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(BHPB & Diavik)

September 17th, 2008

Files: MV2003L2-0013

Ms. Laura Tyler
BHP Billiton Diamonds Inc.
#1102, 4920-52nd Street
Yellowknife, NT X1A 3T1

Dear Ms. Tyler,

Re: 2007 Aquatic Effects Monitoring Program (AEMP) Report

The Wek'èezhii Land and Water Board met on September 15, 2008 to consider BHP Billiton's 2007 AEMP Report, submitted as required by Part I, Item 6 of licence MV2003L2-0013.

Although the report was as thorough and informative as usual, the Board's reviewer, Dr. Don Hart of Ecometrix Incorporated, noted some errors and inconsistencies in the fish data analyses which may affect the report's conclusions. The two issues, and the Board direction for each, are summarized below:

1. According to the Board reviewer, the power analysis for the fish parameters contains errors. The Board directs BHPB to thoroughly check and revise the analysis as well as reconsidering the conclusions drawn from this analysis.
2. According to the Board reviewer, there are some inconsistencies between the statistical analyses of fish parameters and the conclusions drawn in the summary. As well, there is no useful discussion of the lake x period interactions. The Board directs BHPB to check the conclusions against the results, resolve the discrepancies and discuss significant interactions as to whether they are mine effects.

Rather than rewriting the 2007 AEMP, the Board requests BHPB to submit the results of the above analysis as an addendum to the report due by November 1, 2008.

If you have any questions, please feel free to contact Kathleen Racher at racherk@wlwb.ca or by phone at 867-669-9591.

Sincerely,

A handwritten signature in black ink, appearing to read "V. Camsell-Blondin".

Violet Camsell-Blondin
Chair, WLWB

Copied: BHPB Distribution List



STAFF REPORT

Company: BHP Billiton (BHPB)	
Location: Lac de Gras	License: MV2003L2-0013
Date Prepared: August 25, 2008	Meeting Date: September 15, 2008
Subject: BHPB's 2007 AEMP Annual Report	

Purpose

The purpose of this report is to present to the Board BHPB's submission of their 2007 AEMP Annual Report as required by Part I, Item 6 of MV2003L2-0013. This report summarizes the results and analysis of sampling data collected in 2007.

Background

The current AEMP Design for the Ekati mine site was approved, with conditions, by the WLWB on April 19, 2007 and applies to the monitoring years of 2007 to 2009. On April 30, 2008, BHP Billiton submitted their 2007 AEMP Annual Report. The report was sent out to all reviewers on May 8, 2008 with comments requested by June 20, 2008. Reviewers were reminded, at that time, that the AEMP Annual Report is not for approval according to the water licence, but that the report should be compared to the conditions of Part I, Item 6 to ensure compliance. Board Staff also hired Dr. Don Hart, of Ecometrix Incorporated, to review the report for both its compliance to the licence as well as its technical soundness. Comments were sent to BHP Billiton on July 2, 2008 and responses received back from the company on July 23, 2008.

Discussion

1. Overview of Study Approach and Findings for 2007:

Appendix 1, attached, provides an excellent summary, as written by Dr. Don Hart, of the major findings of the Aquatic Effects Monitoring Program for 2007. As well, Board Staff will review the information from the Summary Report during the September 15, 2008 Board meeting. A few key findings are discussed below.

Water Quality –

Changes in water quality downstream of the Long Lake Containment Facility have been detected, in the Koala watershed, for many chemical parameters as far down the lake system as Lac de Gras. Similar results were obtained in the King-Cujo watershed. In this AEMP design, changes are defined as a significant difference in concentration of a chemical in a lake compared to reference lakes (i.e., lakes away from the mine site that are not expected to ever be affected by mine operations). With the exception of molybdenum and nitrate, none of the chemical parameters measured are approaching the CCME water quality guidelines for the protection of aquatic life. The molybdenum was coming from the processing of rock from the Misery pit which was completed in 2007, therefore, molybdenum concentrations are expected to continue to decrease.

Nitrate levels currently exceed guideline levels in Leslie Lake and Moose Lake. In response to this finding, BHP Billiton halted discharge from the LLCF until either nitrate levels dropped or they could find a way to mitigate the problem. Note that this is a voluntary measure as no effluent quality criteria have been set for nitrate in BHPB's water licence. As well, BHPB has hired Rescan consultants to perform some experiments in Cell D of the LLCF to see if there is a way to use natural degradation to reduce nitrate levels in the LLCF.

Fish –

Round whitefish, Lake trout and Slimy sculpin were sampled and analysed in 2007 (fish are only sampled every 5 years). One striking result from this year's sampling was that the catch-per-unit effort for the whitefish and trout has decreased over time in both the potentially affected lakes and in the reference lakes. The conclusion drawn from this result is that the sampling itself, as opposed to releases from the mine, is having an effect on fish populations around the Ekati site.

For the first time in the Ekati AEMP, certain fish tissues were analysed for hydrocarbon metabolites. This analysis tells us whether fish have been exposed somehow to hydrocarbons (e.g., gasoline, oil etc). The results showed that the trout and whitefish in Leslie Lake (the lake directly downstream of the LLCF) have been exposed to hydrocarbons but the source of those hydrocarbons is currently unknown. BHPB conducted a special study in August 2008 which involves sampling and analyzing fish from Cell E (the last lake in the LLCF chain) to see if the fish there have also been exposed to hydrocarbons. If the Cell E fish do show evidence of hydrocarbon exposure, BHPB will likely conduct more investigations as to where the hydrocarbons are coming from.

Another new observation in 2007 was a high incidence of parasitic infection in slimy sculpin in non-reference lakes, in both the Koala and King-Cujo watersheds. The parasite, a tapeworm, that was found most often in the sculpin is called *Ligula intestinalis*. There are many environmental and genetic factors that might make the fish more susceptible to this kind of infection, but so far BHPB does not know the cause. As part of their special study of fish in Cell E of the LLCF, BHPB will be checking the fish for this same parasitic infection. This will tell us if the cause of the increased infection is coming from the LLCF in the case of the Koala watershed. Board Staff are not aware, yet, of any investigation into the cause of the increased infection rate in the King-Cujo watershed.

2. General Review Comments on the 2007 AEMP Report:

This report is not for Board approval; however, the Board must judge whether the report meets the conditions of the licence and whether the report is technically sound. Reviewers were asked to comment on the 2007 AEMP Report with that caveat in mind.

Those parties that submitted comments on the AEMP report were: Indian and Northern Affairs Canada (INAC), Environment Canada (EC), Fisheries and Oceans Canada (DFO), the North Slave Metis

Alliance (NSMA), the Independent Monitoring Agency (IEMA) as well as the Board-hired consultant, Dr. Don Hart. The majority of the review comments expressed concern over some of the above-noted changes and/or effects to water quality, zooplankton and fish that are due to mining operations. These reviewers were not alarmed by the measured results, but highlighted the need for an approved Adaptive Management Plan under which the extent, cause and possible mitigation of the environmental changes/effects would be investigated. Board Staff agree that an approved Adaptive Management Plan is much needed and we note that work is underway to achieve that. The issues that were noted by reviewers as possibly needing to be adaptively managed include: the levels of molybdenum, chloride, total dissolved solids, and nitrate levels in water, zooplankton changes, hydrocarbon metabolite levels in round whitefish and lake trout, and the presence of parasites in slimy sculpin.

Both IEMA and DFO recommended that, in light of some of the fish results, there should possibly be changes to the fish sampling program. BHPB said that this possibility was best discussed during the next 3-year review of the program scheduled for 2009; Board Staff agree (see attached Comment Table, tracking # 4, 14 -16).

As a condition of approval for BHPB's 2007-2009 AEMP Re-evaluation, the Board asked BHPB to develop "effect sizes" for their AEMP although the term "effect sizes" was not defined in the directive (April 19, 2007). Some reviewers commented that BHPB's discussion of "effect sizes" was not correct and Board Staff agree. In response to this, BHPB has recommended developing a scoping document, for review by all parties, that will define effect sizes and come up with a plan for determining them in consultation with reviewers. After speaking to Board Staff, it was agreed that BHPB would submit this document by November 15, 2008. This particular issue is also addressed in the Staff Report about the conditional approval of BHPB's 2007-2009 AEMP Re-evaluation.

The Board's consultant, Dr. Don Hart, noted that the statistical analysis done on the fish data contained errors and he recommended that the analysis be "thoroughly checked and revised, and that the conclusions drawn from this analysis should then be reconsidered". This is a serious matter and Board Staff have already communicated this problem to BHPB. We agreed that BHPB's consultants, Rescan, should speak directly with the Dr. Hart about the errors that were found in the calculations. BHPB will then revise their analysis and conclusions accordingly.

3. Conclusions and recommendations

Overall, the 2007 AEMP report from Ekati shows that adaptive management may be appropriate for the following environmental changes/effects that were noted this past year: the levels of molybdenum, chloride, total dissolved solids, and nitrate levels in water, zooplankton changes, hydrocarbon metabolite levels in round whitefish and lake trout, and the presence of parasites in slimy sculpin.

The 2007 AEMP report was thorough and well-written, as usual; however, Dr. Hart has raised some issues about how scientifically defensible the statistical analyses on the fish data were. Board Staff have already spoken to BHPB about this issue and BHPB has committed to re-examining their analyses and to making the necessary revisions. As a follow up to this conversation, Board Staff recommend that the Board direct BHPB, as follows, to address the issues as raised by Dr. Hart (also see Tracking # 37 and 38 in the attached Comment Table):

1. According to the Board reviewer, the power analysis for the fish parameters contains errors. The Board directs BHPB to thoroughly check and revise the analysis as well as reconsidering the conclusions drawn from this analysis.
2. According to the Board reviewer, there are some inconsistencies between the statistical analyses of fish parameters and the conclusions drawn in the summary. As well, there is no

useful discussion of the lake x period interactions. The Board directs BHPB to check the conclusions against the results, resolve the discrepancies and discuss significant interactions as to whether they are mine effects.

Rather than rewriting the 2007 AEMP, Board Staff recommend that the results of the reanalysis be submitted as an addendum to the report, due by November 1, 2008.

Respectfully submitted,



Kathy Racher, PhD.
Regulatory Director



Ryan Fequet, B.Sc.
Regulatory Specialist

Attachments:

- Appendix I: "Overview of Study Approach and Findings" as written by Dr. Don Hart of EcoMetrix and submitted in June 2008.
- Comment Table: "BHP Billiton's Submission of the 2007 AEMP Required by Part I, Item 6 of Water Licence MV2003L2-0013 – Submitted June 2nd, 2008"
- BHPB cover letter for 2007 AEMP Report, submitted April 20, 2008
- BHPB 2007 AEMP Report (Summary Report plus Appendices A, B and C), submitted April 20, 2008 – **on enclosed cd**
- INAC comments, submitted June 20, 2008
- DFO comments, submitted June 20, 2008
- IEMA comments, submitted June 18, 2008
- NSMA comments, submitted June 20, 2008
- Dr. Don Hart (consultant for the Board) comments submitted June 27, 2008

Appendix I: Overview of Study Approach and Findings" as written by Dr. Don Hart of EcoMetrix and submitted in June 2008

2.2.1 Overview of Study Approach and Findings

The 2007 AEMP report, dated April 2008, consists of a Summary Report and three appendices, as follows:

- Appendix A: the Evaluation of Effects Report;
- Appendix B: the Data Report; and
- Appendix C: the Statistical Report.

This technical review focuses on the study approach and key findings, as outlined in the Summary Report, with reference to the Appendices as needed to critically evaluate the approach or the findings.

The AEMP is focused on the aquatic environment receiving treated effluent from the Ekati Diamond Mine, specifically on the Koala Watershed and the King-Cujo Watershed. In the Koala Watershed, the Long Lake Containment Facility (LLCF) discharges to Leslie Lake, and effluent is dispersed through Moose, Nema and Slipper lakes into Lac de Gras. In the King-Cujo Watershed, the King Pond Settling Facility (KPSF) discharges to Cujo Lake, and effluent is dispersed through the Christine-Lac du Sauvage stream into Lac du Sauvage.

The aquatic environment monitoring began with baseline studies from 1994-97 in the Koala Watershed, through 2000 in the King-Cujo Watershed. The 2007 AEMP report presents raw data for the 2007 study year (Appendix B) and evaluates trend through time (from 1998) as an indication of mine effects (Appendix A). The detailed statistical results supporting this evaluation are provided in Appendix C.

Three reference lakes are an integral part of the study design: Vulture Lake in the Koala Watershed, and Nanuq Lake and Count Lake in other watersheds. The AEMP is designed to allow comparison of reference lakes (as a group if possible) and exposed lakes (receiving mine effluents) through time. The lakes have associated connecting streams, which are quite different habitats than lakes. Reference streams and exposed streams are also compared through time.

The environmental measurements that are the subject of these comparisons include various water quality parameters (pH, sulphate, total dissolved solids (TDS), chloride, potassium, total ammonia, nitrate, nitrite, ortho-phosphate, total phosphorus, aluminum, arsenic, copper, molybdenum, nickel and zinc); limnology parameters (Secchi depth, winter dissolved oxygen); phytoplankton parameters (chlorophyll *a*, density, diversity); zooplankton parameters (biomass, density, diversity); lake benthos parameters (organism density, dipteran diversity); stream benthos parameters (organism density, dipteran diversity, EPT diversity); lake trout and round whitefish parameters (catch-per-unit-effort (CUPE), length, weight, condition, age, growth rate, residual length at age, sex ratio, percent maturity, egg number, gonadosomatic index (GSI), liver somatic index (LSI), dietary composition, metal concentrations in liver and muscle, chlorinated phenols in liver and muscle, hydrocarbon metabolites in bile, and incidence of deformities, erosions, lesions and tumours (DELT)).

Important changes in the 2007 program, as compared to previous years, included the dropping of shallow water sediment and benthos sampling (mid-depth and deep water stations were retained); addition of slimy sculpin as a fish species (to evaluate its suitability as an alternative to lake trout and whitefish for destructive sampling); evaluation of DELT and parasite incidence in fishes; and detailed

taxonomic identification of nematodes in the benthos samples. In addition, the statistical method of identifying effects was changed in 2007 for most environmental parameters (all except fish parameters). Specifically, the time trend in each exposure lake (or stream) was compared to that in the reference lakes (or streams) if the reference sites showed a common trend. This departs from the historical “BACI” approach, where the pre-mine – post-mine difference for each exposure lake (or stream) was compared to that in the reference lakes (or streams). Thus, the 2007 approach involved testing hypotheses about regression coefficients for the time trend, rather than hypotheses about means for groups of lakes and years.

The results indicated that there were measurable effects on water quality in the lakes and streams downstream of the LLCF in the Koala Watershed. The effects were evident as increasing concentrations over time in the following water parameters and locations:

- pH (downstream to Lac de Gras station S2);
- sulphate (downstream to Lac de Gras station S3);
- total dissolved solids (downstream to Lac de Gras station S2);
- chloride (downstream to Lac de Gras station S2);
- potassium (downstream to Lac de Gras station S3);
- total ammonia (possible effect) (in Moose and Slipper lakes);
- nitrate (downstream to Nema Lake);
- total arsenic (downstream to Moose Lake);
- total molybdenum (downstream to Lac de Gras station S3); and
- total nickel (downstream to Slipper-Lac de Gras).

At present, with two exceptions, the lake mean concentrations of these parameters do not approach the CCME water quality guidelines for protection of aquatic life. The exceptions are nitrate and molybdenum. Nitrate means slightly exceed the CCME interim guideline of 2.9 mg/L in Leslie Lake and Moose Lake, but the confidence limits on the mean overlap the guideline, so the hypothesis of equivalence to the guideline cannot be rejected. Molybdenum (Mo) means are slightly below the CCME guideline of 0.073 mg/L in Leslie Lake and Moose Lake, but the upper confidence limit of the mean exceeds the guideline in both cases. An interim site-specific guideline of 16 mg/L (Rescan, 2006a) is cited. Processing of Mo-rich ore from the Misery pit was completed in 2007; therefore, Mo concentrations are expected to decrease in future.

In the King-Cujo Watershed, measurable effects on water quality were identified downstream of the KPSF. The effects were evident as increasing concentrations over time in the following water parameters and locations:

- pH (downstream to Cujo Outflow);
- sulphate (downstream to Christine-Lac du Sauvage);
- total dissolved solids (downstream to Christine-Lac du Sauvage);

- chloride (downstream to Christine-Lac du Sauvage);
- potassium (downstream to Christine-Lac du Sauvage);
- total ammonia (downstream to Cujo Lake);
- total arsenic (downstream to Cujo Lake);
- total molybdenum (downstream to Cujo Outflow); and
- total nickel (downstream to Cujo Outflow).

At present, the lake mean concentrations of all measured parameters do not approach the CCME water quality guidelines in the King-Cujo Watershed.

Possible biological effects observed in the Koala Watershed included reduced zooplankton density over time in Moose Lake. No such effects were observed in Leslie Lake immediately downstream of the LLCF, while increased zooplankton density over time was observed in Kodiak Lake upstream of the LLCF.

In the King-Cujo Watershed, possible biological effects included increased zooplankton density over time in Cujo Lake. Benthos density has followed the same pattern.

Changes in fish parameters were identified for round whitefish and lake trout, in both exposed lakes and reference lakes in both watersheds, and were attributed to sampling mortality over the years. Specifically, catch-per-unit-effort has declined. Possibly related to this, fish size has increased for lake trout in the Koala Watershed, and for both species in the King-Cujo Watershed. Round whitefish in the Koala Watershed are reported to be older but not larger, although the age effect may pertain to lake trout based on appendix results.

Hydrocarbon metabolites in fish bile, measured for the first time in 2007, were found to be higher in Leslie Lake and Moose Lake (in the Koala Watershed) than in Nanuk Lake (reference). The differences were not statistically significant, but the sample sizes were small. Similar effects were not seen in the King-Cujo Watershed. The detection of these metabolites indicates that fish have been exposed to hydrocarbons, but is not necessarily indicative of adverse effects.

The DELT analysis of slimy sculpin indicated a higher incidence of infection by *Liquila intestinalis* (a tapeworm) in Leslie Lake and Moose Lake, than in Nanuk Lake (reference). The same thing was found in Cujo Lake as compared to Nanuk Lake. Since this analysis was undertaken for the first time in 2007, nothing can be said about the time trend of the observed differences.

BHP Billiton's Submission of the 2007 AEMP Required by Part I, Item 6 of Water Licence MV2003L2-0013 – Submitted June 2nd, 2008

Tracking Number	Comment ID	Topic	Review Comment	Company Response / Proposed Revision	WLWB Response / Recommendations
A: Independent Environmental Monitoring Agency (IEMA) Comments – Received June 18th, 2008					
1	IEMA – 1	Water Quality	We note that molybdenum levels continued to rise in Moose Lake relative to previous years, but declined slightly in Leslie. Both are near or at the CCME guideline. This is still a worrisome development.	<p>BHP Billiton believes that the increasing molybdenum concentrations observed downstream of the LLCF are due to processing of the molybdenum-enriched ore from the Misery Open Pit. Processing of this ore was completed in 2007 and it is expected that total molybdenum concentrations in lakes and streams downstream of the LLCF will begin to decrease.</p> <p>BHP Billiton conducted a Tier I Ecological Risk Assessment (ERA) for molybdenum in 2006 which indicated that a concentration of 16 mg/L would be protective of the environment. This is much greater than the current CCME guideline of 0.073 mg/L and much greater than the concentrations observed in the LLCF and the receiving lakes. BHP Billiton's ERA used an HC5 approach, similar to that now adopted and recommended by the CCME.</p> <p>BHP Billiton will monitor molybdenum concentrations through 2008 and will take appropriate actions based on those results.</p>	The increased levels of molybdenum downstream of the LLCF is worrisome to the Board as well; however, the best place to deal with this will be through the Adaptive Management Plan. The review and approval of an Adaptive Management Plan for BHPB is a priority of the Board.
2	IEMA – 2	Water Quality	While molybdenum is near the CCME guideline level, we notice that selenium has risen above it for the first time in Leslie, Moose & Nema lake water. It is	The results show that during the ice-covered sampling season the average concentration of selenium in water was found to be above	It is appropriate that selenium has been added to the list of

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			<p>noteworthy that trout livers in Moose Lake also contained higher selenium levels (mean of over 1 mg/kg more) than those sampled in 2002. This result is not adjusted for age however. This indicates to us that selenium should be evaluated in future AEMP reports.</p>	<p>the CCME guideline of 0.001 mg/L in samples collected from the middle and deep depths of Leslie Lake (0.0020 and 0.0014 mg/L, respectively) and from the deep depth of Moose Lake (0.0013 mg/L). It was below the CCME guideline in all other AEMP lakes. BHP Billiton has added selenium to the list of parameters of interest evaluated in 2008.</p>	<p>parameters of interest for 2008.</p>
3	IEMA – 3	Water Quality	<p>The Agency is disappointed to learn that no winter oxygen measurements were taken in 2007 due to problems with the measuring instruments. Since Cujo and Kodiak lakes have had to be aerated in past years to overcome problems of low winter oxygen levels, winter measurements have proven critical to warning BHPB of potential anoxic conditions that may need to be mitigated before fish are harmed.</p>	<p>Water quality measurements including DO were collected throughout the winter/spring of 2007 as required. The data obtained showed that no mitigating efforts were necessary. During this period regular protocol was followed which included a probe calibration each day the probe was used. All calibrations were completed successfully during that time.</p> <p>Subsequently, the summer of 2007 it was determined that the DO sensor on the Sonde multiprobe was not operating correctly. This raised a question as to the validity of the data obtained during the winter water quality surveys. After the discovery of the probe malfunction it was decided that the 2007 winter data would not be used for the technical assessment in the AEMP.</p> <p>Once the problem with the DO probe was identified it was immediately rectified and</p>	<p>OK.</p>

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				<p>steps were taken to prevent a recurrence. These steps included:</p> <ul style="list-style-type: none"> ○ Sending the Sonde multiprobe to Hoskin Scientific for a full test and check. This will now be completed on an annual basis. ○ A second probe was purchased and is now used as the primary water quality meter. Having two probes allows each probe to be shipped in for an annual check while still maintaining the capacity to do the measurements. ○ The new probe utilizes an updated technology (optical DO) which is much less likely to malfunction or to drift from calibration. 	
4	IEMA – 4	Fish	<p>We are interested in the finding that infection rates of the tapeworm <i>Ligula intestinalis</i> in slimy sculpin are much higher in lakes immediately downstream of mine activity (Kodiak, Leslie, Moose & Cujo) than those further downstream and in reference lakes (see Fig. 3.7-77 of AEMP report). As heavy parasite infection is often associated with exposure to stressors in fish, we think BHPB should consider continuing this area of study in future years. The frequency of monitoring of slimy sculpin could be every 2 or 3 years rather than every five, as this is a more abundant species in AEMP lakes than either lake trout or round whitefish and thus populations should withstand more frequent lethal sampling.</p>	<p>BHP Billiton feels any substantial changes to the AEMP program, such as increasing the frequency for sampling of one or more species of fish, are best discussed during the next 3 year review in 2009.</p> <p>BHP Billiton is including follow up sampling of sculpin in Cell E in 2008 as part of the special 2008 fish program. This will provide additional information for discussion during the next 3-year review (scheduled for 2009).</p>	<p>It is appropriate to wait until the next 3 year review before considering changing the sampling frequency of any parameter – unless otherwise stipulated in the final approved Adaptive Management Plan for example.</p> <p>The Board appreciates BHPB's proposal to sample fish in Cell E in</p>

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					2008 however, and hopes to see the results of that survey in the 2008 AEMP Annual Report.
5	IEMA – 5	Fish	Molybdenum was elevated in whitefish livers in Moose Lake in 2007 compared to 2002 (See Fig. 3.7-62). Even so, the report states that “there is no evidence for an effect of mine activities” on the uptake of molybdenum in round whitefish. This conclusion does not seem to be compatible with the Moose Lake results. We think this question is deserving of greater attention.	The fourth sentence of the fourth paragraph of page 3-107 of Appendix A noted that the average concentration of molybdenum in livers of round whitefish from Moose Lake was elevated in 2007 compared to 2002. This was based on graphical comparison, however. The statistical significance of this difference could not be evaluated for two reasons: (1) there are no baseline tissue metals data for round whitefish from Moose Lake; and (2) the data for 2002 and 2007 did not satisfy the basic assumptions of analysis of variance, primarily the homogeneity of variances.	OK. Again, IEMA may want to discuss this in the context of an approved Adaptive Management Plan.
6	IEMA – 6		A “total of 24 lake trout liver samples and 10 myomere samples exceeded the Health Canada mercury guideline of 0.5 mg/kg WW” (p. 3-109 of AEMP report). It has been brought to our attention by BHPB that these numbers are erroneous. It was actually 12 liver and 3 myomere samples above the guideline value. The majority of these samples were from lake trout caught in lakes downstream of the LLCF (Kodiak, Nema and Slipper). In contrast, in 2002 lake trout liver samples from only Slipper Lake exceeded the mercury guideline. Average mercury concentrations in 2007 exceeded the guideline in	BHP Billiton concurs with IEMA's presentation of the corrected facts and statistics regarding mercury occurrence in fish. Body length is the conventional covariate for statistical analysis of mercury concentrations in fish tissue because length is more easily and accurately measured than age and because fish length is highly positively correlated with age within a population. Graphical analysis indicated that both	OK.

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			<p>livers of lake trout caught at Kodiak and Nema lakes (average concentrations were 0.874 mg/kg WW and 0.531 mg/kg WW, respectively). The average mercury concentration in lake trout livers caught farther downstream, in Slipper Lake, approached the guideline but did not exceed it.</p> <p>Since mercury is not elevated in the water of any of these lakes, and two of the 12 trout liver samples above the Health Canada guideline value were from control lakes, the Agency does not dispute the following RESCAN evaluation, "The elevated mercury concentrations in some potentially affected lakes may be linked to the larger, older fish that were captured during 2007 monitoring." However, it would have strengthened that contention if it had been supported by comparison of the ages of the contaminant-studied trout in 2007 with those of 1999 and 2002, since not all aged fish were sampled for contaminants.</p>	<p>average length and average age of lake trout were higher in 2007 than in 2002 and in baseline years. The relationship between mercury concentration and age of lake trout will be examined in greater detail in the next fish sampling period (i.e., in 2012).</p>	
7	IEMA – 7	Fish	<p>Hydrocarbon metabolites in the bile of both whitefish and trout of Leslie Lake are equivalent to levels found in areas elsewhere in the world exposed to significant oil spills. RESCAN finds that there was no increased incidence of parasitism in these fish species in Leslie, which would suggest no adverse physical effects from hydrocarbon exposure.</p> <p>However, slimy sculpin from both Leslie & Moose lakes did have elevated rates of parasitism compared to control lakes. It would be helpful to know if those</p>	<p>Metabolites were analysed according to the plan agreed to in the 2006 3-year AEMP review. For clarity of understanding, BHP Billiton draws IEMA's attention to the very low number of samples with elevated concentrations and the lack of any meaningful statistical power to the results which creates uncertainty. This is why BHP Billiton has proposed the follow-up Cell E Fish Survey in August 2008.</p>	<p>The Board looks forward to the results of the 2008 fish survey in Cell E of the LLCF to help clarify the results obtained so far.</p>

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			<p>infected fish also had evidence of hydrocarbon exposure.</p> <p>RESCAN suspects the source of the hydrocarbons is the LLCF and suggests sampling fish within Cell E in future to verify this possibility. This is a very good idea. We also note that BHPB's ICRP Section 4 responses (tracking #168) states that underground minewater contains hydrocarbons averaging <u>29.1 mg/l</u> although Eric Denholm of BHPB is looking into this situation as he believes the number may be erroneous. Even if the minewater is high in hydrocarbons, it is not clear to the Agency whether a significant portion of that loading to the LLCF would make its way into Cell E from the upper cells. Additional work may be required to resolve this matter.</p>	<p>The AEMP report suggests that the fish may have been exposed to <u>trace</u> amounts of hydrocarbons in water. The SNP analyses for Oil and Grease, TPH and BTEX in water released from the LLCF (SNP 1616-30) consistently return concentrations less than the laboratory detection limit. This means that there have been no releases of anything greater than trace concentrations of hydrocarbons in water from the LLCF.</p> <p>The follow up 2008 study of fish in Cell E is expected to provide further clarity. However, exposure to hydrocarbons is not thought to be the cause of the ligulosis as explained below.</p> <p>The similar spatial pattern of elevated bile metabolites in round whitefish and lake trout and of ligulosis in slimy sculpin that was observed in the AEMP lakes in 2007 suggests a common origin – exposure to hydrocarbons. However, if exposure to trace hydrocarbons in the water discharged from the LLCF increases the incidence of ligulosis in slimy sculpin, then it should also increase the incidence of ligulosis in other fish species, particularly in species such as lake trout that reside closer to the water surface, where hydrocarbons would be expected to be concentrated, than slimy sculpin. This is</p>	

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				<p>not the case.</p> <p>This would also be difficult to sample as bile would not be extractable from a slimy scuplin to produce an adequate sample volume, and the analysis of a whole fish sample would likely dilute any metabolites present in the bile.</p> <p>The question referred to by IEMA on clarifying the historical concentrations of hydrocarbons in underground mine water is being investigated.</p>	
8	IEMA – 8	Minimal Detectable Differences	<p>As a result of the AEMP Re-Evaluation workshop in November 2006, the Agency understood that BHPB committed to determining effect sizes--that is, what degree of change in water quality variables is deemed to be <u>acceptable</u>. What we have received instead is an examination of what level of change to those variables is <u>detectable</u>. In our view, these are not the same thing. The intent of this requirement needs to be clarified. If it is the former, BHPB needs to show it intends to canvass stakeholders to determine the maximum level of change acceptable to them so as to establish effect sizes for the statistical analyses in the AEMP. If it is the latter, the study currently presented appears to address the issue.</p>	<p>A mine operator can not determine what is an acceptable level of ecological change. This is an issue that is determined through public and regulatory consultation during the Environmental Assessment of a project.</p> <p>Part of the reviewer's requests for a discussion of "critical effect sizes" appears to be a request that the WLWB re-do a portion of the original project Environmental Assessment to numerically define an acceptable level of ecological change from Leslie to Slipper Lakes. In fact DIAND explicitly recommended "that the original EIS be updated".</p> <p>BHP Billiton believes that the initial</p>	<p>The Board greatly appreciates BHPB's suggestion of developing a scoping document to define assumptions and expectations before actually beginning work on defining effects sizes for the Ekati mine site. The Board would like BHPB to include their ideas on how they will consult with parties once expectations have been defined.</p>

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				<p>Environmental Assessment for the project stands and can not be re-opened or updated in this manner.</p> <p>Regardless, BHP Billiton is committed to protecting the environment from significant adverse effects and this includes the aquatic environment from Leslie to Slipper Lakes. In the final proposed 2007-2009 AEMP Program, BHP Billiton committed to "evaluate critical effect sizes appropriate for selected parameters measured in the field". In the cover letter to that report BHP Billiton further committed to consulting with stakeholders on the issue of effect sizes.</p> <p>As has been previously communicated to the WLWB, the target date of February 2008 proved overly optimistic for an evaluation of critical effect sizes including stakeholder consultation. BHP Billiton stands by its commitment to evaluate this issue and to lead a consultation effort with stakeholders. However, the "issue" is not well defined or well understood, as evidenced by reviewer comments.</p> <p>Prior to consultation, BHP Billiton proposes to firstly circulate to the WLWB and reviewers a scoping document that will better define "the issue of effect size"</p>	

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				specific to and appropriate for EKATI. In this document, BHP Billiton can describe its understanding and intention as regards linkages between the adaptive management plan, AEMP, effect thresholds, and critical effects size as regards sampling design. Based on responses from the WLWB (and reviewers) this might be the basis of an initial workshop. BHP Billiton feels that this approach will establish a necessary common understanding of the scope, direction and objectives for an evaluation of effect sizes for EKATI. This will reduce the risk of misunderstanding and disagreement at a later date after substantial resources have been applied by all parties to a scope that has not been defined.	
B: Department of Fisheries and Oceans (DFO) Comments – Received June 20th, 2008					
9	DFO – 1	Linkages to the Adaptive Management Plan (AdMP)	<p>DFO agrees with BHPB that the AEMP is a key component of an adaptive management plan (AMP). However, the direct linkages with an AMP are not currently clear. As per the Guide for Preparation of Adaptive Management Plans prepared by ESSA Technologies Ltd, components of a successful AMP include:</p> <ul style="list-style-type: none"> • A list of the key uncertainties (management questions) to be addressed by the AMP. • A description of the alternative management 	An Adaptive Management Plan (AMP) has been completed and submitted to the WLWB. BHP Billiton believes that discussions on this plan should be carried out under the review process of the AMP.	The points that DFO has made in their review of the 2007 AEMP results will be brought forward into the finalization of the Adaptive Management Plan for Ekati. The review and approval of an Adaptive Management Plan for BHPB is a priority of the

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			<p>actions to be employed in the AMP, and how they relate to the uncertainties listed above.</p> <p>DFO realizes that BHPB has recently submitted an AMP to the WLWB and that it is not yet approved. There is now an opportunity to modify the AMP to address key uncertainties that have been identified in the 2007 AEMP report (water quality parameters, zooplankton increase, <i>Ligula intestinalis</i> infection rate for slimy sculpin).</p>		Board.
10	DFO – 2	Water Quality	<p>In 2007, 10 water quality parameters were found to have increased significantly in affected lakes and streams in the Koala Watershed and 9 parameters increased significantly in the King-Cujo watershed in comparison to reference lakes and streams. In the report CCME limits are focused on.</p> <p>CCME WQGs are not to be used as "pollute up to" limits as stated in the CCME non-degradation policy: <i>"The degradation of the existing water quality should always be avoided. The natural background concentrations of parameters and their range should also be taken into account in the design of monitoring programs and the interpretation of the resulting data"</i>.</p>	<p>BHP Billiton does not use the CCME guidelines as "pollute up to" limits. The CCME site specific guidance discusses several approaches for water resource management that use the CCME water quality guidelines as a tool to help develop appropriate effluent criteria.</p> <p>As a result of the 2006 3-year AEMP review new statistical methods using regression modeling techniques replaced the Before-After-Control-Impact (BACI) analyses for long time data series (>3 years). This new approach can incorporate multiple years of monitoring data that have now been collected. The use of a Temporal-Spatial Level by time design (Wiens and Parker, 1995) was recommended and completed. This approach improves the ability of the AEMP in detecting gradually increasing trends over time and decrease the</p>	<p>Again, this discussion is best done in the context of the finalization of an Adaptive Management Plan. The review and approval of an Adaptive Management Plan for BHPB is a priority of the Board.</p>

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				<p>variability.</p> <p>Baseline water quality data collected from 1994-1997 were not used in the statistical evaluation of effects but were included in the tabular and graphical results.</p>	
11	DFO – 3	Water Quality	<p>Low effect levels, compared to baseline conditions should also be identified that trigger adaptive management. Each parameter that is shown to be increasing over time as a result of mine activities offers an excellent opportunity to use the Adaptive Management Cycle to explore why the effect was happening, followed by mitigation experiments to attempt to reduce levels to acceptable limits prior to reaching CCME thresholds. It is noted that nitrate has already reached the CCME interim guideline and the confidence intervals for molybdenum overlap the CCME guideline, emphasizing the importance of triggering adaptive management at an early stage.</p>	See response to DFO -1 (Tracking #9)	See responses to Tracking # 9 and 10.
12	DFO – 4	Water Quality	<p>For parameters such as TDS and total phosphorous where no CCME water quality guideline or WL criterion exists, it is unclear how the monitoring results will be used. There is no sense in monitoring for the sake of monitoring so effect levels have to be provided that are linked to the AMP.</p>	See response to DFO -1 (Tracking #9)	See responses to Tracking # 9 and 10.
13	DFO – 5	Zooplankton	<p>In 2007, zooplankton density increased in Kodiak Lake and Cujo Lake. The AEMP report states that the cause for the increase was unknown as it was not accompanied by an increase in phytoplankton</p>	<p>As a general rule, the planktonic ecosystems of Arctic and sub-Arctic lakes are simpler than those of more southern waterbodies</p>	DFO's point about the uncertainty surrounding this result is well taken. More discussion on

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			<p>biomass or density which would be expected for a trophic effect. The following response was provided by Michael Turner, a DFO research scientist at the Freshwater Institute.</p> <p><i>I disagree with BHP's assertion that it is necessary for increased zooplankton abundance (density) to be associated with increased phytoplankton abundance. In a simple system an increase in zooplankton abundance would be expected to increase grazing pressure (assuming that it was algal grazers that had increased). Increased zooplankton grazing would decrease algal abundance if algal growth rates were unchanged. If the algae were growing more rapidly (as might have occurred in response to increased nutrients), then there might not be any large change in abundance.</i></p> <p><i>Unfortunately there is insufficient information provided to determine unequivocally the exact relationship between the zooplankton and phytoplanktons. Information on zooplankton (or zoobenthos) and phytoplankton (or phytobenthos) density or abundance provides information only about the size (and composition) of the standing crop (i.e. the compartment size). There is no information provided about the rapidity of algal growth, productivity or photosynthesis (i.e. the rate of compartment turnover). (This is important because a small population growing very rapidly but with high loss rates might be as [or more] productive as a large population growing slowly.) Nor is there information</i></p>	<p>because of the low productivity of northern waters. There are fewer trophic levels and the pathways between predator and prey are shorter. Exclusively carnivorous zooplankton make up a smaller portion of the planktonic communities of northern waterbodies than of southern waterbodies. Therefore, it is reasonable to assume that simpler relationships may exist between the density of zooplankton and the density of their phytoplankton prey for the lakes of the EKATI claim block than for more southerly lakes.</p> <p>It would be speculative to link in a causal manner zooplankton and phytoplankton densities without taking into account such ecological phenomena as production rates and lag periods. Research information on those phenomena are not collected as part of the AEMP, which is primarily a monitoring system for ecologically significant effects.</p>	<p>these observations in future may be warranted, possibly in the context of the Adaptive Management Plan.</p>

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			<p><i>provided about zooplankton grazing rates. Without understanding algal growth rates and grazing rates, it would be speculative to try to link algal and zooplankton densities based on abundance information alone. (Another compositional piece of the puzzle that would be helpful would be to understand which of the zooplankters are algal grazers given that not all zooplankton are created equal in terms of trophic function.)</i></p> <p><i>Zooplankton grazing could selectively decrease 'edible' algal taxa, leaving less desirable species. It is also possible that there were lags in responses of the zooplankton populations to shifts in phytoplankton abundance, which is an argument for increasing the sample frequency.</i></p> <p>As stated in the AEMP report, the cause of the increase in zooplankton density is uncertain. With this uncertainty identified the AM cycle should again be implemented.</p>		
14	DFO – 6	Infection Rates	<p>“Ligula intestinalis infection rates were generally greater in potentially affected lakes in the Koala watershed than in reference lakes and the infestation incidence appears to resemble the spatial pattern of a mine effect. However, it is uncertain whether this truly a mine effect because of the lack of a plausible mechanism to link ligulosis in slimy sculpin, the absence of ligulosis in any other species of fish monitored by the AEMP, and the absence of historical information for before-after comparisons.”</p>	<p>To the best of our knowledge, tapeworms have not been observed in any of the hundreds of lake trout that have been captured and autopsied from lakes of the EKATI claim block over the last decade. This limited evidence suggests that it is unlikely that lake trout can get ligulosis by eating infected sculpins or infected copepods.</p>	<p>The Board again appreciates BHPB efforts to gather more information relevant to the parasitic infection rates noted in 2007 through their proposed 2008 fish sampling in Cell E of the LLCF. Clearly, the discussion</p>

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			<p>This was also the case for the King-Cujo watershed. Again this is an uncertainty that should be addressed by the AMP. Is it possible for the tapeworm to be transferred to lake trout that feed on infected sculpin or even infected copepods?</p>	<p>This observation is supported by a preliminary literature survey that showed that in North America <i>Ligula intestinalis</i> has mainly been found in members of the cyprinid, catostomid and percid families. Cyprinids include minnows, chub, carp, dace and shiners. The principal cyprinid in the EKATI claim block is the lake chub (<i>Couesius plumbeus</i>). Rescan biologists observed tapeworms in lake chub that were captured from Pelzer Pond in 2003 (Pelzer Pond is close to the main camp), and in some of those chub the infections were similar to those observed in slimy sculpins in 2007.</p> <p>Catostomids are suckers, and the principal representative on the EKATI claim block is the longnose sucker (<i>Catostomus catostomus</i>). The incidence of infection of longnose suckers of the EKATI claim block by <i>L. intestinalis</i> is not well known, mainly because that species is less often captured and autopsied than lake trout and round whitefish.</p> <p>Percids include such species as yellow perch, walleye and the darter group, none of which are known from the EKATI claim block.</p>	<p>around what the cause of the increased parasitic infections will continue, very possibly in the context of adaptive management.</p>

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				<p>Sculpins are a large group of perciform-like fishes.</p> <p>BHP Billiton will be conducting a follow-up Cell E Fish Survey in August 2008. A component of this survey will sample slimy scuplin in an attempt to determine if the incidence and intensity of infection of slimy scuplin is elevated in Cell E compared to reference lakes and to lakes downstream of the LLCF because of the presence of environmental stressors in the LLCF produced by mine activities.</p>	
15	DFO – 7	Fish Sampling	<p>As reported in the 2007 AEMP report, catch per unit effort (CPUE) of round whitefish and lake trout has declined when compared to baseline years and to 2002, most likely as a result of historical sampling. However, further reduction of the sample sizes of these species may not allow the detection of significant changes in a number of parameters being assessed. It is important to ensure sampling is not having a negative effect on fish populations; however, some level of monitoring is required to determine whether mine effects are occurring. BHPB has indicated that “the use of slimy sculpin as a surrogate is not yet supported scientifically for EKATI.” While sculpin have a different life history and habitat requirements than lake trout and whitefish they should remain as an important component in the AEMP. Elevated levels of mercury in sculpin were recently identified in Lac de Gras through the Diavik</p>	<p>Since the next fish sampling program is not scheduled until 2012, BHP Billiton feels any changes to this program, such as the addition of a new fish species, are best discussed during the AEMP 3 year review in 2009.</p> <p>BHP Billiton is completing a follow-up Cell E Fish Study in August 2008. Data from this survey will provide more information towards determining if slimy scuplin can be used as a surrogate.</p>	<p>Ok, but this discussion should occur again at the next three-year review.</p>

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			AEMP.		
16	DFO – 8	Fish Sampling	<p>In order to reduce the amount of whitefish and lake trout sacrificed in the next sampling phase of BHPB's AEMP, other alternatives should be assessed. One possibility would be the use of lake chub as a primary indicator species. The following comments on the suitability of lake chub are from Pete Cott, DFO Science and Dr. John Gunn, a professor at Laurentian University, Canada Research Chair for stressed aquatic ecosystems.</p> <p><i>Lake chub are a good candidate for fish health studies, and would show affects more quickly than large bodied fish, that tend to be long lived and slow growing and slower to react to environmental changes. Lake chub are low in the food chain - eating benthic organisms – and fast growing and short lived. They are ecologically important linking benthic and near shore energy flow to top level predators like lake trout. Also, they occupy a wide variety of habitats in the lake, so would be representative of the whole lake. From a logistics standpoint they are abundant and easy to catch, and can be caught year after year. Their high fecundity and abundance means that the sample size can be quite large without risk of population level impacts from sampling.</i></p> <p>It should be determined what information is necessary to obtain from future lake trout and</p>	<p>Since the next fish sampling program is not scheduled until 2012, BHP Billiton feels any changes to this program, such as changes to the fish species sampled are best discussed during the AEMP 3-year review in 2009.</p>	<p>The Board encourages DFO to bring this idea forward during the AEMP 3-year review in 2009.</p>

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			whitefish sampling and then identify how it can be accomplished in a non-lethal manner. For instance, non lethal fish tissue plugs could be used for metals analysis to compare to past sampling results if the number of metals being looked at is reduced to focus on particular ones of interest.		
C: North Slave Metis Alliance (NSMA) Comments – Received June 20th, 2008					
17	NSMA – 1	Traditional Knowledge	The AEMP report does not detail the inclusion of Metis Traditional Knowledge. The NSMA desires more involvement in the design and the implementation of the Ekati Aquatic Effects Monitoring Program (AEMP), as well as better reporting of our involvement. In particular, we desire involvement in establishing acceptable limits of change, or effects sizes. Acceptable limits of change should not to be mistaken for detection limits of analytical techniques.	BHP Billiton works hard at involving Aboriginal people in the environmental monitoring programs at EKATI and is proud of what has been accomplished. In the 2007 AEMP BHP Billiton initiated the DELT program which had direct participation of Aboriginal Traditional Knowledge Holders working in the field with biologists. The DELT program is a component of the fish palatability study where fish were visually check and catalogued for any deformities, erosions, lesions or tumours. See BHP Billiton response to IEMA – 8 (Tracking #8) for a discussion on acceptable limits.	OK.
18	NSMA – 2	CCME Guidelines	We do have concerns about the reported results showing that water contamination with molybdenum, selenium, and nitrate are exceeding or almost exceeding CCME guidelines. We strongly disagree with the reasoning used to discount the	See response to IEMA - 1 (Tracking #1) for discussion on molybdenum. See response to IEMA - 2 (Tracking #2) for discussion on selenium.	NSMA's points have been noted. Appropriate responses are given above as indicated by BHPB.

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			<p>importance of exceeding the COME guidelines, which was, essentially, that since the 95% confidence interval overlaps the CCME guideline, you can't prove that the CCME guideline was surpassed until you get a value quite a bit over the CCME guideline.</p> <p>We do not consider the CCME guidelines to be "pollute up to" variables, and this argument is not compatible with the "precautionary principle" of environmental management which we insist on.</p>	<p>See response to DFO - 2 (Tracking #10) for discussion on CCME guidelines.</p> <p>Nitrate was slightly greater than the interim CCME guideline of 2.9 mg/L in Leslie and Moose lakes in 2008. This is an interim guideline and the CCME is currently working on an update for nitrate using its now recommended HC5 approach.</p> <p>In an effort to avoid releasing water that is likely to raise nitrate concentrations in receiving lakes above the interim guideline, BHP Billiton has voluntarily withheld discharge from the LLCF through freshet 2008. This makes use of the available storage capacity within the LLCF to provide time for BHP Billiton to investigate alternate solutions. This displays BHP Billiton's proactive commitment to providing the highest level of protection to the environment, based on an interim guideline that is recognized as requiring update.</p>	
9	NSMA – 3	Oxygen Measurements	<p>We are alarmed by the reports of elevated hydrocarbon, mercury, molybdenum, and selenium in fish, and very disappointed to hear that no winter oxygen measurements were taken in 2007, in lakes where low winter oxygen has been a problem in the past. Traditional Knowledge should have been solicited, and used, to obtain the required winter oxygen measurements.</p>	<p>See response to IEMA - 3 (Tracking #3).</p>	<p>OK.</p>

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20	NSMA – 4	Infection Rates	We are also concerned about the elevated infection rates of tapeworm in slimy sculpin.	See response to DFO - 6 (Tracking #14).	Noted.
D: Indian Northern Affairs Canada (INAC) Comments – Received June 20th, 2008					
21	INAC – 1	Linkages to the Adaptive Management Plan (AdMP)	<p>First, INAC feels it is important to note that BHPB has identified that the AEMP is a key component of adaptive management because it provides the annual monitoring data and analytical assessments that are used to determine if the mine is affecting aquatic ecosystems. INAC agrees with this statement but does not believe that the AEMP is being used properly to interpret potential impacts in the receiving environment, and as such, formal adaptive management of aquatic effects is not presently being conducted (these two things need to be instruments of each other).</p> <p>INAC believes the main reasons for this are: the lack of effect sizes (see discussion below), and, the fact that a formalized Adaptive Management Plan (AdMP) has only recently been submitted but not yet reviewed or approved.</p>	See response to DFO -1 (Tracking #9)	Board Staff agree with INAC's conclusions. Please see responses in Tracking #9 and 10.
22	INAC – 2	Increasing Parameters	Each year BHPB's AEMP identifies a number of increasing parameters. Again this year concentrations of nine parameters, which include pH, sulphate, total dissolved solids, chloride, potassium, nitrate, arsenic, molybdenum and nickel have continued to increase. At some point these increases will cause impacts which BHPB may or may not be able to fully mitigate. Therefore, the adaptive management framework must be applied now to	See response to DFO - 1 (Tracking # 9). Further, BHP Billiton questions INAC's statement that "At some point these increases will cause impacts..." BHP Billiton disagrees with the inference that impacts are certain to occur (i.e. use of the wording "will cause").	See Board Staff response above, in Tracking #21.

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			help address these issues before they become significant impacts.		
23	INAC – 3	Minimal Detectable Difference	INAC commends BHPB for committing to develop effects levels for the site. Unfortunately, there seems to be a misunderstanding in what INAC and others were requesting. BHPB has estimated the Minimal Detectable Difference (MDD) from the current sampling regime using CCME water quality criterion; minimal detectable differences are not effects. Effects levels are levels that stakeholders agree are unacceptable. Once effect levels are agreed upon, some lower value or early warning signals trigger action (i.e. adaptive management). This is done before unacceptable effects are observed.	See response to IEMA - 8 (Tracking #8)	Please see WLWB Response to Tracking #8 as well.
24	INAC – 4	CCME Guidelines	INAC is very concerned that BHPB's 2007 AEMP results are being assessed relative to CCME guidelines and not particular baseline, background or reference conditions. Again, as INAC has stated before, CCME guidelines are not "pollute up to limits" and therefore should not be used to develop triggers for adaptive management. Active adaptive management should occur when low level effects or impacts are observed to prevent effect levels from being exceeded.	See response to DFO - 2 (Tracking #10)	Please see responses in Tracking #9 and 10.
25	INAC – 5	CCME Guidelines	Lake water quality in the north usually falls below laboratory detection limits and is typically reported as <DL (Kokelj <i>et al</i> , 2008, 2009; Peinitz <i>et al</i> (1997a, b)). The CCME non-degradation policy states that: <i>"The degradation of the existing water quality should always be avoided. The natural background</i>	The statistical analysis for the 2007 AEMP were completed as agreed to in the 2007-2009 AEMP Plan, reviewed in 2006. See response to DFO -1 (Tracking #9) for comments on the AMP	Board Staff understand INAC's points and feel this discussion is best had in the context of the finalization of the Adaptive Management Plan for Ekati.

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			<p><i>concentrations of parameters and their range should also be taken into account in the design of monitoring programs and the interpretation of the resulting data”.</i></p> <p>Therefore the allotted change inherent in using CCME guidelines is too large and should not be use as the primary trigger mechanisms for adaptive management. INAC understands that BHPB has proposed benchmarks as part of their AdMP but at this point this plan has not been fully reviewed or approved by the Wek'èezhii Land and Water Board. As such INAC is suggesting that potential low level effects or impacts should be determined in a way which is more consistent with other mines. An example of which is provided below; note, this is not an exhaustive list:</p> <ul style="list-style-type: none"> • Statistical differences in the immediate receiving environment (to be determined) relative to baseline, background or reference conditions; or, • Statistical increasing trend predicting exceedances of thresholds or benchmarks (to be determined) within three years in the immediate receiving environment; <p>It is these effects levels that may signify early warnings or potential low level impacts that would trigger active adaptive management and lead to potential mitigation strategies. The absence of effects levels or triggers for adaptive management</p>		

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			can only lead to continued monitoring and identification of effects.		
26	INAC – 6	Linkages to the Adaptive Management Plan (AdMP)	INAC understands that BHPB does have internal processes that are used to determine if operational changes can help mitigate effects in the receiving environment; however, 1) this process has not yet been formalized; 2) the recent AdMP has not been approved; and, 3) acceptable/unacceptable effects must be developed through consultation with stakeholders. INAC stresses that the results of the AEMP must be used to help make decisions regarding operations. Aquatic effects monitoring must not only be a monitoring and assessment tool. Direct linkages between the AEMP to the AdMP must be evident and concrete in order to facilitate continued improvement and to mitigate any potential future impacts.	See response to DFO -1 (Tracking #9) for comments on the AMP. See response to IEMA - 8 (Tracking #8) for discussion on acceptable limits.	Please see responses in Tracking #8 -10.
27	INAC – 7	Effect Levels	In closing, BHPB has taken steps to distinguish between changes, effects and impacts. However, BHPB has not identified at what point an effect becomes an impact nor have they defined what constitutes a significant effect (effect levels). BHPB has stated (p. 1-3) that there are no impacts resulting from their operation; INAC notes this is a broad statement which is open to interpretation because the word significant has not yet been defined. Since concentrations of parameters of concern may be much higher than baseline, background or reference conditions “impacts” may already exist. BHP (p. 3-4) states that there is a potential for adverse biological effects in Leslie and Moose lakes even when CCME	In distinguishing the difference between a change, effect or impact BHP Billiton uses the word significant to mean a statistically significant difference based on $p < 0.05$. Therefore, a change occurs when a variable is found to be statistically different from natural background variation. This becomes an effect if that change can be attributed to mine activities and an impact if that change is negative. On pg 3-4 the CCME guidelines are not used as the definition of “significant” but rather as a reference point where no biological effects	The scoping document, proposed by BHPB in their response to Tracking #8, should help to clarify this issue.

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			guidelines are used as the definition of "significant".	would be expected. See response to IEMA - 8 (Tracking #8) for discussion on critical effects sizes / acceptable limits.	
28	INAC – 8		When calculating the MDDs, BHPB used 90% for the statistical power and 0.05 for the significance level. These two intervals should be similar, for example if BHPB wants to use 0.05 as the significance level then statistical power should be set at 95%. This way the allotted level of protection would be equal.	A test with power of 95% is more likely to detect a difference than a test with power 90%, but 1 of two things must happen: the sample size must increase or the Type I Error probability will increase. A test that has higher power is either more costly or more prone to mistakes in the other direction. Various references in the literature recommend values between 85% and 95%, but there is no strict reason to set alpha and beta equal. Choosing a power of 95% rather than 90% entails multiplying by 1.96 rather than 1.64 in one part of the calculation. However, the other values used in the calculations (error variances) are not exactly correct - they are estimates derived from noisy data- and so the MDDs should not be taken as exact values. They are approximate guidelines for judging the ability of the analysis and the current sampling design to detect changes over time.	Perhaps INAC can bring this issue forward in the 3-year review to be completed in 2009.
29	INAC – 9		Again BHPB is seeing increases in parameter as far downstream as Lac de Gras (sampling sites S2 & S3).	No response required	Noted.

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			It seems that these sites continue to represent far-field exposure areas.		
30	INAC – 10		INAC acknowledges that BHPB has concentrated much effort in calculating MDDs for a number of parameters. This work is exhausting and very detailed. However, INAC feels in the context of Adaptive Management, arguing over uncertain in concentrations being above, at, or below CCME water quality guidelines is not fruitful at this point in time. It is clear concentrations are increasing signaling the need for formal adaptive management processes, particularly for nitrate, molybdenum and nickel.	See response to DFO -1 (Tracking #9).	Please see responses in Tracking #8 -10.
31	INAC – 11		BHPB has noted that fish in Leslie Lake were exposed to trace concentrations of hydrocarbons as it was detected in fish bile. INAC understands that BHPB may look into this further and strongly encourages this process. To do so, it will likely be necessary to conduct trace analyses for trace hydrocarbons in both water and sediment in Cell E and Leslie Lake.	BHP Billiton will be completing a follow-up Cell E Fish Survey in August 2008, which will include sediment and water sampling.	OK.
32	INAC – 12		Section 1.2 (p. 1-3) distinguishes between a change, an effect and an impact. Considering the list of parameters in Section 3 (p. 3-1) it is unclear how increases in these parameters could not be defined as potential low effects or impacts (particularly nitrate, nickel, chloride, and molybdenum). A more robust investigations and potential justifications are needed before statements about impacts can be made. INAC notes that consistently increasing trends in parameters of interest are typically not favourable (possible) signs	Table 3.8-1 in Appendix A provides a summary of the evaluation of effects for the Koala Watershed (Table 4.8-1 for King-Cujo Watershed). This table highlights if there has been a change and if that change represents a mine effect. Several of the water quality parameters do show a mine related effect.	Please see responses in Tracking #8 -10.

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33	INAC – 13		<p>Section 3 (p. 3-1) claims that the chemical composition of water discharged from the LLCF in 2007 remained below discharge limits of the Water License and CCME guidelines, with the single exception of nitrate. The Surveillance Network Program's (SNP) results from November 2007 indicate that at station 1616-30 (discharge point from Cell E) molybdenum concentrations averaged 0.0878 mg/L for 10 samples. The highest reading was 0.0926 mg/L and the lowest was 0.0819 mg/L. The CCME guideline for molybdenum is 0.073 mg/L</p> <p>Misery pit; we note that it is possible that Misery will reopen at some point in the future and at present there are still elevated levels of molybdenum in the LLCF.</p>	<p>BHP Billiton acknowledges that INAC's statement is correct. Water discharged from the LLCF in November was above the CCME guideline for molybdenum. The statement in the AEMP report was only considering the Open-water Season Average as this is what is used in the data analysis.</p> <p>These molybdenum concentrations are however, more than an order of magnitude lower than the site specific objective derived by BHP Billiton in a Tier I Ecological Risk Assessment (ERA) for molybdenum in 2006 which indicated that a concentration of 16 mg/L would be protective of the environment.</p> <p>See response to IENA -1 (Tracking #1) for more discussion on molybdenum.</p>	
34	INAC – 14		<p>Figure 3-1 lists all the parameters measured and whether they have increased, decreased or remained the same. The figure is accompanied by the graphs for all the parameters listed. However, the phytoplankton density and diversity graphs are not included for either watershed. Was this omission an error? This is particularly importance for the King-Cujo watershed as the data sets show some uncertainty.</p>	<p>To keep the AEMP Summary Report manageable not all of the graphical information can be brought forward into this report. The graphs chosen for this report are those where a change in the parameter/variable has been observed. No change was observed in phytoplankton.</p> <p>The graphs in question are in Appendix A Figures 3.3-1 and 3.3-2 for the Koala Watershed and Figures 4.3-1 and 4.3-2 for the King-Cujo Watershed</p>	<p>See also WLWB Response to Tracking #1.</p>

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35	INAC – 15		<p>Section 2 (p.3-6) states that if the elevated parameters in Kodiak Lake, the Lower PDC and Kodiak-Little Stream are due to a mine effect, the effects had already occurred by the time the AEMP began and has remained stable since then. Why doesn't BHPB look into this to determine if this is or isn't a mine effect; all that is required are comparisons with baseline data?</p>	<p>It is not known if the elevated parameters in the Kodiak Lake area are natural in origin, and existed before the mine was built, or if they were due to anthropogenic disturbance that occurred before the mine was built. An exploration camp was established on the shore of Kodiak Lake prior to the initiation of baseline environmental studies. From 1997 to 1998, Kodiak Lake received treated sewage effluent while the Long Lake Containment Facility was being built. Therefore, to avoid confounding natural and anthropogenic effects, the AEMP has always avoided defining a baseline period for Kodiak Lake.</p> <p>Kodiak-Little Stream is the only outlet of Kodiak Lake, hence it also lacks a baseline period.</p> <p>The PDC is a human-made structure, hence it has no baseline period.</p>	OK.

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36	INAC – 16		Section 4 indicates that there is an increase in zooplankton density and mid depth lake benthos in Cujo Lake. Similarly, there is an increase in the zooplankton density in Kodiak Lake. These increases are concerning and lends us to believe that possibility the increased nutrients (e.g. nitrate, ammonia, etc.) maybe having an effect on the plankton and benthic community dynamics. Due to the potential importance of this finding, a great deal of effort should be made to determine the cause of the increase and to better understand the plankton community.	Kodiak Lake has been the subject of intensive sampling every year since 1994. As a result, more is known of the water quality and aquatic ecology of Kodiak Lake than of any other waterbody on the EKATI claim block. It will continue to be sampled each year in the future as an AEMP lake. Cujo Lake has been sampled every year since 1999 and will continue to be sampled in the future as an AEMP lake.	OK.
<p>E: EcoMetrix Incorporated (HART) Comments – Received June 27th, 2008</p> <p>Note: Complete background information and observations are contained within the review of “EKATI Diamond Mines 2007 Aquatic Effects Monitoring Program” Report</p>					
37	HART – 1	Power Analysis	The power analysis for the fish parameters seems to contain errors; we <u>recommend</u> that this analysis should be thoroughly checked and revised, and that the conclusions drawn from this analysis should then be reconsidered;	BHP Billiton will re-examine the analysis and revise it, if necessary.	Board Staff have contacted BHPB about this and asked that their consultants, Rescan, speak directly to Don Hart to expedite revisions. Revisions, or a case as to why they do not need to be done, will be required by the Board in order to ensure compliance with the water licence.
38	HART – 2	Statistical Discrepancies	There are some inconsistencies between the statistical analyses of fish parameters and the conclusions drawn in the summary, and there is no	BHP Billiton will re-examine the analysis and revise it, if necessary.	Board Staff have contacted BHPB about this and asked that their

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			useful discussion of the lake x period interactions that were found; we <u>recommend</u> that the conclusions should be checked against the results, discrepancies resolved, and significant interactions discussed as to whether they are mine effects;		consultants, Rescan, speak directly to Don Hart to expedite revisions. Revisions, or a case as to why they do not need to be done, will be required by the Board in order to ensure compliance with the water licence.
39	HART – 3	Chloride	The report appropriately highlights water quality parameters that are both increasing relative to reference, and approaching or exceeding water quality guidelines, e.g., nitrate and molybdenum; the exponential increase in chloride in the LLCF and downstream lakes should also be highlighted;	Acknowledged. Chloride has been identified as a water quality parameter of interest at EKATI for some time and is the focus of other reports and studies, such as the Watershed Adaptive Management Plan and the Long Lake Water Quality Model Report(s).	Ok, and Board Staff believe that the best place to deal with this will be through the Adaptive Management Plan. The review and approval of an Adaptive Management Plan for BHPB is a priority of the Board.
40	HART – 4	Ammonia & Nitrate	The reason why some lakes and not others have increasing ammonia downstream of the LLCF is unclear, e.g., Moose Lake but not Leslie Lake; if the dynamics of ammonia and nitrate can be explained in the report, it would be appropriate to do so;	Nitrate is a parameter of interest and BHP Billiton has initiated a response plan regarding nitrate, which includes voluntarily withholding discharge through freshet 2008 while investigating sources and solutions. The linkages between ammonia and nitrate are acknowledged and form part of the investigations that are underway.	The increased levels of molybdenum downstream of the LLCF is worrisome to the Board as well; however, the best place to deal with this will be through the Adaptive Management Plan. The review and approval of an Adaptive

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					Management Plan for BHPB is a priority of the Board.
41	HART – 5	Two-sided Tests	It is unclear why two-sided tests have been used in identifying water quality parameters that are increasing relative to reference; if there is a reason, it should be explained in the report; otherwise, one-sided tests should be considered;	<p>The regression models that were fit included quadratic and linear terms on the log-scale because the linear models did not provide adequate fit for some of the parameters. That is: $y = b_0 + b_1 * year + b_2 * year^2$.</p> <p>The tests that were performed compare the coefficients b1 and b2 for the reference and monitored lakes. In this way they are "2-sided" because it is possible to detect a difference caused by a decline in the parameter in the monitored lake. But, there are also other behaviours that could lead to a significant decrease, e.g., an increase over the first few years followed by a decrease or vice versa. The tests performed compare the hypotheses: H0: b1 and b2 are the same for the reference and monitored lakes, vs. H1: either b1 or b2 are different. These tests are standard, and can be computed easily.</p> <p>The reviewer is suggesting only testing for an increase, but it isn't clear what this means in terms of b1 and b2 and how one would construct the hypotheses mathematically. It</p>	Ok.

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				<p>is possible for either b1 or b2 to be lower in the monitored lake and still have higher parameter concentrations if the other parameter is large enough. So, simply testing that both parameters are higher in the monitored lake will not do. To our knowledge there is no method for implementing such a one-sided test and what the reviewer is suggesting is certainly not standard methodology.</p> <p>BHP Billiton believes that it is completely valid to test for a difference in trends between the reference and monitored lakes and then to use the other information in the analysis to draw conclusions about the direction and magnitude of any significant difference.</p>	
42	HART – 6	Minimum Detectable Differences	It is unclear if the comparison of lake mean to water quality guideline, anticipated in the derivation of the MDD, has a place in the decision framework within the Watershed Adaptive Management Plan; this should be clarified in the AEMP report, or in the Adaptive Management Plan;	The AMP is where triggers and thresholds are determined.	Ok.