BHP Billiton Diamonds Inc.
Operator of the EKATI Diamond Mine

bhpbilliton

BHP Billiton Diamonds Inc.
#1102 4920-52nd Street
Yellowknife NT Canada X1A 3T1
Tel 867 669 9292 Fax 867 669 9293
bhpbilliton.com

November 19, 2007

Wek'eezhii Land and Water Board (WLWB)
#1, 4905 - 48th Street
Yellowknife, NT X1A 3S3

Attention: Ms. Violet Camsell-Blondin
Chair

Re: Technical Review of Proposed Chloride Discharge Criterion for the Sable Kimberlite Pipe Development

BHP Billiton Diamonds Inc. (BHP Billiton) has prepared the attached response to comments on the report *Proposed Chloride Discharge Criterion for the Sable Kimberlite Pipe Development (Water License MV001L2-0008), January 2007*. Our responses include consideration of the comments provided by the WLWB's technical advisors, EcoMetrix Incorporated and Gartner Lee Limited.

One of the technical uncertainties identified in the January 2007 report is the potential for hardness to act as a toxicity-modifying factor for chloride. This issue was also raised by a number of reviewers. BHP Billiton has initiated additional tests to investigate this issue, which is described in the relevant responses to comments attached. The tests are anticipated to be completed during the first quarter of 2008. BHP Billiton will circulate the results when available.

We trust the above information meets with your requirements at this time. Please contact the undersigned should you have any questions.

Yours Sincerely,
BHP Billiton Diamonds Inc.

Eric Denholm
Superintendent – Traditional Knowledge and Permitting
EKATI Diamond Mine

Attachment:
c.c.: Jason Brennan, DIAND

BHP BILLITON RESPONSE TO STAKEHOLDER AND REGULATORY AGENCY COMMENTS OF REPORT:
"PROPOSED CHLORIDE DISCHARGE CRITERION FOR THE SABLE KIMBERLITE PIPE DEVELOPMENT (WATER LICENSE MV2001L2-0008), JANUARY 2007"

NOVEMERB 19, 2007

Tracking Number	Reviewer	Topic	Review Comment	BHP Billiton Response	Action Item (if applicable)
1	DFO/ Independent Environmental Monitoring Agency	Mixing Zone	*The first 100 metres of Horseshoe Lake should not be used as a mixing zone.*	Minimum dilutions stated in the report are predicted to be met at a distance of 100 m from the mouth of Two Rock Stream. Discharges to the 'mixing zone' will be non-acutely toxic, which is an accepted measure of 'deleteriousness' in relation to the Fisheries Act. There is precedent in the NWT for the use of mixing zones, "outside of which there should be no chronic toxicity to aquatic life" (MV2004L8-0001, Colomac Mine Site). In addition, there is a practical reason why a distance of 100 m was chosen. It would be difficult to verify *in situ* concentrations close to the river mouth due to the boulder strewn nature of the area.	None.
2	Environment Canada	Mixing Zone	*From a review of the information requests subsequent to the EAR, it appears that stakeholders did accept that there could be some changes to Horseshoe, but were not to be detectable at the end of the watershed (i.e. by Exeter inflow). Use of a mixing zone is consistent with other mine sites in the NWT and NU, but further evaluation is needed as to what the extent should be of such a mixing zone.*	BHP Billiton suggest that a mixing zone is defined as an area where parameter concentrations may occasionally be greater than the chronic toxicity level but lower that the acute toxicity level. The size of a mixing zone so defined should depend upon the size and nature of the receiving water body as well as the location of the discharge. The quantity of fresh water to mix with effluent in Two Rock Stream is modest. The Two Rock Sedimentation Pond Outflow is enhanced by only 50% before it enters Horseshoe Lake; e.g., a flow of 100 L/s discharging form Two Rock Sedimentation Pond would be enhanced to a flow of 150 L/s within Two Rock stream before entering Horseshoe Lake. Chloride concentrations at the mouth of the stream will be 67% of those in Two Rock Sedimentation Pond. The further dilution of this flow in Horseshoe Lake varies. The Two Rock Sedimentation Pond flow is enhanced at least 2.6 times within the first 100 m of Horseshoe Lake. This means that chloride concentrations 100 m from the Two Rock Stream mouth are less than 38% of the concentrations in Two Rock Sedimentation Pond. Changing the extent of the mixing zone will affect the minimum dilution available as follows. Zero metres from the mouth of Two Rock Stream, chloride concentrations will be less than 67% of those in Two Rock Sedimentation Pond. At a distance of 100 m from the mouth of Two Rock Stream, chloride concentrations over a 21-day period will be less than 23% of the concentrations in Two Rock Sedimentation Pond. At the discharge from Horseshoe Lake, the concentrations will be 19% of those in Two Rock Sedimentation Pond. When examining chronic toxicity, we considered the life cycle exposures of the sensitive receptors (i.e. 21 days).	None.
3	EcoMetrix	Mixing Zone	*Rescan (2007) has offered little justification of need for a 100-m mixing zone, although it may be needed. Discussion of anticipated effluent quality and quantity would help to clarify the need for the requested mixing zone. Rescan suggests that the 100-m distance is conservative, because the SNP compliance monitoring station (0008-Sa6) has been placed at 500 m. However, it is unclear what reasoning was behind that placement.*	The goal is to determine the concentration of chloride that could be discharged from Two Rock Sedimentation Pond that would meet the chronic toxicity criterion of 313 mg/L at the edge of a 100 m mixing zone. Therefore, the 100 m distance was assumed and the effluent discharge concentration back-calculated through the mixing calculations. For example, if the hydrodynamic and mixing models showed a dilution of 10:1 was achieved at the edge of the mixing zone, then a discharge concentration of 10*313 = 3,130 mg/L would be permissible. The rational provided for the selection of the 0008-Sa6 station is given in the Water Licence as:	None.

				"To detect impacts due to effluent discharged from Two Rock Lake." Based on this distance, Rescan's assumptions are conservative as compared to selecting station 0008-Sa6 because the concentration at 500 m distance will certainly be lower than at 100 m.	
4	EcoMetrix	Mixing Zone	*Overall, a 100-m mixing zone in Horseshoe Lake, if needed, does not seem unreasonable. However, information to demonstrate the need, based on anticipated effluent quality and quantity, and application of DFs for different distances, should be provided, as well as documentation of the expected ecological effects (within the context of CEAA) within the mixing zone.*	Please refer to tracking number 76.	See comment #76.
5	DFO	Discharge of Deleterious Substance	*No impacts to fish and/ or fish habitat have been authorized by DFO for Horseshoe Lake and under the Fisheries Act DFO cannot authorize the deposit of a deleterious substance.*	BHP Billiton is not requesting an authorization to deposit a deleterious substance. There will be no discharge of deleterious substances into Horseshoe Lake. The discharge will be non-acutely toxic.	None.
6	DFO/ North Slave Métis Alliance/ Independent Environmental Monitoring Agency	Discharge Compliance Point	*Whatever the approved toxicological threshold for chloride is set at by the Board, it should be met at the outlet of Two Rock Sedimentation Pond (SNP station 0008-Sa3)*	BHP Billiton disagrees with this recommendation. For further explanation, see responses #1 through 5.	See responses #1 through 5.
7	INAC/EcoMetrix	Potential Hardness Dependent Toxicity	*Rescan identified that hardness is a main factor that influences Chloride toxicity but has not modified the proposed limit to compensate for the measured hardness of Horseshoe Lake*	Based on preliminary toxicity tests with Ceriodaphnia, Rescan identified hardness as a potential modifying factor to chloride toxicity. BHP Billiton is undertaking additional tests with *Ceriodaphnia* in order to investigate the potential relationship between chloride toxicity and water hardness. Tests are being conducted over a range of hardnesses encompassing that of Horseshoe Lake. If a hardness relationship is identified, a new hardness dependent threshold may be derived. Based on preliminary information, it is anticipated that at lower hardness (i.e., <80 mg/L) the toxicity may be higher than the current HC_5. At higher hardness, the toxicity threshold may be greater than the HC_5 identified in the study.	BHP Billiton will circulate the additional test results when available.
8	North Slave Métis Alliance	Potential Hardness Dependent Toxicity	*The current toxicity tests were conducted at moderate hardness, i.e. 80 to 100 mg/L of CaCO3, however the natural hardness of Horseshoe Lake is said to be only 7 to 9 mg/L. The toxicity of the chloride might actually be higher than that tested in this study.*	See response #7.	See response #7.
9	Independent Environmental Monitoring Agency	Potential Hardness Dependent Toxicity	*313 mg/l chloride should only apply at locations where the water hardness is at least moderately hard (i.e. 80 – 100 mg/l as CaCO3) because cladocera testing was done in hard water. To fully protect cladocera, it would be necessary to lower the 313 mg/l chloride toxicological threshold for softer water such as that found in Horseshoe Lake.*	See response #7.	See response #7.

10	INAC/Zajdlik & Associates	Potential Hardness Dependent Toxicity	*If the HC_5 was estimated under hardness conditions of 80 to 100 mg/L (as CaCO3) and exposure to Cl is at much lower hardness' in the Horseshoe lake ecosystem then the protective effects of hardness claimed by BHP (2007) will not occur. The consequence is that the estimated HC_5 will be under-protective.*	See response #7.	See response #7.
11	Independent Environmental Monitoring Agency	Potential Hardness Dependent Toxicity	*To support its proposal for a less conservative, and less protective, chloride discharge criterion, then BHPB should rerun the toxicological threshold analysis using soft water.*	See response #7. BHP Billiton disagrees with the comment that the proposed HC_5 is less conservative and less protective than previous toxicity thresholds. The proposed value is based on more data than previous thresholds and is a more robust derivation. Note that additional tests being conducted include testing the toxicity of chloride in softer and harder waters than that which was originally tested.	See response #7.
12	INAC/Zajdlik & Associates	Potential Hardness Dependent Toxicity	*One factor that modifies Cl toxicity was identified by BHP. No provision to incorporate the effect of hardness was proposed by BHP. Given that the hardness under which the toxicity tests were conducted is likely one order of magnitude greater than that of the receiving water, the adequacy of the proposed criterion should be demonstrated.*	See response #7.	See response #7.
13	Environment Canada	Potential Hardness Dependent Toxicity	*We note that hardness in the effluent is predicted to be in the order of 103 mg/L and this will modify receiving water values upward. It would be helpful to have an estimate of the extent and effect of this, to help evaluate the effect of hardness on chloride toxicity.*	See response #7.	See response #7.
14	EcoMetrix	Potential Hardness Dependent Toxicity	*It should be noted that Ceriodaphnia is not a soft water species, and may be subject to trace nutrient deficiencies in soft water cultures, unless trace nutrients are added. Therefore, toxicity tests in soft water can be subject to confounding stresses related to nutrient deficiency. Without details of the tests performed, it is difficult to judge the reality or the implications of the suggested hardness effect.*	Additional testing is being conducted with water of varying hardness. The nutrients in the test water will be those specified in the protocol (i.e. those in standard, synthetic, dilution water) (EPA 7-day Ceriodaphnia survival and reproduction protocol EPA-821-R-02-012).	BHP Billiton will circulate the additional test results when available.

<table>
<tr>
<td>15</td>
<td>North Slave Métis Alliance/ Environment Canada</td>
<td>Temperature of Toxicity Tests</td>
<td>Most of the tests conducted were done at above 20^{o}C, except for one toxicity test on fish. We believe that some of the tests should be done at temperatures that are nearer the natural temperatures of Horseshoe Lake. Temperature could either increase or decrease the toxicity of chloride and we feel it is important for the toxicity tests to be comparable to natural conditions so that we can be confident that the results of these tests are representative of the actual toxicity in Horseshoe Lake.</td>
<td>Additional toxicity tests with resident cladocerans (collected from Horseshoe Lake) are being conducted under a number of conditions that better mimic natural conditions (i.e. pH, light, temperature, hardness, DO, other ions, etc.). The tests are being conducted with temperatures that that are observed during the open water season in Horseshoe Lake (i.e. 11°C). For this reason, these tests deviate from standard toxicity testing protocols.</td>
<td>BHP Billiton will circulate the additional test results when available.</td>
</tr>
<tr>
<td>16</td>
<td>North Slave Métis Alliance</td>
<td>Interactions with other ions</td>
<td>We would like BHP to provide baseline values for all possible dissolved ions, including sodium and potassium, in the background, in groundwater on or near site and in the effluent.</td>
<td>Please see the data as follows:
<table>
<tr><th>Parameter</th><th>Units</th><th>Horseshoe Lake – Ave Open Water 2002</th><th>Groundwater from closest groundwater well (Avg of Wetbay in Panda)</th></tr>
<tr><td>Alkalinity, Total (as $CaCO_3$)</td><td>mg/L</td><td>8.00</td><td>38.58</td></tr>
<tr><td>Bicarbonate (HCO_3)</td><td>mg/L</td><td>9.83</td><td>47.08</td></tr>
<tr><td>Carbonate (CO_3)</td><td>mg/L</td><td><2.5</td><td><2.50</td></tr>
<tr><td>Conductivity (EC)</td><td>µS/cm</td><td>15.60</td><td>11,797</td></tr>
<tr><td>Hydroxide (OH)</td><td>mg/L</td><td><2.5</td><td><2.5</td></tr>
<tr><td>pH</td><td>pH</td><td>6.55</td><td>7.39</td></tr>
<tr><td>Chloride (Cl)</td><td>mg/L</td><td><0.5</td><td>4,328</td></tr>
<tr><td>Hardness (as $CaCO_3$)</td><td>mg/L</td><td>4.33</td><td>4,270</td></tr>
<tr><td>Sulphate (SO_4)</td><td>mg/L</td><td>1.19</td><td>2,423</td></tr>
<tr><td>Total Suspended Solids</td><td>mg/L</td><td>3.00</td><td>96</td></tr>
<tr><td>Turbidity</td><td>NTU</td><td>0.31</td><td>25.7</td></tr>
<tr><td>Ion Balance</td><td>%</td><td>Low EC</td><td>98.22</td></tr>
<tr><td>TDS (Calculated)</td><td>mg/L</td><td>8.67</td><td>7,216</td></tr>
<tr><td>Calcium (Ca)</td><td>mg/L</td><td>0.71</td><td>1,642</td></tr>
<tr><td>Magnesium (Mg)</td><td>mg/L</td><td>0.58</td><td>83</td></tr>
<tr><td>Potassium (K)</td><td>mg/L</td><td>0.48</td><td>17.1</td></tr>
<tr><td>Sodium (Na)</td><td>mg/L</td><td>0.70</td><td>943</td></tr>
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</td>
<td>None.</td>
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<tr><td></td><td></td><td></td><td></td><td>The Sable Mine is not in operation and there is no effluent to monitor. This will be monitored as station 0008-Sa3 under the existing SNP.</td><td></td></tr>
<tr><td>17</td><td>North Slave Métis Alliance/EcoMetrix</td><td>Effluent quality</td><td>At no point has the effluent been characterized. In order to properly understand the interactions chloride might have in the receiving environment, it should be recognized that several factors such as dissolved oxygen concentration, temperature, exposure time and the presence of other contaminants influence chloride toxicity. Please provide some information to this regard.</td><td>The table below presents the possible ranges of future effluent quality. As with the other permitted discharges at EKATI, monitoring (SNP and AEMP) will provide the best means of assessing the future potential for water quality effects. The results of the monitoring program will be considered with respect to toxicity of the discharge water. Temperature and dissolved oxygen in the receiving environment are not expected to change.

<table><tr><th>Parameter</th><th>Possible Range in Effluent</th></tr><tr><td>Hardness</td><td>69 to 750 mg/L</td></tr><tr><td>Chloride</td><td>7 to 690 mg/L</td></tr><tr><td>Dissolved Ortho Phosphate</td><td>0.002 to 0.0045 mg/L</td></tr><tr><td>Ammonia</td><td>3 to 8 mg/L</td></tr><tr><td>Nitrate</td><td>8 to 27 mg/L</td></tr><tr><td>Nitrite</td><td>0.3 to 1 mg/L</td></tr><tr><td>Sulphate</td><td>28 to 75 mg/L</td></tr><tr><td>Total Phosphorus</td><td>0.053 to 0.061g/L</td></tr><tr><td>Total Aluminum</td><td>0.1 to 1.5 mg/L</td></tr><tr><td>Total Arsenic</td><td>0.0012 to 0.0036 mg/L</td></tr><tr><td>Total Cadmium</td><td>0.00007 to 0.00028 mg/L</td></tr><tr><td>Total Calcium</td><td>15 to 200 mg/L</td></tr><tr><td>Total Chromium</td><td>0.0005 to 0.004 mg/L</td></tr><tr><td>Total Copper</td><td>0.003 to 0.009</td></tr><tr><td>Total Lead</td><td>0.0002 to 0.0008 mg/L</td></tr><tr><td>Total Magnesium</td><td>8 to 63 mg/L</td></tr><tr><td>Total Molybdenum</td><td>0.01 to 0.08 mg/L</td></tr><tr><td>Total Nickel</td><td>0.02 to 0.03 mg/L</td></tr><tr><td>Total Potassium</td><td>5 to 25 mg/L</td></tr><tr><td>Total Zinc</td><td>0.004 to 0.008 mg/L</td></tr></table>
BHP Billiton maintains it’s commitment to comply with the water licence requirement that (whole) effluent released from Two Rock Pond not be acutely toxic.</td><td>None.</td></tr>
<tr><td>18</td><td>Environment Canada</td><td>Effluent quality and interaction with other toxicity modifying factors</td><td>An effluent characterization is necessary, and potential interactions with other water parameters and substances should be assessed (e.g., the concentration of what other substances (cations and anions) will increase), especially if hardness increases significantly.</td><td>See response #17.</td><td>See response #17.</td></tr>
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<tr><td>19</td><td>EcoMetrix</td><td>Effluent quality and interaction with other toxicity modifying factors</td><td>The EVS (2004) report notes that the sum of cations (related to TDS) is approximately three times the chloride concentration in seepage samples.</td><td>The EVS report is referring to seepage from the Koala watershed, not the Horseshoe water shed. Notwithstanding, BHP would like clarification of the comment. Is the reviewer eluding to charge balances?</td><td>Reviewer requested to provide clarification.</td></tr>
<tr><td>20</td><td>EcoMetrix</td><td>Effluent quality and interaction with other toxicity modifying factors</td><td>TDS should be included in the effluent characterization, and its possible contribution to toxicity, along with chloride, should be considered.</td><td>TDS will be included in the effluent characterization (as is required by the existing Surveillance Network Program) and will be considered with respect to its possible contribution to toxicity.

Water Effects Ratio testing was conducted with water from Leslie Lake (the receiving environment of the LLCF discharge). This water had higher concentrations of TDS than the lab water. No significant difference was observed between the lab water tests and the receiving environment water tests indicating no difference in toxicity between laboratory and site water samples.</td><td>BHP Billiton to carry out the SNP as provided by the WLWB.</td></tr>
<tr><td>21</td><td>INAC/Zajdlik & Associates</td><td>Modifying Factors</td><td>The potential effect of modifying factors is discussed but no practical methods are presented to deal with these effects.</td><td>Water quality parameters in the discharge will be monitored as part of the SNP upon mine development and operation. The results of the monitoring program will be considered with respect to toxicity of the discharge water. The water license stipulates that toxicity tests be conducted to ensure that the whole discharge is not acutely toxic to aquatic life. The AEMP also includes physical and biological monitoring to assess any ecosystem changes in the receiving environment. This monitoring will identify potential modifying factors.</td><td>None.</td></tr>
<tr><td>22</td><td>Independent Environmental Monitoring Agency</td><td>Species Used for Toxicity Testing</td><td>The report submitted by BHPB states that <u>Ceriodaphnia dubia</u> do not exist in lakes around the mine site (see page 6-2) when in fact Ceriodaphnia comprised 1.4% of all cladocera in Moose Lake in 2003 (AEMP 2003, Appendix 1, Table 1.9-4) and was also found in 2005 (AEMP 2005, Appendix B, Table 12-4).</td><td>Some species within the genus Ceriodaphnia do exist at low numerical and biomass abundance. However, the species <u>Ceriodaphnia dubia</u> has not been identified in EKATI samples. Regardless, the reviewer is correct that Ceriodaphnia can be considered resident species since taxonomic identification to the level of genus is generally considered sufficient for determination of resident species.</td><td>None.</td></tr>
<tr><td>23</td><td>North Slave Métis Alliance/ Environment Canada/ EcoMetrix</td><td>Species Used for Toxicity Testing</td><td>It is unclear how many, if any, species used are residents in the Horseshoe Lake watershed.</td><td>See information as follows:

<table>
<tr><th>Species</th><th>Organism</th><th>Resident/Surrogate</th></tr>
<tr><td>Daphnia magna</td><td>Cladoceran</td><td>Resident</td></tr>
<tr><td>Ceriodaphnia dubia</td><td>Cladoceran</td><td>Resident</td></tr>
<tr><td>Brachionus calyciflorus</td><td>Rotifer</td><td>Surrogate</td></tr>
<tr><td>Pimephales promelas</td><td>Larval fish</td><td>Surrogate</td></tr>
<tr><td>Chironomus tentans</td><td>Midge</td><td>Resident</td></tr>
<tr><td>Nitzschia</td><td>Phytoplankton (Bacillariophyceae)</td><td>Resident</td></tr>
<tr><td>Lumbriculus variegatus</td><td>Oligochaete</td><td>Resident</td></tr>
<tr><td>Tubifex tubifex</td><td>Oligochaete</td><td>Resident</td></tr>
<tr><td>Oncorhynchus mykiss</td><td>Salmonid</td><td>Surrogate</td></tr>
<tr><td>Chlamydomonas</td><td>Phytoplankton (Chlorophyta)</td><td>Resident</td></tr>
</table>
</td><td>None.</td></tr>
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<table>
<tr><td></td><td></td><td></td><td></td><td>Taxonomic identification to the level of genus is considered sufficient for determining resident organisms. This is because members of the same genus generally have similar sensitivities to chemical exposure.</td><td></td></tr>
<tr><td>24</td><td>North Slave Métis Alliance</td><td>Species Used for Toxicity Testing</td><td>“although the HC5 value calculated would be expected to be protective of these species, resident species may exhibit a higher or lower degree of sensitivity to chloride”</td><td>The report indicated that Daphnia magna and Ceriodaphnia dubia are not resident species, however, other species of the same genus are present in the system and, as indicated in response #23, this is sufficient to establish them as resident species.</td><td>See response #23.</td></tr>
<tr><td>25</td><td>North Slave Métis Alliance</td><td>Species Used for Toxicity Testing</td><td>We ask that BHP/Rescan specify which species tested are residents of EKATI lakes, and if no resident species was tested, we ask that at least two resident species be tested at average temperatures for the Horseshoe Lake.</td><td>See response #23.</td><td>See response #23.</td></tr>
<tr><td>26</td><td>Environment Canada</td><td>Surrogate Species</td><td>Tested fish species are rainbow trout and fathead minnow. While acceptable, it is unfortunate, as resident species testing would have resulted in a more appropriate site-specific water quality guideline. It is acknowledged that sourcing native species is often difficult, but would be worth attempting.</td><td>See response #27.</td><td>See response #27.</td></tr>
<tr><td>27</td><td>EcoMetrix</td><td>Surrogate Species</td><td>The preponderance of non-resident species in the chronic data set raises questions about how well it represents the resident aquatic community. This should be addressed to the extent possible by explaining how the non-resident species retained act as surrogates for taxonomically-related resident species. The species at the lower end of the SSD, i.e., the cladocera, are particularly important. While it is not a simple matter to develop culture and test methods for new species, work toward this objective should be encouraged, perhaps in collaboration with Environment Canada.</td><td>Only 3 non-resident species were included.

The 3 non-resident species were included because they were considered to be adequate surrogates for resident genera that occur at EKATI as follows:
<table>
<tr><td>Test Species</td><td>Surrogate for</td><td>Rational</td></tr>
<tr><td>Brachionus calyciflorus</td><td>Kellicottia longispina
Keratella cochlearis</td><td>These rotifers are all within the family Brachionidae</td></tr>
<tr><td>Pimephales promelas</td><td>Lower Trophic Level Fish
Slimy sculpin (Cottus cognatus), Lake chub (Couesius plumbeus), Longnose sucker (Catostomus catostomus), Ninespine stickleback (Pungitius pungitius)</td><td>This fish species is in the same family (Cyprinidae) as lake chub and the same order (Cypriniformes) as both lake chub and longnose suckers. Furthermore, fathead minnows have been widely used in toxicity testing investigations in Canada and the USA and have standardized methods developed for toxicological evaluations.</td></tr>
</table></td><td>BHP Billiton will circulate the additional test results when available.</td></tr>
</table>

				<table><tr><td>Additional tests are being conducted that include testing the toxicity of chloride with cladocerans obtained from Horseshoe Lake. *Oncorhynchus mykiss*</td><td>**Higher Trophic Level Fish** round whitefish (*Prosopium cylindraceum*), lake trout (*Salvelinus namaycush*) and Arctic grayling (*Thymallus arcticus*).</td><td>Rainbow trout, round whitefish, lake trout and arctic grayling, are all non-anadromous salmonids. They are higher trophic level fish that live in cold water environments and have similar diets.</td></tr></table> BHP Billiton works co-operatively with Environment Canada and other agencies on various projects and would consider taking part in research projects related to the development of culture and test methods. However, these tests are not essential to determine an appropriate chloride EQC under this water licence.	
28	INAC/Zajdlik & Associates/EcoMetrix	SSD Species	*The species used to develop the criterion are not clearly based upon available documentation*	Data points used to develop the HC_5 were based on the geometric means of data for the same genus. Figure 3.3-2 presents the geometric mean genus data used to derive the HC_5.	None.
29	EcoMetrix	SSD Species	*Hyalella was said to be excluded because it is non-resident in the study area (although 5 other non-resident species were included).*	See response #23 and #27. Only 3 non-resident species were included. The 3 non-resident species were included because they were considered to be adequate surrogates for resident genera that occur at EKATI. For instance, *Brachionus calyciflorus* was considered a surrogate for resident rotifers. However, in the case of Hyalella, there are no amphipods at EKATI. Therefore, Hyalella is not resident and is not good surrogate for any resident genera that occur at EKATI.	None.
30	INAC	SSD Methodology	*Approach used for estimating Chloride discharge criterion is not advocated in any of the guidance documents reviewed by Rescan.*	A variety of approaches have been used by various parties for calculation of species sensitivity distributions. The primary goal of this modeling is to provide a good fit to the data. The approach taken was selected because it was consistent with methodology used in EVS (2004), and provided a good fit to the data ($r^2 = 0.96$).	None.
31	EcoMetrix	SSD Methodology	*While several references to SSD methodology have been provided by Rescan (2007), it is not clear what differences exist between the cited methods, whether any have been followed exactly, or whether there were deviations from the cited methods. It would be appropriate for the authors to discuss this in detail, as part of their justification for the method actually used.*	See responses #29, 33, 34, 35, 36 and 40.	See responses #29, 33, 34, 35, 36 and 40.
32	INAC	SSD Methodology	*A discharge criterion at the edge of the mixing zone of 313 mg/L is higher than all other criterion proposed by all other sources in Rescan's report.*	The discharge criterion is based on a substantially larger data set of chronic toxicity test data than what was previously available to all other parties. Outside of this water licence process, a manuscript is being prepared for publication which will make the new data available to a broad scientific audience for their use in this field.	None.

33	INAC/Zajdlik & Associates	SSD Methodology	*BHP (2007) states that the 10 most sensitive chronic values of the dataset compiled above, were used to estimate the HC5. This selection process does not follow the methodology for estimating water quality guidelines in the documents cited by BHP. Additionally the methodology used by BHP to estimate the HC5 is inconsistent with those documents.*	Exclusion of algal data for three species from the species sensitivity distribution was considered appropriate in this case because the sensitivity of the three algal species excluded was substantially lower than the remaining species, and resulted in a poor overall fit of the curve to the data. The approach used is somewhat analogous to that used by the EPA for deriving guidelines, in which only data for the most sensitive species (typically four) are used to derive the guideline. Thus, although the methods employed do not directly follow a cited methodology, they are generally consistent with approaches for deriving water quality guidelines, and produced a result that was protective of all the tested species. The review conducted by EcoMetrix concurs with the removal of the non-sensitive algal species. The statistical tool used for calculation of the HC_5 was selected to be consistent with EVS (2004).	None.
34	INAC/Zajdlik & Associates/ Environment Canada	SSD Methodology	*the method used to estimate the HC5 is inconsistent with the cited documents.*	See response to comment #39.	See response to comment #39.
35	EcoMetrix	SSD Methodology	*The chronic IC50 data for algae that were utilized by Rescan from other literature sources were divided by 2 to provide an estimate of IC25. It should be noted that this estimation procedure assumes a 1:1 relationship between percent response and concentration, over the specified response range, which may or may not be consistent with the actual dose-response relationship. Some justification for this assumption would be appropriate.*	We agree that this procedure assumes a 1:1 relationship between % response and concentration. In the absence of the dose response data, a value of 1:1 ratio was considered to be a reasonable assumption. The difference between the chronic IC50's and IC25's for the 9 species tested ranged from 1.1 to 16.9. The average difference was 5.3.	None.
36	EcoMeix	SSD Methodology	*Chronic data were available from U.S. EPA (1988) for 3 species (D. pulex, P. promelas and S. gairdneri=O. mykiss). These data were averaged with the chronic test data from Nautilus for the same species, or genera in the case of Daphnia (D. pulex and D. magna were averaged). However, data available for Nitzchia from BCMWLAP and EVS were apparently not averaged (the BCMWLAP value was used). The approach to data averaging was not discussed or rationalized. Some sort of averaging seems appropriate, at least within species.*	The Nitzschia value of 1,239 mg/L, reported by EVS is the geometric mean of three data points presented in US EPA, 1988. The three data points were as follows: Potassium Chloride EC50 : 642 mg/L Calcium Chloride EC50: 2,003 mg/L Sodium Chloride EC50: 1,482 mg/L Due to the relative preponderance of sodium as the counter-ion in the Horseshoe Lake system, the toxicity data included in the derivation of the HC5 of sodium chloride. Thus, the 1,482 mg/L value was used in the calculation. Although it is stated in the report that the BC MWALP (2003) value of 1,475 mg/L was used, it was not. The geometric mean of the EPA and BC MWALP values is 1478.5 mg/L. The difference between the value used and geometric mean value would not have significantly affected the calculated HC_5.	None.

<table>
<tr>
<td>37</td>
<td>INAC/Zajdlik & Associates</td>
<td>SSD Methodology</td>
<td>The approach used by BHP is also not that advocated in CCME (2006) or in the supporting document Zajdlik (2006).</td>
<td>The rationale for the approach used by BHP Billiton is provided in the report.

A request was made by Rescan to the CCME to obtain Zajdlik (2006). Below is the CCME’s response.

“The document you are searching was never published. It is a consultant's report that was prepared strictly for internal use. We do not distribute unpublished documents.

Could you tell me where did you get the reference regarding this document? Please advise.”

It is our understanding that the CCME (2006) guidance is in draft and has not been publicly released. The CCME has requested that consultants who have received a copy not reference it or distribute it. Therefore, it was not appropriate to reference the CCME (2006) document in the report or the review of the report.

BHP Billiton requests that INAC provide a rationale for it’s use of an unpublished guidance document (CCME 2006).The CCME (2006) document was not publicly available when the chloride criterion report was issued. Therefore, the CCME was not advocating the methodology that it comprised.</td>
<td>INAC requested to provide rationale for reference to unpublished guidance document (CCME 2006).</td>
</tr>
<tr>
<td>38</td>
<td>INAC/Zajdlik & Associates</td>
<td>SSD Methodology</td>
<td>There are numerous theoretical flaws in the approach that was used by BHP to estimate chloride criteria.</td>
<td>The wording “numerous theoretical flaws” is vague and does not allow for a specific response. In this sense, BHP Billiton finds the comment unfair and unconstructive. BHP Billiton has provided a technically valid and defensible report to the WLWB and is willing to respond to any reasonable comments or questions.

BHP Billiton requests that INAC clarify this review comment and provide specific examples, comments and/or questions in a manner to which BHP Billiton can provide a specific response.</td>
<td>INAC requested to clarify the review comment with specific examples, comments and/or questions.</td>
</tr>
<tr>
<td>39</td>
<td>INAC/Zajdlik & Associates/ Environment Canada</td>
<td>SSD Methodology</td>
<td>BHP should recalculate the chloride criteria in a manner consistent with the cited documents and/or the additional documents provided above.</td>
<td>It is recognized that a variety of approaches have been used by various parties for calculation of species sensitivity distributions. The primary goal of this modeling is to provide a good fit to the data. The approach taken was selected because it was consistent with methodology used in EVS (2004), and provided a good fit to the data ($r^2 = 0.96$).</td>
<td>None.</td>
</tr>
<tr>
<td>40</td>
<td>INAC/Zajdlik & Associates</td>
<td>Toxicity dataset composition</td>
<td>The chronic dataset used by BHP is comprised of results from the 9 toxicity tests described above, data “ in US EPA (1988) for Daphnia, rainbow trout and fathead minnows, values for algal species summarized by EVS (2004) and values for Nitzchia summarized in the BC Water Quality Guidelines (BCMWLAP, 2003)”.
It is not clear exactly what data from the first two of the documents cited were included in the dataset nor is it clear which observations (if any) were omitted, based on the text provided. This information may be contained in Appendix A, but this document was not available for review. As dataset composition is one of the primary practical challenges in estimating water quality criterion as illustrated by BHP’s concern regarding single observations, this potential omission</td>
<td>Information as follows:

<table>
<tr><th>Species</th><th>Source of Data</th><th>Derivation of Value used</th></tr>
<tr><td>Daphnia magna</td><td>Current toxicity tests and US EPA (1988)</td><td>Geometric mean of two data points</td></tr>
<tr><td>Ceriodaphnia dubia</td><td>Current toxicity tests</td><td>Geometric mean of twenty data points</td></tr>
<tr><td>Brachionus calyciflorus</td><td>Current toxicity tests</td><td></td></tr>
<tr><td>Pimephales promelas</td><td>Current toxicity tests and US EPA</td><td>Geometric mean of two data points</td></tr>
<tr><td>Chironomus tentans</td><td>Current toxicity tests</td><td></td></tr>
</table>
</td>
<td>None.</td>
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</table>

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<tr>
<td></td>
<td></td>
<td></td>
<td>is of concern.</td>
<td>
<table>
<tr><td>Nitzchia</td><td>EVS 2004, BC MWLAP 2003</td><td>Divided EC50 by 2 as a safety factor</td></tr>
<tr><td>Lumbriculus variegatus</td><td>Current toxicity tests</td><td></td></tr>
<tr><td>Tubifex tubifex</td><td>Current toxicity tests</td><td></td></tr>
<tr><td>Oncorhynchus mykiss</td><td>Current toxicity tests and US EPA</td><td>Geometric mean of two data points</td></tr>
<tr><td>Chlamydomonas</td><td>EVS 2004</td><td>Divided EC50 by 2 as a safety factor</td></tr>
</table>

Data included from USEPA (1988) were the only three chronic data points presented in that guideline (one each for Daphnia, rainbow trout and fathead minnows). Data included from EVS (2004) were for algal tests which had inappropriately been described as “acute” data, except as excluded below.

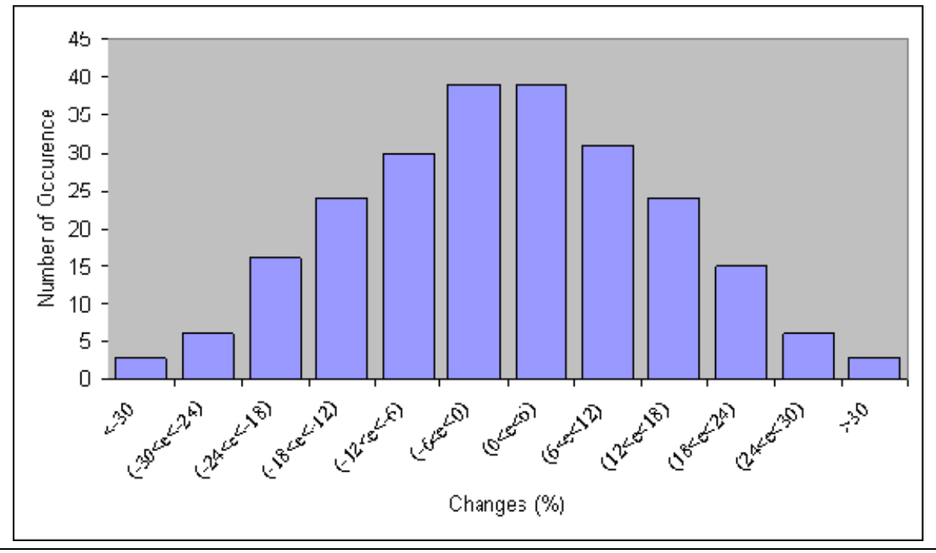
Data excluded:
Hyalella (from the current study) – excluded because amphipods are not observed in EKATI waterbodies.
Anabaena (from EVS, 2004) – excluded because of low sensitivity to chloride (EC50 14,300 mg/L)
Anacystis (from EVS, 2004) – excluded because of low sensitivity to chloride (EC50 >24,300 mg/L)
Chlorella (from EVS, 2004) – excluded because of low sensitivity to chloride (EC50 7,000 mg/L)
Nitzschia (from EVS, 2004) – two values excluded because they were tested with potassium and calcium salts. One value for sodium chloride included.
</td>
<td></td>
</tr>
<tr>
<td>41</td>
<td>EcoMetrix</td>
<td>Toxicity dataset composition</td>
<td>Other literature data, from BCMWLAP (2003) and EVS (2004), also were not utilized by Rescan (2007). The reasons for excluding these data were not discussed. The BCMWLAP data were chronic IC50 data. They could have been used to estimate IC25 (as done by
Rescan for Nitzchia). The EVS (2004) data were acute LC50 data for non-algal species, and (arguably) chronic IC50 data for algal species. They could have been used to estimate IC25 (as done by Rescan for the alga Chlamydomonas) possibly using an acute-chronic ratio (ACR) for non-algal species. While the rationale for excluding most of the data from these other sources is unclear, it appears that the effect of including these additional data (for a data set of n=28 species) would be to increase the calculated HC5 from 313 mg/L to 432 mg/L. Thus, Rescan’s use of a smaller data set seems to be conservative.</td>
<td>Agreed that the approach taken provides a conservative derivation.</td>
<td>None.</td>
</tr>
</table>

42	North Slave Métis Alliance	Other Regulatory Agency Criteria	*Please describe and compare the EDC values described in section 5.4 and how they are justifiable or comparable with the CCME standards, where drinking water should not exceed 250mg/L and the freshwater chronic and acute levels are of 150mg/L and 600mg/L respectively.*	There is currently no CCME guideline for chloride for the protection of freshwater aquatic life (the relevant guideline in this case). The reviewer is likely referring to the British Columbia water quality guidelines which are 150 and 600 mg/L. If so, a discussion of its relevance for the Sable derivation is provided in Section 3.2.1 of the report. Horseshoe Lake is not a drinking water supply as contemplated in the CCME guidelines. Additionally, the CCME guideline for drinking water is based on a taste endpoint rather than a toxicological endpoint, which means that a person will not get sick if they consume water containing more than 250 mg/L chloride. BHP Billiton recognizes that this is a traditional use area for First Nations and Inuit organizations and that people may have used water form this area in the past. When mining is taking place, at Sable Pit, it will be clear to land users that may be in the area that active mining is taking place in close proximity and it is unlikely that people will use the water at those times.	None.
43	EcoMetrix	Other Regulatory Agency Criteria	*The Iowa DNR (2003) recently went through a similar exercise of updating the U.S. EPA (1988) ACR, and found that a value of 3.797 was more appropriate, applied this to the U.S. EPA FAV of 1,720 mg/L, and rejected the calculated criterion of 453 mg/L as non-protective for Daphnia. A final chronic criterion of 372 mg/L was recommended, which was the chronic value for Daphnia pulex (from EPA), the lowest value in the chronic data set.*	Noted.	None.
44	INAC/Zajdlik & Associates	Description of Receiving Environment	*Lower trophic level fish are not identified.*	Information as follows: Slimy sculpin (*Cottus cognatus*) Lake chub (*Couesius plumbeus*) Longnose sucker (*Catostomus catostomus*) Ninespine stickleback (*Pungitius pungitius*)	None.
45	INAC/Zajdlik & Associates/EcoMetrix	Rejection of Existing Criteria	*BHP rejected BC WQG criteria based on the application of a large safety factor in the case of the chronic criterion and the non site-specific nature of the guideline. However the lack of site-specificity of the BC guidelines are not discussed.*	The uncertainty factor applied in the derivation of the BC WQG was used in order to provide a generic guideline that is protective of all sites, regardless of specific waterbody characteristics. Therefore, this is not considered to be a site specific WQG. Furthermore, the guideline was calculated for conditions and species present in British Columbia.	None.
46	North Slave Métis Alliance	CCME Policy	*It should also be noted that CCME has a non-degradation policy and should not be used for benchmarks.*	The CCME Water Quality Guidelines (WQG's) has not been used as a "benchmark" in this derivation.	None.
47	Environment Canada	DFO Policy	*Under Section 36(3) of the Fisheries Act (and the terms of the water license) the effluent must be non-acutely toxic at end of pipe, and this is generally established using the standard rainbow trout bioassay test. (It is noted that there is also precedent for chronic tests to be used in defining deleteriousness.)*	The proposed end of pipe criterion is 1,332 mg/L. The calculated acute HC_5 is 1,644 mg/L and the geometric mean of all the LC_{50} data for rainbow trout is 4,163 mg/L. Therefore, effluent is not expected to be acutely toxic. BHP Billiton maintains it's commitment to comply with the Fisheries Act and the existing water licence requirement that effluent released from Two Rock Pond is not acutely toxic (part G, Item 11d).	None.

48	North Slave Métis Alliance	Reliability of Modeling	*We expect some sort of ground truthing, particularly at peak freshet, which is said to be the time of lowest dilution.*	Although somewhat counterintuitive, mixing is weakest at freshet when Two Rock Stream outflow is very rapidly transported along the western shore of Horseshoe Lake. The process is quite well known particularly at the confluence of rivers (e.g., the Liard and Mackenzie) where the distinct coloration of the two flows is notable for many kilometers. Rapid transport during freshet decreases the time during which wind driven lake currents can mix with the stream outflow.	None.
49	North Slave Métis Alliance	Cumulative Effects	*We would like BHP to address the potential cumulative effects on this watershed.*	The potential cumulative effects on the Horseshoe watershed were assessed during the Environmental Assessment process conducted by the Mackenzie Valley Environmental Impact Review Board. There have been no changes to the project as it was assessed at that time.	None.
50	North Slave Métis Alliance	Lack of Consultation and Traditional Knowledge	*Aboriginal parties must be consulted about the level of change they are willing to accept.*	The proposed discharge criterion for chloride is provided in response to a requirement of the water licence (MV2001L2-0008). All comments on the proposal are being responded to by BHP Billiton according to the review process of the Wek'eezhii Land and Water Board. Aboriginal parties were consulted on the project as a whole during the Environment Assessment conducted by the Mackenzie Valley Environmental Impact Review Board. There has been no change to the project as it was assessed at that time.	None.
51	INAC/Zajdlik & Associates	Mis-interpretation of Project Objectives	*BHP is requesting that they be allowed to discharge wastewater containing Cl to an environment where Cl is not usually detectable and without attempting to remove Cl from the wastewater prior to discharge.*	Water Licence MV2001L2-0008 for the development of the Sable, Pigeon and Beartooth kimberlite pipes at EKATI requires that BHP Billiton undertake studies to determine an appropriate and rationalized site specific chloride discharge criterion which will be added to the water licence.	None.
52	INAC/Zajdlik & Associates	Rejection of Historically Proposed Criteria	*BHP (2007) disagrees with the Tier I number on the basis of 1) an acute-chronic-ratio based upon one study and 2) inclusion of 5 short -term datasets using in the dataset used to derive the acute SSD HC5 because the response measured for these tests was not lethality.* *BHP's removal of the algal results is unwarranted for the reason stated; however removal of the algal results is warranted on the basis of the following statement from CCME (2006) regarding derivation of water quality criteria using SSDs: All toxicity tests with Algae are considered long-term exposure tests because of the length of the algal life cycle compared to the duration of the exposure.*	Exclusion of the algal data from the acute toxicity test dataset was appropriate on a scientific basis, both on the basis of the rationale provided in the report, and that indicated by the reviewer. It is our understanding that the CCME (2006) guidance is in draft and has not been publicly released. The CCME has requested that consultants who have received a copy not reference it or distribute it. Therefore, it was not appropriate to reference the CCME (2006) document in the report or the review of the report. EcoMetrix, another reviewer, also concurs with the inclusion of the algal data in the chronic data set. BHP Billiton requests that INAC provide a rationale for it's use of an unpublished guidance document (CCME 2006).	INAC requested to provide rationale for reference to unpublished guidance document (CCME 2006).
53	INAC/Zajdlik & Associates/EcoMetrix	Review of Other Documents	*Environment Canada (1999) assessed the toxicity of road salt to various components of the biosphere including aquatic ecosystems. They estimated an HC_5 of 210 mg/l based on median lethal concentrations. Environment Canada (1999) concludes that "Aquatic ecosystems experiencing such chloride levels (210 mg/l) are expected to be impaired."* *BHP did not review this document.*	The HC_5 of 210 mg/L referred to by the reviewer was calculated based on predicted chronic toxicity data. An acute-to-chronic ratio (ACR) of 7.59 was used to convert acute data into chronic data. Due to the uncertainty associated with the ACR, this HC_5 would not have been selected for use in the development of the Sable discharge criteria. The primary uncertainty of the ACR was that it was derived as geometric mean of ACRs that ranged from 3.95 to 22.1. It should be noted that ACR testing conducted with a range of species (and provided in the report) have indicated that the actual ACR for chloride is substantially lower than 7.59. Empirical chronic toxicity data such as those presented in the proposed chloride discharge criteria report are preferred over predicted toxicity data generated using an ACR.	None.

54	INAC/Zajdlik & Associates	Other Regulatory Agency Values	*The HC5 of 313mg/l estimated by BHP (2007) is higher than that proposed by BCMWLAP, (2003), US EPA (1988) and (EVS, 2004). The US EPA value of 230 mg/l corresponds to a four day average that should not be exceeded more than once every 3 years. BHP's proposed criterion is higher at 313 mg/l and corresponds to a longer 21-day average.*	The relevance of other guidelines has been evaluated in the report.	None.
55	INAC/Zajdlik & Associates	Literature on Chloride Toxicity	*The Bacillariophyceae which are one on the predominant phytoplanktonic taxa in receiving environment (BHP, 2007) may be particularly sensitive to chloride shifts (Dixit et al, 1999). Therefore a lower value may be required to protect this predominant taxon. (Note that Dixit refers to the Diatomaceae which may not comprise the majority of the Bacillariophyceae in the Horseshoe watershed.)*	Chloride was used as a general marker for anthropogenic impacts on lakes in the referenced study, and was not definitively implicated as the cause of shifts in phytoplankton taxa.	None.
56	Environment Canada	Potential Chloride Accumulation	*The study shows what the dilution is, but not really what the overall inflow and outflow to the lake is. How much chloride by mass will be added to Horseshoe Lake, how much is flowing out, and could this result in a gradual salination over time? If it does result in a gradual increase in chloride concentration, it could pose a problem.*	The outflow from Horseshoe Lake is 5.1 times the outflow from the Two Rock Sedimentation Pond. Thus in steady state, the Horseshoe Lake outflow would have a chloride concentration about 19% of that in Two Rock Sedimentation Pond. However, steady state is not achieved in the long term because the freshet flushes Horseshoe Lake every year. Therefore chloride concentrations at any given location in Horseshoe Lake will vary throughout the year. Chloride concentration will vary over Horseshoe Lake with the smallest, nearly un-measureable increases in the northern portions and the largest increases at the mouth of Two Rock Stream.	None.
57	EcoMetrix	Potential Chloride Accumulation	*Rescan (2007) has not discussed the potential for chloride accumulation in Horseshoe Lake, and the modelling analysis performed does not contemplate such accumulation.*	"Accumulation" is best characterized as an increase in chloride concentration within the Lake. The chloride concentration varies over the year and as a function of position in the lake but does not increase year-by-year. Refer also to responses to comments #56 and 58.	None.
58	EcoMetrix	Potential Chloride Accumulation	*A potential mechanism of accumulation could be development of a chemocline. Since the lake is relatively shallow (maximum 8 m), wind-driven vertical mixing during the open water period would act against such stratification. Rescan (2007) has stated that thermal stratification in Horseshoe Lake is unlikely, due to wind-driven vertical mixing. No further detail supporting this determination is provided. Similar arguments may be applicable to the question of chemical stratification.*	The 3-D model that was used includes stratification. Chemical stratification (the formation of a chemocline) can only occur if physical stratification (a pycnocline) is present. During winter, the presence of ice cover prevents wind mixing and the upward heat flux accompanied by ice growth tends to create a seasonal gradient in the water column with the coldest, least dense water near the surface. At freshet and thereafter, first the flow through and then the wind mixing completely breaks down any winter gradients and this condition is maintained throughout the open water period.	None.
59	EcoMetrix	Potential Chloride Accumulation	*It would be reasonable to expect BHP Billiton to present the arguments in detail, supported by long-term modelling of chloride in Horseshoe Lake as a whole, over the period of pit development, and over the recovery period if any changes at the lake outlet are anticipated. Even if whole lake changes in chloride are not expected, the analysis would serve to alleviate concerns around this issue.*	As described in the response to comment #58, Horseshoe Lake will be completely flushed at each annual freshet. Therefore, the results of such a modeling exercise would be identical year to year.	None.

60	INAC/Zajdlik & Associates	Modelling Water Flow	*Pit water discharge was modelled for open water conditions. The effect of ice on pit water discharge should be assessed particularly given the relative lengths of the ice-cover and open-water seasons. Wind-induced dilution will be almost nil during the ice-cover season.*	See response #65.	See response #65.
61	INAC/Zajdlik & Associates	Modelling Water Flow	*Daily flows are estimated for only a fraction of the calendar year. It is not clear what if any consideration was given to water flows for the remaining 7 months of the year.*	See response #65.	See response #65.
62	INAC/Zajdlik & Associates	Modelling Water Flow	*BHP (2007) states that yearly flow to Horseshoe Lake should be equivalent to the natural flow because the catchment area will be unchanged. While this may be true it assumes that overland flow is driven by the surficial catchment only. This assumption will be incorrect if substantive ground-water flow is encountered, which would be altered by pit-dewatering.*	Agreed. However, it is estimated based on the Panda and Koala pits that the groundwater flow is at all times less than 25% of total flow of mine water pumped from the pit. Further, a portion of the overland runoff may be taken up in rock piles as frozen water content	None.
63	EcoMetrx	Modelling Water Flow	*It has been suggested that pit dewatering at times of ice cover on Horseshoe Lake may necessitate discharge during the ice-covered period, and that redirection of groundwater to surface water in general may require the discharge to deviate from natural flow patterns.* *This is essentially a water management problem.*	See response #65.	See response #65.
64	INAC/Zajdlik & Associates	Modelling Water Flow	*The second paragraph of section 2.5 is confusing. There seems to be an implication that Horseshoe Lake is unfrozen during the winter but the following sentence discusses discharge of pit water to the frozen Horseshoe Lake. It may be that operations/dewatering are restricted to certain times of the year?*	See response #65.	See response #65.
65	EcoMetrix	Modelling Water Flow	*Section 4.5, para. 2 of the derivation document "During operations, it was assumed that there will be negligible ice cover on Horseshoe Lake …" and "…On the other hand, Sable Pit water discharge may occur during ice covered conditions in Horseshoe Lake ". What is the difference between* *"operational discharges" (which may include ground water inflow to the pit) and "Sable Pit water discharge" ?*	The initial one-time dewatering of Sable Lake will take place in winter to minimize suspended sediment load from Sable Lake. Operational discharges refer to the period of mining after the initial dewatering of Sable Lake. The Water Licence currently states that "There are to be no under-ice discharges from the Two Rock Sedimentation Pond" (Part G, Item 11c). In the water licence renewal application that BHP Billiton will be submitting to the WLWB early in 2008, BHP Billiton will request that this clause be stricken or amended based on several practical factors, which will be fully explained in that application.	None.

66	INAC/Zajdlik & Associates	Modelling Water Flow	*It is not clear whether inputs to the model such as bathymetry, bed resistance, wind field, hydrographic boundary conditions etc. were entered as fixed values, a range of values or values representing a worst-case scenario*	Bathymetry is fixed. Bottom friction coefficient is fixed. The air-water drag coefficient is fixed. Wind field varies with time based on measured winds from the area. Flows vary daily based on local stream flow measurements. Wind set-up causes increased discharge at Horseshoe lake outlet. To estimate the precision of the dilutions predicted by numerical simulation, we varied the values of the significant inputs within physically realistic ranges. Effects on dilution were estimated by applying a ±10% variation of: Chezy number (bed friction), wind drag coefficient, wind speed, stream discharge and water depth. The effect on dilutions was calculated for 243 possible combinations by considering increase, decrease and no change in each parameter. The maximum change was estimated to be ±32.6% and the RMS of the changes was 13.7%. The 95% confidence band of the dilution estimates is approximately ±20%. The distribution of the estimated effect on dilution estimate versus percent of occurrence is plotted below. The table of results is available upon request. 	None.

67	EcoMetrix	Modelling Flow	*The hydrograph data (2005) and wind data (2004/2005) provided to the MIKE3 model provide the basis for determination of the minimum 21-day average dilution factor. It is possible that data for other years would produce somewhat different minimum dilution factors for the specified averaging period. This year-to-year variability would represent uncertainty in the minimum dilution factor. If data are available for other years, the model runs could be repeated to provide an estimate of this uncertainty.*	The differences in dilution from year to year would be expected to be minimal and BHP Billiton feels that there is not a strong technical rationale to re-run the model several times (a substantive work task). BHP Billiton requests that the reviewer provide a technical rationale for the request.	The reviewer is requested to provide a technical rationale for the suggested work.
68	EcoMetrix	Modelling Flow	*It should be noted that we are discussing uncertainty in the minimum dilution factor for the specified averaging period. Actual dilution is expected to be greater than this most of the time. This can and should be verified by monitoring once the mine is operating. One or more monitoring points at the agreed mixing zone radius, in addition to monitoring of the effluent discharge, would be needed to permit such verification. Monitoring parameters should not be limited to chloride, but should include other major ions, TDS and hardness, as factors relevant to potential ion effects.*	The current requirement of the Water Licence is for BHP Billiton to propose an effluent quality criterion (EQC) for chloride. The Surveillance Network Program (SNP) already requires sampling of the effluent released from Two-Rock Pond (0008-Sa3) with analyses to include total hardness, total dissolved solids (TDS), chloride and other major ions (SNP, Part B, Item 5). BHP Billiton agrees that the SNP should be amended, at the time of approval of the chloride EQC to also include sampling at the edge of the mixing zone for the same suite of parameters.	WLWB to consider amending the SNP Program at the time of approval of the chloride EQC to include sampling at the edge of the mixing zone.
69	INAC/Zajdlik & Associates	Modelling Water Flow	*The 21-day dilution minimum is predicted at a 100m distance from the discharge of Two Rock Stream into Horseshoe Lake. This dilution rate is presented as an absolute value rather than a predicted value with associated imprecision.*	The value is the minimum occurring over any 21 day period during the record. Model predicted values were sampled every 4 hours. 126 of these values represent 21 days. 84 overlapping periods of 21 days each were available from the model run. The minimum dilution (the worst case) was selected from these 84 realizations. That is, 83 are larger dilutions than that presented.	None.
70	Environment Canada	Modelling Water Flow	*The use of a 21 day average is also of concern, as this could incorporate wide fluctuations in concentrations. It would be useful to have confidence intervals attached to the predictions around flow and chloride concentrations.*	See response #69.	See response #69.
71	Environment Canada	Modelling Water Flow and Calculated HC_5	*The concern with pulse exposures of the chloride is also raised as a factor that should warrant a lower endpoint estimate, i.e. the HC5 would be expected to go down if testing had been done under non-static conditions.*	"Pulses" of chloride in the discharge water are not expected because there is no anticipated inflow of connate groundwater into the Sable Pit. In the unlikely event that there would be flows of deep groundwater into the Sable Pit, the chloride concentrations in the groundwater below the permafrost layer would be anticipated to be homogenous after mixing and retention in Two Rock Pond. Further, conducting toxicity tests under "pulsing concentration conditions" is not standard procedure. If such methods were used, the results could not be applied to the species sensitivity distribution.	None.
72	INAC/Zajdlik & Associates	Modelling Water Flow	*The predicted dilution factors do not acknowledge imprecision or variation of model input parameters. There may therefore be considerable unacknowledged variation in the dilution factor used. This variability is addressed through qualitative statements by BHP but a more complete investigation is warranted.*	See response to comment #66.	See response to comment #66.
73	INAC/Zajdlik & Associates/EcoMetrix	21-Day Averaging Period	*The 21day average was selected to represent the results of chronic exposures in laboratory toxicity tests. It is not clear that a 21 day average is appropriate. The effects of using an*	The 21 day average is considered appropriate. Figure 4.6 presents the frequency distribution for both the 48 hr and 21 day lowest average dilutions. The difference between these two exposure periods is only a factor of 1.6. If the 48 hr lowest average dilution was used along with the chronic	None.

			alternate exposure period should be discussed.	$HC_{5,}$ the proposed discharge criterion would be 820 mg/L instead of 1,332 mg/L. This would mean that an acute exposure is being applied to a chronic threshold value, and although, more conservative, it is considered inappropriate.	
74	EcoMetrix	21-day Averaging Period	*It is unclear how well this duration represents the life-cycle of resident cladocerans that are supposed to be protected by the proposed criteria; however it seems reasonable to associate the life cycle duration of the most sensitive species with the criterion*	The 21 day average is considered appropriate. The life-cycle test for the most sensitive genus (Daphnia) was 24.5 days. As noted by the reviewer, this life-cycle duration is applicable to both *Daphnia magna* and *Daphnia middendorffiana.* The life cycle test of the second most sensitive species *(Ceriodaphnia dubia)* was 7 days. This duration is considered appropriate given the life cycle of the laboratory test species and is standard in toxicity testing with *Ceriodaphnia dubia.* However, testing with cladocerans collected from Horseshoe Lake have shown life cycles in the 21-day range (*personal comm.* Nautilus Environmental, November 2007) and thus, the averaging period is appropriate. If 2% of the time (*i.e.* 7 days in a row in the spring) the chloride values were to reach 313 mg/L in the receiving environment, effects on Ceriodaphnia are not anticipated as the IC_{25} for Ceriodaphnia is 450 mg/L, this is 137 mg/L higher than the HC_5.	None.
75	EcoMetrix	Predicted Chloride Concentrations	*What is missing from all documents is an assessment of the likely levels of chloride in the Sable Pit discharge itself.*	See response to comment #76.	See response to comment #76.
76	EcoMetrix	Predicted Chloride Concentrations	*What are the chloride levels expected in the discharge and how do they change over the mine life?* *As discussed in Section 3.1, without this source characterization, it is not possible to assess the likelihood that BHP will need a discharge limit of chloride at the levels proposed, or the risk of non-compliance inherent in any limit adopted by the Board. For example, there is no point in setting a limit at 1,332 mg/L and accepting a mixing zone of 100 m, if the expected discharge was 700 mg/L or lower with a correspondingly smaller mixing zone. We recommend that BHP-Billiton provide the Board with a summary of expected volumes and chemical characteristics of the Sable Pit discharge over the life of the mine.*	BHP Billiton has assessed the range of likely chloride concentrations from the Two Rock Sedimentation Pond. A key factor is that there is no talik (thawed) zone beneath Sable Lake and the Sable pit will be well within the zone of permafrost (pit depth is approximately 200 m less than the depth of permafrost). This creates an extremely low likelihood that deep connate groundwater would ever enter the Sable Pit. Regardless, extreme projections to assess the implications of such a low probability event show that the proposed chloride EQC at the outlet of Two Rock Pond would continue to be achieved if deep connate water entered the Sable Pit. BHP Billiton also maintains an underlying commitment to achieve the EQC's that are set by the WLWB. BHP Billiton disagrees with the suggestion that the chloride EQC would be based on modelling projections of possible effluent chloride concentrations.	None.