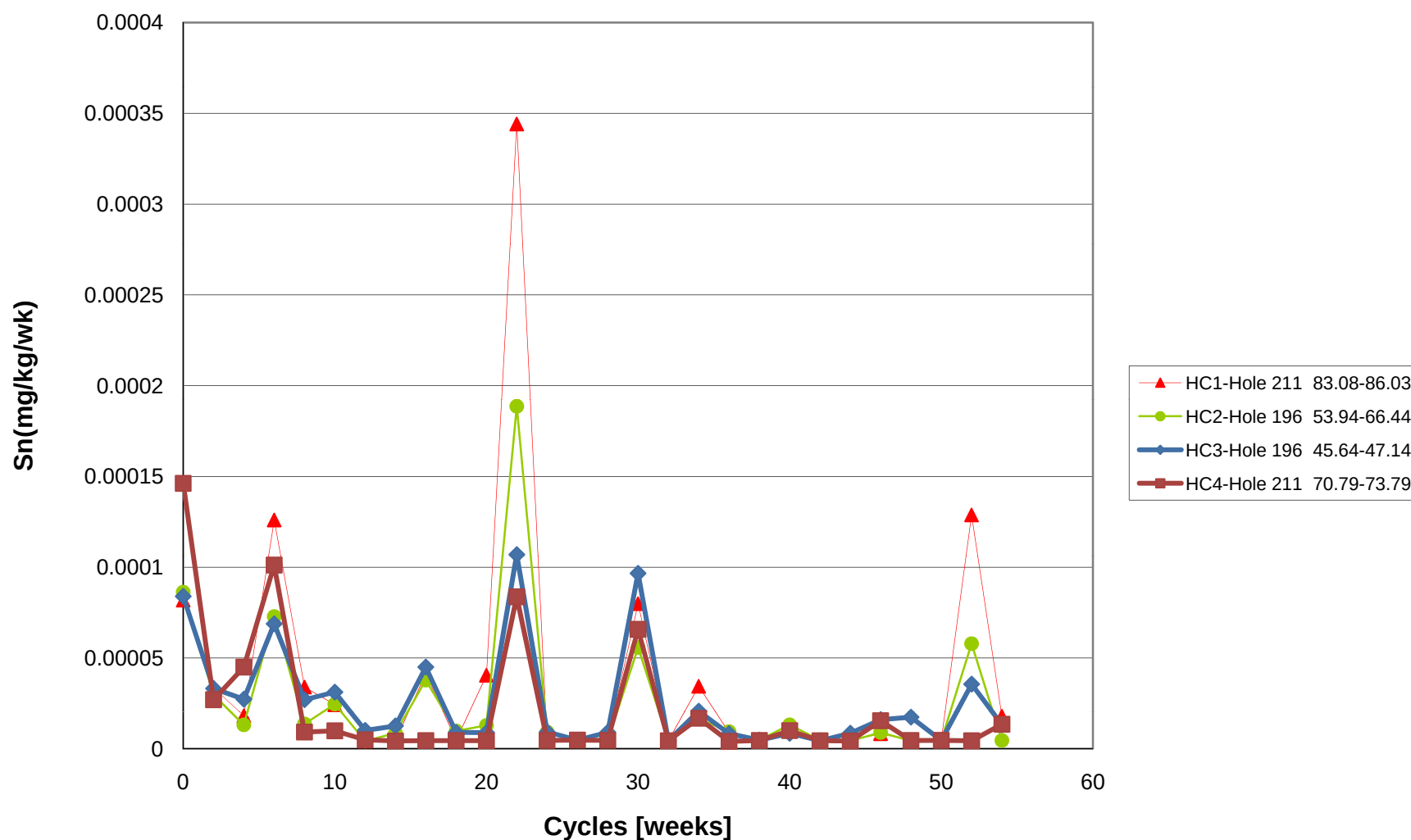


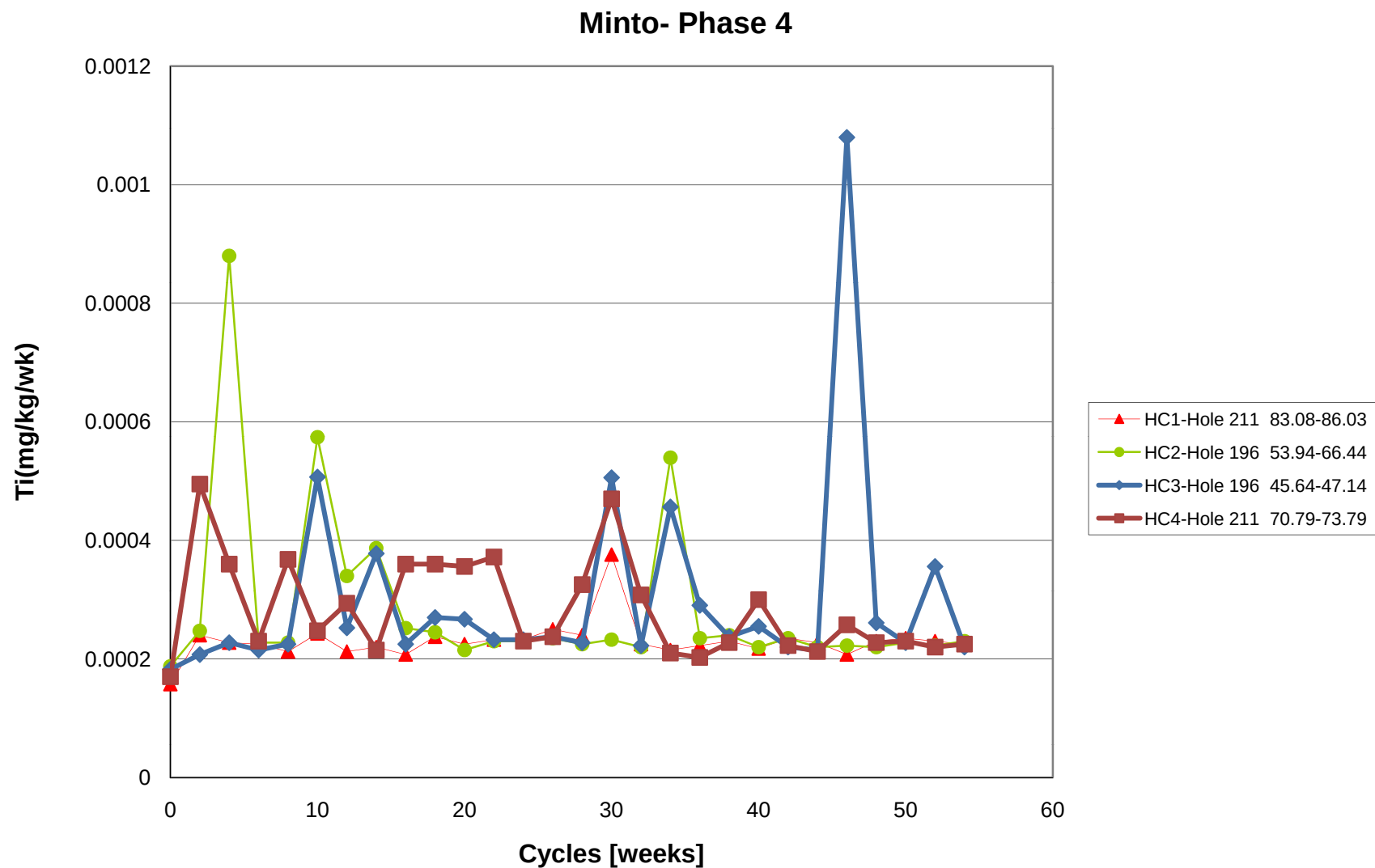


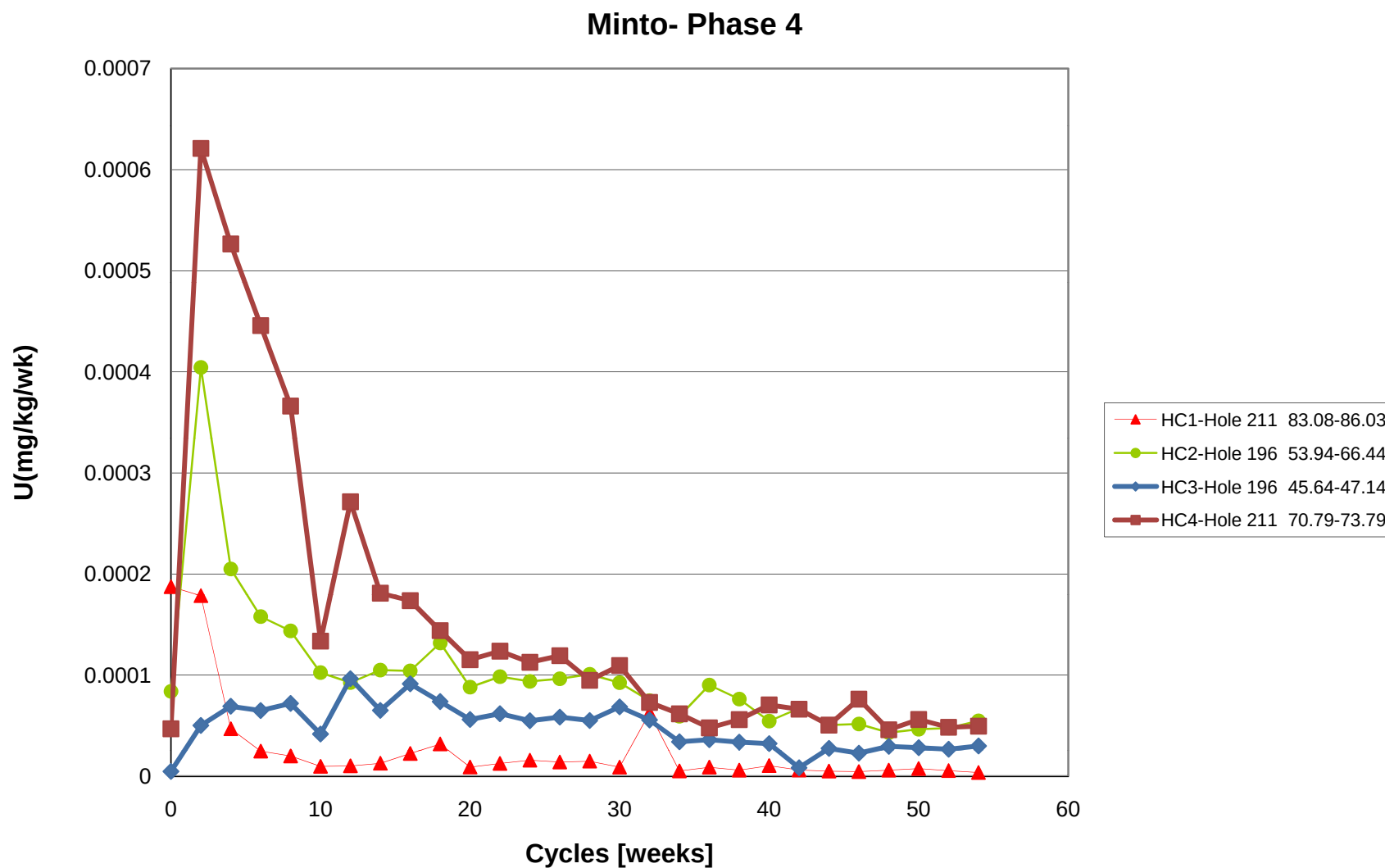


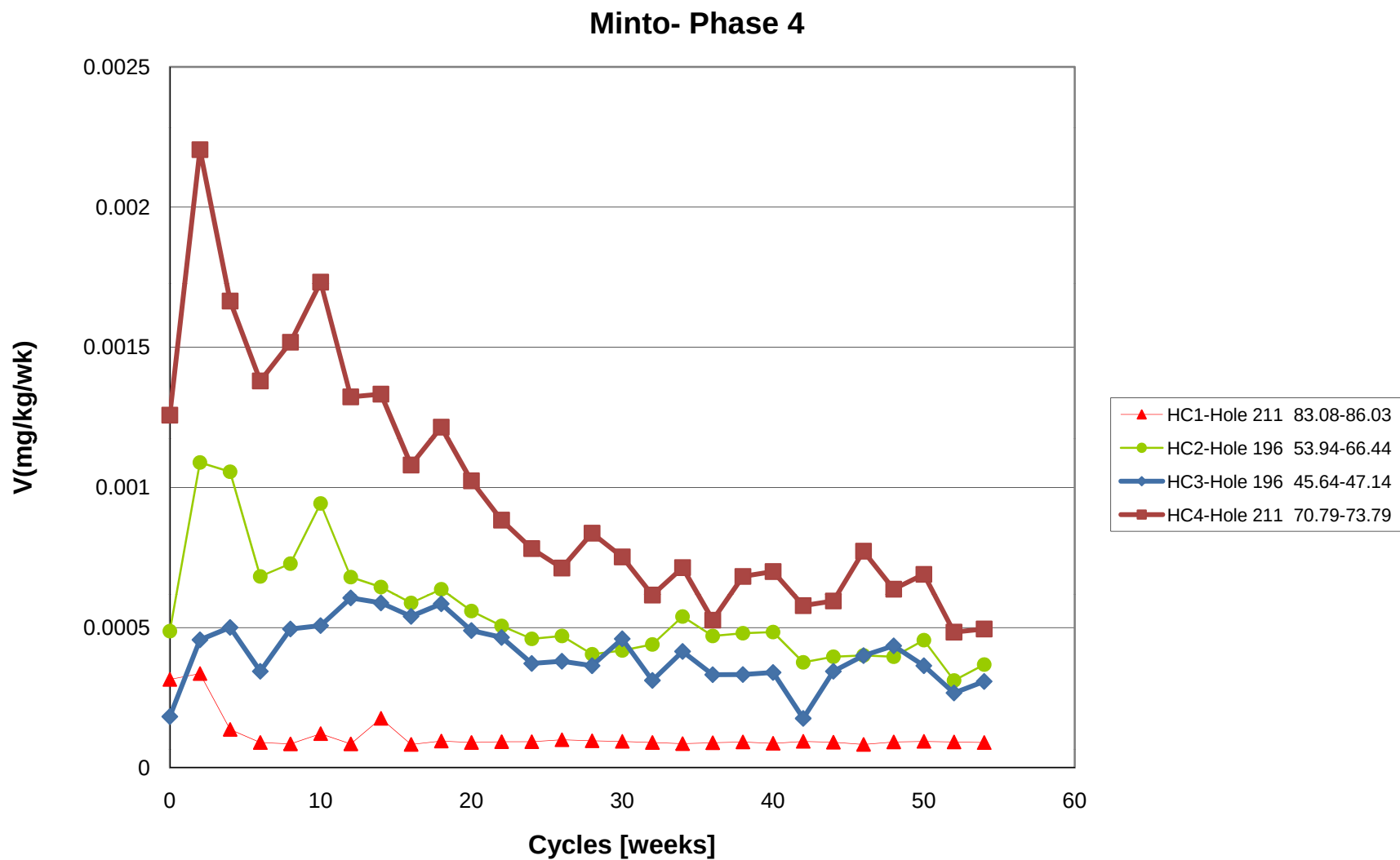


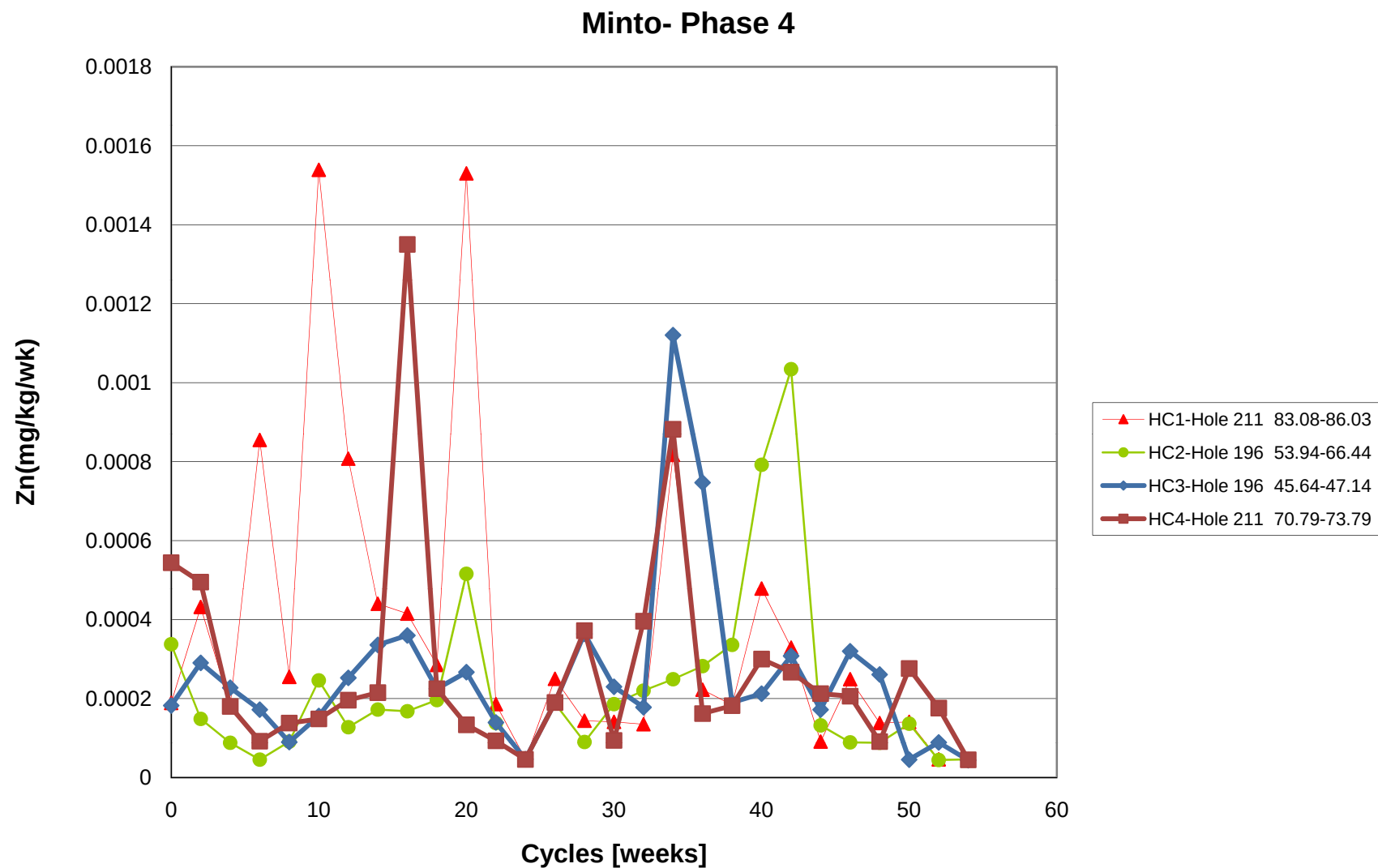
Minto- Phase 4

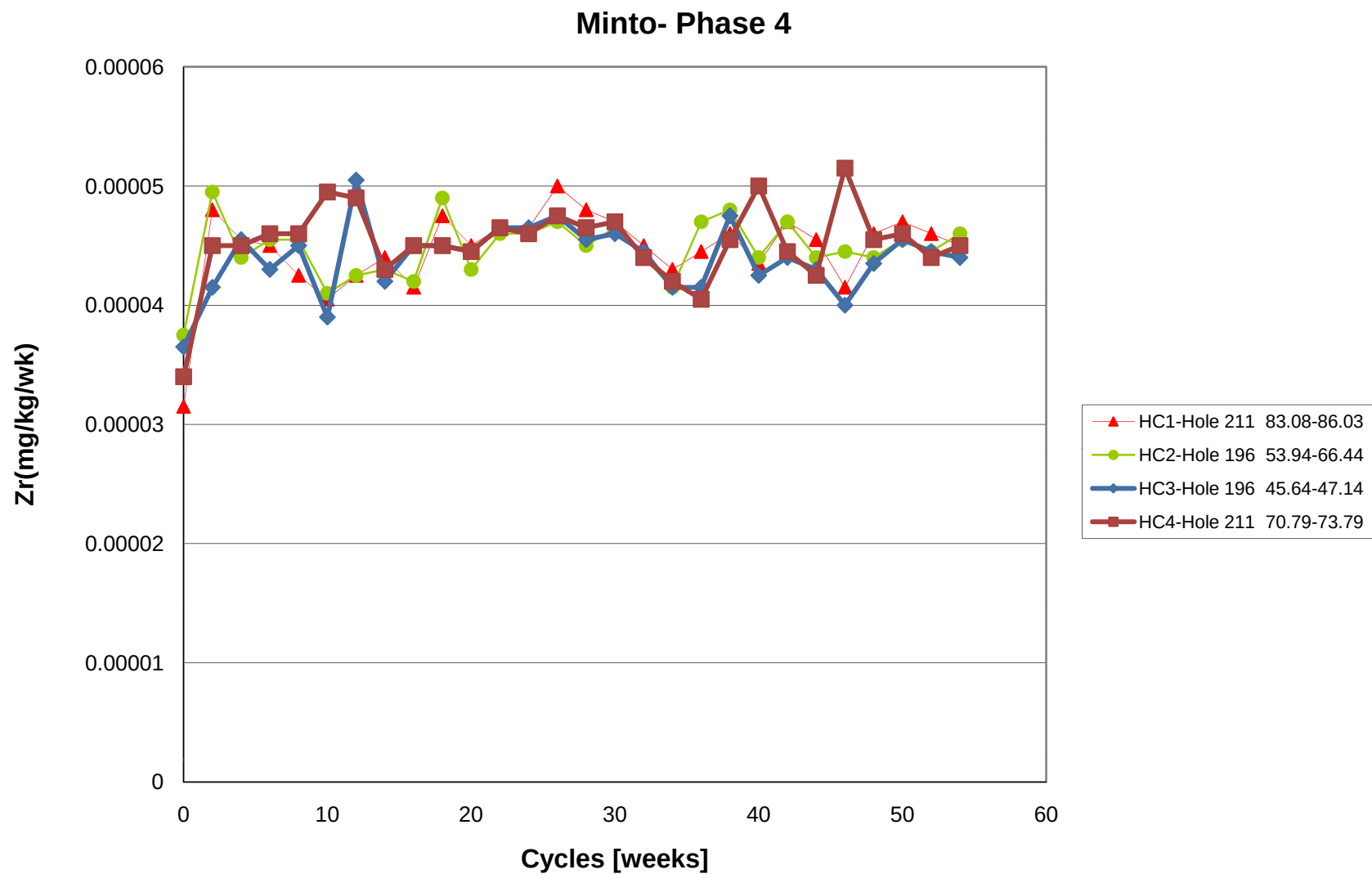












Appendix F
Phase IV Tailings: Static Test Results

Mine Area	Notes	Sample ID	Paste pH Std. Units	CO2 % CO2	Equiv. CaCO3 kg CaCO3/t	Total S % S	Sulphate % S	Sulphur Diff. % S	AP kg CaCO3/t	NP kg CaCO3/t	Net NP kg CaCO3/t	NP/AP Ratio	Fizz Test Visual
		LOD Method Code	0.01 Sobek	0.02 HCl Leach	#N/A Calc.	0.02 Leco	0.01 HCl Leach	#N/A Calc.	#N/A Calc.	0.2 Modified NP	#N/A Calc.	#N/A Calc.	#N/A Sobek
Area 118- Lower	Locked cycle tails, G&T report KM2351	Composite 2351-33	8.39	1.69	38	0.04	0.01	0.03	0.9	30.1	29	32	Slight
Area 118- Upper	Locked cycle tails, G&T report KM2351	Composite 2351-34	8.62	1.98	45	0.08	<0.01	0.08	2.5	38.2	36	15	Slight
Area 2	K1 Zone	KM 1966-13,22 MINTO K1	7.9	2	45	0.12	<0.01	0.12	3.8	57	53	15	Slight
Area 2	L+M Zone	KM 1966-29,30 MINTO L+M ZONE	8.3	0.7	16	0.09	0.01	0.08	2.5	31	29	12	Slight
Area 2	N Zone	KM 1966-28 MINTO N ZONE	8.2	0.2	5	0.08	0.02	0.06	1.9	22	20	12	Slight
Area 2	M Zone	KM 1966-29 MINTO M ZONE	8.4	0.5	11	0.06	0.01	0.05	1.6	27	25	17	Slight
Area 2	L Zone	KM 1966-30 MINTO L ZONE	8.2	0.6	14	0.1	<0.01	0.1	3.1	25	22	8.0	Slight
Area 2	O Zone	KM 1966-40 MINTO O ZONE	8.1	1.4	32	0.1	<0.01	0.1	3.1	43	40	14	Slight
Area 2	P Zone	KM 1966-41 MINTO P ZONE	7.8	<0.2	4.5	0.52	0.37	0.15	4.7	18	13	3.8	Slight
Area 2	Q Zone	KM 1966-42 MINTO Q ZONE	7.9	0.2	4.5	0.28	0.13	0.15	4.7	28	23	6.0	Slight

Source: U:\CM002\001_PhaseIV_WaterQualityPrediction\Report_MLARD\characterization+WQPA\Appendices\App_F_PhIVTailings_StaticTestResults\AppF_PhIVTailings_StaticTestResults.xlsx

Mine Area	Notes	Sample ID	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppb	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %
		LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01
		Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Area 118- Lower	Locked cycle tails, G&T report KM2351	Composite 2351-33	0.4	591	2	151	0.5	5	9	794	4.5	<0.5	0.1	88.9	2	34	0.8	<0.1	0.1	72	0.91
Area 118- Upper	Locked cycle tails, G&T report KM2351	Composite 2351-34	2.6	515	3	109	0.3	9	7	651	3.0	0.6	0.7	45	4.7	57	0.4	<0.1	<0.1	77	1.12
Area 2	K1 Zone	KM 1966-13,22 MINTO K1	7.0	249	14	70	0.2	5	7	677	3.3	1.3	1.4	<200	5.7	90	0.2	0.21	0.05	72	2.13
Area 2	L+M Zone	KM 1966-29,30 MINTO L+M ZONE	1.1	1330	43	229	2.4	7	10	953	8.1	2.6	0.35	200	3	33	0.7	30.2	0.27	105	0.97
Area 2	N Zone	KM 1966-28 MINTO N ZONE	1.4	672	25	145	1.1	5	12	591	3.8	4	1.04	200	4.7	75	0.5	0.8	0.08	97	1.24
Area 2	M Zone	KM 1966-29 MINTO M ZONE	0.7	1005	9	150	0.9	5	10	869	7.1	1.3	0.35	200	2.9	30	0.4	0.13	0.24	81	0.91
Area 2	L Zone	KM 1966-30 MINTO L ZONE	0.9	1580	42	253	1.3	6	13	1030	8.3	3.2	0.21	200	2.8	31	0.7	1.34	0.28	130	0.81
Area 2	O Zone	KM 1966-40 MINTO O ZONE	1.1	1570	5	107	1.1	4	9	885	6.1	1.5	0.46	200	2.7	47	0.2	0.14	0.31	72	1.36
Area 2	P Zone	KM 1966-41 MINTO P ZONE	0.9	1940	5	151	1.0	7	10	749	4.7	1.7	0.27	200	4.4	272	0.5	0.1	0.15	87	1.43
Area 2	Q Zone	KM 1966-42 MINTO Q ZONE	0.8	1990	4	138	1.1	5	10	771	5.9	1.8	0.35	200	3.5	196	0.4	0.16	0.53	87	0.99

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARD\characterization+WQPA\Appendices\1App_F_PhIVTailings_StaticTestResults\1AppF_PhIVTailings_StaticTestResults.xlsx

Mine Area	Notes	Sample ID	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Hg ppm	Sc ppm	Tl ppm	S %	Ga ppm	Se ppm
		LOD	0.001	1	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5
		Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Area 118- Lower	Locked cycle tails, G&T report KM2351	Composite 2351-33	0.067	5	9	0.68	238	0.114	<20	0.92	0.01	0.68	<0.1	0.02	2.6	0.3	<0.05	8	0.6
Area 118- Upper	Locked cycle tails, G&T report KM2351	Composite 2351-34	0.114	12	17	0.91	322	0.161	<20	1.08	0.014	0.99	<0.1	<0.01	4.6	0.3	0.06	6	0.6
Area 2	K1 Zone	KM 1966-13,22 MINTO K1	0.101	30	6	0.82	260	0.112	<10	1.27	0.02	0.65	0.1	<0.01	5.9	0.31	0.13	7.07	0.9
Area 2	L+M Zone	KM 1966-29,30 MINTO L+M ZONE	0.061	4.2	12	0.76	260	0.154	<10	1.24	0.02	0.71	0.08	0.84	3.5	0.3	0.1	12.4	1.7
Area 2	N Zone	KM 1966-28 MINTO N ZONE	0.118	14.7	9	1.02	160	0.223	<10	1.62	0.04	0.33	0.08	0.01	3.9	0.1	0.08	9.27	1.2
Area 2	M Zone	KM 1966-29 MINTO M ZONE	0.051	4.6	9	0.66	170	0.116	<10	1.02	0.02	0.53	0.06	0.01	3	0.22	0.07	11.85	1.3
Area 2	L Zone	KM 1966-30 MINTO L ZONE	0.072	3.8	9	0.92	390	0.215	<10	1.52	0.02	1.02	0.07	0.02	5.1	0.41	0.11	14.75	2.2
Area 2	O Zone	KM 1966-40 MINTO O ZONE	0.047	4.7	6	0.54	200	0.017	<10	0.71	0.01	0.12	0.05	0.06	1.9	0.06	0.11	9.45	1.7
Area 2	P Zone	KM 1966-41 MINTO P ZONE	0.101	8.6	15	0.99	190	0.231	<10	1.45	0.04	0.47	0.08	0.02	3.3	0.13	0.63	8.98	1.7
Area 2	Q Zone	KM 1966-42 MINTO Q ZONE	0.06	7.1	9	0.7	130	0.142	<10	1.12	0.02	0.33	0.06	0.01	2.7	0.11	0.29	10.5	2.3

Source: U:\1CM002.001_PhaseIV_WaterQualityPrediction\Report_MLARD\characterization+WQP\Appendices\1App_F_PhIVTailings_StaticTestResults\1AppF_PhIVTailings_StaticTestResults.xlsx

Appendix G
Operational Monitoring of Main Pit Tailings:
Elemental Determinations

Operational Monitoring Results: Main Zone Tails

		Parameter Unit	Ag g/t	Al g/t	As g/t	Au g/t	Ba g/t	Be g/t	Bi g/t	Ca g/t	Cd g/t	Co g/t	Cr g/t	Cu g/t	Fe g/t	K g/t	Li g/t	Mg g/t	Mn g/t	Mo g/t	Na g/t	Ni g/t	P g/t	Pb g/t	Pd g/t	Pt g/t	Sb g/t	Se g/t	Sn g/t	Sr g/t	Ti g/t	Tl g/t	U g/t	V g/t	Y g/t	Zn g/t		
Lab File	Sample ID	Month	Year																																			
AG02625	1 Final Tails Comp (Jun Monthly Comp)	June	2009	< 2	77000	< 30	0	1800	0.7	< 200	22000	< 4	< 20	120	1500	42000	32000	< 10	8500	730	< 10	24000	< 20	940	< 100	< 0.02	< 0.02	< 10	< 30	< 20	570	2600	< 30	< 30	84	6.5	150	
AG02625	4 Monthly Final Tails Comp (May2009)	May	2009	< 2	75000	< 30	0	1900	0.7	< 200	22000	< 4	< 20	94	1800	50000	30000	< 10	8900	750	< 10	22000	< 20	1000	< 100	< 0.02	< 0.02	< 10	< 30	< 20	580	2700	< 30	< 30	92	5.7	180	
AG02625	6 Final Tails Comp Monthly (April 2009)	April	2009	< 2	75000	< 30	0	1900	0.7	< 200	21000	< 4	< 20	32	2400	53000	31000	< 10	8700	750	< 10	21000	< 20	950	< 100	< 0.02	< 0.02	< 10	< 30	< 20	560	2700	< 30	< 30	95	5.4	170	
AG02625	8 Final Tails Comp March Monly Comp	March	2009	< 2	73000	< 30	0	1700	0.7	< 200	24000	< 4	< 20	20	2200	63000	24000	< 10	8900	720	< 10	23000	< 20	840	< 100	< 0.02	< 0.02	< 10	< 30	< 20	620	2900	< 30	< 30	110	4.9	170	
AG02625	9 Final Tails Cmp Monthly Comp Feb	February	2009		3	69000	< 30	0	1700	0.7	< 200	22000	< 4	22	37	2600	70000	23000	< 10	9200	800	< 10	20000	< 20	890	< 100	< 0.02	< 0.02	< 10	< 30	< 20	610	3100	< 30	< 30	130	5.2	190
AG02639	21 Final Tails Comp (July Monthly Comp)	July	2009	< 2	80000	< 30	0.15	1800	1.6	< 200	26000	< 4	< 20	59	1200	38000	30000	< 10	9000	730	< 10	24000	< 20	1000	< 100	< 0.02	< 0.02	< 10	< 30	< 20	630	2700	< 30	< 30	85	7.3	150	
SP02387	21 Final Tails Comp August Monthly Comp	August	2009	< 2	75000	< 30	0.15	1800	0.9	< 80	23000	< 2	< 20	120	1600	40000	32000	< 10	8600	790	< 10	25000	< 20	1000	< 100	< 0.02	< 0.02	< 10	< 30	< 20	590	2800	< 30	< 30	84	6	130	
OC02543	17 Final Tails Comp (Sept monthly Comp)	September	2009	< 2	80000	< 30	0.13	1700	1	< 40	22000	< 2	13	75	1100	45000	29000	< 10	8900	830	< 10	25000	< 20	1100	< 200	< 0.02	< 0.02	< 10	< 30	< 20	660	2700	< 30	< 40	91	6.8	170	
DC02847	3 Final Tails Comp (Nov Monthly Comp)	November	2009	< 2	67000	< 30	0.34	1700	0.7	< 30	17000	< 4	< 20	44	2100	65000	31000	< 10	7800	810	< 10	19000	< 20	690	< 80	< 0.02	< 0.02	< 10	< 30	< 20	520	2500	< 30	< 30	94	5.1	190	
				Max	3	80000	--	0.34	1900	1.6	--	26000	--	22	120	2600	70000	32000	--	9200	830	--	25000	--	1100	--	--	--	--	--	--	660	3100	--	--	130	7.3	190
				95th Percentile	3	80000	--	0.26	1900	1.36	--	25200	--	21.6	120	2520	68000	32000	--	9120	822	--	25000	--	1060	--	--	--	--	--	--	648	3020	--	--	122	7.1	190
				75th Percentile	3	77000	--	0.15	1800	0.9	--	23000	--	19.8	94	2200	63000	31000	--	8900	800	--	24000	--	1000	--	--	--	--	--	--	620	2800	--	--	95	6.5	180
				50th Percentile	3	75000	--	0	1800	0.7	--	22000	--	17.5	59	1800	50000	30000	--	8900	750	--	23000	--	950	--	--	--	--	--	--	590	2700	--	--	92	5.7	170
				25th Percentile	3	73000	--	0	1700	0.7	--	22000	--	15.3	37	1500	42000	29000	--	8600	730	--	21000	--	890	--	--	--	--	--	--	570	2700	--	--	85	5.2	150
				5th Percentile	3	67800	--	0	1700	0.7	--	18600	--	13.5	24.8	1140	38800	23400	--	8080	724	--	19400	--	750	--	--	--	--	--	--	536	2540	--	--	84	5	138
				Minimum	3	67000	--	0	1700	0.7	--	17000	--	13	20	1100	38000	23000	--	7800	720	--	19000	--	690	--	--	--	--	--	--	520	2500	--	--	84	4.9	130
				Mean	3	74556	--	0.09	1778	0.86	--	22111	--	17.5	66.8	1833.333	51777.78	29111	--	8722	768	--	22556	--	934.4	--	--	--	--	--	--	593	2744	--	--	96.1	5.9	167
				Standard Deviation	--	4419	--	0.12	83.33	0.3	--	2421	--	6.36	37.6	526.7827	11766.24	3333.3	--	405.5	40.2	--	2185.8	--	117.9	--	--	--	--	--	--	41.8	174	--	--	15	0.8	20
				Count	1	9	0	9	9	9	0	9	0	2	9	9	9	0	9	9	0	9	0	9	0	0	0	0	0	0	9	9	0	0	9	9	9	

Appendix H

Phase IV Tailings: Kinetic Test Results

Appendix H1
Phase IV Tailings Elemental Content

CLIENT : SRK Consulting
PROJECT : Minto
CEMI Project # : 0907
Test : Metals by Aqua Regia Digestion with ICP-MS Finish
Date : June 25, 2009

Sample ID	Mo ppm	Cu ppm	Pb ppm	Zn ppm	Ag ppm	Ni ppm	Co ppm	Mn ppm	Fe %	As ppm	U ppm	Au ppb	Th ppm	Sr ppm	Cd ppm	Sb ppm	Bi ppm	V ppm	Ca %	P %	La ppm	Cr ppm	Mg %	Ba ppm	Ti %	B ppm	Al %	Na %	K %	W ppm	Hg ppm	Sc ppm	Tl ppm	S %	Ga ppm	Se ppm
LOD	0.1	0.1	0.1	1	0.1	0.1	0.1	1	0.01	0.5	0.1	0.5	0.1	1	0.1	0.1	0.1	2	0.01	0.001	1	1	0.01	1	0.001	20	0.01	0.001	0.01	0.1	0.01	0.1	0.1	0.05	1	0.5
Method Code	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX	1DX
Composite 2351-33	0.4	591	2	151	0.5	4.9	9.4	794	4.52	<0.5	0.1	88.9	2	34	0.8	<0.1	0.1	72	0.91	0.067	5	9	0.68	238	0.114	<20	0.92	0.01	0.68	<0.1	0.02	2.6	0.3	<0.05	8	0.6
Composite 2351-34	2.6	514.5	2.6	109	0.3	8.7	7.2	651	3.04	0.6	0.7	45	4.7	57	0.4	<0.1	<0.1	77	1.12	0.114	12	17	0.91	322	0.161	<20	1.08	0.014	0.99	<0.1	<0.01	4.6	0.3	0.06	6	0.6
Composite 2351-35	0.7	383.7	2.9	129	0.3	4.5	7.1	582	4.53	1.1	0.2	66.9	2.8	25	0.6	<0.1	<0.1	67	0.87	0.089	8	10	0.82	246	0.143	<20	0.96	0.012	0.84	<0.1	<0.01	3.7	0.3	<0.05	7	0.7
Composite 2351-36	2.1	1332.6	2.6	69	0.2	2.7	5.3	396	2.5	1.1	0.3	35.9	3	28	0.2	<0.1	0.2	63	0.84	0.065	7	5	0.69	227	0.105	<20	0.75	0.016	0.62	0.2	<0.01	3.5	0.2	<0.05	5	1.2
Composite 2351-37	2.5	1340.3	3.7	68	0.2	3.4	5.1	379	2.31	0.8	0.3	37.2	2.7	25	0.2	<0.1	0.2	60	0.8	0.067	6	6	0.68	227	0.106	<20	0.73	0.014	0.62	0.2	<0.01	3.7	0.2	<0.05	5	0.9

Appendix H2
Phase IV Tailings: ABA Characteristics

CLIENT : SRK Consulting
PROJECT : Minto
CEMI Project # : 0907
Test : Sobek Acid-Base Accounting
Date : May 22, 2009

Sample ID	Paste pH Std. Units	CO2 % CO2	Equiv. CaCO3 kg CaCO3/t	Total S % S	Sulphate % S	Sulphur Diff. % S	AP kg CaCO3/t	NP kg CaCO3/t	Net NP kg CaCO3/t	NP/AP Ratio	Fizz Test Visual
LOD	0.01	0.02	#N/A	0.02	0.01	#N/A	#N/A	0.2	#N/A	#N/A	#N/A
Method Code	Sobek	HCl Leach	Calc.	Leco	HCl Leach	Calc.	Calc.	Modified NP	Calc.	Calc.	Sobek
Composite 2351-33	8.39	1.69	38.4	0.04	0.01	0.03	0.9	30.1	29.2	32.1	Slight
Composite 2351-34	8.62	1.98	45.0	0.08	<0.01	0.08	2.5	38.2	35.7	15.3	Slight
Composite 2351-35	8.58	2.55	58.0	0.04	<0.01	0.04	1.3	32.9	31.7	26.3	Slight
Composite 2351-36	9.01	1.87	42.5	<0.02	<0.01	<0.02	<0.6	37.2	37.2	62.0	Slight
Composite 2351-37	9.26	1.9	43.2	0.04	<0.01	0.04	1.3	35.2	34.0	28.2	Slight
Duplicates											
Composite 2351-33	8.56				0.01			29.9			Slight

Note:

Equivalent CaCO3 is calculated from the CO2 originating from carbonate minerals.

Sulphur Difference = Total S - Sulphate S

AP = Acid Potential in tonnes CaCO3 equivalent per 1000 tonnes of material. AP is calculated from the sulphur difference.

NP = Neutralization Potential in tonnes CaCO3 equivalent per 1000 tonnes of material.

NET NP = NP - AP

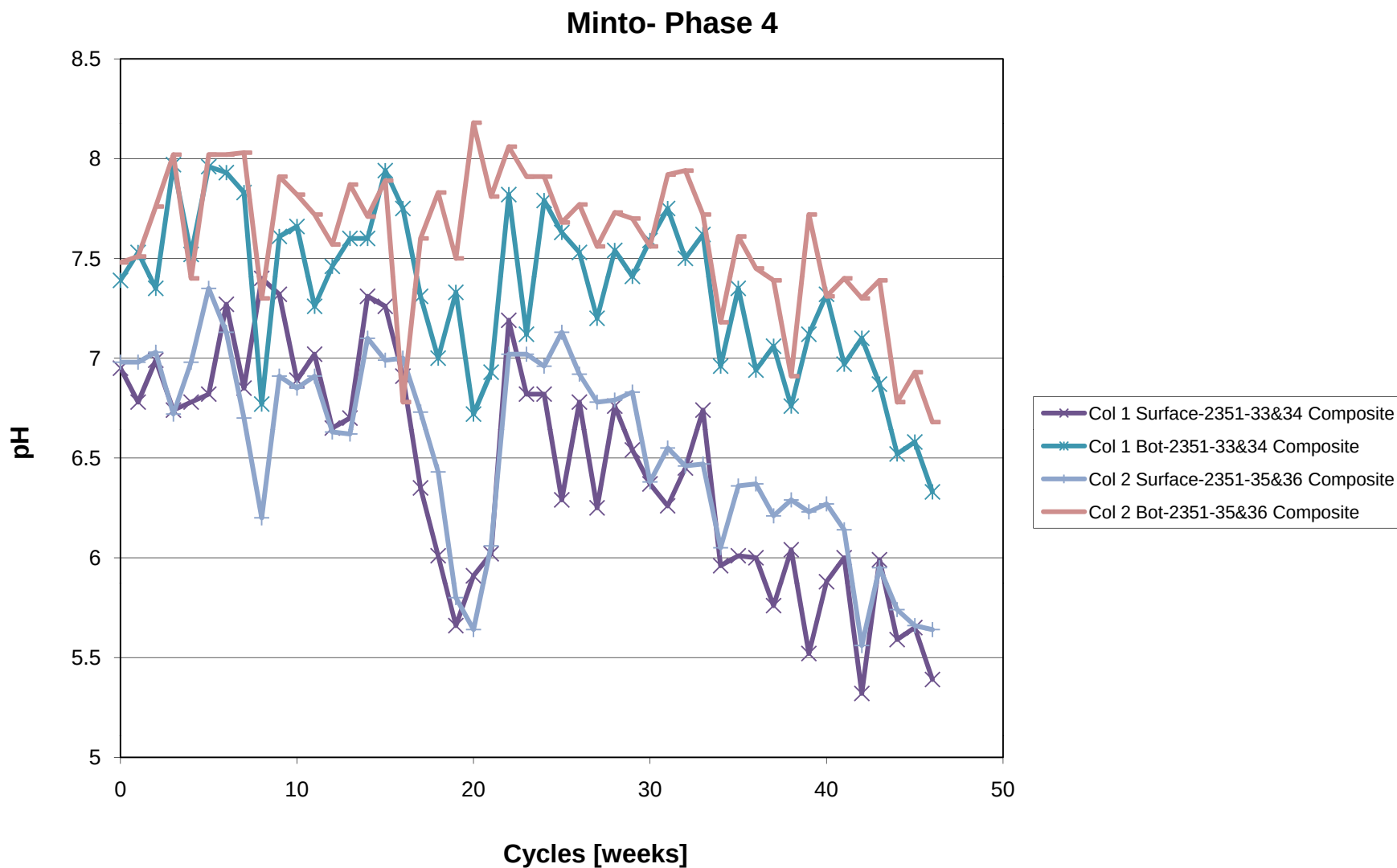
Appendix H3
Phase IV Tailings Column Test Results: Tables

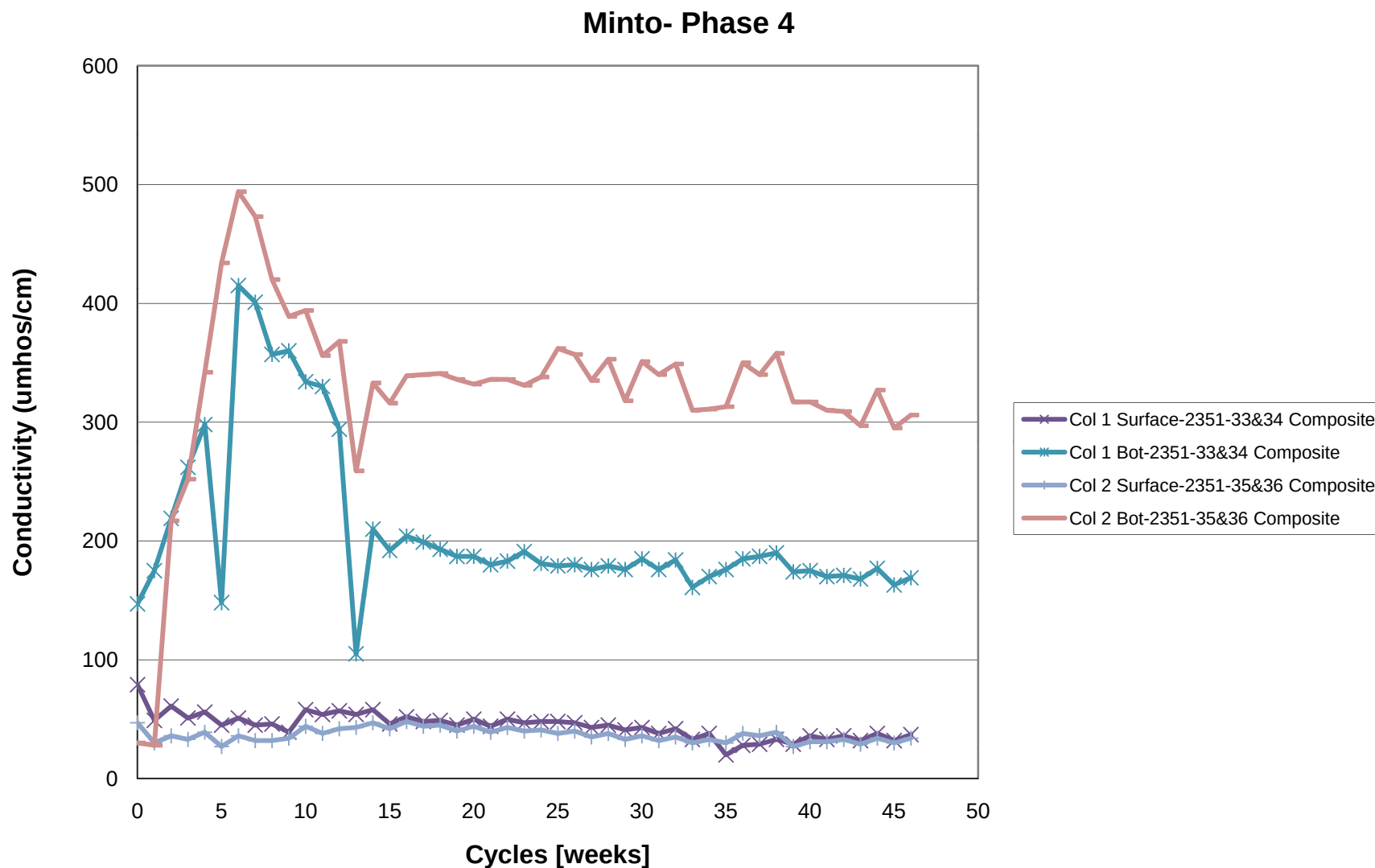
Col 1 Surface Sample = 2351-33&34 Composite																																																		
Date	Cycle No.	Volume Input Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate	DO	Chloride	Fluoride	Hardness CaCO3 mg/L	Al	Sb	As	Ba	Be	Bi	B	Cd	Ca	Cr	Co	Cu	Fe	Pb	Li	Mg	Mn	Hg	Mo	Ni	P	K	Se	Si	Ag	Na	Sr	S	Tl	Sn	Ti	U	V	Zn	Zr		
9-Sep-09	0	160 160	6.95	214	79	#N/A	3.1	24.3	20	7.40	0.8	0.26	34.3	0.0196	0.00021	0.00032	0.0682	-0.00001	-0.000005	-0.05	0.000041	11.1	0.0002	0.000077	0.00409	0.005	0.000015	0.0008	1.57	0.0362	-0.01	0.00295	0.00036	0.089	4.32	0.00141	0.701	-0.000005	2.92	0.152	8	0.000041	0.00166	-0.0005	0.000097	0.0006	0.0043	-0.0001		
16-Sep-09	1	50 50	6.78	320	49	#N/A	4.1	22.1	9	7.50	1.5	0.2	27.9	0.0083	0.00016	0.0003	0.0631	-0.00001	-0.000005	-0.05	0.000038	8.96	-0.0001	0.000076	0.00224	0.003	0.00393	0.001	1.35	0.0298	-0.01	0.00289	0.00037	0.141	4.18	0.00111	0.728	-0.000005	2.75	0.13	6	0.000019	0.00569	-0.0005	0.000018	0.0002	0.0044	-0.0001		
23-Sep-09	2	160 160	6.99	281	61	#N/A	4.1	22.1	9	8.40	1.5	0.2	27.9	0.0083	0.00016	0.0003	0.0631	-0.00001	-0.000005	-0.05	0.000038	8.96	-0.0001	0.000076	0.00224	0.003	0.00393	0.001	1.35	0.0298	-0.01	0.00289	0.00037	0.141	4.18	0.00111	0.728	-0.000005	2.75	0.13	6	0.000019	0.00569	-0.0005	0.000018	0.0002	0.0044	-0.0001		
30-Sep-09	3	50 50	6.74	399	51	#N/A	4.2	21.6	17	7.90	-0.5	0.14	25.2	0.0074	0.00007	0.00013	0.0486	-0.00001	-0.000005	-0.05	0.000015	7.96	-0.0001	0.000075	0.00632	0.002	0.00214	0.0006	1.29	0.0254	-0.01	0.00242	0.00045	0.036	3.4	0.0009	0.757	-0.000005	2.31	0.118	5	0.000005	0.0108	0.0006	0.00003	0.0004	0.0036	-0.0001		
7-Oct-09	4	160 160	6.78	453	56	#N/A	4.2	21.6	17	7.90	-0.5	0.14	25.2	0.0074	0.00007	0.00013	0.0486	-0.00001	-0.000005	-0.05	0.000015	7.96	-0.0001	0.000075	0.00632	0.002	0.00214	0.0006	1.29	0.0254	-0.01	0.00242	0.00045	0.036	3.4	0.0009	0.757	-0.000005	2.31	0.118	5	0.000005	0.0108	0.0006	0.00003	0.0004	0.0036	-0.0001		
14-Oct-09	5	50 50	6.82	370	45	#N/A	4.1	22.0	9	8.70	0.8	0.27	24.5	0.0113	0.00021	0.00056	0.0449	-0.00001	-0.000005	-0.05	0.000055	7.56	0.0002	0.000046	0.00357	0.008	0.000146	0.0006	1.36	0.0239	-0.01	0.00168	0.00048	0.21	2.86	0.00078	0.83	0.000036	1.98	0.114	3	0.00004	0.0197	-0.0005	0.000034	0.0003	0.0074	-0.0001		
21-Oct-09	6	160 160	7.27	312	51	#N/A	3.1	22.0	9	8.70	0.8	0.27	24.5	0.0113	0.00021	0.00056	0.0449	-0.00001	-0.000005	-0.05	0.000055	7.56	0.0002	0.000046	0.00357	0.008	0.000146	0.0006	1.36	0.0239	-0.01	0.00168	0.00048	0.21	2.86	0.00078	0.83	0.000036	1.98	0.114	3	0.00004	0.0197	-0.0005	0.000034	0.0003	0.0074	-0.0001		
28-Oct-09	7	50 50	6.85	370	45	#N/A	4.9	22.6	6	8.80	0.8	0.27	24.5	0.0113	0.00021	0.00056	0.0449	-0.00001	-0.000005	-0.05	0.000055	7.56	0.0002	0.000046	0.00357	0.008	0.000146	0.0006	1.36	0.0239	-0.01	0.00168	0.00048	0.21	2.86	0.00078	0.83	0.000036	1.98	0.114	3	0.00004	0.0197	-0.0005	0.000034	0.0003	0.0074	-0.0001		
4-Nov-09	8	160 160	7.40	352	46	#N/A	4.9	22.6	6	9.00	-0.5	0.13	23.5	0.0107	0.00014	0.00023	0.0419	-0.00001	-0.000005	-0.05	0.000024	7.29	0.0006	0.000022	0.00302	0.003	0.000053	-0.0005	1.28	0.0171	-0.01	0.00111	0.00034	0.105	2.35	0.00061	0.683	-0.000005	1.37	0.098	-3	0.000011	0.0255	-0.0005	0.000031	-0.0002	0.0035	-0.0001		
11-Nov-09	9	50 50	7.32	294	39	#N/A	4.9	22.6	6	7.90	-0.5	0.13	23.5	0.0107	0.00014	0.00023	0.0419	-0.00001	-0.000005	-0.05	0.000024	7.29	0.0006	0.000022	0.00302	0.003	0.000053	-0.0005	1.28	0.0171	-0.01	0.00111	0.00034	0.105	2.35	0.00061	0.683	-0.000005	1.37	0.098	-3	0.000011	0.0255	-0.0005	0.000031	-0.0002	0.0035	-0.0001		
18-Nov-09	10	160 160	6.89	328	58	#N/A	6.4	26.7	5	7.90	-0.5	0.09	22.4	0.0112	0.00011	0.00015	0.0435	0.00003	-0.000005	-0.05	0.000025	6.98	-0.0001	0.000026	0.00212	0.006	0.000084	-0.0005	1.21	0.0161	-0.01	0.0008	0.00035	0.046	1.81	0.00046	0.721	0.00001	0.9	0.0902	-3	0.000033	0.0287	0.0005	0.00005	-0.0002	0.0031	-0.0001		
25-Nov-09	11	50 50	7.02	315	54	#N/A	6.4	26.7	5	7.20	-0.5	0.09	22.4	0.0112	0.00011	0.00015	0.0435	0.00003	-0.000005	-0.05	0.000025	6.98	-0.0001	0.000026	0.00212	0.006	0.000084	-0.0005	1.21	0.0161	-0.01	0.0008	0.00035	0.046	1.81	0.00046	0.721	0.00001	0.9	0.0902	-3	0.000033	0.0287	0.0005	0.00005	-0.0002	0.0031	-0.0001		
2-Dec-09	12	160 160	6.65	364	57	#N/A	4.7	24.5	6	7.50	-0.5	0.08	23.1	0.0237	0.0001	0.00017	0.0422	-0.00001	-0.000005	-0.05	0.000018	7.23	0.0001	0.000029	0.00217	0.009	0.000182	0.0006	1.23	0.0136	-0.01	0.00065	0.00036	0.043	1.67	0.00046	0.856	0.000008	0.85	0.0873	-3	0.000018	0.033	0.0005	0.000039	0.0003	0.0067	-0.0001		
9-Dec-09	13	50 50	6.70	399	54	#N/A	4.7	24.5	6	8.00	-0.5	0.06	22.2	0.0091	0.00009	0.00007	0.0394	-0.00001	-0.000005	-0.05	0.000014	7.05	0.0001	0.000008	0.0012	0.002	0.000014	-0.0005	1.11	0.00843	-0.01	0.00047	0.00029	0.034	1.32	0.00046	0.932	-0.000005	0.57	0.0773	-3	0.000009	0.0357	0.0006	0.000037	-0.0002	0.0017	-0.0001		
16-Dec-09	14	160 160	7.31	376	58	#N/A	3.4	23.3	5	7.80	-0.5	0.06	22.2	0.0091	0.00009	0.00007	0.0394	-0.00001	-0.000005	-0.05	0.000014	7.05	0.0001	0.000008	0.0012	0.002	0.000014	-0.0005	1.11	0.00843	-0.01	0.00047	0.00029	0.034	1.32	0.00046	0.932	-0.000005	0.57	0.0773	-3	0.000009	0.0357	0.0006	0.000037	-0.0002	0.0017	-0.0001		
23-Dec-09	15	50 50	7.26	430	46	#N/A	3.3	20.8	6	7.50	0.7	0.06	20.2	0.0074	0.00004	0.00007	0.0392	-0.00001	-0.000005	-0.05	0.00001	6.39	-0.0001	0.000016	0.00341	0.001	0.000007	-0.0005	1.03	0.00694	-0.01	0.00039	0.00025	0.03	1.19	0.00033	0.878	-0.000005	0.44	0.0723	-3	0.000005	0.0338	-0.0005	0.000042	-0.0002	0.0019	-0.0001		
30-Dec-09	16	160 160	6.91	264	52	#N/A	3.3	20.8	6	6.80	0.7	0.06	20.2	0.0074	0.00004	0.00007	0.0392	-0.00001	-0.000005	-0.05	0.00001	6.39	-0.0001	0.000016	0.00341	0.001	0.000007	-0.0005	1.03	0.00694	-0.01	0.00039	0.00025	0.03	1.19	0.00033	0.878	-0.000005	0.44	0.0723	-3	0.000005	0.0338	-0.0005	0.000042	-0.0002	0.0019	-0.0001		
6-Jan-10	17	50 50	6.35	178	48	#N/A	3.8	21.0	5	7.60	-0.5	0.04	20.5	0.011	0.0004	0.0007	0.0417	-0.0002	-0.0001	-1	-0.0001	6.5	-0.002	-0.0001	0.002	-0.02	0.0006	-0.01	1	0.006	-0.2	-0.001	0.0026	-0.04	1.2	-0.0008	-2	0.0001	0.4	0.07	-10	0.0001	0.0356	-0.01	-0.00004	0.01	0.006	-0.002		
13-Jan-10	18	160 160	6.01	329	49	#N/A	3.8	21.0	5	7.40	-0.5	0.04	20.5	0.011	0.0004	0.0007	0.0417	-0.0002	-0.0001	-1	-0.0001	6.5	-0.002	-0.0001	0.002	-0.02	0.0006	-0.01	1	0.006	-0.2	-0.001	0.0026	-0.04	1.2	-0.0008	-2	0.0001	0.4	0.07	-10	0.0001	0.0356	-0.01	-0.00004	0.01	0.006	-0.002		
20-Jan-10	19	50 50	5.86	352	45	#N/A	3.0	21.0	6	8.20	-0.5	0.04	20	0.008	-0.0002	0.0004	0.0394	-0.0001	-0.00005	-0.5	-0.00005	6.31	-0.001	-0.00005	0.0029	-0.01	0.00019	-0.005	1.02	0.0061	-0.1	-0.0005	0.0035	0.059	1.06	0.0005	-1	-0.00005	0.37	0.0655	-6	-0.00002	0.041	0.008	0.00004	0.003	0.005	-0.001		
27-Jan-10	20	160 160	5.91	281	50	#N/A	3.0	21.0	6	7.10	-0.5	0.04	20	0.008	-0.0002	0.0004	0.0394	-0.0001	-0.00005	-0.5	-0.00005	6.31	-0.001	-0.00005	0.0029	-0.01	0.00019	-0.005	1.02	0.0061	-0.1	-0.0005	0.0035	0.059	1.06	0.0005	-1	-0.00005	0.37	0.0										

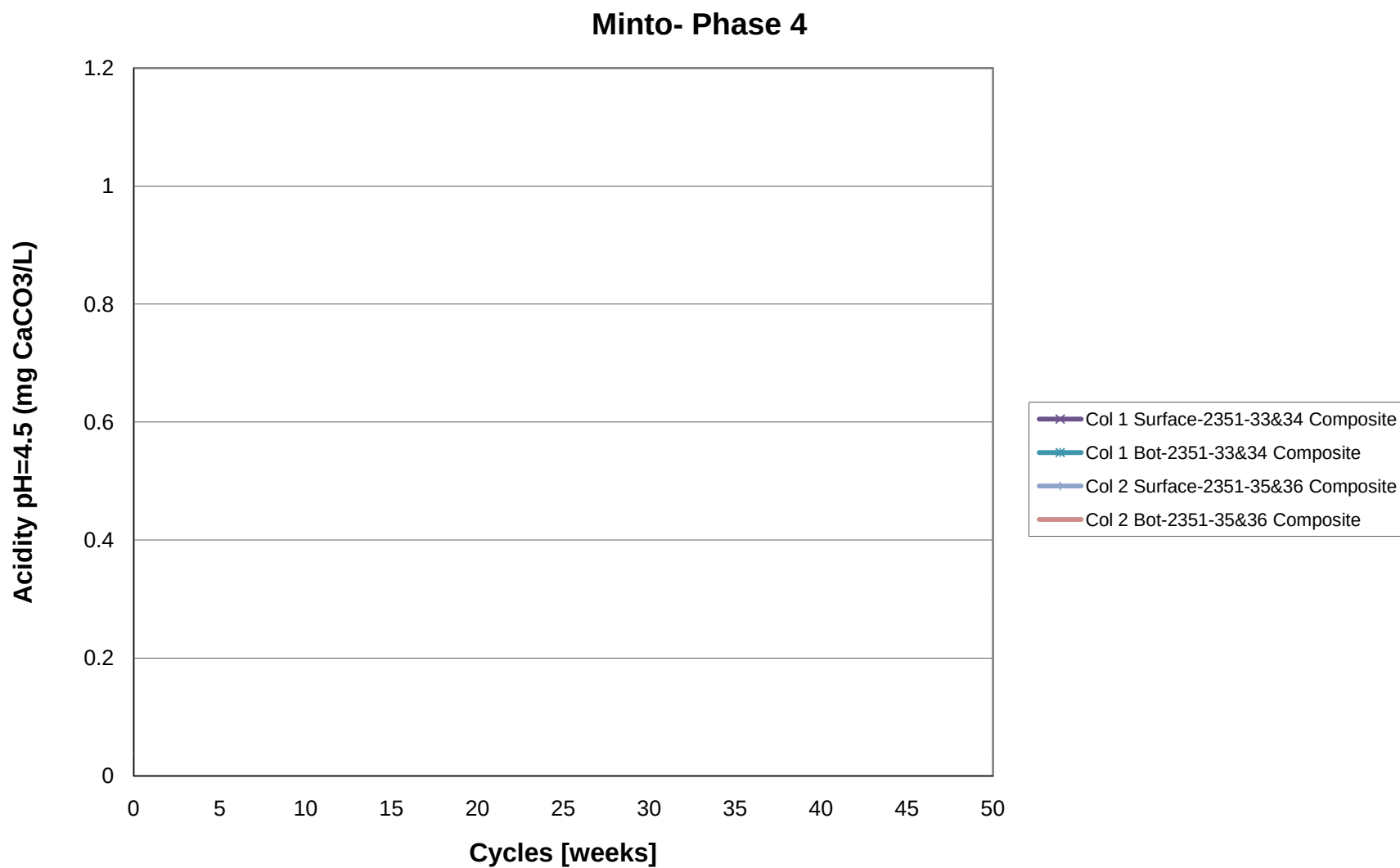
Col 1 Bottom Sample = 2351-33&34 Composite																																																								
Date	Cycle No.	Volume mL Input Output	pH	ORP mV	Cond. umhos/cm	Acidity (pH 4.5) mgCaCO3/L	Acidity (pH 8.3) mgCaCO3/L	Alkalinity mgCaCO3/L	Sulphate	DO	Chloride mg/L	Fluoride mg/L	Hardness CaCO3 mg/L	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Be mg/L	Bi mg/L	B mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	Pb mg/L	Li mg/L	Mg mg/L	Mn mg/L	Hg ug/L	Mo mg/L	Ni mg/L	P mg/L	K mg/L	Se mg/L	Si mg/L	Ag mg/L	Na mg/L	Sr mg/L	S mg/L	Tl mg/L	Sn mg/L	Ti mg/L	U mg/L	V mg/L	Zn mg/L	Zr mg/L								
9-Sep-09	0	160 160	7.39	219	147	#N/A	4.2	73.5	27	4.30	0.8	0.93	79.8	0.0488	0.00025	0.00019	0.297	-0.00001	-0.000005	-0.05	0.000076	26.2	-0.0001	0.000164	0.0102	0.003	0.00156	0.0022	3.48	0.0324	0.01	0.00861	0.00038	0.011	6.49	0.00129	2.16	0.000011	1.81	0.401	9	0.000032	0.0284	0.001	0.00101	0.0009	0.0042	-0.0001								
16-Sep-09	1	50 50	7.53	319	175	#N/A																																																		
23-Sep-09	2	160 160	7.35	217	219	#N/A	2.8	130.7	38	6.00	0.6	1.12	135	0.022	0.00032	0.00021	0.37	-0.00001	-0.000005	-0.05	0.000039	42.2	-0.0001	0.000143	0.00765	0.003	0.00172	0.0034	7.29	0.0471	-0.01	0.0156	0.00029	0.1	11	0.00198	3.09	-0.000005	4.91	0.742	13	0.00004	0.0231	-0.0005	0.00269	0.0003	0.0033	-0.0001								
30-Sep-09	3	50 50	7.97	340	262	#N/A																																																		
7-Oct-09	4	160 160	7.52	340	298	#N/A	8.2	165.5	49	5.40	1	1.17	160	0.0141	0.00022	0.00014	0.261	0.00002	-0.000005	0.057	0.00003	47.6	-0.0001	0.000072	0.0102	0.013	0.000104	0.0036	9.95	0.0587	-0.01	0.0242	0.00065	0.007	14.6	0.0027	3.82	-0.000005	11.5	0.893	17	0.000006	0.0226	0.0005	0.00196	-0.0002	0.0027	-0.0001								
14-Oct-09	5	50 50	7.96	254	148	#N/A																																																		
21-Oct-09	6	160 160	7.93	252	415	#N/A	#N/A	#N/A	67	5.60	2.5	1.21	171	0.0128	0.00033	0.00029	0.15	-0.00001	-0.000005	0.071	0.000052	48.7	0.0004	0.000045	0.00365	0.017	0.000098	0.0033	11.9	0.0644	-0.01	0.0287	0.00043	0.013	16.7	0.0022	3.55	-0.000005	16.1	0.985	22	0.000033	0.0167	0.0009	0.000751	0.0003	0.002	-0.0001								
28-Oct-09	7	50 50	7.83	221	401	#N/A	6.9	182.4	48	4.50																																														
4-Nov-09	8	160 160	6.77	310	357	#N/A	#N/A	#N/A	48	5.60	2.2	1.31	170	0.0085	0.00028	0.00023	0.113	-0.00001	-0.000005	0.068	0.000017	48.6	-0.0001	0.000022	0.00416	0.006	0.00003	0.0026	11.9	0.0638	-0.01	0.0179	0.0002	0.006	17.4	0.00123	3.43	-0.000005	14.8	0.934	19	0.000019	0.0203	-0.0005	0.000257	-0.0002	0.0009	-0.0001								
11-Nov-09	9	50 50	7.61	289	360	#N/A																																																		
18-Nov-09	10	160 160	7.66	173	334	#N/A	8.8	155.9	37	3.90	1.4	1.62	138	0.0095	0.00029	0.00023	0.0956	0.00001	-0.000005	0.051	0.000017	39.5	-0.0001	0.000035	0.00189	0.012	0.000054	0.0022	9.69	0.0495	-0.01	0.00627	0.00023	0.008	16.9	0.00019	3.1	0.000008	10.8	0.741	13	0.000049	0.023	-0.0005	0.000197	-0.0002	0.0011	-0.0001								
25-Nov-09	11	50 50	7.26	105	330	#N/A																																																		
2-Dec-09	12	160 160	7.46	70	294	#N/A	6.4	133.3	26	4.80	0.8	1.96	110	0.0278	0.00025	0.0003	0.083	-0.00001	-0.000005	-0.05	0.00001	31.4	0.0002	0.000212	0.00212	0.034	0.00041	0.002	7.75	0.0482	-0.01	0.00415	0.00052	0.007	15.2	0.00008	3.53	0.000007	8.34	0.634	11	0.000028	0.0312	0.0011	0.000185	-0.0002	0.0046	-0.0001								
9-Dec-09	13	50 50	7.60	381	105	#N/A																																																		
16-Dec-09	14	160 160	7.60	25	210	#N/A	4.1	117.6	8	4.50	0.6	2.25	85.8	0.008	0.00025	0.00018	0.0977	-0.00001	-0.000005	-0.05	0.000028	24.3	0.0002	0.000049	0.0023	0.011	0.000045	0.0013	6.1	0.0255	-0.01	0.00288	0.00039	0.007	14.2	0.00006	2.87	-0.000005	6.83	0.52	4	0.000026	0.0249	-0.0005	0.000077	-0.0002	0.0013	-0.0001								
23-Dec-09	15	50 50	7.94	113	192	#N/A																																																		
30-Dec-09	16	160 160	7.75	121	204	#N/A	4.6	102.8	4	4.50	1	2.03	76.8	0.0085	0.00016	0.00027	0.46	-0.00001	-0.000005	-0.05	0.000022	22.5	-0.0001	0.000029	0.00264	0.015	0.000016	0.0013	5.02	0.0209	-0.01	0.00617	0.00034	0.006	14.4	-0.00004	3.31	-0.000005	5.97	0.551	-3	0.000002	0.0252	-0.0005	0.000067	-0.0002	0.0014	-0.0001								
6-Jan-10	17	50 50	7.31	161	199	#N/A																																																		
13-Jan-10	18	160 160	7.00	184	193	#N/A	6.5	101.3	1	5.40	-0.5	1.97	68.5	0.034	0.0005	0.0005	0.73	-0.0002	-0.0001	-1	-0.0001	19.3	-0.002	-0.0001	0.002	-0.02	0.002	-0.01	4.9	0.016	-0.2	0.006	0.0053	-0.04	14.4	-0.0008	3.54	-0.0001	5.8	0.556	-10	0.00007	0.0204	0.00007	0.00007	0.007	0.004	-0.002								
20-Jan-10	19	50 50	7.33	291	187	#N/A																																																		
27-Jan-10	20	160 160	6.72	187	187	#N/A	3.3	96.1	-1	4.30	-0.5	2.12	60.1	0.01	0.0002	0.0004	0.844	-0.00005	-0.00003	-0.3	-0.00003	17.2	-0.0005	-0.00003	0.0034	0.02	0.00031	-0.003	4.19	0.0141	-0.05	0.009	0.0018	0.013	13.1	-0.0002	2.8	-0.00003	5.48	0.499	-3	0.00003	0.0197	0.004	0.00005	-0.001	0.0018	-0.0005								
3-Feb-10	21	50 50	6.93	265	180	#N/A																																																		
10-Feb-10	22	160 160	7.82	229	183	#N/A	3.3	94.6	1	3.80	-0.5	1.86	67	0.011	0.0002	0.0007	1.3	-0.00005	-0.00003	-0.3	-0.00003	19.9	-0.0005	-0.00003	0.0052	0.034	0.00015	-0.003	4.18	0.0143	-0.05	0.0121	0.0006	0.013	15.8	-0.0002	3.19	-0.00003	6.16	0.545	-3	-0.00001	0.0218	-0.003	0.00003	-0.001	0.0037	-0.0005								
17-Feb-10	23	50 50	7.12	219	191	#N/A																																																		
24-Feb-10	24	160 160	7.79	316	181	#N/A	3.1	90.9	-1	4.40	-0.5	1.72	54.7	0.01	-0.0004	-0.0004	1.47	-0.0002	-0.0001	-1	-0.0001	16.6	-0.002	-0.0001	0.003	-0.02	0.0001	-0.01	3.2	0.013	-0.2	0.012	0.0055	-0.04	11.7	-0.0008	2.65	-0.0001	4.9	0.541	-10	-0.00004	0.0226	-0.01	-0.00004	-0.004	0.003	-0.002								
3-Mar-10	25	50 50	7.63	317	179	#N/A																																																		
10-Mar-10	26	160 160	7.53	307	180	#N/A	3.1	89.6	1	5.00	-0.5	1.74	58.1	0.0108	0.00014	0.0003	1.62	-0.00001	-0.000005	-0.05	0.000015	17.2	-0.0001	0.000011	0.00346	0.096	0.00029	0.0016	3.68	0.0136	-0.01	0.0115	0.00018	0.02	12.5	0.00004	3.14	0.000007	5.91	0.574	-10	0.000016	0.0198	-0.0005	0.000044	-0.0002	0.0155	-0.0001								
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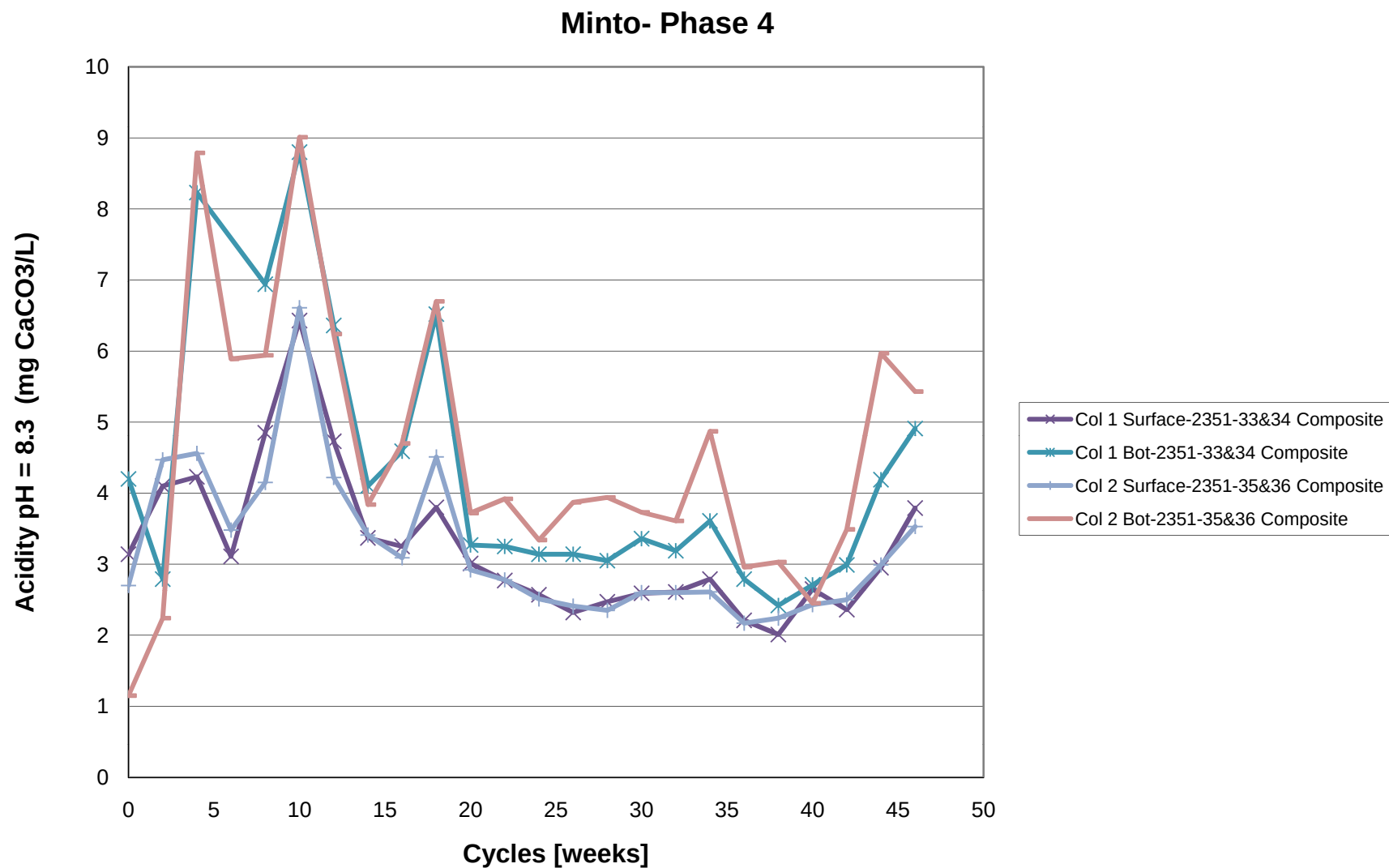
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Appendix H4
Phase IV Tailings Column Test Results: Charts

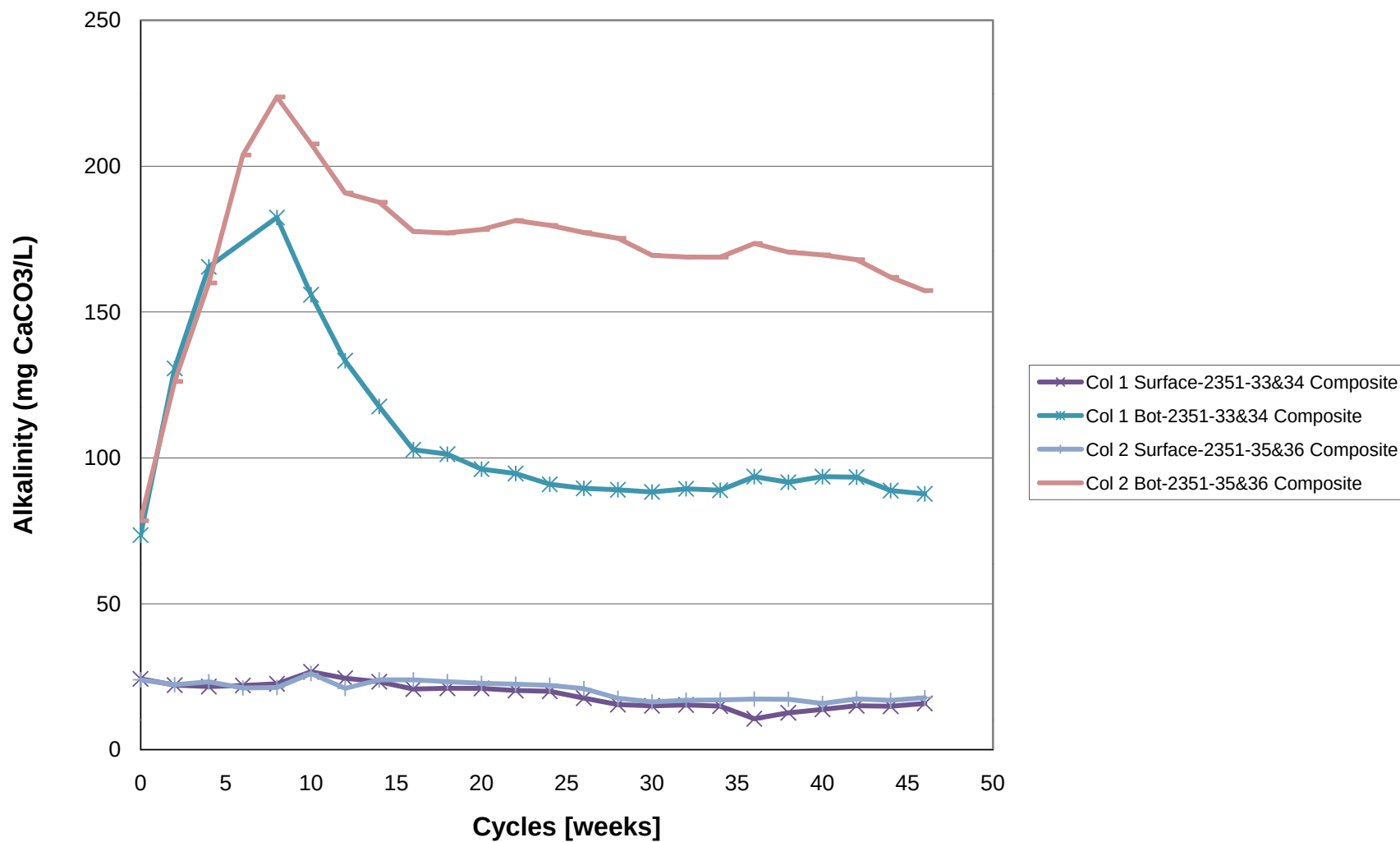


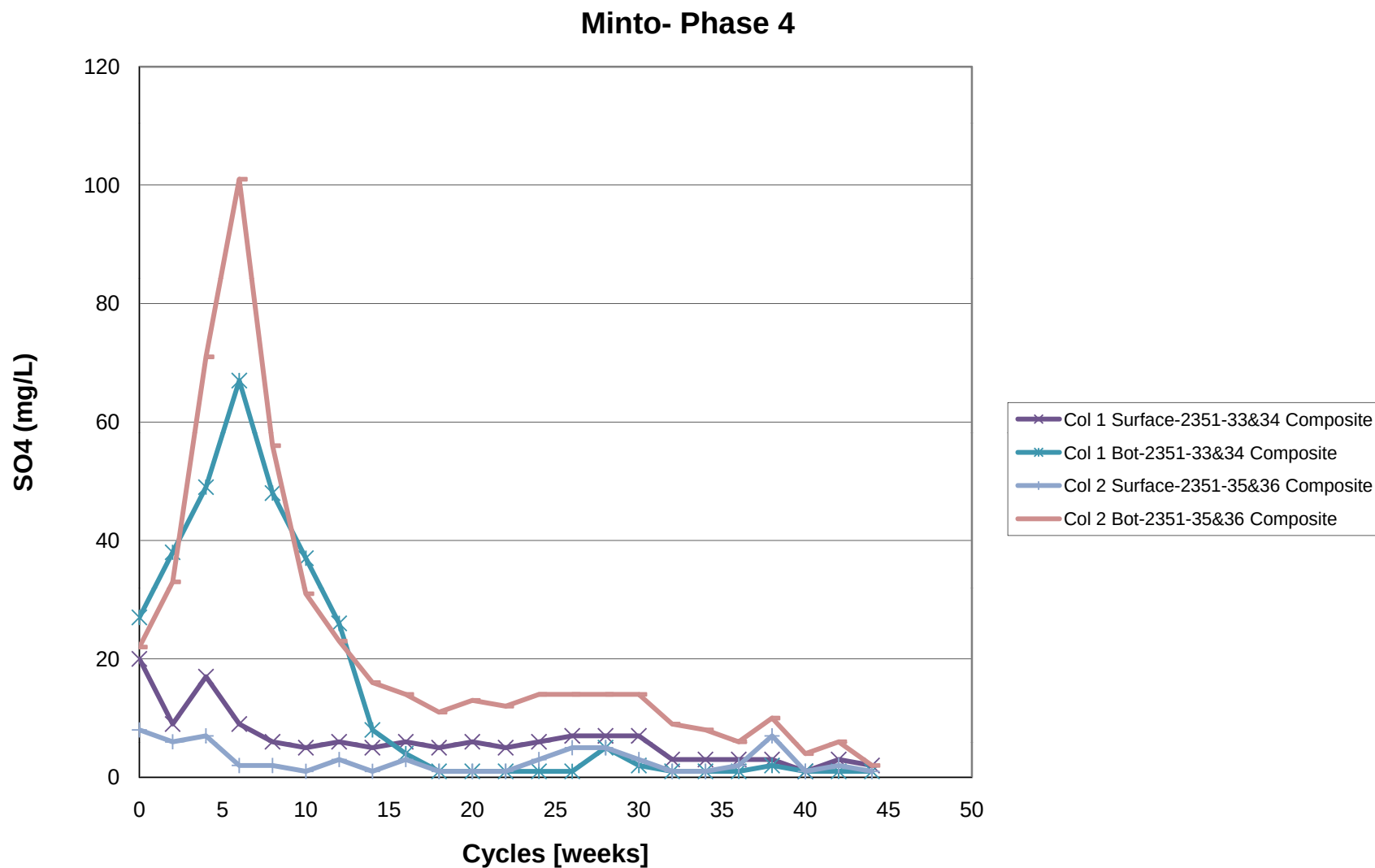




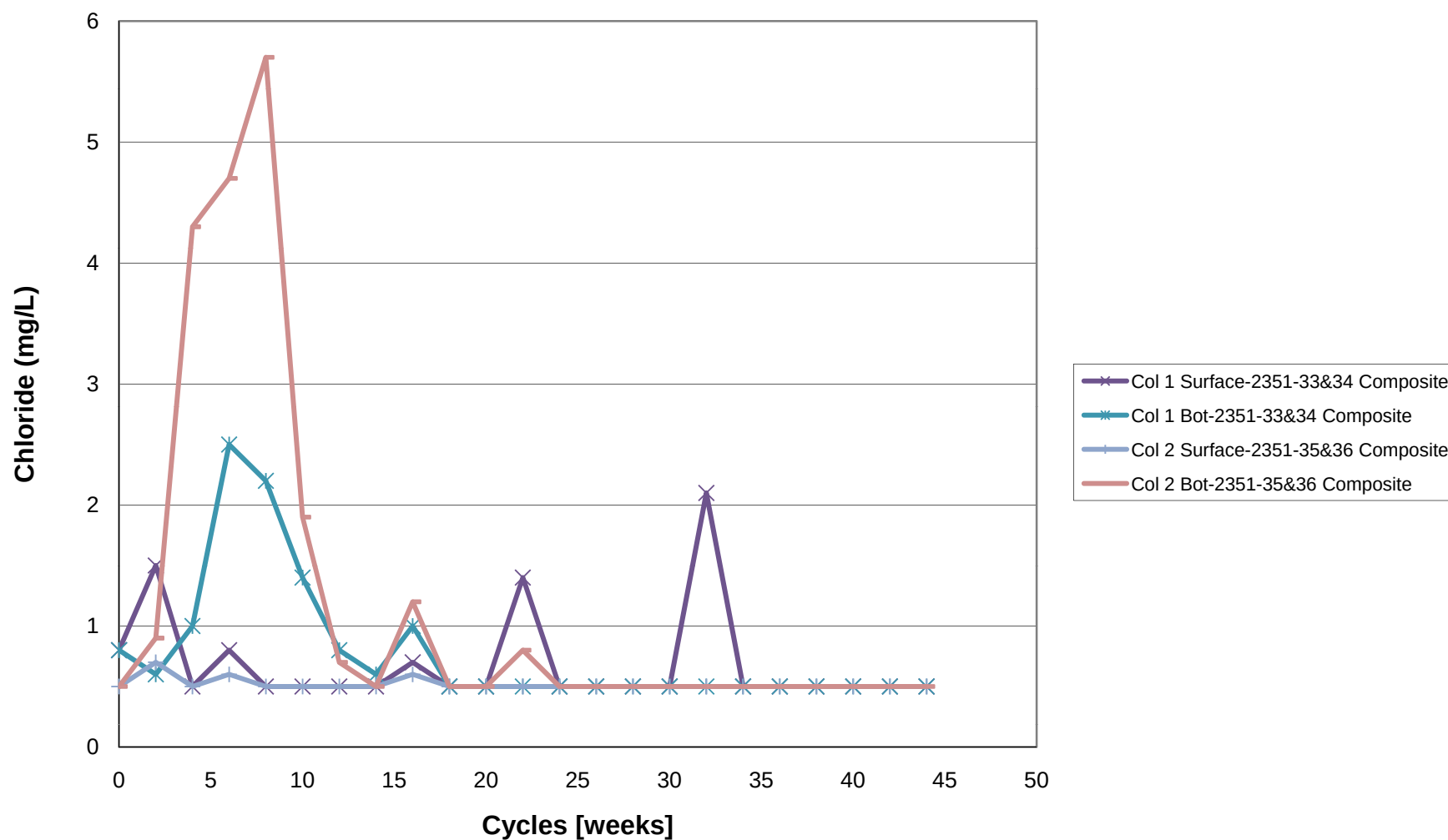


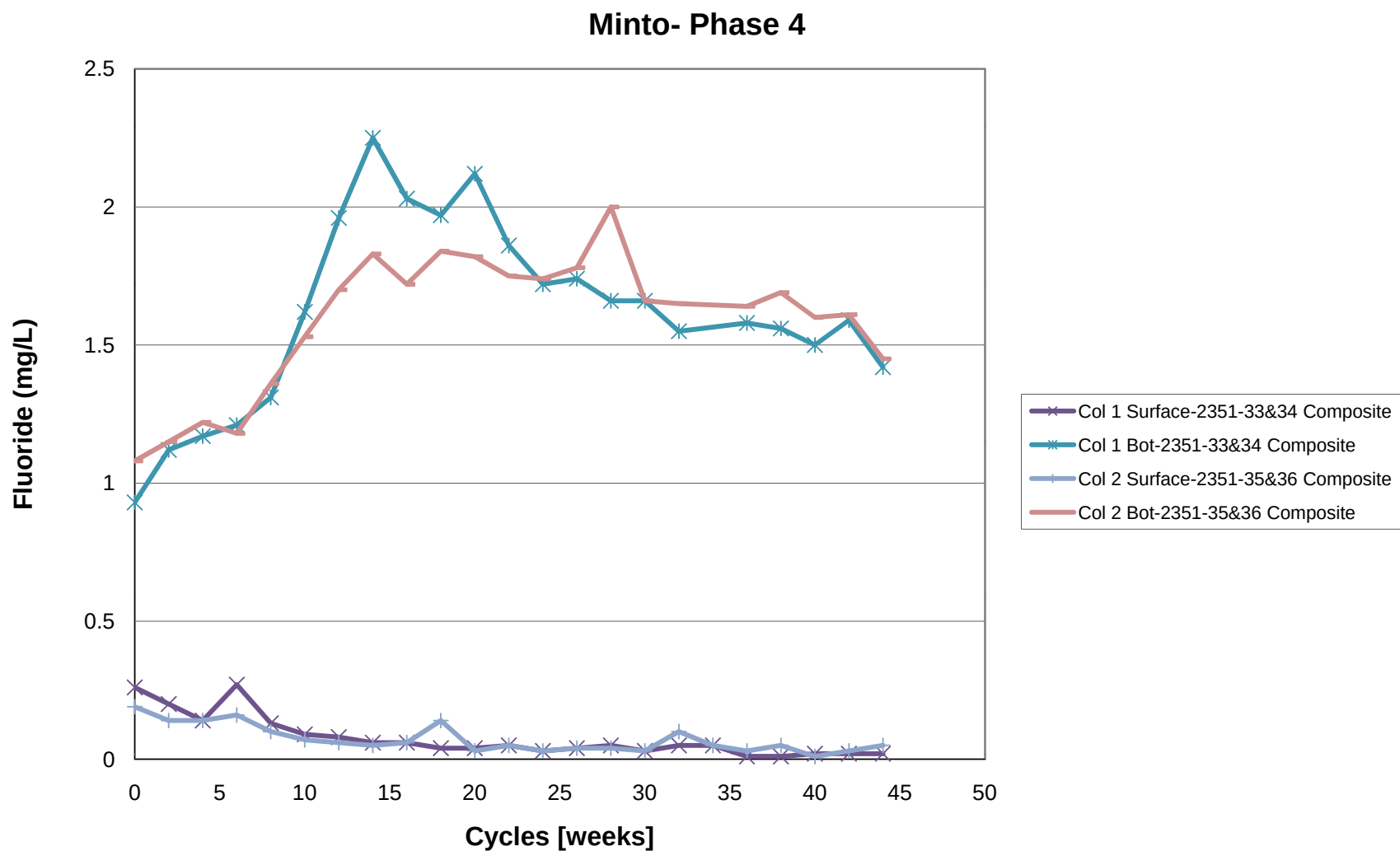
Minto- Phase 4

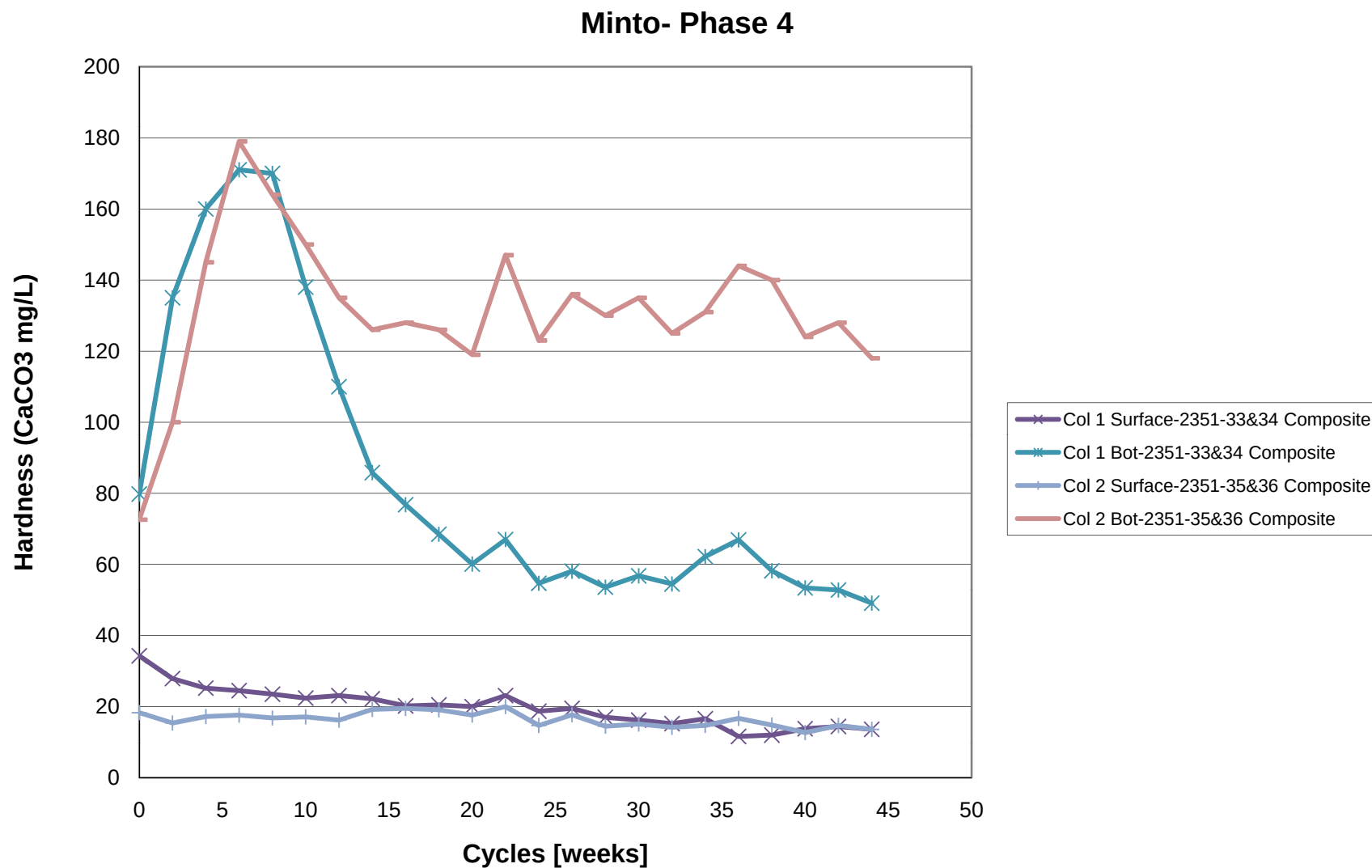


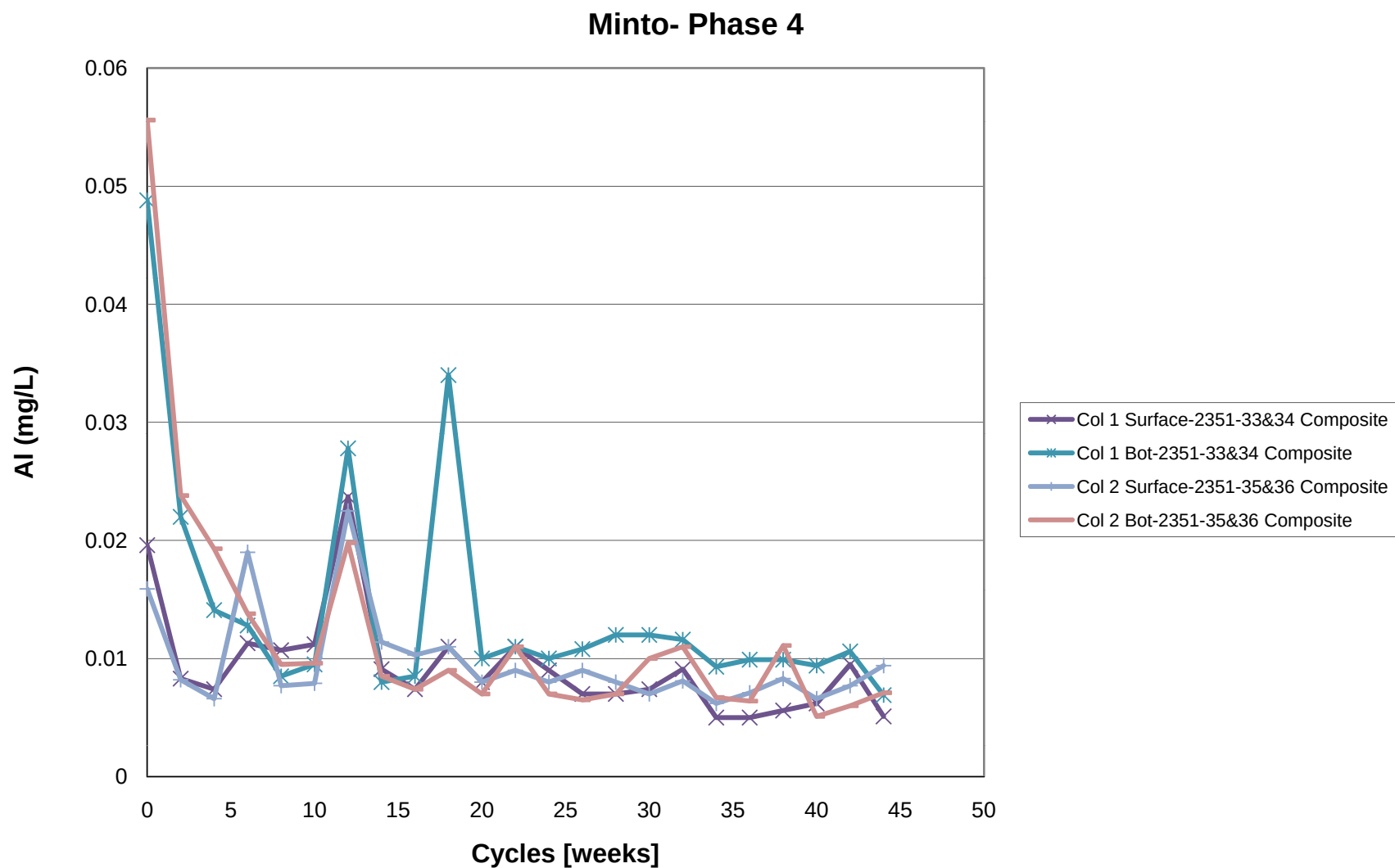


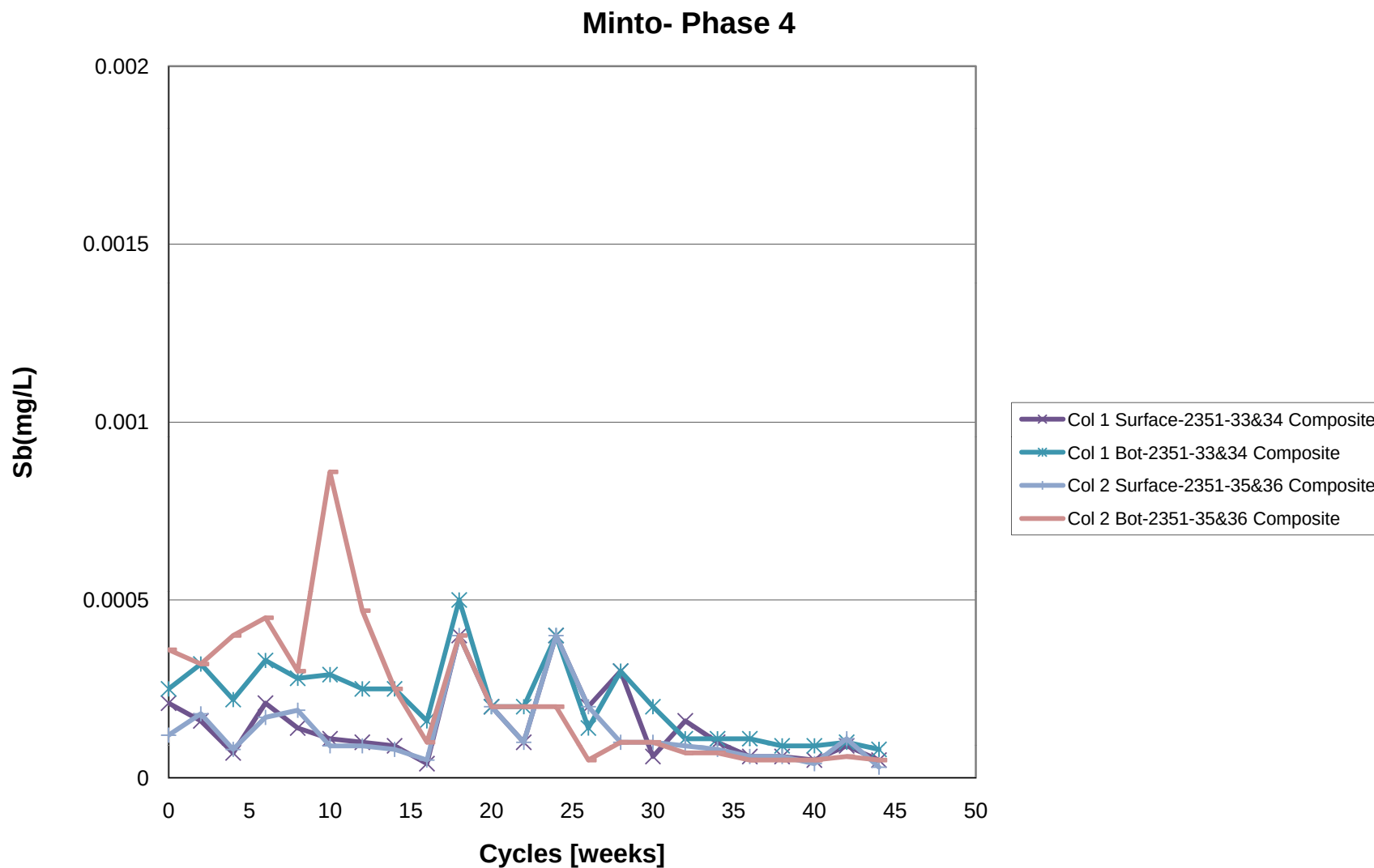
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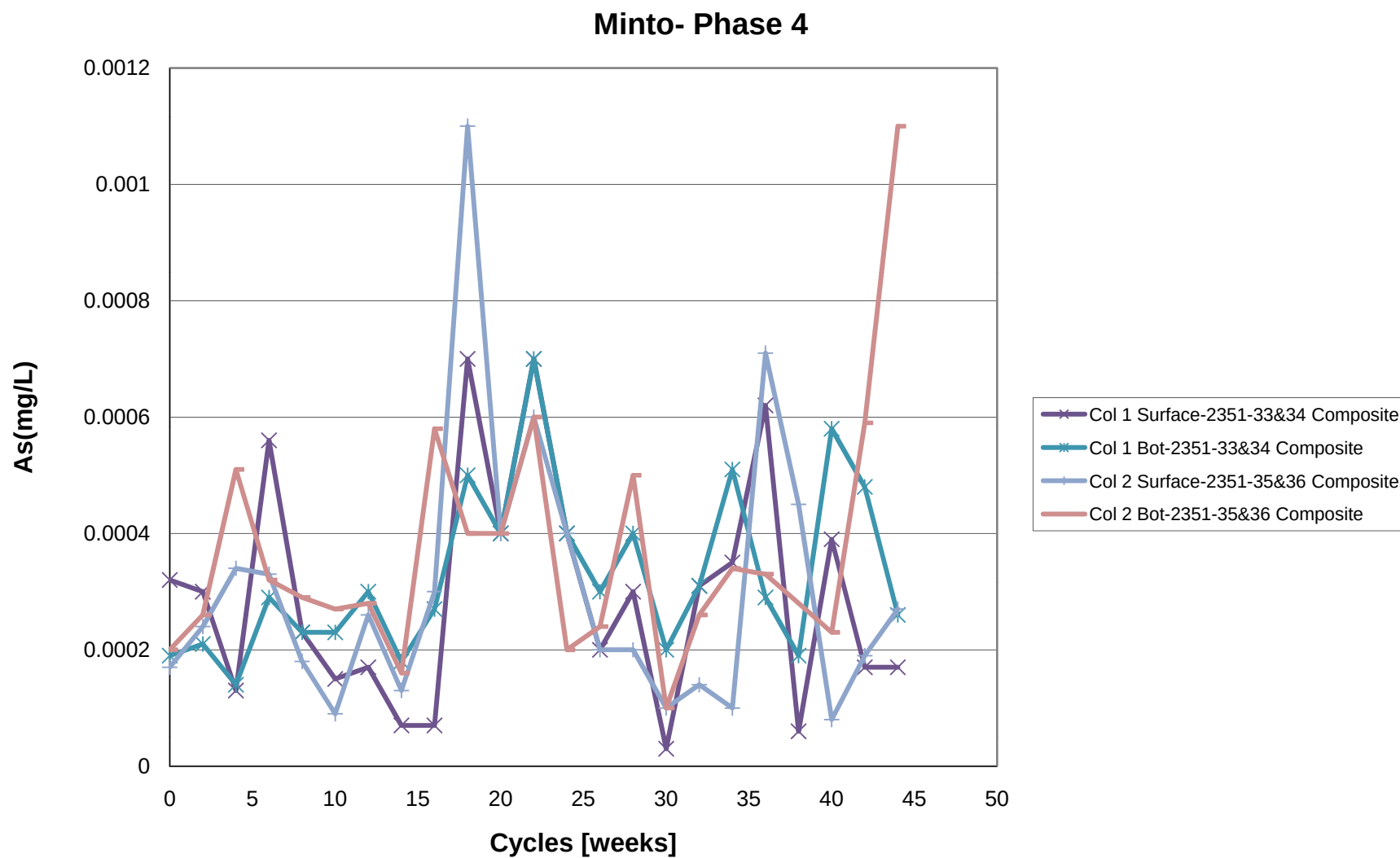


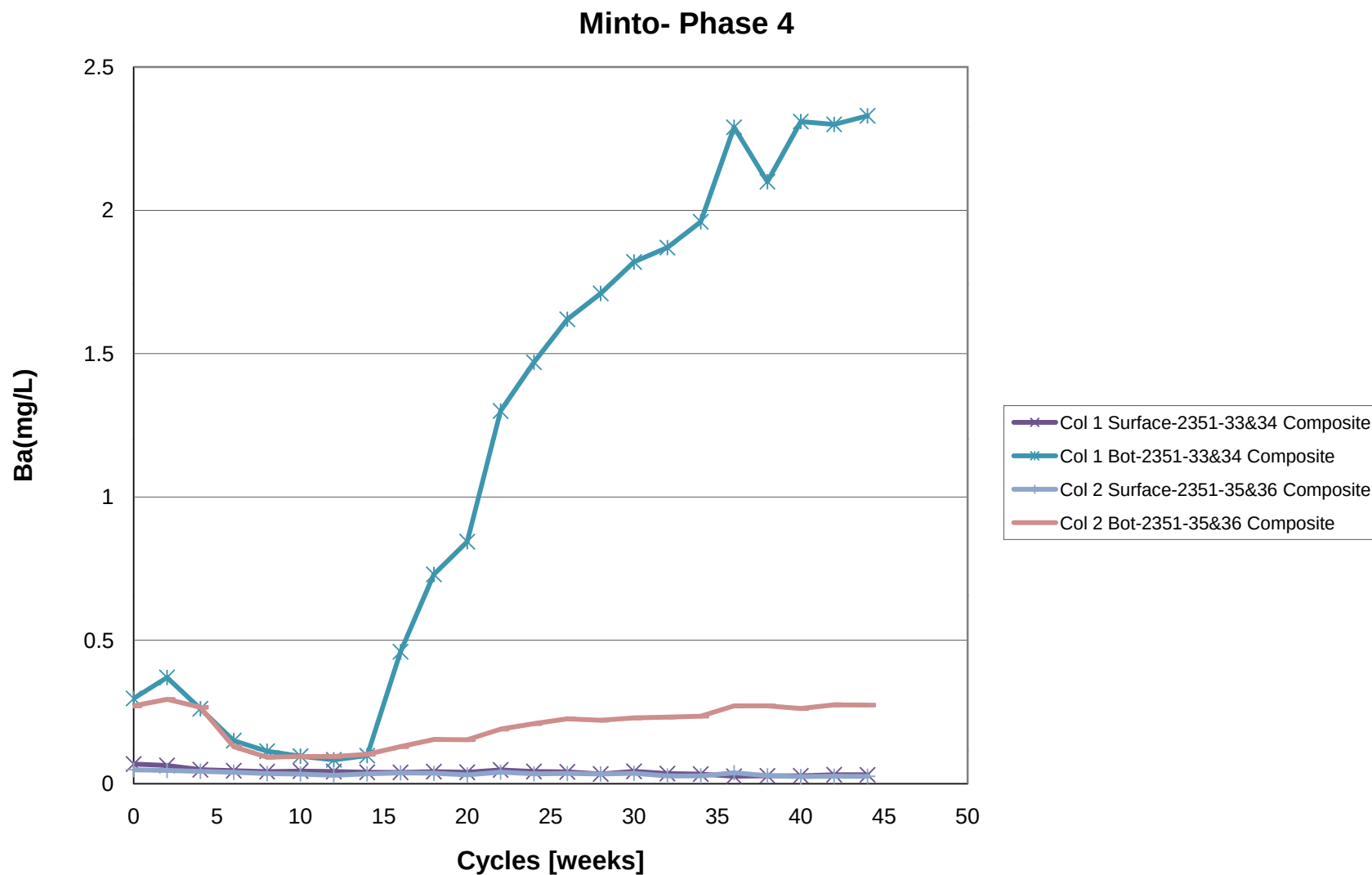




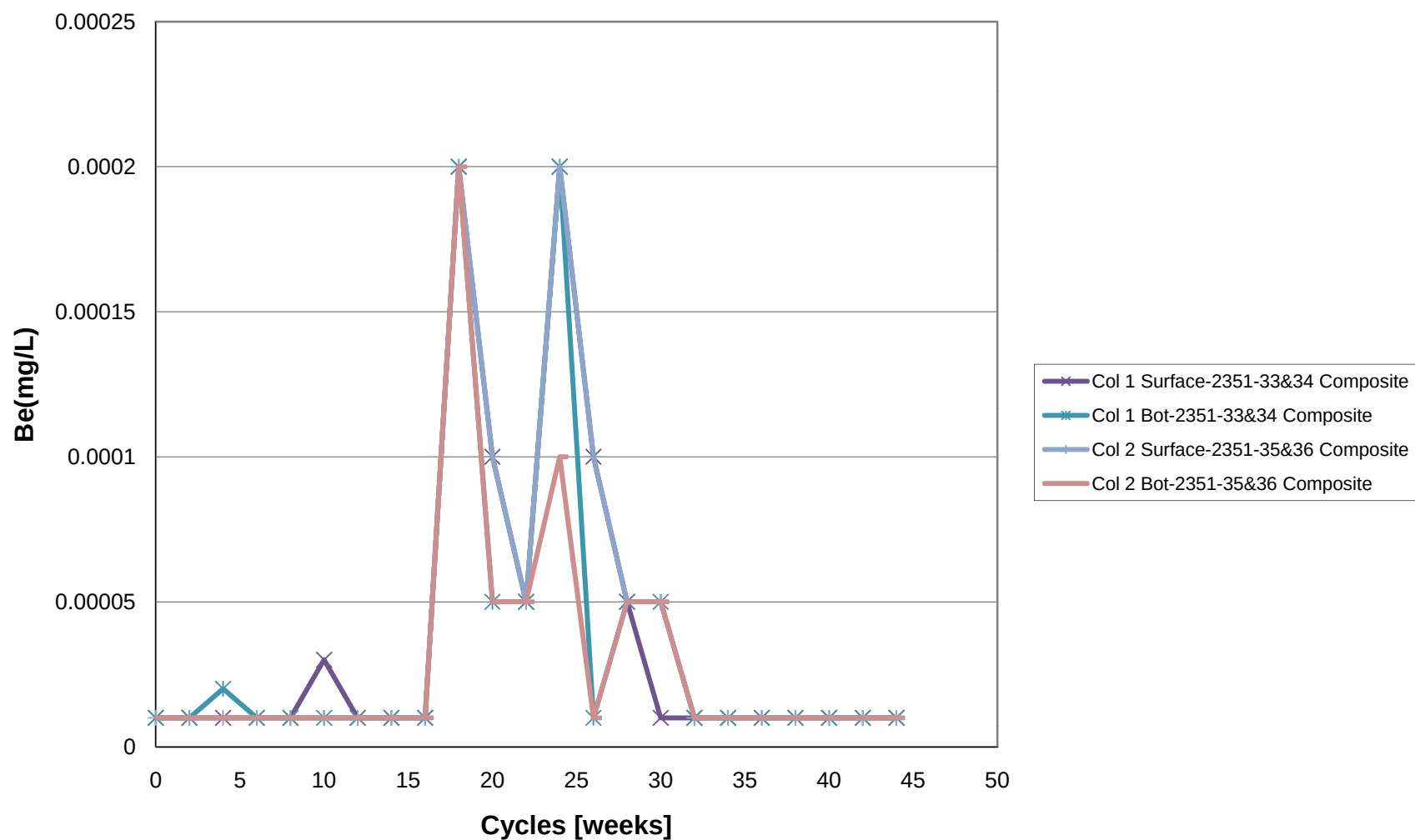


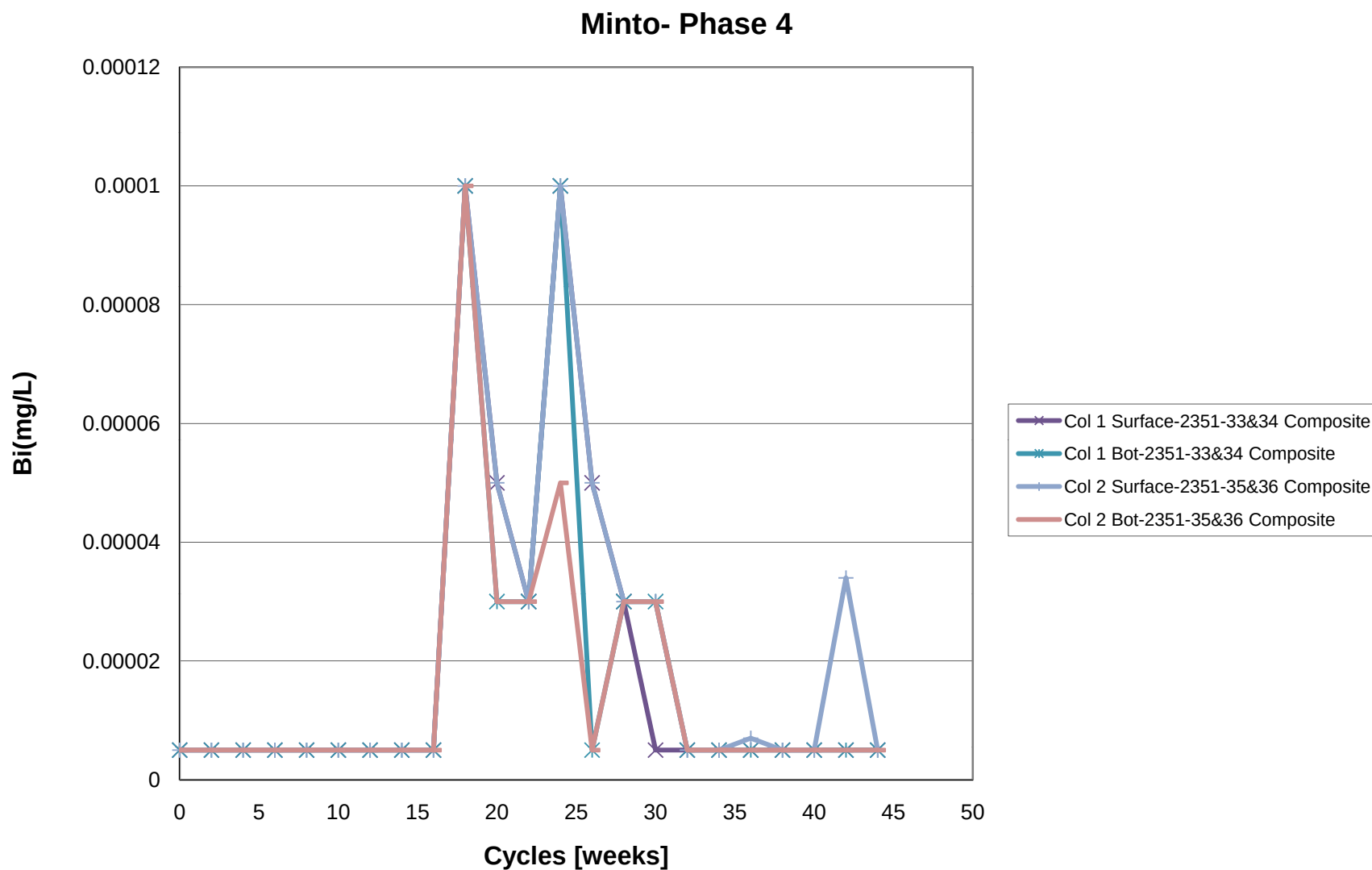


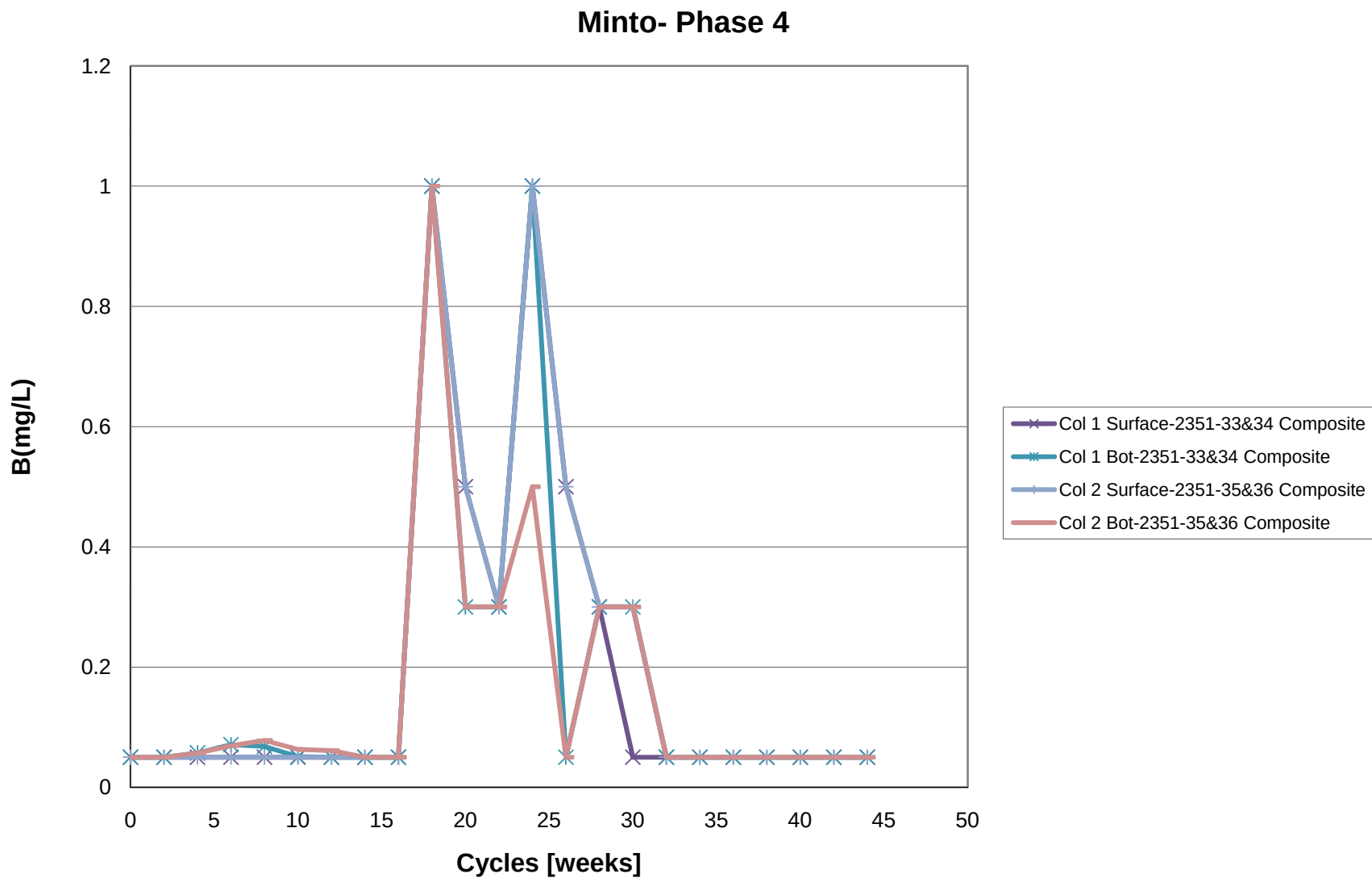


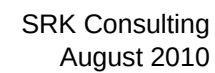


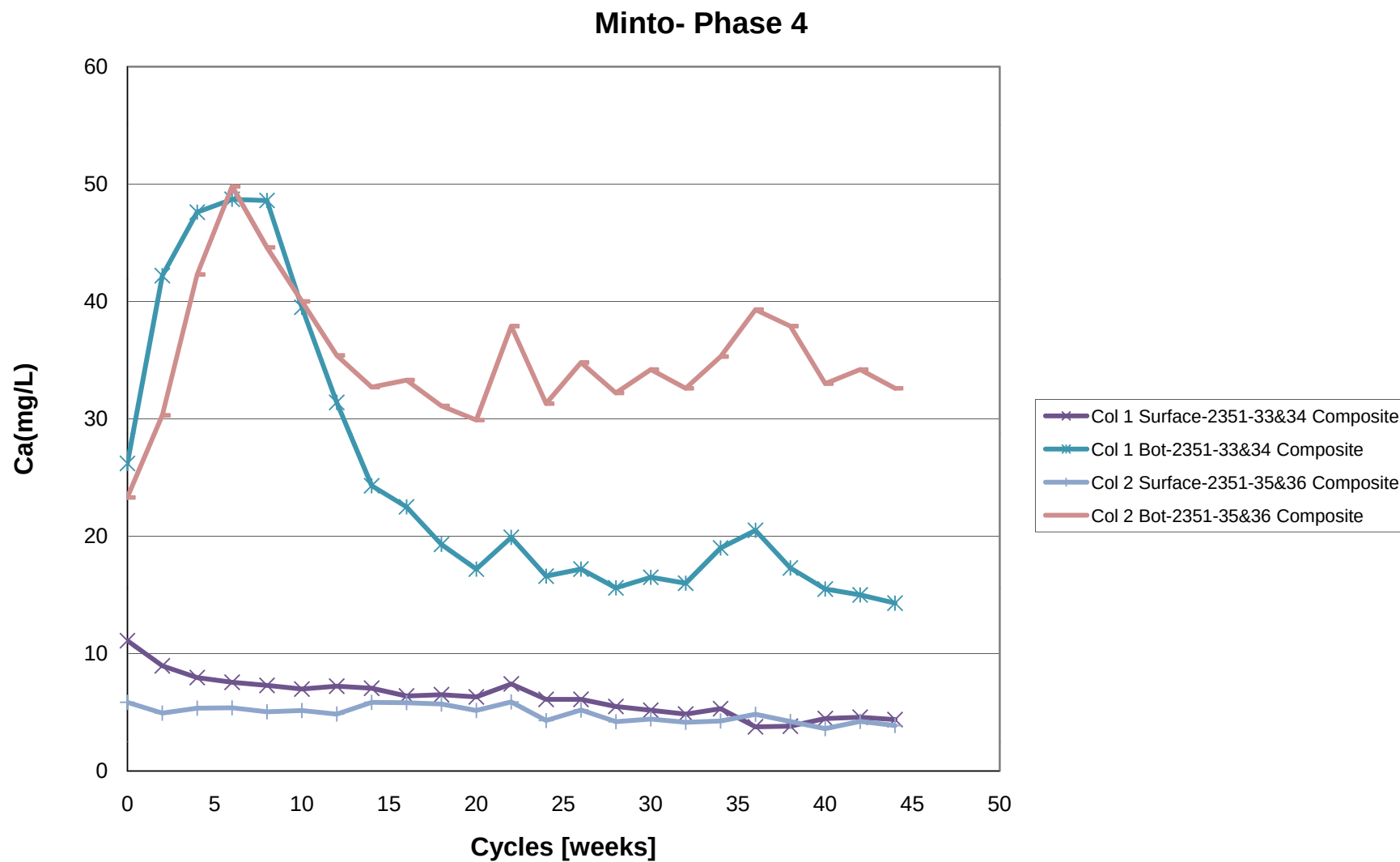
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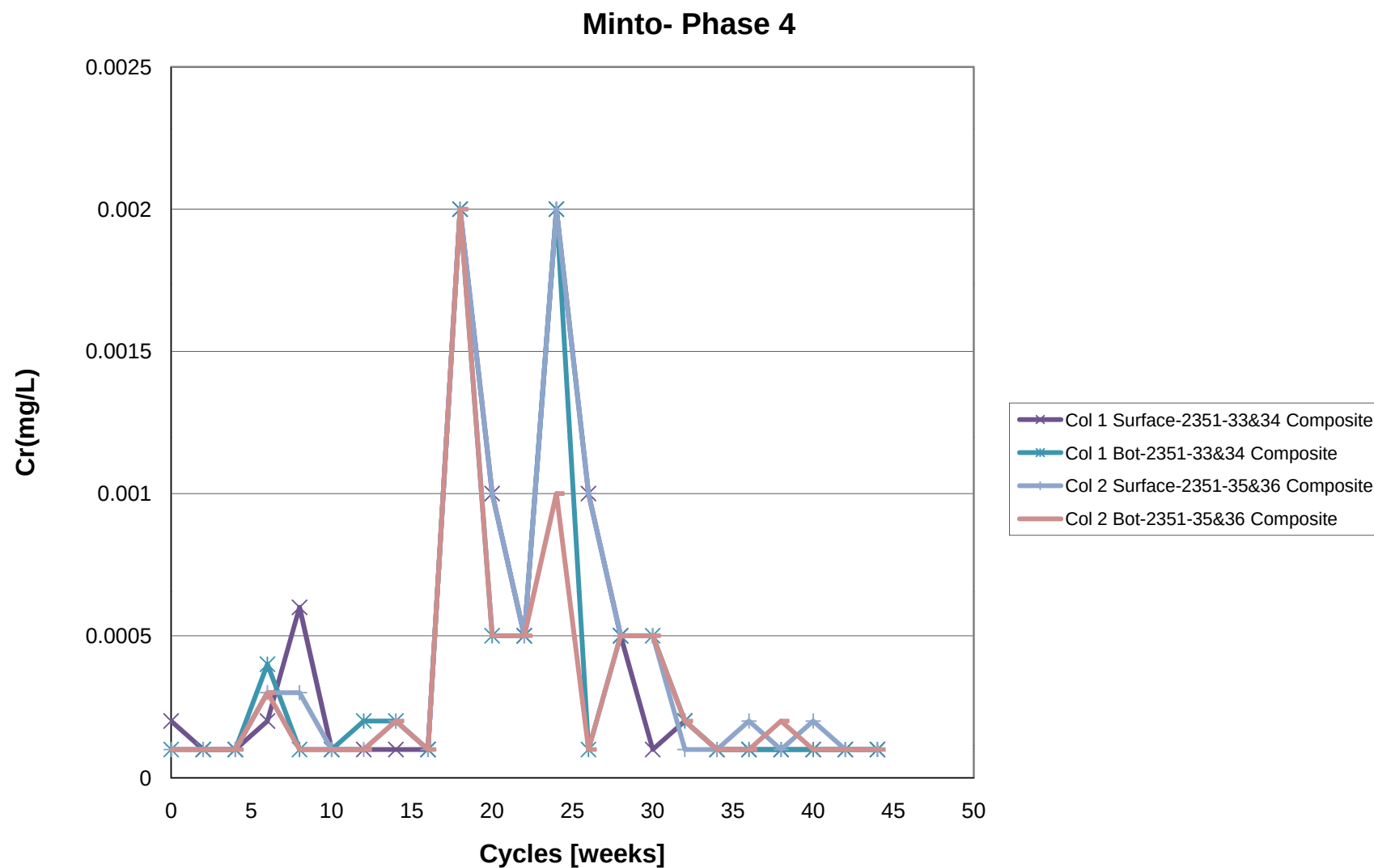


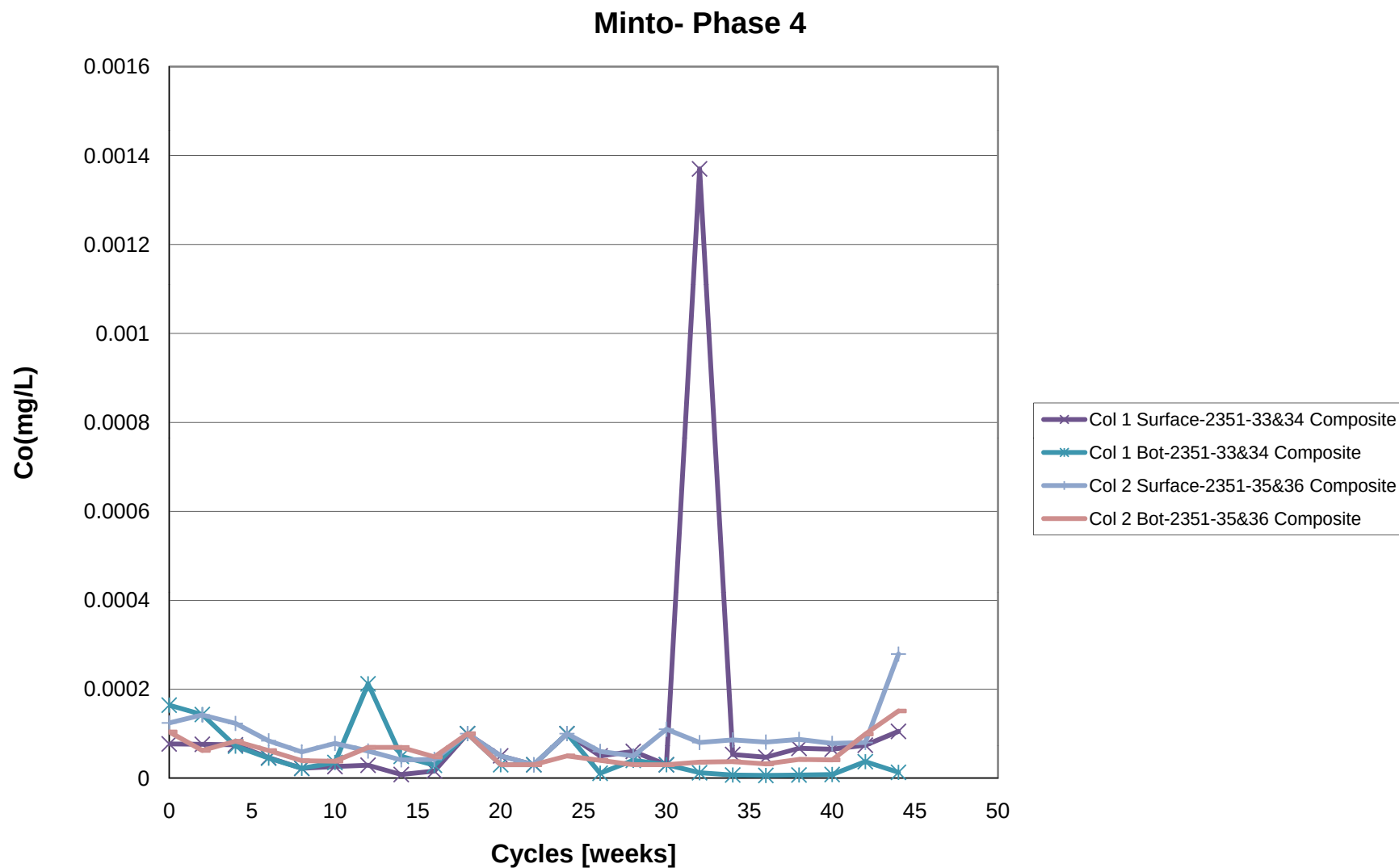


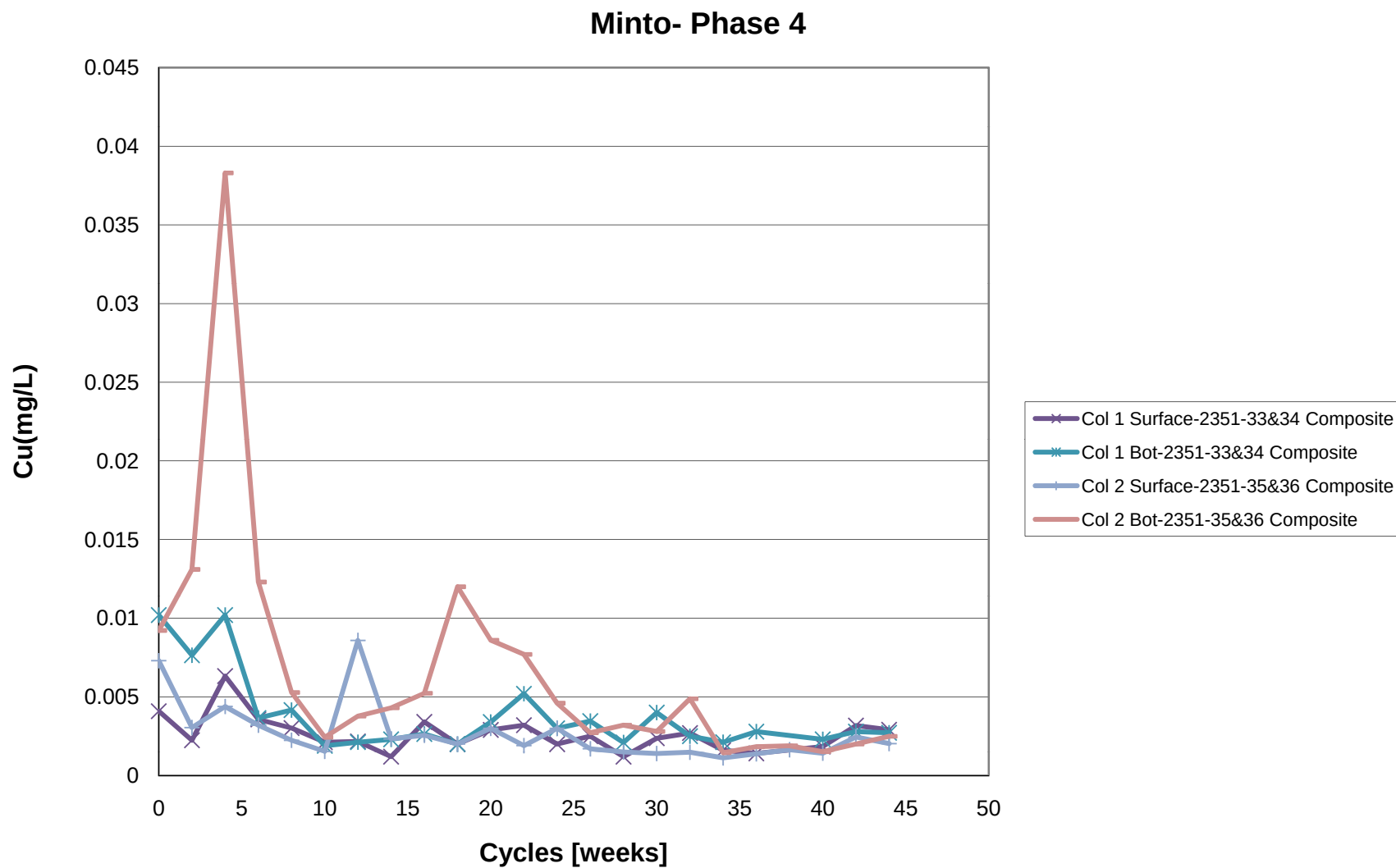


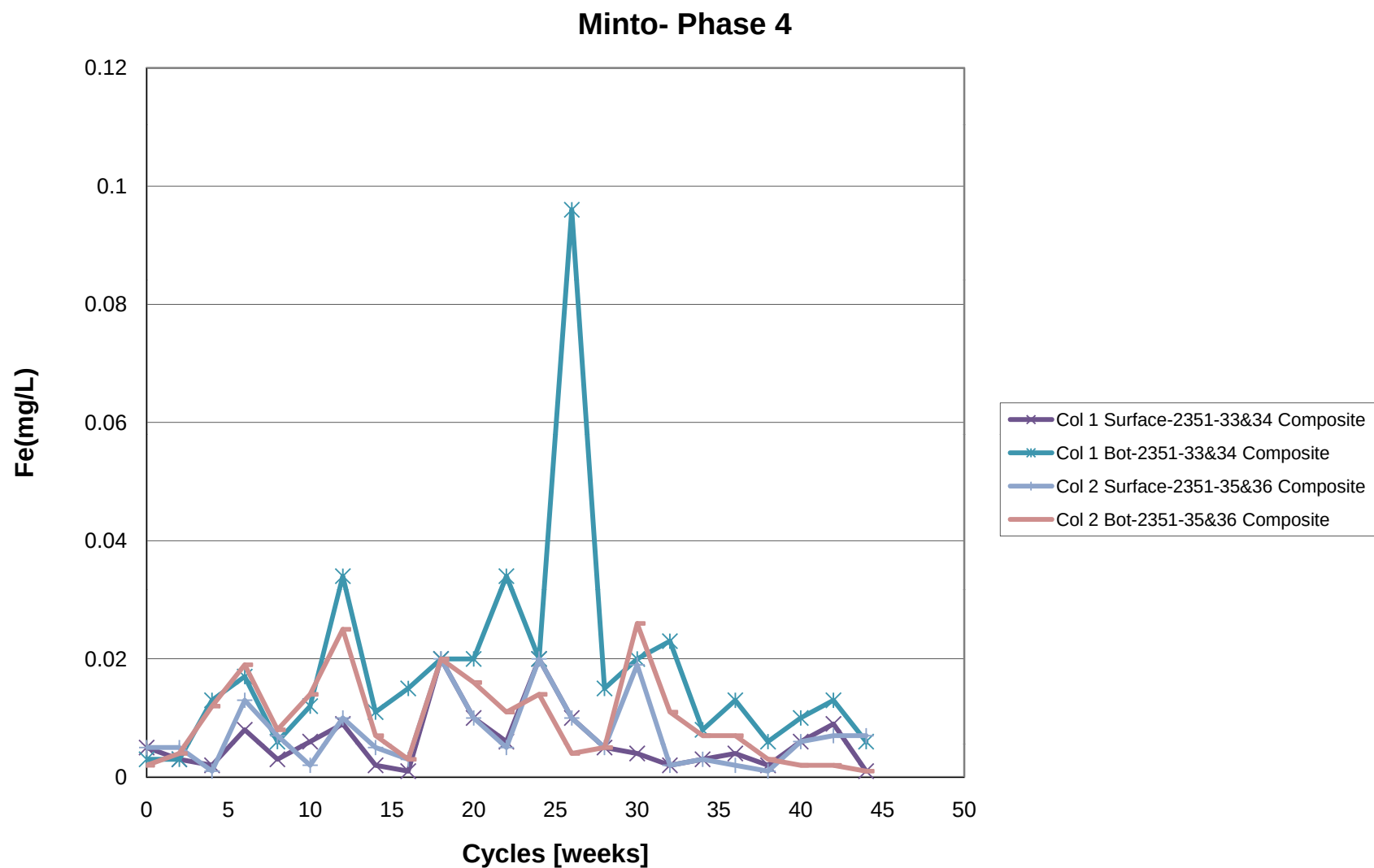


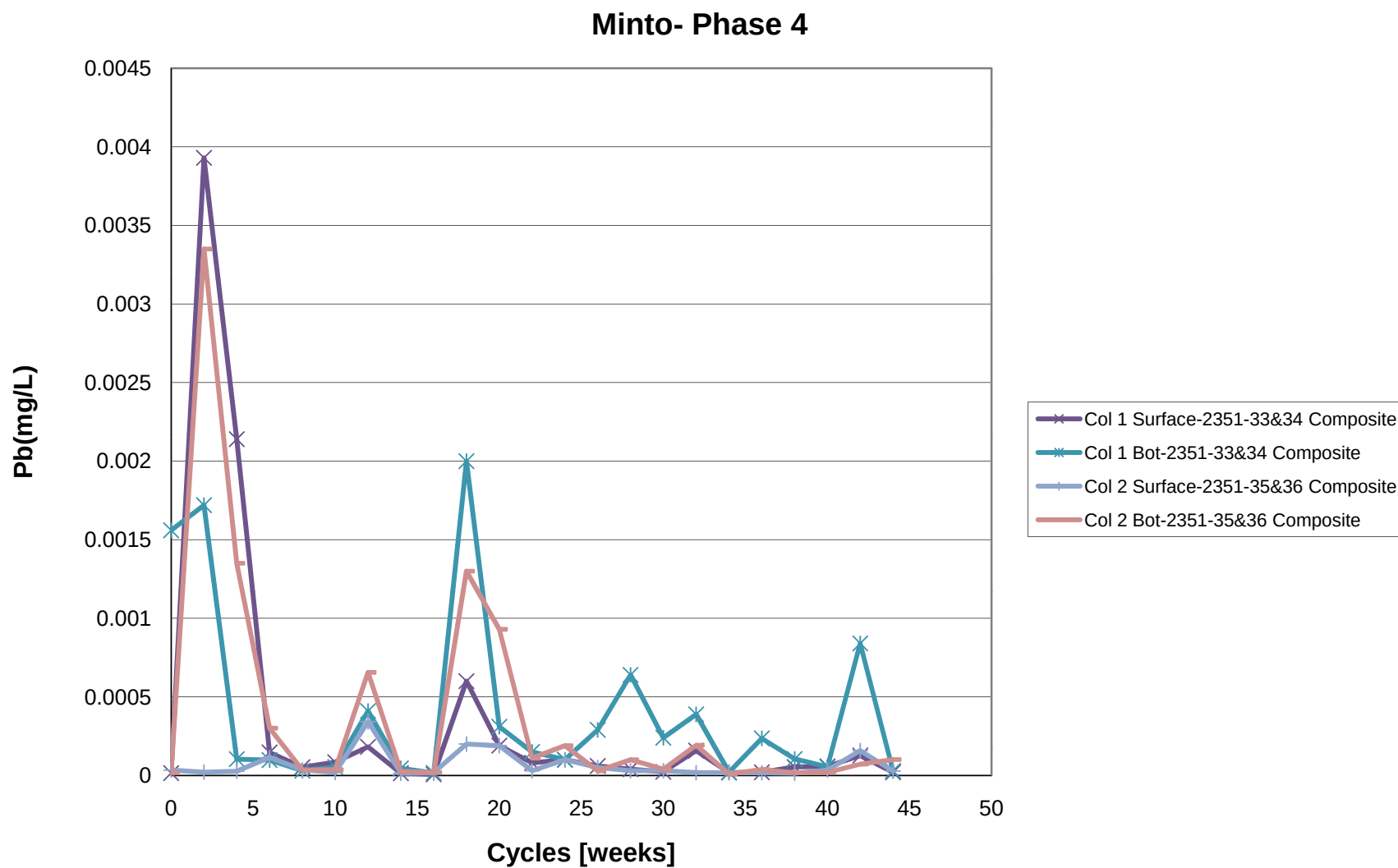


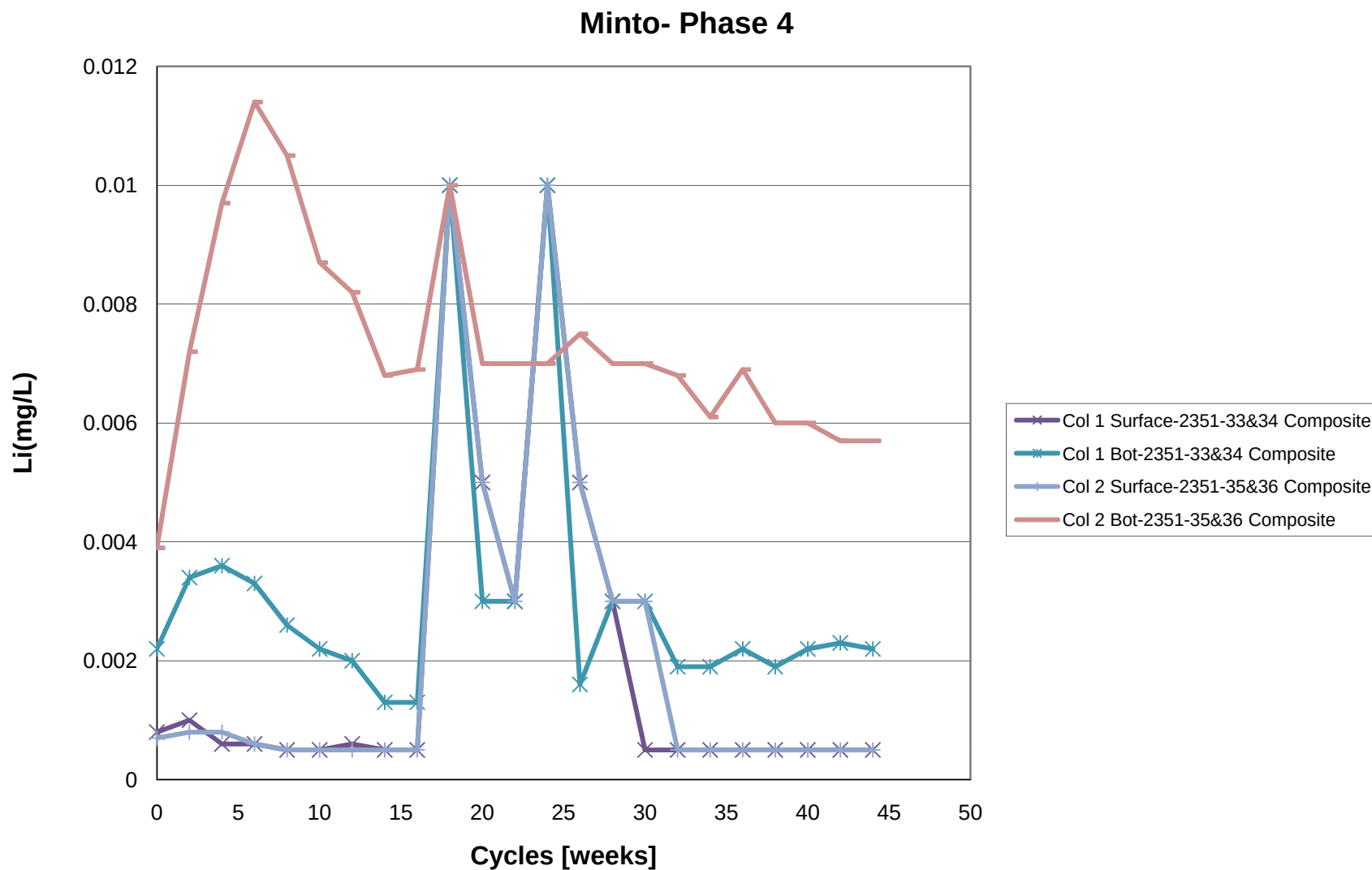


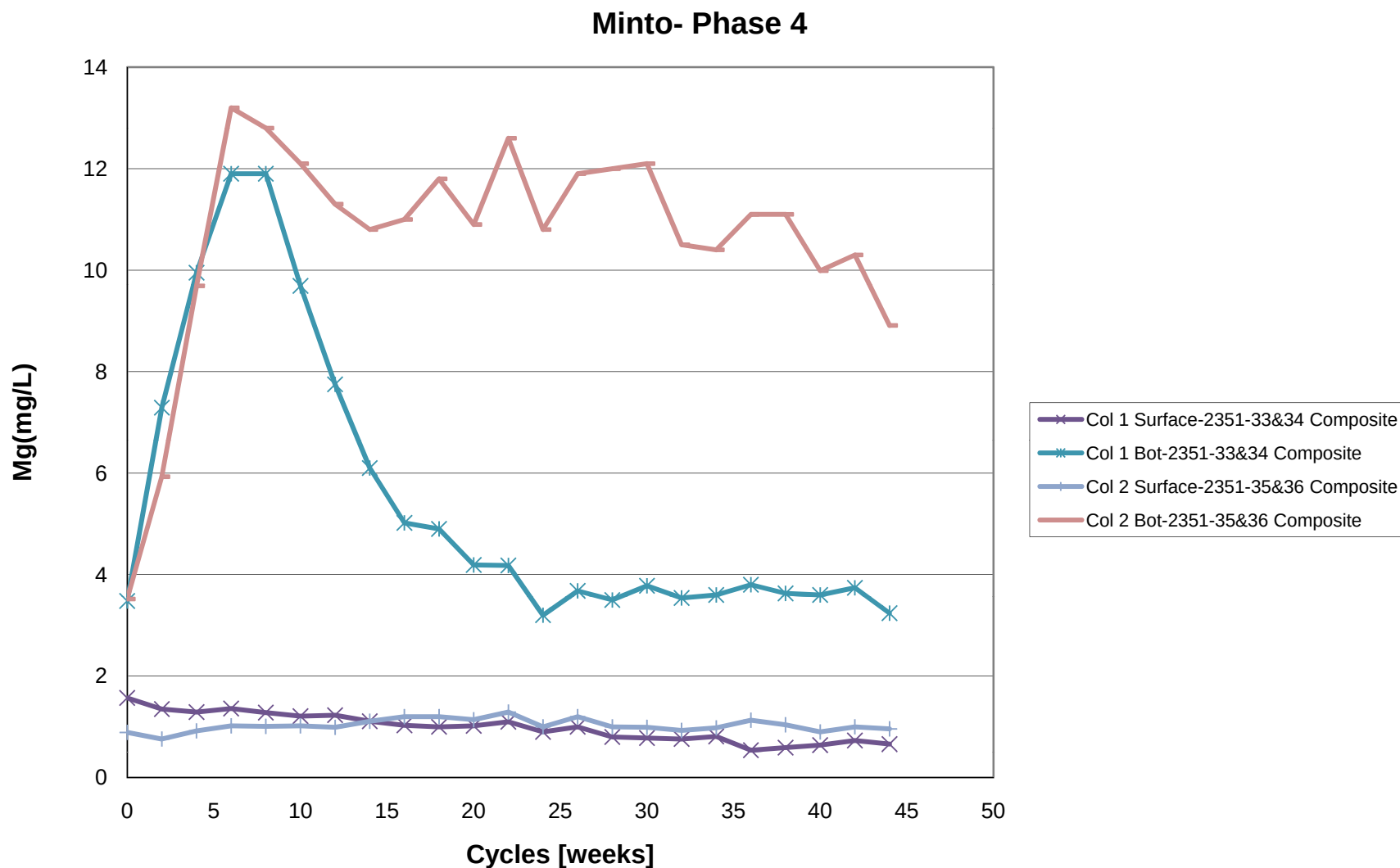


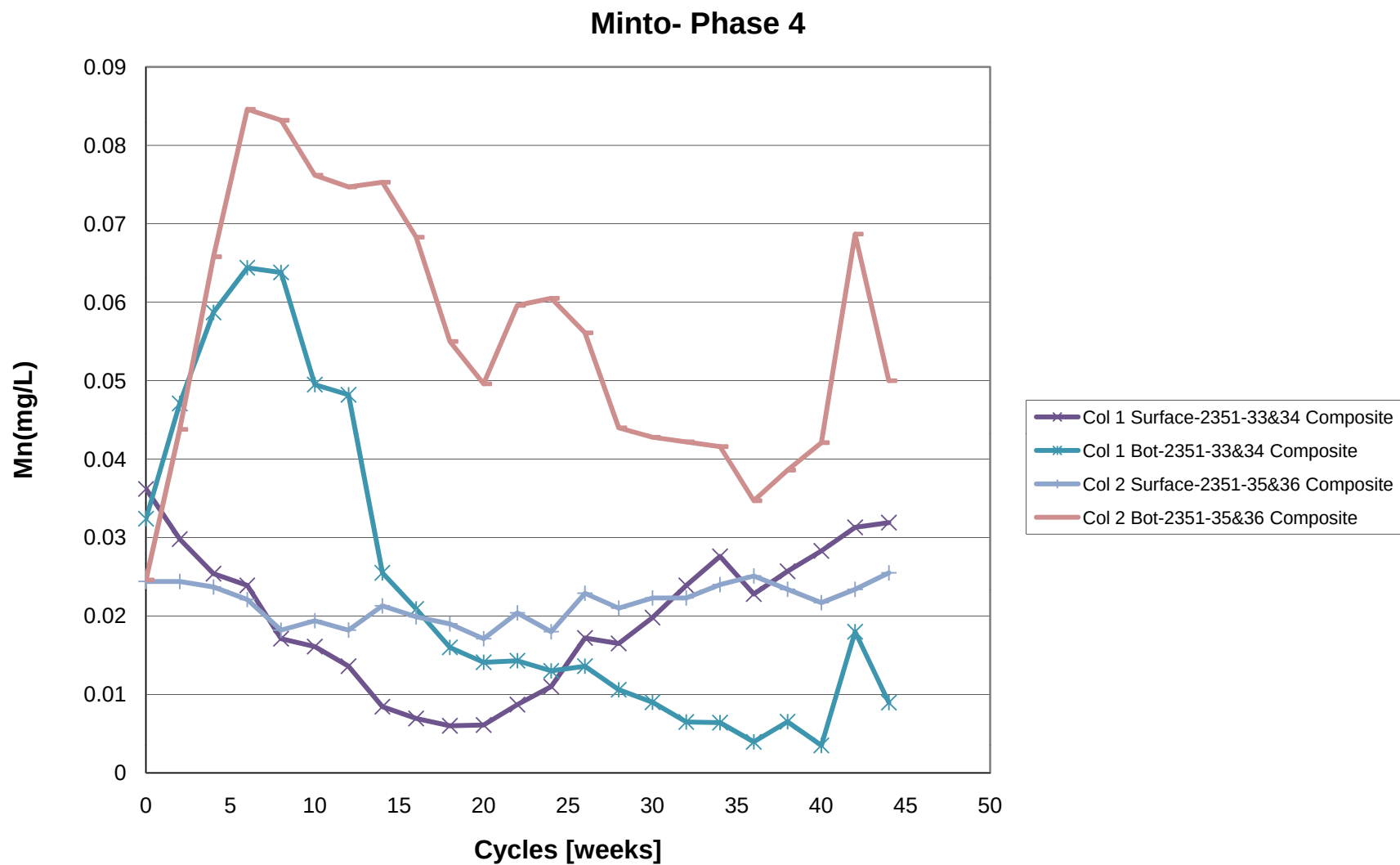


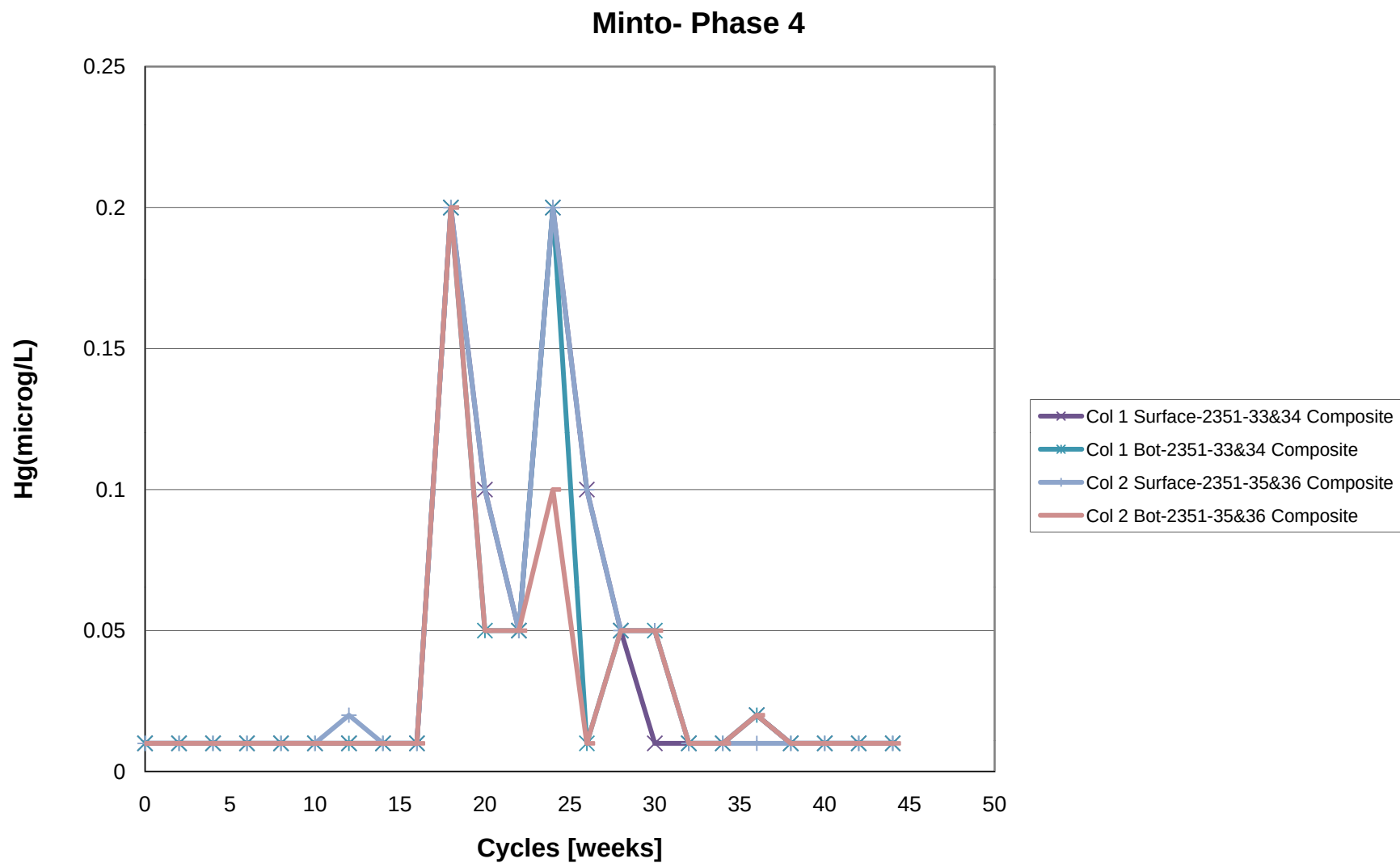


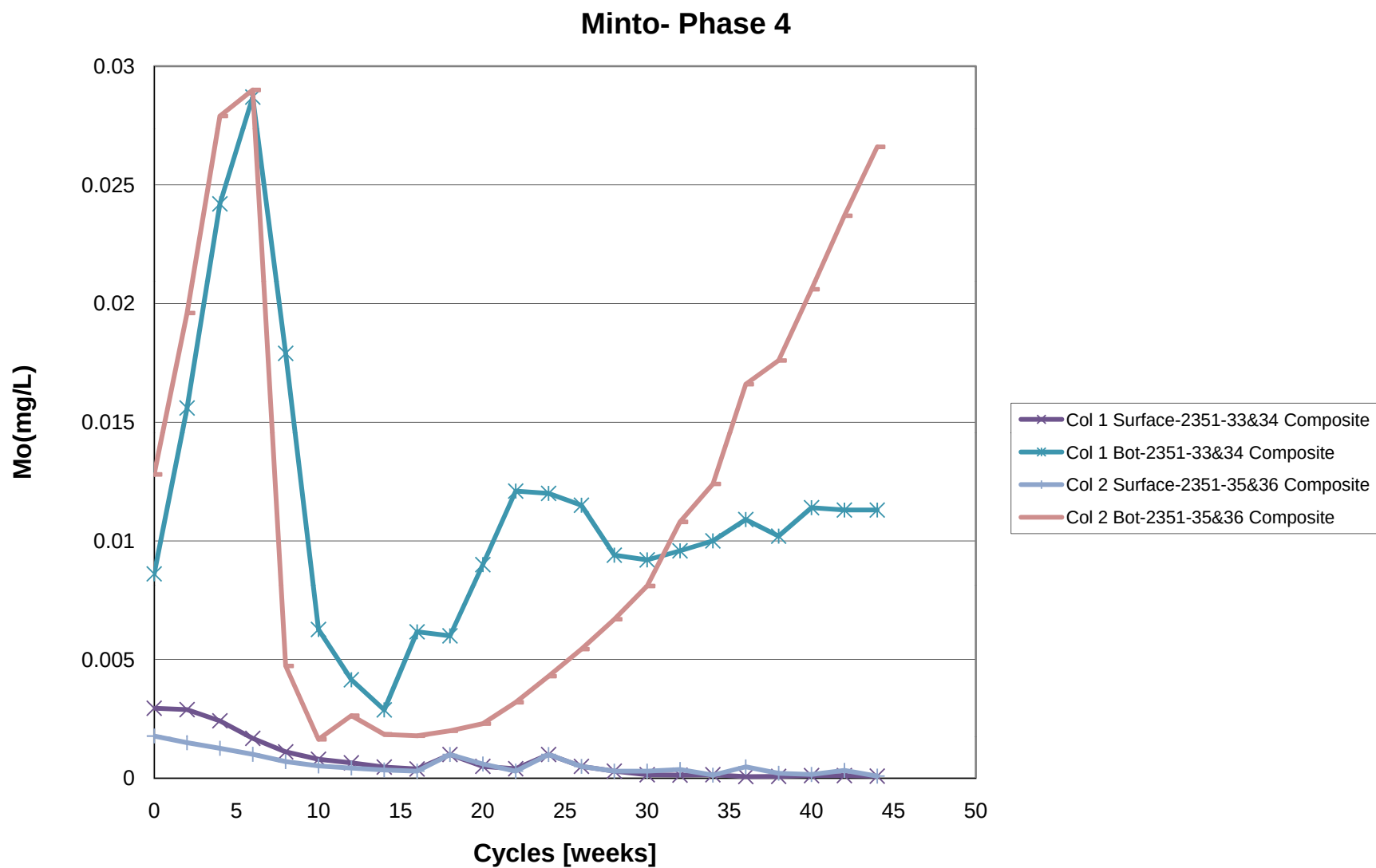


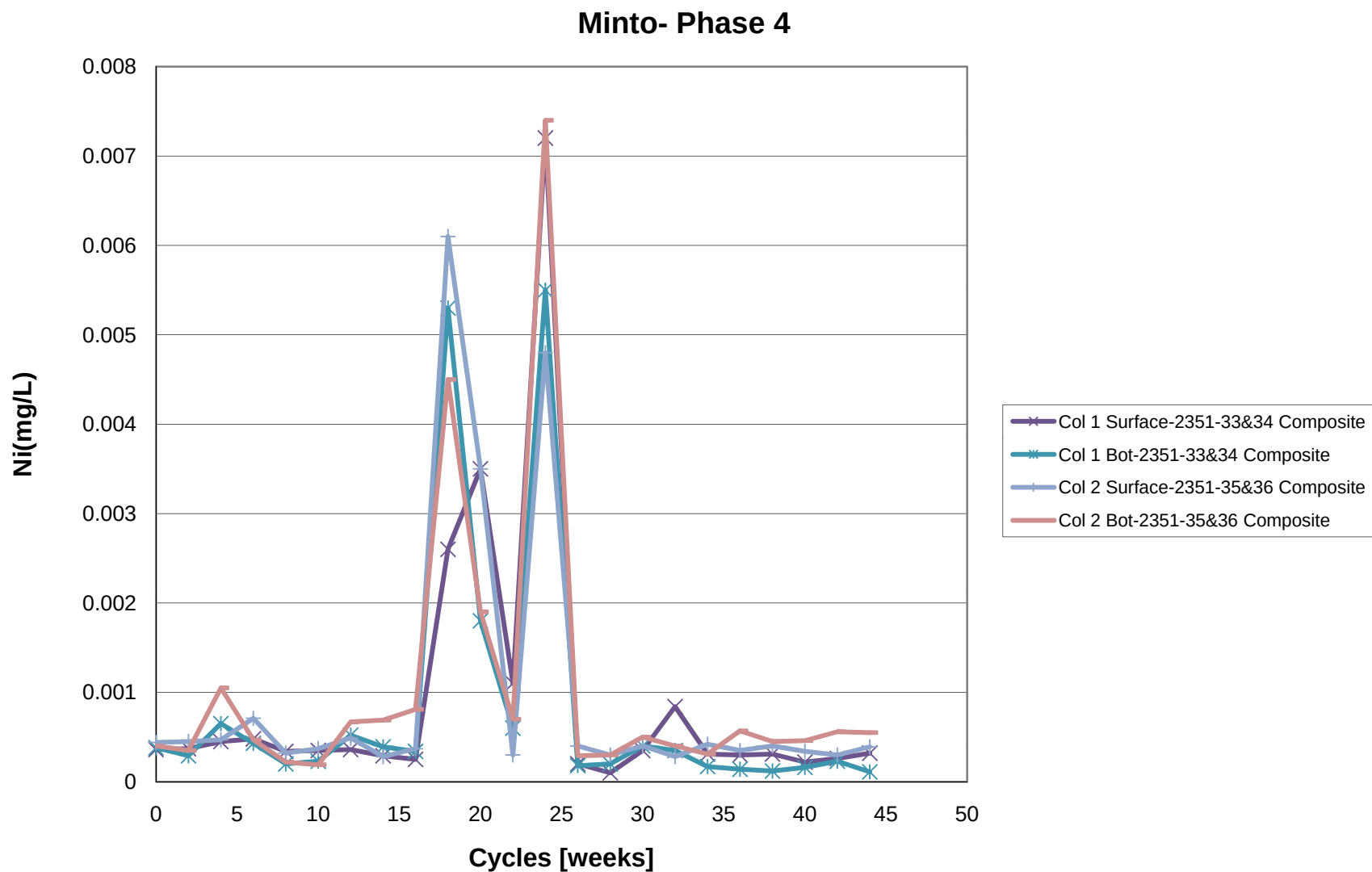


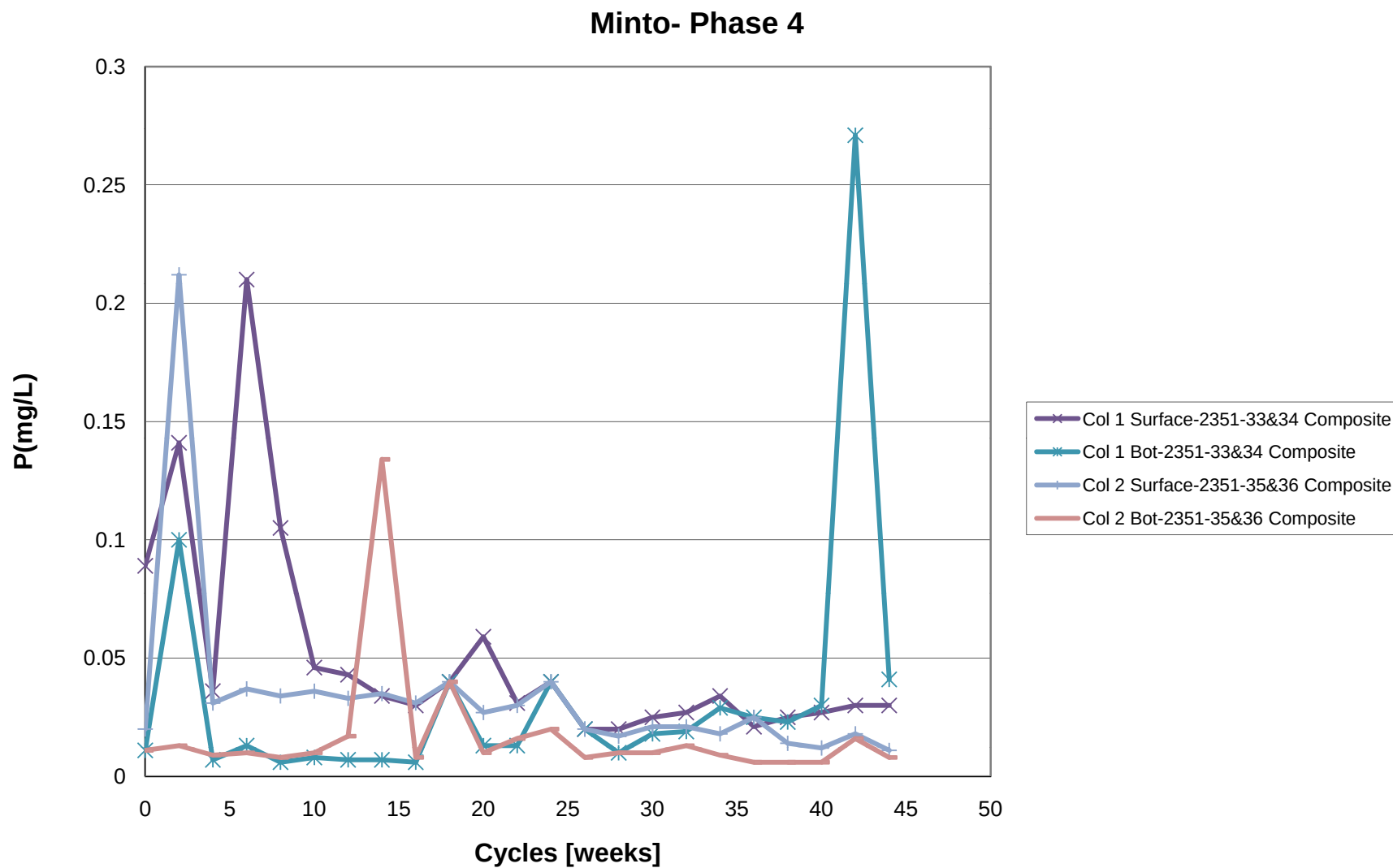


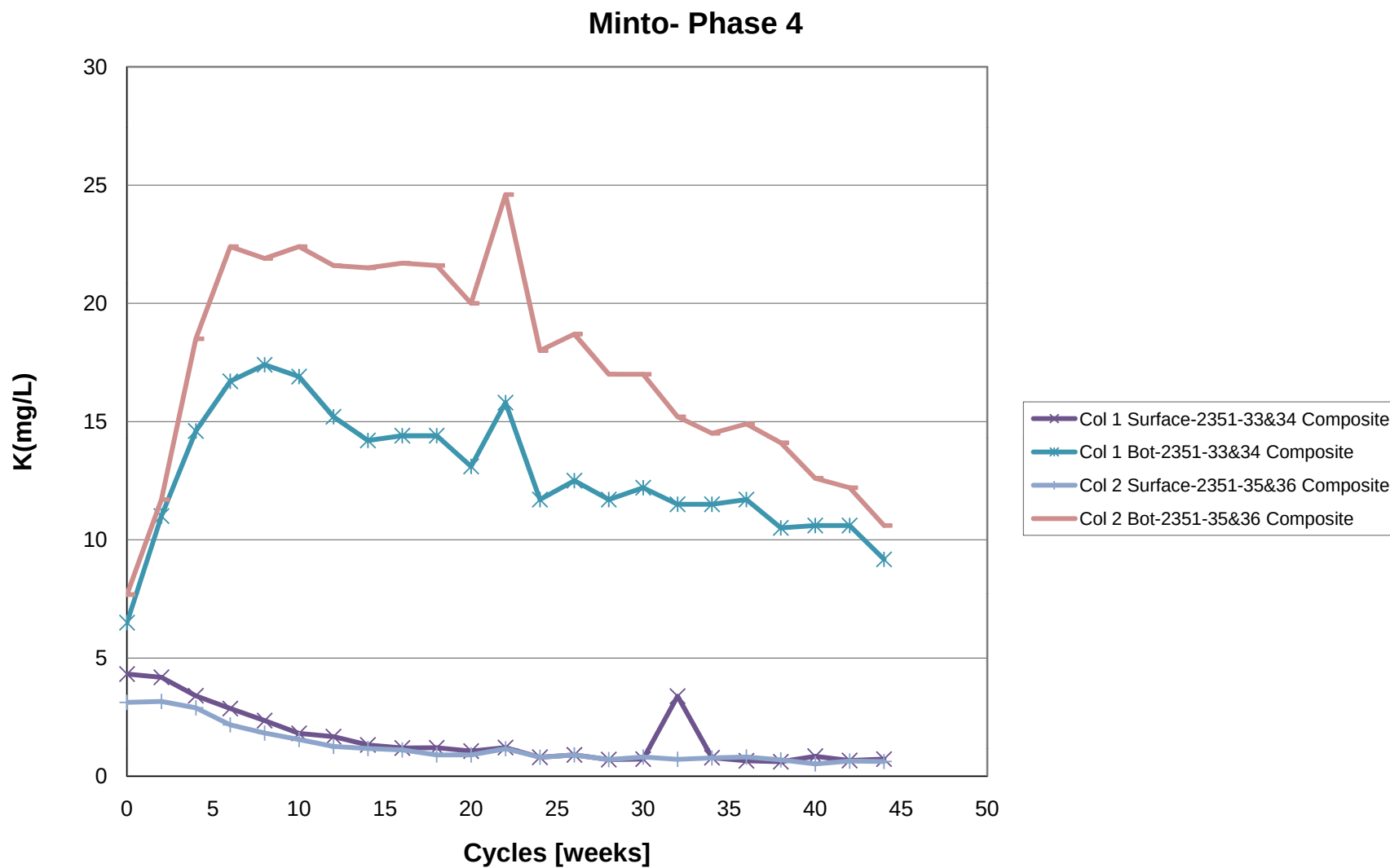


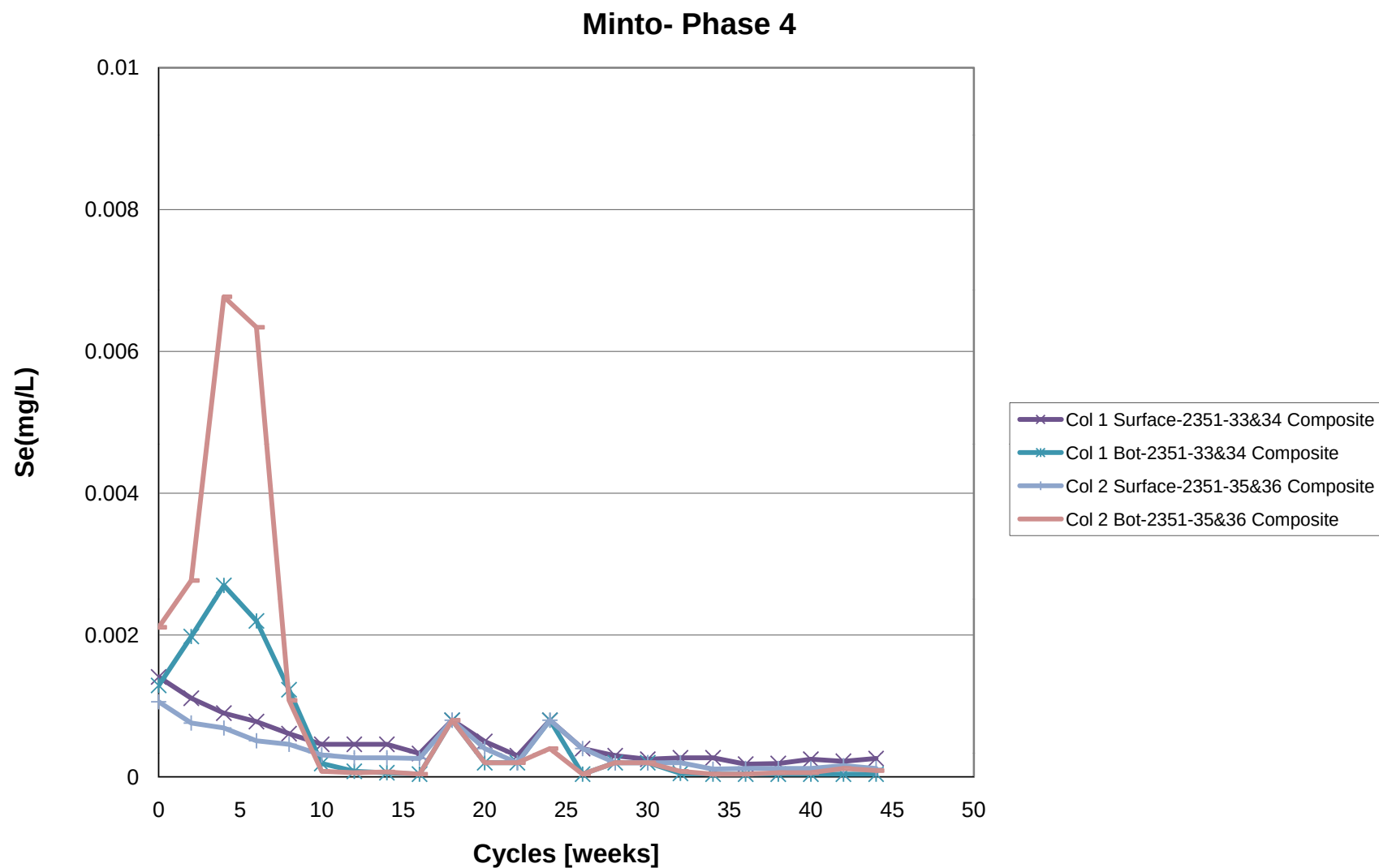


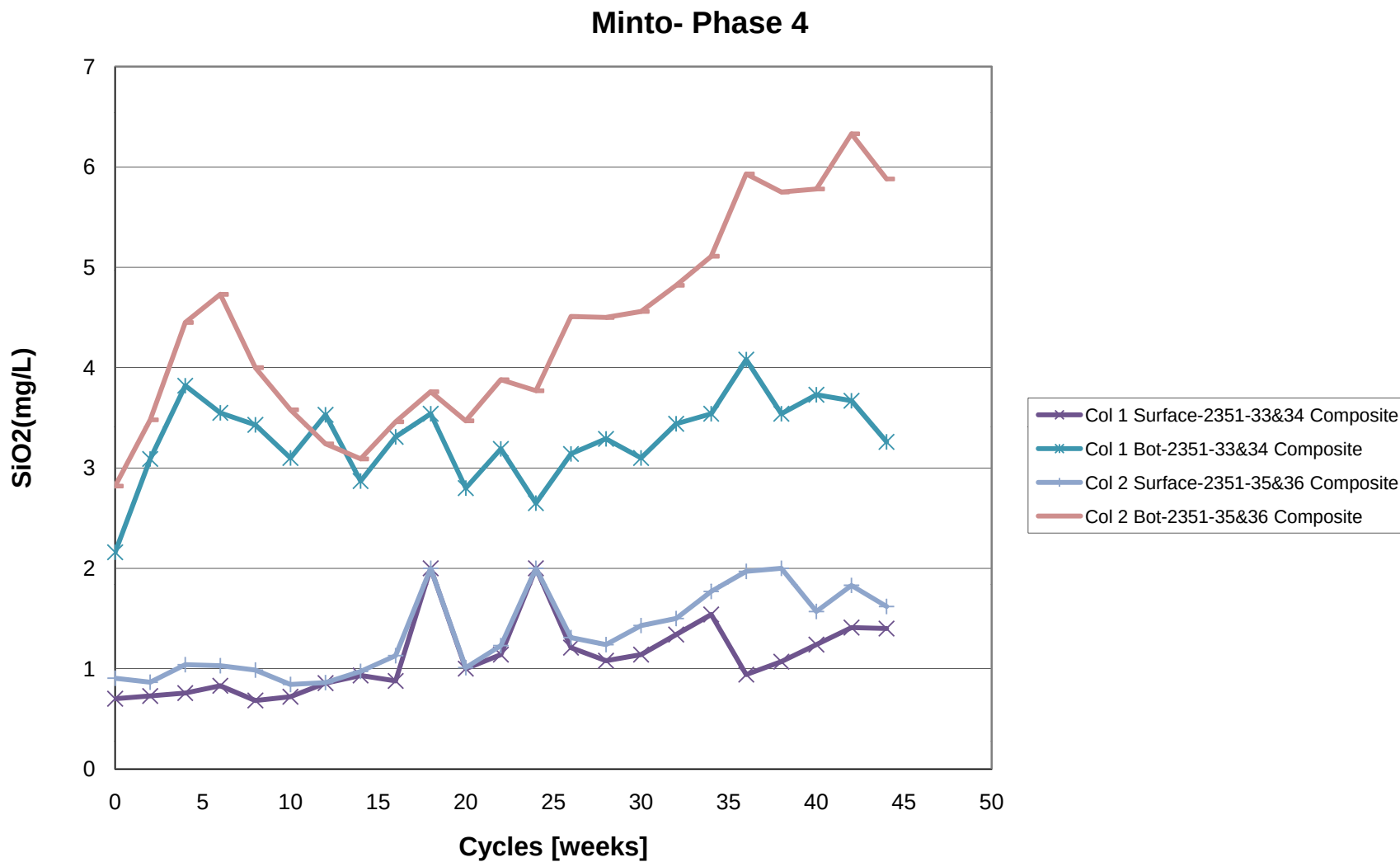


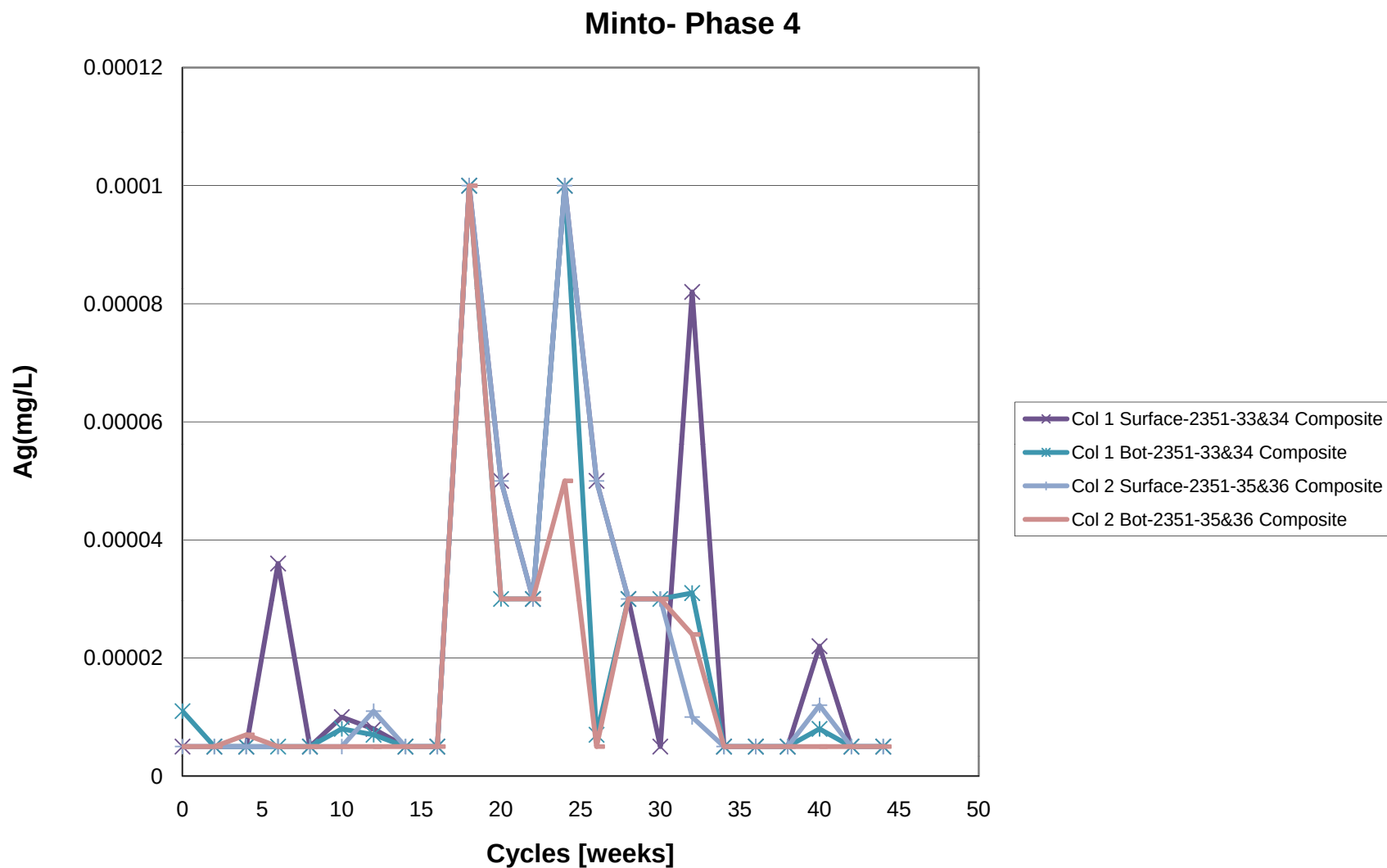


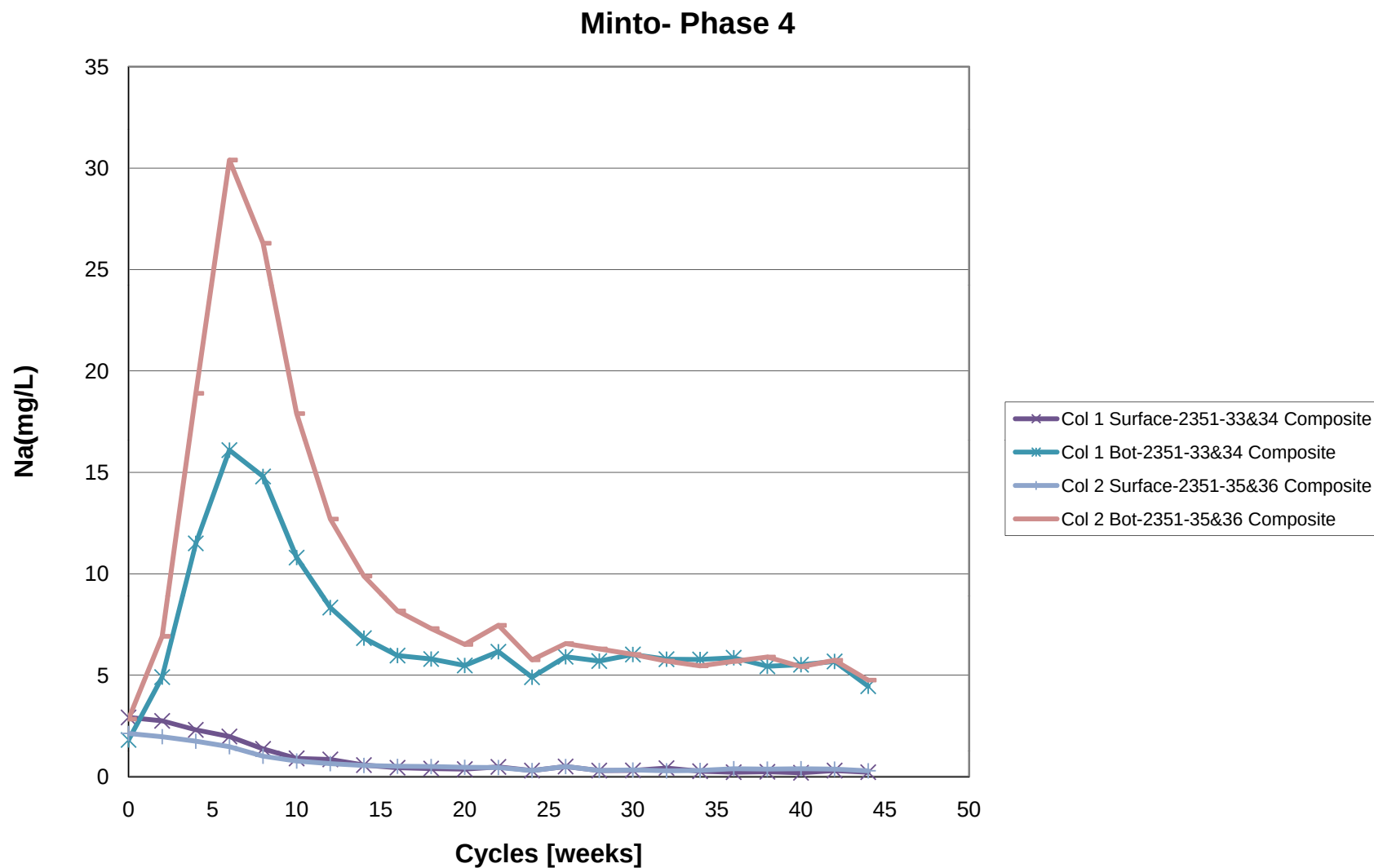




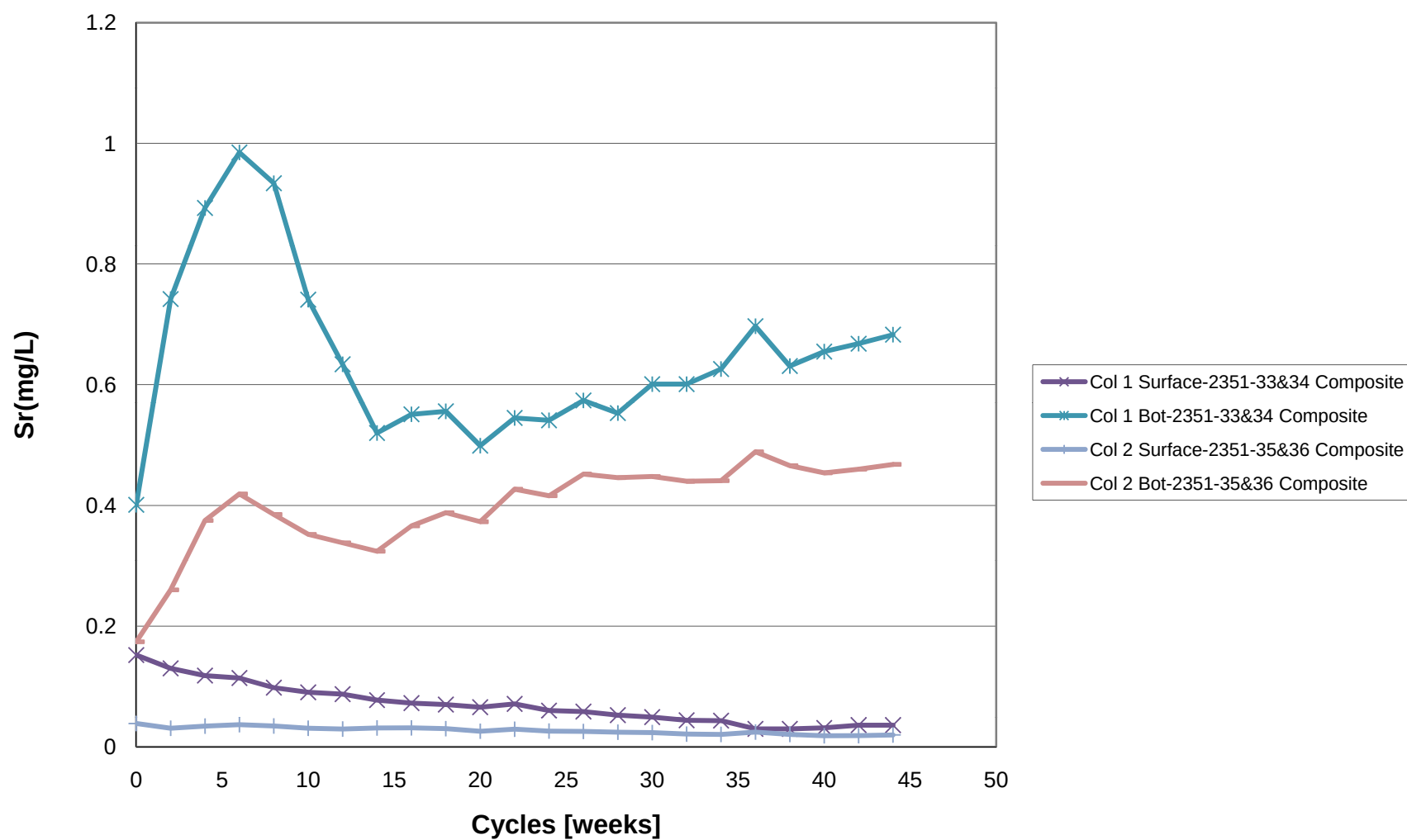




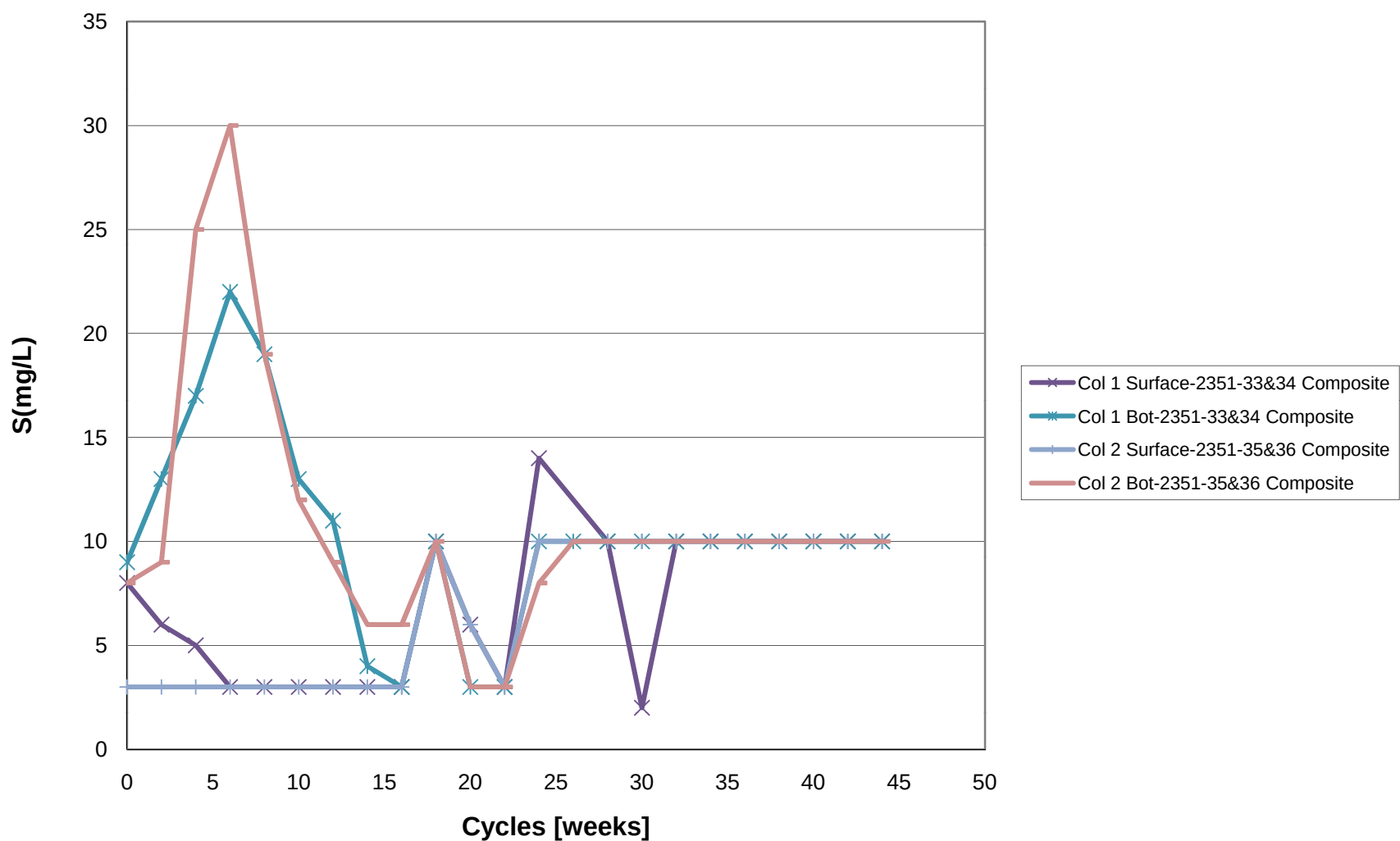


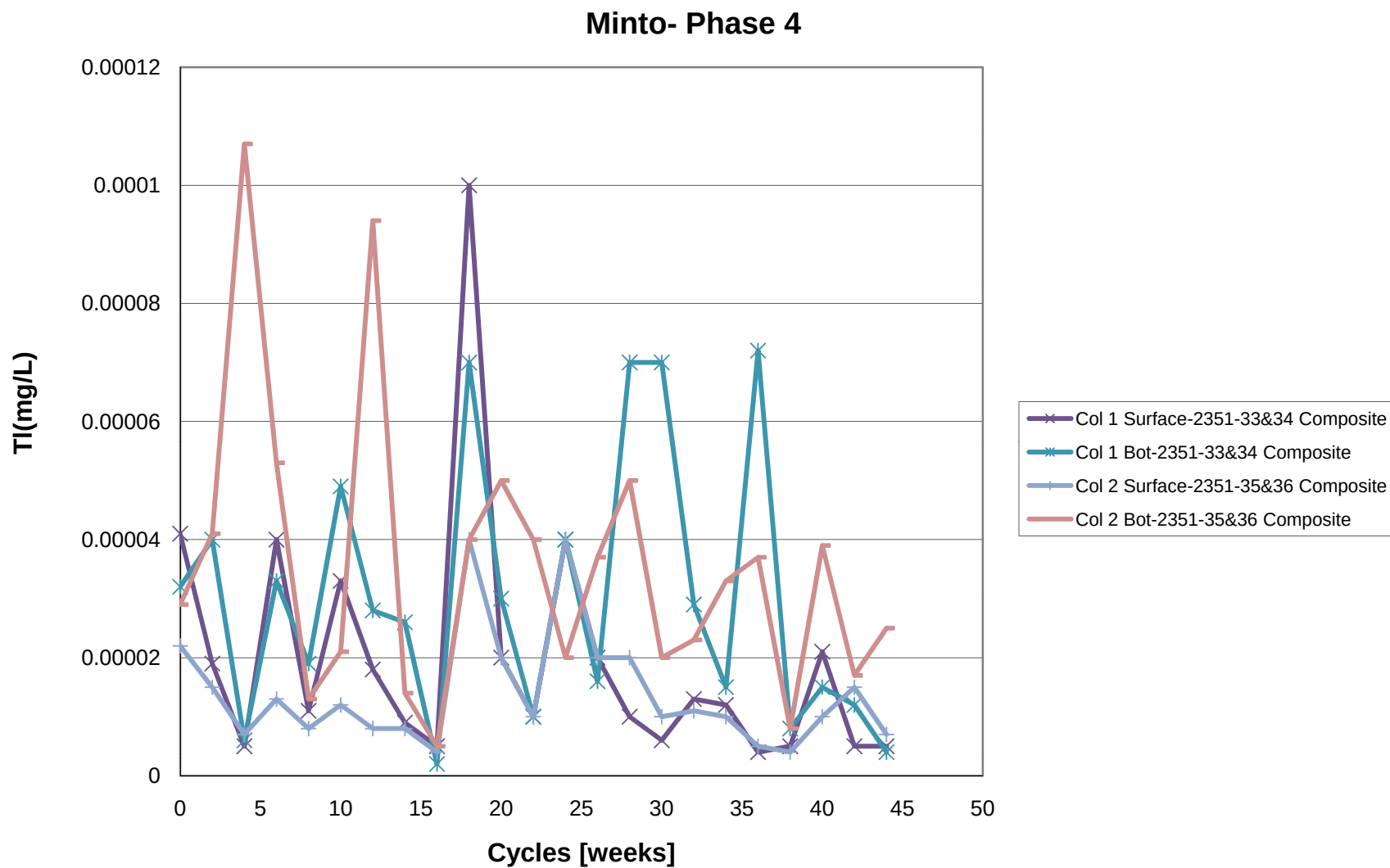


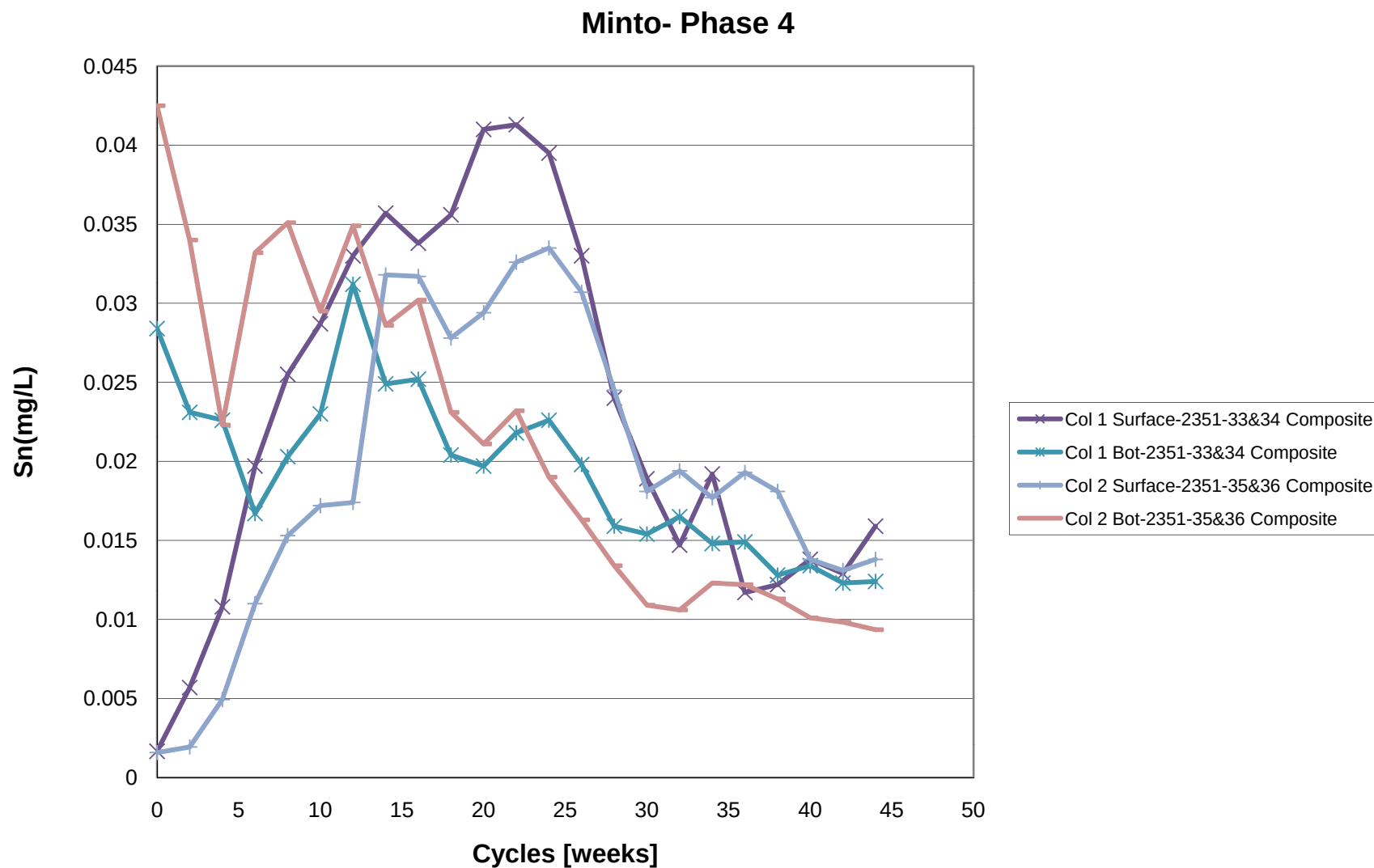
Minto- Phase 4

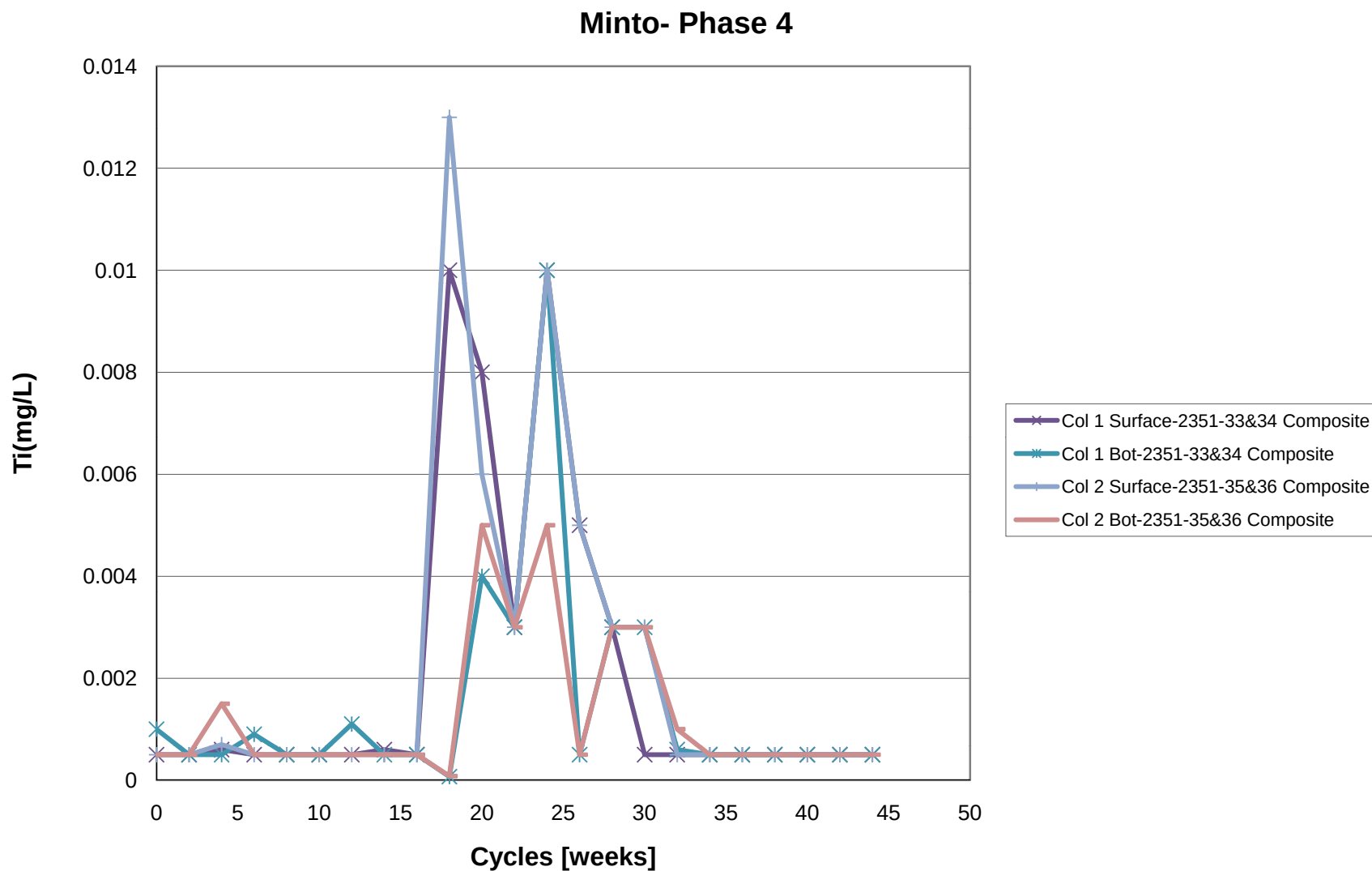


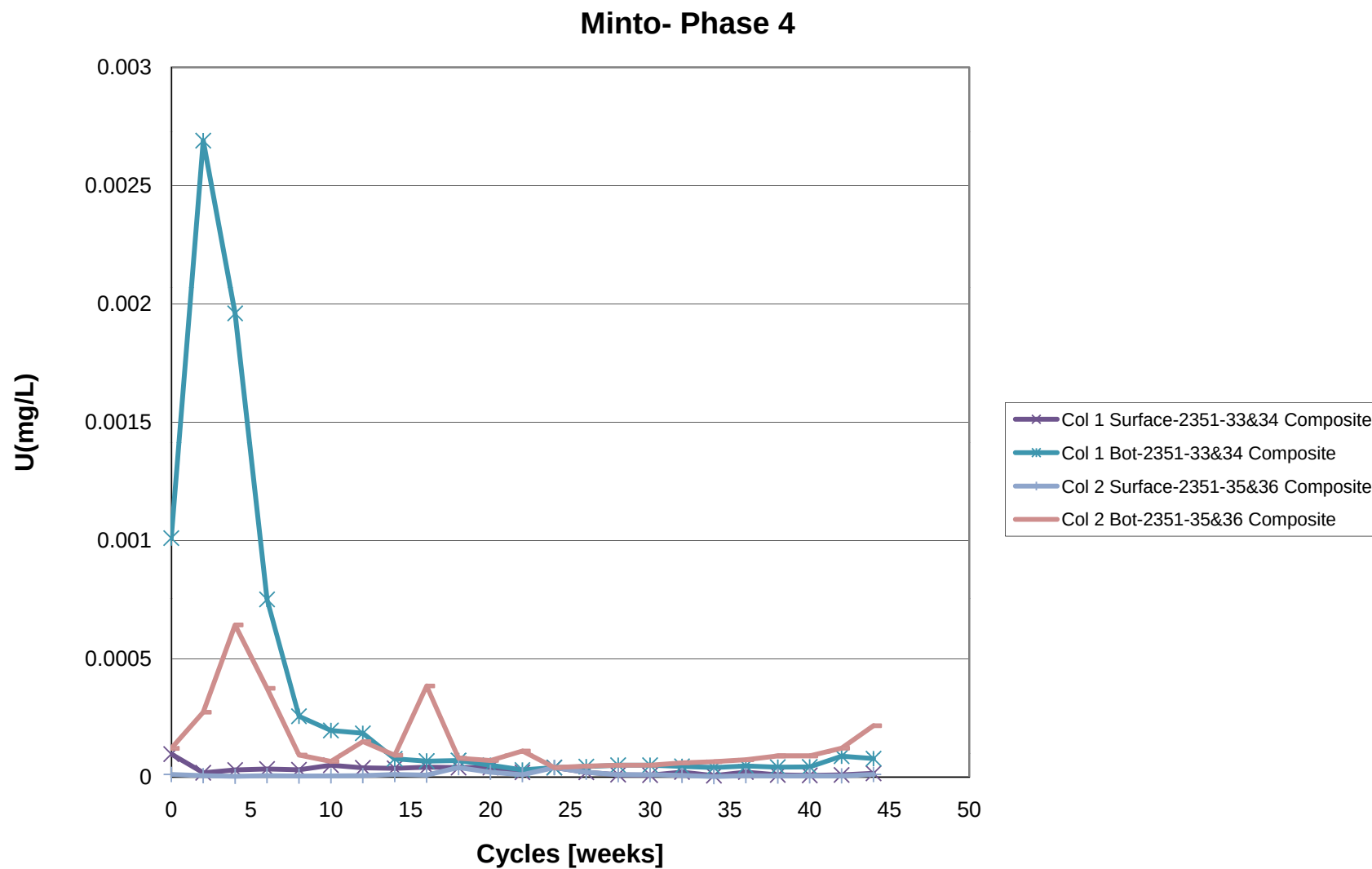
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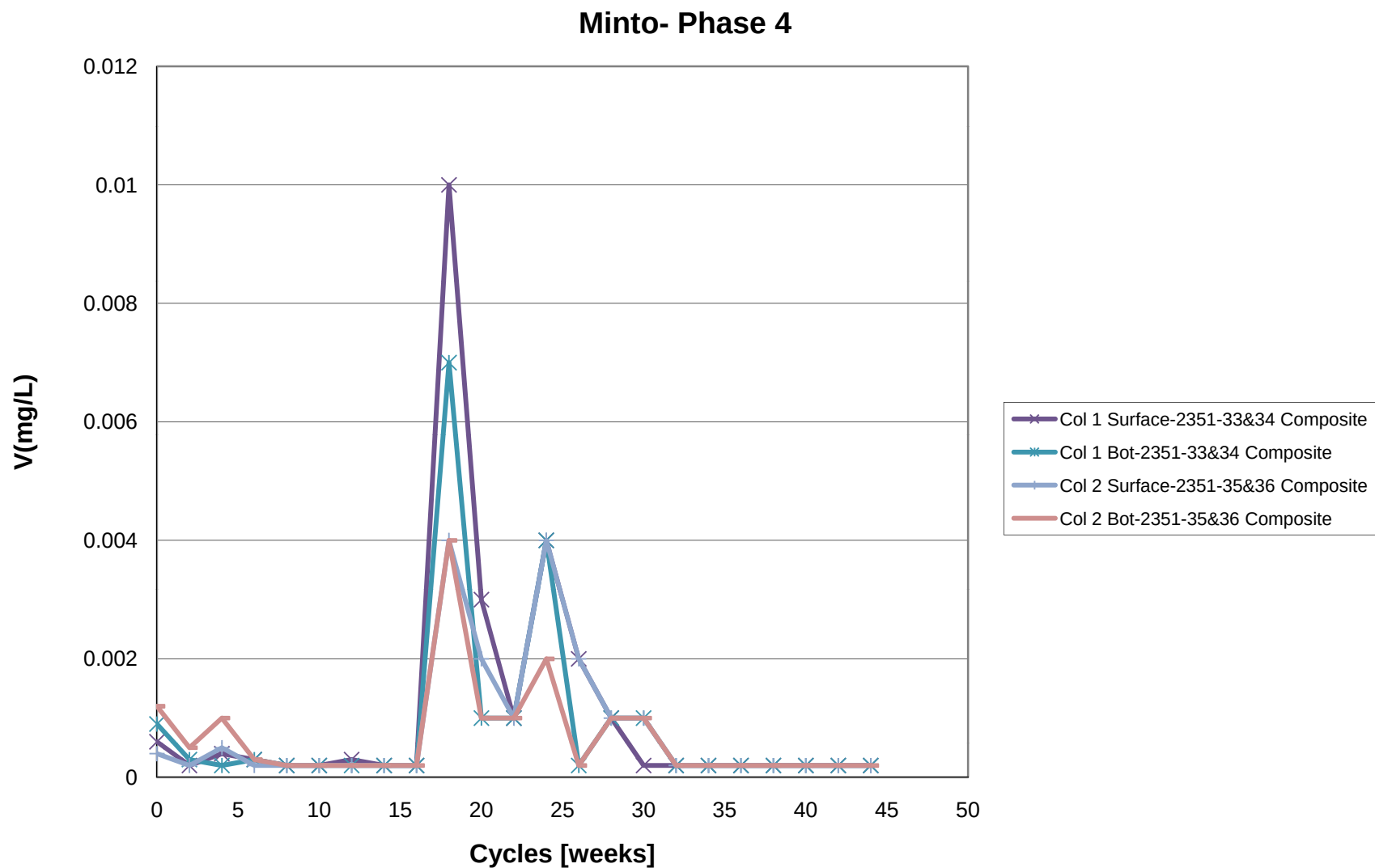


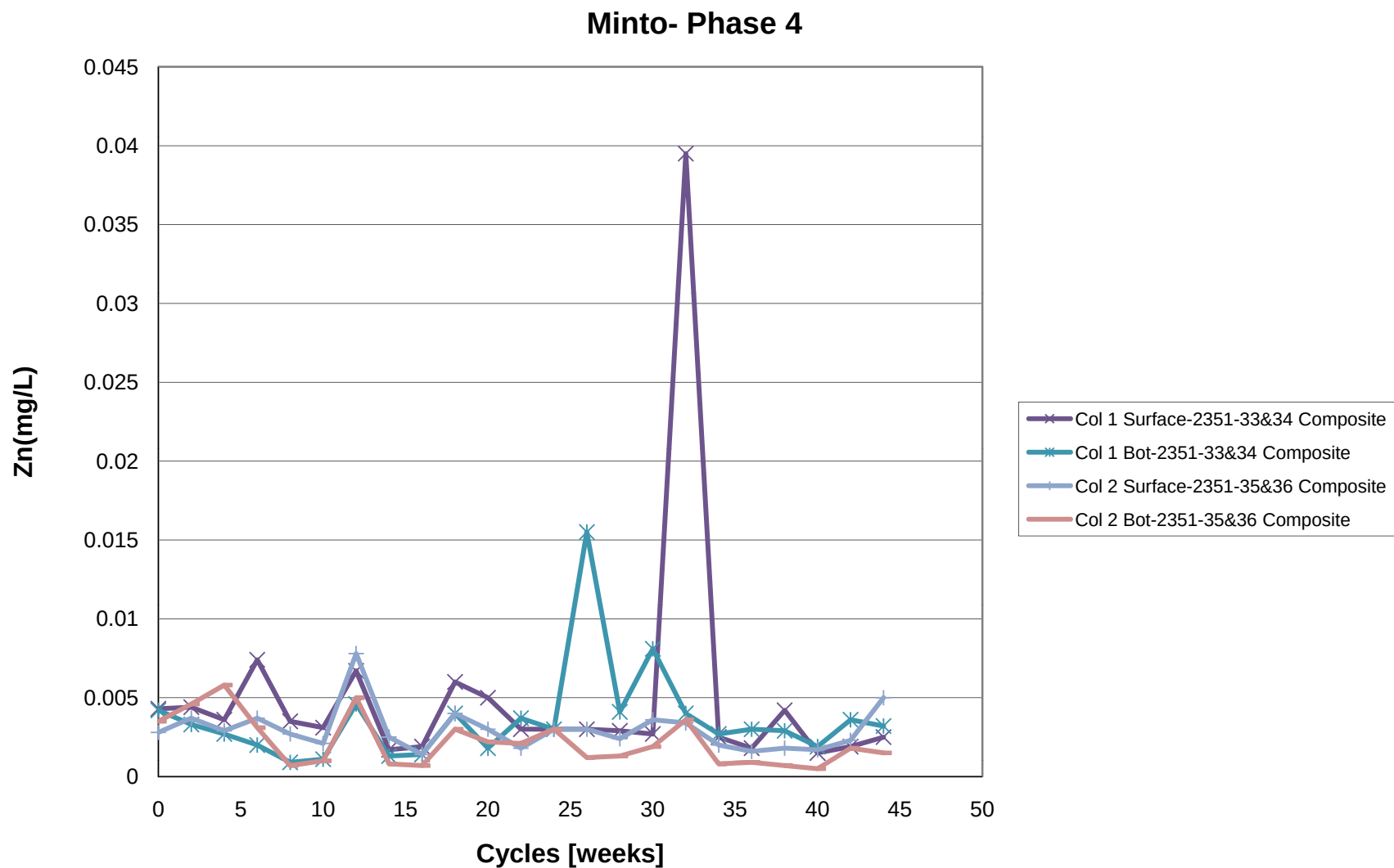


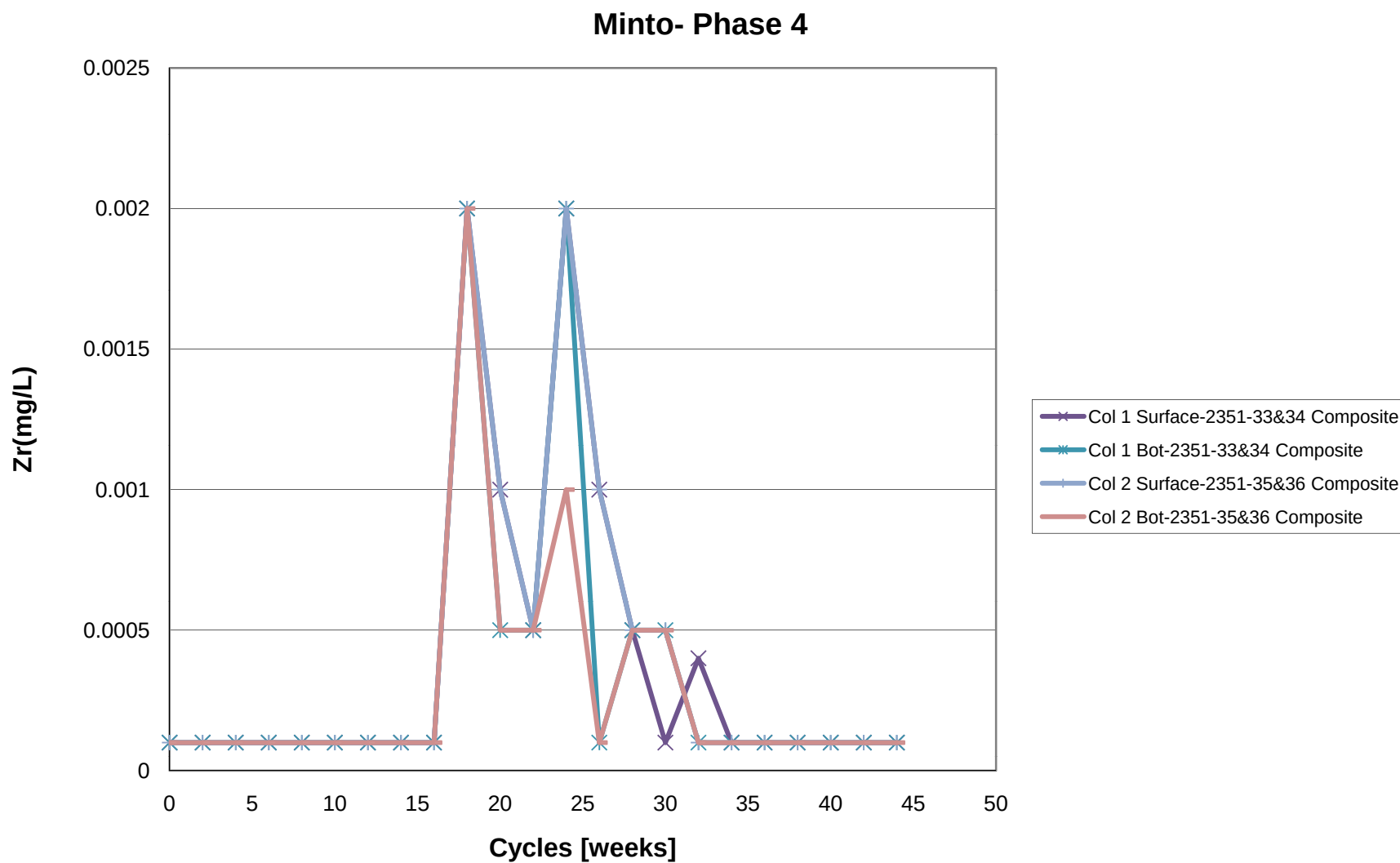












Appendix I
Phase IV Post-Closure Water Balance

Memorandum CCL-MC7

Date: August 6, 2010

Our File: 087.04

To: Access Consulting Group – Scott Keesey (skeesey@accessconsulting.ca)

From: Clearwater Consultants Ltd. - Peter S. McCreath (pmccreath@shaw.ca)

Subject: Minto Mine – Phase IV Closure Water Balance

1. Introduction

This Memorandum CCL-MC7 prepared by Clearwater Consultants Ltd. presents a description of the Minto Mine site Phase IV closure water balance model. The model is based on the site water balance model update presented in Design Memorandum CCL-MC5, “Minto Copper Site Water Balance Update – May 2010”. Details of the model including basic hydrology assumed conditions were presented in that memorandum and will not be repeated herein. The closure water balance model provides estimates of annual and monthly runoff from site area sub-catchments. Catchment areas for mine components were estimated by the Access Consulting Group. Results of the model have been forwarded to SRK Consultants Ltd. for evaluation of water quality conditions upon closure of the Phase IV operations.

2. Phase IV Closure Water Balance Model Input Data

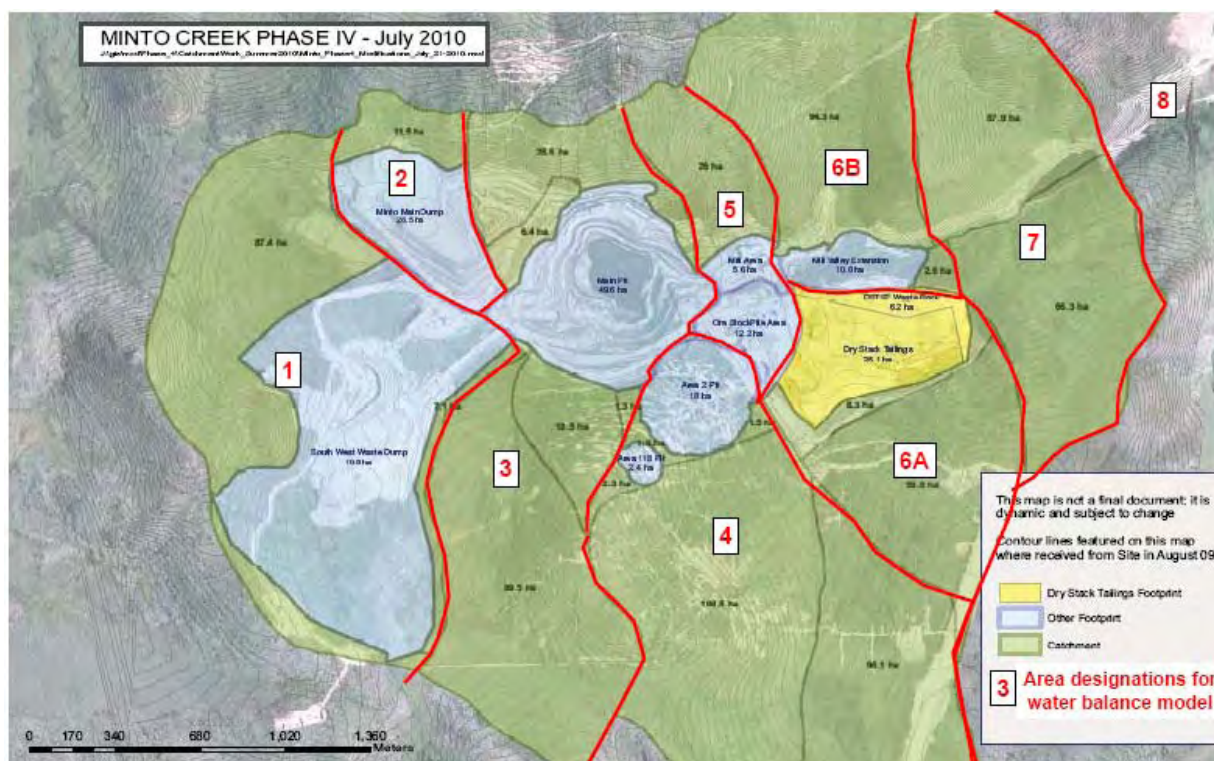
Figure 1, prepared by Access Consulting Group, shows the contributory catchment areas up to the Water Storage Pond on Minto Creek at the assumed end of Phase IV mining operations. Catchment areas and sub-areas are summarized on Table 1 divided into total areas, disturbed ground that has been reclaimed, undisturbed land, areas covered by water (ponds), and disturbed ground that has not been reclaimed. Figure 2 shows a schematic of the flows estimated in the water balance model.

Climate assumptions (precipitation, evaporation) for average and extreme wet and dry years were presented in Memorandum CCL-MC5 and are shown on Table MC7-1 in Appendix 1.

Potential total water storage volumes within the open pits after they have filled were estimated by Access as follows: Main Pit 1.6 Mm³, Area 2 Pit 5.8 Mm³. The closure water balance model assumed the pits were filled at the start of the year.

Monthly flows in Minto Creek between stations W3 and W1 for a range of return periods were estimated based on the updated surface water hydrology evaluation presented in Memorandum CCL-MC6 “Minto Copper Project – Surface Water Hydrology Conditions” dated July 19, 2010.

Figure 1 – Minto Mine Site – Phase IV Closure Catchment Areas

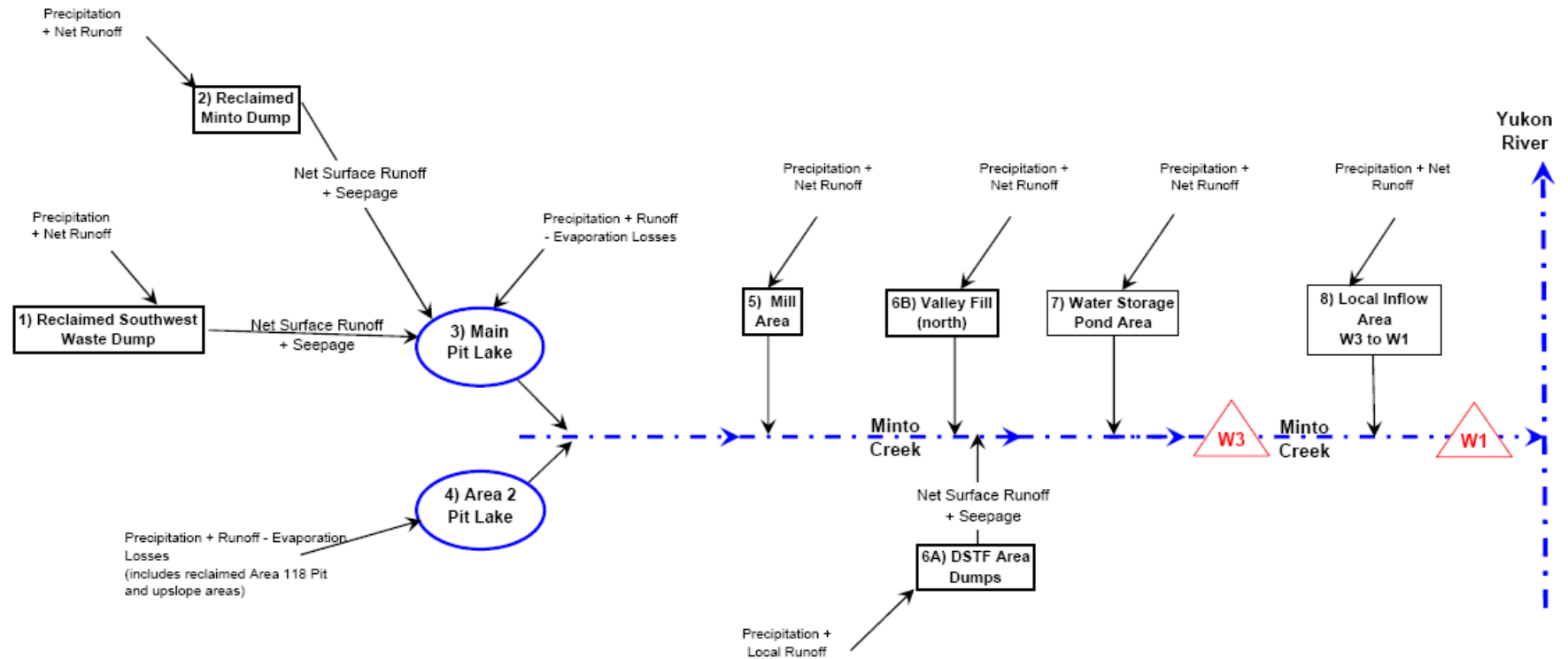


(Figure prepared, and catchment areas estimated, by Access Consulting Group, July 2010)

Table 1 – Phase IV Closure Catchment Areas for Water Balance

Area ID	Feature	Area (ha)	Type	Total Area	Disturbed/Reclaimed	Undisturbed Land	Pond	Disturbed/NOT Reclaimed
1	South West Dump SW Dump SW Dump	109.0 87.4 7.1	Disturbed/Reclaimed Dump Undisturbed Upgradient Undisturbed/Impacted Downgradient	203.5	109.0	94.5	0	0
2	Minto Dumps Minto Dump	28.5 11.5	Disturbed/Reclaimed Dump Undisturbed Upgradient	40.0	28.5	11.5	0	0
3	Main Pit Main Pit Lake Main Pit Undisturbed into Main Pit Undisturbed into W15/Main Pit	32.3 17.3 35.0 19.8 89.5	Pit Walls Pit Lake (estimated) Undisturbed Upgradient (north) Undisturbed Upgradient (south) Undisturbed Upgradient (south)	193.9	0.0	144.3	17.3	32.3
4	Area 2 Pit Area 2 Pit Lake Undisturbed above Area 2 pit Area 118 Pit Undisturbed above Area 2 Pit Undisturbed above Area 2 Pit Area 118 Pit	3.9 14.1 1.8 2.4 110.0 96.1 2.3	Pit Walls Pit Lake (estimated) Undisturbed Upgradient Backfilled/Reclaimed Pit Undisturbed Upgradient Undisturbed Upgradient Undisturbed Upgradient	230.6	2.4	210.2	14.1	3.9
5	Mill Area Mill Area Upslope Ore Stockpile Area	5.6 26.0 12.2	Disturbed/Reclaimed Undisturbed Upgradient (north) Disturbed/Reclaimed	43.8	17.8	26.0	0	0
6A	Waste Rock Dump (over DSTF) DSTF Waste Rock Face Undisturbed above DSTF	25.1 6.2 66.9	Disturbed/Reclaimed Dump Disturbed Dump not reclaimed Undisturbed Upgradient (south)	98.2	25.1	66.9	0	6.2
6B	Mill Valley Extension Upslope of Mill valley Ext North	10.3 97.5	Disturbed/Reclaimed Dump Undisturbed Upgradient (north)	107.8	10.3	97.5	0	0
7	Water Storage Pond catchment	57.9 66.3	Undisturbed into Minto Creek (north) Undisturbed into Minto Creek (south)	124.2	4.0	120.2	0	0
	Minto Creek at W3		Total to W3	1042.0	197.1	771.1	31.4	42.4
8	Minto Creek W3 to W1 Minto Creek at W1	3158.0 4200.0	Undisturbed into Minto Creek	3158.0 4200.0	0 197.1	3158.0 3929.1	0 31.4	0 42.4

Figure 2 – Minto Mine – Schematic Phase IV Closure Water Balance Flows



3. Phase IV Closure Water Balance Results

The Phase IV closure water balance results are presented in Appendix 1 as follows:

- Table MC7-1 – Input Data and Assumptions
- Table MC5-2 - Monthly Water Balance Volumes (2 pages)
- Table MC7-3 – Annual Runoff Volumes and Depths – Wet and Dry Years

The water balance model was used to estimate potential annual volumes of net runoff from all mine sub-catchments for a range of annual precipitation depths from 10 year dry conditions to 200 year wet conditions. Table 2 summarizes the total volumes of net runoff from the Phase IV closure area that would be reporting to Minto Creek at station W3. Table MC7-3 in Appendix 1 summarizes annual volumes from each of the modeled sub-catchments.

For a given annual precipitation, the actual volume of excess water generated over a year will depend strongly on factors such as the actual monthly distribution of the precipitation, the relative amounts of rainfall and snowfall, the timing of and rate of snowmelt in the spring, the daily distribution of rainfall in the summer, and actual temperatures and amount of sunshine during the year.

Table 2 – Annual Total Runoff and Annual Total Precipitation

Precipitation Return Period	Precipitation Depth (mm)	Annual Total Runoff (m ³)
10 Year Dry	268.2	409,000
Average	341.4	887,000
10 Year Wet	420.3	1,554,000
50 Year Wet	477.7	2,052,000
100 Year Wet	500.3	2,250,000
200 Year Wet	520.5	2,440,000

(Runoff rounded to nearest 1000 m³)

CLEARWATER CONSULTANTS LTD.

Peter S. McCreath P.Eng.

APPENDIX 1

Minto Mine Phase IV Closure Water Balance - Tables

Table MC7-1 – Input Data and Assumptions

Table MC7-2 - Monthly Water Balance Volumes – Average Conditions

Table MC7-3 – Annual Runoff Volumes & Depths for Wet and Dry Years

TABLE MC7-1 - Minto Mine Project - Phase IV CLOSURE Water Balance - Input Data & Assumptions

VERSION 3.3

(July 25, 2010)

- 1) Hydrology Annual Snowfall each year = **42.0%** of Total Precip
 Annual Pond Evaporation = **430** mm
 Annual Disturbed Reclaimed Ground Losses = 172.0 mm, or **40.0%** of Pond Evap.
 Annual Evapotranspiration = 215.0 mm, or **50.0%** of Pond Evap.
 Winter Snowpack Losses = **80** mm (sublimation)
 October Rainfall Runoff = **15%** of October Precipitation

Return Period	2
Snowmelt % in April	0%
Snowmelt % in May	100%

3) Annual Precipitation Probability (mm)

Return Period	Precip.
10 year	1
Average	2
Wet	10
Wet	50
Wet	100
Wet	200

- 5) Waste Dump Runoff
 Closure
 Infiltration = **30%** April/May Snowmelt
 30% June to October
 (Infiltration = P - E/T)
 Void Losses = **0%** of Infiltration

- 6) Pit Runoff
 Pit Walls Runoff Coefficient = **0.8**
 (summer only)

- 3) Pit Lake Volumes (nominal)
 Main Pit **1600.0** x 1000 m3
 Area 2 Pit **5800.0** x 1000 m3

2) Phase IV Closure Catchment Areas

	Total	Dist'd	Land	Pond
1) Southwest Dump	2.035	1.090	0.945	0.000
2) Minto Dumps	0.400	0.285	0.115	0.000
3) Main Pit	1.939	0.323	1.443	0.173
4) Area 2 & 118 Pits	2.306	0.063	2.102	0.141
5) Mill Area	0.438	0.178	0.260	0.000
6A) DSTF Area Dumps (south)	0.982	0.313	0.669	0.000
6B) Valley Fill (Inorth)	1.078	0.103	0.975	0.000
7) Water Storage Pond Area	1.242	0.040	1.202	0.000
8) Minto Creek W3 to W1	31.580	0.000	31.580	0.000
Minto Creek at W1	42.000	2.395	39.291	0.314

(Disturbed = Walls)
 (Disturbed = Walls+Reclaimed Area 118 p
 (Disturbed=Reclaimed + not-reclaimed)

4) Average Monthly Conditions (mm)

Month	Average Precip.	Average Snowfall	Lake Evaporation	Actual EvapoTrans	Disturbed Losses
April	16.4	13.0	12.0	6.0	4.8
May	24.2	0.0	83.0	41.5	33.2
June	40.0	0.0	119.0	59.5	47.6
July	57.7	0.0	112.0	56.0	44.8
Aug	41.7	0.0	80.0	40.0	32.0
Sept	30.1	0.0	24.0	12.0	9.6
Oct	29.0	29.0	0.0	0.0	0.0
Nov	27.0	27.0	0	0.0	0
Dec	23.6	23.6	0	0.0	0
Jan	21.9	21.8	0	0.0	0
Feb	16.4	16.4	0	0.0	0
Mar	13.7	13.6	0	0.0	0
YEAR	342	144	430.0	215.0	172.0

Average Time to Fill Pits		
	Avg Inflow Yrs to Fill	
Main Pit	395.845	4.0
Area 2 Pit	165,107	35.1
	m3	years

(based on Average Precipitation conditions)

TABLE MC7-2 - Minto Mine Project - Phase IV Closure Monthly Water Balance Volumes (1000 m³)

VERSION 3.3

Month	Hydrologic Parameters					(1) SW Waste Dump - Inflows			(2) Minto Dump - Inflows			(3) Main Pit - Inflows, Losses & Outflows						
	Return Period (years)	Total Precip mm	Pond Evap mm	Actual E'Trans mm	Dist'd Losses mm	Surface Runoff	Seeps	Other Local Runoff	Surface Runoff	Seeps	Other Local Runoff	Direct Rainfall	Snowmelt + Runoff	Evap Losses	Net Local Inflow	Net Total Inflow	Main Pit Lake Volume	Main Pit Spill
April	2	16	12	6	5	8.8	3.8	9.8	2.3	1.0	1.2	2.8	19.2	2.1	20.0	48.9	1,800.0	48.9
May	2	24	83	42	33	36.0	15.4	44.5	9.4	4.0	5.4	4.2	97.6	14.4	87.5	202.2	1,800.0	202.2
June	2	40	119	60	48	0.0	0.0	0.0	0.0	0.0	0.0	6.9	10.3	20.6	-3.4	-3.4	1,596.6	0.0
July	2	58	112	56	45	9.9	4.2	1.6	2.6	1.1	0.2	10.0	17.4	19.4	8.0	27.6	1,800.0	24.2
August	2	42	80	40	32	7.4	3.2	1.6	1.9	0.8	0.2	7.2	13.2	13.8	6.5	21.6	1,800.0	21.6
September	2	30	24	12	10	15.6	6.7	17.1	4.1	1.7	2.1	5.2	33.8	4.2	34.9	82.1	1,800.0	82.1
October	2	29	-	0	0	3.3	1.4	4.1	0.9	0.4	0.5	0.8	7.4	0.0	8.2	18.8	1,800.0	18.8
November	2	27	-	-	0	0	0	0	0	0	0	0	0	0	0.0	0.0	1,800.0	0.0
December	2	24	-	-	0	0	0	0	0	0	0	0	0	0	0.0	0.0	1,800.0	0.0
January	2	22	-	-	0	0	0	0	0	0	0	0	0	0	0.0	0.0	1,800.0	0.0
February	2	16	-	-	0	0	0	0	0	0	0	0	0	0	0.0	0.0	1,800.0	0.0
March	2	14	-	-	0	0	0	0	0	0	0	0	0	0	0.0	0.0	1,800.0	0.0

	(4) Area 2 Pit - Inflows, Losses & Outflows						(5) MILL Area - Inflows		(6A) DSTF Area Dumps (S) - Inflows			(6B) Valley Fill (N) - Inflows			(7) WS Pond - Inflows		Total from Mine Area	(8) Minto Creek	
Month	Direct Rainfall	Snowmelt + Runoff	Evap Losses	Net	Area2 Pit Lake Volume	Area 2 Pit Spill	Direct Rainfall	Snowmel t + Runoff	Surface Runoff	Seeps	Other Local Runoff	Surface Runoff	Seeps	Other Local Runoff	Direct Rainfall	Snowmelt + Runoff		Minto Ck W3 to W1	Total at W1
April	3.1	21.8	1.7	23.3	5,800.0	23.3	0.0	4.8	2.5	1.1	7.0	0.8	0.4	10.1	0.0	13.0	109.9	553	662
May	4.6	108.7	11.7	101.6	5,800.0	101.6	0.0	20.6	10.3	4.4	31.5	3.4	1.5	45.9	0.0	58.5	480.1	825	1,305
June	7.6	0.0	16.8	-9.1	5,790.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	86	86
July	11.0	3.6	15.8	-1.1	5,789.7	0.0	0.0	2.7	2.8	1.2	1.1	0.9	0.4	1.7	0.0	2.6	37.7	302	340
August	8.0	3.5	11.3	0.2	5,789.9	0.0	0.0	2.2	2.1	0.9	1.1	0.7	0.3	1.6	0.0	2.4	32.9	286	319
September	5.8	37.9	3.4	40.3	5,800.0	30.2	0.0	8.3	4.5	1.9	12.1	1.5	0.6	17.6	0.0	22.5	181.4	309	490
October	0.8	9.2	0.0	10.0	5,800.0	10.0	0.0	1.9	1.0	0.4	2.9	0.3	0.1	4.2	0.0	5.4	45.0	373	418
November	0	0	0	0.0	5,800.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0.0	5,800.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0
January	0	0	0	0.0	5,800.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0.0	5,800.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0.0	5,800.0	0.0	0	0	0	0	0	0	0	0	0	0	0	0	0

VERSION 3.3

TABLE MC7-3 - Minto Mine Project - Phase IV CLOSURE Water Balance - Annual Runoff Volumes & Depths for Wet and Dry Years
(Volumes in m3 per year)

Return Period	Total Precip mm	1 Southwest Dump		2 Minto Dumps		3 Main Pit (local)		3 Main Pit Spill		4 Area 2 Pit		5 Mill Area	
		Volume	mm	Volume	mm	Volume	mm	Volume	mm	Volume	mm	Volume	mm
10 Dry	268	92,165	45.3	18,480	46.1	70,101	36.2	180,725	41.3	65,558	28.4	19,562	44.7
Average	341	194,363	95.5	39,817	99.5	161,664	83.4	395,845	90.5	165,107	71.6	40,543	92.6
10 Wet	420	324,412	159.4	65,492	163.7	288,153	148.6	678,057	155.0	312,930	135.7	68,444	156.3
50	478	426,027	209.3	85,993	215.0	380,309	196.1	892,329	204.0	420,629	182.4	89,893	205.2
100	500	467,309	229.6	94,407	236.0	416,448	214.8	978,164	223.6	462,864	200.7	98,538	225.0
200	521	505,807	248.6	102,143	255.4	451,026	232.6	1,058,976	242.1	503,865	218.5	106,699	243.6

Return Period	Total Precip mm	6A DSTF Dump Area		6B Valley Fill (North)		7 W. S. Pond Area		Total from Mine to W3		Minto W3 to W1		Minto at W1	
		Volume	mm	Volume	mm	Volume	mm	Volume	mm	Volume	mm	Volume	mm
10 Dry	268	43,440	44.2	46,518	43.2	53,212	42.8	409,014	39.3	1,720,974	54.5	2,129,988	50.7
Average	341	88,935	90.6	92,144	85.6	104,388	84.0	886,942	85.1	2,733,400	86.6	3,620,342	86.2
10 Wet	420	151,353	154.1	160,282	148.7	182,748	147.1	1,553,812	149.1	4,204,284	133.1	5,758,096	137.1
50	478	198,800	202.4	210,574	195.3	240,104	193.3	2,052,329	197.0	5,394,089	170.8	7,446,418	177.3
100	500	217,818	221.8	230,432	213.8	262,650	211.5	2,250,467	216.0	5,890,751	186.5	8,141,218	193.8
200	521	235,886	240.2	249,691	231.6	284,650	229.2	2,439,757	234.1	6,368,311	201.7	8,808,068	209.7

The annual Runoff Depths expressed in millimeters (mm) are equal to the annual runoff volume divided by the respective catchment area.

Appendix J
Evaluation of Background Runoff Water Chemistry

July 8, 2010

Minto Explorations Ltd.
Suite 900 – 999 West Hastings Street
Vancouver, BC V6C 2W2
Attention: Randall Thompson, General Manager

Dear Mr. Thompson,

Re: Minto Creek Background Water Quality Data and Seasonality

The Minto Mine is in the process of preparing an update water quality model for the site. A key requirement for model development and application is background water quality. Background water quality was characterized in 2009 using data available to the end of 2008 (Minnow 2009). This brief letter report provides an update to the end of 2009 and a simple examination of seasonality of water quality.

Methods

Water quality data from 2005 to 2009 were provided by the Minto Mine. Non-detect concentrations were replaced with $\frac{1}{2}$ the method detection limit (MDL) in order to calculate summary statistics. Summary statistics included mean, median, number of samples, 25th percentile, 75th percentile and 95th percentile. Three scenarios (options) were considered when calculating the summary statistics:

- Option 1: data from stations W1, W2, W3, W8, W9 and W10 for 2005 (i.e., prior to significant site disturbance associated with final development of the Minto Mine), and reference stations W6 and W7 from 2005 to 2008 (extracted from Minnow 2009);
- Option 2: data from reference stations only, W6 and W7, from 2005 to 2009;
- Option 3: data from Minnow (2009) updated with reference station data for 2009.

Water quality data were assessed for any outliers, defined here as those concentrations that are greater than three standard deviations about the mean. No outliers were identified for any parameter. Data from the two latter scenarios (which include 2009 data) were sorted by month. Number of samples and mean were calculated for each parameter within each scenario, and compared to the annual average to help identify which months may have a greater incidence of higher than average concentrations.

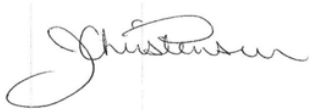
Results

Generally, the average concentrations of all parameters were comparable between calculation scenarios (Table 1). Concentrations of many parameters were slightly greater in the two calculation scenarios which included 2009 data (Options 2 and 3), likely a result of either inclusion of all data [whereas Minnow (2009) excluded water quality data for sampling days with total suspended solid concentrations >50 mg/L] or concentrations of those parameters are higher in 2009 at all background/reference stations. Closer examination of parameters with water quality guidelines suggests that despite different calculation scenarios, concentrations for Options 2 and 3 are well within the 95th percentile of Minnow (2009) background calculations, with exception of TSS (Table 2).

Water quality data was available from the months of April to October. Fewer data were available for Option 2, whereas Option 3 which also included 2005 data for all stations had higher sample numbers, with exception to the month of April. Using Option 2 data, there was a greater percentage of parameters that had concentrations greater than the annual mean for the month of August, where 46% of parameters measured had higher than average concentrations (Table 3). All other months appeared similar with a limited range from 20% to 36% of parameters measured with concentrations greater than the annual mean. Results were similar using Option 3 data where August had the greatest percentage of parameters with concentrations greater than the annual mean (48%), and all other months lower falling within a range of 27% to 38% (Table 4).

I trust that this brief letter communicates the general seasonality of background Minto Creek water quality, and provides you with the calculated values necessary for your purposes. If you have any comments or questions on the content of this letter, I would be pleased to discuss them with you.

Sincerely,
Minnow Environmental Inc.

A handwritten signature in black ink, appearing to read "JChristensen", is written over a light gray grid background.

Jennie Christensen, Ph.D., R.P.Bio.
Aquatic Toxicologist

Reference

Minnow (Minnow Environmental Inc.). 2009. Evaluation of the Background Water Quality of Minto Creek and Options for the Derivation of Site-Specific Water Quality Objectives. Report Prepared for Access Consulting Group and Minto Explorations Ltd. April 2009.

Table 1: Summary statistics for background water quality using three calculation scenarios

Parameters	Units	Option 1						Option 2						Option 3					
		Minnow 2009 - all sites 2005, W6 and W7 2005 - 2008						W6 and W7 2005 - 2009						All sites 2005, W6 and W7 2005 - 2009					
		#	Mean	Median	25th Perc	75th Perc	95th Perc	#	Mean	Median	25th Perc	75th Perc	95th Perc	#	Mean	Median	25th Perc	75th Perc	95th Perc
Ag-T	mg/L	77	0.00003	0.00001	0.000005	0.00005	0.00010	54	0.00005	0.00005	0.00001	0.00005	0.0001	91	0.00003	0.00001	0.00001	0.00005	0.0001
Al-T	mg/L	78	0.198	0.082	0.048	0.197	0.618	54	0.603	0.130	0.229	0.383	1.781	91	0.453	0.096	0.049	0.25	1.67
As-T	mg/L	78	0.0005	0.0005	0.0004	0.0006	0.0008	54	0.00063	0.0005	0.00052	0.0006	0.0014	92	0.00058	0.0005	0.0004	0.00062	0.001018
Ba-T	mg/L	78	0.059	0.058	0.051	0.068	0.076	54	0.071	0.068	0.038	0.073	0.120	91	0.0642	0.059	0.052	0.07	0.09
Be-T	mg/L	78	0.00024	0.00025	0.00005	0.00044	0.00050	54	0.00013	0.00005	0.0005	0.00025	0.0005	92	0.00024	0.00025	0.00005	0.0005	0.0005
Bi-T	mg/L	52	0.00026	0.00025	0.00025	0.00025	0.00050	44	0.00028	0.00025		0.00025	0.0005	62	0.00027	0.00025	0.00025	0.00025	0.0005
B-T	mg/L	78	0.019	0.005	0.005	0.05	0.050	54	0.0113	0.005	0.05	0.007	0.05	92	0.0185	0.005	0.005	0.05	0.05
Ca-T	mg/L	78	28.3	29.6	24.6	32.8	39.1	54	29.7	29.95	17.4	32.5	41.6	91	28.5	28.7	24.35	33.5	39.65
Cd-T	mg/L	78	0.00002	0.00002	0.00001	0.00003	0.00004	54	0.00004	0.00001	0.00003	0.00003	0.00008	91	0.00003	0.00003	0.00001	0.00003	0.00007
CN-T	mg/L	25	0.014	0.010	0.0025	0.013	0.022	0						25	0.014	0.0101	0.0025	0.013	0.022
Co-T	mg/L	78	0.0002	0.0002	0.0001	0.00026	0.0006	54	0.00054	0.000175	0.00015	0.0004	0.001641	92	0.00045	0.000165	0.0001	0.000378	0.001232
Cr-T	mg/L	78	0.0007	0.0005	0.0003	0.0008	0.0020	54	0.0016	0.00075	0.0005	0.0014	0.0037	92	0.0012	0.0005	0.0005	0.001125	0.003425
Cu-T	mg/L	65	0.004	0.003	0.0015	0.0056	0.013	54	0.0034	0.0018	0.0021	0.004	0.012	91	0.0046	0.003	0.001335	0.00575	0.013
Fe-T	mg/L	78	0.46	0.35	0.10325	0.6995	1.08	54	0.95	0.233	0.363	0.707	2.978	91	0.82	0.363	0.1065	0.7815	2.62
Hg-T	mg/L	36	0.00002	0.00001	0.00001	0.00005	0.00005	24	0.00044	0.00001	0.00001	0.00005	0.0042575	43	0.00025	0.00001	0.00001	0.00002	0.00005
K-T	mg/L	78	0.99	1.00	1	1	1.10	54	1.08	1	1	1.0775	1.936	91	1.04	1	1	1	1.55
Li-T	mg/L	78	0.00192	0.00250	0.001	0.0025	0.00250	54	0.0017	0.001	0.0025	0.0025	0.0025	92	0.0020	0.0025	0.001	0.0025	0.0025
Mg-T	mg/L	78	9.53	9.74	7.24	11.3	14.4	54	9.84	10.1	4.88	11.2	15.4	91	9.53	9.57	7.24	11.3	15.4
Mn-T	mg/L	78	0.04	0.04	0.025	0.051	0.09	53	0.062	0.039	0.017	0.054	0.166	90	0.057	0.041	0.026025	0.054	0.152
Mo-T	mg/L	77	0.001	0.001	0.0005	0.0011	0.002	53	0.0011	0.001	0.0005	0.001	0.0018	90	0.0010	0.001	0.0005	0.0011	0.001683
Na-T	mg/L	78	5.90	6.00	4.43	7.08	8.70	54	6.46	6.55	2.7	7.19	9.59	91	6.02	6	4.45	7.1	9.05
Ni-T	mg/L	78	0.0016	0.0014	0.0011	0.0018	0.0030	54	0.0024	0.0015	0.0021	0.002	0.0059	92	0.0022	0.00156	0.001098	0.002	0.00465
N-TKN	mg/L							21	0.503	0.44		0.51	0.76	21	0.503	0.44	0.32	0.51	0.76
Pb-T	mg/L	78	0.0002	0.00020	0.00006	0.00025	0.00041	54	0.0004	0.0002	0.00025	0.0004	0.0017	92	0.0003	0.00025	0.00006	0.000261	0.00128
P-PO4-T	mg/L							21	0.050	0.04		0.06	0.14	21	0.050	0.04	0.025	0.06	0.14
P-T	mg/L	32	0.12	0.15	0.1225	0.15	0.15	27	0.107	0.06		0.15	0.171	45	0.124	0.15	0.04	0.15	0.15
P-TRP (Ortho)	mg/L							9	0.0539	0.05		0.09	0.096	9	0.054	0.05	0.025	0.09	0.096
Sb-T	mg/L	78	0.0002	0.0001	0.00005	0.00025	0.0003	54	0.00014	0.0001	0.00025	0.00015	0.0002675	91	0.00014	0.0001	0.00008	0.00025	0.00025
Se-T	mg/L	78	0.0004	0.0005	0.0003	0.0005	0.0005	54	0.00039	0.00035	0.0005	0.0005	0.000735	91	0.00043	0.0005	0.0003	0.0005	0.00065
Si-T	mg/L	55	5.99	5.85	5.485	6.35	7.25	48	6.38	5.915		6.5775	8.2165	66	6.25	5.835	5.4575	6.445	8.2575
Sn-T	mg/L	78	0.00031	0.00025	0.00005	0.0005	0.0010	54	0.00038	0.0005	0.00025	0.0005	0.001	91	0.00029	0.00025	0.00005	0.0005	0.00075
Sr-T	mg/L	55	0.253	0.286	0.150	0.333	0.367	48	0.283	0.299		0.343	0.455	66	0.262	0.284	0.148	0.334	0.391
S-T	mg/L							33	4.18	3.6		4.0	8.76	33	4.18	3.6	3.2	4.0	8.76
Te-T	mg/L							12	0.00005	0.00005		0.00005	0.00005	12	0.00005	0.00005	0.00005	0.00005	0.00005
Th-T	mg/L							12	0.00010	0.00005		0.0002	0.0002	12	0.00010	0.00005	0.00005	0.0002	0.0002
Ti-T	mg/L	78	0.009	0.005	0.005	0.005	0.023	54	0.025	0.005	0.005	0.0145	0.0792	92	0.019	0.005	0.0049	0.008475	0.07727
Tl-T	mg/L	78	0.00007	0.00005	0.00003	0.0001	0.00010	54	0.00003	0.00003	0.0001	0.00005	0.0001	91	0.00005	0.00005	0.00003	0.0001	0.0001
U-T	mg/L	78	0.0006	0.0006	0.0001	0.001	0.0012	54	0.00084	0.00095	0.0001	0.0011	0.0014	92	0.00068	0.000678	0.000188	0.001085	0.0014
V-T	mg/L	78	0.0056	0.0014	0.00087	0.015	0.0150	54	0.0041	0.0011	0.015	0.0027	0.015	91	0.0058	0.0013	0.0008	0.015	0.015
Zn-T	mg/L	78	0.0039	0.0025	0.0016	0.0046	0.0105	54	0.0058	0.004	0.0025	0.0078	0.0137	92	0.0048	0.0025	0.001925	0.006	0.0139
Ag-D	mg/L	72	0.00002	0.00001	0.000005	0.00005	0.00005	45	0.00004	0.00005	0.00001	0.00005	0.00005	82	0.00003	0.00001	0.00001	0.00005	0.00005
Al-D	mg/L	72	0.022	0.013	0.0078	0.0258	0.071	45	0.025	0.011	0.014	0.016	0.071	82	0.028	0.01385	0.00815	0.027	0.072
As-D	mg/L	72	0.0004	0.0004	0.00025	0.0005	0.0006	45	0.00039	0.0004	0.00025	0.0005	0.000588	82	0.00040	0.0004	0.000253	0.0005	0.00059
Ba-D	mg/L	72	0.055	0.055	0.049	0.063	0.071	45	0.059	0.062	0.035	0.068	0.075	82	0.055	0.055	0.048	0.064	0.07195
B-D	mg/L	72	0.019	0.005	0.005	0.05	0.050	45	0.0105	0.005	0.05	0.005	0.05	82	0.0185	0.005	0.005	0.05	0.05
Be-D	mg/L	72	0.00026	0.00025	0.00005	0.0005	0.00050	45	0.00014	0.00005	0.0005	0.00025	0.0005	82	0.00025	0.00025	0.00005	0.0005	0.0005
Bi-D	mg/L	43	0.00027	0.00025	0.00025	0.00025	0.00025	34	0.00028	0.00025		0.00025	0.00057	52	0.00027	0.00025	0.00025	0.00025	0.0005
Ca-D	mg/L	73	28.7	29.6	25.2	33.5	39.8	45	29.2	30	17.9	33	41.2	82	28.3	29.1	24.1	33.4	40.4
Cd-D	mg/L	72	0.00002	0.000024	0.000005	0.000025	0.000032	45	0.00002	0.00001	0.000025	0.000025	0.00004	82	0.00002	0.00002	0.00001	0.00003	0.00003
C-DOC	mg/L							13	11.1	9.2		14.3	17.6	13	11.1	9.2	8.2	14.3	17.6
Co-D	mg/L	72	0.00011	0.00011	0.00005	0.00015	0.00021	45	0.00012	0.0001	0.00015	0.00014	0.000244	82	0.00013	0.00011	0.00005	0.00015	0.000249
Cr-D	mg/L	72	0.0005	0.0005	0.00025	0.0006	0.0013	45	0.00067	0.0006	0.0005	0.0009	0.0015	82	0.00055	0.0005	0.00025	0.000608	0.001295
Cu-D	mg/L	72	0.0031	0.0021	0.0011	0.004	0.0083	45	0.0017	0.00119	0.0016	0.002	0.004	82	0.0030	0.00206	0.001028	0.003875	0.0081
Fe-D	mg/L	72	0.19	0.10	0.07	0.2515	0.58	45	0.105	0.088	0.072	0.1	0.2842	82	0.182	0.1	0.07	0.25075	0.5555
Hg-D	mg/L	32	0.00002	0.00001	0.00001	0.00005	0.00005	19	0.00028	0.00001	0.00001	0.00003	0.000545	38	0.00015	0.00001	0.00001	0.00001	0.00005
K-D	mg/L	70	1.0	1.00	1	1	1.10	44	1.0	1	1	1	1.5	81	1.0	1	1	1	1.1
Li-D	mg/L	72	0.0020	0.0025	0.001	0.0025	0.0025	45	0.00147	0.001	0.0025	0.0025	0.0025	82	0.00193	0.0025	0.001	0.0025	0.0025
Mg-D	mg/L	73	9.69	9.80	7.68	11.6	14.4	45	9.82	10.2	5.01	11.4	14.0	82	9.58	9.75	7.67	11.6	14.2
Mn-D	mg/L	72	0.031	0.028	0.014	0.038	0.067	45	0.031	0.031	0.005	0.04	0.064	83	0.030	0.024	0.012	0.039	0.080

Table 1: Summary statistics for background water quality using three calculation scenarios

Parameters	Units	Option 1						Option 2						Option 3					
		Minnow 2009 - all sites 2005, W6 and W7 2005 - 2008						W6 and W7 2005 - 2009						All sites 2005, W6 and W7 2005 - 2009					
		#	Mean	Median	25th Perc	75th Perc	95th Perc	#	Mean	Median	25th Perc	75th Perc	95th Perc	#	Mean	Median	25th Perc	75th Perc	95th Perc
Mo-D	mg/L	72	0.00087	0.0010	0.0005	0.0011	0.0017	45	0.00109	0.001	0.0005	0.001	0.0019	82	0.00094	0.000909	0.0005	0.001045	0.001629
Na-D	mg/L	70	6.06	6.40	4.53	7.38	9.02	44	6.36	6.65	2.8	7.33	8.64	81	5.97	6.20	4.50	7.30	9.20
Ni-D	mg/L	72	0.0011	0.0011	0.0009	0.0015	0.0017	45	0.00110	0.001	0.0015	0.0013	0.0021	82	0.00118	0.001135	0.000908	0.0015	0.001819
O-DO	mg/L							0						0					
Pb-D	mg/L	71	0.00011	0.00005	0.000025	0.00025	0.00025	45	0.00014	0.00005	0.00025	0.0001	0.00048	82	0.00015	0.00005	0.00005	0.00025	0.00025
P-D	mg/L	32	0.17	0.15	0.15	0.15	0.49	17	0.081	0.06		0.15	0.15	35	0.117	0.15	0.105	0.15	0.15
P-TDP	mg/L							8	0.01000	0.01		0.01	0.01	8	0.01000	0.01	0.01	0.01	0.01
Sb-D	mg/L	72	0.0002	0.0001	0.00005	0.00025	0.0007	45	0.00042	0.0001	0.00025	0.00025	0.0013	82	0.0003	0.0001	0.00005	0.00025	0.000995
S-D	mg/L							26	3.98	3.75		4	4.28	26	3.98	3.75	3.5	4.0	4.3
Se-D	mg/L	71	0.0004	0.0005	0.00025	0.0005	0.0005	45	0.00036	0.0003	0.0005	0.0005	0.00106	82	0.0004	0.0005	0.0003	0.0005	0.0005
Si-D	mg/L	48	5.72	5.81	5.42	6.16	6.73	38	5.68	5.86		6.26	6.97	56	5.68	5.81	5.39	6.16	6.83
Sn-D	mg/L	72	0.00026	0.00025	0.00005	0.0005	0.00050	45	0.00034	0.0005	0.00025	0.0005	0.0005	82	0.00026	0.00025	0.00005	0.0005	0.0005
Sr-D	mg/L	51	0.501	0.284	0.199	0.327	0.421	39	0.273	0.284		0.330	0.369	57	0.251	0.277	0.147	0.322	0.346
Te-D	mg/L							9	0.00007	0.00005		0.00005	0.00014	9	0.00007	0.00005	0.00005	0.00005	0.00014
Th-D	mg/L							9	0.00008	0.00005		0.00005	0.0002	9	0.00008	0.00005	0.00005	0.00005	0.0002
Ti-D	mg/L	72	0.004	0.005	0.00078	0.005	0.005	45	0.0024	0.0009	0.005	0.005	0.005	83	0.0036	0.005	0.00075	0.005	0.005
Ti-D	mg/L	72	0.00006	0.00005	0.000025	0.0001	0.00010	45	0.00004	0.00003	0.0001	0.00005	0.0001	82	0.00005	0.00005	0.00003	0.0001	0.0001
U-D	mg/L	71	0.00060	0.00055	0.0001	0.001	0.00130	45	0.00074	0.0008	0.0001	0.001	0.00136	82	0.00059	0.000575	0.0001	0.001	0.001267
V-D	mg/L	71	0.0053	0.0011	0.0005	0.015	0.0150	45	0.0030	0.0011	0.015	0.0017	0.015	82	0.00525	0.0012	0.0005	0.015	0.015
Zn-D	mg/L	71	0.0030	0.0025	0.0013	0.0025	0.0080	45	0.0028	0.002	0.0025	0.003	0.00632	82	0.0030	0.0025	0.00125	0.0025	0.008445
Zr-D	mg/L							9	0.00021	0.0002		0.0003	0.00036	9	0.00021	0.0002	0.0002	0.0003	0.00036
Alk-Bicrb	mg/L							41	140	147		157	190	41	140	147	129	157	190
Alk-Carb	mg/L	77	106	115	89	128	146	53	26.0	3	61.2	3	115	89	54.1	44	3	99.3	145
Alk-OH	mg/L							41	2.50	2.5		2.5	2.5	41	2.50	2.5	2.5	2.5	2.5
Alk-P	mg/L							0						0					
Alk-T	mg/L							51	110	117	32	128	147	70	109	116	93	128	154.1
Bromine	mg/L							2	0.025	0.025		0.025	0.025	2	0.025	0.025	0.025	0.025	0.025
C-TiC	mg/L							0						0					
C-TOC	mg/L	3	13.9	17.3	12.1	17.5	17.6	11.0	11.1	9.4		14.0	17.6	11.0	11.1	9.40	8.65	14.0	17.6
Chloride	mg/L	58	0.45	0.25	0.25	0.6	0.93	36	1.90	0.44	0.25	0.708	7.09	73	1.18	0.38	0.25	0.7	3.14
Colour	TCU							20	56.5	38.5		49.3	132	20	56.5	38.5	29	49.3	132
Cond-F	µS/cm	6	236	235.5	209	254	290	0						0					
Cond-L	µS/cm	77	217	224	176	258	320	55	230	233	127	259	346	92	219	218	176	259	330
Discharge	L/s							0						0					
Fluoride	mg/L							2	0.166	0.166		0.171	0.175	2	0.166	0.166	0.160	0.171	0.175
Hard-D	mg/L							35	126	126		131	180	35	126	126	110	131	180
Hard-T	mg/L	67	112	115	95.2	131	163	18	109	106	65.4	119	168	49	106	101	86	134	162
IB	%							0						0					
Ammonia	mg/L	76	0.019	0.013	0.01	0.025	0.040	45	0.020	0.021	0.01	0.025	0.0278	83	0.019	0.014	0.01	0.025	0.0408
Ammonium	mg/L							7	0.039	0.025		0.043	0.088	7	0.039	0.025	0.025	0.0425	0.088
N-NO2	mg/L	59	0.01	0.00	0.0005	0.0017	0.03	28	0.019	0.0034	0.0016	0.025	0.07	66	0.008	0.0005	0.0005	0.001675	0.048
NO2+NO3	mg/L							21	0.614	0.12		0.18	2.93	21	0.614	0.12	0.04	0.18	2.93
N-NO3	mg/L	75	0.067	0.039	0.0056	0.115	0.193	47	0.094	0.082	0.032	0.155	0.223	84	0.064	0.03565	0.0092	0.104	0.199
pH-F	pH units	6	7.35	7.26	7.09	7.71	7.95	0						0					
pH-L	pH units	77	7.82	7.87	7.74	8.01	8.22	55	7.83	7.87	7.91	7.95	8.18	92	7.83	7.88	7.76	8.01	8.23
Radium - 226	Bq/L	27	0.0028	0.0025	0.0025	0.0025	0.0057	0						25	0.0030	0.0025	0.0025	0.0025	0.007
SO4-D	mg/L							50	11.16	10.35	11.8	11.5	36.0	69	14.0	10.4	5	12.4	44.5
SO4-T	mg/L	75	12.1	10.9	6.1	15.3	28.1	12	9.07	5.82	2.4	8.2	29.5	48	13.14	12.1	5.1	19.0	29.5
Sulphide	mg/L							0						0					
TDS	mg/L	67	157	153	130	182	198	82	165	155	128	182	223	82	158	155	128	182	223
Temp-F	C	6	3.05	3.35	2.28	3.98	4.33	0						0					
Temp-obs-pH	C							0						0					
TSS	mg/L	62	7.20	4.00	1.5	9.38	24.6	89	40.8	4	1.5	14.5	93.4	89	27.5	4	1.5	14.5	93.4
Turb	NTU	14	0.62	0.60	0.225	0.9	1.28	22	1.92	0.6	0.2	1.23	2.37	22	1.92	0.6	0.2	1.23	2.37
Turb-F	NTU							0						0					

Annual mean concentrations highlighted for easier viewing and comparing

Table 2: Differences in average concentrations for select parameters for varying background data

Parameters	Units	Option 1			Option 2			Option 3		
		Minnow 2009 - all sites 2005, W6 and W7 2005 - 2008			W6 and W7 2005 - 2009			All sites 2005, W6 and W7 2005 - 2009		
		#	Mean	95th Perc	#	Mean	95th Perc	#	Mean	95th Perc
Ag-T	mg/L	77	0.00003	0.00010	54	0.00005	0.00010	91	0.00003	0.00010
Al-T	mg/L	78	0.198	0.618	54	0.603	1.781	91	0.453	1.67
As-T	mg/L	78	0.0005	0.0008	54	0.00063	0.0014	92	0.00058	0.0010
Cd-T	mg/L	78	0.00002	0.00004	54	0.00004	0.00008	91	0.00003	0.00007
Cr-T	mg/L	78	0.0007	0.0020	54	0.0016	0.0037	92	0.0012	0.0034
Cu-T	mg/L	65	0.004	0.013	54	0.0034	0.0119	91	0.0046	0.0134
Fe-T	mg/L	78	0.46	1.08	54	0.95	2.98	91	0.82	2.62
Hg-T	mg/L	36	0.00002	0.00005	24	0.00044	0.0043	43	0.00025	0.00005
Mo-T	mg/L	77	0.0009	0.002	53	0.0011	0.0018	90	0.0010	0.0017
Ni-T	mg/L	78	0.0016	0.0030	54	0.0024	0.0059	92	0.0022	0.0047
Pb-T	mg/L	78	0.00022	0.00041	54	0.00043	0.0017	92	0.00035	0.0013
Se-T	mg/L	78	0.00042	0.0005	54	0.00039	0.00073	91	0.00043	0.00065
Tl-T	mg/L	78	0.00007	0.00010	54	0.00003	0.0001	91	0.00005	0.0001
Zn-T	mg/L	78	0.0039	0.010	54	0.0058	0.014	92	0.0048	0.014
N-NO2	mg/L	59	0.01	0.03	28	0.019	0.07	66	0.008	0.048
N-NO3	mg/L	75	0.067	0.193	47	0.094	0.223	84	0.064	0.199
pH-L	pH units	77	7.82	8.22	55	7.83	8.18	92	7.83	8.23
TSS	mg/L	62	7.20	24.6	89	40.8	93.4	89	27.5	93.4

Annual mean concentrations greater than 95th percentile of background concentration calculated by Minnow (2009)

Table 3: Summary of monthly water quality at W6 and W7 from 2005 to 2009

Parameter	Units	Annual Mean	April		May		June		July		August		September		October	
			n	mean	n	mean	n	mean	n	mean	n	mean	n	mean	n	mean
Ag-T	mg/L	0.00005	2	0.00003	2	0.00001	15	0.00005	7	0.00004	10	0.00006	11	0.00005	7	0.00003
Al-T	mg/L	0.603	2	0.074	2	0.359	15	1.713	7	0.238	10	0.063	11	0.250	7	0.132
As-T	mg/L	0.00063	2	0.0003	2	0.0006	15	0.0011	7	0.0005	10	0.0005	11	0.0004	7	0.0004
Ba-T	mg/L	0.0708	2	0.043	2	0.046	15	0.085	7	0.069	10	0.070	11	0.061	7	0.074
Be-T	mg/L	0.00013	2	0.00002	2	0.00050	15	0.00012	7	0.00011	10	0.00014	11	0.00013	7	0.00011
Bi-T	mg/L	0.00028	1	0.00005	0		12	0.00023	7	0.00025	8	0.00038	9	0.00023	7	0.00036
B-T	mg/L	0.0113	2	0.004	2	0.050	15	0.005	7	0.008	10	0.015	11	0.013	7	0.011
Ca-T	mg/L	29.7	2	22.9	2	18.4	15	25.9	7	34.8	10	33.4	11	28.5	7	34.5
Cd-T	mg/L	0.00004	2	0.00006	2	0.00003	15	0.00004	7	0.00001	10	0.00001	11	0.00001	7	0.00015
CN-T	mg/L		0		0		0		0		0		0		0	
Co-T	mg/L	0.00054	2	0.00009	2	0.00032	15	0.00135	7	0.00019	10	0.00015	11	0.00035	7	0.00019
Cr-T	mg/L	0.0016	2	0.0007	2	0.0011	15	0.0037	7	0.0006	10	0.0006	11	0.0010	7	0.0007
Cu-T	mg/L	0.0034	2	0.0085	2	0.0026	15	0.0045	7	0.0040	10	0.0021	11	0.0018	7	0.0039
Fe-T	mg/L	0.95	2	0.120	2	0.570	15	2.52	7	0.453	10	0.133	11	0.520	7	0.257
Hg-T	mg/L	0.00044	2	0.00001	2	0.00001	7	0.00145	1	0.00005	3	0.00002	6	0.00002	3	0.00002
K-T	mg/L	1.08	2	2.03	2	1.00	15	0.97	7	1.00	10	1.22	11	0.80	7	1.34
Li-T	mg/L	0.0017	2	0.0013	2	0.0025	15	0.0022	7	0.0014	10	0.0014	11	0.0012	7	0.0016
Mg-T	mg/L	9.84	2	10.5	2	5.9	15	8.7	7	11.9	10	10.7	11	9.0	7	11.0
Mn-T	mg/L	0.062	2	0.021	2	0.034	15	0.106	7	0.042	10	0.039	11	0.057	6	0.043
Mo-T	mg/L	0.0011	2	0.0009	2	0.0008	15	0.0010	7	0.0011	10	0.0018	11	0.0007	6	0.0011
Na-T	mg/L	6.46	2	6.55	2	3.30	15	5.85	7	7.23	10	7.36	11	5.69	7	8.23
Ni-T	mg/L	0.0024	2	0.0005	2	0.0026	15	0.0049	7	0.0013	10	0.0011	11	0.0019	7	0.0016
N-TKN	mg/L	0.503	2	1.39	0		7	0.436	1	0.310	4	0.340	4	0.415	3	0.467
Pb-T	mg/L	0.00043	2	0.00013	2	0.00025	15	0.00078	7	0.00019	10	0.00020	11	0.00023	7	0.00070
P-PO4-T	mg/L	0.050	2	0.043	0		7	0.075	1	0.025	4	0.033	4	0.040	3	0.043
P-T	mg/L	0.107	2	0.055	0		12	0.163	2	0.150	3	0.017	4	0.028	4	0.088
P-TRP (Ortho)	mg/L	0.0539	1	0.090	0		1	0.040	1	0.050	3	0.037	2	0.095	1	0.005
Sb-T	mg/L	0.00014	2	0.0001	2	0.00025	15	0.0001	7	0.0001	10	0.0002	11	0.0001	7	0.0002
Se-T	mg/L	0.00039	2	0.00030	2	0.00050	15	0.00037	7	0.00029	10	0.00032	11	0.00036	7	0.00064
Si-T	mg/L	6.38	2	2.74	0		15	7.60	7	6.01	8	5.79	9	6.40	7	5.84
Sn-T	mg/L	0.00038	2	0.0010	2	0.00025	15	0.00025	7	0.00038	10	0.00046	11	0.00042	7	0.00031
Sr-T	mg/L	0.283	2	0.262	0		15	0.223	7	0.329	8	0.347	9	0.230	7	0.371
S-T	mg/L	4.18	1	0.50	0		7	3.17	5	3.90	8	4.74	7	2.77	5	7.70
Te-T	mg/L	0.00005	2	0.00005	0		4	0.00005	0		2	0.00005	2	0.00005	2	0.00005
Th-T	mg/L	0.00010	2	0.00005	0		4	0.00005	0		2	0.00020	2	0.00005	2	0.00020
Ti-T	mg/L	0.025	2	0.003	2	0.014	15	0.068	7	0.012	10	0.003	11	0.010	7	0.006
TI-T	mg/L	0.00003	2	0.00001	2	0.00010	15	0.00003	7	0.00003	10	0.00004	11	0.00004	7	0.00003
U-T	mg/L	0.00084	2	0.0012	2	0.0003	15	0.0009	7	0.0011	10	0.0009	11	0.0006	7	0.0007
V-T	mg/L	0.0041	2	0.0003	2	0.015	15	0.006	7	0.001	10	0.004	11	0.004	7	0.001
Zn-T	mg/L	0.0058	2	0.006	2	0.003	15	0.009	7	0.004	10	0.004	11	0.005	7	0.005
Zr-T	mg/L	0.00056	2	0.00013	0		10	0.00077	5	0.00050	8	0.00054	9	0.00054	5	0.00045
Ag-D	mg/L	0.00004	2	0.00025	2	0.00001	10	0.00002	7	0.00004	9	0.00003	10	0.00003	5	0.00002
Al-D	mg/L	0.025	2	0.032	2	0.019	10	0.059	7	0.007	9	0.013	10	0.015	5	0.022
As-D	mg/L	0.00039	2	0.00010	2	0.00025	10	0.00044	7	0.00043	9	0.00037	10	0.00041	5	0.00042
Ba-D	mg/L	0.059	2	0.043	2	0.040	10	0.055	7	0.066	9	0.069	10	0.057	5	0.058
B-D	mg/L	0.0105	2	0.00225	2	0.0500	10	0.0040	7	0.0043	9	0.0163	10	0.0127	5	0.0050
Be-D	mg/L	0.00014	2	0.00002	2	0.00050	10	0.00012	7	0.00011	9	0.00014	10	0.00013	5	0.00012
Bi-D	mg/L	0.00028	1	0.00005	0		9	0.00023	7	0.00038	7	0.00032	6	0.00025	4	0.00025
Ca-D	mg/L	29.20	2	23.1	2	18.7	9	24.7	7	34.3	10	32.8	10	28.9	5	30.2
Cd-D	mg/L	0.00002	2	0.00006	2	0.00003	10	0.00002	7	0.00001	9	0.00001	10	0.00003	5	0.00001
C-D-DOC	mg/L	11.13	1	17.6	0		2	8.70	1	14.30	3	8.37	3	15.37	3	8.07
Co-D	mg/L	0.00012	2	0.00009	2	0.00015	10	0.00019	7	0.00005	9	0.00012	10	0.00011	5	0.00007
Cr-D	mg/L	0.00067	2	0.00090	2	0.00050	10	0.00059	7	0.00065	9	0.00068	10	0.00093	5	0.00030
Cu-D	mg/L	0.0017	2	0.0028	2	0.0017	10	0.0016	7	0.0019	9	0.0019	10	0.0016	5	0.0010
Fe-D	mg/L	0.105	2	0.040	2	0.104	10	0.114	7	0.077	9	0.097	10	0.128	5	0.124
Hg-D	mg/L	0.00028	2	0.00001	2	0.00001	3	0.00169	1	0.00005	5	0.00002	5	0.00002	1	0.00001
K-D	mg/L	1.03	2	2.09	2	1.00	9	0.87	7	0.94	9	1.29	10	0.82	5	1.00
Li-D	mg/L	0.00147	2	0.0013	2	0.0025	10	0.0014	7	0.0014	9	0.0014	10	0.0015	5	0.0015
Mg-D	mg/L	9.82	2	11.04	2	5.89	9	8.13	7	12.03	10	10.64	10	9.33	5	10.14
Mn-D	mg/L	0.031	2	0.018	2	0.012	10	0.035	7	0.027	9	0.035	10	0.030	5	0.033
Mo-D	mg/L	0.00109	2	0.00087	2	0.00050	10	0.00090	7	0.00108	9	0.00188	10	0.00085	5	0.00088
Na-D	mg/L	6.36	2	6.90	2	3.35	9	5.50	7	7.24	9	7.60	10	5.98	5	6.22
Ni-D	mg/L	0.00110	2	0.0005	2	0.0016	10	0.0014	7	0.0010	9	0.0010	10	0.0010	5	0.0010
O-DO	mg/L		0		0		0		0		0		0		0	
Pb-D	mg/L	0.00014	2	0.00008	2	0.00025	10	0.00009	7	0.00007	9	0.00018	10	0.00026	5	0.00004
P-D	mg/L	0.0815	2	0.033	0		5	0.122	2	0.150	3	0.022	2	0.020	3	0.102
P-TDP	mg/L	0.01000	0		0		3	0.01	1	0.01	1	0.01	2	0.01	1	0.01
Sb-D	mg/L	0.00042	2	0.00335	2	0.00025	10	0.00027	7	0.00009	9	0.00050	10	0.00027	5	0.00024
S-D	mg/L	3.98	1	0.40	0		5	3.64	5	4.04	7	5.51	6	3.10	2	3.80
Se-D	mg/L	0.00036	2	0.00030	2	0.00050	10	0.00052	7	0.00023	9	0.00033	10	0.00032	5	0.00034
Si-D	mg/L	5.68	2	2.73	0		9	5.38	7	5.85	7	5.69	8	6.14	5	6.40
Sn-D	mg/L	0.00034	2	0.00103	2	0.00025	10	0.00023	7	0.00037	9	0.00034	10	0.00036	5	0.00023
Sr-D	mg/L	0.273	2	0.263	0		10	0.224	7	0.299	7	0.349	8	0.257	5	0.257
Te-D	mg/L	0.00007	2	0.00005	0		2	0.00013	0		2	0.00005	2	0.00005	1	0.00005
Th-D	mg/L	0.00008	2	0.00005	0		2	0.00005	0		2	0.00020	2	0.00005	1	0.00005
Ti-D	mg/L	0.00237	2	0.0013	2	0.0050	10	0.0037	7	0.0018	9	0.0015	10	0.0019	5	0.0025
Tl-D	mg/L	0.00004	2	0.00001	2	0.00010	10	0.00003	7	0.00003	9	0.00004	10	0.00004	5	0.00003
U-D	mg/L	0.00074	2	0.00115	2	0.00023	10	0.00072	7	0.00097	9	0.00082	10	0.00057	5	0.00069
V-D	mg/L	0.00303	2	0.0004	2	0.0150	10	0.0012	7	0.0013	9	0.0042	10	0.0044	5	0.0007
Zn-D	mg/L	0.00276	2	0.0050	2	0.0025	10	0.0046	7	0.0019	9	0.0026	10	0.0021	5	0.0012
Zr-D	mg/L	0.00021	2	0.00013	0		2	0.00030	0		2	0.00013	2	0.00030	1	0.00020

Table 3: Summary of monthly water quality at W6 and W7 from 2005 to 2009

Parameter	Units	Annual Mean	April		May		June		July		August		September		October	
			n	mean	n	mean	n	mean	n	mean	n	mean	n	mean	n	mean
Alk-Bicrb	mg/L	140	2	119	0		10	123	7	143	8	165	9	139	5	141
Alk-Carb	mg/L	26.0	2	3.0	2	64.8	12	20.5	9	34.9	10	24.6	11	19.6	7	31.6
Alk-OH	mg/L	2.50	2	2.50	0		10	2.50	7	2.50	8	2.50	9	2.50	5	2.50
Alk-P	mg/L		0		0		0		0		0		0		0	
Alk-T	mg/L	110	2	99.5	2	34.4	14	99.1	7	118.7	10	130.5	11	110.7	5	118.4
Bromine	mg/L	0.0250	0		0		2	0.0250	0		0		0		0	
C-TIC	mg/L		0		0		0		0		0		0		0	
C-TOC	mg/L	11.1	1	17.60	0		2	8.10	0		3	9.30	2	17.5	3	8.40
Chloride	mg/L	1.90	2	0.59	2	0.25	11	0.82	5	1.62	5	2.21	6	0.46	5	7.13
Colour	TCU	56.5	2	73.0	0		7	85.0	3	29.7	3	11.7	4	58.0	1	33.0
Cond-F	µS/cm		0		0		0		0		0		0		0	
Cond-L	µS/cm	230	2	200	2	140	14	191	9	271	10	259	11	218	7	270
Discharge	L/s		0		0		0		0		0		0		0	
Fluoride	mg/L	0.166	0		0		2	0.166	0		0		0		0	
Hard-D	mg/L	126	2	103.0	0		5	106	7	127	10	134	6	124	5	140
Hard-T	mg/L	109	0		2	71.0	4	93.0	3	155	3	112	3	102	3	111
IB	%		0		0		0		0		0		0		0	
Ammonia	mg/L	0.020	1	0.03	2	0.01	13	0.02	6	0.01	8	0.02	10	0.02	5	0.03
Ammonium	mg/L	0.039	1	0.03	0		1	0.03	0		2	0.043	1	0.01	2	0.06
N-NO2	mg/L	0.019	1	0.070	2	0.002	10	0.024	3	0.009	3	0.009	6	0.005	3	0.047
NO2+NO3	mg/L	0.614	2	0.01	0		7	0.09	1	0.22	4	0.85	4	0.04	3	2.83
N-NO3	mg/L	0.0942	1	0.01	2	0.06	13	0.11	7	0.18	8	0.10	11	0.05	5	0.07
pH-F	pH units		0		0		0		0		0		0		0	
pH-L	pH units	7.83	2	7.62	2	7.93	14	7.81	9	7.81	10	8.01	11	7.85	7	7.63
Radium - 226			0		0		0		0		0		0		0	
SO4-D	mg/L	11.2	2	14.1	2	6.03	13	7.69	7	15.9	10	12.4	11	6.70	5	21.7
SO4-T	mg/L	9.07	0		2	4.29	2	5.35	2	29.6	2	4.32	2	4.83	2	6.08
Sulphide	mg/L		0		0		0		0		0		0		0	
TDS	mg/L	165	2	158	2	110	14	136	6	194	8	191	7	162	6	191
Temp-F	C		0		0		0		0		0		0		0	
Temp-obs-pH	C		0		0		0		0		0		0		0	
TSS	mg/L	40.8	2	1.00	2	22.0	14	106	9	11.4	8	2.19	10	44.1	7	3.79
Turb	NTU	1.92	2	0.95	0		7	1.16	3	9.27	3	0.18	4	0.56	3	0.57
Turb-F	NTU		0		0		0		0		0		0		0	
% > annual mean				29		28		36		34		46		20		33

Monthly mean is greater than annual average

Table 4: Summary of monthly water quality at W1, W2, W3, W8, W9, W10 from 2005 and W6 and W7 from 2005 to 2009

Parameter	Units	Annual Mean	April		May		June		July		August		September		October	
			n	mean	n	mean	n	mean	n	mean	n	mean	n	mean	n	mean
Ag-T	mg/L	0.00003	2	0.00003	9	0.00001	21	0.00004	13	0.00002	16	0.00004	17	0.00004	13	0.00002
Al-T	mg/L	0.453	2	0.07	9	0.36	21	1.24	13	0.39	16	0.11	17	0.20	13	0.12
As-T	mg/L	0.00058	2	0.00030	10	0.00051	21	0.00090	13	0.00055	16	0.00052	17	0.00045	13	0.00044
Ba-T	mg/L	0.0642	2	0.043	9	0.049	21	0.075	13	0.067	16	0.066	17	0.059	13	0.063
Be-T	mg/L	0.00024	2	0.00002	10	0.00050	21	0.00016	13	0.00017	16	0.00028	17	0.00026	13	0.00017
Bi-T	mg/L	0.00027	1	0.00005	0		18	0.00024	13	0.00025	8	0.00038	9	0.00023	13	0.00031
B-T	mg/L	0.0185	2	0.0043	10	0.0500	21	0.0050	13	0.0068	16	0.0283	17	0.0258	13	0.0081
Ca-T	mg/L	28.5	2	22.9	9	19.0	21	26.6	13	33.1	16	31.2	17	28.2	13	31.1
Cd-T	mg/L	0.00003	2	0.00006	9	0.00003	21	0.00004	13	0.00002	16	0.00001	17	0.00001	13	0.00009
CN-T	mg/L	0.01350	0		0		5	0.004	5	0.003	5	0.011	5	0.012	5	0.037
Co-T	mg/L	0.00045	2	0.00009	10	0.00040	21	0.00102	13	0.00037	16	0.00018	17	0.00029	13	0.00021
Cr-T	mg/L	0.0012	2	0.0007	10	0.0011	21	0.0028	13	0.0010	16	0.0006	17	0.0008	13	0.0006
Cu-T	mg/L	0.0046	2	0.0085	9	0.0073	21	0.0044	13	0.0057	16	0.0032	17	0.0031	13	0.0048
Fe-T	mg/L	0.82	2	0.12	9	0.60	21	1.92	13	0.68	16	0.33	17	0.56	13	0.37
Hg-T	mg/L	0.00025	2	0.00001	9	0.00001	7	0.00145	1	0.00005	9	0.00001	12	0.00002	3	0.00002
K-T	mg/L	1.04	2	2.03	9	1.00	21	0.98	13	1.00	16	1.14	17	0.87	13	1.18
Li-T	mg/L	0.0020	2	0.0013	10	0.0025	21	0.0023	13	0.0019	16	0.0018	17	0.0017	13	0.0020
Mg-T	mg/L	9.53	2	10.49	9	6.21	21	9.09	13	11.36	16	10.24	17	9.15	13	10.19
Mn-T	mg/L	0.057	2	0.021	9	0.030	21	0.083	13	0.050	16	0.042	17	0.057	12	0.062
Mo-T	mg/L	0.0010	2	0.0009	9	0.0007	21	0.0009	13	0.0011	16	0.0014	17	0.0007	12	0.0010
Na-T	mg/L	6.02	2	6.55	9	3.12	21	6.02	13	6.89	16	6.73	17	5.54	13	6.79
Ni-T	mg/L	0.0022	2	0.0005	10	0.0024	21	0.0039	13	0.0016	16	0.0013	17	0.0018	13	0.0015
N-TKN	mg/L	0.503	2	1.39	0		7	0.436	1	0.310	4	0.340	4	0.415	3	0.467
Pb-T	mg/L	0.00035	2	0.00013	10	0.00029	21	0.00060	13	0.00028	16	0.00022	17	0.00024	13	0.00040
P-PO4-T	mg/L	0.050	2	0.043	0		7	0.075	1	0.025	4	0.033	4	0.040	3	0.043
P-T	mg/L	0.124	2	0.055	0		18	0.159	8	0.150	3	0.017	4	0.028	10	0.125
P-TRP (Ortho)	mg/L	0.0539	1	0.090	0		1	0.040	1	0.050	3	0.037	2	0.095	1	0.005
Sb-T	mg/L	0.00014	2	0.00010	9	0.00025	21	0.00009	13	0.00008	16	0.00020	17	0.00018	13	0.00012
Se-T	mg/L	0.00043	2	0.00030	9	0.00050	21	0.00040	13	0.00038	16	0.00039	17	0.00041	13	0.00058
Si-T	mg/L	6.25	2	2.74	0		21	7.00	13	6.15	8	5.79	9	6.40	13	5.86
Sn-T	mg/L	0.00029	2	0.00103	9	0.00025	21	0.00020	13	0.00025	16	0.00038	17	0.00036	13	0.00019
Sr-T	mg/L	0.262	2	0.262	0		21	0.215	13	0.281	8	0.347	9	0.230	13	0.291
S-T	mg/L	4.18	1	0.50	0		7	3.17	5	3.90	8	4.74	7	2.77	5	7.70
Te-T	mg/L	0.00005	2	0.00005	0		4	0.00005	0		2	0.00005	2	0.00005	2	0.00005
Th-T	mg/L	0.00010	2	0.00005	0		4	0.00005	0		2	0.00020	2	0.00005	2	0.00020
Ti-T	mg/L	0.019	2	0.0025	10	0.0147	21	0.0502	13	0.0186	16	0.0043	17	0.0085	13	0.0056
Tl-T	mg/L	0.00005	2	0.00001	9	0.00010	21	0.00003	13	0.00004	16	0.00006	17	0.00006	13	0.00004
U-T	mg/L	0.00068	2	0.00115	10	0.00042	21	0.00081	13	0.00089	16	0.00073	17	0.00050	13	0.00055
V-T	mg/L	0.0058	2	0.0003	9	0.0150	21	0.0047	13	0.0017	16	0.0080	17	0.0076	13	0.0008
Zn-T	mg/L	0.0048	2	0.0060	10	0.0036	21	0.0081	13	0.0042	16	0.0037	17	0.0042	13	0.0031
Zr-T	mg/L	0.00056	2	0.00013	0		10	0.00077	5	0.00050	8	0.00054	9	0.00054	5	0.00045
Ag-D	mg/L	0.00003	2	0.00025	9	0.00001	16	0.00002	13	0.00002	15	0.00002	16	0.00002	11	0.00002
Al-D	mg/L	0.028	2	0.0315	9	0.0399	16	0.0486	13	0.0149	15	0.0182	16	0.0204	11	0.0252
As-D	mg/L	0.00040	2	0.00010	9	0.00028	16	0.00045	13	0.00044	15	0.00039	16	0.00039	11	0.00044
Ba-D	mg/L	0.055	2	0.043	9	0.043	16	0.053	13	0.060	15	0.063	16	0.055	11	0.052
B-D	mg/L	0.0185	2	0.002	9	0.050	16	0.004	13	0.005	15	0.030	16	0.027	11	0.005
Be-D	mg/L	0.00025	2	0.00002	9	0.00050	16	0.00017	13	0.00017	15	0.00029	16	0.00027	11	0.00019
Bi-D	mg/L	0.00027	1	0.00005	0		15	0.00024	13	0.00032	7	0.00032	6	0.00025	10	0.00025
Ca-D	mg/L	28.27	2	23.1	9	19.2	15	26.1	13	33.0	16	30.9	16	28.7	11	29.5
Cd-D	mg/L	0.00002	2	0.00006	9	0.00003	16	0.00002	13	0.00002	15	0.00001	16	0.00002	11	0.00002
C-DOC	mg/L	11.13	1	17.6	0		2	8.7	1	14.3	3	8.4	3	15.4	3	8.1
Co-D	mg/L	0.00013	2	0.00009	9	0.00015	16	0.00017	13	0.00008	15	0.00013	16	0.00013	11	0.00010
Cr-D	mg/L	0.00055	2	0.00090	9	0.00050	16	0.00051	13	0.00049	15	0.00061	16	0.00077	11	0.00027
Cu-D	mg/L	0.0030	2	0.0028	9	0.0059	16	0.0024	13	0.0029	15	0.0027	16	0.0025	11	0.0026
Fe-D	mg/L	0.182	2	0.040	9	0.136	16	0.153	13	0.144	15	0.197	16	0.224	11	0.248
Hg-D	mg/L	0.00015	2	0.00001	9	0.00001	3	0.00169	1	0.00005	11	0.00001	11	0.00001	1	0.00001
K-D	mg/L	1.02	2	2.09	9	1.00	15	0.92	13	0.97	15	1.17	16	0.89	11	1.00
Li-D	mg/L	0.00193	2	0.0013	9	0.0025	16	0.0018	13	0.0019	15	0.0019	16	0.0019	11	0.0020
Mg-D	mg/L	9.58	2	11.04	9	6.24	15	8.86	13	11.50	16	10.25	16	9.43	11	9.98
Mn-D	mg/L	0.030	2	0.018	10	0.006	16	0.028	13	0.025	15	0.034	16	0.035	11	0.053
Mo-D	mg/L	0.00094	2	0.0009	9	0.0005	16	0.0009	13	0.0010	15	0.0014	16	0.0008	11	0.0009
Na-D	mg/L	5.97	2	6.90	9	3.19	15	6.05	13	6.99	15	6.88	16	5.77	11	5.81
Ni-D	mg/L	0.00118	2	0.00050	9	0.00141	16	0.00133	13	0.00113	15	0.00117	16	0.00113	11	0.00106
O-DO	mg/L		0		0		0		0		0		0		0	
Pb-D	mg/L	0.00015	2	0.00008	9	0.00025	16	0.00008	13	0.00007	15	0.00021	16	0.00025	11	0.00003
P-D	mg/L	0.1167	2	0.033	0		11	0.137	8	0.150	3	0.022	2	0.020	9	0.134
P-TDP	mg/L	0.01000	0		0		3	0.010	1	0.010	1	0.010	2	0.010	1	0.010
Sb-D	mg/L	0.00030	2	0.00335	9	0.00025	16	0.00019	13	0.00007	15	0.00040	16	0.00026	11	0.00014
S-D	mg/L	3.98	1	0.40	0		5	3.64	5	4.04	7	5.51	6	3.10	2	3.80
Se-D	mg/L	0.0004	2	0.0003	9	0.0005	16	0.0005	13	0.0004	15	0.0004	16	0.0004	11	0.0004
Si-D	mg/L	5.68	2	2.73	0		15	5.42	13	5.66	7	5.69	8	6.14	11	6.28
Sn-D	mg/L	0.00026	2	0.0010	9	0.00025	16	0.0002	13	0.0002	15	0.00031	16	0.00032	11	0.0001
Sr-D	mg/L	0.251	2	0.263	0		16	0.214	13	0.262	7	0.349	8	0.257	11	0.220
Te-D	mg/L	0.00007	2	0.00005	0		2	0.00013	0		2	0.00005	2	0.00005	1	0.00005
Th-D	mg/L	0.00008	2	0.00005	0		2	0.00005	0		2	0.00020	2	0.00005	1	0.00005
Ti-D	mg/L	0.00357	2	0.0013	10	0.0050	16	0.0042	13	0.0033	15	0.0029	16	0.0031	11	0.0039
Tl-D	mg/L	0.00005	2	0.00001	9	0.00010	16	0.00004	13	0.00004	15	0.00006	16	0.00006	11	0.00004
U-D	mg/L	0.00059	2	0.0012	9	0.0004	16	0.0007	13	0.0008	15	0.00064	16	0.0005	11	0.0005
V-D	mg/L	0.00525	2	0.0004	9	0.0150	16	0.0009	13	0.0009	15	0.0085	16	0.0084	11	0.0006
Zn-D	mg/L	0.00298	2	0.0050	9	0.0032	16	0.0053	13	0.0024	15	0.0027	16	0.0022	11	0.0012
Zr-D	mg/L	0.00021	2	0.00013												

Table 4: Summary of monthly water quality at W1, W2, W3, W8, W9, W10 from 2005 and W6 and W7 from 2005 to 2009

Parameter	Units	Annual Mean	April		May		June		July		August		September		October	
			n	mean	n	mean	n	mean	n	mean	n	mean	n	mean	n	mean
Alk-Bicrb	mg/L	140	2	119	0		10	123	7	143	8	165	9	139	5	141
Alk-Carb	mg/L	54.1	2	3.0	8	63.1	18	48.2	15	66.0	16	55.3	17	44.7	13	61.8
Alk-OH	mg/L	2.50	2	2.50	0		10	2.50	7	2.50	8	2.50	9	2.50	5	2.50
Alk-P	mg/L		0		0		0		0		0		0		0	
Alk-T	mg/L	109	2	100	6	75	19	103	7	119	15	126	16	107	5	118
Bromine	mg/L	0.02500	0		0		2	0.025	0		0		0		0	
C-TIC	mg/L		0		0		0		0		0		0		0	
C-TOC	mg/L	11.1	1	17.60	0		2	8.10	0		3	9.30	2	17.45	3	8.40
Chloride	mg/L	1.18	2	0.59	10	0.25	16	0.98	11	0.94	11	1.19	12	0.44	11	3.49
Colour	TCU	56.5	2	73.0	0		7	85.0	3	29.7	3	11.7	4	58.0	1	33.0
Cond-F	µS/cm		0		0		0		0		0		0		0	
Cond-L	µS/cm	219	2	200	9	143	20	200	15	258	16	241	17	211	13	240
Discharge	L/s		0		0		0		0		0		0		0	
Fluoride	mg/L	0.166	0		0		2	0.166	0		0		0		0	
Hard-D	mg/L	126	2	103	0		5	106	7	127	10	134	6	124	5	140
Hard-T	mg/L	106	0		9	74	4	93	9	134	9	110	9	107	9	112
IB	%		0		0		0		0		0		0		0	
Ammonia	mg/L	0.019	1	0.025	10	0.016	19	0.023	12	0.012	14	0.024	16	0.015	11	0.023
Ammonium	mg/L	0.039	1	0.025	0		1	0.025	0		2	0.043	1	0.011	2	0.063
N-NO2	mg/L	0.008	1	0.070	10	0.001	16	0.015	9	0.003	9	0.003	12	0.003	9	0.016
NO2+NO3	mg/L	0.614	2	0.005	0		7	0.087	1	0.220	4	0.848	4	0.039	3	2.833
N-NO3	mg/L	0.0645	1	0.010	9	0.034	19	0.083	13	0.104	14	0.059	17	0.038	11	0.062
pH-F	pH units		0		0		0		0		0		0		0	
pH-L	pH units	7.83	2	7.62	9	7.87	20	7.83	15	7.78	16	8.04	17	7.83	13	7.64
Radium - 226	Bq/L	0.00304	0		0		5	0.0025	5	0.0034	5	0.0025	5	0.0034	5	0.0034
SO4-D	mg/L	14.0	2	14.1	6	35.0	18	10.9	7	15.9	15	12.1	16	8.3	5	21.7
SO4-T	mg/L	13.14	0		8	9.2	8	15.6	8	19.0	8	10.5	8	10.7	8	13.9
Sulphide	mg/L		0		0		0		0		0		0		0	
TDS	mg/L	158	2	158	9	116	20	145	12	176	14	177	13	157	12	173
Temp-F	C		0		0		0		0		0		0		0	
Temp-obs-pH	C		0		0		0		0		0		0		0	
TSS	mg/L	27.5	2	1.00	9	20.3	20	75.1	15	10.9	14	3.46	16	30.3	13	4.73
Turb	NTU	1.92	2	0.95	0		7	1.16	3	9.27	3	0.18	4	0.56	3	0.57
Turb-F	NTU		0		0		0		0		0		0		0	
% > annual mean				29		37		38		35		48		27		38

Monthly mean is greater than annual average

Memo

To:	Scott Keesey, Scott Davidson (Access Consulting Group)	Date:	November 10, 2010
cc:	Anne Labelle (Capstone)	From:	Dylan MacGregor
Subject:	Minto Phase IV Application: Response to Adequacy Review Comment 26-27C	Project #:	1CM022.001

1 Introduction

As part of Minto's response to agency adequacy review comments, SRK was asked to provide input to the response to Comment 26-27C. This comment is copied below for ease of reference.

R26-27C. Provide water quality predictions for the receiving environment. These additional predictions could be reasonably based on expected reduced loads from the various source terms after mitigation. The analysis should include scenarios that predict the effects of individual source term mitigations and scenarios that include multiple source terms mitigations. The analysis should include a clear discussion of limitations and uncertainty and a revised cost analysis.

Following discussions and subsequent email communication between SRK and Access Consulting, it was agreed that the potential effects of soil covers and passive wetland treatment on post-closure water quality would be evaluated. The following sections describe how this evaluation was carried out and present the results.

2 Approach

2.1 Model update

In advance of carrying out additional model runs to assess load reductions that could reasonably be achieved through various closure measures, a review was carried out of the new water quality monitoring results that had been received since July 2010 (the latest results considered for the initial prediction source terms). The purpose was to ensure that the model source terms for the waste rock and tailings facilities incorporated any new peak concentrations identified during post-July 2010 monitoring. Selenium was the only trace element with post-July 2010 maxima that exceeded previously observed values, and the new maximum dissolved selenium concentrations in DSTF seepage (Station W8- dissolved Se concentration of 0.0146 mg/L) and waste rock seepage (Station W15- dissolved Se concentration of 0.0052 mg/L) have been incorporated into the updated prediction.

2.2 Assessment of potential for load reductions due to mitigation

The potential load reductions from application of two mitigation methods were evaluated. These mitigation methods consisted of 1) application of soil covers to reduce loading through reduction of

infiltration, and 2) the application of soil covers combined with development of a wetland to provide additional load removal. There is a large body of literature of treatment wetlands that shows they can be effective in removing both metal and nutrient loadings in northern environments (S. Davidson, personal communication, 2010/11/09). Reviewers are referred to the Global Acid Rock Drainage (GARD) Guide for further information on passive treatment wetlands. To evaluate the range of load reductions that could be realized, six scenarios were evaluated as summarized below.

1. Soil covers on waste dumps and dry stack tailings
 - a. Scenario 1: 60% reduction of infiltration on benches and 50% on faces
 - b. Scenario 2: 80% reduction of infiltration on benches and 50% on faces
2. Soil covers on waste dumps and dry stack tailings, with a polishing wetland receiving the discharge from both the Main Pit and the Area 2 Pit (located roughly in the location of the current Mill Water Pond)
 - a. Scenario 3: 60% reduction of infiltration on benches and 50% on faces; wetland removing 66% of received loads.
 - b. Scenario 4: 80% reduction of infiltration on benches and 50% on faces; wetland removing 75% of received loads.
3. Soil covers on waste dumps and dry stack tailings, with a polishing wetland receiving the discharge from both the Main Pit and the Area 2 Pit (located roughly in the location of the current Mill Water Pond) and a second polishing wetland receiving drainage from all mine elements above Station W3 (located roughly in the current location of the Water Storage Pond)
 - a. Scenario 5: 60% reduction of infiltration on benches and 50% on faces; wetland removing 66% of received loads (both wetlands).
 - b. Scenario 6: 80% reduction of infiltration on benches and 50% on faces; wetland removing 75% of received loads (both wetlands).

3 Basis for Evaluation

Effects of Soil Covers: The values chosen for the evaluation of load reduction that could be achieved through the use of soil cover represent the effectiveness of a basic soil cover (60% reduction of infiltration on benches) and a high quality soil cover (80% reduction of infiltration on benches). In all scenarios, an infiltration reduction of 50% was applied to the face (sloped) areas of the waste dumps and the tailings stack.

Breakdowns of bench and face areas for the waste dumps and the dry stack tailings were provided in Table 4.2 of the Closure Plan submitted with the application (Appendix M); this table is reproduced below for ease of reference.

TABLE 4-2. MINTO MINE WASTE DUMP AND TAILINGS FACILITY SURFACE AREAS

Area	Total Surface Area (m ²)	Bench Area (m ²)	Dump Face Area (m ²)	Percentage Benches
Dry Stacked Tailings Storage Facility	380,000	310,000	70,000	81.6%
Southwest Waste Dump	740,000	653,000	87,000	88.2%
Main Waste Dump	435,000	278,100	156,900	63.9%
Mill Valley Fill Expansion	102,000	80,100	21,900	78.5%

Effects of Wetlands: The critical performance period for passive treatment wetlands in northern environments tends to be the spring freshet, when high inflow volumes lead to relatively shorter residence times (and attendant lower load removal rates) than are typical of other times of the year.

Evaluating the supplemental effect of passive treatment wetland systems, in addition to installation of soil covers on waste dumps and dry stack tailings, for removing chemical loads from feed water was carried out by running two freshet performance scenarios:

1. Basic soil cover + lower estimate of freshet load removal in wetland;
2. High quality soil cover + higher estimate of freshet load removal in wetland(s).

4 Evaluation of Effects of Mitigation Measures on Water Quality at Station W1

4.1 Unmitigated Condition

Table 1 presents the results of the post-closure water quality model for the unmitigated condition at Station W1. Predicted concentrations were compared with Site Specific Water Quality Objectives (SSWQO) where available, and with Canadian Water Quality Objectives for the Protection of Aquatic Life (CWQO) for those parameters where no SSWQO were available; for the purposes of this discussion, the term 'Water Quality Objectives' (WQO) will refer to the combined SSWQO (where available) and CWQO (where no SSWQO has been developed).

Modelled concentrations for the unmitigated condition exceeded WQO for several parameters in the month of June, and for Al, Cd, Cu, Fe, and Hg for several months.

- June results:
 - The June model results are a reflection of concentrations adopted for June background runoff water quality.
 - The lack of June flow from the upper catchment (above W3) introduces minor artifacts to the model results at W1, as model structure required end of May loads into the beginning of June for computational purposes. These artifacts manifest only in the month of June due to the lack of flow modelled for that month.
 - For this and subsequent discussion of mitigated scenarios, June concentrations that exceed WQO will not be addressed unless exceedances are also modelled to occur in other months.
- Mercury results:
 - Mercury predictions are very challenging, and always end up being very conservative when 'reasonable worst case' source terms are adopted and a mass-balance approach is followed.
 - Mercury is commonly eliminated from surface water through mechanisms such as loss to the atmosphere (volatilization) or sorption onto mineral and organic soils and sediments.
 - These and other mechanisms typically control mercury concentrations to levels below common commercial laboratory detection limits- this is why mercury is rarely detected in surface water quality analyses.
 - Notwithstanding this, the modelled mercury concentrations are less than two times the WQO (except for June- see previous point).
 - Mercury is therefore not considered to be a parameter of particular concern for the Minto Phase IV project, and mercury exceedances will not be discussed in further detail either for the unmitigated case or for the mitigated scenarios.
- Silver results:
 - The total silver concentration modelled for October exceeds the WQO by less than 10%. As silver is highly insoluble in surface waters, this modelled concentration is likely to be highly conservative. Therefore, silver is not considered to be a parameter of concern, and the October silver results will not be discussed further.

4.2 Evaluation of Effects of Soil Covers on Water Quality at Station W1

Tables 2 and 3 present the results of the post-closure water quality model for the cases where the effects of infiltration reduction covers were assessed, with Table 2 reflecting a 60% reduction of

infiltration and chemical load, and with Table 3 reflecting a 80% reduction of infiltration and chemical load.

The following observations can be made:

- If the 'reasonable worst case' predicted concentrations are reflective of actual loadings during the post-closure period, then soil covers alone will not be sufficient to prevent WQOs from being exceeded at W1.
- The cover performance has a modest degree of influence on the modelled concentrations at Station W1.
- Outside of the points raised in the Section 4.1, the remaining parameters of concern appear to be Al, Cd, and Cu.

4.3 Evaluation of Effects of Soil Covers and a Single Polishing Wetland on Water Quality at Station W1

Tables 4 and 5 present the results of model scenarios that include basic covers on waste dumps and tailings, and a wetland located near the current Mill Water Pond. The Table 4 scenario consists of basic covers and 66% removal of intercepted load in the wetland, while the Table 5 scenario consists of higher quality covers and 75% removal of load in the intercepted wetland.

The following observations can be made:

- If the 'reasonable worst case' predicted concentrations are reflective of actual loadings during the post-closure period, then both 'soil covers + 1 wetland' options appear to be capable of reducing loads such that WQOs for copper are met at W1.
- Cadmium remains consistently above WQO for both scenarios.
- Aluminum is modelled to be above the WQO during the freshet period. Modelled concentrations are similar to aluminum concentrations observed in runoff from undisturbed portions of the catchment, and are driven by background loads that are accounted for in the modelling process.

4.4 Evaluation of Effects of Soil Covers and Two Polishing Wetlands on Water Quality at Station W1

Tables 6 and 7 present the results of model scenarios that include basic covers on waste dumps and tailings, a wetland located near the current Mill Water Pond, and a second wetland located near the current location of the Water Storage Pond (just upstream of Station W3). The Table 6 scenario consists of basic covers and 66% removal of intercepted load in the wetlands, while the Table 7 scenario consists of higher quality covers and 75% removal of intercepted load in the wetlands.

The following observations can be made:

- If the 'reasonable worst case' predicted concentrations are reflective of actual loadings during the post-closure period, then both 'soil covers + 2 wetland' options appear to be capable of reducing loads such that WQOs for all parameters except cadmium are met at Station W1.
- Cadmium remains consistently above WQO for both scenarios.
- Cadmium concentrations are near or above the WQO in the background runoff source term for the months of April, May, June, and October. The post-closure cadmium concentrations at Station W1 are unlikely to be lower than background runoff concentrations; when the undisturbed catchment runoff contains concentrations that exceed WQO, it is almost certain that the concentrations at Station W1 will also exceed WQO.
- The maximum modelled Cadmium concentration (October) exceeds the WQO by a factor of about 3.5; the modelled concentrations for all other months is less than 1.5 times the WQO concentration.

5 Conclusions

Based on the modelling results, it appears that a combination of a reduction of infiltration through waste rock and tailings (through installation of soil covers) and of load removal in polishing wetlands will be capable of adequately mitigating chemical loadings from the mine site in the post-closure period.

As site loadings are decreased, background runoff loadings become proportionally more important. In cases where background runoff concentrations are greater than WQOs, it is highly likely that WQOs will be exceeded at Station W1. The model results suggest that cadmium is the parameter that is most likely to exceed WQOs under the mitigation scenarios evaluated, and that this will largely result from load contributions from undisturbed portions of the catchment.

Table 1 W1 Post-closure Water Quality Prediction (Unmitigated Condition)

	Ag mg/L	Al mg/L	As mg/L	Cd mg/L	Cr mg/L	Cu mg/L	Fe mg/L	Hg mg/L	Mn mg/L	Mo mg/L	Ni mg/L	Pb mg/L	Se mg/L	Tl mg/L	Zn mg/L
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000051	0.26	0.00046	0.000077	0.00089	0.018	0.37	0.000013	0.070	0.0013	0.0010	0.00024	0.00039	0.000006	0.0085
May	0.000068	0.83	0.00103	0.000089	0.00162	0.034	1.16	0.000019	0.154	0.0021	0.0036	0.00056	0.00081	0.000093	0.0106
June	0.000050	1.68	0.00105	0.000044	0.00363	0.006	2.48	0.001402	0.108	0.0010	0.0049	0.00077	0.00041	0.000030	0.0091
July	0.000055	0.47	0.00079	0.000046	0.00095	0.025	0.74	0.000074	0.132	0.0018	0.0020	0.00036	0.00057	0.000035	0.0080
August	0.000073	0.30	0.00080	0.000044	0.00090	0.024	0.44	0.000035	0.121	0.0025	0.0018	0.00037	0.00057	0.000041	0.0078
September	0.000106	0.81	0.00104	0.000090	0.00163	0.043	1.21	0.000036	0.198	0.0025	0.0033	0.00061	0.00084	0.000041	0.0144
October	0.000050	0.30	0.00055	0.000156	0.00090	0.014	0.48	0.000023	0.083	0.0015	0.0020	0.00076	0.00069	0.000031	0.0076
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWQG (mg/L)	0.0001	0.01	0.005	0.00004	0.001	0.003	0.3	0.000026	none	0.073	0.11	0.004	0.001	0.0008	0.03
SSWQO (mg/L)		0.62			0.002	0.017	1.1		1.045						

Source: W:\01_SITES\Minto\!Databases\ML-ARD\WQ_Predictions\Load Balance\V02\[Minto.MitigationPrediction.Tables.CAJ.v02.xlsx]

Notes: Grey cells indicate values exceeding either the proposed site-specific water quality objective (SSWQO) for Station W1 (where developed) or the Canadian Water Quality Guideline values (CWQG) for the Protection of Aquatic Life (<http://ceqg-rcqe.ccme.ca>).

Table 2 W1 Post-closure Water Quality Prediction- Mitigation Scenario 1: Soil Cover (60% infiltration reduction) on DSTF and Waste Dumps

	Ag (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Tl (mg/L)	Zn (mg/L)
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000052	0.27	0.00044	0.000077	0.00089	0.016	0.38	0.000014	0.055	0.0013	0.0010	0.00025	0.00040	0.000007	0.0085
May	0.000068	0.75	0.00087	0.000073	0.00149	0.020	1.07	0.000019	0.106	0.0017	0.0032	0.00047	0.00068	0.000091	0.0088
June	0.000050	1.68	0.00104	0.000043	0.00363	0.005	2.47	0.001402	0.106	0.0010	0.0048	0.00077	0.00041	0.000030	0.0090
July	0.000054	0.41	0.00067	0.000034	0.00085	0.014	0.67	0.000072	0.086	0.0015	0.0018	0.00030	0.00047	0.000035	0.0067
August	0.000073	0.24	0.00067	0.000030	0.00081	0.013	0.37	0.000035	0.080	0.0022	0.0016	0.00031	0.00046	0.000041	0.0064
September	0.000105	0.69	0.00083	0.000066	0.00145	0.024	1.07	0.000036	0.136	0.0019	0.0028	0.00049	0.00066	0.000040	0.0117
October	0.000050	0.28	0.00049	0.000148	0.00086	0.009	0.45	0.000023	0.067	0.0014	0.0019	0.00073	0.00064	0.000031	0.0069
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWQG (mg/L)	0.0001	0.01	0.005	0.00004	0.001	0.003	0.3	0.000026	none	0.073	0.11	0.004	0.001	0.0008	0.03
SSWQO (mg/L)		0.62			0.002	0.017	1.1		1.045						

Source: W:\01_SITES\Minto\!Databases\ML-ARD\WQ_Predictions\Load Balance\V02\[Minto.MitigationPrediction.Tables.CAJ.v02.xlsx]

Notes: Grey cells indicate values exceeding either the proposed site-specific water quality objective (SSWQO) for Station W1 (where developed) or the Canadian Water Quality Guideline values (CWQG) for the Protection of Aquatic Life (<http://ceqg-rcqe.ccm.ca>).

Table 3 W1 Post-closure Water Quality Prediction- Mitigation Scenario 2: Soil Cover (80% infiltration reduction) on DSTF and Waste Dumps

	Ag (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Tl (mg/L)	Zn (mg/L)
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000052	0.26	0.00042	0.000075	0.00087	0.014	0.36	0.000014	0.048	0.0013	0.0009	0.00023	0.00036	0.000007	0.0082
May	0.000067	0.72	0.00082	0.000068	0.00145	0.016	1.04	0.000019	0.092	0.0016	0.0031	0.00045	0.00061	0.000090	0.0083
June	0.000050	1.68	0.00104	0.000043	0.00363	0.005	2.47	0.001402	0.106	0.0010	0.0048	0.00077	0.00041	0.000030	0.0090
July	0.000054	0.40	0.00063	0.000031	0.00082	0.011	0.66	0.000072	0.074	0.0014	0.0017	0.00028	0.00042	0.000035	0.0064
August	0.000073	0.23	0.00064	0.000026	0.00078	0.010	0.35	0.000035	0.068	0.0021	0.0015	0.00029	0.00041	0.000041	0.0060
September	0.000105	0.66	0.00077	0.000059	0.00140	0.018	1.03	0.000036	0.118	0.0017	0.0027	0.00046	0.00057	0.000040	0.0109
October	0.000050	0.27	0.00048	0.000147	0.00084	0.008	0.44	0.000023	0.062	0.0013	0.0019	0.00072	0.00062	0.000031	0.0067
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWQG (mg/L)	0.0001	0.01	0.005	0.00004	0.001	0.003	0.3	0.000026	none	0.073	0.11	0.004	0.001	0.0008	0.03
SSWQO (mg/L)		0.62			0.002	0.017	1.1		1.045						

Source: W:\01_SITES\Minto\!Databases\ML-ARD\WQ_Predictions\Load Balance\V02\[Minto.MitigationPrediction.Tables.CAJ.v02.xlsx]

Notes: Grey cells indicate values exceeding either the proposed site-specific water quality objective (SSWQO) for Station W1 (where developed) or the Canadian Water Quality Guideline values (CWQG) for the Protection of Aquatic Life (<http://ceqg-rcqe.ccm.ca>).

Table 4 W1 Post-closure Water Quality Prediction- Mitigation Scenario 3: Soil Cover (60% infiltration reduction) on DSTF and Waste Dumps, Wetland for Polishing Pit Discharge Waters (66% load reduction)

	Ag (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Tl (mg/L)	Zn (mg/L)
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000050	0.24	0.00038	0.000069	0.00082	0.013	0.34	0.000012	0.049	0.0011	0.0008	0.00021	0.00033	0.000006	0.0077
May	0.000064	0.65	0.00071	0.000060	0.00128	0.014	0.96	0.000015	0.092	0.0012	0.0028	0.00039	0.00052	0.000079	0.0075
June	0.000050	1.68	0.00104	0.000043	0.00362	0.005	2.47	0.001402	0.106	0.0010	0.0048	0.00077	0.00040	0.000030	0.0089
July	0.000053	0.36	0.00059	0.000027	0.00074	0.010	0.60	0.000055	0.079	0.0013	0.0016	0.00025	0.00040	0.000032	0.0059
August	0.000071	0.19	0.00060	0.000023	0.00072	0.008	0.31	0.000026	0.072	0.0019	0.0014	0.00026	0.00039	0.000039	0.0055
September	0.000097	0.59	0.00064	0.000052	0.00122	0.015	0.94	0.000025	0.116	0.0013	0.0024	0.00039	0.00048	0.000033	0.0096
October	0.000048	0.25	0.00045	0.000143	0.00080	0.007	0.42	0.000021	0.062	0.0012	0.0018	0.00070	0.00059	0.000029	0.0064
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWQG (mg/L)	0.0001	0.01	0.005	0.00004	0.001	0.003	0.3	0.000026	none	0.073	0.11	0.004	0.001	0.0008	0.03
SSWQO (mg/L)		0.62			0.002	0.017	1.1		1.045						

Source: W:\01_SITES\Minto\1Databases\ML-ARD\WQ_Predictions\Load Balance\V02\{Minto.MitigationPrediction.Tables.CAJ.v02.xlsx}

Notes: Grey cells indicate values exceeding either the proposed site-specific water quality objective (SSWQO) for Station W1 (where developed) or the Canadian Water Quality Guideline values (CWQG) for the Protection of Aquatic Life (<http://ceqg-rcqe.ccme.ca>).

Table 5 W1 Post-closure Water Quality Prediction- Mitigation Scenario 4: Soil Cover (80% infiltration reduction) on DSTF and Waste Dumps, Wetland for Polishing Pit Discharge Waters (75% load reduction)

	Ag (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Tl (mg/L)	Zn (mg/L)
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000049	0.23	0.00036	0.000068	0.00080	0.012	0.34	0.000012	0.043	0.0010	0.0008	0.00020	0.00030	0.000006	0.0075
May	0.000064	0.63	0.00066	0.000057	0.00123	0.011	0.93	0.000014	0.080	0.0011	0.0027	0.00037	0.00046	0.000077	0.0071
June	0.000050	1.68	0.00104	0.000042	0.00362	0.005	2.47	0.001402	0.105	0.0010	0.0048	0.00077	0.00040	0.000030	0.0089
July	0.000052	0.34	0.00056	0.000025	0.00071	0.008	0.59	0.000053	0.067	0.0012	0.0015	0.00024	0.00035	0.000031	0.0057
August	0.000070	0.18	0.00057	0.000021	0.00070	0.006	0.30	0.000024	0.062	0.0018	0.0013	0.00025	0.00034	0.000039	0.0053
September	0.000096	0.56	0.00058	0.000047	0.00117	0.011	0.91	0.000024	0.101	0.0011	0.0023	0.00037	0.00040	0.000032	0.0091
October	0.000047	0.24	0.00043	0.000142	0.00079	0.006	0.41	0.000021	0.058	0.0012	0.0018	0.00069	0.00057	0.000029	0.0063
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWQG (mg/L)	0.0001	0.01	0.005	0.00004	0.001	0.003	0.3	0.000026	none	0.073	0.11	0.004	0.001	0.0008	0.03
SSWQO (mg/L)		0.62			0.002	0.017	1.1		1.045						

Source: W:\01_SITES\Minto\1Databases\ML-ARD\WQ_Predictions\Load Balance\V02\[Minto.MitigationPrediction.Tables.CAJ.v02.xlsx]

Notes: Grey cells indicate values exceeding either the proposed site-specific water quality objective (SSWQO) for Station W1 (where developed) or the Canadian Water Quality Guideline values (CWQG) for the Protection of Aquatic Life (<http://ceqg-rcqe.ccme.ca>).

Table 6 W1 Post-closure Water Quality Prediction- Mitigation Scenario 5: Soil Cover (60% infiltration reduction) on DSTF and Waste Dumps, Wetland for Polishing Pit Discharge Waters (66% load reduction) and Additional Wetland for Polishing All Mine Site Drainage

	Ag (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Tl (mg/L)	Zn (mg/L)
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000048	0.22	0.00034	0.000065	0.00076	0.011	0.33	0.000011	0.039	0.0010	0.0008	0.00019	0.00028	0.000006	0.0073
May	0.000063	0.59	0.00059	0.000053	0.00113	0.009	0.88	0.000013	0.069	0.0010	0.0025	0.00034	0.00038	0.000069	0.0067
June	0.000049	1.68	0.00103	0.000042	0.00361	0.005	2.47	0.001402	0.105	0.0010	0.0048	0.00077	0.00040	0.000029	0.0089
July	0.000052	0.33	0.00053	0.000023	0.00068	0.007	0.57	0.000049	0.059	0.0011	0.0015	0.00023	0.00031	0.000030	0.0055
August	0.000070	0.17	0.00054	0.000019	0.00067	0.005	0.28	0.000022	0.054	0.0018	0.0013	0.00024	0.00031	0.000038	0.0051
September	0.000091	0.53	0.00052	0.000044	0.00107	0.009	0.86	0.000021	0.087	0.0010	0.0021	0.00033	0.00033	0.000029	0.0085
October	0.000046	0.24	0.00041	0.000139	0.00076	0.006	0.40	0.000020	0.054	0.0011	0.0017	0.00067	0.00055	0.000028	0.0061
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWQG (mg/L)	0.0001	0.01	0.005	0.00004	0.001	0.003	0.3	0.000026	none	0.073	0.11	0.004	0.001	0.0008	0.03
SSWQO (mg/L)		0.62			0.002	0.017	1.1		1.045						

Source: W:\01_SITES\Minto\!Databases\ML-ARD\WQ_Predictions\Load Balance\V02\[Minto.MitigationPrediction.Tables.CAJ.v02.xlsx]

Notes: Grey cells indicate values exceeding either the proposed site-specific water quality objective (SSWQO) for Station W1 (where developed) or the Canadian Water Quality Guideline values (CWQG) for the Protection of Aquatic Life (<http://ceqg-rcqe.ccme.ca>).

Table 7 W1 Post-closure Water Quality Prediction- Mitigation Scenario 5: Soil Cover (80% infiltration reduction) on DSTF and Waste Dumps, Wetland for Polishing Pit Discharge Waters (75% load reduction) and Additional Wetland for Polishing All Mine Site Drainage (75% load reduction)

	Ag (mg/L)	Al (mg/L)	As (mg/L)	Cd (mg/L)	Cr (mg/L)	Cu (mg/L)	Fe (mg/L)	Hg (mg/L)	Mn (mg/L)	Mo (mg/L)	Ni (mg/L)	Pb (mg/L)	Se (mg/L)	Tl (mg/L)	Zn (mg/L)
January	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
February	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
March	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
April	0.000048	0.22	0.00033	0.000064	0.00075	0.010	0.32	0.000011	0.036	0.0009	0.0008	0.00018	0.00026	0.000006	0.0072
May	0.000062	0.58	0.00056	0.000051	0.00110	0.008	0.87	0.000012	0.063	0.0009	0.0024	0.00033	0.00035	0.000067	0.0065
June	0.000049	1.68	0.00103	0.000042	0.00361	0.005	2.47	0.001402	0.105	0.0010	0.0048	0.00077	0.00040	0.000029	0.0089
July	0.000052	0.32	0.00051	0.000022	0.00066	0.006	0.56	0.000048	0.053	0.0011	0.0014	0.00022	0.00029	0.000030	0.0053
August	0.000069	0.16	0.00053	0.000018	0.00066	0.004	0.27	0.000021	0.050	0.0017	0.0013	0.00023	0.00029	0.000038	0.0050
September	0.000090	0.52	0.00048	0.000042	0.00103	0.008	0.84	0.000020	0.079	0.0009	0.0020	0.00032	0.00029	0.000028	0.0082
October	0.000046	0.23	0.00041	0.000138	0.00075	0.005	0.40	0.000020	0.052	0.0011	0.0017	0.00067	0.00054	0.000028	0.0060
November	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
December	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
CWQG (mg/L)	0.0001	0.01	0.005	0.00004	0.001	0.003	0.3	0.000026	none	0.073	0.11	0.004	0.001	0.0008	0.03
SSWQO (mg/L)		0.62			0.002	0.017	1.1		1.045						

Source: W:\01_SITES\Minto\IDatabases\ML-ARD\WQ_Predictions\Load Balance\V02\[Minto.MitigationPrediction.Tables.CAJ.v02.xlsx]

Notes: Grey cells indicate values exceeding either the proposed site-specific water quality objective (SSWQO) for Station W1 (where developed) or the Canadian Water Quality Guideline values (CWQG) for the Protection of Aquatic Life (<http://ceqg-rcqe.ccme.ca>).